National Climate Change and Health Action Plan for the
Republic of Kiribati

Ministry of Health and Medical Services, Government of Kiribati

World Health Organization

25th November 2011
Acknowledgements:

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Table of Contents

ACKNOWLEDGEMENTS: ................................................................................................................................. 2
LIST OF TABLES ................................................................................................................................................. 4
LIST OF FIGURES ............................................................................................................................................... 4
LIST OF ABBREVIATIONS ................................................................................................................................. 5
FOREWORD ......................................................................................................................................................... 6
1. INTRODUCTION .............................................................................................................................................. 7
2. CLIMATE CHANGE ADAPTATION PLANNING IN KIRIBATI ................................................................. 11
3. CLIMATE CHANGE AND HEALTH IN KIRIBATI ....................................................................................... 13
   3.1 WATER SAFETY AND WATER-BORNE DISEASES ............................................................................... 14
      3.1.1 Likely Impact of Climate Change ........................................................................................................ 14
      3.1.2 Current Activities .................................................................................................................................. 16
      3.1.3 Needs/Gaps .......................................................................................................................................... 16
      3.1.4 Adaptation Strategies ......................................................................................................................... 16
      3.1.5 Work plan for water safety and water-borne diseases ......................................................................... 17
   3.2 FOOD SAFETY AND FOOD-BORNE DISEASES .................................................................................... 18
      3.2.1 Likely impact of Climate change .......................................................................................................... 18
      3.2.2 Current Activities .................................................................................................................................. 18
      3.2.3 Needs/Gaps .......................................................................................................................................... 18
      3.2.4 Adaptation Strategies ......................................................................................................................... 18
      3.2.5 Workplan for food safety and food-borne diseases ............................................................................. 19
   3.3 VECTOR-BORNE DISEASES ..................................................................................................................... 19
      3.3.1 Likely Impact of Climate Change ........................................................................................................ 20
      3.3.2 Current Activities .................................................................................................................................. 20
      3.3.3 Needs/Gaps .......................................................................................................................................... 20
      3.3.4 Adaptation Strategies ......................................................................................................................... 20
      3.3.5 Workplan for vector-borne diseases .................................................................................................. 21
   3.4 DISEASE SURVEILLANCE ......................................................................................................................... 22
      3.4.1 Likely impact of Climate Change ........................................................................................................ 22
      3.4.2 Current Activities .................................................................................................................................. 22
      3.4.3 Needs/Gaps .......................................................................................................................................... 22
      3.4.4 Adaptation Strategies ......................................................................................................................... 22
      3.4.5 Workplan for disease surveillance ..................................................................................................... 23
   3.5 CIQUATERA/FISH POISONING .................................................................................................................. 24
4. VULNERABLE POPULATIONS ........................................................................................................................ 26
5. RECOMMENDATIONS ................................................................................................................................... 28
6. REFERENCES ..................................................................................................................................................... 29
7. APPENDICES .................................................................................................................................................... 30

APPENDIX 1. TABLES OF OTHER CLIMATE-SENSITIVE HEALTH RISKS, NEEDS AND ADAPTATION STRATEGIES FOR KIRIBATI. ........................................................................................... 31
List of Tables

TABLE 1: Future sea-level rise projections for Kiribati for time periods around the years 2030, 2055 and 2090 under three different “emissions scenarios”, compared to the average of the period 1980-1999 (source: PCCSP, 2011) ....................................................................................................................... 8


TABLE 3: Climate change adaptation activities in Kiribati ........................................................................... 11

List of Figures

FIGURE 1: Annual climate variability for South Tarawa (source: Pacific Climate Change Science Program, PCCSP, 2011) ....................................................................................................................... 7

FIGURE 2: Increasing air temperature in South Tarawa 1950-2008 (source: PCCSP, 2011). Light blue bars indicate El Nino years, dark blue bars indicate La Nina years and the grey bars show neutral years. 8

FIGURE 3: Proportion of samples within (blue) and in excess of (red) WHO standards for faecal coliform counts, reticulated water, South Tarawa, 2005 – 2010 ................................................................. 14

FIGURE 4: Proportions of samples within (in blue) and in excess of (red) WHO standards for faecal coliform counts, well water, South Tarawa, 2005-2010 ........................................................................... 15

FIGURE 5: Average monthly rainfall (Kiribati), and reported cases of diarrhoea (Betio) 2009-2010. Source: Pacific Climate Change Science Program, and Department of Health ................................................. 16

FIGURE 6: Relationship between SST and ciguatera rates in Kiribati (source: Llewellyn, 2010) ............... 24

FIGURE 7: Ciguatoxic reef areas in Kiribati. Source – MFMRD & SPC ......................................................... 25

FIGURE 8: Main source of drinking water, households in South Tarawa, 2010 (source: national census 2010) ............................................................................................................................. 26

FIGURE 9: Main toilet facility, households in South Tarawa, 2010 (source: national census 2010) ....... 27
List of Abbreviations

AHI  Assistant Health Inspector
CCAPS  Climate Change Adaptation Plan and Strategy
CSDs  Climate-sensitive diseases
CSIRO  Commonwealth Scientific and Industrial Research Organisation
EHU  Environmental Health Unit
ENSO  El Nino-Southern Oscillation system
GoK  Government of Kiribati
HYCOS  Hydrological Cycle Observing System
ILI  Influenza Like Illness
IPCC  Intergovernmental Panel on Climate Change
KAP  Kiribati Adaptation Program
KDP  Kiribati Development Plan
KPA  Kiribati Port of Authority
LF  Lymphatic filariasis
LRTI  Lower Respiratory Tract Infections
MCIC  Ministry of Commerce Industries and Cooperatives
MELAD  Ministry of Environment, Lands and Agricultural Development
MFMRD  Ministry of Fisheries and Marine Resources Development
MHMS  Ministry of Health and Medical Service
MISA  Ministry of Internal and Social Affairs
MPWU  Ministry of Public Works and Utilities
NAPA  National Adaptation Program of Action
MS1  1st Monthly Surveillance
NCCHAP  National Climate Change and Health Action Plan
NCDs  Non-Communicable Diseases
NFCCA  National Framework for Climate Change Adaptation
NGO  Non-government Organisation
OB  Office of Te Beretitenti
OECC  Overseas Environmental Cooperation Center
PacELF  Pacific Elimination of Lymphatic Filariasis Program
PCCSP  Pacific Climate Change Science Program
PS  Permanent Secretary
PUB  Public Utilities Board
RTI  Respiratory Tract Infection
SAS  Senior Assistant Secretary
SOPAC  South Pacific Applied Geosciences Commission
SPC  Secretariat of the Pacific Community
SST  sea-surface temperature
TB  Tuberculosis
TTM  Taiwan Technical Mission
UNFCCC  United Nations Framework Convention on Climate Change
UNICEF  United Nations International Children's Emergency Fund
UNOCHA  United Nations Office for the Coordination of Humanitarian Affairs
WHO  World Health Organization
**Foreword**

Climate change is a new kind of environmental health problem.

