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Telehealth and outbreak prevention and control: the foundations and advances of the Pacific Public Health Surveillance Network

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Abstract

The Pacific Public Health Surveillance Network (PPHSN) of which PACNET is now an integral part was established in 1996. PACNET is an innovative technical communication facility for strategic and high priority disease outbreak detection and control. PPHSN consists of National and International agencies, networks and institutions involved in Health activities in 22 Pacific island countries. Its aim is to improve public health surveillance in the Pacific Islands in a sustainable way with outbreak alert and response a current priority. This report reviews the development of PPHSN, its associated public health Laboratory network (LabNeT) and the more recent EpiNet that is a regional investigation and response service. Telehealth is also discussed in terms of what services can PPHSN currently provide and what improvements can it pursue to actively contribute to the dynamic development and welfare of Pacific communities in the twenty first century.

Introduction

Nearly three years ago, this journal carried a general presentation by the same author of the Pacific Public Health Surveillance Network (PPHSN) focussing on PACNET which had recently been set up as an innovative technical communication facility for strategic and high-priority regional outbreak prevention and control¹. The next few pages provide an assessment of the Network's current configura-

tion, its structural and technical developments over the three-year period and the development prospects for the body of professionals and health-service users in the Pacific².

PPHSN's aim is to improve public health surveillance in the Pacific Islands in a sustainable way.

What services can PPHSN currently provide? What are the potential avenues of improvement and expansion it can pursue in the near future in order to consolidate its status as a modern, appropriate, flexible and sustainable public health facility and tool which is capable of actively contributing to the dynamic development and welfare of Pacific communities in the 21st century? How does telehealth stand from each of these angles?

The challenges

The telehealth concept and application of its many facets clearly illustrate the considerable advances made by modern technology and know-how and the enormous promise they hold for PPHSN against an intricate backdrop of both change within the Pacific and the globalisation which has become as unavoidable in terms of outbreak prevention and control as it is in other areas of

human development. The facts and issues are as complex, justified and relative as are the various stakeholders' expectations. Nowadays, known and emerging communicable diseases can travel as quickly and easily around the globe and from one Pacific island to another as humans do individually or in groups or as do goods, food products in particular. In any attempt to effectively control their spread and ravages, information and resources must circulate and be accessible at even greater speeds!

We must, then, do our best to gradually achieve the following:

- overcoming isolation;
- being prepared for the occurrence of outbreaks;
- early detection and timely dissemination of useful information (with the degree of usefulness varying according to circumstances);
- effective co-ordination and rapid mobilisation of suit-

PACNET is an innovative technical communication facility for strategic and high priority disease outbreak detection and control.

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- able public health resources;
- ensuring that facilities and resources are sustainable and adaptable.

PPHSN must be able to meet these challenges by using telehealth and other resources appropriately and by taking its place and interacting on the world public health scene (that the very concept of telehealth can only bring closer to its users) for the good of the Pacific Islands. At this point, it would be appropriate to give a brief overview of the Pacific Island context.

The Pacific island context

*"An island is defined by its shores."*³

To begin with, we have the Pacific Ocean - this ocean which is the be all and end all of the Pacific Island context. But as this article calls for a more down-to-earth approach, we feel that the terms *vastness*, *diversity*, *mobility* and *ownership* form the principle outlines of a broad-brush, but vivid picture of the situation.⁴

It is a vast and diverse region nearly 30 million square kilometres in area, 98% of which is made up of ocean waters which form the natural and cultural reference link between islands. Only 7.5 million people live on the 2% that accounts for the land masses scattered across both sides of the equator comprising thousands of islands of every size, with geology, climates, biology and environments which are as complex and varied as might be expected in such a geographical host flung across about 1/5th of the globe. The history of its inhabitants is diverse with waves of population ranging from 70,000 years to a few decades ago. Its languages are no exception, with some 1200 spoken forms, as against only two regional *linguæ francae*, i.e. English and French. The same applies to culture, despite the simplistic Western approach of generally describing three major cultural groupings, i.e. Melanesia, Polynesia and Micronesia. A wide range of colonial influences and political statuses also exist among the 22 countries and territories which make up the region. Its population is highly mobile, originally due to the ever-present seas and their historical, mythical and even primeval role and to the strength and extent of family ties, culture and navigation skills. Nowadays, this high mobility is also due in large part to social and economic factors and the disparities which exist within the region between the various Pacific Islands and between the latter and their former colonial powers or wealthy neighbours in the Asia-Pacific region.

Insularity, huge distances, relative remoteness, very high mobility both within and outside the region, biological and cultural diversity and socio-economic disparities make up the Pacific region's primary characteristics...

The above simple listing of a few of the region's features makes it easy to get an idea of the principle hurdles facing surveillance development, i.e. logistics, communications and human resource development. Obviously these fields have to be kept in mind during any assessment of telehealth's potential contributions.

Aside from the usual list of weaknesses and expressed needs which health management and planning schools create almost as a natural reflex, it is even more natural to examine the Pacific Islands' assets in this area. It so happens that, contrary to the initial impression of a disparate mosaic or a regional entity whose exact form bends and changes with the market's geopolitical winds, our impression is that the Pacific Islands are brought together by a strong sense of being part of "Oceania". Experience has shown that this sense of ownership has been one of the PPHSN's underlying strengths and it is a determining factor and driving force for a community such as that formed by the network's members. It is also recognised as one of the most positive factors when it comes to assessing human development endeavours. It should always remain at the forefront of PPHSN's development and facilitation, both in general terms and more specifically in the telehealth approach, as

well as in outbreak prevention and control. Despite possible problems triggered by biological diversity and high mobility, these factors also have positive potential and should be listed on the asset side. In terms of land occupation, social links and kinship, to

mention only a few of the more commonly recognised issues, one of the more salient advantages for the members of PPHSN is that networks are structurally and functionally ingrained in Pacific culture and history, and were so well before globalisation and Internet provided them with worldwide recognition.

Insularity, huge distances, relative remoteness, very high mobility both within and outside the region, biological and cultural diversity and socio-economic disparities make up the Pacific region's primary characteristics, which, in terms of epidemic risk exposure and response capacities, determine the baselines of the fragile public health equilibrium⁵. Weaknesses, natural obstacles and specific environmental factors do exist along with specific assets, which is why it is important to factor Pacific-related aspects into PPHSN's future development and improvement orientations. It appears that such an endeavour can only be successful if it remains sensitive to the Pacific Island context and is carried out for its benefit – while, at the same time, being of benefit to other regions⁶.

In the light of the above, what can telehealth and its practical applications contribute in terms of improving the wide range of PPHSN outbreak prevention and control services?

Telehealth: definitions, key concepts and... the Pacific islands

When scanning available documentation⁷, it soon becomes apparent from the plethora of references and attempts at describing telehealth that no standardised concept based on a universally accepted definition yet exists. Although this may be one of the typical signs of novelties and fads, it is now becoming the norm: telehealth is the new "craze"! Although this does not necessarily have a completely negative connotation, it should be remembered that fashions tend to emphasise form over intent. Such a slippage in human development initiatives could have dramatic consequences. PPHSN members should, therefore, strenuously avoid the traps set by reckless opportunism or glossy appearances. Above all, PPHSN members must clearly define the purpose of telehealth and then identify realistic application options for the Pacific Public Health Surveillance Network.

Nevertheless, a core of key concepts emerges from the various writers' definitions. The following is our perception of these concepts:

- Telehealth practice involves using computer, information and communications technologies to facilitate, extend or improve health services.
- It is generally difficult to define specific boundaries for possible applications, as the technological tools and systems are constantly changing. Once the practical context is known, there is scope for greater precision. The more common range of services, however, include curative and preventive care, health education and information, service management and training for health professionals.
- Strategically, telehealth aims at alleviating problems of distance, remoteness, professional isolation, accessibility in general, communications and human resource development so as to improve public health while reducing costs in sectors such as logistics (mainly equipment and medical evacuations), telecommunications and training⁸.

With regards to the principle challenges facing the Pacific, this initial overview gives us an indication of how telehealth can contribute to improving and extending PPHSN's services. In the final analysis, the Pacific Island context must be the guiding principle in choosing the most appropriate and

realistic practical applications over both the short and long terms.

Telehealth made its first appearance in the Pacific Islands in 1993 but initially it was not regional in nature. The initiative came from the United States' Military Health Services and was applied to an atoll in the Marshall Islands. It involved the Kwajalein Military Base health clinic and the Tripler Army Medical Center in Honolulu, Hawaii. The goal was to reduce US Army expenditures on over-frequent medivacs to Tripler by setting up a specialised long-distance consultation system (telemedicine)⁹. Although limited, relatively unsophisticated technically and very discrete at the outset, it soon proved effective, thereby winning over its promoters who then allocated more resources to it. Bolstered by its success, the concept found its way into the wider Pacific through professional contacts. It was readily adapted to differing scales in related registers.

