Capacity Building Strategy on Climate Change and Health Related Risks

- FINAL TECHNICAL REPORT
Climate change, including climate variability, has multiple influences on human health. Both direct and indirect impacts are expected. These include alterations in the geographic range and intensity of transmission of vector-, tick-, and rodent-borne diseases and food- and waterborne diseases, and changes in the prevalence of diseases associated with air pollutants and aeroallergens. Climate change could alter or disrupt natural systems, making it possible for diseases to spread or emerge in areas where they had been limited or had not existed, or for diseases to disappear by making areas less hospitable to the vector or the pathogen. The World Health Organization (WHO) estimates that climate change may already be causing over 150,000 deaths globally per year. While direct and immediate impacts such as deaths in heat waves and floods can often be dramatic and provoke immediate policy-responses, the most important long-term influences will likely act through changes in natural ecosystems and their impacts on disease vectors, waterborne pathogens, and contaminants.

Despite the increasing understanding of health risks associated with climate change, there has been limited identification and implementation of strategies, policies, and measures to protect the health of the most vulnerable populations. Reasons for this include the relatively recent appreciation of the links between climate change and health, which means that existing public health related policies and practices globally do not reflect needs with respect to managing likely climate change-related health impacts.

Recognizing the fact that Ghana experiences an extremely high burden of climate-sensitive diseases such as malaria, diarrhoeal, cerebrospinal meningitis and other infectious diseases and given the fact that Ghana is significantly vulnerable to climatic changes, The Ministry of Health (MOH), Ghana in partnership of United Nations Development Programme (UNDP) is implementing a Global Environment Facility (GEF) funded project to pilot climate change adaptation for health in Ghana.
Malaria, Cerebrospinal Meningitis and Diarrhoeal Diseases, were identified as climate sensitive diseases of interest for the pilot project. The pilot will cover three districts – Bongo in the Upper East Region, Keta in the Volta region and Gomoa West in the Central region.

The proposed project will develop systems and response mechanisms to strengthen the integration of climate change risks into the health sector. Critical barriers will be overcome to shift the current response capacity of the health sector from being reactive towards being more anticipatory, deliberate and systematic. Project actions will identify, implement, monitor, and evaluate adaptations to reduce likely future burdens of malaria, diarrhoeal diseases, and cerebrospinal meningitis (CSM), priority climate change-related health issues identified by national stakeholders.
Acknowledgement

The production of this report was facilitated by the Climate Change and Health Project Implementation Unit, Ministry of Health, led by Benjamin Yaw Manu, the Project Manager, with the support of Abena Nakawa, the Project Associate, and in consultation with Mr. Isaac Adams, Director, Research, Statistics, Information Management, Ghana.

The content of this report was developed, discussed and validated through extensive consultations led by the Ministry of Health with stakeholders from government agencies including Ghana Health Service, Ghana Meteorological Service, National Malaria Control Programme, National Development Planning Commission, National Disaster Management Organization, Ministry of Local Government and Rural Development, Environmental Protection Agency, Ministry of Environment Science and Technology, National Disease Control Programme, Health Promotion Unit, Ministry of Health, Ministry of Finance and Economic Planning (External Relations Unit).
Capa City Building Strategy on Climate Change and health related risks
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Capacity Building Strategy on Climate Change and Health Related Risks

- Final Technical Report

By: Mike Walsh MIC and Associates

Capa City Building Strategy on Climate Change and health related risks
Annexes

Annex 1 .................. Schedule of work for the inception phase of capacity building assignment
Annex 2 .................. Training Programme

List of acronyms

MOH ...................... Ministry of health
GHS ...................... Ghana Health Service
MDAs ...................... Ministries, Department and Agencies
MDGs ...................... Millennium Development Goals
MMDA .................... Metropolitan, Municipal and district Assemblies
UNDP ...................... United Nations Development Programmes
Executive summary

This project is aimed at building capacity to integrate climate change into the management of priority health risks in Ghana in order to improve climate change resilience of the health sector. The project focused on three pilot districts, namely Bongo, Keta and Gomoa West in the Upper East, Volta and Central regions respectively.

The overall goal was to improve processes for the development and implementation of action plans that respond to current and future climate change imperatives. This is to be owned by local health practitioners, community members, partners and local authorities and expressed in a local useful form by enhancing the capacities of local practitioners to become knowledgeable champions of the healthcare and climate change agenda. This will provide a legacy for further actions and training of health practitioners in other districts who will continue replication and dissemination of the process locally.

To achieve this, 25 Health District level participants of differing professional backgrounds drawn from the three regions were invited for a five-day training workshop. Participatory action research using Soft Systems Methodology and Results Chain approaches supported by power point presentations on facts about climate change and health were deployed. These approaches enabled the development of conceptual models for action plans for the various districts.