It does not matter where carbon dioxide and other greenhouse gases are created. They might come from coal burnt in Asia, or forests cleared in Africa. The results affect everyone, right across the globe.

These effects of climate change include a steady increase in temperatures and swelling of the oceans as they warm. Melting ice sheets will cause sea levels to rise further. Changes in the rainfall patterns will see longer dry periods and more intense rainfall.

Kiribati is particularly at risk. Water supplies are hard-stretched. Nowhere on South Tarawa, where half the national population lives, is higher than 3 metres above sea level. Most of the population, right across all the islands of Kiribati, live adjacent to the ocean.

Climate change is an environmental problem, and an economic problem. It is also a health problem. Rising temperatures and sea levels will aggravate diseases that are already present in Kiribati. They will also make it more likely that there will be further outbreaks of conditions like dengue fever.

This document presents a national plan of action on climate change and health.

The plan describes ways in which climate change will affect the health of Kiribati. It also includes strategies for dealing with these risks.

The plan provides direction for the health sector. The document is a reference point, but it is not the final word. We will be monitoring progress against the plan, and in 12 months time will review its priorities, and decide whether there need to be changes.

I would like to acknowledge everyone who has contributed to this important work.

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Mr Elliot Ali

Secretary

Ministry of Health and Medical Services
1. Introduction

The Republic of Kiribati (Kiribati) is a low-lying country of 33 atolls in the central Pacific with a maximum height above sea level of about 3 metres, and a population of approximately 105,000. According to the Government of Kiribati’s (GoK) 2010 census, about half the national population resides on South Tarawa, which has an extremely high population density of approximately 2,500 persons per square kilometre.

Kiribati is highly vulnerable to the impacts of climate change, due to the low elevation of the islands, crowding and the lack of secure water supplies. The climate is hot and humid, with very little variation in maximum and minimum temperatures throughout the year, and the heaviest rainfall occurring in the months of December - March (see Figure 1). The islands are strongly affected by the El Niño-Southern Oscillation (ENSO) system, with El Niño phases generally associated with higher rainfall and stronger winds, and La Niña phases bringing lower rainfall. Droughts, usually associated with La Niña, can be very severe in Kiribati, with recent droughts occurring in 1988-1989, 1998-1999, 2007-2009 and early 2011.

![Figure 1: Annual climate variability for South Tarawa (source: Pacific Climate Change Science Program, PCCSP, 2011)](image)

The particular threats posed by climate change for Kiribati include sea-level rise, increasing air and sea surface temperatures, ocean acidification, altered rainfall patterns and the unpredictability of events such as droughts, storm surges and extreme high winds. On short time scales, some of these changes can be seen already. The historical trend of air temperature (closely related to sea-surface temperature in the case of Kiribati) in South Tarawa, since 1950, is shown in Figure 2 below.
Figure 2: Increasing air temperature in South Tarawa 1950-2008 (source: PCCSP, 2011). Light blue bars indicate El Nino years, dark blue bars indicate La Nina years and the grey bars shown neutral years.

Sea-level rise is an issue of special concern in atoll countries such as Kiribati. Its effects include inundation, exacerbation of flooding, erosion (worsened by sand extraction and coastal infrastructure projects) and salt intrusion (which affects crops and drinking water sources). Since 1992, the annual rate of sea-level rise in Kiribati has been reported to be 3.9mm per year, three times faster than the global average (Aung et al, 2009). Future sea-level rise projections for Kiribati under three different “emissions scenarios” (i.e. modelled on projections of global greenhouse gas emissions, the main driver of climate change) are shown in Table 1 below.

Table 1: Future sea-level rise projections for Kiribati for time periods around the years 2030, 2055 and 2090 under three different “emissions scenarios”, compared to the average of the period 1980-1999 (source: PCCSP, 2011)

<table>
<thead>
<tr>
<th>Scenario</th>
<th>2030 (cm)</th>
<th>2055 (cm)</th>
<th>2090 (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low emissions scenario</td>
<td>4-13</td>
<td>9-25</td>
<td>16-45</td>
</tr>
<tr>
<td>Medium emissions scenario</td>
<td>5-14</td>
<td>10-29</td>
<td>19-57</td>
</tr>
<tr>
<td>High emissions scenario</td>
<td>5-14</td>
<td>10-28</td>
<td>20-58</td>
</tr>
</tbody>
</table>

The figures in Table 1 are based on the 4th assessment that was carried out by the Intergovernmental Panel on Climate Change (IPCC) and published in 2007 (IPCC, 2007). Information that has come to light since 2007 suggests that the IPCC projections were conservative, and have very likely under-estimated the extent of sea-level rise, globally. A 2010 review by the Royal Society of New Zealand concluded that global average sea-level rise by 2100 could be as much as 1.0-2.2 metres (a range of 2-5 times the IPCC estimates). See Table 2 below.

<table>
<thead>
<tr>
<th>Source</th>
<th>Sea level rise by 2100 (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pfeffer13</td>
<td>0.8 plausible (2.0 maximum possible)</td>
</tr>
<tr>
<td>Rahmstorf15</td>
<td>0.5 - 1.4</td>
</tr>
<tr>
<td>Horton16</td>
<td>0.5 - 1.0</td>
</tr>
<tr>
<td>Grinstead17</td>
<td>0.3 - 2.2</td>
</tr>
<tr>
<td>Vermeer18</td>
<td>0.75 - 1.9</td>
</tr>
<tr>
<td>Jevrejeva19</td>
<td>0.6 - 1.6</td>
</tr>
</tbody>
</table>

The climate projections for Kiribati suggest that rainfall will tend to increase, throughout the year, and the risk of droughts will be reduced. Extremely heavy rainfall events will be more common (PCCSP, 2011; Australian Bureau of Meteorology and CSIRO, 2011).

