

RISK AND RESILIENCE: A GLOBAL INITIATIVE TO MEASURE, MAP AND MITIGATE THE VULNERABILITY OF INDIVIDUALS AND COMMUNITIES TO WATER-RELATED DISEASES IN THE FACE OF ENVIRONMENTAL CHANGE

Meeting Report: Kuala Lumpur March 11th – 13th 2009

INTRODUCTION

This document summarises the outcomes of an initial planning meeting for the vulnerability mapping initiative (see agenda, Appendix I). The meeting was co-sponsored by the United Nations University (International Network on Water, Environment and Health; International Institute for Global Health) and the Canadian Institutes for Health Research. The objectives of the meeting were as follows:

- a. To build a research team (Wed am)
- b. To build project consensus (Wed pm)
- c. To identify funding options (Thurs am)
- d. To plan for operationalization of the project (Fri)

The meeting unfolded smoothly and consensus on goals, objectives, and next steps was reached within the designated meeting time. The off-site field trip facilitated off-line conversations and networking while providing an opportunity for all participants to witness public health on the ground within the context of a Dengue control operation. A key outcome of the meeting was the project team's commitment to a community-based research approach informed by a transdisciplinary focus and a commitment to strong science linked to policy.

GOAL AND OBJECTIVES

The overall goal of the project agreed to at the meeting is: to examine the impacts of environmental change¹ as they pertain to water-related infectious diseases, through the development of capacity building tools, in order to help reduce illness and enhance the health and quality of life of the world's vulnerable populations.

The project objectives are:

1. To describe and map the current global burden of illness from selected water-related infectious diseases
2. To identify environmental factors (physical, social, economic, cultural, political) impacting distribution and diffusion of, and adaptive capacity for, selected water-related infectious diseases

¹ To be operationally defined within the project to incorporate both human and physical drivers

3. To develop a vulnerability index for water-related infectious diseases that facilitates comparison across time and a range of spatial scales
4. To map the location of populations currently identified as vulnerable to water-related infectious diseases
5. To identify areas where populations may become increasingly vulnerable to water-related infectious diseases as a result of anticipated environmental change
6. To design and develop a globally applicable and accessible suite of interactive mapping tools for water-related infectious diseases in the context of environmental change
7. To develop a capacity-building strategy through dissemination of the suite of tools to a range of end-users at the water-health nexus

PROJECT DETAILS

The proposed research utilizes a combination of approaches and methodologies in order to identify the key environmental risk factors (both human and physical) influencing the prevalence of and vulnerability to specific water-related infectious diseases. 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 and environmental change scenarios, integrated modeling and digital mapping platforms. This will be facilitated by a broad transdisciplinary research team and multiple partners brought together to undertake this project.

DISEASE SELECTION: The following diseases have been selected for their broad geographic distribution, the significant morbidity and mortality they represent, local need for action, and varying transmission cycles:

- Dengue (and Dengue Haemorrhagic) Fever (vectorborne – mosquito; expanding beyond the tropics)
 - Chikungunya (emerging virus that shares a common vector, associated with debilitating sequelae)
 - Yellow Fever (shares a common vector with potential for global spread)
- Schistosomiasis (intermediate host – snail, a chronic parasitic disease prevalent in many river deltas of the tropics)
- Cholera (a waterborne bacterial disease of global significance due to faecal contamination from unsanitary conditions that may prevail in both the developing and developed world)
- Leptospirosis (bacterium) - alternate

SITE SELECTION CRITERIA: In order to ensure global applicability and local relevance, the project will develop a flexible suite of tools that are easily adapted to spatio-temporal variations in data availability and reliability, while maintaining a basis for comparison. These tools will be verified using pilot study sites to be selected according to the following criteria:

- a. Variability in exposure
 - i. Climate
 - ii. Surface hydrology
 - iii. Land cover
 - iv. Land Use
- b. Population distribution/demographics
- c. Socio-economic factors
- d. Governance structure and political context
- e. Data availability, quality and access (and infrastructure to enhance collection)
- f. Variability in Outcome
 - i. Incidence
 - ii. Mortality versus morbidity
- g. Interest and local expertise

POTENTIAL PILOT SITES: The project team has expertise and current research platforms established in several areas representing different regions around the world. If these fit the site selection criteria, additional benefits accrue in utilizing them for this initiative, including potential economies of scale, the ability to build upon established local and regional networks, and a familiarity with the physical and human environments and their interlinkages. Three such regions have been identified:

The Mekong Delta – the location of several complementary initiatives either being planned or currently undertaken that would provide a strong platform for the proposed vulnerability mapping. The WISDOM project (http://www.wisdom.caf.dlr.de/intro_en.html) is the product of a bilateral agreement between Germany and Vietnam to co-ordinate the design and implementation of an information system for the Mekong Delta that will incorporate hydrologic, sociologic, information technology and earth observation data. Additionally, a joint initiative by 7 UNU centres around the world is proposing to examine current and future impacts on, and responses of, human health and ecosystem integrity as a result of water resources degradation related to environmental change in the Mekong Delta.

Lake Victoria Basin, East Africa – with local representation on the project team by a member of the Kenya Medical Research Institute and the location of the UNU Research Chair in Africa, this is a region where several UNU initiatives examining international water governance and water quality as it pertains to health have been undertaken over the past 5 years. Furthermore, a UNU distance education training centre has been established in Kenya to provide professional integrated water resources management certification.

Malaysia – as the host location for the planning meeting and with local representation on the project team through university researchers, the Institute for Medical Research and the International Institute for Global Health (a UNU centre hosted by the Malaysian Government) it is a region demonstrating a strong established network that could be utilized to great benefit within this research programme.

TARGETED END-USERS: The key target users of the suite of tools developed within this project will be researchers, water and health professionals and international organizations. This should be differentiated from the target users of the information provided through the application of the tools and the visualization of the outputs who will be policy and decision makers, public health officials and local water authorities. Other user groups who are likely to be interested in either the tools, or the information provided through their application, include communities, health economists, economic development councils, local authorities, city planners, NGOs, international funding agencies, pharmaceutical companies, private sector health providers and water technology companies. While it is recognized that end-users may be asking different questions, it should also be recognized that all will require the basic knowledge of who is vulnerable to what, where and under which conditions.

As part of the development of the suite of tools and dissemination platform, caution will need to be exercised and the team will endeavour to ensure that the tool is utilized appropriately to avoid misuse or abuse of the outputs. The application and limitations of the tools will be clearly defined. A rigorous knowledge translation, synthesis and exchange framework will be developed and applied as part of this initiative to incorporate stakeholder and end-user consultations at all stages within the project in addition to the development of training materials in order to minimize the potential for this to occur. The team has dedicated expertise in the area of appropriate uses of mapping tools and technologies.

KEY EXOGENOUS FACTORS: This initiative will require data that represent the broad human and physical environmental factors impacting the burden of illness associated with the selected diseases. An ideal list of exogenous factors was identified (Appendix II) and pared down to the following essentials:

- a. Education
- b. Income/wealth/poverty
- c. Climate
- d. Surface hydrology
- e. Land cover/use/change
- f. Population distribution/demographics
- g. Vector(s)/pathogen dynamics
- h. Mobility /Migration
- i. Governance and policy
- j. Access to healthcare

KEY RESEARCH THEMES AND METHODOLOGICAL APPROACHES: The team identified four broad research themes within the initiative that will focus activities and expertise while providing for the practical realization of transdisciplinary research, culminating in theme 4:

1. Human Resilience
2. Disease Dynamics

3. Environmental Change
4. Synthesis, Development and Dissemination of Spatio-temporal Tools

Certain methodological approaches, such as the use of a geographic information system (GIS), vulnerability analyses, integrated modeling techniques and secondary data analysis will be common across all themes. In addition, each theme will utilize specific approaches:

Human Resilience - the primary focus will be to document the lives, experiences and needs of vulnerable populations using primarily interpretive methods that will privilege the voices of populations affected by environmental change.

1. Qualitative Methods
 - a. Participatory Action Research (PAR)
 - b. Community mapping
 - c. Focus groups
 - d. Field observation
 - e. Interviews
2. Quantitative Methods
 - a. Questionnaires
 - b. Secondary data analysis
3. Document /discourse analysis

Disease Dynamics – the primary focus will be to explore the factors impacting disease transmission cycles, exposure routes and human health impacts.