The first two "regional" telehealth applications came into existence in 1997:

- one in telemedicine, i.e. the Western Pacific HealthNet (WPHNet), launched at the behest of the Pacific Basin Medical Association (PBMA) as an extension of a medical officer's training programme in Micronesia, supports clinical practices and curative care;
- the other in telehealth in a more generic sense, i.e. PACNET, set up at the Secretariat of the Pacific Commu-

nity's (SPC) initiative as part of the newly established PPHSN, aims at strengthening outbreak prevention and control in the Pacific by means of regional health information and epidemiological surveillance, prevention and control¹⁰.

... the Pacific Island context must be the guiding principle in choosing the most appropriate and realistic practical applications over both the short and long terms.

Telehealth evidently started on a practical note in the Pacific, with training, information, management and curative and preventive care, by applying elements of the theoretical definitions which would follow later. So, what is the current situation - simply with regards to the initiators of the first telehealth projects?

The US Office for the Advancement of Telehealth defines telehealth as follows: "*Telehealth is the use of electronic information and telecommunications technologies to support long-distance:*

- *clinical health care (this alone might be defined as telemedicine);*
- *patient and professional health-related education and information;*
- *public health;*
- *and health administration."*

The Fiji School of Medicine adopted this definition, but specified that the concept encompassed the breadth of activities envisioned within the Pacific¹¹, involving "a variety of activities using different levels of information tools:

- contacting a distant specialist consultant on the telephone for an opinion;
- communicating with a health assistant on an outer island via high-frequency radio regarding a difficult clinical situation;
- seeking the critique of a research proposal from a public health professional through electronic mail;
- using a Web page on the Internet dedicated to the reception and triaging of clinical consultant requests at a referral site;
- performing a search of the medical literature through the Internet;
- taking part in a live audio or videoconference as part of a distance education or distance consultation process, etc.

For SPC and PBMA, the joint organisers of the Pacific Telehealth Conference, supporting telehealth under PPHSN means, "To promote and develop accessibility and use of information and communication technology (ICT) for the purpose of improving health services management and delivery in the PPHSN country and territory members, especially in the fields of:

- outbreak prevention and control
- public health surveillance and disease control
- distance clinical, epidemiology and public health consultations
- distance education¹²

Although there is obviously still a bit of work to be done by PPHSN members before a common definition for telehealth and its components (telemedicine, distance education, etc) is adopted, there is a heartening consensus about its ultimate purpose and the basic principle that practical applications must complement each other. As telehealth is strategically suited to the Pacific Island context and its operations make it possible to create and strengthen links across the Pacific, this consensus will need to be preserved over the long term for the sake of a public health balance in the islands.

The Pacific Public Health Surveillance Network (PPHSN)

This section of the paper is designed to give an overview of the current configuration of PPHSN by avoiding, wherever possible, unnecessary repetitions for "inside" readers while at the same time responding to the legitimate need for understanding of our other readers and by highlighting those structural changes or improvements which have occurred over the past three years.

The Pacific Public Health Surveillance Network was officially created in December 1996 by the SPC/WHO Pacific Islands Meeting on Public Health Surveillance. Originally, the idea for a regional surveillance network arose from the simple recognition and admission by all concerned regional and international stakeholders of a "chronic" technical problem with regards to communicable disease control, i.e. mediocre regional surveillance and extremely disparate national surveillance systems, all of which were overburdened, largely due to regional and international demands. In 1995, through its Public Health Surveillance and Communicable Disease Control Section, SPC proposed a conceptual and technical solution: methodically identifying common priorities and complementary partnerships¹³. A regional working group was then formed in December 1995, which concentrated on implementing a joint proposition for a practical solution, i.e. setting up a regional public health surveillance network¹⁴. The group had to work intensively for a period of one year to gather the initial institutional, structural and technical proposals required before calling an international gathering to baptise PPHSN.

Certain basic principles guide our approach to networking:

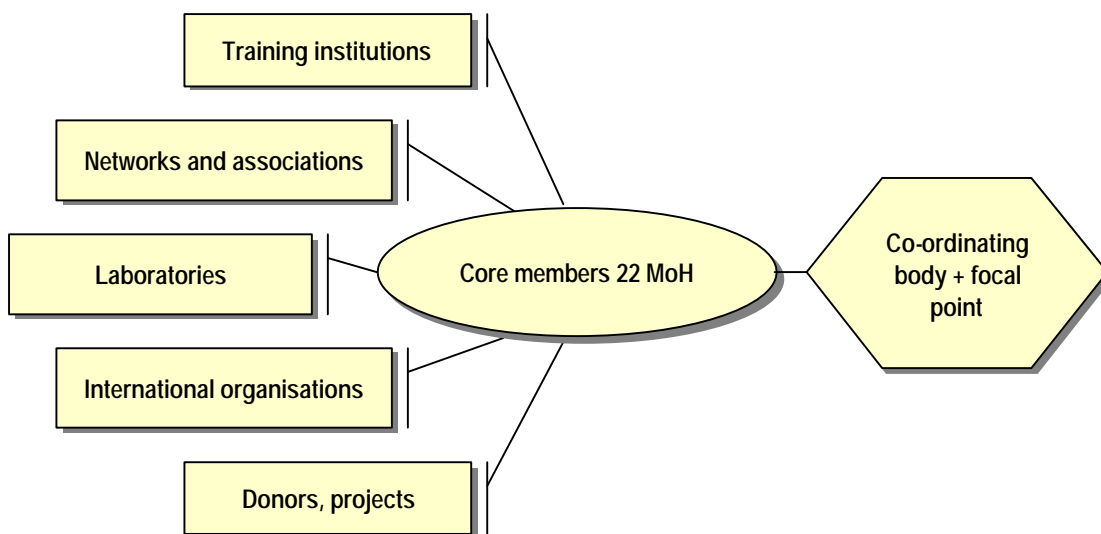
- building on what already exists to minimise costs and bureaucracy and to be able to act without too much delay;
- strengthening the bottom-up approach to information needs, without underestimating the viewpoints of the upper or central levels¹⁵;
- identifying common issues and further integrating appropriate existing resources: "complementary development";
- taking advantage of technological progress (ICT).

Institutional framework

Even if PPHSN's basic philosophy is to be primarily a network of services – and not a new regional institution – it also has to have a structure which allows the partnership, for a common goal, of a variety of international, regional and national institutions working in the development and public health areas. A well-organised structure of these institutional relationships for the benefit of public health, setting out the expected roles and prerogatives for each group of partners, has been developed over these past three years (see Figure 1).

PPHSN's core members are the 22 health departments and ministries of the Pacific Island countries and territories. In the end, they are the ones who decide on the network's structural and technical advancements. Its allied members are those organisations, networks and agencies which wish to contribute resources to help PPHSN attain its goal, i.e. the Secretariat of the Pacific Community, World Health Organisation (WHO), Fiji School of Medicine, International Network

Fig. 1. The Pacific Public Health Surveillance Network (PPHSN)



of Pasteur Institutes, Australian National University, UNICEF, Communicable Diseases Network for Australia and New Zealand (CDN/ANZ), Pacific Basin Medical Association and many others.

PPHSN’s development is coordinated and facilitated by its Coordinating Body, which is a logical offshoot of the regional working group which conceived and establish PPHSN. The Coordinating Body is composed of 10 members¹⁶, i.e. 5 core member representatives plus 5 allied members. The SPC’s Public Health Surveillance and Communicable Diseases Control Section serves as the Focal Point for PPHSN’s Coordinating Body. The Coordinating Body meets once or twice a year¹⁷, makes reports to PPHSN’s core members through its Focal Point, then acts in response to the remarks and directives received. Since PPHSN’s creation, the Coordinating Body has been working on improving the relevancy and quality of services offered to Pacific Island member countries and territories, with priority given to outbreak prevention and control. Efforts have mainly concentrated on capitalising on an increasingly more effective partnership based on matching resources in general, most importantly among Coordinating Body members. The Body met for the sixth time on 17-18 April 2000 in Noumea (SPC Headquarters) to discuss, as usual, PPHSN’s structural and technical advances and to see to the final details for the Inaugural Meeting of the PPHSN Public Health Laboratory Network (which followed directly afterwards on 19-20 April 2000).

The principle results and foreseeable technical improvement of services offered by PPHSN will be discussed in the following pages. As for the Network’s structure, current proposals involve expanding the Coordinating Body in 2001 to 12 members by adding two additional core members; and the gradual and partial renewal, at regular intervals, of the Body’s members. The details of these proposals must be

submitted to all core members before they can be implemented.

Strategic framework

Five main strategies guide PPHSN’s development and activities:

- Harmonisation of surveillance data and development of adequate surveillance systems (with priority given to acute communicable disease outbreaks);
- Development of relevant and cost-efficient computer applications;
- Adaptation of field epidemiology and public health surveillance training programmes to local and regional needs;
- Extension of the e-mail network to new partners, new services and other public health networks;
- Publication/distribution of timely, accurate and relevant information in a variety of forms.

What is telehealth’s role?