Throughout the Pacific, the rise in average temperatures will be accompanied by a sharp increase in the number of very hot days. See Volume 2 of the 4th Assessment Report of the IPCC for more details on the effects of climate change in the region (IPCC, 2007). Night-time temperatures are projected to increase more markedly than day-time temperatures. There will be direct effects on health (for instance, outdoor workers will be exposed more frequently to extreme heat). Increased force of floods and storms will increase risk of injuries. The changes will also favour many disease-causing micro-organisms (for instance, those responsible for food poisoning).

Heavy rainfall makes it more likely that bacterial and chemical contaminants are washed into reservoirs for drinking water. The forecast climate conditions (increased temperatures and heavier rainfall) will boost mosquito breeding and increase the potential for transmission of diseases such as dengue fever. Note that these statements are all couched in terms of probabilities. Whether or not the potential for harm is actually translated into outbreaks of disease will depend on factors other than climate change, such as the presence of mosquito breeding sites close to homes, protection of drinking water sources, levels of food hygiene, crowding, and housing quality.

Since June 2010, the Kiribati Ministry of Health and Medical Services (MHMS) has been working with the World Health Organization (WHO), supported by a team of climate change and health experts from the University of Auckland (New Zealand) to carry out a climate change and health vulnerability analysis. This has included stakeholder consultations, a review of the health sector’s capacity to deal with current and future climate-sensitive health risks, and analysis of the available data on climate and climate-sensitive diseases (CSDs) in Kiribati. This three-phase climate change and health project involved an inception workshop in Auckland for participants from Kiribati, Tonga, Tuvalu, Niue and the Cook Islands, as well as technical support and visits to Kiribati by the University of Auckland team (Professor Alistair Woodward and Mr Timoci O’Connor) and staff from the WHO South Pacific office in Suva, Fiji.

This National Climate Change and Health Action Plan (NCCHAP) is the end product of this process, and represents the health sector’s contribution towards climate change adaptation planning in Kiribati. Its purpose is to describe the specific health risks posed by climate change in Kiribati, and to outline strategies that may be followed to anticipate and avoid the most serious impacts of climate change on health.
This Plan concentrates on activities to be carried out by MHMS, but also points to where wider actions are required, involving other agencies than Health. The focus is very much on adaptation (coping with change) rather than the primary prevention of climate change. However, we note in passing that there are opportunities in Kiribati for health-positive mitigation. Examples that were mentioned during consultations include redesigning the main road on South Tarawa to encourage walking and cycling, and promoting access to effective local medicines that might replace imported pharmaceuticals.
2. Climate change adaptation planning in Kiribati

Kiribati is one of the leaders in climate change adaptation in the Pacific region. Work began on Kiribati’s National Adaptation Program of Action (NAPA) in 2004 and was completed in 2007. The Kiribati Adaptation Program (KAP) also commenced in 2003-2004 and is now in its third phase (KAP III), with priority given to activities in the areas of freshwater supply and coastal protection. In the meantime Kiribati also developed a Climate Change Adaptation Plan and Strategy (CCAPS), which is now being updated in the form of a National Framework for Climate Change and Climate Change Adaptation (NFCCA). Kiribati is also currently working on its Second National Communication to the United Nations Framework Convention on Climate Change (UNFCCC), and its activities in the climate change arena align with its priorities under the Kiribati Development Plan (KDP, 2008-2011). These activities are summarised in Table 3 below (Note this list is limited to programs that explicitly tackle health adaptation – many other relevant activities are taking place in other sectors).

Table 3: Climate change adaptation activities in Kiribati

<table>
<thead>
<tr>
<th>Name of program</th>
<th>Responsible agency</th>
<th>Initiated</th>
<th>Completed</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Adaptation Programme of Action (NAPA)</td>
<td>Ministry of Environment, Lands and Agricultural Development (MELAD)</td>
<td>2004</td>
<td>2007</td>
<td>There are a number of initiatives now being taken to implement the NAPA (for instance, promoting food security)</td>
</tr>
<tr>
<td>Kiribati Adaptation Plan (KAP) I (Preparation)</td>
<td>Finance OB (Office of Te Beretitenti)</td>
<td>2003</td>
<td>2005</td>
<td></td>
</tr>
<tr>
<td>KAP II (Implementation)</td>
<td>OB</td>
<td>2006</td>
<td>2010</td>
<td></td>
</tr>
<tr>
<td>KAP III (Expansion)</td>
<td>OB</td>
<td>2011</td>
<td>continues</td>
<td></td>
</tr>
<tr>
<td>Climate Change Adaptation Plan and Strategy (CCAPS)</td>
<td>OB</td>
<td></td>
<td>2005</td>
<td></td>
</tr>
<tr>
<td>NFCCA</td>
<td>OB</td>
<td>2011</td>
<td>continues</td>
<td></td>
</tr>
<tr>
<td>2nd National Communication</td>
<td>MELAD</td>
<td>2007</td>
<td>To be completed end of 2011</td>
<td></td>
</tr>
<tr>
<td>KDP</td>
<td>Finance</td>
<td>2008</td>
<td>2011</td>
<td></td>
</tr>
</tbody>
</table>
Kiribati’s NAPA specifically considers the health impacts of climate change, noting that: “Human health is the recipient of all downstream effects of the impacts of climate change on other sectors, such as agriculture, fisheries, water supply, coastal areas, biodiversity resources and waste management” (NAPA, 2007). Some of the examples of CSDs mentioned in the NAPA include diarrhoeal disease, dengue fever and fish poisoning; mention is also given to the issue of high population density, which is particularly problematic on South Tarawa atoll.

The NFCCA outlines the following priority areas for the GoK:

1. Mitigation
2. Integration of climate change and climate change adaptation into national planning and institutional capacity
3. External technical and financial assistance
4. Population control and resettlement
5. Governance and services
6. Survivability and self-reliance

The OB is responsible for coordination of activities related to climate change and climate change adaptation under the NFCCA, which requires each sector to consider its specific adaptation needs and strategies. In compiling this NCCHAP, the MHMS is making its contribution to this whole-of-government planning process, aligning neatly under priority #2 above for the health sector.