1. Environmental data analysis
2. Secondary data analysis
3. Disease transmission models
4. Disease epidemiology
 - a. Incidence
 - b. Mortality
 - c. Notification system
 - d. Spatial analyses
 - e. Exposure analysis/mapping
5. Vector/pathogen biology
 - a. Surveillance indices/vector survey
 - b. Control programs
 - c. Understanding environmental determinants (functional relationships)
6. Disease burden study
 - a. Disability Adjusted Life Years (DALYs)
 - b. Disease costing

Environmental Change – the primary focus will be to assess the impact of select dimensions of future change upon disease dynamics and human resilience.

1. Collection and assessment of water availability and water quality data
2. Analysis of land use/cover changes
3. Climate scenarios

4. Downscaling
5. Human component (scenario based)
 - a. Agent based modelling
 - b. Bayesian networks

Synthesis, Development and Dissemination of Spatio-temporal Tools – the primary focus is to synthesise outputs from the previous three themes, integrate tools and develop a dissemination platform for both the tools and visual representation of the resulting information.

1. Geostatistical methods (GIS and integrated modeling tools)
2. End-user participation interviews
3. Knowledge translation, synthesis and exchange (KTSE) techniques including PAR models
4. Open source tool
5. Lessons learned
6. Best Management Practices
7. Characteristics of output and dissemination model

THE PLATFORM: A GIS, linked to a suite of applications, will form the foundation for data management, data visualization (maps) and analyses. By linking the database, integrated modeling techniques, an open source GIS or viewer and resultant map layers to Google Earth[®], the project will provide a user-friendly, globally recognized and accessible tool for end-users that can be easily linked with other initiatives. It is anticipated that this will be linked with other UN data repository and mapping websites to enhance uptake and exposure. Additionally, information and map outputs will be provided through published reports and interactive DVDs.

Visual representation of information is a powerful communication tool, particularly for comparative purposes and identification of “hotspots”. In conjunction with a GIS, the qualitative visualisation can be augmented with quantitative analyses of spatial and temporal trends. The platform will further provide the structure for examining scenarios related to environmental change which will aid future planning, policy and intervention decisions.

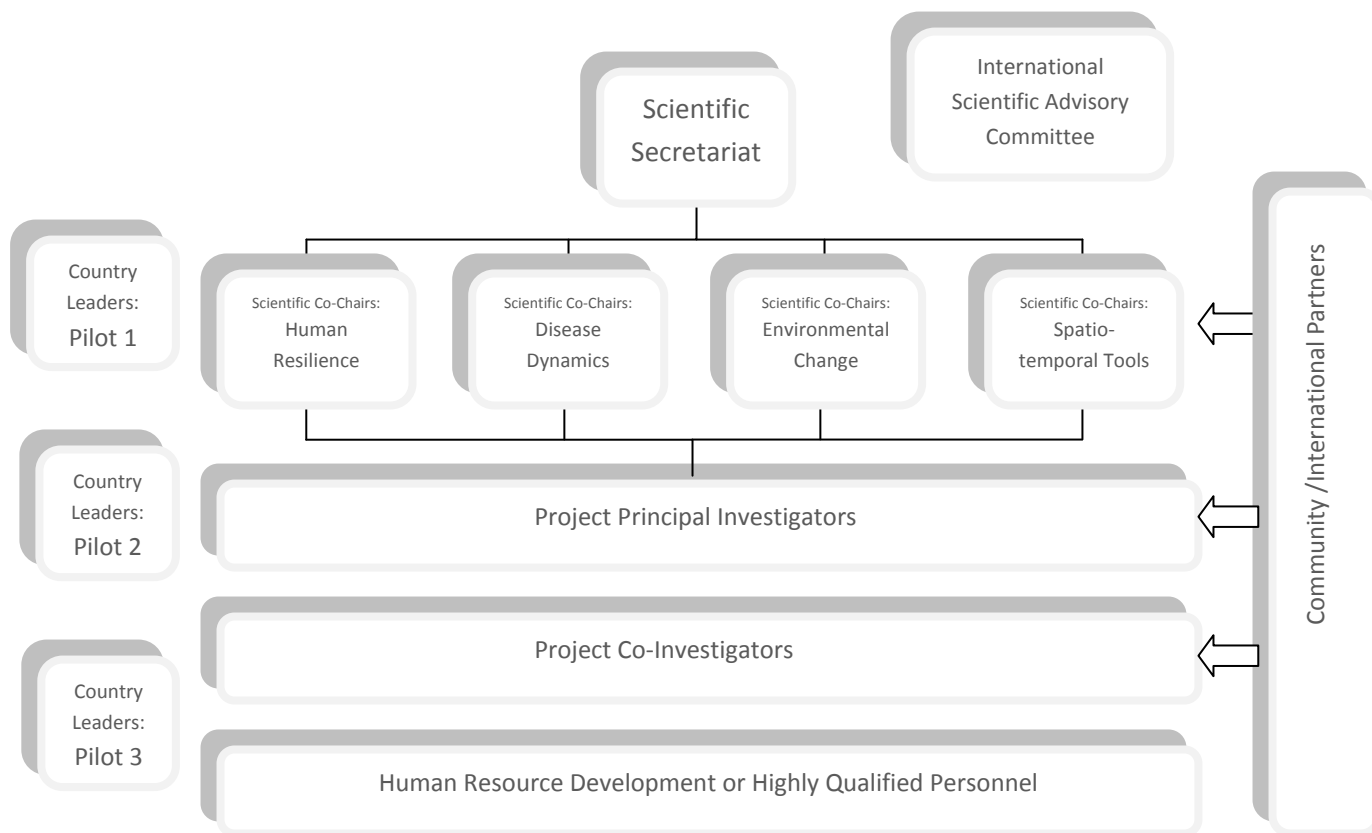
PROOF OF CONCEPT STUDY: The team will undertake a proof of concept study in 2009/2010 limited to a country specific and disease specific approach (Dengue Fever and Chikungunya in Malaysia). This short-term analysis will provide for a scoping exercise of the exogenous factors matrix, available data sets and organizational structures through secondary data synthesis / analysis, local informant interviews. Furthermore, it will inform process-based method development, provide ground truthing of the foundational concepts and demonstrate the cohesion and capacity of the research team. Funds for the proof of concept will be solicited from UNU-INWEH (confirmed), UNU-IIGH (confirmed), the UNU Joint Activity Fund, the Malaysian Government and small team member research grants.