Findings revealed that the Soft Systems and Results Chain approaches enabled participants to identify practical steps to address and overcome obstacles and bottlenecks related to problem solving and planning. Participants learnt about the process itself and how it could be used. There was a stronger knowledge transfer, exchange and learning mechanism embedded within the training session.

Finally the training enabled increased capacity as participants were able to demonstrate new skills and competencies in the use of planning tools for local needs assessment on climate change and health related risks.

This report is the final account of events that took place during the five day training workshop and a validation workshop held in Accra for participants from the three regions and other senior managers from the national level. In-depth analysis and narratives of the capacity assessment and capacity building assignments have been incorporated into the training manual.
CAPACITY BUILDING STRATEGY ON CLIMATE CHANGE AND HEALTH-RELATED RISKS

6
Introduction
1.1 Overview
The introduction provides the general overview of the report on the *Capacity Building Assignment*. It outlines the terms of reference for the consultancy services, the overall goal of the project and the aims and objectives of the assignment provided under this phase of the consultancy. Finally this section describes the organization of the entire report.

1.2 Terms of Reference of Consultancy services
We refer to the terms of reference in response to the above consultancy services with the following stated objectives:

**Main objectives**
- Develop and implement climate change and health training programmes for selected health workers at the district level so that they can identify the current and likely future health risks of climate change on *diarrhoeal disease, malaria*, and *CSM*, and effective and efficient options to reduce those risks.
- Establish and implement district train-the-trainer courses to train additional health workers to identify and manage climate change-related health risks.
- Generate specific actions to be captured in next medium term development plan.

**Specific Objectives**
- Outline strategy for training
- Define training methodology for district teams for climate related health risks
- Develop guidelines for preparing district teams

The terms of reference of the consultancy services clearly spelt out the boundaries of the assignment as follows:

**Boundaries of the assignment**
- Focus on district teams with regional level participation
- Outline of training methodology to include training content, process and expected outcome for preparing the districts for the training

**Task of consultant(s)**
- Deliver series of training programmes
- Report on specific training programmes conducted within selected districts
- Submit a trainer-of-trainers plan for building the capacity of additional health workers
- Debrief stakeholders on training programmes

We also refer to our initial preliminary report under section A of our technical project report on phase two of the capacity development strategy assignment and the final report on phase one of the capacity assessment assignment.

The phase one of this project was to identify knowledge gaps between evidence, policy and practice among healthcare practitioners and other stakeholders in the three regions (Central, Volta and Upper East) to be able to provide a relevant training model for planning on climate change and health related issues at the district level. A training needs assessment using multiple approaches was carried out in the three regions:

- **Desk reviews:** The desk reviews examined the policy issues on climate change and health, the need for assessing knowledge gaps and international evidence on climate change and health. It also provided information on the role of the Ministry of Health and international bodies on climate change and health. The review examined policy documents, plans, guidelines, research studies and other available documents.
- **Interviews:** Interviews were conducted at national, regional and district levels. The regional and district level interviews were held in three regions (Upper East, Volta...
and Central) while the national interviews were held in Accra. In order to validate the data, findings from the district level interviews were discussed with some regional managers.

- **Group Discussions:** Group discussions took the form of action research where soft systems methodology was deployed to develop a conceptual model by the districts.

This report under section B of the *Capacity Development Strategy Assignment* is the final account of the assignment. The report seeks to provide the final overview of activities, recommendations and conclusions of phase two of the capacity development strategy. This report provides the final account of events during the training workshop which aimed at developing capacity to:

Integrate climate change into the management of priority health risks in Ghana in order to improve climate resilience of the health sector, starting with pilot districts in Bongo, Keta and Gomoa West in the Upper East, Volta and Central regions respectively.

1.3 *Organisation of the report*

The structure of the report includes:

- Introduction of the report
- Background and technical issues
- Approach/methodology
- Findings
- Next steps
- Recommendations/conclusion
- Appendix (Schedule of field work, viewpoints from districts, questionnaire, guidelines for action research workshops).
Background
Capa City Building Strategy on Climate Change and Health-related Risks
2.1 Overview

This section gives the background to the project. It describes climate change effects on the environment and health among many others and the need for capacity development in the area. It also presents the project outcome, scope of consultancy, time schedule for the assignment, aims and objectives of the workshop. It also includes challenges encountered during the conduct of the assignment.