Other activities in Kiribati that are not specifically related to climate change, but are relevant to this plan, include:

- National Sanitation Implementation Plan (coordinated by the National Water and Sanitation Committee, through the Ministry of Public Works and Utilities) released March 2010
- Report on ENSO in Kiribati (compiled by UNOCHA, SPC/SOPAC and UNICEF) published April 2011
- National Disaster Risk Management Plan (now being prepared).
3. Climate change and health in Kiribati

The first step was to review health issues in Kiribati that are likely to be affected by changes in climate. This list includes a number of communicable diseases (water-, food- and vector-borne diseases, infections of the eyes, skin and respiratory tract and zoonotic diseases), injuries, non-communicable diseases (NCDs), food security, nutrition and mental health.

The next steps were to assess the strength of the evidence relating these conditions to changes in climate, the amount of illness (i.e. the burden of disease that would result), and what is known about interventions that are likely to reduce the effects of climate change. Wherever possible, the team drew on national health data. Though the records are not complete, there are sufficient baseline data to identify significant climate-sensitive health problems in Kiribati. For instance, outbreaks of typhoid and other diarrhoeal diseases are evident in records from outpatient clinics; childhood deaths from these diseases are more common in Kiribati than most other Pacific countries, and dengue fever has been present recently.

To determine the priorities for this plan, the team focused on conditions that were strongly linked to changes in climate that would add substantially to the burden of disease in Kiribati, and where there was good information on interventions that were likely to make a difference. The team consulted with health stakeholders from a number of fields (environmental health, communicable diseases, NCDs, nutrition and mental health), and sought views of experts in the field. As a result of this process, the team recommends the following shortlist of priority areas for climate change and health planning and adaptation in Kiribati:

- water safety and water-borne diseases
- food safety and food-borne diseases
- vector-borne diseases

In addition, the team recommends that disease surveillance is treated as a priority topic, since this is a vitally important tool for climate change adaptation in general.

Each of these priority areas is considered in turn below, under the headings of: Health Issue, Likely Impact of Climate Change, Current Activities, Needs/Gaps, Adaptation Strategies and Workplan. Ciguatera/fish poisoning, which is a special instance of food-borne disease, is discussed in detail in Section 3.5.

There are other conditions, such as mental health and NCDs, that are very important public health problems in Kiribati, and may be influenced indirectly by climate change, but are not included on the present priority list for this particular plan. These are outlined in Appendix 1, where possible links with climate change and adaptation strategies are noted.
3.1 Water safety and water-borne diseases

3.1.1 Likely Impact of Climate Change

A recent report on the effects of the La Nina-induced dry period (2010-2011) contains a comprehensive account of water sources, trends in usage and at-risk populations and locations in Kiribati (UNOCHA, 2011). In summary, the report concludes that efficient distribution of water is the major issue for Kiribati at present, and flags as issues of concern: the effects of population growth on South Tarawa; risks posed by sea level rise; and difficulties in avoiding bacterial and chemical contamination of water reservoirs.

Water testing by the Environmental Health Unit (EHU) shows that coliform counts frequently exceed WHO guidelines, in both reticulated water supplies and wells. This is illustrated in Figures 3 and 4. It appears that the proportions of samples measuring over the standard value have increased in recent years. However, we note the intensity of sampling has varied, particularly for well water (only 7 tests conducted in 2007, compared with 93 in 2009), which makes it difficult to be certain whether high coliform counts are truly increasing over time.

![Reticulated Water Quality Parameter - Faecal Coliform](image.png)

Figure 3: Proportion of samples within (blue) and in excess of (red) WHO standards for faecal coliform counts, reticulated water, South Tarawa, 2005 – 2010
Figure 4: Proportions of samples within (in blue) and in excess of (red) WHO standards for faecal coliform counts, well water, South Tarawa, 2005-2010

There is strong evidence from international research that rising temperatures and changes in rainfall patterns increase the risk of diarrhoeal diseases, particularly in situations in which the sources of drinking water are unprotected and it is difficult to maintain high standards of food hygiene. At present there is a marked seasonal variation in reported cases of diarrheal disease, and it is likely that fluctuations in rainfall play a significant part.

Figure 5 shows the numbers of cases reported from the hospital in Betio, the most heavily populated area in South Tarawa, in 2009-2010, by month, and the average monthly rainfall over the same years. The rains at the end of the driest period of the year (August – November) appear to be associated with a sharp rise in the reported incidence of diarrheal disease in December. End of year gatherings of large groups may contribute to an increase in food-borne diseases, but it is likely that run-off following heavy rains and contamination of drinking water sources also causes an upswing in diarrhoeal diseases. Future climate scenarios project an increase in the number of days of very heavy rainfall, and these will bring an increased risk of water-borne disease in conditions such as those that apply in Betio.
3.1.2 Current Activities

- Water Monitoring and testing
  - EHU carries out sampling of PUB and well water. Tests are done occasionally on ocean and lagoon water, and testing of rain water tanks is only carried out on request.
  - Limits on resources in the medical laboratory mean that no more than six samples may be tested every week.
- Awareness on water and sanitation (guidelines for sanitary methods)
  - Carried out during community talks. This is only done if there is an activity carried out by another project, for instance in work done by UNICEF and a variety of KAP projects.

3.1.3 Needs/Gaps

- Lab space for water testing is needed as EHU relies on the medical laboratory to test the water.
- Reagents for water testing need to be maintained and have funding available. Hydrological Cycle Observing System (HYCOS) project used to fund the reagents but this has stopped now and there is now no available funding for reagents.
- The hospital has limited number of cars and this has affected scheduled water monitoring due to the unavailability of transport.
- Computers are needed for data entry and report writing. EHU currently has only one computer for all AHI staff to share.
- Proper data storage and security – at present the results of water testing are held on laptop computers without systematic backup and storage.