The specific choice of Dengue Fever and Chikungunya in Malaysia is justified through:

- The wide variability in disease incidence geographically, as demonstrated during our field trip; variable climate conditions; and, variations in soil types (affecting surface hydrology), topography, land cover and vegetation.
- A demonstrated close link with local authorities and institutions and excellent access to human resources and expertise to help achieve successful execution and dissemination of the initiative
- Availability of data (including chikungunya case data collected in the public health system; census in 2000; national morbidity survey in 2007; CDC CIS database; satellite imagery)
- Malaysia's experiences in an expanding suburban fringe (of relevance to experiences elsewhere in the world)
- Competing policies, e.g. Putrajaya vector control versus beautifying the town
- A practical need for the research findings in order to inform the development of new economic corridors - Putrajaya was a model planned community but still failed to plan for dengue

PROPOSED MANAGEMENT STRUCTURE

The proposed management structure (below) provides opportunities at all levels for interaction between the research team, stakeholders and end-users. It retains ultimate oversight in a single scientific secretariat in order to facilitate efficiency, efficacy and accountability in management of the initiative. Further, the structure provides for targeted themes, rather than geographical areas to facilitate outputs while maintaining transdisciplinarity through membership of individuals in multiple themes. Each pilot study will have a local operational team responsible for co-ordination on-the-ground and links to stakeholders and end-users. Moreover, involvement in all pilot studies and regular communication through various means will be actively encouraged in addition to face-to-face meetings in order to stimulate dialogue to inform activities and to maintain the same approaches across all pilot studies.



TEAM STRENGTHS

Dr. Md Pauzi Abdullah Centre of Water and Research Analysis, Faculty of Science and Technology, National University of Malaysia

Dr. Cécile Aenishaenslin Groupe de recherche en épidémiologie des zoonoses, Faculté de médecine, Université de Montréal

Dr. Syed Mohamed Aljunid Professor of Health Economics & Consultant Public Health Medicine, Senior Research Fellow United Nations University International Institute for Global Health

Dr. Chris Dunn Senior Lecturer, Department of Geography Durham University

Dr. Joseph Eisenberg Associate Professor, Epidemiology, University of Michigan

Dr. Ramah Elfithri Research Fellow, Institute for Environment and Development, National University of Malaysia

