Understanding the role of technology in health information systems

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PACIFIC HEALTH DIALOG

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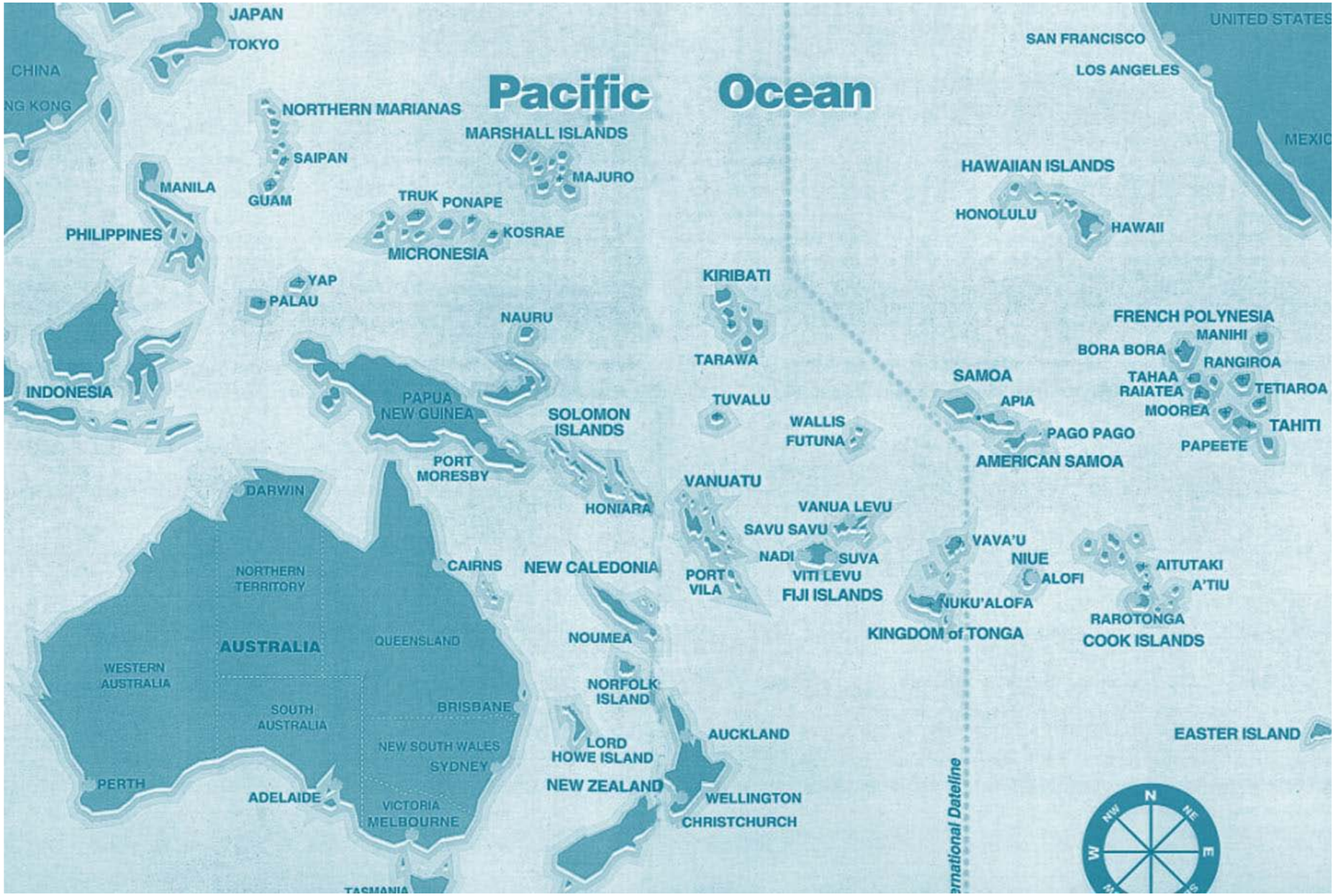
SPECIAL EDITION

Health Information Systems in the Pacific

The Pacific region



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Guest editorial

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It is with great pleasure that I welcome you to this Special Edition of the Pacific Health Dialog. The Health Information Systems (HIS) Knowledge Hub is committed to improving the communication of its work in the Pacific. One initiative supported by the Hub is the Pacific Health Information Network (PHIN), which was created to provide a mechanism for networking, support, information sharing and training for people working as health information professionals in the region. In order to give this group of professionals a voice, as well as an opportunity to publish, the Hub committed to supporting an edition of the Dialog in 2011.

This publication is an important testament to the progress of health information systems in the region, and will serve to promote recent achievements, goals and developments in HIS. I hope you will all agree in reading what follows that significant contributions to addressing key public health concerns around HIS have been made. These contributions will, I am sure, prove to be of great value in accelerating HIS development in the Pacific.

The need for accurate health information is more important than ever. We are at a crucial point in global health when we have the opportunity to consolidate and accelerate some great progress with disease control programs, particularly for key global health concerns such as HIV/AIDS, malaria and vaccine preventable conditions such as measles. However, consolidating these gains and further improving progress towards the Millennium Development Goals will depend on a comprehensive and informed health system response, which in turn will depend on accurate, relevant and timely health information systems.

Many countries still struggle with the task of providing reliable information on the pattern of births, deaths and cause-of-death occurring in their populations, and it is vital that we continue to work together to improve the quality of health information systems and, in turn, the health outcomes of some of the world's most vulnerable communities. A framework for working as a collective group is provided in the Regional Health Information Systems Strategic Plan 2012-2017, launched by PHIN in 2011.

The six strategic action areas in the Regional Plan, concerned with advocacy, human resources, data quality, information and communication technology, leadership and governance, and policies, regulations and legislation, have determined the research themes contained inside.

Readers will also find articles on emerging issues for HIS in the region, including the urgent need for health information in addressing non-communicable diseases, and the continued importance of providing accurate and locally-relevant maternal and child health indicators. Discussions on important tools and resources for action are also provided, to assist countries in advocating and implementing HIS improvements.

I trust you will enjoy reading the many articles and case-studies submitted from across the region, and will take the time to reflect on the substantial gains made in strengthening HIS, but also the continued work and dedication required to overcome the remaining challenges. Health systems-strengthening, particularly HIS-strengthening in the Pacific, have been long neglected and have not benefitted from a strategic, collaborative approach involving Knowledge Hubs, such as the Australian Agency for International Development (AusAID)-funded Hub at the University of Queensland, development partners such as the Secretariat of the Pacific Community (SPC), World Health Organization (WHO) and Asian Development Bank (ADB), regional organisations such as PHIN, and individual countries.

There is no better time to benefit from such an approach than now, with much momentum already underway and increased interest in improving HIS from development partners, including the Health Metrics Network (HMN), WHO and SPC. It is crucial that countries see the importance of urgently strengthening their HIS on this wave of interest and utilise available resources to maximum effect. This publication of the Pacific Health Dialog will hopefully motivate and assist countries to do so.

Guest editorial

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Information is considered one of the six building blocks of a health system by the World Health Organization, and this was formally endorsed as a key priority for the Pacific in 2006 with the publication of the Health Information System Strategic Plan for the Western Pacific Region. Among the key features of this building block are the production, analysis, dissemination and use of reliable and timely information to monitor health system performance and provide advice on national health priorities and needs. Sadly, health information systems in Pacific Islands Countries and Territories are repeatedly defined as 'data cemeteries'; with incomplete, unreliable, obsolete and poor quality data. While previous investments have been made in some countries to improve HIS, many have provided limited success.

A health information system is an 'Invisible Giant' with intelligent processes to move data around a health system to assist evidence-based healthcare services. Until now, our Pacific communities have understood health information systems in different ways, and usually defined them in a way that relates to our greatest area of interest. For instance, people working in Human Resources or with National Health Accounts will define the actions and responsibilities of a HIS very differently to a clinician or someone working in public health. Another common definition is that health information systems are sophisticated computer systems. While computer systems are one of the technical tools used by the 'Invisible Giant', as health information systems cut through the whole spectrum of health care services, they are much more than computers.

The regional attempt at improving HIS initiated by PHIN with the development of its Regional Health Information Systems Strategic Plan is anticipated to be a long and complex journey given the large number of organisations involved. Thus, ongoing communication to share the same understanding between parties is paramount for success.

The PHIN Management Committee and Secretariat are committed to maintain close communication with relevant stakeholders, member countries and interested parties, including updates on the progress of implementation of the Strategic Plan.

This is a rare opportunity that the Pacific Health Dialog has given to Health Information Professionals of Pacific Island Countries and Territories, and it is greatly appreciated. We are grateful for the support of the HIS Hub, WHO and PHIN development partners, which enable us to share our experiences and stories on HIS with Pacific communities, and also with the world at large. Despite many HIS milestones achieved recently, it is too early to declare victory. If national support towards regional HIS investment is not sufficient and appropriate, we are fighting a losing battle.

Faka'apa'apa atu

Journal overview: Why HIS?

Health information is a national asset

Quality, timely and complete health information from multiple sources—including but not exclusively from the health sector—should be generated, compiled, analysed, communicated, and used for evidence-based decision-making on policy, planning, and management at all levels of the health system. This is not the case in the Pacific, as health information systems (HIS) tend to be incomplete and fragmented by function, disease or condition and donor or global health initiatives. In most countries, those responsible for operating the national health information system are under-resourced to perform effectively and influence the allocation of health system resources. Those responsible for collecting and analysing data at local levels are also under-resourced and are often unable to use information to influence local health decisions. Investments in HIS are scarce, though increasing, but more advocacy is needed to make the link that HIS strengthening can improve policy and, thus, help achieve priority health outcomes. There are a few examples of how this has occurred in the Pacific.

Stronger advocacy for reliable health information begins by: 1) mobilising greater political will; 2) identifying effective leadership; 3) improving institutional capacity; and 4) organising a coordinated, multi-sectoral approach. These are four of the strategic enablers of an effective national HIS which will improve health information and make it a national asset. At the 9th Meeting of Pacific Health Ministers in June 2011, strengthening HIS and vital statistics was determined to be of the highest priority for health. The Pacific Health Information Network (PHIN), comprising HIS professionals from Pacific Island Countries and Territories, has responded to this political declaration and the need to transform the culture of health information use. However, HIS strengthening is not simply a technical issue, but also heavily influenced (or affected) by political, social, environmental, and multi-sectoral factors. Greater leadership at all levels of the health system is required to make incremental improvements over time. The health information units within the Ministry of Health must be provided additional resources and authority while also actively engaging other sectors, such as statistics, education, planning, finance, and information and communication technology (ICT), to accelerate reliable health information use within countries as well as more accurately reporting health statistics for the Pacific region.

A two-prong approach to advocate for stronger HIS can be effective, but requires a shift in thinking about health information. From a top-down perspective, operationalising country ownership and aid effectiveness in HIS strengthening is rooted in the Paris Declaration (2005),[1] Accra Agenda for Action (2008),[2] and more recently, the Bussan Partnership.[3] The creation of a functioning, national, multi-sectoral HIS coordination mechanism, if not existing already, with adequate oversight, and risk management, coupled with sufficient capacity to influence priority setting and future resource allocation can promote progress.

Development partners have an obligation to countries to be better coordinated among themselves, fully aligned with country priorities and strategies, and provide assistance to build and/or strengthen sustainable health systems. Development partners are beginning to recognise and act according to the six shared principles[4] that emphasize an effective country-led HIS strengthening process and the promotion of improved institutional readiness to ensure sustainable progress. One of these principles is agreement to strategically coordinate and harmonise HIS work in low-resource settings and allocate combined resources in ways that are increasingly shareable, where possible, to reduce duplication of effort. Development partners should work with governments in the region to promote these principles.

From a grassroots or bottom-up perspective, HIS professionals in the Pacific, including members of PHIN and other stakeholders, are becoming empowered and should be advocating for stronger HIS as a group. The PHIN already serves as a technical resource for learning and sharing and peer-to-peer assistance to build on technical and advocacy techniques that work. The PHIN membership and country level HIS professionals should identify the most critical HIS issues in the region and begin regular, collaborative dialogue with senior managers and decision-makers.

Increasing the visibility of the importance of health information by the public is essential for HIS advocacy, and the success of the annual Health Information Days in Tonga is a good example of how to raise public awareness. Time and energy will be required to convince senior policy makes to adequately finance medium- to long-term HIS improvements. Clear evidence of the impact of improved health information systems upon national health and development outcomes will be necessary, presented in formats that support senior policy makers in their deliberations. Effective HIS planning is also essential, as illustrated by the development of a costed HIS strategic plan in Fiji in 2011, which brought multiple sectors and stakeholders around the

table to prioritise and take action. This plan provides development partners with one longer-term 'roadmap' which will enable the donors and Fiji to make coordinated and rational investments in the national HIS over several years.

The Pacific region has a unique opportunity for achieving substantial gains in the quality and use of health information. But the optimal use of HIS to improve health outcomes will never be realised unless we harness the current momentum and political will and increase the level of in-country, multi-sectoral engagement and both country-level and regional-level coordination. Continuing to build a 'community of practice' within and between Pacific Island Countries and Territories will facilitate increased HIS leadership and institutional capacity to make positive change happen.

Mark Landry

World Health Organization Western Pacific Regional Office

John Novak

United States Agency for International Development

Maxine Whittaker

The University of Queensland

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Special edition on HIS

The objectives of this special edition are two-fold: to advocate for the continued investment in health information systems in the Pacific, and to explore the strategic points for action from the Regional Health Information Systems Strategic Plan. As previously discussed in the guest editorials, substantial gains in HIS have been made in recent years, however much work is required to consolidate and build-upon this progress.

The first section provides an overview of HIS; exploring key concepts and providing case-studies of common issues and challenges faced by countries in the Pacific. Section two is dedicated to the Regional Health Information Systems Strategic Plan, and it outlines five of the six strategic action points. Section three contains information on emerging issues facing HIS in the region, including non-communicable diseases, maternal and child health, and the development of civil registration systems. Finally, section four provides readers with an overview of available tools and resources for action.

Health information systems

The first section, *Health information systems*, contains three parts: in part one we are provided with a short article on health information systems, including a conceptual representation of the components and standards of a system as provided by the Health Metrics Network. We will also hear about the rise in recognition of the important role information systems play in the wider health system, as well as the considerable issues and challenges that remain. The issues and challenges facing health information systems are further discussed in the second article of the section, which summarises common issues and challenges as identified by Pacific participants at two meetings held in 2009. While many of the issues and challenges in the Pacific region are similar to those identified elsewhere, we will learn that it is in the solutions that the Pacific Islands are unique, as there is a strong potential for regional approaches to collectively resolve issues, especially in the area of data standards, workforce and technological investments.

Part two provides two country case-studies. The first case-study comes from Kiribati, a country facing complex issues with their health information system including years of unanalysed data; duplication of data; gaps in reporting; and issues with their health database. Despite these issues, Kiribati is making progress with their system, and we will also learn about the solutions being implemented and the experiences and learning's so far. Papua New Guinea is the location of the second case-study. The issues and challenges here differ from those of Kiribati: while Papua New Guinea has a well established national health information system that has been operating since the late 1980s, their challenge lies in the poor utilisation of information in planning and management. Potential solutions are provided in the case-study, including the need for a systematic approach with strong partnerships among relevant stakeholders.

Part three, the final in this section, begins with a policy brief outlining six key recommendations for strengthening health information systems in the Pacific: improving data integration and sharing; increasing data analysis skills; adopting regional approaches; strengthening advocacy; improving knowledge on health surveys; and making better use of institution-based data. The section ends with a case-study highlighting the success of a regional mechanism established to progress health information in the region, the Pacific Health Information Network. The Regional Health Information Systems Strategic Plan launched in 2011 is also discussed here, as are the six main strategic points for action.

Strategic actions for strengthening HIS

Advocacy

Strategic actions for strengthening HIS contains articles and case studies on five of the six strategic action points developed in the Regional HIS Strategic Plan. Part one is dedicated to the topic of advocacy, and it begins with an article detailing how to use advocacy to bring about changes in legislation, social policy and resource allocation with the goal of strengthening civil registration and vital statistics systems. This article is complemented by a case-study outlining how a number of donor partners and organisations in the region have collaboratively worked together to improve vital statistics through a 'bottom-up' approach to systems-strengthening.

Human resources

Human resources for health is the topic of part two, and the Human Resources for Health Knowledge Hub provides a comprehensive overview of information flows and gaps concerning the health workforce, potential stakeholder information needs, and recommendations for improving the availability and quality of human resource information. The next article is based on workshops held in Samoa and Fiji on improving the use of existing datasets. Learning's from the two workshops, which were designed to provide public health officials with the necessary skills to critically assess the quality of data they collect and utilise, and learn how to compute indicators for use as evidence for health policy, are discussed here, as are workshop outcomes and recommendations for action. Following this is a case-study on the development of a health information systems short course by the University of Queensland, currently one of the only courses available world-wide. Part two concludes with an article on improving the utilisation of demographic and health surveys.

Data quality

Part three focuses on data quality: a central issue in most discussions on improving information systems globally. The first article provides readers with an introduction to the concept of quality – what it means, why it matters and what can be done to improve it. Six recommendations for action are put forward for the region, ranging from developing a core dataset for sharing health information; to conducting regular, systematic and institutionalised monitoring and review of HIS. Following on from this broad introduction is a succinct overview of issues that countries and the donor community might wish to consider when developing strategies and practices to improve the quality and use of health information. A case study from Fiji provides the country context in this part: drawing on previous experiences on the production of National Health Accounts, readers will gain an appreciation of the types of health information required to produce a health account. Two further case-studies complete part three. The first is on the importance of quality data for improving adolescent reproductive health, and has been prepared by the Women and Children's Health Knowledge Hub. The second is on assessing the reliability of cause-of-death data reported by vital registration systems and provides three key recommendations to improve the quality of data.

Information and communications technology

Information and communications technology, also referred to as ICT or IT, is the topic of part four. While it is believed that the use of appropriate technologies can increase the quality and reach of both information and communication, decisions on what ICT to adopt have often been made without evidence of their effectiveness; or information on implications; or extensive knowledge on how to maximise benefits from their use. This point is discussed in detail in the first article, which also provides readers with eight key recommendations on how to maximise opportunities and benefits from the use of ICT in Pacific Island Countries and Territories. Two country-case studies conclude this part. The first is from the Cook Islands, and it describes the implementation of a computerised patient information system, MedTech32, the benefits and goals of the system, and also the significant challenges users faced. Actions taken to address the challenges are also discussed, as are key messages for other countries in the region. The final case-study is from Fiji and it illustrates in detail the issues encountered by the Ministry of Health in implementing a different patient information system, PATIS, how these issues were resolved and the impact of the system for health information in the country.

Leadership and governance

The final part of this section covers the topic of leadership and governance. Readers are first offered an insight into Nauru and the work currently being done to improve the quality of health information so that decisions can be made with confidence regarding health planning and, ultimately, policies can be developed based on quality information. The next case-study explores Fiji's experience in carrying out a nationwide assessment of the National Health Information System using the Health Metrics Network's Assessment Tool. Following the recommendations from this assessment, a reform agenda was introduced, which included the development of the first Health Information System Strategic Plan and the formation of a multi-sectoral working group.

The final case-study is from the Human Resources for Health Knowledge Hub, and it describes the current state of health management and leadership capacity and issues that affect management performance in the Solomon Islands. Included is a discussion on the health management information system and the issues it faces, including infrequent data collection and insufficient management information.

Emerging issues for HIS

Section three, *Emerging issues for HIS*, provides readers with information on a selection of emerging issues facing information systems in the region. The first article is from the Health Policy and Health Finance Knowledge Hub, and deals with the issue of non-communicable diseases and the need for health sector reform. It discusses the need for accurate cause-of-death data to assist countries with monitoring and evaluating health sector responses to this 'epidemic'. Potential phases of health reform are discussed, including policy issues to be considered during the reform process. Following this article is a short case study on the urgent need for reliable health information, which discusses two key areas for action to assist Pacific countries to better respond to non-communicable diseases.

Maternal and child health is the theme of the next two articles. The Pacific Child Health Indicator Project, a clinician-led project with the primary objective of improving child health in the Pacific through effective health information, clinical governance and decision support, is the topic of the first article. Readers are presented with an overview of child health indicators and the urgent need for local indicators in the region. Important findings from the review of child health data are also discussed, as are key policy and service implications and recommendations for action. The second article, on making sense of maternal mortality estimates, details the importance of measuring maternal mortality and the issues associated with maternal mortality definitions. Several different maternal mortality indicators are discussed, as are the sources of data and collection methods. Guidelines when interpreting and using maternal mortality data are also presented, including the use of metadata, avoiding over-interpreting specific values and assessing the plausibility of maternal mortality values.

Annual Reports, the focus of the next article, provide a wealth of raw data: however they are often comprised of pages of complex tables, with little interpretation or descriptive analysis provided, thus limiting their usefulness in monitoring and evaluating health outcomes. Despite the growing recognition of the vital role HIS play in informing health care decisions, the area remains severly under-researched and under-resourced, with few systematic attempts at improving the quality of reporting practices. As well as discussing common limitations and weaknesses, four key recommendations for improving the quality and use of Annual Reports in evidence-based decision-making are presented: carrying out a comprehensive review of reporting practices, and developing data quality assessment tools, regional reporting templates and a minimum data set for reporting.

The final article in this section deals with 'interim' methods for generating vital statistics for countries that do not have civil registration, or have weak and dysfunctional systems. While many countries are moving ahead with strengthening their HIS, attainment of timely, accurate statistics on births, deaths and cause-of-death will require years of strategic and prioritised investment, with technical assistance. In the meantime however, countries will need accurate and unbiased data in order to measure progress with their health programs and broader development goals. This article introduces some interim strategies that can yield adequate vital statistics and cause-of-death data as countries work to strengthen their civil registration systems.

Tools for action

This, the final section, contains a selection of tools, resources and action guides to assist countries in improving their health information systems. The first action guide provides useful guidance to decision-makers on the essential strategies to improve the quality and use of health information systems. Six steps for action are presented, from increasing awareness about the importance of reliable and comprehensive health information, to creating incentives and obtaining health data. Following this is a second action guide on how to assess health system performance by measuring effective coverage.

Following this is a detailed discussion of both how to assess the quality of vital statistics systems, and lessons learned from national evaluations in Sri Lanka and the Philippines. The WHO Framework for Assessing the Functioning of Civil Registration Systems is provided, along with the process used in piloting the framework and prioritising the recommendations. An assessment guide and toolkit for assessing the quality of mortality statistics is also provided. A ten-step process is described, which details relatively simple ways of analysing the internal validity and coherence of mortality data and shows how comparisons with other, external, sources of mortality data can be used to assess data consistency and plausibility.

The assessment guide and toolkit are complemented by guidelines for doctors on how to certify cause-of-death. While health decision-makers and planners around the world require extensive mortality statistics, the quality of these statistics depends on the accuracy with which individual doctors complete death certificates. Unfortunately, the accuracy of death certification is poor in many countries. These guidelines have been written for doctors and medical students, particularly in developing countries, and provide a basic overview of how to certify cause-of-death.

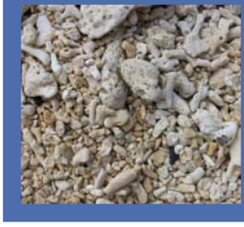
The final article in this section is an action guide on the immediate health responses to natural disasters, and six 'steps for action' are discussed: 1) appropriate

baseline data; 2) processes and protocols; 3) identifying a team; 4) establishing linkages; 5) data processing and compilation; and 6) developing disaster response manuals. The timely availability of information is vital to effective disaster response, and several major disasters in the Pacific region over the last decade have highlighted the fact that many developing countries do not have adequate disaster preparedness within their health information systems. To assist in lifesaving responses, information must be available to personnel on the ground immediately after a disaster, and this action guide will assist countries in planning key activities to improve their disaster preparedness.

Health Information Systems Knowledge Hub

The University of Queensland

Health Information Systems



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- *Original article:* Issues and challenges for health information systems in the Pacific
- *Case-study:* Kiribati: Issues and challenges for health information systems in a small island nation
- *Case-study:* Health information challenges in Papua New Guinea
- *Policy brief:* Why strengthen health information systems in the Pacific, and how could this be done?
- *Case-study:* The Pacific Health Information Network: Progressing health information systems in the region

What are health information systems, and why are they important?

Original article

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Introduction

Sharing information about health gives a clearer picture of health and illness across populations, and this knowledge can help prevent the spread of disease and improve health outcomes. An effective and integrated health information system (HIS) is the foundation of a strong health system and key to making effective, evidence-based health policy decisions. Without health information systems to inform decision-makers of where the health problems are and if the health of a population is improving or getting worse, sound judgements cannot be made. However, few developing countries have sufficiently strong or effective health information systems. Often countries with the greatest need do not have access to reliable and timely information, and when data are available, they are often out-of-date, making the challenge of assessing trends even more difficult. Without investments in HIS countries risk making policy and planning decisions arbitrarily, driven by political interests, anecdotal evidence and external agendas.

This article provides an overview of health information systems, including a description of the six components of a HIS as provided by the Health Metrics Network. Common issues and challenges, such as under-investment and neglect, are also discussed, along with recommendations for advocating, prioritising and strengthening HIS.

Health Information Systems

Health information systems (HIS), defined by the World Health Organization as integrated efforts to 'collect, process, report and use health information and knowledge to influence policy making, programme action and research', are essential to the effective functioning of health systems worldwide.[1] Routine HIS, such as those operated through health information departments or national statistics offices, provide information on risk factors associated with disease, mortality and morbidity, health service coverage, and health system resources.[2] Governments rely on the information provided to them from HIS for the production of high-quality, user-friendly statistical information on the health status of the community; the use and need of health services; formulating, monitoring and evaluating health policies; and measuring progress made in the provision of health services.[3]

HIS can also identify health problems; help to form effective health policies; respond to public health emergencies; select, implement and evaluate interventions; and allocate resources.[4]

Collecting, analysing and sharing health information is a complex process that requires a clear understanding of its underlying components and how these components interact. The Health Metrics Network provides a conceptual representation of the components and standards of a health information system in Figure 1:

1. HIS resources – such as appropriately trained staff, finance, logistics support and context-specific technologies. These resources (or inputs) must be situated within the broader legislative, regulatory and planning framework of a country
2. Indicators – the basis of a HIS strategic plan must include a core set of indicators and related targets that can provide a picture of the determinants of health, health system condition, and the status of population health
3. Data sources – such as civil and vital registration (births, deaths and cause-of-death), censuses and surveys, medical records, service records and financial and resource tracking
4. Data management – includes data collection, storage, quality, flow, processing, compilation and analysis
5. Information products – the transformation of data into information and therefore into a tool for evidence-based decision-making that will lead to improved health
6. Dissemination and use – increasing the value of health information by making it accessible to decision-makers and providing incentives for the use of health information.

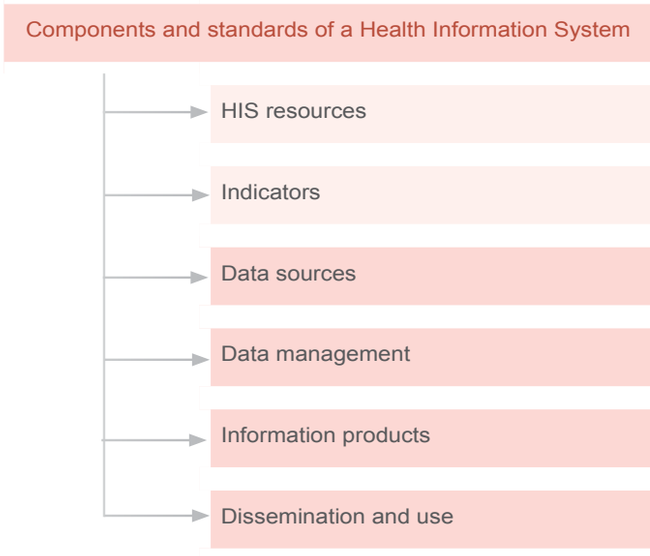

Figure 1 Representation of the components and standards of a Health Information System[5]

HIS are part of the wider statistical system, which covers non-health sectors such as education and employment.[2,6] Most traditional HIS collect data at a granular level by various means such as surveys, clinical observation, diagnostic testing or through management and financial information systems. They focus on individuals (citizens, patients, health care providers), characteristics of the services they need, use or deliver, the resources required to deliver those services and the impacts that they achieve. Those data are then consolidated, analysed and reported in various ways to create summary information for use by service providers, managers, planners, researchers, commentators and others with an interest in the health sector.[7]

Building a health system: The importance of information

HIS are a core building block of a health system.[1] Health information underpins the entire health system: it strengthens stewardship, can be used in strategic planning and priority-setting, as well as within clinical diagnosis and management, quality assurance and improvements, and global epidemics.[8-9] Healthcare information promotes excellence in care; describes the types of people using a service and the types of services received; helps coordinate services; provides meaningful information on the health status of the community; and ensures accountability.[3] A core value of the Health Metrics Network is that better health information will lead to better decision making, and as such, better health. Decision makers, for example, cannot identify problems and needs, track progress, evaluate the impact of interventions or make evidence-based decisions when they lack information.[5]

Data are becoming increasingly required to track performance, monitor progress and evaluate the effectiveness, efficiency and impact of health services.[1,8] Data are also driving more healthcare decisions, and many initiatives have been established to use data in monitoring performance improvement efforts, improving outcomes, and comparatively as benchmarks.[10-11] The elevated importance of data in health is reflected in the growing number of organisations and publications dedicated to the topic.

Several organisations have also recognised the role of data and information in healthcare, including the release of the United Nation's Fundamental Principles of Official Statistics;[12] publications from the World Health Organisation on improving data quality;[3] and more recently, the establishment of the Health Metrics Network in 2005, with its focus on improving global health and strengthening the systems that generate health information. Furthermore, in the recently released 'Keeping Promises, Measuring Results', the WHO's Commission on Information and Accountability for Women's and Children's Health listed 'better information for better results' as their top recommendation for improving the health of women and children.[13] Increasing the number of countries with well-developed systems to measure births, deaths and cause-of-death (vital statistics) was also listed as the top priority for improving information.

Recently (2011), the UN General Assembly emphasised the important role of HIS in addressing NCDs globally. This includes clauses 45 (k) and (j) of the UN General Assembly Political Declaration on the Prevention and Control of NCDs, noting the need to, *'strengthen, as appropriate, information systems for health planning and management, including through the collection, disaggregation, analysis, interpretation and dissemination of the data and the development of population based registers and surveys, where appropriate, to facilitate appropriate and timely interventions for the entire population' and 'give greater priority to surveillance'.* Further, clause 58 states the need to *'promote the use of ICT to improve … reporting and surveillance systems'* and throughout the resolution calls upon the need to identify evidence-based cost-efficient interventions, and strengthened monitoring and evaluation systems that, 'are integrated into existing national health information systems and include the monitoring of risk factors, outcomes, social and economic determinants of health, and health systems responses'.[14]

Issues and challenges

Despite global interest and investment in health outcomes, and the 'statistics maelstrom' this has produced, little is reliably known on the mortality or incidence and duration of disease in many developing countries.[11,15] It is still a struggle, for example, to answer simple questions such as 'who dies from what' for most of the world's population. While a basic building block of HIS is counting births and deaths, the stark reality remains that, 'most people are born and die uncounted, the reasons behind their deaths unknown'.[16] Due to historical, social and economic forces, most HIS are complex, fragmented and unresponsive to users' needs.

Furthermore, chronic under-investment in systems for data collection, analysis, dissemination and use mean that few developing countries have strong and effective HIS to monitor the health status of their populations or progress towards internationally agreed outcomes such as the Millennium Development Goals.[5,16]

Many HIS have technical inefficiency: they lack centralised databases, standardised processes and quality assurance procedures.[8] The statistical data skills and capacity of human resources are often overlooked, especially in developing countries, with staff poorly paid and undervalued.[9] Ministries of Health often do not manage large components of their HIS and authority over data collection is out of their control. HIS in countries where global health investments are directed are usually weak and fragmented by disease-focused data requirements, leaving them overwhelmed by multiple, parallel information demands and overburdened by excessive reporting requirements.[1,5,11,16-17] Many developing countries are also driven by historical norms, donor interests and lobbying pressures, with little incentives or capacity to collect, share, analyse and interpret local data.[18]

There is also a noticeable lack of evidence regarding HIS due to the limited role information systems play in research priorities, with current knowledge on the topic referred to as '*ad-hoc, disjointed, and an unsystematic collection of facts, figures and points-of-view'*.[17] HIS are historically a neglected field, and underinvestment continues to be the root cause of many weaknesses.[9] There remains a large disconnect between the need for information and a country's ability to respond. This tension between country needs and global demands raises many questions around what 'essential' information is, and who it is essential for.[11,19] It also questions how information can be created and used locally to respond to relevant local needs and demands.[19-20]

Data

While there is general agreement that improved health outcomes need strong health systems, much of the data and information produced from HIS, '*remain unprocessed, or, if processed, unanalysed, or, if analysed, not read, or, if read, not used or acted upon'*.[5]

That is, as well as having their own issues, HIS are also affected by issues related to their core building block: data.

Raw data alone are rarely useful; they must be converted into credible and compelling evidence; compiled, managed and analysed to produce information; integrated; and evaluated in terms of issues confronting the health system (Figure 2).[1] Data require an organised set of processes and procedures for this flow of collecting, collating, analysing and communicating: they need a fully functioning HIS.[9] It should not come as a surprise that many developing countries struggle with this complex task and have become what many refer to as '*data-rich but information-poor*'.[1,5] The issue of too much data and not enough information is not restricted to the health sector. In their research on rational data choice in politics, Mudde and Schedler[21] remark that while there is an abundance of cross-national political data, with datasets expanding every year, political actors are ill-equipped to deal with the luxury (and necessity) of choice. Due to issues of both information supply and quality, they conclude how, *'swimming in data wealth, we run the risk of drowning in numbers'*.[21]

Furthermore, despite the important role data plays in healthcare management, planning, monitoring and evaluation, there remains little awareness on the impact greater information use has in advancing health, and even less attention on the systems needed to provide accurate, timely and relevant information.[1,9] There is also a false assumption that data can be used directly by decision-makers; however, it must be presented, communicated and disseminated appropriately so that people understand the data and can link it to health issues, needs and actions.[4-5] Overall, common barriers to the use of data include poor quality of the evidence, failure to frame issues in a policy context relevant for decision-making, failure to package and present data in an understandable and compelling format, and a lack of trust in the overall quality of the HIS.[4] Factors compromising the quality of data include inadequate training for data collectors and processors; limited feedback from end-users; and a lack of understanding about the importance of data in health.[2]

What is needed to strengthen health information systems?

To advocate, prioritise and strengthen HIS, the following steps are required to support sustainable change at the national level:

- Country leadership and ownership – to advocate and lead sustainable change
- Responsiveness to country needs and demands – no 'one size fits all' approaches
- Building upon existing initiatives – it is important that strengthening strategies are realistic; recognising what can be achieved with the available resources and capabilities
- Supporting gradual and incremental processes with a long-term goal – ensure that HIS are included in country plans to guide investments.[22]

Conclusion

HIS are integrated efforts to collect data and transform it into useful information for use in policy, program action and research. Accurate, relevant and timely information on the health status of communities is essential to public health as it assists in identifying risk factors and the characteristics of people who use and need health services. HIS play a key role in health system stewardship, priority setting, clinical management, monitoring global epidemics, and resource planning. Better data can provide insight into public health

problems and guide the development of policies: both resulting in improved health.

However many HIS remain complex and fragmented due to years of chronic under-investment, with little awareness on the true value of information in health care. Many countries still do not have reliable information regarding trends in mortality and morbidity, and while many countries are collecting increasing amounts of data, there is a lack of appreciation that data alone have no value, as data must be transformed into information for use. Despite these issues and challenges, there is growing international demand and attention on improving HIS. This is a positive step forward in the wider recognition of HIS as an essential component of health system development, and continued work is required to strengthen HIS to support evidence-based decision-making.

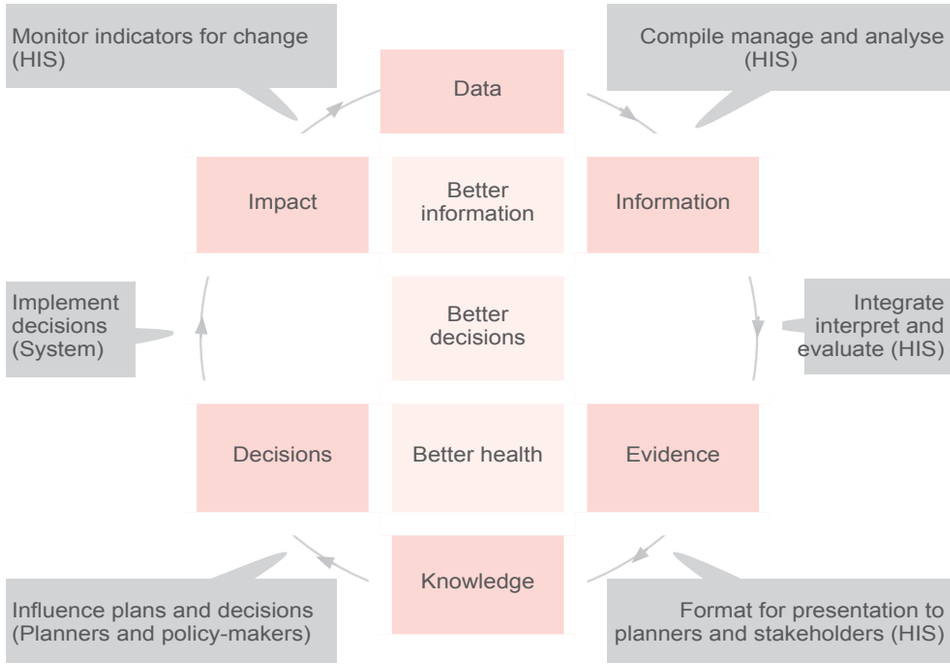

Figure 2 Cyclic representation of transforming data into evidence[5]

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Issues and challenges for health information systems in the Pacific

Original article

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For the full version of this paper, *Issues and Challenges for health information systems in the Pacific: Findings from the Pacific health Information Network meeting 29 September – 2 October 2009 and the Pacific Health Information Systems Development Forum 2 – 3 November 2009,* please contact the HIS Hub by email *hishub@sph.uq.edu.au* or download a copy from the website *www.uq.edu.au/hishub*

Abstract

The aim of this paper is to summarise common issues and challenges for health information systems (HIS) in Pacific Island Countries and Territories (PICTs) as identified by Pacific participants at two meetings held by the HIS Knowledge Hub in 2009 and provide suggestions for future action. The global agenda and drivers of HIS were discussed at both meetings to provide a clearer understanding of how Pacific Island countries are positioned within the larger international agenda. The two meetings provided the opportunity for participants to highlight suggestions for future action. Many of the solutions proposed highlighted the potential for regional solutions to progress the issue. This suggests an urgent need for national health authorities and regional partners to agree on strategies and programs to derive maximum benefit from regional HIS resources.

Introduction: The global HIS agenda

Globally there is an increasing understanding of the rigorous demands on HIS and the importance of a well functioning health system. This is being realised in the context of increasing requirements to be accountable for resource allocation and the need for measuring health outcomes. The interest of donors and policy makers in investing financially in HIS has been amplified so that performance requirements such as quality, coverage and efficiency, can increasingly be met. HIS now have many expectations placed upon them, and thus need to be shrewdly designed. They are expected to be fit-for-purpose to meet multiple user's needs and serve multiple purposes, regardless of perspective – be it from patients, providers, programme managers, communities, civil societies, and policy makers. HIS must inform all dimensions of health system performance; quality, coverage, and efficiency and provide this information in a timely way. An additional expectation is that HIS will be the basis for research and knowledge generation.

HIS in the Pacific

There is very little published on health information systems in the Pacific region. It is often thought that information from many Pacific Island Countries and Territories is incomplete, unreliable, obsolete and of poor quality.[1] To address these misconceptions and strive to close this research gap, the Pacific HIS Development Forum and a meeting of the Pacific Health Information Network (PHIN) were designed to bring together regional country stakeholders and global HIS leaders to engage in discussions regarding the latest knowledge developments in HIS. Both events were designed to synthesize greater knowledge about what is happening within the region, and provide an opportunity to discuss common issues and challenges and learn from relevant local advances.

Fifteen partner countries were represented at the Forum and/or PHIN meeting including:

- American Samoa
- Cook Islands
- Commonwealth of Northern Mariana Islands
- Federated States of Micronesia
- Fiji
- Kiribati
- Nauru
- Palau
- Papua New Guinea
- Republic of Marshall Islands
- Samoa
- Solomon Islands
- Tuvalu
- Tonga
- Vanuatu.

To summarise learning's from country presentations at the Forum, a number of concurrent working groups further explored key themes, priorities and knowledge gaps that had emerged from the country presentations. The paper has been structured around these six specific themes and identifies key issues and challenges for Pacific Island Countries in these areas and contains a number of suggestions for future action.

I. Improving data integration and sharing

Data integration is the effort to link independent data elements, sources, types or storage media to create new information. It covers all aspects of data handling from collection, storage, quality-assurance and flow, to processing, compilation and analysis. The goal of "perfect" data is largely unattainable because all data collection methods have weaknesses or limitations of one kind or another. In general, there is more scope for data omissions and for transcription and computation errors at the primary collection source, e.g. at the clinic level. As a result, data reported by health facilities often have issues with quality, particularly missing values, bias, and computation errors. This highlights the need for data quality assessment, including adjustment and reconciliation of data from different sources, in order to be able to use the data reliably for planning and to report progress on key indicators.

During the discussions held at the Forum and PHIN, participants recognised that collection of the same data multiple times for multiple purposes is inefficient and costly. They also noted that different sources of information often generate different results for the same indicator, for example maternal mortality ratios calculated via death registrations versus those calculated via Demographic Health Survey (DHS). While this can appear problematic, it can also allow a more critical appraisal of the reliability of different data sources. Reconciling and integrating data from multiple sources can serve a useful validation function and can also help fill critical data gaps.

For the Pacific Island Countries a number of common challenges with data quality and integration were identified:

1. Poor sharing of data among HIS stakeholders
2. Lack of clarity of ownership of data
3. Lack of HIS legislation or regulation
4. The need for unique identifiers
5. The need for data standards
6. Better use of technology to increase data sharing
7. Inadequate human resources for management of data.

Participants came up with a number of suggestions to improve data integration and sharing as indicated below. These included ideas for structural changes in health information systems as well as suggestions regarding the utility of normative frameworks to promote enhanced data sharing.

- The establishment of independent health statistics units
- Bringing together data from multiple sources into a data warehouse
- Developing an international standard or code of practice regarding data sharing
- Developing a core data set for sharing health information.

II. Increasing analytical skills among data producers

Data analysis is the process of transforming raw data into usable information, often presented in the form of a published analytical article, in order to add value to the statistical output.[2] It can be both quantitative and qualitative. At present, the health information systems in many low- and middle-income countries tend to be 'data-rich but information-poor'.[3] To meet the increasing demand for information to measure performance against national priorities and policies there is an urgent need to increase the data analysis skills of information producers. Meeting participants were asked to discuss what kind of data analytical skills are needed and to provide suggestions on how access to these could be improved. People producing health data are often from a variety of backgrounds, and are also often required to produce data for a variety of reasons. As such, the types of analytical skills needed are diverse, but effectively need to cover the following nine key areas of health information[4]:

- Census
- Population and household surveys
- Surveillance and response systems
- Continuous monitoring of births and deaths, with certification of cause-of-death
- Service-generated data (facilities and patient-provider interactions)
- Modeling, estimates and projections
- Behavioural surveillance (focus on risk factors)
- Health research
- National health accounts, financial and management information.

Based on this framework, the group identified a number of key challenges and issues that need to be addressed in the Pacific region; including:

1. Need to increase capacity for data analysis
2. Ensuring communication of analysis and findings

It was agreed that there is a need for:

- The delivery of appropriate training on data analysis
- Regional dialogue on the incentives for data collection at the health system level.

III. Potential for regional approaches to HIS

It was felt by the participants at both meetings that there is need for serious consideration of the potential of regional approaches to HIS in Pacific Island Countries. The geographic area covered by the region is vast; over 30 million square kilometers.[5] However, measured by population size, all countries in the Pacific are quite small, with the exception of Papua New Guinea. This leads to issues including isolation, remoteness and difficulties of transmission of data, but also with the scale and sustainability of infrastructure for any HIS activity. The collective strength of Pacific Island Countries advocating for the need for strong health information systems would be more successful than one country on its own, especially in niche specialist and technical areas of health information and technology development. A non-health sector demonstration of this kind of initiative currently underway in the Pacific region is the Pacific Rural Internet Connectivity System[6] which was established in 2008 by SPC and the Pacific Island Forum Secretariat to provide two-way internet connectivity. There are now 16 pilot sites across the Pacific region providing access to the internet to countries that previously did not have a stable connection.

Within the field of HIS there are many potential areas for a Pacific regional approach. The common challenges identified were:

1. Recruitment of HIS workforce
2. Retention of HIS workforce
3. Definition of core regional HIS competencies
4. The need for a Health Information Committee
5. Cost of information technology
6. Maintaining quality of mortality coding.

It was recommended that:

- A regional scoping project could be undertaken to define the core challenges for HIS positions
- Further research on evaluating the current sustainability of health information technology investments in the region is needed
- Work should be undertaken to establish either core specifications for a Chief Information Officer or for the establishment of a Health Information Committee that operates at an executive level
- An initial concept or business case for establishing a regional mortality initiative is needed.

IV. Strategies for advocacy for HIS

In many Pacific Island Countries health planning and policy decisions are made in the absence of reliable information and are often based on politics, anecdotal evidence, or donor pressure. It is a common scenario that HIS activities and personnel do not receive attention or financial support within a health system. Advocacy is needed to motivate decision makers to make investments and changes to improve data collection and quality, and therefore increase confidence in its validity as evidence. Advocacy is a combination of individual and social actions designed to gain political commitment, policy support, social acceptance and systems support for a particular goal.[7] Stakeholders need to think more about the actions needed to promote and increase understanding of HIS and the value of information.

From the presentations and discussions several challenges and issues were identified for the Pacific:

1. Advocacy for health information
2. Engaging decision makers.

It was recommended that:

- HIS staff need to be encouraged to align emerging HIS needs and activities to current management priorities (e.g. human resourcing shortages)
- HIS expectations of clinicians need to be increased during training at medical school by building HIS awareness into the curriculum.

V. The role of health surveys

Health surveys are a key source of population-based data and are used to reduce gaps in country health information collection where routine data may not be accurate or complete; such as vital registration systems. Surveys can be linked to other data sources to provide a broader picture of a health problem and non-health socio-economic determinants.[6] There are a multitude of surveys commonly undertaken in the Pacific; the best known of these include:

- WHO STEPwise approach to chronic disease risk factor surveillance (STEPS)[8]
- UNICEF Multiple Indicator Cluster Surveys (MICS) program focuses on child mortality, nutrition, immunization, environment, development, education and protection
- Demographic and Health Surveys (DHS).

In light of these examples, the meeting participants discussed some issues and challenges regarding the value and role of surveys within a HIS:

1. Linking surveys to routine surveillance
2. Making surveys accessible to stakeholders
3. Cost of surveys.

Recommendations include:

- Develop a Pacific regional review of the role of health surveys and a strategic plan to identify which information should come from routine HIS and which should come from surveys
- Develop a guide for survey methodology and questions.

VI. Use of institution-based data

Institution-based data are the by-product of operational activities and are often the only data that can be disaggregated down to provinces or districts. Institution-based data has been defined by HMN as consisting of three kinds. These are:

- Individual records: includes any documentation of services to individual patients
- Service records: measure and record occasions of health service, actions or events
- Resources records: measure and record administrative information about quality, availability and logistics of resources.[6]

Institution-based data is often the primary focus of attention for clinicians as it involves clinical data for the management of patient treatment, and is the source of information for health service managers to use for the management of the health service. It is usually the source of most performance indicator data (for example immunization coverage, number of overseas referrals, or cost of drug distribution). A limitation of institution-based data sources is that they are representative only of those who have accessed health services and may not cover vulnerable groups or those with less or no access to services.

Common issues and challenges identified were:

1. The quality of individual records
2. Transmission of data in geographically isolated areas
3. Using service and resource records for policy making
4. Validity of mortality reporting.

It was recommended that:

- Clinicians should develop a set of criteria to use for auditing medical records to determine deficiencies, as well as establish a process for the design or improvement of forms
- An investigation of emerging data transmission technologies should be carried out to determine if they provide practical and sustainable solutions for use in remote locations of the Pacific
- Interactive workshops for physicians and curriculum development for medical students about the correct application of the International Classification of Diseases (ICD) to certify cause-of-death need to be developed.

Conclusion

Health information systems need to be recognised as an essential component of health system development in the region and valued for their ability to provide evidence for decision making. Globally there is an increasing understanding of their critical importance within any well functioning health system to provide accountability for resource allocation and measuring health outcomes. This recognition is also taking place in the Pacific region and countries are being empowered to take ownership of their own health information and to take the lead in initiating strategies or action plans to address persistent HIS issues.

The suggestions for future action in this paper should not to be taken as a ‘wish list’ of HIS specific tasks that must be undertaken. What have been presented are the actual suggestions of Pacific Island participants in the context of the two HIS Knowledge Hub facilitated meetings. This paper has not sought to assess their comparative priority or feasibility of implementation. The practicalities of implementing these suggestions are vast and more properly determined by countries, requiring significant statistical organisational reform in countries, donor input, and regional consultation.

A number of common issues and challenges for HIS in PICTs were raised at the PHIN meeting and at the Pacific HIS Development Forum. Similar themes were raised by participants at both meetings, with many different countries sharing similar experiences. The key challenges detailed in this paper are:

- Improving data integration and sharing, particularly rationalizing duplication of effort, multiple data systems collecting the same data, and lack of clarity about data ownership and the benefits of data consolidation
- Increasing data analytical skills among data producers, particularly to assess the quality and completeness of basic health statistics such as mortality and causes of death
- Realising the potential for regional approaches to HIS to address problems associated with the small numbers of trained staff in many countries, and to more efficiently process data
- Strengthening strategies to advocate for HIS, including the need for producers and users of health data to be more aware of their potential to inform health policy debates
- Improving knowledge about the potential importance of health surveys, and increasing analytical capacity to analyse them to better support policy, and
- Making better use of institution-based data, particularly resolving issues around cost-effective means for data transmission, and improving practices and knowledge.

Many of the HIS issues and challenges in the Pacific region are similar to those identified elsewhere. However, it is in the solutions that the Pacific Islands are unique, as there is strong potential for regional solutions to collectively resolve some of these issues, especially in the area of data standards, workforce and technological investments. The way forward to address these HIS issues for the Pacific region is to work as a collective group; helping each other to provide advocacy for such an integral part of a health system.

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Issues and challenges for HIS in a small island nation

Case-study

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Summary

Kiribati is among one of the least developed countries in the world. Every year international agencies and other health stakeholders request information on Kiribati mortality and morbidity, but unfortunately most health data has never been analysed and therefore, health reports have never been formally provided. Despite this, Kiribati has taken important steps forward in improving its health information system (HIS) by prioritising health information in the Ministry of Health's Strategic Action Plan. The main purpose of this case study is to explore the HIS issues and challenges Kiribati faces, actions taken to address these challenges, its next steps, and key messages for other countries in the Pacific.

Health situation and trends

The Republic of Kiribati consists of 32 low-lying atolls and one volcanic island in three main groups (the Gilbert, Line and Phoenix Islands), stretched over 4,000 kilometres from east to west and 2,000 kilometres from north to south (Figure 1).[1-3] While the country only has a total land area of 811 square kilometres, it covers over 3.5 million kilometres of ocean, presenting significant challenges for both the healthcare and social service systems.[2] With such a widely dispersed population, those living on outlying islands are not always able to access (or afford) an airlift or boat to the nearest medical facilities.[1] Furthermore, the low-lying atolls of Kiribati are very vulnerable to climate change and rising sea-levels, with issues already arising from groundwater depletion, marine-life and sea-water contamination from human and solid waste, and over-fishing of the reefs and lagoons.[2] Protection of water sources from pollution, mainly from nearby sanitation systems, is a constant public health concern.

High internal migration from the outer islands to the capital, South Tarawa, coupled with ad-hoc urban planning and management has resulted in overcrowding, and inadequate sanitation.[2] As with many countries in the Pacific region, communicable diseases remain a significant disease burden in Kiribati. Tuberculosis (TB) incidence in Kiribati has surpassed that of other countries in the Pacific, and most cases are found in the urban settlement of Betio in South Tarawa.[2] Other health indicators suggest that the health of I-Kiribati living in South Tarawa is now worse than that of people living in the outer islands: in the 2005 Census, for example, the infant mortality rate in South Tarawa was higher than that in the outer islands.[2,4] Overall, life expectancy in Kiribati is low for the Pacific region. In 2009, life expectancy at birth was estimated at 65 for males and 70 for females (when only looking at the population in South Tarawa, life expectancy decreases to 58 for males and 65 for females).[2-3]

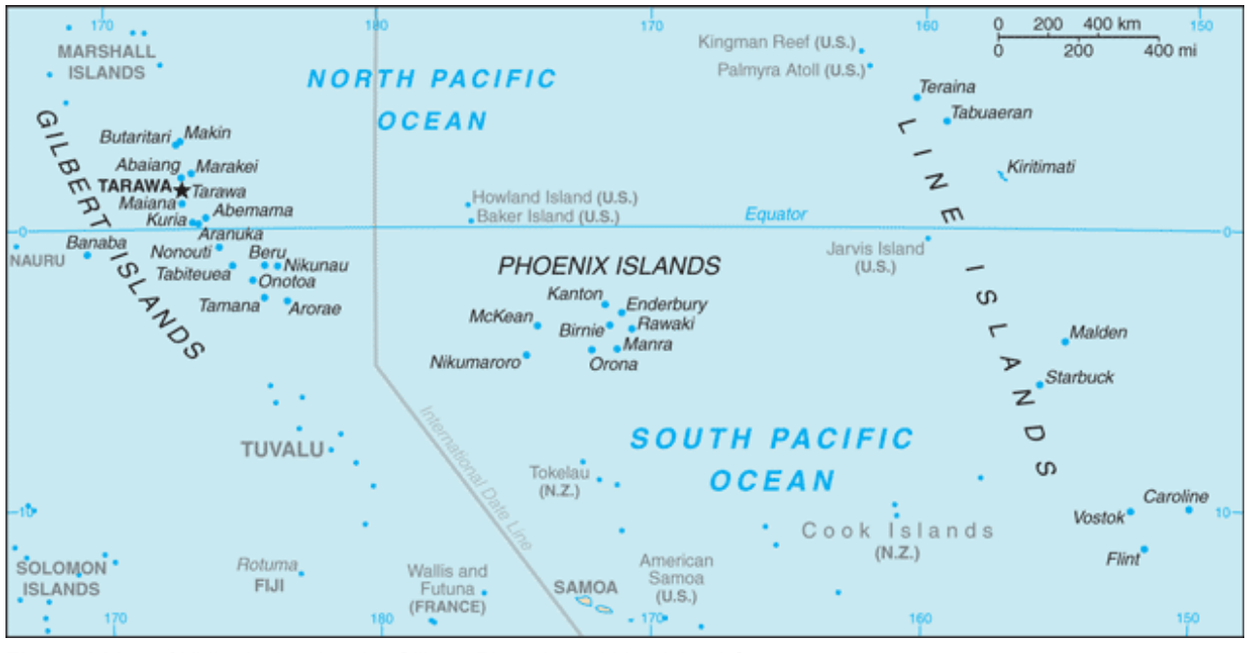

Figure 1 Map of Kiribati, showing the Gilbert, Phoenix and Line Islands[3]

Non-communicable diseases (NCDs) such as diabetes, high blood pressure, stroke, cancer and heart disease are also steadily increasing.[4] High smoking prevalence (approximately 76% of males and 48% of females), poor nutrition (99% of the population consume less than five combined servings of fruit and vegetables per day), and low levels of physical activity represent the major behavioural risk factors contributing to the growing epidemic of NCDs.[2,5] Physical risk factors, such as the increasing numbers of overweight and obese people (82% and 51% respectively) combined with a high diabetes prevalence rate, are also contributing to this growing health concern.[5]

Health system

Kiribati has a well-established, publicly funded, formal health system administered by a central Ministry of Health and Medical Services (MHMS).[2] In parallel a traditional health system also exists, provided by traditional healers and offering local medicines, massage and antenatal, childbirth and postnatal care. While most of the population use both the formal and traditional system, there is no coordination between the two.[2] Comprehensive primary health care services are offered through a network of 92 health centres and dispensaries located throughout the outer islands.[2] Health centres are managed by medical assistants and registered nurses who carry out additional training and also supervise up to eight dispensaries. Dispensaries are staffed by nurses and nurse aides employed by the Island Council. Six principal nursing officers, located in Tarawa, are responsible for the support and oversight of health services in each district and for selected national programs. The MHMS faces a number of challenges related to the quality of health service delivery, the availability of supplies, and the availability and maintenance of equipment.[2] There is no established system to ensure the quality of secondary medical and surgical services provided.[4]

The National Referral Hospital is situated in South Tarawa and provides a comprehensive range of curative services, while Kiritimati Island has a hospital providing basic surgical, medical and maternity services.[2] A new hospital has been constructed in North Tabiteuea, serving the Southern District of the Gilbert Islands, and there is also a small hospital providing basic medical services in Betio, South Tarawa.[2] Overall, these four hospitals and the one health centre in South Tarawa are the only facilities with medical physicians present. People requiring tertiary curative services are referred overseas if they fulfil the clinical criteria established by the MHMS, however this equates to a very small number.[2,4]

Despite significant challenges, including outdated public health legislation,[4] the standard of health care delivery has improved, with most health indicators showing positive results.[5]

The construction of 10 new clinics throughout the Gilbert Islands during the 2000's, and an improvement in the nurse-to-population ratio (from 1:450 to 1:375) has enhanced access to primary care on some of the outer islands.[5] In general though, outer island facilities are poorly supplied, maintained and staffed compared with those on South Tarawa, with many women isolated from basic maternal and infant health services. Much work is needed in this area, especially to improve the delivery of public health and basic curative services and to decrease the incidence of both communicable and non-communicable diseases.[5]

Situational analysis

A key objective of the HIS in Kiribati is to ensure the quality of its data in order to provide good information for planning and decision-making. One way to do this is to ensure the provision of quality data at the source. As part of their commitment to improving quality, in 2005 a situational analysis of the Kiribati health system was undertaken by senior managers within the Ministry, and 15 key issues were identified (see Box 1). From these 15 issues, six strategic objectives were agreed upon, forming the basis of the Ministry's Strategic Plan:

1. Improve I-Kiribati health status in the highest priority areas
2. Improve access to, and utilisation of, quality curative services to all I-Kiribati citizens
3. Improve the quality of public health service delivery through increased efficiency, effectiveness, sustainability, accessibility and affordability and also by being responsive to public health needs and ensuring continuity of care
4. Improve, manage and maintain appropriate legislation, health financing, plans, policies, protocols, systems and structures within MHMS
5. **Improve the quality of health information and data, in terms of its accuracy, timeliness and dissemination, in order to achieve better planning, decision making, allocation of scarce resources and monitoring and evaluation of performance**
6. Develop a well-performing, highly skilled and supported workforce to enhance the delivery of quality health services.[4]

The high ranking of improved health information to inform and monitor health planning reflects the strong support from management to invest in HIS improvement in Kiribati.[6]

Issues and challenges

Kiribati's health system faces many of the challenges faced by other Pacific Island countries; however its geography, isolation and small population exacerbate those challenges, including challenges associated with ensuring there is sufficient accurate, timely and relevant health information to inform planning, policy development and monitoring of health sector performance.[2,4] There are a number of quite complex issues experienced within the health information system in Kiribati. Some of these issues have been addressed, while others are still a 'work in progress'; many more remain unaddressed.

Box 1 Key issues arising from situational analysis[4]

1. Declining health status in South Tarawa compared to the outer islands
2. Unsafe water supplies and poor sanitation
3. An increase in infant mortality (main causes: diarrhoea, pneumonia and neonatal conditions)
4. The high prevalence of TB, an increase in STIs and ongoing threat of human immune-deficiency virus (HIV)
5. The increasing prevalence of non-communicable diseases
6. Outdated laws and regulations that don't meet current and future health situations
7. Policies, guidelines and management decisions that are not disseminated or followed by staff
8. Ministry of Health Operational Plans (MOPs) based on out-dated national strategies
9. **The poor quality of health information**
10. Lack of motivation among health staff
11. Significant levels of untrained or unskilled staff
12. Poor communication
13. Lack of quality control and patient focus
14. Unclear management reporting lines
15. Financial constraints to implementing MOPS

Back-log of unanalysed data

The Kiribati health information unit possesses a large amount of data within their system that has never been analysed. This is an issue for decision-makers as they are unable to access time-series data to assess the change in health status over time. Solutions to this issue include:

- A Senior Health Information Officer with basic experience in statistics has been appointed and is beginning to analyse the data by year, disease groups, age group and gender
- There is a plan to allocate staff with training in the International Classification of Diseases Version 10 (ICD-10) to work in Betio, Christmas Island and Southern Kiribati hospitals to code and enter the back-logged data
- A workshop was carried out in November 2011 at the National Non-Communicable Diseases Centre at Bikenibeu, with technical assistance from WHO. The workshop was designed for staff from the health information unit and provided basic data analysis skills, including the use of statistical software (such as Excel).

The need to classify health information

The coding of certain diseases has had to be recoded, to ensure they are consistent, as the reporting template has changed three times since the 1990s, due to changes in reporting requirements. Also compounding this issue is the fact that only three staff have undergone training in using ICD-10. The Senior Health Information Officer has been tasked with analysing and classifying this data.

Patient registration duplication

This is a significant issue due to the movement of people from the outer islands to the main island, as there is no formalised system in place for recording (and cross-checking) patient details. This means the same patient and their health system interactions may be captured multiple times in the data, and lead to double-counting. A workshop is planned with health workers from South Tarawa and the outer islands on the concept of data quality, especially the need for accurate patient identifiers. Work is also required to develop consistent processes for recording and registering patients from one clinic and/or island to the next.

Mortality data gaps

Cause-of-death from Betio, Christmas Island and the Southern hospital have never been coded or analysed on a consistent basis. Further, as there is no medical records officer on Christmas Island, data has never been coded there. Solutions to this issue include:

- The medical records officer in Betio hospital has been requested to report to the main hospital every month on the number of inpatients, discharges and deaths. Inpatient and death data will be coded and sent to the centre every month
- The MHMS has also endorsed the funding of one medical records officer on Christmas Island from 2012.

HIS database

Data stored in the database is hard to analyse due to difficulties in extracting and comparing data over the years, especially as data is now stored in a Microsoft Access database (previously Excel was used). The database can only provide aggregate information on age-groups for the population, and as it is an ICD-10

coded database, can only provide aggregated information on certain disease groups (for example, information on sexually transmitted infections cannot be broken down into specific types, such as syphilis or Chlamydia). There is a plan to review and modify the reporting template, as this determines the information entered into the database. Health clinics in South Tarawa, Betio and the outer islands will also report single-year ages (not age groups) by the next census in 2012.

Storage of decentralised health data

Medical records often sit within each of the main units or departments in hospitals and have not been collated at a central level. In order to improve the quality of health data, it is important that the Health Information Unit has a copy of all data stored in one central office. Kiribati is currently in the process of centralising all health data. So far, DOTs data, leprosy data, diabetes clinic data and data from the gynaecology clinic have been centralised at the Statistics Office.

Collection of surveillance data

Transport difficulties between the islands mean that health surveillance data is not entered every day, resulting in a delay in notification of an outbreak. A solution to improvement the timeliness of surveillance notification is under development.

Conclusion: Next steps and key messages

Transforming health data into meaningful information is a challenge due to its broad and complex nature. The next steps for Kiribati to ensure continued improvement in its HIS is to build on its strengths and continue to work on its weaknesses. It is important that an Annual Report is produced, so that decision makers can access data on the trends in mortality and morbidity and gain a better understanding of the health status of the population. Such a report has not been produced for almost five years, and while it is a difficult task, the Ministry is committed to producing one in early 2012.

It has been noticed that many health leaders do not use heath information when making decisions, do not know what the information produced could be used for, and so do not see the importance of health information units. As such, workshops on how to make data useful to the Ministry are also very important, as are advocacy activities in general (including the development of the Annual Report). Overall, regular investment from technical partners and sharing across relevant stakeholders will help improve health data in Kiribati.

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Health information challenges for Papua New Guinea

Case-study

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Introduction

Papua New Guinea (PNG) has a reasonably well-established national health information system (NHIS) which provides essential information on health services and health status. The NHIS has been operating since 1987, and collects information monthly from all health centres and hospitals.[1] Though the health information generated is generally of good quality, it is not used extensively at all levels of the health system for planning and management. Information and data are often unavailable due to a lack of staff skills in analysis and report writing. Information and communications technology (ICT) and infrastructure are poor and reporting is still paper-based, resulting in delays.

This case study outlines PNG's plan to address some of these health information system challenges. The goal is to strengthen the NHIS to provide quality information in a timely manner that is used by all decision makers at all levels of the health system. The challenges in PNG's health information system require a systematic approach to effectively address them both in the short and long term. Strong partnerships with relevant stakeholders, guided by key national policy guidelines including HIS and ICT policies and a NHIS Strategy, are critical to guide the strengthening and maintenance of a high quality NHIS in PNG.

Strengthening the National Health Information System

The vision for the NHIS in PNG is to produce high quality, relevant and timely health information to support the delivery of improved health services. The information generated must be available and used at all levels of the health system for effective health planning and management.

However, the paper-based NHIS is time consuming and places a heavy burden on clinicians. In addition, the paper reports result in transportation delays from the health facilities to the provincial health office. All primary recording of data from the 800 health facilities is completed on paper forms, which are transported to provincial offices and the data entered into a desktop computer. Data are then transferred to the national department of health to be analysed.

Transmission of data to the national level is further delayed because of poor, or in some cases, a lack of, electronic communication infrastructure. Currently, updated copies of provincial data are mailed to the Monitoring and Research Branch at the national level, running the potential risk of being lost or stolen. Delays in data transmission from health facilities to the national level can take between three to six months resulting in delayed, or a lack of feedback to health facilities.

The lack of feedback to facilities from the provincial or national health offices often results in the poor quality of reported data. Facility reporting staff, who are most often health workers with minimal training in data collection and analysis, are unable to detect changes in disease trends or detect whether there are mistakes in the data collected. It is only when they are provided with feedback from provincial or national health offices on data quality issues, that they are able to improve the data. Furthermore, the provision of feedback from the provincial or national levels to health facilities encourages continued data collection and reporting, as people feel they are contributing to the system.

It is expected that the delays and risk of lost data will be minimized after the completion of a three year ICT project, which started in 2011. Faster transmission of data will also allow data sharing and feedback, resulting in improved data quality. The HealthNet project is fully funded by the government of PNG (GoPNG) as a health sector development project to improve the current ICT electronic infrastructure. Phase I of the project focused on upgrading and strengthening the databases and server at the national level. Phase II and III will see the rollout to provincial health offices and hospitals in the 22 provinces in 2012 and 2013. The National government is also rolling out a major Integrated Government Information System (IGIS) project to link all departments' databases for easier access and sharing of information. The IGIS project will also provide support to the Health Sector, thus minimising the cost of the HealthNet project. After completion of these projects, transmission of data will be faster and feedback to the provinces will be provided in a timely manner. It is envisaged that data entered at provincial level will be linked to a national database.

There will be quarterly feedback to the provincial health offices from the national level, while provinces will be expected to communicate monthly with reporting facilities to address data quality issues. The rollout of the NHIS database and email connectivity to provincial health offices and hospitals has resulted in faster transmission of data. Reporting rates have increased on average by 90% in the past five years and will further improve with the rollout of Phases II and III of the HealthNet project.

The NHIS requires a highly skilled workforce at both the national and provincial levels. The National Department of Health (NDoH) is currently recruiting staff skilled in statistics, epidemiology and demography. A capacity needs assessment will be carried out at all levels to assess the competence and skill level of staff. This will be followed by a comprehensive capacity development plan as addressed in the Monitoring and Evaluation Strategic Plan 2011-2020 that will upgrade the skills and knowledge of national level staff. Provincial health advisors and provincial hospital chief executive officers are beginning to realize the critical role provincial health information officers (PHIOs) play in providing health information to their superiors in a timely manner. Some provinces have started rewriting the job descriptions of their PHIOs to include data analysis and reporting. Under the M&E Strategic plan it is envisaged that PHIOs will take on more analytical roles at the provincial level in addition to data quality assurance and the supervision of reporting facilities.

Given the added responsibilities and skill set required for the roles, the salary grading will also increase. PHIOs will now play a strategic role in providing their superiors at provincial levels with more updated information in a timely manner. Technical assistance is needed from training institutions to train this critical mass of personnel with the skills and knowledge to perform their tasks better. Training will be targeted at three levels of workers:

1. Data collectors will be trained on data collection methods to minimise errors and improve data quality
2. PHIOs will need skills in epidemiology and statistics to do basic analysis and monitor disease trends at provincial levels
3. National level staff will require skills in secondary data analysis and report writing to support evidence-based decision making.

The national level will continue to provide overall guidance through policies, plans and national benchmarks, and high-level analysis. Provincial health offices will be staffed and equipped to analyse data monthly on selected indicators, disaggregated by health facility. The provincial and district quarterly reviews are important avenues where information generated by the NHIS can be disseminated to stakeholders to make more timely decisions.

The Performance Assessment Framework (PAF) in the Monitoring and Evaluation Strategic Plan of the National Health Plan 2011-2020, gives a guide on what indicators to track on a monthly, quarterly and annual basis at the health facility, district, provincial and national levels. Health centres will provide the district health manager with a report card on a minimum of five indicators (staff, funding, aid posts open, drugs and supervision) on a monthly basis. The PHIO will provide quarterly and annual reports on indicators focusing on MDGs and Minimum Priority Areas (MPAs) that will include support for rural health, access to services, maternal and child health, disease control and medical supplies. The capacity of facilities to compile monthly statistics, and districts and provinces to generate and submit regular and timely quarterly reports, produce information sheets and newsletters, will be enhanced through the provision of ICT systems as per the Monitoring and Evaluation Strategic Plan.

Next steps

Effective strengthening of the NHIS requires networking and partnership with key central agencies to work under proper policy guidelines. This process requires a phased approach starting with an upgrade of the current database and server at the national level, followed by a gradual rollout to provinces. The goal is to have data entered at provincial level and linked to the national level.

Regular reviews through monthly facility audits and provincial and district quarterly reviews will strengthen and improve data quality. Regular feedback from provincial to district and facility levels, as well as from the national to provincial level, will greatly improve data quality and use. Providing feedback to those who generate data increases their sense of ownership of data thus enabling them to take more time and care to do a better job. Information will be demanded more as policy development and program planning move into the direction of evidence-based planning.

It is important that available technical and financial assistance is leveraged to improve data quality and ensure continued provision of quality patient care. Proper training of a critical mass of skilled data collectors, provincial data quality assurance and analysts, and national data analysts is one way to progress towards improving the quality and use of data.

Key stakeholders and partners who have a niche role in specific areas of the NHIS will be identified and their support sought. For example, the Secretariat of Pacific Communities (SPC), have offered to assist PNG in the area of Civil Registration under the Pacific 10 Year Statistics Strategic Plan. The department will seek technical support in the areas of NHIS and ICT policies and infrastructure from WHO and possibly training on ICD 10 Coding and Death Certification from the University of Queensland. These are just a few of the many areas to be explored when addressing NHIS in PNG.

Conclusion

Papua New Guinea has a reasonably well-established national health information system. However, the vision of the NHIS – to produce high quality, relevant and timely health information to support the delivery of improved health services – is hampered by numerous technical and logistical challenges. The paper-based data recording system is time-consuming for clinicians and there are significant time delays and data security issues when transferring data between institutions. There is a lack of demand for health information and limited accessibility for users. Limited workforce capacity and expertise further exacerbate these problems. There is also a need for improved communication and coordination between the different operational levels within the health system and a need to enhance networks and partnerships with key central agencies to develop policy guidelines. Linked to all these challenges are poor information and communications technology and infrastructure.

The commencement in 2011 of the three-year HealthNet project signals an opportunity to address these challenges and strengthen the NHIS in PNG. A NHIS policy has been developed that will provide guidance on strengthening health information governance systems and development of strategies to strengthen and bring coherence to data collection, analysis, dissemination, use and feedback. The ICT project will develop the infrastructure for health information in PNG, upgrading the databases and server. It will also link with the Integrated Government Information System (IGIS) project for easier access and sharing of information between different departmental databases. At the same time, the National Department of Health is recruiting staff skilled in statistics, epidemiology and demography to strengthen the HIS workforce. These staff will be given the opportunity to upgrade and advance their knowledge and skills as part of the comprehensive capacity development plan addressed under the NHIS Strategy.

Improving the ICT infrastructure will hasten data entry, transmission and analysis, and improve communication channels. When merged with the strategies to build an expert workforce and link health information across all government sectors, opportunities will arise to improve user accessibility to health information and create demand so that information will be more readily used for policy and practice. The HealthNet project and its links with broader health and cross-sectoral initiatives therefore represent a significant step in ensuring that the goal and vision of the NHIS can be fully realised. That is, to produce high quality, relevant and timely health information that decision makers at all levels of the health system can use to support the delivery of improved health services in PNG.

Further reading

- Papua New Guinea National Health Plan 2011-2020
- Information and Communications Technology Policy & Enabling Policy 2011
- Health Information System Policy 2011
- Monitoring and Evaluation Plan 2011-2020
- Pacific Health Information Network Regional Health Information Systems Strategic Plan 2012-2017

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Why strengthen health information systems in the Pacific, and how could this be done?

Policy brief

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Executive summary

In an environment of increasing accountability and dwindling resources, timely, accurate and up-to-date information is critical to inform evidence-based policy decisions. This policy brief provides practical recommendations on how health ministers in the Pacific can strengthen health information systems. The recommended actions to strengthen health information systems are:

- Increase staff ability to critically assess the quality of data
- Increase staff ability to utilise data collected at various levels of the health system
- Make use of simple computer programs like Excel to produce graphics that may be more easily used by staff
- Increase the use of vital statistics and improve civil registration systems
- Review legislation in regard to health information systems.

Introduction

There is an increasing demand from donors, governments and communities for health systems to accurately account for resources and to demonstrate improvements in the health of populations. Health ministers require timely, accurate and up-to-date information if they are to make evidence-based policy decisions to address issues that impact on health systems including:

- The emerging epidemic of non-communicable diseases threatening the Pacific Region[1]
- An increasing impact on health from natural disasters
- Ongoing major health concerns from infectious diseases including HIV, tuberculosis and malaria.[2]

An effective health information system is the foundation of a well-functioning health system and is a key component in improving health outcomes.

However, health information systems in the pacific are often described as 'data-rich but information-poor' and therefore require targeted strategies to ensure that timely, relevant and up-to-date information is available to support evidence-based decision-making.

Why is this issue important?

Without health information systems to inform decision-makers of where the health problems are, and whether the health of the population is improving or getting worse, sound judgements cannot be made. Investing in health information systems is therefore vital for creating a strong health system that will improve the health of a population.

The health information systems of many Pacific Island Countries and Territories have numerous expectations placed upon them from a range of stakeholders, for example:

- Patients and communities
- Health providers and program managers
- Policy-makers
- International and global players such as the World Health Organization (WHO), Australian Agency for International Development (AusAID) and international non-government organisation (NGOs).

These stakeholders have different uses of information, including:

- Targeting their program or service activities
- Advocacy purposes
- Tracking trends for reporting on Millennium Development Goals (MDGs).

There is a common belief among donors and senior managers in government that information from many Pacific Island Countries and Territories is typically incomplete, unreliable, obsolete and of poor quality.[3] This is not universally the case. A systematic review of health information systems in several countries and territories in the region has identified both the strengths and weaknesses of their systems, thereby addressing this misconception with evidence.[4]

What does the research tell us?

There is very little published on health information systems in the Pacific region. To address this gap, the Pacific Health Information System Development Forum and a meeting of the Pacific Health Information Network (PHIN) were held in 2009, to share knowledge and expertise among a broad community of stakeholders. As a result of these meetings, a range of learning emerged that identified key themes, priorities and knowledge gaps for Pacific Island countries in health information systems.[5] These included the following areas for action:

1. **Improving data integration and sharing.** Collection of the same data multiple times, for multiple purposes, is inefficient and costly. Duplication of efforts must be avoided. Ownership of data must be clarified and data quality requires improvement. Better integration and enhanced data sharing depends critically on improved human capacity and appropriate technological infrastructure. Bringing together data producers and data users is a vital step towards strengthening health information systems
2. **Increasing data analytical skills among data producers.** The analytical skills needed are diverse. Emphasis in the Pacific should be on increasing skills to assess the quality and completeness of basic health statistics such as mortality and cause-of-death
3. **Realising the potential for regional approaches to health information systems.** The Pacific region is vast yet the population is quite small, resulting in insufficient numbers of qualified professionals available in countries to support minimum health information system requirements. Regional approaches have a role to play to address problems of recruitment and retention, to efficiently and cost-effectively process data, as well as improve data quality
4. **Strengthening strategies to advocate for health information systems.** Advocacy is needed to motivate decision-makers to make investments and changes to improve data collection and quality. This will increase confidence in the information for policy and planning purposes
5. **Improving knowledge about the potential importance for health surveys.** Health surveys play a key role in reducing gaps in country health information when routine data may not be accurate or complete. Increased capacity to analyse, use and connect health survey data will support policy by providing a broader picture of a health problem and other socio-economic determinants
6. **Making better use of institution-based data.** Institution-based data is usually the source of most performance indicator data and is the source of information for use in managing a health service. Finding cost-effective means for data transmission, plus improving quality and use of data for using in policy-making decisions is essential.

Recommendations

The following can be done to strengthen health information systems through better access to and use of existing data:

- Increase staff ability to critically assess the quality of data
- Increase staff ability to utilise data collected at various levels of the health system
- Make use of simple computer programs like Excel to produce graphics that may be more easily used by staff (guidelines and tools have been developed to assist this process)
- Review legislation in regard to health information systems
- Increase the use of vital statistics and civil registration systems.

Conclusion

Health information systems need to be recognised as an essential component of health system development in the Pacific: they must be strengthened to support sound decision-making that is based on evidence. The key messages to assist strengthening of health information systems are:

1. Improve data integration and sharing
2. Increase data analysis skills among data producers
3. Realise the potential for regional approaches to health information systems
4. Strengthen strategies to advocate for health information systems
5. Improve knowledge about the potential importance of health surveys
6. Make better use of institution-based data.

The evidence used to develop this policy brief was gathered during two meetings on health information systems held in 2009. Fifteen partner countries were represented including:

- American Samoa
- Cook Islands
- Commonwealth of Northern Mariana Islands
- Federated States of Mirconesia
- Fiji
- Kiribati
- Nauru
- Palau
- Papua New Guinea
- Republic of Marshall Islands
- Samoa
- Solomon Islands
- Tuvalu
- Tonga
- Vanuatu

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The Pacific Health Information Network: Progressing HIS in the region

Case-study

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The Pacific Health Information Network

The Pacific Health Information Network (PHIN) is a non-government, not-for-profit organisation established at a Health Metrics Network meeting in Noumea in 2006. It was created to provide a mechanism for networking, support, information sharing and training for people working as health information professionals in the region. The vision of PHIN is that health in Pacific Island Countries and Territories (PICTs) is enhanced through better use of quality and timely information. PHIN aims to support health systems achieve better outcomes through strengthening the quality and improving the use of health information. To achieve this PHIN has a number of regional target outcomes including:

- Supporting the integration of health information systems and to ensure that cost-effective, timely, reliable and relevant information is available, and used, to better inform health development policies
- Promoting health information systems in the broader health system strengthening agenda
- Implementing standards-based, interoperable information systems
- Providing a sustainable competency-based capacity building mechanism for networking, collaborative support, information sharing, technical transfer, and training for people working as health information professionals.

Membership

Membership is currently free for individuals and institutions, and members must complete an application form to be officially registered with the Network. PHIN members are encouraged to recommend other colleagues in the region to join the Network to broaden and strengthen its effectiveness. As of March 2012, there were 48 PHIN members from 14 different PICTs, including:

1. The Cook Islands
2. Federated States of Micronesia
3. Republic of Fiji
4. Hawaii
5. Republic of Kiribati
6. Republic of the Marshall Islands
7. Republic of Nauru
8. Republic of Palau
9. Papua New Guinea
10. Independent State of Samoa
11. Solomon Islands
12. Kingdom of Tonga
13. Tuvalu
14. Republic of Vanuatu.

Members represent a range of professional organisations and roles, including health planning and information managers, medical records officers, statisticians, health information officers, quality assurance officers and IT directors. The website for PHIN, www.phinnetwork.org, is a portal for PHIN members to apply for membership, access PHIN documents and links to online resources. It allows individual members to post profiles, utilise discussion groups for inquiries and peer-assistance, and learn about upcoming events and opportunities.

Regional Health Information Systems Strategic Plan

In November 2010, a joint meeting was held with representatives from PHIN, the WHO Western Pacific Regional Office (WPRO) and the Health Information Systems Knowledge Hub (HIS Hub) at the University of Queensland, Australia. The purpose of the meeting was to explore opportunities in supporting the PHIN to develop a Regional HIS Strategic Plan, including enhancing local capacity in technical expertise, facilitation and communication, and evaluation and monitoring.

In recognition of the strong desire for a regionally coordinated approach to addressing many of the common issues and challenges faced by PICTs, and building on the *Health Information Systems Strategic Plan for the Western Pacific Region* developed by WPRO in 2005,[1] PHIN developed a *Regional Health Information Systems Strategic Plan (2012-2017)*.

The goal of the PHIN Strategic Plan is to align all HIS stakeholders to a common vision and way forward to maximise every investment in HIS throughout the Pacific and provide a framework for action to aid HIS professionals achieve better health outcomes. The purposes guiding the strategy are complementary and together encompass a coordinated approach to HIS capacity-building in the Pacific for effective and sustainable HIS improvements and accountability. The five primary purposes are to:

1. Enhance the capacity of HIS professionals in PICTs to achieve and sustain well-functioning HIS through country-led processes, national HIS planning and development, implementation, progress monitoring, and evaluation
2. Strengthen coordination of regional-level responses by delivering tailored country-focused HIS support better and faster in a transparent and more collaborative manner and enable technical transfer, knowledge sharing and learning across PICTs
3. Mobilise resources and expertise to assist PHIN members to achieve their health information needs
4. Help PICTs to achieve and report on their national and international targets in response to improving HIS
5. Accelerate momentum in HIS in the Pacific by reinforcing and complementing the diverse activities already underway or planned at regional and country levels.

The Strategic Plan recognises health information as a national asset to improve the health of individuals and strengthen health systems in PICTs. Members of PHIN endorsed the Strategic Plan in August 2011 in Nadi, Fiji. In endorsing the six-year regional plan, HIS professionals, development partners, technical agencies and institutions recognised the urgent need to effectively address HIS issues and challenges in the region (a sentiment endorsed at the 9th Health Ministers Meeting held in Honiara in June 2011). A PHIN Implementation Working Group (IWG) was tasked with developing a detailed Implementation Plan to operationalise the Strategic Plan, with the support of the HIS Hub and WPRO.

Strategic Action Points

The following section outlines the six strategic action points within the Strategic Plan, which were selected after a number of consultative meetings on common issues and challenges faced by PICTs. The action points are as follows:

Professionals working in health information systems in Pacific Island Countries and Territories shall promote and use reliable, complete and timely information for decision-making and for achieving greater health outcomes

1. Advocate for the recognition of and improvement to HIS within PICTs
2. Enhance institutional capacity and opportunities for workforce development and training
3. Strengthen the application of information and communications technology (ICT)
4. Improve data integration, quality and sharing
5. Develop policies, regulations and legislation on HIS-related issues
6. Enhance HIS leadership and sustainable governance.

Advocacy

'*Advocacy can be thought of as the pursuit of influencing outcomes – including public policy and resource allocation decisions within political, economic and social systems and institutions – that directly affect people's lives*'.[2] Advocacy is a dynamic process that involves a number of actors, ideas, agendas and politics, and as such, it requires a number of different strategies or techniques.

As many health planning and policy decisions are made in the absence of reliable information, advocacy is needed to motivate decision makers to make investments and changes to improve data collection and quality. Advocacy also increases our understanding of HIS and the value of information in health systems. The goal of advocacy should be to stimulate a culture of evidence and enthusiasm for data utilisation that will lead to increased demand for information and drive improvements from the top down. It is also critical to take a multi-sectoral approach by engaging with other government departments at a high-level.

There is a clear need to identify 'HIS Champions' at senior levels who come from a variety of backgrounds (or professional groups) within the health sector: clinical, administrative, academic and political. These champions will act as central advocates for their respective professional groups for the promotion of HIS, and mitigate problems if they arise.

Institutional capacity and workforce development

Workforce development is a '*multi-faceted approach which addresses the range of factors impacting on the ability of the workforce to function with maximum effectiveness*'.[3] It is more than just the education and training of individual workers: enhancing capacity needs

to be broad and comprehensive and have a systems' focus. This includes government policies and strategies; organisational structures, systems and culture; and knowledge, skills and experience, as demonstrated in the figure below.

Figure 1 The strategic imperatives model[3]

To meet the increasing demand for information to measure performance against national priorities and policies, there is an urgent need to increase the data analysis skills of information producers. The people who produce data can be from a variety of backgrounds and be required to produce data for a variety of reasons. Similarly, the types of analytical skills needed are diverse, but effectively need to cover the nine key areas of health information:

- Census
- Modeling, estimates and projections
- Population and household surveys
- Behavioural surveillance
- Surveillance and response systems
- Health research
- Continuous monitoring of births and deaths, with certification of cause-of-death
- National health accounts, financial and management information
- Service-generated data.

Institutional capacity and workforce development are important strategic action points as countries in the Pacific are faced with major issues in relation to workforce (training, retention, coverage, etc). However, it is vital to focus on upgrading institutions (rather than people) as people move between roles, organisations and countries. By supporting institutions and the structures that affect performance and outcomes, we can ensure there will be enough skilled workers for the future.

Information and communications technology

The use of emerging information and communications technology (ICT) has increased rapidly in all development contexts, including healthcare. It is believed that the use of appropriate technologies can increase the quality and reach of both information and communication. ICT can be used to transfer large amounts of data across large distances and assist in the management, storage and retrieval of important health information.

However, decisions on what ICT to adopt are often made without evidence of their effectiveness; or information on implications; or extensive knowledge on how to maximise benefits from their use. While there is a large and growing body of work exploring health ICT issues in the developed world, and some specifically focusing on the developing country context emerging from Africa and India; there is very limited research on the use of ICT in the Pacific region. This strategic action point is one of the most important, and most challenging, areas for action within the Strategic Plan.

Improve data integration, quality and sharing

Integration involves linking independent data elements or data from different sources so that they can be collected, stored, processed, compiled and analysed together. Integration can take place at many levels of a HIS. While there is no one 'simple' definition of quality, it includes aspects such as timeliness, accuracy, completeness, and reliability.[4-5] Overall, quality refers to the 'fitness for use' of data for a particular reason. Improving data integration, quality and sharing are key strategic areas for action as the collection of the same data multiple times for multiple purposes is inefficient and costly. Furthermore, improving the quality of data produced in-country is an important step forward in getting people (and organisations') to trust the data, and as such, use it.

Enhance HIS leadership and sustainable governance

Governance is what a government 'does': it refers to the use of political authority and institutional resources to manage society's problems and affairs and also the capacity of the government to formulate and implement sound policies. Effective leadership, on the other hand, is the ability to successfully attain goals through the use of available resources, such as people and funds. Strong leadership and governance are important as people in senior roles need to promote HIS and mitigate potential problems if they arise. Furthermore, without the support of leaders and senior decision makers, few attempts at strengthening HIS will succeed. Enhancing leadership and governance is also a key strategic action point as it provides people involved in policy development and change with a cohesive framework for improved collective action.

Implementation and the way forward

Implementation of the Strategic Plan will cover the six-year period from 2012 to 2017. The coordination and performance framework for implementation of the Strategic Plan have been documented in the *Regional Health Information Systems Strategy Implementation Plan* (RHISSIP). The purpose of activities under the RHISSIP is to:

- Align directly with the vision and broad objectives of the Regional HIS Strategy for implementation through country-led processes, enabling long-term and sustainable national HIS implementation planning, progress monitoring, and regular follow-up
- Deliver tailored HIS support better and faster in a transparent and more collaborative way using a regional country-focused approach, which enables a flexible platform for emergent requests for technical assistance to be rationalised, resourced, and implemented
- Build greater trust among PICTs and development partners and accelerate momentum in HIS in the Pacific by reinforcing and complementing the diverse activities already underway or planned at regional and country levels
- Ensure the primary focus is on training and retention of HIS professionals that will secure stronger and sustainable HIS capacity directly in the Pacific.

Implementation activities are already underway, with three key areas of work outlined in the first phase (2012-2013):

1. Enhancing HIS leadership and sustainable governance
2. Enhancing institutional capacity and opportunities for the creation of professional development pathways
3. Advocating for the recognition and improvement to HIS within PICTs

PHIN has catalysed support from development partners working in health information and vital statistics in the Pacific, including the WHO Western Pacific Regional Office (WPRO), the Secretariat of the Pacific Community (SPC), University of Queensland HIS Knowledge Hub, Fiji National University (FNU), the Pacific Health Information Officers Association (PIHOA), AusAID, plus other development partners. Successful collaborative initiatives are underway across the Pacific with excellent leadership and coordination by all partners.

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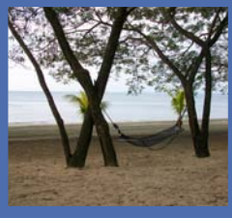

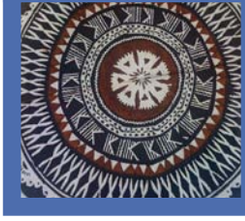

Strategic Actions for Strengthening HIS

Overview of section

Advocacy

- *Original article:* Advocacy for strengthening civil registration and vital statistics
- *Case-study:* Improving vital statistics in the Pacific 2011-2014

Human Resources

- *Original article:* Improving the quality of HRH information
- *Original article:* Training workshop to improve the use of existing datasets
- *Original article:* Building health system capacity: A training course on health information systems
- *Original article:* Improving utilisation of demographic and health surveys as a source of health information

Quality

- *Original article:* Quality for health information: What does it mean, why does it matter, and what can be done?
- *Original article:* Improving the quality and use of health information systems: Essential strategic issues
- *Case-study:* Health information needs for producing National Health Accounts

- C*ase-study:* Improving adolescent reproductive health - the importance of quality data
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Leadership

- *Case-study:* Improving health information systems for better health policy and planning
- *Case-study:* Health information systems reform: The Fiji way
- *Original article*: A review of health leadership and management capacity in the Solomon Islands

Advocacy for strengthening civil registration and vital statistics

Original article

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This article has been adapted from 'Strengthening Practice and Systems in Civil Registration and Vital Statistics: A Resource Kit', Working Paper 19, Health Information Systems Knowledge Hub. The draft version is available for download from www.uq.edu.au/hishub (the final version will be published later in 2012 in conjunction with the World Health Organization)

Introduction

Being aware of problems within an information system and having identified solutions is not sufficient if there is no political will to act and bring about change. Moreover, a civil registration system will never function effectively without community collaboration, as people will not register vital events if they are not convinced of the need and value in doing so. Similarly, registration of cause-of-death is only possible if the medical establishment collaborates and follows standard death certification procedures. In addition, the information that doctors' record on death certificates has to be of sufficient quality to allow coders to make sense of it and correctly identify the underlying cause-of-death. If not, the cause-of-death fractions reported in mortality statistics might be misleading.

In most countries, improvement strategies will have to include advocacy with different constituencies to bring about legislative and policy change, secure investments for improving civil registration and vital statistics (CRVS) systems, and engage civil society. This article is about building support for CRVS systems in places and with groups where the value of these systems is not fully understood or appreciated. It discusses strategies that might be useful to convince government and local authorities of the significant benefits they can derive from improving CRVS systems and how to harness community support for specific aspects of civil registration that provide benefits to individuals and the community.

This article answers questions such as:

- What strategies can be used to effectively advocate for improving CRVS systems?
- Who is likely to support you in advocating for CRVS improvement?
- What is the process of advocacy and the steps to consider?
- What are the tools and resources that can assist the development of an advocacy strategy?

Background

Why is advocacy needed?

It is human nature to resist change and anyone who has tried to introduce new procedures into a work environment will have experienced the need to convince staff and co-workers that doing things differently is in the common interest. These struggles have given rise to the field of 'change management' that deals with how to plan better for implementation of change and how to overcome resistance.[1] Managers who are faced with introducing new technologies or other profound organisational changes can increase their chances of success by consulting the literature on change management and change leadership, which argues that leaders must transform themselves if they are to successfully lead transformation in their organisations.

There are several useful toolkits on how to advocate and promote a policy change. If you are not familiar with the advocacy process, steps and policy analysis that will help you build an effective strategy you should begin by consulting the toolkits from:

- PARIS21 (2010), which advises on country-level advocacy for managers and statisticians
- Sprechmann & Pelton (2001), which is a training guide for program managers in developing countries
- Stafford et al. (2009), which is a tool-kit for health professionals.

Each of these provides useful practical advice to help you and your organisation advocate for change and include examples and case studies that illustrate different strategies and partnerships.

What is meant by 'advocacy'?

There is no agreed standard definition of 'advocacy' because there are many different ways to conceptualise advocacy. For PARIS21, '*Advocacy is pleading for, defending or recommending an idea before key people in order to obtain a change*'.[2]

Alternatively, '*Advocacy is the actions and strategies used and effective collaborations created to shift public opinion, create political and community support, and influence decision-makers in addressing and improving specific health topics*'.[3] For Sprechman et al, advocacy is about creating or reforming policies and ensuring that good policies are implemented.[4] Whatever definition is used, advocacy is about influencing outcomes – including public policy and resource allocation – and convincing policy makers or those responsible to take action.

In this article, the focus of advocacy is to bring about changes in legislation, social policy, and resource allocation with the goal of strengthening civil registration and vital statistics (CRVS) systems. Advocacy is often needed to engage and convince governments, politicians, policymakers, private sector directors, and community leaders (and many others) that investing in and improving CRVS systems is necessary and in the best interest of the country. These target audiences are one component of advocacy, as seen in Figure 1. Other components are the processes and tools used to engage the target audiences and persuade them of the need for change. Together, these three components comprise the core of an advocacy strategy, which can be employed to achieve an advocacy goal at country or lower levels.

The development of your strategy should be informed by careful policy and stakeholder analysis. The processes required include lobbying decision-makers and politicians, engaging CRVS champions to inspire and motivate others, and building capacity of personnel across government or non-government sectors to influence policy makers, as well as developing partnerships with individuals or organisations that support your cause.

Reaching different target audiences requires selecting the right kind of communications tools. Tools may include policy briefs about the importance of reliable statistics for health planning, a business case for increased investment in CRVS with a cost-benefit analysis, or a mass media campaign to increase awareness of registration issues and workshops targeted at specialised groups (physicians, hospital staff, etc.). Other options include television debates and media interviews to deliver your key messages and create pressure on politicians for change.

As well as externally directed advocacy, you may need to do *internal advocacy* within your own organisation in order to build organisational or institutional support for changes in policies, services, work routines or funding in support of CRVS. Anyone, irrespective of their function within an organisation can be an advocate, but there are a number of simple rules that you need to follow.[3] For instance, your cause must not be self-serving and you must act with integrity and adhere to high professional standards or you will not be credible.

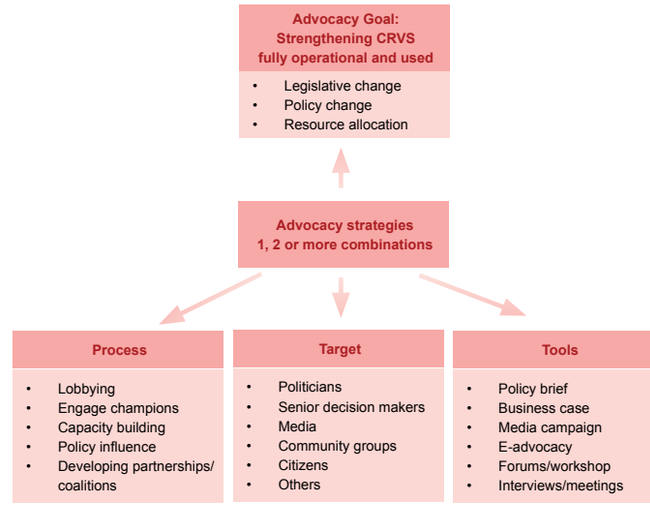

Figure 1 Components of an advocacy strategy

Your advocacy strategy, whether internal or not, will always be a combination of processes, target audiences, and tools, depending on the nature of the problem and the goal you are trying to achieve. It will usually begin by a thorough analysis of the problem and a selection of the issues that are suitable for advocacy. This first step is best done with concerned partners and should lead to a full understanding of the problem and its underlying causes.

Creating and maintaining partnerships is also very important for effective advocacy. You need to build a coalition of like-minded individuals and organisations to help you make the case for change. PolicyMaker is a policy advocacy tool for Windows which provides step-by-step guidance to help you conduct a stakeholder analysis and understand the political dynamics of policymaking (see Tools and Resources). This, along with the key components and steps of advocacy, is covered in more detail in the 'Strategies and solutions' section of this article.

Some of the key features you have to consider when advocating for change are shown in Box 1.

Box 1: Key features of successful advocacy

- **The issues for change:** are people aware that the problem exists or does it need to be explained?
- **The solution suggested:** do you know that it will work or how to investigate it?
- **The target audience:** do you have a good knowledge of the audience you want to influence?
- **The timing for beginning the campaign:** are people ready to listen?
- **The goal:** can you break it into several smaller goals as interim steps towards the main goal?

Who advocates for civil registration and vital statistics and what is their focus?

Potential advocates and partners for CRVS include country non-government organisations (NGOs) and rights-based organisations as well as sectoral ministries and international development agencies. Local organisations are particularly skilled at identifying disparities in access to registration services for minority or disadvantaged groups. Sectoral decision-makers in health, education, and labour are likely partners in advocacy for CRVS based on their needs for solid data to base planning and programming decisions. The health sector has been particularly vocal in calling for the need to improve registration systems and the data they produce. In 2007, for example, a series of papers were published in the medical journal The Lancet drawing attention to the past neglect of CRVS systems in developing countries and the need to redress this.[5]

The Director-General of the World Health Organization, Dr Margaret Chan, has repeatedly called for greater support to civil registration and the Health Metrics Network (HMN) has advocated for increased attention to CRVS as part of overall strengthening of country health information and statistics systems.[6-8] The UN Secretary General's Commission on Information and Accountability for Women's and Children's Health has identified improved civil registration as one of 10 priority actions in its report *Keeping Promises, Measuring Results*.[9]

Increased advocacy for CRVS has also come from the United Nations agencies. In 2011, the UN Statistics Division commenced an in-depth review of the 2001 *Principles and Recommendations for a Vital Statistics System* which included the need to build a stronger advocacy case among both users and producers of vital statistics.[10] Regional agencies such as the Economic Commission for Africa (ECA), the African Development Bank (AfDB), the African Union, and the Economic and Social Commission for Asia and the Pacific (ESCAP) have helped to mobilise political commitment to strengthen CRVS systems.[11-13] They have sponsored ministerial and regional planning meetings and assisted in developing regional and country plans.

PARIS21, an international partnership for improved statistics established in 1999, has developed guidance and advocacy strategies about the importance of improved statistics and the use of evidence for policymaking. While PARIS21 has a broad focus on statistics and does not specifically address the development of civil registration, it has developed a range of resource materials that can be adapted to make a case for increased investment in vital statistics and greater use of these in policymaking. These and other resources for advocacy are available on the PARIS21 website at http://www.paris21.org.

Civil society organisations such as Plan International have led global advocacy campaigns for improving civil registration and have extensive experience in advocating for increased birth registration using a variety of strategies.[14-16] Plan's campaign report, *Count Every Child: the right to birth registration* outlines their advocacy success in increasing birth registration over a five-year period in 32 countries.[15] Plan has adopted a rights-based approach to birth registration, based on the *Universal Declaration of Human Rights and Article 7 of the Convention on the Rights of the Child.*[17-18] Plan International has successfully mobilised support and resources for universal registration from stakeholders at many levels, including governments, UN agencies, other non-government organisations (NGOs), and corporate partners.

UNICEF is a powerful champion for birth registration, the absence of which is a violation of the child's inalienable human right to be given an identity at birth. Children of foreign residents, refugees, the poor and minority groups are most likely to be excluded from registration. Because of the association of a birth certificate with nationality, which often is granted according to the principle of *jus soli* or law of the soil, many countries are unwilling to register all children born within their borders. Such children often grow up stateless and unable to become full citizens of the countries in which they live. They are, as a result, denied access to social and economic rights such as employment in certain occupations, access to health, education or other government services.

Despite the importance of cause-of-death data for health planning, there was, until recently, a marked absence of champions for death registration. Greater advocacy for death registration is needed to provide reliable evidence about the number of people who die and from what. Knowledge about the causes of death in specific populations is essential for determining the public health actions needed to promote and protect health and prevent premature mortality.[5] In light of the massive increase in non-communicable diseases and the rapid health transitions occurring in many low-income countries, better cause-of-death data is a pressing need.

Using advocacy to overcome barriers to CRVS

Advocacy is essential to overcome the 'vicious cycle' of underinvestment in CRVS systems, as illustrated in Figure 2. Weak and dysfunctional CRVS systems are unable to generate vital statistics or provide legal documentation on vital events. As a result, there is little allocation of resources, with policy-makers failing to see the potential benefits of CRVS systems. Instead, they allocate resources to alternative data collection methods, not realising that these have a number of limitations compared to functioning CRVS systems. This in turn results in weak institutional and organisational development of CRVS, thus perpetuating the circle of neglect.

Advocacy can bring about a changed perception that CRVS systems are 'public goods' that every government should provide to their citizens as they benefit individuals and communities as well as generating reliable birth, death and cause-of-death data.

Advocating for the improvement of CRVS systems can appear particularly challenging because in most countries responsibility for CRVS is spread across multiple agencies and government departments, including the civil registration authorities, the national statistical office, the health department, and the judicial system. A coordinated approach is needed that brings together all the key players for making change happen. Experience has shown that collaborative action by key players can bring about improvements in a short timeframe. For example, in South Africa, where major stakeholders joined forces and government has made a concerted effort to invest in improving vital registration, completeness of registration greatly improved in a relatively short time period (*see country case study*). Three government institutions jointly took the lead in tackling the challenge and academic institutions and researchers were major contributors throughout the improvement process.

At the country-level, there is emerging consensus around the need for advocacy for civil registration and vital statistics systems.[20-21] For most countries with poorly functioning systems, the major challenges that advocacy should address include the following:

- **Political commitment** is lacking to CRVS systems because the current systems do not produce useable data for governance and decision-making
- **Financial resources** are insufficient to properly support CRVS systems. Development agencies and donors fund other data collection efforts in order to fill data gaps but see CRVS as a government responsibility
- **Legislative frameworks** are inadequate or out-dated and there is no strong legal base to support CRVS
- **Lack of awareness of registration obligations and lack of incentives to register** result in low registration coverage and incomplete data
- **Inadequate and unresponsive infrastructure and registration services** discourage people from registering
- **Lack of clarity of roles and responsibilities** leads to inefficiency and duplication of tasks among government agencies
- **Shortages of human resources with the necessary skills and expertise** in civil registration and departments such as health and statistics adversely affect both the quality of service and the quality of the data.

A two-pronged advocacy approach is needed that focuses on the benefits both for governments and for individuals. Advocacy directed at increasing the demand for vital statistics and at encouraging individuals to register vital events will help break the vicious cycle of underinvestment. Box 2 gives some examples of advocacy messages from CRVS champions that together illustrate the two-pronged approach. Overall, the goal is to influence governments to make CRVS a priority and ensure that development partners recognise that these systems are key to development.[22] Increasing public awareness of the importance of CRVS is also important for getting the support of civil society and NGOs for demanding better CRVS systems.

Strategies and solutions

In this section, we consider the advocacy process and the strategies that can be used to achieve advocacy goals and objectives. The international development community has developed a conceptual model showing how to design an advocacy strategy that is focussed on those who are best placed to deliver the improvements. This 'drivers of change' approach specifically targets the institutions and individuals who can act as key levers to bring about desired changes in countries and

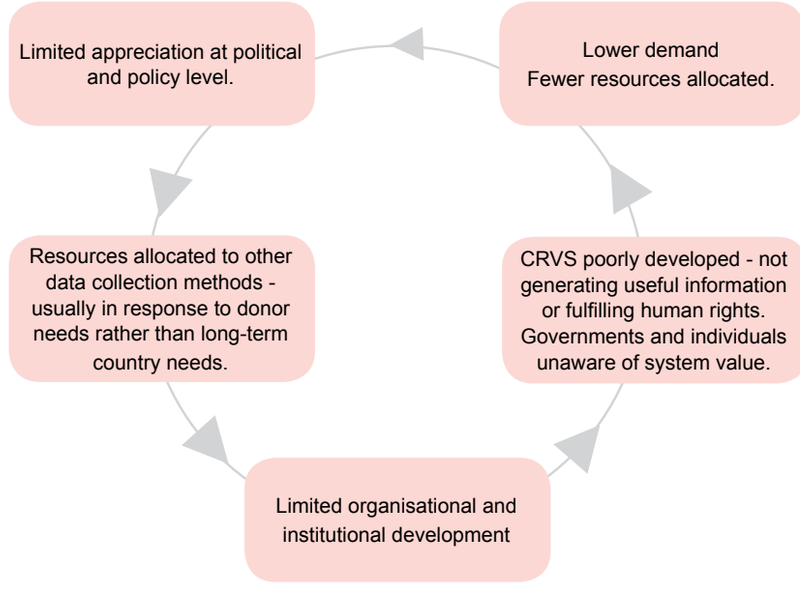

Figure 2 Vicious cycle of underdevelopment of CRVS systems[19]

who need to be convinced to act.[2] If the goal is the general improvement of the national civil registration and vital statistics systems like in the case study, their improvement demands a deep understanding and appreciation of the complex relationships within and between the agencies and individuals involved. It is, therefore, essential that all stakeholders take part in developing the advocacy strategy. Participants in this exercise would include representatives of the civil registration office, health departments, national statistics office, and other relevant government departments as well as civil society representatives.

In all cases, PARIS21 recommends that stakeholders come together to discuss the following questions:

- What changes are needed and which ones can advocacy help to bring around?
- What social, political, economic and institutional factors are impeding change?
- Which organisations, groups and individuals can drive the needed changes?
- How can they be motivated and what messages will work best?
- How can the messages be best delivered to each stakeholder?

Even when the purpose is overall CRVS system improvement, the most effective approach is to focus on a few key priorities and use these as the basis for the advocacy strategy. The advocacy strategy should cover a range of messages and materials developed to suit different target audiences.

The advocacy wheel shown in Figure 3 illustrates the various options and strategies available for developing a comprehensive advocacy strategy. Each box represents a different approach, for example, using the 'media', 'champions', 'community education', etc., to advance the overall goal. If, for example, your analysis of the problem has identified that the most important drivers of change are government officials and politicians, then it will be most appropriate to use strategies such as media releases, letters to politicians, and meetings with politicians. It can also be productive to generate debate and discussion at community level and among civil society organisations who can be effective allies in bringing issues to the attention of government. Most likely it will be necessary to use a combination of strategies to reach diverse audiences.