3.1.4 Adaptation Strategies

- At least maintain scheduled water monitoring and, ideally, increase the frequency of testing and monitor a wider range of water sources.
- Improve water testing and analysis by ensuring that there is a constant supply of reagents for scheduled tests and requests.
- Improve public awareness on water safety.
### Work plan for water safety and water-borne diseases

<table>
<thead>
<tr>
<th>Goal</th>
<th>Specific Activities</th>
<th>Responsible Agencies</th>
<th>Timeframe</th>
</tr>
</thead>
</table>
| To renovate the existing workspace in order to carry out testing and analysis and accommodate all 11 EHU staff | **Workspace Renovation for EHU staff**  
  o Draft a renovation plan that will include the following:  
    • Specifications of what is needed in the room to make it functional for Environmental Health team. Eg: secure space for storage of computer, power for analytic equipment, cabinets and desks.  
    • Costs of equipments & resources needed  
  o Apply for funding for renovation of EHU office and Lab space  
  o Renovation of workspace completed | EHU                                                                                              | A renovation plan has been prepared, materials have been sourced but funding has not yet been obtained |
| EHU to carry out Biological and Chemical testing to water samples    | **Testing Equipment**  
  o Obtaining missing parts for DRELL 4000 (these have been misplaced during moving) in order to undertake chemical testing.  
  o Reagents to be ordered for bacteriological testing from Australia/New Zealand | MHMS (EHU & Medical Laboratory)                                                                  | 1st Quarter 2012                        |
| To Train ALL Assistant Health Inspectors (AHI’s) on the use of the chemical and biological testing equipment | **Capacity Building to EHU staff**  
  o AHI need training in using DRELL 4000  
    • Request letter to be written to WHO/SOPAC for a consultant to conduct a training on the use of the DRELL machine | EHU                                                                                              | 2nd Quarter 2012                        |
| To maintain water monitoring on South Tarawa                         | **Transport for Water Monitoring**  
  o Sometimes transport is not available and so sample sites cannot be visited  
  o To seek a review of transport needs for EHU water monitoring | EHU                                                                                              | Immediately                             |
| To have a maintained and secure data collection system               | **Storage of data and findings**  
  o Draft a budget for IT System in place  
  o Find funding sources for IT system | EHU                                                                                              | End of 2011                             |
| To increase public awareness on water safety                         | Work in conjunction with other key agencies to improve public understanding of water and sanitation    | Water Unit (MPWU), Public Utilities Board (PUB), Environment and Conservation Division (MELAD) and EHU (MHMS) | Ongoing                             |
3.2 Food safety and food-borne diseases

3.2.1 Likely impact of Climate change

Many food-borne diseases are climate-sensitive, and in general the risk of enteric infections transmitted by food increases as temperatures rise. Internationally, many studies have shown this relationship applies for illnesses caused by salmonella, campylobacter and a wide range of enteroviruses. In crowded conditions which make it difficult to maintain high levels of food hygiene, and where there are limited supplies of clean water, risks of disease are increased.

3.2.2 Current Activities

- Border control inspection (for food) at Kiribati Ports Authority (KPA). This started in May 2011 when health became part of border control.
- Inspection of food establishments (wholesalers, retailers, school hawkers, street vendors and restaurants). Some establishments are inspected daily while others are visited less frequently (e.g. monthly).
- Training and awareness of food handlers. This covers all restaurants on South Tarawa and training will be carried out for primary school vendors in November 2011. On spot awareness is also given by health inspectors during inspection.

3.2.3 Needs/Gaps

- There is no office space at KPA for the health inspectors, and this sometimes leads to delays with food inspection and slow release of food containers.
- Inspections are hindered due to the unavailability of transport for the EHU staff. Bus tickets are provided by the Ministry but there have been many times when the tickets are not maintained and staff end up sitting around the office.
- At present there are no facilities to perform food testing for bacterial and chemical contamination.
- There is a lack of manpower within EHU to tackle food inspection needs. There are only four AHI’s on Tarawa and the demand for food inspection is very high, especially with wholesalers.

3.2.4 Adaptation Strategies

- Ensure there is a constant food inspection regime
- Prevent the delay in food being released from the port
- Capacity building for EHU staff on food testing and analysis
- Maintain food handler trainings and increase public awareness on food safety
### 3.2.5 Workplan for food safety and food-borne diseases

<table>
<thead>
<tr>
<th>Goal</th>
<th>Specific Activities</th>
<th>Responsible Agencies</th>
<th>Timeframe</th>
</tr>
</thead>
<tbody>
<tr>
<td>To prevent Health from delaying food being released from port and to</td>
<td><strong>Work space</strong>&lt;br&gt;  - Write a request letter to OECC for an available container to</td>
<td>EHU</td>
<td>End of 2011</td>
</tr>
<tr>
<td>be able to carry out food testing</td>
<td>be used as an office at KPA&lt;br&gt;  - Draw up a budget for equipment needed at office</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>in Betio&lt;br&gt;  - Workspace for EHU staff at headquarters&lt;br&gt;  - Refer to “Workspace</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>renovation for EHU staff” (table 3.1.5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>To maintain constant food safety inspections</td>
<td><strong>Transport</strong>&lt;br&gt;  - Write a letter of reminder to PS, SAS and Account on the need</td>
<td>EHU, SAS &amp; Account</td>
<td>1st Quarter 2012</td>
</tr>
<tr>
<td></td>
<td>for a sustainable ticket issue&lt;br&gt;  - Draw up a proposal for the need of a vehicle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enable EHU to carry out Biological and Chemical testing of food</td>
<td><strong>Testing Equipments</strong>&lt;br&gt;  - Prepare a business case to carry out biological and</td>
<td>EHU</td>
<td>Throughout 2012</td>
</tr>
<tr>
<td>samples</td>
<td>chemical food testing in Kiribati, rather than relying on overseas laboratories</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Order food testing equipment, and seek funding for consultants to visit</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kiribati and train staff in testing and analysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>To introduce a well-maintained and secure system for collection and</td>
<td><strong>Storage of data and findings</strong>&lt;br&gt;  - Draft a budget for IT System in place&lt;br&gt;</td>
<td>EHU</td>
<td>End of 2011</td>
</tr>
<tr>
<td>storage of data</td>
<td>- Find funding sources for IT system</td>
<td></td>
<td>1st Quarter 2012</td>
</tr>
<tr>
<td>Increase food establishment coverage</td>
<td><strong>Improve manpower</strong>&lt;br&gt;  - Make a case for more staff-time for visiting food</td>
<td>EHU</td>
<td>Ongoing</td>
</tr>
<tr>
<td></td>
<td>establishments&lt;br&gt;  - Draft a proposal for change in EHU Establishment Register</td>
<td></td>
<td></td>
</tr>
<tr>
<td>To increase public awareness on food safety</td>
<td><strong>Capacity building</strong>&lt;br&gt;  - Train food handlers and food producers on food safety</td>
<td>EHU with external</td>
<td>Ongoing</td>
</tr>
<tr>
<td></td>
<td>plans</td>
<td>assistance where</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>needed</td>
<td></td>
</tr>
</tbody>
</table>

### 3.3 Vector-borne diseases


3.3.1 Likely Impact of Climate Change

As with food-borne infections, a number of vector-borne diseases are promoted by warmer conditions and changes in rainfall. Other factors that are critical in causing outbreaks include presence of vector breeding sites, population density, the immune status of the population, and effective health care. In South Tarawa the large numbers of abandoned vehicles and other solid waste in close proximity to settlements could provide suitable sites for mosquito breeding.

