

# Improving human and environmental health in urban informal settlements: the Revitalising Informal Settlements and their Environments (RISE) programme

Rebekah Brown, Karin Leder, Tony Wong, Matthew French, Diego-Ramirez-Lovering, Steven L Chown, Steven Luby, Tom Clasen, Daniel Reidpath, Mohamed El Sioufi, David McCarthy, Andrew Forbes, Julie Simpson, Pascale Allotey, Bruce Cahan



Urbanisation is a major demographic trend globally. Urban informal settlements account for much urban growth, with nearly 1 billion people currently living in informal settlements and 2 billion having inadequate water and sanitation services.<sup>1,2</sup> Polluted water and inadequate water supply, sanitation, and hygiene cause around 80% of diseases and one in four deaths in low-income countries.<sup>3</sup> Projections indicate that, unless radical changes are made, more than 3 billion people will live in urban informal settlements by 2050.<sup>1</sup> Informal settlements exacerbate the inextricably linked challenges of sanitation, water provision, environmental degradation, and public health. Conventional, centralised trunk water and sanitation approaches to these challenges have changed little in 150 years; come at major financial, environmental, and social costs; and frequently overlook informal settlements.

Part of the Wellcome Trust's Our Planet, Our Health funding programme, the Revitalising Informal Settlements and their Environments (RISE) programme is empirically testing an alternative, water-sensitive-cities approach to upgrading informal settlements that integrates environmentally sustainable and socially inclusive design with management of the water cycle, benefiting human health and urban ecosystems.

The RISE hypothesis is that changing the physical environment and improving water servicing will enhance psychological, social, and economic outcomes in informal settlements, resulting in further benefits to human health and wellbeing. The programme is empirically testing whether water-sensitive revitalisation leads to improved physical characteristics, including altered microbial and biological diversity, bioacoustics, greenness, and flood hazards, and decreased potential for vector breeding and pathogen contamination. Additionally, the programme is investigating whether the interruption of faecal–oral transmission reduces infection, leading to reduced enteric inflammation and carriage of drug-resistant gene markers, increased diversity of the gastrointestinal microbiome, and increased responsiveness to oral vaccines.

RISE is upgrading 12 settlements in Makassar, Indonesia, and 12 in Suva, Fiji; each site comprises an average of 50 dwellings, assuming five to six people per dwelling, with a total of 6000–7200 people. This intervention scale and sample size will ensure statistical power to assess primary health and environmental outcomes. The research programme uses a parallel-cluster, randomised controlled trial design, with plans for stratified randomisation by tidal versus non-tidal sites. Six settlements in each of Suva and Makassar will be randomly

assigned to the intervention group and six to the control group. Environment and human health monitoring will be undertaken for all settlements for 24 months after implementation of the intervention to monitor and assess the effects on primary outcomes.

In close consultation with government stakeholders and communities, RISE has developed a community co-design process that facilitates residents' involvement in planning and design, and addresses each individual sites' unique bio-physical opportunities and constraints. The programme has established one pilot site in each country for trialling and fine-tuning the implementation of the water-sensitive interventions (eg, constructability). These also serve as demonstration and stakeholder-engagement platforms during the co-design phase of the programme.

The RISE programme is pioneering a new approach to informal settlement upgrading that is underpinned by the emerging discipline of planetary health. It will provide new evidence linking environment and human health in some of the world's poorest and most vulnerable urban environments. Implementation in Fiji and Indonesia is ongoing, and baseline data will be available in mid-2018. Valuable lessons have been learned during the first year of implementation. These include how to operationalise meaningful interdisciplinary research across diverse disciplines, comprising science, engineering, medicine, architecture, urban design, economics, sociology, anthropology, and international development.

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## Contributors

All authors contributed to the study design and data collection, analysis, and interpretation.

## Declaration of interests

We declare no competing interests.

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**Monash Sustainable Development Institute** (Prof R Brown PhD), **Cooperative Research Centre for Water Sensitive Cities** (Prof T Wong PhD), **Faculty of Medicine** (Prof K Leder PhD, Prof Andrew Forbes PhD), **Monash Sustainable Development Institute** (M French PhD), **Faculty of Art Design and Architecture** (Prof D-R Lovering PhD, Prof M El Sioufi PhD), **School of Biological Science** (Prof S L Chown PhD), **Centre for Health Economics** (Prof D Johnston PhD), **Monash University Malaysia, Subang Jaya, Malaysia** (Prof D Reidpath PhD); **Faculty of Engineering, Monash University, Melbourne, VIC, Australia** (Prof D McCarthy PhD); **Stanford University, Stanford, CA, USA** (Prof S Luby PhD); **Emory University, Atlanta, GA, USA** (Prof T Clasen PhD); **United Nations University, Tokyo, Japan** (P Allotey PhD); **University of Melbourne** (Prof J Simpson PhD); and **Urban Logic, Palo Alto, USA** (B Cahan JD)

Correspondence to:  
Prof Rebekah Brown, Monash Sustainable Development Institute, Monash University, Melbourne, VIC 3800, Australia  
[rebekah.brown@monash.edu](mailto:rebekah.brown@monash.edu)

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