A detailed description of each of the strategies shown in the advocacy wheel can be found in the Tool Kit for public health professionals together with some useful tips and case studies to illustrate some of the approaches.[3]

Box 2: Key messages from advocates for civil registrations[23-26]

Establishment and development of civil registration and vital statistics systems is one of the fundamental measures that African governments must take in addressing our challenges

H.E Lawrence K. Masha (MP), Minister for Home Affairs of the United Republic of Tanzania

Civil registration is also about improving the efficiency and fairness of the justice system. It is also about facilitating the health, education and other social services to the public. Furthermore, civil registration is about provision of vital statistics data and information, primarily to the local administration and service providers at the community level

H.E Mr. Berhan Hailu, Minister of Justice of the Federal Democratic Republic of Ethiopia

It is important that countries recognize that civil registration is a developmental and human rights issue and our ability to monitor progress in this regard will depend on functional vital registration systems and availability of reliable and timely vital statistics

Mr. Pali Lehohla, Chairperson of the Statistical Commission for Africa and Statistician General, South Africa

... the value of civil registration lies in its linkage between the government and the citizens, this being one of the few direct transactions between the government and the people. Ensuring efficient, smooth and user-friendly registration of vital events carries the added value of increasing the credibility of the authorities and their capacity to deliver services

Paul Cheung, Director, United Nations Statistics Division

Sustainable civil registration systems that yield reliable information about the state of a population's health should be a key development goal

Dr Prasanta Mahapatra, President, Institute of Health Systems, Hyderabad, India

... the consequences of inadequate systems for civil registration – that is, counting births and deaths and recording the cause of death….. Without these fundamental health data, we are working in the dark. We may also be shooting in the dark. Without these data, we have no reliable way of knowing whether interventions are working, and whether development aid is producing the desired health outcomes

Dr Margaret Chan, WHO Director-General

The Process of advocacy

Advocacy steps

As should be clear, there are a number of steps you can take to develop a successful advocacy campaign. The ten steps outlined here do not necessarily need to be followed in the order described and several steps may occur simultaneously and may need to be revisited from time to time as a campaign is developed. However, the steps do require a variety of skills from various disciplines. Working in partnership with others can help you access the skills you need. The steps to consider are described below.

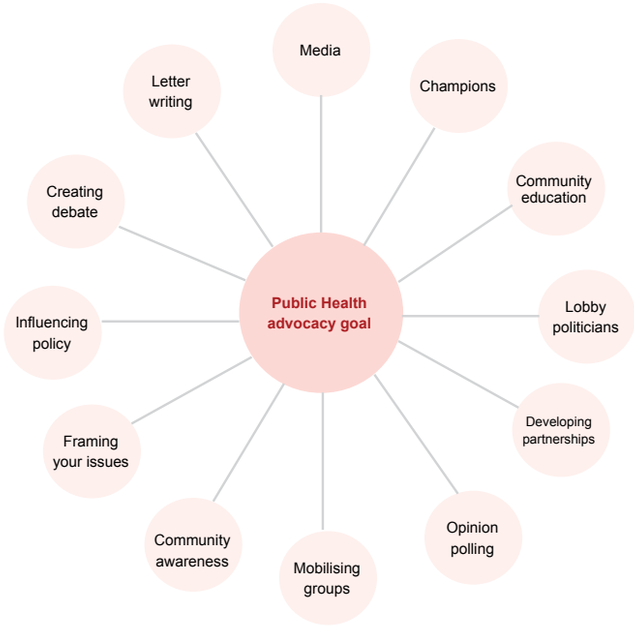

Figure 3 The advocacy wheel[3]

Identify or analyse the problem. What are the key issues and options for bringing about change? The process of advocacy starts, as mentioned above, with getting stakeholders together and identifying a problem or issue that requires policy action, which can be influenced by advocacy. If your country has undertaken the comprehensive assessment of your CRVS systems, you may already be aware of priority issues needing improvement. The partner meeting then can be used to discuss which of the priority issues are most suited to be selected for advocacy and to identify the most effective 'drivers of change'. An in-depth understanding of the problems facing CRVS and the underlying causes makes it easier to define effective strategies and solutions. Policy analysis can help identify any underlying policy causes that contribute to the problem. For further information on policy analysis, see Chapter 4 in the CARE publication, *Advocacy Tools and Guidelines: promoting policy change*).[4] Tools such as the computer software program, PolicyMaker 4, can also assist with this task (see the 'Tools and resources' section of this article).

Identify your goal. What change are you aiming for? Is your goal to increase registration of births and deaths by changing legislation? Or, is it to increase government budget allocation to strengthen CRVS systems? For advocacy efforts to succeed, it is important to have a clear goal that is achievable, addresses the problem, and that will have multiple supporters. The multiple actions needed to improve CRVS systems can appear complex and overwhelming. It is, therefore, essential to set realistic short and longer term goals and to build incrementally on successes. Clear objectives and targets related to your overall goal should be defined and should be SMART (Specific, Measurable, Attainable, Reasonable, and Time-specific) so that you can report on progress. For examples of goals and related objectives, see the UN *Handbook on Civil Registration and Vital Statistics Systems: developing information, education and communication*.[27]

Identify your target audiences. Who are the people or organisations with influence that can help you achieve your goal? Audiences can be categorised into primary and secondary audiences. Primary audiences are those with direct authority to bring about policy change; secondary audiences are those who can influence the primary target audience. Usually there are several secondary audiences, so the focus should be on those that have the most capacity to influence your primary audience. Understanding your target audiences is vital and begins with your policy (problem) analysis. It is easier to devise an advocacy strategy when you have full knowledge and understanding of those who influence and affect policy change. It can be useful to construct a policy map of your audiences and identify their degree of influence and authority (high, medium, or low) for policy change. For an example of policy mapping, see page 22 of *Advocacy tools and guidelines: promoting policy change* at http://www.care.org/getinvolved/advocacy/tools.asp.

Identify the factors that will promote or hinder the change you want. What are the social, economic, and political factors that will affect the likelihood of you achieving your goal? As mentioned above, knowing your context and policy environment is an important step in planning an effective advocacy initiative. An understanding of how social, political, economic and institutional factors affect possibilities for change is important as is information on how policy decisions are made, both formally and informally. This knowledge will guide you in your choice of advocacy strategies.[4] You need to know where key decisions about CRVS policy are likely to be made and who makes these decisions. Without this knowledge it is difficult to effectively advocate for policy change.

Develop and deliver your key messages. What messages will motivate your audience? How will the messages be delivered — directly or indirectly? One of the keys to a successful advocacy campaign is developing concise, persuasive, action-orientated messages for your target audiences. Messages that have been tailored for different audiences are critical to ensure understanding, and therefore, effectiveness. Messages targeting decision-makers will be different to those targeting citizens, as shown in Table 1.

Table 1: Key messages for different audiences[28]

Audience	Key messages for investing in civil registration and vital statistics
Minister of finance and planning	Investment in civil registration will generate reliable annual population, fertility, and mortality statistics and will pay for itself many times over by improving the efficiency of resource allocation
Government officials	Investing in civil registration will provide better statistics that enable better planning and development, and permit the evaluation of government programs
Director of health and medical services	Investing in civil registration will provide better statistics about fertility, mortality and patterns of cause-of-death and enable the health sector to identify major health threats and vulnerable groups
Media and civil society	Investing in civil registration will improve governance. Government departments at all levels will know what services are needed and who to provide them to. Better statistics generated from civil registration will improve the means of holding the government accountable for its policies
Citizens	Investing in civil registration provides individuals with legal documentation and proof of identity. Civil registration also generates statistics necessary for governments to provide you with services to meet your health and social needs
Donor groups	Investing in civil registration will provide good quality statistics that can be used to improve allocation and monitoring of aid

Build working partnerships. Who can you invite to support your cause? Effective advocacy is often about building a critical mass of people and organisations that support your goal. It is important to develop alliances with credible partners so that you can present a united front and common messages for change. Partnerships with organisations or individuals that have influence both inside the system (for example, managers of civil registration offices or directors of the justice and planning authorities) and outside the system (for example, representatives of NGOs) will also increase the likely success in achieving your advocacy goal. While there are many benefits in working in partnership or through coalitions, it is also important to remember that building these takes time and requires strong leadership to be effective.[4] Partnerships are particularly important in advocacy for CRVS because so many stakeholders are involved at different stages, including the ministry of home affairs, justice, interior, local government, the health sector, health professionals, and civil society.

Do your research. Do you have sufficient evidence to back your cause? Researching and using data to support your message is important. For instance, you may show the poor quality of existing data or how out-of-date the most recent data are. Websites providing bibliographic databases and directories of population resources can be a good source for gathering comparative evidence.[29] Having accurate, high quality, documented information also protects you from counter attacks from opponents and helps to maintain your credibility in the public arena.[3]

Secure resources. What sort of financial and human resources do you need for your campaign? How can these be secured? A common misunderstanding is that you have to have a big budget. On the contrary, many advocacy strategies have proved effective despite limited funding. Developing coalitions can help you secure resources. Your partners may have access to public relations specialists, communication experts, political analysts, or business managers that can assist in developing and implementing your strategies.

Devise an action plan. This should cover the activities, roles, timeline, and budget for your campaign. As advocacy is a dynamic process, it is important to be flexible in setting timelines. The policy environment can change quickly and events beyond your control may require you to change the scheduling of your activities. Similarly, new opportunities may arise in response to a change in government or personnel and you will need to respond immediately to take advantage of the new situation. Your choice of strategies (see Figure 1) and associated activities will be reflected in your action plan.

Evaluate your advocacy efforts. Have you succeeded in reaching your goal? To be able to answer this question it is important from the outset to have a clear goal and targets, and an idea of how you will measure success. This will enable you to plan your monitoring and evaluation methods and collect the relevant information to demonstrate success. It is important to show that your advocacy strategies have made a difference, particularly to funding bodies and stakeholders. Evaluation also assists you to learn from your experiences of what works and what does not, which in turn informs planning of future advocacy campaigns. For more information about evaluating and improving your advocacy campaigns, see the publications *Advocacy in action: a toolkit for public health professionals*[3] *and An Introduction to Advocacy: training guide*.[30]

Case-study: Country level strengthening of CRVS

During the late colonial era (from the 1920s), South Africa had a comprehensive system of civil registration and vital statistics that applied to all citizens. However, the 1950 Population Registration Act introduced a race identifier into the population register, setting the legal basis for the apartheid era.[31] From this time onwards, registration was the means used for producing race-based identity documents and a basis for the apartheid policies that greatly influenced the organisation of social life, access to resources and health services.[32]

Civil registration data were not used as the source of national vital statistics. Some statistical information was available on the white, coloured and Indian groups, but there was little data on the black African group that constituted over 70 percent of the population.[33] With the end of apartheid and emergence of a democratic society in 1994, the country embarked on an ambitious series of policy reforms designed to end racial and sexual discrimination and build institutions of the state.[34] However, national planners and decision-makers faced a dearth of reliable, population-based data upon which to take forward this huge social, political and economic transformation. The climate was not good for promoting registration because of the mistrust that had built up during the apartheid era in the registration authority.[35] Yet South Africa managed within just a few years, between 1997 and 2004, to make birth registration almost universal and coverage of death registration increased from 63 to 82 percent.[33]

The key components of this massive change were leadership, political commitment and advocacy, the formation of partnerships across different parts of government, and building community awareness. Champions for civil registration and vital statistics were active at all levels – in government departments (especially statistics, health and home affairs); among health professionals and academic researchers; and within grassroots organisations working to overcome entrenched inequalities. Working together, these powerful stakeholder groups succeeded in overcoming the long-standing mistrust of the registration system and fostering trust among communities.

At the national level, the tone was set by the Government of National Unity, which identified the allocation of resources for national information systems to redress the severe inequalities of the apartheid era as a key priority. Three agencies took the lead in tackling this challenge. The Department of Health constituted a National Health Information System for South Africa and identified the need for reliable and comprehensive data on births and deaths as an essential prerequisite for identifying and redressing inequalities.

Statistics South Africa undertook study tours to learn from other countries how to establish universal and sustainable civil registration that would generate reliable data for the whole population. The Department of Home Affairs raised awareness of civil registration, introduced new registration forms and organised outreach efforts to communities and local village chiefs. School enrolment was made contingent on demonstrating a valid birth certificate. Each government agency introduced staff training and conducted outreach to outer levels in order to create awareness among communities of the importance of civil registration and reliable vital statistics.

Academic institutions and researchers, especially in health, were major contributors throughout the improvement process. In practice, improving cause-of-death statistics turned out to be a bigger challenge than improving nationality statistics, not only because of the technical challenges involved in accurately determining cause-of-death, but also because of denial about the levels and causes of HIV/AIDS within some parts of the political establishment. Further, notably in rural areas, the proportion of deaths occurring outside of health facilities (often at home) remained high. By 2005, despite improved coverage of death registration, the quality of cause-of-death data remained poor with 20 percent of deaths assigned to ill-defined causes, extensive miss-classification of HIV/AIDS deaths, and lack of information regarding causes of injury deaths.[36] Rurally-based health and demographic surveillance systems helped bridge this gap.[37-40]

Researchers played active roles in advocating for improvements to the system and reaching out to decision-makers and to communities by producing easy to understand policy-guidance and summaries of research findings.[41-44] Cause-of-death data were used to identify the leading causes of deaths, which enabled government to identify interventions, allocate the health budget and deliver necessary services to people who need them.[45] Making use of the data ensured that resources continued to be allocated to improving civil registration and vital statistics and to gain the support and trust of civil society.

Improving civil registration in South Africa also has been identified as important for monitoring and understanding the HIV epidemic as it generated information critical to understand the dynamics of HIV/AIDS in children – their age and sex, the status of their parents, and the communities into which they were born.[46] Community level interventions to improve civil registration included working with village headmen as part of the registration process and encouraging registration by providing child support grants to registered births. Mobile facilities were used to facilitate registration for people without easy access to registration facilities sometimes in partnership with research and development organisations.[47]

South Africa identified improved civil registration and vital statistics as central to achieving the national goal of redistribution and improved equity. The Equity Gauge, a national project to monitor progress towards improved equity in health, involved a partnership between South African Legislators and the Health Systems Trust. Together they advocated for increased attention to civil registration in order to improve statistics on mortality and cause-of-death and permit analysis of patterns and trends in different ethnic groups and parts of the country. A particular strength of this approach was the close link with parliamentarians, which helped build capacity for applying an equity lens to policy, institutionalise equity considerations in decision-making and keep equity issues on the political agenda.

South Africa provides a vivid example of the power of advocacy, partnerships and stakeholder involvement to achieve substantial and rapid improvements in the civil registration and vital statistics systems. Four elements were crucial to this success:

1. The leadership role exercised by senior government officials in health, statistics and home affairs
2. The continued and sustained involvement of academic institutions and researchers in finding solutions to the challenges identified
3. The explicit efforts made to reach out to community leaders and grassroots organisations, and
4. The commitment of parliamentarians and legislators to apply an equity lens to the development of policy and legislation.

Tools and resources

Tools for developing an advocacy campaign

There is no single approach for advocacy. The process will depend on the type of problem, the possible solutions, and the available opportunities and resources for change. However, there are a number of manuals, tools, and training materials from other related fields that can help outline a process. Even though the focus of the listed advocacy resources is not specific to civil registration, the process and elements are similar. With some thought, you can apply these resources to advocacy for CRVS systems. You can also draw on skills and tools for advocacy from other disciplines, such as communication, social marketing, and political science.

The following resources may be a useful starting point:

- *Advocating for the National Strategy for the Development of Statistics: Country-level toolkit* focuses on country-level advocacy. It is aimed at managers and statisticians who need to plan an advocacy campaign to convince policy-makers, civil-society, the media and NGOs in developing countries of the importance of statistics and information. It explains the "Drivers of change" approach; gives examples of advocacy material that has been produced in developing countries; and has tips on how to use the media and how to craft a targeted message to different audiences. A copy of this toolkit can be found at: http://www.paris21.org/sites/default/files/advocacytoolkit.pdf

- *Advocacy in Action: a toolkit for public health professionals*, 2nd edition, is a good introduction to advocacy and contains examples of key advocacy strategies and samples of practical tools to get started. It gives some very good tips on how to prepare for advocacy; what strategies to use with different audiences; and what are the best tools to use in each case. It also explains how to advocate within an organisation for change, i.e. "internal advocacy". A copy of this toolkit can be found at: http://www.phaa.net.au/documents/100114PHAIAdvocacyToolkit%202ndedition.pdf

- *An Introduction to Advocacy: A training guide* focuses on advocacy for policy change. It is suitable for a variety of audiences. The guide introduces the concept of advocacy and provides a framework for developing an advocacy campaign. It is designed for a workshop setting, but can also be used as a self-teaching device. A copy of this guide can be found at: http://www.aed.org/Publications/upload/PNABZ919.pdf

- *Advocacy Tools and Guidelines: Promoting policy change*. This guide was written for project managers in developing countries and provides a step by step guide for planning advocacy initiatives. It lays out a framework for identifying policy goals, creating a plan of action and effectively building a case for change and implementing it. A copy of this guide can be found at: http://www.careclimatechange.org/files/toolkit/CARE_Advocacy_Guidelines.pdf

Communication

Population reference bureau website

The Population Reference Bureau website provides a wealth of information and tools that can assist in researching and communicating your message. It provides a list of websites about population and health resources, including bibliographic databases, directories of population resources, information about health in Asia and globally, as well as population policy and development sites. You can access this section of the website directly at: http://www.prb.org/pdf04/Pop&HealthResources.pdf

If you are looking for help to develop and communicate population and health research to policymakers, try the training materials section of the website at: http://www.prb.org/EventsTraining/TrainingMaterials.aspx

It contains guidelines for effective data presentations, including:

- Steps to developing an effective presentation
- Delivering an oral presentation
- Presentation dos and dont's
- Tips for preparing great slides.

There are also guidelines on creating a window of opportunity for policy change. This website can be accessed at: http://www.prb.org/

Media strategy

Handbook on civil registration and vital statistics systems: developing information, education and communication

This useful handbook provides guidance on identifying target groups, developing key messages and using mass media.

This handbook can be found at: http://unstats.un.org/unsd/publication/SeriesF/SeriesF_69E.pdf

Media advocacy: lessons from community experiences

The use of media advocacy as a tool for policy change is discussed in this journal article. It provides helpful tips about using mass media in the context of health issues of alcohol and tobacco. Although it does not deal with CRVS, the lessons learned can be applied to other contexts.

The reference for this journal article is:

Jernigan D & Wright P. 1996. Media advocacy: Lessons from community experiences. Journal of Public Health Policy, 17(3), 306–330. Retrieved 2 November 2011, from, http://www.jstor.org/stable/pdfplus/3343268.pdf

Policy analysis

Computer software programs such as PolicyMaker 4 can be a useful tool for analysing and managing the politics of public policy. It provides step-by-step guidance to help you conduct a stakeholder analysis and design political strategies to support your policy. The software helps you to define policy content, players, opportunities and obstacles, and strategies and the impact of strategies. It provides practical advice on how to manage the political aspects of policy. The program is promoted as a policy advocacy and lobbying tool and was developed by Professor Michael Reich from the Harvard School of Public Health. Further details and a tour of the program can be accessed at http://polimap.books.officelive.com/default.aspx

Summary

This article has presented the key elements of the advocacy process and the steps to consider in developing an advocacy campaign. There are compelling reasons for engaging in advocacy, particularly as civil registration systems in many countries have progressed very little over the past 50 years. Lack of awareness of the benefits for individuals and governments has contributed to a vicious cycle of under development of civil registration and vital statistics systems. Advocates are needed across a range of sectors to persuade governments to make CRVS a priority and to work towards a greater political commitment and allocation of resources for establishing and improving systems. Advocating for better legal frameworks and policies that fully support a functioning and well-used CRVS system is needed. A selection of tools and resources has been included in this module to get you started in advocating for improvements in your CRVS system. Box 4 summarises some key considerations when developing your advocacy campaign.

Box 4: Guidelines for engaging in advocacy

- Be clear about your advocacy goal. Be sure it is realistic, achievable, and supported by others
- Be aware of the policy environment, the people who can change policy, and how policy can be changed
- Timing is important. Be open to opportunities to promote your message for improving CRVS systems
- Be on the lookout for champions who can motivate and inspire others to support your cause
- Be well prepared and do your research about the problem(s) and possible solutions
- Be strategic and develop an advocacy strategy and plan that uses the most appropriate processes and tools to engage and persuade your target audience
- Be creative and informed when developing your key messages
- Be connected and develop partnerships that give a strong support base for your advocacy campaign
- Be persistent and committed to your goal

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Building the evidence base for health policy: Guidelines for understanding and utilising basic health information

Original article

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Background

The collection and availability of public health data has increased in recent years in many countries.[1] Greater demand from governments and donors for evidence to inform decision-making for the planning, management and evaluation of health services has led to the provision of such data from numerous sources. These data sources provide information on a wide range of indicators covering health status, health system performance, risk factors and other determinants of health.[1]

Despite these advancements, many low- and middle-income countries have been described as 'data-rich' but 'information-poor'.[1] Large reporting burdens are regularly placed on health officials that can adversely affect data quality. Many health officials also have a lack of understanding about how to assess, analyse and interpret data to provide valuable evidence for policy-makers. There is a need for public health staff at various levels of the health system to develop skills and knowledge to better utilise existing datasets.

This article details a set of guidelines to aid public health officials to understand and critically assess the quality of available data, and effectively utilise these data to provide evidence for health policy. It is designed to ensure that data users follow a set of principles when analysing any dataset so as to derive maximum utility and information content to guide policy. The guidelines are designed for staff involved in the collection of data and production of information as part of their ongoing functions, and with a basic understanding of statistics.

These guidelines were originally developed for a training workshop conducted for public health officials in Samoa, entitled 'Training in the Use of Existing Datasets'. They have since been refined based on this workshop, to provide a basis for application in other Pacific countries. The objectives of this article are to:

- Detail the guidelines, and how they assist public health officials assess and utilise existing data to inform health decision-making
- Examine the application of the guidelines in Samoa, and describe their use in a training workshop to develop existing capacities within the health system
- Discuss the potential for the guidelines to be applied in selected other Pacific countries.

Existing staff capacity

The guidelines are designed for staff involved in the collection of data and production of information as part of their ongoing functions. These staff would have a range of roles and responsibilities, including:

- Producing external reports from the Ministry of Health (or similar)
- Producing internal reports for management within the Ministry of Health (or similar)
- Data collection for surveys
- Data collection within health facilities - this may include staff responsible for the maintenance of medical records, and nurses and midwives who record information as part of their ongoing functions
- Production of internal reports within health facilities.

Guidelines to assist data quality assessment and utilisation

A set of guidelines were developed to assist public health officials assess the quality of existing health data, and effectively utilise such data to compute indicators to inform health sector policy-making.

Data quality assessment should also provide insights that lead to improvements in data collection processes, to improve the reliability and accuracy of health indicators. The design of the guidelines was informed by data quality assessment frameworks developed by HMN and the ABS (see Box 1).

Box 1: Data quality assessment frameworks

Data quality assessment guidelines have been utilised in the past by national statistical bureaus and multilateral organisations such as the Australian Bureau of Statistics (ABS) and Health Metrics Network (HMN).
HMN, building on the International Monetary Fund (IMF) Data Quality Assessment and IMF General Data Dissemination System, developed criteria to assess the quality of health-related indicators:[1]

- **Timelines -** the period between data collection and its availability to a higher level, or its publication;
- **Periodicity -** the frequency an indicator is measured;
- **Consistency -** the internal consistency of data within a dataset as well as consistency between datasets and over time; and the extent to which revisions follow a regular, well established and transparent schedule and process;
- **Representativeness -** the extent to which data adequately represents the population and relevant subpopulations;
- **Disaggregation -** the availability of statistics stratified by sex, age, socioeconomic status, major geographical or administrative region and ethnicity, as appropriate; and
- **Confidentiality, data security and data accessibility -** the extent to which practices are in accordance with guidelines and other established standards for storage, backup, transport of information (especially over the internet) and retrieval.

The ABS also developed a Data Quality Framework (DQF), to help assess and report the quality of their data.[2] The ABS DQF assesses data quality across seven dimensions:

- **Institutional Environment -** the factors that impact the effectiveness and credibility of the agency producing the statistics;
- **Relevance -** an assessment of the relevance of data to issues important to policy-makers, researchers and the community;
- **Timeliness -** the length of time between the reference period of the data and the availability of data, and the frequency of the data collection;
- **Accuracy -** whether data accurately describe what they are purported to measure;
- **Coherence -** the internal consistency of a data collection, and its comparability with other sources of information;
- **Interpretability -** presentation of information and supporting documentation to assist understanding and appropriate utilisation; and
- **Accessibility -** the ability of users to access data.

For each dimension, the quality of a dataset can be evaluated with consideration of a number of different aspects. For example, the accuracy of a dataset can be evaluated with reference to coverage error, sample error, response error and non-response error.[2] The ABS DQF also provides a set of questions to help data users assess data quality for that dimension.

Within this range of roles and responsibilities, there would be a broad range of capacities in terms of statistical training and software usage.

Therefore the majority of the guidelines do not require extensive training, and are designed for those with some familiarity of the data collection processes of the relevant datasets, and with a basic understanding of statistics and capacity to use Microsoft Excel.

Ideally, the staff would learn how to utilise the guidelines during a training workshop. Such training was conducted in Samoa in October 2010 for Ministry of Health (MoH) and National Health Service (NHS) staff. In this workshop staff applied the guidelines during in-class exercises to real and hypothetical data sets. Based on the application of the guidelines in the workshop, and feedback from participants, they were refined accordingly.

Not all the guidelines would need to be used by this range of staff in their ongoing functions. However, the experience from the training workshop in Samoa, which comprised a similar range of staff, is that participants find it beneficial to understand such information. For example, nursing staff found it useful knowing how important indicators such as early age mortality rates are calculated. More advanced techniques would require specific in-depth training. Staff involved in analysis of surveys with complex designs would require further training in data analysis, such as methods to estimate standard errors and confidence intervals of rates from multi-stage sampling techniques.

These guidelines are not exhaustive, and are can be further adapted for use in specific countries depending on available data and the capacity of participants.

Details of the guidelines

The guidelines comprise:

- A series of questions to guide data quality assessment and data utilisation
- Excel templates to assist data quality assessment and data utilisation.

The questions to guide data quality assessment and data utilisation are shown in the next section. These questions are classified according to data source and type of indicator. The categories for data source are all datasets, population surveys and health facility data. The categories for type of indicator are early age mortality, all age mortality, causes of death/morbidity and birth statistics. There is a separate classification for type of indicator because data can be available from a range of sources. Guidelines for mortality registration data are provided in the early age mortality and all age mortality sections.

The Excel templates are designed to be applicable for assessment of data quality and computation of indicators for staff working with public health data. Many of the templates provide further information to assist in the application of specific questions to guide data quality assessment and utilisation (e.g. age-standardisation template where the question is regarding age-

standardisation of data).

The templates help users:

- Compute mortality and morbidity indicators from health surveillance data
- Calculate the 5% confidence interval of a mortality rate
- Calculate the 95% confidence interval of a proportion
- Assess the age-sex consistency of cause-of-death reporting
- Assess the validity of the age pattern of mortality
- Directly age-standardise mortality rates and other rates
- Compute indicators from pregnancy, birth, postnatal and disease incidence data from a health facility
- Compute life tables from age-and sex-specific mortality data.

Questions to guide data quality assessment and data utilisation

This section provides a brief description of each question to guide data quality assessment and data utilisation.

All datasets

Which institution(s) conducted the data collection?

The quality of data can be influenced by a number of factors relevant to the institution undertaking the data collection. The institution's objectivity, independence from outside influence, quality control processes and sufficiency of its resources will influence its ability to collect reliable and accurate statistics.[2]

How regularly is the data collection conducted? On an ongoing basis or every few years?

Data collected on an ongoing basis, such as from a vital registration system, will provide more up-to-date information to policy makers than data collected every few years, such as from a population survey or a census. Ongoing data collections also enable trends in indicators to be established, which are useful for data users and policy makers. Data collected every few years are more difficult to use to establish trends. In such an instance, results from different data collections may be combined to determine trends.

What is the population coverage of the data source?

The population coverage of the data source is important for data users to identify, especially for routine data collections such as vital registration systems. Some data sources may not collect information about the entire population within a country because the routine data collection is still developing and does not operate throughout the country.

In sub-Saharan Africa, many countries have vital registration systems that only cover a small proportion of the population.[3] Reporting of indicators from such countries should mention the population coverage, and the likely impact this has on indicators.

Do the numerators and denominators refer to the same population?

Computation of rates, ratios and percentages require that the numerator (event) and denominator (population-at-risk) refer to the same population. This is important when the numerator and denominator are obtained from different datasets. For example, measurement of immunisation rates may use immunisation data from a health facility that covers a district and the population of children of a certain age within that district. An accurate immunisation rate would need to include all children in the district who received an immunisation, which may not be recorded in one register or health facility.

Can the data be analysed for different demographic and socio-economic groupings?

Accurate demographic and socio-economic data provide information that are of much use to policy makers. Analysis of data by demographic and socio-economic groupings allows for assessment of inequalities in health indicators. They also provide evidence for health programs to be targeted to reduce these inequalities. Socio-economic status can be represented by a summary measure derived from a number of variables, such as the asset index in the Demographic and Health Surveys (DHS) program.[4]

Do the data provide an adequate level of geographic detail to inform policy-makers?

The availability of data with a high level of geographic detail means that health indicators can be computed reliably for a number of geographic areas within the population. This can be important to provide evidence for policymakers about geographic inequalities in health outcomes, as well as to provide information to local health offices about their jurisdiction. In sample surveys, there may be considerable sampling uncertainty about indicators for geographic areas within the population, because of a small number of cases.

Are geographic areas consistent between datasets?

Consistent geographic areas across datasets allow comparison of different indicators collected by different data sources. For example, if one data source has an infant mortality rate for each country's regions, and another data source has the percentage of births attended by a skilled birth attendant for each region, then analysis can be made of these two indicators. Inconsistent geographic areas between the two datasets would not allow this analysis.

Are data items consistent over time and between data sources to enable trends and differentials to be analysed?

Consistent data items over time and between data collections are important in determining trends and differentials in an indicator. Differences in the characteristic of a data item between data collections, such as the wording of a question or the time of year data of a seasonal illness is collected, is likely to affect the value of an indicator.

Are international standard data items used?

International standard data items are important to allow monitoring of health indicators with other countries, and to assess progress to benchmarks such as the Millennium Development Goals.[5] They also provide validity to data items used. There are international standards for a range of data items. These include the International Classification of Diseases (ICD) and HIV-related indicators.[6-7]

Are there manuals and user guides to help interpretation of the datasets?

Manuals and user guides are essential to guide different aspects of the data collection process, including fieldwork and data cleaning. For the data user they provide information regarding the data collection, such as response rates, and so assist the assessment of data quality. Manuals and user guides also provide information specifically to assist analysis of data, for example whether sample weights should be applied.

Are there clear definitions of all data items?

Clear definitions of data items allow the user to understand and interpret the data they are analysing. For example, health utilisation data often require definitions to distinguish between health service providers, such as the type of facility.

Is there a substantial number of missing values?

Missing values occur when there is incomplete information provided in the data. This would normally be caused by the respondent not providing complete information. All reports should mention the extent of missing data, and how missing values were handled (i.e. they were imputed, or not included in the analysis).

Was the dataset cleaned before publication of results (i.e. removed duplicate cases, corrected inconsistent data)?

Removing obvious errors in the dataset, such as duplicate cases, ensures that data re of a high quality. Data cleaning is a standard process in large-scale data collections such as the DHS.

How were the data collected (e.g. interview with respondent, diagnostic measurement)?

It is important that information about how data were collected is detailed wherever data are disseminated to policy makers or other end users. For example, reporting indicators of health status should mention whether it is based on self-reported health status or a diagnostic measurement.

Population surveys

Were there any events that adversely affected the data collection, such as a natural event like a flood?

The data collection for a population survey may be disrupted by an event such as a natural disaster. If this has occurred, and has adversely affected data collection, this information should be reported in any manual or guide for data users. This should also be mentioned in a report of results from the population survey.

Was the training of interviewers and others involved comprehensive?

The success of a population survey is reliant upon comprehensive training of interviewers, field supervisors, data entry clerks, data processing staff and those involved in analysis and report writing. This should be supported by detailed manuals of each stage of data collection, processing and analysis, which can be referred to by data collection staff once data collection commences.

At which geographic level are results from the survey reliable? That is, national, provincial, or urban/rural level?

Users of a population survey will often want to compute measures for provinces and other geographic areas. The sample of a population survey will be designed to produce reliable results for certain domains, or sub-units, of the population. A manual or guide for users of sample survey data should state at which geographic level that rates and other measures can be computed. Generally, national sample surveys allow computation of reliable measures for urban and rural areas, and often for each province or other sub-national jurisdiction.

Was the survey conducted with an established and detailed sampling frame?

The availability of a suitable sampling frame is very important in determining whether a survey can produce reliable data.[8] A sampling frame can be derived from a detailed and up-to-date listing of area units within the country (such as census blocks), including accurate maps and an estimate of population or households. A sampling frame can also be based on a pre-existing sample that has been used for another survey.

Were sampling weights used in the survey?

The DHS defines sampling weights as: '*…adjustment factors applied to each case in tabulations to adjust for differences in probability of selection and interview between cases in a sample*'.[9] Sampling weights enable sample data to produce results that are representative of the population. Some areas within the population may be under-sampled by the survey, and so need to have a greater weight applied compared with other areas in order to produce reliable estimates for that population. Sampling weights are also used to account for non-response in the survey. The guide for data users should clearly state whether sampling weights need to be applied when computing measures from the data.

Are 95% confidence intervals reported with the indicators?

Indicators derived from sample surveys are subject to sampling error. The degree of sampling error is represented by the 95% confidence interval. The 95% confidence interval represents the range of values where there is 95% certainty that the true value of the indicator lies. To ensure correct interpretation of results, the reporting of results from population surveys should mention the 95% confidence interval for each indicator, especially where the confidence interval is wide.

What was the response rate of the survey? Have the data been adjusted for non-response?

The response rate in a survey is normally calculated as the number of households or individuals who with a completed interview as a percentage of all households or individuals in the sample. A low response rate is an indicator of poor data quality. The DHS excludes absent households from the calculation.[10] Sampling weights commonly adjust for non-response.

Was there comprehensive checking of data quality in the field?

During the collection of survey data, data quality should be checked by field supervisors so that appropriate corrections can be made while collection is still being undertaken. The field supervisor should check that all households have been visited, all appropriate interviews have been conducted, and all questionnaires completed. Data quality control sheets should be used to facilitate this process.

Health facility data

If using health facility data for population level indicators, how representative are health facility data of the whole population? That is, the number of births, deaths, disease cases, immunisations, growth monitoring etc.

Health data collected from health facilities can be problematic to use for population-level indicators if the data are not representative of the population of interest. Such data will not be representative of a population if they are only collected from a health facility, but there are cases that are not reported to the facility. For diseases such as diarrhoea, it is likely that there would be a significant number of disease cases not presented to a health facility, and so it would be difficult to know the number of cases for the whole population.

Are the demographic data complete?

Complete data on the demographic characteristics of the patients that visit a health facility means that all relevant information on each patient's age, sex and place of residence (as well as other characteristics) are reported. Such information is necessary to understand patterns of mortality, disease prevalence and service utilisation of all those who visit a health facility, to inform health services management and health policy.

Are patient records complete (e.g. are all admissions entered and are all discharges matched to an admission)?

Effective health services management requires accurate data on patient admissions and discharges. The quality of such data can be checked by ensuring patient records are recorded completely. For example, processes should be in place to ensure there is an admission recorded for every patient, and each discharged patient should be linked to an admission.

Are facility details accurate (e.g. bed numbers, staffing numbers)?

Accurate information about health facility details, including the number of beds and staffing numbers, is important for health services management and development of programs based on available physical and human resources. Staffing details can include number and type of staff, their qualifications and experience. Bed numbers are necessary for the accurate computation of occupancy rates and other key facility indicators.

Are growth monitoring and immunisation provision data complete?

Health facilities can be valuable sources of information on the provision of growth monitoring and immunisation services. It is therefore important that the quality of reported growth monitoring and immunisation data is regularly checked for accuracy with data recorded at the time of service.

If comparing data from health facilities over time is age-standardisation used?

Age-standardisation of population-level indicators produced from health facilities, including separation rates, is important when comparing rates from populations with different age structures. This is because utilisation of certain health services varies with age, and so

populations with differing age structures require utilisation rates to be age-standardised.

Do hospital data used for internal and external reports match other records that are maintained at the facility (e.g. records kept by nursing staff)? Are there processes to ensure all data are entered into an electronic system?

Health facility data that are used for internal and external reports (often maintained centrally by the medical records department) can be checked for quality by matching them with other records maintained at the facility, such as those kept by nursing staff. Processes should be in place to ensure that all records kept by nursing staff are reported electronically by the medical records department. This will impact the accuracy of internal and external reporting of key health facility data.

Are pregnancy records complete, and match birth and postnatal data?

Records of pregnancies, births and postnatal care maintained by health facilities include detailed information on the health of the mother and baby (illness, mortality), as well as the number and nature of visits to the facility (e.g. number of antenatal visits, number and type of immunisations). It is important that a mother and her baby can be identified through the antenatal, birth and postnatal periods, to provide detailed information for health services management as well as health outcome indicators (e.g. perinatal mortality rates, immunisation rates).

Are individual identification numbers (e.g. health record numbers) accurate and individuals not duplicated?

Individual identification numbers are key data for health information systems, as they allow multiple utilisation of health services, and often health outcomes, to be linked. Health information systems should have processes to ensure that an individual's identification number is readily accessible across facilities, so that a new number is not created for an individual when they attend a different facility.

Mortality data

The guidelines to assist assessment of the quality of mortality data are presented in brief. Detailed instructions for mortality data quality assessment are presented in the Health Information Systems Hub Working Paper 13, Mortality statistics: a tool to enhance understanding and improve quality.[11] Readers are directed to the relevant steps described in Working Paper 13 for more information.

Early age mortality

Early age mortality refers to the measurement of mortality rates of children under the age of five years. These include the following mortality rates: perinatal, neonatal, post-neonatal, infant, child and under-five.

Mortality rates
Perinatal mortality rate: number of stillbirths and deaths in the 7 days of life per 1,000 live births
Neonatal mortality rate: number of deaths at age less than 28 days per 1,000 live births
Post-neonatal mortality rate: number of deaths at age 28 days to less than 12 months per 1,000 live births
Infant mortality rate: number of deaths at age less than 12 months per 1,000 live births
Child mortality rate: number of deaths at ages 12 months to less than 60 months per 1,000 children surviving to age 12 months
Under-five mortality rate: number of deaths at age less than 60 months per 1,000 live births

Is there a clear definition of live births and still births?

Staff involved in collecting such early age mortality data should be aware of the WHO definition of a live birth and still birth. This is described in more detail of Step 5 (page 17) of Working Paper 13.

Which data source and technique was used to measure mortality?

Early age mortality can be computed from a vital registration system, using direct estimation techniques from retrospective birth histories from a population survey (as used in the DHS), or using indirect techniques from child survival data in a survey or census. Working Paper 13 describes data sources in detail in Step 5 (page 18).

What is the reference period of the mortality rates?

Direct and indirect early age mortality estimates from a population survey or census are based on retrospective reporting of deaths, and so refer to a period of time in the past. Direct early age mortality rates, based on a retrospective birth history, generally refer to a five-year or ten-year period prior to the survey. The reference period for indirect mortality estimation from child survival data can be computed using methods developed by Coale and Trussell, or by applying the Maternal Age Period-Derived Method developed by Rajaratnam et al.[12-13]

Is there any heaping of deaths at age 12 months or five years?

Age-heaping of deaths refers to the over reporting of death at certain ages, such as 12 months or five years. This may affect the accuracy of the resultant mortality rate. More detail about assessment of age-heaping is presented in Step 4 (page 15) of Working Paper number 13.

What is the 95% confidence interval for the estimate of early age mortality?

Where the early age mortality rate is obtained from vital registration or health facility data, there may be uncertainty due to small numbers of deaths. This

uncertainty can be represented by a 95% confidence interval. The 95% confidence interval of direct estimates of early age mortality rates obtained from a survey with a complex survey design are computed using advanced techniques which require more advanced statistical training.

All age mortality

All age mortality refers to the measurement of mortality rates at ages five years and above.

What data source was used to measure mortality?

The most common data sources for mortality are a vital registration system, a population survey, census and hospital reporting systems. Working Paper 13 describes mortality data sources on page four.

Is the estimated completeness of reporting of mortality reported? If so, was completeness estimated using another data source or through indirect techniques?

The completeness of mortality data from a vital registration system can be assessed through an independent capture-recapture survey or through indirect methods. Working Paper 13 details capture-recapture surveys on pages 19-20. Indirect demographic techniques estimate incompleteness from the internal consistency of the data source.[14-15]

Is the age pattern of mortality reliable?

The age pattern of mortality is a key indicator of the quality of mortality data. Step 4 of Working Paper 13 provides guidance for assessing the validity of the age distribution of mortality.

Is the population data from a reliable source (such as the government statistics office)?

Population data require a high degree of accuracy because they provide the denominator used in computing mortality rates. A reliable source for population data is the government statistics office, which should provide annual estimates of population by age and sex. In some settings a local population administration office (or similar) may maintain updated population numbers for a small jurisdiction. However the quality of local data will vary and so should only be used if of reliable quality.

If mortality rates are compared between two different populations, has age-standardisation been used?

Age-standardisation is required when comparing overall mortality rates between populations with different age structures, because mortality risk varies by age. In a population with an old age structure, the crude death rate may be higher than in a population with a young age structure, even if the latter population has higher age-specific death rates. Age-standardisation removes the effect age structure when calculating mortality rates. The age-standardisation spreadsheet provides a template for computing age-standardised mortality rates for two different populations.

How is maternal mortality measured?

Maternal mortality can be identified from accurate cause-of-death data. Where reliable cause-of-death data are not available, maternal mortality can be estimated from a survey or census. The sisterhood method is often used by surveys to measure maternal mortality, and is based on a set of questions to a woman about a deceased sister to estimate if it was a maternal death. Maternal mortality is a statistically rare event, even when mortality levels are high. Therefore, it is important that 95% confidence intervals are always reported with a maternal mortality rate or ratio.

Mortality rates
Maternal mortality rate: number of maternal deaths per 100,000 women aged 15-49 years
Maternal mortality ratio: number of maternal deaths per 100,000 live births

Cause-of-death and morbidity

Have doctors received training in completion of the medical certificate of cause-of-death (MCCD)? Are MCCDs completed soon after death?

Pages 20 and 21 of Working Paper 13 detail the MCCD and information regarding proper certification practices to ensure accurate data are generated.

Has a validation study been conducted to assess the quality of cause-of-death reporting?

The quality of cause-of-death reporting can be assessed through a validation study.[16] In a validation study, each reported cause-of-death from the relevant data source is compared with a 'gold standard' cause-of-death. The 'gold standard' data will be deaths in a facility where a physician has reviewed the patient's medical record and completed a MCCD and the death is coded by a person who has received training in ICD. An estimate of the quality of non-facility cause of death data can be conducted by using the instrument to measure these causes of death (e.g. a verbal autopsy) to ascertain the cause of facility deaths, and comparing with the cause determined using gold standard methods.

Have ICD coding staff received appropriate training?

The accuracy of cause-of-death and morbidity reporting is reliant upon ICD coding staff having received appropriate training. Details of the role of an ICD coder are described on pages 20 and 21 of Working Paper 13.

Are the leading causes of death consistent with the level of mortality and epidemiological profile of the population?

Populations with a lower life expectancy have a higher proportion of deaths due to infectious diseases, while populations with a higher life expectancy have a higher proportion of deaths due to non-communicable diseases and external causes. Step 6 of Working Paper 13 provides methods to assess the quality of cause-of-death reporting.

Are the causes of death and morbidity consistent according to the age and sex?

The quality of cause-of-death and demographic data can be assessed by whether each cause is consistent with the age and sex of the deceased. Step 7 of Working Paper 13 shows how this can be evaluated.

What percentage of deaths and illnesses are from ill-defined causes?

Ill-defined causes of death do not have value in providing information on public health. The types of causes that are ill-defined, and methods to assess the extent of ill-defined cause reporting, are described in Step 10 of Working Paper 13.

Birth data

What are the data sources for births?

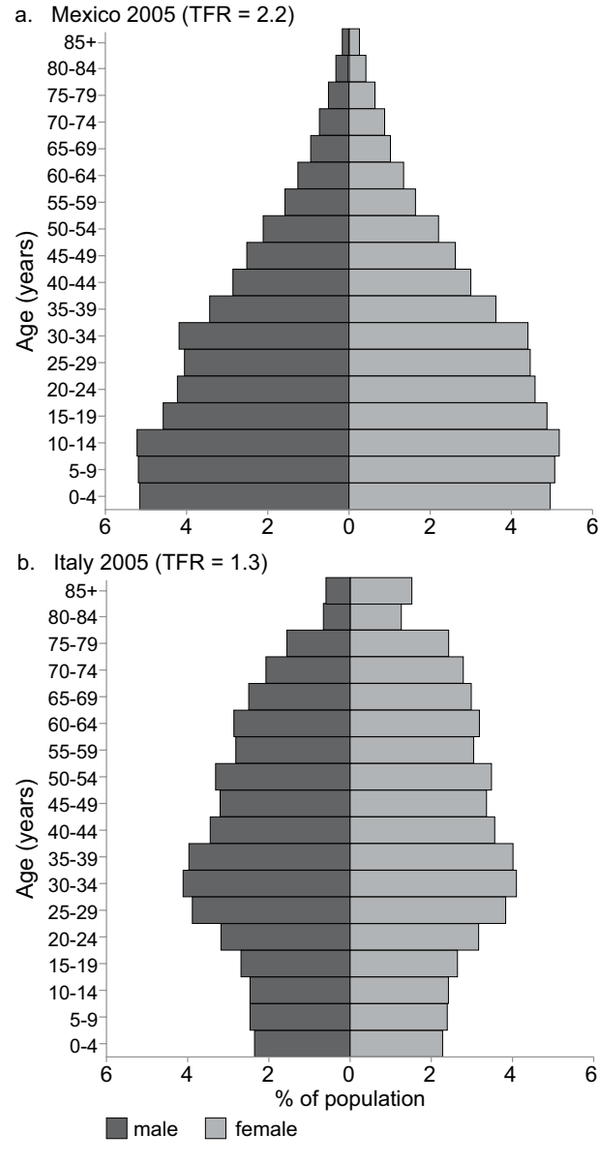
A range of data sources are available to produce birth statistics. The most reliable data source is a complete vital registration system. Birth registration is generally more complete than death registration, because of a range of incentives for registering a child (e.g. a birth certificate may be required for a child to attend a government school). In countries with incomplete birth registration, a population survey is regularly the most reliable source of birth data. The birth history in the DHS is used for summary measures of births. This has information on the date of birth, sex of the child and age of the mother. A population census and hospital data are also other sources for birth statistics where birth registration and population surveys are not available or of adequate quality.

What is the summary measure of births (fertility)?

There are a number of summary measures of births or fertility. The crude birth rate measures the total number of births per 1,000 people. The crude birth rate is a useful indicator of the level of births in a population, for example to plan for child care demand. However the crude birth rate does not measure the propensity of women of childbearing age to give birth. This is better represented by the age-specific fertility rate, which measures the number of births per the population of women of certain age groups (e.g. 25-29 years). The total fertility rate is the most commonly used summary fertility measure. It measures the number of children each woman would bear if they hypothetically experienced the age-specific fertility rates of all women in that given year.

Is the total fertility rate above or below the level of replacement fertility? Is the total fertility rate consistent with the age structure of the population?

The replacement fertility refers to the level of fertility required to replace the mother and father of the child, accounting for mortality of the child. The replacement level of fertility is a total fertility rate of 2.1 births per woman. Fertility that is significantly below this level implies that the population has an old age structure. Fertility well above the replacement level generally implies a younger age structure of the population. The population pyramid, shown below for Mexico and Italy, presents the proportion of the population at each age. In Italy, a low total fertility rate (1.3) corresponds to an old age structure, where a high proportion of the population are aged over 50 years. In contrast, in Mexico where the total fertility rate is near replacement level, the population is much younger.



Source: United Nations Population Division, World Population Prospects: The 2006 Revision

Potential application of guidelines to countries in the Pacific

This section briefly discusses the potential for the guidelines to be applied in selected Pacific countries. This is dependent on the type of data collected as well as the capacity of the participants. These guidelines would ideally be taught to local officials as part of a training workshop as in Samoa, to appropriately develop their skills to utilise the data in the future.

Fiji

PATIS is a key component of the Fiji health information system, as in Samoa, and operates in numerous hospitals throughout the country. It comprises similar modules as the Samoan version of PATIS. An important input to PATIS is the National Health Number (NHN), which links an individual's data across different facilities using this system throughout the country.[17] The NHN has provided a means to improve the analysis of individual patient engagement with the Fijian health system.

The primary data sources for Fiji's mortality reporting are the civil registration system and Ministry of Health reporting system. The main weaknesses of mortality data are associated with completion of the MCCD and ICD coding.[18]

The guidelines that can be applied to Fiji are mainly associated with those that can assess health facility data (i.e. PATIS), as well as mortality data, in particular cause-of-death data. The question regarding individual identification numbers are particularly important for PATIS, given that NHNs are a key input into the system. Processes to ensure that an individual's identification number is readily accessible at each participating facility should be used, to prevent duplication of NHNs. Further, there is much potential for the cause of death data to be assessed using the relevant questions, in particular those examining training of physicians and staff in medical certification and ICD coding.

Vanuatu

In 2007 Vanuatu conducted a Multiple Indicator Cluster Survey (MICS), a population sample survey. The survey comprised a sample of 2,632 households, 2,692 female respondents aged 15-49 years and 1,634 children aged under five years.[19] The MICS collected data was used to produce a number of indicators, including those to assess progress to the Millennium Development Goals. The indicators included those assessing child mortality, child health, nutrition, reproductive health, as well as other factors.

There are a number of relevant questions used to assess the quality of data from the Vanuatu MICS, and much of this information is detailed in the MICS Final Report.

The report describes that the sample frame used for the survey was based on the 1999 Population Census of Vanuatu, which was updated in the 2006 Agricultural Census. Further, the sample was designed to provide estimates representative at the national level, for urban and rural areas, as well as for the six provinces in Vanuatu.

The guidelines can also be used to assess the early age mortality methods used in the MICS. The MICS final report answers many of these questions. The data source of early age mortality in the MICS survey uses data where the woman is asked to report the number of children she has ever given birth to, and how many of these have survived. Such data requires the use of indirect methods to estimate early age mortality rates; the MICS survey used the Brass-Trussell methods. These methods use a number of assumptions, including constant fertility, the application of an appropriate model life table, and that the five-year cohort of women used have the same mortality level as all women giving birth. These methods also require that the reference period is estimated.

Tonga

Tonga's mortality data are primarily sourced from its civil registration system and reporting through the Ministry of Health.[20] The civil registration system comprises death reports from local officials to the Prime Ministers' office. However, such data is not utilised for reporting or analytical purposes. Death reporting in the health information system of the Ministry of Health is mainly comprised of completed MCCDs. As with Fiji, the guidelines to assess the quality of cause of death reporting have much potential in Tonga. The template to evaluate the age- and sex-consistency of cause of death reporting, as well as the question regarding the percentage of deaths from ill-defined causes or garbage codes, would be particularly useful.

Tonga has also recently procured a computerised patient administration system for health facilities, which can be evaluated using the questions in the health facility section.[17]

Conclusion

This article has detailed a set of guidelines to assist public health officials critically assess and effectively utilise existing data to inform health decision-making. Many low- and middle-income countries have extensive public health data, however such information is commonly underutilised as evidence to support health policy-makers plan, manage and evaluate health services.

The guidelines can be applied widely in other Pacific countries. They were designed to provide a basis for data quality assessment and data utilisation for staff with a range of capacities. In each country, they can be adapted given existing datasets and staff capacities, and taught to local officials as part of a training workshop.

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Improving vital statistics in the Pacific 2011-2014

Case-study

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Background

The Pacific region comprises 15 independent, diverse countries and seven territories, all of which rely on national or territorial statistical services to guide planning, development and government decisions. Reporting on demographic, economic, social and development indicators requires reliable statistics to monitor trends. Vital statistics are especially important in the health and development sectors. The paucity of data in Pacific countries has been highlighted in the last decade by the need to monitor progress on the Millennium Development goals (MDGs). The Pacific also faces challenges in dealing with what appears to be a rapid and exaggerated health transition from communicable to non-communicable diseases (NCDs). Reliable, timely data are needed for planning, delivery and evaluation of population health strategies and intervention services. The absence of this data is a significant barrier to effective planning and cost-effective resource allocation. By investing in civil registration and vital statistics systems, costs and inefficiencies can be reduced by lessening dependence on very costly demographic health surveys, and also ultimately obtaining better quality and more timely data, rather than data via indirect estimation and with information only available every five to ten years.

The impetus for improving vital statistics in the Pacific has arisen in part from priorities articulated in the Pacific Plan of Regional Heads of Governments as well as through global initiatives such as the MDGs. The Economic and Social Commission for Asia and the Pacific (ESCAP) has also recognised the urgent need to place civil registration systems on the regional agenda rather than relying on alternate sources of vital event information, such as population censuses or household sample surveys. There is now greater awareness of the need for quality and timely data to inform decision making, particularly in relation to NCDs and around the development of policy and provision of technical and financial assistance, especially from donor countries and development agencies.

A comprehensive report entitled *A Pacific Island Regional Plan for the Implementation of Initiatives for Strengthening Statistical Services through Regional Approaches 2010-2020*, was tabled at the 3rd Regional Conference of Heads of Planning and Statistics held in Noumea, July 2010. The report led to the subsequent development by the Secretariat of the Pacific Community (SPC) of the T*en Year Pacific Statistics Strategy 2011-2020* and the design of a prioritised Pacific Vital Statistics Action Plan, Phase 1 (2011-2014), which features improvement to vital statistics and civil registration as one of the three strategic priority areas.

The Brisbane Accord Group (BAG)

At the initiative of the Health Information Systems Knowledge Hub (HIS Hub) at the University of Queensland and the Statistics for Development Programme of SPC, a meeting of Pacific partners, including the United Nations Population Fund (UNFPA), World Health Organization (WHO), United Nations Children's Fund (UNICEF), Pacific Health Information Network (PHIN), Australian Bureau of Statistics (ABS), Queensland University of Technology (QUT), University of New South Wales (UNSW) and Fiji National University (FNU) was convened in December 2010 in Brisbane. The aim was to collectively understand ongoing and planned vital statistics development activities in the Pacific and to discuss strategies to improve vital statistics in Pacific countries within the Ten Year Pacific Statistics Strategy being implemented by SPC.

At the first meeting the BAG proposed long-term goals and priority actions for a collaborative initiative to improve vital registration practices in Pacific countries as part of the rollout of the strategy. The main outcome of the meeting was a comprehensive mapping and categorisation of current activities on vital statistics systems development activities in the Pacific as well as an agreement to focus on five priority areas, namely:

1. Improving data integration and sharing, particularly rationalising the duplication of efforts, providing clarity about data ownership and improving understanding about the benefits of data consolidation
2. Increasing data analytical skills among data producers, particularly to assess the quality and completeness of basic health statistics including fertility, mortality and cause-of-death, realising the potential for regional approaches to HIS to address problems associated with the small number of trained staff in many countries, and to more efficiently process data
3. Strengthening strategies to advocate for HIS, including the need for producers and users of health

data to be more aware of their potential to inform health policy debates

4. Improving knowledge about the potential importance of health surveys for cross-validating vital statistics data, and increasing analytical capacity to analyse them to better support policy
5. Making better use of institution-based data to improve vital statistics, particularly resolving issues around cost-effective means for data transmission, and improving practices and knowledge.

The Brisbane Accord Group includes the following agencies: UQ HIS Hub, SPC, WHO, UNFPA, PHIN, ABS, UNSW and FNU. Other agencies that have not yet joined the BAG but are also working to improve statistics in the Pacific region include the International Monetary Fund (IMF), Asian Development Bank (ADB) and the World Bank.

Country engagement

A critical element for the success of this initiative will be country engagement through the Pacific Statistics Steering Committee (PSSC). The role of the BAG is to provide strategic and technical support to countries to improve their vital statistics as part of the implementation of the Ten Year Pacific Statistics Strategy. SPC and the HIS Hub will facilitate the leadership and coordination of this engagement through the implementation of the Vital Statistics Improvement Plan.

Aims

The overarching aim of the plan is to assist Pacific countries to understand the critical importance of vital statistics on births, deaths and cause-of-death and thereby to improve their availability, accuracy and use. The Implementation Plan focuses specifically on helping countries to improve the completeness of registration of births and deaths and to improve the quality and reliability of data on cause-of-death through a range of strategies and linked activities.

The implementation plan is aligned with the *Pacific Strategy Action Plan, Phase 1 2011-2014.* It specifically relates to Objective 2: Pacific Island Countries and Territories are producing the agreed core sets of statistics across key sectors; and Output 2-2.2: technical assistance and training is provided to countries with weak or incomplete registration systems to produce reliable birth and death statistics. These statistics are part of the National Minimum Development Indicator (NMDI) database being developed by SPC.

Objectives

The action plan for strengthening vital statistics and civil registration in the Pacific will systematically address the following specific objectives:

1. Establish mechanisms for the coordination and alignment of all in-country personnel and development partners to work with countries on a comprehensive, prioritised and achievable country strategy for improving vital statistics
2. Develop country-specific strategic plans that can be carried out within the framework of the Ten Year Pacific Statistics Strategy drawing on the technical and financial resources of the BAG
3. Encourage and assist all countries to undertake an assessment of their vital and civil registration systems involving key stakeholders across sectors of health planning and statistics to identify weaknesses and priorities for strengthening the two systems using the WHO/HIS Hub Assessment Framework
4. Promote both community awareness and government commitment to improve civil registration and vital statistics systems through improved legislation, capacity and resourcing
5. Enhance understanding of the importance of vital statistics among, and collaboration between, all offices and agencies involved in registering vital events and producing vital statistics
6. Strengthen training of personnel involved in civil registration and production of vital statistics and improve technical capacity of countries to record, process and analyse information on vital events
7. Promote the use and dissemination of vital statistics
8. Establish mechanisms for regularly reviewing progress on the development of vital statistics and civil registration systems.

Achievements and the way forward

So far, implementation of the Action Plan has resulted in:

- Five countries developing their own vital statistics improvement plans with specific actions, which have been endorsed by their respective Ministry or National Department of Health
- Four countries currently preparing to write a plan
- Three countries engaged in medical certification training with their doctors
- A number of in-country meetings hosted with representatives from Statistics, Civil Registration and Health present.

The Pacific Health Information Network (PHIN) has been working closely with the HIS Hub and WHO to build awareness about data; promote best practice for data collection; and increase analytical capability and capacity to analyse, interpret and use data to better support policy action. Through these various strategies, frameworks, action plans and collaborations, civil registration and vital statistics systems in the Pacific will improve, leading to stronger health information systems and ultimately resulting in improvements in health.

Improving the quality of HRH information

Original article

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Introduction

Accurate, accessible and quality information about the providers of maternal, neonatal and reproductive health (MNRH) care at the community level, how they are performing as well as how they are managed, trained and supported, is central to workforce planning, personnel administration, performance management (PM) and policy making. A number of documents have identified the need for timely, reliable, detailed and consistent workforce data in order to provide evidence to justify requests for both new and ongoing investment in human resources for health (HRH) development.[1-2] This information is critical to quality service delivery, and at the community level this includes health workers delivering evidence-based packages of care to women and newborns and making emergency referrals to facilities beyond the community.

The community is often the first point of contact people have with the health system and it is at the household level that the activities of the health sector are ultimately directed.[3] People-centred health care is a key principle of primary health care (PHC) and health workers and HRH management processes have an important role in '*enabling people to increase control over, and to improve, their health*'.[4] The community level has received renewed attention due to the revitalisation of PHC. Primary health care reform has highlighted the need to better link community-level care with district-level services[5], improving the support of HRH and strengthening referral mechanisms.

Health workforce information, along with information concerning service delivery, finance, governance and the supply of medical products, vaccines and technologies, make up a country's health information system (HIS).

Maternal mortality remains unacceptably high in many developing countries, with an estimated **61% of women delivering alone** or with an unskilled attendant

This system produces relevant and quality intelligence necessary for decision making.[1] Information about the workforce also contributes to monitoring progress toward the Millennium Development Goals (MDGs). Skilled health workers at delivery are the key to reducing maternal mortality which constitutes the first target of MDG 5. Although no specific target has been agreed upon to increase the proportion of skilled birth attendants (SBAs), the United Nations International Conference on Population and Development + 5 (ICPD+5) has set a goal to have 90% of all births attended by a SBA by 2015.[6] MDG 5 is the goal towards which least progress has been made. Maternal mortality remains unacceptably high in many developing countries, with an estimated 61% of women delivering alone or with an unskilled attendant, and access to reproductive health services, including family planning, remains limited.[7] At the community level, health workers are also involved in the collection of data that contributes to the assessment of progress towards all aspects of MDG 5 as well as other data that forms part of a country's HIS. This highlights the importance of health worker skills in gathering information for monitoring health service delivery as well as for monitoring health workforce performance.

Despite the importance of accurate information about health service personnel and the context in which they practice, little is known about providers at the community level. The purpose of this article is to:

- Describe some information flows and gaps concerning the workforce that provide MNRH care and services at the community level
- Discuss potential stakeholders' HRH information needs and uses
- Provide recommendations for improving the availability, quality and use of HRH information.

This article may be of particular use to district managers as well as non-government organisations (NGOs) and donors wishing to improve their knowledge management and exchange practice in the Asia and Pacific regions.

The conclusions about HRH information availability, quality and use in this article are drawn from an analysis of information systematically collated for a

report on MNRH personnel at the community level in 10 countries. This article includes profiles of MNRH staff at the community level in Bangladesh, Cambodia, Fiji, Indonesia, Laos, Papua New Guinea (PNG), the Philippines, the Solomon Islands, Timor-Leste and Vanuatu. The analysis of HRH country information is restricted to documents that are available through electronic databases, on the internet and those accessed through in-country contacts. However, a key strength of the article is the fact that its conclusions are drawn from a synthesis of information from a wide range of sources, including grey and peer-reviewed documentation as well as key informant knowledge.

The need for quality information on HRH in MNRH at the community level

At the community level, information about the workforce is needed to provide a picture of staff supply, productivity, competence and responsiveness. This information contributes to knowledge about staff performance so that gaps and problems can be identified, interventions planned and the need for additional resources justified.[8]

Health service managers require such information to establish appropriate staffing levels, training needs and to ensure staff members are deployed in the most suitable way. HRH indicators also provide important information for benchmarking, ensuring patient safety and allowing comparisons between different components of a health system.[9]

Staff supply concerns the availability, retention and loss of staff and includes information about staff numbers, their distribution, employers, roles, work attendance and absenteeism, resignation and retirement. This enables an assessment to be made in terms of the current workforce stock, which may include health workers employed by the state, or non-state sectors, including private practitioners who may also be self-employed. Interventions such as workforce planning forecasting, recruitment drives, task shifting activities or multi-sectoral partnership agreements for service delivery may be planned with community-level input by managers at the district level using this information.

Information about waiting times (for example, how long it takes for a pregnant woman to receive an antenatal check at the aid post), can shed light on the available numbers of staff as well as staff productivity. Other examples of productivity might be gained from data concerning the number of household visits made, or the number of family planning counselling sessions held by each health worker. Information about efficiency in the workforce can be compared with agreed benchmarks, enabling managers to gauge what improvements may be required, and in what areas.

Financial or non-financial incentives may be provided to improve productivity or supervision enhanced to help improve practice. Knowledge about staff competence involves the collection of data on the quality of education and training, health worker knowledge, skills and attributes in MNRH and the achievement of required competencies needed to perform specific functions such as normal delivery or the insertion of an injectable contraceptive. Managers may use this information to upgrade skills through in-service training and to better monitor individual and team competence through improved PM systems and audit processes. Professional organisations and education and training institutions may undertake curriculum reviews and development based on such information.

Information about staff responsiveness relates to data about client satisfaction with the service they receive. It also concerns information about how quickly and accurately staff members are able to detect danger signs and symptoms in order to treat, manage or refer, thereby preventing or reducing the risk of death or disability. This information may be used by supervisors to assess adherence to protocols and feed into staff PM. Incentives such as promotion may be awarded on the basis of performance excellence.

This information provides insight into individual performance at the community level but more is required in order to better understand the management, policy and regulatory environment that affects how individuals and teams of health workers operate at the community level. Examples of this information include details about staff supervision, selection and recruitment policy and processes, training regimes, incentives, job classification systems, conditions of service, national human resources (HR) policy, certification and professional regulation. In addition, information about logistics and infrastructure helps to build a profile of the supportive mechanisms that provide health workers with drugs, equipment and reproductive health commodities as well as transport and communication systems for referral and advice.

Overview of information sources, gaps and issues at the global, regional and national levels

There are a number of sources of workforce information, but there are many information gaps and conflicting data at the global, regional and national levels. At the global level, numerical data on the supply of health workers can be accessed from the World Health Organization (WHO) atlas on health workers,[10] the World Health Statistics Report,[11] and the online WHO Statistical Information System.[12] Unlike Europe, Africa and the Americas, the Asia and Pacific regions currently lack a health observatory which provides access to comprehensive information about health systems in countries, including HRH data.

Health service managers require such information to **establish appropriate staffing levels, training needs** and to ensure staff members are deployed in the most suitable way

At the regional level, the WHO Western Pacific Regional Office provides access to workforce data through the online country health information profiles (CHIPs) and health databank.[13] However, detailed data concerning health worker roles and functions in MNRH, or information about how they are managed or educated and trained and to what level they are employed, is not available. These WHO sources provide incomplete data on community health workers (CHWs). For example, ratios of CHWs to 1000 people are only provided for Fiji (0.13), PNG (0.60), Cambodia (0.13)[13], Bangladesh (2) and Timor (<1)[10]; these densities falling somewhat below the recommended value of 2.28.[14] However, data for the three other countries in the Asia region for which CHW information is available quote higher ratios (Maldives 16, Myanmar 9 and Nepal 6).[10] It is unclear what cadres are included in these figures as a large range of formal and informal workers can be incorporated in this or the nursing and midwifery group. Information is available in these databases concerning nursing and midwifery numbers; some are disaggregated by rural or urban location but not according to community service. No data is available on other workers such as traditional birth attendants (TBAs), village health workers (VHWs) and workers in other sectors who may be involved in the provision of MNRH care and services, including school teachers and community development workers.

Information on skilled birth attendants can also be sourced from MDG reports.[7] However, there is no information about the distribution of this cadre, including how many SBAs work at the community level or facility level and how they are managed and interact with TBAs and other health workers. Stanton et al.[15] point out a number of improvements that could be made in the collection of data on skilled birth attendance. Their detailed analysis of the coding of country-specific providers and facilities in survey data files suggests that more careful attention needs to be paid in international survey programs to accurately classify the type of health care provider and type of facility used for delivery. This is especially pertinent where country-specific cadres of providers (i.e. midwifery assistants, CHWs, TBAs) and facilities are used. They call for the documentation of the skills and training of various cadres of providers, as well as the basic or comprehensive obstetric care capacity of various types of facilities to assist in the assessment of birth attendants as 'skilled providers' as defined by WHO.[15]

Data on health financing, HR and infrastructure in low and lower middle income countries are still too poor to monitor basic information on the inputs of the health system.[16] Many countries do not have the technical capacity to accurately monitor their own health workforce. Data are often unreliable and out-of-date, common definitions and statistical analytical analysis are absent, and the skills needed to make crucial policy assessment are lacking.[2] Ministries of health do not always collect information on all cadres. For example, the Ministry of Health (MoH) in India has excluded roughly 1.5 million CHWs from its estimates of HRH. A separate occupational code is not included in the current data classification system; however, some of these workers may be included under nursing and midwifery.[2]

The Kampala Declaration and Agenda for Global Action issued at the First Global Forum on HRH calls for '*countries to create health workforce information systems to improve research and to develop capacity for data management in order to institutionalise evidence-based decision-making and enhance shared learning*'.[17] At the country level, there have been some efforts to build national capacity in HRH information systems (HRIS). The Health Metrics Network[1] and the Capacity Project[18] have undertaken much work in this area along with the USAID Health System 20/20 Programme.[19] However, work in MNRH and HRIS has been limited. One example from Malawi highlights efforts to link information systems in order to track the deployment and training of family planning and reproductive HRH, including those at the community level.[20]

HRH indicators for health information systems

There have been a number of efforts to identify HRH measures for HIS and health systems research. As a result, there has been a proliferation of tools for collecting and processing HRH information. These have a variety of foci including HRH planning,[21] rapid assessment for HRIS strengthening,[22] monitoring and evaluating HRH,[2,23] examining particular cadres such as nursing and midwifery,[24] assessing HRH as part of a health information systems analysis,[25] or as part of a health systems situational analysis.[26] These tools draw upon a number of indicators that make up data sets used to collect information and make assessments.

HRH indicators can be defined as '*a measurable variable (or characteristic) that can be used to determine the degree of adherence to a standard or the level of quality achieved*'.[27] HRH indicators have been grouped into categories by various authors. Hornby and Forte present 12 areas,[9] while Dal Poz et al.[2] outline selected key indicators for monitoring and evaluation in four areas: stock and distribution, labour activity, productivity, and renewal and loss.

Few data collection tools include specific indicators that allow for the collection of HRH data at the primary level, and there is an even greater paucity of indicators that include community-level information. Collecting HRH data at the community level would require the inclusion of cadres such as lay or non-clinical health workers, as well as traditional and cultural workers. This highlights a need for additional occupational categories or space allocated for a description of them. In addition, fields are also required that help to capture quantitative data concerning how these cadres interact with each other and how they are supported by policy and management processes. Indicators that facilitate the collection of information concerning the role of community members in HRH processes are also pertinent and contribute to a better understanding of community participation.

There are a range of fields from which indicators can be drawn to gather information about HRH at the community

level. These areas have been listed in Figure 1. The indicators cover fields of policy, management and education and training areas. They capture information concerning supply, productivity, competence and responsiveness as well as the key areas highlighted by Hornby and Forte[9] and Dal Poz.[2]

Collecting information about personnel who provide MNRH services at the community level may require the adaptation and modification of generic indicators. The development of indicators and those selected depends upon the objectives of the evaluation itself and the perspective taken. Approaches can range from a focus on the economic viability of the workforce to a management perspective health systems approach to the use of a human rights framework to assess practice such as that suggested by Thompson.[28] An overview of the mechanics of developing and using human resource indicators is provided by Hornby and Forte,[9] which includes an assessment of the management situation in order to determine what HRH indicators best fit with current PM needs. Kongnyuy and van den Broek[29] highlight an evidence-based approach to developing context-specific criteria and indicators for HRH performance through a consultative process.

Three workshops were held with stakeholders to establish standards for women-friendly care. The first involved the collating of evidence from existing guidelines and agreeing on objectives, structure, process and outcome criteria for each. In the second, participants agreed on a final list of standards and criteria, and the third workshop involved the selection of criteria to audit. This approach ensures 'buy-in' from stakeholders and staff, and ensures consensus and ownership, which is conducive to the success of a performance-management process.

This article has identified the need for quality information on HRH engaged in MNRH at the community level and the types of information required in order to plan interventions and justify resources to improve performance. The article will now provide a brief overview of cadres at community level and their roles in MNRH and then consider what information is available in key indicator fields and identify the gaps in knowledge.

Brief overview of HRH cadres at the community level in selected Asia and Pacific countries

Health workers who provide MNRH health services in communities are part of a large PHC workforce that includes practitioners employed by the public and non-state sectors who may be based in facilities or reside within the community itself. These health workers are usually multi-functional and provide other services such as child immunisations and first aid; they dispense drugs and refer patients with chronic conditions. A focus on MNRH care and services provides an opportunity to examine which cadres are engaged in this work, their specific roles and functions, and the human resource issues related to this practice. This is useful in the light of the need to accelerate progress towards MDG 5.

The term 'community level' refers to community-based MNRH care which can involve home-based and/or outreach services. Home-based refers to care and services that are delivered in the patient's or consumer's home. This may include births that take place in a woman's home or visits made to the family home to distribute family planning commodities. Outreach includes visits that are made by health workers who reside in one village or community to another community, or the visits that midwives or auxiliary nurses make to communities. These outreach services can be delivered in a purpose-built structure sometimes known as an aid post, or at a central point in the community, such as a community meeting place, a youth centre or a market.

Human personnel at the community level can be broadly categorised into three main groups: nursing and midwifery professionals, CHWs and traditional or cultural practitioners. These three categories are described below with examples. Workers in other sectors may also be involved in the provision of MNRH care and services, including school teachers and community development workers.

Skilled birth attendants

The term 'skilled birth attendant' (SBA) is generally applied to workers in the nursing and midwifery cadre.[30] However, in some circumstances CHWs may have received specialised training in midwifery, qualifying them as SBAs. Examples of cadres within the SBA category are given in Table 2.

Key to acronyms in Table 1

CHWs	Child Health Workers
HRH	Human Resources for Health
HR	Human Resources
MNRH	Maternal, Neonatal and Reprodcutive Health
TBAs	Traditional Birth Attendants

Table 1 HRH indicator fields

Policy/ Regulation/ Legislation	HR dedicated budget and community services identified
• Presence of national and linked district HRH policy that addresses community-level and MNRH workers in private and non-state sector • Presence of job classification system that includes community cadres and service functions • Compensation and benefits system used in a consistent manner to determine salary upgrades and awards • Formal processes for recruitment, hiring, transfer, promotion, disciplinary actions • Employee conditions of service documentation (e.g. policy manual) • Presence of a formal relationship with unions (if applicable) • Registration, certification, or licensing is required for categories of staff in order to practice	*Personnel administration/ Employee relations* • Salary: average earnings, average occupational earnings and income among HRH • Health and safety in the workplace, standard operating procedures, protocols and manuals • Incentives: monetary and non-monetary • Teamwork practice and functional partnerships *Performance management* • Job descriptions and duty statements are present • Supervision (especially clinical supervision) schedule • Frequency of supervision visists to the field planned that were actually conducted • Relative number of specific tasks performed correctly by health workers/adherence to protocol etc. • There is a formal mechanism for individual performance planning and review • Peer review mechanisms • Level of job satisfaction, level of staff motivation • Education, training and competencies • Existence of a formal in-service training component for all cadres • Existence of a management and leadership development program
Management systems	**Community/ Consumer engagement in HRH**
Staff supply, retention and loss • Ratio of CHWs, nurses and midwives and TBAs at community level to 1000 people (recommended level: 2.28)[14] • Distribution of HRH in urban and rural communities • Distribution by age, distribution of HRH by sector (state/ non-state), distribution by sex • Distribution of HRH by occupation, specialisation or other skill-related characteristic • Proportion of staff in dual employment/employed at more than one location • Number of vacancies, posts filled, duration of job, proportion of HRH unemployed • Hours worked compared with hours rostered • Presence of HR information system • Existence of a functioning HR planning system • Days of absenteeism among health workers • Ratio of entry to and exit from the health workforce • Proportion of nationally trained health workers	• Client satisfaction, number of patient contacts • Frequency of community meetings attended and evidence of community participation • Presence of a formal relationship with community organisations • Mechanisms for involving community and HRH in pre- and post-service curriculum development and review • Community involvement in: policy development, recruitment and selection, performance management (i.e. supervision)

Community health workers

The diverse category of CHWs is used to describe practitioners who are often '*selected, trained and work within the communities from which they come*'.[31] The definition of a CHW depends on the health system they are working within and therefore it is not possible to create a standard set of functions for them as CHW tasks are assigned according to local conditions.[32] CHWs perform a broad range of tasks in MNRH which can be classified as curative, preventive and promotive functions. These include health education and promotion, advocacy, community mobilisation, dispensing reproductive health commodities and drugs and basic clinical interventions and referral. In addition, CHWs perform a mix of health service functions and development functions, the latter involving mobilising the community to improve their social and economic as well as health status. Examples of cadres within the CHW category are given in Table 3.

Traditional birth attendants

Traditional birth attendants (TBAs) are traditional or cultural workers engaged in MNRH whose practice is based on the socio-cultural and religious context of the communities in which they work. TBAs in some countries are independent of the health system and considered alternative or complementary to Western medicine. TBAs are not formally trained or employed but receive direct payment from their clients in the community. However, in other contexts they play a more formal role. In Samoa, for example, TBAs, are licensed to assist in deliveries and are trained and supervised by midwives.[5] In other settings, they may be involved in referring women to services and providing sociocultural support before, during and after delivery. A number of names are given to TBAs depending on the context. For example, they are referred to as *hilots* in the Philippines,[33] *dunkun bayi* in Indonesia,[34] and *yalewa vuku* in Fiji.[35]

Table 2 Examples of skilled birth attendant cadres

Country	Designation	Role in MNRH	Training	Coverage (ratio per 1,000 people)
Cambodia	Primary midwife	Basic midwifery	One-year Diploma of Midwifery following post-basic training	0.10
	Secondary midwife	Can perform caesarean sections and abortions in authorised places[36]	Three-year diploma	0.13
Fiji	Nurse practitioner	Acts as replacement doctor in some areas[37]	13-month additional diploma in addition to three-year diploma	N/A
Indonesia	*Biden di desa* (PTT; village-based midwife)	Birth attendant, ANC and PNC[38]	Three-year training course on completion of secondary school	0.22
Bangladesh	Community-based skilled birth attendant	Carries out home deliveries, referral in case of complication[39]	Six-month training for those who had been trained and practised as family welfare assistants and family health assistants Practical Nursing – 1.5 years	0.019 (new cadre)
Philippines	Registered nurse	Carries out normal deliveries, ANC and PNC, insert IUDs	Diploma or Certificate of Nursing – three years plus additional midwifery training and in-service training from Marie Stopes	4.0
Papua New Guinea	Community health worker	Carries out normal deliveries at aid post health promotion, ANC and PNC	Three to six month module is being planned to upgrade CHW skills as auxiliary midwives[40]	0.61

Key to acronyms in Tables 1 and 2			
ANMC	Australian Nursing and Midwifery Council	N/A	not available/applicable
ANC	antenatal care	NDoH	National Department of Health
CHW	community health worker	PNC	postnatal care
IUDs	intra-uterine devices	PNG	Papua New Guinea
IMCI	integrated management of childhood illnesses	PTT	*pegawi tidak tetap* (non-permanent employees)
MoH	Ministry of Health	SBAs	skilled birth attendants
MoHFW	Ministry of Health and Family Welfare		

Table 3 Examples of community health worker cadres

Country	Designation	Role in MNRH	Training	Coverage (ratio per 1,000 people)
Bangladesh	Community health worker	Makes ANC home visits to promote birth and new-born-care preparedness, postnatal home visits to assess newborns, refers or treats sick neonate[41]	14-20 day training	0.31
	Family welfare assistant	Supplies condoms and contraceptive pills during home visits. May act as SBA if trained by MoH[43,101]	N/A	0.15
	Shasthya sebika	Female volunteer who disseminates family planning messages, registers pregnancy cases[44]	Four-weeks basic training	0.45
Indonesia	Village family planning volunteers	Promotes family planning, organises meetings, provides information, organises income-generation activities, gives savings and credit assistance, collects and reports data[45]	N/A	N/A
	Peer health educators	Education and promotion[46]	Three-day training	N/A
	Kader	Voluntary health worker. Basic clinic care and education[47,48]	IMCI trained	N/A
Vanuatu	Peer health educator	Delivers reproductive health information and education[49]	Two-year certificate	N/A

Available information on HRH in MNRH at community level in selected Asia and Pacific countries

This section will outline what information is available to those outside ministries of health about health personnel engaged in MNRH at the community level in key HRH indicator fields across 10 countries in the Asia and Pacific regions. These countries are: Bangladesh, Cambodia, Fiji, Indonesia, Laos, PNG, the Philippines, the Solomon Islands, Timor-Leste and Vanuatu. This is derived from a desk-based mapping exercise undertaken by the HRH Hub and Burnet Institute. The source of this information is discussed, as well as critical gaps that need to be addressed, if more accurate assessments are to be about HRH in MNRH at the community level by donors and international health NGOs in order to assist in planning aid policy and programs.

Policy, legislation and regulation

National HRH policies and plans exist for the 10 countries; however, few plans make specific reference to cadres at the community level. The Bangladesh Health Workforce Strategy[42] is one plan that aims to improve incentives to work in rural and remote areas and integrate more community-focused aspects into training programs. The health strategies and plans of nations, particularly those concerning MNRH, do not provide much consideration of HRH issues at the community level. The Timor-Leste National Health Plan[50] is one example of a policy document that makes special mention of strategies to improve HRH skills in community-based approaches.

One Government Act from the Philippines[51] and a report on HRH in the Asia and Pacific regions were the only sources of information on CHW benefits.[52] The latter report outlines the benefits that *barangay* (local administrative division) health workers are entitled to receive, including hazard allowance, subsistence allowance, longevity pay, laundry allowance, housing

allowances and privileges, remote assignment allowance, free medical examination and leave benefits.[52] To receive these benefits they must be registered with the local health board.[51] No details were available on the use of a benefit system for community workers in a consistent manner to determine salary upgrades and awards.

A number of country HRH plans and strategies highlight the need to improve formal processes for recruitment, hiring, transfer, promotion and community involvement; however, little detail is provided. The Cambodian National Health Plan,[53] for example, aims to promote active local recruitment of trainees. Large gaps in information were identified in knowledge concerning community cadres within a national job classification system, documentation outlining community-level employee conditions of service and material concerning formal relationships with community organisations relating to health workers.

There were a number of references to the registration, certification or licensing required for nurse and midwives to practice.[37] However, there is a lack of information regarding the practice and regulatory framework governing CHWs and other informal cadres, such as volunteers and TBAs. A World Bank report[54] provides some information on the different accreditation bodies for privately- and publicly-trained nurses and midwives in Indonesia, while a conference presentation details barriers to midwife registration in PNG over the past nine years.[55]

Management: supply, rentention and loss

Information on the supply of formal cadres, especially those employed by the MoH in the nursing and midwifery area, is more accessible than information concerning informal or selfemployed cadres, such as solo nurse providers who practise illegally in Indonesia.[56] In addition to the WHO regional database sources, such as secondary sources, CHIPs and the Health databank,[13] there are other key sources of information pertaining to regional nursing and midwifery. The Australian Nursing and Midwifery Council website[37] provides country profiles which sometimes include numbers of personnel, such as in the case of the Cambodian and Fijian profiles. However, further details concerning nursing and midwifery distribution, retention and loss is unavailable.

Detailed information concerning nurses and midwives is also available at the national level. For example, a World Bank Report on medical and nursing personnel provides ratios of personnel in urban, rural and remote locations.[54] A number of United Nations documents, such as those by UNFPA in Laos,[57] provide information on numbers of auxiliary nurses, PHC workers and mid-level nurses (formal health workers), and details of the number of births attended by these workers as well as by TBAs and relatives. This draws upon national statistical data on current workforce and facility capacities. However, there is no disaggregation of the health worker data by community level, so it is not known how many formal health workers are available in a home-based or outreach capacity.

There is a lack of information regarding the **practice and regulatory framework** governing CHWs and other informal cadres, such as volunteers and TBAs

NGO reports including The Bangladesh Health Watch Report,[42] provides HRH supply data at the community level. This data was gathered through a series of surveys over all six divisions of the country. Inventory lists of health workers were developed which include numbers of workers at the community level including CHWs, drug sellers, TBAs and other traditional cultural workers. This is disaggregated by gender and rural and urban location. However, it is not apparent what MNRH services these cadres actually provide, nor is it clear what nursing and midwifery cadres provide community-level services.

Some government plans and reports provide information on the supply of community-level cadres. The Vanuatu Ministry of Health Accounts[58] and National Workforce Plan[59] outline numbers of traditional healers at the village level, although it is not clear how many of the listed numbers of nurse aides, nurses, midwives and nurse practitioners provide services at the community level. MoH personnel inventories are a key source of country supply information, such as that provided by Yambilafuan[60] at an HRH meeting. Data from these primary sources is available in some donor and WHO reports.

There is a range of information about HRH at the community level in MNRH. An AusAID report[61], for example, that draws upon data from the Fijian Government, does not disaggregate data according to service at community level. However, a WHO report for Laos[62] provides numbers of village health volunteers, TBAs, village health staff and traditional healers across all provinces in the country, but it is not apparent what MNRH services they provide at the community level. Other sources provide information about staff employed in the non-state sector. For example, a World Bank report gives the number of CHWs employed by the church in PNG, but it is unclear what number of the nurses employed are engaged in outreach work in communities.[63]

Other areas of information about supply are concerned with dual employment and selection. Project evaluations provide some information on dual employment. An USAID project report on a survey it undertook in the Philippines in 2006, found that 25% of midwives practised exclusively in the private sector, while 47% provided dual public and private services.[64] A World Bank report comments on the lack of data available on private midwife practice.[54] In the Philippines, a WHO report provides insight into community involvement in the selection of *barangay* health workers, which involves the village council or chair and the rural health midwife.[65]

There is an overall lack of information on ratios of TBAs and CHWs to population, as well as information about the distribution by age, gender, specialisation or skill of all nursing and midwifery professionals, CHWs, and traditional or cultural practitioners at the community level. In addition, there is a scarcity of detail concerning labour activity such as employment rates, proportion of workers employed in the state or non-state sectors and dual employment. Ratios of exit from the community-level workforce are also not published.

Management: personnel administration/ employee relations

Details about health worker remuneration were available from a limited number of documents. The Bangladesh Health Watch Report[42] provides key information about CHW income in a NGO environment and in public posts, as well as details concerning extra incentives in the form of gifts from clients including money and clothing. A peer-reviewed article and a World Bank report gave details of salaries of nurses and village midwives in Indonesia.[54,66] The media was also a source of information on salaries. For example, an article in the Fiji Times[67] reported that nurses' salaries may be as low as a quarter of what nurses could earn overseas. Low salaries are cited as a reason for high migration levels; however, it is not clear how this affects nurses who provide services at the community level.

Information concerning incentives for community-level workers is difficult to access. Some information about incentives for staff is available in government health and health workforce plans. Broad statements are made about incentives, whose aims range from encouraging workers to rural posts[59] to improving performance.[50, 53, 68] It is not evident how workers at the community level will benefit from these incentive plans. Program evaluations shed some light on the impact of financial incentives. For example, in Indonesia and Cambodia small sums of money have encouraged TBAs and community volunteers to refer pregnant women to midwives.[69-71] An evaluation of a training program in PNG reports on the incentives that village health volunteers and village midwives receive, including food, firewood, soap and other goods provided by the community and/or the supervising health centre in the absence of a regular stipend or salary.[72]

There is limited information concerning teamwork functionality at the community level in MNRH and the ways in which staff support each other through peer supervision, consultation and mentoring. Some information is available concerning improved working relationships between CHWs, SBAs and health workers in clinics in Timor-Leste through the introduction of a Family Health Promoters program[73] and the teamwork of mobile community clinics that are part of the Cooperativa Cafe Timor-Leste Program.[74-76] In Vanuatu, nurses reportedly work in the dispensary with a nurse aide and volunteers;[77] however, little information could be gleaned concerning their performance. Mobile teams also operate in Laos.[78]

Research studies in Bangladesh, such as that provided by Blum et al,[83] have reported that providers of **home-based births are largely unsupervised**

Details of community involvement as part of the MNRH team are only available from the Philippines. A government report outlines Women's Health and Safe Motherhood Teams which operate at community level in every *barangay* and include a rural health unit midwife (who heads the team), at least one *barangay* health worker and one TBA.[79]

Management: performance management

Some information on PM was available for countries such as Indonesia; sourced from a World Bank report[54], a peer-reviewed article[80] and a WHO University of Gadjah Mada report.[81] However, the focus of these documents is on nurses and midwives at the facility level. The Bangladesh Health Workforce Strategy[82] discusses the need for PM for all staff, but community-level workers are not specified.

An important part of PM is supervision, and there is limited information on the guidance providers receive at the community level. Research studies in Bangladesh, such as that provided by Blum et al.,[83] have reported that providers of home-based births are largely unsupervised. The Bangladesh Government has recognised the need for clear lines of supervision for community-level SBAs,[84] and the engagement of family welfare visitors in the supervision of community-based SBAs is reported in a research paper by Ahmed and Jakaria.[39]

The need to improve supervision is also stated in national health workforce plans such as in the case of Laos[78] or in health plans such as the PNG's MoH National Sexual and Reproductive Health Policy,[68] but the community level is not specified. Evaluations of projects present isolated examples of supervision at community level in PNG.[72] A government circular from the Philippines sheds light on the supervisory expectations of nurses and midwives at the community level. This includes who will be responsible for selecting *hilots* (TBAs) for training, providing training, monthly meetings and supervision.[85] Research studies have also shed light on dual reporting, such as work in Indonesia that identifies village midwives in some districts being required to report to a local clinic doctor and also to the head of the village.[86]

Overall, little material is available concerning job descriptions of HRH, and in some cases job descriptions do not exist for some cadres or are unclear. For example, Rokx et al.,[54] discuss the lack of job descriptions attached to nursing grades in Indonesia, which impedes the introduction of a PM system. Details of the motivation levels of staff, including at the community level, are not generally available. National plans discuss the need to improve staff motivation and satisfaction levels of all staff.[53, 78] Project evaluations and media articles describe

the lack of motivation of community staff due to low pay and the lack of clear policy on remuneration and incentives.[67, 72] Conference papers and reviews of HRH in the region have provided some information about government policy specifically designed to encourage retention of CHWs in the Philippines. However, the implementation of the Barangay Health Workers Benefit and Incentives Act has been challenging.[52, 87]

Information in the performance area with respect to community-level staff involved in MNRH is comprised of plans for improving workforce management and some isolated examples from project evaluations in the field or isolated research studies. There is a lack of information concerning community involvement in HRH processes, such as recruitment and supervision, as well as how health workers might support each other in rural and remote community locations. General information about staff motivation and job satisfaction is reported in a number of documents but this is not accompanied by data.

Education and competencies

There is a large amount of material on public and private pre-service education and training of midwives and nurses. For example, the Australian Nursing and Midwifery Council (ANMC) provides an overview of nurse and midwifery courses and their length,[37] while reviews of curricula in Cambodia[36, 88] and in PNG[55, 89] outline ways of improving the nursing and midwifery curriculum, including recommendations for community-level specialisation. Other key information about pre-service nursing and midwifery education can be located on MoH websites, such as the Fiji MoH website[90], or in government reports.[91] The range of nursing and midwifery curricula, numbers of graduates and qualifications possessed by midwives in Indonesia is described in a research study reported in a series of journal articles by Hennessy and Hicks et al.[80, 92]

For some countries, a number of documents contribute different types of information. For example, details on SBA training in Laos can be accessed from MoH documents regarding plans for training[93] and from UNFPA documents on the in-service teaching skills of staff.[57]

Information about in-service training is often available from NGO documentation such as the web report outlining The Blue Star Network, a project implemented by Marie Stopes International Australia and Population Services Pilipinas Incorporated, which provides support and training for independently operating midwives.[94]

There is a lack of information concerning community involvement in HRH processes, such as recruitment and supervision, as well as **how health workers might support each other** in rural and remote community locations

Despite these examples of publications relating to nurse and midwife education and training, there is a lack of detailed material concerning targeted training for these practitioners at the community level, whether it is in the form of clinical placement or specialist content, and the role of community members in this.

Documentation of the pre- and in-service training of CHW cadres is less accessible than that concerning nurses and midwives. NGO reports, including the Bangladesh Health Watch Report,[42] provide broad information about courses and the institutions involved in the training of nurses and midwives, as well as family welfare assistants and community SBAs. Project evaluations in PNG provide insight into the training of village midwives,[72] village birth attendants and community sexual health educators.[95] However, these are short-term training initiatives undertaken in specific areas, in contrast to the institutionalised national training of CHWs that is soon to be enhanced.[96] Information from acts of parliament in the Philippines shed light on the government's plans for scaling up the capabilities of CHWs through a new *barangay* health worker course, which also addresses nurse shortages at community level due to migration.[97]

Details of the competencies of health workers at the community level in MNRH are mostly available for SBAs or for cadres engaged in delivery, such as TBAs. An UNFPA study[57] in Laos of auxiliary nurses, PHC workers and mid-level nurses found that midwifery competencies are very low in all provinces at health centre level. Some of these staff may be providing outreach services to communities but it is not clear from the data.

Most births are shown to be attended by TBAs and family members, which indicates that SBAs may not be available at the community level. Research studies also provide information about workforce skills at the community level. For example, a study in Indonesia[38] found that village midwives were more likely to be on a temporary contract and were less experienced than health centre midwives. However, improvements in midwife training have been found to be effective, with research studies confirming less need for training for village midwives who had undertaken the new program.[92]

Discussion points

The conclusions from a desk-based review of available documentation concerning providers of MNRH services at the community level summarised above reveals that there are difficulties in accessing information as well as gaps and inconsistencies in its quality. However, in order to establish what initiatives are required to address this situation, it is necessary to determine what actual community-level HRH information is needed about those providing MNRH services by whom and for what purpose. For example, a district maternal and child health program manager will require certain detailed information about the current staff supply for workforce planning. This differs from the information needs of a midwife providing outreach services and supervising nurse aides or TBAs.

Effective district management, leadership and quality improvement processes are central to information systems which **can be built through appropriate training for managers as well as community-level staff** who are involved in data collection

Midwives may be more concerned with information concerning the performance of these staff and the availability of continuing education for them. This section explores the types of community-level MNRH provider information that may be required by stakeholders in order to clarify what may be needed at various levels for decision-making.

Table 4 lists a range of community MNRH provider information that can be made available, collected, processed, analysed and utilised at various levels by health workers and managers. This would ideally be integrated into a larger system of data collection for health planning. The table identifies who might apply this information and for what purpose in a decentralised system.

The table outlines some possible scenarios but this is heavily dependent on contextual factors. This includes the size of the country and its population, the capacity of districts and provinces, and their level of political autonomy. In addition, the way in which HRH is organised, and how the HRH budget is disbursed and accounted for, decision-making processes and the socio-cultural context affect how and what information is collected and used. For example, workforce planning in Indonesia is highly devolved[98] and involves the consideration of large numbers of personnel to meet the needs of 240.3 million people in this ethnically diverse and densely populated nation. In Vanuatu, capacity and population size issues have meant that the central government is largely responsible for overall planning[99] in this largely Melanesian island archipelago of just over 200 000 people.

In a decentralised health system the district is essential to the implementation of services and management of resources including staff in MNRH at the community level. Target setting and accountability in this area are also important tasks for district managers who require quick access to accurate information.

At the district level the development of a system of information gathering for monitoring and evaluating community-level personnel and their performance is critical. This requires the development of standard indicators for reporting, which will feed into health systems assessment and mapping progress towards MDG 5. Effective district management, leadership and quality improvement processes are central to information systems which can be built through appropriate training for managers as well as community-level staff who are involved in data collection. In addition, the non-state sector and the public need to be engaged so that data is comprehensively collected using standard indicators.

This process will enable the collection of data about personnel employed in the private and NGO sector as well as informal, lay or volunteer workers. Innovative approaches to collecting and sharing these data could be utilised such as mobile phone technology, especially in remote or difficult-to-access locations. It also should be noted that both qualitative and quantitative HRH information needs to be collected. Descriptive data will help to understand the behaviour of health workers, their needs and the socio-cultural context.

Although health workers at village and sub-district levels and those acting as district managers are the key personnel involved in the collection of information concerning personnel engaged in the provision of MNRH, clear links need to be maintained with the provincial and national levels.

Long-term plans requiring additional resources may need to be presented to the provincial level, with data justifying the need. Allocation of district funds may be made at the provincial level and requests for additional resources made to national Ministry of Health or Ministry of Finance and Treasury. Health workers at the community level must be aware of the national, district and provincial policy, regulation and legislation that concerns their scope of practice. They must also be given the opportunity, through a regular system of consultation, to feed into the on-going revision of policy, regulation and legislation so they remain relevant and responsive to MNRH at community level.

Donors and NGOs need to not only be engaged in the collection and analysis of HRH information related to MNRH programs that they are funding and/or managing at the community level, for their own planning needs, but they also require access to wider community-level HRH information. This is necessary to ensure that national, provincial and district HRH policy, regulation and legislation is complied with and that workforce commitments are in-line with district needs and plans. Knowledge of government planning enables donors and NGOs to make investments that are consistent with the goals of aid effectiveness.

Table 4 Possible types of community MNRH provider information required at various levels

Policy	Management
Village/Health-post level - nurses, midwivies, child health workers, traditional birth attendents and community people	
Disseminate information about policy, legislation and regulation. Record and report information concerning implementation, community and workforce. Feedback to sub-district	Collect and report staff supply, retention and loss information using standard indicators to sub-district Undertake PM and report to sub-district as per agreed templates. Report feedback on salary, incentive disbursements and OHS to sub-district
Sub-district level - outreach staff, nurses, midwives, supervisors of health-post staff at health centre	
Disseminate information about policy, record community and workforce feedback and report to district	Report, collect and deliver community and health care staff supply, retention and loss information to district
Adopt HRH policy that is informed by stakeholder input	Discuss and develop PM indicators, undertake PM and report to district level as per agreed templates Report on salary, incentive disbursements and OHS
District level - district management team, district medical officer, district nursing manager at health centre and hospital	
Develop system for policy dialogue and debate to gain feedback from village and sub-district. Collate reports and send information to provincial level	Process and analyse village-level and community outreach staff supply, retention and loss information for planning at sub-district and village levels and report to provincial level
Develop district HRH plans based on national policy and provincial strategies but informed by community and workforce input	Develop and adapt PM system Analyse information and take management decisions. Report actions to province. Engage non-state sector in process
Apply job-classification system, processes for recruitment, promotion, conditions of service etc., possibly modified to suit context from provincial and national guidelines	Set system for monitoring and reporting salaries and incentive disbursements. Make available standard workplace health and safety operating procedures, protocols and manuals
Provincial/Regional level - Ministry of Health and Hospitals	
Develop action plan that includes community-level MNRH personnel in response to community and workforce input from all districts	Some analysis of regional staff supply, retention and loss information at all levels for workforce planning and resource allocation
Report all community stakeholder responses to policy to the province	Collate PM information and report to national level Deliver financial reports to national level
National level	
Develop national HRH policy, regulation and legislation that includes community-level and MNRH workers in private and non-state sector, informed by standard reporting at village sub-district and district levels	Collate and analyse all regional staff supply, retention and loss information for monitoring and evaluation KPIs and policy making. Some useful MNRH HR indicators are SBA attendance, number of nurses, midwives and CHWs for every 1000 people Develop PM system with standard indicators adaptable to service level

Education and training	Community engagement
Disseminate information regarding in-service training opportunities, identify needs and report to sub-district	Identify community leaders/decision makers, characteristics, possible approaches, areas for involvement and rapport building. Report to sub-district level Undertake and record community engagement in HRH activities. Report to sub-district level
Disseminate information regarding in-service training opportunities and identify needs Make recommendations regarding those who require in-service training to district level	Analyse community decision-making structures, plan engagement in HRH activities and develop and present reporting mechanism to district managers Modify community engagement plan, strengthen additional resources allocated/sought, if required, and report to district level
Make decisions concerning who at community level should recieve in-service training and in which areas. Plan for future needs	Plan for engaging community leaders based on approaches gathered from sub-district. Develop reporting mechanism. Assign budget to activities and implement them Report to provincial level on activities, with justification if further resources required Incorporate modifications into plan and assign resources
Collate information regarding those who received in-service training and report to national level Plan and disburse resources	Collation of community engagement approaches across province, report generated and policy recommendations
Collate and analyse all information concerning in-service training at community level and develop policy	Collate all HRH community engagement activities and formulate policy

Summary

This article has highlighted the need for information about the health workforce in order to make assessments concerning HRH productivity, competence and responsiveness to patient needs. In addition, the discussion has identified key stakeholders and uses of information which enable policy, management and education and training interventions to be planned and implemented and appropriate resources targeted. A profiling exercise of personnel involved in MNRH at the community level in 10 countries in the Asia and Pacific region has identified a number of significant knowledge gaps concerning the management of this workforce, their education and training, and the relevant policies guiding all of these processes. The information gathered was pieced together from a range of sources that were often different in their perspectives and contained conflicting information. The quality of the information was also variable, which is reflected in the range of methods employed in project evaluations, consultant reviews, research studies as well as regional and national health data. This highlights the fact that HRH indicators for staff engaged in MNRH at the community level are not well defined and that information is not routinely or systematically collected, analysed and managed.

In order to improve access to and the quality of community-level HR information, consideration needs to be given to the information needs of health workers engaged in MNRH provision, as well as managers with responsibility for planning and coordinating service delivery. This will enable the development of an information system that is tailored to the requirements of the health system and the socio-cultural context. In a decentralised setting this needs to be accompanied by the development of appropriate indicators, training, as well as partnerships with those engaged at the community level, and stakeholders across the state and non-state sectors. Based on the discussion above, a number of recommendations can be made regarding what HRH information is needed at the community level in all aspects of MNRH and the indicators that are most useful in this context. In addition, some suggestions can be made concerning how this HRH information should be collected, shared and supported.

Planning a HR information system of community-level MNRH providers

The development of a HR information profile may be a useful step in the planning of such a system. This requires an assessment of the types of information – policy, management, education and training, community engagement – required by health workers and managers at various levels. A table such as that presented at Table 4 could be employed for an assessment of information needs for stakeholders at any level to plan their requirement and responsibilities. In addition, attention should be paid to the assessment of presentation formats needed by stakeholders which will facilitate access to and uptake of information. Appropriate training in data collection, management, analysis and reporting should also be planned, along with protocols for delivery and the application of required information. This will assist the development of key indicators to specify information in order to achieve standardisation and a systematic approach to collection and analysis.

Indicator areas

Community-level HRH data needs to be incorporated as part of a minimum data set. Indicators need to be qualitative as well as quantitative and be drawn from the following areas refined from those listed above:

Policy

- Job classification systems that include community cadres
- Compensation and benefit systems used in a consistent manner to determine salary upgrades and awards
- Formal processes for recruitment, hiring, transfer, promotion and community involvement
- Employee conditions of service documentation (e.g. policy manual)
- Presence of a formal relationship with community organisations
- Registration, certification or licensing is required for all cadres

Management systems

Staff supply, retention and loss of staff engaged in MNRH at community level

- Ratio of CHW, nurses, midwives, TBAs, VHWs at community level to population
- Distribution by age, sector and gender
- MNRH skill mix
- Proportion of staff in dual employment
- Presence of HR data system
- Number of vacancies, posts filled, duration in job, proportion of HRH unemployed
- The existence of a functioning HR planning system
- Ratio of entry to and exit from the health workforce
- Hours worked compared with hours rostered and days of absenteeism
- Community involvement in recruitment and selection
- Proportion of locally trained and recruited health workers
- Dedicated HR community-level budget

Personnel administration/Employee relations

- Salary: average earnings, average occupational earnings and income among HRH
- Health and safety in the workplace, standard operating procedures, protocols and manuals

- Incentives: monetary and non-monetary
- Teamwork practice and functional partnerships

Performance management

- Job descriptions
- Supervision (especially clinical supervision) schedule, community involvement in supervision
- Percentage of planned supervision visits to the field that were actually conducted
- There is a formal mechanism for individual performance planning and review
- Community involvement in performance management
- Peer reivew mechanisms
- Level of job satisfaction, level of staff motivation

Education and competencies

- Existence of a formal in-service training component for all cadres
- Existence of a management and leadership development program
- Mechanisms for involving the community and HRH in pre-and post-service curriculum development and review
- Relative number of specific tasks performed correctly by health workers/adherence to protocols, etc.
- Client satisfaction, number of patient contacts
- Number of community meetings attended and evidence of community participation.

Standard indicators can be constructed from these areas. This involves assigning numerators and denominators for quantitative indicators and criteria for qualitative assessment. Agreement must be reached at district, provincial, national and regional levels so that agreed benchmarks can be realised in appropriate areas, ensuring informed HRH decision making and suitable resource allocation at the community level.

In many countries in the Asia and Pacific region there is an active private, faith-based and NGO sector whose **data collection systems are not always apparent or included in national systems**

The collection and sharing of information

In order to guarantee timely, reliable, detailed and consistent community-level workforce data, HRH information systems need to be strengthened at district, provincial and national levels. This involves the collaboration of public, private, faith-based and NGO sectors.

A coordinated effort by the Ministries of Health, Finance and Education ensures that information from all indicator areas across the public sector can be collated. In many countries in the Asia and Pacific region there is an active private, faith-based and NGO sector whose data collection systems are not always apparent or included in national systems. Standard indicators as well as regular dialogue with these sectors will improve the quality and sharing of HRH data.

This highlights the need for donors and NGOs to take on the responsibility of quality HRH data collection, management and exchange as a routine part of their country programs. This requires regular reporting on the HRH components of their work to the relevant ministry officials and other agencies. These processes also help to ensure that information is available to other agencies and personnel to facilitate coordination of strategies, prevent duplication and build on successful efforts in the field.

Support required

In addition, donors have a responsibility to contribute to the strengthening of national information systems through direct investment in health systems research and development work that is rigorously documented and widely disseminated to all stakeholders.

This will also facilitate stronger linkages to regional databases such as the WPRO Country Health Information Profiles, which will contribute the necessary HRH information required for Health System in Transition Profiles under the planned Asia and Pacific Health Observatory.

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Training workshop to improve the use of existing datasets

Original article

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The need for building capacity

There have been efforts in many countries in recent years to increase public health data collection and availability.[1] These advances in data availability have occurred due to greater demand from governments and donors for evidence to inform decision making for the planning, management and evaluation of health services. These data have improved the understanding amongst public health professionals about the health status of populations and how it can be improved.

Despite these advancements, many low and middle income countries tend to be 'data-rich' but 'information-poor'.[1] There are often large reporting burdens placed on public officials, which leads to data not being used. There is also a lack of understanding among many public health staff on how such data can be assessed, analysed and interpreted to provide evidence for policymakers. Therefore, there is a need for such public health staff at various levels of the health system to develop skills and knowledge to utilise existing datasets better.

In 2010, a training workshop entitled 'Training in the Use of Existing Data Sets' was conducted by Dr Tim Adair in Samoa, as part of the capacity building activities of the Health Information Systems (HIS) Knowledge Hub at the University of Queensland. In that workshop staff from the Ministry of Health and local health facilities were taught techniques to best utilise data from a range of sources. Based on the findings of that workshop, a series of guidelines were developed to assist public health officials in developing countries to assess and analyse their existing health data, for application throughout the Pacific.

To further build capacity in the Pacific amongst public health officials, a workshop to provide 'Training in the Use of Existing Data Sets' was conducted in Fiji in October 2011. This training formed part of the HIS Knowledge Hub's approach to strengthening and expanding the HIS workforce. A key aim was to improve utilisation of existing data so as to reduce reporting burdens on staff. The workshop was adapted from the training conducted in Samoa in 2010. The training aimed to develop the ability of public health officials to critically assess the quality of data they collect and utilise, and to learn how to compute indicators for use as evidence for health policy.

The training workshops comprised lectures, in-class discussions and in-class exercises using Microsoft Excel. There was an additional focus on in-class exercises and interpretation in the Fiji workshop, compared with that in Samoa. To complement the training, participants were provided with a set of guidelines to assess data quality and compute indicators. During in-class discussions, participants identified a number of quality issues with data they use in their daily roles.

Workshop evaluations revealed that many participants benefitted from learning about data sources, data analysis and interpretation, and from doing the in-class Excel-based exercises. They expressed a desire for more training in data utilisation. Such further training is needed, and should be appropriately targeted, because of the range of knowledge, skills and responsibilities of public health officials and researchers requiring training.

Training Workshop

The training program was developed bearing in mind that the participants were from a range of backgrounds from both the Ministry of Health (MoH), as well as from health facilities. The MoH staff included those who are responsible for production of internal and external reporting of health information to inform policy. These staff are involved in reporting of such information from PATIS and were responsible for DHS fieldwork coordination and data analysis and reporting. Participants from the health facilities in the NHS are heavily involved in reporting of data and their roles also include data collection, as well as management of information flows within the health system.

Although the participants in the training workshop have a wide range of responsibilities, they each are involved in the collection of data and production of information within the health system. Therefore, there is a need for such staff to have a range of knowledge and skills to best assess and utilise available data sources to inform policy in the health sector.

The training program was developed to provide participants with knowledge and skills to:

1. Understand the key components of health information systems
2. Develop appropriate indicators for health sector monitoring and evaluation,
3. Identify potential data sources to compute indicators,
4. Compute indicators and assess the quality of a data source using a variety of techniques,
5. Fully utilise health datasets, in particular PATIS and the Demographic and Health Survey, to inform decision-making.