2.2 Effects of climate change

Climate change issues are of great concern among governments and other public institutions especially in Sub Saharan Africa. This is partly due to limited empirical studies on climate change and health in Africa. Studies at global, level have indicated that on-going climate change have shown varied scales of ill-impacts on water resources, biodiversity, health, livestock, agriculture, infrastructures, human settlements and so on. Because of this, communities are likely to suffer increased loss of infrastructure and shelter from floods, decreased productivity, diseases, social disruption and displacements, and reduced earning capacity. The World Health Organization (WHO) estimates that climate change may already be causing over 150,000 deaths globally per year.

Despite the increasing understanding of health risks associated with climate change, there has been limited identification and implementation of strategies, policies, and measures to protect the health of the most vulnerable populations. This has resulted in low level of consideration to incorporate issues of climate change in the course of development planning, disaster preparedness and environmental monitoring and evaluation system.

- The case for Ghana

It is on record that Ghana experiences an extremely high burden of climate related diseases such as malaria, diarrhoeal, cerebrospinal meningitis and other infectious diseases, yet Ghana's public health organizations have inadequate capacity to address the conventional and emerging issues of climate change and health related risks. Building institutional and communication capacity through effective coordination mechanisms are highly desirable. Such policies also need to have defined procedures to promote effective collaboration between the central and local health institutions as well as the district assemblies, and among agencies, communities, and the private sector. The Ghana Ministry of Health does not have the required capacity on climate change and health issues. Virtually, designing and conducting training programs for the public sector health workers, on climate change and health related risks are necessary for the country’s resiliency to the ill-impacts of climate change in the country.

Given the importance of the cross-cutting nature of climate change and health, it is important to raise the awareness and ability of public sector health workers and other interested parties to strategically plan adaptation measures at the local level and incorporate climate change and health management into development plans at the regional and national levels. In the light of this, designing and conducting training programs for public sector health workers and other stakeholders involved in healthcare on climate change and health related risks become important to national development.

However, as a result of inadequate resources to effectively address climate change and health risk, the Ghana Ministry of Health has collaborated with the United Nations Development Programme (UNDP) under a Global Environment Facility (GEF) funded project to pilot climate change adaptation by developing Capacity Strategies on climate change and health related risks for district level health staff and other local agents in three districts; Bongo, Keta and Gomoa West Districts. The first phase involved a training
needs assessment (see report on phase one of the project). Results from the training needs assessment revealed the following major findings:

- We found that district practitioners had immediate district priorities and there was a degree of awareness of climate change issues in both the short and longer terms, with recognition of the possible impact of this on local healthcare.
- The participants in all the three districts expressed consciousness of the impact of climate change and disease prevalence. However, participants were not aware of the degree of effect of climate change on disease prevalence due to inadequate data at the district level.
- Inadequate data at the district level and inconsistencies in data at the district and national levels were also uncovered. We also found out that healthcare practitioners had limited facts on climate change and health related issues.
- Again the literature review showed that there was limited empirical evidence on climate change and health from Africa.
- In general, healthcare professionals and stakeholders in all the action research workshops demonstrated the need to intensify current practices that are known to provide positive outcomes and to replace less effective interventions with more effective practices.
- Lack of a policy framework that will contribute to government plans for capacity development on climate change and health.

Drawing from the findings above, a training manual was developed to guide the training of potential trainers on climate change and health and the subsequent sections of this report describe the training and provide the training outcomes.

2.3 Project Outcome

The project is focused on three broad outcomes:

- Improved national and local health technical sector capacity to plan for and manage climate change related alterations in the geographic range and/or incidence of climate-sensitive health outcomes, including malaria, diarrhoeal diseases and meningococcal meningitis.
- Mechanisms established for cross resilient health policy formulation and implementation at national and local policy making levels.
- ‘Lessons learned’ collected and knowledge management components established.
2.4 Scope of consultancy service and identified consultation

The scope of services identified in this assignment involved phase two of the consultancy services as specified in our proposal. This includes the training of field officers in climate change and health related risks from three regions (Volta, Upper East and Central regions) specifically Gomoa West, Bongo and Keta districts with the following objectives:

- Develop capacity on climate change and health related risks at the district level for healthcare professionals and other identified groups in three regions (Volta, Upper East and Central regions) and specifically Gomoa West, Bongo and Keta districts.
- Improve knowledge and skills of participants on planning for results in response to climate change and healthcare needs.
- Support the regions to develop district action plans for adoption by the district health management teams.

2.5 Period of assignment

The capacity development assignment under phase two of the capacity strategy component was undertaken between 12th and 16th June 2012.

2.6 Overall goal

Our overall goal is to improve processes for implementation of action plans owned by local health practitioners, community members, partners, local authorities and expressed in a local useful form by enhancing the capacities of local practitioners. Thus providing a legacy of further action and training, comprising:

- Trained personnel who will continue replication and dissemination of the process locally and in other districts.