In addition to the priority placed on outbreak prevention and control, it can be seen from the preceding array of strategies that training, information and communications, supported by information and electronic technologies, form the broad outline of a work programme designed to integrate the use of telehealth. In this regard, it is extremely interesting to note that the strategy of a network of professional networks – the logical corollary of the dynamics of information networks – is no more and no less than the definition of the Internet for communications in general. It is important to point out that even today in the Pacific, HF radios, telephones and faxes are both common and relevant, particularly at the edges of the health care system. However it must be recognised that, in practice, these types of technology mainly allow the use of “point to point”

telehealth, i.e. not networking. For outbreak prevention and control, surveillance and public health in general, particularly on a regional scale, and even more so in the Pacific Islands, it is a networking approach which is most suitable and which possesses, as we have seen, specific assets to ensure its success. Going hand in hand with this, the Internet –in particular e-mail, a less sophisticated, more accessible application which is remarkably cost-effective– has really allowed telehealth to “take off” at a regional level and continues to augur further significant advances.

Even so, can the problem of improving public health in the Pacific be reduced to a simple equation:

$$\text{NETWORK (STRUCTURE + CULTURE) * INTERNET = TELEHEALTH'S SUCCESS?}$$

Access to this modern technology remains a problem – mainly economic –for our colleagues in Pacific Island health services, even if now this mainly involves outlying services (the 22 Pacific Island countries and territories have outside connections used by 19 health ministries and departments, some of which also have internal networks¹⁸). PPHSN's institutional framework can help them, in particular by serving as their “loudspeaker” and demonstrating telehealth's advantages and merits in the Pacific, with regards to telecommunications service providers and economic and political decision-makers. Moreover, this involves a strategy which has already been integrated, in practice, into our strategic set-up.

Luckily, human development, and therefore public health development, go far beyond the sole logic of mathematical models and exact sciences. More than just the physical access to the technology, we feel the true challenge for controlled development of public health in the Pacific Islands is to guarantee the sustainability and complementarity of the resources made available (equipment, funding, expertise and skills) in combination with

professional and cultural relevancy, and ownership of all the elements of telehealth services.

How does that apply to outbreak prevention and control?

Outbreak prevention and control: alert and response in the Pacific

A quest to improve the region's communicable disease control brought the various players together to design and then implement the current network. The decision to concentrate on outbreak prevention and control (sometimes referred to in a broader sense as emerging and re-emerging disease control) was the Pacific Island countries and territories' reaction to an urgent need to set regional communicable disease surveillance priorities, as demonstrated in 1995 by the initial efforts of the members of the current Co-ordinating Body.

In the Pacific Island context, the diseases currently targeted by PPHSN, the list of which is not final, present an epidemiological profile, both epidemic and endemo-epidemic, which favours sudden outbreaks. As a rule, poorly managed outbreaks are not just detrimental to public health, but cause a wider crisis which destabilises the society involved, sometimes seriously and over the long term, thereby impairing its development. History abounds with such examples and the Pacific has paid a heavy price to learn this lesson¹⁹. In today's Pacific, the challenges are the same and, as the most common cases indicate, outbreaks and tourism can be a dangerous mix, as can food products and overseas trade, something demonstrated by some very recent examples. It may well be asked whether this is all justified and, although the answer may appear simple, the explanation are quite often rather complex and experience has shown that viewpoints almost always vary according to the speaker's own position.

Fig. 2. Distribution of PACNET members, 30 Nov. 2000. N = 343

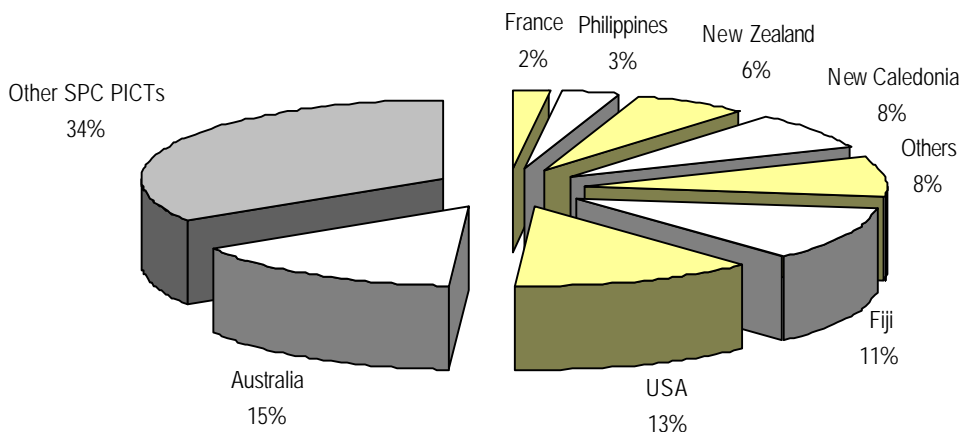
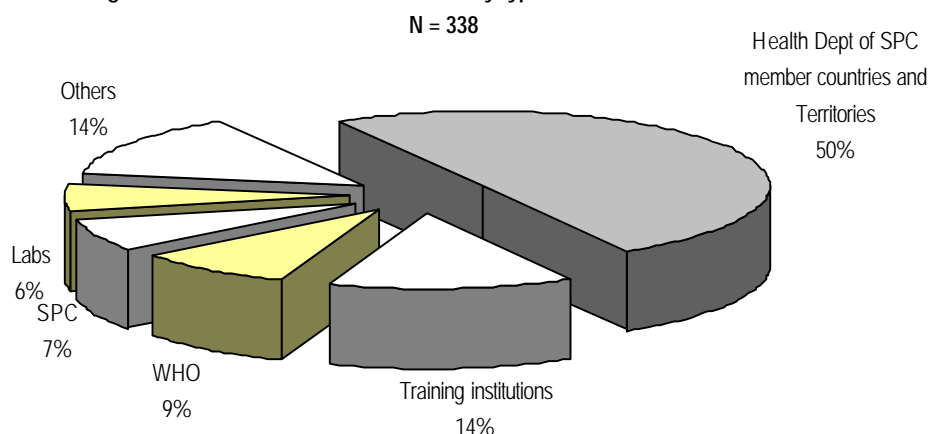


Fig. 3. Distribution of PACNET members, by type of institution, 31 Oct. 2000.



Yet today, the diseases selectively targeted by regional surveillance all readily lend themselves to recognised control programmes which combine prevention and control measures²⁰. As far as health professionals are concerned, one of the salient features of outbreak control is that it involves the skills of many practitioners²¹ drawn from a variety of public health disciplines, e.g. clinicians, microbiologists, epidemiologists, health inspectors, veterinary surgeons and entomologists, to name just a few of the most frequently concerned professions. Although the involvement of several disciplines may give rise to certain difficulties, particularly in terms of co-ordination and communications, it nevertheless does have the enormous advantage in public health terms of assembling a pool of skills and knowledge for the service of community health and with a single operational aim, i.e. controlling or preventing outbreaks. For those reasons, PPHSN needs to increase outbreak control effectiveness in the Pacific by developing available inter- and trans-disciplinary service networks and using them as a support base. In order to achieve this, the skills of those in the field must be strengthened, they must be able to exchange information and links need to be created between the skills of public health practitioners so as to be able to create the greatest possible synergy when responding to outbreaks.

Training, information, co-ordination, laboratory, clinical and preventive services - outbreak prevention and control clearly has everything to gain from the use of telehealth, which is designed to serve these objectives. By building on what already exists and enabling outbreak prevention and control to reconcile and reassemble a range of local and regional public health skills which all too often function separately and in isolation, both professionally and geographically, telehealth finds a relevant application area, which, although basically Pacific-oriented, can be actively broadened within PPHSN to include other partners in a realistic and constructive manner. It appears that the network's current dynamics and the services which PPHSN can now offer, demonstrate this double analysis.

It is common practice to describe outbreak prevention and control by breaking them down into three operational phases²², i.e.:

- Preparedness and alert;
- Verification and identification;
- Investigation and response.

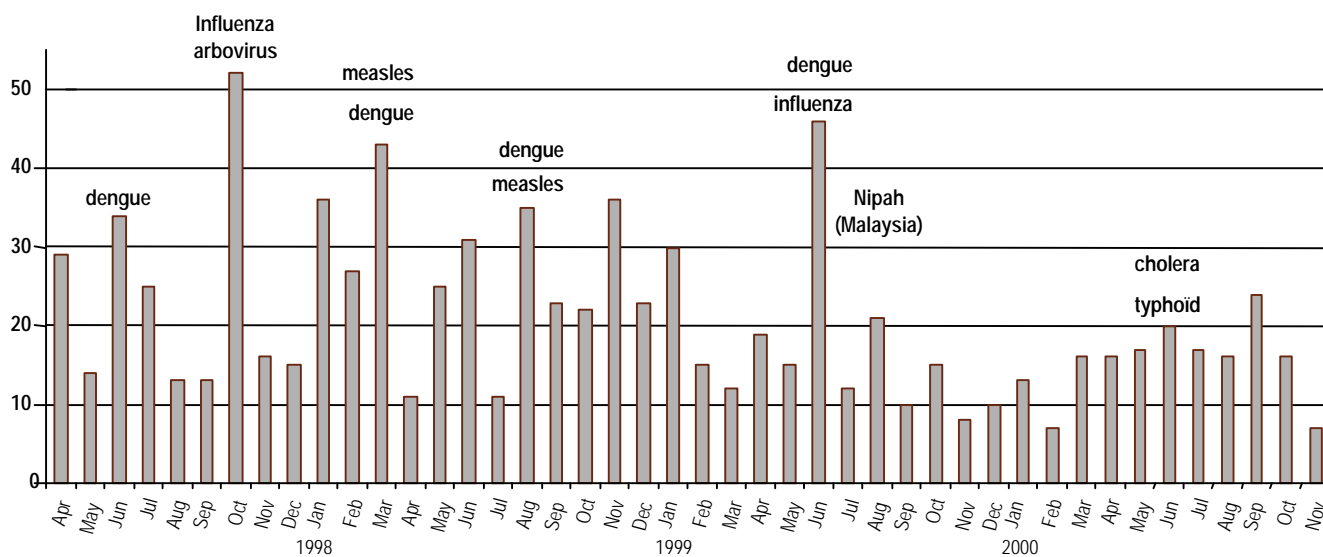
In the Pacific, from information to public health action²³, telehealth is regularly used for the alert and response stages. These interactions are examined below.