Training Program

The training workshop was comprised of lectures, in-class discussions and in-class exercises using Microsoft Excel. The in-class exercises were a major focus of the training. These exercises included practical application of tools and guidelines to hypothetical data relevant to Samoa and Fiji to guide assessment of data quality and computation of health indicators. A set of training materials were also prepared for reference after completion of training.

The training program covered a wide range of topics related to health information assessment and utilisation. The program was designed in the context of the type of health data available, and the health issues most relevant to the participants' daily work. Furthermore, the training had to be developed with the existing knowledge and skills, especially computer literacy, of the participants in mind. Given this, the techniques taught to compute indicators were at the basic and intermediate level.

The training program was focused on the type of health information collected in data sources such as PATIS and the DHS. These included data on mortality, causes of death, morbidity, maternal and child health, and health service utilisation.

The training sessions, and a brief description of each, are below:

- **Introduction to the components of health information systems:** This session presented participants with the components of health information systems, described some of the problems with health information systems and emphasised the potential for existing data sets to be better utilised
- **Use of appropriate indicators within the health sector:** This session explained the different domains of measurement that health indicators can address (health status, health system and determinants of health). Global health indicators, such as the Millennium Development Goals, were discussed in the context of the appropriateness for the epidemiological context of the Pacific
- **Discussion about appropriate indicators for Samoa and Fiji:** An open discussion was conducted with participants about appropriate health indicators for Samoa and Fiji
- **Data sources to compute indicators:** This session detailed different types of data sources available to produce health indicators. The global availability of mortality data was demonstrated
- **Assessing data quality:** This session detailed a data quality assessment framework, based on those developed by the Australian Bureau of Statistics and Health Metrics Network.1,7 The components of the framework are Institutional Environment, Timeliness, Relevance, Accuracy, Disaggregation, Consistency, Interpretability, Confidentiality, and Data Security and Accessibility
- **Computing key indicators Part 1 (rates and ratios), in-class exercise:** This session showed participants how to compute basic rates and ratios. In-class Excel exercises provided practical application to compute these indicators
- **Computing key indicators Part 2 (early age mortality rates, adult and maternal mortality rates, life tables, age standardisation), in-class exercise:** Participants were shown how to compute early age, adult and maternal mortality rates. They were instructed how to compute age-standardised mortality rates. An in-class Excel exercise allowed students to compute such rates
- **Utilisation of health facility data:** This session explored the potential uses for health data to produce health indicators. The quality issues of health facility data, including that health status data are not representative of the entire community, was emphasised
- **In-class discussions about data quality of PATIS/ CHNIS (Samoa only):** An open discussion was conducted where participants provided details of their own experience with PATIS and CHNIS data, in particular the data quality issues of each data set
- **In-class exercises using health facility data (1):** This exercise used hypothetical data from the PATIS antenatal care module. Participants used Excel to compute basic indicators, for example the percentage of mothers receiving a tetanus toxoid immunisation during pregnancy
- **Cause-of-death and morbidity data, including in-class exercise:** This session detailed cause-of-death, including medical certification, ICD coding, factors impacting data quality issues, data quality assessment (ill-defined and garbage codes and inconsistent reporting by age and sex), potential of multiple cause of death data, and verbal autopsy. Participants were provided with an exercise where they were asked to assess the quality of reported cause of death data

- **Utilisation of the Demographic and Health Survey (DHS) (Samoa only):** This exercise provided a detailed overview of the characteristics of the DHS, and sample surveys more generally. It described the indicators that can be computed from the range of DHS modules. The potential data quality issues of the DHS were outlined. Participants were also taught how mortality indicators, including early age, adult and maternal mortality, are computed from DHS data
- **In-class exercises using health facility data (2):** An extension of the first health facility data exercise. This exercise included data on postnatal care, birth weight and infant mortality. Participants were asked to use Excel to compute indicators from these data
- **Utilisation of other data sources – vital registration (Samoa only):** A description of the operational characteristics of vital registration systems and potential data outputs. Discussion on the development of a vital registration system also took place, using the example of Indonesia.

Guidelines and tools

The guidelines and tools were developed to assist participants in the assessment and utilisation of various health data sources in their role in the health system. The guidelines and tools were aimed at those who collect and utilise data. That is, health facility staff that collect data and report to management, medical records staff who provide facility data to the MoH, and MoH staff who produce internal and external reports. These guidelines and tools were utilised in the in-class exercises of the training workshop.

The guidelines and tools comprised:

- Questions to guide data quality assessment and data utilisation
- Computation of mortality and morbidity indicators from health surveillance data (Excel template)
- Calculation of 95% confidence interval of a mortality rate (Excel template)
- Calculation of 95% confidence interval of a proportion (Excel template)
- Checklist to assess the age-sex consistency of cause of death reporting (Excel template)
- Assessment of the consistency of the age pattern of mortality (Excel template)
- Computation of direct age-standardisation of mortality and other rates (Excel template)
- Computation of indicators from pregnancy, birth and postnatal data from a health facility (Excel template).

Questions to guide data quality assessment and data utilisation

Questions to guide data quality assessment and data utilisation were developed with the aid of data quality frameworks developed by the Health Metrics Network and the Australian Bureau of Statistics, and adapted to the country context.[1-2] For some of the questions, the user is advised to see the relevant tool for that question (e.g., age-standardisation template where the question is regarding age-standardisation of data).

These questions were classified according to data source and type of indicator. The categories for data source are all datasets, population surveys and health facility data. No questions were provided for vital registration data, given the data quality issues in Samoa. The categories for type of indicator were early age mortality, all age mortality and causes of death/morbidity.

Excel template tools

This section provides some examples of the Excel template tools. These tools are designed to be applicable for assessment of data quality and computation of indicators for staff working with public health data.

The spreadsheet in Figure 1 shows the Excel template to assist in assessing the validity of the age pattern of mortality. The age pattern of mortality is a key indicator of the quality of mortality data. The Gompertz law states that the death rate increases exponentially with age above approximately age 35 years.[3] Where mortality data are of good quality, the graph of the natural logarithm of age-specific mortality rates will increase in a straight line after early ages (Figure 2). Poor quality mortality data will have a line that is not straight (Figure 3).

Figure 1 Excel template for checking the validity of the age pattern of mortality

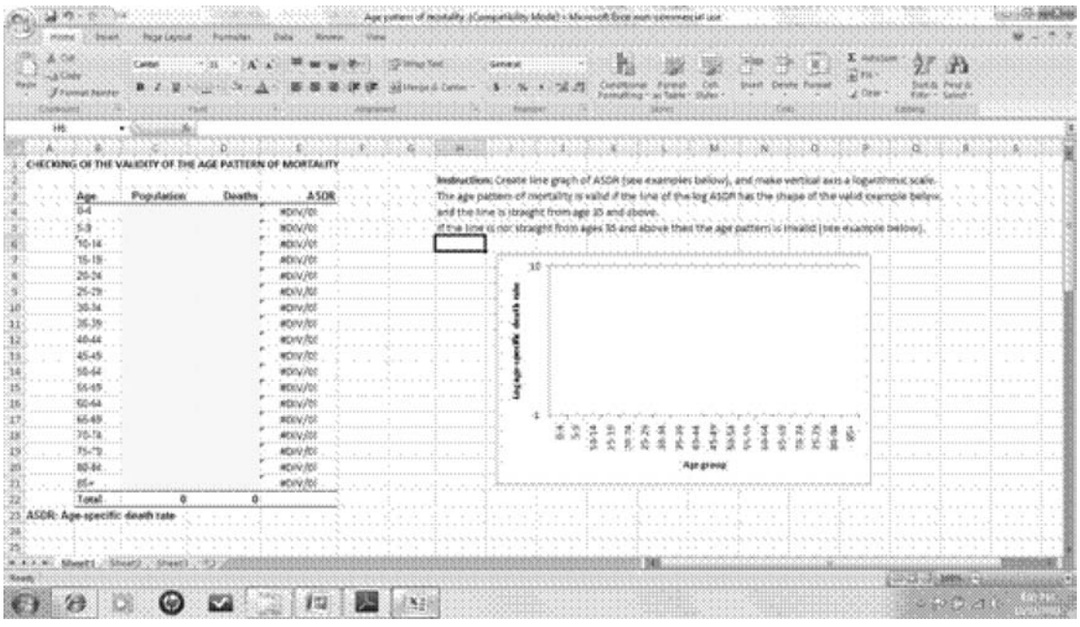
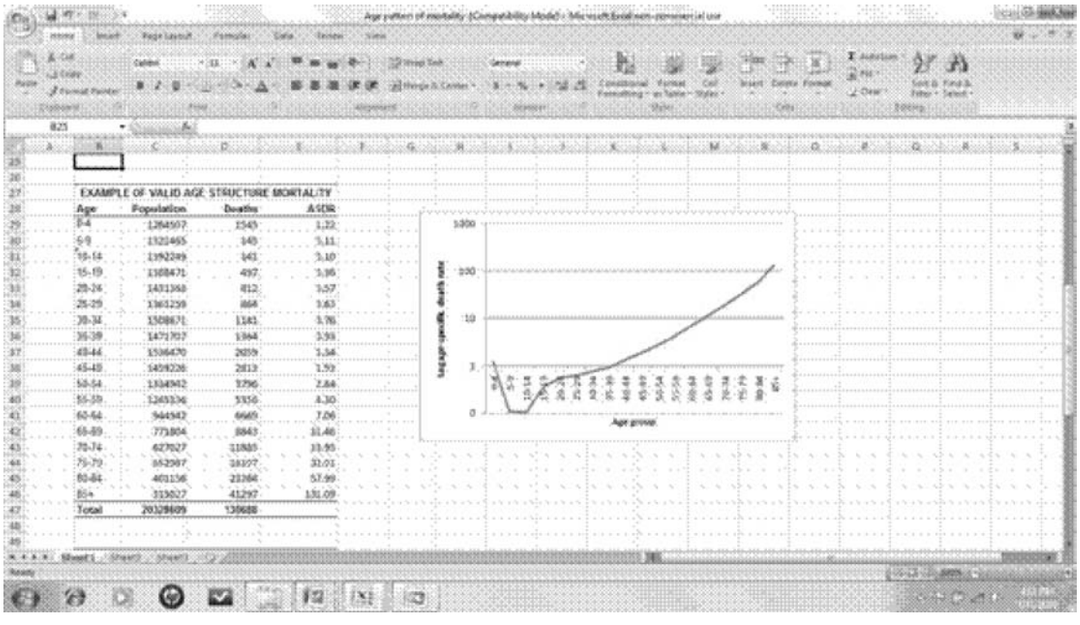


Figure 2 Excel template of valid age structure of mortality



Age standardisation is an important tool to remove the effect that different age composition between populations has on total rates, whether mortality or other rates. The Excel template in Figure 4 computes age-standardised death rates for users based on inputted mortality and population by age for each population.

Figure 3 Excel template of invalid age structure of mortality

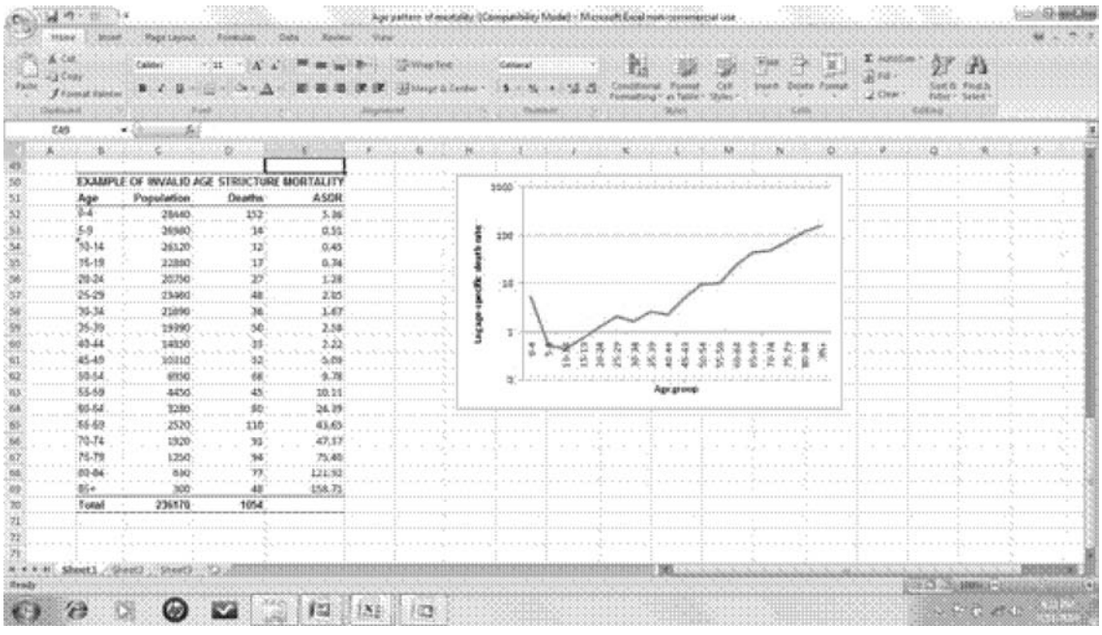
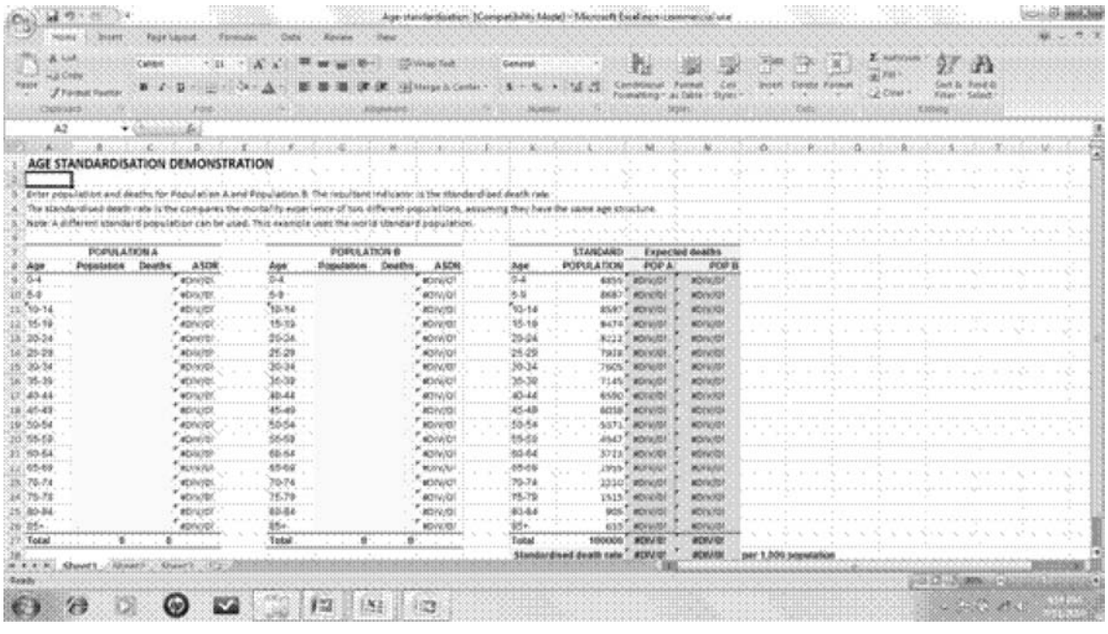


Figure 4 Excel template of age-standardisation



An in-class exercise was included to compute indicators from hypothetical pregnancy, birth and postnatal data from a health facility. These are shown in Figures 5 and 6.

Figure 5 Health facility data exercise

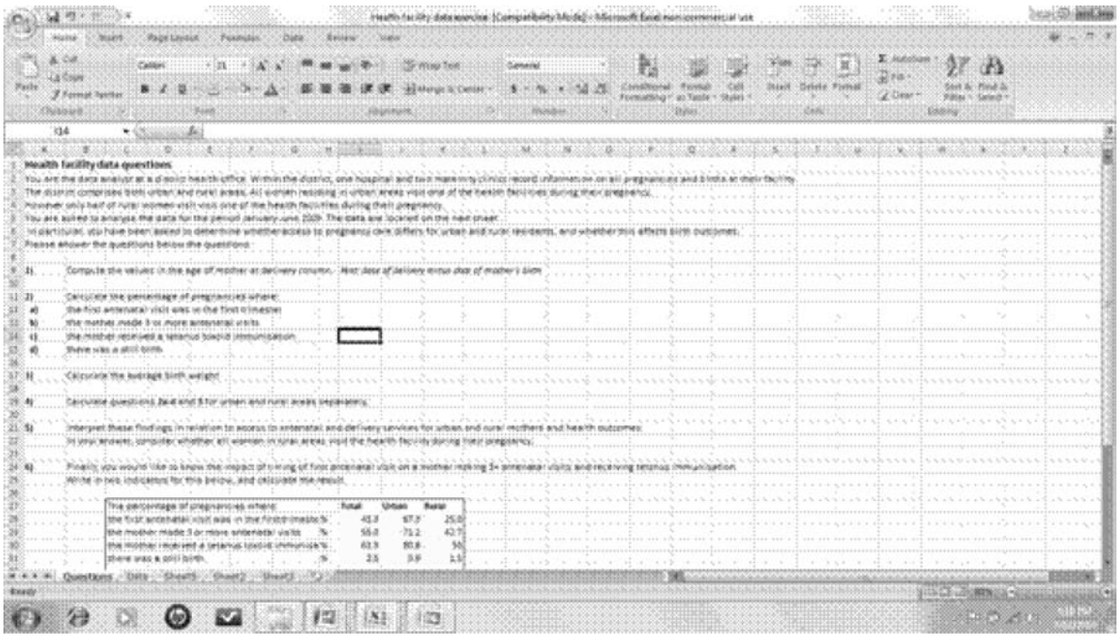
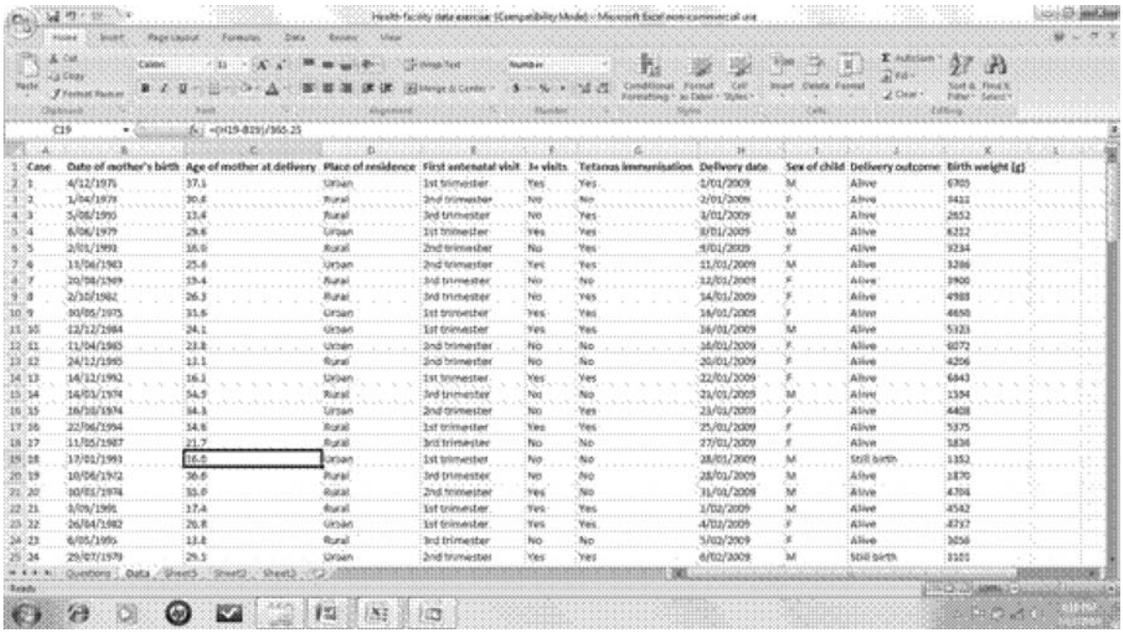


Figure 6 Data for health facility exercise



Manual for participants

Each participant in the Fiji workshop was provided with a 67-page manual to assist in learning key concepts and techniques during the course, as well as to provide a reference in future when applying the content to their work.

The manual provides a chapter on each training session presented in the training workshop. The chapters are:

- Introduction to the components of health information systems
- Use of appropriate indicators within the health sector
- Data sources to compute indicators
- Assessing data quality
- Computing key indicators (rates and ratios, early age mortality rates, maternal mortality rates, life tables, age standardisation)
- Utilisation of health facility data
- Cause of death and morbidity data
- Utilisation of the Demographic and Health Survey (DHS)
- Utilisation of other data sources – vital registration.

For each chapter, the manual provides detailed information shown in the workshop presentations. The manual also outlines further learning materials for participants, including many of the key questions that should be asked by participants when assessing and analysing data, information for the use of templates to aid participants in assessing and analysing data, and examples demonstrating the operation of key techniques explored in the workshop. The manual was designed to be read in conjunction with practical in-class exercises conducted by participants during the workshop. For further information on any of these topics, participants were instructed refer to readings provided during the workshop, as well as the references provided in the manual.

Outcomes of training

Workshop evaluations

The Workshop Evaluations were mainly positive. The participants enjoyed learning about the different sources of data available, the tools to assess data quality and to analyse health data, and doing the in-class Excel-based exercises applying these tools to data. Many believed the training to be particularly relevant to their work. From the evaluations they indicated that they would have liked the workshop to have had more of a focus on hospital data.

In the feedback sheets, many participants commented that they benefitted from learning about data sources, data analysis and interpretation, and from doing the in-class Excel-based exercises. Many stated that they found the training relevant to their work and they will apply the knowledge and skills gained from the course in their daily work. One participant stated that the training is vital for managers at all levels, and another said that the training will enable them to analyse their data and report to their managers. Many of the participants expressed a desire for more training in the future.

Many of the participants also stated that they would have liked the training to be longer and to be conducted on a periodic basis. Overall, they stated a desire to learn more about data analysis and quality assessment and to apply the methods they learnt into their daily role in the health system.

Another suggestion to improve the course, which was made by more than one participant, was to have more help on basic computing and use of Microsoft Excel. Addressing this suggestion is a challenge, given that the course also includes participants with extensive experience using Excel. Perhaps a short introductory session on using Excel could be conducted for those who require it, before the commencement of the training. Another suggestion would be to use more local data and examples in the in-class exercises, rather than hypothetical data. This could be readily addressed in future training.

Table 1 provides the feedback sheet used for the course evaluation. Participants marked the course according to six criteria, with a score from 1 (very poor) to 5 (very good). These scores are higher in Fiji than those provided by participants from the same course in Samoa

in 2010. In Samoa, the average overall rating of the course was 4.4, with the average rating of the other five criteria ranging from 4.0 to 4.4. This shows that, following refinements of the course based on feedback received from the 2010 training, it was better received by participants in Fiji in 2011.

Table 1 Average scores of both workshops

Criteria		Average Samoa score	Average Fiji score
1.	How helpful was the course content in teaching you about how to utilise existing datasets?	4.3	4.8
2.	Did you find the course content relevant to your role?	4.3	4.9
3.	How useful were the lectures/presentations in teaching you the course content?	4.2	4.7
4.	How helpful were the in-class exercises in improving your understanding of the course content?	4.4	4.7
5.	Was the facilitator helpful at teaching the course?	4.0	4.8
6.	Overall, how did you rate the course?	4.4	4.8

Conclusions

This case study has described training workshops conducted for public health officials in Samoa and Fiji to improve their knowledge and skills to utilise existing datasets to inform health policy. A major component of the training was the development of tools and guidelines to aid the public officials in assessing data quality and utilising data.

Evaluations of the workshop were positive, with participants expressing a desire for further training of a similar nature. The participants identified data quality issues they face in their daily roles. Such training can improve the ability of existing data to be fully utilised as evidence for health policy. To build on the success of this workshop, future training efforts in Fiji should be focussed on training of staff who work in health centres and hospitals, and who collect and report data to management as part of their daily functions. To complement this training, those with more skills in data utilisation at the Ministry of Health and Fiji School of Medicine would benefit from a workshop addressing more advanced topics in data analysis.

Overall, a key priority for Fiji health information systems development is to strengthen capacity to assess, use and interpret existing data, rather than to collect more of it.

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I also wish to thank the participants of the training workshop for providing detailed information about the data quality issues regarding the data they collect and utilise on a daily basis.

Building health systems capacity: An introductory training course on health information systems

Original article

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Abstract

The inadequate capacity of health information systems (HIS) in developing countries of Asia and the Pacific has been an ongoing issue. Training of data producers and data users in generating, analysing and using data has been identified as a key option in strengthening HIS in the region and consequently building health system capacity. Accordingly, the HIS Knowledge Hub at the School of Population Health, the University of Queensland, has developed HIS curriculum, piloted and evaluated the course. Experiences in the development and design of the curriculum, and delivery and evaluation of the course, are presented in this article. The participants evaluated that the course met their expectations in usefulness to their roles, demonstrated adequate HIS knowledge and skills in their group presentations at the end of the course, and applied what they learnt from the course in their workplace.

Key words: *health information systems, training, education, curriculum, course*

Introduction

Accurate health statistics available from functioning health information systems (HIS) are essential in making decisions, implementing plans and monitoring performance in the health sector.[1-2] The capacity of health workers and health information staff in generating such data,[3] and the capacity of data users in understanding and using the data, determine how effectively health plans can be developed, implemented, monitored and evaluated at both sub-national and national levels.[4-5] The capacity required in HIS lies in data collection, transmission, processing, analysis, interpretation, presentation and utilisation.[6] 'Human resources for HIS' is a cross-cutting theme across many HIS-strengthening activities, and organisational factors, specifically training, supervision and the promotion of a 'culture of information', are key elements in HIS capacity-building. Investments in building the capacity of health workers and HIS staff is therefore justified and recommended for improving the availability, quality and use of health information.[7-8]

Poor data production, analysis and utilisation have been persistent issues for HIS in Asia,[9-10] and the Pacific,[11-12] and the training of data producers and data users has been identified as a core strategy to address those issues.[13-14] In addition to recognising training needs from the literature, the Health Information Systems Knowledge Hub (HIS Hub) at the School of Population Health (SPH), the University of Queensland, identified the need for the development of HIS-specific curriculum for delivery in the Asia-Pacific region.

This need was confirmed through a range of stakeholder consultations in 2009 including the Capacity Building Think Tank in July, the Pacific Health Information Network (PHIN) meeting in September, and the Pacific Health Information System Development Forum in November.[15] Subsequently, a short training course on HIS was piloted by the HIS Hub during 2010 in Brisbane, Australia in collaboration with Australian Institute of Health and Welfare (AIHW). Based on participant feedback and a number of consultative meetings with key technical experts, a second modified version of the HIS Short Course was held in October 2011.

Methods

A targeted literature review was conducted in the PubMed database with the key words 'health information systems training' to identify content and experiences of existing/previous education on HIS. In addition to the peer-reviewed literature, a web-based search was conducted to identify existing curricula and education programs on HIS. The overall learning objectives for a short course on HIS were identified, the curriculum was outlined by the consultant from AIHW and HIS Hub staff, and detailed learning objectives were developed. Lecturers with expertise in their assigned module(s) developed and delivered the lectures. Support in the development of the materials was provided by key staff within the School, with extensive experience on health and development, health systems, and/or background in educational design. The training course was conducted in Brisbane for five full days from the 27th September to the 1st October 2010.

Evaluation of the course was done at three out of Phillips' five levels of evaluation as in Box 1.[16]

Box 1 Levels of evaluation of the HIS course
1. Reaction and satisfaction: to measure participants' reaction and satisfaction to the content and delivery of the training course and identify the 'fit' factors (participants' evaluation of the course)
2. Learning: to observe skills, knowledge, or attitude changes related to the training
3. Application: to identify changes in the participants' workplace and their role regarding HIS (within six months after the course) due to their participation in the course.

For participants' evaluation of the course, baseline survey questionnaires were distributed to the participants before the course. Throughout the course, the participants evaluated, in a set format, every module and lecturer individually after each lecture. At the end of the course, an evaluation survey questionnaire was completed by all participants. Quantitative data was analysed using SPSS statistical software, and qualitative data was analysed manually. Evaluation findings for each individual module and lecturer were sent to the corresponding lecturers for improvement of the course content and teaching.

To assess learning of the participants, course facilitators used assessment methods and criteria, which are based on the guidelines of SPH, as described in Table 1.

To assess the application of competencies gained from the course at their workplace, participants were emailed four questions six months after the course. The questions explored health information related challenges the participants encountered in their work, whether the knowledge and skills gained from the course helped them overcome these challenges (if so, how), and changes they made in their role or organisation using the knowledge and skills gained from the course and using networks made during the course. The responses from the participants were compiled and analysed manually.

Development, design and delivery of the HIS course

Peer-reviewed literature on HIS-related training

While health information systems encompass both computerised and non-computerised components, paper-based systems still prevail in most developing countries in the Asia-Pacific region, especially at the facility level. However, many of the HIS education programs found in the peer-reviewed literature focus on computerised HIS, such as health informatics and electronic medical records, as the majority of the existing literature comes from developed countries.[17] An exception is the research findings from the introduction of an externally developed training program (the Primary Health Care Management Advancement Program – PHC MAP) in east Africa. The training materials were intended to promote an informational approach to management at the operational health service level in low-income countries.[18] Lessons learnt from the literature review, which were used in designing the HIS Hub course, include:

- The need for a good fit in the use of materials
- Linking information management and general management and the tools for these domains
- Tailoring to the country context
- Identifying common problems and solutions, and
- Using case studies.[18]

Web-based HIS course search

Courses with HIS-related content in English were searched through the websites of all universities in Australia, TropEd institutions and some leading universities in the United States. In addition, a general Google search was performed using key words: 'health information systems training/courses'. Although the course outlines/summaries often appeared on the websites, course content and materials were rarely available. The health information related courses were found mainly on subjects like 'health information management' or 'health informatics', focusing on computerised information systems, primarily in the facility-based setting. On the other hand, most of the Masters of Public Health and similar programs focus on disciplines like demography, epidemiology and biostatistics. Exceptions are a course unit on 'health data and decision making' from La Trobe University's School of Public Health (2007), and a course on 'health information systems' from Johns Hopkins Bloomberg School of Public Health (2011). These courses seemed to fulfil some of the content requirements identified; however the detailed content of the courses were not freely accessible.

Design and outline of the HIS course

The literature review confirmed the need for a detailed curriculum which focused around the definition of HIS stated above. Taking the experience of Riegelman and Persily as an example, the course aims to cover '*the population perspective of public health, the institutional perspective of health services, and the individual perspective of clinical medicine*'.[19] The course is designed in a way that participants can appreciate the HIS as a whole, considering both national and sub-national HIS as well as both paper-based and computerised components of the system. Targeted course participants are mid-level managers working in state/provincial and federal government departments or Ministries of Health, hospital or health information system units and National Statistical Offices, who are responsible for the collection, storage, analysis and use of health information for performance reporting or health policy and planning. It is expected that these participants are or will be responsible for routine HIS plus the use of surveys, vital registration, or other data sources that support national monitoring and evaluation frameworks.

The short course aims to equip those working in a health system with a broad knowledge of the key concepts and components of a good health information system, as well as the value of reliable, timely health information for policy, planning and improved health outcomes. It will build confidence among participants in the use of health information and to critically review their HIS and the data it generates. The key learning objectives of the course are described in Table 1.

The HIS course comprises 16 modules organised into four themes: Introduction to HIS, Data sources in HIS, HIS data use and dissemination, and Managing HIS (Table 2). In addition to the one-hour lectures for these modules, there are two half-hour panel discussions and tutorials. Panel discussions are on 'Managers, policy makers and donors talk: how have I used HIS and what makes me use it?' and 'Common resource problems for HIS'. One tutorial provided a chance to review context of the sessions of the previous days and the other is on 'Discussion on the different levels of country HIS'. Additionally, afternoon sessions involved group work, focussing on a case which participants needed to address over the four days. The daily 'challenges' set for the team on the case study were linked to the day's fixed resource sessions (modules), and supported by facilitators with practical field experience in managing and building capacity of HIS in resource-limited settings. On

Table 1 Assessment methods and criteria based on key learning objectives of the course

Learning objectives	Assessment methods	Criteria
Define the core components of an effective HIS	Class and tutorial participation Group presentation: content (evidence and argument)	• Participant, when asked in class, can define component/s of HIS • Structures group presentation in manner that reflects core component of HIS • Searches for data on country and topic of interest demonstrating components of HIS
Recognise potential areas for improvements according to local environment	Group work Group presentation: content	• Identifies key systems and 'environmental' factors in case study that may affect the operation of HIS or components of HIS • The presentation shows adaptation of improvement strategy from the theoretical to the situation presented in the case (regarding health problem and country)
Define the strengths, weaknesses and uses of various types of health information	Group presentation: content (evidence and argument) Class and tutorial participation	• Framework used to present case for improvement demonstrates an analysis of strengths and weaknesses • Presentation of health information by the group illustrates understanding of strengths and weaknesses and of the best uses of information • Individuals, when asked, can identify criteria to be used to assess health information (including coverage, timeliness, accuracy)
Critically analyse the strengths and weaknesses of a HIS project or system	Group work Group presentation: content (evidence and argument)	• Individuals, when asked, can discuss reasons for the approach their group is recommending for the case study being analysed • Presents a case for improving funding, investments or interventions, etc., based on the data they could find and HMN framework and criteria of a strong HIS
Appropriately present and disseminate HIS information according to task set and audience	Group presentation: structure and organisation, style and format, sources and references	• Effective communication of main concepts • Coherent expression of ideas • Logical organisation and presentation • Effective use of visual aids (if applicable) • Speaking at appropriate volume and speed • Eye contact with class • Presented within the time provided • Utilisation of techniques which stimulated audience engagement • Provides strong and appropriate evidence-base for argument
Demonstrate ability to work effectively in a multi-sectoral group	Group work: observed behaviour	• Active participation in discussions • Active role in developing presentation • Observed active role in research and analysis • Demonstrated respect, fair play, and supporting role and participation of others
Show appreciation of professional development as a lifelong activity	Individual self-reflection tools	• See Box 2

the final day, these case studies were presented – both as an additional resource to the course materials and as a means of demonstrating knowledge and skills gained in a simulated environment.

Piloting the HIS course

Health information and health professionals from two countries in Asia and eight countries in the Pacific participated in the course. There were 14 participants (10 females and four males) from a variety of health-related professions as shown in Figure 1.

Throughout the course, eight lecturers with technical experience (such as in vital statistics and civil registration systems, health information management, health informatics, health financing, monitoring and evaluation systems and general health information systems) and experience in health and development, were engaged in teaching in person (six) or through video recording (two). Facilitators present in every session encouraged active discussion during and after the lectures.

Table 2 Modules and their objectives

Module and session topic	Learning objectives (by the end of this session participants will be able to)
Module 1 Introduction to Health Information Systems (HIS) Provides an overview of the role of HIS within the health system and the importance of strengthening HIS to achieve health system improvement. This module will also increase understanding and application of statistics.	
Session 1 The importance of Health Information Systems	• Demonstrate an understanding of the importance of health information systems • Describe the health information system structure (theoretical framework and continuum) • Discuss the relationship between health information systems and health systems • Outline the way that HIS improvements are linked to health system improvements • Demonstrate an understanding of the rationale for strengthening health information system
Session 2 Components and standards of a Health Information System	• Discuss and understand the HIS Framework developed by the Health Metrics Network (HMN) • Describe the fundamental components and standards of a health information system • Demonstrate an understanding of how to improve structurally and operationally a national health information system
Session 3 Understanding health information: Statistical literacy for HIS managers	• Demonstrate an understanding of the basic statistical concepts required to interpret data • Discuss, use and interpret statistical information in tables and charts • Demonstrate capacity to evaluate and communicate basic statistical information and results
Module 2 HIS Processes A successful health information system must include relevant indicators with measurable targets as well as a range of data sources including those outside the boundaries of the health sector, such as civil registration and censuses. This module will develop students understanding of health indicators and the range of data sources available to support decision-making.	
Session 4 What are health indicators and how do we interpret them?	• Demonstrate an understanding of different domains of health indicators • Recognise the importance of metadata—including common data definitions, unified data collection methods, applicable standards to use • Understand the difference between data sources and indicators • Manage and interpret commonly presented indicators • Identify and interpret sources of uncertainty in health indicators • Map indicators to different components of health information systems

Session 5
Health management information systems
	• Describe why it is important to have management information systems for the health sector in the fields of
	  • Financing,
	  • Human resources, and
	  • Logistics
	• Discuss the core indicators needs for each of these three management information systems
	• Describe data sources for each of these management information systems
	• Demonstrate an ability to interpret these data and critically analyse the qualityof the data

Data sources	
Session 6 Health information data sources: An overview	• Demonstrate an understanding of the wide range of health information data sources, including estimated and directly measured data, and across the continuum of care • Describe the various population-based data sources and institution-based data collections and their purposes • Describe the strengths and weakness of these various sources
Session 7 Vital registration systems	• Demonstrate an understanding of the importance and use of reliable and timely vital statistics • Understand principal data collection practices for vital statistics and basic analytical uses • Discuss the global status of the quality and completeness of birth, death and cause-of-death data • Discuss the efforts and methods available to strengthen civil registration and vital statistics systems
Session 8 Health surveys and censuses	• Demonstrate an understanding of the role of surveys and censuses in a health information system and their use • Describe the minimum standards and best-practice for data collection through surveys and censuses • Discuss how to analyse and interpret health survey and census data
Session 9 Measurement and management of health services coverage: An overview	• Understand the minimum data sets needed to measure effective coverage • Be able to routinely assess health services coverage at national and sub-national levels

Session 10
Using vital registration data in the Pacific Islands
	• To present and discuss real world examples of how health information (vital statistics) have been used to:
	  • Identify previously unrecognised health problems
	  • Provide evidence for action for key health issues
	  • Guide discussions re: funding with key donor agencies
	• To examine how inaccurate health information can affect policy decisions
	• To discuss the role of estimation of vital statistics and the importance of empirical data
	• To identify some of the common issues that prevent the use of empirical data and discuss ways in which these can be overcome

Session 11 Clinical services management systems	• Describe the components of a clinical management system • Discuss issues affecting clinical data management with special reference to data retrieval and linkage in • Describe the uses of clinical management data including patient care, health facility management, and public health program management and planning
Module 3 Data Management—Ensuring Quality and Coverage Data management is the third part of HIS Processes, covering all aspects of data handling—it is essential to ensure, relevant, timely and quality information is available for effective decision-making. Though part of HIS processes in the HMN cycle, it has been developed as a separate module recognising that poor quality data will have a major impact on decision-making.	
Session 12 Assessing the quality and reliability of routine HIS data sources	• Understand and be able to apply standard checks to data on births, deaths and causes-of-death • Understand how to critically appraise the quality of data from censuses and surveys • Understand how to critically appraise the quality of data from health services (patient information and effective coverage)
Session 13 Minimum data sets for health system management	• Describe the critical information needs for managing a health system • Define the principles for selecting a minimum data set • Provide recommendations and justification for a core set of health indicators and data sources to effectively manage a health system
Module 4 Outputs The following section will outline the role of quality HIS data for planning and policy purposes to achieve improved health outcomes. Through this module, students will understand the importance of telling the story that accompanies the data therefore increasing its ability to inform policy and planning decisions.	
Information products	
Session 14 Best practices for data presentation	• Understand the basic principles of communicating data using different means for different audiences and data types • Demonstrate an understanding of the advantages and disadvantages of different chart types • Demonstrate skills in preparing good tables and charts with appropriate disaggregation of data and clarity of presentation

Dissemination and use	
Session 15 From data to policy	• Understand best HIS practices at the country and global level to facilitate better use of health data for health policy • Describe the use of data for core health planning activities • Describe the role of health information for performance management in the health sector • Discuss implications for implementation of these practices in the participant's own setting
Module 5 Inputs—Completing the Circle A range of resources are required for the effective functioning of a health information system not least, workforce, financing, logistics and legislative and regulatory frameworks. This module will provide students with an overview of these essential inputs, assisting them to identify the inputs required to development HIS in their country.	
Session 16 The workforce to manage and support HIS	• Understand staffing implications at each level of a health system in collecting, analysing, storing, transmitting, using and disseminating health information, including staff planning and projections • Describe the range of skills required of these staff at different levels of the health system • Demonstrate an understanding of the different types of skills and staff needed to operate an effective HIS • Understand the most effective ways to build HIS capacity in countries
Session 17 HIS architecture and infrastructure	• Describe an architectural planning approach for enhancing HIS effectiveness using information and communications technology (ICT) • Identify the different types of infrastructure needed for a health information system and demonstrate an understanding of their role in producing timely, reliable health information • Discuss the role of the Internet and other communication technologies for strengthening HIS • Discuss the barriers to the use of information technology in HIS in both urban and rural areas
Session 18 HIS plans, strategies, standards and policies: The health sector and beyond	• Outline the national and sub-national governance arrangements required for an effective HIS • Demonstrate an understanding of the range of agencies that are needed to ensure HIS are integrated across sectors • Understand the importance of an integrated and costed strategic plan for improvements in a National HIS • Demonstrate an understanding of the importance of national standards for the collection of health data across all sectors
Module 6 Changing your HIS – Tools and Strategies This module is designed to assist students to apply their newly aquired knowledge and skills in their professional settings. The module will provide them with the tools and strategies to develop a plan of action for improving HIS in their country.	
Session 19 HIS advocacy and leadership	• Discuss the importance of a multi-sectoral approach to strengthening HIS • Discuss the impact of organisational culture and belief systems on Health Information Systems and approaches to address any potential issues • Demonstrate an understanding of the strategies to regulations and legislation that should underpin a HIS, including model examples • Discuss privacy and confidentiality principles and the need for ethical frameworks for working with health information
Session 20 Mapping your gaps: Tools to strengthen HIS	• Understand the principles and purpose of the HMN HIS Assessment Tool • Understand the principles, uses and application methods of the WHO/HIS Hub Comprehensive Vital Statistics Assessment Tool • Be able to apply the HIS and VR assessment frameworks to develop and prioritise strategic development plans

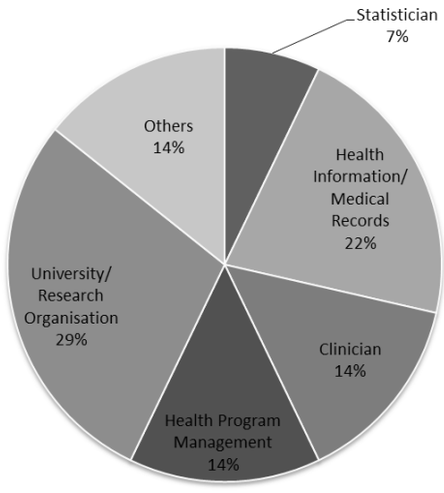

Figure 1 HIS short course participants by occupation (N=14)

Evaluation of the training

The evaluation of the training course involved three levels: (1) participants' evaluation of the course, (2) assessment of participants' learning, and (3) observation of participant-reported application of what was learnt in the course.

Participants' evaluation of the course

This level of training evaluation focuses on findings from the baseline and evaluation surveys before and after the course. It is mainly to explore how the training fits the requirements and expectations of the participants with different health-related responsibilities and duties, and to get suggestions from participants for further improvement of the course. Although there were a total of 14 participants in the course, only 13 participants (93%) filled out the baseline survey questionnaire, which has both quantitative and qualitative components. At the end of the course, evaluation survey questionnaire was completed by all 14 participants.

The participants were asked about the relevance of their participation in the course and their exposure to health information and/or HIS in their day-to-day tasks at work. This data provided background on the participants and the extent of their exposure to HIS. The facilitators utilised this information to both target their tutorial support to the group and individuals and adapt details of course content to better meet the needs and interests. It was also a self reflection tool for the participants on four key questions (Box 2).

Pre- and post-course data on participants' exposure to various HIS components and HIS issues were obtained to observe the change in their perspectives and understanding on these components and issues. Participants' responses identified that after the course, some participants reported the components and challenges in a more organised way, frequently using the terminology/phrases/examples they had learnt in the course on HIS components and issues.

Box 2 Points for reflection/ review through baseline survey
In the participants' day-to-day tasks at work,
• What health information they generated
• What health information they used
• To which parts of HIS they were exposed
• What challenges related to Health Information they encountered

Before and after the HIS course, participants rated the course based on their expectation (pre-) and actual (post) usefulness of the course to their current role. Before the course, 83% of participants expected the usefulness of the course to be excellent and 17% to be good. More participants (86%) found the course highly useful (excellent) to their current roles after they participated in the course (Figure 2). One participant, who rated the usefulness as 'excellent', commented that the course benefited them in preparing reports in their role and another mentioned improvement in individual capacity and demanded more courses.

The participants also rated the course based on their expectations and perceptions of the usefulness of the course to their current institution or organisation. Before the course, 82% of participants expected the usefulness of the course to be excellent and 18% to be good. However, after the course, the rating slightly decreased to 69% as excellent, 23% as good and 8% as average (Figure 3).

Before the course, most of the participants (62%) rated their knowledge on HIS as average, 23% as good and 15% as below average. None of them rated their knowledge as excellent. After participating in the course, most of the participants (64%) rated their HIS knowledge as good and 36% thought that their HIS knowledge had become excellent. Thus, it is reasonable to infer that a majority of participants believe that their HIS knowledge had improved after participating in the HIS course (Figure 4).

The majority of the participants (64%) responded that it was very likely that they will do things differently in their current position due to their participation in the course, 29% likely and 7% unsure (Figure 5).

In sum, participants' evaluation results indicate that a majority of participants expressed a very high opinion of the HIS course, in the baseline survey, individual module evaluations and end-of-course survey. In general, the participants felt that the course was useful and relevant to their current roles and organisations. In addition, the course had exceeded their expectations in both learning (content) and benefits gained.

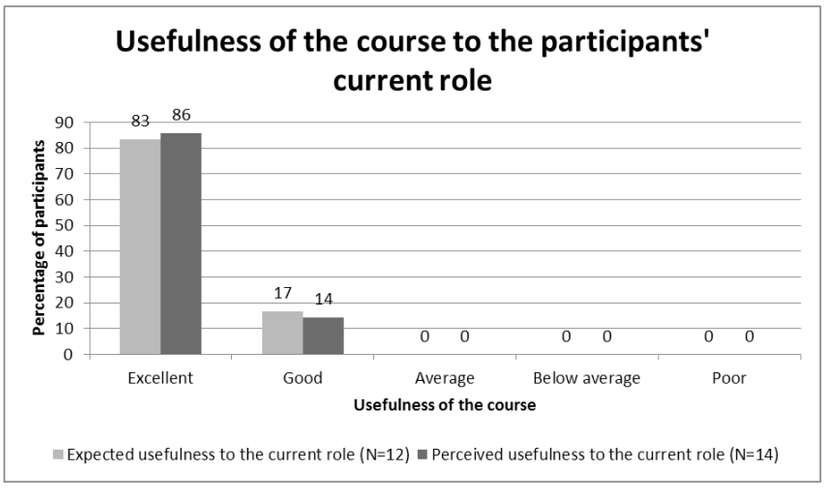

Figure 2 Expected (pre-) and perceived (post-) usefulness of the course to current role

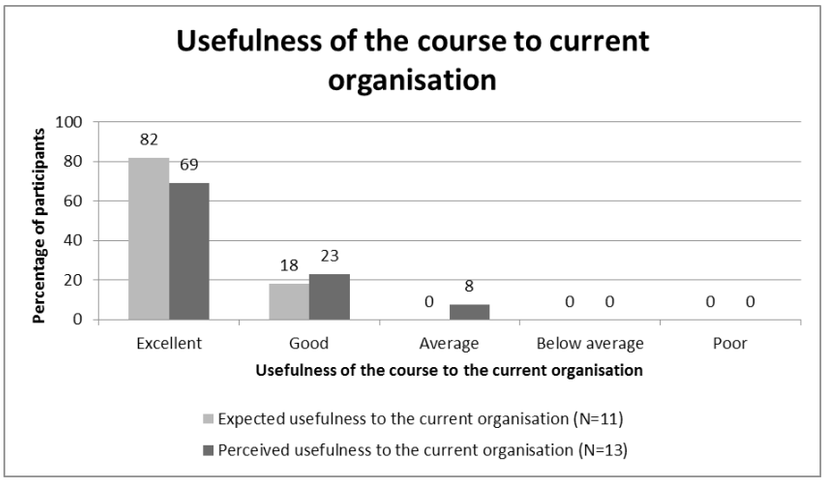

Figure 3 Expected (pre-) and perceived (post- usefulness of the course to participants' current organisation

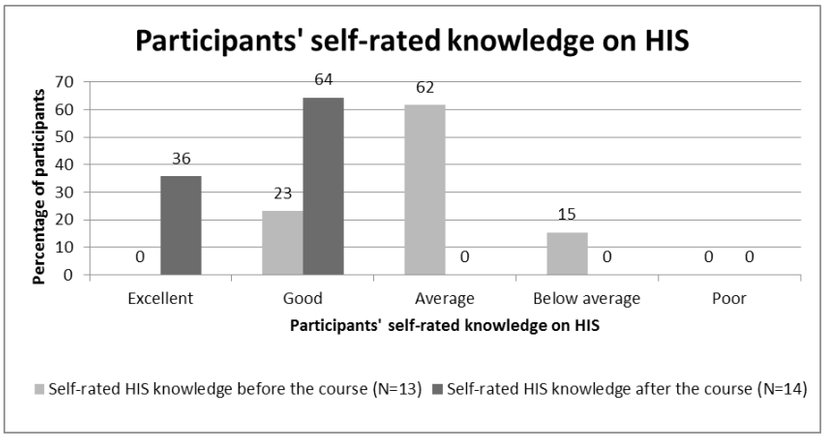

Figure 4 Pre- and post-course self-rated knowledge level on HIS

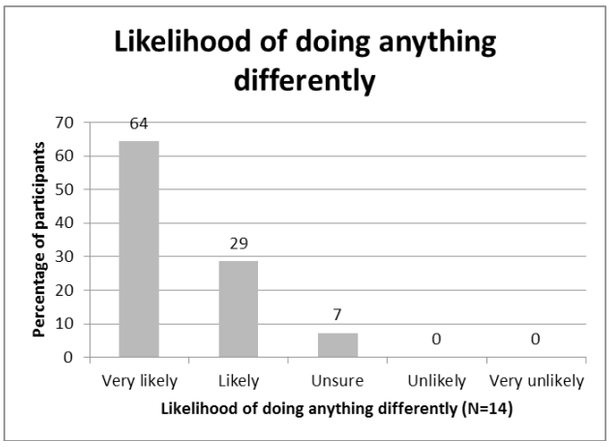

Figure 5 Post-course self-assessment of likelihood of doing anything differently in their current position

Most of the participants were optimistic that they would apply the knowledge and skills gained from the course when they got back to their countries and draw on the networks made during the course. Networking and sharing experiences appeared to be top the benefits perceived by participants, and they were a common reason for participating in the course. The most common suggestions for course improvement were to provide practical exposure to a successful HIS implementation site and to conduct an internship program in a location with a functioning HIS.

The participants gave overall ratings on each module in the course and the quality of teaching (lecturer) for each module, on a scale of 1 to 5: 1 being "Very poor", 3 being "Satisfactory" and 5 being "Outstanding". The average for mean overall ratings of all 16 modules was 4.2, and the average for mean overall ratings of quality of teaching in all lectures was 4.3, where 4 was "More than satisfactory". The majority of modules (13 out of 16) got a mean rating of more than satisfactory and the quality of teaching in 14 out of 16 lectures was rated the same as well.

All participants reportedly generated and used health information at work and were regularly exposed to HIS components; and they believed that completion of the course had given them more confidence in carrying out their HIS-related tasks. Overall, there was demand from the participants for conducting the tailored HIS course in their own countries, and they believed that capacity building of this kind could help strengthen their Health Information Systems.

Assessment of participants' learning

Overall, the facilitators assessed that the participants had increased their knowledge on various aspects of HIS. The group work (Box 3) encouraged active engagement by all participants, and tutors supported group members who were having problems as part of active learning process.

The group presentations showed that the participants had addressed the question/topic reasonably, although there were some minor omissions in information. The facilitators identified that data provided for the assignment was mostly interpreted correctly.

This included identifying the need to review the strengths and weaknesses of data/information provided, demonstrating an ability to develop a cohesive argument supported with adequate evidence and providing some original observations. Each group member and the group had their presentation assessed for adequacy of the new issues identified; areas of knowledge or skills needed/used in addressing the case; 'fitness for purpose' of the data found/presented and ability to find enough information in the public domain to address the scenario and its objectives. Based upon the answers the panel of experts found all participants demonstrated adequate knowledge and critical use of data.

Box 3 Group work for the HIS course

The group work focussed upon demonstration of knowledge and critical use of information through an activity which asked the participants to convince the Minister of Health to improve investments on one of the five scenarios allocated to the groups, namely:

1. HIV and AIDS in Papua New Guinea
2. Tobacco use in Indonesia
3. Infant mortality in Papua New Guinea
4. Cervical cancer screening in Samoa and Fiji
5. Screening and dialysis for diabetic nephropathy in Federated States of Micronesia.

To address these case studies, participants needed to:

1. Research what available data there was on these issues (sources of data were suggested to the teams)
2. Present a case for improving funding, investments or interventions, etc. based on the data they could find
3. Present the data in a way that would 'tell an important policy story to convince decision makers'

Observation of participant-reported application

At six months post-completion of the course, feedback was sought on how participants had overcome HIS-related challenges using what was learnt in the course, its application in their roles and organisations, and the use of networks made during the course. Out of 14 participants in the course, nine participants (64%) responded.

One participant described how course reading materials helped address challenges in data collection, documentation and reporting by giving guidance on what data to collect and document and also information on data sources, processing, storage and issues of bias. The participant described how application of the knowledge gained was facilitated by continued support from HIS Hub staff. The course enabled another participant to discuss with other staff how identified issues such as inaccurate data, lack of baseline data for health programming and confusion among clinical staff due to continuous changes in standard forms, could be solved. Moreover, two participants described use of skills

gained in advocacy and proper packaging of information to support improvement in data accuracy and quality, human and financial resources provision, and capacity development, by getting one's supervisor to share the HIS vision. One participant described how transforming data into useful information at the operational/clinical level, such as giving feedback on the progress of health staff work, helped the previously poorly recognised medical records section gain attention. It was also reported that knowledge gained on human resources on HIS during the field visit to a hospital in Brisbane was useful in addressing issues in human resource for HIS back in the participant's country.

Conversely, one participant still found it challenging to make the district level health team understand health programming needs and get data from them despite efforts in introducing simple reporting forms. Another participant faced the problem of missing data for auditing due to inadequate recording of data, and the course helped the participant in understanding the concepts of data collection and practising it; however other staff behaviours concerning data recording had not improved as the work environment itself was not conducive to change. One participant who identified lack of skilled human resources as a continuous challenge believed that the problem continued not because of lack of training opportunities or funding for training, but due to poor communication and coordination and not recognising the problem let alone finding solutions for it. This participant was doubtful that the situation would improve despite awareness-raising on this matter at the planning level.

According to the end-of-course survey, 64% of the course participants said it was 'very likely' that they would do things differently in their current position due to their participation in the course, and 29% 'likely'. According to feedback from the participants, it was observed that different participants applied what was learnt in the course differently at their workplaces.

Participants reported improvement in their practices regarding HIS processes and promotion of a culture of information at their workplace. After the HIS course, one participant was applying the skills learnt in the course when taking on a new role as 'Health Information Officer', to analyse and interpret the data collected in their country. The participant also started advocating and teaching on proper and regular documentation of evidence with neat, legible handwriting, creating awareness on the value of datasets, and making discussions on accredited training at their institution for Health Information Unit staff at the Ministry of Health. Another participant reported using statistical information more frequently in the presentations and when requesting materials, meeting with and requesting information from their statistics department more often, making suggestions for improvement of their HIS (such as using verbal autopsy) and making co-workers aware of the importance of statistics in health care.

The course reportedly made one participant more aware of data issues and enabled the participant to identify these issues during monitoring visits and share the relevant information from HIS course to clinical staff in the field. In addition, the participant had personally developed the habit of proper and timely recording and filing of data, and realised that it made their work easier by having access to information whenever needed. One participant became more aware of transforming data into information and was able to analyse data over time and present information at their institute and to relevant authorities.

The application of what was learnt in the course has crossed the boundaries of one's defined role and organisational unit. Being confident in the role and the vision of a functioning HIS as a whole was reported by one participant as an impact from the course. Another participant became aware of 'bigger picture' issues outside of one's job scope, put these in perspective, realised how to improve the operation and function of data presentation and utilisation for management purposes, and shared the information generated from HIS among different levels more effectively through work interactions. A participant reported strengthening networks with stakeholders (including district and provincial HIS staff, academics and Ministry staff) as what had been done differently after the course. Another participant was trying to establish a Patient Information Committee with different representatives from different areas to address issues related to information.

When asked about using networks made during the course, less than half of the nine respondents reported that they had used the networks although, in the end-of-course survey, a majority of them reported networking and sharing experiences as one of the benefits they got from the course. One participant commenced collaboration with UQ in cause-of-death certification training to medical students in their institution and was also working with UQ and their Ministry of Health for other HIS-related trainings both in the country and in the region. Scarce training resources for HIS staff was identified as one of the challenges, and another participant reported taking advantage of the networks as an avenue to lobby for staff training and sharing experiences among Pacific Island countries. One participant kept in touch with the HIS Hub staff for information and guidance on improving the quality of cause-of-death data.

HIS curriculum now and in the future

Based on participants' evaluation results and requests for a repeated offering of the course, the School of Population Health, with partners including World Health Organization Regional Office for the Western Pacific (WHO/WPRO), Fiji National University and PHIN, are planning to offer the short course on a regular basis, both in Australia and in countries within the region.

The main changes in the modified curriculum are a strengthened focus on:

- Clinical health services management information systems,

- HIS for measurement and management of health services coverage,
- Health Management Information Systems, and
- HIS architecture.

To assist participants work through the short course, a 'refresher' session on basic statistical literacy, which will focus partially on the basic statistical concepts required to interpret data, has been added.

The case studies for the team activities are being strengthened, with clearer data sets and better focus on 'real life' scenarios on the use and dissemination of data for various purposes, advocacy for HIS investments, and planning for action on HIS strengthening based on tools introduced during the course. Stronger 'capacity assessment' criteria for the facilitators to use in assessing participants' progress against objectives will be added, based on adult learning principles.

This course is envisioned as an introductory level for HIS capacity development. Discussions with partners in the region, including WHO/WPRO, have started to define a competency pathway for HIS – from introductory skills to more specialised competencies according to responsibilities in cause-of-death certification, verbal autopsy, assessment of vital registration systems, use of existing survey data, HIS architecture and leadership in HIS. For some key staff, higher degree training in, for example, epidemiology, biostatistics, demography, health economics, and health systems management may be part of the pathway. The aim is to develop this competency framework in the next six months to enable focussed investments in regional HIS capacity development, and for validation by employers, managers and staff already in HIS positions.

Conclusion

To fulfil the health system capacity building needs of the Asia Pacific region, the HIS Hub has developed and piloted a short training course on HIS. Course participants were from the Asia Pacific region and their expectations of the usefulness of the course in their roles were largely met. Their feedback confirmed that the content of the course addressed their training needs. Overall, a positive attitude of the participants towards the course, course contents and lecturers was observed. More than half of the participants reported applying their knowledge and skills gained from course in their roles and workplaces during the six months after the course. Demands for such training in the region continue to be expressed, with the continued delivery of a modified HIS short course planned.

The course will be one component of the development of capacity of health and HIS-related staff in the region to generate and use information to improve health care planning and management at all levels of the health system.

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Improving the utilisation of demographic and health surveys as a source of health information

Original article

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Key points
• Improving the utilisation of existing health datasets can provide better evidence for health decision-making
• Demographic and Health Surveys (DHS) provide a wealth of health data in many countries where data from other sources are lacking
• DHS data can be used to produce a range of key health indicators, as well as allow for analysis of inequalities in indicators by various population sub-groups
• This article describes tools for public health officials to use to produce health indicators from DHS data, and analyse these by socio-economic status and place of residence

Summary

In many countries, existing health data sources are underutilised to inform health decision-making. Improving the capacity of public health officials to assess, analyse and interpret existing data is a primary means for overcoming this issue. One data source with much potential to inform health policy is the Demographic and Health Survey (DHS). The DHS, which has been conducted in over 90 countries, collects data in a standardised fashion that can produce a range of key indicators for health policy, including health outcomes, health service utilisation, environmental factors, and demographic and socio-economic factors. The DHS also allows for comparison of indicators over time within a country, as well as comparison of indicators between countries. This article details the type of data available in the DHS and details a range of indicators that can be produced from these data.

A major advantage of the DHS is that the datasets are freely available for analysis. The DHS therefore provides much potential for harnessing existing skills of public health officials and researchers to assess, analyse and interpret its wealth of data. This article presents tools, for use in Stata software, to compute these indicators and analyse them according to geographic, socio-economic and other factors. Such tools can be adjusted to suit the type of information the analyst wishes to derive from the data. Improving the use of DHS data in settings where health data from other sources is lacking will strengthen the evidence-base for health policy.

Introduction

Effective health planning and policy requires accurate indicators of health outcomes, health system characteristics and determinants of health within a population.[1] Such information can only be provided through reliable data sources. Although the availability of health data sources has increased in recent years, these remain underutilised to inform health decision-making in many parts of the world. Better utilisation of these data requires improved capacity of public health officials to assess, analyse and interpret existing quantitative data.

Population surveys are one such data source that have been used widely to produce public health indicators. Surveys have been of particular use to provide information in settings where timely and accurate routine data are lacking. They have been extensively used to measure a wide range of health outcomes, as well as health service utilisation, environmental factors, and demographic and socio-economic factors.

The primary population survey for collecting public health data is the Demographic and Health Survey (DHS). The DHS has been conducted throughout many countries in recent decades, including in much of Southeast Asia, and more recently in Samoa. It collects a wide range of information and is a valuable dataset to provide key indicators as evidence for health policy, for local and national governments as well as international organisations. A major advantage of the DHS is that (most) survey data are freely available for analysis. The DHS is therefore a very appropriate data source to use as a basis for improving the skills of public health officials to analyse existing data to inform health decision-making.

This article will examine potential applications of the DHS to produce indicators for health decision-making. The objectives of the article are to:

- Describe how DHS data are collected and examine the DHS questionnaires
- Detail the indicators that can be derived from the DHS, including some indicators that are not presented in standard DHS publications
- Explain how the indicators can inform health policy, how they are computed, and how they can be analysed by geographic, socio-economic and other

factors

- Present tools, for use in Stata software, to compute these indicators and analyse them according to geographic, socio-economic and other factors.

Population surveys

Population surveys are used in many countries to collect information on the health status of a population. Surveys are conducted amongst a sample of the population, and are designed to produce results that are representative of a population, such as for an entire country or population group.

An advantage of surveys is that they generally collect detailed information when compared with many ongoing data collections and population censuses. Surveys may collect data on a number of factors, including health status, service utilisation, risk factors, and demographic and socio-economic factors. This range of information allows for assessment of health indicators, such as health outcomes or access to health services, relevant to the epidemiological profile of the population. Such breadth of information provides evidence for policymakers and international donor agencies to monitor and evaluate existing disease prevention and control programs over time, when multiple surveys are conducted. This evidence can also provide information to design new health intervention programs. It also allows for identification of at-risk populations according to economic status or place of residence, which provides evidence to design health interventions targeted specifically at reducing these inequalities.

Surveys can be particularly important where routine administrative data collection systems are not complete. In much of the developing world, such routine systems are still being developed, and surveys can fill vital information gaps. Even where routine reporting systems are operating, they may not collect data from the whole population. A survey can be conducted to provide information in certain geographical areas not being covered by routine systems. Also, where data are only collected from people who utilise a certain institutional service, such as a hospital, surveys can seek information on people who use non-institutional services such as providers of traditional medicine. Surveys that are regularly conducted can also be used to include a module that collects data on a specific health issue.

A framework developed by Mosley and Chen[3] shows how a range of information, including health outcomes, risk factors and socio-economic information, can be analysed to understand how inequalities in health outcomes are manifested. The Mosley-Chen framework was designed specifically for child survival, but can be applied to other health outcomes. This framework describes how background socio-economic determinants affect child mortality and morbidity by operating through proximate or intermediate determinants (risk factors). Population survey data can be used, for example, to analyse the extent to which socio-economic inequalities in infant mortality rates are due to inequalities in the more proximate determinant of maternal health service utilisation.

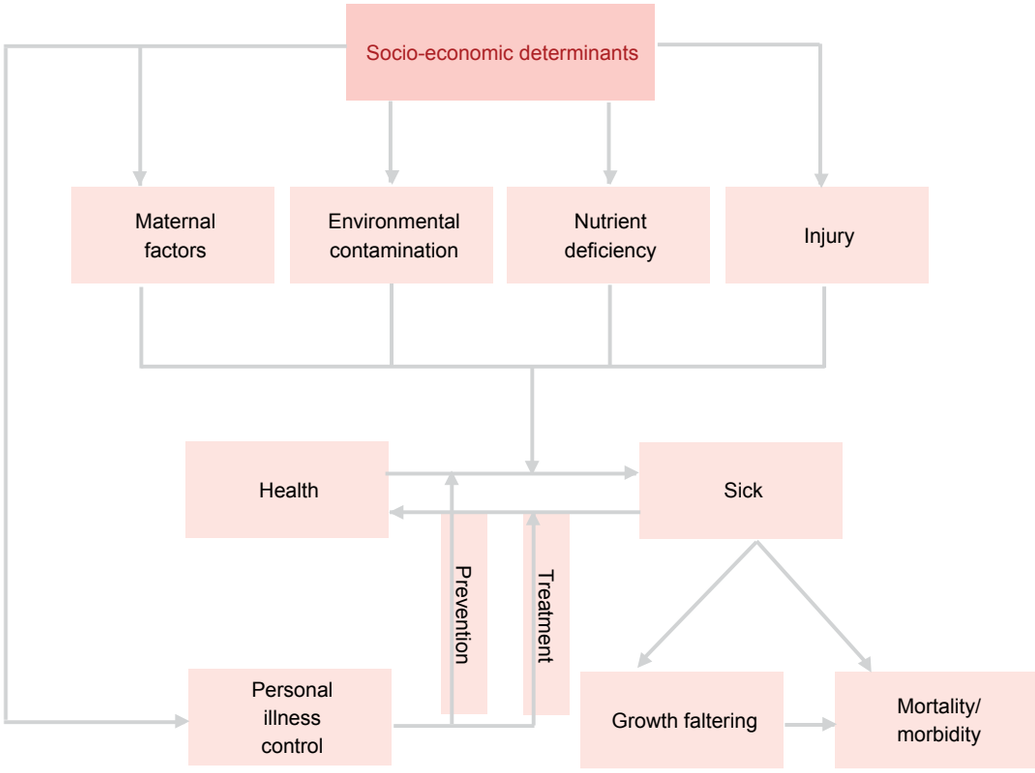

Figure 1 Mosley-Chen framework for the determinants of under-five mortality[3]

Demographic and health surveys

Background

Demographic and Health Surveys (DHS) have been conducted in over 90 countries since 1984.[4] They are a major source of public health and demographic data throughout the world, especially in countries lacking such data from other sources. DHS data are commonly used to compute key indicators that are used to monitor a country's population health.

The DHS is implemented commonly by a national statistical office, Ministry of Health or university with sufficient expertise and experience in conducting surveys. Technical assistance is normally provided by ICF Macro (formerly ORC Macro and Macro International). A DHS can range in size from 2,000 to 40,000 households, although samples over 20,000 households are normally reserved for countries with large and diverse populations. Overall, the DHS takes on average 18-20 months from initial planning to the release of final results in a publication.[5] The DHS questionnaires are very large, and conducting such a survey is can be a cost-intensive exercise.

The DHS has standard questions in consecutive surveys within a country, providing an important data source of trends in health indicators. Also, these questions are asked in surveys in a number of countries, and so allow for comparison of health indicators across countries.

A major advantage of the DHS is that data for most surveys are freely available for analysis. This allows users to examine the data and conduct analyses that are not available in the final publication of results. The 'tools for using DHS data' later in the article detail how data users can analyse the free datasets with Stata software.

Data collected in each DHS are subject to rigorous procedures to ensure quality and consistency. These procedures include how data are collected and processed, how surveys are designed and how uncertainty is measured; these are described below. The thoroughness of these processes ensures that public health officials can have confidence in the quality of the data collected by a DHS.

Data collection and processing

Data collection in DHS is conducted by interviewers, field editors and supervisors, who visit households that have been included in the sample. These staff commonly have a background working in health, such as nurses or midwives. They receive comprehensive training that includes knowledge of the DHS questionnaires, interviewing skills, data collection techniques for collecting biomarker information such as blood samples, and data quality control. There is ongoing data quality checking in the field so that problems can be rectified before fieldwork completion to ensure final data are as accurate as possible. Fieldwork is undertaken at a time of the year when there is reduced risk of natural events, such as flooding, which may adversely affect data collection.

The collected data are processed upon the completion of fieldwork to ensure the quality of the final data. After the fieldwork data entry is continued, data are cleaned, coded and assessed for consistency (such as reported date of birth and age), and any blood samples are tested in a laboratory.[5] All data are de-identified to ensure confidentiality. Once the data processing has been completed, data analysis is conducted to produce the final report, which is written by public health experts for the particular country.

Survey design

The sample for a DHS is chosen based on an established sampling frame. A sampling frame can be obtained from a census or other survey, and should provide an up-to-date listing of units of enumeration (such as census blocks) throughout the country, as well as an estimate of the population.[6] In most countries, a DHS is nationally representative, with the exception of remote areas or where there is a disaster or conflict that prevents the survey being undertaken in certain areas.

A DHS most commonly uses a multistage stratified cluster sample design based on the sample frame. The sample is stratified into population sub-groups, based on urban or rural residence, socio-economic status or some other similar characteristic.[6] An example of the multistage stratified cluster sample design is in the 2007 Zambia DHS, where each of nine provinces in the country were stratified into urban and rural areas. Enumeration areas within each of 18 stratums were selected with probability proportional to population size. Then, in each enumeration area or cluster, 25 households were selected, according to systematic sampling whereby each household had equal probability of selection.[7]

As well as being representative of the whole nation, the DHS sample is designed to provide estimates at sub-national level as well, such as urban and rural areas, major regions, or administrative areas such as provinces or states. These areas for which representativeness is sought are called domains. Often certain geographic areas are over-sampled to ensure appropriate sample size for reliable estimates.

During analysis of DHS data, use of survey weights is necessary to produce results that are representative of the population. The DHS defines sampling weights as: '*…adjustment factors applied to each case in tabulations to adjust for differences in probability of selection and interview between cases in a sample*'.[8] Some areas within the population may be under-sampled by the survey, and so need to have a greater weight applied compared with other areas in order to produce reliable estimates for that population. Weights are also used to account for non-response in the survey. There are different types of weights in the DHS; for the household, women/children, men and, if collected, HIV data.

Data error

Sampling error is a particular issue in surveys with small samples and also for indicators where the outcome is rare, such as mortality rates. Some key indicators therefore need to be interpreted with reference to the 95% confidence interval. The 95% confidence interval represents the range of values where there is 95% certainty that the true value of the indicator lies. If the 95% confidence interval indicates considerable uncertainty about the true value of the indicator, then the utility of that indicator is reduced. The sample size needs to be sufficient to ensure rates, especially mortality rates, do not have too large confidence intervals. The 95% confidence interval for proportions and means is computed using the Taylor linearization method. The DHS publications report the 95% confidence intervals for major indicators in the Appendix, both at the national and sub-national levels, including urban and rural areas and provinces and states.

The DHS data will have a degree of non-sampling error. Non-sampling error refers to mistakes such as non-response by the household, misunderstanding of question by the respondent, error in recording by the interviewer, and data entry error.

The response rate in the DHS is calculated as the number of households or individuals with a completed interview as a percentage of all eligible households or individuals in the sample. A low response rate is an indicator of poor data quality. The DHS excludes absent household and vacant or destroyed dwellings from the response rate calculation.

Where there are missing values in the DHS, they are presented as missing in the data file.

Indicators from DHS data

Health indicators are a key component of health information as evidence for health policy. Indicators help determine progress towards health goals, whether local or international. An example of international health goals is the UN Millennium Development Goals (MDGs).[9] The MDGs are international measures to help countries track health status of their population. Table 1 shows the indicators used in MDGs 4 and 5. Indicators in a population should also be related to priority health areas within the country, depending on the epidemiological profile.

The DHS has been a key data source used to track MDGs in many countries. The DHS has been conducted in Indonesia since the late 1980s, providing policymakers with a strong database to track trends in the under-five mortality rate to assess achievement of MDG 4. The Indonesian Government has used the under-five mortality rate from the 1991 DHS as the baseline for MDG 4, and subsequent DHS to assess progress to the target (see Table 2).[10] The Indonesian Government has assessed that MDG 4 is on target to be met. It should be noted that progress towards MDGs is also being undertaken using various data sources and advanced statistical modelling.[11]

The DHS allows a range of health indicators to be measured, as well as risk factors and a range of socio-economic and demographic characteristics of the population. Other major health priority areas that a country can monitor using indicators are described below. The areas described are child morbidity and treatment, maternal health services, non-communicable disease control, and socio-economic determinants of health outcomes and health service utilisation. These indicators can be obtained from the DHS, although, as described below, the DHS could be strengthened with more questions relating to risk factors for non-communicable diseases.

Table 1 UN Millennium Development Goals

Goal 4	**Reduce child mortality**	**Indicators**
Target	Reduce by two-thirds, between 1990 and 2015, the under-five mortality rate	Under-five mortality rate Infant mortality rate Proportion of 1-year-old children immunized against measles
Goal 5	**Improve maternal health**	**Indicators**
Target	Reduce by three-quarters, between 1990 and 2015, the maternal mortality ratio	Maternal mortality ratio Proportion of births attended by skilled health personnel

Table 2 Indonesia under-five mortality rates from DHS and MDG 4 target

	1991 DHS (Ref. date 1986-91)	2007 DHS (Ref. date 2003-2007)	MDG 4 target 2015
U5MR (95% confidence interval)	97 (confidence interval not reported)	44 (39-49)	32

Note: For explanation of 95% confidence interval and reference date, please see early age mortality section

Child morbidity and treatment

Reducing the incidence of childhood illness and improving timely access to treatment is of high importance for reducing early age mortality levels, and form a major component of illness control in the Mosley-Chen framework (Figure 1). Infectious diseases such as pneumonia and diarrhoea are major causes of death between age one year and five years, especially in mortality settings.[12] The DHS collects data on recent childhood diarrhoea and acute respiratory infection episodes, and the types of treatment responses. Such information can provide critical evidence to Governments to inform provision of health centres and for health promotion campaigns. DHS data can also be used for broader analyses; DHS data have revealed that declines in under-five mortality in developing countries in the 1990s were associated with an increased proportion of children being treated by modern providers for acute respiratory infection, diarrhoea and fever.

Maternal health services

Achievement of reductions in under-five mortality and maternal mortality requires highly accessible and appropriate maternal health care.[14] A range of intervention packages are available to reduce early age and maternal mortality, through programs to improve newborn care. Skilled birth assistance helps implement these interventions to reduce early age and maternal mortality.[14] The data collected on maternal health services allows Governments to conduct detailed analyses of the provision of these services, whether by type of provider or by the type of intervention delivered. These data can then inform Governments about where gaps in maternal services exist, and provide evidence for delivery of specific programs.

Non-communicable disease control

Non-communicable diseases are an increasingly important cause of mortality and morbidity throughout the world, especially in Asia and the Pacific.[15] The risk of an individual having a non-communicable disease such as ischemic heart disease, stroke and diabetes is strongly influenced by behavioural risk factors such as smoking, obesity, dietary intake and physical exercise. Governments can seek to reduce the burden of non-communicable diseases through interventions aimed at reducing the prevalence of these risk factors.

Population surveys have been described as the best way of measuring these behavioural risk factors.[2] The DHS collects information on current tobacco consumption and, in some surveys, measures the body mass index (BMI) of adults. In Samoa, where there has been a rapid epidemiological transition from infectious to non-communicable diseases, the 2009 DHS also collected information on the fruit and vegetable intake of adults.[16-17]

There is considerable scope for the DHS to collect a broader range of data on behavioural risk factors to provide evidence for non-communicable disease control in every survey. These include data on dietary intake, physical activity and alcohol consumption, which are risk factors strongly linked to major non-communicable diseases such as ischaemic heart disease, stroke and liver cirrhosis. Data on these risk factors have been widely collected in health surveys, such as the US Behavioural Risk Factor Surveillance System, which is conducted as a telephone survey.[2] Data collected can include information from the respondent about their dietary intake, physical activity or alcohol consumption over the preceding day or week.

Such data could be readily added to an existing DHS, perhaps in place of HIV data where HIV is not an epidemiological priority. Detailed information on these behavioural risk factors will provide evidence for Governments to introduce interventions to the population, which can then be tracked in future DHS.

Socio-economic determinants

In the Mosley and Chen framework shown in Figure 1, socio-economic determinants influence health outcomes by operating through more proximate (immediate) health determinants. Analysis of health indicators by socio-economic status can demonstrate inequalities in health outcomes as well as access to health services. For Governments, socio-economic data provide evidence for targeted programmatic interventions to address inequalities. For example, an assessment of socio-economic inequalities in skilled delivery assistance would provide evidence for specific programs to be targeted at women who have poor access to these services. The DHS constructs a wealth index based on a range of factors (see below). The wealth index has shown large inequalities in early age mortality rates in some countries, such as Indonesia.[18]

Key indicators derived from DHS data

This section presents a description of a wide range of health indicators used in DHS publications and more broadly by the international health community.[19] It also presents other indicators assessing maternal health service utilisation that can also be derived from DHS, but are not included in standard publications.

Early age mortality

Early age mortality indicators are shown in Box 1. Disaggregated data are particularly useful in the evaluation and planning of services to reach health-related goals. Disaggregated mortality rates, whether measured as neonatal, post-neonatal, infant, child or under-five mortality rates, can be analysed by risk factors or socio-economic status and provide evidence for planning of health interventions. DHS data can be used to assess inequalities in mortality rates and the relationship of various risk factors with mortality risk.

Box 1 Early age mortality indicators[8]

- **Neonatal mortality rate:** Number of deaths in the first month of life per 1,000 live births *(Please note that the neonatal mortality rate is often measured elsewhere as deaths in the first 28 days of life)*
- **Post-neonatal mortality rate:** Number of deaths from one to 11 months per 1,000 children surviving to 28 days
- **Infant mortality rate:** Number of deaths at age less than 12 months per 1,000 live births
- **Child mortality rate:** Number of deaths at age 12 to 59 months per 1,000 children surviving to 12 months
- **Under-five mortality rate:** Number of deaths at age less than 60 months per 1,000 live births
- **Perinatal mortality rate:** Number of perinatal deaths (still births from seven months gestation plus deaths within one week of live birth) per number of pregnancies of seven or more months plus live births, multiplied by 1000 *(Please note that elsewhere the perinatal mortality rate is also defined as the number of stillbirths and deaths in the first week of life per 1,000 live births)*[20]

The estimation of early age mortality rates from DHS data uses a method called direct estimation. Direct estimation utilises birth history data on the date of birth, whether the child is alive or not, and, if died, the age at death. The method used for direct estimation is called the synthetic cohort life table approach.[8] The synthetic cohort life table approach computes death probabilities in small age segments, and combines these to calculate early age mortality rates. These age segments are 0-1 month, 1-2, 3-5, 6-11, 12-23, 24-35, 36-47 and 48-59 months.

For each age segment, the numerator and denominator are computed based on three cohorts (A, B and C). The cohorts are defined based on the upper and lower limits of the age interval (a1 and au) and the upper and lower limits of the time period for which the mortality rates are being computed (t_1 and t_u). The three cohorts are defined as children born between dates $t_l - a_u$ and $t_l - a_l$ (cohort A), $t_l - a_l$ and $t_u - a_u$ (cohort B) and $t_u - a_u$ and $t_u - a_l$ (cohort C). Figure 2 presents the age interval, time period and cohorts graphically. Cohort B includes those children who spent the entire time period in the age interval, while cohorts A and C lived both within and outside the time period in the age interval.[8]

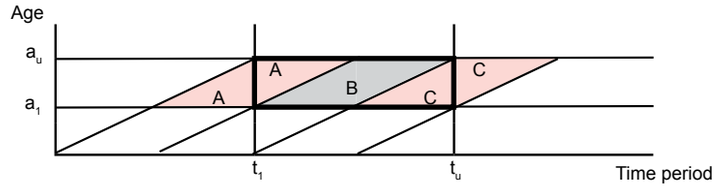

Figure 2 Early Age Mortality Rate cohorts

The numerator for cohort A equals the sum of half of all deaths between ages a_1 and a_u, for cohort B it is all deaths between ages a_1 and au, and for cohort C it is half of all deaths between ages a_1 and a_u. Half of all deaths of cohorts A and C are used because children in these cohorts lived through the age interval both within and outside the time period.

There is one exception to computing the numerator. When the time period ends at the time of survey, all deaths in cohort C are used to compute the numerator. This is because all deaths in cohort C in this time period will represent half deaths in cohort C over the age interval.

The denominator equals the sum of half of all survivors at a_1 in cohort A, all survivors at a_1 in cohort B and half of all survivors at a_1 in cohort C.

For each age segment, the numerator is divided by the denominator to compute the death probability.[8] The mortality rate is computed by multiplying all the death probabilities within the age period for which the mortality rate is being computed.

The 95% confidence interval of the early age mortality rate is conducted using the Jackknife repeated replication method.[19]

The directly estimated mortality rate is most commonly reported for the five years prior to enumeration. A common mistake when reporting mortality results is to state that they are for the year that the survey occurred. One drawback of direct estimation is that there is a delay between the period for which the mortality rates refer and the publication of results, which can occur over two years after the survey is undertaken.

It is important to consider other drawbacks of using the direct estimation method. One potential weakness of the data relates to accuracy due to errors related to recall of details by the mother. The reporting of child deaths is also culturally sensitive, and so may be under-reported. There may be some confusion over the reporting of stillbirths, even though they are explicitly asked to report on live births. The accuracy of age at death reporting may also be a problem because of the reliance of retrospective reporting; the heaping of deaths at age 12 months has been found in past surveys. There is also no information on women that have died, which is an issue as maternal and early age mortality are highly correlated.

Box 2 Computation of early age mortality rates[8]

Numerator of age segment =

$$\frac{\text{deaths } a_1 \text{ to } a_u \text{ cohort A}}{2} + \text{deaths } a_1 \text{ to } a_u \text{ cohort B} + \frac{\text{deaths } a_1 \text{ to } a_u \text{ cohort C}}{2}$$

Exception: Numerator of age segment when time period ends at survey =

$$\frac{\text{deaths } a_1 \text{ to } a_u \text{ cohort A}}{2} + \text{deaths } a_1 \text{ to } a_u \text{ cohort B} + \text{deaths } a_1 \text{ to } a_u \text{ cohort C}$$

Denominator of age segment =

$$\frac{\text{survivors at } a_1 \text{ cohort A}}{2} + \text{survivors at } a_1 \text{ cohort B} + \frac{\text{survivors at } a_1 \text{ cohort C}}{2}$$

Age segment death probability =

$$\frac{\text{Numerator}}{\text{Denominator}}$$

Mortality rate 0-59 months =

death probability age 0 mths x 1-2 mths x 3-5 mths…x 48-59 mths

Box 3 Example to calculate the neonatal mortality rate

Calculate the neonatal mortality rate for the one year prior to 30 June 2010. The survey was conducted in 2011.

t_1 = 30 June 2009, t_u = 30 June 2010, a_1 = 0 months (i.e. birth), a_u = 1 month

Using the computation of each cohort:

Cohort A: born between 31 May 2009 to 30 June 2009

Cohort B: born between 30 June 2009 to 31 May 2010

Cohort C: born between 31 May 2010 to 30 June 2010

Chort	Deaths less than one month	Survivors age 0 (i.e. births)
A	90	1125
B	1275	12543
C	80	1195

Numerator = (0.5 x 90) + 1275 + (0.5 x 80) = 1360

Denominator = (0.5 x 1125) + (0.5 x 12543) + (0.5 x 1195) = 13703

Age segment death probability = 0.09925

Neonatal mortality rate = 99.25 per 1000

Note: The neonatal mortality rate only requires the use of one age segment death probability.

Child morbidity and treatment

Prevalence of acute respiratory infection (ARI):

Percentage of children under five years with symptoms of ARI (cough with short, rapid breathing) in previous two weeks.

Prevalence of fever: Percentage of children under five years with fever in previous two weeks.

Treatment for ARI/fever: Percentage of children for whom advice or treatment was sought for ARI or fever in previous two weeks.

Prevalence of diarrhoea: Percentage of children under five years with diarrhoea in previous two weeks.

Treatment for ARI/fever: Percentage of children for whom advice or treatment was sought for diarrhoea in previous two weeks or who received oral rehydration therapy or who received other treatment.

Adult and maternal mortality

Adult mortality is also an issue in many parts of the world, and remains high in some countries that have achieved declines in early age and maternal mortality. The major causes of adult mortality include chronic diseases that are caused by smoking, alcohol and poor diet, external causes such as traffic accidents and suicides (especially among males), as well as infectious diseases such as HIV/AIDS.

Maternal mortality, as shown in Table 1, is the basis for MDG 5. In many parts of the world, the risk of death for women during childbirth remains unacceptably high.

Unlike early age mortality, where the mother is the obvious respondent, it is not clear who we should ask to report adult and maternal deaths. There are a number of potential respondents; the DHS questionnaire elicits information on adult and maternal deaths from siblings, using a technique called sibling survivorship. The questions are much like birth histories used to estimate child mortality. They include age data, including age at death, and can used to estimate indicators of adult or maternal mortality for a defined period (e.g. seven years before the survey).

Age-specific death rates

Age-specific death rates can be computed from the adult mortality data. Age-specific death rates are computed as the number of deaths divided by the number of person years and multiplied by 1000. They are normally computed from DHS data for ages 15-19, 20-24.... 45-49.

To compute the age-specific death rate for the seven years prior to the survey:

- Numerator: Calculate total deaths in each five year age group between 15 and 49 (i.e. 15-19, 20-24, 25-29 ... 45-49) in the seven years before the survey
- Denominator: The number of person-years lived is computed for both surviving siblings and deceased siblings. It is the number of years lived in each five year age group between 15 and 49 (i.e. 15-19, 20-24, 25-29 ... 45-49) in the seven years before the survey. This needs to be computed separately for surviving siblings and deceased siblings. A person-year of exposure is simply the total number of years lived by a person within that age group (e.g. 25-29) over that period (seven years before the survey).

For example, if the seven years prior to the survey was from 1 July 2004 to 30 June 2011, then a person aged exactly 31 years 6 months at 30 June 2011 would have spent 1.5 years in the 30-34 age group, 5 years in the 25-29 age group and 0.5 year in the 20-24 age group (because they would have been aged 24.5 years at 1 July 2004).

Using the same survey, if someone died at exactly age 42 years 6 months on 1 January 2008, they would have been alive for 3.5 years during the seven year period, of which they would have spent 2.5 years in the 40-44 age group and one year in the 35-39 age group (because they would have been 39 years 0 months on 1 July 2004).

For each age group, the number of deaths is divided by the number of person years and multiplied by 1000 to obtain age-specific death rates.

Adult mortality rate

The adult mortality rate measured in DHS publications is the number of deaths from ages 15 to 49 years per 1,000 person-years lived for a specified period. This adult mortality rate is computed by firstly calculating the proportion of respondents in each five-year age group, multiplying this by the age-specific death rate, and then summing these age-distribution-adjusted mortality rates. The adult mortality rate is measured per 1000 person-years lived. Below in Table 3 is an example from the Zambia 2007 DHS.

The adult mortality rate is most commonly computed as the probability of dying between ages 15 and 60 years for a hypothetical cohort. This is a different measure to that used in DHS publications, because it uses a different age group, as well as assuming that a person who lives from 15 to 60 years will experience the reported age-specific death rates. It is computed using the age-specific death rates by applying conventional life table techniques.[21] The DHS publication adult mortality rate, on the other hand, is simply computed by age-weighting the age-specific death rates for a particular person-year and multiplying by 1000.

Maternal mortality

To compute indicators of maternal mortality, we need to be aware of the standard definition of a maternal death, as defined by the WHO:[22]

The death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration

and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes.

The two main measures of maternal mortality are:

- *The maternal mortality ratio*: the number of maternal deaths per 100,000 live births for a specified period
- *The maternal mortality rate*: the number of maternal deaths per 100,000 woman-years lived in ages 15-49 years for a specified period. This is computed in the same manner as the adult mortality rate above.

Maternal mortality is difficult to measure using surveys, so there is much uncertainty about the estimates. Obviously maternal mortality is easier to measure where deaths occur in a facility. However, in many settings home births are more common, even when there are complications that increase the risk of death.

There are some issues related to this method of estimating adult and maternal mortality:

- A maternal death is defined by when it occurred, not by cause – so it includes non-maternal deaths
- Maternal mortality is a rare event, so most useful where fertility is higher (four births per woman or greater)
- The respondent may not still know all of his/her sisters
- There may be multiple counting of the same death by different siblings
- For high mortality families, if one sibling is deceased, another sibling may be more likely to be deceased, this may lead to missing some deaths
- A higher number of siblings may be positively related to the risk of maternal death. May lead to upward bias of estimate - because bigger families are generally poorer, and poorer families have higher mortality.

and how to respond should they arise, is key for these problems to be managed appropriately. This information can help program managers to target knowledge dissemination campaigns amongst population groups with least knowledge.

Knowledge of problems that can endanger a woman in pregnancy, and how to respond: Percentage of women aged 15-49 who know of 0, 1-2, etc problems that can endanger a woman when she is pregnant. Percentage of women who report that she should see doctor, midwife or visit a health facility if there is a problem in pregnancy.

Knowledge of problems that can endanger a woman in delivery, and how to respond: Percentage of women aged 15-49 who know of 0, 1-2, etc problems that can endanger a woman when during delivery. Percentage of women who report that she should see doctor, midwife or visit a health facility if there is a problem during delivery.

Being told of pregnancy complications and antenatal care usage

Understanding of the impact of antenatal care visits on knowledge of pregnancy complications and intervention provision can help evaluate the effectiveness of existing antenatal care services and inform programs aimed at increasing antenatal care usage of pregnant women.

Whether told about pregnancy complications and number of antenatal visits: Percentage of women who made 1, 2-3 or 4+ antenatal care visits for most recent live birth in preceding five years, who were told about signs of pregnancy complications.

Whether received tetanus toxoid immunisation and number of antenatal visits: Percentage of women who made 1, 2-3 or 4+ antenatal care visits for most recent live birth in preceding five years, who received 0, 1 or 2+ tetanus toxoid immunisations.

Table 3 Adult mortality rates, Zambia 2007 DHS[7]

Age group	Deaths	Person-years	Age-specific death rate per 1000 (A)	Proportion of person-years in age group (B)	Age-distribution-adjusted death rate (A x B)
15-19	83.5	17,173.4	4.9	0.20	1.0
20-24	126.5	18,878.1	6.7	0.22	1.4
25-29	229.8	17,671.3	13.0	0.20	2.6
30-34	281.8	14,240.2	19.8	0.16	3.2
35-39	225.5	9,841.0	22.9	0.11	2.6
40-44	146.4	6,106.4	24.0	0.07	1.7
45-49	60	3,379.5	17.8	0.04	0.7
	1453.3	87,290.0			**Adult mortality rate = 13.2 per 1000**

Further reading about using survey data for adult mortality can be found in Gakidou et al[23] and for maternal mortality in AbouZahr[24] and Stanton et al.[25]

Maternal health services

Antenatal care provider: Percentage of women who received antenatal care from a skilled provider for their last birth in preceding five years. 'Skilled' refers to doctor, nurse, midwife and auxiliary nurse/midwife.

Timing of first antenatal visit: Percentage of women who made their first antenatal visit in first trimester, second trimester and third trimester for most recent live birth in preceding five years.

Number of antenatal care visits: Percentage of women who had a birth in preceding five years who made 0, 1, 2-3 or 4+ antenatal care visits for most recent live birth.

Iron tablets: Percentage of women who received iron tablet(s) for their last birth in preceding five years.

Tetanus toxoid immunisation: Percentage of women who received at least one tetanus toxoid immunisation at last birth in preceding five years.

Place of delivery: Percentage of live births in five years preceding survey that occurred in a health facility.

Assistance during delivery: Percentage of live births in five years preceding survey assisted by a skilled provider. 'Skilled' refers to doctor, nurse, midwife, and auxiliary nurse/midwife.

Birth weight: Percentage distribution of birth weight for births in five years preceding survey.

Delivery complications: Percentage of women who had a birth in five years preceding survey who had any complications during delivery in last birth. Complications include prolonged labour, excessive vaginal bleeding, fever/foul smelling vaginal discharge, convulsions, and water breaking over six hours before delivery.

Postnatal care: Percentage of women who had a birth in five years preceding survey who received postnatal care. Timing of postnatal care at last birth that occurred outside institution.

Additional indicators from maternal health services

In addition to the standard maternal health service indicators presented in DHS publications, there are additional indicators that can provide policy makers with detail about how pregnant women interact with the health system. These are presented below.

Knowledge of complications in pregnancy or delivery

Knowledge of complications in pregnancy or delivery,

Table 4 Being told of pregnancy complications and antenatal care usage (%), 2007 Indonesia DHS[19]

Number of antenatal care visits	Told about pregnancy complications		
	Yes	No	Total
1	14.5	85.5	100
2-3	23.0	77.0	100
4+	42.7	57.3	100

Antenatal care provider and delivery attendant

In many developing country settings, use of a skilled delivery attendant is far less common than using a skilled antenatal care provider. Knowledge of the types of women who use an unskilled birth attendant after using a skilled antenatal care provider can inform programs based with skilled antenatal care providers aimed at reducing use of unskilled attendants in delivery.

Type of antenatal care provider and type of delivery attendant: Percentage of women who used a skilled antenatal care provider and unskilled delivery attendant in most recent birth in preceding five years, who are of each education level and in each wealth quintile. (For information on education and wealth quintile, see socio-economic, demographic and geographic factor section below). These percentage distributions can be compared to see which women are more likely to use an unskilled delivery attendant after using a skilled antenatal care provider.

Further to reducing the use of unskilled birth attendants, discussions during pregnancy about birth delivery can be helpful for informing women about where their delivery will take place and who it will be attended by. This can increase the use of skilled birth attendants in health facilities rather than unskilled attendants for home births.

Discussion during pregnancy about delivery, and subsequent place of delivery and type of attendant: Percentage of women who discussed place of delivery for last birth in preceding five years, and who subsequently had a delivery in a health facility. Percentage of women who discussed delivery attendant for last birth in preceding five years, and who subsequently had delivery attended by skilled attendant.

Mass Media

Mass media is a key component of the promotion of public health messages to the population. Assessment of health service utilisation according to people's engagement with the media can help policymakers understand the reach of media and its effectiveness in disseminating public health messages, and help inform further appropriate promotion campaigns.

Number of antenatal care visits and exposure to media: Percentage of women who read a newspaper at least once per week, watches television at least once per week, listens to the radio at least once per week, is

exposed to all three of the sources at least once per week or none of the sources at least once per week, and who made 0, 1, 2-3 or 4+ antenatal visits for most recent birth in preceding five years.

Table 5 Type of delivery attendant for mothers who used skilled antenatal care provider by education (%), 2007 Indonesia DHS[19]

	Highest education level			
	None	Primary	Secondary	Higher
Skilled antenatal care & unskilled delivery attendant	50.0	36.6	12.3	1.5
Skilled antenatal care & skilled delivery attendant	50.0	63.3	87.7	98.5
Total	100	100	100	100

Table 6 exposure to media and number of antenatal care visits (%), 2007 Indonesia DHS[19]

Media	Number of antenatal care visits				
	None	1	2-3	4+	Total
TV					
Never/less than once per week	9.9	4.5	18.9	65.8	100
At least once per week	2.6	2.0	9.0	85.8	100
Radio					
Never/less than once per week	4.8	2.9	11.8	79.9	100
At least once per week	2.6	1.5	9.3	85.9	100
Newspaper					
Never/less than once per week	4.6	2.8	12.0	80.0	100
At least once per week	1.3	0.9	4.8	92.6	100

Child immunisation

Immunisation has become widespread in recent decades as primary health care has become a major global health priority. The WHO's Expanded Programme on Immunisation (EPI) has been prominent since its inception by substantially increasing DPT3 (three doses of Diphtheria-Tetanus-Pertussis vaccine) coverage, and improving life expectancy in high mortality countries.[26]

Immunisation at age 12-23 months: Percentage of children aged 12-23 months who had received vaccinations (BCG, DPT 1, 2, 3, Polio 1, 2, 3). Uses mother's report or health card.

Immunisation by age 12 months: Percentage of children who had received vaccinations (BCG, DPT 1, 2, 3, Polio 1, 2, 3) by age 12 months. Uses mother's report or health card.

Infant feeding

Exclusive breastfeeding for the first six months of life and with complementary feeding until 12 months can reduce the risk of early age mortality.[27-28]

Ever breastfed: Percentage of children born in last five years ever breastfed.

Breastfeeding and complementary foods: Percentage of children of each age group currently breastfeeding and/or consuming complementary foods.

Duration of breastfeeding: Median duration of breastfeeding of children born in last three years.

Nutrition

Child malnutrition is a major cause of early age mortality; it has been found that child mortality risk increases exponentially as malnutrition rises, most commonly due to disruption of the immune system.[29] Maternal malnutrition has also been found to increase early age mortality risk.[30]

Height-for-age: Percentage of children under five years with a height-for-age of below two standard deviations (chronically malnourished) or three standard deviations (severely stunted).

Weight-for-height: Percentage of children under five years with a weight-for-height of below two standard deviations (acutely malnourished) or three standard deviations (severely wasted).

Weight-for-age: Percentage of children under five years with a weight-for-age of below two standard deviations (underweight) or three standard deviations (severely underweight).

Body Mass Index (BMI): BMI equals kg/m^2. Mean BMI of women aged 15-49 years. Percentage of distribution of BMI of women aged 15-49 years (<17 moderately and severely thin, 17.0-18.4 mildly thin, 25.0-29.9 overweight, >=30 obese).

HIV/AIDS, Knowledge Attitudes and Practices

An advance made by the DHS in the past decade has been the collection of HIV data in many surveys. Respondents voluntarily provide blood samples for HIV tests, following being informed of procedures, confidentiality and voluntary counselling and testing services. Three to five drops of blood are collected from a finger on a filter paper card, and the filter paper is dried overnight and taken for laboratory testing. The DHS has collected data on knowledge, attitudes and practices regarding HIV/AIDS and other sexually transmitted infections for a longer period of time.

HIV prevalence: Percentage of women or men 15-49 years who were tested for HIV who are HIV-positive.

Knowledge of AIDS: Percentage of women (ever-married) and men (currently married) who have heard of AIDS.

Knowledge of HIV prevention methods: Percentage of women (ever-married) and men (currently married) who are aware of specific HIV prevention methods.

Attitudes towards people with AIDS: Percentage of women (ever-married) and men (currently married) who have heard of AIDS expressing specific accepting attitudes toward people with AIDS.

Unsafe sexual practices: Percentage of currently married men who had sexual intercourse in the past 12 months with a non-marital, non-cohabiting partner.

Non-communicable disease control

Tobacco consumption is a risk factor for a range of non-communicable diseases, including lung cancer, chronic obstructive pulmonary disease, ischaemic heart disease, stroke, and a number of cancers.[31] Low fruit and vegetable intake is a risk factor for ischaemic heart disease, stroke and some cancers.[32]

Tobacco consumption: Percentage of women and men who currently use tobacco. Percentage distribution of number of cigarettes smoked in last 24 hours.

Fruit and vegetable intake: Number of servings of fruits and vegetables per week. This information was collected in the 2009 Samoa DHS. Some Ministries of Health recommend at least five servings of fruits and vegetables per day.

Fertility rates

Fertility rates are key demographic measures within a population. There are three primary measures of fertility rates in a population used from DHS data: the crude birth rate, age-specific fertility rate and total fertility rate. In the DHS, fertility measures are commonly presented for the three years prior to enumeration.

Crude birth rate: The crude death rate is simply the number of births per 1000 women aged 15-49 years in a population.

Age-specific fertility rate: The age-specific fertility rate (ASFR) is defined as the number of births per 1000 women in a particular age group. It is normally computed for five-year age groups over the reproductive ages, which are normally 15-49 years. It is a useful measure of the timing of fertility and family building patterns within a population.

The ASFR is computed as follows, using age group 25-29 in calendar years 2008-2010 as an example:

$$\frac{\text{Number of births to women age 25-29 in 2008-2010}}{\text{Person-years of exposure of women age 25-29 in 2008-2010}} \times 1000$$

The ASFR is presented as an annual rate, and so is computed using person-years. Some women would only contribute a fraction of a person year over this period, if they were outside the age group 25-29 over the period 2008-10. For example, a woman aged 24 years 6 months at 1 January 2008 will experience 2.5 person-years of exposure within the age group 25-29 over the period 2008-2010 (see Figure 2).

Figure 2 Example of person-years of exposure – age 25-29 in 2008-10 for woman aged 24 years 6 months at 1 January 2008

Table 7 presents the ASFRs from Indonesia in the 2007 DHS. The ASFR peaks in ages 20-34 years, before falling from age 35 onwards. In some societies with earlier childbearing patterns, the ASFR begins falling from approximately age 25 years.

Table 7 Age-specific fertility rate and total fertility rate, Indonesia 2007 DHS[19]

Age	Age-specific fertility rate (per 1,000)
15-19	51
20-24	135
25-29	108
30-34	134
35-39	65
40-44	19
45-49	6
Sum of ASFRs	518
Total fertility rate	**2.59**

Total fertility rate: The total fertility rate (TFR) is the primary summary measure of fertility. It measures the average number of births per woman of reproductive age. It is the number of births that a woman would be expected to bear in her reproductive life, assuming she experiences the age-specific fertility rates of women in the period under consideration. It is therefore a hypothetical rate using a synthetic cohort of women.

The TFR is computed as the sum of the age-specific fertility rates of women in five-year age groups from ages 15-19 to 45-49 years multiplied by five (the age interval used).

It is written as (with i being five-year age group):

$$5 \times \sum_{i=15\text{-}19}^{45\text{-}49} ASFR_i/1000$$

For example, referring to the ASFRs in Indonesia in 2007 (Table 7), the sum of the age-specific fertility rates is 518, and multiplied by 5 equals 2590. This divided by 1000 (which the ASFRs are reported as) equals 2.59 births per woman.

The total fertility rate is the most commonly used summary measure of the fertility of a population. A TFR of 2.1 is approximately the replacement level of fertility. Replacement level fertility is the number of children that need to be born to replace both parents, accounting for those persons who do not have children or die before having the chance to have children.

Other fertility related indicators from the DHS are:

Mean (or median) age at first birth: for monitoring trends in fertility patterns.

Teenage pregnancy: Percentage of women aged 15-19 who have had a live birth or are pregnant with their first child.

Environmental factors

Environmental factors such as poor quality drinking water and sanitation are major causes of early age mortality. It has been estimated that approximately 88% of child deaths from diarrhoea worldwide are due to ingestion of unsafe water, inadequate availability of water for hygiene, and lack of access to sanitation.[33]

Source of drinking water: Piped (in dwelling yard/plot, public), open well (in dwelling yard/plot, public), protected well (in dwelling yard/plot, public), spring, river/stream, pond, lake, dam, tanker truck, bottled water. The DHS states that water sources that are likely to provide water suitable for drinking include a piped source within the dwelling or plot, public tap, tube well or borehole, protected well, or spring and rainwater.[19]

Sanitation/toilet facility: Private with septic tank, private with no septic tank, shared/public, river/stream/creek, pit, bush/forest etc, no facility.

Socio-economic, demographic, geographic factors

Household

Wealth index: The wealth index is a summary measure of household standard of living.[34] The wealth index is constructed based on household reporting of asset ownership and house construction (e.g. own TV, radio, material of floor etc), source of drinking water; toilet facilities and other socio-economic characteristics.

Household durable goods: radio, television, telephone/ mobile phone, refrigerator, bicycle, motorcycle/scooter, car/truck.

Material of floor: dirt/earth, bamboo, wood, brick/concrete, tile, ceramic/marble/granite.

Geographic

Geographic data allow for sub-national analysis of indicators. Users should check the final publication as to which geographic level that the DHS produces representative indicators.

Place of residence: urban/rural.

Province/state/region of residence.

Individual

Age.

Sex: All key health indicators should be analysed by sex. For example, for child health care it can reveal whether

parents' health care choices differ between boys and girls. There are some exceptions such antenatal health services where analysis by sex is not possible.

Education: Mother's education has been consistently found to be a strong determinant of early age mortality and maternal health. Caldwell[35] argues that education helps mothers improve child survival by adopting modern health knowledge and practices, having more empowerment within the family to make health decisions for the child and greater capability to interact with trained health personnel. Education is categorised as no schooling, some primary, completed primary, some secondary, completed secondary, more than secondary.

Literacy: Categorised as whether can read a whole sentence, can partly read sentence, cannot read at all.

Employment status: Categorised as currently employed, employed in last 12 months but not currently working, not employed in last 12 months. Aside from housework, work for which paid in cash or in kind.

Religion.

Women's empowerment

Measures of women's empowerment provide valuable insight into how gender discrimination in a population may manifest. It also provides a way to determine whether women's empowerment is related with health outcomes or use of health services. For example, the 2007 Zambia DHS found that use of a skilled birth attendant was higher for women who had participated in 3-4 household decisions compared with those who didn't participate in any decisions.[7]

Women's participation in decision-making according to women: Percentage of ever-married women reporting they had final say in specific household decisions (own health care, large household purchases, daily household purchases, visits to family/relatives, what to cook each day).

Women's participation in decision-making according to men: Percentage of currently married men aged 15-59 years reporting women had final say in specific household decisions (large household purchases, daily household purchases, visits to family/relatives).

Women's attitudes to wife beating: Percentage of ever-married women who agree that a husband is justified in hitting or beating his wife for specific reasons.

Men's attitudes to wife beating: Percentage of currently married men who agree that a husband is justified in hitting or beating his wife for specific reasons.

Tools for using DHS data

This section presents tools for use of freely available DHS data. The tools have been developed to use the available DHS data to produce many of the key indicators that have been discussed previously. The tools are designed to harness existing capacity amongst public health officials and researchers to explore data from their own country to produce evidence for health policymakers. Furthermore, they allow users to examine how health indicators differ between population sub-groups, such as socio-economic status or place of residence.

The tools are presented as do-files for use with Stata software (StataCorp 2009). The DHS datasets can also be used with SAS, SPSS or CSPro. They assume the user has some knowledge of using data software programs, however they do not require extensive experience. Such existing knowledge is likely to be common within the data analysis and dissemination sections of a public health ministry or within a public health or demography department of a university.

DHS data files

Accessing DHS data requires free registration at www.measuredhs.com. Different data sets are available for download, according to the different DHS questionnaires. The tools are provided for the analysis of the household file, woman's file and birth file. An advantage of analysis of DHS data is that variable names are standardised across surveys. Therefore, the tools can be easily applied to multiple surveys. Results from analysis of available DHS data sets should produce the same results as in the DHS publications.

Using the tools in Stata

Analysis of data using Stata can occur in two ways: by using the command box or by using do-files. The tools are in the form of do-files, which comprise Stata syntax to open the relevant data file and run multiple commands to produce results in a log file, as well as save the syntax for later use. Use of the command box requires the user to manually open the data file and enter each command in the command box, however it does not allow the user to save these commands in Stata.

The do-file tools provide syntax to compute key indicators and analyse them by population groups. They are designed to produce indicators irrespective of the DHS being analysed. The only adjustments to the tools that the user must make is to the directory of the Stata file, do-file and log file. There may be a survey which uses different categories or variable names to what is provided in the tools, but that is likely to be a rare occurrence. Do-file tools are provided for analysis of key indicators in the birth file, woman's file and household file.