Dr. Susan Elliott Senior Scientific Advisor for Water-Health, United Nations University International Network on Water, Environment and Health

Dr. Jamal Hisham Hashim Professor of Environmental Health, Research Fellow, United Nations University International Institute for Global Health

Dr. Muhammad Amir Kamaluddin Head, Environmental Health Research Centre, Institute for Medical Research, Malaysia

Mr. Marcus Kaplan Resident Scholar, United Nations University Institute for Environment and Human Security

Dr. Nicholas Ogden Director, Groupe de recherche en épidémiologie des zoonoses, Faculté de médecine, Université de Montréal

Dr. Diana Karanja Chief Research Officer, Kenya Medical Research Institute Centre for Global Health Research

Dr. M. Lutfan Lazuardi Lecturer, Public Health Department, Faculty of Medicine, Gadjah Mada University, Indonesia

Dr. Glen MacDonald Professor, Department of Geography, University of California, Los Angeles

Dr. Mazlin Mokhtar Director, Institute for Environment and Development, National University of Malaysia

Dr. Hisashi Ogawa Regional Adviser in Healthy Settings and Environment, World Health Organization, Western Pacific Regional Office

Dr. Nick Ogden Director Centre for Environment and Health, Public Health Agency of Canada

Dr. Colin Polsky Assistant Professor, Graduate School of Geography, Clark University

Dr. Fabrice Renaud Associate Director, Head of Environmental Vulnerability & Energy Security Section United Nations University Institute for Environment and Human Security

Dr. Saravanan Subramanian Senior Researcher, Department of Politics and Cultural Change, Centre for Development Research (ZEF) Germany

Dr. Lokman Hakim Sulaiman Head, Infectious Disease Research Centre, Institute of Medical Research, Malaysia.

Dr. Laksono Trisnantoro Center for Health Service Management, Faculty of Medicine - Gadjah Mada University

Dr. Corinne Wallace Programme Officer Water-Health, United Nations University International Network on Water, Environment and Health

Dr. Bambang Wispriyono Dean, Faculty of Public Health, University of Indonesia

Dr. Mohamed Salleh Mohamed Yasin Director, United Nations University International Institute for Global Health

► The team will further benefit from an entomologist yet to be identified.

► Expertise in knowledge translation, synthesis and exchange (KTSE) may be a team gap (to be addressed towards the end of the proof of concept).

THEME MEMBERSHIP

	Human Resilience	Disease Dynamics	Environmental Change	Spatio-temporal Tools
Dr. Md Pauzi Abdullah		√	√	
Dr. Cécile Aenishaenslin		√		√
Dr. Syed Mohamed Aljunid		√	√	√
Dr. Chris Dunn	√			√
Dr. Joseph Eisenberg	√	√	√	
Dr. Ramah Elfithri			√	
Dr. Susan Elliott	√	√		√
Dr. Lokman Sulaiman				
Dr. Jamal Hisham Hashim		√	√	√
Dr. Muhammad Amir Kamaluddin		√	√	
Dr. Nicholas Ogden		√		√

Dr. Diana Karanja	√	√		
Dr. M. Lutfan Lazuardi				√
Dr. Glen MacDonald		√	√	
Dr. Mazlin Mokhtar				
Dr. Colin Polsky				
Dr. Saravanan Subramanian	√			√
Dr. Laksono Trisnantoro				
Dr. Corinne Wallace		√	√	√
Dr. Bambang Wispriyono	√	√		
Dr. Mohamed Salleh Mohamed Yasin		√		
UNU-EHS	√		√	
WHO	√	√	√	

IDENTIFIED RESOURCE OPPORTUNITIES

DATA AND INFORMATION

WHO Guidelines for health vulnerability and adaptation assessments to be published by the end of 2009

Government Statistic Departments

Demographic Health Study covers East Africa

Look for in-kind contributions

PARTNERS / STAKEHOLDERS / END-USERS

WHO headquarters and regional and country offices

FINANCIAL

UNU-INWEH

UNU-IIGH

UNU Joint Activity Fund

Malaysian Government (Ministries of Health, Science, Economic Development and Planning)

Asian Development Bank

Arab Gulf UN Development Fund (AGFUND)

Global Environmental Facility

Indonesia (Bambang Wispriyono) – meeting host

Individual Researchers - Research development fund in Geography at Durham University (up to £1000 with call for applications in October)