Preparedness and alert

The first task assigned to the Co-ordinating Body by the Pacific Island countries and territories was to set up an early-warning system for outbreaks likely to affect the Pacific. PACNET was launched in April 1997 with this aim in mind. It was an innovative and regional telehealth initiative designed to meet the requirements of a fast and economical communications network so as to facilitate the flow of health information in the region at a pace quicker than that of the epidemic. It was to provide easier access to adequate resources for Pacific health services which were, more often than not, ill prepared for outbreak threats. While PPHSN connected institutions to other institutions, PACNET connected individuals to each other. The technological support consisted of an e-mail based list server, relayed by fax, however, to about a third of the initial subscribers (26/83) in response to the access constraints of that era. At that time, all 22 Pacific Island health ministry and department heads were connected to PACNET by fax.

Today's situation is a far cry from those early stages. In less than four years and at a negligible cost for a development initiative²⁴, PACNET has extended its audience to nearly 350 health professionals, only five of whom are not connected by e-mail. While the Internet "epidemic" which broke out in the Pacific obviously gave a major boost to PACNET's scope, the merit of Coordinating Body members, particularly those at SPC, lies in their foresight and prompt

Fig 4. Number of PACNET messages, by month, April 1997 - Nov 2000



action in seizing this wonderful opportunity to practise telehealth correctly in the service of regional outbreak prevention and control. Besides a spectacular growth in the number of users, other indicators illustrate the quality of PACNET's audience and operations and the relevancy and degree of ownership of this Pacific outbreak alert and response network. At the risk of repeating some of the information provided elsewhere²⁵, an update is now in order and is provided in Figures 2 and 3.

The geographical breakdown of PACNET's membership (Figure 2) indicates that more than half of its members is based in PPHSN core-member countries and territories. By spreading towards Australia, New Zealand, the Philippines (WHO's Western Pacific regional headquarters), Hawaii and the United States of America, PACNET draws 90 % of its members within the rims of the great Pacific Island basin. This is an essential requirement for an effectiveness that has been recognised on several occasions. The system's potential for achieving this objective is also illustrated by the distribution of PACNET members according to their participating institutions' professional disciplines - in other words, in terms of the type of resources which could be made available to PPHSN (Figure 3). It is not surprising, then, that all the major domains covering the human, technical and financial resources which PPHSN requires to support the three operational phases of outbreak prevention and control can be found, i.e. SPC member countries and territories' health departments (50% of subscribers), international technical organisations (mainly SPC and WHO), public health laboratories, training institutions, professional networks and funding agencies.

"Over-information kills information" summarises one of the most frequent objections to modern communication marketing, particularly in the face of the flood of virtually

infinite amount of information available on the Internet and Web. Because of this, some professional networks have been dragged under by the sheer numbers of their members. This has not been the case with PACNET. The monthly tally of messages posted on the list since it was first opened (Figure 4) indicates that, not only is the volume of communications on PACNET unrelated to changes in the number of subscribers, but also that, against a background of about 10 messages a month, this volume varies in terms of regional epidemic activity or potentially dangerous outbreaks, such as the epidemic emergence of the Nipah virus in humans in Malaysia in 1999 or the influenza A(H5N1) virus in Hong Kong in 1997.

PACNET currently monitors six specific diseases: dengue fever, measles (targeted by the WHO Elimination Programme)²⁶, influenza, leptospirosis, typhoid fever and cholera. As previously stated, this is not a definitive list, but rather reflects a currently realistic compromise between the priorities established to meet the Pacific Island epidemiological context and those resources which are systematically placed at PPHSN's disposal, i.e. on a routine basis, as surveillance requires by definition²⁷. The other essential technical characteristic which could potentially add to the above list and which defines PACNET is the system's intentional sensitivity, which is partly the result of the decision to use syndromic surveillance, which, in turn leads to a wider possibility of monitoring other emerging and re-emerging communicable diseases. The surveillance approach recommended by the PPHSN's Coordinating Body with regards to PACNET involves monitoring both acute rash and fever (or even viral syndromes) along with diarrhoeal syndrome surveillance. Although this technical option guarantees a certain amount of flexibility for the surveillance network, the main reason for choosing it was to ensure timely communication of useful information, as highlighted at the

beginning of this article in relation to the various challenges facing surveillance in the Pacific.

Establishing the specific etiological (i.e. microbiological) diagnosis of an outbreak is not an easy task and requires experience, know-how and technical facilities. These resources are far from being available at all levels of health care services in Pacific Island countries and territories. Often, particularly for viral diseases, an ideal combination of these requirements simply does not exist at the local or even national levels. As a general rule, the farther towards the periphery of the health care system a site is located, the more limited the resources available to health care workers. In such cases, epidemiological surveillance must be able to adapt to circumstances or else risk contributing to the failure of public health services.

Overcoming professional and geographical isolation, quickly disseminating useful information and preparing for outbreaks are precisely what telehealth, when combined with clinical syndrome surveillance, can contribute to outbreak prevention and control. The *clinical* syndromic diagnosis of the infectious phenomena under surveillance represents useful and relevant information which, if made available quickly, can enable communities located at some distance from the outbreak's epicentre to take preparatory action or, even better, to prevent the epidemic from spreading to other Pacific Islands. When combined with PACNET as a telehealth facility, this is by far the most suitable information for the alert and preparedness phase as it makes it possible both to detect the outbreak threat early and to disseminate the information quickly to "those who need to know" so that decisions can be made and action taken at the initial response level. This is the first link in a long chain of systematic and scientific operations and decisions based on the broad principle of "information for action" which, in a nutshell, defines public health surveillance in general.

The effectiveness of outbreak control in the Pacific does, then, depend primarily on the performance of the system adopted in the initial alert phase, something which is also linked to the telehealth facilities used and, in general, to the crucial condition that the usefulness of surveillance information be defined in terms of available resources and in keeping with the content of the public health response, i.e.:

- sensitive clinical information constitutes the syndromic diagnosis and gives rise to alert and preparation;
- microbiological information provides the specific etiological diagnosis and makes it possible to decide on appropriate treatment and/or adequate preventive measures;



- epidemiological information, in particular, the findings of the investigation, sheds light on risk factors, contamination modes and transmission routes. It also makes it easier to modify and assess the preventive and control measures taken in the field²⁸.

At the same time, in a service network such as PPHSN, research becomes better targeted and its applications more effective, since they fit in better with outbreak prevention and control practices as the overall philosophy and aim can be more readily discussed and understood by all those involved.

This vital concept of information usefulness is emphasised because the response to an outbreak depends on the way information is used by decision-makers and those in the field. While the usefulness of information can only be clearly defined in a specific context, particularly with regards to telehealth, the way it is perceived by users will ultimately determine its usage. This serves as a reminder that PACNET can only be developed effectively as an outbreak alert and telehealth application system if it is tailored to the Pacific Island context. One category of users, i.e. PPHSN core-member decision-makers, recently -and rightfully- stated how they perceived the usefulness of sensitive information, i.e. that while getting the information out is important,

... epidemiological surveillance must be able to adapt to circumstances or else risk contributing to the failure of public health services.

PACNET must manage its growth and identify how to make this information more useful for those most directly concerned by it.

It cannot be overstated that PACNET was not designed "to be talked about", but rather "to be used for talking" in confidence and with the guarantees required for effective use of the information. While syndromic information is epidemiologically sensitive (and is, therefore, unrefined data as far as the cause of the outbreak is concerned), it is also sensitive in terms of human relations or even politics. It is easy to understand that the desire to quickly inform neighbours and clients of a country's health problems is accompanied by an equally strong desire to be able to do so under conditions which are clearly understood by all concerned so that communications will remain positive and constructive.

PACNET's information flow must, then, develop along three lines:

- the rapid communication of sensitive information (both in epidemiological and human-relation terms) for alert and preparedness purposes remains a priority, but this must be restricted to directly concerned senior decision-makers;
- syndromic information must be simultaneously verified and refined by PPHSN services (and thus become specific

in epidemiological terms) so that appropriate action can be taken;

- all PACNET members should, then, have access to specific, high quality information, including a summary of actions taken or the response envisaged for a reported epidemic outbreak.