2.7 Objectives of workshop

Our training objectives were to:

- Examine how evidence on climate change is accessed.
- Enable health practitioners and community to provide feedback on gaps in evidence to authorities, agencies, and the scientific health community or other appropriate national ministry and local agencies.
- Strengthen the knowledge and skills of individuals, locally and nationally in health systems.
- Explore how evidence is used (i.e. what used is actually made of evidence?).
- Explore the barriers that may prevent implementation. In particular we wanted to establish to what extent lack of intelligibility or acceptability (especially local social or cultural acceptability), perceived trustworthiness and scientific quality and relevance of evidence pose implementation difficulties and challenges.
- Identify the activities that are necessary to overcome these barriers.
- Enhance the skills of participants to be able to train local practitioners from other districts.

2.8 Challenges

The diverse professional backgrounds presented major challenge with coordination and communication.
CAPACITY BUILDING STRATEGY ON CLIMATE CHANGE AND HEALTH RELATED RISKS
III Methodology
3.1 Overview and study design

This section provides the approach adopted for the capacity building. The assignment involved the integration of educational learning and group discussions. It ensured equalization of opportunities for both the consultants and participants in the form of knowledge exchange. Representatives of the Regional Health Administrations, and District Health Directorates were involved in the training.

3.2 Geographical Coverage

The project covered three regions namely; Upper East (Bolgatanga), Volta (Ho) and Central (Cape Coast). The pilot districts were Bongo, keta and Apam

3.3 Target Beneficiaries

In all 25 healthcare practitioners and other stakeholders benefited from the assignment. Practitioners from three regions in Ghana (Central, Volta and Upper East Regions) were involved in action research workshops.

The team comprised members from:
1. District Health Administration
2. District Assemblies
3. Regional Health Administration
4. Other stakeholders

Table 2.1 outlines the project design and indicators for measurement as proposed in the project proposal.
### Table 2.1 Project Objectives and Indicator Framework

<table>
<thead>
<tr>
<th>Overall objectives</th>
<th>Indicator</th>
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<tbody>
<tr>
<td>Our overall goal was to improve processes for implementation of action plans owned by local health practitioners, community members, partners, local authorities and expressed in a local useful form by enhancing the capacities of local practitioners. Thus providing a legacy of further action and training, comprising:</td>
<td>Participants’ ability to transform knowledge acquired into practical issues through the development of district action plans.</td>
</tr>
<tr>
<td>- Trained personnel who will continue replication and dissemination of the process locally and in other districts.</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Specific objectives 1</th>
<th>Indicator 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Examine how evidence on climate change is accessed.</td>
<td>Presentations on scientific evidence of climate change and health related risks.</td>
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</table>

<table>
<thead>
<tr>
<th>Specific objectives 2</th>
<th>Indicator 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enable health practitioners and community to provide feedback on gaps in evidence to authorities, agencies, and the scientific health community or other appropriate national ministry and local agencies.</td>
<td>Case studies from scientific evidence on climate change. Group discussions to identify gaps.</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Specific objectives 3</th>
<th>Indicator 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strengthen the knowledge and skills of individuals, locally and nationally in health systems</td>
<td>Provide facts about climate change and health related risks through presentations and engage in group discussions</td>
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</table>

<table>
<thead>
<tr>
<th>Specific objectives 4</th>
<th>Indicator 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify the activities that are necessary to overcome these barriers</td>
<td>Group work</td>
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<tr>
<th>Specific objectives 5</th>
<th>Indicator 5</th>
</tr>
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<tbody>
<tr>
<td>Explore how evidence is implemented (i.e. what use is actually made of evidence?)</td>
<td>Presentations on Results Chain and action plans</td>
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<thead>
<tr>
<th>Specific objectives 6</th>
<th>Indicator 6</th>
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<tbody>
<tr>
<td>Explore the barriers that may prevent implementation. In particular we will establish to what extent lack of intelligibility or acceptability (especially local social or cultural acceptability), perceived trustworthiness and scientific quality and relevance of evidence pose implementation difficulties and challenges.</td>
<td>Presentations on effective communications. Group discussions to identify barriers from experience</td>
</tr>
</tbody>
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<tr>
<th>Specific objectives 7</th>
<th>Indicator 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enhance the skills of participants to be able to train local practitioners from other districts</td>
<td>Participants expressed competencies and skills through individual presentations and contributions to group and class discussions</td>
</tr>
</tbody>
</table>
3.4 Format of Training

A mixed methodology comprising the use of problem structuring / action research methods and didactic presentations were used to build district level capacity on climate change health related risks and to develop a model for identifying solutions and developing action plans for implementation at the district level. We worked with local Healthcare practitioners, district assembly, community members and other stakeholders at district level and a number of regional level policy makers.