A major concern in Kiribati is dengue fever. This disease has spread widely through the region in the last 50 years. Pacific-wide, the number of outbreaks varies with the ENSO (increasing with warmer and wetter conditions) (Hales et al, 1999). The most effective mosquito vector (*Aedes aegypti*) is prevalent in Kiribati, and outbreaks of dengue occurred in 2003, 2004 and 2008.

Another mosquito-borne disease, long-established in Kiribati, is lymphatic filariasis (LF). The prevalence of LF on South Tarawa was approximately 2% in 2008, but the disease is becoming less common and Kiribati is on track for elimination of LF by 2020 (as per the objectives of the Pacific Elimination of Lymphatic Filariasis Program, PacELF).

3.3.2 Current Activities

- Inspection of breeding sites for mosquito presence is carried out on all incoming vessels at the port during quarantine duty. However, this is not done at the airport.
  - *Vector control is an important program within EHU but due to heavy demands on time and resource constraints, these activities have not been carried out*

3.3.3 Needs/Gaps

- Lab space is required for mosquito identification
- Vector control equipment required as there are no mechanical prevention methods for vector control available
- Most EHU staff have been occupied by the heavy demand for food safety and as a result there have been no activities in vector control

3.3.4 Adaptation Strategies

- Re-establish vector control activities
- Re-commence house index surveys
### 3.3.5 Workplan for vector-borne diseases

<table>
<thead>
<tr>
<th>Goal</th>
<th>Specific Activities</th>
<th>Responsibility</th>
<th>Timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>To carry out vector control activities</td>
<td><strong>Need for manpower</strong>&lt;br&gt; o Request more staff&lt;br&gt; o Draft a proposal for change in EHU Establishment Register&lt;br&gt; o Increase public awareness and knowledge about vector-borne diseases</td>
<td>EHU</td>
<td>Ongoing</td>
</tr>
<tr>
<td></td>
<td><strong>Improve Airport quarantine and vector control</strong>&lt;br&gt; o Request to be included in the airport inspection</td>
<td>EHU</td>
<td>End of 2012</td>
</tr>
<tr>
<td>Carry out mosquito identification and maintained collection of data</td>
<td><strong>Workspace Renovation</strong>&lt;br&gt; o Workspace for EHU staff at headquarter&lt;br&gt; Refer to &quot;Workspace renovation for EHU staff&quot; (table 3.1.5)</td>
<td>EHU</td>
<td>A renovation plan has been prepared, materials have been sourced but funding is to be sourced&lt;br&gt; 1st Quarter 2012</td>
</tr>
<tr>
<td>Vector control</td>
<td>o Order vector control kits to collect larvae and adult mosquitoes</td>
<td>EHU</td>
<td>1st Quarter 2012</td>
</tr>
</tbody>
</table>
3.4 Disease surveillance

3.4.1 Likely impact of Climate Change

Earlier sections in the plan point out that climate change will provide more favourable conditions for many infectious diseases. Therefore a well-functioning disease surveillance system is an important element of a national climate change adaptation plan.

3.4.2 Current Activities

- WHO is providing external assistance to improve syndromic surveillance systems in Kiribati.
- At present information is collected from 14 clinics on South Tarawa on a daily basis (including cases of Diarrhoea, Acute Respiratory Infection, Dysentery, Meningitis, Fever with rash, Fever with no rash and Pneumonia).
- Weekly Reporting to WHO in Fiji on Diarrhoea, Prolonged fever, Fever with rash and Influenza Like Illness (ILI) (from Betio hospital and Tungaru Central Hospital).
- Monitoring of trends and identification of possible outbreaks.

3.4.3 Needs/Gaps

- Repeated training for public health nurses is required due to staff turnover.
- Lack of knowledge and skill in Kiribati to carry out statistical analyses.
- A large amount of information that is collected is never analysed.
- The quality of surveillance data is sometimes questionable.
- No syndromic surveillance diseases on Christmas island or health centres in the south of Kiribati.
- Difficult to get direct access to data and verify outbreaks in the field due to lack of transport for public health staff.
- Slow turnaround from laboratories on diagnostic samples.
- The Health Information Unit currently has no access to climate early warning systems that may provide valuable advance notice of high risk periods.

3.4.4 Adaptation Strategies

- Capacity building for clinic nurses.
- Capacity building for data surveillance officers.
- Special training on data analysis is required.
- Review of current syndromic surveillance system tools and consider including other conditions that are of local importance eg ILI.
- Advocacy of disease surveillance as essential to cope with challenges that climate change will provide.
- Analysis of existing data to better understand present climate-related health risks and guide adaptation in the future.
### 3.4.5 Workplan for disease surveillance

<table>
<thead>
<tr>
<th>Goals</th>
<th>Specific Activity</th>
<th>Responsible</th>
<th>Timeline</th>
</tr>
</thead>
</table>
| To promote and strengthen the health information system in Kiribati | Formal review of the health information system in Kiribati  
Advocacy of health information to high level people (Permanent Secretary, Deputy Secretaries & Directors) | External assistance & Senior Health Information Officer | Ongoing |
| Capacity building | Review of training needs amongst Health Information Officers | External assistance (eg: from experts at the University of Queensland) | 2nd Quarter 2012 |
| | Regular workshops for Public Health and Outpatient Nurses on the case definitions of the surveillance diseases | Communicable Diseases Surveillance team | Ongoing |
| To improve the reach and quality of syndromic surveillance | Establishing syndromic surveillance system on Christmas island  
Expand syndromic surveillance system to include critical conditions such as ILI | Communicable Disease Surveillance Team | Throughout 2012 |
| Resources - availability of surveillance transport | Make the case for better access to appropriate transport for communicable disease surveillance team | Communicable Diseases consultant & team | 1st Quarter 2012 |
3.5 Ciguatera/fish poisoning

Kiribati has one of the highest rates of reported cases of fish poisoning in the Pacific region (South Pacific Epidemiology and Health Information Services; SPC, 2011). It is important to distinguish between true ciguatera (a toxic syndrome which mainly affects the nervous system and is caused by consumption of a harmful dinoflagellate organism which bio-accumulates in the marine food chain) and “food poisoning” caused by consumption of fish contaminated with bacteria (which may or may not involve enterotoxins from the bacteria themselves). This potential ambiguity (e.g. the situation in which a patient reports feeling unwell and/or vomits after eating fish, which could be attributed to either ciguatera or food poisoning) requires a clear case definition for each syndrome. At present, there is no specific guidance on this provided to health staff in Kiribati.