These observations gave rise to a great deal of discussion among PPHSN Coordinating Body members with regards to the technical advances and operational changes needed to make this possible. The outcome of these discussions could be summarised as follows:

- SPC would draw up a restricted distribution list within PACNET itself comprising only the decision-makers from each health department or ministry within PPHSN core members (two or three persons to be identified) plus Co-ordinating Body members;
- PPHSN would build up a network of quality public health laboratories specialising in those diseases targeted by PACNET which could assist in verifying and identifying the suspected causes of outbreak alerts;
- all PACNET members would receive rapid and accurate information on reported outbreaks, confirmed diagnoses and actions taken and envisaged both in the field and at the regional level;
- collaborative efforts would be made as quickly as possible to develop the PPHSN Web site, including adequate documentation on preparedness for the targeted outbreaks (protocols, resources, contacts etc); this documentation would also be disseminated through appropriate channels on request or wherever circumstances require.

Of course, each of these measures involves improving telehealth epidemic control applications. All are designed to improve alert effectiveness, but they all also concern, to varying degrees, the different operational stages of outbreak prevention and control. The Public Health Laboratory Network is at the very heart of the so-called verification and identification phase. This involves PPHSN's most recent and most ambitious technical (and structural) advance and so what are its practical implications?

Verification and identification

In order to set up appropriate response mechanisms for a given epidemic, reliable and specific information is required. As mentioned earlier, this must involve verifying the nature of the outbreak and identifying the relevant infectious agent. This phase of outbreak control is largely dependent on access to quality public health laboratories.

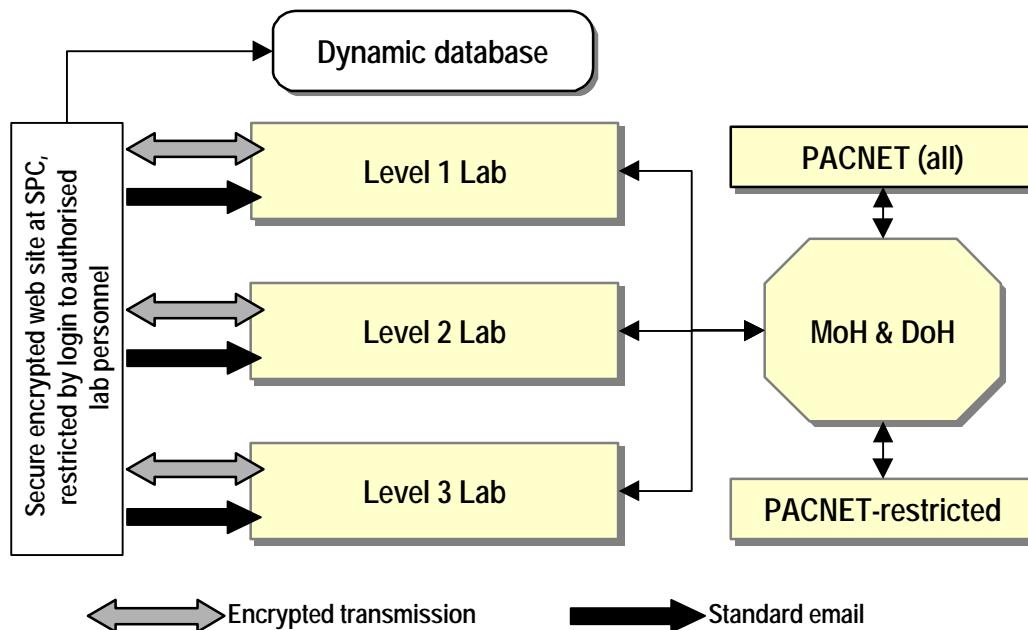
As the existing WHO Collaborating Centre network relied on highly specialised laboratories that were all located in industrialised Pacific-rim countries, the region's healthcare professionals had, for quite some time, dearly wished to see an additional network on a Pacific Island scale. The reason it took so long to put the project into place appears to be explained largely by a lack of multilateral consultation and an imbalance in needs and interests in terms of how the usefulness of the information required was perceived, i.e. between operational requirements in the field and the wider needs for research on emerging and re-emerging diseases. Finally, until recently, communication facilities were simply inadequate to the task. When PPHSN appeared on the scene, together with fresh potential for telehealth, a few Pacific Island laboratories did exist which had sufficient capacity and technical expertise to make this aspiration feasible after certain equipment and organisational adjustments. At the same time, WHO's most senior officials in the domain were putting into writing the Organisation's worldwide outbreak control vision in which they cited a handful of tangible global and regional partners which the Organisation could rely on for support in translating that vision into reality^{29,30}. Two PPHSN partner institutions were referred to by name, i.e. the US Department of Defence Global Emerging Infections Surveillance and Response System (DoD-GEIS) network and the Pasteur Institutes' international network, along with PACNET, which is often seen as being interchangeable with PPHSN by observers located outside the Pacific Island network. It appeared to be a good opportunity to take advantage of these global arrangements by adjusting them to suit the Pacific Island context.

In practical terms, the discussions held in 1998 between the World Health Organisation and SPC would extend and broaden in scope during the Pacific Telehealth Conference. During that meeting, one of the working groups outlined an action plan which was immediately assigned to the PPHSN Co-ordinating Body in a view to setting up a Pacific public health laboratory network.

The first stage of assessing existing Pacific Island capacities, was assigned to New Caledonia Pasteur Institute (*Institut Pasteur de Nouvelle-Calédonie* - IPNC) specialists with the technical and financial support of WHO³¹. The Coordinating Body was then to identify the ideal configuration and technical and financial requirements for setting up the Pacific Public Health Laboratory Network based on the conclusions of the regional assessment. With this aim in mind, SPC and WHO jointly organised the Inaugural Meeting of the PPHSN Public Health Laboratory Network on 19 and 20 April 2000. After the meeting, attended by the Coordinating Body members, the representatives of the various

While syndromic information is epidemiologically sensitive (and is, therefore, unrefined data as far as the cause of the outbreak is concerned), it is also sensitive in terms of human relations or even politics.

Fig 5. PPHSN: development of the information flow



institutions involved and their host countries and territories, a service network adapted to existing priorities was established. While intentionally Pacific Island-based as an overriding priority, this network is also supported by Pacific-rim sponsors, in keeping with PPHSN's approach to development.

The system is called LabNet and comprises three geographical access and service delivery levels:

- Level 1 includes the central laboratories of PPHSN member countries and territories.
- Level 2 is regional and draws on the capacities of four Pacific Island laboratories, i.e. the National Centre for Scientific Services in Virology and Vector-Borne Diseases in Fiji, the Guam Public Health Laboratory, the New Caledonia Pasteur Institute and the Malardé Institute in French Polynesia.
- Level 3 is international and relies on WHO Collaborating Centres located in Australia, i.e. Melbourne (Victorian Infectious Disease Reference Laboratory, VIDRL) and Brisbane (Queensland Health Scientific Services); in New Zealand³² and at the US Naval Medical Research Unit, NAMRU 2, based in Jakarta, Indonesia (a member of the DoD-GEIS network).

Its overall framework encourages and facilitates movement between increasingly sophisticated performance levels. Once again, networking between pre-existing structures has provided a system which is more flexible and complex than a simple approach where technical performances strictly depend on geographical levels, only one of the possible solutions. In the Pacific Island context, care must be taken not to systematically mix referral levels, geographical closeness and available service delivery levels.

For practical purposes, IPNC is considered a Level-1 laboratory for New Caledonian purposes, a Level-2 laboratory for general purposes (although it should be easier to access for Vanuatu than Palau) and Level 3, for example, for a leptospirosis diagnosis confirmation request, regardless of where it originated. On the other hand, depending on the air-transport facilities or the prevailing economic and cultural situation at the time, the Cook Islands Laboratory can refer its requests to either the Level-2 laboratory located in Fiji, the Malardé Institute in French Polynesia, or even directly to the Level-3 laboratory in New Zealand. As a final example, Nauru can choose, depending on circumstances, between Fiji, Guam and Australia, to name but a few of the well-served airline destinations from Nauru.

There are many possible scenarios depending on the circumstances surrounding any particular outbreak. For the time being and for the purposes of ensuring that the implementation of an operational LabNet network is monitored and overseen, a Technical Working Body (TWB) made up of SPC, WHO and Pasteur Institute International Network representatives (in practice, IPNC) has been assigned the task of facilitating and co-ordinating the network. The Technical Working Body reports to the PPHSN Coordinating Body via SPC, its Focal Point.

In addition to the collective efforts towards organising LabNet described in detail, mention must also be made of the World Health Organisation's significant contributions in equipment – both in terms of strengthening the Level-2 laboratories in Fiji and Guam and the provision of dengue fever rapid diagnosis kits to national laboratories at Level 1.

What telehealth applications should LabNet use?