We adopted a world class problem structuring method, Soft Systems Methodology (SSM) (Checkland and Poulter, 2006), a general planning and problem solving methodology, that has already been piloted and tested in the capacity assessment assignment in three health districts in Ghana (Bongo, Keta and Apam) during phase one of this project as stated in the proposal document and concept note. SSM was used to enable participants to synthesize and explore problems of local health systems caused by climate change and to develop possible solutions. Participants were also introduced to the use of Results Chain instruments for district action plans. Activities were defined and analysed in the Results Chain tool with respect to the aims and objectives as well as the overall project outcomes.

3.5 Approach adopted

Preparation

Immediately after the completion of phase one of the project, we engaged in consultations with the Climate Change Project Secretariat in respect of information, logistics, accommodation and other relevant arrangements that would ensure a successful execution of phase two of the project. Further consultations were made with the districts involved to discuss the details of relevant stakeholders and extension of invitations, arrangement of venue for the workshop and other logistical provisions.

The training took a three stage approach:

- **Introductory phase**
  
  This was the learning process and it involved the explanation of ground rules, code of ethics and mode of presentations. The introductory phase had components of didactic teaching in the form of power point presentations. Facts and information about climate change and health related risks were presented using power point. Issues in the introductory phase covered the historical background of the problem and expectations of outcome of training from participants.

- **Group phase**
  
  The group discussions took the form of action research where soft systems methodology was deployed to develop a conceptual model by the districts. This phase constituted the engagement phase or group engagement phase. It involved brainstorming, agreeing and disagreeing and consensus discussions: This phase can be seen as enhancing personal constructs (Kelly, 1963) and group learning. Photo 2.1 below shows a section of participants during a group discussion.

What is action research?

Action research is a thoughtful and interactive means of finding solutions to problems and implementing them in a collaborative context.
**Plenary phase**

The plenary involved discussions reviews, clarifications and analyses of issues that occurred during the group stages (making use of elements of the critical theory of Kemmis, 2008 and the idealising element of Ackoff 1981 Interactive Planning). It involved the identification of constraints, opportunities and resources for implementation of action plans. Photo 2.2 below depicts a section of participants in plenary during the capacity building workshop held in Accra.

The group phase and plenary ensured a higher participation, transparency and openness to discussions. Participants realised that all were colleagues and valued each other’s contributions. Participants understood that it was a professional training programme and that confidentiality, gender and culturally sensitive issues were to be addressed in conformance to professional and Ministry of Health expectations. This high level of confidence made discussions fruitful as participants were able to ask questions and to seek clarification where necessary.

**Why this format of training?**

The format was relevant in ensuring:

- Experiential learning
  
  ‘Learning from and through action or concrete experience as well as taking action as a result of this learning’

- Learning from Systems theory to see and create synergies:

- Praxis - integration between theory and practice

**3.6 Medium of communication**

The medium of communication used during the training relied mainly on Habermas (1991) ‘Theory of communication action’ where emphasis was placed on:

- Intelligibility of information (language and style of delivery)
- Acceptability (local, social or cultural issues relevance and in specific context)
- Perceived trustworthiness, culture of trust, and trusting the source of information
- Facts (relevance, validity and reliability of evidence)

Participants were advised to seek clarification or further explanation to ensure validity of information throughout the training.
3.7 Day to day activities

13th June 2012

1. The workshop was formally introduced by officials from the climate change project.

2. The training modalities, ground rules, and code of ethics for the training were later spelt out by the consultants. Participants were made to list their expectations on a flip chart which were to be evaluated at the end of the training.

3. A presentation on the training manual; rationale, uses and guidelines for the use of the manual was made.

4. A presentation on the significance of global linkage between science and climate change was made. This presentation provided the scientific information on climate change and health related risks using existing literature both globally and locally.

5. Group discussions (clarifications, contributions, questions and suggestions) were made after the presentation.

6. Participants were then taken through a presentation on the importance of climate change and health focusing especially (but not exclusively) on malaria, meningitis and diarrhoea diseases.

7. Group discussions. Participants went into groups to discuss case studies from other Africa countries.

8. Group work: four groups of 6 were put together to discuss issues around three case studies selected from peer reviewed journals: groups were to identify the nature of articles, the messages from those articles and raise questions from the articles for plenary discussions.

9. Plenary discussions: group representatives presented the findings from their groups and the house discussed the issues. The discussions examined the case studies and examples of summaries of observations from participants are provided as follows:

- The ecology of anopheles mosquitoes under climate change; case studies from the effects of deforestation in East Africa highlands.