To use the tools in Stata, the user must save the relevant survey data files in a directory. This directory should be the same as used for do-files and log files (or individual folders should be used within this directory for files, do-files and log files).

Below is the introductory syntax for the birth file tool. This opens the file and allows sufficient space in the hard drive to use the data. The coloured text are the sections which the user will need to change, depending on the directory used for the data file and log file, as well as the name of the data file (which will end in '.dta').

```
**Initial setup**
clear
capture log close
set logtype text
set more 1
log using "C:\Documents and Settings\userid\My
Documents\birthfile.log", replace
set mem 500m
use "C:\Documents and Settings\userid\My Documents\
IDBR51FL.DTA", clear
```

The survey weights need to be used in the analyses to ensure results are representative. This syntax computes the weighting of each case to produce correct total population numbers. The Stata file presents weights as multiples of one million.

```
 **Compute weight variable**
gen weight=v005/1000000
```

Many of the indicators require the data in the file to be adjusted or recoded, to produce results in the categories we desire. In this example, we firstly generate a new variable called 'tetanus' which is the number of tetanus toxoid injections a woman received before birth. We then produce categories of 'tetanus' of 0, 1, 2 or more, and 'don't know/missing' using the variable m1. We then define these categories of our new variable and label this variable using the 'lab def', 'lab val' and 'lab var' commands.

```
**Number of tetanus toxoid injections before birth**
gen tetanus=.
recode tetanus (.=0) if m1==0
recode tetanus (.=1) if m1==1
recode tetanus (.=2) if m1>=2 & m1<=7
recode tetanus (.=3) if m1==8|m1==9
lab def tetanus 0 "None" 1 "1" 2 "2+" 3 "DK/missing"
lab val tetanus tetanus
lab var tetanus "Number of tetanus toxoid injections
before birth for most recent birth in five years preceding
survey"
```

Next, we can produce the required indicator using the 'tab' command. We use the iweight command to apply the survey weights.

```
tab  tetanus [iweight=weight]
```

The results will be produced on screen (see below), as well as in the log file which will automatically be saved in the directory as instructed.

. tab tetanus [iweight =weight]

Number of tetanus toxoid injections before birth for most recent birth in previous five years	Freq.	Percent	Cum.
None	**3,635.222**	**25.89**	**25.89**
1	**3,061.9864**	**21.80**	**47.69**
2+	**6,976.2078**	**49.68**	**97.37**
DK/missing	**369.289724**	**2.63**	**100.00**
Total	**14,042.706**	**100**	

Further down in the do-file tool is an example of how to analyse indicators by population sub-group. These are in the section entitle '**Bivariate**'. As an example, if we wanted to analyse tetanus provision by household wealth index (variable name v190) we would use the command below.

```
tab  tetanus v190  [iweight=weight], col
```

The command 'col' states they we would like percentages to be computed for each column.

In each do-file a number of key indicators are computed – this list is not exhaustive and additional variables can be included. The examples in the do-file tool are designed to be adjusted depending on the combination of variables to be analysed. If the user wishes to analyse antenatal care provider by urban/rural residence, this can be done easily. Once the data file is open, the all variables in the file are listed in Stata.

Additional variables can be introduced if they are in the Stata file. Also, should the data user seek to produce variables with different categories to that in the file, they can follow the examples shown in the do-file tool.

Once any adjustments to the do-file have been made, the do-file syntax can be run simply using the do-file editor. If there is an error in running the syntax, ensure you read the error message – it is likely the problem may be misspelling of a command or file name. As stated above, the results will appear on screen or be saved in the log file.

The results produced by the Stata do-file tools do not compute more complex indicators, such as early age, adult or maternal mortality rates. Also, the tools do not produce 95% confidence intervals. More advanced syntax is required for such commands, and is beyond the scope of the application of these tools.

Conclusion

The DHS is a valuable source of information for health policy. It collects data on a range of health information, including health outcomes, health service utilisation and socio-economic determinants. This allows for a range of health indicators to be analysed, especially at the sub-national level. The standard questions that are asked in a DHS in consecutive surveys within a country provide an important database on trends in health indicators over time. Furthermore, these questions are asked in DHS in a number of countries, and so allow for inter-country comparison of health indicators. Given the increasing importance of non-communicable diseases in many countries, additional questions about behavioural risk factors for non-communicable diseases, including dietary intake, physical exercise and alcohol consumption, will further strengthen the information collected by the DHS. The indicators can be vitally important for monitoring and evaluating programs over time, and providing evidence for policy decisions of Governments.

A major advantage of the DHS is that the data files are freely available, and so data users can conduct a range of analyses of the data. The DHS is an appropriate data source for public health officials or researchers to utilise for their own health information needs. To support such analyses, this article has described the types of data available in the DHS, detailed a range of indicators that can be produced from these data, and presented tools to produce indicators from the freely available DHS data files. The tools to produce these indicators can be used as a basis for harnessing the existing capacity of public health officials to analyse existing data.

The DHS has been a key source of health indicators in many countries for decades where timely and accurate routine data are lacking. The evidence-base for health policy in many countries can be improved by public health data users more fully exploiting this wealth of data to inform health decision-making.

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Quality for health information: What does it mean, why does it matter, and what can be done?

Original article

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Improving data quality: Recommendations for action

- Investigate the feasibility of a regional data warehouse (i.e. a system of linked databases, aligned around agreed standards of data and metadata quality, with user-friendly access)
- Implement an international standard or code-of-practice regarding data sharing
- Develop a core dataset for sharing health information
- Develop, document and disseminate data quality standards
- Develop and implement a systematic, regular and institutionalized system for the supervision, monitoring and evaluation of data quality
- Conduct regular, systematic and institutionalized monitoring and review of HIS

Introduction

Attention to quality in healthcare has become a central issue in recent years, with increasing awareness on the role quality plays in informing public policy, supporting healthcare management and building public awareness about the factors affecting health.[1] As argued by the Western Pacific Regional Office of the World Health Organization; hospitals, community health centres, clinics, aid posts and high-level health ministries and departments should all be concerned with the impact poor quality data has on the quality of health care provided to users.[2] Overall, data quality is important for determining the current and future needs of patients; medico-legal responsibilities; ensuring diseases are being treated and procedures performed; measuring outcomes of health care interventions; obtaining information on the users of services; teaching healthcare professionals; planning; and decision-making.[2,3]

In everyday language, quality represents where, on a scale of 'bad-good-excellent', a user may place a certain product with regard to its intended use, and also in light of comparisons with other available products.[4] Quality assessments generally take one of two paths: procedural or substantive. Procedural assessments are concerned with issues related to transparency, reliability and replicability: how the data was processed and analysed.[5,6] Substantive assessments, on the other hand, deal with data outcomes and have criteria based on validity, accuracy and precision. However, ensuring the quality of data is much more difficult than ensuring the quality of other raw materials, and as Tayi and Ballou argue, this difficulty is further compounded by the low priority assigned to data quality assessments.[7]

Defining quality

While the literature provides us with a wide range of techniques to assess and improve data quality; as health information systems (HIS) increase their size and scope, issues of quality are becoming more complex and controversial.[8] Due to the contextual nature of 'quality' there remains a discrepancy in definitions of its dimensions, and no agreement on which set of dimensions defines quality. As discussed by Brackstone, the traditional statistical concept of quality, related to measures of standard error and bias, does not adequately address the broader meaning quality takes on in the management of organisations and systems.[9] Here, he argues, quality refers to the 'fitness' of final products and services in meeting the needs of users.

However, if users' needs are taken as the primary factor in assessing the success of products and services, and quality is taken to reflect the aspects of statistical outputs that reflect their fitness for use – the varied number and needs of users mean that we are still left without an operational definition.[9] Furthermore, in defining quality in terms of its 'fitness for use' this implies that the concept of quality is relative and that data with quality for one use might not have quality in another; again leaving us without a clear definition.

Other authors and agencies have attempted to define the concept of quality: Elvers and Rosn, the Canadian Institute of Health Information and Wang et al similarly regard quality as a measure of how well statistics meet users' needs and expectations.[1, 4, 10] In their work on quality, Arah et al argue that performance indicators (measures to capture health and health system trends and factors) provide an operational definition of quality, as performance indicators are essentially a quantitative measure of quality.[11] The World Health Organization regards quality as the production and dissemination of understandable information for government policy-makers, community leaders, health planners and healthcare providers.[2] Quality has also taken on a descriptive meaning, and quality assessments need

to consider both the product in question, and also its purpose.[4] The Health Metrics Network echo this sentiment over a decade later, when they describe the process of assessing existing HIS in order to understand users' current and perceived future requirements for statistical information. They propose that such assessments must be carried out if we are to, '*increase the availability, quality and use of health information vital for decision-making at country and global levels*'.[3]

Overall, while there remains no single definitive definition of quality, most authors agree that it lies beyond the traditional statistical concept concerned with accuracy, and that it is made-up of a number of important components or dimensions.[4, 9] Again, while there is no universal consensus on which dimensions are required to 'produce quality', a number of dimensions are interrelated and there is significant overlap between different authors and agencies. In their review of the literature, Batini and colleagues provide a list of what they consider the four most basic quality dimensions as used by the majority of authors on the topic: accuracy, completeness, consistency and time-related dimensions.[8] Table 1 provides a summary of the different quality dimensions defined by various authors and agencies. In general, the different dimensions of quality assess two main features: if information on the right topics is being produced, and if the appropriate concepts of measurement are being used.[9, 12]

Table 1 Quality dimensions

Quality dimensions	Source
Accuracy	WHO 2007;[13] Lewin et al 2010; Elvers & Rosn 1997; Brackstone 1999; WPRO 2003; WHO 2004; IMF 2006;[14] AHIMA 2008; CIHI 2009; Batini et al 2009; Wang et al 1997
Timelines	GDDS 2003;[15] Elvers & Rosn 1997; Brackstone 1999; WPRO 2003; WHO 2004; HMN 2008; AHIMA 2008; CIHI 2009; Batini et al 2009; Wang et al 1997
Consistency	WHO 2007; GDDS 2003; WHO 2003; HMN 2008; AHIMA 2008; Batini et al 2009; Wang et al 1997
Accessibility	Brackstone 1999; WPRO 2003; IMF 2006; AHIMA 2008; Wang et al 1997
Completeness	WHO 2007; WPRO 2003; WHO 2004; Batini et al 2009; Wang et al 1997
Relevance	Brackstone 1999; AHIMA 2008; CIHI 2009; Wang et al 1997
Comparisions	WHO 2007; Elvers & Rosn 1997; CIHI 2009
Disaggregation	GDDS 2003; HMN 2008; AHIMA 2008
Periodicity	GDDS 2003; HMN 2008; Batini et al 2009
Representative	GDDS 2003; Lewin et al 2010; HMN 2008
Security	WPRO 2003; HMN 2008; Wang et al 1997
Comprehensiveness	Elvers & Rosn 1997; AHIMA 2008
Interpretability	Brackstone 1999; Wang et al 1997
Usability	CIHI 2009; Wang et al 1997
Adequacy	WHO 2004
Adjustments	HMN 2008
Appropriate	Lewin et al 2010
Believability	Wang et al 1997
Coherence	Brackstone 1999
Collection method	HMN 2008
Confidentiality	GDDS 2003
Coverage	WHO 2007
Currency	AHIMA 2008
Definition	AHIMA 2008
Legible (readable)	WPRO 2003
Objectivity	Wang et al 1997
Precision	AHIMA 2008
Reliability	IMF 2006
Reputation	Wang et al 1997
Serviceability	IMF 2006
Usefulness	WHO 2003

Out of the 31 dimensions of quality identified; accuracy, timeliness and consistency were mentioned by a number of different authors and organisations, reflecting their elevated status in assessing data quality. While many authors support the continued use of accuracy as a single measure of quality, Tayi and Ballou highlight the limitations of 'accuracy', as data may be accurate but unfit for use if untimely.[7] Interestingly, only a limited number of authors mention the component of relevance when discussing quality.[1, 9, 10, 16] All raise the question of whether the data is relevant to topical policy issues and adequately meeting the needs of users, or, as Brackstone asks, if agencies are still counting 'buggy whips'.[9] The question of relevance seems, on face value, to be an important one to ask. However, as explicitly discussed by Elvers and Rosn and implicitly inferred by other authors and agencies in their exclusion of the dimension; relevance is not an intrinsic property of statistics.[4] While some data may be highly relevant to certain users, for others it may have no value at all, due to their conflicting interests. Only users can decide the relevance of information, and as such, it offers little practical guidance for quality assessments.

Why does quality matter?

Confidence in the quality of information produced by an agency[a] is vital for its survival: as soon as any information is regarded as 'suspect' the credibility of an agency is called into question and their perception as being a trustworthy source is undermined.[9] When information in public health reports is not accurate or available when needed, potentially disruptive consequences can result, including debates becoming focused on who has the 'right' numbers instead of the pros and cons of public health policy.[9, 17]

In their work on quality, Lewin and colleagues are very clear that while local data (evidence available from the location the decision or action will take place in) is important in contextualising and making relevant global data; we should remain cautious about using local data alone, as it is less reliable and can be misleading.[6] They further argue that global data is often the best starting point for making judgements on the effects, modifying factors and ways to approach and address health problems, as much local data is difficult to locate and of poor quality.

Caution over the use of local data is reflected in the widely accepted consensus that information and data from the Pacific is, 'incomplete, unreliable, obsolete and of poor quality'.[18] This consensus is clearly demonstrated at an international level: while Fiji's Annual Reports, for example, show a maternal mortality ratio (MMR) ranging between 31 and 51 during 2004 to 2008; the World Bank, World Health Organization, UNICEF and UNSTATS all officially report the MMR for Fiji in 2005 as 210.[19-22]

In the majority of these external sources no reference is made to the reported MMR provided from Fiji, and while calculations are provided for how the 'adjusted' or 'modelled' MMR was established, no justification is provided for why Fiji's MMR (which is approximately four-times lower than the modelled data) is not included in the official statistics. Overall, it would seem that due to the long-held perception that the quality of data being produced in the Pacific is of dubious quality, much of the information is ignored and underutilised.

The example of the limited and lessening use of data produced from within the Pacific Region is what Wang et al refer to in their work on data quality, as an 'intrinsic data problem' (Figure 1). The logic behind an intrinsic data problem is as follows:

1. Mismatches in data provided from different sources initially causes a *believability* problem as users do not know which source is incorrect, only that the data conflicts
2. As information on the causes of the mismatches accumulate, evaluations on the *accuracy* of the data are generated
3. This leads to certain data gaining a poor *reputation*
4. As this reputation builds, the data are seen as having little *value-add* and so are used less.[10]

Intrinsic data problems can also stem from judgements of the data production process; for example, placing a higher value on raw data as opposed to aggregated (this is demonstrated in 'path two' in Figure 1). The authors state that, 'a reputation for poor quality can also develop with little factual basis'.[10] This is of heightened importance for Pacific Island Countries and Territories, as they not only have to improve the quality of their data, but also improve the *reputation* of their entire HIS: an undoubtedly challenging and complex task.

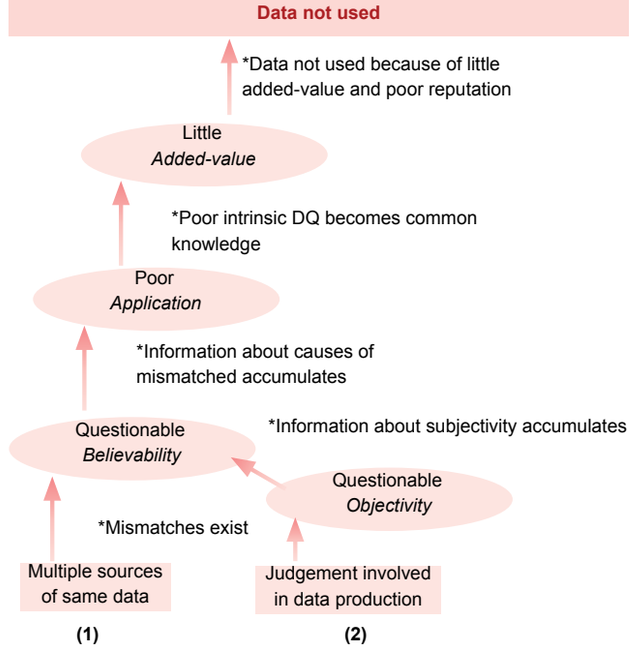

Figure 1 Intrinsic data quality problem[10]

a Here, an agency could refer to the Ministry of Health, Statistics Department, District hospital or individual healthcare clinic, for example

Where to from here?

The Regional HIS Strategic Plan launched by the Pacific Health Information Network (PHIN) in 2011 promotes a number of strategic activities for improving the quality of data in the region, including:

- Investigating the feasibility of a regional data warehouse (i.e. a system of linked databases, aligned around agreed standards of data and metadata quality, with user-friendly access)
- Implementing an international standard or code-of-practice regarding data sharing
- Developing a core dataset for sharing health information
- Developing, documenting and disseminating data quality standards, including best practice for data collection methods
- Developing and implementing a systematic, regular and institutionalised system for the supervision, monitoring and evaluation of data quality, covering all activities from data capture to data processing and analysis
- Conducting regular, systematic and institutionalised monitoring and review of HIS, including periodic reviews of information requirements and monitoring and assessment of the efficiency of core and support components of the system.

The Plan, and strategic activities within it, provide HIS stakeholders with a common vision and way forward to maximise investments in HIS throughout the Pacific, and also provides a framework for action to aid HIS professionals achieve better health outcomes. A number of activities have already begun to improve data quality, including the development of a national health data dictionary with common metadata specifications, and providing training on improving the quality of death certification processes. A number of guidelines and tools have also been developed to assist countries improve the quality of their data, such as the Rapid Assessment of National Civil Registration and Vital Statistics Systems developed by the HIS Knowledge Hub at the University of Queensland.

Conclusion

While there is no one simple definition of quality it includes aspects such as timeliness, accuracy, completeness and reliability. Improving the quality of data produced in a health information system is a good thing in itself; is also an important step forward in getting people (and organisations) to trust the data, and as such, use it.

The Regional HIS Strategic Plan provides guidance on important activities HIS professionals can undertake to improve the quality of data produced from their system. It also provides a common framework for the region, with a number of activities already taking place throughout Pacific Island Countries and Territories.

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Improving the quality and use of health information systems: Essential strategic issues

Original article

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Introduction

This paper sets out some of the critical issues that countries and donors should consider when investing in health information system development. These range from incentives and practices to improve the quality, and especially the use of health information by those in policy who have greatest need of reliable, timely, and relevant health information for planning, to strategies to create a culture of information demand and use. Experiences from countries such as Mexico and Brazil have been analysed in order to draw attention to practices that might profitably be adopted elsewhere, particularly in the Asia-Pacific region.

The paper is intended to provide a **succinct overview of issues** that countries and the donor community might wish to consider **when developing strategies and practices** to improve the quality and use of health information

The paper includes a cursory overview of international initiatives in health information strengthening and reviews the critical role of various health data sources in supporting indicator development for the monitoring and evaluation of health status and health program effectiveness. The paper is intended to provide a succinct overview of issues that countries and the donor community might wish to consider when developing strategies and practices to improve the quality and use of health information.

Recent developments in strengthening health information systems

Incentivising quality and use

For a typical health information system in a developing country, it is not easy to achieve data quality. Frequently, health data in developing countries are incomplete—they either miss a portion of the population or do not cover all relevant aspects of health. This is often through no fault of their own; they simply do not have the resources needed to achieve a comprehensive system instantaneously, but they can definitely work to improve what they have. There is also sometimes a lack of support from the supply perspective for improving data quality. There are few incentives to correct the crude data gathered for the health information system at a national or district level. This generates a perverse cycle in which decision-makers reacting to the quality problems in the data exclude those data from their decision-making. In turn, providers of data choose not to invest in improvements because nobody is consuming their products to begin with.[1]

To break this cycle, it is necessary to create incentives, both to use better information at the local level and for providers to deliver high-quality, timely data. A good starting point would be for the central health information system to require data to be disseminated on a clear schedule. However, this would not be enough to ensure that local providers are using the information. In other words, ensuring high-quality data is a necessary precondition for getting that information used by decision-makers and practitioners, but it is, in itself, not enough.

Creating a culture of information and building capacity

Building capacity in a country, like fostering a culture of knowledge, requires a good understanding of the operational environment. In many countries, building capacity requires reorganising past methods of information collection. For example, for some national surveys, if the sample process is not standardised, the results are not comparable. This discontinuity allows health information system managers and other decision-makers to operate in different dimensions; they may only focus on immediate results or specific areas and not examine nationwide trends. A lack of harmonisation between national surveys also results in a weaker information system because managers and decisionmakers have no uniform way to hold their systems accountable at a larger scale. Also, the capabilities of health information system workers are more difficult to understand without a uniform test to apply. With more rigorous programs to build worker capabilities and program capacity, health information systems could become stronger both within and across countries.

Another reason that capacity is sometimes weak is that health information systems do not span across a ministry of health or equivalent. Instead, there are sometimes only small units of information and informatics within

the health programs, but no organised systems to bring them together. In order to scale up the abundance of data across units, branches and departments, it is necessary to highlight the importance of having a logical and transparent structure; the importance of integration to serve all users; and the importance of keeping autonomy regarding any kind of information (avoiding conflicts of interest).[2] If these principles were applied to the information gathering systems by ministries of health in a comprehensive and systematic manner, the quality, use and usefulness of information would increase markedly.

The lack of a culture of information is widespread. This concept can be defined through several selected domains by attempting to understand the degree to which a country: (1) uses numbers to describe problems and their solutions; (2) attempts to understand a problem through the collection of data and information; (3) establishes a continuous quality learning process; and (4) empowers people through imparting information and knowledge. In summary, in developing countries, there is often an absence of a common commitment to, and support for, good-quality data. There is also a scarcity of incentives to use the information collected through health information systems for decision-making and poor use of evidence from any source for decision-making.

There is a very useful tool developed by the Routine Health Information Network (RHINO) to identify which attributes of health information systems directly contribute to developing poor-quality products.[3] The instrument used by the Publishing Requirements for Industry Standards Metadata (PRISM) framework, organises the determinants of the health information system performance into three blocks: technical, organisational and behavioural. The instrument was designed to be applied at a local level, and the results obtained, until now, have been used more for local consumption. Nevertheless, it is possible, and important, to generalise some lessons after its application in South Africa, Tanzania, Pakistan and Mexico. In relation to the organisational and behavioural determinants, two main problems have emerged as common in all countries: the lack of a culture of information, and the immense need for in-country capacity building.

Conversely, there are some experiences that demonstrate that a positive and supportive culture can be constructed around the production and use of information using the products of the current health information system. For example, since 2001, the ministry of health in Mexico has been publishing an annual accountability report called Salud-Mexico.[4] The goal of this report is to document the state's performance benchmarking system. The model adopted to present the information was based on selecting mainly health outcome indicators. The report uses the past year (or sometimes the past two years) as reference points to measure improvements in the health system.

The Mexican Government created incentives for information providers by mandating that the report be released publicly in a citizen's forum, which brings together important federal and state decision-makers, civil society leaders, academics and the media. The government presets a date for the release of the report to provide a clear deadline—the beginning of the second quarter of the year. Taking this approach created strong incentives for information providers to complete data collection, data processing and data integration within a short period. Because it was a national accountability exercise, the effort included other public and private health institutions. There was a strong emphasis on maternal deaths and correcting the misclassification of the cause-of-death. The process used to count the deaths one by one was adapted from the well-known Reproductive Age Mortality Surveys.[5]

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Federal government decision-makers were motivated by their desire to monitor health system performance at a subnational level to better understand differences among various regions of the country and hold each region accountable to national goals. Local providers were motivated by the possibility of using a very powerful, political, evidence-informed instrument to identify determinants of success or failures. They were also motivated to focus on these determinants for subsequent policy actions, rather than on far-removed national priorities that did not match their local needs and situations. All parties therefore had serious incentives for making the instrument work and generating high-quality data that would be linked to decision-making.

Global health information system networks

International agencies and donors have recognised the great social importance of health information system reform. With the intention of incentivising this reform to achieve better outcomes in health, they have recently strengthened efforts at the global level to facilitate the incorporation of evidence-informed decision-making in developing countries and to address the problems related to the production of much-needed health information. Several networks started within the past decade have attempted to bridge the gaps between the demand and the supply of good-quality information by using different strategies and frameworks. These networks include:

- RHINO, which is a collaboration between the United States Agency for International Development (USAID), the World Bank and the World Health Organization (WHO), was formed in 2001. RHINO focuses on promoting high-quality, sustainable, practical approaches to the development of routine health information systems. RHINO pursues this aim through research and development, improving

practices in developing countries, advocating for the use of evidence-informed decision-making, and investing in routine health information systems

- Partnership in Statistics for Development in the 21st Century[6] was established in 1999 with participation of the United Nations, the Organisation for Economic Co-operation and Development,[7] the World Bank, the International Monetary Fund and the European Community. Its goal is to develop a culture of evidence-informed decision-making, particularly by helping low-income countries to design, implement and monitor efforts to achieve the Millennium Development Goals (MDGs)
- The Health Metrics Network (HMN) has been an important global partnership that seeks to convene health and statistical constituencies to build capacity and expertise, mainly in developing countries. The HMN also aims to improve the availability, quality, use and dissemination of data for decision-making. Operating since 2002, and officially launched in 2005, it is hosted by WHO and has projects to support over 65 developing countries. The HMN has developed a comprehensive framework that is intended to help countries to strengthen their health information systems for health information production and use. The framework focuses investments and technical assistance on standardising health information system development and using the standardised system as a baseline for system assessments.[8]

These efforts are mirrored by national government funding agencies. For example, the School of Population Health at the University of Queensland was selected to establish a Health Information Systems Knowledge Hub. The hub provides improved knowledge and expertise to inform policy dialogue at national, regional and international levels. It also provides guidance to the Australian Agency for International Development (AusAID) on how to ensure better health outcomes from its bilateral aid programs through strengthened health information systems in countries of the region. The hub works in partnership with global and regional organisations such as WHO, the HMN, the United Nations Economic and Social Commission for Asia and the Pacific, the Secretariat of the Pacific Community and the Asian Development Bank. It facilitates the development and integration of health information systems and local capacity to ensure that cost-effective, reliable, relevant information is available, and used, to better inform health development policies across the region.[9]

The health information system as a statistical tool

Health information systems are defined in many different ways, depending on who is using them versus who is implementing them. Although these definitions vary, health information systems more generally are the nexus of information, technology and the accompanying processes to provide strategic access to information for decision-makers. Health information systems are comprised of resources, mechanisms and methods that facilitate the acquisition, storage, retrieval and use of data in health and health decision-making. The role of a health information system is to determine what information needs to be collected and tracked; to establish mechanisms for collecting the information; to build and sustain an ongoing process of adding value to the data collected; to ensure that the data are understood and used; and to substantiate the need for data collection so that funding is maintained. Health information systems can have multiple attributes. They can be: patient-centred or public health oriented; subject-based (patients, doctors, etc) or task-based (hospital discharges registries); paper-based or computer-based.

The **role of a health information system** is to determine what information needs to be collected and tracked; establish mechanisms for collection; build a process of adding-value to the data; ensure the data are understood and used; and substantiate the need for data collection

In any of their contexts, a health information system should act as a value chain with different components that transform the original facts gathered into knowledge that can be applied by decision-makers to improve population health. While there are differing opinions in the literature about the scope of health information systems, there is general agreement that they are complex, dynamic, context based and of great social importance.[10,11] To capture this information in a more standardised and comparable way, the use of health metrics has been increasing. Most recently, flexibility of health information systems has been highlighted as an important component. This flexibility includes being able to receive and store data from many different sources and from multiple dimensions—from individual patient information to population-level time trends of morbidity; from storing only alphanumeric information to storing medical diagnostic images.

Other recent changes include the heightened consideration of health information system users. This is evidenced by the inclusion of patients and health consumers and through diversifying the use of data beyond patient care and administrative purposes. The shift from focusing mainly on technical health information system problems to those of change management and strategic information management demonstrates the various capacities in which health information systems have been used.

The HMN developed a particular health information system assessment framework to help countries assess how best to improve their systems. This framework adapts key components articulated by the General Theory of Systems—inputs, process, outputs and boundaries. As such, it does not prescribe precise, step-by-step requirements, but rather what the general components are and why they are needed. The HMN framework proposed a new structure in which health information system resources, not data, are the input.

Specifically, the structure defines inputs as the legislative, regulatory and planning framework required to ensure fully functioning health information systems, and the resources to ensure that each system is functional (personnel, financing, logistics support, and information technology and communication).

The framework identifies three key components in the process of strengthening the health information system for a particular country. The components are identifying indicators, data sources and methods for data management. According to this approach, collecting, storing, processing, compiling and analysing the data are all integral parts of a well-functioning health information system. The outputs include two key components: information products, and dissemination and use (i.e. the transformation of data into information that will become the basis for evidence, and how to make the products of the system available and accessible to decision-makers).

The important connection between this framework and how health information systems can be used by decisionmakers has been presented by Lozano et al[12] in the context of assessing effective coverage for key interventions. Three specific lessons were articulated, which could be generalised to other types of health information:

1. National or local household health surveys are good data sources to measure effective coverage; however, they must be supplemented by other techniques to measure some aspects (e.g. quality)
2. Routine registries can also be very good data sources; however, registries should be at the individual level and have a high degree of accuracy. In the coverage example, follow-up of people with chronic conditions such as high blood pressure and diabetes, and other acute conditions, is necessary
3. Fragmentation of the health system generates a fragmented health information system. Effective coverage is a metric that is useful in combining information from both the public and private sectors of the health system.

The use of information with sufficient quality for comparability requires establishing a broad (national or international) and widely accepted mechanism of standardisation. Sometimes, there is tension amongst the involved groups that works against such acceptance of standardisation. As information becomes more global, this problem will likely receive more attention. The International Statistical Classification of Diseases and Related Health Problems, 10th revision (ICD-10), is a good example of a statistical tool that creates constant tension between universal standardisation and local circumstances. However, this tension cannot be resolved by sheer force because the problem is persistent. For example, whenever there is an update to the ICD, to ensure the highest degree of comparability between countries, each individual country must comprehensively update their systems and retrain their health workforce to code deaths using the updates. The ICD creates updates because it wants to incorporate latest advances in medical knowledge, but the transitional cost to individual countries can be high.

Health information systems must have standards, but, at the same time, countries should have the flexibility to adapt to changes in their own health systems. The need for both standardisation and flexibility must be balanced in any health information system. In many instances, these opposing attributes have helped drive reform discussions. For example, in South Africa, standardisation of health data was a major element in the process of changing the health information system. In Brazil in 1995, an ad hoc group was formed to develop and agree on a way to design databases at different institutions to help store information to calculate a core set of agreed indicators. Representatives from the main areas of the ministry of health, key participants from the information institutions of the country, and representatives from universities and academia all played a role. The Pan American Health Organization (PAHO) was also an important player in this initiative.[13]

The project became known as the Interagency Network for Health Information (with the acronym RIPSA in Portuguese). The consensus process was arduous and lasted about six years. However, the product delivered was a manual that included detailed analyses about the quality of each database, key indicators to track, and common definitions and ways to measure them. The agreement included a national mandate about the use of crude and corrected statistics when reports are used to describe subnational levels. It included descriptions of the data source to be used and the methods to correct completeness problems. RIPSA continues to operate today as a valuable process to ensure high-quality, standardised indicators.[14]

Getting national agreements about the inclusion of corrected statistics as an input for decision-makers is crucial. In Brazil, it was possible because there was a critical mass of experts that were able to employ these statistical methods and to engage in nuanced and informed arguments with the national group charged with making information available and useful. They were even able to strategically think about useful indicators for measuring progress with MDGs, such as infant mortality and maternal mortality. This opened the door to bridging the gap between information and policy.

AbouZahr et al[15] proposed a schema to smooth the pathway from information to policy. Their recommendations for good practice in the information production process should be considered seriously because they apply to all health systems and to both developing and developed countries. According to the WHO framework for Health Systems Performance Assessment,[16,17] health information is one of the key components of the stewardship function of health systems. To support key activities such as priority setting and performance assessment, high-quality information is a fundamental ingredient. Today, health information is becoming more important and is identified as a

fundamental building block of the health system (Figure 1).[18] It is as important as service delivery, the health workforce or financing.

AbouZahr et al[15] also raise the importance of the tension that international agencies usually generate for countries when the local and international indicators do not match. In a country with a decentralised health system, a similar problem also arises, though on a smaller scale, between the federal/national and the regional or local authorities. Another obstacle can be a misunderstanding about 'official data'. For many people, official data by definition are those figures produced by government agencies, regardless of the quality of the data. If the information comes from the office of statistics of the ministry of health, it is automatically considered to be official and ready to use. However, information released by a government agency must still be scrutinised for quality.

Despite this tension, from a country perspective, it is important that a health information system responds primarily to country needs and secondarily to international needs, such as those of the WHO. Even after these priorities have been sorted out, data ownership is not a minor issue, and is likely to be one of the most common sources of misunderstandings and a significant obstacle to successful collaboration between national and international agencies. When there is no clear ownership of information, there is likely to be tension. The problems arise when the calculations from international agencies produce estimates for the same indicator that differ from those of national agencies. Sometimes, it is difficult methodologically to explain why the two might be different.

However, even if there is good reason for the two to differ methodologically, it is even more difficult to explain politically, and to a non-technical audience, why a predicted value from an international agency is much higher or lower than the 'official data' of the country. The negative consequences of these problems generate two different reactions. National stakeholders, believing that the international organisations are not acting in their best interest, will not share their data. Subsequently, the international organisations end up using incomplete databases, which forces them to model more estimates with limited data and simply perpetuates the original problem.

Health data sources

At a more general level, health statistics can be classified under two broad categories: primary microdata, and combined (aggregated) secondary macro-datasets. Several typologies exist that capture specific types of health data within these main categories.

Primary microdata

This is the category of major importance for generating health statistics and is the foundation of most other datasets.

Vital registration

Vital registration data collects birth and death information and, given their importance, provides some of the most advanced and standardised types of health data across countries. The goal of any vital registration system is to accurately record all births and deaths in the population as a whole. We can classify vital registration sources into four different types:

1. Complete vital registration systems, including cause-of-death certification and coding according to the WHO ICD-10. For this system, the death certificate can provide critical data, particularly if the information is digitised along with the ICD-10 codes. These data become even more useful if they include a national ID number on the death certificate that allows matching to other data collected in household surveys, censuses or health service registries
2. Incomplete vital registration systems that collect cause-of-death information according to the ICD-10, but are incomplete and/or do not have reliable death

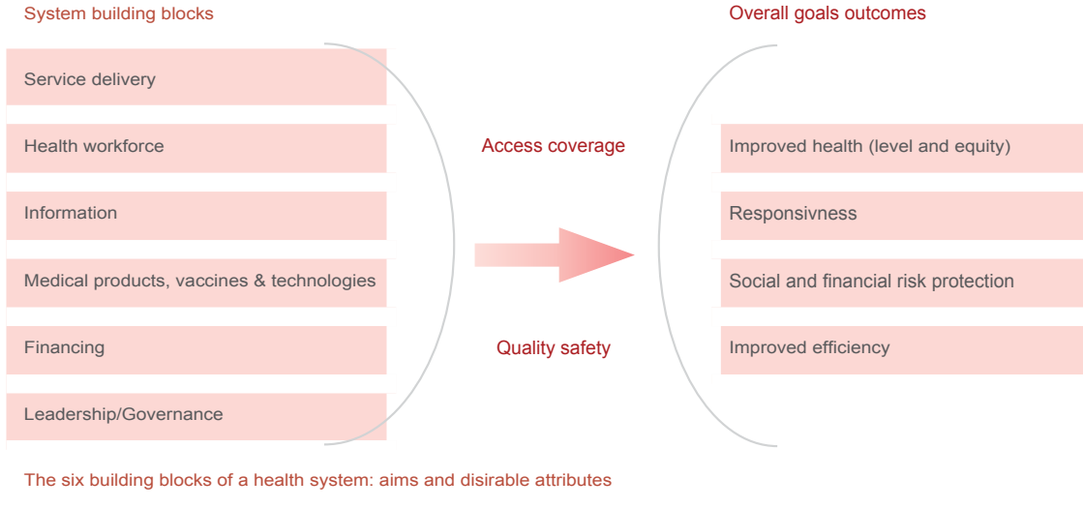

Figure 1: Six building blocks of a health system[18]

certification or national ID systems in place

3. Sample registration systems, where vital registration has been implemented in a sample of localities that are intended to be representative of the entire country. These systems have been successfully introduced in very populous countries such as India and China
4. Demographic surveillance sites (DSS) are used in many low-income countries to monitor vital events in specific communities. DSS were often initially developed as research sites and have been used for large-scale clinical trials. However, a number of them have persisted and diversified the information they collect. The largest network of such sites is the International Network of Field Sites with Continuous Demographic Evaluation of Populations and Their Health in Developing Countries (INDEPTH). Because they are not designed to be nationally representative, these sites are less useful to monitor national health levels.

Household interview surveys

Household interview surveys have followed standardised instruments and protocols, beginning with the World Fertility Survey in the 1970s. It is useful to think of them under several different headings according to their main purpose.

First, there are a set of fairly standardised multi-country health interview surveys. These are not standardised with one another, but each survey program is implemented in approximately the same form in multiple countries. These include the demographic and health surveys (DHS), the World Health Surveys, the multiple indicator cluster surveys (MICS), the Pan Arab Project for Family Health (PAPFAM), the Pan Arab Project for Child Development (PAPCHILD) and the United States Centers for Disease Control and Prevention (CDC) Reproductive Health Surveys. These surveys provide valuable information across and within countries, particularly because each survey is fairly standard across the countries in which it has been implemented. For example, each DHS is fairly comparable to another, regardless of the country or the year in which it was implemented. The surveys are also useful because of the amount of specific health details that can be elicited from these interviews.

Second, there are standardised multi-country surveys, whose primary purpose is collecting socioeconomic data, but which also have health modules. Examples include the Living Standards Measurement Surveys (LSMS) and the United Nations Household Surveys. The LSMS includes detailed health questions that are helpful in measuring the utilisation of health care and health expenditures.

Third, national household health interview surveys are sometimes utilised by countries to track health issues and levels within their own countries.

These surveys allow for standardisation over time and are specifically tailored to a country's health profile. In the United States, the National Health Interview Survey has been conducted for over 30 years. The Behavioural Risk Factor Surveillance System (BRFSS) is a state-based system of health surveys in the United States. The objective of the BRFSS is to collect uniform, state-specific data on health risk behaviours, clinical preventive health practices and health care access that are associated with the leading causes of morbidity and mortality. Data are collected from a representative sample in each state, and the sampling is designed to provide national estimates when data from all states are combined.[19]

Fourth, disease-specific or condition-specific standardised surveys, often sponsored by WHO to examine a particular health problem, have been carried out in many countries of the world. These surveys, which are relatively standardised due to WHO sponsorship, cover malnutrition, adolescent risk factors, oral health, etc. A good example is WHO's Global Database on Child Growth and Malnutrition, which comprises information collected from population-based national and subnational surveys that follow a standard procedure to obtain comparable results from about 155 countries. In Australia, the National Survey of Mental Health and Wellbeing (SMHWB) is designed to collect information on the mental health and wellbeing of the Australian population. The objectives of the survey are to provide information, about Australians aged 18 years or more, on the prevalence of selected major mental disorders, the level of disability associated with these disorders, and the health services used and the help needed as a consequence of mental health problems. The information is collected by personal interview from usual residents from approximately 15 000 private households.

Fifth, verbal autopsy is a highly specialised survey to estimate cause-of-death patterns in populations that lack vital registration. The survey focuses on collecting information from families of the deceased about signs and symptoms before the death. It can also be used by trained health professionals to identify causes of death in environments where most individuals die at home or without any contact with medical establishments. The verbal autopsy method has been developed to ask relatives of the deceased a series of symptom-based questions about the events leading up to death, as well as broader socio-demographic and risk factor information that might yield clues as to the cause of death of the deceased. Based on this information, a cause of death can be assigned by a clinician. Although potentially very useful, there is less standardisation in verbal autopsy instruments that have been used. However, there have been efforts to improve their comparability. Also, not all verbal autopsy questionnaires assign causes using the ICD-10. This limits their usefulness for public health purposes.

National health examination surveys

These surveys go beyond asking standardised questions and gather physical examination data as well. They may collect blood samples, administer audiometry or optometry tests, conduct radiological examinations or administer performance tests for basic functional health status (e.g. motor capabilities). The United States National Health and Nutrition Examination Survey (NHANES) has become the global standard in this regard and has been conducted four times. The NHANES includes a full physical examination lasting more than one day. Many countries cannot afford the expense and infrastructure necessary to carry out such extensive physical examinations. Instead, they adopt slightly modified alternative interview surveys by selecting easy-to-administer diagnostic components such as the collection of dried blood spots.

Health service registry data

The focus of health service records is typically on subnational information used in the management of health services. These records are based on service generated data derived from health facilities and patient–provider interactions. The data covers care offered, quality of care, treatments administered, etc. This type of data is collected as a service by public facilities and by some private providers. These administrative data are used for a wide range of purposes, including epidemiological surveillance, monitoring of intervention-specific programs and quality evaluations. Point-of-service data collection is not highly standardised, with the exception of some data collected on high-profile interventions such as immunisations, directly observed treatment short course (DOTS) (eg chemotherapy for tuberculosis) or antiretroviral drugs for human immunodeficiency virus (HIV) infection. In addition, these data are sometimes used to complement other sources for detecting and reporting epidemic outbreaks.

The major strength of health service statistics is their local use for facility management. Where appropriate, such service statistics may be used to develop population-based estimates of, for example, immunisation coverage and maternal care. Such estimates provide a regular source of information that can be validated periodically with statistics from occasional household surveys. However, the estimates can be imprecise due to the need to estimate denominators and the possibility of either undercounting or double counting.

Hospital discharge data

Hospital discharge data are a specific type of health service registry data. They are widely available and very useful for monitoring the quality of health services. This source almost always includes individual records that capture different dimensions of the interactions between the health service and the individual. The data generally include attributes of the individuals (eg age and sex), treatment and interventions (often using the ICD Clinical Modification), and cause of admission and cause of discharge (also often using the ICD Clinical Modification). When a particular patient dies in hospital and is assigned an ICD-based cause-of-death, this information is reasonably comparable between populations, though obviously dependent upon quality. Population-level cause-of-death data for many developing countries are not available, but information on deaths-in-hospital by cause is available in many low and middle-income countries. Hospital deaths are not a representative sample of deaths in the population. However, there are methods available to estimate population cause-specific mortality fractions using in-hospital death records. These methods are particularly useful when hospital records include ICD-10 codes and there is partial vital registration for a country.[28]

Hospital discharge data are also very useful to produce diagnosis-related groups (DRG). This system classifies hospital cases into one of approximately 500 groups. All cases within a particular group are expected to have similar hospital resource use. DRGs were originally produced in the United States to aid in setting prices for government-funded medical procedures, but the system has since been applied usefully in a number of countries worldwide for similar costing purposes. DRGs are assigned by a 'grouper' program based on ICD-10 diagnoses, procedures, age, sex, discharge status and the presence of complications or comorbidities. Hospital discharge data have been used in quality-of-care research and, recently, as an input for effective coverage assessment.

As a result, it is advisable to regularly assess the quality of health service data and to help ensure some basic standardisation, to the extent possible, to better serve national and regional interests. Regular monitoring also helps to better understand the aggregate capacity of a health system to provide care. Supervisory systems can be used to collect standardised and systematic data and to provide comparisons over time and between clinics and regions. Additional data may be collected through a health facility survey, which is usually based on a sample of clinics.

Such a survey may consider different aspects of service quality such as the availability of drugs, commodities and trained staff. Special techniques such as record review and observing client–provider interactions can add considerable value to the assessment, but they also increase costs and complexity. Data collected from record reviews and staffing inventories can be used to validate routine administrative statistics on the volume of services delivered and on the availability and geographical distribution of human resources.

Census data

Where available, population-level census data can serve as the primary information source for determining the size of a population; its geographical distribution; and the social, demographic and economic characteristics of its people. Censuses have been undertaken in most countries in recent decades and, in some places, for

more than a century. The Statistics Division of the United Nations Department of Economic and Statistical Affairs (UNDESA) has developed principles, recommendations and manuals for population and housing censuses available from their website.[20]

From a health perspective, information on population numbers and distribution by age, sex and other characteristics is essential for national and local planning, estimating target population sizes and trends, and evaluating rates of service coverage and future needs. Census data can also provide valuable information on some key health outcomes, particularly mortality. Information on major health determinants and other key factors such as poverty, housing conditions, water and sanitation, can also be collected in a census. The nature of the census allows for small-area estimation and disaggregation by key stratifiers such as socioeconomic status. Censuses can also provide valuable information on the number of health professionals working in the health sector.

Budgets and expenditure reports

Expenditure and budgetary data provide valuable information on financial resources for health. These data come from national budget documents, expenditure reviews and audit reports. Most often, this information is available at the summary level. As part of the management of health services, budget and expenditure data are frequently provided by financial management information systems, which are sometimes maintained for the government as a whole, rather than just for the health system. There is less information collected on individual expenditures on health, but these data are certainly desirable to obtain when possible.

For policy development and strategic planning, financial data are often compiled using the methodology for national health accounts (NHA).[7,21,22] This system provides information on the amount of financial resources available for health and their flows across the health system. The breakdown of data into private and public sector categories is an important aspect in this regard. In addition, the disaggregation of financial information by major disease or health program area is possible. At subnational levels, budgetary information linked to health system functions and, in particular, health interventions, is a minimum requirement for performance budgeting.

Epidemiological observational studies

Epidemiological observation studies follow a cohort of individuals over a number of years and are useful to provide information about disease progression and other key factors for disease and survival. They are generally completely researcher driven but, nonetheless, can be useful for assessing population health. Studies in the United States that have tracked individuals include the Framingham cohort, the Nurses' Health Study and the American Cancer Society's Cancer Prevention Study.

Health facility assessments

Health facility assessments are intended to capture the resources and inputs of a specific health centre, be it a primary care clinic, a community health centre or a specialty clinic. Modules include facility infrastructure, health centre budget reviews, pharmaceutical inventories, secondary output review, and services for specific conditions such as tuberculosis treatment.

Health facility assessments are important in evaluating not only the resources that are necessary to provide health services to a population, but also to evaluate the quality of the services being provided and factors related to the regular provision of medicines, such as stockout rates.

DHS Macro conducts service provision assessments in selected countries on a quasi-regular basis, gathering information from health facilities on the type and quality of care that they provide. The information provided to decision-makers includes data on health facilities in-country, and their resources, basic systems and specific health services (eg basic child health services or maternal care).

Secondary macro-datasets

Aggregate health indicators, such as those created by international organisations, are generally based on datasets that aggregate individual data. They are usually a mixture of datasets, often poorly documented. Two major problems exist with these types of datasets. First, some countries do not have data on the variable of interest. Therefore, although some aggregates can be compared, they are not entirely comparable cross-nationally, due to missing information from some countries. Second, those who create these aggregates (e.g. WHO, World Bank, United Nations Children's Fund, United Nations Development Programme and United Nations Population Fund) do not always detail how the aggregate was generated. What is worse, countries often report back to WHO the estimates that WHO provides as being their national estimates. This practice discourages countries' investment and interest in developing national health information systems designed to meet their health development needs.

Data that are generated through research are often coupled with results that are very important for policy. These sources vary widely, depending on the aim of the research, and therefore the data obtained are difficult to categorise. However, they are useful as further sources of information. Thus far, the availability of these datasets has not been standardised, but there is increasing pressure to ensure that such data be made available by publication. The Institute for Health Metrics and Evaluation (IHME), for example, has included this as a core principle of its operation, and makes all data used in publication available on its website.[23]

The most significant learning to take from these concepts is the **interdependence of, and interactions between, those who collect data and process them, and those who use the information**

Conclusion

Developing and managing country health information systems

Any information system is a complex entity composed of diverse parts, but with one common plan and purpose. A critical feature is that its components have regular interactions and interdependences. If an information system is built properly by following a plan and is synchronised with the information needs of the organisation, it should manoeuvre and function without problems. In an ideal scenario, contingencies can be perfectly anticipated and planned for. There are manuals and books that explain how such an information system should be designed.[6, 24, 25] Some authors prefer the term 'information architecture' as a '*guiding metaphor in developing coherent and well-integrated information systems*'.[26] The most significant learning to extract from these concepts and apply to information systems in the health sector is the interdependence of, and interactions between, those who collect data and process them into information and evidence, and those who use the information.

A successful health information system should connect the two groups and respond to their needs. A formal, complete health information system infrastructure with accurate and verifiable reporting of all the aspects of the included health metrics is the best option; however, such systems are costly and time-consuming to create and, in many instances, impossible to implement. It is better to supplement partial implementation with surveys, when useful, than to not obtain information. While a supplemented information system is not a substitute for gold-standard information, ultimately, specific surveys can be very useful as ongoing components of a robust health information system.

To satisfy old, and face new requirements for individual-level information, many health information systems have undergone technical and organisational changes in the last decade. We can distinguish those related to the shift from institution-centred departmental systems to decentralised health information systems. This transformation allows doctors to utilise local information to process and report patient-centred information. As part of this shift, there is movement from paper-based to computer-based processing and storage at hospital and district levels. We have also observed the recent architectural developments of health information systems with enough flexibility to receive and store data from computing, environmental, sensor-based technologies or other noninvasive new technologies that enable continuous monitoring of patient health status. They also allow the movement of traditional alphanumeric data to images and data at a molecular level. Other recent changes include the heightened consideration of health information system users. This is evidenced by the inclusion of patients and health consumers in the systems, and by the shift from focusing mainly on technical health information system problems to change management and strategic information management.[27] High-quality health information is a critical input into clinical, local, national and global decision-making. The potential for good health information to help create a culture of evidence-informed decision-making for public health and medicine is well recognised. However, the current landscape is characterised by enormous gaps in the availability and timeliness of information. Information on basic health outcomes—including mortality rates, causes of death, and the incidence and prevalence of major diseases—is not available for many communities, countries and regions. Information on financial resources, human resources, and other inputs to health care and the quality and coverage of health interventions is even more deficient. Rigorous evaluation of the costs and consequences of past health investments is seldom undertaken. In the absence of good information, decisions must be made only on the basis of models, individual experience, guesses or ideological positions. In such an environment, decisions are less strategic than is optimal and the maximum positive impact on health is not likely to be achieved.

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The health information needs for producing National Health Accounts

Case-study

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Introduction

The purpose of this paper is to provide some guidelines on what health information is necessary for the production of National Health Accounts (NHA). Drawing on previous experiences in the production of the Fiji National Health Accounts (FNHA),[3] I discuss what health information is required during their process and production, based on international standards, specifically the system of health accounts published by the Organisation for Economic Co-operation and Development (OECD). I hope that other Pacific Islands Countries (PICs) will find this paper useful and that it can help identify the necessary existing data sources and information gaps before embarking on the production of NHAs.

National Health Accounts are an important tool for monitoring the health spending of a country. Based on a standard international guideline called the System of Health Accounts (SHA), NHAs in its most basic form can tell us where a country sources funds for health, where it is spent and to whom it is paid, and what activities are generated from the use of these funds. In a more complex form, NHAs can provide information on trade in healthcare, health spending by beneficiary characteristics, capital formation in healthcare, classification of healthcare revenues, and price and volume measures.

A global trend emerging is that most nations are making it mandatory to establish the routine production of NHAs. The level, depth and accuracy to which countries report their NHAs is largely determined by the availability of data and the systems that capture and retain these data in a form that is accessible and able to be analysed and used to generate information. In the Pacific region, only two countries have managed to routinely report their health expenditures and produce annual NHAs – Samoa and Tonga. Only recently have other PICs begun efforts to compile their NHAs and institutionalise the process, most notably Fiji, which is used as a case-study in this paper, with now a third-round report published.

Producing a NHA report – where to start?

This section is aimed at PICs that have not yet produced any NHA reports. Before identifying what data is required and its sources, a team must be established to coordinate and undertake the task of developing the NHA report. The following should be considered when beginning a NHA.

Firstly, there needs to be political will and support from the Minister or the head of the health ministry or department on the production of a NHA report. A written endorsement is preferable, which may involve some lobbying and advocacy for NHA. For instance, the 2011 Pacific Health Ministers meeting in the Solomon Islands had health financing on the agenda and production of health accounts was on the top ten priority list of things to be achieved. Public high level endorsements such as these can be used as important 'trump cards' in advocating for NHA.

Endorsement by the government means that they must also allocate a budget for NHA production. Over the years, some PICs have relied on donor funds for NHA production. Unfortunately, when donor funds ceased, production ceased as very little capacity was built within the countries. The issue of how much budget is necessary for NHA production is difficult to answer. Largely it depends on factors such as how much data collection and analysis is required, and who is undertaking the task of producing the NHA report (ministry or an external organisation). When beginning NHA for the first time, it is expected that costs will be high. But once production becomes routine, costs can be significantly lowered. On average, PICs that have routinely produced NHA reports have needed a budget of between 15,000 to 30,000 USD for this task.

After endorsement by the Ministry, a national NHA committee must be established to oversee the production of the NHA report. The chair of this committee should come from the Ministry and someone in a position to make senior decisions is preferred. Retaining the chairmanship within the Ministry ensures that ownership of the NHA report remains with the Ministry. While production and analysis can happen outside the Ministry, the final report should be published as an official ministry document. To ensure that the document remains unbiased and objective, the composition of the NHA committee members should have persons from other government ministries, private sector, development aid partners, academic research institutions and non-government organisations. A membership of 8-12 persons is sufficient. A suggested NHA committee is given in Table 1.

The NHA committee members are selected from important stakeholder groups in the health sector, as well as from organisations that can assist and aid in the

collection of data for the report. The role of the committee is to review the estimations in the report, monitor the NHA production timelines, map out a work plan for routine reporting of NHA including the frequency of reporting, support and facilitate access to data, organise and plan stakeholder workshops, and organise the launch of the report. The committee may or may not be directly involved in the actual data analysis or writing of the report.

Ideally, the NHA committee members should have some knowledge of what NHA are. A one-week training course on the fundamentals of NHAs is recommended for each member of an effective functioning committee. This is mandatory if the committee is engaged in estimating the numbers and writing the report. Every committee member must have access to important NHA manuals such as the System of Health Accounts Manual (2000) published by OECD,[1] and the Guide to producing National Health Accounts (2003) by WHO, World Bank and US-Aid.[2] A familiarity with the contents of these manuals is strongly recommended.

What health information is required for the NHA report?

A key challenge for those engaged in NHA production is the identification of data sources and their assessment for use in NHA estimations. The quality and credibility of an NHA report will largely depend on the availability of the data, the accuracy of the data and the source from which the data was obtained. For example, numbers that are estimated because no actual data exists carry's little weight, even when estimation techniques are sound. Actual data points found in published reports or obtained from actual systems have greater credibility. Amongst PICs there are many data gaps. Thus, before beginning NHA production, there should be a full scoping and review of all available data sources.

NHAs report on the health expenditure of a country. It informs us where the money comes from (financing sources), who manages and coordinates the money (financing agents), on whom is the money is spent (health providers) and what health related services do health providers deliver as a result of receiving that money (health functions). These four NHA classifications (financing sources, financing agents, health providers, and health functions) form the skeletal framework around which health expenditure is reported.

An example is provided in Figure 1 showing how the funds flow across the four classifications. In asking what information is required for NHA, we must consider information across all four classifications. This paper organises the data sources according to these classifications.

Information on financing sources and agents

Financing sources are those that supply the funds for health. Amongst PICs, the largest financing sources are public funds (Government), private funds (mostly households) and donor funds (development partners). Agents are those that manage the funds and in most PICs this is the Ministry of Health (MoH). I discuss sources and agents together because the two are very closely related. Often a financing source can also function as a financing agent.

Financial data relating to public funds can either be sourced from the Ministry of Finance or in some PICs from the Ministry of Health. Most public systems have this data stored in financial accounting systems. The data is often complete and structured by accounting codes that allow costs to be tracked all the way down to 'health functions'. It is recommended that data is obtained at transaction level and has already been audited. In Fiji, the Ministry of Health EPICOR accounting system enabled the Fiji NHA Team to access transaction level audited data for the years 2003 to 2010. This provided accurate reporting of public funds and their subsequent allocation to health providers and functions.

Table 1 Suggested NHA Committee composition

Health Ministry (three people)	One senior MoH decision maker, one from accounts section, one from health information unit
Finance Ministry (two people)	One senior decision maker, one from the budget unit
National Statistics Office (one person)	Senior decision maker
Development partners (two people)	For example; one from WHO and one from AusAID
Private Health Sector (two people)	One from private doctors, one from private dentists (or other)
Academic institutions (one person)	Example; the director of research from an academic institution
NGOs (one person)	Health NGOs

In terms of private funds, the largest contributor in most countries is 'households'. Households pay directly out of their pockets for various health services. Households are therefore both the financing source and the agent, since they manage their own health spending. Data on household spending for health is often obtained from Household and Income Expenditure Surveys (HIES) which are often carried out by the National Statistics Office of the country. Because HIES are usually only done every four to five years, the data needs to be inflated to the year for which the NHA report is written.

If there are no HIES reports, or the report does not contain health expenditure data, then surveys[a] of private health providers need to be commissioned by the NHA committee. This can be a time consuming as well as laborious task and needs to be manage well. Household funds spent on government health facilities (e.g. user fees) can often be obtained from the government financial accounting system.

Another important financer for health is development partners through what is commonly called donor funds. Donor funds are either channelled via the Government (Ministry of Health or Finance) or directly to health providers. Data on funds channelled through the government can be accessed from the Ministry of Finance or the Ministry of Health. Data on donor funds directly channelled to financing agents or health providers would require carrying out a survey of donors within the country. Some donors have annual published reports that provide the required information. There are also databases on donor funding such as the OECD Development Assistance Committee database that can provide useful information. In Fiji, a donor matrix coordination meeting, facilitated by the Ministry of Health brings together the main health donors in the country. This forum is an avenue by which development partners can be approached to supply data on funds donated for health.

a NHA surveys are a complex exercise requiring significant resources. They therefore must be carefully planned and coordinated. This paper does not discuss surveys in detail other than mention that they need to be undertaken in the situation where there is no data available

Other private providers of funds for health can be private companies (e.g. banks that donate funds for special health programs, companies that pay health insurance for their workers) and non-government organisations. Data on how much funds they give for health can either be obtained from secondary literature, direct interviews with the companies or surveys of the private sector.

The Ministry of Health, via the NHA committee chair, should maintain an accurate and updated list of all key stakeholders that finance health expenditures in the country. A key focal person within each stakeholder agency should be identified and constant lines of communication be established to foster collaboration and partnership. Regular feedback from collected data should be communicated to donors and private organisations to ensure their continuous commitment to supporting and providing data for NHA reports.

Information on health providers

Health providers who receive funds from agents and use this to produce a variety of health services are both private and public (public here means government-owned facilities). Health expenditure on public health providers are easily obtained from the Ministry of Finance or Ministry of Health. In Fiji, the Ministry of Health accounting software has transactions that allow tracking of health expenditure to health providers such as hospitals, health centres, nursing stations and health programs.

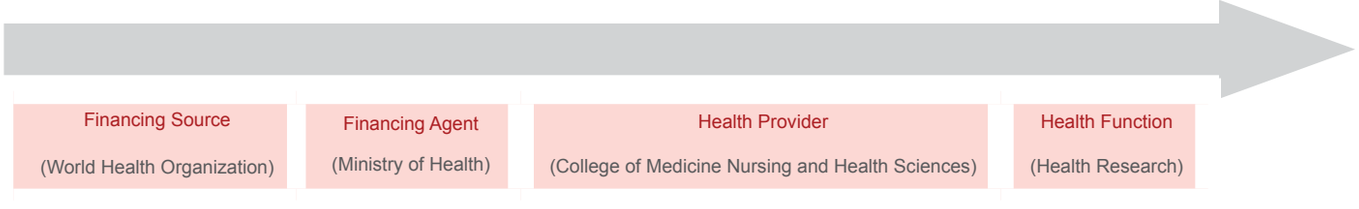

Figure 1 Flow of funds across NHA classification

Data on private health providers is more difficult to obtain. This is because, in PICs, often the private sector operates in isolation from the public (government) health sector, is unregulated and lacks monitoring. The private health sector encompasses a myriad of providers that include hospitals, general practitioners, dentists, opticians, laboratories, x-ray services, pharmacies, acupuncturists, traditional healers, etc. Data on how much the private sector is spending on health is important for NHA reporting. For example, in Fiji, the NHA report for 2010 states private sector spending as accounting for 30% of total health expenditure. Certainly a contribution of that magnitude cannot be ignored.

Because of the lack of reporting of the private sector within PICs, a survey of the private health sector may need to be carried out. This means that the NHA committee should have compiled an accurate and updated listing of all stakeholders actively engaged in the private health sector. In Fiji, a list of companies was obtained from the Companies Registrar. This included charitable organisations and non-government organisations that contribute to the health sector. The estimations from the surveys can also be triangulated with data obtained from the taxation office with regards to health spending. In some PICs, the National Statistics Office runs surveys on private companies and non-profit organisations that provide useful information.

Information on health functions

Information on heath functions is the most difficult to obtain partly because of the complexity and scarcity of data. Functions are defined as the various activities that health providers are engaged in. It describes the various health services and activities that are produced. The major categorizations of health functions are curative services (inpatient and outpatient), ancillary services, medical goods dispensed to outpatients, prevention and public health services, health administration and health insurance, and other health related functions.

To be able to divide health costs across the aforementioned categories, data must be available to enable the division of costs and their subsequent allocation to categories. The task is straightforward when a health provider is engaged in one activity and thus the cost is in its entirety allocated to that function. For example, most private general practitioners provide only outpatient services and therefore all (or most) of their costs are allocated to the function ‘outpatient’. Likewise, the costs of private lab and x-ray services are given the functional classification ‘ancillary services’.

Health providers that perform several functions need some method of disaggregating the costs to the various functions. For example, hospitals can provide inpatient care, outpatient care, and ancillary services. In the case of Fiji, the accounting system does not tell us how much a hospital spent on inpatient care alone. But it will tell us how much was spent on all the functional activities for the hospital during the year. To divide costs, we then had to use data from the hospital patient information system that told us how many inpatients (and patient days), outpatients, and ancillary tests were carried out during the year. Using results from hospital costing studies that informed us of the unit costs per inpatient, cost per outpatient, cost per lab test and cost per x-ray examination, we then allocated the hospital costs by applying ratios. This was done for all health providers in the public system. For private providers, surveys had to be administered which asked for their patient numbers, number of tests carried out and other functional areas such as administration, capital investment and education and training.

Other information

NHAs also report certain ratio indicators that are important at a national level for health policy making as well as useful for cross country comparisons. These indicators often require national statistics data at the macro level to be used as denominators. Most macro level data can be obtained from national statistics departments, ministry of finance, and the central banks. Some of the required macro data are population numbers, gross domestic product (GDP), general government expenditures (GGE), final consumption expenditure, and annual exchange rates. For many PICs, national ministries do not release timely national statistics data. Thus PICs can refer to international organisations that provide estimations for countries. Examples include, the World Bank, WHO, and IMF. However it is advised that figures from official national agencies be used whenever it is available.

Conclusion

This paper briefly describes the information needs for the development of NHAs, as well as suggesting possible sources of this information. Most of the information with respect to government-owned facilities can be sourced from the health ministry and thus a close collaboration is required between the NHA team and the Ministry’s health information unit. In most PICs it is the Ministry of Finance that is the main source for detailed government health expenditures.

In the private health sector, there is very little regulation or monitoring by governments (or the health ministry). In most PICs, data on the private health sector will require the commissioning of surveys and interviews. Indeed, the scarcity of data on the private health sector, who are important stakeholders a country’s health system, suggests that some mechanism be developed that will provide routine data on private health providers. A good start is to ensure that health ministry’s keep an accurate and updated list of all private health providers and the nature of the services they provide. It is expected that routine reporting of NHA overtime will encourage us to fill data gaps, and therefore strengthen data sources, reporting and collection.

Table 2 Summary of various data sources discussed

Type	Data	Example data sources	Data agency	Fiji example
Macro	Population	Website, Key Statistics publications, Census reports, Annual reports, HIES Surveys	National Statistics Office	Key Statistics September 2011
	Gross Domestic Product (GDP)			HIES Report 2009-10
	Private Consumption			
	Household Consumption			
	Exchange rates	Annual reports, Quarterly financial reports, Central bank website	National Central Bank	Fiji Reserve Bank Annual report 2010
	General Government Expenditure	Final budget estimate reports	Ministry of Finance	Fiji Budget Estimates 2011
Public	Costing of govt health institutions	Financial managemnent system	Ministry of Health or Ministry of Finance	EPICOR system
	Health utilisation data	Annual reports, Patient information system	Ministry of Health	PATIS
	Drug spending	Pharmaceutical warehouse database, annual reports, interview	Ministry of Health, Pharmaceutical Division	Fiji Pharmaceutical Services warehousing database
Private	Contacts/address of health providers	Telephone directories, Yellow Pages, Ministry of health	Ministry of Health, Registrar general, Private health provider associations	Fiji Medical Council, Fiji Council of General Practitioners
	Costing of Private health providers (GPs, dentists, opticians, etc.)	Annual reports, published secondary data, Survey of health providers		
	Health Insurance schemes	Insurance company annual reports, Central Bank insurance reports, Survey of Insurance companies	Insurance companies, National Central Bank	Fiji Reserve bank insurance report 2010
	Private drug consumption	Survey of retail pharmacies	Ministry of Health, health Facilities, Retail pharmacies	Survey of retail pharmacies
	Private companies	Survey of private firms		Survey of private firms

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Improving adolescent reproductive health: The importance of quality data

Policy brief

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Key messages

- Adolescents suffer a disproportionate burden of reproductive mortality and morbidity, and also face unique barriers to accessing reproductive health information and services
- Quality data on adolescents' reproductive health outcomes, risk and protective behaviours, and access to and utilisation of information and services are essential for the development of evidence-based policies and programs
- DHS and MICS surveys commonly relied upon by policy-makers and programmers are limited in their capacity to provide these data due to the omission of important cohorts and indicators, and failure to report data disaggregated by age
- A review of DHS and MICS sampling strategies, and a consideration of alternative data collection strategies, are warranted

Background

Adolescents (aged 10 to 19 years) undergo rapid development characterised by an increasing physical capacity to be sexually active, but a less than fully developed psychological and emotional capacity to assess the unintended consequences of sexual activity and negotiate safe and consensual sex. Adolescents also experience unique barriers to accessing reproductive health information and care, and are unlikely to benefit from reproductive health interventions targeted at the overall population. As a result, adolescents experience a disproportionate burden of poor reproductive health outcomes including sexually transmitted infections (STIs) and unintended pregnancies.

Pregnancy has significant implications for adolescents. Girls aged 15-19 are twice as likely to die from pregnancy-related causes as women in their twenties; girls aged 10-14 are five times more likely to die. Globally, maternal mortality is the most common cause of death amongst adolescents aged 15-19 years. Babies born to adolescent mothers are also at a higher risk of death in their first month of life.[1,2]

Adolescent pregnancy also has socio-economic consequences, with pregnant girls in much of Asia and the Pacific being forced to leave school. This reduction in their educational attainment reduces their livelihood opportunities, increases their dependence on their husbands and families, and is correlated with poorer health outcomes for themselves and their children.

Developing evidence-based policies and programs to improve adolescent reproductive health requires quality data on adolescents' reproductive health outcomes, health-risk and protective behaviours, and access to and utilisation of health information and services.

In most developing countries, policymakers and program designers rely on data collected by two national-level household surveys: the Demographic and Health Survey (DHS) and UNICEF's Multiple Indicator Cluster Survey (MICS). Both surveys collect and report reproductive health indicators, and have gained reputations for being accurate and representative. However, the extent to which they report outcomes for adolescents had not previously been determined.

Research findings

A mapping of 128 indicators relevant to adolescent reproductive health was undertaken using the DHS and MICS reports from nine countries: Bangladesh, Cambodia, Indonesia, Papua New Guinea, Philippines, Solomon Islands, Timor-Leste, Vanuatu and Vietnam.[3] The mapping found that DHS and MICS have limited capacity to provide data to inform evidence-based adolescent reproductive health policy and programs for three main reasons:

1. **Omission of important cohorts.** The sampling strategy selected by DHS and MICS in most countries excludes unmarried women and all males. Adolescents aged 10-14 are omitted in all countries. Unmarried women, males and adolescents under 15 are all at risk of poor reproductive health outcomes, and there is evidence that reproductive health information is most effective prior to the commencement of sexual activity. This lack of data is a missed opportunity to develop evidence-based policies and programs for these cohorts of adolescents
2. **Omission of important indicators.** DHS and MICS exclude data on indicators relevant to adolescents including the direct and indirect causes of maternal mortality, prevalence and causes of maternal morbidity, nutritional status prior to and during pregnancy, diagnosis and treatment of STIs, and abortion and post-abortion complications
3. **Failure to report disaggregated data.** Data relating to nearly 30% of reproductive health indicators are not age disaggregated in DHS and MICS reports. For those indicators that are age-disaggregated, further disaggregation by marital status, urban/rural location, education level and wealth quintile is not undertaken. This reduces the capacity of reported data to identify at-risk groups and inform targeted policy and programs.

DHS and MICS do, however, provide valuable data on contraceptive prevalence, exposure to family planning information and services, and access to general health services; all of which are reported disaggregated by age. These are of direct relevance to policy and programs aimed at promoting healthy sexual decision-making among adolescents, delaying first pregnancy, increasing birth spacing, and empowering young women to choose when to commence childbearing and how many children to have.

Policy recommendations

- Recognise that adolescents have different reproductive health needs to adults, and that adolescent-specific data are required to inform evidence-based policy and programs
- Advocate for a review of DHS and MICS sampling strategies, including a cost effectiveness study of including unmarried women, males, and adolescents under 15
- Advocate for the inclusion in DHS and MICS of a minimum set of indicators relevant to adolescent reproductive health
- Increase investment in the development of methods for collecting reliable data on causes of maternal mortality and morbidity
- Examine the potential for collecting data on omitted cohorts and indicators through separate surveys or strengthening of routine health information systems
- Assess the cost-effectiveness of routinely reporting all relevant indicators disaggregated by age versus the development of specific adolescent-focused reports targeted at policymakers and programmers

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Assessing the quality of cause-of-death data reported by vital registration systems: Issues, challenges and the way forward

Policy brief

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Summary

Cause-of-death (mortality) information is the cornerstone of any health information system as it guides policy, planning and resourcing of health priorities. Health Ministers, managers, clinicians, policy makers and planners need timely, accurate and up-to-date information if they are to make evidence-based policy decisions to address issues impacting on the health of the population. However, reliable cause-of-death statistics are generally not available in many low- and middle-income countries. This policy brief outlines the need for strengthening cause-of-death data and provides practical recommendations on how this can be achieved.

Recommendations

The recommended actions to improve cause-of-death data are:

- Provide regular and systematic training to doctors on standard death certification practices
- Introduce the WHO International Standard Death Certificate
- Promote periodic assessment and validation of cause-of-death data

Introduction

The evidence used to develop this policy brief was gathered during a medical records review carried out in Colombo, Sri Lanka, in 2010.[1] Using a modified version of the Study Instrument from the Population Health Metrics Research Consortium, the review assessed the quality of medical records to measure the accuracy of registered diagnoses of death. Overall, the review found that the majority of medical records were of 'average' quality, and major misclassification errors occurred in identifying deaths due to non-communicable diseases. This is a key conclusion with important public health implications, as cause of death data that is frequently incorrect has limited value in health policy, planning and monitoring and evaluation.

Why is this issue important?

Information on cause-of-death data is critical for informed decision making in the health sector. However, reliable cause-of-death statistics are generally not available in many low- and middle-income countries, where the need for robust evidence for decision-making is most critical. Moreover, even when cause-of-death information is available from hospitals, it is often unreliable. This greatly limits confidence in the use of cause-of-death data for national and international health situation assessment and for policy and planning, despite the considerable annual cost of collecting them.

What does the research tell us?

Medical records are widely expected to contribute full and accurate information about a patient's condition, treatment and events that led to their death. However, there is limited research evaluating the quality of medical records and the accuracy of cause-of-death diagnoses written by treating physicians. In the medical records review highlighted here, researchers found that non-communicable diseases (especially cerebrovascular diseases) were under-counted the most by the vital registration system, while external causes of mortality and diseases of the respiratory system were the most over-counted. The consequences of such misclassification of leading causes-of-death could have a substantial effect on public health programs, since strategies and approaches to prevention are different for each disease category.

Recommendations

There are three important steps that can be taken to improve the accuracy of physicians' diagnoses of the causes-of-deaths for a population:

1. **Regular and systematic training to doctors on standard death certification practices.** Basic medical training should give more emphasis on training medical undergraduates in writing a proper cause-of-death certificate. The public health importance of accurate cause-of-death statistics should be emphasised more in the training of

physicians. Practical advice about constructing a proper death certificate needs to be emphasised in the training

2. **Implement the WHO International Standard Death Certificate in all countries.** A major issue affecting diagnostic accuracy in many countries is the absence of part two of a death certification form, where the contributory causes are recorded. This can lead to confusion in selecting the final underlying cause of death. The immediate introduction of the WHO Standard Death Certificate is a priority to improve the quality of cause of death certificates and would contribute greatly to improving the quality of cause-of-death statistics
3. **Periodic assessment and validation of cause-of-death data reported.** Periodic auditing of a small sample of medical records and communicating findings to doctors and other officers involved in medical record maintenance is a simple procedure that would have great impact on improving medical record practices, and thus the quality of cause-of-death data. Independent review of clinical evidence contained in the medical records of deceased patients can yield important insights into the reliability of routine cause-of-death data, particularly in developing countries.

Conclusions

It is hoped that the research this policy brief is based on, a medical records review in Sri Lanka, will inspire and provide guidance to many other countries on how to conduct a hospital cause-of-death validation study as a quality assurance method for evaluating the quality of their death certification system. Countries spend substantial amounts of money on the annual collection of cause-of-death statistics for their populations: it is critical that they are fully aware of the biases in these data so that public health policy and planning can proceed on the basis of reliable data. Finally, it is important to note that such periodic investigations of death certification and medical record practices are not costly. The total cost of the investigation in Sri Lanka was less than US$5,000 – extremely cost-effective given the critical policy value of the findings.

Since the medical records review was carried out in Sri Lanka in 2010, three separate reviews of medical certification processes have been carried out in Bangladesh, Fiji and Tonga. While not as comprehensive as a medical records review, these reviews have assessed the quality of death certification processes in order to make recommendations for improving certification practices and processes in each of the countries visited.

As part of the reviews, training has also been provided to physicians in each country to develop their skills and ability to correctly certify deaths according to international standards following guidelines prescribed by the International Classification of Diseases (ICD-10).

What can I do to improve cause-of-death data in my country?

A copy of the full working paper this policy brief is based on, including a detailed methodology on how to conduct a medical records review, is available online at http://www.uq.edu.au/hishub/docs/WP_14.pdf

The WHO has also developed online training tools on ICD-10 and death certification practices. At the end of the training, participants will be able to correctly report and interpret the events and conditions leading to death using the international certificate of cause-of-death. This training tool is available at http://apps.who.int/classifications/apps/icd/icd10training/ICD-10%20Death%20Certificate/html/index.html

If you would like assistance in conducting a medical records or death certification review in your country, please contact the HIS Hub on (+617) 3365 5405 or hishub@sph.uq.edu.au

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Understanding the role of technology in health information systems

Original article

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Abstract

Innovations in, and the use of emerging information and communications technology (ICT) has rapidly increased in all development contexts, including healthcare. It is believed that the use of appropriate technologies can increase the quality and reach of both information and communication. However, decisions on what ICT to adopt have often been made without evidence of their effectiveness; or information on implications; or extensive knowledge on how to maximise benefits from their use. While it has been stated that '*healthcare ICT innovation can only succeed if design is deeply informed by practice*',[1] the large number of 'failed' ICT projects within health indicates the limited application of such an approach.

There is a large and growing body of work exploring health ICT issues in the developed world, and some specifically focusing on the developing country context emerging from Africa and India; but not for the Pacific Region. Health systems in the Pacific, while diverse in many ways, are also faced with many common problems including competing demands in the face of limited resources, staff numbers, staff capacity and infrastructure. Senior health managers in the region are commonly asked to commit money, effort and scarce manpower to supporting new technologies on proposals from donor agencies or commercial companies, as well as from senior staff within their system. The first decision they must make is if the investment is both plausible and reasonable; they must also secondly decide how the investment should be made.

The objective of this article is three-fold: firstly, to provide a common 'language' for categorising and discussing health information systems, particularly those in developing countries; secondly, to summarise the potential benefits and opportunities offered by the use of ICT in health; and thirdly, to discuss the critical factors resulting in ICT success or failure, with an emphasis on the differences between developed and developing countries. Overall, this article aims to illuminate the potential role of information and communication technologies in health, specifically for Pacific Island Countries and Territories (PICTs).

Key points

The following can be done to maximise the opportunities and benefits from the use of information and communication technology in health in Pacific Island Countries and Territories:

- Ensure **senior management** are committed to the project and willing to undergo the difficulties encountered in overcoming the barriers associated with change
- **Engage with clinicians and other end-users** throughout the process. It is fundamental that users of ICT can see its benefits or they will not use it
- Clearly specify the **technical and functional requirements** of the technology (what do you need it to do?)
- Allow **sufficient time and resources** for organisational and process change. The introduction of new ICT systems usually requires the introduction of new ways of working, new staff skills, new roles and may require organisational restructure
- Understand the capacity and limits of your **telecommunications infrastructure**
- Ensure local **human resource capacity-building** is a core part of the process
- Assess the **affordability** of the technology in the long-term (after any donor funds have expired)
- Assess the **appropriateness** of the technology – will it work in a tropical climate; are software applications available in languages other than English; can it be easily integrated into everyday life; is it socially and culturally acceptable?

Introduction

Information and Communications Technology (ICT) has been referred to as a 'key instrument' in healthcare delivery and public health internationally.[2] When designed and implemented effectively, ICT can improve access for geographically isolated communities; provide support for healthcare workers; aid in data sharing; provide visual tools linking population and environmental information with disease outbreaks; and is an effective electronic means for data capture, storage, interpretation and management. In this context, ICT for health refers to any tool that facilitates the communication, processing or transmission of information by electronic means for the purpose of improving human health.[3]

In the developed world there has been enormous investment in health ICT since the late 1960s and this is has expanded dramatically over the last 10 years. Obvious examples are the Canadian Health Infoway (www.infoway-inforoute.ca), the United Kingdom's National Program for Information Technology (NPfIT) which is the world's largest civil information technology investment program (www.connectingforhealth.nhs.uk) and the Health*Connect* program and subsequent National e-Health Transition Authority programs in Australia (www.nehta.gov.au). Each of these programs, and many others, have carried out substantial policy research within e-Health, particularly in the areas of benefits and benefits realisation. Despite this there is still a remarkably small evidence base of rigorously evaluated health ICT interventions available to support informed investment decisions. For the developing world, this evidence base is even smaller.

On a global level, there are many organisations and institutions working to support this field of work. The World Health Organization (WHO) hosts the Global Observatory on e-Health (www.who.int/kms/initiatives/ehealth/en) to respond to the limited systematic research that has been carried out to inform e-Health policy and practice. In 2005 a global survey was carried out to describe e-Health activities and action areas being undertaken at a country level. A key finding was the urgent need for guidance in implementing health technologies;[4] however no follow-up survey has been undertaken, nor have any practical recommendations been released.

Another initiative is a global concept named ICT4D, which relates to the application of Information and Communication Technologies for Development (www.infodev.org/ict4d). The World Bank has also established infoDev (www.infodev.org), a financing program, and convenes discussions to support information sharing on ICT4D, and to help reduce the duplication of efforts and investments. Within the Pacific Region, there are limited strategic initiatives relating specifically to health technologies.[5] However, an activity that may have an overarching impact is the Pacific Rural Internet Connectivity System (PacRICS), which was established in 2008 by the Secretariat of the Pacific Community and the Pacific Island Forum Secretariat to provide two-way internet connectivity (www.pacrics.net).

While the assumption is made that technology can and does have a positive effect in healthcare; the evidence-base supporting its practical use is slender.[6] In reality, many decisions on the adoption of new healthcare technologies are made in the absence of information on implications of its use.[7] Decision-makers are often unaware of the information they lack, and rarely obtain feedback on the consequences of their decisions; be it feedback on the effectiveness, costs, ethical, legal or social implications of technology.[6-7] Aside from the paucity of research on evidence for making informed decisions; available information on the selection of new technologies is often unstructured and unclear, and further compounded by the increasing number of technologies, and their increasing complexity.[8-9] There are a number of specific problems with the use of ICT that are generally better understood: costs associated with hardware and software, availability of broadband and mobile networks, the development of user interfaces and applications in languages other than English, and ongoing maintenance costs, to name a few.[6] However, broader knowledge on the social, political and economic constraints (also referred to as the 'soft' barriers), is often lacking in consideration of technology innovations in healthcare.[9]

In response to this evident knowledge gap, a literature review on past health information technology implementations in the region was conducted by the HIS Knowledge Hub. This article presents initial findings from the review. There are three main research questions this article aims to address:

1. What are the potential opportunities and benefits of ICT in assisting health information systems?
2. Why do health ICT technology investments succeed or fail?
3. Can a common 'language' for categorising and discussing Health Information Systems in the Pacific be developed?

ICT in the Pacific

Countries and Territories making up the Western Pacific Region are commonly grouped according to their level of development, as defined by per capita income. As such, countries such as New Zealand, Australia, Japan and Guam are usually grouped as 'high income'; Malaysia, American Samoa and Palau 'upper middle income'; the Philippines, Fiji and Kiribati 'lower middle income'; and Cambodia, Papua New Guinea and the Solomon Islands are generally grouped as 'low income'.[10] While per capita income is likely to be good predictor of the level of sophistication in health ICT that a country can support at the current time; an important marker of the long term need for complexity and sophistication in the use of ICT in health, is a country's total population. A large country such as Papua New Guinea, with its population of over six million, requires a relatively complex HIS; however a country such as Tokelau, with a population

of less than 2,000, can adequately operate its health system with relatively simple tools. While Fiji, with a population of just under 840,000 may require a scaled-down version of the overall system that would be suited to Papua New Guinea; it is unlikely that a country such as Tuvalu (10,000 people) would require a scaled-down version of Fiji's system, and even less likely to require a system modelled on that of Papua New Guinea. Overall, at a certain point in size, there is likely to be an almost quantitative step change in system requirements for ICT.

Despite country-level differences in terms of both income per capita and total population, one of the most visible changes to the use of ICT in the Pacific has been the dramatic uptake in the use of mobile phones. With liberalisation of the telecommunications sector for a number of countries, the availability and affordability of mobile services has improved considerably (though penetration remains low when compared to other developed countries).[5] The growth of mobile cellular subscriptions has rapidly outpaced growth in fixed telephone lines and estimated internet users. Between 2000 and 2009, for example, the number of mobile cellular subscriptions in Samoa increased from 1.42 to 84.43 per 100 inhabitants; while fixed lines increased from 4.83 to 17.84, and internet users from 0.57 to 5.03.[11] A similar pattern has also emerged for Fiji, and to a lesser extent, the Cook Islands. An important limiting factor to the use of new technologies in the Pacific, and in developing countries in general, is the lack of competition among service providers, especially for countries with small total populations. State-owned monopolies, such as those within the Federated States of Micronesia and Kiribati, continue to restrict the opening-up of ICT markets within the Region, stalling development and inflating prices.[5]

Health information systems

The aim of this section is to provide a common language for talking about Health information Systems. The first question is what we do mean by a Health Information System (HIS); as the term is used with two very distinct meanings. The restricted meaning refers to systems that capture and report aggregated health statistical information. This is the meaning that, for example, the Health Metrics Network (HMN) and World Health Organization (WHO) traditionally use. WHO defines HIS as integrated efforts to, '*collect, process, report and use health information and knowledge to influence policy making, program action and research*' and further states that they are essential to the effective functioning of Health Systems worldwide.[12] For the purposes of this article we will refer to such systems as Routine Health Information Systems (RHIS). RHIS, such as those operated through health information departments or national statistics offices, provide information on risk factors associated with disease, mortality and morbidity, health service coverage, and health system resources.

The broader meaning of HIS refers to any system that captures, stores, manages or transmits information related to the health of individuals or the activities of organisations that work within the health sector. It is this broader meaning of Health Information Systems that is used in this article. This extended definition incorporates such things as district level routine information disease systems, disease surveillance systems but also includes laboratory information systems, hospital Patient Administration Systems (PAS) and human resource management information systems (HRMIS) for health workers.

The following diagram (Figure 1) illustrates the typical components of such an extended Health Information System. The dashed box to the right of the diagram displays the components of a 'traditional' HIS for a 'developing country', these include;

- A routine health information system capturing aggregate activity data from paper forms via 'district'[a] level reporting to be eventually recorded in an electronic system at the 'provincial' and/or national level
- Notifiable disease reporting system (possibly using both routine reporting and sentinel sites)
- Disease registries.

There is significant academic literature regarding the implementation of such systems, particularly in Africa, but few robust quantitative evaluations of their benefits. Over recent years there has also been significant research published on the impact of new technologies such as the use of mobile phones to improve the operation of these 'traditional' systems.

The remainder of the diagram illustrates the components that may make up the electronic HIS environment of many developed countries. Of course many HIS environments will not include all such components and where they do exist, they will have been implemented over an extended period of time building on earlier developments and dependencies. The diagram illustrates a number of key elements of the differences between the HIS environments:

- Investment in departmental (auxiliary) systems to support acute care, such as radiology and Laboratory Information Systems, initially the prime purpose of these is to manage work flow efficiently
- A focus on systems that store, transfer and use information on individual patients for prospective clinical decision making rather than on aggregated information used for policy and monitoring
- A focus on sharing information between health care providers to enable continuity of care, reducing duplication and improving patient safety
- Richer integration of information available from multiple sources to inform policy and management decisions.

a The terms 'district' and 'province' are used here generically to refer to geographic administrative units, Fiji for example use the terms Sub-division and Division.

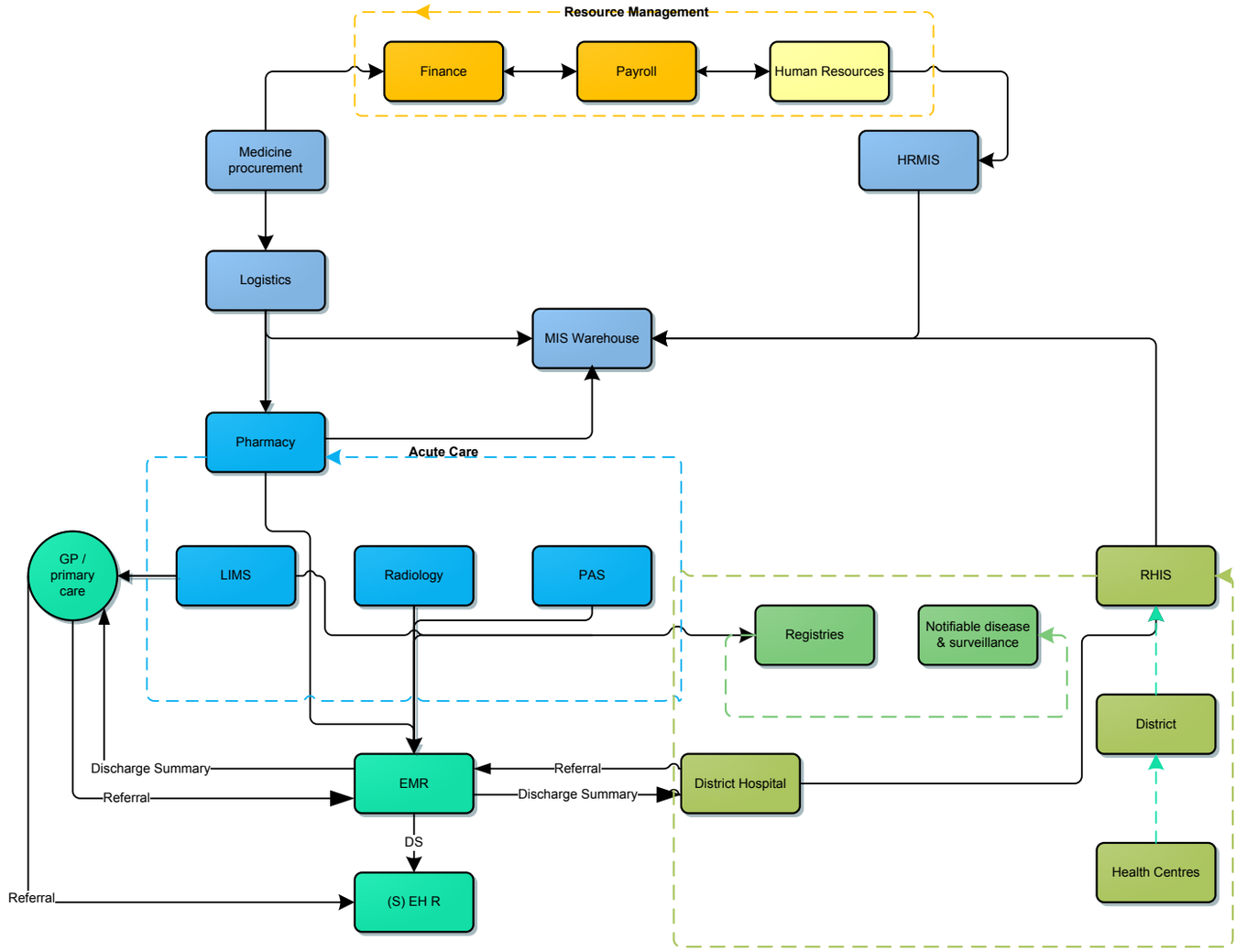

Figure 1 Components of an extended HIS

It can be expected that countries in the Pacific will be looking to adopt and implement such systems over time. The rate of adoption will vary from country to country but will be driven by factors such as:

- Changes in disease patterns, the shift from communicable to non-communicable and chronic diseases, requiring changes in patterns of care and supporting systems
- Increased expectation of stakeholders, this includes both increasing expectations from patients and possibly more significantly increasing demands from clinicians.

This extended Health Information System is composed of a large number of individual systems. In the past many of these have been isolated, 'stand alone' systems but intersystem communication for data sharing and integration is increasingly the norm. Such communication of clinical data progresses through a number of distinct stages.

Initially data is communicated in a form understandable by humans but not by machines (a facsimile is a simple example of this) and later moves to full semantic interoperability where transmitted data can be used by the receiving system for things such as computerised decision support. Individual systems include:

- **Patient Administration System (PAS).** Basic component of a hospital computer system which records patient details, all admission, discharge, ward allocation and transfer, treating clinicians and outpatient attendance. Coding of diagnoses and treatment options allows for the analysis of hospital and national disease burden. Usually one of the first systems to be installed in starting to 'computerise' a hospital
- **Laboratory Information System (LIMS).** Primary purpose is to manage the flow of samples through a pathology laboratory. This requires the electronic registration of samples as they flow through the laboratory and the interaction with all laboratory machines to electronically capture the results. The secondary purpose is to provide the results to clinicians in a timely and convenient manner

- **Electronic Medical Record (EMR).** Facility or organisation-based records of all patient interactions. Includes details of patient problems, diagnoses, investigations, test results, treatments and prescribed medicines. Usually requires input from auxiliary systems such as laboratory information systems
- **Electronic Health Record (EHR).** Sometimes termed a Shared Electronic Health Record (SEHR). Includes details from multiple organisations and care settings to provide a complete longitudinal patient medical history. Information is usually a summary from the contributing EMRs. Available to all healthcare providers delivering care to a patient
- **Management Information System (MIS).**The intention of such a system is to bring together and present in an integrated manner all the information needed to manage and plan the health system. Ideally this includes health system activity data, human resource, financial, supply, disease incidence and demographic information. Few health systems in the world would have such an ideal MIS.

Opportunities and benefits

In the developed world there have been two key drivers for investment in health ICT. The first is the ever increasing burden from chronic disease, often with complex co-morbidities, on the health care system with costs increasing significantly faster than population or GDP growth. In Australia, for example 80% of the burden of disease is now from chronic diseases (including cancers).[13] The treatment and management of such chronic diseases continues over an extended period of time and is performed by multiple health care providers in multiple settings. The second key driver is the recognition of the need for greatly improved quality and safety in the delivery of health care. This recognition has been driven by such things as the National Institutes of Medicine report, *To Err Is Human,* which estimated that in hospitals alone, between 44,000 and 98,000 Americans died each from medical error.[14]

Both of the these factors have lead to very significant investments in the development of systems to enable the sharing of structured data to provide more complete and timely information for clinical decision making. These have included such things as the development of local electronic medical records, secure messaging to interface systems and shared longitudinal electronic health records. There has been the expectation that these developments would lead to major savings in cost and increases in patient safety. In the United States, for example, a RAND Corporation Study estimated that it would take 10 to 15 years to establish a full eHealth system but this system would then deliver savings of $81 billion dollars per year as well as delivering greatly improved quality of care.[15]

In Australia, the projected cost of implementation of the national broadband network is $42 billion, but in its submission to the NBN Senate Select Committee, iSoft, an Australian medical software company, estimated the cost savings for integrated health records to be of the order of $8-$10 billion annually, and emphasised the importance of broadband in realising the full e-health system.[16]

Yet, as noted previously the quantitative evidence-base to support particular investments is small. The U.S. based Centre for Information Technology Leadership (CITL) reviewed a sample of studies from academic, industry, and provider sources, aiming to answer the question: What are the demonstrated benefits of a given system or application? They found few concrete answers, noting that:

'*There is very little hard evidence demonstrating the value of specific HIT investments*';

'A good deal of the current literature is conceptual. Rather than discuss demonstrable benefits of HIT, about one-quarter of sources did not address specific benefits at all. Instead, these largely theoretical works discussed value assessment frameworks or barriers to value realization. Benefits like cost containment or outcomes improvement were mentioned with little if any supporting primary data';

and

'*Existing evidence is not sufficient to clearly define "who pays for" and who benefits from HIT implementation in any organization – except those …that are responsible for paying for and delivering all the care for the defined population*'.[17]

While there has been limited rigorous quantitative analysis of the benefits from specific ICT investments in the developed world there has been even less for the developing world. There has been a significant level of published literature over recent years around:

- Use of mobile phone technology for disease surveillance
- Low cost technologies for clinical video case conferencing
- Open source technology for the development of routine health information systems and the use of technologies, like hand-held PDAs to improve the efficiency and timeliness of systems.

It is likely over the next decade that the major ICT investments in health in the developing world will be in:

- Hospital patient administration systems (PAS) to optimise the use of scarce resources, hospital bed-days and clinicians
- Logistics systems to help manage the storage and distribution of drugs and medical supplies, and to reduce loss through retention of out-of-date drugs and pilfering
- Simple information transfer systems (referrals and discharge) to support continuity of care as patients move between primary care settings and acute care

- Extension of access to routine health information systems to lower geographic levels so data can be entered closer to source and a wider range of users can access information directly
- Pathology, radiology and pharmacy information systems to manage the work flow in these areas and subsequently provide information to clinicians and support continuity of care.

The following table (Table 1) lists examples of health ICT investments describing the types of initiatives, their benefits and dependencies. This is not intended to be an exhaustive list but does cover a wide spread of the types of investments that could be made in health ICT.

Table 1 Health ICT investments

Investment	Description	Benefit	Dependencies
Electronic decision support on drug ordering	Prescription entered electronically and sent to dispensing (pharmacy) system and possibly drug administration tracking system. Provides immediate electronic advice to prescriber on alternatives and potential interactions and side effects	Reduced cost of drugs and reduced risk of adverse event from drug – drug interaction	1. Data entry terminals widely available at point of ordering 2. Electronic laboratory and pharmacy systems 3. Standardised drug coding 4. Standardised, secure electronic messaging 5. Electronic medical record with standardised coding of patient history and allergies
Coordinated care SEHR	Central repository that contains summary information from multiple source systems. Enables healthcare providers to have a complete view of current problems and treatments	Reduced duplication of diagnostic tests. Enables earlier treatment of emerging problems and reduces hospitalisation stays	1. Source systems such as GP, primary care and hospital 2. Standards for data recording 3. Standardised, secure electronic messaging
Hospital patient administration system (PAS)	Records patient admissions to acute care hospitals	Allows local management of hospital bed usage and contributes to overall analysis of burden of disease and health system costs	1. Availability of local area network and terminals at admission desk, ward and management offices 2. Staff capacity 3. National data warehouse / management information system
Electronic transfer of laboratory results	Secure transfer of results to clinician who ordered tests and other interested clinicians. Initially message is at the human readable level only but later moves to automatic transfer of system-interpretable data	Quickly and more reliable availability of pathology results. Reduction in duplication of tests and unnecessary tests. Eventually electronic decision support for the ordering and interpretation of pathology tests	1. Compatible systems in laboratory and remote sites 2. Affordable, reliable wide area communications 3. Agreed messaging standards
Laboratory information system with auto-tracking	A laboratory information system (LIMS) is one of the key clinical auxiliary systems. Its primary purpose is to manage the workflow of samples through the laboratory. It can enable clinician access to results	Efficient work flow in the laboratory. More timely availability of results. Distribution of results to clinicians across different sites and settings. Storage of results for later review and time trend analysis	1. Basic implementation has no dependencies other than local network, reliable power within the laboratory and staff capacity to maintain the various machine interfaces 2. Local network and interface to patient administration system to obtain patient identifier details

Web based entry and reporting of routine health information at sub-national levels	Network system that enables entry of data from local / district level directly into single national repository with immediate reporting and comparison of performance indicators	Eliminates duplicate entry of data and provides much more timely availability of meaningful local reports	1. Robust and affordable wide area communication networks. Does not need to be real time wide band 2. Human capacity to manage system and monitor data and training of users in interpretation and use of data
Simple telemedicine case conferencing	Use of slow scan video equipment to provide video conferencing and diagnostic imaging over low band width networks. Clinician from referral hospitals can provide specialist advice at local and district facility level	Enables specialist medical consultation at local level, may reduce need for patient transfer to other facilities	1. Organisational commitment of specialist time to be available on scheduled basis 2. Wide spread distribution of simple video and audio equipment 3. Robust and affordable wide area communication networks
Mobile phone notification of disease outbreaks	Programmed mobile phone notification of occurrence of disease. Usually from sentinel sites rather than all sources	Faster and more complete notification of disease occurrence	1. Wide spread mobile phone coverage 2. Low cost programmed mobile phones 3. Central agency with capacity to rapidly react to disease outbreaks.

ICT project failure

While the potential health and financial benefits from the use of technological innovation in health are large, the risks are also substantial. A World Bank Study conducted in 2005 found, for example, that the majority of public sector ICT applications in developed countries were either partial or total failures.[18] Furthermore, in his report on e-Government projects for development, Heeks[19] states that 35% of such projects are total failures, 50% partial failures, and only 15% are considered successful. A study by Gheorghiu[20] found that 70-80% of all information technology and information systems fail. Similarly, Kaplan and Harris-Salamone[21] reported international failure rates of major health IT projects of between 30% and 70%.

Such figures are found repeatedly throughout the academic and industry literature. There is a far smaller literature base on the developing world, but intuitively one would expect the failure rates to be at least as high as in the developed world. The International Development Research Centre (IRDC) (www.idrc.ca) noted a significant failure rate (up to 50%) in the small scale telemedicine projects it had sponsored and in general, an inability to demonstrate improved patient outcomes from the projects.

Developed world experience

Given the high failure rate and the very visible and often politically embarrassing failure of many health ICT projects, there has been substantial academic and industry research on the factors that cause projects to fail. Health systems are significantly different from other information system environments, due to their complexity, lack of one single 'owner', and 'hyper turbulent' and 'information sensitive' nature.[22-23] Common failure factors for health ICT projects thus include:

1. Lack of senior management sponsorship[3,22,24-25]
2. Lack of engagement of clinicians and other end users[24,26]
3. Inadequate specification of requirements[27-28]
4. Insufficient time and resources allocated to organisational and process change
5. Inadequate understanding of the complexity health domain by IT companies[23]
6. Under-investment in human resource capacity-building.[3,26]

These factors are discussed briefly below. Success factors, i.e. what leads to project success, can be defined easily as the converse of these; however a number of studies have also researched this area in depth.[18,29]

1. **Lack of senior management sponsorship** is often cited as number one cause of project failures in ICT, and this is particularly the case in health ICT projects. In the 12 years since Dorsey[25] published his report stating that almost every study to-date had identified top management support as a key factor in project success, it would appear that very little has changed. Any worthwhile project causes disruption within an organisation and challenges existing interests and practices. If senior management are not committed to the project and willing to undergo the difficulties involved in overcoming the internal and external barriers then the project is almost certain to fail
2. **Lack of engagement** of clinicians and other end-users remains a critical factor in the ultimate success

or failure of an ICT project. In their research on lessons learnt from telehealth projects, Elder and Clarke[26] remark that the fundamental issue pervading the continued failure of ICT projects in health is the lack of focus on the end-user. The internal dynamics of clinical organisations are quite different from those of other businesses. In a bank for example, management can enforce the introduction of new systems even if the end-users are opposed. In a clinical setting, doctors who have not been engaged in the introduction of new technology, who feel the systems waste their time or affect patient safety, can refuse to use the technology and often have the organisational power, even if informal, to have their wishes implemented

3. **Inadequate specification of requirements**. In some studies this is listed as the number one cause of ICT project failure. If the technical and functional requirements of the system are not completely and clearly specified and linked to the benefits that the new technology is supposed to deliver then the project can easily be a technical success but a business failure. Correct requirements specification will also elucidate the dependencies of the project on other systems and projects
4. **Insufficient time and resources** allocated to organisational and process change. The introduction of new ICT systems usually requires the introduction of new ways of working, new staff skills, new roles and may require organisational restructure. In general, people are resistant to such changes especially if they feel threatened by them. To successfully overcome such resistance so that the new technology will deliver the anticipated benefits requires effort into business process analysis, stakeholder communication and user training. The amount of time and effort needed for these activities is very often underestimated
5. **Health information systems are complex**. They not only deal with complex clinical information technologies, medical science, research and practices, but are often fragmented, disorganised and do not operate or progress as a coherent whole.[23,30] Frequently, technology companies coming into the health domain underestimate its complexity and proceed on the assumption that if something has worked in another domain then it should be possible to achieve the same in health
6. **The under-investment in human resource capacity-building** is a critical factor in the continued failure of ICT projects in health. As discussed by the UN agency on ICT for development, many proponents of ICT mistakenly assume that such projects are only about hardware, networking, software and applications; however a substantial amount of human activity is required when dealing with ICT.[18]

Developing world situation

Health ICT projects in the developing world face all of the issues and challenges of projects in the developed world plus having their own specific risk factors. Some of these risk factors are common across the sector and others are more specific to particular regions. In their discussion on the past, present and future of telehealth, Elder and Clarke[26] provide us with an all-too common scenario: a pioneering telehealth project is established in Uganda to enhance access of rural patients to doctors in urban hospitals through online consultations. However due to challenges with equipment, infrastructure and connectivity, no online consultations are ever made, and despite the considerable investment made to the project, no direct benefits to the health of the rural population were observed. They go on to describe this project as typical of its time: donor-driven, overly ambitious, lacking in adequate planning and capacity (human and technological) and too expensive to be widely adopted in resource-poor settings.[26] Despite this story dating back 10 years, and the 'bitter' experience of the countless other failed ICT projects, we are still in the position of having limited knowledge on what works, how it works and how much it costs; with limited actual evidence on the impact of ICT in health.[22,27]

One of the most common causes of ICT failure is the temptation to 'leapfrog' certain aspects of the development path, in an attempt to decrease the gap between developed and developing countries.[31] While technology offers an attractive means to bypass some processes in the accumulation of human or system capabilities, this approach is inherently risky for developing countries as few, if any, technologies are so well specified that they only need to be installed and turned on to work – most require a process of learning and adaption from the people and systems who will use them.[32] Furthermore, technology rarely stands independently; rather, it is embedded in a system of complementary technologies and capabilities and requires three key elements for success: (1) people, (2) process, and (3) technology.[18,32-33]

If ICT is to be used to provide information at the right time and when required, key elements must be understood including what to collect; where to collect; whom to report to; and how the information will be used and by whom.[34] Poorly planned 'interventionalist' behaviour that ignores user needs, fails to understand host capacities, demands action, neglects cultural constraints and ignores the local knowledge base, will only result in failure for health technologies.[35]

Pacific island countries and territories

In their conclusions on Pacific ICT capacity and prospects, the Pacific Islands Forum Secretariat remark that Pacific Countries and Territories continue to face the same issues and challenges: no or limited access to phones; high telecommunications costs and charges; a poor supply of skilled persons to manage and operate the technology; outdated legislation; and limited ongoing financial support.[36] Overall, four key challenges to the successful implementation of ICT initiatives in the Pacific have been identified: (1) telecommunications infrastructure; (2) human capacity and training; (3)

Furthermore, the **technology needs to be appropriate to the capacity and maturity of the health system**, and this includes both human and technological maturity, as 'if you automate a mess, you'll get an automated mess'[30]

affordability; and (4) appropriateness.

Telecommunications infrastructure

In their work on telemedicine and telehealth in the Pacific, Bice et al,[37] conclude that the state and cost of telecommunications and information infrastructure is one of the major barriers to the implementation of ICT in the region. They further remark that this problem is not unique to the Pacific, but rather a common barrier faced by rural and remote communities in developed countries, as well as other geographically dispersed populations. Overall, limited and unequal access, the high costs involved with both purchasing equipment and accessing its services, insufficient bandwidth, and an overall low investment in infrastructure networks make it extremely difficult to implement effective ICT projects.[36]

This sentiment is echoed in Chetley[38] when he discusses 'connectivity' and its role as an important constraint to the introduction and successful implementation of ICT in the health sector, and also in the work of Khazei and colleagues in their discussion of telehealth in Tanna Island, Vanuatu, and the stark reality that basic public health needs and infrastructure development remain a higher priority than any telehealth or other e-Health applications.[39] PATIS in Fiji;[40] the use of video-conferencing in the Marshall Islands;[41] the scanning of death certificates and use of SMS-based health promotion in Sri Lanka all relied heavily on an adequate supporting infrastructure.[42-43] PATIS has encountered issues with the reliability and quality of phone lines used to transmit data and an intermittent power supply. The limited infrastructure system in the Marshall's ultimately led to the downfall of the video-conferencing project. Furthermore, without the relatively sophisticated infrastructure systems of Sri Lanka, scanning of death certificates and the use of SMS simply would not have succeeded.

Human capacity and training

A second key finding is the impact of human capacity and training, as any technology will be insufficient if people do not understand how to put it into effective use.[44] Trained human resources for health are a major problem in healthcare systems in most developing countries, and particularly a problem in small Pacific nations.[38] The limited human resources and capacity available in the Pacific region, both in terms of technical skills in how to use ICT, as well as high-level technical support skills to ensure set-up and maintenance, has resulted in a high reliance on external resources and experts.[45] Such a reliance on external capacity drives ICT costs upwards, and also produces significant retention problems and a lack of locally-qualified personnel. However, it is not only the recipient country that needs capacity development and training in the use of ICT. As demonstrated in Vanuatu,[39] international e-Health consultants must know what local resources are available and have an understanding of the conditions of the country they are providing information to (for example standard treatment protocols and availability of various drugs and diagnostics). Overall, while technology can provide a link to information and knowledge, the critical factor in all ICT initiatives is human resources and capacity.[35,46]

Affordability

The affordability and use of technology is another key issue to emerge from previous experiences with ICT in the Pacific. If an intervention is to succeed, people and organisations need to be able to afford to obtain and access the technology. However expensive hardware and the high cost of telecommunications and internet connectivity remains a major barrier in developing countries, especially in remote communities.[44] While affordability represents an immediate problem, this will shift to issues of sustainability in the long-term, and as such, realistic choices about introducing costly ICT in resource-poor communities must be made. If people and organisations cannot afford ICT now, then subsidised projects will not succeed if long-term steps are not taken to improve the economic situation.[44] When planning ICT projects, there are often a large range of costs which are not considered in project proposals. These include initial costs such as infrastructure development (servers and networks), training and process change management and ongoing costs such as licence fees, technical support, system upgrades and ongoing training.