With regards to a communications infrastructure, the Inaugural Meeting of the PPHSN Public Health Laboratory Network recommended the following in its action plan³³:

“Develop necessary infrastructure to support communication policies and procedures of the PPHSN LabNet:

- Maintain PACNET-Lab for on-going discussion of developmental issues among an extended working group
- Establish PACNET-Restricted [distribution list] for verification of outbreaks
- Make available a secure server at SPC
- Develop customised website for the exchange of encrypted information within PPHSN LabNet
- Develop dynamic database that documents all website activity and provide system for monitoring/analysis of usage
- Establish QC system to trial/monitor/revise above system
- Upgrade capability of all PPHSN LabNet users to use above Internet-based system (dedicated equipment, sustainable access to the Internet, training, technical support).”

PACNET-LAB is an e-mail list which shares the PACNET server. It was created in December 1998 to enable a regional working group established by the Pacific Telehealth Conference and appointed by the PPHSN Coordinating Body to continue work on setting up the public health laboratory network. After becoming inactive for several months, LabNet’s launching caused SPC to “revive” PACNET-LAB in November 2000, in response to the above recommendation. PACNET-LAB currently has 19 members representing the Technical Working Body’s member institutions and all Level-2 and 3 LabNet laboratories. The messages shared on the list concern technical and operational problems related to the on-going implementation of LabNet.

PPHSN’s various technical and structural advances must, of course, be mirrored by a corresponding flow of information shared within the network. The recommendations made by the LabNet Inaugural Meeting indicate the basic outlines³⁴. Figure 5 illustrates its basic operational thrust.

Without going into great detail, the effects of developing the “verification and identification” stage within PPHSN, both on an increase in the surveillance information flow and on the shared information’s confidentiality and security, can clearly be discerned. The system’s key users are senior health department professionals in Pacific Island countries and territories. The network must enable the best possible

surveillance information to be circulated and used as close to the grassroots as possible, i.e. where the problem and the public health response to it are both located. All PPHSN development efforts, whatever they may be, must work towards this goal.

The reality in the field is the best proof. Only actual usage of a model can demonstrate its relative usefulness in practice, thereby allowing it to be improved or modified. Less than two weeks after LabNet was launched, a cholera outbreak struck Pohnpei in the Federated States of Micronesia³⁵, thereby providing an opportunity to get a glimpse of the new strengths PPHSN can use to make further progress towards its goal. The excellent co-operation which was established between the Pohnpei Hospital, where the cholera vibrio was isolated; the Guam Public Health Laboratory, which serotyped *V. cholerae* O1 Ogawa; and the New Caledonia Pasteur Institute, which biotyped *V. cholerae* O1 Ogawa El Tor, confirmed that the newly adopted public health laboratory network could function efficiently in practice.

This cholera outbreak also made it possible to test restricted-access information for the first time. Selected items from the preliminary outbreak investigation report were placed on a secure page at the SPC Web site. Only PACNET members could obtain access keys by means of an express personal request. The trial, which was conducted under emergency conditions, proved highly informative and conclusive in terms of data security, even though it differed from, but was complementary to, the technological medium (i.e. e-mail) which will be used by the future restricted distribution list – a PACNET sub-network for unconfirmed outbreak alerts.

Finally, the public health crisis which affected Pohnpei was also an opportunity for the Coordinating Body and, by extension,

PPHSN, to assess what its operational response potential to an epidemic actually was “in the heat of the action”, i.e. its ability to instantly provide support to local skills, where necessary, and to prepare for the future.

Investigation and response

Early investigation of epidemic threats or outbreaks is an integral part of a systematic response and is one of public health’s primary protection measures.

Investigation provides better information on the nature of the attack and serves as the initial inter-disciplinary link between clinicians, field epidemiologists, microbiologists and decision-makers. Developing and maintaining effective investigation and response capacities are the most funda-

In the Pacific Island context, care must be taken not to systematically mix referral levels, geographical closeness and available service delivery levels.

mental challenges of outbreak prevention and control. Today this also involves a decisive commitment at both the field and regional levels to gain control of public health development in the Pacific Islands.

Why place such emphasis on the investigation and response phase?

This is the stage at which the full implications of outbreak prevention and control and the essential soundness or deficiency of the package of measures making up such control are articulated in practical terms. The ultimate aim of control measures resides in the actual battle against and the complex response to an outbreak threat or attack. Unless an appropriate response is made, all other efforts are futile and the crisis gains the upper hand.

The essential ingredients for success are appropriate and properly co-ordinated resources, communication facilities and informed decision-making. The *links* between players and resource *complementarity* are clearly vital. When an outbreak occurs, applying the universal action principle of "protecting public health", which is our professional community's driving force, directly depends on interdisciplinary links among the various public health practitioners, on cross-disciplinary links between practitioners and decision makers and on accessible resources. Such links must exist or be forged and they must be reliable: available resources and the links that tie them together must be both trusted and used if the outbreak's advance is to be halted by the net they form. This applies at all levels, whether local, regional or global, regardless of geopolitical boundaries, for which epidemics show little respect. It is an inescapable fact, however, that the battle takes place chiefly in the field. That is where it all happens and that is where the outcome will be seen, whether it is satisfactory or disastrous.

By strengthening national capacities, PPHSN can help bolster regional outbreak investigation and response capacities as a whole. The Pacific Public Health Surveillance Network will thereby contribute towards ultimately providing the Pacific Islands with the resources they require to better maintain the health balance in their communities. Achieving this aim requires ensuring an on-going supply of the resources needed for this key phase through the provision of services which sustainably work towards the following:

- developing human resources;
- establishing an interdisciplinary approach and encouraging cross-disciplinary interaction;
- encouraging active partnerships and the mobilisation of the resources available in the region.

The Coordinating Body plays a vital role in this area by proposing appropriate measures and plans and endeavouring to transform them into concrete actions by harmoniously rallying both the energies available within the CB itself and the resources available to the Pacific network as a whole. Following a WHO proposal, the Body is currently working on a third practical network application after PACNET and LabNet, known as EpiNet. This project matches the aims and three development orientations of the investigation and response phase as outlined above, in both spirit and configuration. EpiNet involves setting up small interdisciplinary units at the national level with three or four public health practitioners each aimed at strengthening domestic and regional capacities by integrating training into the networking of Pacific epidemic investigation and response expertise. In other words, by combining and harmoniously structuring the efforts of a number of different parties over the years to promote public health surveillance with training resources (in applied epidemiology as well as general public health practice), EpiNet would contribute to gradually building up a real pool of Pacific Island-oriented expertise, which is exactly what the heads of Pacific health departments have requested time and again. With PPHSN already well established, such a network application, running alongside existing services, would complete the Pacific Public Health Surveillance Network's technical framework.

While EpiNet is scheduled for the immediate future, recent PPHSN endeavours also clearly and abundantly illustrate the various practical measures taken by Coordinating Body members with a similar aim in mind, particularly training activities and the formation of investigation and response teams under PPHSN's umbrella.

Training in applied epidemiology and general public health practice is definitely one of PPHSN's major policy thrusts and one which shows the most promise for progress in the Pacific, whatever the operational facet of outbreak prevention and control under consideration. It is also an area in which telehealth offers considerable advantages and should produce enormous benefits, particularly in the Pacific Island context, through the development of distance education and training. As this approach has already been discussed at length elsewhere in this issue of *Pacific Health Dialogue*³⁶, no detailed analysis will be provided here. Commentary will be restricted to field training, particularly as it combines acquiring and exchanging professional knowledge, attitudes and practices. Concrete application of field training in outbreak crisis situations is a prominent feature of models such as Field Epidemiology Training Programmes (FETP) and Public Health Schools without Walls

The essential ingredients for success are appropriate and properly co-ordinated resources, communication facilities and informed decision-making. The *links* between players and resource complementarity are clearly vital.

(PHSW), now commonly provided in the Asia-Pacific region and throughout the world. The same concept was referred to when the Coordinating Body began contributing to outbreak investigation and response activities in the Pacific Islands as part of PPHSN services.

An effective response to a typhoid fever outbreak was made in Nauru in April 1999 through the joint efforts of Nauru national health authorities, WHO, the Fiji School of Medicine, the CDC³⁷ and SPC. When the Federated States of Micronesia (FSM) were stricken by a cholera outbreak, partners' resources were swiftly mobilised amongst Coordinating Body members, namely FSM National and Pohnpei State health authorities, CDN/ANZ, Fiji School of Medicine, WHO and SPC, leading to an exemplary regional response. Three regional practitioners were recruited for the investigation team within 48 hours and reinforcements arrived in the field within a week of the FSM Government's request. In each instance, the funding required to place the interventions under PPHSN's umbrella was raised through close partnership between SPC and WHO. In both Nauru and Pohnpei, investigation and control teams set up by the Coordinating Body were made up of Pacific Island public health practitioners and seasoned experts for two reasons:

- to provide swift support to local capacities;
- and, to sustainably strengthen the Pacific Islands' capacity to prevent and control outbreaks, through field training.

Such training opportunities must be capitalised on more often and set into a formal institutional framework which guarantees the sought-after results, i.e. quality supervision and assessment, immediate effectiveness in outbreak crisis resolution, academic recognition for the professional experience acquired and a shared desire to repeat and perpetuate such services. This is fertile soil in which the network of Pacific Island specialists can put down its roots.