(Participants observation)

Disease appearance and evolution against a background of climate change and reduced resources

- What are the new methods of dealing with malaria?
- What are the effective ways of dealing with malaria?
- What improvements in existing methods are available?
- How existing measures such as the use of ITNs could be evaluated?

Progress towards understanding the ecology and epidemiology of malaria in the western Kenya highlands: Opportunities and challenges for control under climate change risk

(Participants’ observation)

Influence of climate change on malaria transmission depends on daily temperature variation

- Regime shifts and heterogeneous trends in malaria time series from Western Kenya Highlands

(Participants observation)

Modeling climate change and malaria transmission

- Climate change and vector-borne diseases: an economic impact analysis of malaria in Africa

(Participants observation)

Relevant micro-climate for determining the development rate of malaria on mosquitoes and possible implications of climate change

Other issues discussed included

- Adaptive mechanisms
- Causes
Vulnerability
Data on climate change and health related risks
Surveillance on specific disease
Policy issues surrounding climate change and health
Climate variability
Research methods
Other related effects such as Malnutrition
Preparedness to respond to increases

14th June 2012
a. The programme started with a formal introduction by officials from the Climate change project
b. The day’s activities and format for the training was explained during the introductory session.
c. A presentation on principles to bridging gaps between evidence, policy and practice was delivered by the lead consultant.
d. A presentation on viewpoints from the capacity assessment meetings was made and participants were asked to validate those findings.
e. Group work on district priority health issues: Four groups of 6 persons examined district priorities and identified issues related to climate change and health. They further identified common issues across the districts and the differences and interventions that needed to be improved or changed.
f. Plenary. The groups presented their findings during plenary for further deliberations

g. Presentation on soft systems methodology. Participants were taken through step by step guide on soft systems methodology. The advantages and disadvantages of soft systems methodology and other alternatives of action research were clarified and explained to participants.
h. Group work: Four groups of 6 practiced the use of soft systems methodology in problem finding and problem solving using CATWOE.

During the group sessions, groups were asked to pick a problem, identify an activity that could be used to solve the problem and use rich pictures or rich narratives to describe the issue. The groups then used CATWOE to identify customers, actors, justify to the world, owners and the environmental constraints needed to address the problem.

The groups also identified specific skills that would be needed to implement the activities identified. The photo below demonstrates a group action using CATWOE in identifying and analyzing a local health problem related to climate change.
i. Plenary discussions: group representatives presented the findings from their groups and the house discussed the issues during the plenary. This brought the day’s session to an end. Participants engaged each other in social networking which was part of the programme and the district representatives took turn to meet with other consultants.

15th June, 2012

1. The programme started with a reflection of the previous day’s activities and validation of findings from the previous day’s engagements.

2. Participants were taken through the day’s programmes.

3. The lead consultant introduced participants to the use of Results Chain and interactive planning.

4. Participants were allowed to discuss and to seek clarifications on the use of the planning tools. Contributions and suggestions came from participants to enrich the final outcome of which planning tool was most suitable. Modifications were made to the original tool to suit local needs and context and finally the house agreed on a flexible framework based on the Results Chain model.

5. Group work on district action plans: 3 groups made up of representatives from the three regions: Central, Volta and Upper East engaged in the use of planning models.

6. Groups were to use the Results Chain framework to develop district action plans for interventions on climate change and health related risks for a three year period

16th June 2012

The regions/districts presented their action plans for discussions. Participants’ expectations at the beginning of the workshop were evaluated through a post workshop evaluation (See post workshop evaluation results from Climate Change Project).
IV Findings
4.1 Overview
This section provides the findings of the assignment under phase one of the capacity strategy projects. The findings are in three main components; major findings, unanticipated outcomes; and relationships established during the execution of the assignment.

4.2 Major Findings
The soft systems approach enabled participants to identify practical steps to address and overcome obstacles and bottlenecks related to problem solving. Participants learnt about the process itself and how it could be used. Thus there was a stronger knowledge transfer and exchange and learning mechanism embedded within this approach.

Policy implication
On policy, the assignment has offered a focus to discussions about climate change and health at district, regional and national levels. It has been viewed as a vehicle to supporting their existing concerns and visions through offering gateways to accessing climate change and health related issues in Ghana and African as a whole. The action plans provide evidence for more resources and further investments to support climate change and health related activities at the district level. The review of international literature, and other training materials during the course of training and professional networking consolidated this point. In particular, it provides opportunity for Ghana to offer something to the international community.