APPENDIX I – MEETING PLANNING AGENDA



UNITED NATIONS
UNIVERSITY
UNU-IIGH
(International Institute for Global Health)



UNITED NATIONS
UNIVERSITY

UNU-INWEH



Canadian Institutes
of Health Research

Instituts de recherche
en santé du Canada

Addressing Global Vulnerability to Disease

INTERNATIONAL PLANNING MEETING

March 11th – 13th 2009
9th Floor

Legend Hotel, Kuala Lumpur, Malaysia, Rajawali Room,

WEDNESDAY MARCH 11th

09:00 **Greetings** (Dr. Salleh Yasin, Director UNU-IIGH)

09:15 Introduction to UNU

IIGH (Sayed – introduce IIGH))

INWEH (Susan Elliott)

09:35 **Table Introductions** (Facilitated by Syed Aljunid)

09:45 **Project Background** (Schedules A, B) (Corinne Wallace/Susan Elliott)

10:15 Break

10:30 **Participants' Background and Interest** (5 min each) (Schedules C and D)

(Facilitated by Jamal Hashim)

12:00 Lunch (break 12:00-14:00)

14:00 **Building Project Consensus** (Facilitated by Susan Elliott)

Goal

Objectives

Disease selection

Exogenous Factors

Pilot locations

15:30 Break

16:00 **Building Project Consensus** (cont.)

17:00 **Summary of Day 1 and Agenda Review for Day 2** (Corinne)

17:30 Meeting closes

19:45 Group Dinner (in the meeting room)

THURSDAY MARCH 12th

8:00 UNU planning meeting

09:00 **Review of Project Consensus and Map of Tasks for the Day** (Salleh)

09:45 **Funding the Initiative** (Facilitated by Sayed)

Budgetary Requirements

Funding Agencies: mandates and requirements

Partners: contributions (cash, in-kind)

10:30 Break

10:50 **Funding the Initiative** (cont.)

12:00 Lunch (break 12:00)

13:30 **Field Trip** – A Dengue Surveillance and Control Operation in Putrajaya (Schedule E)

MEET on the ground floor at 1:30 sharp.

18:00 Approximate time of return to hotel.

19:45 Group Dinner (location TBA; transportation provided)

FRIDAY MARCH 13th

08:00 UNU Planning meeting

09:00 **Operationalising the Project** (Facilitated by Susan Elliott)

Management Structure

Study Design

Data Requirements

Data Processing

Teams

10:45 Break

11:15 **Discussions and next steps** (Facilitated by Corinne)

12:30 Lunch

14:00 **Timelines, tasks and responsibilities** (Facilitated by Jamal)

15:30 Break

16:00 **Timelines, tasks and responsibilities** (cont.) and **Wrap-up**

16:30 **Closing Remarks** (Dr. Salleh Yasin, Director UNU-IIGH)

APPENDIX II – LIST OF EXOGENOUS FACTORS

NATURAL ENVIRONMENT

BUILT ENVIRONMENT

Climate

Waste management

Surface hydrology

Access to water and sanitation

Vegetation

Infrastructure

Landuse

Communication

Water quality and quantity

Transportation networks

Animal reservoir/predators

Drainage

Disease agent ecology and genetics

Vector ecology and genetics

Chemical resistance

AMR

DEMOGRAPHICS

ECONOMIC

Population structure

Economic activity

Population density

Per capita income

Settlement patterns

Financial assets /wealth

Family structure

Fiscal capacity

Migration patterns

Economic diversity (household)

Mobility

Poverty

Public investment in healthcare

Public investment in water supply and sanitation

Public investment in social services

SOCIO-CULTURAL**HEALTH**

Education

Access to healthcare

Literacy rates

Primary healthcare practitioners:population ratio

Gender

Quality of health care

Willingness to pay (Health care/water supply and sanitation)

Proximity to healthcare

Access to shelter

Access to maternal and child health

Access to amenities

Immunization coverage

Social networks/community cohesion/capital

Nutritional status

Communication

Hygiene behaviour

Religion

DALYs

Local customs

Infant mortality rates

Ethnicity

Use of traditional medicine

Public Health infrastructure

POLITICAL**OTHER**

Political structure

Water stress index

Governance

Water use

Conflict

Water management

Civil stability and security

Project sustainability

Legal and policy frameworks