The threat of outbreaks, however, continues to loom large and there can be no hope that it will fortuitously disappear, even temporarily. In the overwhelming majority of cases, Pacific Islands which are stricken by an epidemic are currently forced to call upon outside assistance, regionally and/or beyond the Pacific basin. Today it is important to emphasise that, in light of current PPHSN's projects, such requests for help should be made in close partnership with the PPHSN Coordinating Body. No outside assistance, even if basically motivated by a desire to take swift action, should replace or be carried out to the detriment of the goal of strengthening local and regional capacities. Rather, it should consistently be tied to this goal so as to lessen the need for such requests in the future. The whole issue is the responsible drive of public health development in the

Pacific. It cannot be overstated that available resources and the links that tie them together must be both trusted and used if the outbreak's advance is to be halted by the net they form.

The use of telehealth in outbreak investigation and response will contribute to this aim, even if in a less "spectacular", though just as relevant, way (compare with previous operational phases), by ensuring information sharing, outbreak monitoring and follow-up among the various players, by facilitating coordination of both decisions and operations in real or almost real time despite distances, and by making it possible to provide distance education in outbreak prevention and control in the very theatre of future or current operations.

In mankind's unending quest to achieve a balance in public health, competition with microbiological life is an intrinsic, age-old constant, which must never be put aside.

Attacks and related responses evolve against a multidimensional background of population, space and time. It is up to us to come up with the right answer at the right time and

the right place, using today's resources, enlightened by yesterday's experience and prepared for tomorrow's challenges.

Conclusion

We have now arrived at the end of this overview, in which the questions about the Pacific Public Health Surveillance Network raised in introduction have, for the most part, been answered even if in just basic terms, i.e.: What services does PPHSN currently offer? What are the major avenues for potential advances? Where does telehealth stand in regard to these two areas? It is hoped that this overview has shed some light on what we feel to be the foundations of the Pacific Public Health Surveillance Network and the advances it has made.

Pacific Island context

The Pacific Island context comes first: it is the network's motivating force as well as the overriding and determining factor for current and future efforts. As a dynamic expression of historical, geophysical and cultural networking practices and as the regional application context, it also offers considerable potential for orderly and sustainable development in outbreak prevention and control, as long as the network itself remains predominantly Pacific-island oriented.

It would be a breach of professional ethics to allow telehealth practice's potential pitfalls, generally speaking, to be glossed over.

Telehealth

Modern information and communication technology has made telehealth possible in a network configuration, which has, by the same token, moved health information and public health surveillance into a time-space dimension that lends itself better to outbreak prevention and control in the Pacific Island setting. Because it strategically meets the needs of the Pacific and its machinery is conducive to forging and improving links across the region, telehealth is at the founding origins of PPHSN and holds great promise for appropriate development in public health surveillance.

The importance of cultural and professional ownership and the pertinence of telehealth applications in the Pacific Island context has been emphasised. It would be a breach of professional ethics to allow telehealth practice's potential pitfalls, generally speaking, to be glossed over. Whatever applications are encouraged, it is vital not to reduce telehealth to "easy" access to equipment whose high maintenance costs could prove difficult to support over the medium term or to specialists located in Pacific-rim countries, even if such resources are currently provided free-of-charge. Responsible management of public health development in the Pacific requires that the region's intrinsic island resources be developed in priority. All telehealth applications must be coupled with and sustain the development of appropriate training programmes, obviously using distance education whenever appropriate. The economic logic that goes along with globalisation currently impacts on health services management with reforms aimed at rationalising government spending. Pacific Islands must, then, guard against any avoidable economic dependence which will inevitably result from the possible privatisation of outside (distance) technical services, which today are "free", but tomorrow could well be swept over by the all-encompassing tide of economic realism.

In regard to telehealth, it should be stated in these closing paragraphs that telemedicine, as a specific application, has deliberately not been discussed in depth. With the Western Pacific HealthNet, telemedicine in the Pacific has become one of two well-established regional applications of telehealth. While initially almost totally restricted to a Micronesian zone located north of the equator, thereby reflecting PBMA membership, WPHNet is now beginning to spread into the South Pacific with the Fiji School of Medicine's acting as a new stakeholder. Although it is both conceivable and desirable that telemedicine play a role in public health surveillance and occasionally be involved in outbreak control by providing assistance with diagnoses

and case management, for example, its scope, while complementary, remains somewhat removed from clinical practice in outbreak situations, both in terms of practice and published material³⁸. For that reason we decided to keep discussions here relevant to our area³⁹. We cannot, however, leave the topic without mentioning the request for further information made in March 1999 in Palau by the WHO Meeting of the Ministers and Directors of Health of the Pacific Island Countries. Participants at the meeting conveyed their desire for further clarifications and requested that WHO and SPC provide more detailed information on the cost-effectiveness of telemedicine, particularly over the long term. The potential problems arising from the adoption of some sort of universal model and the difficulties in securing long-term resources for it were correctly identified as major risks which needed to be better understood – particularly in complex situations as can occur in some Melanesian countries. As had been the case with sensitive information during outbreak alerts, the question here was how decision-makers perceive the tool's usefulness.

Outbreak prevention and control

Because outbreak prevention and control must, in order to be effective, run both between and across disciplines, it is also a basic element in the development of health services and the activities of networks such as PPHSN. Outbreak prevention and control forges links and strengthens or highlights them.

When an outbreak occurs, the various health practitioners, decision-

makers and communities are abruptly faced with the compelling importance of a holistic approach to health and realise how difficult it is to strike a balance. Unless the required effort is made to acknowledge this and to work together effectively, they become overwhelmed by the epidemic, which inevitably results in a fairly serious social, and often political, crisis. In both success and failure, it is in the actual practice and analysis of outbreak prevention and control that many players "rediscover" the fact that public health is a field for action which reaches far beyond the all-too-widespread stereotypes, both narrow and mistaken, of bureaucracy versus medicine, of an epidemiologists' exclusive preserve or an area which only concerns health professionals. In the absence of any obvious problem, this perception is difficult to overcome when strengthening outbreak prevention and preparedness is involved.

In general, both surveillance and outbreak prevention and control benefit greatly from telehealth applications and are perfectly suited to the networking concept. The latter fact, in particular, has made it possible to incorporate

Although it is both conceivable and desirable that telemedicine play a role in public health surveillance and occasionally be involved in outbreak control by providing assistance with diagnoses and case management...

several functional configurations (e.g. PACNET, LabNet and EpiNet) within a single structural arrangement, i.e. PPHSN. The challenge is to continue working towards greater operational integration in the face of the somewhat artificial picture of outbreak prevention and control as being divided into three easily distinguishable technical phases, both in terms of practice and chronology. In the final analysis, there is just one single movement and one single professional network. In reality, particularly on a regional scale, the phases overlap in time, cut across functional distinctions, and require common resources, particularly human ones (interdisciplinarity and practitioners skilled in a number of fields). Still further on the topic of potential advances, the structure of the PPHSN should be taken advantage of in order to channel efforts devoted to integrating operations between disciplines towards two cross-disciplinary components of outbreak prevention and control, i.e. education and research, so as to increase their Pacific Island appropriateness and ownership.

Finally, it would appear essential to underline the regional pattern of communicable diseases and outbreaks in the Pacific, in contrast to the improvements made and the progress yet to be achieved through and within the Pacific Public Health Surveillance Network. History and current events, such as the cholera re-emergence in Micronesia, show undeniably that outbreak prevention and control in the Pacific can only be successful if it is conducted on a regional basis. It is for this reason that outbreak prevention and control is a vital cornerstone of the Pacific Public Health Surveillance Network. This justifies co-ordinating PPHSN members' efforts against epidemics in such a way as to favour the sustainable development of regional outbreak prevention and control capacities in a view to achieving greater public health balance in the Pacific.