4.3 Unanticipated outcomes from the assignment
There have been many unanticipated outcomes, both positive and less so:

Positive outcomes:
- High levels of expressed knowledge and commitment to the assignment by participants during the training workshop.
- Ability to collaborate in a participatory manner irrespective of diverse professional and culture background
- Wealth of high quality, existing e-learning resources freely available online, via other global health networks

There have also been real challenges including:

Communications:
- Working with groups from diverse professional backgrounds presented and major challenge with coordination and communication. This was partially addressed from the beginning of the project as part of the ‘ground rules’

4.4 What key relationships were developed during the assessment?
This project was largely about assessing knowledge and skill gaps on climate change and health related risks.

Internal project relationships and partnerships
The assignment brought together 3 consultants and a local NGO based in Ghana with international experiences and relationships between these experts and organization ensured higher output.
External project relationships and partnerships

Working effectively with the Climate change project has been one of the key successes of this assignment and, as well as developing internal project relationships; we have made many valuable new links including district level, regional and Ministry of Health contacts. We received much support from the district health authorities during the conduct of this assignment.

4.5 Pathway to success

The pathway to success of the training workshop relied on classic theory of basic human needs and motivation. Within this framework, four levels to achieving success was identified and emphasized during the training. They are:

- All participants feeling a sense of belonging to the group
- All participants having the free will to contribute to the group discussions
- Creating fun and sense of humour making the training exercise very flexible but educative
- Identifying the value attached to the training programme and working in a collaborative manner to achieving success

4.6 Which levels did we anticipate to impact?

The training aimed at achieving impact at the following levels:

- Individual learning
- Group learning
- Inter-organisational learning
- Organizational learning
Recommendations and Lessons Learned
Next Steps
- Update the draft training manual after the district level training
- Final Training manual and guidelines produced

District Level Capacity Development
- Continuous development of staff at all levels of healthcare
- Training of trainers programme to build capacity

Support received from the Project Management Team
- Guidance/advice
- Contacts
- Networking
- Support during particularly challenging times

The Climate Change Project been particularly supportive and encouraging during the process of this assignment. For this we are very grateful. Perhaps a little more clarification of budget disbursement processes and dates should be made known and also to align more closely with the financial processes.

Conclusion
The Awareness creation and capacity building workshop for district health care practitioners’ and other stakeholders generated a lot of interesting discussions. The issues raised regarding concerns on climate change and health in Ghana especially in local communities were much revealing. The need
- Ghana needs to develop comprehensive policy on capacity for climate change and health to ensure that the potential negative impacts of climate change on health are mitigated.
- It is believed this first attempt to raise awareness and to build capacity on climate change and health was up to expectation judging from the level of participation during the workshop. One thing that came out from the workshops is the appreciation for the organisation of this important workshop and the need for more of it, not only in the districts that were covered, but throughout the country.
- Participants were able to develop local district action plans, reflecting local district priorities, for responding to climate change based on a synthesis of local knowledge with scientific climate change evidence.
- A training manual bringing together the scientific evidence, with the analytical and planning tools, to exemplify how district personnel can, locally, analyse and respond to climate change imperatives served as the guide for the workshop.

The table below presents the objectives for the workshop and the corresponding outcome of each objective after the workshop.
### Table 5.1 Project Objectives and Results from assignment

<table>
<thead>
<tr>
<th>Overall objectives</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Our overall goal was to improve processes for implementation of action plans owned by local health practitioners, community members, partners, local authorities and expressed in a local useful form by enhancing the capacities of local practitioners. Thus providing a legacy of further action and training, comprising: Trained personnel who will continue replication and dissemination of the process locally and in other districts.</td>
<td>The training enabled increased capacity as participants were able to demonstrate new skills and competencies in planning for local needs on climate change and health related risks. District action plans were finally produced.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Specific objectives 1</th>
<th>Indicator 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Examine how evidence on climate change is accessed</td>
<td>Presentations on scientific evidence of climate change and health related risk were delivered by the consultants</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Specific objectives 2</th>
<th>Indicator 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enable health practitioners and community to provide feedback on gaps in evidence to authorities, agencies, and the scientific health community or other appropriate national ministry and local agencies.</td>
<td>Participants were made to examine case studies from scientific evidence on climate change and groups identified and discussed knowledge gaps</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Specific objectives 3</th>
<th>Indicator 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strengthen the knowledge and skills of individuals, locally and nationally in health systems</td>
<td>Presentations on facts about climate change and health related risks were delivered by the consultants</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Specific objectives 4</th>
<th>Indicator 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify the activities that are necessary to overcome these barriers</td>
<td>Groups were able to reach consensus on activities needed to overcome barriers to implementing climate change health related challenges</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Specific objectives 5</th>
<th>Indicator 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explore how evidence is implemented (i.e. what use is actually made of evidence?)</td>
<td>Presentations on Results Chain and action plans delivered by consultants and participants were made to undertake practical exercise during group work</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Specific objectives 6</th>
<th>Indicator 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explore the barriers that may prevent implementation. In particular we will establish to what extent lack of intelligibility or acceptability (especially local social or cultural acceptability), perceived trustworthiness and scientific quality and relevance of evidence pose implementation difficulties and challenges.</td>
<td>Presentations on effective communications delivered by consultants. Groups discussed local climate change and health related issues to identify barriers from experience and solutions</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Specific objectives 7</th>
<th>Indicator 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enhance the skills of participants to be able to train local practitioners from other districts</td>
<td>Participants expressed competencies and skills through individual presentations and contributions to group and class discussions</td>
</tr>
</tbody>
</table>
Recommendations