Bice and colleagues[37] also discuss affordability issues in relation to 'appropriate expenditures': while it is common for the majority of funding to be allocated to the purchase of ICT equipment there are other important factors requiring funds such as training and education and maintenance. Other less visible issues related to affordability and cost relate to how to value and assess the cost of medical consultations and other services across the region.

Appropriateness

The appropriateness of the technology or equipment itself is the fourth key finding, and it covers a broad range of topics related to the actual item of technology. As an example, only a limited number of ICT software applications have been developed in languages other than English. This is an especially important barrier in countries with small sub-populations who speak a number of different local dialects, as working in the field of ICT may require considerable working knowledge of a common language (such as English).[37] If ICT are to be meaningful, they must be locally relevant, and this extends to educational materials, health information and environmental data produced through e-Health initiatives.[44] Electronic equipment must be suited to a

tropical climate (including high humidity and sand/dust contamination).[39] The example of telepathology in the Solomon Islands demonstrates the difficulty in replacing specialised equipment, especially in remote and isolated areas. Furthermore, the video-conferencing phones used as part of the e-Health project in the Marshall's were discontinued, and the use of Rapid SMS in Vanuatu encountered major issues when over 100 mobile phones were stolen and could not be replaced easily.

Discussion

Overall, information and communication technologies have a potentially major role to play in health information systems. Technology in healthcare can improve access for geographically isolated communities; provide support for healthcare workers; aid in data sharing; provide visual tools linking population and environmental information with disease outbreaks; and is an electronic means for data capture, storage, interpretation and management. Such possibilities are especially important in the Pacific; a region that is characterised by remoteness, dispersed and small total populations and limited human resource capacity.

However, key issues have emerged in the implementation of ICT in the region: telecommunications infrastructure remains a major limiting factor in the success of many ICT initiatives in the Pacific (and developing countries in general). It is vital that aspects such as electricity systems, phone lines and internet connectivity are taken into consideration before implementing any new technology. Furthermore, human capacity and training are fundamental aspects of any ICT initiative. The affordability of the technology (and use of it) must also be assessed in terms of initial and ongoing costs such as licence fees, maintenance and support costs. Any ICT initiative that is heavily reliant on external funding is unlikely to be sustainable over the long term. Additionally, the exceptionally high cost of many telecommunications services in the Pacific remain a significant limiting factor to their use. There are also important hidden costs associated with technology, including maintenance, upgrades and replacing broken equipment, which need to be assessed.

Judgements must be made on the appropriateness of the technology itself. Moreover, the tropical climate of the Pacific region is damaging to equipment, such as computer hard-drives that require climate-controlled and dust-free environments. Appropriateness also refers to the anticipated benefits of the technology in comparison to its costs. While ICT initiatives have the potential to support health information systems, any project or new policy must have an appreciation of the context and challenges of the implementation environment.

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Issues and challenges for enhancing statistical capacity: Cook Islands perspective

Case-study

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Introduction

The Cook Islands consist of 15 small islands with a total population (in 2011) of 17,791 people, scattered over two million square kilometers in the South Pacific Ocean.[1] They lie in the centre of the Polynesian Triangle, flanked to the west by the Kingdom of Tonga and Samoa, and to the east by Tahiti. The total land area is 240 square kilometers. The islands are divided into two groups: the northern Cook Islands, made up of seven low-lying, sparsely populated coral atolls; and the southern Cook Islands, where most of the population lives, consist of eight elevated, fertile volcanic isles, including Rarotonga.[2]

Approximately 72 percent of the total population lives in Rarotonga; 21 percent in the southern group islands; and seven percent in the northern group islands. The remote outer islands are experiencing a steady decline in population.

The relatively small population, geographically dispersed islands, isolation, and distance between islands makes travel and transportation of goods and supplies generally very costly and time-consuming, providing a challenging environment in which to plan, develop and ensure access to equitable healthcare services.

Distance between islands	
Rarotonga > Mangaia	215 km
Rarotonga > Aitutaki	277 km
Penrhyn > Rakahanga	351 km
Rakahanga > Pukapuka	447 km
Rarotonga > Rakahanga	1204 km
Rarotonga > Pukapuka	1325 km
Rarotonga > Penrhyn	1366 km

Northern Cook Islands: Penrhyn, Rakahanga, Manihiki, Pukapuka, Nassau, Suwarrow

Southern Cook Islands: Palmerston, Aitutaki, Atiu, Mitiaro, Mauke, Mangaia and Rarotonga

The islands of Manuae and Takutea are uninhabited

Figure 1 Map of the Cook Islands[2]

Information and communications technology: MedTech32

Timely and reliable health information is vital to support evidence-based decision making. Previously, the patient information system in the Cook Islands used paper-based data capture and storage, with limited electronic systems. For the outer islands, reports were received on a monthly basis via faxes and/or postal mail. In Rarotonga, information was received monthly from departments (often from various registers), and data entered into a Microsoft Excel database, from which tabulations and analysis were executed and loaded into Microsoft Word for publication.

Because of unreliable transportation schedules, delays in receiving these reports resulted in the delayed publishing of health information and in most instances, published information was only available for the main island of Rarotonga, with a complete country report published over one year later. In some instances reports were lost in transit, with the data unavailable for future use.

In late 2004, MedTech32, a patient information system, was established to improve the health information system of the Cook Islands. The system enables the centralisation of patient medical records. It also electronically transmits results of laboratory tests sent to the main hospital on Rarotonga, back to the patient files kept on the main database for the Outer Islands. Goals of the system include centralising patient medical records; making all patient records available electronically; providing timely, accurate and up-to-date information; improving data collection, flow, processing, compilation and analysis. The overall vision is to provide a better picture of the state of population health in the Cook Islands.

Expected benefits

- Immediate access to key information, such as patient diagnoses, allergies, laboratory test results and medications, to facilitate clinical decision-making in a timely manner
- Increased patient safety and effectiveness of care, with all providers participating in the care of a patient (across multiple settings) able to access new and previous test results
- Enhanced legibility, reduced duplication and improved timeliness, through entering and storing orders for prescriptions, tests and other services in a computer-based system
- Using computerised decision-support systems (such as reminders, prompts, and alerts) to improve compliance with best clinical practices, ensure regular screenings and other preventive practices, identify possible drug interactions, and facilitate diagnoses and treatments
- Efficient, secure, and readily accessible communication among providers and patients to improve the continuity of care, increase the timeliness of diagnoses and treatments, and reduce the frequency of adverse events
- Tools that give patients access to their health records, provide interactive patient education, and help them carry out home-monitoring and self-testing to improve the control of chronic conditions, such as diabetes
- Computerised administrative tools, such as scheduling systems, to greatly improve hospital and clinic efficiency
- Electronic data storage that employs uniform data standards to enable health care organisations to respond more quickly to country and island reporting requirements.

Challenges

It was anticipated that MedTech32 would be able to provide the Cook Islands with timely and up-to-date information. The system would also be able to improve data integration and sharing within the Ministry and health centers on the Outer Islands. However, due to the lack of appropriate training provided to data providers and a lack of motivation to change among service providers, the system was unable to provide accurate and reliable information until five years after initial implementation.

Implementation of the new system added extra responsibilities to the two medical records personnel assigned to monitor the completeness of data entry processes, audit and edit the main database, classify unclassified consultations, and enter admission and discharged templates. With a fixed budget it was not possible to employ another staff member to manage monitoring of the database and to train others in this area of work.

The resistance to change also impacted on how well people accepted or involved themselves in training. The varying knowledge and experience of health professionals with regards to working with electronic systems (with a number of them working only with paper-based systems) impacted on providing appropriate training. Understaffing also impacted on staff availability for training sessions.

Overall, limitations identified with the system following implementation include:

- An insufficient number of licenses, which impacted on availability of the system
- There is no flexibility in modifying the system to accommodate local and future needs
- Providing appropriate training, especially to clinicians who now classify and enter disease codes at the time of patient consultations
- The outer islands are disadvantaged by slow and unreliable connectivity even-though their connectivity has changed from dial-up to broadband. As more users gain access to the network, it also runs slower.

Actions taken

In order to address these challenges, discussions between stakeholders were held to identify the needs required by the Ministry of Health to fulfill its aim of strengthening the information system and for it to be operational at all times. Discussions were held with Telecom, the only internet provider in the Cook Islands, and the MedTech32 developer to ensure continuous commitment and to provide follow-up services and training. More importantly, fruitful discussions were also held between data providers within the Ministry.

As a result of these discussions, the following actions were taken:

- More MedTech32 licenses were bought. Funding was identified and more licenses were bought increasing the accessibility from 40 to 55 users
- Connectivity was upgraded to broadband. Connectivity in the outer islands was changed to broadband from the dial-up system with new servers purchased. All Islands were given a computer
- Training was provided. More training was given to all health professionals, including visits to the Outer Islands, to improve the database for patient registrations, immunisations, classifications and required selected screening templates for completeness. Trainers are trained in each department to provide training to others and to monitor individual progress within their directorates
- A common disease listing was compiled. A compressed common classification listing was created for clinicians to use with common keywords given for all to classify similarly. With thousands of different keywords in the system it was identified that clinicians were not classifying diseases consistently across the country. Providing a common disease listing also reduced the risk for double classifications.

Results

As a result of these actions more users were able to use the system; faster connectivity was provided; standard common classification listings made it easier to code and retrieve data; and more staff were trained and continued to provide training to other staff members.

Medical professionals are able to view patient information that is critical to diagnosing patients, such as laboratory results, to be readily available and accessible to healthcare workers regardless of the hospital they are operating from. The Ministry of health is now able to get a better picture of the state of health in the entire Cook Islands in a timely manner.

Key messages

- Understanding your existing work practices is essential before undertaking system redevelopment
- Building a document that outlines the requirements for a new system is essential before developing a new system
- Identifying training needs prior to, and during development is essential
- Being aware of the resistance to change is essential along with finding ways to reduce the resistance
- Consultation with all stakeholders at all stages of system implementation is essential. It allows you to identify earlier issues such as staff dissatisfaction with the development and those resistant to change so that you can work out ways to resolve the issues before the development and training takes place
- Timely monitoring and upgrading of the system is crucial
- The provision of regular training is essential for the maintenance of quality information to all and targeting more trainers to continue divisional training
- Up-to-date, reliable and timely reports to Directorates and data providers are important
- The centralisation of data is an important aspect in ensuring timely access to information

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Developing a patient information system in Fiji

Case-study

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Introduction

Health Information Systems (HIS) are usually caught in a vicious cycle. Data is not trusted or used for policy-making at the country level so there is a weak demand for it. This leads to a weakened HIS and statistics systems with limited capacity to generate or analyse data. As a result, little investment is made into HIS from countries themselves, with investments rather being driven by donors, which focus primarily on their own data needs. Therefore, it is vital for countries to realise the importance of using their own local data to create a virtuous HIS cycle.

This document illustrates in detail the issues encountered by the Ministry, how these were resolved and what has been the impact on the ground with the improvements.

Patient Information System

Fiji, with the assistance of the Australian Agency for International Development (AusAID), developed its own Patient Information System (PATIS), based on an earlier system deployed in Samoa. The system collects health service information about patients and is designed to improve patient services and outcomes (out-patient appointments, immunisations, other medications taken); assist health service administration (bed allocation, occupancy rates, wait list monitoring); collect information for timely public health surveillance; and assist in health program monitoring. Information is recorded at a patient level to enable information to be retrieved at individual patient, village, facility, sub-division, division or national levels.

PATIS has eleven (11) modules, namely Patient Master Index (PMI); Admission Transfer and Discharge (ATD); Accident and Emergency (A&E); General Out-Patient (GOPD); Specialised Out-Patient (SOPD); Public Health, Dental, Pharmacy, Microbiology, Disease Index (DI) and Radiology. The PMI is used by all other modules to uniquely identify the client and record the incidences of services in the appropriate modules. Regular enhancements to PATIS have been made over the last eight years to meet the demands of the HIS. The general principle behind the development of PATIS was to ensure a clinical system that allows improved patient care and records management as opposed to the manual system. However, the reality was that the technological design of a decentralised patient information system had data quality and clinical information issues.

Reality Check: Issues encountered

When PATIS was deployed to health facilities around Fiji it was installed in database servers at each site. These servers would then replicate the changed data collected during the day to the server at headquarters (HQ), which would then consolidate all data files from each facility and upload to each server to synchronise records. At the time, this approach allowed synchronisation of multiple databases using low bandwidth dialup connections. The system would generate a national health number (NHN) for each patient visiting the facility to uniquely identify them.

This system worked fine with low volume transactions during the early years through the dialup and leased-line connections to HQ. With the increasing demand and numbers for NHN, together with high volume of transactions per module, it was becoming a problem to successfully transmit all data across to HQ through its existing bandwidth. This resulted in multiple databases becoming increasingly unsynchronised.

There were data quality issues such as duplicated records; incomplete, inaccurate data; and missing records in health facilities. Patients would also forge names or present their relatives' NHN cards for accessing patient care, thus creating inaccurate patient records that jeopardised continuous care on the system for a particular NHN.

Overall, there was an urgent need to redevelop a centralised web-based electronic medical records (EMR) system with a focus on sharing clinical and statistical information on patients. The central database would then be continuously linked to all health facilities accessing information (compared to previous implementation where there was a need to synchronise).

The central database would be interfaced with a web-based graphical user interface (GUI) to allow faster access and ease of use. Such a setup would also mean that enhancements only had to be done at the point-of-change, rather than updating multiple servers at each site.

This solution was viable due to the improved infrastructure development in Fiji for communications on higher bandwidth, increased skilled resources in the country to develop and manage such systems and enhanced hardware and software capabilities, which

were all not initially possible.

Redevelopment

The redevelopment process involved many stakeholders. These included the data custodian (Ministry of Health, Fiji Bureau of Statistics and Register General), project sponsors (AusAID – Fiji Health Sector Improvement Program and Fiji National University) and the system developers (Software Factory Limited (SFL)).

The approach was to source donor funding first by presenting the issues and constraints of the existing system. Once funding was secured through AusAID, a tender was called for the new system. A technical review team was established to select the vendor to complete this project. After various stringent screening processes, a local company (SFL) was selected to redevelop the system with additional features. The system, once implemented, would be handed over to Ministry of Health with all source codes and documentation to ensure the Ministry of Health's information technology team could maintain and sustain the system for years thereafter.

Issues and Constraints

During the scoping of the tender requirements all issues and constraints in the system were highlighted and documented. Data quality issues identified included: misspelled names of individuals; duplicate entries; individuals having multiple NHNs; incorrect data (date of birth, address, date of death, cause-of-death, discharge date) and types, quantity and cost of drugs being utilised.

Other issues and constraints included:

Data Issues

- **Data replication and sharing between servers.** Data replication was done by creating text files from the system using database scripts and keeping them in a dedicated folder, which was then sent via the network medium to HQ. The HQ server would then read from its dedicated folder all the files and create a consolidated file for others to read and update their databases. This process had problems at every stage, where data or data packets would be lost, thus resulting in incomplete data. The size of file also had an impact and usually caused the replication to fail
- **Data inaccuracy.** Most reports were not producing 'true data' due to inaccurate data and also the way the system processed and rules were set for calculating bed occupancy, average length of stay and statistical summary data
- **Local data.** The system did not capture local data such as clinical notes on outpatient episodes of care, dietary details, physiotherapy and Operation Theater encounters. It also did not have provision to capture laboratory-test results and radiology images.

Human Resource Issues

- **Coding training.** The coding process using ICD-10 was a concern as only a limited number of staff were trained in this and major interventions and policy decisions were made based on data classifications for morbidity and mortality
- **Insufficient training.** Significant data entry problems were encountered as experienced users retired, went on leave or resigned, and new users were not properly trained on the concepts of proper data entry and standards. Spelling errors, incomplete entries and failure to meet validations were common issues

Capital Resources Issues

- **Infrastructure.** The architecture of PATIS was built on Microsoft Access 2000 and Microsoft SQL 2000; however both of these systems are old and not conducive to latest technological advancement of Microsoft Office 2010 and Microsoft SQL 2008 R2. The computers were also outdated and slow, and there was demand for more
- **Finance.** There was very limited budget to sustain the system in the Ministry. Significant donor funding was used to pay vendors to maintain the system and do enhancements.

Resolution

To resolve the data quality issues there was an urgent need to develop health information policy that would encompass all aspects of health information, and was country-owned. The policy needed to address issues such as data dictionary, metadata, health indicators, data repository, data sources, reporting templates, guidelines, role of health information unit, monitoring and evaluation, staff capacity building and information and communication technology needs. The policy was used as a strategic 'weapon' to ensure data quality measures were put in place with efficient monitoring and evaluation. Database issues were resolved by hiring a short-term advisor to review and clean the 15 databases using computer algorithms. A thorough analysis was done on the PATIS application to determine causes of error and whether these were programmatic or due to replication. Various software tools and a team of staff were brought together to resolve these discrepancies. The correct methodologies were then documented and put in place to ensure sustainability and reliable data. Lessons learnt from these exercises were used for the new application and applied for better performance and reliability.

Resource constraints for technology were resolved by ensuring the new system used the latest versions of software such as Microsoft SQL Server 2008 R2, residing on Microsoft Windows Server 2008, .Net 4.0 Framework for application development with Rapid Application Development tools. The network infrastructure was changed to a virtual provider network with service level agreements in place with vendors to ensure maximum

24/7/365 up-time. The user interface was changed from windows client deployment to a web-user interface for ease of use and maintenance. The IntelliSense feature of Visual Studio 2010 was applied to assist in faster data entry through auto-completion. Additional staff were appointed; particularly an assistant for the National PATIS Administrator. There were also four health information officers per division to strengthen health information and allow advocacy of health data dissemination and use. These staff are now engaged full time in the Ministry assisting in the implementation, training evaluation and strengthening of the health information systems. Technical staff such as coders and recorders were trained on a more regular basis to improve data standards.

Business Process Mapping

One of the key success factors for any new system is to conduct a business process mapping exercise. A full requirements specifications document was created and endorsed. This was done through various walkthroughs of hospitals departments, meeting with key personnel and coming to a consensus during workshops. User-case diagrams were created and verified with module champions. Every report from the current system was assessed by the user community and module champions. Its importance, use, whether it was working and if there was any changes required were all documented. Non-functional reports were analysed for causes of failure such as programmatic or poor quality data. New reports were designed to ensure maximum use of local data. Workflows were designed for “as is” scenarios and “to be” scenarios. These were then tested with other processes by creating test case scenarios. Initial testing was done by the developers, then the testers (IT Staff) and finally the users. This ensured complete testing on various aspects including black box and white box testing.

Impact

There has been a massive impact by the development and endorsement of the health information policy. Health Stakeholders are now adhering to the policy requirements and value the importance of data and its use. Fiji is seeing an improvement in the reporting and quality of health data. The policy led to the development of a National HIS Strategic Plan 2012-2016. There have been various advocacy and promotion activities on data quality and use of health information by Health Information Officers (HIOs) and National PATIS Administrator (NPA). We have seen appropriate application of information and communication technology (ICT) resources such as emails and internet. The strengthening of the National Health Information Committee (NHIC) has led to enhancement of mechanisms for effective communication, cooperation and coordination. The Ministry has also formed a donor coordination matrix that allows pooling of resources (human and financial) through development partners and government assistance for health information initiatives whilst focusing on health indicators and outcome.

The system is now able to provide clinical and statistical data based on roles to staff for operational or strategic decision making. Due to better record keeping and centralised storage of data it allows improved patient care and builds a platform for public private partnership. The aim is for the whole nation to have one source of all medical records for better care of individuals.

What steps are being taken to ensure continued impact?

To ensure continued impact the Ministry has enacted steering committees and a working group to manage various components of health data. There is regular monitoring and evaluation with feedback from the Division of Health Information, Monitoring and Evaluation. Staff capacity strengthening and retention strategies have been put in place through training needs assessment and consultations with Public Service Commission on succession plan or pathways for various cadres.

Key messages

It is ideal to dream but to achieve goals one must pick short-term quick-win solutions that reap rewards that are visible. ‘Think big and start small with quick rewards/ achievements to gain support’: this gains the support of senior management and also donors who would continue to support initiatives.

Communication is a vital tool that is necessary for any project to succeed. Let’s communicate more for a better regional HIS.

The approach taken by Fiji has seen its reward and it has the potential to be used as a regional HIS model. Other countries that would like to develop new HIS systems must ensure the importance of local data is emphasised and the system is developed on local requirements. It is not wise to buy first and then align your processes to suit the system.

1. *Think before you do, not after you’re done*
2. *You know, you teach, you don’t know, you learn*
3. *Don’t ride an elephant to catch a grasshopper*

Further reading

www.patisplus.gov.fj

Improving HIS for better health policy and planning

Case-study

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Introduction

Effective decisions on health policy and planning are made based on quality health information; therefore, without quality health information, adequate planning and the implementation of new health policies cannot be expected to be effective. Nauru is a small, single island country based in the Southern Pacific region. Due to its small size and isolated geographic location, Nauru faces significant challenges when it comes to health planning that are not uncommon to small island countries. The biggest issue Nauru faces in terms of health information is duplication and inconsistencies in the information collected. The aim of the work currently being conducted in Nauru is to improve the quality of health information so that decisions can be made with confidence regarding health planning and, ultimately, policies can be developed based on quality information.

Health information in Nauru

Prior to 2009, upon requesting the total number of births for Nauru there were four separate figures available:

- Registry of Births Deaths and Marriages
- Republic of Nauru Hospital – Maternity Ward birth register
- Republic of Nauru Hospital – Medical Record Department
- Bureau of Statistics.

The issue here is not only the duplication of services in an already stretched workforce, but also a general lack of consistency in the figures provided by each information source. It is these inconsistencies in numbers from different sources that undermine the confidence of decision makers when seeking to use this data. Furthermore, the inconsistencies witnessed within the data exist at each stage of the process; including the collection methods, analytical methods and reporting methods. Further investigation of these issues indicated that they existed in the majority of health statistics used in Nauru.

Numerous reasons were identified for these inconsistencies, including the use of paper-based data collection methods. This style of collection can be problematic; particularly if staff have large work and/or patient loads, are not trained on how to complete the forms correctly, or if there is a low level of educational attainment within the country leading to literacy and numeracy difficulties. Another issue was that much of the data was aggregated rather than presented at the unit record level. This means that data was only available on a country or provincial level and not at a regional level. For example, this makes it impossible to identify differentials in fertility rates on a sub-national level. There was also no set of standards to report to/against. Many indicator reporting requirements were to external agencies and there was a general lack of experience and skills of staff. Appropriate infrastructure was also scarce, particularly at the village/community level.

After these issues were identified, it was decided the relevant sectors of the Nauruan government, along with the assistance of external agencies, would ensure effective decision making by creating a Health Information System (HIS) where skilled staff are collecting, managing and storing health information using best practice methodology.

In order to do so, there was an inherent need to bring together the key players in Nauru as well as seek assistance from external agencies (Box 1). The first step in this process was to conduct a HIS assessment, which occurred in in May 2009. This was undertaken over the course of one week and resulted in a detailed report with a number of action items identified. Some of these tasks were undertaken immediately; others required further assistance which led to the implementation of a Policy Partnership Initiative.

Box 1 Key players in HIS-strengthening in Nauru

Within Nauru

- Ministry of Health
- Registry of Births, Deaths and Marriages
- Bureau of Statistics
- Planning
- Information, Communication and Technology

External agencies

- AusAid
- AIHW
- HIS Hub
- HIS Consultant

The next step was the Strategic Planning Workshop which occurred in February 2010. Using the previous assessment conducted in 2009 as a base, further discussion was held by the consultants during this visit. The workshop was held with the aim of developing a strategic plan to allow Nauru to move forward with the improvement process. Nineteen key actions were identified in the strategic plan, some of which included:

- Improved reporting
- Improved collection
- Improved communication
- Increased skill levels and knowledge of HIS.

Actions were operationalised and have been progressively addressed since February 2010, including:

- Development of a National Health Data Dictionary
- Review of Indicators
- Establishment of standard reporting templates
- Review of birth and death registration processes
- Establishment of a National Health Information Committee
- Health Information Register for morbidity data
- Forms review.

Outcomes and key achievements

The activities carried out in Nauru have improved the quality and availability of health information, as well as contributing significantly to the establishment of a computerised patient information system. Other key outcomes include:

- More comprehensive reporting on a regular basis has been achieved since the establishment of a unit record level data collection in the Nauru health information register. This register includes data that details hospital wards, gender, treating doctor(s), principal and other conditions as well as district
- The ability to analyse cause-of-death and mortality information is now possible, since implementating coding of this data. This is something that has not been done previously by Health Information staff
- The roles and responsibilities of staff at different levels and in different sectors are now much more clearly understood. Important tasks such as who collects what, when, how and why, is now much more explicit. This in turn allows a better understanding of the scope of the data collected, and the identification of ways to improve collection, gain consistency and remove duplication
- An improvement in cross-sector communication has also been witnessed since the workshop; different departments no longer work in isolation of one another. The Ministry of Health recognises that they are not the only ones that collect and are responsible for health information. There is now greater communication between Health, the Bureau of Statistics and the Registry of Births Deaths and Marriages. Also within the health sector people are talking to each other about how they can improve health information
- Increased awareness of the importance of health information across departments has been achieved, including an understanding of their role in health information. People are now asking questions about health information – asking if there is a better way for them to collect the information, if it is already being collected, which helps to identify inconsistencies and improve consistency in collecting and reporting
- Rather than basing decisions on anecdotal evidence, managers can now make better decisions on health resources. For example, if a manager wants to know how busy the maternity ward is, the health information unit can ask questions of the data, like 'has there been an increase in births?' Likewise with the number of outpatient attendances, which are said to be increasing, the unit can not only confirm that this is true, but also provide a listing of all patients seen including the conditions treated, age, gender and treating doctor
- All of this has lead to the staff working with health information feeling more confident in the role that they undertake and considering that it is more than just a data entry role. They have a role in the quality of the information and have been working hard to improve the quality
- The Minister of Health has demonstrated a keen interest in making sure that this project is successful. He reads the regular reports and provides comments. He has indicted that he is willing to discuss issues with Ministers in other departments if necessary to keep activities moving

Key learning's for other countries

Training options, face-to-face, online or self-directed, need to be considered and appropriate training offered to staff when the timing is right – i.e. when the people can go back and expand on the skills that they have learnt. A key aspect is to not let the consultants do the work for the staff; as staff learn little from this approach. It is better to provide the training, but ensure that people are given the opportunity to do practical exercises that are relevant to the work that they do. Consultants should then take a step back and observe as the people do the job themselves which builds local capacity. Other key takeaway messages are outlined below:

- *Everyone needs to work at making this a success* – it cannot just be one person driving the change – there needs to be commitment at all levels. It will not happen in a short period of time – be realistic about what you can achieve and when. Set realistic timeframes for completion
- *Ensure health Information strategies cross department boundaries* – the Ministry of Health are not the only people who should be involved. Get your Bureau of statistics involved, your Registry of Births Deaths and Marriages – and any other agency who you identify collects/stores/manages/uses health information
- *Keep the conversation going and never stop talking* – keep the messages coming from all levels. Ensure key personnel keep passing on the messages about the importance of health information – but make sure that the people who are responsible for it at all levels, hear the message and pass it back up the line and across the boundaries
- *Do not reinvent the wheel* – Nauru used a number of activities and products developed by others, and those developed in Nauru can be shared among other countries
- *Develop a National Health Data Dictionary* – Nauru adapted the Tongan dictionary and have continued to expand and define terms – including the many indicators currently reported on, which could also be used by others
- *Improve birth and death reporting processes* – Nauru now have an information sheet for parents for birth registration, which others could use. Nauru also "tinkered" with the format to make it more user-friendly (no change to the questions), and this information can be shared, as can the work done so far on death certification and registration processes
- *Develop standard reporting formats* – simple easy to complete standard reports
- *Make activities available through an information portal* – all of the above activities and products are ones that could and should be shared. Even if there is only one idea or concept that is adopted by another country, we should share our experiences and make our work available. We need to consider some method of being able to make our tools, materials, etc, available to others
- *Develop a regional approach to training* – countries need to consider what can be offered online – with good support material. What can be offered through a self directed approach with a mentor or tutor to provide support? Is it valid to undertake a training needs assessment and then develop a regional training plan?
- *Consider a regional approach to the development of a computerised patient information system* – Nauru will soon be approaching the point where it wants to introduce a computerised patient information system. Are other countries in the same place? Can we consider how to do this as a team, rather than each country struggling along to identify relevant options – can we explore them together – identify the advantages and disadvantages of each, and work on business proposals and implementation plans together?

This case-study has outlined the health information issues faced by Nauru. Firstly it described the issues and problems within the system, then identified the key actors and required actions to implement change. The case-study outlines the outcomes and achievements and finally concludes with the key learning's for other countries to consider when trying to implement change within the HIS.

Health Information Systems Reform: The Fiji way

Case-study

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Introduction

Health information must be appropriate and have the ability to provide meaningful information to all users, whether these are health managers, administrators, clinicians, or any persons in the health sector or in the community more broadly. Reforms in health information systems (HIS) have long been on the radar of health administrators globally. The Ministry of Health of Fiji was among those that realised the inherent need for quality, timely, relevant and accurate health information to make critical decisions to enable equitable distribution of resources for the provision of health services in Fiji.

Subsequently, with support from the Health Metrics Network (HMN), the Ministry of Health carried out a nationwide cross-sectional assessment of the National Health Information System on the 6th and 7th of February 2008 using the HMN Assessment Tool.[1] The main objectives of the assessment were to:

1. Raise awareness of the importance of HIS at an inter-governmental level between the major health information producers and users
2. Introduce the HMN Framework and Tool to improve health information sharing, analysis and use
3. Explore the views of stakeholders on the current status of HIS in Fiji and capture recommendations for improvements.[2]

Following the recommendations from this assessment, the Health Information Unit in collaboration with development partners and stakeholders, progressed the agenda of health information reform for the Republic of Fiji.

Components of the HIS:

A situational analysis of HIS in Fiji, conducted as a pre-requisite to HIS reforms, stated that 'a well-functioning health information system is one that ensures the production, analysis, dissemination and use of reliable and timely information on health determinants, health system performance and health status, particularly when resources are limited and needs to be allocated to most deserving areas'.[3]

The components for such a HIS are rooted in the HMN definition and are identified as follows:

1. Resources
2. Indicators
3. Data Sources
4. Data Management
5. Information Products
6. Dissemination and use.[4]

The HMN assessment (2009) identified aspects of the components as priorities for reform in Fiji. The situational analysis (2011) also identified a relative lack of strategic direction and policy coverage for HIS.

Prompt for Action

Fiji's participation in the Asia-Pacific Leadership forum on HIS held from June 13-16th, 2011 in Manila, was the catalyst for the reforms in progress. The multi-sectorial contingent from Fiji was made-up of seven participants representing a range of agencies, including Fiji Bureau of Statistics, Ministry of Health (health information, policy and information technology), Registrar General's Office, Ministry of Finance and Ministry of Strategic Planning.

The forum included approximately 120 participants from the Asia-Pacific region, which provided participants exposure to a diverse range of health information systems and a myriad of discussions on strategies to improve HIS. This included specific discussions on how to use health information to ensure the equitable distribution of health resources for quality healthcare for all. Forum objectives included:

1. Broadening participants' perspectives on implementation options, challenges and roles related to HIS by interaction with colleagues from other countries and sectors
2. To develop participant awareness of the roles of various sectors in strengthening HIS and strategies for improving cross sector coordination
3. To explore leadership roles in managing HIS as a national asset
4. To develop action plans to promote stakeholder engagement and commitment to HIS
5. To allow development partners to contribute to

and follow on resources (information, financial and technical assistance) to countries, post action planning.[5]

The need for multi-sectorial collaboration is illustrated in the health information flow, which cuts across many different sectors and institutions. This is also seen in the close link between economic development and health; or alternatively in the case of road safety and disaster management. The success factors for multi-sectorial collaboration include HIS leadership and ownership at all levels, better information and evidence provision, pooling and sharing of resources, better understanding of organisations and structures within institutions, common understanding of the issues at hand, capacity and commitment for collaboration, and improvement of trust and legitimacy between stakeholders. The multi-sectorial participation in this forum was the foundation for the tide of HIS reforms that followed.

Vision

The Fijian delegations' vision of reforms in HIS for Fiji were, *'to work towards a well-coordinated, efficient, accessible and accurate health information system through strengthened multi-sectorial engagement to improve health outcomes'.*

High-level support

The political commitment to HIS reforms were exhibited through the support and initiation of reforms by the Honourable Minister for Health, Doctor Neil Sharma, who has been the catalyst for action on the HIS front and continues to provide support for HIS. His leadership has brought the inherent need for quality, timely, accurate and relevant health information to the forefront, through his evidence-based practices for policy initiation and implementation.

Action plans

The action plans developed reflected this vision and were based on the HIS Country Ownership and Leadership Continuum:

1. Governance and multi-sectorial engagement
2. Strategic planning and financing
3. Policy and the regulatory environment
4. Information use
5. Infrastructure
6. Human Capital Development
7. System and Data interoperability.

Furthermore, this was in alignment with the HMN assessment (2009), which looked at gaps in six HIS components.

However, the Continuum strategically directed reforms through a multi-sectorial lens and allowed the facilitation of a higher level of reforms than those targeted by the HMN assessment, which looked at institutional facilities within the Ministry of Health.

The establishment of a multi-sectorial working group was one of the areas identified as a priority in the action-planning phase. The second area targeted was the coordination of development partner assistance in-line with national policies and priorities.

A national Health Information Policy was achieved through the technical assistance of the World Health Organization, the Global Fund Round 8/9 funding and the Multi-sectorial Working Group. Further to this, the first Health Information System Strategic Plan (HISSP) was drafted (both version one and the first costed strategic plan) in consensus with the Multi-sectorial Working Group. The strategic and policy direction were country led and country owned, and the Multi-sectorial Working Group was committed to producing a plan policy for the reorientation of the HIS in the country.

Conclusion

A well-managed and well-coordinated HIS is crucial in ensuring that decisions that impact on the provision of life-saving interventions and disease-reducing public health interventions are made on the basis of accurate, relevant, timely and quality evidence. Health information is required by a wide range of stakeholders, from the community through to policy leadership levels; to measure overall performance, impact of programs and activities for improvement in service provision. Health information continues to provide the basis for planning, implementation, monitoring and evaluation of all components required to improve disease-specific and general service delivery in Fiji.

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A review of health leadership and management capacity in the Solomon Islands

Original article

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Executive summary

This article describes the current state of health management and leadership capacity and issues that affect management performance in the Solomon Islands. Solomon Islands has a population of about 500,000, nearly 40% of which are under the age of 15 and around 80% live in rural areas.

The country has undergone significant social and economic upheavals over the past decade which have greatly affected its developmental efforts. Armed conflict arising from tensions between rival ethnic groups contributed to the degradation and near collapse of the economy between 1998 and 2003.

The tensions led to the deployment of the Australian-led Regional Assistance Mission to Solomon Islands (RAMSI) to restore law and order in 2003. As a result of the internal conflict and weak domestic revenue generation, the Solomon Islands economy currently relies heavily on external donor support. Overseas development assistance accounted for nearly 48% of the country's gross national income in 2006. The Australian and New Zealand governments provide significant budget support to the health and education sectors. The health sector has seen some improvements since independence but formidable challenges remain. Life expectancy at birth rose by nearly five years from 62.2 years in 2000 to 67 in 2010. Infant mortality has dropped significantly from 66 per 1,000 live births in 1999 to 24 per 1,000 in 2007. An increasing number of births occur in a health facility under the supervision of skilled health personnel.

According to the Solomon Islands Demographic and Health Survey 2006–2007, eight out of 10 births occur in a health facility and about 85% of births are attended to by a trained health professional. The maternal mortality ratio, nonetheless, remains high at about 220 per 100,000 live births. Overall, the Solomon Islands will have difficulty in meeting its Millennium Development Goals (MDGs) by 2015. Solomon Islanders also face increasing risks of non-communicable diseases: the recent Solomon Islands STEPS Survey reported that 46% of the population is at high risk.

Significant challenges exist in the area of human resources for health, relating to cost containment, production and deployment. As at December 2010, there were a total of 2,728 health workers in the public sector in Solomon Islands. Of these, 153 were medical doctors or dentists, 936 were nurses, 524 were nurse aides, 569 were allied health professionals, 126 were administrative staff and 420 were in other support roles.

Shortages in certain cadres of health workers have been reported, particularly specialist doctors and nurses, and allied health professionals. The doctor per population ratio stands at about 1:3,300. The Solomon Islands Government (SIG) has signed a cooperation agreement with Cuba which has led to the supply of 10 Cuban doctors to work in Solomon Islands and 75 Solomon Islands students going to study medicine in Cuba, most of these students are due to return in 2013.

Improving health management and leadership capacity and performance has been identified by the Solomon Islands Ministry of Health and Medical Services (MHMS) as critical to improving health delivery and achieving the MDGs. The review this article is based on identified several issues that are affecting management and leadership capacity and performance at the provincial level, where 10 provincial health directors are appointed. There is good evidence that health management capacity in the provinces is generally weak, as the turnover rate of provincial health directors is high and the posts are filled by recent graduates. Provincial health directors and members of their health management teams reportedly have clinical backgrounds and few have training in public health planning or health management.

Financial and human resource management skills

Improving health management and leadership capacity and performance has been identified by the Solomon Islands Ministry of Health and Medical Services as critical to improving health delivery and achieving the Millennium Development Goals

are limited, with provincial health authorities in need of training in the use of the MYOB computer software adopted by MHMS for accounting purposes. The desire of the MHMS to strengthen management capacity is made explicit in the National Health Strategic Plan 2006–2010. Several management and leadership training activities have been organised, however, they appear to have been largely donor-driven. As in other Pacific Island countries, high staff turnover and mobility require management and leadership training programs to be available on a continuing basis.

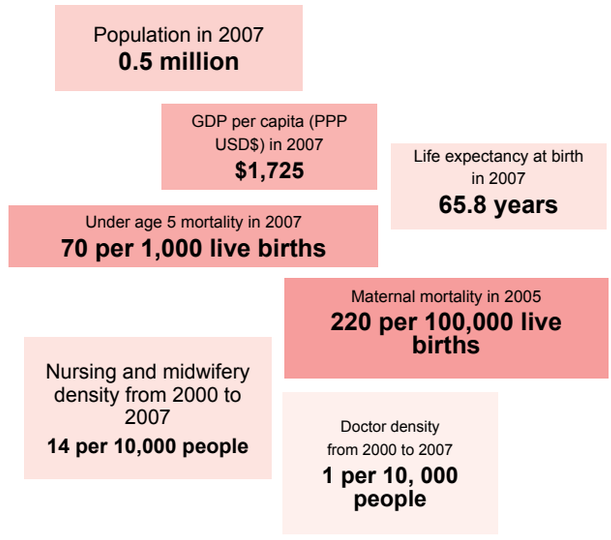
The dual role responsibility of managers is perhaps the biggest obstacle to management effectiveness at the provincial level. The provincial health directors are clinicians and reportedly spend much of their time providing clinical services and less in planning and managing services. The emphasis on primary health care and strengthening provincial and sub-provincial services requires accompanying management guidelines to detail the responsibilities of national and provincial health authorities. Out-of-date job descriptions, failure to structure work activities, lack of performance management systems, and poor time and attendance records make it difficult to improve service performance, particularly where the roles, responsibilities and lines of accountability of staff extend beyond provincial to central authorities.

Management support systems do not adequately support provincial health managers. The budgeting and financial management system, in particular, poses a significant challenge to provincial health directors. Due to limited budgeting and accounting skills within the health system, there are often delays in the release of funds to provinces from the central level, disrupting service provision and resulting in under-spending budgetary provisions at year's end.

The health management information system serves the purposes of annual planning and national reporting rather than personnel management and resource allocation decision making. It is reported that provincial health directors rarely use health data for management decision making. This may be due to the infrequent collection of data, insufficient management-relevant information and limited ability of provincial health managers to analyse and understand the available data for operational and day-to-day management activities.

In conclusion, the challenges facing health managers and leaders in the Solomon Islands are similar to those of many low- and middle-income countries; they relate both to the managerial competence of individual provincial health directors and the constraints of the national economy, organisational structures and the societies in which they operate. In seeking to strengthen management and leadership capacity, Solomon Islands will need to build the competence of individual managers while concurrently addressing the broader structural and systemic issues that constrain management performance.

Snapshot Solomon Islands basic demographic and socio-economic data (Adapted from UNDP[29,49])



Key to acronyms	
GDP	Gross domestic product
PPP	Purchasing power parity
USD$	United States Dollars

Introduction

The Solomon Islands is the third largest country in the South Pacific after Papua New Guinea and Fiji with a population of about 500,000. The population is scattered across more than 5,000 villages on 350 inhabited islands and speaks over 80 distinct languages.[1] About 80% of the population lives in rural areas, and 40% is under the age of 15. The population growth rate is currently estimated at about 3%; one of the highest in the developing world.[2] The Solomon Islands has undergone significant social and economic upheavals over the past decade that have greatly affected the country's developmental efforts. Armed conflict arising from tensions between rival ethnic groups contributed to the degradation and near collapse of the economy between 1998 and 2003.[3] The tensions led to the deployment of the Australian-led RAMSI to restore law and order in 2003.

The Solomon Islands' economy is heavily reliant on external donor support partly as a result of the internal conflict but also due to weak domestic revenue generation. Overseas development assistance accounted for nearly 48% of Solomon Island gross national income in 2006.[4] The Australian and New Zealand governments have provided budget support to the health and education sectors since 2005. The Australian Government provided AUD$216 million in development assistance to Solomon Islands in 2008–2009, while the New Zealand Government's bilateral assistance for the same period totalled NZD$35.7 million.[5,6] Taiwan provides recurrent budget support for national debt servicing. Overall, donors have provided a steady level of on-budget (grant) funding for development spending as well as funding for off-budget expenditures.[2]

Despite this significant donor support, the well-being of the vast majority of Solomon Islanders appears to have seen little improvement since independence in 1978.

In recent years, the Solomon Islands' economy has witnessed rapid growth; between 2003 and 2008 the economy grew substantially at an average annual rate of 7%. However, this has not been enough to recover from the decline partly due to the civil conflict.[7] The rapid growth of the economy has been driven largely by a surge in aid flows and an increase in logging activities, which contributes over SBD$200 million to the economy annually.[2] As the country's natural forest is depleting rapidly, the Solomon Islands faces severe challenges in sustaining the high economic growth it has enjoyed in recent years. Efforts are being made by government and its development partners to improve public sector management and also to build and stimulate growth in the private sector. However, growth in the local private sector will not be sufficient to provide jobs for the rapidly growing labour force, and for many Solomon Islanders the best prospects for well-paid, productive employment may lie overseas.[7]

With rapid population growth the health sector poses a growing challenge. Despite significant progress since independence, several health indicators compare poorly with those of other Pacific Island countries. Along with other countries in the Pacific, infant mortality has improved markedly, dropping from 66 per 1,000 live births in 1999 to 24 in 2007.[8] However, it still lags behind neighbouring countries, such as Fiji and Tonga, where rates have dropped to 16 and 19 per 1,000 live births respectively. The maternal mortality ratio was estimated at 220 per 100,000 live births in 2005; significantly higher than the East-Asia and Pacific region average of 120 per 100,000 births.[9] Life expectancy at birth, on the other hand, rose by nearly five years from 62.2 years in 2000 to 67 in 2010.[10]

Like many developing countries, the Solomon Islands is undergoing an epidemiological transition and now faces a double burden of communicable and non-communicable diseases. Malaria continues to be a leading cause of mortality and morbidity, especially among children and infants. In 2007 clinical malaria and fever accounted for 28% of acute care attendances.[11] At the same time, non-communicable disease risk appears to be rising in the Solomon Islands; a recent study by the SIG and WHO reported that 46% of the population is at high risk of developing a non-communicable disease. About 67% of the study population was considered overweight and 33% diabetic.[12]

Like many developing countries, the Solomon Islands is undergoing an epidemiological transition and now faces **a double burden of communicable and non-communicable diseases**

Purpose and approach

The purpose of this article is to describe the current status of health management and leadership capacity in the Solomon Islands public health sector and to analyse issues that affect the performance of provincial health managers. It is part of a review study intended to inform the development of policy recommendations for improving management and leadership performance in six AusAID priority countries – Cambodia, Fiji, Lao PDR, Papua New Guinea, Solomon Islands and Timor-Leste.

A review was conducted through desk review of both published and grey literature and discussions with key individuals. The next three sections of this article provide a brief description of key aspects of the health system of the Solomon Islands and the final four sections attempt to assess management and leadership capacity by using a modified version of the WHO MAKER[a] framework.[13] Key components of the framework include the number and distribution of managers, managerial competency, the management working environment, management support systems and socio-cultural context in which managers operate. A summary of key points about management and leadership in the Solomon Islands is provided at the end of this report. Detailed analysis and discussion of the issues identified in this series of reviews will be presented in a separate paper that brings together all of the issues identified from the six countries, and will be available at www.hrhhub.unsw.edu.au

Access and utilisation of health care

The Government of the Solomon Islands has the primary responsibility of providing hospital and primary health care services to the population under the Health Services Act of 1979.[14] Overall, health care is available at national, provincial, area and village/ward levels.[15]

The National Referral Hospital in Honiara provides tertiary level care while provincial hospitals provide secondary level care. Primary health care is mainly provided by area health centres and rural clinics. As of December 2010, there were two large provincial hospitals in Western and Maliata provinces and seven smaller ones in other provinces; 37 area health centres; 103 rural health clinics and 185 nurse aide posts.[16] Church health services, particularly the United Church and Seven Day Adventists run and staff health clinics, hospitals and nurse training schools, which are also supported through Health Sector Support Program funding.

Access to health care in the Solomon Islands is constrained by a range of factors including security, human resources, finance and socio-cultural factors.[17, 18] The armed conflict that engulfed Solomon Islands between 1998 and 2003, and on-going ethnic tensions thereafter have endangered the safety of health workers especially in rural and remote areas and significantly disrupted the provision of primary health care services.

a MAKER: Managers taking Action based on Knowledge and Effective use of Resources.

In the Solomon Islands National Health Strategic Plan 2006– 2010, the Health Minister acknowledged that the population has experienced severe health problems as a result of the ongoing tensions and armed conflict, which have partly led to a relative collapse of primary health care in the country.[17]

In addition to the disruption of service provision, primary health care infrastructure has degraded over time, as a result of prolonged neglect, physical isolation and harsh tropical conditions. However, despite these deficiencies access to health care is relatively high with 87% of the population seeking care while sick.[19]

Access to quality health care depends on adequate numbers of a well distributed workforce. With about 2.2 health workers (doctors and nurses) per 1,000 people, Solomon Islands appears to have an adequate number of health workers[b]. However, shortages in certain cadres (medical specialists, laboratory scientist, pharmacists and others) are constant and some inequalities in staff distribution exist across provinces and Honiara. Differences also exist in access indicators, for example, utilisation of health care in times of sickness is reportedly lowest in Makira province and highest in Western province.[20] It is also reported that isolated pockets of the population live eight hours or more from a health facility and receive health care only infrequently.[19]

Access to health care is also affected by socio-cultural factors. Traditional beliefs about diseases and low levels of education, especially among women, have been identified as barriers to health service utilisation.[21] While the overall utilisation of health care has reportedly increased, self-medication for diseases such as malaria and the use of traditional medicine (kastom medicine) for a variety of illnesses are still widespread in Solomon Islands,[22] thus affecting the rates at which formal health services are utilised.

Financing the health system

The Solomon Islands health system is financed by government and a host of development partners. Operational funding (recurrent expenditure) for the MHMS comes from two major sources – the Solomon Islands Government (SIG) and Government of Australia through the Health Sector Trust Fund.

Funding from SIG sources usually goes towards payroll expenses, utilities and staff travel, while funding from the trust fund pays all other recurrent expenses. Investment funding (capital expenditure) is primarily provided by donor agencies and largely used for construction or renovation of facilities, acquisition of equipment, motor vehicles, furniture and fittings.[23]

In 2006, the total amount of funds from SIG sources was about SBD$116 million[c] representing nearly 14% of total government expenditure.[3] Together with funding from donor sources, including the Health Sector Trust Fund account, almost SBD$283 million (AUD$35.1 million) was spent on health services and health sector development in 2006. Payroll expenses consume the largest proportion of the MHMS budget – usually over 50% of total government health expenditure.[3, 23]

Key components of the WHO MAKER[a] framework include the **number and distribution of managers, managerial competency, the management working environment, management support systems and socio-cultural context** in which managers operate

Recently the SIG placed a series of reservations on ministerial goods and services budgets that effectively reduced budget by 33%, severely impacting on provincial budgets and resulting in acquired debts. Shortfalls have been addressed by allocating Health Sector Support Program funds to the provinces to allow services to continue, a strategy that will likely recur, but by which donor support replaces government provision.

Government expenditure on health as a proportion of GDP is around 5% on average in the last decade: relatively higher than the proportion of GDP spent on health in other lowand middle-income countries, including Fiji and Cambodia. Figure 1 shows GDP per capita and government health spending as a proportion of GDP in 1990 and 2000 to 2004 in the Solomon Islands.

Household spending on health appears negligible in the Solomon Islands. WHO estimates that Solomon Islands has the lowest annual out-of-pocket household spending on health in the world at about USD$1 per annum.[24] Thus, health expenditure in is almost exclusively public. This contrasts sharply with neighbouring Fiji where about 15% of health expenditure is out-of-pocket and government allocation to health is around 3% of GDP.[25] However, a significant proportion of public funding for health in Solomon Islands is provided by development partners.

The World Bank estimates that around 50% of total health expenditure is provided through external assistance.[20] AusAID contributes significantly to the operating and development budgets of the MHMS and provides individuals and teams of technical advisers. Other key health development partners include the World Bank, the UN agencies and other bilateral donors such as Taiwan and Japan.

b WHO recommends 2.3 health workers per 1,000 people[40]. The 2.2 per 1,000 stated here is based on 2010 figures for public sector doctors and nurses obtained from the Solomon Islands Ministry of Health and Medical Services.

c This amounts to approximately AUD$14.7 million as per October 2009 exchange rate. SBD$ = Solomon Islands Dollars.

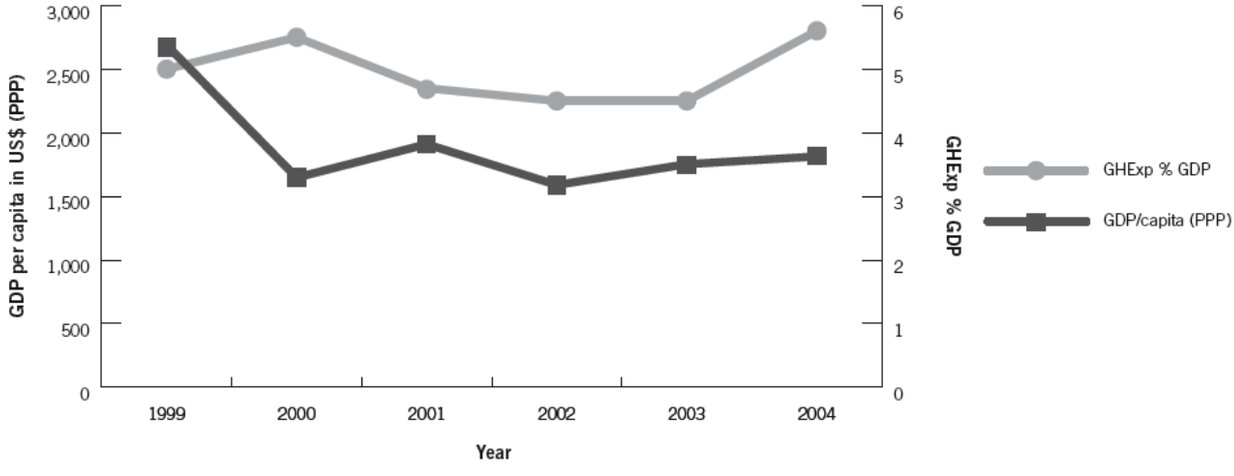
Management of financial resources for health in Solomon Islands largely remains the responsibility of the Department of Administration at the MHMS head office in Honiara, which receives allocations for health from the National Treasury. AusAID's review of the Solomon Islands health sector identifies the excessive share being spent on the National Referral Hospital in Honiara and that the lack of financial administration skills at the provincial level has hindered the decentralisation of financial management.[26]

Human resources for health

As of December 2010, there were a total of 2,728 health workers in the public sector in Solomon Islands. Of these, 153 were medical doctors (including dentists), 936 were nurses, 524 were nurse aides, 569 were other professionals (pharmacists, etc.), 126 were administrative staff and 420 were in other support roles.[16] Only 29% of the 153 medical doctors in Solomon Islands is female. The pie chart in Figure 2 shows the workforce distribution by proportion of cadre.

Solomon Islands has shortages of certain cadres of health workers, particularly doctors and medical specialists, but also medical laboratory staff, radiologists and other allied health professionals. At the National Referral Hospital in Honiara, most clinical departments reportedly have had 50% of their clinical posts vacant.[27] The Under-Secretary of Health Improvement stated in a radio interview in 2008 that Solomon Islands is 'in desperate need of anaesthetists, obstetricians, gynaecologists and doctors in general medicine'.[28] He observed that there was only one anaesthetist in the whole country. While WHO estimates one doctor per 10,000 people, recent figures from the MHMS give a public sector doctor to population ratio of about 1:3,300; relatively lower than that of neighbouring Fiji, which has a ratio of 1:2,200 people.[16, 29] Solomon Islands has a nurse to population ratio of approximately 13 per 10,000 people.

The armed conflict that engulfed Solomon Islands between 1998 and 2003, and on-going ethnic tensions thereafter, have endangered the safety of health workers, especially in rural and remote areas, and significantly distriputed the provision of primary health care services



	1999	2000	2001	2002	2003	2004
GDP/capita (PPP)	2,689	1,648	1,910	1,590	1,753	1,814
GHExp % GDP	5.0	5.5	4.7	4.5	4.5	5.6

Key to acronyms

GDP	gross domestic product
GHE	government health expenditure
PPP	purchasing power parity
USD$	United States dollars

Figure 1 GDP per capita and government health expenditure in Solomon Islands as a proportion of GDP, 1990 and 2000-2004[42-47, 48]

Only minor disparities exist in the distribution of MHMS staff across provinces: Guadacanal, Temotu and Malaita have slightly more health workers than required[d] compared to Isabel, Makira and Chiuseul slightly understaffed (Figure 3).

d The MHMS has established the number of health workers required for health delivery in each province. It is unclear whether this is based on how many the MHMS can recruit based on its budget or how many are necessary to deliver health services to meet the health needs of the population.

WHO estimates that Solomon Islands has the **lowest annual out-of-pocket household spending on health in the world** at about USD$1 per annum

In 2007 the Solomon Islands Government signed a cooperation agreement with Cuba which has led to the supply of Cuban doctors to work in Solomon Islands and Solomon Islands students being offered scholarships to study medicine in Cuba. As of December 2009, there were 10 Cuban doctors working in Solomon Islands and 75 Solomon Islanders studying medicine in Cuba.[30] The Solomon Islands Government, under the Cuban Cooperation Agreement, requested 40 specialist doctors[31], hence there are likely to be more Cuban doctors arriving in Solomon Islands in the years to come. Remunerating, supplying and housing these 75 returning graduates and 40 expatriate staff presents a significant management and resourcing challenge.

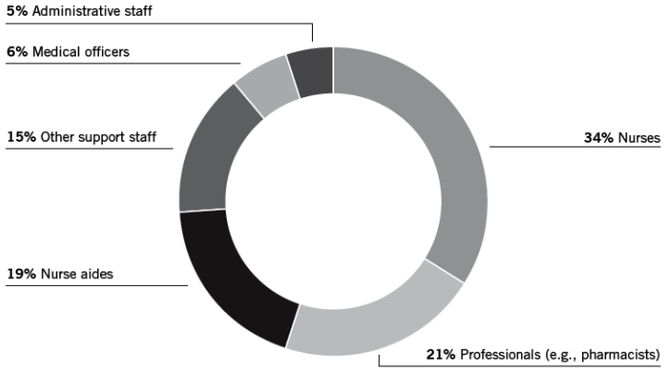


Figure 2 Distribution of health workforce by proportion of cadre in the Solomon Islands, 2010[16]

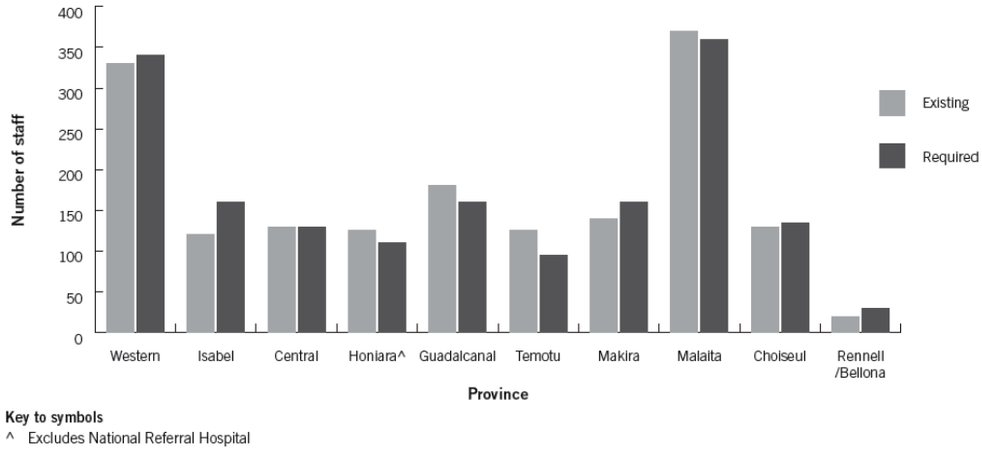


Figure 3 Distribution of Solomon Islands Ministry of Health and medical services staff by province, 2010[16]

Health management structure

The structure of health and human resources for health management in the Solomon Islands is complex. In principle, provincial governments share with the national government the responsibility for the management of several government services. Provincial government divisions are headed by professional staff seconded from national line ministries, who report to the Provincial Secretary, the chief public servant in the province. These professional staff also report to their line ministries. In practice, however, it is unclear how much authority provincial governments have with regard to management of government services.

Unlike decentralisation in Papua New Guinea, where a significant amount of power has been transferred to provincial authorities from the central government, the Solomon Islands Provincial Government Act 1981 allows for partial devolution of national government functions to provincial governments.

Functions for key national government services such as health and education were not envisaged under the Act to be fully devolved functions.[32] Cox and Morrison (2004) described Solomon Islands' decentralisation as a '*political decentralisation through the Provincial Assemblies without the corresponding devolution of adequate powers, functions, staff, budgets and clear lines of accountability and adequate support and supervision from the National level*'.

Within the health sector, the central MHMS has the overall responsibility for health policy development, coordination and provision as required by the country's constitution.

The central Ministry of Health and Medical Services retains a considerable degree of control in the relationship with provincial health authorities, **with all donors and UN agency projects subject to central approvals and coordination**

The Permanent Secretary for Health, through the three under-secretaries (Under-Secretary for Health Care, Under-Secretary for Health Improvement and Under-Secretary for Administration and Finance) translates political aspirations for the health sector into technical, practical and operational national health policies and development plans, some of which are vertical programs funded by development partners.

The provincial directors of Health Services and various heads of divisions and departments of the MHMS have the responsibility to operationalise and implement these national health policies and plans.[33] Given the high national interest in health, the central MHMS retains a considerable degree of control in the relationship with provincial health authorities, with all donor and UN agency projects subject to central approvals and coordination; now increasingly so, as Solomon Islands moves towards a sectorwide approach to donor coordination.

Responsibility for management of public sector health personnel is shared between the Public Service Division (PSD), the Central Payroll Treasury and MHMS[23], and a PSD staff member is deployed to the MHMS office in Honiara. The PSD controls appointment of new staff and has the power to terminate appointments. It produces an establishment register to facilitate human resources for health planning within the MHMS. Recruitment of new employees requires the agreement of PSD as the employer, but in practice procedures are not always followed.[23] However, payments of all health worker salaries are controlled by the Central Payroll Treasury, except those employed by the provinces as direct wage earners; usually ancillary and casual staff.

In general, health and human resource management skills at both central and provincial levels have been identified in almost all national health reports as being limited. The Solomon Islands Health Corporate Plan 2006–2008[e] specifically mentions improvement of management and supervision of services and human resource management in its eight priority areas. The National Health Strategic Plan 2006–2010 identifies improving management and leadership capacity throughout the MHMS as a key goal.[17]

e See WHO WPRO 2008.

Number and distribution of managers

As in other countries, there are different categories of health managers at different levels of the Solomon Islands health system. This section attempts to capture the number and distribution of health managers at the provincial level; essentially provincial health directors and members of their health management teams.

With the focus of this series on management of the public and primary health care services, it does not seek to capture managers of hospitals unless the same person manages both the hospital and primary health care service.

Administratively the Solomon Islands is divided into nine provinces plus the capital territory – Honiara City Council (Table 1). The provinces are sub-divided into smaller regions managed by the Senior Clinician of Area Health Centres. Information on the characteristics of provincial health directors who manage the provincial health service indicate they are 10 in number (one in each province and one in Honiara City Council) with only one female.[39]

These middle-level managers lead provincial health management teams in providing support to area health centres, which are largely run by consultant nurse aides.[34]

The Provincial Health Management Team comprises the Provincial Director of Health Services, Hospital Secretary, Health Accountant, Dental Officer (some provinces have a Dental Therapist), Director of Nursing, Assistant Director of Nursing (in big provinces only), Principal Field Officer (Vector Borne Disease Control Program), Chief Health Inspector (in small provinces, Principal Health Inspector), Senior Pharmacy Officer, Medical Technologist and Radiographer.[39]

Competence of provincial health managers

Managerial competence is acquired through a combination of training, experience and coaching.[36] All the 10 provincial health directors leading the provincial health management teams are clinicians with basic medical degrees. Only three of them have a Master in Public Health Degree that may have exposed them to health service planning and management. Most of the provincial health directors are also recent graduates and have not been in their current position for a long time.[39]

The Solomon Islands MHMS and its development partners recognise the need to scale-up managerial competence through further training. A draft national training plan was to be completed by the end of 2004[f].

f No further information could be found on the draft training plan. Presumably, it was a plan for the training of health staff at different career levels and not only provincial health directors.

Table 1 Distribution of health personnel and facilties by province in Solomon Islands, 2010[16, 35]

Province	Population	Health facilities	Health personnel^	Ratio: Health workers to population
Central	27,928	26	127	1:220
Choiseul	25,870	28	110	1:235
Guadalcanal	78,870	40	184	1:425
Honiara#	63,311	14	124	1:511
Isabel	26,310	35	123	1:214
Makira	40,386	38	139	1:291
Malaita	159,923	73	370	1:432
Rennell and Bellona	3,025	3	22	1:138
Temotu	24,412	17	119	1:205
Western	81,214	60	333	1:244
Total	**530,669**	**334**	**1,651**	**1:321**

Note to Table 1

^ Includes all health personnel

Excludes National Reference Hospital

The 2009 AusAID country report notes that some provincial health directors are undertaking relevant postgraduate training – on their own initiative – through WHO's Pacific Open Learning Health Network.[34] In 2006, a health leadership and management course was presented by the University of New South Wales School of Public Health and Community Medicine for about 30 senior and middle managers from national and provincial levels.[3]

A 2008 World Bank Health Sector Support Program included a training and capacity-building component that sought to strengthen the management capacity of senior managers and provincial health directors to be more effective in strategic planning, particularly in donor coordination. The Program planned to finance part of the MHMS strategic human resource training plan, particularly in the area of leadership skills for senior managers and training in technical subjects related to health service management.[20]

In general, it is assumed in Solomon Islands, as in other Pacific Island countries, that clinicians can be effective service managers and that management training within public health programs is sufficient. Currently the MHMS has no plan to create a cadre of trained health administrators.[39]

Management working environment

In common with other countries, one of the key challenges faced by provincial health directors in the Solomon Islands is a lack of supportive supervision. This has been noted in several MHMS documents (National Health Plan 2004– 2005[41]; National Health Strategic Plan 2006–2010[17]; National Health Annual Report 2006[3]).

AusAID has observed that provincial health directors receive no supportive supervision from senior managers at the national level; neither do they provide supervision to area health centres. In turn, the area health centres do not supervise rural health facilities in the expected manner.[34]

At the community level, lack of supervision of staff is a reason for low confidence in government clinics among the general population.[22] While there will be a range of reasons for the lack of supervision, the most important seems to be limited finance; it has been reported that there is an insufficient budgetary allocation for supervisory activities[34], although improving management and supervision is a priority the MHMS had emphasised in its Corporate Plan for 2006–2008.[18]

Lack of proper role delineation presents another challenge for provincial managers. At the national level, the demarcation of roles and responsibilities between central and provincial health authorities remains unclear despite the continuing emphasis on health delivery at local levels.[20] At the provincial level, roles, responsibilities and lines of accountabilities of staff (including managers) are not properly defined. To be able to manage health service delivery effectively, provincial health directors and their local management teams need to know exactly what is required of them and have sufficient resources and time to perform these functions.

Provincial health directors' roles include both clinical and managerial functions with no clear directives for how

much of each role is expected of them. As reported by[34], many provincial directors spend much time providing clinical services at the hospitals and are unable to put sufficient energy into managing the health services. With a shortage of doctors, it is hard to see how medically trained provincial health directors could be freed from clinical duties[g]. The anticipated influx of Cuban trained doctors may present an opportunity for senior clinical provincial level staff to strengthen their management skills, and develop dedicated managerial roles in provinces.

It's not clear how much control provincial health directors have over centrally employed health staff in the province. The authority to manage health personnel, other than the direct wage earners employed from provincial budgets, is vested in the Public Service Division, while at the provincial level, the Provincial Secretary is the highest public servant to whom all employees in the province are responsible.

In addition to the above, there is no established system of incentives for promoting good performance in Solomon Islands.[20] Provincial health directors don't have an appropriate forum, apart from the Annual National Health Conference, to meet regularly and share ideas or exchange experiences. Many of them face acute problems with housing, as the market for rental housing is non-existent in many locales served by provincial and area health services.[3]

Government-owned housing is available for rent in some locations, but is often of substandard quality and availability is unable to meet demand. Some provinces, such as Choiseul, have initiated a provincial health staff housing project to alleviate the housing problems of health workers, as the MHMS provides minimal funds for renovating the houses of provincial staff. However, concerns about poor staff housing conditions for health workers in all provinces remain.[3]

Functioning of management support systems

Budgeting and financial management is a significant challenge for provincial-level managers. The Government provides funds through a grant system which is theoretically effective for financial control but practically inappropriate for implementation. The 'advance and acquit' system releases funds only when previous grants have been reconciled. While this may ensure that reconciliation functions are carried out at the provincial level, there is reportedly a scarcity of qualified personnel with sufficient financial management skills in the provinces to successfully acquit the funds.

Provincial accountants are said to have been inadequately trained in the use of the new computer-based financial system[34], resulting in provinces sending original statements to the central MHMS in Honiara instead of analysing and reconciling them at the provincial level.

Many provincial directors spend much time providing clinical services at the hospitals and are **unable to put sufficient energy into managing the health services**

This inability to analyse financial data at the provincial level contributes to delays in the release of provincial grants and to an end-of-year under spending of budgeted funds. At the end of 2006 the MHMS had under spent by about SBD$2.8 million[3]. The Government has planned to address this issue by outsourcing its accounting functions while it trains provincial staff in financial management[34], but at the time of this review there was no timetable for implementing this plan.

The health information system used in the Solomon Islands is reportedly of a reasonable standard but appears to offer little support to provincial managers. Available evidence suggests that provincial health directors rarely use health information for decision making. Health data from the province is often passed directly to MHMS head office in Honiara, and largely serves the interests of the head office and donors.[34]

The limited use of health data in the province is due to a combination of management issues; the inability of provincial health directors to understand financial information, the demands of other concurrent roles and the lack of management-relevant information in the datasets. As observed in other countries reviewed in this series, Solomon Islands information systems are largely based on counts of clinical presentations; information that may assist in managing staff performance and resources more effectively is not collected.

Delayed supply of essential drugs and materials is a recurrent problem and a serious challenge for provincial health directors. The National Medical Store in Honiara is responsible for the procurement and distribution of medical supplies for the departments and divisions within MHMS.

Despite some improvements in recent years, many provinces still have problems with delayed supply of essential drugs and other consumables. A special audit report into the affairs of the MHMS notes that drug supplies can take up to half a year after ordering before being received. It also observed that around 30% of items requested or ordered were out of stock.[23] The Health Institutional Strengthening Project's Independent Completion Report notes that '*there still remain serious shortages of essential drugs, clinical equipment and medical supplies at health facilities*'.[34]

Socio-cultural context

The Solomon Islands shares a series of socio-cultural characteristics with its fellow Melanesian states, which

g The provincial directors might also be more comfortable in clinical than managerial roles given their limited training in health service management.

may influence management and leadership practices. The laen (lineage) system of familial allegiance and the associated 'big-man' leadership type, which are unique to Melanesian societies[37, 38], have the potential to affect health management at the provincial level.

The role of the big-man is fundamental to concepts of leadership in the Solomon Islands, particularly in the political arena.[38] A big-man is one whose success is determined by personal power, oratory and status. This differs from a hereditary chief (as in Fiji), whose power is positional rather than personal. A big-man will reward supporters for their patronage.

In the context of managing health workers, these cultural features create issues where a manager may be reluctant to discipline a member of their clan or a big-man may favour supporters or patrons over others. Additionally, the culture of respecting one's elders may make a younger manager reluctant to criticise an older subordinate or a superior.[38]

A gender bias against women is apparent in perceptions about a woman's role in Solomon-Islands society: masculine political cultures, violence against women, restrictions of women's social mobility and their limited economic independence.[38] These factors are manifested in the form of limited participation by women in management and leadership roles. For example, there are no female representatives in the national legislature.[38]

These factors are likely to impact the work environment negatively for a female manager. Internal migration, especially from the island of Malaita to Guadalcanal, created ethnic tensions over property rights between migrating Malaitans and the traditional landowners of Guadalcanal. Fukuyama[37] argues that big-man leaders turned what was essentially competition for resources into an ethnic rivalry that ultimately escalated into open conflict. The intervention of the Regional Assistance Mission to the Solomon Islands was required to pacify the conflict. An element of distrust between the ethnic groups continues.[37] These ethnic tensions, as noted earlier, create an atmosphere of insecurity which affects health worker performance and health delivery generally.

Summary

Access and utilisation of health care

- The armed conflict that engulfed the Solomon Islands between 1998 and 2003 significantly disrupted the provision of health care especially in rural and remote areas. There is one doctor for 3,300 people and approximately 13 nurses and midwives for 10,000 people. Despite limitations 87% of people seek health care when sick.

Financing the health system

- The SIG placed a series of reservations on ministerial goods and services budgets that effectively reduced the budget by 33%, severely impacting provincial budgets and resulting in acquired debts. Shortfalls have been addressed by allocating Health Sector Support Program funds to the provinces to allow services to continue, a strategy that will likely recur, but by which donor support replaces government provision
- Provincial health accountants have received training in MYOB in 2009 but acquittal systems require higher level accounting skills for reports to be submitted on time to permit the release of subsequent funding tranches.

Human resources for health

- The shortage of doctors and specialists is a key challenge. As at December 2010, there were a total of 2,728 health workers in the public sector in Solomon Islands. Staff costs consume on average 55% of provincial health grants
- Filled Public Service Division staff establishments and budgetary reservations have reduced the ability to meet the salary and wage costs of new graduates. Solomon Islands is currently negotiating to assist Vanuatu in filling its nursing staff vacancies with its surplus
- The return of 75 Cuban trained medical officers from 2013 presents the management challenge of accessing budget provisions for so many new positions and in funding the infrastructure needed to house, equip and maintain them in service.

Health management structure

- Provincial health managers are operationally responsive to local needs, managerially responsible to provincial governments, while being concerned with adherence to central MHMS policy and to Ministry of Finance and Public Service Division regulations
- The delineation of central and provincial health authorities' responsibilities requires guidelines in a changing system, where both population-based and targeted vertical programs are implemented at local levels.

Number and distribution of managers

- Nine of the 10 positions of Provincial Health Director have experienced high turnover, which reportedly occurs without adequate handover to incoming appointees, most of whom are recent clinical graduates. Health services in the Honiara urban area are provided through the Honiara City Council. Church health services are staffed by government employees.

Competence of district health managers

- Management skills are reportedly weak at the provincial level. The Regional Assistance Mission

to Solomon Islands provides governance training inputs to provincial government staff. Provincial health departments have limited financial and human resource management capacity. They also have clinical backgrounds and no training in public health planning or health services management, other than that provided by donors, the Regional Assistance Mission itself and the MHMS.

Management working environment

- Provincial health directors have limited control over health staff. Little supportive supervision in management is provided to new provincial health directors. No performance management systems are in place to ensure that staff are properly assessed and supported to do their best
- Large numbers of non-government organisations working at the provincial level in youth and women's programs require coordination by Provincial health directors to avoid duplication or implementation of programs that will require ongoing funding, but this is not done.

Functioning of management support systems

- Management support systems for budgeting and finance, management information and procurement and supply do not function adequately to support provincial health directors to manage effectively.

The socio-cultural context

- Socio-cultural issues such as favouritism based on kinship, discrimination against women and the big-man culture have implications for effective management and strong health leadership
- These cultural features create situations where a manager may be reluctant to discipline a member of their clan, or where a person with cultural influence may be able to distort systems.

Provincial accountants are said to have been **inadequately trained in the use of the new computer-based financial system,** resulting in provinces sending original statements to the central MHMS in Honiara, instead of analysing and reconciling them at the provincial level

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Emerging Issues for HIS

Overview of section

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- *Case-study:* Pacific in crisis: The urgent need for reliable information to address non-communicable diseases
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Non-communicable diseases and health systems reform in low-and-middle-income countries

Original article

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Summary

There is growing evidence that non-communicable diseases (NCDs) are a major health and socio-economic issue in low- and middle-income countries (LMICs). According to World Health Organization (WHO) estimates, deaths from cardiovascular disease, cancer, chronic respiratory disease and diabetes accounted for 63 per cent of global mortality in 2008, of which 80 per cent was in LMICs. The NCD burden is projected to increase: by 2030, NCDs will be the greatest killer in all LMICs. Thus, governments of these countries cannot afford to overlook policies in relation to NCDs.

Several cost-effective measures exist to prevent and control NCDs. These include both population-wide interventions such as tobacco control and targeted treatment for individuals at high risk. Experience from high-income countries that have been able to control NCDs shows that responses must be comprehensive and multi-sectoral, integrating health promotion, prevention and treatment strategies, and involving the community as well as the health sector. Such a multi-faceted approach requires well-functioning health systems. In the majority of LMICs, however, health systems are fragile and will need to be adapted to address NCDs appropriately, while also continuing to tackle communicable diseases.

We propose that the reform of health systems can occur in a four-phased approach in four areas: building political commitment and addressing health systems constraints, developing public policies in health promotion and disease prevention, creating new service delivery models and ensuring equity in access and payments. Several policy issues will also need to be addressed, including financing of NCD programs and the broadening of concepts of health and responsibilities for health.

Adapting health systems to respond to NCDs will require a change in mindset and practices in programming for health, as well as substantial financial resources. There is scope for development partners and global health initiatives to support LMICs in addressing NCDs.

Introduction

Non-communicable diseases (NCDs) like cardiovascular disease, cancer, diabetes and chronic respiratory disease have been thought to be mainly diseases of industrialised nations. Now there is growing evidence that they are also a major health issue in developing countries. The WHO estimates that deaths from the four diseases mentioned above accounted for 63 per cent of all deaths worldwide in 2008, and 80 per cent of these deaths occurred in LMICs.[1] The social and economic consequences of deaths on this scale are only recently being recognised.

The decision to hold a United Nations High-Level Meeting on NCDs in September 2011 raised the profile of these diseases considerably. It has broadened the discourse around NCDs, from being framed as a health problem to an issue that is global in nature and of concern to socio-economic development. Still, most development partners, governments and global health institutions have largely overlooked NCDs when investing in health development in LMICs. It is estimated that less than three per cent of development aid is currently directed towards NCDs.[2-3] This apparent gap between the global burden of NCDs and the investments of development partners indicates the need for those in health development to understand better the implications of this burden and how to control and prevent NCDs.

Rising poverty, globalisation of trade and marketing, increases in urbanisation, the ageing of populations and changes in other social determinants all seem to be part of the complex and interrelated processes contributing to the rising burden of NCDs. Importantly, NCDs are largely preventable through the reduction of four risk factors: tobacco consumption, physical inactivity, harmful alcohol consumption and unhealthy diets. This aspect of prevention gives these diseases qualities and characteristics that make them particularly amenable to public policy interventions. These policy dimensions, and how they relate to health systems reforms in LMICs, are the focus of this paper.

The paper discusses health systems reform in LMICs and the public policies required to respond effectively to the rise of NCDs. It does so by:

1. Reviewing what is known about the burden of NCDs in LMICs;
2. Outlining the evidence available on how to address NCDs;
3. Highlighting the central role of health systems in responding to NCDs and the implications for LMICs; and
4. Suggesting a process by which health systems can be reformed, and the corresponding policy issues that need to be considered.

The paper is not intended to be a systematic review of all the literature related to the status and problems of NCDs in LMICs. Rather it aims to raise issues that will assist in translating discussions into action. It draws upon the following documents:

- World Health Organization (WHO) publications and resolutions issued between January 2000 and May 2011 (prior to 2011 World Health Assembly);
- Publications of the World Bank related to NCDs in the Asian region, primarily the reports on NCDs in south Asia and in China;[4-5]
- Publications related to the Global Burden of Diseases, Injuries, and Risk Factors study of WHO, funded by WHO and the Gates Foundation. This study produced the body of data that underpins most of the analysis, reports and publications used in this paper; and
- Publications of the Lancet NCD Action Group and the Global NCD Alliance produced before June 2011, which present the current debates around NCDs and development.

The scope of the problem

Definitions: What do we mean by 'NCDs'?

There has been considerable debate in recent literature around what exactly constitutes a non-communicable disease.[6] This paper uses the same definition of NCDs as used by the WHO in recent reports and publications and by resolutions of the World Health Assembly—namely that NCDs encompass four major health conditions: cancers, cardiovascular diseases, chronic respiratory diseases and diabetes.[1] These diseases are grouped because of their strong relationship to four behavioural risk factors: use of tobacco, unhealthy diets, lack of physical exercise and harmful use of alcohol; and to four underlying metabolic or physiological factors that are measurable: excess body weight, high levels of serum cholesterol, high fasting plasma glucose levels and high systolic blood pressure. Table 1 lays out the relationships between the four NCDs and the various risk factors.

Table 1 Relationship between NCDs and risk factors

Risk Factor	CVDs	Diabetes	Cancer	COPD
Tobacco use	X	X	X	X
Alcohol abuse	X	X	X	
Unhealthy diet	X	X	X	X
Physical inactivity	X	X		X
Obesity- BMI ≥ 30 kg/ sq m	X	X	X	X
Raised blood pressure[i]	X	X		X
Raised blood glucose - FPG[ii]	X	X	?	
Abnormal blood lipids[iii]	X	X	X	?

[i] Raised systolic blood pressure - mmHg
[ii] Fasting plasma glucose in mmol/L

[iii] Serum total cholesterol in mmol/L

NCD-related mortality and morbidity - The current situation

The Global Status Report on Non-Communicable Diseases describes the burden of NCDs in 2008.[1] It establishes a comprehensive baseline of data on NCDs in the world for the first time. These data are largely drawn from the WHO Global Burden of Diseases, Injuries and Risk Factors Study, an ongoing project funded by WHO and the Gates Foundation. As such, it is important to understand the quality of the data.

As the Global Status Report states (pp. 3, 7 and 11), accurate data on causes of death are not always available in several countries. Appendix 4 of the report comments on the availability of recent data for each WHO member state and assesses the quality of that data. A review of this indicates that for the 43 countries categorised as low income, 91 per cent are reported as having either no data or no data since 2002; of the 54 countries categorised as low-middle income, slightly more than half did not have reliable or recent data. For high income countries, the same figure was 12 per cent. Of course these figures do not refer to information collected since 2008, but as stated in the report, there are '*serious deficiencies in surveillance and monitoring of NCDs*' in many LMICs, and data on NCDs, if they do exist, are

As such, **it is important to understand the quality of the data.** As the Global Status Report states, accurate data on causes of death are not always available in several countries

not always integrated into national health information systems.

Despite the problems with data quality, the report still provides the best estimates on NCD mortality. The data presented show that NCDs are the leading cause of mortality worldwide, with 80 per cent of all NCD deaths occurring in LMICs.[1] In fact; NCDs are now the leading cause of death in all LMICs, apart from those in sub-Saharan Africa, where infectious diseases are the greatest killer.[1] Still, even in this region, it is projected that NCDs will overtake infectious diseases as the main cause of mortality by 2030.[1] Presently, over 80 per cent of cardiovascular and diabetes deaths and almost 90 per cent of deaths from chronic obstructive pulmonary disease occur in LMICs.[1] These figures dispel the myth that NCDs are a concern only of the developed world.

More importantly, mortality from NCDs in LMICs is occurring in younger age groups than in high income countries, more often in the economically productive years of life. 29 per cent of NCD deaths in LMICs are among people under the age of 60 years, as opposed to only 13 per cent in high-income countries. For deaths under 70 years, the figures are even more striking: 48 per cent of all NCD deaths in LMICs compared to 26 per cent in high-income countries.[1]

Morbidity data for specific NCDs, like cancer or diabetes, are being revealed. It is estimated that in 2008 there were approximately 347 million adults[a] in the world with diabetes and around 12.7 million new cases of cancer.[1,7]

Future burden of disease

The burden of NCDs worldwide is expected to increase, the WHO projecting that NCD deaths will increase by 15 per cent between 2010 and 2020. Cardiovascular disease and cancer will be the main killers.[1] By 2020, mortality from NCDs is expected to be almost 75 per cent higher than that from communicable, maternal and child diseases.[1] The rise in mortality will be more acute in the WHO regions of Africa, South-East Asia, and the Eastern Mediterranean, where it is expected to be over 20 per cent.[1] The greatest number of deaths from NCDs will be in South-East Asia and the Western Pacific.[1] These increases in LMICs are thought to be largely explained by demographic factors - ageing and population growth - as well as behavioural changes such as the spread of Western diets and increasingly sedentary lifestlyes.[7-10]

Impact on socio-economic development

The rise of NCDs is more than a public health issue. It is increasingly being recognised as a socio-economic issue. The rising cost of treating NCDs is evident in the expanding health budgets in developed countries in recent years. There is also recognition of the growing economic and social costs associated with high levels of disability and loss of productivity resulting from NCDs.

The greatest number of deaths from NCDs will be in South-East Asia and the Western Pacific. These increases in LMICs are thought to be largely explained by demographic factors—ageing and population growth

NCDs can exacerbate poverty and increase health inequities and therefore put at risk the recent gains of social and economic development. NCDs and poverty form a vicious circle as a result of several factors:

- When family income is restricted, more nutritious foods are replaced by cheaper food options that are often high in sugar and fat, particularly in urban populations
- The costs of treating NCDs can further impoverish already poor households because of the chronic nature of the diseases and the need to access drugs and health services over long periods. In addition, when NCD treatments are not part of the core services delivered by the public health system, individuals may need to seek services or drugs in the private sector at higher, up-front costs
- Illness, disability or premature death from NCDs may prevent individuals from attending or seeking employment, leading to a loss of income for the household. Family members may also have to withdraw from income-earning activities or education to care for family members living with NCDs
- Lack of information and public awareness means late presentation of most NCD patients in LMICs, making treatment much more expensive (treatments for late stages of diabetes, lung cancer or stroke that require more radical intervention and longer hospitalisation, for example)
- The poor live in settings where there is weak control over exposure to NCD risk factors such as tobacco and alcohol use, which may increase their risk of developing NCDs.

There is also a growing body of evidence that links the rise of NCDs to a lack of progress in achieving targets to alleviate the burden of communicable diseases such as AIDS and tuberculosis. Anti-retroviral therapy, for instance, may increase the risk of cardiovascular disease, while smoking is associated with 21 per cent of adult Tuberculosis (TB) cases.[1] Thus, tackling NCDs needs to be seen as a contribution to helping poor countries deal with problems related to poverty, particularly in relation to the consequences of premature death and increasing rates of disability. Governments cannot afford to overlook their policies in relation to NCDs.

a Uncertainty interval 314-382 million, which is higher than previous estimates for 2010 of 285 million

Responding to NCDs

What do we know about what works?

Given the chronic nature of NCDs, and the fact that they are largely associated with lifestyle factors such as diet and tobacco consumption, any response will need to comprise a judicious mix of health promotion, prevention strategies and treatment services. Interventions that aim to reduce the prevalence of risk, prevent NCD occurrence and re-occurrence in high-risk individuals, diagnose NCDs in early stages and provide appropriate care and treatment are all crucial. In addition, national policies in areas not traditionally thought of as having an impact on health outcomes, such as those related to agriculture or urban planning, have a major bearing on the behavioural risk factors linked with NCDs. This means that non-health actors will also need to be engaged when developing and implementing policies and programs to address NCDs.

The most robust evidence for cost-effectiveness exists for the following population-wide and targeted treatment interventions:[1,12-16]

1. Tobacco control as outlined in the Framework Convention on Tobacco Control: increased taxes on tobacco products, enforcement of smoke-free workplaces, packaging and labelling of tobacco products with comprehensive health warnings supported by public education and comprehensive banning of tobacco advertising, promotion and sponsorship
2. Reduction of population-wide salt consumption: voluntary reduction of salt levels in processed foods and food additives, and sustained public education to encourage change in food choices
3. Promotion of physical activity: combining 'upstream' policy support with 'downstream' community-based activity in schools, workplaces and religious centres
4. Reduction of population-wide harmful alcohol consumption: increased taxes on alcoholic beverages, limiting access to retail alcohol and comprehensive banning of alcohol advertising, promotion and sponsorship, and
5. Treatment with cheap and readily available drugs for individuals at high risk of cardiovascular disease: use of aspirin and selected off-patent drugs to lower blood pressure and cholesterol.

Other than evidence on specific interventions, experience from countries that have reduced NCD mortality and morbidity, such as Finland (Box 1), Wales and Australia, suggests that certain facilitating contextual factors are also important:

- Community mobilisation
- Joint medical and political consensus on the problem and on the strategy to address it
- Ongoing collaboration between bureaucrats, politicians, community members, health professionals and media
- Linking of medico-technical and social science evidence, and
- Integration of treatment and prevention activities into one sustained strategy.

The Organisation for Economic Cooperation and Development recently undertook a review of its member country policies and actions on NCDs.[17] The study found that a successful response to NCDs required the development of comprehensive strategies that are pervasive and sustained, and that involve the integration of a variety of actors and actions. These approaches did lead to improved prevention outcomes across NCDs and their risk factors. The OECD also found that strategies combining multiple interventions and targeting different age, gender and population groups are more cost-effective because they exploit synergies between the various interventions.[17] It went on to suggest that multi-pronged approaches may be up to twice as effective as the single most effective intervention carried out on its own. The impact of some of these interventions in developed countries is demonstrated by the decreasing trends in NCD burden or metabolic risk factors of NCDs reported in a series of articles in the Lancet and in Appendix 4 of the Global Status Report.[1,7-10]

Box 1: What we know about NCD prevention and control: lessons from North Karelia, Finland (1960s to 2006)[18-19]

- Evidence is important and necessary in order to recognise the problem
- Governments must work with communities to design NCD programs
- Implement a 'bottom-up' programmatic response, involving an alliance comprising several different groupings such as doctors, nurses, health workers, schools, libraries, local media, supermarkets and the food industry
- Bottom-up involvement negates the 'nanny state' argument—local community representatives are needed to be the messenger so that there is broad-based community support for action
- It is important to have an evidence-base about local community conditions
- It is important that there is a multidisciplinary base to the science
- Networking is vital for the exchange of information and practice between community members on change—need to provoke multiple conversations about the benefits of change, support for changing behaviour
- Sustained commitment is needed to producing the evidence that change is happening—scientific evidence on outcomes as well as feedback to/from the community that there is progress
- Role of the government is to coordinate and ensure that those with less power are not left behind
- Understanding and leveraging the point that people do care about the quality of their life is important, so that when armed with locally sensitive advice and support of others, people will change behaviours

Is health service delivery for NCDs different?

The characteristics of NCDs and the corresponding response required bear important implications for health systems. Table 2 highlights the key differences in health service delivery between a communicable and a non-communicable disease. The chronic nature of NCDs means:

- Patients need long-term sustained health services from health professionals with different skills
- Diagnosis and treatment can be technologically intensive
- Drugs and technologies must be sustainably supplied over the long term
- Community involvement is a key ingredient for promoting access to services and for advancing self-care.

Furthermore, as was highlighted above, NCDs are best addressed through comprehensive and sustainable approaches, which integrate population-wide health promotion and NCD prevention measures with health care and treatment targeted at individuals at risk of or already with NCDs. Any response to NCDs will also require training of health workers and an effective surveillance and monitoring system. Such a multifaceted response demands a well-functioning health system.

Health systems in LMICs have been largely structured around infectious diseases, maternal and child health and acute care. This traditional model emphasises hospitals and service delivery that is planned around discrete events as opposed to one in which both prevention and treatment are regularly offered over a sustained period of time and in which individuals assume greater responsibility in managing their own care.

Table 2 Why NCDs demand a new mindset in health service delivery

Diarrhoea	Diabetes Mellitus
Simple diagnosis Generalist can treat Short duration of treatment – days/weeks Recovery is fast Return to full function follows Follow-up, if necessary, is brief	Diagnosis requires multiple tests Multiple medical roles, referral involved Specialist skills required Prolonged care, over life course Care instead of cure Lifelong follow-up, high risk of further complications

This was made clear in the recent World Bank report on NCDs in China, which suggests that health sector reform is required in order to shift from a system geared towards combating acute and infectious diseases to one that is prepared also to tackle chronic diseases.[5] This suggests that LMIC health systems are currently not equipped with the resources or capacity to mount the comprehensive response required to address NCDs.

Indeed, the little information available on NCD programs in LMICs indicates that in most countries, the current response to NCDs is unstructured and inadequate, particularly in the primary health sector.[20] Weaknesses exist in all six components of health systems. In a recent Lancet article, Samb, Desai et al outlined the health system constraints and challenges in LMICs that need to be addressed in order to respond to NCDs.[21] These included:

1. Inadequate financing for the complex public policies, population-wide primary care interventions and high cost medical interventions required to address NCDs, as well as to provide financial protection to the poor who risk being further impoverished from the social and economic costs associated with NCDs
2. Unsuitable service delivery models, which are often over-centralised and characterised by poor referral systems, for NCDs that require coordination across a continuum of care
3. Shortages of adequately skilled health workers, particularly in rural areas, and lack of investment in training in NCDs
4. Weak governance structures and health sector plans or policies that hinder effective regulation, resource allocation and inter-sectoral collaboration; the hierarchical and centralised health systems in most LMICs also pose challenges to the involvement of communities, which is crucial for community-based interventions and self-management programs in addressing NCDs
5. Weak health information systems that lack integrated and coordinated collection of data on NCDs, and
6. Weak supply management chains and procurement systems that result in undersupply or shortages, as well as in the high cost of drugs and medical products.

In addition, conclusions drawn from a series of studies of trends in NCD metabolic risk factors (blood glucose, cholesterol, blood pressure and body mass index) from 1980 to 2008 include: (1) health systems need to prepare for rising numbers of NCD cases, and (2) data collection on NCDs (mortality, morbidity and risk factors) needs to be enforced, strengthened and standardised.[7-10] These findings further support the crucial role of health systems in responding to NCDs and the need to address weaknesses in the systems.

What we know and its implications

Evidence presented so far in this paper shows:

- The NCD burden in LMICs is high and expected to increase
- NCDs are more than just a health issue; they also impact on poverty and socio-economic development
- Control of NCDs requires the implementation of comprehensive approaches integrating health promotion, prevention and treatment

Taking into account that **health systems in LMICs are also largely fragile, mounting a comprehensive and multi-sectoral** response to NCDs will thus require reforms in the way that health systems are perceived and managed nationally

- These approaches, in turn, need to be underpinned by well-functioning health systems that are able concurrently to address both communicable and non-communicable diseases.

In most LMICs, there is a worrying gap: the linkages and coordination between prevention and treatment are either missing or very weak. Taking into account that health systems in LMICs are also largely fragile, mounting a comprehensive and multi-sectoral response to NCDs will thus require reforms in the way that health systems are perceived and managed nationally. At the same time, these reforms cannot be divorced from broader issues of financing, poverty alleviation and equitable access to primary health care services. Taken together, these needs pose an important challenge to policy makers. In the next section, we propose that health systems reforms be undertaken in a phased approach and outline the corresponding policy issues that will need to be addressed.

A framework for policy makers

Elements of a response

The characteristics of NCDs and evidence on what would comprise effective responses suggest that any approach needs to address simultaneously four areas:

1. Building political commitment and addressing health systems constraints—in particular, collecting country data that would justify prioritising and increasing investment in NCDs, and building a coalition of political support to act on this;
2. Re-orienting or developing new public policies in health promotion and disease prevention that address the population risk factors of NCDs and extend beyond the health sector and traditional allies to include agriculture, the food industry and transport and urban infrastructure;
3. Developing new service delivery models that integrate primary care, individual health promotion, long-term maintenance treatment and appropriate access to high technology diagnostic and treatment facilities in a continuum of care; and
4. Ensuring equity in access and payment for NCD services in an affordable manner that does not deflect resources away from communicable disease and maternal and child health.

An effective approach to NCDs should also integrate prevention and risk management for high-risk populations into a strengthened primary care delivery model. Currently how to achieve this integration is not sufficiently well understood by LMICs or their development partners. Neither is it comprehensively addressed in current health system strengthening approaches, which give less attention to the cost-effective opportunities that legislation and regulation may provide in behavioural change in both the general and high-risk populations. There is a risk that if prevention strategies, surveillance approaches and treatment are not planned in a coherent manner, not only will cost-effectiveness be at risk but measuring outcomes may also be more difficult. Both cost-effectiveness and monitoring change are key to the multi-sectoral policy response that is vital for control of NCDs.

Phases of health systems reform

We suggest that reform to adapt health systems better, to NCDs in particular, can be thought of as occurring in four largely sequential phases of growing understanding and commitment, as outlined below. This approach helps to identify the policy issues associated with making such a shift. It can also be thought of as means of evaluating the degree of 'readiness' to deal positively with the complex challenges required by such a reform. The use of the term 'phases' is somewhat of an arbitrary convenience because the reform can be considered more as a continuum. The phases, however, are designed to mark transitions along a continuum: from a series of fragmented, less coherent responses to NCDs, to responses that are fully integrated into a sustainable system in which prevention and treatment are seen as parts of a holistic approach to health.

In the preliminary stage, Phase 1, there is both political and community recognition that NCDs pose an immediate challenge to improving national health outcomes. This phase is characterised by fragmentation and lack of political support or leadership. As a result, working groups, task forces, committees of experts or the like need to be established that include traditional health sector players as well as the more non-traditional actors required for a multi-sectoral response. In addition, a preliminary evidence base needs to be designed so that research and data collection can be commissioned and a business case for preventing and treating NCDs can be developed and tested. Movement through this phase to the next may require a narrower definition of the challenge of NCDs, say as a largely health issue, as a means of gaining support for a broader strategy for action.

In Phase 2, NCD programs may be seen as being developed in parallel or as additional to other health programs. During this period, there is an advanced understanding of the scope of the problem at the national level, with development of the broader vision required to scale activities and setting of longer term time frames for action. Parameters of the broader evidence base required for multi-sectoral change are defined. Population prevention activities are designed, while the basics of early diagnostics and treatment are established—perhaps as pilot or district trials. Reporting mechanisms and surveillance are set up, roles and responsibilities formalised and accountability frameworks established.

Lastly, there is broader involvement in discussion and debate on evaluation and research priorities.

Phase 3 is characterised by visible signs of increased accountability and formalisation of approaches to NCDs vis a vis other health priority areas. It builds on Phase 2 through:

- Further developing and refining the evidence base for NCD programs; and
- Expanding partnerships and scaling up integrated NCD-focused service delivery in parallel with prevention activities and other health sector strengthening activities, including financial plans, human resource plans and performance measures.

The challenge here is to maintain the integration of prevention and treatment while expanding engagement of the more non-traditional players. This phase needs NCD prevention and treatment activities to be integrated and mainstreamed into primary health care models across both public and private sectors. There is also broad political and community engagement in NCD programs, and the needs of the poor are being monitored and addressed. The role of development partners in the programs is decreasing.

Lastly, Phase 4 achieves sustainability of service delivery, with integration of early diagnostic and treatment services into primary health care services nationally and identification of efficiencies in service delivery and plans across the whole sector, while continuing with prevention strategies. NCDs are seen as just one part of a fully functioning efficient health system. Funding sources for future services are known, particularly for poor and vulnerable groups, and development assistance for health is reasonably predictable. Future projections of demographic change and demand for services are also largely predictable, the burden of disease on the national population is understood and a strategy for resolving competing priorities has been developed.

While countries will vary in the time they take to move through each phase, the phases are sequential and are characterised by increasing integration of NCD services into strengthened health systems until they are a mainstream part of cost-effective, equitable and comprehensive service delivery. The phases in service delivery go hand in hand with activities that are designed to ensure that prevention and education are reducing NCD prevalence and thereby also demand for more expensive and intrusive interventions over time. Progression through the phases will depend on local factors such as national public policy settings concerning health financing and equitable access to primary care health services.

Based on the elements that need to be addressed in any response to NCDs, and the sequential phases that countries will go through in reforming health systems, a strategic framework can be developed that will help national policy makers and development partners to assess countries' readiness to deal with the changes. This framework, presented in Table 3, outlines actions that would be taken in each of the four phases according to the elements listed previously: (1) building political commitment and addressing health systems constraints; (2) public policy in health promotion and disease prevention; (3) service delivery models; and (4) equity in access and payments.

According to the actions listed, NCD national programmers can apply the framework to individual country contexts to:

- Assess the extent to which health policy and health systems are ready to adapt and provide the response needed for addressing NCDs;
- Identify gaps where additional support or investment is needed; and
- Identify areas where capacity building is required in order to address NCDs.

Policy issues to be considered in the reform process

Underlying the actions listed in the framework, a number of policy issues need to be addressed to drive health systems reforms. These issues, reviewed below, must be taken into account when applying the framework and assessing health system's readiness to respond to NCDs.

Broadening and developing concepts of health and responsibilities for health

Addressing NCDs challenges some of the prevalent ideas about health and responsibilities for health. Reducing the negative impacts of NCDs will require that new practices and attitudes be adopted in the initial phases of the reform, including:

- Identification of the barriers to prevention and other health services, particularly for the poor;
- Emphasis on the responsibility of other government and corporate sectors in promoting good health;
- Use of taxation and economic policies to steer changes in population behaviour; and
- Promotion of the Ministry of Health as an advocate for public health and a facilitator and intermediary in developing coalitions across public and private sector providers to support health changes.

Table 3 Strategic framework for responding to NCDs

Element	Phase 1	Phase 2
1. Building commitment and addressing health systems constraints	• Broadened awareness of problem across government and community • Identified partners—public private, academic, NGOs, CSO, external—to form alliances • Develop advocacy strategy and business case • Baseline data for population using STEPs or mini-STEPs approach	• Strong commitment to NCD problem by key players • System for keeping individual health records has been decided • Elements of a national NCD plan agreed
2. Public policy in population health promotion	• Determine overall strategic approach inside and outside government	• Prevention strategy developed, partners identified • Evaluation and accountability framework agreed at high level • Strategy developed for legislation, taxation and regulation • Strategy for mobilising community agreed
3. Service delivery models	• Potential high risk populations identified by characteristics of gender, age, location, ethnicity • NGO and community partners for service delivery identified • Training needs for pilot delivery identified	• Service delivery model developed for small-scale intervention for early diagnosis and treatment
4. Ensuring equity in access and payments for services	• Equity in access and costs to prevention and treatment services examined for high risk populations	• Appropriate low cost services developed and piloted for high risk groups with inequitable access or cost burden
5. Indicators	• Key partners are on board—inside and outside government • Key messages and advocacy case are clear	• Political will/leadership and advocacy are solid • Community involvement is growing • Baseline data are collected and used effectively • Population prevention strategy ready for implementation • Legislative/regulatory program on track • Pilot service delivery models ready for implementation, including reliable individual, human resources, diagnostic processes

Phase 3	Phase 4
• Drug purchasing policies to meet NCD needs revised and refined • Human resources plan for health revised to cover prevention, diagnosis and delivery of good quality NCD models • Sources for new finances identified through taxes, efficiencies as part of national health budgets • National NCD plan for next five years and cost for delivery of core services refined	• National health plans and budgets have been aligned with strategy • Community is satisfied with services
• Business and industry engaged as partners at the community level • Implementation of population strategies begun	• Community, business and industry are playing their role in national strategy
• Lessons from Phase 1 and scale-up built on to expand coverage	• Treatment of NCDs fully integrated into mainstream primary health care services nationally and are sustainable
• Measurement of equity of access and payments part of scale-up • Appropriate financial support provided to those with financial barriers	• Ongoing monitoring of equity of access and payments
• Expanded evidence base in place to support policy/ decision making • Longer-term strategy involving key partners is agreed • Prevention and treatment are covered for 75 per cent of high risk population • Service delivery is evaluated for affordability, accessibility and quality	• Patient satisfaction levels are measured • Forward plan is fully funded and staffed • Prevalence is tracked and declining across all major population groups

Developing a business case for investment in NCD control

Political policy change is often most responsive to what are essentially economically framed arguments. An understanding of the economic and developmental impact that NCDs are likely to have on individuals, families, communities and national economies needs to be developed in the following areas:

- The complex role that NCDs play in determining health inequities within and between countries
- The economic impact of healthy years lost to communities and national economies, and
- The impacts of not integrating prevention and treatment into one NCD strategy.

Determining how to finance NCD programs

The issue of 'Who pays?' needs to be assessed and an evidence base built to support policy making. There are several parts to the overall financing issue; some to be considered include:

- The proportion of health sector resources to be allocated to NCDs
- Monitoring of out-of-pocket expenses related to NCDs and their impact on individuals and households
- Determining costs of service delivery and cost-effectiveness of prevention and treatment options
- The role of international donors and global financing partnerships in national NCD programs, and the potential impact of their operations on these programs, and
- Taxation as a means of both prevention and resource mobilisation.

Monitoring of NCD initiatives

In comparison with the data collected on indicators for the Millennium Development Goals (MDGs), the lack of systematic data in LMICs on NCDs makes the tracking of trends, evidence-based policy making and research more difficult. In addition to improving data collection with regards to morbidity, mortality and users accessing services, it will also be necessary to monitor the impact of NCD population-wide interventions on health practices and finances, of both businesses and individuals.

The political economy of public health policy

Understanding the problems that silence and misinformation about NCDs in LMICs have on international, national and community priority setting is essential. The political dimensions of NCDs cannot be ignored in any analysis; the need to create grassroots social movements to raise the priority of NCDs requires a shift in political action concerning research and analysis.

Specific health system strengthening policy needs

The core issues of health system strengthening need to be taken into account in meeting the challenges of NCDs. Financing has been already mentioned above, but other issues include:

- How to redeploy human resources into primary care and equitably allocate human resources while maximising cost-effectiveness; and how to regulate and monitor pricing of drugs which are commonly not available in LMICs and therefore supplied through the private or informal sectors.

It is important to recognise that weak health systems with insufficient health workers and health facilities can still begin to take action in relation to NCDs relatively cheaply, by starting with interventions like legislation on tobacco, salt and fats, while the longer term tasks of developing treatment models begin.

Conclusion

The growing burden of NCDs cannot be ignored, particularly in LMICs, where mortality and morbidity rates are currently high and projected to increase. NCDs bear important consequences for the health of populations, as well as for overall socio-economic development. To mitigate the devastating impacts of NCDs, it is crucial that effective responses be implemented urgently.

Experience from high-income countries that have made inroads into controlling NCDs, such as Finland, shows that to be effective, responses need to be comprehensive—integrating health promotion, prevention and treatment. This must involve a broad range of actors within and outside the traditionally conceived health sector. NCD responses also need to comprise both population-wide and targeted interventions, and simultaneously address both men and women, as well as different age and population groups. Given the chronic nature of NCDs, interventions related to both prevention and treatment will need to be delivered over sustained periods. All of these requirements demand a well-conceived public policy response, as well as robust health systems adapted to addressing both communicable and non-communicable diseases.

Health systems in most LMICs, however, are largely weak, with shortcomings in governance, financing, human resources, health information systems and supply and availability of drugs and technologies. Consequently, this paper has argued that health systems in LMICs need to be reformed in order to deliver comprehensive approaches that will halt and reverse the rising mortality and morbidity rates from NCDS.

The process of adapting health systems will no doubt be complex. In an attempt to clarify this, we have suggested that reforms will need to be targeted in the key areas of building political commitment and community involvement, public policy in multi-sectoral health promotion and disease prevention, service

delivery models and equity in access and payment for NCD services. The framework offered here might assist national policy makers to assess health systems' readiness to respond to the four NCDs. Taking the characteristics of the reform process into account, this paper also outlines the policy challenges that will need to be considered when implementing an approach that integrates prevention and treatment. It may not be unreasonable to expect that the need to develop a coherent response to NCDs in countries in resource constrained settings can also drive health sector reform more broadly. As such, the response to NCDs can become a 'tool' for reform for policy makers.

It is clear that adapting health systems to respond to NCDs will require a change in mindset and practices in programming for health, as well as substantial financial resources. Here, the role of development partners such as AusAID or the World Bank cannot be overlooked. Development partners that are considering how to allocate development assistance could consider supporting LMICs in:

- Building or strengthening data collection and surveillance related to NCDs
- Quantifying the investment needed to address NCDs in order to build a strong case for investment
- Building capacity in implementing health promotion policies and interventions, and
- Developing and testing service delivery reforms and pilots that combine health promotion, prevention and treatment, as well as providing a continuum of care.

Investments in these areas would not only benefit NCD programming, but also strengthen health systems and the health sector in ways that would benefit responses to many other diseases as well.

The more contentious issue is the extent to which a regional or global engagement in NCDs is warranted.

As a result of the UN summit on NCDs, there has been considerable discussion about the role of various development partners. The Paris Agenda has already set the tone for greater coordination between partners and has put more responsibility for priority setting into the hands of LMICs. The nature of the relationships between various development partners is a rich area for research in itself. Tracking transaction costs and disbursement of funds together with developing a better understanding of the intended and unintended consequences of various health development projects and programs are all important.

The fact that aid directed to NCDs constitutes such a small proportion of current aid may provide an opportunity to develop better quality initiatives from better targeted and more coordinated efforts between development partners.

The new form of development partnering envisaged in the principles set out in the Paris Declaration and Accra Agenda, the establishment of the International Health Partnership, the H8 and so on, could form the basis of making this happen.[22] Waage, Banerji et al in their recent article on focusing advocacy, improving targeting and the flow of aid in a post-2015 environment, indicate a need for a more holistic approach to development so that gaps between initiatives are not so obvious and, more importantly, that potential synergies between various initiatives are clearly identifiable.[23] This suggests that there is also scope for global health initiatives to better address NCDs.

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Pacific in crisis: The urgent need for reliable information to adress non-communicable diseases

Case-study

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Health information systems (HIS) are the foundation of a strong health system and key to making effective, evidence-based health policy decisions. Without HIS to inform decision-makers of where health problems are and whether the health of the population is improving or getting worse, sound judgements cannot be made. Currently, national HIS in the Pacific do not give Pacific decision-makers enough information to size their non-communicable disease (NCD) problem and address the needs for NCD prevention and control. Decision-makers in the Pacific need information on the magnitude of public health problems posed by NCDs; information on the levels and trends in the prevalence of risk factors; and information on the impact of current policies and programs on these trends.