References

1. SOUARÈS, Yvan, PPHSN and PACNET: the Pacific Islands are now tuned into the 21st century, *Pacific Health Dialog*, vol. 5, n° 1, March 1998, pp. 200-204
2. The Pacific Community (formerly the South Pacific Commission - SPC) is an intergovernmental organisation, which currently has 27 member countries and territories. Founded in 1947, it is the oldest regional organisation. Its headquarters and secretariat are located in Noumea, New Caledonia, and it has a large branch in Suva, Fiji. The SPC's mandate is to enhance the social and economic development of Pacific Island peoples and so it has developed a number of programmes in this regard. The Public Health Surveillance and Communicable Diseases Control Section is part of the Community Health Programme. It played a decisive role in setting up PPHSN and currently serves as the Focal Point for the Network's Coordinating Body.
3. BONNEMAISON, J., *The tree and the canoe: history and ethnography of Tana*, South Sea Books, University of Hawaii Press, Honolulu, 1994, p. 105
4. I hope my friends, colleagues and other Pacific Island readers will forgive me for speaking in such terms at this time of questioned identities and citizenship across Oceania. They will understand that any summary is fraught with shortcuts and omissions due in part to my fragmentary experience of the Pacific. I have expressed my personal perception and interpretation of the Pacific Island context in very general terms simply to explain the bases for developing a Pacific outbreak surveillance, prevention and control network. I take full responsibility for any bias and subjectivity and accept any objections. I have no intention whatsoever of presenting these thoughts as universal and or dogmatic truths and would be more than willing to discuss them at any time, as an opportunity to share views, learn more and make whatever contribution I can.
5. Other macroscopic characteristics which are more restricted in time but which have a major impact, e.g. urbanisation, alter population density and can thereby disrupt contamination and transmission modes and the overall impact of infectious diseases. This is not, however, a specifically Pacific phenomenon, but rather a product of globalisation.
6. As outbreak-related phenomena show no consideration whatsoever for geopolitical boundaries, any improvement in outbreak prevention and control in the Pacific Islands also represents a direct health advantage for Pacific-rim countries and for the greater Asia-Pacific region and indirectly serve the global campaign to control emerging and re-emerging diseases.
7. For an overall view of detailed references, please consult the various papers and sections which make up this issue of *Pacific Health Dialog*
8. Reducing the "human cost" resulting from disease, death or disability is considered to be included in actions to improve public health.
9. For further details see Norton, Scott A *et al*, *Telemedicine in Micronesia, Public Health Surveillance in the Pacific*, Secretariat of the Pacific Community, Noumea, 1998.
10. Setting up an early warning system for a limited number of acute risk epidemic diseases (e.g. initially: dengue fever, measles, influenza and cholera) was one of the priorities identified at the PPHSN's founding meeting in December 1996. Cf SPC/WHO Pacific Islands Meeting on Public Health Surveillance, Conference Report, Secretariat of the Pacific Community (SPC), Noumea 1998.
11. Also in this issue, see Jan PRYOR's article, *Telehealth in the Pacific Islands: a perspective and update from the Fiji School of Medicine*
12. Pacific Telehealth Conference, PACNET/Western Pacific HealthNet, Report of Meeting, p. II. Objectives, Secretariat of the Pacific Community (SPC) Noumea, 1999
13. SOUARÈS, Yvan; SAUVE, Laura, Harmonisation of regional health data: requirements in the Pacific, *Public Health Surveillance in the Pacific*, Secretariat of the Pacific Community, Noumea, 1998
14. Interagency Meeting on Health Information Requirements in the South Pacific, Conference Report, South Pacific Commission, Noumea, 1997
15. I would like to admit here how much, in spite of its colourful, systemic meaning, this technical jargon can appear out-

dated, today even more so than in 1995. As elsewhere, in the Pacific, more widespread access to modern telecommunications technology has, in large part, made possible the accelerated development of many collateral information circuits, multidimensional in time and space. Consequently, networking structures are laid out and will increasingly be laid out in modern alternatives which are much more flexible and efficient – in terms of the rapid dissemination of information for decision-making and response purposes – than the classic health information system (vertical, pyramidal and centralising) taught and used up to now. It is precisely this alternative approach which supports the development of telehealth.

16. The Federated States of Micronesia, Fiji, New Caledonia, Samoa and the Solomon Islands currently serve as core members. The Fiji School of Medicine, SPC, WHO, UNICEF, CDN/ANZ network and the Australian National University's National Centre for Epidemiology and Population Health (NCEPH) are the allied members, with the latter two Australian institutions, i.e. CDN/ANZ and NCEPH sharing a single representative.
17. Although there have been some attempts to hold biannual meetings, as had been recommended by the Sixth Coordinating Body Meeting, the members' work calendars make this an uncertain practice. Most often these meetings are organised during regional conferences, seminars or other workshops in order to streamline expenses. Between December 1995, i.e. the date when the Regional Working Group on Public Health Surveillance was created) and December 2000, Coordinating Body members met a total of six times.
18. At the end of the year 2000, only the health departments of Tuvalu, Nauru and Pitcairn were not connected to PACNET by e-mail.
19. McArthur Norma, *Island Population of the Pacific*, Canberra, Australian National University Press, 1967
20. Dengue fever, measles, influenza, leptospirosis, typhoid fever and cholera
21. According to the dictionary, "one who practices a profession" as opposed to a "theoretician" and giving the word an initial meaning which goes far beyond a simple "doctor (or surgeon), one who practices or specialises in the healing arts", also mentioned to oppose it in the same way to "researcher, theoretician"
22. Such a presentation is mainly justified by a desire for greater clarity. In practice, these three phases are very interwoven and both their chronology and the resources needed for each are often superimposed or melded. In a humorous way (if you appreciate humour!) an almost anatomical analogy can be seen in this division: the head which observes and perceives the alert; the body and its microscopic truths; the legs and footprints of those running around in the field... in the image of the famous "shoe leather" epidemiologists. In passing, I might also mention, bare feet or "flip-flops" also work for this analogy!
23. "Information for action" is the shortest and most commonly agreed on functional definition of surveillance in the small world of field epidemiologists.
24. For more than two years, from April 1997 to September 1999, PACNET operated through use of a freeware available on the Web and was housed in the SPC Fisheries Department's server. PACNET now uses a more sophisticated commercial software programme and is housed on the SPC Health Department's common server. List management and administration is still conducted by the Public Health Surveillance and Communicable Diseases Control Section and maintenance of the computing system is carried out by the SPC Information Technology and Communications Section. Since its inauguration, investment and equipment maintenance costs for PACNET itself have been less than US\$ 5000. Its specific operating costs, mainly related to work time spent on the list itself and on the computer system are difficult to assess as they form part of the overall duties of the people involved. No doubt, however, that they are still minimal, both in terms of the work time and the benefits reaped for public health in the Pacific.
25. SOUARÈS Yvan, PPHSN and PACNET [...], op. cit.
26. The Pacific Island region is well integrated into the Programme as no cases of measles have been reported in the region for more than three years now.
27. "Public health surveillance (sometimes called epidemiological surveillance) is the on-going and systematic collection, analysis, and interpretation of outcome-specific data essential to the planning, implementation, and evaluation of public health practice, closely integrated with the timely dissemination of these data to those who need to know. The final link of the surveillance chain is the application of these data to the control and prevention of human disease and injury" THACKER, Stephen, in *Field Epidemiology*, edited by Gregg Michael B., Oxford University Press, New York, 1996.
28. Clinical and epidemiological aspects can also, in certain circumstances, strongly orient diagnosis towards a precise etiology; this is even more so the case as public health practitioners have clinical and epidemiological data and their interpretations are based on all this information. However, these can only be clues and not the irrefutable proof provided by microbiology... in a specific clinical and epidemiological context.
29. HEYMAN, David & RODIER, Guénaël, Global Infectious Disease Surveillance, Fact Sheet no. 200, WHO, June 1998
30. HEYMAN, David & RODIER, Guénaël, Global Surveillance: An Essential Public Health Instrument, Emerging Infectious Diseases, vol. 4, no. 3, July – September 1998, p 363 – 365
31. O'LEARY, Michael, Towards a Pacific Public Health Laboratory Network, Inform'ACTION, no. 6, March 2000, pp 13 -15
32. Our New Zealand colleagues will need to specify the extent to which the Institute of Environmental Science and Research (ESR) and Pacific Paramedical Training Centre (PPTC – also a WHO Collaborating Centre) will each be involved in the PPHSN's Public Health Laboratory Network. Both institutions contributed with interest and in tandem to the Inaugural Meeting.
33. Inaugural Meeting of the PPHSN Public Health Laboratory Network, Draft Report, SPC/WHO, Noumea, April 2000
34. Below is a summary of the challenges identified, as grouped under three broad outstanding problem categories:
 - Making diagnostic resources accessible: compliance with current international air-freighting requirements for bio-

logical samples, quarantine legislation and on-going funding mechanisms;

- Providing effective and secure information circuits: confidential distribution of sensitive information and material, bio-ethical framework and intellectual property right observance
- Setting up reliable and sustainable services: on-going domestic and regional capacity building, ie training programmes, appropriate equipment and quality control mechanisms

In order to successfully take up the above challenges, PPHSN will have to progressively reach out to new partners such as airline companies, national and regional quarantine authorities, i.e. the Pacific Plant Protection Organisation (PPPO), the World Intellectual Property Organisation (WIPO), etc.

35. The first cases were diagnosed by Pohnpei Hospital clinicians at the very time that the Inaugural Meeting of the PPHSN Public Health Laboratory Network was being held.
36. Adjustment of training materials to suit the Pacific environment, distance education and harmonisation of the various existing training forms, i.e. initial and continuing training, against the background of a regional field epidemiology training project. See, inter alia, Tom Kiedrzinsky's contribution on this topic in *Regional Training in Public Health Surveillance: How far are we? An SPC perspective*.
37. Centers for Disease Control and Prevention, Department of Health and Human Services (DHHS), a US Government technical agency.
38. As a telehealth application, telemedicine has generated by far the most written material (i.e. publications) in world health professional circles, judging by the references identified. Not one classified under "telemedicine" mentions clinical practice in connection with an outbreak situation of infectious origin.
39. This issue of PHD carries many contributions from various colleagues providing in-depth discussions of those telemedicine applications they are familiar with. •

Most powerful is he who has control over himself
Seneca (Roman philosopher) 4 BC - 65 AD