

DEVELOPING AN INTERACTIVE GLOBAL HEALTH VULNERABILITY TOOL

RATIONALE

A comprehensive global tool that identifies environmental factors associated with selected diseases, predicts increased vulnerabilities and changes in spatial patterns as a result of projected environmental change would demonstrate a significant step forward in the practical application of eco-health research. Making this tool widely available and interactive enhances its utility in finding ways to reduce the burden of illness resulting from environmental exposures and forms the basis for further research and evidence-based policy development.

Initial focus will be on water-related diseases. According to a recently published WHO report (2008), the total disease burden from illness related to water, sanitation and hygiene accounted for 9.1 % of the total global disease burden in 2002. Notably, 62 % were related to drinking water and sanitation and 16 % to ecosystem management, exacerbated by poor nutrition, some types of occupation and energy sources (Prüss-Üstün et al, 2008).

SUMMARY

This project will map global vulnerability to select water-related diseases within a Geographical Information System (GIS) based on environmental factors and current burden of illness. The objective of the research is to identify key areas of elevated risk under current and projected conditions that account for impacts of global environmental change in order to develop intervention, mitigation and adaptation strategies to help reduce the future burden on health and to provide scientific-based evidence for targeted studies and funding. It is anticipated that the project will be able to capitalise on existing databases, models and partnerships, and provide a way to co-ordinate these into disease vulnerability analyses. Once established, the project will pursue additional vulnerability and socio-economic assessment work, particularly in light of climate change. The vulnerability maps generated can be interfaced with maps depicting future population growth trend in a region to estimate health risk outcomes in term of increased morbidity and mortality from the diseases modeled. This can be further translated into disease burden and economic cost.

This research utilizes a combination of approaches and methodologies in order to identify the key environmental and socio-economic risk factors influencing the prevalence of selected water-related diseases. The information on disease prevalence will be re-produced on map layers in association with environmental risk factors and socio-economic vulnerability factors to provide a global vulnerability index map associated with each disease / disease group. Furthermore, the project will examine the ways in which these risk factors will change under future climatic conditions, assess current community vulnerability and project the types of community that will become more vulnerable, and identify associated economic impacts. Future climate scenarios will be incorporated to ascertain regions at

increased risk and the higher prevalence of illness that are likely to result. This, in turn, will empower individuals, community leaders, public health practitioners, funding agencies, policy makers, governments, businesses and other stakeholders to participate knowledgeably in decision-making with respect to decreasing the absolute and distribution of burden of illness.

The project will build upon a considerable body of existing work within various disciplines including, but not limited to, human vulnerability studies, pathogen life cycles, disease transmission models, climate change scenario outputs and digital mapping platforms. This will be facilitated by a broad transdisciplinary research team and multiple partners brought together to undertake this project.

BACKGROUND

The global burden of illness is disproportionately borne by the poor in all countries, and, by the poorest countries globally. Effects of climate change will exacerbate this, as indicated by studies of current weather phenomenon. A clear example of this is the impact of El Nino events on cholera rates in Bangladesh (Pascual et.al., 2000). Another good example is the peak in dengue cases in Malaysia in 1998 (13,742 serologically-confirmed cases) due to increased rainfall during the La Nina event that year following the El Nino event in 1997 (Teng and Singh, 2001). Moreover, these populations are already highly vulnerable to disease and unable to invest to understand changing vulnerabilities or alternatives for intervention.

Environmental diseases (e.g. water-related) have a significant impact on this burden of illness. Identifying the distribution of current and future global vulnerabilities of these selected diseases will allow the identification of potential actions to intervene, mitigate and adapt to increase resilience against the impacts of climate change and reduce the burden of illness. Such solutions might include, but are not be limited to, appropriate technological interventions (e.g. water and sanitation solutions; malaria nets); education and awareness (e.g. hygiene; behavioural practices); enhanced community capacity; and, policy / government intervention at various levels. Such interventions have successfully and substantially decreased the number of mortalities resulting from diarrhoea over the last half century. However, morbidity rates have not demonstrated the same trend, meaning that a significant burden of illness is still attributable to diseases that cause diarrhoea (UNICEF 2008).

PROPOSED OBJECTIVES

The overall goal of this project is to *develop an interactive, globally applicable and globally accessible tool that provides visual representation of current and projected environmental disease indicators and disease incidence for the purpose of targeted research and intervention, as well as policy and capacity development.*

The specific objectives are:

1. To describe the current burden of illness from selected water-associated diseases and identify high-risk regions
2. To design an interactive mapping tool for visualisation and dissemination of results

3. To identify regions vulnerable to increased risk as a result of anticipated global environmental change
4. To develop a community empowerment and capacity-building strategy through dissemination of the tool to a range of stakeholders at the water-health nexus
5. To recommend strategies in preventing and managing water-related diseases, especially for countries in high-risk regions

SCIENTIFIC CONTRIBUTION

This project will result in two applications. The first is map outputs, which will be advantageous to all stakeholders looking at vulnerability to the selected diseases, based on both current and future exposure and conditions. End-users of these maps include communities and their leaders, NGOs, public health officials, policy makers and various levels of government to provide information for future adaptation, aid, public health planning and intervention and to inform monitoring and surveillance network development. The second is a methodological approach that can be used to produce maps of other diseases. This tool will be useful to research institutions and international organisations for the development of a global picture of the disease of interest.

Given the broad-reaching utility of the map outputs and the overall global importance of the expected results of this project, the process of identifying problems in both scope and quality of required global databases should provide momentum at both the national and international scale for improved and co-ordinated data collection and sharing.

PROPOSED OUTPUTS

- Tables of available data sources (type, quality, coverage, scale) for each of the environmental and vulnerability indicators and disease prevalence by country
- Current global disease prevalence maps (seasonal)
- Current maps of environmental risk factors for selected diseases
- Current maps of socio-economic vulnerability based on identified risk factors
- A disease vulnerability index
- Map of current disease vulnerability indices
- Projected future global disease prevalence maps (seasonal)
- Projected future maps of environmental risk for selected diseases
- Projected future maps of socio-economic vulnerability based on changes in identified risk factors
- Map of projected future disease vulnerability
- Interactive internet-based mapping tool
- A screening tool for self-determination of community vulnerability
- Workshops for proposal development, stakeholders, to map community vulnerability and for dissemination purposes
- Dissemination and knowledge translation products, including conference presentations, refereed publications, policy briefs

- Interactive digital mapping and database architecture / platform that can be used for other diseases
- Strategies for mitigation, adaptation, prevention and management of risks associated with water-related diseases in order to reduce morbidity and mortality

OUTCOMES

- Enhanced evidence-based knowledge to identify and prioritise funding, research, interventions and capacity building requirements
- Reduced future burden of illness (BOI) associated with the selected diseases
- Enhanced human capacity through the training of highly qualified personnel (HQP) and empowerment of end-users
- Increased awareness of the need for adaptation / implementation of technical solutions / behavioural change
- Improved basis for planning, policy and decision making at local, regional, national and international levels
- A methodology and dissemination platform suitable for use with other health outcomes

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