A successful response to the rising NCD epidemic will also require the generation and dissemination of accurate information and evidence for decision-makers; national program managers; health facility managers for day-to-day management of NCD services and programs; and for clinicians to facilitate the long-term clinical management of patients. A key system necessary for generating the majority of this information is a Vital Registration (VR) system, in particular death registration systems, as they generate accurate data on trends in cause-specific mortality for different NCDs. Many countries in the Pacific still do not know the real burden of specific components of NCDs as reliable cause-of-death data is often absent.

There are two key areas for action to assist Pacific countries to better respond to the NCD crisis: (1) improve and strengthen the HIS of countries so they can better monitor population exposure to NCD risk factors (such as obesity and smoking); and (2) improve vital statistics so that countries can better understand their NCD problem and monitor disease outcomes.

The Health Information Systems Knowledge Hub, at the University of Queensland, along with a number of development partners working in the region, have begun the complicated task of assisting countries to improve and strengthen their HIS by:

- Providing crucial capacity building to the HIS workforce, including training on data collection, data presentation and dissemination, and offering fellowships and running a HIS Short Course
- Developing tools to assist countries to do their own country assessments and HIS planning
- Supporting countries to extract and analyse existing data-sets
- Synthesizing information so that best practice information on HIS is available to the region and countries can learn from each other
- Providing support on information and communication technology (ICT), including the development of tools to assist investment decisions
- Supporting the development of sound HIS policy, legislation and regulation.

One of the most important initiatives established to improve VR systems is the development of the Pacific Vital Statistics Action Plan. It aims to have operational and functional HIS in Pacific countries that will give national planners and decision-makers the information necessary to make decisions around resources and strategies needed to plan services, prioritise across different services/disease conditions and to monitor the impact of NCD programs on disease burden. Over the next three years the HIS Hub, Secretariat of the Pacific Community (SPC), World Health Organization (WHO), and other technical partners will work with 14 Pacific Island Countries and Territories to assist them to improve the availability and use of their vital statistics, and also assist staff in countries to analyse and correctly interpret data.

The focus of the work is on supporting countries to improve completeness of the registration of births and deaths, and to improve the reliability of data on cause-of-death. So far, implementation of the Action Plan has resulted in:

- Five countries developing their own vital statistics improvement plans with specific actions
- Four countries currently preparing to write a plan
- Three countries engaged in medical certification training with their doctors
- A number of in-country meetings hosted with representatives from Statistics, Civil Registration and Health present.

The Pacific Health Information Network (PHIN), has been working closely with the HIS Hub and WHO to build awareness about data; promote best practice for data collection; and increase analytical capability and capacity to analyse, interpret and use data to better support policy action to reduce risk factors for NCDs. Through these various strategies, frameworks, action plans and collaborations, health information systems in the Pacific will improve, ultimately leading to improvements in health, and, as stated in the Action Plan for Non-Communicable diseases, 'a region free of avoidable NCD deaths and disability'.[1]

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Pacific child health indicator project: Information for action

Original article

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Summary

The Pacific Child Health Indicator Project (CHIP) is a clinician-led project with the primary objective of improving child health in the Pacific through effective health information, effective clinical governance and decision support. The project was developed by Pacific Paediatricians who were concerned at the disconnect between front-line paediatrics and health information systems and policy.

The project initially worked with health services in Samoa and Tonga. Its focus was to develop functional child health information that effectively reflected the priority clinical issues facing children in Samoa and Tonga. In addition to baseline and trends in indicators and health information for priority child health conditions, a project focus has been on policy implications and the development of "Best Bets" for health service intervention. The methodology is inclusive and country driven, building on existing collegial working relationships between the principal investigators (Dr Percival, Dr Fakakovi and Dr Fatupaito-Maru) and in-country health sectors.

Through the development of robust child health information the project will provide a baseline platform to assist clinicians, health services, Ministries, non-government organisations and donors respond to the burden of disease for children.

Background - the need for local indicators

The effective use of health information to describe children's health status and inform policy and health service delivery can make a major contribution to reducing child morbidity and mortality. The Millennium Development Goals (MDGs), in particular MDG 4 (child mortality reduction), act as a focal point for development and aid efforts centred on children in developing countries.[2] Within the Pacific, an improvement in infant mortality and under-five mortality has been observed.[3] Some countries such as Samoa would seem to have achieved MDG 4 already with a two-thirds reduction in their under-five mortality.

'*Sound information is the prerequisite for health action: without data on the dimensions, impact and significance of a health problem it is neither possible to create an advocacy case nor to establish strong programmes for addressing it*'[1]

However, these widely used mortality indicators tend to create an 'averaging' effect on child health status, hiding growing disparities and emerging health problems within child population groups in the Pacific. Civil registration and systems required to maintain 'gold standard' mortality data within Pacific countries, overall, is lacking.[4] Indirect methods to calculate mortality may be used: as such, this mortality data needs to be used with caution.

Also of concern is that when MDGs and mortality are used to inform policy-makers in isolation from more sensitive child health indicators; they potentially create a policy environment where disinvestment in children's health could occur. Health information and child health indicators need to be a number of things. They should be specific, measurable, appropriate, relevant and time-framed.[5] Essentially there should be a suite of functional health indicators that reflect key child health issues for Pacific children, enabling effective and responsive decisions within the Island Nations. These indicators are sensitive to the conditions within the country settings and should reflect this.

Metodology

Engagement - a critical aspect of data collection

The focus of this phase was to gain project support, seek and understand local contextualisation, obtain advice and access information and data. In addition to individual meetings, large group meetings were held prior to and after data collection to verify and provide feedback. The approach utilised in this project is a combination of two Pacific methodologies – the Helu-Thaman Kakala model and the interwoven aspect of Talanoa. Both build on the local knowledge, open collaboration, respect, reciprocity and context. Each element of the Kakala model is in itself a journey and outcome, fitting the context of this project. Both of these elements of engagement are critical to the success of the project and to future developments.

Talanoa is a traditional Pacific way of discussion and decision-making and a recognised Pacific research methodology.[6] 'Tala' literally means 'to tell stories' and 'noa' means 'zero' or 'without concealment'. Using 'Talanoa' ideas are discussed in an open and frank manner until group consensus is achieved. The process of Talanoa is as valued as the outcome, building co-operation and respectful relationships.[7]

There were four key components to the **Kakala** methodology (Table 1). Firstly 'nofo' is a preparatory phase of literature review, and setting up a project steering group and country teams. Consultation and consensus occurred led by the country teams to decide on the priority child health conditions. Secondly 'toli mo fili'; a data review of what available information was currently collected and readily available for clinicians and decision-makers was undertaken in each country. Thirdly 'tui'; the data was reviewed and a set of functional indicators identified using criteria of timeliness, functionality, reliability. This set of indicators also went through a process of consultation and consensus. Finally 'luva'; the sharing and returning of information and reports with each country, where discussions and presentations were held on project findings.

Finding appropriate data – toli mo fili

The definitions of data for extraction, including codes and fields, were identified collectively by the project leader, project manager, health information manager and health information services manager for Tonga. However for Samoa the data extraction process was limited to that of clinical, health information specialist, project leader and project manager input. The health information service team in Tonga provided the expertise for collection of the data, extractions and verification of data prior to hand-over. All avenues of data sources have not been explored. Outer island hospital data for both Samoa and Tonga were not included in the data collection due to the time constraints on the project. Clinical coding verification with the Health Information Manager and clinicians over coding levels and codes for extractions were confirmed and defined. Principle diagnoses were utilised for all extractions due to the limitation in field extractions and systems available.

Sources

Collection of PATIS (Samoan Patient Information System) and THIS (Tongan Health Information System) data was undertaken for all conditions except for immunization and rheumatic fever, where data sources were in separate registers. The pre-set PATIS report formed the basis from which Samoan data were collected, with the exception of data from the PATIS pregnancy module which was extracted directly from the PATIS database by the health information specialist within the Ministry of Health.
In Tonga, the Health Information Services Manager extracted all data and information directly from THIS database (2009-2010) and MS Access database (2000 – 2008).

All data extracted from Samoa and Tonga's information systems were loaded into an MS Access Database, from which queries were built and executed.

Table 1 Kakala methodology

Phase	Kakala phase description	Kakala phase applied
Nofo	To sit and consider the purpose and style of the Kakala	• *Planning the project* • *Considering what data and reports*
Toli mo fili	Finding, selecting and picking the appropriate flowers	• Finding and deciding on appropriate data
Tui	Weaving the flowers to make the kakala	• Analysing and reviewing data • Constructing reports
Luva	The Kakala is not complete until it is given away	• Sharing reports, returning information to countries

Data completion and coding issues

A number of issues were noted in the data review, mainly that:

- Some of the fields where information were extracted from showed that the patient management system (PMS) did not have a validation check mechanism in place to eliminate duplications
- Some ICD codes were incorrectly assigned, e.g. adult only specific conditions coded to an infant
- Gastroenteritis had been incorrectly coded as non-infective gastroenteritis in children's cases for several years before being corrected three years prior
- Incomplete data sets – a number of fields within the databases did not have values, especially addresses or villages
- Problems also exist with simply using ICD coding itself as the application of diagnoses may vary
- Fields missing demographic values.

Coding and data entry anomalies such as incorrect adult diagnoses assigned to a child occurred in a small minority of cases. Others, such as address not being completed in the hospital patient data, occurred commonly. For the child health conditions requiring data for indicators, these anomalies had a small effect. When able to verify coded data with a second source such as ward admission books, we found data for common conditions such as pneumonia was very accurate.

For less common conditions, such as Kwashiokor, the coding accuracy improved in later years.

"Health Information" needs clinicians' input

A large number of generic codes are assigned –the accurate coding of malnutrition, for example, is reliant on doctors to document this as the principle condition for which a patient is admitted for treatment. If this is not clearly documented, clinical coders who may not understand the forms of malnutrition will assign a symptomatic generic code rather than being specific. This will result in the under-recording and reporting of malnutrition. This also applies to the example of gastroenteritis for children under-five coded to non-infective gastroenteritis. Clinicians need to provide input to clinical coders to ensure classifications are correct and reflect the burden of disease within the health system.

Clinicians' need "health information" input

Where classification of diseases have changed, it is important that both coders and clinicians are able to discuss which new codes best capture the disease correctly. Capturing low birth weights and pre-term babies born using ICD coding will require further training to maintain consistent agreement of definition and application between clinician and coders.

Review, analysis and reporting of data - Tui

Samoa and Tonga are two countries that are 'data rich', with a plethora of data sources, many in the way of manual registers. Apart from the data available from the PMS, it has proven difficult at times to physically access the data, as most registers are held by individuals in separate offices. Much time is needed to manually review each register, whether this is the obstetric or special care unit or ward registers. Some data and information is captured by individual disciplines, for example in the paediatric wards, nurses keep an admission book of all patients that are admitted to the ward, which details admission information, family socio-economic information, feeding practices, conditions/ disease, treatment provided and discharge information. A manual rheumatic fever, benzathine, penicillin and malnutrition register is also kept by paediatric nurses. In Tonga, a rheumatic fever book (for patient injections) is kept in outpatients. Therefore not all information pertaining to a patient is comprehensively stored, complete, accessible in a single location, or in the PATIS and THIS databases.

Data findings and information were reviewed, analysed and graphed. Not all information and data that was found was useful for indicators development. Some data from the Samoan Community Health Nurses Information Systems (CHNIS), though useful in the day-to-day care of children, was inaccessible due to constraints in timeframe and scope. This was similar to some information gathered from the Tongan Reproductive health nurses.

The previous toli mo fili (data collection) phase involved a review of the functionality and accuracy of computer based health information systems: PATIS in Samoa and THIS in Tonga. It took the approach of validating some of the key indicators with a second information source where it was unclear if the PATIS and THIS data truly reflected what was occurring within the country. During the Tui Kakala phase, information was analysed and graphed to show trends.

Use of rates and raw numbers and hospital data

Clinicians found raw numbers of child hospital admissions for conditions useful in reflecting trends and paediatric service burden. Rates were also calculated with the denominator being total child admissions. Another option would have been to use latest Census information. A decision to use hospital-based admission data was made for pragmatic reasons in that it was accessible and could be validated using a paper-based hospital source in addition to the PATIS/THIS systems. Similarly hospital death data was accessible with 'discharge death' diagnoses recorded in both country systems. In countries with limited vital statistics around child deaths and few patients having autopsies, this is perhaps the most direct and accurate death information we could find for cause of child deaths in Samoa and Tonga.

Summary of key activities and findings

The Pacific CHIP team worked with clinicians in 2010 to identify priority child health concerns in their countries (Table 2) and then went on to find available data that might reflect those health concerns in a meaningful way. The limitations of data are important in developing countries, so the emphasis was very much on available data, validating data with more than one source and mapping the human and clinical structure in information generation and use. The project produced health information on nine health priorities.

Table 2 Priority child health conditions (Samoa and Tonga)

1.	Neonatal morbidity (increasing numbers of low birth weight and preterm babies, congenital abnormalities)
2.	Neonatal mortality
3.	Severe malnutrition (marasmus and kwashiorkor)
4.	Acute respiratory disease (pneumonia and bronchiolitis)
5.	Gastroenteritis
6.	Rheumatic fever and Rheumatic heart disease
7.	Childhood injury
8.	Immunization rates and vaccine preventable disease
9.	Childhood cancer

Findings were presented to stakeholders in both countries. All policy and health service implications based on project findings have yet to be fully discussed with country health services and ministries. However a number of key findings with policy/service implications have already been highlighted (Table 3).

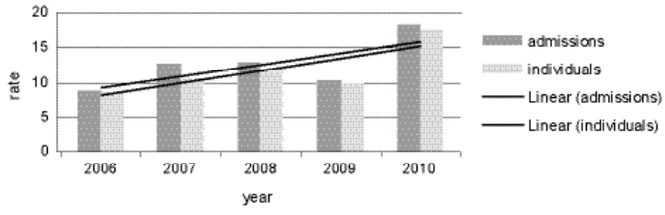
One key finding is the number child admissions in Samoa and Tonga with serious malnutrition (Figure 1).

Every week, at least one child is admitted to the National hospital in Samoa with either Kwashiokor or Marasmus. A clinical audit of malnutrition cases found associations with lack of breastfeeding, lack of understanding of dietary needs, use of traditional medicine and overcrowding.[8] A wider survey assessing the growth of children under two-years old in Samoa is needed.

Table 3 Key policy and service implications

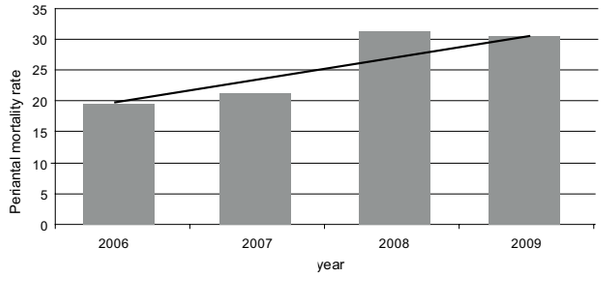
Child health finding	**Policy/ service implication**
Most child deaths occur in the first week of life	• Need for increased focus on antenatal, peripartum and neonatal care • Up-skill nursing workforce in neonatal care • Develop and **implement** guidelines for hospital based neonatal care • Need for clinical audit and process review of current health sector input into home care of the newborn in the first month of life • Further study of maternal health and low birth weight prevention
Lower respiratory tract infections (LRTI) continue to be commonest cause for admission and a leading cause of death	• Need to develop and **implement** clinical guidelines for management of pneumonia and bronchiolitis in hospital • Further study of preventable risk factors for LRTI needed
High numbers and rising rates of serious malnutrition cases admitted to hospital	• Retrospective clinical audit of marasmus and kwashiorkor in Samoa is underway • Further study of child nutrition (focused on under 2 yr olds) needed
Leading causes of child injury hospitalisation – burns, pedestrian injuries, falls	• Develop targeted injury prevention programmes such as burns prevention • Work with Land transport and Police to make the child pedestrian journey to school safer
Increasing perinatal mortality rate (Samoa)	• Registrar retrospective stillbirth clinical audit planned. Prospective study of Stillbirth risk and protective factors needed

Figure 1 Paediatric malnutrition admissions to Tupua Tamasese Meaole Hospital, Apia, Samoa (PATIS health information database, national health service)



* Rate = total admissions for malnutrition per 1,000 total admissions of under-five year olds

Figure 2 Perinatal mortality rate, Tupua Tamasese Meaole Hospital, Apia, Samoa (PATIS health information database, national health service and delivery unit records book, Tupua Tamasese Meaole Hospital)



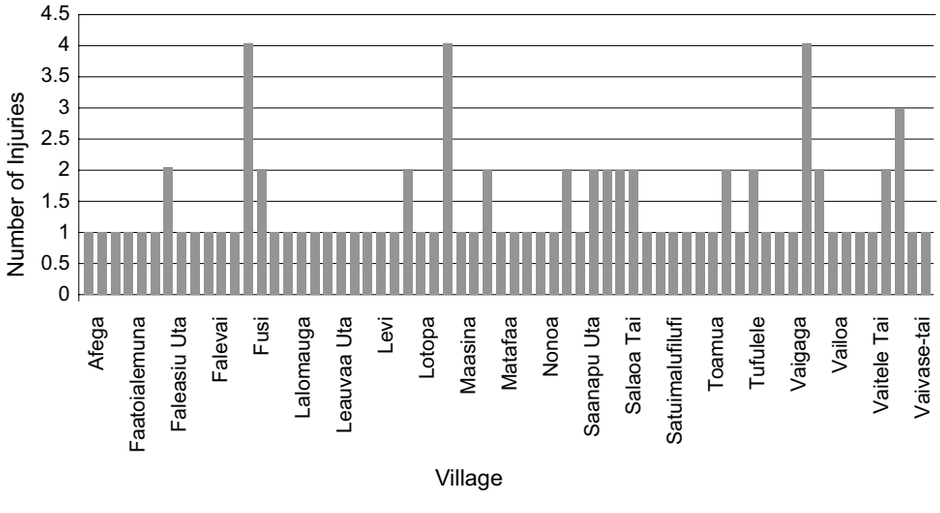
* Perinatal mortality rate = number of neonatal deaths plus stillbirths of 500gms or more, over the total number of live births per year

As expected, acute lower respiratory tract infections (LRTI) and gastroenteritis are leading causes of hospitalisation in both countries. Rates are static, neither increasing nor decreasing. LRTI's are also one of the leading causes of paediatric deaths in the countries. This is an area where more rigorous development and implementation of clinical guidelines could be undertaken. As with other low- and middle-income countries, a large proportion of deaths in childhood in Samoa and Tonga occur in the neonatal period (i.e. in the first month of life). The project has found the neonatal death rate remains steady with the leading causes of neonatal deaths being prematurity, sepsis, asphyxia and pneumonia. The rate of low birth weight[a] at 3.5 – 4% is not dissimilar to other countries.

Given the well-recognised increase in mortality, and long-term morbidity and health sector costs with low birth-weight babies, ongoing measures in maternal health and antenatal care need to continue to reduce their numbers. Pacific CHIP has found over 90% of low birth-weight babies in the countries are in the 1500gm – 2500gm range. This is the group with most potential for mortality and morbidity reduction in low- and middle-income countries through Level 2 neonatal medical care interventions, including temperature control, oxygen, intravenous fluids and antibiotics. The local Paediatric team in Samoa have been able to use this baseline data to facilitate funding and implement neonatal nurse training.

Another key finding has been the rising perinatal mortality rate[b] in Samoa (Figure 2). Perinatal mortality is an important international indicator of healthcare services and is particularly reflective of the health of pregnant women, new mothers and newborns.[9-10] A more in-depth review of maternal health and maternity care in both countries would be a useful area for future focus.

Figure 3 Total traffic related pedestrian injuries by village, as measured by children admitted to Tupua Tamasese Meaole Hospital, Apia, Samoa, 2005-2006



Childhood injuries are another priority condition. The project has been able to extract external mechanism of injury for hospitalised cases. Leading causes include falls, pedestrian injuries and burns. The project has also gone into more depth with each injury type looking at age range, geography and village (Figure 3). Local health information such as child pedestrian injuries by Village is important in enabling local responsiveness in health and transport interventions.

Recommendations

1. Capacity development - Health Information Systems and workforce

    a. The roles and function of health information services/system and health data managers and workers is key in supporting the overall infrastructure of each health system, but more importantly assist in the analysis and reporting, quality process checks on data and systems and research. There is a need for further development of health information systems and workforce capacity within each of the countries

2. Use of health information for policy and service delivery

    a. The project has described the burden of key child health concerns for Samoa and Tonga with increasing trends for serious malnutrition, perinatal mortality and continuing large numbers of lower respiratory tract infections, neonatal morbidity and child injury

    Consideration should be given to:

    - Extending the project to develop policy implications and best bet advice and papers for both countries

a Low birth weight = babies born alive with weight less than 2.5 kg

b Perinatal mortality – fetal deaths of 500gms or more and infant deaths up to and including 28 days of life per 1000 live births

- Further in-depth study of maternal health and care
- Further study of child nutrition and growth in both countries.

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Making sense of maternal mortality estimates

Original article

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Key points

Careful use of maternal mortality data can tell us about societal health and development, and the performance of health systems. In interpreting such data, use these simple rules:

- Examine definitions, data sources, data collection, margins of uncertainty and statistical methods
- Take into account the hierarchy of sources — some are better than others
- Avoid over-interpreting specific values — remember the context (particularly the confidence intervals or boundaries of uncertainty associated with each set of estimates)
- For general advocacy purposes, consider using bands (narrow bands in countries with low mortality and wider bands in countries with high mortality)
- Any maternal mortality ratio higher than 500 per 100 000 women requires urgent action
- Use the maternal mortality ratio with care, especially when the absolute number of maternal deaths is low
- Make use of the range of maternal mortality indicators (the maternal mortality ratio, the proportion of maternal deaths, and the lifetime risk) to provide deeper insights. Also, track the absolute numbers of maternal deaths
- Compare maternal mortality estimates with other maternal health data and indicators (e.g. fertility, nutrition) to assess their reliability
- Use estimates developed by external agencies (e.g. United Nations agencies) for comparison or to test country-reported values
- Remember that national maternal mortality data hide major disparities between geographic areas, socioeconomic groups and ethnic groups within a country

Why is it important to monitor maternal mortality?

Maternal mortality is an important marker of societal health and development and a particularly sensitive indicator of health system performance, hence its inclusion in the Millennium Development Goals.[1] The health of mothers is inextricably linked to that of their children, who are 10 times more likely to die within two years of their mothers' death.[2] In addition, for every woman who dies in childbirth, around 20 more suffer injury, infection or disease.[2]

In fact, pregnancy, childbirth and their consequences are still among the leading causes of death, disease and disability among women of reproductive age in developing countries. The risk of maternal mortality remains highest for adolescent girls under 15 years-old: complications in pregnancy and childbirth are the leading causes of mortality in adolescent girls in most developing countries.[2] Most of these deaths are preventable. It is for these reasons that so much emphasis is placed on maternal mortality and its measurement, even in countries where the number of maternal deaths may be small.

Despite its importance as an indicator, there are a number of uncertainties and misunderstandings around the measurement of maternal mortality that can be unsettling for those working in health and development. Different measurement methods generate varying figures that cannot be compared over time or between countries, resulting in multiple, often divergent values that are difficult to interpret and use. While this is also true for other indicators such as child mortality, the size of the discrepancies are such that the interpretation of maternal mortality data can be particularly difficult. This article provides useful guidance for understanding and interpreting maternal mortality statistics. More detailed guidance is provided in Working Paper 11, available at www.uq.edu.au/hishub

The decision-maker's dilemma

Table 1 demonstrates the dilemma faced by decision-makers (in this case for Nepal and Zimbabwe) when interpreting figures on maternal mortality. Presented with this set of maternal mortality figures, a number of questions arise. Are things getting better or worse? Which of these different numbers should be used to help determine policy and guide programmes? What can explain these large differences from one year to the next?

Table 1 Maternal mortality data, Nepal and Zimbabwe, selected years

Nepal MMR per 100,000 live births	Year	Zimbabwe MMR per 100,000 live births	Year
539	1993	283	1994
281	2003	695	1999
830	2005	880	2005
88	2007	555	2006
240	2008	725	2007
380	2008	624	2008
-	-	790	2008

This article offers some guidance on interpreting and using different estimates of maternal mortality and it shows how different values arise from variations in definitions, data sources, data collection methods, and statistical imputation techniques. It is not primarily directed at technical experts, but at those working in the field that may be less familiar with the statistical complexities, who are nonetheless users of the available data and advisers to government. It is not intended to be a manual on maternal mortality methods.[a] Rather, its focus is on how to interpret and use data that are already available.

Issues with maternal mortality definitions

The Tenth Revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10) defines a maternal death as "the death of a woman while pregnant or within 42 days of termination of pregnancy. . . from any cause related to the pregnancy or its management, but not from accidental or incidental causes"[3] (Box 1).

Maternal deaths are subdivided into those due to obstetric complications such as eclampsia, obstructed labour, puerperal sepsis, and obstetric haemorrhage (direct maternal deaths) and those due to existing conditions aggravated by pregnancy or its management (indirect maternal deaths). Deaths among pregnant women that are unrelated to the pregnancy are classified as incidental and should not be included as maternal deaths.

The main issues with this definition are to do with applying it correctly. Some causes of maternal deaths are hard to identify, easily missed, or not reported. There may also be miscoding or misclassifying of maternal deaths as a result, for example, of inadequate understanding of ICD rules by medical practitioners or due the difficulties that present when differentiating between what is an indirect and incidental causes of death.

To avoid some of these problems, the ICD introduced an additional category or definition called the 'pregnancy-related death', which only relies on determining the time of death rather than the specific cause. In most settings, the difference between pregnancy-related and maternal deaths is small (and often the terms are used interchangeably).

Box 1

Maternal death: '*....the death of a women while pregnant or within 42 days of termination of pregnancy....from any cause related to the pregnancy or its management, but not from accidental or incidental causes*' (ICD-10).*

Maternal deaths are classified into:

- Direct - obstetric causes (i.e. directly related to the pregnancy)
- Indirect - exisiting conditions aggravated by pregnancy or its management
- Incidental - unrelated to pregnancy

Pregnancy-related death: death of a women while pregnant or within 42 hours of terminations of pregnancy, irrespective of cause of death.

Late maternal death: The death of a women from direct or indirect obstetric causes, more than 42 days but less then one year after termination of pregnancy.

*International Statistical Classification of Diseases and related health problems, 10th revision, WHO[3]

Making sense of maternal mortality indicators

There are multiple indicators of maternal mortality. Each can be useful to describe different aspects of the level of maternal (or pregnancy-related) mortality. Deciding which indicator to use can be confusing. The maternal mortality ratio receives the most attention among policy makers, programme managers, and the donor community, and would therefore appear the most obvious to select. However, because the data required for any of these indicators can be inaccurate, unreliable or unavailable, in practice, it is advisable to use more than one indicator as this will provide valuable insights into maternal health as a whole. Ideally, measures of maternal mortality should reflect:

- The annual risk of maternal death per women (MMrate)
- The obstetric risk (MMratio)

a See, for example, www.maternal-mortality-measurement.org/

Table 2 Summary of maternal mortality data indicators and their uses

Indicator	Definition	What it measures
Maternal mortality ratio (MMratio)	Number of maternal deaths / Number of live births (often expressed per 100,000)	Expresses the risk of dying faced by women with each pregnancy (the obstetric risk). It is the most commonly used indicator of maternal mortality
Maternal mortality rate (MMrate)	Number of maternal deaths / Number of women aged 15-49 (often expressed per 1,000)	Expresses the risk of maternal death among women of reproductive age. Captures the relationship between maternal mortality and fertility[+]
The lifetime risk of maternal death (LTR)	$1- (MMRatio)^{TFR}$ / 100,000	Summarises the risk of a women dying from maternal causes over her 35-year reproductive life span. Used due to the fact that most women become pregnant more than once in their lives
The proportion of maternal deaths in females (PMDF) among women of reproductive age	Number of maternal deaths / Total deaths in women aged 15-49 (often expressed per 100)	Useful when information on the numbers of live births or numbers of women of reproductive age is not readily available

[+] General Fertility Rate (GFR) = $\frac{\text{Number of live births}}{\text{Number of women aged 15-49}} * 100$

- The overall level of fertility (General Fertility Rate)
- The overall level of mortality in the population and its distribution by age, sex and cause (PMDF).

It is also important to track the absolute numbers of deaths, especially in small countries or where maternal mortality levels are low. A simple distribution of numbers of deaths by time of occurrence (during pregnancy, during delivery, and post-delivery) provides valuable information for policy and programming.

Sources of maternal mortality data

There are many different sources of maternal mortality data and data collection methods (Table 3). These sources tend to yield different maternal mortality measures with varying degrees of accuracy and certainty. There are numerous factors, besides the quality of the data, that dictate which methods are used including costs, accessibility (e.g. geography, population spread, language etc.), resources and time. Hence, whilst the ideal is to use sources that provide the highest quality data, in reality, there is no single perfect method for every situation. Each source has its strengths and weaknesses that will suit a situation. Different data sources and methods also offer different opportunities for gathering other important data alongside the measurement of maternal mortality. This has important implications for the efficiency and cost-benefits of different measurement approaches as well.

The best routine source of data on maternal deaths is a civil registration system. A good civil registration system assures the continuous, permanent, compulsory and universal recording of the occurrence and characteristics of vital statistics, including births and deaths[b]. However, it takes considerable time and money to develop such systems completely and comprehensively. In the near future therefore, civil registration systems may be unattainable in many developing countries.

The important elements to consider when interpreting maternal mortality from different data sources, or when deciding which data collection method to use are:

- What event is being measured, i.e. maternal deaths or pregnancy-related deaths
- The accuracy, precision and certainty of the estimates produced
- The time period the data refers to (how recent is the data and thus how reflective is it of the current circumstances), and
- The costs, time and resources needed to establish and maintain the data source.

b For more details, please refer to the Principles and Recommendations for a Vital Statistics System, Revision 2 (United Nations Publication, Sales No. 01.XVI.10).

Table 3 Summary of maternal mortality data sources and data collection methods

Method and event measured	Advantages	Disadvantages	Time period measured
Civil registration with medical certification of cause-of-death Maternal mortality	Routine data collection based on administrative records Provides ongoing record of births and deaths and cause-of-death for the whole population Benefits individuals and families through the provision of legal certificates Generates complete listing of deaths in women of reproductive age	Maternal deaths can be misclassified (up to 50% under-reporting in some studies) Civil registration may not be functional in developing countries	Previous year
Sample registration with verbal autopsy Maternal mortality	Can be used where civil registration is not functional Provides nationally representative estimates Verbal autopsy is useful for determining cause-of-death outside health care facilities	Variable accuracy of diagnosis in verbal autopsy, and cause-of-death may be misclassified May not identify maternal deaths early in pregnancy WHO standard verbal autopsy tool is complex to administer Often not cost-effective as uses medical practitioners to determine cause-of-death	Previous year
Household survey with direct estimation Pregnancy-related mortality	Survey can provide information on wider aspects of maternal health and care as well as mortality Reports on the preceding 2–3-year period which is adequate for monitoring	Measures pregnancy-related mortality, not maternal Need large samples for reliable estimates Estimates have wide confidence intervals, making it hard to monitor trends	Usually one to two years prior to survey
Household survey with direct or indirect sisterhood methods Pregnancy-related mortality	Cost effective (require smaller sample sizes than direct methods)	Measures pregnancy-related mortality, not maternal Estimates have wide confidence intervals, making it hard to monitor trends Provides retrospective (not current) estimates of maternal mortality	Around 10-12 years prior to survey
Census Pregnancy-related mortality	No sampling errors (entire population counted) Allows detailed analysis of results (trends in time, location, and social strata) Provides recent (1–2-year) estimates of maternal mortality	Subject to non-sampling errors (i.e. human errors: biased questions, errors in data collection) Requires demographic adjustment techniques to deal with under-reporting of births and deaths in the census Usually only done once a decade limiting usefulness for monitoring	Usually one to two years prior to census
Health facility reporting Maternal mortality	Provide useful information on trends in hospital maternal mortality over time Can be first step in conducting audits to identify and address weaknesses in health care systems	Not representative of a population's maternal mortality because only a proportion of all deaths occur in health facilities	Usually recent reference period
Reproductive age mortality studies Maternal mortality	Provide a reliable estimate of maternal mortality, if done properly	Complicated, time consuming and expensive; therefore usually restricted to sub national populations Does not always generate reliable data on live births for calculating maternal mortality ratio	Method brings together data from other sources

Hierarchy of data sources

When multiple data sources are available, and assuming that each is correctly implemented, there is a hierarchy for assessing the resulting maternal mortality data. At the top of the hierarchy are methods that involve a full count of events and generate unbiased population-based values. These methods include civil registration with medical certification of cause-of-death (assuming high completeness rates), followed by sample registration with verbal autopsy (assuming that the sample sites are representative of the total population).

At the next level is longitudinal surveillance in specific sites. This involves a full count of events and verbal autopsy to establish cause of death, but it is limited to the population under surveillance. The sites are not randomly selected and are not nationally or even locally representative. Reproductive age mortality studies aim to establish a full count of events by reconciling data from different sources (registration, health facilities, cemeteries, religious institutions etc.) but are rarely conducted at national level.

Household surveys are of value for generating broad orders of magnitude but sample size considerations mean they are not efficient instruments for generating sub national data and can be problematic for monitoring trends.

The census can generate data at the sub-national level and identify inequities between population groups. However, for technical reasons the estimates may be biased and incomplete. Moreover, the census is conducted only every 10 years so is not a good method for ongoing monitoring. The census should be used as an adjunct to other data sources rather than a stand-alone source.

Health facility-based data do not produce population-based estimates of maternal mortality unless all women deliver in health facilities, all maternal deaths are correctly identified, and all facilities report maternal deaths. However, this could be a useful source if sustained efforts were made to ensure complete reporting by all facilities (public and private) and there were complementary mechanisms for identifying deaths in the community. Failing that, facility data can be used to identify individual deaths and conduct audits and case reviews to evaluate quality of care, describe the causes and circumstances associated with each death, and identify locally relevant avoidable factors.

Monitoring rare events

Many of the problems associated with monitoring maternal mortality arise from the fact that maternal deaths are relatively rare, only about 5% as common as child deaths. The small numbers involved means that national trends based on indicators tend to be unstable (or can appear to fluctuate dramatically). In countries with small absolute numbers of maternal deaths, changes of one or two deaths can appear to have a disproportionate effect on the maternal mortality ratio. For example, a country with some 4,000 live births annually, and between four and six maternal deaths in a given year, will see the maternal mortality ratio fluctuate between 100 and 150. For this reason, WHO advises countries to use a three to five year moving average to illustrate trends, rather than year-on-year values.

Small absolute numbers are particularly problematic in countries with fewer births annually than 100,000 used in the calculation of the maternal mortality ratio, as is the case in most small island countries in the Pacific and the Caribbean. As mentioned earlier, in such settings, it can be argued that rather than monitoring the maternal mortality ratio, which will be subject to seemingly substantial variations associated with small numbers, it is more appropriate simply to track the overall numbers of maternal deaths and to carefully investigate each in order to address the underlying causes to avert such deaths in the future.

Taking trends

The uncertainty inherent in measuring maternal mortality means that it can often be difficult to make definitive statements about trends in the data and whether they are in fact improving or getting worse. In such cases, other trend data will be needed to support the interpretation of the observed time trends. But even when there is greater certainty in the measurements so that the estimates can be assumed to reflect a real trend, other data should be brought into play to reinforce the conclusions. A common finding is that more than one kind of indicator is needed to explain trends. These may include fertility, coverage of maternal health care, availability of maternal health care services, female education, nutrition, and women's status in society. When used in conjunction, these indicators can reveal the underlying reasons behind any observed trends that may appear unusual or unexpected.

Trends in pregnancy-related mortality can also be compared with trends in other health indicators, notably child mortality, for which there is better data availability. There is a typical relationship between maternal and infant or child mortality (or neonatal mortality if the data are available and of sufficient quality). Because deaths in infants and children are much more frequent, the estimates tend to be more stable (i.e. less dramatic fluctuations). Thus, a given level of maternal mortality should be associated with a measured level of infant or child mortality. Departures from this relationship are more likely to be indicative of problems with the maternal mortality data than with the child mortality data.

Global estimates of maternal mortality

The rationale for global estimates

A group of UN agencies – WHO, UNICEF, UNFPA and the World Bank – have been producing global and country estimates of maternal mortality since 1996[4-7]. The most recent UN estimates, issued in 2010 for the year 2008, include not only point estimates but also, for the first time, country-by-country time trends from 1990 to 2008[8]. Also, in 2010, the Institute for Health Metrics and Evaluation (IHME) at the University of Washington in Seattle, produced a set of global estimates of maternal mortality levels and trends between 1980 and 2008[9]. Both exercises were driven by the need to track progress towards the Millennium Development Goals. To achieve this, it was necessary to monitor global and regional trends using a common format (given the variety of definitions, data sources and data collection methods being used to measure maternal mortality at country level) in order to generate a set of figures comparable across countries and over time. There was also a need to account for countries and time periods for which empirical data was unavailable.

A consequence of using different statistical models, data resources, assumptions about data quality and missing data is that statisticians will arrive at different estimates of mortality levels and trends for countries, regions and the world. This is a normal and predictable outcome of the scientific process, and while inconvenient for policy, reflects the uncertainty arising from poor health information systems in many countries.

International agencies or academic institutions may not always have access to the latest available country data or perspectives in levels of maternal mortality. Both the IHME and the UN statistical models produce estimates for countries and time periods without primary data. They are, however, essentially predicted statistics derived from a statistical model relating maternal mortality to independent variables or covariates. Such predicted statistics are useful for advocacy, planning, strategic decisions, and identifying research priorities. However, they are not designed for country monitoring of progress towards targets and for an assessment of what is effective and what is not[10].

These estimates can still be very useful to countries however, as a means for comparison or a way of testing country reported values. Where the estimates are close to the country-generated data, this can reinforce the overall picture and provide greater certainty of estimates. Where they are radically different, it may cause countries to consider conducting an exercise to understand the source of the differences.

Presenting and interpreting maternal mortality data

When maternal mortality data are presented to decision makers, it is important to provide assistance in interpreting the values and understanding trends:

- Include metadata (definitions, data sources, uncertainty) when presenting results in order to avoid inappropriate comparisons across different methods and times
- Use the maternal mortality ratio with care, especially when the absolute number of maternal deaths is low. Smooth year-to-year data by applying a three or five-year moving average. Establish surveillance systems for individual cases, coupled with facility audits and confidential enquiries, to discover the underlying causes of deaths and potentially avoidable factors
- When presenting maternal (or pregnancy-related) mortality ratios to decision-makers, avoid over-relying on point estimates and consider presenting estimates within bands of numbers of deaths to number of live births:
    - Narrow bands for countries with low maternal mortality
        - <20
        - 21 - 39
        - 40 - 59
        - 60+
    - Wider bands for countries with high maternal mortality
        - 300 - 499
        - 500 - 699
        - 700 - 899
        - 900+
    - Medium bands for countries with intermediate levels of mortality
        - 50 - 99
        - 100 - 199
        - 200 - 299
        - 300+
- Make use of the range of maternal mortality indicators - the maternal mortality ratio, the maternal mortality rate, the proportion of maternal deaths in females (PDMF) and the lifetime risk. Also track the absolute numbers of maternal deaths
- Assess the reliability of maternal mortality estimates by comparing them with other data on infant and child mortality and with indicators such as fertility,

coverage of maternal health care, availability of maternal health care services, female education, nutrition and women's health in society

- Use estimates developed by external bodies such as UN agencies or academic institutions for comparison or to test country-reported values

- Remember that national maternal mortality figures hide major disparities between geographic areas, socioeconomic groups and ethnic groups. The extent and persistence of such inequities can be surmised by tracking disparities in such maternal health care indicators as coverage of maternity care, educational attainment and other socioeconomic indicators, as well as other pregnancy-related outcomes such as stillbirths and early neonatal mortality rates (where available)

- It is important to note that any maternal mortality value higher than 500 per 100 000 live births reflects a problem that requires urgent action. Differences of 550 or 750 per 100 000 live births are of little significance.

Resolving the decision-maker's dilemma

But what to do about the dilemma faced by country decision-makers when faced with a set of apparently inconsistent and contradictory estimates of maternal mortality data, such as those for Nepal and Zimbabwe (Table 1). Ultimately, what a decision-maker wants to know is: Are things getting better or worse, and why? It is clear that it is not sufficient to answer this question using pregnancy-related or maternal mortality figures in isolation. Interpreting any figures must be accompanied by an understanding of the metadata associated with each number; in other words, the definitions, sources and data collection methods, the estimation methods and the uncertainty around the values. Interpretation is also reliant on an understanding of broader developments in related indicators, such as overall levels of mortality, patterns of disease and risks, and coverage of essential maternal health care interventions; for example, use of skilled birth attendant at delivery, levels of fertility, nutritional status, etc.

Conclusions

This article draws attention to the challenges of measuring and interpreting data that monitors maternal mortality. To address these challenges, decision makers and technical experts should work together to analyse maternal mortality data, bearing in mind the definitions and sources used. All efforts should be made to clarify the underlying causes and circumstances of deaths, and data should be interpreted in conjunction with information on the coverage of program interventions and other determinants such as fertility, nutrition and women's education.

When interpreting and using maternal mortality data, observe a few simple rules:

- Be sure to review all metadata, including definitions, data sources and data collection methods, margins of uncertainty, and statistical methods for adjustment and imputation. This will help avoid inappropriate comparisons across different methodologies and time periods

- Take into account the hierarchy of maternal mortality data sources. Preferred sources generate population-based, unbiased estimates on a continuous basis; these include civil and sample registration. Household surveys and censuses produce population-based estimates but only on an occasional basis and they have margins of uncertainty that render them problematic for monitoring trends. Facility-based data can be available continuously but do not generate population-based estimates unless all deliveries take place in health facilities and all facilities report maternal deaths accurately. This is rarely the case in developing country settings

- Avoid over-interpreting specific values. The maternal (or pregnancy-related) mortality ratio is expressed per 100,000 live births. In practical terms, this means that the difference between 600 and 650 is not dramatic. For presentation to policy-makers, avoid over-reliance on point estimates and consider presenting estimates within bands. In low mortality countries, the bands can be relatively narrow: <20; 21-39; 40-59; 60+. In high mortality countries, the bands should be wider: 300-499; 500-699; 700-899; 900+. In countries at intermediate levels, the bands could range from: 50-99; 100-199; 200-299; 300+. The important point to grasp is that any maternal mortality value higher than 500 per 100,000 reflects a problem. It matters little if the value is 550 or 750 per 100,000. While this approach will make it harder to monitor trends, it will help shift attention away from minor changes in the ratio and foster a broader understanding of the uncertainties involved in monitoring maternal mortality

- Use the maternal mortality ratio with care especially when the absolute number of maternal deaths is low. Small countries, such as Pacific Island nations, and those with low numbers of deaths, will inevitably see large stochastic variations in the maternal mortality ratio from year to year. It is good practice to smooth year-on-year data using a three- or five- year moving average. It is also important to establish systems of surveillance of individual cases coupled with facility audits and confidential enquiries in order to ascertain the underlying causes of death and potential avoidable factors

- Make use of the range of maternal mortality indicators, not only the ratio, but also the rate, the PMDF and the lifetime risk and track the absolute numbers of maternal deaths

- Assess the plausibility of maternal mortality values

by comparing them with other data such as levels of infant and child mortality as well as with indicators such as fertility, coverage of maternal health care, availability of maternal health care services, female education, nutrition, and women's status in society

- Use estimates developed by external agencies, such as UN agencies or academic institutions, as a sounding board or way of testing country reported values. Where the estimates are close to the country-generated data, this can reinforce the overall picture. Where they are radically different, consider conducting an exercise to understand the source of the differences. International agencies or academic institutions may not always have access to the latest available country data or perspectives in levels of maternal mortality

- Remember that national maternal mortality data will hide major disparities between geographic areas, socio-economic groups and ethnic groups. The extent and persistence of such inequities can be surmised by tracking disparities in maternal health care indicators such as coverage of maternity care, educational attainment, and other socioeconomic indicators as well as other pregnancy-related outcomes where available, such as stillbirths and early neonatal mortality rates.

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Annual reports in the Pacific: Transforming data into information and knowledge

Original article

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Abstract

Annual Reports provide a wealth of raw data. However, they are often comprised of pages of complex tables with little interpretation or descriptive analysis provided, thus limiting their usefulness in monitoring and evaluating health patterns. This article provides an overview of research carried out as part of a Masters Dissertation, which was concerned with what Annual Reports from Pacific Island Countries can tell us about the quality of data being produced from Health Information Systems (HIS). Five dimensions of quality were selected for assessment (comparability, disaggregation, interpretability, presentation and timeliness), and methods of measurement developed accordingly.

Findings from the research are two-fold. Firstly, reports are often excessively long, with a wide range of information on the entire Health System and include pages of dense tables with little critical analysis on implications for policy or decision-making. The second main finding relates to the concept of quality. Overall, the research found that the quality of data produced from HIS, as presented in Annual Reports, is poor. The wealth of data contained within Annual Reports deserve wider dissemination and use, and could play a crucial role in evidence-based decision making and the monitoring and evaluation of health systems and health outcomes. As such, four key recommendations are proposed: (1) comprehensive review of reporting practices; (2) development of quality assessment tools; (3) development of regional reporting templates; and (4) development of a minimum data set.

Key words: **Annual Report; Data; Health Information System (HIS); Pacific Island Countries and Territories ('the Pacific'); Quality**

Annual health yearbooks or reports are one of the routes through which health information is transferred from data producers to end-users or decision makers[1]

The Annual Report

Health Information Systems are comprised of a number of components, ranging from resources and indicators, to data management and dissemination practices. Annual Reports (also referred to as health or statistical yearbooks or bulletins), represent 'information products': the formatting and packaging of information into readily available formats such as dashboards, reports, queries and alerts.[2] Reports are generally comprised of numerical data on the characteristics of people using healthcare facilities and the services provided, and often contain a wealth of raw data.[3,4] Information on the types of diseases, number and sex of newborns, characteristics of deaths, and service use are all commonly contained in Annual Reports. Such information can be used to inform comparisons of past and present performance and health status, planning, assessing the work performed by providers and funding requirements.[4] Annual reports also play an important role in monitoring and evaluation.[5,6]

In their workshop on country best practices, the World Health Organization (WHO) formulated three broad 'types' of Annual Reports:

- Type 1: Raw Data. These reports include detailed tabulations of data on health facilities and health service performance, including monitoring progress towards health goals and health service use. However, these reports are of limited use other than to researchers
- Type 2: Statistical Reports. Basic summary statistics with an analysis of the data in terms of comparisons between groups and areas and overall trends are included in this type of report. Also included are activities conducted within the health sector, and operational descriptions of health care facilities
- Type 3: Summary Report with Interpretation and Analysis. This type of report includes characteristics from the previous two, as well as information on the program and policy implications of data and is suitable to a non-technical audience. It reflects, in essence, the 'best practice' approach to reporting.[1]

Common limitations and weaknesses

From the limited previous research on Annual Reports available, it is apparent that most reports are underutilized, cumbersome and poorly presented, have too many tables with insufficient analysis and visual presentation, and have enormous variation in content and format.[1] While data published annually by most countries are assumed to be meaningful, this is not always the case.[7] In the case of Annual Reports, data is often collected and presented in crude formats, with limited attempts at analysing the data for use in day-to-day management and planning.[2] While, 'there is little point in engaging in the time- and resource-consuming process of data collection if there is no commitment to analysing the data, disseminating the information and using it to improve health system functioning', many Annual Reports seem to do just that.[2] As remarked by the Western Pacific Regional Office of WHO (WPRO) in their publication on improving the quality of reports, many Annual Reports only present work done during the reporting period, which is not particularly useful for problem identification or decision-making.[4] They argue that reports comparing a select number of indicators over time are far more useful for such purposes.

There are many reasons for the poor quality of Annual Reports, ranging from issues of incomplete, inaccurate or insufficient source data; to poor transfer of data from one document to another; inaccurate coding; and the lack of standard terms and formulae.[4] Further, the use of different sources, definitions and methods reduces data comparability between countries and within reports over time.[8] As such, assessing trends becomes difficult, and opinion, extrapolation and estimates are favoured above the reported data itself: a pattern clearly demonstrated in the limited international (and national) use of Pacific-generated data. Annual Reports are also primarily comprised of administrative data: data that is the by-product of delivering services to people. However, as argued by Iezzoni,[9] such data was never intended to assess outcomes; it is only due to its readily available and inexpensive nature that the use of administrative data has taken on a wider role in reporting. Administrative data are further limited due to its inherent bias in only reporting on the population using health services.[2]

Annual Reports often serve multiple purposes, including the development of statistical databases and acting as basic public health reports. More importantly, they act as the sole or main outlet for the dissemination of facility-based data: yet there is no standard reporting system guiding the contents of such reports, or the processes around data analysis or presentation.[1] More often than not, lower level managers are required to report on a vast quantity of data to higher levels: data for which they receive no feedback and data that is rarely used at higher levels, due to what AbouZahr and Boerma refer to as 'information overload'.[8] As such, processes for improving quality revolve around preparing reports in a logical, useful and meaningful manner; checking data for face validity and consistency; proof-reading; and explicitly defining the purpose, objectives and scope, through asking questions such as 'what information does the user want', 'what information is available', and 'what is routinely collected or will require additional work'.[4]

There is little point in engaging in the time- and resource-consuming process of data collection if there is no commitment to analysing the data, disseminating the information and using it to improve health system functioning[2]

Increasing global attention

In July 2010, representatives from ten countries[a] and a number of international agencies convened a technical meeting to assess current country reporting practices. The review centred on the following themes:

- Well chosen and balanced indicator selection
- Appropriate data sources
- Quality assessment and processes
- Sufficient capacity for analysis and synthesis, and
- Effective communication of results to key audiences.[1]

The main findings from this review were that while most countries had a list of core indicators, in some cases this included more than 100 indicators, and they were often skewed towards particular elements in the results chain.[1] The challenge here, reviewers argue, is to ensure an appropriate balance across the range of input, output, outcome and impact indicators. In terms of data sources, most countries were found to include references to the origin of the data, which ranged from administrative sources to household surveys. While the data contained within each report varied between countries, a common characteristic was the lack of systematic quality assessments, resulting in biased, incomplete and tardy data. Capacity for analysis and synthesis was also limited, with most countries relying on external consultants.

Other issues related to the production of Annual Reports reviewed included numerous reporting requirements, challenges between the demand from donors and available supply of data from countries, continued data gaps and the limited capacity at every point in the system.[1] Furthermore, challenges affecting the use of reports in decision making ranged from issues with completeness and coverage; comprehensiveness; data quality and triangulation; data standards; timeliness; capacity to respond to different demands; and ability to cater to diverse audiences.[1] Finally, in terms of communication and use, it was found that annual statistical yearbooks, abstracts or reports were the most common mode for transferring information from data producers to end users. However, despite the

a Benin, Ethiopia, Ghana, Kenya, Nepal, Mali, Mozambique, Rwanda, Thailand, and Uganda

considerable effort and resources invested in producing reports, they remain underutilised in the health and development community due to poor presentation (long and complex tables), limited accessibility (unavailable or undownloadable from websites) and poor timeliness.

A similar workshop facilitated by the WHO was held in South Africa in October 2010, with the intent of enhancing the analytical capacity of countries to conduct comprehensive health progress and performance reviews in the context of national health plans and related global health goals. Overall though, despite the growing international attention Annual Reports have received in recent years, little follow-up action has occurred (such as the production of country guidelines or training on data analysis that were due for publication by the WHO in 2008) and no work has been carried out in the Pacific as yet.

Aims, objectives and methods

In light of the paucity of research in this field, and the absolute dearth of information related to Annual Reports in the Pacific, research was carried out in 2010 to addresses the overall question of, *'What can Annual Reports tell us about the quality of data produced from Health Information Systems in three different Pacific Island Countries?'* Specific objectives were to: (1) detail what is presented in Annual Reports and assess how this varies both between countries and over time; (2) explore the structure of reports; (3) describe what the data in Annual Reports 'tells us'; and (4) assess the quality of the data between countries and over time.

The overall research design was an intensive desk-top review of *Annual Reports to the Minister of Health* produced by Pacific Island Countries and Territories. Three criteria were applied when selecting countries for review: Annual Reports were readily available in English (either online or in hardcopy); the cross-section of reports selected were all from a relatively stable system; and the reports were from a variety of Pacific Island Countries and Territories, representing different population sizes, level of development and cultural influences.

After reviewing the Annual Reports available, and in light of the country inclusion criteria developed, the following three countries were chosen for review:

1. Cook Islands
2. Fiji
3. Tonga.

The review of each Annual Report was divided into two main sections: descriptive and analytical (Box 1). As some of the reports were over 100 pages long, and the bulk of the data was contained within tables (and to a lesser extent, figures), it was decided to only assess data contained within tables and figures for this component of the analysis. Five dimensions were used in assessing data quality: comparability, disaggregation, interpretability, presentation and timeliness. In selecting the five quality dimensions for assessment, three main considerations were taken into account: (1) results from the literature review; (2) practical limitations of what could be measured; and (3) relevance to the contents of Annual Reports in the Pacific.

Box 1 Methodology

What can Annual Reports tell us about the quality of data produced from Health Information Systems in Pacific Island Countries?

1. Country inclusion criteria
2. Descriptive review: What is presented? What does it look like? What can it tell us?
    a. Report structure
        i. Audience, purpose and use
        ii. Report type
        iii. Number of pages
        iv. Number of sections
        v. Number of tables and figures
    b. Data characteristics
        i. Data domain
            (1). Determinants of health
            (2). Health system
            (3). Health status
        ii. Indicators presented
            (1). Indicator group
            (2). ICD-10 code
3. Analytical review: What is the quality of the data?
    a. Comparability
        i. Indicator-comparability score
        ii. Indicator stability
        iii. Indicator selection
    b. Disaggregation
    c. Interpretability
    d. Presentation
    e. Timeliness
        i. Production time
        ii. Reference time

Discussion

Annual Reports from the Pacific present us with countries whose Health Information Systems are 'data rich, but information poor'. Each report has anywhere between 25 and 80 tables, 50 to 160 pages, and in most cases, hundreds of indicators: effectively making it hard to understand or even 'see' the information. The reports serve a broad range of purposes including compliance with legislative requirements; donor accountability; the provision of information to the public; planning; and international reporting agreements. As remarked earlier, countries of the Pacific are truly running the risk of 'drowning in numbers' as they swim through the 'vast sea of data' they continue to produce.[10] Very few of the tables or figures are referred to in the text, with some countries opting to place a significant amount of tables as appendices, with no attempt at linking them into the main report itself. Furthermore, most of the text is descriptive in nature and lacks any critical reflection or analysis on what the data is showing. There are, for example, few occasions when reports compare data over time or space, or in light of government policy or objectives; highlighting the apparent lack of appreciation among data producers that data alone means very little, and that it is only through context, comparison and explanation that it can begin to 'tell its story'.

In both Fiji and Tonga, there is a strong emphasis for reporting on measures of health system performance: over half of all tables and figures were based on data related to system inputs, outputs and outcomes. The pattern of reporting for the Cook Islands is different, with over half of the data in their reports relating to measures of health status. Overall however, a common theme linking these countries is the presentation of data as individual 'facts': there is little, or no attempt at linking objectives to inputs, outputs, outcomes and health status. Rather than being presented with information on the flow of progress through the health system, users are presented with segregated data on, for example, 'number of bed days available', 'number of surgical procedures performed', and 'number of surgical-related infections', with no appreciation of the overall picture of what is happening. While the data in Annual Reports may be able to provide us with a number of key indicators on the health system or health status, as it stands, it can only provide us with a 'snapshot' or cross-section of performance for the year in question.

Furthermore, this snapshot we are provided with only skims the surface of the bigger picture. The majority of health status indicators that are presented consistently are high-level aggregate measures of mortality or morbidity (such as top-ten causes), thus providing no information on differences between age groups, gender or regions. Due to heavy reliance on hospital administrative systems, most of the data within Annual Reports can only inform us about the people in contact with health services, and very little attempts have been made at assessing the burden of disease among those disengaged with the system. This reliance on systems-based data is also apparent in the dearth of information related to the socioeconomic or demographic factors impacting on health, including environmental and behavioural risk factors. Information such as this is crucial in the management, planning and implementation of health services, yet very little data within Annual Reports is dedicated to this topic.

Legislative requirements

The legislative requirements and stated potential audience, purpose and use has a direct impact on report content, and this is clearly demonstrated in Tonga. Overall, it would seem that Tonga is suffering from its own success. While there are three legislative acts regarding the development and dissemination of Annual Reports; the guidelines concerning report contents are overly broad and ambitious. In the Health Services Act of 1999, for example, under the heading 'Annual Reports', it states that, '... and if the Legislative Assembly shall *wish to know anything* concerning the department of any minister he shall answer all questions put to him... and *report everything* in connection with his department' [emphasis added].

These broad requirements to answer all questions on anything the Legislative Assembly wishes to know, and report on everything in connection with their department, may very well explain why Tonga produces the largest reports (up to 160 pages) with an enormous amount of indicators (over 1,000 in the five years analysed). It may also explain why indicators range from seemingly unimportant measures of health system performance, including boiler fuel consumption and the number of transport drivers; to everything in-between, including the number of wound dressings applied and number of pharmaceutical items dispensed; to what could be regarded as exceptionally relevant measures of population health and system outcomes such as infant mortality, immunisation coverage and service utilisation.

Furthermore, all three countries have Public Health Acts, which define notifiable and dangerous diseases for mandatory reporting. In all three countries, these notifiable diseases represented the majority, if not all, of indicators that were consistently reported year-to-year. It is unsurprising that legislative requirements play such a formative role in defining what is presented in an Annual Report; what an Annual Report looks like; and what it tells us. What is surprising is the lack of attention to updating legislation, especially in relation to health, which has undergone dramatic changes recently as Pacific Island nations have entered into the demographic transition. Overall, it would appear that Annual Reports are regarded as a means of satisfying legislated reporting requirements, and their potentially broader role in guiding evidence-based decision making, or use in the monitoring and evaluation of both national and international strategies, is not being fully realised.

Quality

Overall, this research has found that the quality of data produced from HIS in the Pacific, as presented in Annual Reports, is poor. It is poor due to the limited success in

each of the five quality dimensions assessed. However, it is also poor due to issues within HIS themselves and issues related to the production of Annual Reports, namely, clarification of report *purpose*. Results from the WHO workshop, one of the only major initiatives aimed at systematically reviewing Annual Reports identified in this research, provide similar findings. From their analysis of 13 country reports, they generated four common challenges: (1) quality; (2) comprehensiveness; (3) the use of standards; and (4) the ability to cater to a wide range of audiences.[1]

Of the five quality dimensions assessed, some of the worst results were related to comparability[b]. Much of the data presented in Annual Reports is simply meaningless, as it cannot be compared over time or space. The inconsistent choice of indicators provides a fragmented picture of health system performance, and a 'patchwork' of different indicators presented for a varied number of years. Most of the data is presented without reference to its source or with any meta-data explanations, making comparisons over time and between countries difficult. While the level of disaggregation of indicators was generally acceptable, this also changed over time and space, making comparisons even more complex.

Presentation is the one quality dimension that scored relatively well, however there remains ample room for improvement, including reducing the use of large, cumbersome tables and providing more user-friendly methods of presenting data, such as simple tables and figures. The final quality dimension assessed was timeliness, and while all countries showed signs of improvement, the delay between reporting period and publication is still a major limiting factor in the usefulness of Annual Reports.

All of this is, however, not purely a problem of reports, but rather a problem of HIS themselves. As has been discussed previously, information systems in the Pacific, and the data they produce, have a number of inherent issues, including fragmentation. It should not come as a surprise then, that Annual Reports are also affected by those same issues, as they are a product of HIS. In his review of six independent health care systems in the Pacific in 1990, Taylor, for example, found that death registration systems were often inaccurate and incomplete; not disaggregated by age, sex or ethnicity; difficult to compare due to differences in coding; and most only present mortality data on the top-ten causes of death, if at all.[11] He further commented on how health care systems were usually defined in terms of personnel, facilities and equipment and the number of patients processed and resources consumed. Such results are clearly replicated here, highlighting that little has changed for HIS or Annual Reports in the 20 years since his research.

Comparability

Of the five dimensions assessed, issues related to comparability deserve special attention due to their impact on the remaining dimensions of quality. Both Fiji and Tonga had large fluctuations in the number and type of indicators presented each year. As well as severely limiting comparability over time and space, such fluctuations present us with reports that contain information that is both seemingly haphazard and fragmented. Issues relating to indicator selection are the primary cause of this limited comparability, and arise due to a number of factors including the lack of a minimum data set for reporting. Core indicators form the backbone of Health Information Systems and they need to reflect changes over time, while being valid, reliable, specific, sensitive and feasible to measure.[2] They also need to be relevant and useful for decision-making, and regularly reviewed: an area in desperate need of improvement for Annual Reports in the Pacific.

A large number of indicators contained within Annual Reports are linked to early Public Health and Notifiable Disease Acts, which list specific diseases for monitoring and reporting requirements. While a number of recent diseases, such as HIV/AIDS, have been added to the lists, a large number of indicators with dubious present-day importance remain. The continued inclusion of such indicators needs to be assessed (despite our intuitive fears over removing anything of potential importance) before reporting requirements expand further beyond the capacity of current HIS. A natural question that arises here is, if there are processes in place for validating the inclusion of indicators into national reporting requirements, are there processes for their exclusion?

A second factor linked to the issue of limited comparability is the role of the international community, and the need for countries to report on global health agreements such as the Millennium Development Goals (MDGs). There has been a clear shift in Fiji, for example, to include MDGs as a core component of their Annual Reports. Arguments over the utility of MDGs aside, it is vital that by incorporating global reporting requirements into national reports, countries do not lose sight of important local health issues. While all three countries have devoted a significant amount of their reports to information on non-communicable diseases, infectious and parasitic diseases remain the top cause of morbidity. This highlights that while an appreciation of the global shifts in patterns of mortality and morbidity are important, countries must still be aware of the realities of their local conditions. Influences of the international community are also seen in other aspects of Annual Reports, such as in the massive increase in reporting on neoplasms during 2004 and 2005, followed by a relative dearth of cancer-related indicators, which was caused by an international survey on cancer in the Pacific at that time.

Report purpose

An overarching theme that has emerged from this research (one that affects both the content and quality

b Also referred to as coherence or consistency; comparability is a measure of how well data can be compared, either internally within the same data set, between data sets or over time

of Annual Reports) is the absolute need for clarification on report purpose. The basis of many issues with the reports is that they have no clear idea of their potential audience, use or purpose, and this is translated into long and complex reports providing poor quality information on an overly wide range of topics. In 2008, the HMN proposed a framework linking information needs and tools at various levels of collection within the health system. The reasoning behind this was the need to identify the different types of data needed for management, disease control and response, strategic decision-making and policy development, and produce information accordingly. While this framework is simplistic in assuming that information required for health-system policy development is simply a summation of data from lower-levels of the system, it does highlight a salient point for countries producing Annual Reports: they must be clear about what data needs reporting on, and for what purpose. Annual Reports from the Pacific are exceptionally broad in their attempt to provide a summary of everything of potential value related to the health system. This over-ambitious approach has resulted in poor quality reports containing high-level population health indicators such as the infant mortality rate; down to individual facility outputs including the number of telephone calls received and loads of washing performed.

Recommendations

Comprehensive review of reporting practices

A mechanism to review and assess reporting processes is required, beginning with either a Pacific-focused workshop similar to what has previously been hosted for countries from Africa and Asia, or individual country reviews. The Pacific Health Information Network (PHIN), established in 2006 to provide health information professionals with a network for information sharing and support, along with key international agencies such as WPRO, could take a lead role in this. Questions to address in any review include:

- Are the reports producing the type of information required by health care facilities and Governments?
- Are the reports being used?
- How much of the reports are not being used?

Annual Reports in the Pacific would benefit immensely from having a clearer idea of who their audience is and what their information needs are, and this needs to be a key outcome of any such workshop. In explicitly defining the purpose, objectives and scope of Annual Reports, discussions need to be facilitated on:

- Who is the user?
- What information does the user want?
- What information is available?
- What is routinely collected or will require extra work?

One country provides us with an example of their own internal review and critique of reporting methods. As part of the World Bank-funded Tonga Health Sector Support Project, work was carried out during 2005 to improve the HIS of Tonga, including revising the 'main information product of the Ministry of Health': Annual Reports.12 As well as focussing significant efforts on improving data quality, information management processes and reporting procedures, a main goal of the project has been to accelerate an 'information culture' within the Ministry of Health and Vaiola Hospital. Specific recommendations to update Tonga's reports include:

- Removing duplication
- Reporting against planning objectives
- Simplifying the format
- Standardising statistical presentation and accompanying narrative
- Establishing a clear link with the National Strategic Development Plan Eight.

Development of data quality assessment tools

One of the main utilities of this research is in the development of specific methods for assessing the quality of data presented in Annual Reports. While a number of tools have been developed for assessing national Health Information Systems and vital statistics systems, few have been developed for assessing the information products of HIS.[14, 15] This apparent niche is further complicated by the wealth of quality dimensions presented in the literature, often with limited practical advice on how to measure comparability, usefulness or comprehensiveness, for example. As such, it is strongly recommended that further research is dedicated to developing a tool for assessing the quality of data within Annual Reports. Part of this tool may involve prioritising the most important aspects of quality based on recommendations from the literature, or from areas in need of improvement as identified by previous research in the Pacific. Creating a tool that provides operational definitions of quality and how to measure the concept without the need for external consultants or expertise would give countries in the Pacific Region the means to apply the tool themselves, thus building capacity within local HIS.

Other recommendations for improving the quality of Annual Reports include:

- Preparing reports in a logical, useful and meaningful manner[6]
- Checking data for face validity and consistency
- Proof-reading
- Reducing the number of long and complex tables
- Improving the timeliness.

Development of regional reporting templates

Research on the development of a regional Annual

Report template, including a minimum dataset and the use of standard data definitions, would be of exceptional benefit to HIS strengthening in the Pacific. In providing a standardised template, production time of reports should be reduced, while aspects of quality such as presentation and interpretability should increase dramatically. A standardised report would enhance comparability over time and between countries, and present a stronger, united 'Pacific voice' in terms of emerging trends for the region. Furthermore, in providing a minimum data set with standard definitions and reporting requirements, countries still have the option of reporting more than what is required; however, a minimum amount of data for comparison will be guaranteed. There is also the option of presenting specific annual themes, such as on non-communicable diseases or sexually transmitted infections, to highlight topics of interest in greater detail.

As part of such a template, Excel spreadsheets with formulae already inserted and clear instructions on how to input data could also be developed. Such spreadsheets could calculate simple three- or five-year moving averages of indicators that are sensitive to small populations (such as infant mortality rate and maternal mortality ratio) and also produce basic graphs for presentation. This would again increase the comparability of data, and also strengthen the reputation of data generated from the Pacific, which is often unfairly regarded as unreliable or obsolete, when large fluctuations in reported figures for certain indicators are a product of small population sizes and not a product of poor quality data. In providing templates for both the production and presentation of data, the timeliness of reports could also be improved, as data can be added monthly or quarterly, rather than at the end of each year.

Development of a minimum data set

A final recommendation is the development of a minimum data set. As the primary purpose of recording data is for communication; the process of standardisation, including the development of minimum datasets and data dictionaries, is vital as it ensures communication across time and space.[4] This should include core indicators that reflect changing needs over time, based on the epidemiological profile and development needs of countries. It should also be able to monitor local and national priorities, while meeting international technology standards and linked to key international initiatives such as the MDGs, Global Fund to fight Aids, Tuberculosis and Malaria (GFATM) and Global Alliance for Vaccines and Immunization (GAVI). However, the challenge is to keep the minimum set small and based on a specific framework for selection. While a number of countries still struggle with this, the Pan American Health Organization (PAHO) have produced a compendium of over 100 indicators, along with their definitions and methods of measurement, that many provide a solid reference point for any future reviews of Annual Reports in the Pacific.[16] Overall, a key lesson for the Pacific is to limit the number of reporting requirements and integrate them.

Conclusion

Overall, it is hoped that the results from this research will generate discussion and debate on the role of Annual Reports, and reporting in general, among producers and users of data in the Pacific. For too long we have collected information for the sake of collecting with little reflection on why we are collecting in the first place and what impact such information may have. Collection is a means to an end: it should not be an 'end' to itself. As such, reflection on what it is we want from a HIS product, such as an Annual Report, is needed. Clarification on the purpose of reports is vital: is their purpose to tell us what is making the population sick; or who has been admitted to hospital; or what interventions are being done to help; or what the state of health services are? At the moment, reports provide us with an excessively broad range of segregated 'facts' on activities from all levels and facets of the Health System, with little attempt at transforming the data into useful information and knowledge for action.

As discussed previously, the data contained within Annual Reports could play a vital role in health; from providing an evidence-base for use in strategic decision making, to monitoring the trends in population health, and evaluating the impact of interventions. However, due to long-standing issues of quality, HIS in the Pacific and the data they produce are often regarded with suspicion and simply not used. While this research has highlighted the limited quality of data within Annual Reports as they currently stand, many Pacific Island Countries have taken steps to improve the quality of their reports and it is now up to the international community to provide them with the necessary tools and capacity to strengthen their HIS, rather than continuing to rely on externally produced estimates and models.

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When civil registration is inadequate: Interim methods for generating vital statistics

Original article

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Introduction

In most African and many Asian countries, coverage of civil registration is insufficient and the availability and quality of vital statistics are poor, particularly for mortality and causes of death.[1] When civil registration coverage is low, the vital statistics produced suffer significant selection and other biases. For example, it is more likely that births and deaths will be missed in poor, rural or otherwise hard-to-reach populations that have different birth and death rates and patterns of causes of death from wealthier, urban populations. This limits the representativeness of vital statistics and renders them of little utility for informing policy makers and health system managers about patterns of premature mortality and trends over time.

In low-income and middle-income countries, premature – and largely avoidable – mortality constitutes the major portion of the burden of disease. Given that it is currently possible to achieve significant and rapid progress in reducing many causes of preventable mortality, the health and demographic transition for many countries is accelerating. It is therefore more important than ever that countries continuously monitor changes in their fertility and mortality patterns and track the evolution of all-cause and cause-specific mortality rates. Civil registration is the best means to do this.

This article is intended to support countries improve civil registration and vital statistics. However, achieving high coverage and quality of vital statistics cannot be accomplished rapidly because it necessitates far-reaching administrative reform and requires the collaboration of multiple partners. In the immediate term, country decision makers urgently need reliable information on births and deaths to aid planning, resource allocation and programme monitoring. Interim methods can generate national and sub-national estimates of vital events and cause-specific mortality that can be used to support decision making until the achievement of complete civil registration with adequate certification of cause-of-death.

This article answers questions of particular relevance to countries with no civil registration or with weak and dysfunctional systems. For instance, such countries might want to know:

- What interim methods can they use to generate evidence on levels of mortality by age and sex while they work at strengthening civil registration?
- What techniques are available that can generate some information on causes of death that occur outside hospitals?
- How to do sample registration that is representative of the whole country?

Two kinds of interim approaches that answer the above questions are described in detail in this article: **Health and Demographic Surveillance Systems (HDSS)** conducted on sentinel populations; and **Sample Vital Registration with Verbal Autopsy (SAVVY)** conducted on statistically sampled population clusters representative of the whole population. Both approaches use **verbal autopsy (VA)** to determine causes of death. We provide an overview of the advantages, disadvantages and characteristics of HDSS, SAVVY and their common VA approaches, and provide a guide to more detailed technical resources for each.

Background

Role of interim approaches for generating vital statistics

To respond to the need for data on births, deaths, and causes of death in developing countries, different interim approaches have been developed over the past 40 years. These include innovative strategies both for data collection and for the analytical assessment of the data

and estimation of key indicators. Data collection systems include population censuses, sample vital registration systems, demographic surveillance, and sample surveys. Methods of analysis of incomplete information, yielding indirect estimates of health and demographic indicators, and statistical modelling have also been developed to fill data gaps but will not be dealt with in this article which focuses on strengthening empirical data collection.

Innovations in data collection and analysis have greatly increased our knowledge of demography and descriptive epidemiology of populations in developing countries although gaps remain, particularly for adult mortality, which now constitutes the vast majority of deaths in all developing populations due to the success of child survival interventions. Much of the initial impetus for the development and application of these data collection methods came from the health and development community efforts to monitor population growth and child survival. Investment into the development of the census was critical for generating reliable data on population size, growth and change. Starting in the 1970s attention was increasingly directed to developing international programmes of household surveys that could generate reliable data on fertility, child mortality and their determinants. In the first decade of the 21st century, the accelerating demographic and epidemiological transition has led to new interest in methods and data systems that can also produce data on adult mortality and causes of death, namely civil registration, surveillance and sample registration with verbal autopsy.

Each data collection method has strengths and weaknesses (summarised in Table 1) which have been well described elsewhere.[2] Only civil registration and, to a lesser extent, surveillance and sample registration systems, perform well when it comes to generating data on adult mortality levels, trends and differentials. Only civil registration confers legal benefits to individuals such as proof of identity. However, other methods are potentially of great value for generating vital statistics in settings where civil registration systems are inadequate. In this article we focus solely on primary data collection though sentinel and sample health and demographic surveillance because these methods can generate vital statistics and cause of death data on an ongoing, continuous basis, for the populations they cover.

Countries with dysfunctional or very weak civil registration systems should consider introducing demographic and health surveillance systems in selected areas as a first step in efforts to improve vital statistics. Demographic surveillance sites can help generate capacities for enumeration of vital events and use of verbal autopsy to ascertain causes of death but they will not yield statistics that are representative of the whole country. Countries with several existing health and demographic surveillance sites – usually established for research purposes and often in rural areas – should build upon them and consider adding additional sites – for example in urban areas – to enhance representativeness and generate vital statistics for measuring population-based mortality levels and cause-of-death distributions.

As capacities and resources increase, some of the existing surveillance sites may be integrated into sample registration systems that can be introduced to generate representative vital statistics on a continuous basis (Figure 1).

Progression from surveillance sites to sample and comprehensive registration systems is more likely to be achievable if efforts are made to ensure that enumeration activities are carried out in collaboration with existing civil registration authorities, particularly in urban areas where some form of civil registration exists in many low-income and middle-income settings. This can help create demand for improved vital statistics on the part of national and local authorities and ensure political commitment and resource allocation. Moreover, it can help raise community awareness of the value of civil registration and vital statistics for local level planning and program implementation.

Note that countries do not have to follow the sequence of gradual expansion from sentinel surveillance to sample and comprehensive registration implied in Figure 1. National authorities may decide to opt directly for comprehensive civil registration without passing through either of the intermediate stages, as was the case in South Africa. On the other hand, many countries have found the skills and experiences built up in existing health and demographic surveillance sites of value when extending surveillance to cover a representative sample of the population or, indeed, the whole country. This is the path currently being followed in Tanzania for example.

The schema shown in Figure 1 does also not imply that health and demographic surveillance should be abandoned once sample registration or full civil registration is achieved. Sentinel surveillance will continue to serve the needs of the health authorities and researchers for understanding the context of the changes seen in mortality patterns, but will no longer be the only source of reliable vital statistics. The surveillance systems can also be a source of quality validation and calibration of routine registration systems.

Overall, interim data collection approaches for vital statistics cannot be considered a permanent substitute for civil registration systems; rather, they offer stop-gap solutions to the lack of vital statistics while providing opportunities for countries to develop capacities in birth and death enumeration and cause-of-death ascertainment. Using the data to understand the current health status of the population and potential emerging threats will help generate further demand for reliable vital statistics on the part of decision makers. Interim methods can also be useful to monitor and validate progress in scaling up civil registration and vital statistics systems. They are not needed if civil registration and vital statistics are at a sufficiently high level of coverage (>90%) and quality.

Table 1 Comparison of interim approaches for generating vital statistics[2]

	Level of estimate	Civil registration system	Demographic survillence sites	Sample regis-tration systems	Population censuses	Household sample surveys
Birth	National Differentials	Yes Yes	No Limited	Yes Limited	Maybe* Maybe*	Yes Limited
Child mortality	National Differentials	Yes Yes	No Limited	Yes Limited	Yes+ Yes+	Yes Limited
Adult mortality	National Differentials	Yes Yes	No Limited	Yes Limited	Maybe*# Perhaps*#	Weak~ No
Cause-of-death	All	Yes	Yes^	Yes^	Maybe^	Yes^**

*With assessment and possible adjustment; methods do not always work
+For a recent period by indirect methods
#For an intercensal period
~Methods measuring parental survival or sibling history
^With verbal autposy
**For child deaths identified by a full birth history

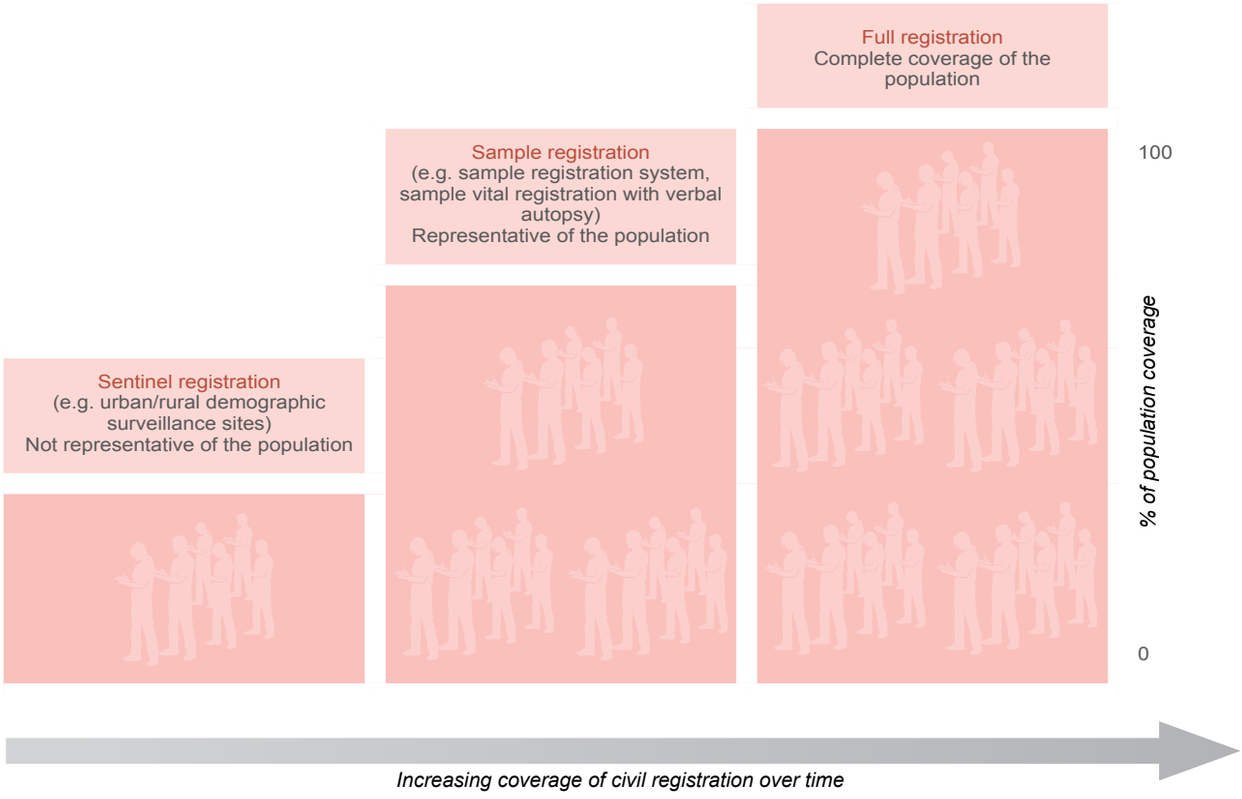

Figure 1 Interim data collection methods while scaling up to full civil registration with vital statistics[3]

Health and demographic surveillance systems (HDSS)

There are currently (in 2012) over 40 HDSS field sites in Africa and Asia that conduct longitudinal health and demographic surveillance in sentinel sites (Figure 2). In these sites, all vital events occurring in continuous populations of between 50,000 and 200,000 people living in defined rural and or urban areas are monitored over time. Prior to 1998, each of these sites functioned independently. In 1998 they came together to form a network called **INDEPTH** – the **I**nternational **N**etwork for the continuous **DE**mographic surveillance of populations and **T**heir **H**ealth – in developing countries. New sites are being established each year but often suffer unnecessary start-up difficulties and delays because of lack of timely access to expertise and technical know-how associated with the practical aspects of starting and running a HDSS site. At the same time, established sites are increasingly being challenged to provide additional information to serve the intensified efforts of countries to reduce poverty and improve health. For this reason INDEPTH has assembled the best practices and experiences of its existing sites into a technical resource kit maintained on its website (www.indepth-network.org).

The relatively small number of HDSS sites within any individual country means that the generalisability of results for areas distant from the site, particularly in large countries with much geographic and socio-economic diversity, is questionable. In order to generate data that reflect the whole country it is necessary to select surveillance sites so that they are statistically representative of the country. SAVVY allows us to do this.

Sample Vital Registration with Verbal Autopsy (SAVVY)

Sample **v**ital registration[a] with **v**erbal autops**y (SAVVY)** is a generalised form of HDSS, in which a larger number of sites (statistically sampled by the census bureau to be collectively representative of the country), monitor all vital statistics for the population covered in the sites so the overall result is statistically representative at the national level. This is essentially natality and mortality enumeration rather than health and demographic surveillance. Hence the intensity of follow-up is 'lighter' and denominators for rates, i.e. population statistics, may not be as robust as in a HDSS site.

Thus, SAVVY is more suited to monitoring fertility and mortality rates and causes of death in populations rather than as a vehicle for research purposes. However proportional mortality by age and cause-of-death is likely to be reasonably accurate in both cases and useful for planning purposes. Both approaches share a common methodology for cause-of-death ascertainment, namely verbal autopsy

a The term 'registration' is something of a misnomer as vital events are counted rather than registered in the legal sense

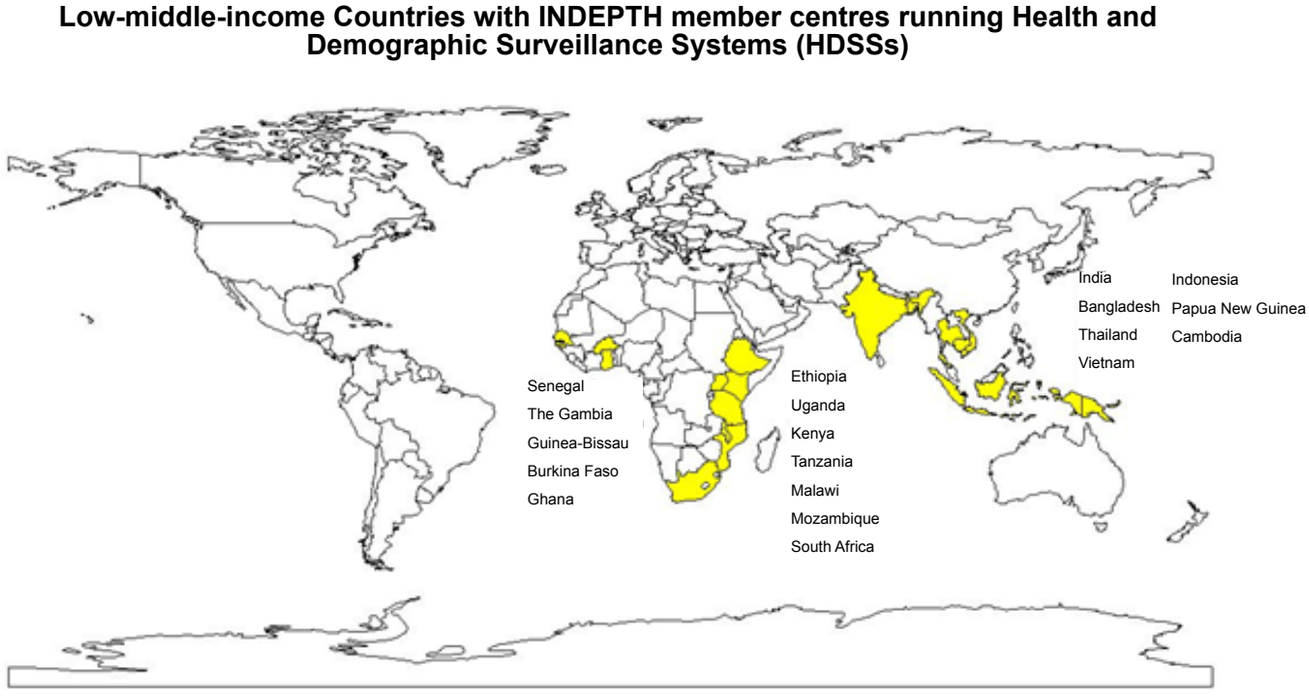

Figure 2 Countries hosting one or more HDSS sites[4]

The best known example of SAVVY is the Indian Sample Registration System, which started in 1964 and expanded to cover the whole country by 1970.[5] In sample areas (about 7,000 areas covering nearly 1% of the population), a part-time officer records births and deaths continuously; additionally, twice a year, an independent survey team interviews all sample households, asking specifically about births and deaths in the previous six months. The two sets of events are then matched, and any discrepancies are investigated. The final count of events is the total of matched events plus those recorded only by the registrar plus those recorded only by the household interview. Independent evaluation suggests that the system captures about 85% of deaths.[2]

In China, sample registration occurs through the disease surveillance point system which currently covers 160 districts and counties scattered in all provinces, autonomous regions, and municipalities, with a population coverage of 73 million people; nearly 6% of the total population of China.[6] The system generates about 500 000 death reports annually. In rural areas, about 80% of adult deaths take place at home, with few occurring at the township hospital or other tertiary hospitals in the vicinity. For deaths taking place at home, the event is reported by a village health worker to the disease prevention unit at the township hospital. A staff member from the unit visits the household, and completes a death certificate on the basis of a verbal autopsy combined with available documents from the most recent contact with health services. For deaths taking place in the township hospital, disease surveillance staff collect the death certificate from the hospital, where it should have been completed by the physician who attended the death. For deaths occurring in other hospitals, relatives of the deceased submit physician-certified death certificates to the disease prevention unit at the township hospital.[2]

Unlike India, where the sample registration system functions entirely separately from the existing civil registration system and there are no plans for integration, in China the plan is to merge the disease surveillance points and civil registration systems in the future. This is the desirable path for any mortality surveillance system, although it is recognised that this process may take many years.

Verbal autopsy process

In situations where physicians are not available to certify the causes of registered deaths, a very useful option for countries is to use verbal autopsy (VA). Verbal autopsies are the most practical option for diagnosing causes of death when deaths occur outside hospitals or in health-care facilities with limited diagnostic capability. Verbal autopsy generates cause-of-death information at the population level, that is, cause-specific mortality fractions (CSMF). The technique is less reliable for cause-of-death ascertainment on an individual basis.

Verbal autopsy is a process for diagnosing causes of death based on responses by the family of the deceased to a series of structured questions about signs and symptoms, and their duration, experienced by the deceased. These responses are usually reviewed by a physician to determine the probable cause-of-death. Recently, **automated** methods have been applied to diagnose the cause-of-death from the responses provided by the family without any need for physicians to be involved, and appear to work very well. Automated methods have the advantage of speed and do not require the involvement of physicians who are generally required to prioritise their clinical responsibilities over other activities.

Verbal autopsy instruments are based on three main assumptions:

1. Each cause-of-death has distinct patterns of signs, symptoms, severity, duration etc
2. These symptoms can be recognised, remembered, and reported by lay respondents
3. It is possible to correctly diagnose deaths, based on the reported information, into categories of causes of death that are useful for public health purposes.

In practice, many factors influence the validity and reliability of verbal autopsy diagnoses, especially for deaths in adults. These factors include the distribution of cause-specific mortality in the population; the specific verbal autopsy tool used (mortality classification, questionnaire, and diagnostic procedures); and the process of data collection and analysis.[7]

Verbal autopsy continues to be an evolving area of research. As a result, there are no definitive questionnaires, data collection methods, or analytical standards. In 2007, WHO brought together researchers and technical experts to compile a standard questionnaire that is increasingly being applied in HDSS sites and elsewhere.[8] However, some adaptation of the standard questionnaire is always required, depending on the local epidemiological and socio-economic context. When planning to introduce verbal autopsies to determine cause of death in your population, it is important to access the experience of researchers, countries, and populations that have used, or are using the approach.[9] Some recent experiences are described in thematic series on verbal autopsy.[10]

Common problems encountered

Representativeness is a major challenge in sentinel systems. In surveillance sites, the poor representation of the national population and lack of access to the data on the part of decision makers are important drawbacks. In sample registration systems, on the other hand, sampled sites might entirely miss health events because of the sampling design or choice of sample population.[2]

In sentinel and sample registration systems the collection system and checking of data, such as that used by the Indian Sample Registration System can delay access to timely results. Delays are compounded by the need for physician review of verbal autopsy questionnaires

which imposes a heavy burden on already overstretched physicians and detracts from their clinical responsibilities.

As a general rule, existing health and demographic surveillance systems have been established for research purposes such as testing and evaluating interventions to reduce fertility and infant and child malnutrition and mortality. For example, one of the longest surviving demographic surveillance sites in Matlab, Bangladesh, was set up to evaluate interventions to prevent child mortality due to diarrhoeal diseases. More recently, surveillance sites have been established to test interventions for the prevention or management of HIV/AIDS and malaria. Dependence on research funding brings both benefits and risks. It helps maintain a high standard of demographic enumeration and application of verbal autopsy techniques but introduces stresses with regard to continuity of funding. Demographic and health surveillance systems can answer complex research and evaluation questions because they generate data that are more complex, complete and contextualized than are produced by sample registration or civil registration systems.

Both sample and sentinel surveillance systems require active follow-up of vital events which has important cost implications. The system of 'disease surveillance points' in China became almost non-functional in 2002 because of budget constraints. After an assessment in 2004, and additional resources, the system was strengthened and adjusted to improve how well it represents the population.[6] Decision-makers considering the introduction of HDSS or SAVVY should include planning for sustainability in their proposals.

An issue requiring further examination is the extent to which HDSS sites are connected to ministries of health and the data they generate are actually used to guide national health and development decision-making. While research findings from HDSS sites are well publicised in the academic literature, not enough is known about the use of the statistics they generate by the health sector, national statistics offices or other decision makers. Sectors with potential interest in vital statistics include education, taxation, insurance, labour, defence, and the private and business sectors. HDSS sites in some countries are now taken over by the Ministry of Health or are co-funded by the Ministry to help resolve this issue. For such sites, an annually-updated profile can be produced consisting of: the proportion of the mortality burden that can be addressed by specific, locally available, and cost effective interventions.[11]

There would be great benefit in ensuring that the enhanced skills developed in health and demographic surveillance systems are transferred to routine systems. For example, in many countries there is a significant backlog of fertility and mortality data from the routine civil registration system that is not compiled and remains underexploited because of lack of capacity and resources in national statistics offices.

To avoid duplication of efforts, it is important that sample registration systems do not function entirely separately from existing civil registration systems. Sample registration should be carried out by, or in close collaboration with, civil registration authorities to ensure effective integration of the two into a full civil registration system able to produce reliable vital statistics, the ultimate goal.

Strategies and solutions

Despite these multiple challenges, health and demographic sentinel and sample surveillance systems remain the best strategy for countries with weak civil registration systems to generate reliable vital statistics on an ongoing basis. The following sections outline the essential steps required and describe important resource materials, guidelines and standards.

As a general rule, countries with dysfunctional or weak civil registrations should review existing HDSS and consider how these could be further strengthened in order to generate vital statistics. For example, if a country has HDSS only in rural areas, consideration should be given to setting up one or more sites in urban or semi-urban areas so as to better reflect the country situation. A first step for countries with no existing HDSS is to seek resources to establish at least one rural and one urban HDSS in order to build skills and capacities and start to produce useable statistics, even though these will not be representative of the whole country.

It is important that in urban areas especially, efforts should be made to link HDSS to existing registration systems of births and deaths and to health information systems, especially data from hospital and health facilities that have medical staff trained in determining causes of death. Multi-sectoral involvement of civil registration, the health system and statistical authorities will promote long term sustainability of vital event collection and compilation.

A very useful strategy for countries setting out to improve civil registration is to initiate a parallel strategy of establishing one or more HDSS or sample registration sites in rural areas, (depending on the availability of resources) and to implement a concerted effort to consolidate all available hospital or health services data on births and deaths that occur in these hospitals. This should include BOTH private and public institutions. If it is not feasible to include all hospitals serving urban populations, then the strategy should be implemented in a sample of urban areas, preferably including the capital city. What is important is that serious efforts are made to obtain, and collate data on ALL births and deaths occurring in a defined urban population.

A detailed evaluation of the quality of the compiled data should be carried out, using established mortality data quality checks.[12] These should particularly check for under-registration of deaths, and for the quality of cause-of-death certification and coding. In principle, it should be easier for countries to collate, check and remedy errors in mortality data coming from hospitals, given that the vast

majority of deaths in these institutions would have been registered in a hospital and would have been certified by a medical practitioner. Particular priority should be given to providing training in the correct certification of causes of death to doctors in urban hospitals that form part of the sentinel system described above.

Countries with multiple established HDSS should first ensure that the data from the various sites are integrated into a shared database so as to maximise their potential for generating sound vital statistics. Where existing HDSS sites are working successfully and skills and capacities for enumeration and application of verbal autopsy are available, consideration should be given to establishing SAVVY systems with random selection of sites that can generate representative population-based vital statistics. SAVVY is, by definition, a nationwide undertaking, and should be carried out as a multi-sectoral endeavour with close involvement of the civil registration authorities and the national statistics office.

Setting up a health and demographic surveillance system (HDSS)

There is no manual or text book for organising and implementing health and demographic surveillance system, either in a sentinel site (HDSS) or across a national network of vital registration areas (SAVVY). On the other hand, a wealth of experience in implementing such systems across diverse population sites has been built up over time by the teams managing the sites. Whereas many of the experiences have been published in the peer-reviewed literature, the detailed practical documentation of methods is scattered across multiple 'grey' reports, manuals, and instruments.

Some HDSS sites (e.g. Matlab in Bangladesh and Niakhar in Senegal) have been running continuously since the early 1960s. A typical site monitors births and deaths in the entire population in a geographically defined sentinel area. The population size required to track trends in the most common causes of mortality depends on the degree of detail required in causes of death and the levels of uncertainty that can be accepted in the estimates.[14] The area covered by a HDSS site may be based on a cluster of sub-districts or localities or on a larger single geographical area such as a clearly defined district. Sites are selected so that households can be reached in all reasonable weather in all seasons. Sankoh and Binka[15] provide a detailed overview of the principles and operation of a HDSS.

It is highly recommended that countries with inadequate civil registration maintain at least one urban and one rural HDSS sentinel site and larger countries with diverse geographic or socio-economic settings should have several rural and urban HDSS sites. Once expertise has been built up in running multiple sentinel HDSS sites, countries should consider establishing sample registration systems (SAVVY) and at the same time implement the urban cause-of-death collation and death certification improvement procedures outlined above.[3]

How HDSS works

A HDSS monitors and reliably records all births, deaths, cause-of-death, fertility and migration in a specified and clearly defined population. The 'catchment' population is determined by a single initial census of all individuals in the sentinel demographic surveillance area (DSA). The initial census should, if possible, geo-locate all households by global positioning satellite (GPS) and capture core information on all residents who intend to reside in the DSA over the next four months. It records the names, sex, age, dates of birth, and civil relationships of everyone in each household, assigns each of them unique and permanent alphanumeric identifiers, and registers them as de facto members of the HDSS. This first census usually takes about three-four months to conclude. From then on, trained enumerators visit each household every four months to update the household register, recording any in- or out-migrations and any pregnancies, pregnancy outcomes, births and deaths.

Most HDSS also collect information about events such as marriage and divorce. Other events recorded by HDSS include the change of a head of household, a household's formation or dissolution or the construction or destruction of building structures. Unlike static populations (i.e. populations defined at one point in time, with no new entrants permitted to be followed up for vital events), HDSS populations allow for the normal dynamics of a population (i.e. births, deaths, migration) and therefore allow the calculation of accurate denominators based on person-time lived in the DSA rather than mid-year populations, essential for calculating precise birth and age-specific death rates. A particularly important output of the HDSS is cause-of-death data, which is critical for proper health planning. This is explained further in the section on verbal autopsy.

Core variables

In addition to pregnancies, births and deaths, other core variables that are monitored in every update round of a sentinel HDSS site are:

- Location: Unique alphanumerical identification that combines a code for the enumeration area name and the unique household structure number
- Individual ID: Unique and permanent numerical identification code assigned to registered individuals who are living in the residential units and household structures and appended to the Location ID
- Residency: The state of being physically present in a given residential unit for a defined threshold of time
- Membership: the state of being a registered individual in the DSS area irrespective of physical presence
- Migration: The movement of people across a specified boundary for the purpose of establishing a new or semi-permanent residence. External migration is where residence changes between a residential unit in the DSA and one outside it, and internal migration is where residence changes from one

residential unit to another in the same DSA

- Causes of death: underlying cause of death for each death that has occurred to a resident member of the DSA (resident since the last visit).

A key product of a sentinel HDSS is the cause-of-death information derived from verbal autopsies conducted on every death within six to eight weeks of the event. These are based on internationally standardised and validated instruments and coding procedures described in more detail later.

To identify deaths for verbal autopsy, the sentinel HDSS, in parallel with the cyclical visits of trained enumerators, also maintains a large number of 'key informants' who are lay residents of the community who continuously identify births and deaths in their local area. These key informants are visited weekly by key informant supervisors from the HDSS who check if the locally identified events have occurred to registered members. In the case of a death, a verbal autopsy supervisor will visit the household after a suitable bereavement interval of two to eight weeks following the death to conduct a verbal autopsy. This reduces the recall period compared to a situation where deaths are only identified through the four month update rounds. Deaths occurring on the last day of a calendar year may not be identified for verbal autopsy until a maximum of four months into the following year. It may take several more months to fully certify and code all causes of death (assuming availability of physicians) and reconcile all migrations in order to lock the annual data set for analysis and production of full and accurate vital statistics.

The ideal frequency of the update cycle is three or four times a year to allow reasonable ability to track pregnancies and their outcomes. This is particularly important for obtaining accurate perinatal and neonatal mortality rates. Three four-month update rounds per year is adequate for most practical purposes. Any less frequent updating will be problematic in areas where accurate neonatal and infant mortality rates are needed.

A critical task of the HDSS is to reconcile the relatively common in- and out-migration of members of the HDSS. Some migration is within the HDSS area and hence such members must continue to contribute person-years to the denominators. Other migration may take members outside the HDSS area for periods exceeding an update round cycle when their person-time will not count in denominators. Returning residents retain their unique identifiers and can resume residency in the system. This requires dedicated resources in the data centre to reconcile all migrations and maintain the database.

Data from the enumerators and migration supervisors are returned to the HDSS data centre weekly and continuously cleaned and entered into a HDSS computer data system that maintains the status of the population, allows the calculation of demographic rates, and links the cause of death and other contextual variables (Figure 3).

A typical sentinel HDSS site monitors a rural population of 70,000 to 100,000. However, reliably tracking causes of death at a more detailed level may require up to 10 times as many people to be monitored. Methods to calculate required population size according to the frequency of particular causes of death of interest are provided in the paper by Begg et al.[14] A typical HDSS employs approximately 30 field enumerators with bicycles, seven enumerator supervisors, three key informant supervisors, three migration supervisors, and three verbal autopsy supervisors with motorcycles, one demographer, one data manager, and five data clerks with one vehicle. Total annualized running costs for a core sentinel HDSS system is in the order USD 250,000 per year. Costs are lower in urban HDSS sites where events are generally easier to trace.

Major considerations in running a sentinel HSDD site

Before establishing a sentinel HDSS site there are numerous issues to consider:

- Legal ownership, status, identity and leadership
- Governance management and advisory committees
- Site strategic plan
- Financing and funding partners
- Data management and sharing
- Users and stakeholders
- Networking
- Permits, institutional and ethics approvals.

Details and examples of approaches to each of these considerations are available from the INDEPTH Resource Kit on their web site. The INDEPTH Resource Kit also provides templates of Finance, Personnel and Administrative Manuals including charts of accounts and tools to estimate HDSS capital investments and running costs.

The data management system for a HDSS requires a reference data model. Most sites in the INDEPTH network currently use the Household Registration System (HRS). New open source applications have allowed a significant updating of the entire data capture, computing system and underlying data model. See the Open Household Demographic System (http://openhds.rcg.usm.maine.edu/).

Technical and methodological details for running a sentinel HDSS are fully described in the INDEPTH HDSS Resource Kit under the topics of: i) Methods for the core baseline round; ii) Methods for the core update rounds; and iii) Optional modules. The 10 key steps to take in setting up a HDSS are listed below in Box 1.

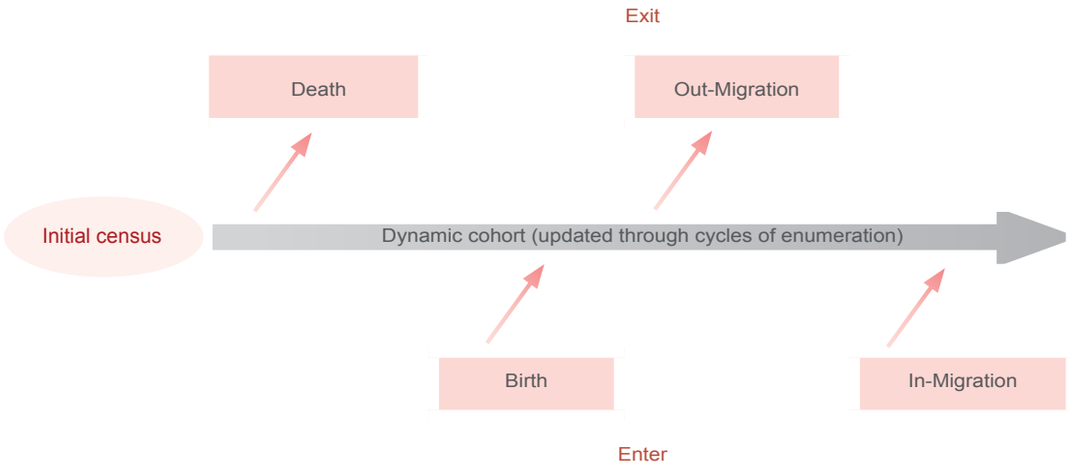

Figure 3 The concept of a dynamic cohort in an HDSS[4]

Box 1 Ten key steps in establishing an HDSS site
1. Establish ownership and governance structures
2. Develop sustainable funding arrangements
3. Identify population size, sentinel site and boundaries
4. Develop design considerations, operational procedures and instruments
5. Recruit and train staff; establish field office; acquire capital equipment and supplies
6. Initiate community approach and information
7. Conduct initial census geolocating all households and establish core database
8. Conduct first update cycle
9. Process first cycle of data including verbal autopsies
10. Prepare feedback to stakeholders and communities

Sample Vital Registration Systems with Verbal Autopsy (SAVVY)

Enumeration of births and deaths coupled with verbal autopsy in sample areas has been conducted in India since 1970 by the India Registrar General's Office Sample Registration System (SRS) and in China since 1989 through the Chinese Disease Surveillance Points System (DSP). Sample Vital Registration with Verbal Autopsy (SAVVY) is a more generalised version of these methods. This method is particularly relevant for countries with weak or absent civil registration systems as it allows them to generate vital statistics on a routine basis in both rural and urban areas.

How Sample Vital Registration with Verbal Autopsy (SAVVY) works

SAVVY is essentially a demographic surveillance system built around vital events monitoring for a representative sample of the population. It operates in a similar way to sentinel HDSS described above, but in this case the sites are distributed across the country and sampled in order to generate estimates that are statistically representative of urban and rural settings. A two stage probability sampling method is used, first sampling geographic areas and then villages and urban districts within the selected geographic areas. The total sample size of a SAVVY is typically in the order of 1-2% of the total national population. The system uses repeated censuses and continuous reporting of vital events to generate information on population, age, sex, household characteristics and migration.

SAVVY was originally developed by USAID (through its MEASURE Evaluation project) and the US Census Bureau (http://www.cpc.unc.edu/measure/tools/monitoring-evaluation-systems/savvy/). The first step engages the national census bureau to identify the sample locations that are statistically selected to provide nationally representative data. Then, as in the sentinel HDSS approach, a complete baseline census is conducted of all households and residents in the sample areas. Subsequently the census information on the residents of each sample area is updated by repeat annual or two-yearly censuses (less frequently than the minimum of three times per year as in the HDSS).

Following the baseline census and continuously thereafter, lay key informants (rather than trained enumerators as in the HDSS) notify a verbal autopsy interviewer of all deaths occurring in the sample area. The VA interviewer is typically a trained health worker (NOT a medical doctor) from a health centre in the sample area. The VA interviewer conducts an interview at the household where that death has occurred. The data are then transferred to a local data centre (usually in the health centre). All data are handled in a dedicated computer system called SAVVY CSPro.

A fully implemented SAVVY system should also be capable of producing sub-national data but in practice this is limited to the level of province or region rather than the district level due to cost considerations. The census and mortality data in SAVVY can be used for monitoring and evaluating major disease control programs at the national level including monitoring progress towards goals and targets, including the MDGs. User-friendly reporting software also permits indicators to be produced separately for age, sex, or poverty groupings, and by

geographic area. The production of routine system outputs can be tailored to local planning and budgeting cycles. For example, an annually-updated profile can be produced consisting of: the proportion of the mortality burden that can be addressed by specific, locally available, and cost effective interventions.

Most people who work to implement SAVVY are selected with community input and participation. The success and sustainability of SAVVY depends upon fostering community participation and ownership. It is important that SAVVY be positioned as part of a national vital statistics strategy, requiring long-term commitment on the part of national and local government and the active participation of a country's national statistics office, ministry of health, civil registration authority, and other relevant partners. It is anticipated that several stakeholders will join together to invest in the establishment and support the scale-up and sustained functioning of a SAVVY- type sample vital registration system. Over time, a SAVVY system should complement the civil registration system and help promote behavioural changes as well as an understanding among the population of the importance of vital statistics that make the registration of births and deaths more locally acceptable.

Despite its significant potential advantages for monitoring vital events and causes of death, apart from the positive experiences in China and India, there is relatively little experience with implementing SAVVY in other regions. Zambia has conducted a sub-national SAVVY and Tanzania is in the process of launching a national SAVVY (www.ihi.or.tz/projects).[16] The geographical location of sample districts in Tanzania is shown in Figure 5. The ten key steps in setting up a sample registration are summarised below in Box 2.

Box 2 Ten key steps in establishing SAVVY

1. Establish leadership and secure funding
2. Get buy-in at the national level (Ministries of Health, Finance, Local Government, Justice or Home Affairs) and governance structures (advisory and technical e.g. census and statistics bureau)
3. Develop sampling strategy with the statistical bureau
4. Sensitize local authorities and establish ownership
5. Recruit key staff (at central and in sample districts)
6. Plan a phased-in approach to inform expansion
7. Adapt key SAVVY documents and develop data management systems
8. Train staff on census enumeration, verbal autopsy and reporting vital events
9. Collect data and process the baseline census and deaths (including year before baseline) in sample populations
10. Prepare analyses, reports and dissemination

As long as the sample of districts is chosen on a strictly representative basis, i.e. according to socioeconomic characteristics of the population identified in a recent census, then the system should yield representative information on births, deaths and causes of death for the whole country. It is important to avoid choosing sample sites because of convenience and cost considerations (e.g. wealthier districts with better infrastructure, roads, etc; urban areas only). The sample of districts chosen should be truly representative of living conditions, access to health care and other factors likely to affect fertility and mortality.

If it is not feasible to monitor all the population of a geographical district chosen for the sample, then a second stage sampling procedure should be used to identify representative population groups (e.g. villages, urban subareas, etc) that are feasible to monitor within the selected districts. If in any doubt about the sampling strategy, it is preferable to choose fewer sampling units (that are still representative of the country) and monitor all events and causes of death in them reliably.