Ciguatera has been shown to be sensitive to changes in the marine environment, including sea-surface temperature (SST), and is therefore assumed to be susceptible to climate change-induced increases in SST. There appears to be an “ideal” temperature window for ciguatera in the Pacific (i.e. conditions can either be too warm or too cool for the organism to survive) so it is not clear at present what the precise effect of climate change will be on ciguatera risk (Llewellyn, 2010).

Figure 6 (below) shows that fish poisoning was reported less frequently in Kiribati between 1973 and 1985 than in the following decade (shown by the grey bars falling below the long term average in the first period, and tending to be above the line in the second period). During the 1970s sea surface temperatures around Kiribati were relatively cool (shown by the blue peaks). In the 1980s and early 1990s the seas were more commonly in the “warm” category (above 30 degrees centigrade), illustrated by the red spikes in the graph.

Figure 6: Relationship between SST and ciguatera rates in Kiribati (source: Llewellyn, 2010)

Studies by the Ministry of Fisheries and Marine Resources Development (MFMRD) and the SPC indicate that the range of ciguatoxic fish may be increasing in Kiribati, with extension of ciguatoxic reef areas and intrusion of ciguatera into atolls previously free of the disease (see Figure 7 below).
According to sources from the MFMRD, fish known or presumed to cause ciguatera in Kiribati include *Acanthurus lineatus* (Stripped surgeonfish), *Cephalopholis argus* (Peacock rock cod), *Gymnothorax javanicus* (Giant moray eel), *Scarus altipinnis* (Minifin parrofish), *Sphyraena barracuda* (Great barracuda), *Lutjanus bohar* (Red bass), *Caranx ignobilis* (Giant trevally) and *Lutjanus monostigma* (Onespot seaperch).

There are also several traditional remedies for fish poisoning in Kiribati, including fruits and sap from several local trees known as *non* (*Morinda citrifolia*), *mao* (*Scaevola frutescens*) and *bukiraro* (breadfruit, *Arocarpus spp*). Further attention could and should be given towards investigating the therapeutic effects of these traditional remedies.

**Spread of Ciguatoxic reef areas**

Figure 7: Ciguatoxic reef areas in Kiribati. Source – MFMRD & SPC
4. Vulnerable populations

The individuals and communities most at risk of suffering adverse health consequences of climate change include:

- children and the elderly
- those in poverty
- those with pre-existing health conditions and disabilities
- people that have been, or are at risk of being, displaced due to sea-level rise, storm surges etc
- certain occupations (eg. farmers, fishermen, outdoor workers)

It is important to note that another “high risk” group exists – those who live in close proximity to the coast and/or on low-lying islands or atolls; in Kiribati this includes the entire population.

South Tarawa is particularly vulnerable to climate change risks because of the pressure on water supplies; the number of people dependent on well water and rainwater collection (see Figure 8 below); population densities; the potential for rapid transmission of infectious diseases; issues with disposal of solid waste (providing plentiful breeding sites for mosquitoes close to human habitation); lack of space and suitable soil for growing local foods; the large proportion (almost a quarter) of households using the beach, bush, lagoon and sea for toileting (Figure 9).

![Main source drinking water, S Tarawa](image)

*Figure 8: Main source of drinking water, households in South Tarawa, 2010 (Source: national census 2010)*
The outer islands are vulnerable for other reasons – apart from physical factors (such as higher risks of drought in the South Gilbert island group), lack of regular communications and distance from services may make it more difficult for these communities to cope with climate-related challenges. Most of the climate change adaptation planning that has been carried out to date has focused on South Tarawa. This is because of population densities on South Tarawa, and the current health problems on the island. Some of the activities in this plan extend to the outer islands (for instance, initiatives to increase public awareness of water- and vector-borne disease, and the expansion of syndromic surveillance). When the plan is reviewed in 12 months, the needs of the outer islands in general should be re-considered.

Figure 9: Main toilet facility, households in South Tarawa, 2010 (source: national census 2010)
5. **Recommendations**

a) There are common themes that run through the workplans for the priority topics, and these deserve particular attention. We include in this group: strengthening disease surveillance, improved transport for staff to carry out environmental testing, training in testing and analysis, equipment and workspace.

b) The EHU of the MHMS should continue to be the lead agency for climate change and health activities in Kiribati for the time being, with the Chief Health Inspector as the focal point, with requests for support from other departments, Ministries and regional agencies as required.

c) Work should commence as soon as possible on the health sector strengthening activities outlined in the Workplans above; this may include consideration of applications for funding, grants and/or technical assistance for implementation of specific activities.

d) This NCCHAP should be presented to the national Cabinet for endorsement, recognising that this document is the health sector’s contribution towards climate change adaptation planning in Kiribati.

e) This document should be reviewed by the EHU in 12 months, to review progress on the workplan and update priority activities as required.

f) At the first review, the EHU should re-visit issues that were identified in the plan as important, but lacked sufficient evidence of links with climate change to warrant being treated as priorities in the NCCHAP. These include mental health and malnutrition.

g) It is recommended that the National Water and Sanitation Steering Committee revive the Water Quality Sub-Committee, review the terms of reference of this body, and ensure that the Sub-Committee meets regularly with representation from all the agencies involved in measuring and promoting water quality.

h) The Health Information Unit should work with Fisheries to explore the feasibility of collecting additional information on sources of fish poisoning from patients who present to clinics and hospitals.

i) To better understand present climate-related health risks and guide adaptation in the future, the Health Information Unit should work with the external advisors to extend the analysis of existing climate and health data.
6. References

Aung T, Singh A, Prasad U. A study of sea-level changes in the Kiribati area for the last 16 years. Weather 2009; 64(8): 203-206


Llewellyn LE. Revisiting the association between sea surface temperature and the epidemiology of fish poisoning in the South Pacific: reassessing the link between ciguatera and climate change. Toxicon 2010; 56(5): 692-697


World Health Organization & Secretariat for the Pacific Community. Madang Commitment. WHO 2009; pg 13-14

WHO Regional Framework for action to protect human health from effects of climate change in the South East Asia and Pacific region. WHO 2007; accessed online August 2011 http://www.searo.who.int/en/Section260/Section2468_14335.htm
7. Appendices
## Appendix 1. Tables of other climate-sensitive health risks, needs and adaptation strategies for Kiribati.