Figure 6 shows a chart of how a typical SAVVY system would operate, showing the roles and reporting relationships of different personnel. Causes of death are collected continuously using verbal autopsy methods as described in the next section. Dedicated personnel have to be recruited to carry out the annual census of the population living in each sample site. Staff responsible for the annual census and the continuous collection of verbal autopsies should report to a field office manager whose role is to consolidate the annual vital statistics on births, deaths, and causes of death for each site

Verbal autopsy to ascertain causes of death

Both HDSS and SAVVY use verbal autopsy techniques to ascertain causes of death in the population under surveillance. Verbal autopsy is essentially a two-stage process.

Stage 1: an interviewer (not a medical doctor but preferably a trained lay interviewer) visits the household to interview the family using a pre-designed questionnaire and recording all responses in a standardised manner;[18]

Stage 2: the pattern of responses is reviewed by a physician (never a lay-person who is not medically qualified) to determine the probable cause of death based on the signs and symptoms reported by the family. This process can be aided by reviewing information about the events leading up to death given by the family in their own words (the open narrative), as well as any information reported by the family from contact with health facilities that might be relevant to help diagnose the cause-of-death (e.g. family being told by the hospital what disease the person who died had).

The operational steps in going from a verbal autopsy interview to a final underlying cause of death that is likely to be of use for policy and planning of health services are shown in Figure 6. The figure also illustrates the various factors (in shaded boxes) that are likely to influence accuracy of the underlying diagnoses of causes of death.

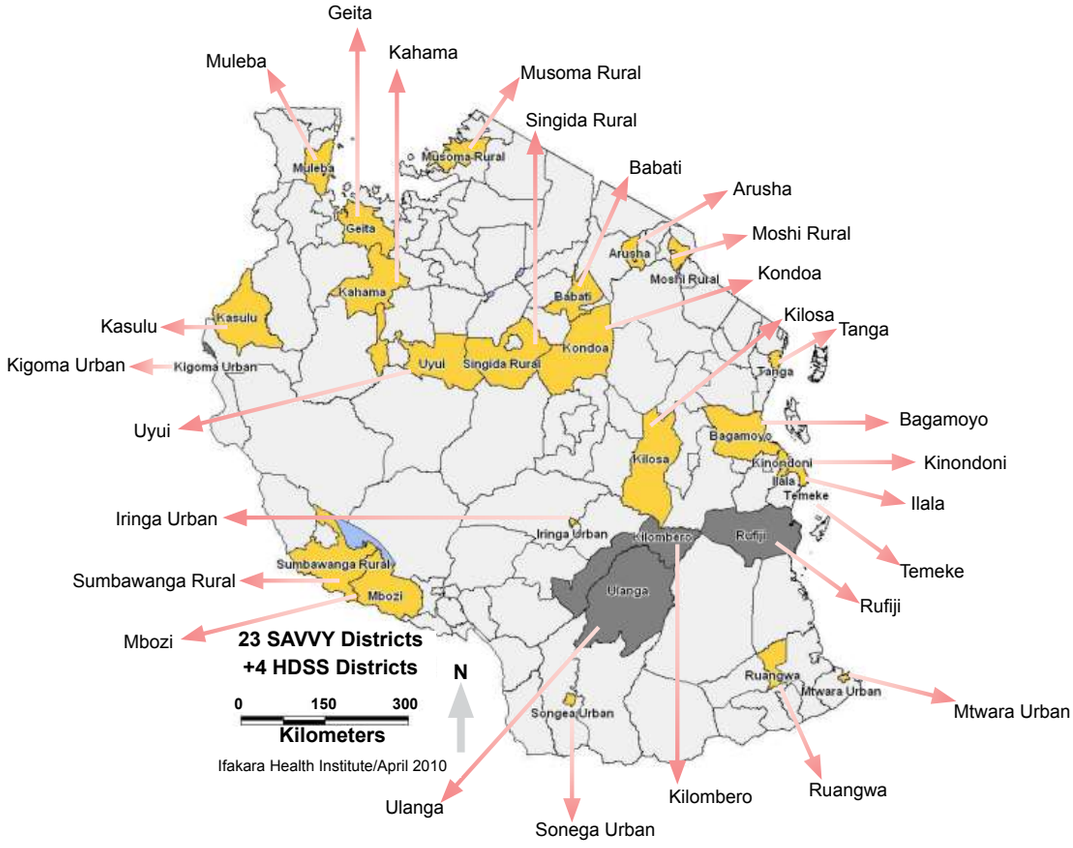

Figure 4 Location of Tanzania's SAVVY sentinel panel of districts[1-7]

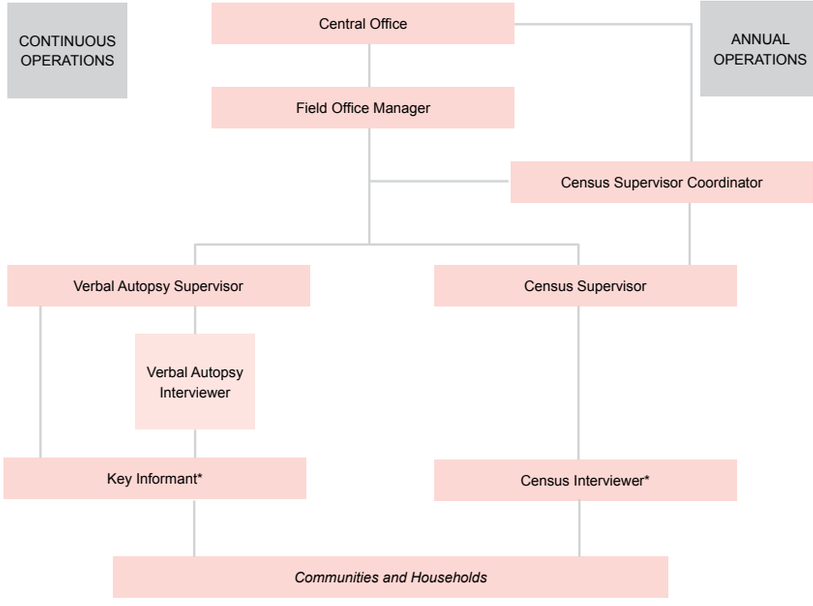

Figure 5 Operation of the SAVVY system

The middle box, referring to Stage 2 of the VA process, offers an alternative to the more expensive and time-consuming task of having physicians review the VA forms, namely allowing computers to read 'patterns' in the responses, to come up with a probable cause of death. The strengths and limitations of these two approaches to diagnosis are discussed in a subsequent section.

Note that the three components – VA questionnaire (stage 1), diagnostic assessment procedure (physician or computer) (stage 2), AND a target cause of death list or classification (stage 3) – together constitute the set of tools required to implement and use VA data. All three tools are described in detail in the WHO verbal autopsy reference manual.[18]

Verbal autopsy interviews

Many factors influence how well verbal autopsy tools will perform in practice, including:

- Language: The language used in verbal autopsy questionnaires and in the interview itself has to be appropriate for the local setting to allow the maximum amount of information to be captured. Standard questionnaires may need to be translated to suit the setting. Translation has to be done very carefully so the meaning of the original question is not altered. It may be useful to validate the translated questions in a small area, before it is applied more widely
- Cultural norms and biomedical concepts: 'Norms' and biomedical concepts of the local setting need to be taken into consideration when selecting the appropriate verbal autopsy questions. For example, blood loss after child birth may be considered normal and heavy bleeding may not be reported by interviewees
- Types of respondents and interviews: The education and socioeconomic characteristics of local respondents as well as their expectations, and the background and training of interviewers also influences the accuracy of verbal autopsy data
- Recall period: Although an ideal time period for recalling information about a death has not been identified, many studies report that less than one year after death is a reasonable period in which to conduct a verbal autopsy, preferably a shorter interval in order to minimise recall errors. In many settings, the verbal autopsy interview is carried out just after a usual period of mourning.

Experience suggests it is preferable NOT to use physicians as interviewers. Nurses, other allied health workers, and even students can be adequately trained to collect data via verbal autopsy questionnaires.

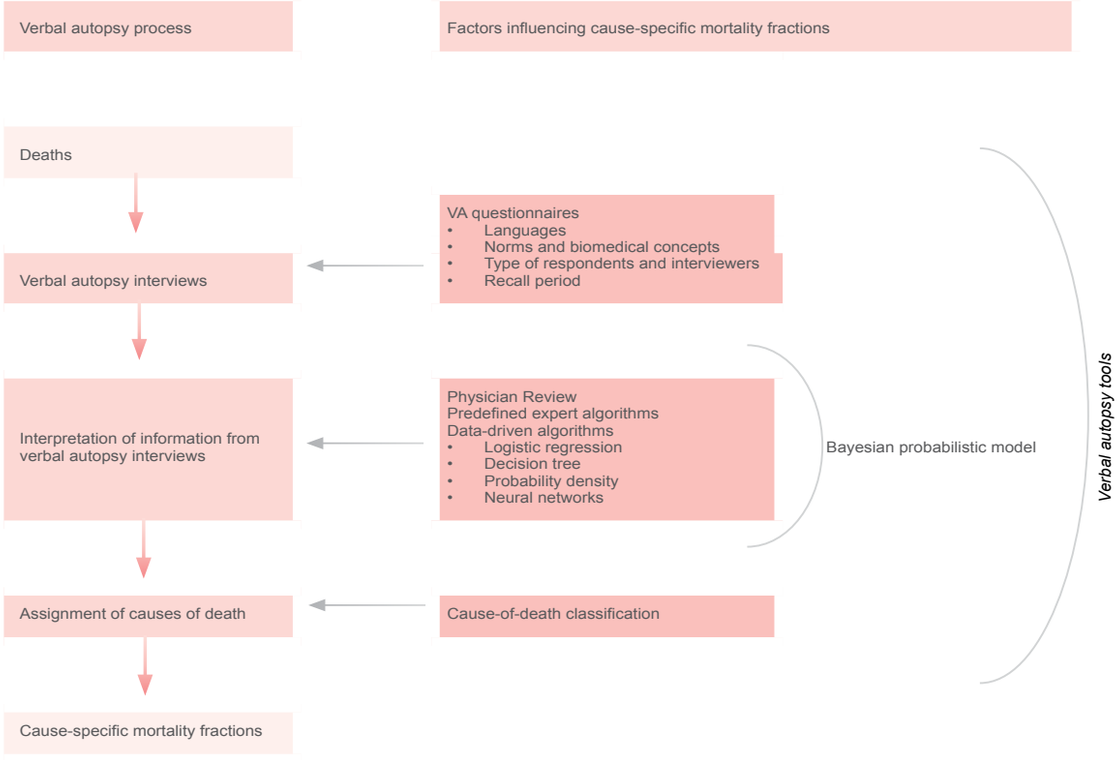

Figure 6 Verbal autopsy process and factors influencing cause od death diagnostic accuracy[9]

Open ended versus close-ended questionnaires

Variation in the structure of verbal autopsy questionnaires may lead to different outcomes or responses. For example, open-ended questions require the respondent to recall specific details, while close-ended questions require recognition of symptoms. Experience suggests that more information is likely to be 'recognised' rather than 'recalled'. Using open-ended questions may require the interviewers to have medical training to prompt recall and recognition of appropriate symptoms and signs that are not voluntarily reported. However, medical training is not necessary to obtain reliable responses to closed-ended questions.[6] These two factors suggest that it is better to use closed rather than open-ended questions. Recent research has suggested that VAs that use both close-ended (a structured set of questions about signs and symptoms) as well as open narrative perform best.[10] However, if automated methods are to be used for diagnosing the cause of death, the open-ended narrative will be difficult to implement. This issue is discussed further below.

WHO verbal autopsy standards

Because verbal autopsy instruments have been developed on an individual basis for application in different sites, there is enormous variation in questionnaires and analysis methods. However, if data derived using verbal autopsies are to be compared over time and across regions or countries, it is important to apply standardised instruments to the greatest extent possible. WHO has produced a useful manual on verbal autopsy standards which countries should use pending further developments.[18] Some local adaptation will be required to take account of differing epidemiological and demographic profiles and the final questionnaire should be field tested and validated before its widespread use. WHO recommends using three different questionnaires for three age groups, as shown in Box 3.

More recently, an adapted version of WHO's standard verbal autopsy questionnaire was used as the basis for a research project led by the Institute for Health Metrics and Evaluation (IHME) at the University of Washington that attempts to assess the performance of various methods of diagnosing causes of death (stage two of the VA process). This adapted questionnaire incorporates advances in medical knowledge since the WHO questionnaire was published. The Population Health Metrics Research Consortium (PHMRC) questionnaire is based on the WHO model and focuses on the same three broad age groups (neonates, children, and adults).[19]

Box 3 WHO verbal autposy questionires[18]

Verbal autopsy questionnaire 1: death of a child aged under four weeks

Questionnaire 1 distinguishes between stillbirths, early neonatal deaths, and late neonatal deaths. It also aims to determine the causes of peri-natal events and deaths. In addition to the 'signs and symptoms noted during the final illness' checklist, the questionnaire contains extensive questions about the history of the pregnancy, delivery, the condition of the baby soon after birth, and the mother's health and contextual factors.

Verbal autopsy questionnaire 2: death of a child aged four weeks to 14 years

Questionnaire 2 is designed to ascertain the major causes of post-neonatal child mortality (i.e. starting from the fourth week of life), as well as causes of death through 14 years. The questionnaire includes all of the standard data described above, as well as modules for children aged four weeks to 11 months.

Verbal autopsy questionnaire 3: death of a person aged 15 years and above

Questionnaire 3 is designed to identify all major causes of death for adolescents and adults (i.e. starting at age 15), including deaths related to pregnancy and childbirth. The questionnaire includes an extensive module for all female deaths. Questionnaire 3 also includes a module about behavioural risk factors (e.g. alcohol and tobacco consumption)

Physician-coded verbal autopsies

Scientifically sound methods for interpreting and analysing verbal autopsy data are essential for verbal autopsies to fulfil their potential as valid sources of cause-of-death data. When a verbal autopsy questionnaire is completed, the next step is to assign a cause of death to individual cases using the information recorded in the questionnaire. In most verbal autopsy systems, the responses to the questions are coded against a partial list of the ICD-10 disease codes because it is impossible to define symptoms and signs for the complete list of causes of death. Most verbal autopsy systems use a shortlist of 40-50 causes for making diagnoses.

Currently, it is common practice for all verbal autopsy interviews to be assessed by one or more trained physicians who determine the probable cause of death on the basis of the interviewee responses, commonly known as 'physician-coded verbal autopsy'. In many VA studies physicians diagnose an underlying cause of death directly from the reported signs and symptoms on the VA questionnaire. More recently, VA studies have followed more strict protocols where physicians review the VA questionnaire responses and complete an International Form of the Death Certificate where they attempt to identify the sequence of morbid conditions leading to death. These certificates are then coded by trained coders. In other words physician-coded VA in these cases requires inputs both from physicians and from coders to code the death certificate.

The principle underlying the practice of physician reviews of verbal autopsies is the expectation that only physicians can correctly interpret signs and symptoms reported to have been experienced by the deceased and hence accurately assign causes of death. Sometimes, one physician does the initial review of the VA questionnaire responses and his/her cause of death diagnosis is then reviewed by a second, independent physician. Where the two physician diagnoses differ, a third physician may be asked to determine the cause of death.

The requirement for physician review is a major bottleneck in terms of human resources and time. In some settings, the analysis of interviews is delayed by months or even years due to the heavy workload or non availability of physicians. Moreover, a growing body of research has raised serious concerns about the assumption of accuracy of physician diagnosis.[10] Some of the main findings of this research are outlined below.

A more fundamental and practical concern with physician-coded verbal autopsies is that they are expensive, time-consuming, and can burden the health systems in resource-poor areas by diverting physicians from their clinical responsibilities.

These concerns have been behind recent research efforts to identify and assess the performance of automated methods that do not require the involvement of physicians to diagnose cause of death from verbal autopsy questionnaires.

Automated coding of verbal autopsies

Computer or automated, coding of verbal autopsies is a promising alternative to the traditional approach of physician-coded verbal autopsies. Computer coding is high speed, low cost, and reliable insofar as it removes inter-physician variability and overcomes many of the other disadvantages of using physicians to code VA interviews. Several INDEPTH sites have switched to use the INTER-VA automated statistical algorithm for coding the responses to VA questionnaires. This is a public-domain method that uses a Bayesian probabilistic model to derive the cause of death from input indicators, such as disease history, signs, and symptoms from the VA interview. www.interva.net

More recently, more complex machine learning methods have been developed, though they have not yet been widely implemented. These are computer algorithms that infer patterns from a set of data, called 'training data', Training data in this exercise are verbal autopsy responses for a set of cases, and for each case, the true underlying cause of death is known because rigorous 'gold standard' procedures have been followed to identify the true cause. Any given automated method can then be developed on the basis of this 'training' data set. The performance of this model is then assessed by applying it to verbal autopsied for an independent data set (the so-called 'test' data set, for which the true cause of death is also known with confidence, because identical gold standard procedures have been followed. More detail on this approach to VA diagnosis is given in the Box 4 below.

Box 4 Study design of the population health metrics research consortium study [10, 20-21]

In an attempt to address the drawbacks identified in previous verbal autopsy validation studies, the Population Health Metrics Research Consortium (PHMRC) undertook a five-year (2005-10) study to develop a range of new analytical methods which could be used to diagnose causes of death from verbal autopsy and compared the results to the traditional practice of physician coding of verbal autopsy questionnaires. These methods were tested using data collected at six sites in four countries: India, Mexico, the Philippines, and Tanzania.

The PHMRC study was unique due to the size of the validation dataset (12,542 deaths in neonates, children, and adults) and the use of rigorously defined clinical diagnostic criteria. The study also provided new evidence on issues related to physician-coded verbal autopsies, such as the impact of a second physician on the assigned cause of death, variations in diagnostic accuracy with and without household recall of health care experience, and the importance of prior information from health services for physicians reading verbal autopsies.

The findings from the PHMRC study confirmed that physician-coded verbal autopsy performs worse than three automated approaches (tariff method, simplified symptom pattern, and random forest verbal autopsies) in nearly all settings in the study

This finding is of major importance for countries wishing to apply verbal autopsy methods to diagnose causes of death in the absence of complete civil registration with full medical certification of the cause of death. Automated methods are more accurate than physicians in diagnosing the cause of death from verbal autopsies. Moreover, automated methods are free, quick, and can be made available on platforms such as mobile phones. Therefore, there is little justification for continuing with expensive and time-consuming physician-coded verbal autopsy. Recent research on the application of verbal autopsy methods, and on the comparative performance of different diagnostic approaches (i.e. stage 2 of the VA process) has been published in the journal *Population Health Metrics* and compiled into a convenient publication. This is listed under 'Tools and Resources' at the end of this module.

Readers are also referred to the website (www.healthmetricsandevaluation.org/publications/summaries) which contains convenient summaries of the methods, advantages and validation characteristics of the various automated methods that can be used for diagnosing verbal autopsies. One of the methods, the so-called "Tariff-method" is particularly appealing since it relies on the "strength of the signal" about symptoms as reported in the VA, rather than a more complex statistical algorithm. In other words, a symptom will be chosen as important for diagnosing a particular cause of death if it appears more commonly (i.e., has a higher "tariff" score) for that particular cause of death than other symptoms.

With the development of inexpensive, timely, and reliable automated methods to measure causes of death in populations, it is now possible to apply these to broader and routine vital statistics systems. Currently efforts to use the new automated verbal autopsy methods in official health information systems in India, China, and Mozambique are being undertaken and likely to provide more lessons on the feasibility of using these automated methods for analysing verbal autopsy data.[10]

The ten steps to follow for collecting cause-of-death data via verbal autopsy are summarized below in the Box 5.

Box 5 Ten key steps to apply when using verbal autopsy to collect cause-of-death information

1. Establish a group of stakeholders familiar with the local epidemiological and socio-economic context to adapt the standard WHO VA questionnaire
2. Use a social scientist to determine local meaning and terminology for all signs, symptoms, diseases and conditions
3. Translate the agreed questionnaire into local language(s)
4. Recruit and train interviewers (do not use doctors)
5. Pilot the questionnaire
6. Validate and revise it
7. Develop data entry screens and database system
8. Start conducting VA's, preferably using electronic data capture at point of interview
9. Code causes of death preferably using machine-learning methods. Avoid physician coding
10. Quality control results e.g. AnaCoD and prepare annual reports for stakeholders and other users

Tools and resources

1. Setting up a HDSS or SAVVY System

For Sentinel HDSS, the INDEPTH Network provides complete access to detailed technical guidance, examples of all instruments, a vast array of manuals, tools, software, and Stata routines in its web and print based INDEPTH Resource Kit for Demographic Surveillance Systems.

For SAVVY a number of resources are available as training materials, sample forms, job aids, electronic documents, spreadsheets, and software.

2. Verbal Autopsy Standards:Ascertaining and attributing cause of death

The WHO Verbal Autopsy Standards: Ascertaining and attributing cause of death manual incorporates standard data collection and cause-of-death assignment resources for verbal autopsies, and some general guidelines. The manual includes verbal autopsy questionnaires for three age groups, cause-of-death certification and coding guidelines for applying ICD-10 and related health problems to verbal autopsy, and a cause-of-death list for verbal autopsy with corresponding ICD-10 codes.

This manual can be found at: http://www.who.int/whosis/mort/verbalautopsystandards/en/index.html

While this manual has proven to be a useful resource to guide countries in the application of verbal autopsy methods, the manual is currently undergoing revision to propose a shorter VA questionnaire that could be more easily used by countries for routine application in their vital registration systems, while they are trying to achieve complete medical certification of all deaths. The manual is also being revised to reflect the new guidelines for using automated methods, rather than physician review, to diagnose the cause of death from verbal autopsies.

3. Verbal autopsy: innovations, applications, opportunities

This most comprehensive publication of verbal autopsy experiences and potential uses was published in 2011 (see Figure 8). It provides examples of applications as well as a complete listing of all available methods and their advantages and disadvantages.[10] The publication can be found at http://www.healthmetricsandevaluation.org/publications/verbal-autopsy-series

The publication summarises the comparative performance of six different approaches to automatic diagnosis of the cause of death from verbal autopsy questionnaires. In most settings, all six methods perform better than physician coding of VA's, and one method in particular – called "Random Forrest" consistently outperforms all other automated methods. The findings of this large research project provide important and compelling evidence that countries should NOT use physicians to code VA forms, but rather should adopt Random Forrest or a closely performing automated method. These methods are currently being tested in China and access to the software to enable their widespread application on Android machines is expected to be announced shortly.

Summary

Comprehensive guidelines and tools to help countries rapidly improve their vital statistics systems, based on international best practice are now available.[22] For many countries, however, attainment of timely, accurate statistics on births and deaths and causes of death will require years of strategic and prioritized investment, with technical assistance from WHO, the United Nations, and academia. In the meantime, however, countries will need accurate and unbiased data in order to measure progress with their health programs and broader development goals, such as the MDGs and the growing crisis of non-communicable diseases.

This article has introduced some interim strategies that can yield adequate vital statistics and cause of death data as countries work to strengthen their civil registration systems. These methods mirror the skills, practices and advantages of complete and functioning

civil registration and vital statistics systems, but for a sample of the population. They are based on the principle of rigorous and continuous data collection for a defined and manageable part of the population. Doing “smaller, representative” populations well rather than “larger populations poorly” will reduce the biases that would otherwise occur from missing data, incorrect application of data management procedures, poor data quality checking and lack of medical certification of causes of death.

A critical component of this strategy is to routinely apply verbal autopsy methods to collect essential cause of death data. When properly applied, VA can yield population-based cause of death data of comparable quality to what is typically collected in hospitals in developing countries. Moreover, with the availability of automated methods to diagnose causes of death, it is now possible to obtain accurate cause of death data routinely, cheaply and quickly in resource-poor settings.

The long-term goal of strengthening civil registration and vital statistics systems is to ensure that every birth and death is properly registered, and that causes of death are accurately certified. Stakeholders wishing to establish sentinel surveillance or sample registration should work in collaboration with national and local authorities responsible for civil registration and should support and promote the formal registration of births and deaths whenever possible. In addition, sentinel or sample registration systems should help strengthen the capacity of the health system to correctly certify the causes of death for each decedent.

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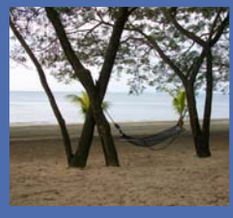
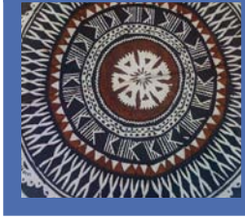
Tools for Action





Overview of section

- O*riginal article:* Improving the quality and use of health information systems
- *Original article:* Assessing health system performance using effective coverage
- *Original article:* Assessing the quality of vital statistics systems: lessons from national evaluations in Sri Lanka and the Philippines
- *Original article*: Mortality statistics: A tool to enhance understanding and improve quality
- *Original article*: Cause-of-death certification: A practical guide for doctors
- *Original article:* Preparing routine health information systems for immediate health responses to natural disasters

Improving the quality and use of health information systems

Original article

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This action guide has been adapted from HIS Hub and IHME, 2009, Improving the quality and use of health information systems: essential strategic issues. Working Paper 5. Health Information Systems Knowledge Hub: University of Queensland. Available at www.uq.edu.au/hishub

Six steps for action Improving the quality and use of health information systems*	
1	Increase awareness about the importance of reliable and comprehensive health information
2	Create incentives for providers to deliver high-quality and timely data
3	Create incentives for policy makers to use information better at the local level
4	Build up the capacity of your health systems to collect and use quality information
5	Establish data ownership, and balance national and local requirements
6	Obtain health data from a variety of primary and secondary sources
*These general steps were developed for countries in Asia and the Pacific. The actual implementation needs to be tailored for each country	

Why do we need to improve the quality and use of health information systems?

Good health information helps you to make sound, evidence-informed policy decisions, which in turn contribute to improved health care outcomes for individuals and the broader community. It also helps donor organisations ensure that their investment is producing real outcomes, which, in turn, provides evidence to support further funding. At a global level, high-quality health information systems allow comparisons to be made across countries and over time by international agencies such as the World Health Organization (WHO), so that specific areas of need can be identified and targeted with assistance.

For a typical developing country with limited resources for their health systems, data on health status and health programs are often incomplete. This means that information on basic health outcomes—including mortality rates, causes of death, and the incidence and prevalence of major diseases—is not available for many communities. Information on financial resources, human resources and other inputs to health care, and the quality and coverage of health interventions, is even more deficient. Despite these difficulties, with the right strategic information, and methods to motivate data collection and use, developing countries can improve what they can achieve with limited resources.

This action guide provides useful guidance to decision-makers on the essential strategies to improve the quality and use of health information systems. Further information is provided in Working Paper 5.

What are the critical issues?

Because health ministries in developing countries have very limited resources, it is critical to develop systems that make the best use of the available funds and staff. In many countries, problems with data collection result in a vicious cycle whereby decision-makers exclude data that are perceived to be poor quality, and providers of data choose not to invest in improvements because nobody is using the results of their work.

This cycle can be broken by introducing strategies to create a strong and effective culture of health information demand and use, supported by incentives to improve data collection and quality, and its subsequent use. It also requires investment in building capacity to collect, store, analyse and disseminate relevant information in a timely manner.

What do we need to do about it?

Step 1—Increase awareness about the importance of reliable and comprehensive health information

The first major step in improving health information services is to increase general awareness about the importance of having reliable and comprehensive statistics on health interventions and their results.

1 2 3 4 5 6

Steps 2 and 3 – Create incentives

To break the cycle of lack of motivation to collect and use health information, it is necessary to create incentives both for providers to deliver high-quality and timely data and for decision-makers to use information better at the local level. A good starting point would be for your central health information collection agency to set a clear schedule for the distribution of health data, such as through a regular publication.

Mexico's annual health report
Since 2001, the ministry of health in Mexico has been publishing an annual report, *Salud-Mexico*, to document the country's performance benchmarking system. The report uses data from the past year or two as reference points to measure improvements in the health system. The report is released publicly in a citizens' forum, which brings together important federal and state decision-makers, civil society leaders, academics and the media. The government sets a clear release date for the report (the beginning of the second quarter of the year). This has created strong incentives for information providers to complete data collection, data processing and data integration in a short period of time.

1 2 3 4 5 6

Step 4—Build the capacity of your health system to collect and use quality information

To build capacity it is important to have a good understanding of the operational environment so that past methods of information collection can be reorganised. It also requires rigorous training programs for workers, and combining all of the health system administration under one central agency.

It is also important to build strong linkages between those agencies which gather data from the recipients of public health care and policy-makers who must make decisions about health care expenditure. This can be done best by a single, strong, competent and independent central information collection and dissemination agency.

1 2 3 4 5 6

Step 5—Establish data ownership, and balance national and local requirements

Health information systems need to achieve a balance between the need for standardisation of data for national or global purposes, and the need for customisation for local or regional purposes. They need to be sufficiently flexible to be able to receive and store data from many different sources and from multiple dimensions. It is vital that they clearly establish data ownership and what is 'official' national data.

1 2 3 4 5 6

Step 6—Obtain health data from a variety of primary and secondary sources

Health data can be obtained from a variety of sources including primary microdata (e.g. vital registration, household interview surveys, national health examination surveys, health service registry data, hospital discharge data, census data, budgets and expenditure reports); and aggregated secondary or macro-datasets.

Where can we get help?

Three global networks provide information about good-quality performance assessment systems, using different strategies and frameworks:

Routine Health Information Systems— a collaboration between the United States Agency for International Development (USAID), the World Bank and WHO, formed in 2001 to promote high-quality, sustainable and practical approaches to the development of routine health information systems.

Partnership in Statistics for Development in the 21st Century—established in 1999 with the participation of the United Nations, the Organization for Economic Co-Operation and Development, the World Bank, the International Monetary Fund and the European Community to help low-income countries to design, implement and monitor efforts to achieve the Millennium Development Goals.

Health Metrics Network—an important global partnership officially launched by WHO in 2005 with projects to support over 65 developing countries. This network has developed a comprehensive framework to help countries strengthen their health information systems. It also aims to improve the availability, quality, use and distribution of data for decision-making.

Conclusion

High-quality health information is a critical input into clinical, local, national, and global decision-making but it is difficult to maintain in developing countries.

Making significant improvements to your country's health information systems requires a number of key strategies. These include:

- increasing awareness among your staff
- providing incentives to collect and use quality data
- building capacity within your health service through training and networking
- balancing national and local requirements
- obtaining data from a variety of sources.

Assessing health system performance using effective coverage

Original article

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This action guide has been adapted from Murray C, 'Assessing health systems performance using information on effective coverage of interventions'. Working Paper 3. Health Information Systems Knowledge Hub: University of Queensland. Available at www.uq.edu.au/hishub

Five steps for action Assessing your health systems performance using effective couverage*	
1	Develop a plan to monitor the effective coverage of priority interventions
2	Choose the most important interventions to assess
3	Work out how to measure the utilisation, need and quality of each intervention
4	Design a system to obtain key data from more than one source
5	Develop national capacity to undertake effective-coverage analysis
*These general steps were developed for countries in Asia and the Pacific. The actual implementation needs to be tailored for each country	

What is the best way to assess health system performance?

Effective performance assessment of health care services enables sound, evidence-informed policy changes to be made to improve health care outcomes for individuals and for the broader community.

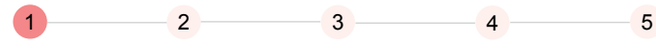
Many public health agencies only use crude 'coverage' metrics of health care interventions, which provide information about the extent of those interventions, but do not provide information about their relative success. 'Effective coverage' is a much better tool because it measures the extent to which the potential health gain associated with an intervention has been achieved. The results can be presented as a single national measure or used to analyse why different states or provinces are achieving different health care outcomes.

Effective-coverage information is the most direct way to understand which of the activities you are funding provide the best value for money. This information will help you to make decisions about whether to continue, change or stop providing particular health care programs.

This action guide provides useful guidance to decision-makers on how to assess health system performance by measuring effective coverage. Further information is provided in Working Paper 3.

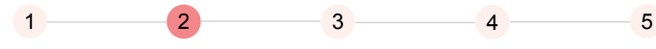
Key Terms
Coverage In health care, coverage refers to the proportion of the population with a health or medical condition who receive treatment. Crude coverage measures are widely used in public health. Examples include the fraction of children who receive doses of a particular vaccine, or the fraction of pregnant women who receive antenatal care.
Effective coverage This concept extends coverage to include the quality, or real-world effectiveness, of the intervention that has been delivered. That is, it measures not only whether an intervention was delivered, but whether the potential health gain associated with the intervention was achieved.

Step into action— key tasks and challenges



Step 1—Develop a plan to monitor the effective coverage of priority interventions

The first step in taking action is to carry out a strategic review of your current health information system. Use this information to develop a plan to deliver sound, annual measurement of effective coverage of priority health interventions. This will help decision-makers understand how different components of the health information system can and should be used together.



Step 2—Choose the highest priority interventions to measure

It is important to select your priority interventions very carefully. Remember that it is more important to get high-quality measurements from a smaller set of interventions

than to get low-quality measurements from a large set.

Several types of information should be used in the choice of priority interventions. These include the burden of disease, the potential to change the burden of disease with affordable interventions, and special considerations of social priority. Decision-makers should not use standard international lists, such as the health-related indicators described in the Millennium Development Goals, unless they are determined to be priorities specific to your country, because this will lead to them missing interventions designed to have a major impact on non-communicable diseases and injuries. The best priority set of interventions will reflect local values, priorities and perceptions.

Step 3—Work out how to accurately measure the utilisation, need and quality of each intervention

Effective coverage has three components: utilisation (the number of individuals receiving the intervention among those who need it); need (the total population in need of the intervention); and quality (the fraction of potential health gain that is actually delivered). Each needs to be accurately measured.

Measuring utilisation

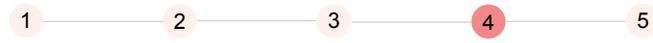
There are many datasets which can be used to measure the number of individuals receiving the intervention (e.g. hospital discharge data, claims data from payers, program-specific registries, manufacturer's data on product distribution, and household surveys). However, it is important to have at least two mechanisms for tracking utilisation of interventions to ensure that metrics are not biased because they are highly program specific, or because they are affected by political or financial incentives.

Measuring need

Some measures of need in a population are relatively easy to obtain because they are normative (e.g. all children at certain ages or all pregnant women). However, other non-normative measures are much more challenging because there may be many people in a population who have a health problem that has not yet been diagnosed (e.g. identifying people with high blood pressure or cancer).

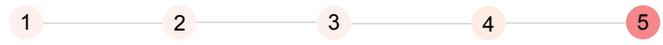
Measuring quality

In the effective-coverage framework, quality is the extent to which potential health gains are actually achieved. It is not sufficient to simply assume that utilisation translates into predicted health benefits. There are six main strategies that can be used in designing a health information system to capture the quality component of intervention delivery (cohort registration, biomarkers of effectiveness, case–control methods, exposure matching in household survey data, statistical methods including instrumental variables, and risk-adjusted outcomes).



Step 4—Design a system to obtain key data from more than one source (triangulate)

A key aspect to developing a strategy for effective coverage is to use more than one source of data (triangulate), such as administrative data sources and periodic household surveys. It is also important to produce information that is timely, local and valid. Measurement of population need over time will require regular household surveys, at least every three years.



Step 5—Develop national capacity to undertake effective-coverage analysis

Creating a robust set of measures for effective coverage at a national or, preferably, sub-national level requires the creation of dedicated capacity within government. Capacity is needed on two fronts: first, to understand how to refine and adapt the national health information system so that it is optimised to collect the necessary information on utilisation, need and quality; and second, to analyse data from the administrative data systems, household surveys and other sources. Skills required include undertaking matching analyses, case–control assessments, survey analysis, record linkage studies, bias assessment and correction.

Conclusion

To accurately assess health system performance, it is vital to track the effective coverage of priority interventions. There is a range of strategies and measures that can be tailored by individual countries to track effective coverage. Some redesign of health information systems may be required to get the right information, and the capacity of systems and personnel may need to be enhanced.

Assessing the quality of vital statistics systems: Lessons from national evaluations in Sri Lanka and the Philippines

Original article

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Introduction

After a long period of neglect, developing countries, international organisations as well as the global network of donors and non-governmental organisations (NGOs) now all accept that vital statistics systems need to be strengthened if gains in health and social goals are to be achieved and sustained, and if the effects of health investments are to be measured.[1] Currently vital statistics data collections in most developing countries are too incomplete, inconsistent and of too poor quality to be reliably used. A major factor contributing to the stagnation of the development of civil registration systems has been the belief that alternative sources (such as surveys and censuses) would adequately meet planning needs for information on vital events. The *Lancet* series "Who Counts?"[2] clearly demonstrated the poor state of vital statistics in most developing countries and the urgent need for a global effort to support countries to improve their civil registration and vital statistics systems.

The fact that there is no single UN agency responsible for vital statistics has meant that advocacy, as well as assistance to countries to improve their civil registration and vital statistics systems, has been piecemeal and has lacked coordination and focus. More recently WHO, primarily to help countries to improve their mortality and cause of death data, has taken the lead by launching the Monitoring of Vital Events (MoVE) initiative and together with the University of Queensland's Health Information Systems Knowledge Hub has developed a comprehensive Framework and guidance tool to assist developing countries to better assess the deficiencies with their systems for birth and death information. The Framework and the tool were piloted in two countries in the Asia-Pacific region, Sri Lanka and the Philippines, both of which have established, but imperfect, vital statistics systems.

This paper brings together the key lessons drawn from this exercise, and from feedback received from countries who have participated in regional meetings[a] where the Framework and tool were presented and discussed.

Framework for assessing the functioning of civil registration systems

The WHO Framework provides a comprehensive approach to systematically assess the functioning of national civil registration and vital statistics systems and evaluate the quality of the information produced. It has five main components, covering inputs, processes and output of the system, and 16 subcomponents that assess the main functions of the civil registration and vital statistics systems in countries (Table 1). By reviewing their systems according to this Framework, and following the process outlined in the Guidance document, individual countries will not only be much better informed about the strengths and weaknesses of their systems, but will know what are the priority steps to take to improve the availability, quality and use of vital statistics.

a The Framework was presented to the UNESCAP Committee on Statistics in Bangkok, 15-17 December 2008 and to the WHO-EMRO Inter-country consultation meeting on Civil Registration and Vital Statistics Systems Assessment Tool in EMR Countries in Beirut, 9-12 November, 2009

Table 1 The WHO framework

WHO framework	
Inputs	
A	Legal basis and resources for civil registration **A1** National legal framework for vital statistics **A2** Registration infrastructure and resources
Processes	
B	Registration practices, coverage and completeness **B1** Organisation and functioning of the vital statistics system **B2** Review of forms used for birth and death registration **B3** Coverage and completeness of registration **B4** Data storage and transmission
C	Death certification and cause of death **C1** ICD- compliant practices for death certification **C2** Hospital death certification **C3** Deaths occurring outside hospital **C4** Practices affecting the quality of cause-of-death data
D	ICD mortality coding practices **D1** Mortality coding practices **D2** Mortality coder qualification and training **D3** Quality of mortality coding
Outputs	
E	Data access, use and quality checks **E1** Data quality and plausibility checks **E2** Data tabulation **E3** Data access and dissemination

Prior to its release, the Framework went through an extensive peer review process; it was presented and discussed at various regional meetings, piloted in countries and finally subjected to a post-pilot review where country representatives from the pilot countries and all six WHO Regional Advisors in Health Information were present. The current version of the Framework was the agreed outcome of that meeting.[3]

From the feedback received, it was clear that many countries felt it would be useful to also have a simpler tool which could be used prior to undertaking the full assessment of their civil registration and vital statistics systems. Consequently, a much "lighter" version the tool was developed with a scoring system that provided a summary score of the state of the civil registration and vital statistics systems. The 'Rapid Assessment' tool was tested by a larger number of countries to ensure that the questions, scores and results produced had content validity and were otherwise useful in helping countries to make the case for action to improve vital statistics.

Piloting the framework

The process described for reviewing the civil registration and vital statistics systems essentially follows three standard phases[b] : 1. *Leadership, coordination & Review*; 2. *Priority Setting and Planning*; and 3. *Implementation of the agreed improvements*. Detailed guidance is given for the first two phases in the document, while less detail is provided for Phase 3 which is likely to vary for each country. The pilot experience was initiated by discussions between the WHO Regional Advisor and the Ministry of Health in Sri Lanka and the Philippines.

Each country decided which Government Department would lead the exercise and selected the members of the Review Committee that was responsible for carrying out the assessment. In Sri Lanka it was decided that the Ministry of Health would be the lead agency, while in the Philippines it was the National Statistical Office that chaired the Committee.

Any strategy to strengthen a country's vital statistics closely depends on how well the key units and institutions involved in the collection and processing of the data function and interact together. The first task of the Committee therefore was to identify all key stakeholders and to secure their involvement and support for the review. In each country the stakeholder list differed slightly, but typically contained the following entities: the Civil Registration Office (Central and Local), Vital Statistics Unit of the National Statistical Office, different departments from the Ministry of Health, other main users in Government, Municipal Health Officers, Medical Records Association, Health Insurance Corporations, Hospital Associations, research institutions and universities, the local WHO office, other local international organisations (UNICEF, WB, UNFPA, UNDP) and selected national NGOs with an interest in vital statistics.

Government authorities in both Sri Lanka and the Philippines are sufficiently aware of the importance of good vital statistics and permission to do the comprehensive review was given rather quickly. However, this may not be the case in all countries and hence it is recommended that the Review Committee carries out the Rapid Assessment first (see previous section) and if needed uses the evidence to convince Government of the need to strengthen the current civil registration and vital statistics systems. In all the countries where the RA was tested, the score obtained was very much in line with what might be expected given the maturity of their systems.

Once the stakeholders had been defined, invitations were sent out to all to participate in a "Launch meeting" for the Review. In Sri Lanka, the Launch meeting was opened by the Deputy Director General of the Ministry of Health and attracted some 70 participants. The duration of the meeting was 2 ½ days. In the Philippines, the Launch meeting was opened by the Under-Secretary of Health and attended by the Head of the National

b See Health Metrics Networks *Framework and Standards for Country Health Information Systems (2008)*

Statistical Office who gave the keynote speech. Forty-five participants took part in the two-day meeting.

The Launch meeting was the opportunity to introduce the Framework; to explain the process to be used for the review and to have different groups go through the review questions to make sure that they were relevant, clear and understood. The meeting was also used to complete the membership of the Review Committee and to assign participants to the different subgroups that were to carry out the review.

In the Philippines, the Review Committee distributed the 16 subcomponents of the Framework among five subgroups, while in Sri Lanka the work was shared among six subgroups. Group members came from different government departments and institutions and had working knowledge and expertise in the topic(s) of the subgroup. The tasks to be achieved and the deadline for the work were set by the Review Committee, but it was left to each group to organize their work as they wanted. The number of meetings that each subgroup held and the agenda for each varied according to the subject matter reviewed; most groups met three to four times for a couple of hours' duration. Each group had a Chairperson and a Rapporteur, who in some cases was the same person. The Chairperson of the subgroup was often a member of the Review Committee. The approach of having several subgroups working in parallel on different aspects of the civil and vital statistics systems meant that the review became less onerous and time consuming. Everyone carried on their usual work functions while being part of the assessment. In Sri Lanka the review work was carried out between March 9 and May 31, and in the Philippines, between March 27 and June 15, 2009. The two first phases of the review therefore can be completed within 12 weeks.

In the Philippines, which has a very decentralized health system, the Review Committee decided to test the review instrument both at the national level and in one of the provinces. However, the results of the pre-test showed that at the sub-regional level it was difficult to find sufficient expertise to review some of the components, and many issues could therefore not be properly assessed. Since the instrument was designed to be applied at the national level it was not surprising that it worked less well when applied at the sub-regional level.

After all subgroups had completed the assessment work, the 2nd phase (Priority Setting and Planning) began with a planning meeting where each group presented their findings and recommendations for general discussion and debate. Since each subgroup had worked alone on a couple of subcomponents of the whole system, it was very important that the findings of each group were presented to the other groups and discussed in plenary. The discussion often brought out inter-linkages or overlapping aspects which needed to be considered if the recommendations were to have the desired effect. The outcome of the 2nd phase was a list of agreed recommendations and prioritized steps for improving the quality of the vital statistics information in both countries.

What were the lessons that came out of the review?

A more detailed account of the experiences of Sri Lanka and the Philippines in doing the comprehensive review of their vital statistics can be found in the two country reports that were prepared as part of the exercise.[4-5] The purpose of this paper is to synthesize some specific and general lessons which can be drawn from the two assessments, particularly concerning what the countries learnt about their systems and how certain weaknesses could be solved. Other countries wanting to undertake a review of their civil registration and vital statistics systems should be able to benefit from these lessons, as well as from the findings and experiences of these two countries.

Specific lessons learnt

The key specific lessons and findings that came out of the review are presented and discussed in this section under the headings of the Framework components (Table 1). For more details, readers are referred to the two abovementioned country papers.

A1 Legal basis

- *It is essential, but not sufficient, to have a law that requires that all deaths are registered. Without linking the burial or cremation permit to the death certificate it is difficult to ensure complete registration;*
- *Without a law that requires that all private health establishments report vital events there is no basis for enforcement;*
- *Personal information on birth and death certificates should be kept confidential and only be accessible by the person or by close relatives;*
- *Passing amendments to civil registration laws needs intensive lobbying by all stakeholders.*

Most countries have laws that make reporting of births and deaths obligatory, indicate who should report the event and by when, and many have penalties for not reporting. However, implementation of these laws is not easy when people are not aware of them and when they have no need for either a birth or death certificate in their daily lives. Thus in Sri Lanka the review of this component concluded that as long as a death certificate is not needed to get buried and cremated in rural areas, some deaths will not be registered. However, a law linking the two cannot be fully implemented until there is sufficient awareness of this requirement and before those who dispose of the bodies (e.g. undertakers and cemeteries) are prepared to collaborate. Obtaining a death certificate to be used for burial purposes is likely to be facilitated with further computerization and automation of the registration points. This need to be carefully planned with the concerned stakeholders to avoid that unofficial burial/cremation places may appear.

Similarly, without strong legislation obliging private institutions to report vital events regularly, collecting information from these can become problematic. In Sri Lanka reporting is done on a voluntary basis for

the moment, while in the Philippines private health establishment are mandated to report births and deaths and their licenses to operate can be removed if they do not conform. With the growth of the private sector in both countries, it will become increasingly important that private institutions not only report all vital events but do so at agreed intervals.

The law in Sri Lanka was also found to be lacking with regard to confidentiality of the birth certificate, which even unrelated persons can get copies of. In the Philippines the problem was different, as the birth certificate is considered highly confidential, but the death certificate is not. The non-confidentiality of information relating to what a person died from may lead to some misreporting to protect the family.

Civil Registration Laws in many countries have not been updated for decades although social norms and technology have changed and there is a need for revising and clarifying many aspects of the law. This is the case in both countries and in the Philippines there currently (2010) is a Bill waiting to be passed in Congress to standardize, modernize and simplify the system and integrate new developments in civil registration and vital statistics. The two stakeholder meetings conducted in connection with the review also turned out to be excellent platforms for the Registrar General's Office to inform every one of this new bill and its consequences and to invite other stakeholders to assist with the lobbying.

A 2 Registration infrastructure and resources

- *In a decentralized system insufficient budget allocated to civil registration in some local areas may affect the quality of the entire national system;*
- *To improve the quality of the data, the skill levels and recruitment criteria for civil registrars would need to improve.*

In the Philippines, because of their decentralized system, the review revealed some surprising differences among local government areas with regard to resources allocated to civil registration. In some provinces, the civil registration budgets provided to local government are clearly insufficient to enable them to carry out this function properly. This was reflected in the poor quality of the information sent to the National Statistical Office and the tardiness of delivery. Lobbying of Provincial Government Authorities to increase the registration budgets was recommended. It was also found that the general awareness among health workers of the importance of vital statistics was very low, and some orientation in this regard would be beneficial.

In Sri Lanka the review found that an increase in the civil registration budget would be necessary to further computerize the data collection and data processing without which the timeliness of data was unlikely to improve. It also became apparent that more resources would be essential to build a more professional system of civil registrars, where recruitment would be based on professional criteria rather than age and status in society as currently is the case. Raising the skill levels of staff and improving the employment conditions are closely related to improving the quality of the vital statistics data.

B1 Organisation and functioning

- *An Inter-governmental Committee with decision-making power is needed to solve cross-cutting problems between the civil registration and vital statistics systems;*
- *The flow of data from periphery to central level should go in both directions so that districts can benefit from the data they collect for their own planning;*
- *For any change to the civil registration system, it is essential that an information campaign is budgeted and planned from the beginning in order to increase its effectiveness.*

Although the civil and vital statistics systems in Sri Lanka and the Philippines function reasonably well, several problems were identified, which were cross-cutting and only solvable through some Committee that had representation from all responsible Ministries and institutions. Specifically, in both countries it was found that the roles and responsibilities of staff needed to be more clearly defined at the district/local area level in order to create a more timely flow of data. Also, the fact that data usually only flowed in one direction – from district to central level – should be rectified. The data, once tabulated for the district, should be sent back to the office that collected them to promote their use at the local level. In the Philippines, local compilation and use of data has improved since the introduction in 2008 of a computerized Civil Registration Information System (CRIS) by the National Statistical Office. The system, however, is not yet universally used, partly because difference in resources for civil registration between the local areas and partly because the limited information campaign promoting the system.

In a decentralized system like the Philippines, it is more likely that there are wide differences on practice between the local civil registration offices. For example, it was found that many charge an administrative fee for registering births and deaths although first-time registration should be free. The new civil registration bill will give more guidance to local government units about their duties and responsibilities. However, local government staff and users need to be made aware of the content of the Bill and hence it was recommended that an information campaign and some lobbying to improve civil registration practices should be undertaken.

B2 Review of forms

- F*orms should not be reviewed without consultation with the main users of the data;*
- *Inexpensive changes to registration forms can have substantial effect on the quality of the data reporte*d.

In the Philippines the death certificate form used by doctors to certify death and cause of death was recently

improved by the National Statistical Office without consulting the Department of Health. Given that the latter is a main user of the data and that the collaboration of doctors is crucial to get good cause of death data, their input should be sought whenever forms or manuals are being prepared or altered by the Registrar General's Office or the National Statistical Office.

Sri Lanka does not currently use the International Form of Medical Certificate of Cause of Death. Instead two different forms are used; one for hospitals (B33) and one for Registrars (B2). The latter has only one line where the registrar notes down the presumed cause of death. But even the hospital form, which has three lines, has notable deficiencies; for instance, the certifier is not directed to report the conditions in a proper sequence and there is no space allocated to record the time interval between the onset of the disease and the time of death. It was therefore recommended that Sri Lanka introduces, as soon as possible, the standard ICD form and eventually use it throughout the system. The addition of a pregnancy box to be ticked on the death certificate is another example of a simple measure that can improve the undercounting of maternal deaths. Finally, when and if a country is considering introducing verbal autopsy for deaths that cannot be medically certified, there is no need to spend resources on developing and testing new forms, the WHO standard verbal autopsy tool is well tested and ICD compliant and contains forms that can easily be adapted to suit different countries.[6] As a result of the review, Sri Lanka is currently looking into exchanging their non-ICD compliant verbal autopsy form for the WHO standard.

B3 Coverage and completeness of registration

- *If there are strongly divergent views about the completeness of birth and death registration, demographic techniques, including a "capture-recapture" study should be applied;*
- *If it is suspected that there are strong regional variations in registration completeness levels should be assessed sub-nationally;*
- *Public awareness campaigns focused on marginalized populations are essential to increase registration.*

The discussion about completeness levels of registration, which took place as part of the review, revealed some divergent views among stakeholders as to whether completeness of death registration was increasing, decreasing or stable. In this case, it is important to undertake a more detailed demographic study to determine the extent of registration completeness and increase confidence in the registration data. In Sri Lanka it was also suggested that it would be worthwhile to insert a question in the 2011 census about household deaths in order to get a better idea about how many deaths escape the registration system, as well as who they are. In the Philippines, registration completeness is suspected to vary substantially by province and hence it was recommended that the level of birth and death registration should also be assessed sub-nationally.

The most common reason put forward in both countries for not registering birth and death events was lack of awareness in certain populations of this requirement. Even in countries with relatively high levels of registration coverage it is often needed to conduct public awareness campaigns specifically targeting marginalized sectors of society, including economically depressed areas. The Muslim population, for whom both countries have adopted different registration rules, is an example of a subgroup that needs special attention.

B4 Data storage and transmission

- *The introduction of new systems needs to be accompanied by an information campaign among managers and local users to stress their benefits. If this is not done there may be little motivation to use the new systems*.

Apart from scanning of the death certificate forms, in Sri Lanka the data transmission system is still largely paper-based. However, computerization is planned to be progressively introduced outside the central office. In the Philippines the lessons from introducing the first version of the Computerized Registration Information System to local governments in 2008 was to stress more the benefits of the new system to local mayors, hospitals and local government users. Hence, to increase acceptance of the revised CRIS, now called PhilCRIS, which it is being rolled out in 2010, it is being accompanied by a promotion campaign for it use.

C1 ICD-compliant practices

- *Awareness training in the important public health use made of mortality data should be offered to all health staff and doctors*
- *Mixing medically certified deaths with non-medically certified deaths in cause of death tabulations dilutes the reliability of the information and should be avoided;*
- *Even in countries which have used ICD for many years, it cannot assume that doctors know how to certify according to ICD rules.*

The assessment revealed that in both countries, health personnel including doctors were not sufficiently aware of the important public health use made of the information provided on the death certificate. It was therefore recommended that some awareness training in the use of mortality data for public health planning should be incorporated into the Medical Curriculum and in the training offered to health officers, nurses and medical records staff.

In Sri Lanka only about 50% of deaths have the cause of death certified by a medical practitioner; for the remainder the cause is determined by the local registrar or some other lay official, after short interview with the family. Despite the lower reliability of the lay-assigned cause of death data the two data sets are merged. It was therefore recommended, as a first step towards improving the utility of the data that the two data sets be compiled separately.

In the Philippines, according to the law, all deaths must be certified by a doctor. Deaths occurring at home in rural areas, may in the first instance, be assigned a cause by the local mayor/headman, but subsequently the cause of death will be confirmed or changed by a Municipal Health Officer who is a medically trained person.

Both countries found that their medical establishments needed to be better trained in ICD practices and in filling in death certificate forms correctly, and hence recommended that a booklet to guide doctors be prepared.

C2 Hospital certification

- *A validation study of the quality of course of death certification should be undertaken and serve as input for a focused training course for doctors.*

Without having carried out a validation study of the quality of hospital certification it is difficult to determine what improvement measures would be appropriate. Since neither country have ever validated their certification practices it was recommended that this should be done with priority. Based on the results of these studies a focused short training course for doctors could be devised and implemented as part of their studies or internships.

C3: Deaths occurring outside hospitals

- *Countries which have a high proportion of people who die outside hospitals ought to introduce proper verbal autopsy procedures to diagnose the presumed cause of death.*

Although in Sri Lanka a verbal autopsy for all natural home deaths is conducted and a uniform national form is used throughout the country, there are no provisions for having a doctor assign the cause of death based on the information reported on the form. Instead, the civil registrar interprets the information, decides on the cause of death and fills in the form. The review helped bring out the importance of having a doctor select the cause of death from the verbal autopsy reports and of using a more detailed verbal autopsy form, in line with the recommended WHO standard.

In the Philippines, there is no special form used for verbal autopsy. Each Municipal Health Officer, conducts an interview with the family of the deceased and from that determines the cause of death. Lack of standard questions and procedures, however, will necessarily affect the comparability of the data.

C4: Practices affecting the quality of the cause of death data

- *Reliable and complete medical record information is crucial for good certification and nurses and health record staff should periodically be offered training courses.*

The discussion in both countries which took place around how current data could be improved revealed that the quality of the medical record documentation is likely to influence the quality of cause of death certification. To correctly complete the death certificate according to ICD rules, the doctors have to indicate not only what was the immediate cause of death, but to trace back what was the underlying cause that initiated the sequence of conditions leading to death. To reliably do this, medical records are invaluable and most doctors would normally consult these to establish the sequence of diseases or morbid conditions. It is therefore important to ensure that some minimum standards are respected for preparing and maintaining medical records and that nurses and medical records staff are well trained in these standards.

D1: Coding practices

- *The quality of cause of death coding is closely related to the quality of the cause of death certification and hence there should be a mechanism allowing coders to query information provided by the certifier.*

Coding is done centrally in Sri Lanka at the Vital Statistics Unit and coders are generally well trained. Coders have access to the original scanned death certificate form and all the causes are coded using ICD-10. More recently, the coders have been trained in using the decision tables of the Medical Mortality Data System (MMDS). However, the review revealed that when there are errors or uncertainties on the death certificate there is no mechanism by which doctors can be queried for further information. This leads to many cases being assigned to “ill defined” or “unspecified” causes by coders.

In the Philippines mortality coding according to ICD-10 is done at several places (hospitals, local civil registration offices, Provincial Statistical Offices) but only the underlying cause of death is coded. All forms are eventually sent to the National Statistical Office where they are verified and corrected by trained coders. Forms are sometimes returned to the Provincial NSO to seek further information, but not uniformly.

D2: Coder qualification and training

- *Coding quality is dependent not only on coders being trained but also on the use of a standard curriculum.*

Sri Lanka does not seem to have any problem with training of their mortality coders. They are locally trained by a well respected teaching institution according to a standard curriculum. However, the review found that their

workload was too heavy and hence there was a constant backlog of death certificates waiting to be coded. The only way to improve that seemed to be to hire more coders.

In the Philippines the training of coders is done by different institutions and there is not one standard curriculum or exam that they all have to pass. Several recommendations were therefore made which specifically referred to improving the skills of coders, standardizing the training and increasing the frequency of the ICD courses.

D3: Quality of coding

- *Introduction of the MMDS decision tables for mortality coding had positively influenced the quality of coding by standardizing the way the underlying cause of death is selected;*
- *A standard list of medical terminology abbreviations used locally should be prepared;*
- *Coding audits should periodically be carried out to assess the quality of cause of death coding.*

In Sri Lanka, the introduction in 2008 of the decision tables of the Medical Mortality Data System (MMDS), had resulted in greater uniformity in the selection of the underlying cause of death but had not helped to speed up the coding since it requires that all causes mentioned are coded.

Neither Sri Lanka nor the Philippines have a national language version of the ICD but use the English language version. However, sometimes coders lose much time and effort trying to decipher local abbreviations of medical terminology. The preparation of a booklet with a standard list of abbreviations, as used in either country would be a worthwhile investment and save time for coders.

Apart from some occasional checking by a supervisor neither country had yet carried out any validation study of coding quality. In the Philippines this would clearly be much more complicated given that mortality coding is done in many places, but the NSO could do a national sample which would be essential if the quality of coding practices is to be known.

E1: Data quality and plausibility checks

- *Before releasing or publishing data, levels of mortality and fertility as well as patterns of causes of deaths need to be checked for consistency and plausibility.*

The review also called attention to the need for more consistency and plausibility checks on the data before releasing them. Although both countries carry out checking routines on their data, it was clear that these were not consistently checked against other sources (surveys, census, and administrative sources). Performing such checks on the levels of mortality and fertility implied from the vital statistics, compared with levels calculated from censuses and surveys, would be very useful and does not demand very sophisticated methods.

In both countries, however, the biggest problem by far is the quality of the cause of death data. In Sri Lanka, the large number of deaths classified to ill-defined categories (above 20%) is the main limitation in understanding the true disease distribution. In the Philippines, all deaths in principle are medically certified, and the proportion of ill-defined deaths is only around 5%. However, only about 35% of deaths are certified by the attending physician. As mentioned earlier, people who die at home are certified by the Municipal Health Officer who is a medical doctor.

However, the review revealed a number of oddities in the Philippine death distribution that seemed to suggest that not all doctors certify the underlying cause well (e.g. septicaemia was among the leading causes), or then use “convenience” codes (e.g. where suicides are recorded as accidental deaths or to some undefined cardio-vascular category) which reduces the reliability of the mortality data. It was therefore suggested that basic disease specific tabulations and studies should be carried out to better understand the extent of misclassification of cause of death in the vital statistics data.

E2: Data tabulation

- *Tabulating the data in different ways is important both as a data check but also should be done to suit different users needs.*

Policy makers and researchers do not have the same need for granularity in the data. For policy purposes, a breakdown into major disease groups and leading causes of deaths may be sufficient, while researchers and epidemiologists should be consulted about what level of detail would be useful to them, and could be provided, given confidentiality requirements. In both countries there seemed to be considerable scope for improving both the published data and the data available electronically.

E3: Data access and dissemination

- *Timeliness is one of the data characteristics most appreciated by users. The later the data are made available, the less useful they are for planning;*
- *A cost-effective way to improve timeliness is to make the data available in electronic format.*

It was clear from the two country studies that the vital statistics produced were not being used as much as they should. Part of this was due to their tardiness in release. In both countries, at the time of the 2009 assessment, the latest Report of Vital Statistics included data from 2004 or 2005. In Sri Lanka, the 2004 Tsunami created a tremendous workload for the Vital Statistics Unit responsible for compiling and publishing the data and although special measures were applied, the 2004 and 2005 data were only recently (2009) released. In the Philippines the most common reason for the publishing delays is that national figures cannot be compiled until all

the local areas have submitted their data to the Provincial Statistical Office.

In Sri Lanka it was suggested that a working group with representation from the Vital Statistics Unit (the producer) and a number of the main users should be formed and serve as a platform for deciding on priority data and make suggestions about how to solve some of the delays.

In the Philippines, those Local Government Units which have begun using the Computerized Civil Registration Information System also receive data compilation software from the National Statistical Office that allows them to generate preliminary vital statistics reports at the municipality level. Providing such kind of tabulation software is a very good way to increase usage of the data. Even preliminary data on causes of death are much more useful for planning than well out-of-date final figures.

From evidence to action: prioritising the recommendations for improving the system

For each problem or issue identified by the review, the subgroup concerned was expected to propose a recommended solution. As a result, each country developed a set of recommendations which clearly needed to be prioritized in some way. Part of the inertia in improving vital statistics systems has arisen from a failure to identify a manageable and feasible set of priority actions that would be likely to have significant impact on data quality, use and/or timeliness. To assist countries to arrive at an agreed and prioritized list of recommendation a simple prioritization process was followed as outlined below. This process was tested in two countries as an integral part of the assessment exercise and slightly modified afterwards. In each case, the exercise was completed collectively by all stakeholders at the final Results meeting (i.e. the group of people who had done the assessment work), who were able to agree on a preliminary action plan during the meeting.

Firstly, at the Results meeting, each of the subgroups assessed their own recommendations according to four criteria: ***urgency, feasibility, cost, and time line*** defined as follows:

- Urgency: the extent to which the recommendation needs to be implemented immediately;
- Feasibility: the ease with which the recommendation could be implemented, given departmental roles and responsibilities in government, or cultural traditions;
- Cost: the expected cost associated with implementing the recommendation and the likelihood of obtaining funding from different sources;
- Timeline: the period required for the full implementation of the recommendation.

Four scenarios were provided for each of the four criteria as shown in Table 2. Scenarios were scored from 1 to 4 by the subgroups depending on the perceived urgency, feasibility, cost and time needed, with the optimal score being 4 and the least desirable scores as 1. Scores across the four criteria were then summed, giving a summary score for each recommendation[c]. The higher the score, the higher priority should be given to implementing the recommendation. These four criteria were chosen to reflect the critical dimensions of any deliberative process countries might follow to decide upon the relative priority of recommendations. This scoring system is clearly very basic and could be modified by countries as required.

Recommendations resulting from the assessment	
Prioritisation method	
Criteria for prioritisation	**Urgency** 4. Must start immediately 3. Could be delayed for up to 6 months 2. Could be delayed for up to 2 years 1. Could be delayed until able to be done **Feasibility** 4. Necessary action can be decided at the departmental level 3. Requires inter departmental agreement 2. Requires legislation change 1. Requires change in tradition / culture/ policy **Cost** 4. No cost implications 3. Can be funded within current budget 2. Need to apply for government funding 1. Need to find external resources **Time line** Action could be completed within 4. 3 months 3. 3 months to a year 2. 1-5 years 1. More than 5 years

One potential danger of this process is that recommendations could score highly on the four criteria, but their implementation might result in little change to quality of the vital statistics, their timeliness or use made of them. All scored recommendations, were therefore entered into a spreadsheet, and the entire stakeholder group collectively reconsidered the scores in the light of the potential impact that each recommendation would have on improving the vital statistics system.

c Both the prioritized list and the scores given to each recommendation have been included in the Sri Lankan and Philippine country reports of the assessment and can be consulted on the HISHub website, see Documentation Note 1 and Documentation Note 2.

Expected impact was graded as HIGH, MEDIUM and LOW. When all recommendations had been evaluated for the impact factor and scored, they were finally ranked in decreasing order in each of the three impact bands. In case of a too large number of recommendations, countries might want to reduce these by only considering, in the first stage, those with scores above a certain cut-off point.

In this way, the planning meeting produced in each country an agreed and prioritized list of actions to guide the Review Committee in developing a final, strategic plan for improving their civil and vital statistics systems. In both countries, efforts to improve the system have already begun with action on some of the specific recommendations. For instance in Sri Lanka, an evaluation study of the quality of medical certification in hospitals in the Colombo District has been carried out;[4] discussions have commenced with the Medical School to introduce a short training course on how to correctly certify deaths according to ICD rules; and revision of the existing death declaration form has begun. A working group to oversee the implementation of priority recommendations with representation from the Ministry of Health, the Vital Statistics Units and the Registrar General's Department, has also been formed.

In the Philippines, the Review Committee has met four times to work on the final strategic plan and discuss budgets. The National Statistical Office has begun to implement measures to speed up the release of the vital statistics data and plan to release data this year for the period 2006-2008.

General lessons learnt from the comprehensive review

While the lessons and findings pertaining directly to the civil registration and vital statistics systems are the focus of this paper, there were a number of more general "value-added" lessons that emerged from having undertaken the review. Several of these have relevance beyond the objectives of the review and are worth briefly mentioning here. These lessons included:

- *The importance of convening stakeholders and collectively brainstorming, e.g. ownership and network building;*
- *The need for systems thinking when dealing with systems that span many stakeholders;*
- *Greatly improved knowledge about global statistical and public health standards through applying the tool, and a better understanding about where to access technical resources;*
- *Much increased awareness about the public health aspects of vital statistics;*
- *The need for critical thinking when using vital statistics in order to improve quality;*
- *A documented resource and a comprehensive understanding of the weaknesses and strengths of their civil registration and vital statistics systems.*

In many countries there is little or no tradition for working across departmental boundaries, and often little knowledge exists of what other institutions are doing in related areas. Problems are mostly solved or partially solved internally, or if that is not possible, left unresolved. The positive meeting dynamic observed among stakeholders in both Sri Lanka and the Philippines was a clear demonstration of how "brainstorming" together can be effective and lead to a sense of ownership in the final product. Although both countries previously had had vital statistics coordination mechanisms, membership had been limited to staff from the Civil Registration Office and the Ministry of Health (Sri Lanka), or to collaboration between the Civil Registration Office and the National Statistical Office (Philippines).

Analysing the civil registration and vital statistics systems from the viewpoint of all key stakeholders promoted a much broader understanding and appreciation of the two systems and their inter-relationships. For many of the problems that were discussed, this lead to "systems thinking" where the implications of an intervention was followed through all the systems and evaluated by all concerned. The principal advantage of system thinking when applied to problem solving that span across different stakeholder groups and decision-making arenas is that all effects are conceptualized and considered. One key lesson to emerge was that sometimes what seemed like a good solution for one part of the system could have potentially undesirable effects in another part. System thinking can only be done if all key stakeholders involved are present; *"every intervention, from the simplest to the most complex, has an effect on the overall system, and the overall system has an effect on every intervention"*.[7]

Civil registration systems often follow national standards, in part because countries are not aware that there are global standards which have been developed to allow countries to derive maximum benefit from their data collections. The UN and WHO have tried to promote these global standards for years but have only recently begun to coordinate their approach. The WHO tool promotes a standards-based review, and countries undertaking it will be exposed to the most recent global standards and tools and be made more aware of the advantages of using them. Both Sri Lanka and the Philippines have implemented ICD-10, but both countries still need to improve their cause of death data. This is not only because a relatively high proportion of people who die are not medically certified (Sri Lanka) or are not certified by the attending doctor (Philippines), but also because doctors do not always bother, or have not been trained, to certify carefully or fill in the death certificate correctly. In neither country is much known about the quality of cause of death certification or the quality of mortality coding since no validation studies of either have been undertaken.

All participants who attended the two meetings were made fully aware of the uses of vital statistics and their essential role in proper planning and policy development by different government departments and local authorities. It is often not understood that vital statistics

derived from civil registration are the only population-based source of cause of death information and the only source that can give information for local areas. Hence, any effort to improve health or to control specific diseases in smaller geographically areas is highly dependent on reliable cause of death statistics. When doctors diagnose and certify the underlying cause that led to death they are rarely thinking of the many important public health uses that their diagnoses are going to serve. The same is true of midwives who attend births and report the weight and other characteristics of the newborn.

Through the methods and exercises proposed in the latter sections of the Guidance Tool, participants in both countries were introduced to the type of critical thinking and analysis necessary to challenge the validity of official data and improve their quality. In particular, countries are urged to routinely compare estimated levels of fertility and mortality indicators derived from their vital statistics with levels of these indicators obtained from censuses and surveys. Participants were also introduced to several routine data checks for cause of death distributions and had opportunity to apply these to their national data and evaluate the results. Application of this kind of routine data checks can soon lead to improvements in the quality of the published vital statistics, provided they are carried out rigorously and critically

A key outcome of doing the review is a substantial increase in the amount of specific and documented knowledge about the functioning of the civil registration and vital statistics systems. For each of the Framework's 16 sub-components, a detailed assessment was completed by those with an intimate working knowledge of the particular subject matter. These reports are in themselves a valuable resource that should form the building blocks from which the national Review Committees can develop a strategic and long-term improvement plan for their systems.

Conclusion

Piloting the WHO Framework in countries provided empirical evidence that the Framework is applicable and useful. Based on these country applications, the Framework was subsequently revised so that other countries using it will benefit even more. Fortunately, as reported in this paper, the two countries that tested the Framework and did the assessment also gained a lot from the exercise. Making these lessons more widely accessible in the hope that other countries in the region may benefit from the knowledge gained was the principle objective of this article.

There is little doubt that undertaking the review has helped build awareness in both countries about the importance of vital statistics and their public health utility. Despite the fact that both Sri Lanka and the Philippines have mature and functioning systems, the review showed that many aspects could function better and needed to be strengthened. A large number of the proposed improvement recommendations would need the collaboration of several stakeholders to be carried out and be sustainable. It is therefore particularly important that functional mechanisms for collaboration, i.e. inter-departmental working groups with decision powers, are established. Some of the proposed changes are likely to require substantial resources but a surprising number could actually be carried out immediately, or within a short period of time, at hardly any cost, e.g. introduction of a communication mechanism, installation of a checking procedure, revision of a form, etc. It has been heartening to see that since the review took place some of these actions have already been carried out, or are currently under serious consideration, in the two countries.

Now that the Framework has been published by WHO and UQ, and has been empirically tested and proven to be of value to countries, it is important that regional organizations make their membership aware of the tool by including it in the agendas of the sub-regional and regional expert meetings they convene around vital statistics. Tools and classifications produced by WHO or the UN need to be effectively and carefully marketed to potential users, and countries trained in their use, in order for them to have the impact intended. This process has already begun with a meeting organized by the WHO Regional Office for the Eastern Mediterranean in November 2009 in Beirut, where some 20 countries of the Region were introduced to the tool.

The vital statistics system does not exist in a vacuum. It is a major and integral part of the health information system and its products are key to improving the performance of the health system.[8] Information on births and deaths as well as causes of death are used as denominators and numerators for a large number of health indicators. If those who determine health and social policy in countries are to have confidence in the basic data and are to make greater use of them in monitoring the impact of health programs and policies urgent measures are required to improve the functioning of the systems and the quality of the vital statistics they provide. As a priority, countries should focus on getting their completeness level up over 90%, and working closely with their medical establishments to improve the certification of causes of death.

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Mortality statistics: A tool to enchance understanding and improve quality

Original article

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Key Points

- Mortality data in some countries may be of unknown or low quality.
- Simple data checks can assess the quality of mortality data. This working paper includes 10 simple steps that can validate and correct mortality data.
- Steps 1-5 focus on assessing the credibility of data based on rates of death
  - *Step 1* - Prepare basic tabulations of deaths by age, sex and cause of death
  - *Step 2* - Review crude death rates
  - *Step 3* Review age and sex-specific death rates
  - *Step 4* - Review the age distribution of deaths
  - *Step 5* - Review child mortality rates
- Steps 6-10 focus on assessing the credibility of data based on causes of death:
  - Step 6 - Review the distribution of major cause of death
  - Step 7 - Review age patterns of major causes of death
  - Step 8 - Review leading causes of death
  - Step 9 - Review the ratio of noncommunicable disease deaths to communicable disease deaths
  - Step 10 - Review poorly defined causes of death
- Step 6-10 are not relevant for survey and census data, as these sources do not generate cause of death information using the World Health Organization International Statistical Classification of Disease and Related Health Problems, 10th revision.
- An electronic tool has been developed to gather and present mortality data in a way that is easy to view and analyse. This tool requires only basic computer skills and familiarity with Microsoft Excel or Access (see Working Paper 13 for the full tool).

Objectives of this guide

This guide is intended to help build analytical capacity to assess the quality of mortality statistics that are currently being collected in order to improve their value in informing health policies and programs.

Countries routinely invest significant resources into collecting mortality data from a variety of sources, including civil registration systems, health care facilities, ongoing longitudinal demographic and health surveillance, and from other data sources such as censuses or household surveys. The primary purpose is to generate critical information to guide public health decision-making. However, data cannot be used appropriately or with any confidence if insufficient attention is paid to the quality. In the absence of systematic data quality assessment, and adjustment where necessary, the data that have been collected—often at great expense—cannot be used to their full potential to guide decision-making.

To assist countries in validating and correcting their mortality data, the World Health Organization (WHO), in partnership with the Health Information Systems Knowledge Hub at the University of Queensland (UQ), Brisbane, has developed this mortality statistics assessment guide and toolkit. The guide describes relatively simple ways of analysing the internal validity and coherence of mortality data, and shows how comparisons with other external sources of mortality data can be used to assess data consistency and plausibility. By carrying out these simple checks, data collectors and practitioners will be able to diagnose weaknesses in their data. If this information is used in conjunction with an assessment of the functioning of the civil registration and vital statistics systems using the WHO/UQ guide,[1] country decisionmakers will have all the tools necessary to develop and target strategies for improving the availability and quality of mortality data. The checks will also assist users in the interpretation of the data so that they can better understand prevailing levels, trends and patterns of mortality in their populations.

Ten simple steps

We describe a 10-step process for assessing the quality of mortality data. The 10 steps can be applied to datasets from different sources, but steps 6–10 are not relevant for survey and census data, as these sources do not generate cause-of-death information using International Statistical Classification of Diseases and Related Health Problems, 10th revision (ICD-10) standards.[2]

At each step, users are led through a process of checking for errors, calculating key indicators, interpreting the public health significance of the indicator values and reflecting on how to use the information to diagnose possible weaknesses in their mortality data systems. The 10 steps are:

Step 1	Prepare basic tabulations of deaths by age, sex and cause of death
Step 2	Review crude death rates
Step 3	Review age and sex-specific death rates
Step 4	Review the age distribution of deaths
Step 5	Review child mortality rates
Step 6	Review the distribution of major causes of death
Step 7	Review age patterns of major causes of death
Step 8	Review leading causes of death
Step 9	Review ratio of noncommunicable disease to communicable disease deaths
Step 10	Review ill-defined causes of death

This guide describes **simple ways of analysing the internal validity and coherence of mortality data**, and shows **how comparisons** with other external sources of mortality data **can be used to assess data consistency and plausibility.**

Applying the 10 steps

This 10-step process can be applied to any mortality dataset. In many settings, mortality data will be the product of the national civil registration and vital statistics systems that routinely collect and compile information to produce statistics on births, deaths and causes of death. Data on mortality by age and sex (but not cause) can also be collected through the decennial census. Mortality data, including information on causes of death, are also generated through longitudinal demographic surveillance in specific sites. In some settings, the most regular source of data on mortality for a population is the routine health information system that records deaths occurring in hospitals. Although these data cannot be considered nationally representative (because they are biased towards deaths occurring in health care facilities and usually confined to the public sector), they can, nonetheless, provide useful information on patterns of hospital mortality and may be of considerable value for understanding mortality patterns in specific sectors of the population. This is especially true in urban areas, where a high proportion of deaths are likely to occur in a health care setting.

Using the electronic mortality data quality assessment tool

To automate the data quality assessment process described step by step in this guide, an easy-to-use electronic tool is available[a] that will perform the calculations needed for the data quality review and automatically generate the associated figures and tables. To use the tool, it is helpful to have basic computer skills and familiarity with software packages such as Microsoft Excel and Access. However, the tool does not require either advanced expertise in software packages, or advanced statistical or computing skills. The tool aggregates and presents mortality data in a format that makes them easier to analyse. It automatically:

- verifies and checks for gross data errors (eg maternal deaths ascribed to males)
- generates information on the reliability of certification and coding practices (eg identifying invalid underlying causes of death)
- carries out basic calculations of health indicators and generates figures, such as the distribution of broad causes of death by age group, and age, sex and cause-specific death rates
- summarises the data in formats that facilitate data sharing and presentation.

Users of this guide are strongly recommended to use the accompanying electronic tool to facilitate the computations and analyses of data described in the following pages.

Following up the results of the review

The purpose of conducting a data quality assessment as outlined in the 10 steps is to diagnose possible problems with the mortality data collection system(s) and to take action to address them. It is important to stress that the review should not be seen as a fault-finding exercise, designed to identify errors and apportion blame. Rather, the purpose is to engage with all those producing and using mortality data—at all levels—to identify weaknesses in the data with a view to correcting problems in the systems that generate them. Ongoing efforts are needed to assure data quality and the regular assessment of the quality of mortality data should become an integral activity of the health information system.

In situations where mortality statistics being reviewed emanate from a civil registration or vital statistics system with information on the causes of deaths, it is strongly recommended to thoroughly assess the functioning

a This tool can be accessed at www.uq.edu.au/hishub

of the civil registration system using the WHO/UQ comprehensive assessment tool.[1] This tool not only provides a detailed framework and road map to identify deficiencies with the mortality data collection system, but also provides detailed guidance about prioritising actions and interventions to improve specific functions.

Step 1 - Basic tabulations of deaths by age, sex and cause of death

The first step is to aggregate the individual death records and tabulate the available data on deaths by age, sex and causes (using ICD-10 codes).

As a minimum, the tabulations should include:

- numbers of deaths for a specified year
- by sex (ie for males and females separately)
- by age at death using the following age groupings
  - within the first 28 days after birth
  - between completed months 1 and 11
  - between completed years 1 and 4
  - completed years 5–9
  - completed years 10–14 and so on, by 5-year age groups, up to completed years 80–84
  - completed years 85 and over
- by ICD-10 short list of causes.

In addition, the tabulations should include the midyear population for the same year, sex and age group. Population estimates are generally available from the decennial census and intercensal projections produced by the National Statistics Office. These data will be used for the calculation of rates and ratios that will be explained in the subsequent steps. A standard template for tabulating the mortality and cause-of-death data is shown as an example in Table 1. It is strongly recommended that countries adhere to the age detail shown in the table. Mortality statistics should always be tabulated and analysed separately for males and females.

It is important that age at death be recorded with precision. A death occurring to a child aged 4 years and 11 months should be classified in the 1–4 years age group. Only when the child has completed the 4th year of age (ie had their 5th birthday) should the death be counted in the 5–9 years age group. It is usual practice to use five year age groups except for deaths occurring in children under 5, which are subdivided into those occurring within the first month of life (28 completed days), those occurring between the ages of 1 and 11 months, and those occurring between the ages of 1 and 4 years. Precision is also important at older ages, which should continue to be grouped into five-year categories at least up to the age of 85 years.

It is poor practice to only tabulate age of death to some relatively low terminal age such as 55+ or 65+. Increasingly, more and more deaths are occurring in populations after about age 50, and it is extremely important for preventive efforts to distinguish between a death at age 80–84 years and an adult death at a much younger age, like 60–64 or 65–69 years old. The use of these standard five-year age groupings is important because the same age groups are used to compile census data on population size and distribution that are used as denominators for the calculation of rates and ratios.

Ideally, causes of death should be shown by the ICD-10 three-digit or four-digit codes. However, many countries have only higher order grouping, such as the ICD-10 short or condensed list of major causes. Although not as informative as the more detailed codes, these groupings can still provide useful information for analysis of data quality and hence for use in policy debates.

The WHO/UQ electronic tool that accompanies these guidelines provides alternative data entry formats for use depending on the degree of detail in the available data. Some datasets will include more detail by age, such as deaths within the first 24 hours after birth, deaths by single completed year of age at death, and causes of death using the detailed ICD-10 four-digit classification. The electronic tool can handle a variety of formats and levels of detail.

The purpose of this initial tabulation is to identify gross errors in the dataset. The WHO mortality tool will automatically identify clearly incorrect causes of death such as male maternal deaths, suicides among young children or prostate cancer deaths in females. It will also draw the attention of users to invalid use of certain codes as underlying causes of death, thus alerting data managers to potential quality problems in coding causes of death from death certificates or in the certification process (eg implausible sequence of morbid conditions reported on the death certificate).

Once the data have been entered according to the format recommended in Table 1, and the gross errors identified and corrected, the tool will automatically calculate totals and distributions of deaths by sex, age group and cause. Steps 2–10 involve the calculation and analysis of key indicators that can alert users to possible weaknesses in their mortality dataset.

Step 2 - Crude death rates

The second step in assessing the quality of a set of mortality data is to review the calculated level of the crude death rate (CDR). This is done for two reasons. First, the CDR is the simplest measure of mortality that can provide insights into the health status of a population over time. Second, the CDR provides a useful indicator of possible problems with the completeness of mortality data. The objectives of Step 2 are to enable users to:

- define and calculate the CDR
- understand the public health relevance of the CDR
- interpret the CDR and judge its limitations
- use the CDR as an approximate indicator of completeness of death registration
- use the CDR as the first step to analyse the quality of mortality data.

Definition and calculation of the crude death rate

The CDR is a measure of the number of deaths in a population, relative to the size of that population during a given period of time. The CDR is typically expressed in units of deaths per 1000 individuals per year; thus, a crude death rate of 9.5/1000 in a population of 500 000 indicates there were 4750 deaths per year in the total population (9.5/1000 × 500 000).

The CDR is defined and calculated as follows:

$$\text{CDR} = \frac{\text{Number of deaths in the usual resident population in a given year}}{\text{Size of the mid-year resident population in that year}} \times 1000$$

Because mortality rates for males and females differ across all ages, it is useful to calculate the CDR separately for both sexes.

$$\text{CDR} = \frac{\text{Number of deaths among females in the usual resident population in a given year}}{\text{Size of the mid-year resident female population in that year}} \times 1000$$

$$\text{CDR} = \frac{\text{Number of deaths among males in the usual resident population in that year}}{\text{Size of the mid-year resident male population in that year}} \times 1000$$

It is important that both numerator and denominator refer to the same population in terms of geography and time. It is standard practice to take the size of the population at mid-year as the denominator because population size may vary during the year (due to migration, births and deaths) and the midyear population serves as an estimate of the average population exposed to the risk of dying over the course of the year.

Table 1 Recommended data tabulation format

Year	Number of deaths by age group									
	<28 days	1-11 months	1-4 years	5-9 years	10-14 years	15-19 years	20-24 years	25-29 years	80-84 years	85+ years
ICD-10 code or short list Males Females Both sexes										
ICD-10 code or short list Males Females Both sexes										
ICD-10 code or short list Males Females Both sexes										
(Repeat this for each individual ICD-10 cause of death for which data are available)										
Total mid-year Population Group Males Females Both sexes										

Interpreting the crude death rate

The CDR is called a 'crude' rate because it does not take into consideration the age and sex structure of the population. In practice, the risk of death in a given population group varies according to age and sex as well as patterns of socioeconomic status, and environmental and other factors. For example, populations with a large proportion of young children or a high proportion of elderly people will, other things being equal, have relatively higher CDRs. This is because mortality risks are highest at youngest and the oldest ages. In general, mortality rates are higher among males than females. Therefore, when comparing populations across countries, geographic areas or over time, it is important to use age and sex-specific mortality rates alongside the CDR (see Step 3). This controls for differences in a population's age and sex structure across the populations being compared.

Crude death rate and population structures

In order to interpret the CDR, it is helpful to refer to the population age–sex pyramid, a graphical illustration of the distribution of the population by standard age groups (usually 5-year groups). The population pyramid typically consists of two back-to-back bar graphs, with age groups on the vertical axis and population size in each group on the horizontal axis. Males are conventionally shown on the left and females on the right. The bars can represent either the absolute numbers (more common) or percentages of the total (male or female) population in each 5-year age group.

In most developed countries, the age–sex pyramid is constructed on the basis of annual birth and death data from the civil registration system and censuses every 10 years. In countries where civil registration systems are weak, age–sex population pyramids can only be reliably estimated from the census. Intercensal estimates of population size by age and sex generally need to be estimated from mortality rates derived from model life tables, which are inherently uncertain. The United Nations Population Division generates regular updates on national population sex and age structures, which should be used where there is doubt about the reliability of country population data.

The use of age–sex pyramids in helping to interpret CDRs is illustrated in Figure 1. The CDR for Sudan in 2005 is estimated at 13 per 1000 population compared with 9 per 1000 population in Japan. This difference reflects the fact that Sudan has a high proportion of children aged below 4 years and this is precisely the age group where mortality rates are highest. By contrast, Japan has a much smaller percentage of population in this age group, although it has a large proportion of older people aged 60+, when death rates are also high. However, this is insufficient to counteract the effect of a large population of children in Sudan, among whom death rates are comparatively high.

Lower limits for the crude death rate

Based on many decades of experience in calculating CDRs, demographers have demonstrated that there is generally a lower limit for the CDR of around 5 per 1000. For example, during the past 20–30 years, Japan has consistently registered the lowest age-specific mortality rates in the world. Yet throughout this period, the CDR in Japan never fell below 5 per 1000.

Table 2 shows the combinations of life expectancy and population growth rates that are associated with different levels of the CDR. In many parts of the developing world, population growth rates are typically around 2 per cent each year. In such populations, the CDR can never get below 5 per 1000, and even for the CDR to fall below 7 per 1000, life expectancy would need to be 75 years or more. This is relatively uncommon in developing countries and hence low CDRs should be treated with great suspicion.

Any CDR under 5 per 1000 should be treated with extreme caution, as such a figure is strongly suggestive of incomplete death registration.

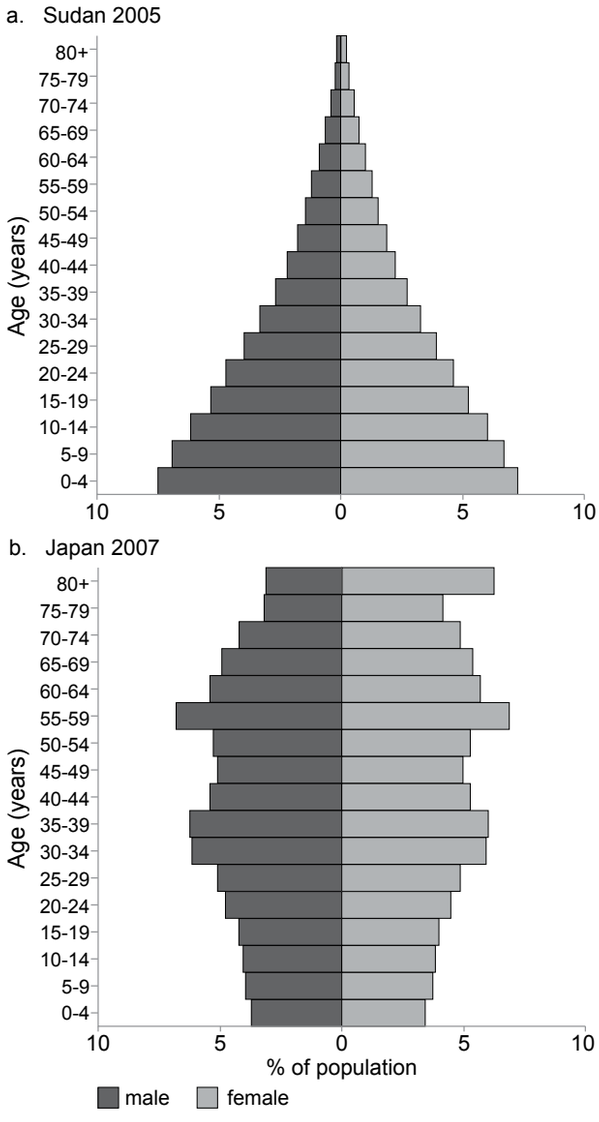
However there are exceptional populations that have both high growth rates—due to natural increase (excess of births over deaths), immigration or both—and low age-specific mortality rates, including low child death rates, implying a comparatively high life expectancy at birth. Several of the Gulf States[b] do in fact have a CDR below five because of this particular demographic configuration. In the vast majority of countries, however, this does not apply and low CDRs below 5 per 1000 are typically a sign of underreporting of deaths.

Trends in crude death rates

An analysis of CDR trends over time can help to improve understanding of the evolution of mortality in a given setting. Moreover, looking at mortality trends over time is a useful way of identifying possible problems with data quality. For example, sudden fluctuations in registered deaths indicate data quality problems because in the absence of severe epidemics, wars or natural disasters, mortality levels change only very marginally from one year to another. This is shown clearly in Figure 2, which shows CDR trends in Japan from 1950 to 2005. Trends in the CDR emerge over time, although it is important to note that there typically are only small fluctuations from year to year. Large fluctuations may arise due to changes in death registration practices (such as legislation to facilitate delayed registration of deaths that occurred several years earlier). These factors need to be taken into account when interpreting trends in the CDR.

b Arab states of the Persian Gulf

Figure 1 Population age-sex pyramids for Sudan (2005) and Japan (2007)



To better understand trends in the CDR, it is useful to compare the CDR with trends in other related indicators, such as under-five mortality rates, life expectancy and the proportion of the population aged 65 years and older. This comparison is shown in Figure 3.

Putting these data together on one graph highlights the nature of the temporal relationship between them in a country with good vital statistics on deaths. In particular, the striking decline in the CDR in Japan between 1950 and 1980—from more than 10 per 1000 to about 5.5 per 1000 (right-hand scale)—coincided with a large decline in mortality in children under 5 years old and is reflected in growing life expectancy during the period, as one would expect (left-hand scale).

Since the 1980s, the CDR in Japan has started to rise, coinciding with a gradual increase in the percentage of population aged 65 years and over (left-hand scale). This ageing of the population in Japan is due to the fact that an increasing number of children and adults are surviving to reach old age. By 2005, the CDR had increased to 8 per 1000, reflecting rising mortality in the growing cohort of older people. Note that despite this increase in CDR, under-five mortality continued to decline and life expectancy continued to increase. A rise in the CDR after a long period of mortality decline is to be expected since it reflects the postponement of death to older ages. As seen for Japan, the CDR started to rise when life expectancy reached about 80 years and the proportion of the elderly (people aged 65 and over) in the population reached about 10 per cent. A key issue to note is that even in a population such as Japan, with very high levels of life expectancy overall, the CDR always exceeded 5 per 1000.

In most countries, estimates of life expectancy, the child mortality rate and percentage of population aged 65 years and older are published in annual official statistics. This enables a similar analysis to be undertaken to compare trends in these indicators with trends in the CDR. On this basis, countries can judge whether their CDR appears plausible, and hence whether or not their reporting of deaths has been reasonably complete.

Summary of Step 2

- Calculate the CDR. A level less than 5 per 1000 is strongly indicative of incomplete registration of deaths.
- Compare the CDR with data on population age and sex structure by calculating a population age–sex pyramid for your country. If the proportion of young children in the population is high, you should expect the CDR to be relatively high. The same is true when the proportion of older people in the population rises.
- Examine the CDR for males and females separately. You should generally expect the CDR for males to be higher than for females. Deviations from this pattern could indicate that women and girls face severe disadvantages in terms of health and nutrition. Alternatively, there may be problems with data completeness and quality with systematic underreporting of female deaths.
- Examine CDR trends over time and compare them with trends in other measures, such as mortality in children under 5 years old, percentage of population aged 65 years and older, and life expectancy at birth. Any rapid fluctuations from year to year indicate possible data problems. You should see a similar trend pattern over time for these indicators as that shown for Japan.

Table 2 Crude death rates at different levels of life expectancy and population growth

Life expectancy (years) \ Annual rate of population growth (%)	5.0	3.0	2.5	2.0	1.5	1.0	0.5	0.0	-0.5	-1.0
40	27.4	24.1	23.6	23.4	23.6	24.1	24.10	25.0	26.2	27.8
45	21.6	19.5	19.3	19.4	19.6	20.2	21.1	22.2	23.7	25.6
50	16.8	15.7	15.8	16.1	16.7	17.5	18.6	20.0	21.8	23.9
55	12.7	12.5	12.9	13.4	14.2	15.2	16.5	18.2	20.2	21.3
60	9.4	9.9	10.4	11.1	12.1	13.3	14.8	16.7	18.8	19.5
65	6.6	7.7	8.4	9.2	10.3	11.7	13.4	14.8	16.7	19.5
70	4.3	5.8	6.6	7.6	8.8	10.4	12.2	14.3	16.7	19.5
75	2.6	4.4	5.2	6.3	7.6	9.2	11.1	13.3	10.9	8.8
80	1.5	3.4	4.2	5.3	6.7	8.3	10.2	12.5	15.1	18.1

Note: Cell values are crude death rate estimates for given values of life expectancy and population growth rates. They have been estimated from the Coale–Demeny 'west' family regional model life tables for females.[3]

Figure 2 Crude death rate trends in Japan, females (1950-2007)

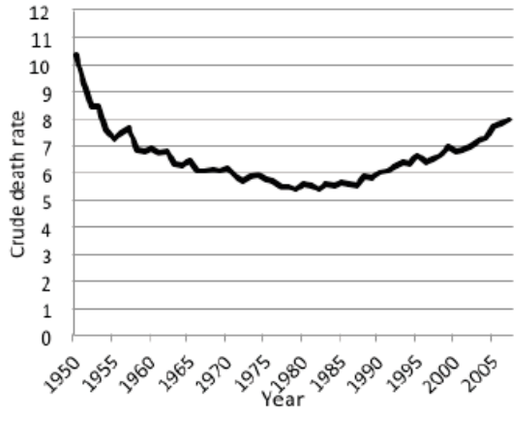
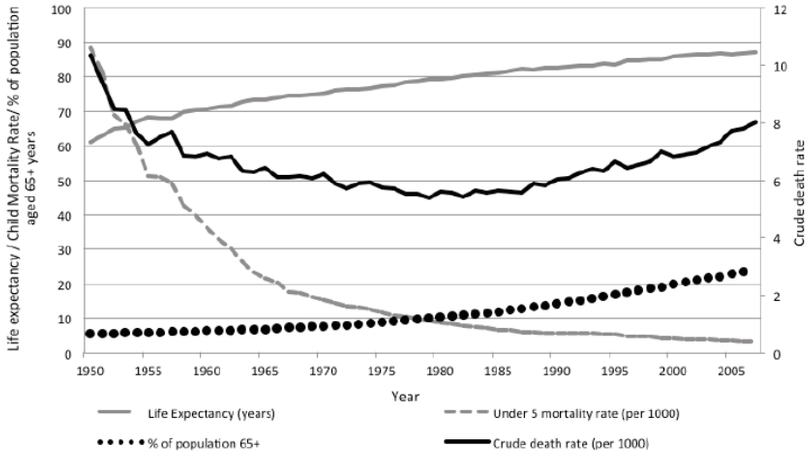


Figure 3 Major demographic trends in Japan, females (1950-2007)



Step 3 Age and sex-specific death rates

In Step 2, we analysed a mortality dataset by calculating the CDR for the population. However, the CDR is a 'crude' rate because it does not take into consideration the age and sex structure of the population. As we saw from Step 2, populations with a large proportion of young children or a high proportion of elderly people will, other things being equal, have relatively higher CDRs because mortality risks are highest at the youngest and oldest ages. Moreover, mortality rates are generally higher among males than females across all age groups. Therefore, when comparing the mortality of populations across countries, geographic areas or over time, it is important to use both age-specific and sex-specific mortality rates alongside the CDR, and to examine these detailed age and sex-specific rates for possible age misreporting of deaths.

The objectives of Step 3 are to enable users to:

- define and calculate the mortality rate specific to a population age group (usually a five-year grouping),known as the age-specific mortality rate (ASMR)
- understand the public health relevance of the ASMR
- interpret the ASMR and understand its limitations
- use the ASMR to assess the quality of mortality data.

Definition and calculation of age-specific mortality rates

The ASMR is calculated as the total number of deaths, occurring at a specified age or in a specified age group, in a defined geographic area (eg country, state, county) divided by the mid-year population of the same age in the same geographic area. By contrast to the CDR, which is expressed per 1000 population, the ASMR is generally expressed as a rate per 100 000 population. This is because there are many fewer deaths within each age group compared with the numbers occurring in the total population. The standard demographic practice is to calculate the ASMR for 5-year age groups, namely < 1, 1–4, 5–9, 10–14 ... 80–84 and 85+. The ASMR is calculated as follows:

$$\text{ASMR} = \frac{\text{Deaths in a specific age group ina population during a specified time period}}{\text{Total mid-year population in the same age group, population and time period}} \times 100\,000$$

Disaggregation of age-specific mortality rates by sex

As noted in Step 2, there are important differences in patterns and levels of mortality between males and females across all age groups. Therefore, it is standard practice to calculate ASMRs separately for males and females within each age group.

Dealing with fluctuations

In countries and settings with small population numbers, the annual number of deaths at specific ages may be very small. As a result, the ASMR would tend to fluctuate and be too unstable for analysis. In order to overcome this problem, it is usual to calculate the ASMR during a 3–5 year period to average out annual fluctuations. This is illustrated in Figure 4 for a small Pacific island population, which shows the large fluctuations in annual ASMR and the smoothed trend data produced by using a 3-year moving average. Alternatively, it is possible to expand the age group or area to be studied, thus increasing the numbers of deaths in the calculation of ASMR.

Interpreting age and sex patterns of mortality

Age-specific mortality rates

Once the ASMR has been calculated for each age group and sex, the next step is to examine the pattern of the data by age to assess plausibility. In order to do this, it is important to have an independent source of comparative data on ASMR—for example, the census. If there is no independent source within a country, it is possible to compare the ASMR with figures from similar countries and settings. The following examples can help in improving the understanding and interpretation of age and sex patterns of mortality in a given country. They also show how this analysis can assist in determining the quality and completeness of the mortality data within specific age groups.

As a general rule, in all settings, mortality rates are high during infancy and early childhood and fall to their lowest levels between the ages of 5 and 14 years. Subsequently, mortality rates start to rise with increasing age and increase exponentially beyond age 35 or so. Figure 5 shows patterns of mortality across age for Australia, where death registration is complete, compared to Russia and South Africa, where death registration is less complete or essential information about the death is missing (eg unknown age or sex). In Australia, mortality rates are very low up to the age of about 15 years old, and although there is a small increase for males during the ages of 15–34 years due to accidents and other injuries, death rates only really begin to rise sharply after about age 55 years. This pattern is typical of most low-mortality populations.

In Russia and South Africa, mortality in infants is relatively high (this is particularly marked in South Africa) but declines during childhood. In South Africa, there is a 'bump' in mortality during reproductive ages in both sexes, reflecting premature mortality due to AIDSrelated illnesses. A similar bump may occur in females of reproductive ages in settings where maternal mortality is very high.

Figure 4 Annual age-specific mortality rates for selected age groups (males) and smoothed trends using a 3-year moving average

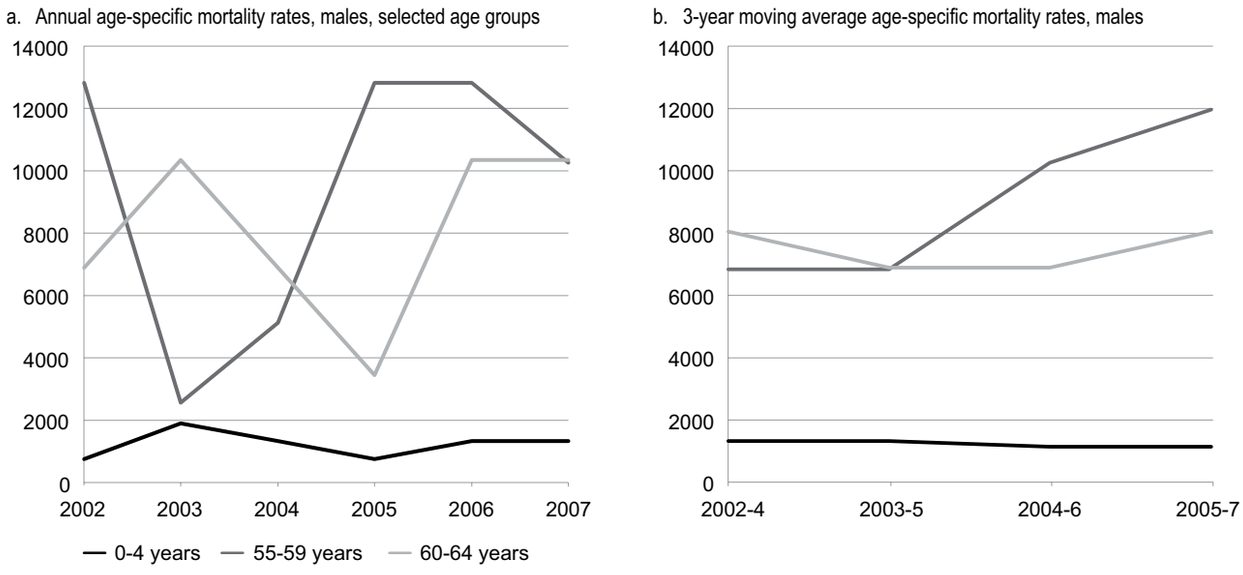
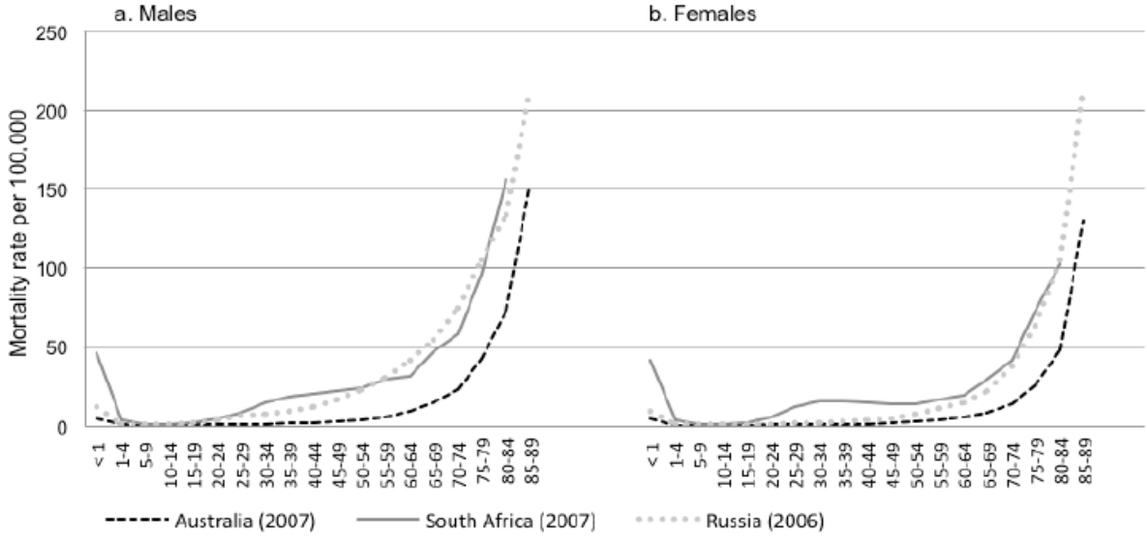


Figure 5 Age-specific mortality rates for Australia, Russia and South Africa, males and females



Comparing your data with this pattern can provide a simple check on the quality of the mortality data and indicate possible underregistration of deaths at certain ages. It is not the level of mortality that matters in this comparison but the relative age pattern of the ASMR among different age groups.

As noted above, beyond about 35 years of age, death rates rise exponentially with age. Therefore, the natural logarithm of the age-specific death rate (mx), written as ln(mx), should be a straight line as age (x) increases[c]. Figure 6 shows examples of ln(mx) for three countries—Australia, Colombia and Mauritius—with very different patterns of mortality and variable quality of mortality data.

The primary purpose of preparing a graph of the log of the death rate at each age is to examine the data for irregular or implausible changes in ln(mx) from age to age. In countries with high maternal or injury mortality in young adults (especially males), death rates will rise steeply (ie ln(mx) will rise) around age 15 years, peak at age 25, and decline to a new low at about age 35 years old. Subsequently, the ASMR will rise linearly with age. Any other departure from this linear pattern in adult death rates suggests that deaths are being selectively (by age) underreported or that there is misreporting of the correct age of death. This is particularly common at older ages.

With this in mind, we can make the following observations from Figure 6 showing age-specific death rates for males:

- Australia— All deaths are registered and hence the

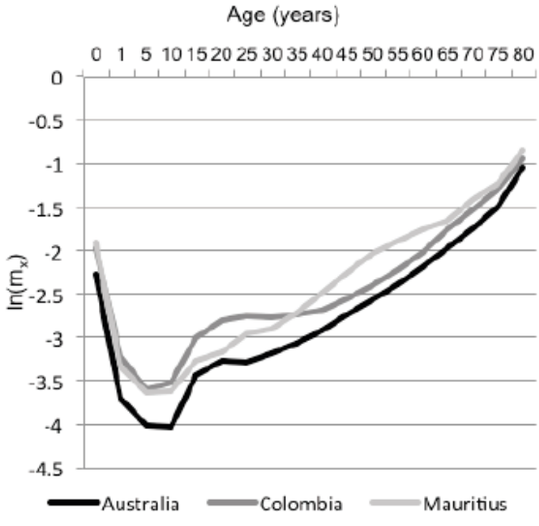
c 'mx' is the standard demographic notation to indicate the level of the ASMR (written as 'm') in any age group 'x'

ln(mx) increases smoothly in a straight line with increasing age (x), as would be expected. Note the slight bump around ages 15–25 years old, indicating an excess in injury-related deaths in this age group.

- Mauritius—Notice that in this case the ln(mx) does not increase linearly with age after about age 65, suggesting underreporting of deaths, particularly at the oldest ages.
- Colombia—Note the large bump in mortality at ages 15–34 years old due to accidents and other violent deaths. One would expect to see a similar large bump in the ln(mx) graph at these ages in countries with high AIDS-related mortality.

Thus, plotting the ln(mx) will help to identify if there are any age groups where deaths are being selectively underreported (eg older ages in Mauritius). In addition, by comparing the graph of ln(mx) for your population with a neighbouring country with good quality mortality data, it will be possible to assess whether, and to what extent, deaths are being systematically underreported at all ages. This will be the case if the graph for ln(mx) for your population is systematically lower than the graph for a neighbouring population.

Figure 6 Log of male age-specific death rates for Australia, Mauritius and Colombia



Source: Institute for Health Metrics and Evaluation database

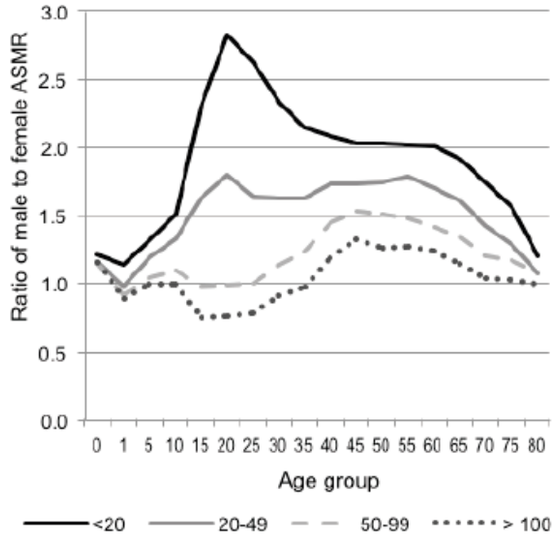
Ratio of male to female mortality rates

As already observed, mortality rates tend to be higher at all ages for males than females. To better understand these male–female differences, it is useful to calculate the ratio of male:female mortality rates by age group. If the ASMR was the same for both sexes, the ratio would be 1 (ie a straight line) for all ages. In practice, the male: female ASMR ratio shows considerable variation over different age groups and at different period of time. Figure 7 shows typical patterns of the male:female ratio in settings with different overall mortality levels, as reflected by levels of infant mortality.

Male death rates are higher than female death rates everywhere except in societies with very low female status. As the status of women in society improves and discriminatory practices against females disappear, female death rates should be lower than male rates at all ages.[4] As Figure 7 shows, in settings with high levels of infant mortality (>100 per 1000 live births), the male mortality excess is relatively small because of high female mortality in reproductive ages. As overall mortality declines, this pattern changes and male mortality is higher than female mortality across all age groups. As already noted, death rates among males aged 15–29 years old tend to be higher largely due to accidents and other external causes. A secondary peak in the male:female ratio of mortality rates typically occurs around ages 55–64 years because males tend to die at higher rates from chronic disease than females, due primarily to increased risk factors such as tobacco, poor diet and being overweight or obese.

Users should prepare a similar chart showing the male:female ratio of age-specific death rates based on the latest available mortality data and compare your pattern with one of the curves shown in Figure 7. If the pattern of male:female ratio of age-specific death rates is very different from what would be expected given your level of infant mortality, there are good reasons for questioning the quality—that is, the completeness of death registration—of the reported data, particularly for females.

Figure 7 Male:female age-specific mortality rate (ASMR) ratios at different levels of infant mortality



Note that in comparing your age patterns of the sex mortality ratio to one of those from Figure 7, it is important to use an independent value of the infant mortality rate derived from censuses or surveys, or estimated by the United Nations, WHO or other sources. Do not use the value from your vital registration data, which could be underestimated.

Summary of step 3

Calculate age and sex-specific mortality rates.

- Examine the ASMR across all age groups for each sex separately. You should find a pattern of relatively high mortality in the 0–4 years age group, very low mortality in the age groups 5–14 and an exponentially increasing mortality rate after the age of about 35.
- Plot the logarithm of the death rate at each age. It should increase smoothly and linearly with age after about 35 years old.
- Examine the ratio of male:female ASMRs across all ages. In general, you would expect male mortality rates to be higher than for females, especially in the age groups 15–35 years old, as young males are more likely to die as a result of violence, road traffic accidents and other external causes. High mortality rates in young adults may also be due to AIDS-related illnesses. In some cases, female deaths are less likely to be recorded than male deaths, leading to higher than expected ratios of male:female death rates.

Step 4 Age distribution of deaths

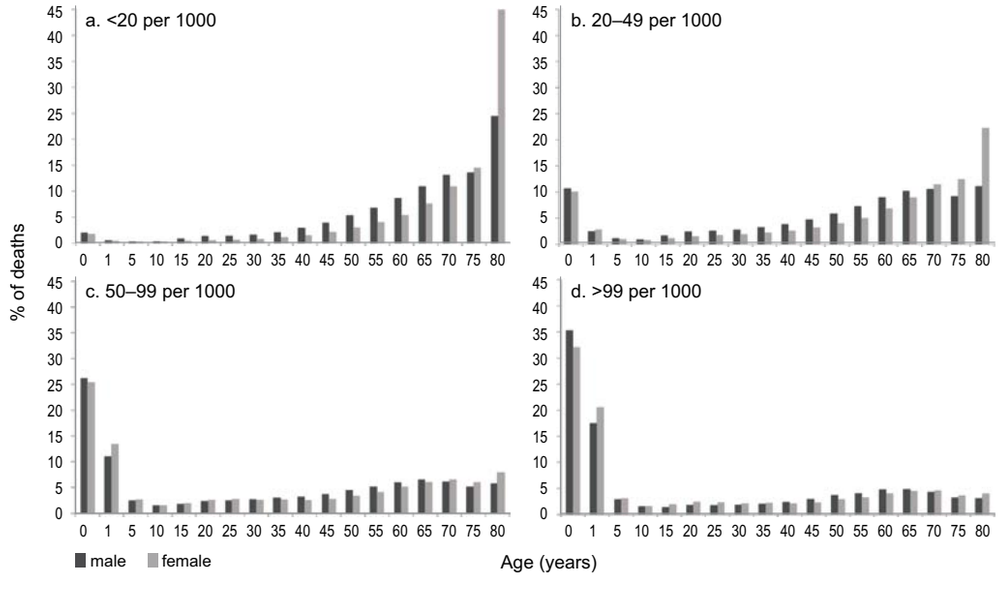
In Step 3 we looked at the age and sex-specific mortality rates, and at how these vary at different levels of overall mortality. The objective of Step 4 is to examine the age distribution of reported deaths. This age distribution should look quite different depending on the overall level of mortality in a population. The basic tabulations of data prepared in Step 1 can be used to prepare a chart showing the distribution of deaths by age group. You should use that same broad age group as shown in Figure 5 to tabulate your mortality data for this exercise. Your calculated distribution of deaths should then be compared with one of the expected distributions shown in Figure 8 that most closely resembles the level of mortality in your population, as reflected in the infant mortality rate.

To determine which of the four models is most relevant to your situation, use an independent estimate (derived from censuses or surveys, or estimated by the United Nations, WHO or other sources) of the infant mortality rate as follows:

- If your infant mortality rate is less than 20 per 1000, the age distribution of your reported deaths should be similar to that shown in panel A in Figure 8.
- If infant mortality is between 20 and 50 per 1000, the age distribution of your reported deaths should be similar to that shown in panel B in Figure 8.
- If infant mortality is between 50 and 100 per 1000, the age distribution of your reported deaths should be similar to that shown in panel C in Figure 8.
- If infant mortality is over 100 per 1000, the age distribution of your reported deaths should be similar to that shown in panel D in Figure 8.

Significant departures from these model age distributions of deaths suggest that the reporting of deaths by age is selectively biased. One reason for such bias may be the way age at death is reported. For example, people tend to have a strong preference to report age at death as a number ending in 0 or 5 (eg 45, 50, 55). This is commonly known as digit preference or age heaping. In other instances, the age of the deceased person may be misreported; it is common for families to report that the deceased person was older than they actually were. This highlights the importance of checking the plausibility of age patterns of mortality, and to test for underreporting of deaths in certain age groups by plotting the graph of ln(mx) versus age (x), as described above.

Figure 8 Typical age distributions of reported deaths at different levels of infant mortality



An example of the application of this check on data quality is shown in Figure 9, which gives the reported age distributions of deaths calculated from civil registration data for Sri Lanka, and from the Sample Registration System (SRS) for India. Sri Lanka has an estimated infant mortality rate of 8 per 1000 (hence panel A should be used as the comparator) while the infant mortality rate for India is closer to 60 per 1000 (hence panel C is chosen). This comparison shows that the age distribution of deaths in Sri Lanka is very similar to what was expected (panel A), but in India, the SRS appears to have more deaths at ages 60–74 years and fewer deaths at ages 75+ than expected from a comparison with panel C. This may or may not reflect problems with misreporting of the age at death for older adults, and should be investigated further.

Draw a chart showing the distribution of deaths by age (for each sex separately) and compare the pattern you see with that which would be expected given your level of infant mortality. Distortions in mortality patterns may be due to poor recording of age at death and should be investigated.

Summary of step 4

- Compare the age and sex distribution of your reported deaths with expected age–sex distributions based on your estimated level of infant mortality as shown in Figure 8. Departures from these expected patterns can be indicative of underreporting of deaths at certain ages for males or females. If, for example, you have very low infant and child mortality rates and also low adult mortality rates, you should suspect problems with the registration of adult deaths.

Step 5 Child mortality rates

Mortality among children under five years old, more than any other age group, reflects a range of economic, social and health conditions that all affect population health. Child mortality is therefore a key indicator for public health monitoring. Mortality in children under five can be divided into several components:

- neonatal mortality—mortality among infants aged less than 28 days old
- postneonatal mortality—mortality in infants older than 28 days but less than 1 year old
- infant mortality—mortality among infants aged less than one year (neonatal and postneonatal deaths)

under-five mortality—mortality among children aged less than 5 years old[d].

The objectives of Step 5 are to enable users to:

- define and calculate indicators of under-five mortality
- understand the public health relevance of measures of under-five mortality
- interpret the indicators of under-five mortality and understand their limitations
- use under-five mortality indicators from various sources to analyse the quality of mortality data.

Definition and calculation of under-five mortality indicators

Under-five mortality rate

The under-five mortality rate (U5MR) is defined as deaths in children aged 0–4 years in a given population over a specified time period divided by the total number of live births in that population over the same period.

$$\text{U5MR} = \frac{\text{Number of deaths in children aged less than five in a specified time period}}{\text{Number of live births in the same time period}} \times 1000$$

However, because of the very different age pattern of mortality risks among children, it is usual statistical practice to transform the mortality rate in children under five into a probability of dying before age five, assuming that children would be subject to the ASMRs of that period. Thus, the U5MR is, strictly speaking, not a rate (ie the number of deaths divided by the number of population at risk during a certain period of time) but a probability of death, expressed as a rate per 1000 live births.[e]

The calculation of the infant mortality rate (IMR) is the same as for the U5MR with the exception that the numerator is the number of deaths in children aged less than one year old (ie died before their first birthday).

$$\text{IMR} = \frac{\text{Number of deaths in infants aged less than one year old in a specified time period}}{\text{Number of live births in the same time period}} \times 1000$$

Neonatal mortality rate

The calculation of the neonatal mortality rate (NNMR) is the same as for the IMR with the exception that the numerator only includes deaths in children less than one month (28 days) old.

d Mortality in children aged between 1 and >5 years is commonly referred to as child mortality.

e There is a well-defined method for calculating the probability of a child dying between birth and age 5 years (written as 5q0) from data on the ASMR at age 0 (defined as deaths at age 0 divided by mid-year population at age 0, and written 1m0) and at age 1–4 years (defined as deaths at age 1–4 years divided by mid-year population at ages 1–4 years, written as 4m1). Specifically, 5q0 = 1 – (1 – 1q0)(1 – 4q1) where 1q0 = 1m0/(1 + (0.7) 1m0) and 4q1 = ((4) 4m1)/(1 + (2.4) 4m1) where 1q0 is the probability of an infant dying between birth and their first birthday, and 4q1 is the probability of an infant who survives until their first birthday dying before age 5 years. These calculations are performed automatically in the accompanying electronic tool.

$$\text{NNMR} = \frac{\text{Number of deaths in infants aged less than 28 days in a specified time period}}{\text{Number of live births in the same time period}} \times 1000$$

Neonatal deaths may be subdivided into early neonatal deaths, occurring during the first seven days of life, and late neonatal deaths, occurring after the seventh day but before 28 completed days of life.

Postneonatal mortality rate

The calculation of the postneonatal mortality rate (PNNMR) is the same as for the NNMR with the exception that the numerator only includes deaths in infants aged from 28 days to one year old.

$$\text{PNNMR} = \frac{\text{Number of deaths in infants aged between 28 days and one year old in a specified time period}}{\text{Number of live births in the same time period}} \times 1000$$

Definitions

The reliability of under-five, infant and neonatal mortality estimates depends on the accuracy and completeness of reporting and recording births and deaths. It is essential to apply standard international terminologies and definitions to ensure comparability over time, and across areas or countries. These have been defined in the WHO ICD-10.[2] Differences in IMRs, and especially NNMRs, can be greatly affected by the failure to apply the standard definition of live birth[f].In practice, underreporting and misclassification of under-five deaths are common, especially for deaths occurring very early in life, many of which are misclassified as stillbirths. In such cases, countries often do not record both the early neonatal death and the live birth. This is poor public health practice, as data on both events are critical to improve maternal and child health services. An example of the calculation of the U5MR, IMR and NNMR based on birth registration and death data is given below.

Table 3 Child death by age calculation of mortality indicators

	Male	Female	Total
Neonatal deaths registered	1563	895	2458
Infant deaths registered	2075	1677	3752
Under-five deaths registered	3980	3456	7436
Live births registered	191 263	182 275	373 538

Neonatal mortality rate (both sexes combined) = (2458/373 538)*1000 = 6.6 per 1000

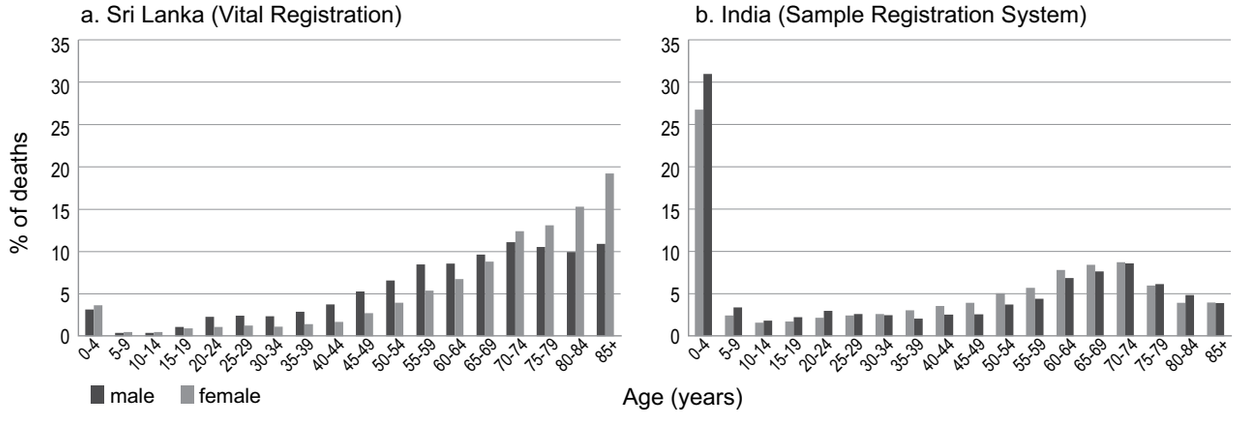
Infant mortality rate (both sexes combined) = (3752/373 538)*1000 = 10.0 per 1000

Under-five mortality rate (both sexes combined) = (7436/373 538)*1000 = 19.9 per 1000

Note: The U5MR would then need to be converted into the probability of dying before age 5 years (5q0) in order to use it to assess the completeness of recording of child deaths in the vital registration system.

f Live birth: The complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of the pregnancy, which, after such separation, breathes or shows any other evidence of life such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles, whether or not the umbilical cord has been cut or the placenta is attached (ICD-10).

Figure 9 Age distribution of reported deaths in Sri Lanka and India



Sources of data on under-five mortality

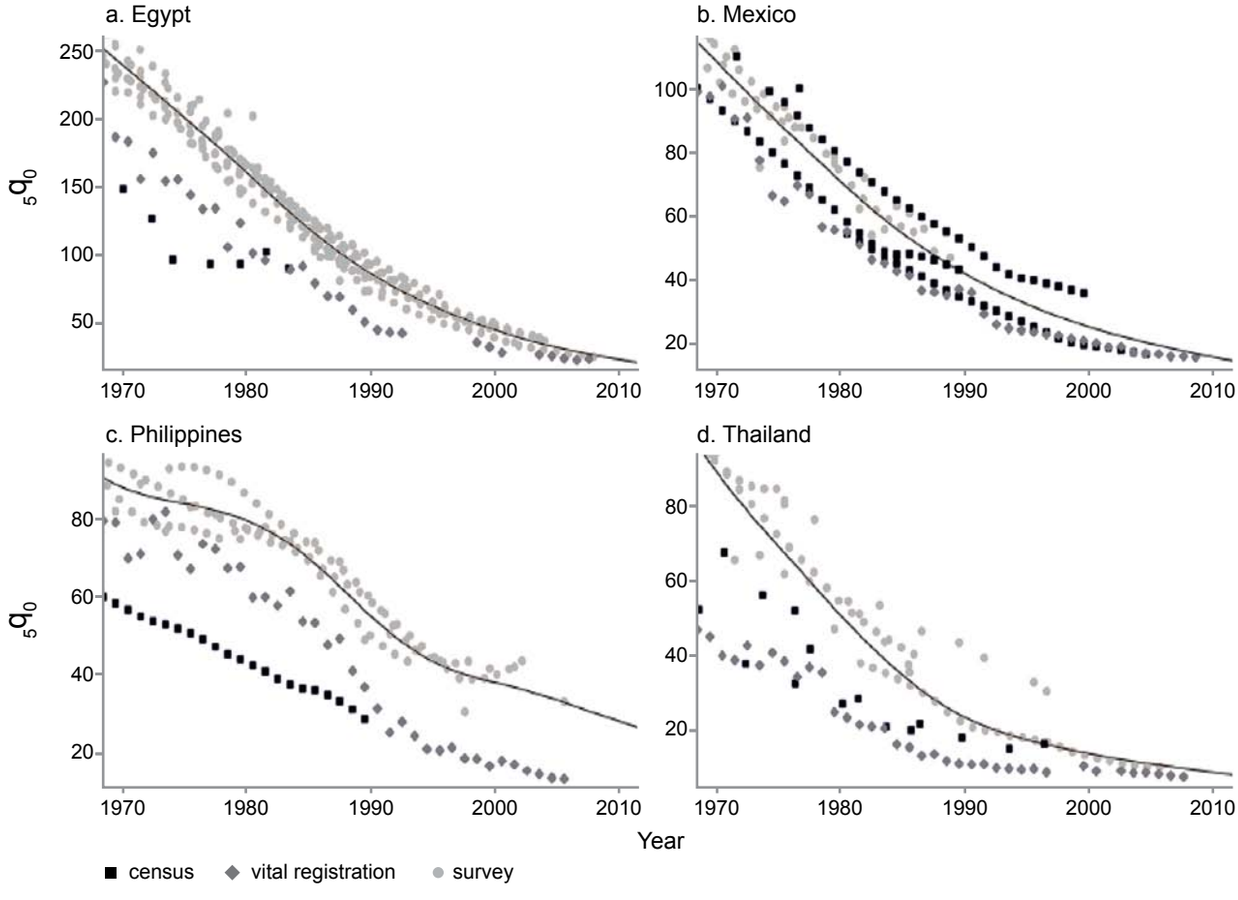
In principle, the civil registration system can generate annual data on under-five mortality at both national and subnational levels, and on a continuous basis. Where civil registration systems are complete, ASMRs among children and infants can be calculated directly from the number of deaths by age and number of births registered. However, the coverage and quality of civil registration systems is often questionable in developing countries, and the resulting vital statistics may be incomplete and biased.

There are particular reasons why deaths occurring in young children are less likely to be registered than deaths in adulthood. In settings where civil registration is not universal, deaths are generally only registered when there are some benefits attached to doing so; for example to claim land ownership and inheritance, or to claim compensation by the dependants. Registering the death of a child is not usually linked to such a benefit and as a result many such deaths remain unregistered. In such settings, data on infant and child mortality estimated from censuses and surveys tend to be more reliable.

In countries with incomplete registration systems, census done every 10 years can be used to generate estimates of child mortality using direct or indirect techniques.[5] The direct method involves questions to respondents about deaths in the household during a specified period of time. More commonly, an indirect method is used based on questions to female respondents on children ever born and children that are still alive. Brass-type methods and model life tables are then used to obtain an estimate of under-five mortality.[6] However, the census is, by definition, an infrequent occurrence (ie only every 10 years), so it is not a good source of data for ongoing monitoring. It does, however, serve a very useful function of providing an alternate source that can be used to validate data from vital registration on the number of child deaths registered and hence the level of child mortality.

In most developing countries, household surveys provide the most common source of data on child mortality using both direct and indirect methods. The indirect method asks questions about children ever born and children still alive, as for the census. The direct method that a woman has had during her lifetime. These births histories are then converted to rates of child mortality corresponding to a particular period in time.

Figure 10 Observed (from vital registration) and estimated levels of the under-five mortality rate, selected countries



Interpreting different estimates of the under-five mortality rate

Most countries have data on child mortality from multiple sources, including the civil registration system, censuses, household surveys and the routine health information system. In this section, we show how information from reliable censuses and surveys can be used to assess the completeness of child mortality reporting by the civil registration system.

In order to compare the data reported from civil registration with estimates from other sources (eg census), household surveys or estimates developed by United Nations agencies, the numbers of deaths and population for age groups 0 years and 1–4 years are used to calculate age-specific death rates, which are then converted into an age-specific probability of dying. Large differences between U5MRs calculated from the reported data, and the levels estimated from censuses and surveys by international agencies are likely to be due to underreporting of child deaths in the country.

Figure 10 shows U5MRs for Egypt, Mexico, the Philippines and Thailand. The data are derived from various sources, including censuses, surveys and the civil registration system. This visual display of data from different sources clearly shows the extent to which the U5MRs derived from civil registration appear to be systematically lower than those derived from the census or household surveys, especially during the earlier periods. This is indicative of substantial underreporting of deaths of children under five in the civil registration system. By comparing the line of best fit for the estimated U5MR derived from censuses and surveys with observed values calculated from the civil registration system for the same year(s) (symbolised by diamonds in Figure 10 for each country), it is possible to estimate the completeness of civil registration of child deaths by comparing the distance of the vital registration estimate rom the solid line, year by year.

This analysis concluded that under-five deaths in Thailand were grossly underreported in the national civil registration system during the 1970s and 1980s.

However, levels of reporting appear to have improved dramatically in the most recent decade (the trend in the vital registrations estimate for Thailand is getting closer and closer to the solid line of best fit for the true level of the child mortality rate). Similarly, the registration system in the Philippines appears to have significantly underestimated the U5MR, especially in the earlier period. Underreporting of under-five mortality in Egypt and Mexico appears to have diminished significantly in recent years.

Users should produce similar figures for their country or populations with death registration, bringing together on one graph estimates of under-five mortality derived from difference sources, including civil registration, to help interpret the multiple data points and diagnose possible incompleteness levels in death registration. To facilitate this, users can refer to the Child Mortality Estimation database (WHO and United Nations Children's Fund), which brings together available datasets from different sources on a country-by-country basis, and presents the information in tables and figures[g].Plots of child mortality are also available from the Institute for Health Metrics and Evaluation, University of Washington, which also maintains a database of child mortality data.[7]

Direct measures of incompleteness of death reporting

Special studies can also be carried out to determine the extent of underreporting of deaths. The most widely used of these so-called direct methods are 'capture– recapture' studies where deaths reported in the civil registration system for a sample of the population are compared (on a case-by-case basis) with deaths 'captured' in an independent survey of the same population[h].

This capture–recapture methodology (more formally known as the Chandrasekar–Deming method) can be used to estimate underreporting of deaths in any routine mortality surveillance system.[8]

Table 4 shows the results of a capture–recapture study of deaths reported in the Chinese national disease surveillance points system in the late 1990s. This confirmed the higher rate of underreporting of death among children compared with adults and among females compared with males at all ages.[9]

Table 4 Underreporting of deaths by age and sex (per cent), Disease Surveillance Points system, China (1996–98)

Sex	<5 years	5-29 years	30-59 years	>60 years	Total
Male	19.8	12.6	10.7	12.6	12.4
Female	23.6	18.6	14.1	13.2	14.1
Total	**21.6**	**14.7**	**12.0**	**12.9**	**13.1**

Table 5 shows the results of a study in Thailand that estimated the percentage of underreporting of deaths by age group in the civil registration system (Popakkam et al 2010). Again, underreporting of deaths was found to be much higher in the 0–4 years age group, probably due to the reasons described earlier in this section.

g www.childmortality.org/cmeMain.html

h 'Independence' as applied to capture–recapture studies means that the probability of a death not being reported under the civil registration system is not related to (ie is independent of) the probability that the same death will not be reported in another system or survey. In practice, this is very difficult to achieve.

Table 5 Underreporting of deaths by age, Thailand (2005)

	Age groups				
	0-4	5-49	50-74	75+	All ages
Percentage undercount in the civil registration system	42.8	14.8	7.7	5.9	8.7

Although not all countries will have the technical and financial resources to carry out capture–recapture studies, we have illustrated their application here to highlight the fact that underreporting of deaths is likely to be much higher among children than adults, and hence special attention should be paid to evaluating probable levels of underreporting of child deaths using the methods proposed in this section.

Summary of Step 5

- Calculate under-five, infant, neonatal and postneonatal mortality rates, and convert the U5MR to a probability of dying before age five years.
- Bring together, in one chart, estimates during the past 20–30 years of the probability of dying before age 5 (5q0) from different sources, including civilregistration, the census, household surveys and other studies, as shown in Figure 10. Use the results to estimate the likely degree of underreporting of deaths in children less than five years old in the civil registration system by comparing levels with those estimated from censuses or surveys.

Steps 6–10 Cause of death

Steps 6–10 focus on simple steps to assess the plausibility of data on causes of death.

Information on the levels and patterns of mortality among different population groups is essential for public health authorities and for the effective allocation of resources to health care. However, a fully functioning civil registration and vital statistics system should not only register deaths by age and sex, but should also have mechanisms for assigning the cause of death according to international standards as expressed in the ICD-10. Only a medically qualified doctor should determine the cause of death. A coding expert trained in the ICD-10 rules and principles should determine the underlying cause of death, from a death certificate properly filled out by a physician, as defined in the ICD-10. Note that this coding expert should not be a medical doctor as this is not the best use of their time.

The objectives of steps 6–10 are to enable users to:

- calculate broad patterns of causes of death using available data on mortality by age, sex and cause
- critically analyse and interpret cause of death data
- assess the plausibility of the cause-of-death patterns emerging from the data.

Definition of the underlying cause of death

The quality of cause-of-death data depends on the reliability of death certification and the accuracy of coding. These are two separate, but related, functions. Death certification, which should only be done by a qualified medical practitioner, involves correctly completing an international form (medical certificate of death). This information is then translated into a code (alpha-numeric digital code) from among the approximately 3000 underlying causes of death in the ICD-10 by a qualified and trained coder (not the physician who certified the death, as they are unlikely to have been formally trained in the coding of information given on a death certificate).

There are well-established rules for assigning the cause of death. It is essential that deaths be classified not by the immediate cause of death but by the underlying cause; that is, the cause that initiated the sequence of events leading to the death. It is the underlying cause of death that generates information that is useful for public health purposes. The underlying cause of death, as defined by WHO, is the disease or injury that initiated the train of events leading directly to death, or the circumstances of the accident or violence that produced the fatal injury. Under international rules for selecting (ie coding) the underlying cause from the reported conditions, every death is attributed to one (and only one) underlying cause based on information reported on the death certificate. The International Form of Medical Certificate of Cause of Death was specially designed to facilitate the selection of the underlying cause of death when two or more causes are recorded on the death certificate. This certificate is shown in Box 1 and should be filled in only by a trained medical practitioner. Moreover, all countries are strongly urged to use this certificate to certify death, and not some other adaptation of it, which will be of limited public health value.

Currently, only about 70 WHO Member Countries produce good-quality cause-of-death data from their civil registration and vital statistics systems.[10] Although a further 50 countries produce some cause-of-death data, the quality of the information is problematic because of poor certification and coding practices. In these settings, deaths that occur outside health care facilities and hospitals are rarely medically certified and consequently many of these deaths are assigned to nonspecific or ill-defined causes.

Even where medical certification of the cause of death is common practice, it does not necessarily mean that the correct cause of death is written on the death certificate in the correct way. Most doctors certify death infrequently, and their medical school training may have been forgotten or be out of date. Lack of diagnostic facilities and awareness of the importance of cause of death data, combined with inexperience and human error, contribute

to poor diagnostic accuracy. In addition, there may be financial or social consequences for the family that deter the doctor from reporting the true cause of death.

For all these reasons, any dataset with information on causes of death by age and sex should be carefully reviewed and assessed to identify and correct potential quality problems. Unless this is done as a matter of course, public health authorities using the data risk diverting resources away from those conditions that are causing the most serious problems of suffering and death in their communities.

Box 1 International form of medical certification of cause of death

INTERNATIONAL FORM OF MEDICAL CERTIFICATE OF CAUSE OF DEATH

	Cause of death	Approximate interval between onset and death
I Disease or condition directly leading to death*	(a)	.....
	due to (or as a consequence of)	
Antecedent causes Morbid conditions, if any, giving rise to the above cause, stating the underlying condition last	(b)	.....
	due to (or as a consequence of)	
	(c)	.....
	due to (or as a consequence of)	
	(d)	.....
II Other significant conditions contributing to the death, but not related to the disease or condition causing it	.....	.....
	.....	.....

** This does not mean the mode of dying, e.g. heart failure, respiratory failure. It means the disease, injury or complication that caused death.*

Step 6 Distribution of major causes of death

A first step in any quality assessment of cause-of-death data is to calculate the percentage of death distribution by broad disease groups and compare the results with what would be expected given the level of life expectancy for the population. These expected patterns have been developed by demographers and epidemiologists on the basis of many years of data and observations on patterns of causes of death in different settings. Any significant deviation from the expected pattern that cannot be explained by some local, external factor should be viewed as a potential problem with the quality of the cause-of-death data.

The ICD-10 contains over 3000 possible causes of death. All of these causes can be further condensed into three very broad groups of causes of death:

Group I[i]

Infectious and Infectious and parasitic diseases (eg tuberculosis, pneumonia, diarrhoea, malaria, measles) Maternal/perinatal causes (eg maternal haemorrhage, birth trauma) Malnutrition

Group II[j]

Noncommunicable diseases (eg cancer, diabetes, heart disease, stroke) Mental health conditions (eg schizophrenia)

Group III[k]

Injuries (eg accidents, homicide, suicide).

The expected percentage distribution of causes of death into these three broad groups varies in different

i ICD-10: A00-B99, G00-G04, N70-N73, J00-J06, J10-J18, J20-J22, H65-H66, O00-O99, P00-P96, E00-E02, E40-E46, E50, D50-D53, D64.9, E51-64

j ICD-10: C00-C97, D00-D48, D55-D64 (minus D 64.9) D65-D89, E03-E07, E10-E16, E20-E34, E65-E88, F01-F99, G06-G98, H00-H61, H68-H93, I00—I99, J3—J98, K00-K92, N00-N64, N75-N98, L00-L98, M00-M99, Q00-Q99

k ICD-10: V01-Y89

countries according to where they stand in relation to the 'health transition'—an interrelated set of changes in demographic structures, patterns of disease and risk factors. Demographic changes include lower mortality rates among children under five years old and declining fertility rates, which result in an ageing population. Epidemiological changes include a shift in the main causes of death and disease away from infectious diseases, such as diarrhoea and pneumonia (diseases traditionally associated with poorer countries), towards noncommunicable diseases such as cardiovascular disease, stroke and cancers. Changes in patterns of risk include declines in risk factors for infectious diseases (eg undernutrition, unsafe water and poor sanitation) and increases in risk factors for chronic diseases (eg being overweight, and using alcohol and tobacco).

Thus, a simple but effective way of checking the plausibility of mortality data is to compare the observed patterns of causes of death with what would be expected given the local levels of life expectancy. As a general rule, countries with low life expectancy are characterised by high levels of mortality due to infectious and parasitic diseases especially in childhood, along with high maternal mortality (ie Group I causes). As life expectancy rises, the pattern of mortality changes, with more deaths occurring in older age groups due to noncommunicable conditions such as cardiovascular diseases and cancers (ie Group II causes).

Table 6 shows how the percentage of deaths assigned to various causes in each of groups I, II and III is expected to change as life expectancy increases. Thus, a country with an average life expectancy of 55 years would typically have about 22 per cent of deaths due to Group I causes of death and 65 per cent due to Group II causes. A country with higher life expectancy of 65 years would typically have a smaller percentage of deaths due to Group I conditions (around 13 per cent) and correspondingly more deaths due to Group II conditions (74 per cent).

Note that these are model-based percentage distributions derived from WHO's large database on causes of death and mortality rates. It is unlikely that any country would fit exactly these proportions, but significant departures from them suggest potential problems with the certification or coding of causes of deaths.

Users should review their most recent available data on causes of death data and calculate the distribution by broad groups of causes (note that ill-defined causes, such as symptoms and cause of death unknown, should be excluded from the calculation of percentage of death assigned to groups I, II and III). The findings can then be compared with the expected distribution in Table 6 according to the average life expectancy in the country. However, in doing this comparison, it is important to use an independent source of life expectancy data (eg WHO, the United Nations or from your census), not the life expectancy calculated from the civil registration data, as this may be unreliable if the system is incomplete.

Figure 11 Distribution of broad causes of death (groups I, II and III) by age (males, Venezuela 2007)

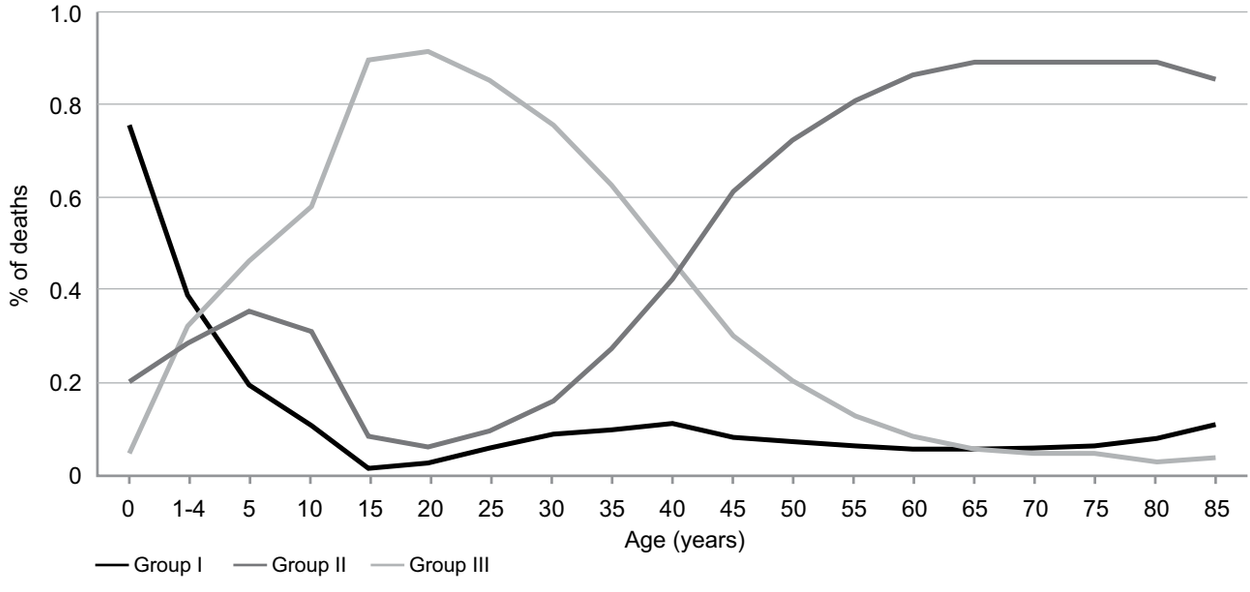


Table 6 Expected distribution of cause of death according to life expectancy by broad groups

Life expectancy	55 years	60 years	65 years	70 years
Group I cause of death	22%	16%	13%	11%
Group II cause of death	65%	70%	74%	78%
Group III cause of death	13%	14%	13%	11%

Summary of step 6

- Use a simple spreadsheet to tabulate your data on cause of death by age, sex and broad causes of death (groups I, II and III).
- Calculate the percentage distribution of deaths by broad cause groups (groups I, II and III). Do not include ill-defined causes. Compare the distribution with the expected distribution for a country with the same level of average life expectancy as your country, as shown in Table 6. Use an independent estimate of life expectancy for this comparison (eg from your country's census). Do not use life expectancy from the vital registration data unless they are known to be complete.

Step 7 Age pattern of broad groups of causes of death

All leading causes of death in a population follow a predictable age pattern that has been identified from decades of epidemiological research. The next step is to check whether the age pattern of deaths from broad causes is consistent with what one would expect from epidemiological research and modelling. These age patterns do not change very much with increasing life expectancy (although the percentage of deaths in each cause group will—see Table 6). Figure 11 shows a typical distribution of deaths across groups I, II and III at different ages for a country (Venezuela) with a life expectancy of around 70 years[I].At each age, the graph shows the expected proportion (fraction) of deaths at that age that are likely to occur on average. At any age, the three fractions will add up to 100 per cent.

Figure 11 shows a commonly found pattern of distribution of causes of death by age in settings with relatively high life expectancy. Ill-defined causes of death have been omitted.

The proportion of deaths due to Group I causes (infectious, parasitic and maternal/perinatal causes) is high among children, but declines thereafter to very low levels, although it may rise again at older ages (above approximately 80 years old) due to pneumonia.

The proportion of deaths due to Group II causes is relatively high in children (eg due to some cancers), declines in adulthood, but rises significantly at older ages due to the increasing incidence of cancers, cardiovascular diseases and stroke.

The proportion of deaths due to Group III causes (ie external causes of death including accidents and violence) is generally highest in young adulthood. This pattern is especially marked among males.

This is a typical cause-of-death pattern by age and would not be replicated exactly in every country.

However, significant departures from this pattern should be closely investigated as they are suggestive of problems such as poor death certification and coding practices, and age-specific misreporting of deaths.

In general, the charts for males and females should be broadly similar, although there is often higher mortality due to external causes among young males, while young women may have high mortality due to maternal causes (which would increase the fraction from Group I causes).

The principal reason for carrying out this step is to identify serious biases in the data. Depending on the data source, there are strong tendencies to avoid coding deaths to infectious diseases (or to overcode them) or to ignore injury deaths (Group III). This check will help to identify the extent of these biases in your data.

Summary of Step 7

- Plot the cause-of-death patterns by sex and age group, and compare your findings with the typical patterns for groups I, II and III shown in Figure 11.

Step 8 Leading causes of death

An analysis of leading causes of death can also indicate the reliability of cause-of-death data and is another way to check reporting in the civil registration system. Figure 12 shows the percentage distribution of leading causes (by specific disease groups) globally, and in lowincome, middle-income and high-income countries (using definitions from the World Bank). These charts can assist countries to ascertain divergences in their reported leading causes of death compared with leading causes of death estimated by WHO and other researchers. These global estimates refer to the average experience of all countries in each of the country groups; hence, it is unlikely that the percentage distribution of deaths in any one country would match them exactly. However, significant departures from these average rankings of leading causes of death are suggestive of problems with the quality of cause-of-death data.

Note that these comparative distributions of leading causes of death do not include ill-defined causes. However, countries should include this category in their rankings in order to see how frequently these causes are coded. In many cases, ill-defined causes may be in the top three or four leading causes of death. This

I WHO mortality database

suggests serious problems with certification or coding in the country. These ill-defined causes—unfortunately, commonly reported—are of absolutely no value for informing public health policies and debates in countries.

Summary of Step 8

- Calculate the leading causes of death from your data and compare the findings with the typical patterns for all ages (both sexes) shown in Figure 12.

Step 9 Ratio of noncommunicable to communicable causes of death

As countries develop their health systems, communicable disease such as diarrhoea and pneumonia, as well as maternal, perinatal and nutritional risks will be increasingly brought under control. As a result, more people will survive to adulthood, where chronic diseases such as ischaemic heart disease, stroke, cancer and chronic obstructive pulmonary diseases claim morethe epidemiological transition (ie as life expectancy increases).

This is illustrated in Figure 13, which shows the ratio of deaths from noncommunicable diseases (Group II) to communicable diseases (Group 1) in selected World Bank income groupings (both sexes combined).[11] If there were the same numbers of deaths in each broad disease group, the ratio would be 1.

Figure 13 shows that, globally, there are more than twice as many deaths due to Group II causes as Group I causes. In high-income countries, noncommunicablelives. Hence, the simple ratio of Group II:I deaths should progressively increase as a country moves through diseases account for nearly 14 times as many deaths as communicable diseases.

By contrast, in low-income countries, there are roughly the same numbers of deaths due to communicable as noncommunicable diseases, so the ratio is nearly 1. In middle-income countries, there are about five times as many deaths due to noncommunicable diseases compared with communicable diseases. This reflects the fact that in high and middle-income countries, most deaths occur later in life, due to chronic conditions such as cancers and cardiovascular diseases. In low-income countries, by contrast, most deaths occur in childhood, due to infectious diseases conditions such pneumonia, diarrhoea and vaccine-preventable conditions, as well as perinatal causes.

Over time, as child mortality decreases and life expectancy increases, the pattern in low-income countries will start to look more like that observed in middle and high-income countries. This is illustrated in Figure 14, which shows estimated trends in the ratio of noncommunicable to communicable conditions in China, India and Latin America. In India in 1990, there were more deaths due to communicable diseases than to noncommunicable diseases; hence, the ratio is less than 1. Since 2000, however, deaths due to noncommunicable diseases have exceeded those due to communicable diseases. Departures from this overall picture are suggestive of errors in cause-of-death data.

Figure 12 Leading causes of death globally, and in low, middle and high-income countries (2005)

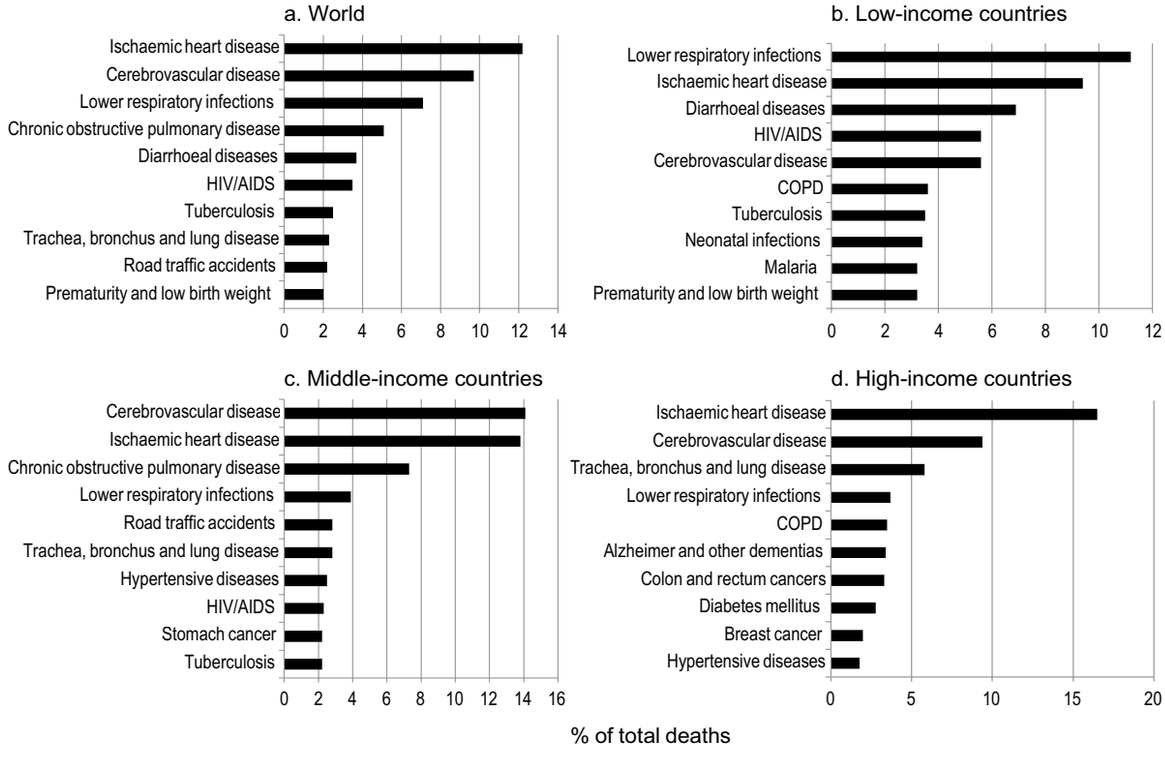
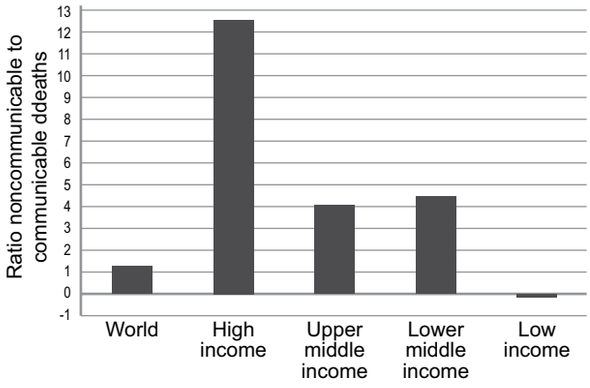


Figure 13 Ratio of noncommunicable to communicable diseases by country income groupings (2004)



Summary of step 9

- Calculate the ratio of deaths from noncommunicable diseases to communicable diseases (Group II to Group I deaths) and compare your findings to those of the most appropriate comparator group as shown in Figures 13 and 14.

Step 10 Ill-defined causes of death

As noted in Step 6, when a death occurs and is medically certified, every effort should be made to correctly ascertain the underlying cause of death in order to be able to draw conclusions about the leading causes and about the need for priority public health interventions. Classification of deaths to ill-defined conditions does not generate information of public health value. Where a high proportion of all deaths is classified as being due to ill-defined causes, the cause-of-death distribution will be biased and unreliable. At the end of this section, users should be able to:

- define and calculate the proportion of deaths attributed to ill-defined causes of death
- understand the implications for the overall quality of mortality statistics of a high proportion of ill-defined causes of death
- understand the definition and calculation of illdefined categories in cause-of-death data.

Ill-defined causes are vague diagnoses often described as 'symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified' that the ICD-10 advises should not be used as the underlying cause of death.

These ill-defined codes arise from two sources:

i. Deaths classified as ill-defined (Chapter XVIII of ICD-10).

ii. Deaths classified to any one of the following vague or unspecific diagnoses:

– I46.1 (sudden cardiac death, so described)

– I46.9 (cardiac arrest, unspecified)

– I95.9 (hypotension, unspecified)

– I99 (other and unspecified disorders of the circulatory system)

– J96.0 (acute respiratory failure)

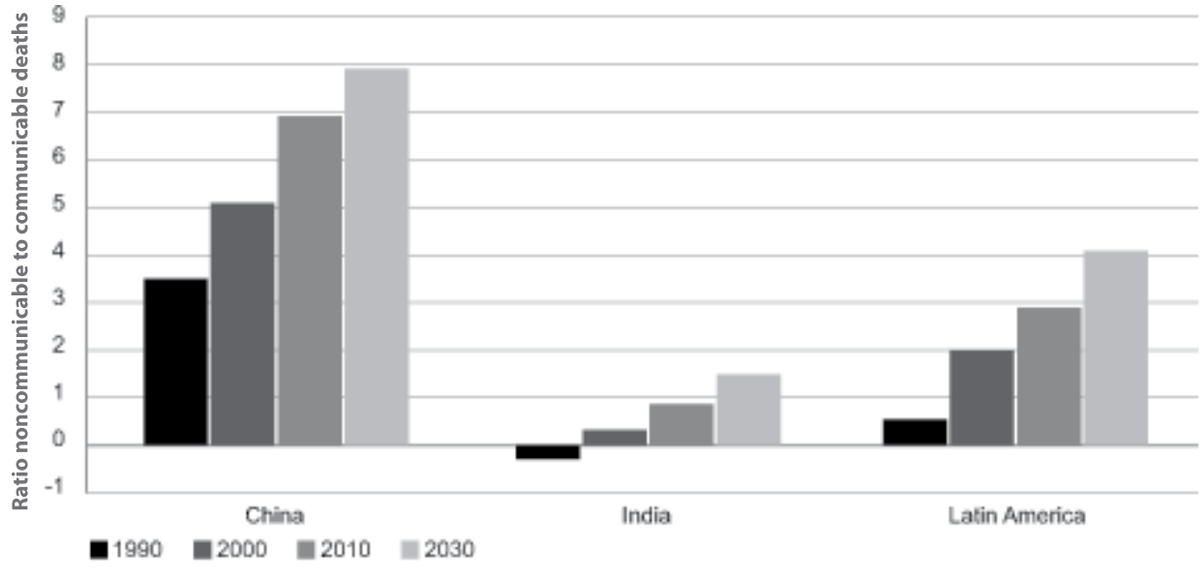
– J96.9 (respiratory failure, unspecified)

– P28.5 (respiratory failure of newborn)

– C76, C80, C97 (ill-defined cancer sites)

– Y10-Y34, Y872 (injury not specified, accidentally or purposefully inflicted).

Figure 14 Estimated trends in ratio of noncommunicable to communicable deaths, selected regions (1990-2030)



Deaths classified to either of these two categories of ill-defined diagnoses are insufficiently detailed to be of value for public health purposes, although in the majority of cases they help to describe the overall mortality due to broad disease (eg cardiovascular or respiratory disease) or injury groups. Separately identifying their frequency in cause-of-death tabulations is essential to decide upon remedial action to reduce their use. This could involve interventions to improve certification practices or coding practices, or both.

Although there will always be individual cases where it is not possible to classify the cause to a specific ICD- 10 category due to lack of appropriate information, such cases should be relatively infrequent. As a general principle, the proportion of ill-defined deaths coded to either category i or ii (above) should collectively not exceed 10 per cent for deaths at ages 65 years and older, and should be less than 5 per cent for deaths at ages below 65 years.

When reviewing a data series of cause-of-death information, it is important to study how the proportion of ill-defined causes of death has changed over time. Large fluctuations may be indicative of changes in coding practices rather than real changes in patterns of mortality.

Table 7 provides a hypothetical example of how to assess the extent of ill-defined causes of death. Out of 12 341 deaths that occurred in this population in a given year, 2052 were assigned to either a category i (1021) or category ii (1031) diagnosis. Thus, the total proportion of deaths assigned to ill-defined causes is 2051/12 341 × 100 = 16.6 per cent, higher than what is considered desirable.

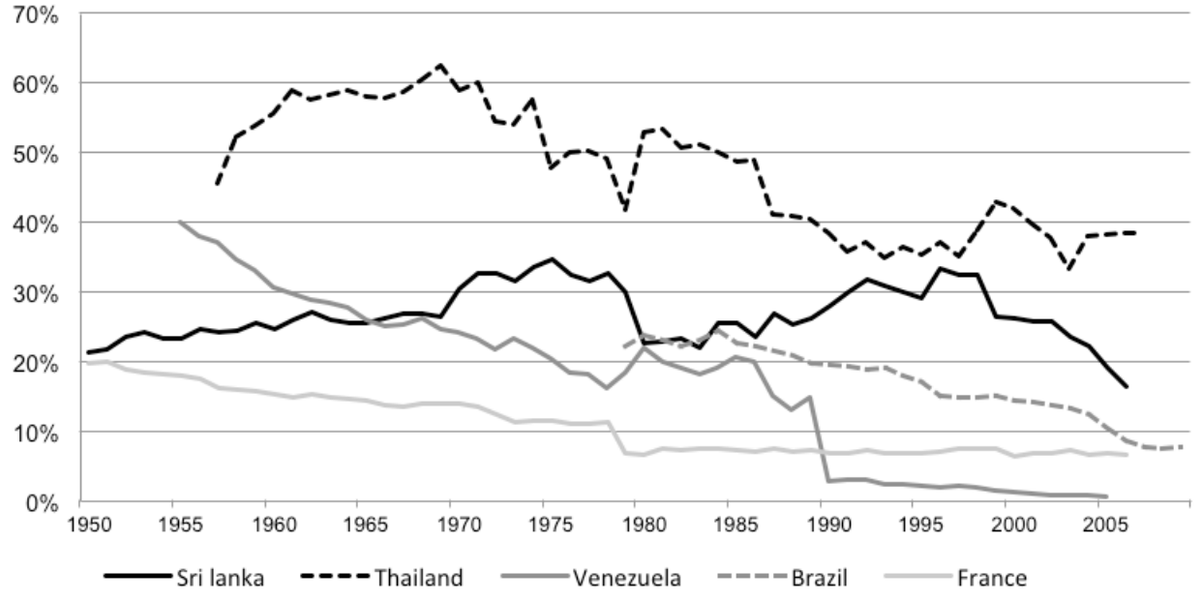
Table 7 Calculating the percentage of deaths assigned to ill-defined causes

ICD-10 code	Number of deaths
146.1	146
146.9	203
195.5	102
199	174
J96.0	147
J96.9	161
P28.5	98
R codes	1021
Total deaths attributed to ill-defined causes	2052
Total deaths in population	**12 341**

Figure 15 shows the trend in the percentage of deaths assigned to ill-defined codes in selected countries for 1950–2000. Developed countries tend to have a lower percentage of deaths assigned to ill-defined categories than developing countries because of better developed cause-of-death reporting systems where all deaths are certified by a medical practitioner, which is often not the case in developing countries where a significant proportion of deaths occur outside hospitals.

Brazil has achieved significant reductions in the percentage of deaths assigned to ill-defined causes, with a decrease of more than 50 per cent between 1980

Figure 15 Trends in percentage of deaths assigned to ill-defined codes, selected countries (1950–2008)



and 2008. In Thailand, ill-defined categories accounted for more than 40 per cent of all deaths in 2008. In Sri Lanka, the proportion of ill-defined causes of death remains unacceptably high despite some improvements in recent years. The overuse of ill-defined causes of death is not only an issue for developing countries. For example, in France in 1950, 20 per cent of all deaths were assigned as ill defined; however, by the early 1980s, the percentage had declined to less than 10 per cent. Both Brazil and Venezuela have achieved significant improvements in recent years, particularly Venezuela.

The proportion of deaths assigned to ill-defined causes tends to be higher for deaths occurring at older ages. There are many possible explanations, including the fact that many such deaths occur outside health care facilities and also because of the existence of multiple comorbidities that renders such deaths harder to correctly diagnose. Nonetheless, with good certification and coding practices, it should be possible to reduce this proportion to less that 10 per cent of deaths among the elderly.

Summary of step 10

- Calculate the proportion of category i and ii illdefined causes in your cause-of-death data for ages <65, 65+ and all ages. The total should not exceed 5 per cent of deaths at ages below 65 and 10 per cent of deaths at age 65+.
- Calculate the trend in the proportion of ill-defined deaths (all ages) and use this information to interpret trends in specific causes of deaths.
- If the proportion increases or decreases over time, it is likely that real changes in disease-specific mortality will be correspondingly lower or higher than your data indicates. For example, if the proportion of illdefined deaths has declined substantially, increases in the percentage of deaths observed for specific causes may largely be spurious, arising due to better certification and coding practices.

Conclusion

This guide and the accompanying electronic tool provide guidance on simple actions that can and should be taken to assess the quality of mortality data, particularly vital statistics on deaths and causes of death. The aim of conducting such a review of data quality is to diagnose problems and identify potential solutions. Solutions may include:

- extending civil registration to remote and underserved areas
- introducing incentives to encourage accurate reporting of all births and deaths
- improving the training of medical doctors in death certification
- improving the skills of coders to correctly assign underlying causes of death
- improving the quality and completeness of medical records so that doctors have all the information they need to correctly certify causes of death[m].

Improving the quality of vital statistics will be of inestimable value to public health decision-makers. It will greatly increase confidence in the data.

More specific guidance on interventions to improve data quality can also be gained by applying the full WHO/UQ Comprehensive Vital Statistics Assessment Tool.

- The guide places emphasis on three particular aspects of data quality:
- The completeness of the data. (Are all deaths registered?)
- The age pattern of reported deaths. (Is there serious age-specific misreporting or underreporting?)

The plausibility of cause-of-death data using a series of comparisons and internal consistency checks. Although these are essential, other dimensions of data quality might be considered as well, particularly timeliness. Cause-of-death data that are 5–10 years out of date are of reduced value for good health policy and planning. We have tried to write this guide so that the operation and rationale for the basic 10 steps are readily interpretable. Continuous data quality improvement requires continuous assessment. It is not intended that these steps be applied once or infrequently. They should form an integral part of the health information system. Improving the quality of vital statistics will be of inestimable value to public health decision-makers. It will greatly increase confidence in the data, and thereby facilitate and promote the use of mortality and cause of death statistics to ensure that resource allocation is evidence informed, and focuses on interventions most needed to improve overall population health levels.

m WHO and UQ 2010 www.uq.edu.au/hishub

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Cause of death certification: A practical guide for doctors

Original article

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The causes of death recorded in the International Form of Medical Certificate of Cause of Death are

> *all those diseases, morbid conditions or injuries which either resulted in or contributed to death and the circumstances of the accident or violence which produced any such injuries*[1]

The underlying cause of death is

> *the disease or injury which initiated the train of morbid events leading directly to death, or the circumstances of the accident or violence which produced the fatal injury*[2]

Preface

Health decision-makers and planners all around the world make extensive use of mortality statistics. The quality of these statistics depends on the accuracy with which individual doctors fill out death certificates. Unfortunately, the accuracy of death certification is poor in many countries. This reduces the quality of national and international mortality statistics and limits their value for health planning and policy.

Guidelines on death certification by doctors are available but are rarely used in many countries. The World Health Organization has developed a computer-assisted learning tool, which is available in both online and offline modes. However, these training materials are not suitable for those with limited computer literacy or access. Also, busy medical doctors may not be able to reference such tools when they need a quick reminder about correct certification procedures. This handbook is designed to be a readily accessible resource that doctors can consult rapidly and easily.

These are generic guidelines about how to certify the cause of death, written for doctors and medical students, particularly in developing countries. They can be read and used as a separate tool, or provide the basis for training in interactive workshops. They form part of a package of resources that includes a workbook of case studies and references for self-directed learning, and a trainers' manual for running workshops. These materials will be available on the Health Information Systems Knowledge Hub website (www.uq.edu.au/hishub) in mid-2012.

These resources can be adapted so that they are relevant for your country.

Introduction

This booklet aims to guide doctors in filling out death certificates. Death certification forms an important part of a doctor's duties because the information recorded in death certificates helps decision-makers determine health priorities for prevention of deaths due to similar causes in the future.

Clinical diagnosis is the basis for therapeutic decision-making. Most patients recover, but some die. When the diagnosis is entered onto a death certificate, it establishes the cause of death for that person. This information is then used in new and quite different ways from its original use, primarily to inform policy-makers about the leading causes of death in their country or district, and how these are changing.

The certificate is provided to the family who may need it immediately to obtain permission for funeral arrangements and for other legal purposes, including wills and testaments. The information on the certificate is also important for family members so that they know what caused the death and are aware of conditions that may occur or could be prevented in other family members.

The cause of death is then coded by an expert who is trained in applying the *International Statistical Classification of Diseases and Related Health Problems*, currently in its 10th revision (ICD-10). The ICD-10 is managed by the World Health Organization and classifies thousands of diseases as individual items and groups similar diseases together in a meaningful way.

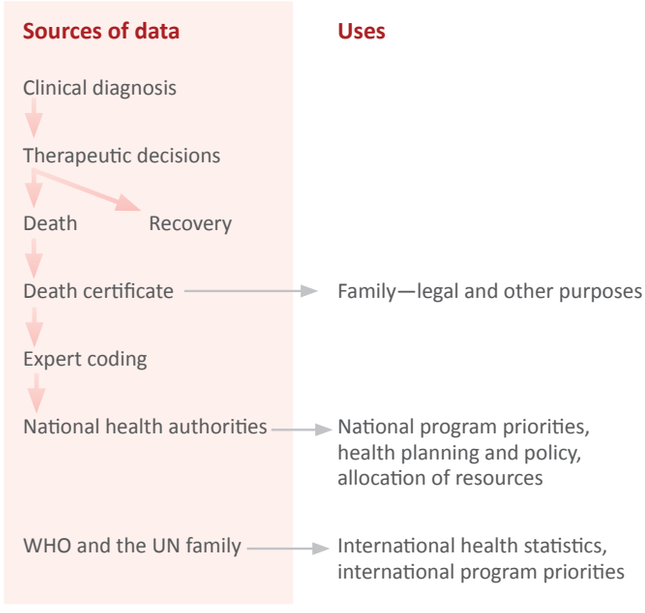
The coded certificates are then tabulated. This tabulation forms the basis for national mortality statistics. These are critical for establishing national health program priorities, for health planning and policy, and to inform debate about the allocation of health resources. Good-quality mortality statistics are fundamental for the prevention of premature deaths.

By agreement, countries are obliged to report their mortality statistics to the World Health Organization. These statistics form the basis for international health statistics and for international program priorities. They

also form the basis for national and global burden of disease estimates and for decisions about global priorities to improve health. These uses are outlined in Figure 1.

In short, the type and the quality of health services provided depend heavily on the accuracy of information obtained from death certificates. These guidelines aim to assist you in accurately completing the *International Form of Medical Certificate of Cause of Death*. This forms the basis of all national and international statistics about leading causes of death, and how they are changing.

Figure 1 Use of cause-of-death data



UN = United Nations; WHO = World Health Organization

Legal implications and confidentiality

A death certificate is a legal document with implications and uses that vary from country to country. Therefore, it is important that the death certificate is completed accurately. It may be needed to proceed with burial or cremation of the body. The family may need it to execute the deceased person's will. The police or, in some countries, the coroner may require access to the certificate. The doctor or the hospital will be required to report details of the death to national authorities such as the health department and the national statistics office. Details of the death and the circumstances of the deceased person are entered into a database, but the actual identity of the deceased person is withheld.

Within these limits, the doctor has a duty to maintain confidentiality about the cause of death. This duty is to the family of the deceased person. Information in the death certificate can be used for research purposes, as long as the deceased is not identified by name or other means.

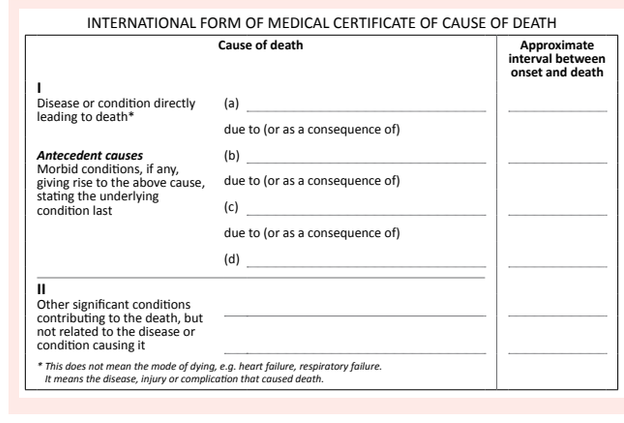
The doctor ***should not reveal the details*** of a death certificate to a third party unless they:

- Are legally required to do so
- Have obtained prior consent from the next of kin of the deceased.

Understanding the International Form of Medical Certificate of Cause of Death

The *International Form of Medical Certificate of Cause of Death* (known as the death certificate) is recommended by the World Health Organization for international use. One way of looking at the death certificate is that it provides a framework for the organisation of clinical diagnoses used for public health purposes. Figure 2 shows the death certificate recommended by the World Health Organization.

Figure 2 International form of Medical Certification of Cause of Death



INTERNATIONAL FORM OF MEDICAL CERTIFICATE OF CAUSE OF DEATH

	Cause of death	Approximate interval between onset and death
I Disease or condition directly leading to death*	(a) _____	
	due to (or as a consequence of)	
Antecedent causes Morbid conditions, if any, giving rise to the above cause, stating the underlying condition last	(b) _____	
	due to (or as a consequence of)	
	(c) _____	
	due to (or as a consequence of)	
	(d) _____	
II Other significant conditions contributing to the death, but not related to the disease or condition causing it	_____	
	_____	

** This does not mean the mode of dying, e.g. heart failure, respiratory failure. It means the disease, injury or complication that caused death.*

The death certificate is divided into three sections:

1. Part I—including diseases or conditions directly leading to death and antecedent causes
2. Part II—other significant conditions
3. A column to record the approximate interval between onset and death.

Before reviewing the sections in detail, it is essential to understand the following concepts:

- The sequence of events leading to death
- The contributory cause(s) of death.

Sequence of events leading to death

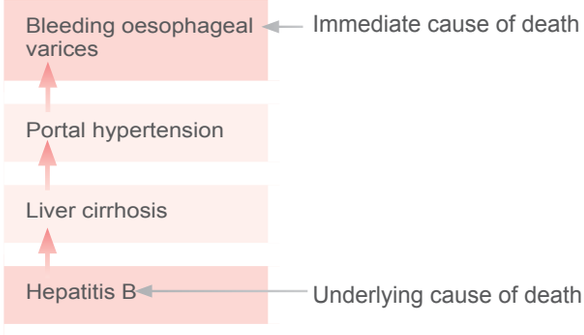
Mortality statistics are based on the ***underlying cause of death***, which is the disease or injury that initiated the sequence of events that led directly to death. For example, imagine a person dies of a cerebral haemorrhage following a motor vehicle accident. Cerebral haemorrhage is the direct cause of death—the motor vehicle accident is the underlying cause of death. The surgeon is concerned with the treatment of cerebral haemorrhage; the public health concern is to reduce injuries by preventing motor vehicle accidents (the underlying cause of death in this case).

It is not always possible to complete all lines in the death certificate. On some death certificates, there will only be one cause of death, which becomes the ***underlying cause***. But, in filling out death certificates, doctors should try to identify and record ***all*** the conditions in the sequence of events leading to death. For many deaths, there will be more than one cause and, in these cases, the doctor will need to establish a sequence of causes before determining the underlying cause.

Case study 1

A 50-year-old woman was admitted to the hospital vomiting blood and was diagnosed as having bleeding oesophageal varices. Investigation revealed portal hypertension. The woman had a history of hepatitis B infection. Three days later, she died. Figure 3 outlines the sequence of events that led to her death.

Figure 3 Sequence of events leading to the death in case study 1



It is extremely important that the underlying cause of each death is correctly determined and accurately recorded. In this case, hepatitis B was the underlying cause of death—not bleeding oesophageal varices, which was the immediate cause of death. Knowing this, the public health response is to implement immunisation programs against hepatitis B virus to prevent such deaths in future.

Contributory cause(s) of death

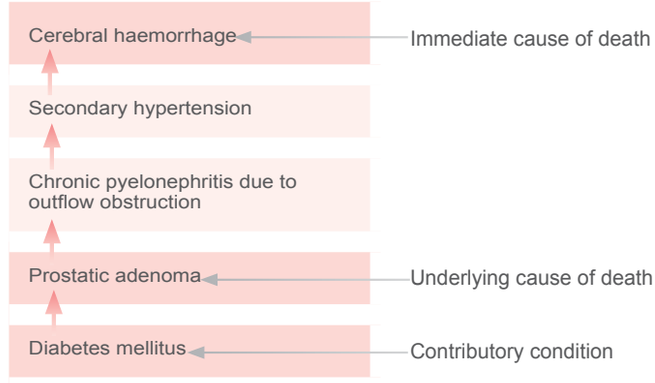
Causes that may have contributed to the death but do not form part of the sequence are listed on the death certificate as ***contributing causes***. More details are given on section on Part II of the death certificate.

Case study 2

A man dies of cerebral haemorrhage due to secondary hypertension due to chronic pyelonephritis. The chronic pyelonephritis was due to outflow obstruction, which was due to prostatic adenoma. He also had a history of diabetes mellitus, which had been diagnosed five years before his death. Diabetes mellitus, which is not in the sequence of events leading to death, would have *contributed* to the death, and therefore should be entered in Part II of the death certificate.

Figure 4 outlines the sequence of events and contributory condition that lead to his death.

Figure 4 Sequence of events and contributory conditions for case study 2



Part I of the death certificate

The death certificate has two parts and a column to record the approximate interval between onset and death.

Part I of the death certificate has four lines for reporting the ***sequence of events*** leading to death; these are labelled I(a), I(b), I(c) and I(d).

The immediate cause of death is entered at Part I(a). If the death was a consequence of another disease or condition, this underlying cause should be entered at I(b). If there are more causes of death, write these at I(c) and I(d).

Important points

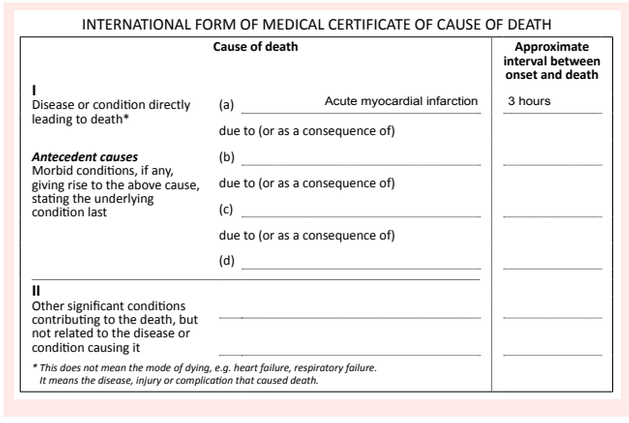
- Always use consecutive lines, never leave blank lines within the sequence of events.
- Each condition listed in Part I should cause the condition ***above it***.
- If there is only **one** cause of death, it is entered at I(a).

Case study 3

A 56-year-old man dies from acute myocardial infarction within one hour of its onset. He did not have any other illnesses.

While it is rare to only have one event leading to death, it does occur. In these cases, cause of death would be reported at I(a) and it would also form the underlying cause of the death, shown in Figure 4. If more information is available in the sequence of events leading to death, these must be reported using the lines provided at I(b), I(c) or I(d).

Figure 5 A death certificate with only *one* cause of death reported



INTERNATIONAL FORM OF MEDICAL CERTIFICATE OF CAUSE OF DEATH

Cause of death		Approximate interval between onset and death
I Disease or condition directly leading to death*	(a) Acute myocardial infarction	3 hours
	due to (or as a consequence of)	
Antecedent causes Morbid conditions, if any, giving rise to the above cause, stating the underlying condition last	(b)	
	due to (or as a consequence of)	
	(c)	
	due to (or as a consequence of)	
	(d)	
II Other significant conditions contributing to the death, but not related to the disease or condition causing it		

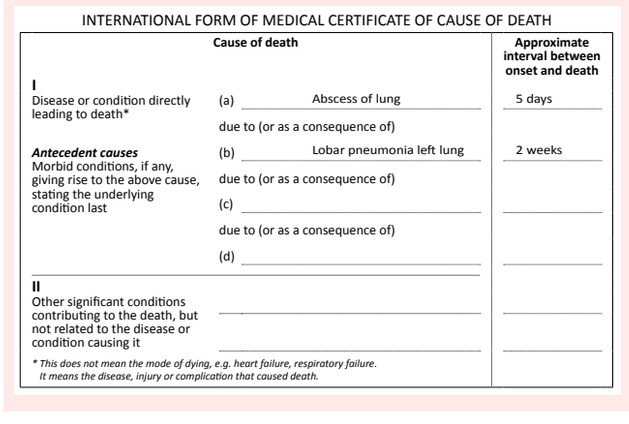
** This does not mean the mode of dying, e.g. heart failure, respiratory failure. It means the disease, injury or complication that caused death.*

Case study 4

A 56-year-old person dies from abscess of the lung, which resulted from lobar pneumonia of the left lung.

When there are two causes of death reported, these are written in at I(a) and I(b), as shown in Figure 5. In this case, underlying cause of death is recorded in line I(b).

Figure 6 A death certificate where *two* events leading to death are reported



INTERNATIONAL FORM OF MEDICAL CERTIFICATE OF CAUSE OF DEATH

Cause of death		Approximate interval between onset and death
I Disease or condition directly leading to death*	(a) Abscess of lung	5 days
	due to (or as a consequence of)	
Antecedent causes Morbid conditions, if any, giving rise to the above cause, stating the underlying condition last	(b) Lobar pneumonia left lung	2 weeks
	due to (or as a consequence of)	
	(c)	
	due to (or as a consequence of)	
	(d)	
II Other significant conditions contributing to the death, but not related to the disease or condition causing it		

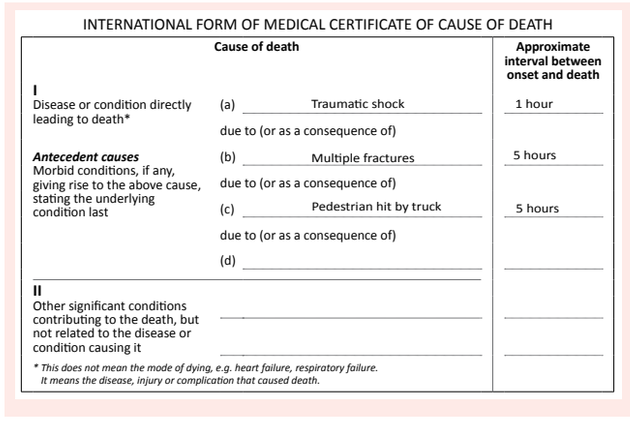
** This does not mean the mode of dying, e.g. heart failure, respiratory failure. It means the disease, injury or complication that caused death.*

Case study 5

A 23-year-old man dies from traumatic shock after sustaining multiple fractures when he was hit by a truck.

Figure 6 shows a death certificate that has used three lines. These events are recorded at I(a), I(b) and I(c).In this case, underlying cause of death is recorded in the line I(c).

Figure 7 A death certificate where *three* events leading to death are reported



INTERNATIONAL FORM OF MEDICAL CERTIFICATE OF CAUSE OF DEATH

Cause of death		Approximate interval between onset and death
I Disease or condition directly leading to death*	(a) Traumatic shock	1 hour
	due to (or as a consequence of)	
Antecedent causes Morbid conditions, if any, giving rise to the above cause, stating the underlying condition last	(b) Multiple fractures	5 hours
	due to (or as a consequence of)	
	(c) Pedestrian hit by truck	5 hours
	due to (or as a consequence of)	
	(d)	
II Other significant conditions contributing to the death, but not related to the disease or condition causing it		

** This does not mean the mode of dying, e.g. heart failure, respiratory failure. It means the disease, injury or complication that caused death.*

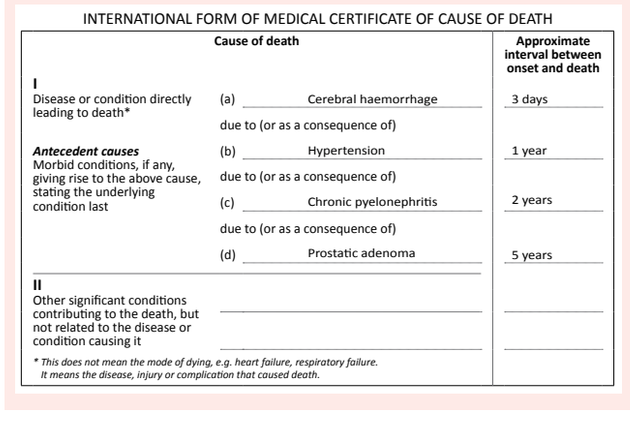
Case study 6

A 70-year-old man dies from cerebral haemorrhage 3 days after its onset. This resulted from secondary hypertension, which he had for the last year. The hypertension was secondary to chronic pyelonephritis, which he had for the last 2 years. He had also had a prostatic adenoma for the last 5 years.

Figure 7 shows a death certificate that has used four lines. These events are recorded at I(a), I(b), I (c) and I(d).The underlying cause of death is reported in line I(d).

In rare situations, there could be more than four sequences leading to death. In this case, you can add a line I(e) and record the underlying cause of death in that line. **Do not record underlying cause of death in Part II of the death certificate.**

Figure 8 A death certificate where *four* events leading to death are reported



INTERNATIONAL FORM OF MEDICAL CERTIFICATE OF CAUSE OF DEATH

Cause of death		Approximate interval between onset and death
I Disease or condition directly leading to death*	(a) Cerebral haemorrhage	3 days
	due to (or as a consequence of)	
Antecedent causes Morbid conditions, if any, giving rise to the above cause, stating the underlying condition last	(b) Hypertension	1 year
	due to (or as a consequence of)	
	(c) Chronic pyelonephritis	2 years
	due to (or as a consequence of)	
	(d) Prostatic adenoma	5 years
II Other significant conditions contributing to the death, but not related to the disease or condition causing it		

** This does not mean the mode of dying, e.g. heart failure, respiratory failure. It means the disease, injury or complication that caused death.*

Part II of the death certificate

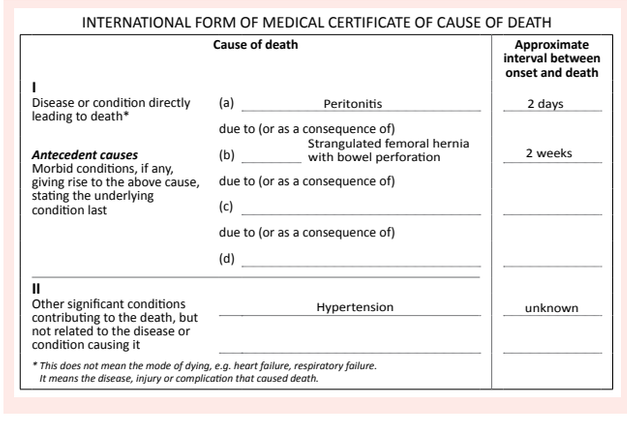
Part II of the death certificate records all other significant or contributory diseases or conditions that were present at the time of death, but did not directly lead to the underlying cause of death listed in Part I.

Case study 7

A 60-year-old hypertensive patient was admitted to the surgical casualty ward with severe abdominal pain and vomiting. She was diagnosed as having strangulated femoral hernia with a bowel perforation. She underwent surgery to release the hernia and resect the intestine, with an end-to-end anastomosis. Two days after the surgery she developed signs of peritonitis, and she died 2days later.

In this example, the underlying cause of death is strangulated femoral hernia. Hypertension, which is not in the sequence of events leading to death but would have contributed to the death, should be entered in Part II of the death certificate, as shown in Figure 9.

Figure 9 A death certificate where a *contributory condition* is recorded



INTERNATIONAL FORM OF MEDICAL CERTIFICATE OF CAUSE OF DEATH

	Cause of death	Approximate interval between onset and death
I Disease or condition directly leading to death*	(a) Peritonitis	2 days
	due to (or as a consequence of)	
Antecedent causes Morbid conditions, if any, giving rise to the above cause, stating the underlying condition last	(b) Strangulated femoral hernia with bowel perforation	2 weeks
	due to (or as a consequence of)	
	(c)	
	due to (or as a consequence of)	
	(d)	
II Other significant conditions contributing to the death, but not related to the disease or condition causing it	Hypertension	unknown

** This does not mean the mode of dying, e.g. heart failure, respiratory failure. It means the disease, injury or complication that caused death.*

Approximate interval between onset and death

The column on the right-hand side of Part I and Part II of the death certificate is for recording the approximate time interval between the onset of the condition and the date of death. The time interval should be entered for all conditions reported on the death certificate, especially for the conditions reported in Part I. These intervals are usually established by the doctor on the basis of available information. In some cases, the interval will have to be estimated. Time periods, such as minutes, hours, days, weeks, months or years can be used.

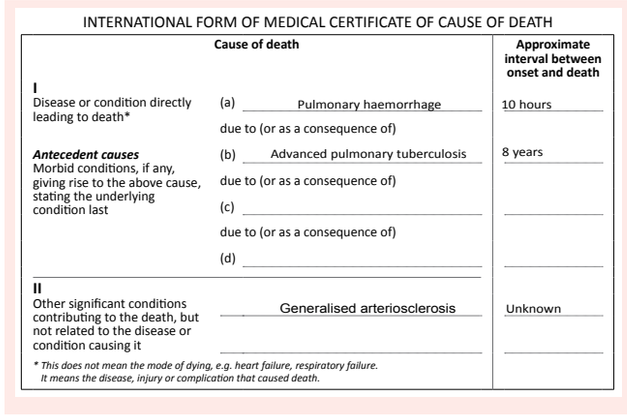
If the time of onset is unknown or cannot be determined, write 'Unknown'.

This information is useful for coding certain diseases and provides a check on the accuracy of the reported sequence of conditions. Therefore, it is important to fill in these lines.

Case study 8

A 58-year-old man presented at a clinic with a long history of haemoptysis and loss of weight. The diagnosis was advanced pulmonary tuberculosis, reactivation type with cavitations, perhaps of 8 years duration. The patient also suffered from generalised arteriosclerosis, probably of long duration. Immediately after the admission, the patient had an acute and massive pulmonary haemorrhage and died about 10 hours later. The patient's death certificate is shown in Figure 10.

Figure 10 A death certificate where the approximate *time intervals* are recorded



INTERNATIONAL FORM OF MEDICAL CERTIFICATE OF CAUSE OF DEATH

	Cause of death	Approximate interval between onset and death
I Disease or condition directly leading to death*	(a) Pulmonary haemorrhage	10 hours
	due to (or as a consequence of)	
Antecedent causes Morbid conditions, if any, giving rise to the above cause, stating the underlying condition last	(b) Advanced pulmonary tuberculosis	8 years
	due to (or as a consequence of)	
	(c)	
	due to (or as a consequence of)	
	(d)	
II Other significant conditions contributing to the death, but not related to the disease or condition causing it	Generalised arteriosclerosis	Unknown

** This does not mean the mode of dying, e.g. heart failure, respiratory failure. It means the disease, injury or complication that caused death.*

Identification data

This information is of critical importance to correctly identifying the deceased for both legal and statistical purposes. The details vary from country to country but are likely to include:

- Date and place of death
- Full name and place of residence
- Sex and ethnicity
- Age
- Profession or occupation.

General instructions for completing death certificates

General instructions for doctors when filling in death certificates are given in Box 1. It is important that doctors pay attention to these guidelines because they will help coders correctly identify and code the death. In most countries, coders are not medically trained, so even a small misinterpretation may result in confusion and the incorrect underlying cause of death being selected.

Box 1 General guidelines for doctors completing death certificates
• Complete each item ***in order following the specific instructions given***
• The entry must be **legible**. Use **black ink**
• Do not make **alterations** or erasures. If you want to delete an entry, draw a single line across it. Do not use correction fluid
• Verify the **accuracy** of identification data, including the correct spelling of the name of the deceased, with the family of the deceased
• Do not use **abbreviations**
• Enter only **one disease** condition or event **per line**

Guidelines for recording specific disease conditions

Doctors need to give as full a description of disease conditions as possible to help the classification and coding process for each death certificate.

Neoplasms (tumours)

Record the following information when certifying deaths due to neoplasms:

- Site of the neoplasm
- Whether benign or malignant
- Primary or secondary (if known), even if the primary site was removed long before death
- Histological type (if known).

If the primary site of a secondary neoplasm is known, it must be stated; for example, primary carcinoma of the lung. If the primary site of a secondary neoplasm is unknown, 'Primary unknown' **must** be stated on the death certificate.

Names of operations must include the condition for which the operation was performed; for example, appendectomy for acute appendicitis.

Pregnancy

If a woman dies during pregnancy or within 42 days of the termination of a pregnancy, the fact that the woman was pregnant should be indicated on the certificate, even if the direct cause of death is not related to the pregnancy or to childbirth. For example, the entry could read 'Pregnant, period of gestation 26 weeks'.

If the death certificate includes a pregnancy check box, it should be ticked to indicate the women was pregnant or was within 42 days of delivery when the death occurred, if that was the case.

Hypertension

It is important to state whether hypertension was essential or secondary to some other disease condition (eg chronic pyelonephritis).

Infectious and parasitic diseases

If the causative agent is known, it should be noted on the certificate. If the causative agent is unknown, write 'Cause unknown'. It is also important to include the site of the infection, if known (eg urinary tract, respiratory tract).

Injuries, poisonings and external causes of death

The circumstances of death from, for example, a motor vehicle accident, suicide or homicide, is known as the external cause of death. When death occurs as a consequence of injury or violence, the external cause should always be listed as the ***underlying cause.***

The external cause is described in as much detail as possible; for example, 'motor traffic accident' is ***not sufficiently accurate***; however, 'pedestrian hit by motor car' is both clear and accurate. In a case of suicide, simply entering 'suicide' is insufficient; the method of suicide should be entered. For example, 'Suicidal death by hanging' is a clear description.

Reporting death of an elderly person

'Senility' or 'old age' should ***not*** be included in Part I of the death certificate if a more specific cause is known to the certifier. If senility is a contributory factor, it can be included in Part II of the death certificate.

Ill-defined conditions

When organ failure (eg heart failure or renal failure) is entered as a cause of death, it is called an ***ill-defined condition***. Ill-defined conditions should ***never*** be entered on a death certificate ***unless*** nothing else at all is known about a patient. The term 'septicaemia', in the absence of more specific information, is also an ill-defined condition and should not be used as the underlying cause of death.

Symptoms and signs

Symptoms and signs (eg chest pain, cough and fever) are considered to be ill-defined conditions on the death certificate. These are not of any use for public health, so doctors should avoid using these terms when completing a death certificate

Mode of dying

Doctors should avoid reporting the ***mode of dying*** on the death certificate, particularly as an underlying cause. This includes terms such as 'cardiac arrest' or 'brain death'.

Unknown cause of death

Where there is insufficient information to be certain of the cause of death, it is legitimate for the doctor to state 'Unknown cause of death'. However, this diagnosis should only be used in exceptional circumstances. Unknown or vague cause-of-death diagnoses are of no public health value. They do not provide any information to decision-makers to guide them in designing preventive health programs.

Perinatal deaths

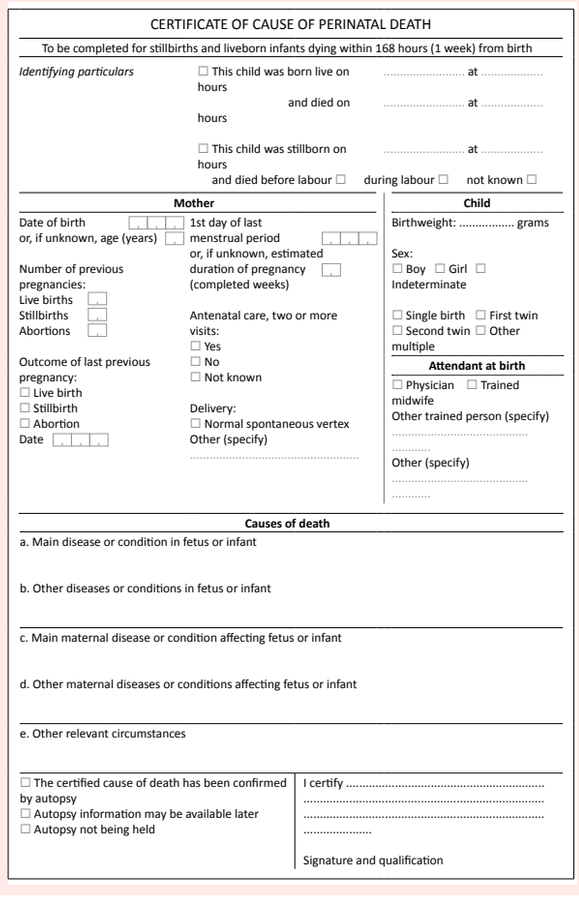
Some countries have a different form of the death certificate for perinatal deaths. The perinatal death certificate recommended by the World Health Organization is shown in Figure 11. The principles governing the concept of the perinatal period are that:

(a) The fetus is potentially viable

(b) Both fetal and maternal causes need to be considered

(c) At a given period after gestation, the pattern of causes will be similar in both live births and stillbirths.

Figure 11 Perinatal death certificate recommended by the World Health Organization



CERTIFICATE OF CAUSE OF PERINATAL DEATH

To be completed for stillbirths and liveborn infants dying within 168 hours (1 week) from birth

Identifying particulars

☐ This child was born live on ..... at .....
hours
and died on ..... at .....
hours

☐ This child was stillborn on ..... at .....
hours
and died before labour ☐ during labour ☐ not known ☐

Mother

Date of birth [. . . . .]
or, if unknown, age (years) [. .]

Number of previous pregnancies:
Live births [.]
Stillbirths [.]
Abortions [.]

Outcome of last previous pregnancy:
☐ Live birth
☐ Stillbirth
☐ Abortion
Date [. . . . .]

1st day of last menstrual period [. . . . .]
or, if unknown, estimated duration of pregnancy (completed weeks) [. .]

Antenatal care, two or more visits:
☐ Yes
☐ No
☐ Not known

Delivery:
☐ Normal spontaneous vertex
Other (specify)
.....

Child

Birthweight: ..... grams

Sex:
☐ Boy ☐ Girl ☐ Indeterminate

☐ Single birth ☐ First twin
☐ Second twin ☐ Other multiple

Attendant at birth

☐ Physician ☐ Trained midwife
Other trained person (specify)
.....
.....
Other (specify)
.....
.....

Causes of death

a. Main disease or condition in fetus or infant

b. Other diseases or conditions in fetus or infant

c. Main maternal disease or condition affecting fetus or infant

d. Other maternal diseases or conditions affecting fetus or infant

e. Other relevant circumstances

☐ The certified cause of death has been confirmed by autopsy
☐ Autopsy information may be available later
☐ Autopsy not being held

I certify .....
.....
.....
.....

Signature and qualification

A perinatal death can be either a live birth or a stillbirth according to the World Health Organization definition and formally covers the period from 28 completed weeks of gestation up to (but not including) seven days after birth. The decision regarding the lower limit of the perinatal period depends on the facilities in the country for a preterm neonate to survive. In some countries, the perinatal period may start at 22 completed weeks.

The death certificate does not ask for an underlying cause of death. Instead, it asks for the main cause in the fetus (stillbirth) or infant (live birth), and the main cause in the mother. It asks for other causes and for other relevant circumstances.

The wording of the perinatal death certificate is:

(a) Main disease or condition in fetus or infant

(b) Other diseases or conditions in fetus or infant

(c) Main maternal disease or condition affecting fetus or infant

(d) Other maternal diseases or conditions affecting fetus or infant

(e) Other relevant circumstances.

Case study 9

A 37-year-old multipara with gestational diabetes mellitus was admitted to hospital at 32 weeks of gestation. She was diagnosed with premature rupture of the membranes and put on antibiotics. Two days later, she delivered a baby boy weighing 1.9 kilograms. On examination, the baby was found to be premature and was short of breath. He was diagnosed with respiratory distress syndrome of neonates. The baby was sent to the premature baby unit for incubator care. Despite treatment, the baby died 14 hours after birth.

Completion of the perinatal death certificate for this infant would be as follows:

(a) Main disease or condition in fetus or infant: Neonatal respiratory distress syndrome

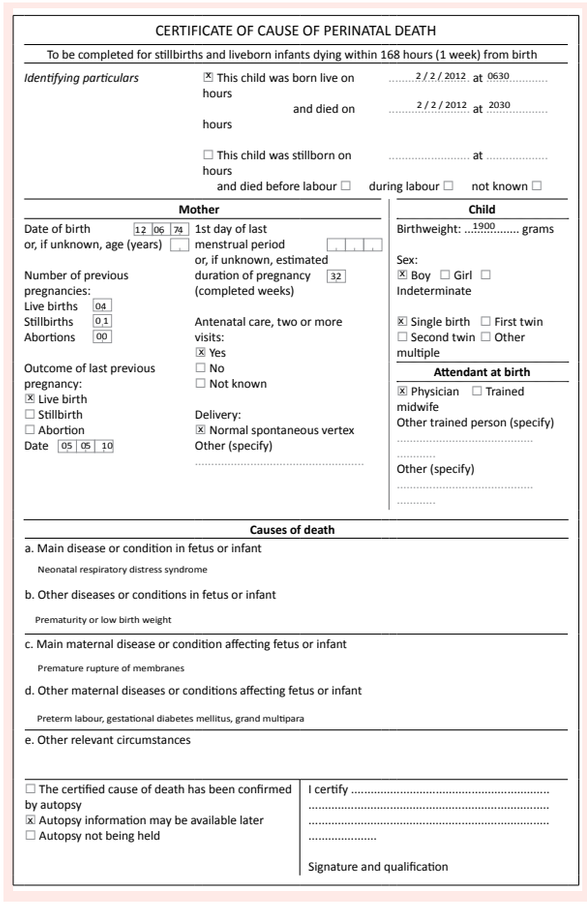
(b) Other diseases or conditions in fetus or infant: Prematurity or low birth weight

(c) Main maternal disease or condition affecting fetus or infant: Premature rupture of membranes

(d) Other maternal diseases or conditions affecting fetus or infant: Preterm labour, gestational diabetes mellitus and grand multipara

(e) Other relevant circumstances: None.

Figure 12 Perinatal death certificate for Case study 9



CERTIFICATE OF CAUSE OF PERINATAL DEATH

To be completed for stillbirths and liveborn infants dying within 168 hours (1 week) from birth

Identifying particulars

☒ This child was born live on 2 / 2 / 2012 at 0630 hours
and died on 2 / 2 / 2012 at 2030 hours

☐ This child was stillborn on ..... at ..... hours
and died before labour ☐ during labour ☐ not known ☐

Mother

Date of birth 12 06 74
or, if unknown, age (years) ..
Number of previous pregnancies:
Live births 04
Stillbirths 01
Abortions 00

Outcome of last previous pregnancy:
☒ Live birth
☐ Stillbirth
☐ Abortion
Date 05 05 10

1st day of last menstrual period . . . . . .
or, if unknown, estimated duration of pregnancy 32 (completed weeks)

Antenatal care, two or more visits:
☒ Yes
☐ No
☐ Not known

Delivery:
☒ Normal spontaneous vertex
Other (specify)
.....

Child

Birthweight: 1900 grams

Sex:
☒ Boy ☐ Girl ☐ Indeterminate

☒ Single birth ☐ First twin
☐ Second twin ☐ Other multiple

Attendant at birth

☒ Physician ☐ Trained midwife
Other trained person (specify)
.....
Other (specify)
.....

Causes of death

a. Main disease or condition in fetus or infant
Neonatal respiratory distress syndrome

b. Other diseases or conditions in fetus or infant
Prematurity or low birth weight

c. Main maternal disease or condition affecting fetus or infant
Premature rupture of membranes

d. Other maternal diseases or conditions affecting fetus or infant
Preterm labour, gestational diabetes mellitus, grand multipara

e. Other relevant circumstances

☐ The certified cause of death has been confirmed by autopsy
☒ Autopsy information may be available later
☐ Autopsy not being held

I certify .....
.....
.....
.....

Signature and qualification

References

1. World Health Organization. 1967. Twentieth World Health Assembly [online]. Available: www.who.int
2. World Health Organization. 2004. International Statistical Classification of Diseases and Related Health Problems, 10th revision, vol 2, 2nd edition, World Health Organization: Geneva

Acknowledgements

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Preparing routine health information systems for immediate health responses to natural disasters

Original article

Health Information Systems Knowledge Hub, School of Population Health, The University of Queensland, Australia

This action guide has been adapted from Aung E and Whittaker M, 2010, Preparing routine health information systems for immediate health responses to natural disasters. Working Paper 12. Health Information Systems Knowledge Hub: The University of Queensland. Available at www.uq.edu.au/hishub

Six steps for action Immediate health responses to natural disasters*	
1	Ensure that appropriate baseline data are available
2	Establish processes and protocols on post-disaster data collection
3	Identify a team of public health professionals with experience in responding to disasters
4	Before the disaster, establish linkages between health information system operators and key groups involved in disaster response
5	Ensure that data processing and compilation can occur during a disaster
6	Use international manuals to develop health-related disaster responses
* These general steps were developed for countries in Asia and the Pacific. The actual implementation needs to be tailored for each country	

Why are health information systems important in responding to large-scale natural disasters?

Many large-scale natural disasters occur suddenly, without sufficient time for preparation, and present a major disruptive force in the lives of people and communities. Disaster preparedness aims to minimise the losses caused by these events, especially in the days immediately after the event. The timely availability of information is vital to effective disaster response, particularly the availability of reliable and relevant health information.

Several major disasters in the Asia–Pacific region over the last decade have highlighted the fact that most developing countries do not have adequate disaster preparedness within their health information systems. Baseline health data from before a disaster is often not available in the immediate aftermath of a disaster. This means that initial relief distributions and assistance by support agencies is often based on guesswork.

To assist in lifesaving responses, information must be available to personnel on the ground immediately after a disaster happens. Local information preparedness is important because it means that those on the ground can assist with health information needs without having to wait for external teams to arrive.

There are well-defined international standards for disaster responses, especially for health. However, despite the availability of this information, there has been very little discussion or analysis of the role that routine health information systems play in disaster preparedness.

Step into action— key activities to get started

1 — 2 — 3 — 4 — 5 — 6

Step 1—Ensure that appropriate baseline data is available

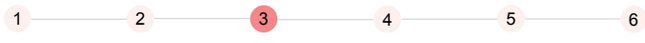
The timely availability of reliable and relevant baseline health data is vital to an effective disaster response. Baseline data can be gathered from a range of health and non-health programs including: population demographics; pre-existing health status, problems and priorities; numbers of pregnant women, children under five years old and people with diseases requiring continuity of care; sources of health care before the disaster; coverage of public health programs; disease vector control practices; human resource data, including availability of community health volunteers; hygiene practices, water supply, excreta and waste management; food security; health system capacities; and health-related partners including community groups, community organisations and nongovernment organisations. Baseline information should be regularly updated, preferably annually.

Step 2—Establish processes and protocols on post-disaster data collection

Most developing countries do not have adequate disaster preparedness within their health information systems, and specific protocols on data collection and dissemination after a disaster need to be established. Procedures for getting data from various data sources, and triangulation of data from those sources, must be identified and described in a rapid assessment protocol. The operational capacity of health information systems, including availability of baseline information must be tested during disaster-preparedness drills.

In addition to the normal processes used to maintain health information systems, some other processes are required to ensure adequate disaster response preparedness. Forms and related processes to collect data during disasters should be incorporated in routine data collection and reporting systems so there is no delay in responding to disaster needs.

Staff need to be trained in the use of disaster protocols and processes, including the various forms that might be used. As the quality and functioning of health information systems affects the quality of data, regular evaluations (every one or two years) of health information system processes should be undertaken to assess whether it is sufficiently prepared for disaster response. Legislation may need to be enacted to allow access to health data by nongovernment health managers and providers in disaster situations.



Step 3—Identify a team of public health professionals with experience in responding to disasters

Identification of a national or regional team of public health professionals with experience in responding to disasters will greatly assist in disaster preparedness. Information about these people should include name, age, sex, location of residence and work, qualifications and special competencies. These people should include: community-based health workers; other clinical health staff; laboratory, pharmacy, mental health, health logistics, health communications and health management staff; and people able to undertake rapid disaster impact assessments. Ideally, response teams should include at least one representative from each of the following four groups: (1) general practice, surgery, epidemiology, public health; (2) economics, statistics, social science, operations research; (3) civil, electrical, sanitation engineering; and (4) management, health planning, geography. The ongoing management of this response team should include regular preparedness meetings and capacity-building exercises.

Step 4—Before the disaster, establish linkages between health information system operators and key groups involved in the disaster response

An integral part of disaster preparedness is the establishment, before a disaster, of linkages between health information system operators and key groups involved in the disaster response. These people will probably include: health sector workers; workers in other sectors such as water, housing and food; community leaders; health department officials; meteorological department officials; local and central government administrators; local nongovernment agencies; international aid agencies and other volunteer groups; and media outlets.

A broader range of stakeholders must be serviced by the health information system during disasters (e.g. humanitarian relief partners, the media, the general public) and each of these groups will have different data needs and timeframes. Plans for how to disseminate information to these groups should be built into the routine health information system to allow a rapid response when required.

Step 5—Ensure that data processing and compilation can occur during a disaster

It is important to ensure that, during a disaster, data processing and compilation can occur on-site, or off-site in an administration area. A major challenge in data transmission after a disaster is that routine communication channels are often unusable. Disaster-preparedness activities should include identifying appropriate telecommunication technologies to invest in and establishing pathways to use telecommunication resources from other sectors. Data collection can be greatly assisted by ensuring access to geographical information systems, aerial photographs and satellite images.

Step 6—Use international manuals to develop health-related disaster responses

Within the field of health information systems there are many potential areas for a regional approach and there is need for serious consideration of this among Pacific island countries and territories. Despite the challenges—the most significant of which are distance, low population levels and electronic communications— collective strength is likely to be more successful than individual countries working on their own.

National health authorities and regional partners need to agree on strategies and programs to derive maximum benefit from regional health information system resources and a more collaborative approach to data collection and sharing, and to recruiting, training and retaining a skilled health information system workforce. There is also the potential for a regional or a combined approach to purchasing software licensing, hardware and medical records–related stationery.

Conclusion

There are clearly opportunities for routine health information systems to assist with disaster preparedness and early response activities. Most health information systems, if developed to meet certain standards, could meet the needs of disaster preparedness and response planning. Forms and related processes to collect minimum data useful for baseline assessment and comparative data to monitor disasters should be incorporated into routine data collection and reporting systems so that data collection can start immediately after a sudden-onset disaster. Appropriate technology, infrastructure and equipment must be in place to efficiently carry out data collection and dissemination activities, and staff must be trained in these activities.

Acronyms and abbreviations

ABD	Asian Development Bank
AIDS	Acquired immune deficiency syndrome
ARI	Acute respiratory infection
AusAID	Australian Agency for International Development
CRVS	Civil registration and vital statistics
DHS	Demographic health survey
EPI	Expanded program on immunisation
HIS	Health information system(s)
HIS Hub	Health Information Systems Knowledge Hub
HIV	Human immunodeficiency virus
HMN	Health Metrics Network
HR	Human Resources
HRH	Human resources for health
ICT	Information and communications technology
IMCI	Integrated management of childhood illnesses
LMICs	Lower- and middle-income countries
MDG	Millennium Development Goal
MMR	Maternal mortality ratio
MoH	Ministry of Health
NCDs	Non-communicable diseases
NHA	National health account
PHIN	Pacific Health Information Network
PICTs	Pacific Island Countries and Territories
TFR	Total fertility rate
UN	United Nations
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
UNSTATS	United Nations Statistics Division
WHO	World Health Organization
WPRO	Western Pacific Regional Office of the World Health Organization

Message from the editor

Sitaleki 'Ata' at Finau

The Health Information Systems Knowledge Hub at the School of Population Health, University of Queensland, have done a tremendous job to produce this PHD issue. We are expecting great new dawns and time will tell. It is my privilege to produce the "PHD Matters" column for this issue. It is from here that I take poetic license.

From inception, the PHD has valued and discussed health information in the Pacific in its various thematic issues: talking about the data cemetries in the Pacific with most countries in data collection paralysis, and the need for evidence-based decisions and policies. In September 2005, SPC produced the PHD issue on "Pacific Health Surveillance and Response" (Volume 12, No.2) in French and English; in 2001 "Emergency Health in The Pacific" (Volume 9, No.1); in 2000 "Telehealth in the Pacific" (Volume 7, No.2); in 2006 PHD reported on the "Pacific Health Summits for Sustainable Disaster Risk Management" (Volume 13, No.1); and so on to such an extent that one may conclude that this is the Pacific's most wicked problem. However it is a problem that is not blessed with the appropriate resources and intellectual engine to address it.

I remember in the late 1970s, when the WHO Regional Office in Suva had four epidemiologists, two statisticians, plus numerous consultants, who were examining, re-examining, constructing, re-constructing, designing, re-designing, and evaluating national health information systems in Pacific countries. During this time there had been a few WHO regional workshops and trainings in epidemiology and health system research. In the last ten years I have also been involved in WHO and NZHRC on regional research training. While these were all and good, there has been resistance to ethnic-specific approaches and small supervised country-specific research projects.

The Hub and this PHD issue addresses the need for improved HIS for improved health outcomes. The strategy is still based on a small economy of scale and a regional strategy. I sense still the absence of some Pacific-specific realities such as the politics of opinion-based policy and management, and the need to supplement the 'technology of reason' with a 'technology of foolishness', wherein individuals and organisations need ways of doing things for which they have no good reason. With 'sensible foolishness', there is relaxation of structures against imitation, coercion and rationalisation; the promotion of playfulness, which involves the suspension of rational imperatives towards consistency and its replacement by a willingness to explore alternatives and engage in experimentation.

Finally, Pacific countries, though small, are very complex and uniquely variable. They are often loosely organised with differing agendas and varying choices of priority and leadership. One may view such countries as an 'organised anarchy', wherein traditional systemic orderliness must be replaced with disruptive innovations. In Tonga the results and publication from a WHO in-country epidemiology research training was hailed then as a success, but was not funded to develop in depth, breadth and further publications.

For successful HIS for health in the Pacific Region, there needs to be a major paradigm shift to national control and innovations, starting with ethnic-specific human resources to generate the disruptive innovation to move to a HER (Health Evidence Research) for Health. HIS must be research constructions to generate evidence, not 'data untouched by human thought'. HER will stop the collection paralysis and close the Pacific data cemeteries!

If this happens then PHD matters!

Malo

Sitaleki 'Ata'at Finau

Message from the editorial assistants

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It is with great pleasure that we bring you this Special Edition on Health Information Systems, representing the culmination of over 10 months of work. In August 2010 the Pacific Health Information Network officially launched its Regional HIS Strategic Plan and in doing so, brought together a number of key individuals and organisations involved with HIS in the Pacific. This platform enabled participants to share the issues and challenges for HIS in the region, and discuss their ideas on how to progress and strengthen HIS and country and regional levels. A number of individuals involved at the launch have contributed to this edition of the Dialog, along with health information professionals and experts in various information-related fields.

The hard work and dedication of these individuals is testament to the quality and depth of articles represented here and the team at the HIS Hub would like to express our sincere gratitude to the many hours donated to the writing and editing process. We would especially like to thank the following peer reviewers: Audrey Aumua, Vicki Bennett, Michael Buttsworth, Pascal Frison, Karen Kenny, Don Lewis, Miriam Lum On, Maxine Whittaker and Maryann Wood.

As editorial assistants to this publication, we have enjoyed the opportunity to work with various health information professionals in the region and ‘give a voice’ to what is largely a silent aspect of health systems. We hope you enjoy reading this, the latest edition of the Pacific Health Dialog, as much as we have enjoyed bringing it to you.

HIS Knowledge Hub

The Health Information Systems (HIS) Hub is one of four knowledge hubs for health funded by the Australian Agency for International Development (AusAID). The Australian Government, through AusAID, has provided $24 million over four years (2008-2011) to establish four Health Knowledge Hubs with the Nossal Institute; the University of New South Wales; the University of Queensland; and a grouping of the Centre for International Child Health, Menzies School of Health Research and the Burnet Institute. The Hubs aim to improve health knowledge and expertise by informing policy dialogue at national, regional and international levels in the Asia Pacific Region. Each Hub has used its convening power to work with others, both within and outside of academia, to build a knowledge and expertise base, link people, strengthen and expand networks, identify opportunities for collaboration and promote multi-disciplinary engagement. Recently, the work of all four Knowledge Hubs has been extended to mid-2013 with a focus on communication and dissemination of already commenced products: this demonstrates AusAID's commitment to the work and dedication of the Knowledge Hubs.

The Health Information Systems (HIS) Knowledge Hub responds to a growing recognition of the need for strong health information systems in developing countries to deliver comprehensive information needed to guide health programs, support policy development and measure progress. Many low and middle income countries only have partial information systems, which are of unknown reliability, poorly coordinated and unable to provide the necessary information for monitoring health outcomes and the proper management of health systems. The aim of the HIS Knowledge Hub is to facilitate the development and integration of HIS into the broader health system strengthening agenda, and increase local capacity to ensure that cost effective, timely, reliable and relevant information is available. The HIS Knowledge Hub also aims to better inform health information systems policies across Asia and the Pacific.

Objectives

- Increase the critical, conceptual and strategic analysis of key HIS issues relevant to the Asia Pacific region that can be used to inform policy thinking and practical application at the national, regional and international levels
- Expand convening powers and engagement (e.g. communication, networks and partnerships) between the Hubs, Australian institutions and Asia-Pacific national, regional and international researchers, development partners and educational institutes
- Effectively disseminate relevant and useful HIS knowledge resources which aim to influence policy thinking at national, regional and international levels
- Expand the HIS capacity of Australian institutions and professionals and through them to Asia Pacific institutions and professionals to participate effectively in evidence informed policy making

Projects for 2011

1. Strengthening HIS investments for health service management
2. Strengthening and expanding the HIS workforce
3. Strengthening vital statistics and cause-of-death data
4. Health information systems strengthening and maternal and child health

Projects for 2012

1. Building health information systems
2. Developing the workforce
3. Strengthening vital statistics and cause-of-death data
4. Tracking progress toward Millennium Development Goals

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All original contributions are peer reviewed.

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Pacific Health Dialog is promoted to members of all health professional and academic groups involved in the health and well-being of the people of the Pacific. These groups include doctors, nurses, administrators and educators as well as those working in public health and other fields

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