<table>
<thead>
<tr>
<th>Health issue</th>
<th>Likely impact of climate change</th>
<th>Current activities/efforts/projects</th>
<th>Needs/gaps</th>
<th>Adaptation strategies</th>
<th>Responsible agency/agencies</th>
</tr>
</thead>
</table>
| **Respiratory infections (including pneumonia, viral RTI’s, TB)** | Possible increase in cases due to increase in temperature, altered rainfall patterns, increasing population density | - dedicated TB team  
- widespread primary health care clinic network  
- latest revision to Notifiable Disease system eg: 1st Monthly Surveillance (MS1) clarified case definitions of pneumonia vs non-pneumonia lower respiratory tract infections (LRTI), (Previously ambiguous, multiple diagnoses etc). | - high risk TB transmission in specific areas (eg. five “hotspots” on South Tarawa); usually areas of severe overcrowding, poor sanitation and limited access to clean water  
- risk of TB further increased by high prevalence of diabetes (often poorly-controlled, therefore patients suffer from compromised immunity) | - need to tackle the difficult issues of overcrowding (relating to, among other things, reproductive health, poverty, displacement) and NCD’s (especially diabetic control) to decrease TB transmission risk  
- ensure appropriate vaccinations (against influenza, pneumococcal infection) for children and high-risk adults in community | MHMS (Public Health, Curative Services), MISA |
| **Malnutrition (under-nutrition)** | Possible increase due to effects on crop yields and nutrient values of local foods, depleted inshore fisheries, compromised food security, dependence on food imports, high price of nutritious foods | - Home Garden Project (Taiwan Technical Mission)  
- NCD Centre growing and selling seedlings and seeds to community  
- competition between mwaneabas for prizes (for growing crops) | - Nutrition Centre lacks funds to do community outreach (for education, health promotion etc)  
- limited space for growing crops  
- common perception that “feeling full” is enough; leads to poor food choices  
- vegetables, fruits more expensive than energy-dense foods such as rice | - support efforts of NCD Centre and Nutrition Office in providing low-cost, highly nutritious foods to community, as well as educating public (especially women/mothers) regarding healthy food choices  
- serious consideration should be given to subsidising nutritious foods (as well as seeds, seedlings and home garden supplies)  
- encourage, support and expand Home Garden Project and domestic agriculture | MHMS (NCD Centre, Nutrition Office), MELAD (Agriculture), MCIC, TTM |
| **NCDs (obesity, circulatory disease, diabetes)** | Possible increase in morbidity and mortality from NCDs due to increasing temperature, compromised food security, diminished variety and quality of local foods, rise in communicable diseases (such as respiratory infections) that may trigger or exacerbate NCDs | - NCD Centre active in programs addressing key risk factors (“SNAP”) [encouraging smoking cessation; encouraging physical activity eg. inter-mwaneaba volleyball competition; promoting nutrition (see above); and encourage safe alcohol use (NB. some mwaneaba have banned or restricted alcohol)] | - need reliable future funding to continue and expand programs  
- lack of human resources for NCD programs (rely on volunteers) | - support NCD Centre in current and future activities tackling key risk factors and ongoing health promotion  
- educate health professionals and public regarding interrelationship between NCD’s and communicable disease (eg. diabetes and infections) and climate change (importance of physical activity despite hot conditions; healthy food choices etc)  
- ensure adequate and appropriate cooling of public buildings and private residences, particularly for high-risk individuals (eg. elderly, | MHMS (NCD Centre et al), MPWU |
<table>
<thead>
<tr>
<th>Category</th>
<th>Possible increase in ciguatera (toxidrome from consumption of bio-accumulated dinoflagellate) due to changes in sea surface temperature, coral and algae ecology; also “food poisoning” from fish contaminated by bacteria</th>
<th>Possible increase in cases of depression, anxiety, post-traumatic stress disorder, substance abuse</th>
<th>High fertility rates exacerbate problem of population density, overcrowding, communicable disease transmission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ciguatera, fish poisoning</td>
<td>- “fish poisoning” included as notifiable disease on MS1 (need to clarify what this means ie. ciguatera, scombroid, “food poisoning” from fish)</td>
<td>- Mental Health ward staffed by nurses and orderlies  - public health nurses see mental health patients in the community  - low level of recreational drug use at present (mainly cannabis in adolescents)  - “mental illness” usually defined as “abnormal behaviour”; most common diagnoses are psychotic illnesses rather than mood disturbances (ie. depression likely under-reported)</td>
<td>- increase the uptake and accessibility of family planning methods through aggressive health promotion awareness and behavioural changes</td>
</tr>
<tr>
<td></td>
<td>- confusion/lack of clarity regarding case definitions/diagnoses of “fish poisoning” (as opposed to ciguatera, food poisoning etc)</td>
<td>- no professional counselling services (apart from doctors and nurses)  - no psychiatric service  - no consistent Medical Officer presence at Mental Health ward  - lack of appropriate, modern pharmacological treatments for a range of mental health conditions  - overcrowded, unsanitary, insecure conditions at Mental Health ward (NB. water scarcity a significant problem)  - Mental Health ward used to care for patients with physical disabilities  - lack of allied health staff (eg. mental health nurses, OT’s etc)</td>
<td>- The effect will be seen after 10 years and will require lots of effort to change behaviour of the people.</td>
</tr>
<tr>
<td></td>
<td>- results of MFMRD ciguatera survey should be forthcoming in near future</td>
<td>- review case definitions and treatments for mood disturbances (depression, anxiety)  - recruitment and training of mental health staff urgently needed (including trained counsellors)  - consider options for online Psychiatric support (eg. email referrals to Australia, NZ – NB. GPPsychSupport model for remote practitioners in Australia)  - consider applying for volunteer assistance at Mental Health ward (eg. nurses, occupational therapists)</td>
<td>- need to work closely with schools, church groups, NGO’s to promote women’s education, options for family planning etc</td>
</tr>
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MHMS, MFMRD

MHMS