- We recommend a scientific publication of the research findings in a peer reviewed journal or in a book form for approval by the Climate Change Project and sponsors of the project.
- The Ministry of Health should integrate climate change and health into the National Programme of Work. Districts should also integrate climate change response into their normal programme of work, building on the plans produced in the final workshop and creating district ownership of the Climate Change and healthcare agenda.
- Front line practitioners’ awareness of gaps between evidence and local practice is crucial for effective local response to climate change. Therefore feedback about such gaps (capturing local knowledge from districts) should be integrated into National Health policy via regions.
- The capacity enhancement of the health sector in climate change and health related risks is basic to providing better services that will prepare people on climate resilience and adaptability. Therefore there is the need for pre-service training and in-service training on core competencies and skills on climate change and health.
- Further support is necessary to enable the training of trainers, to expedite the cascade of knowledge and skills in relation to climate change and local action.
- Dissemination of the evidence on responding to climate change via the training manual to all Health Districts with participants from original training events providing support.
- District level actions can be reported nationally via regions. After analysis best practices can be used to update the manual.

References

<table>
<thead>
<tr>
<th>Activity</th>
<th>Deliverables</th>
<th>Description</th>
<th>Deadlines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparations for the inception phase</td>
<td>Letters to stakeholders</td>
<td>The Management of Climate Change is expected to send out letters to all stakeholders that would be involved in the meetings and discussions informing them about the project, the need for their participation and the dates for the meetings</td>
<td>25 May</td>
</tr>
<tr>
<td>A1. Meeting with stakeholders in Accra</td>
<td>Minutes of meeting</td>
<td>Meeting will take place at Climate Change or Ministry of Health offices. Participants will include project management team and consultants</td>
<td>2/6/2012</td>
</tr>
<tr>
<td>A1.1 Outline of training programme</td>
<td>Activities and training contents</td>
<td>Ministry of Health/Climate change offices</td>
<td>2/6/2012</td>
</tr>
<tr>
<td>A2. Power point presentation of propose training plan</td>
<td>Minutes of meeting</td>
<td>Meeting with stakeholders</td>
<td>4-6/6/2012</td>
</tr>
<tr>
<td>A3. Training: Updates on Climate change and health</td>
<td>lecture</td>
<td>Participants from the three regions A maximum of 30</td>
<td>11/6/2012</td>
</tr>
<tr>
<td>A4. Significance of climate change and health</td>
<td>Lecture</td>
<td>A maximum of 30 participants/ from the district is expected to take part in the focus group discussions at Apam</td>
<td>11/6/2012</td>
</tr>
<tr>
<td>A5. Introduction to training manual (Volta Region, Ho)</td>
<td>lecture</td>
<td>A maximum of 30 participants/ from the district is expected to take part in the focus group discussions at Apam</td>
<td>12/6/2012</td>
</tr>
<tr>
<td>Introduction to problem solving methodologies</td>
<td>Group discussions</td>
<td>Participants into small groups of 6</td>
<td>13/6/2012</td>
</tr>
<tr>
<td>A7. Introduction to results for action planning tools</td>
<td>Group discussions</td>
<td>Participants into small groups of 6</td>
<td>14/6/2012</td>
</tr>
<tr>
<td>A8. District action plans and costing</td>
<td>Group discussions</td>
<td>District teams</td>
<td>15/4/2012</td>
</tr>
<tr>
<td>A9. District action plans and costing</td>
<td>Group discussions</td>
<td>District teams</td>
<td>16/4/2012</td>
</tr>
<tr>
<td>A10. Evaluation of workshops</td>
<td>Questionnaires</td>
<td>Individual responses</td>
<td>16/12/2012</td>
</tr>
<tr>
<td>A11. Outcome of the entire training</td>
<td>Preliminary Training report</td>
<td>Presented to Ministry of Health/ Climate change management team</td>
<td>17/12/2012</td>
</tr>
</tbody>
</table>
# Annex 2: Programme for District Level Training on climate change awareness and action on priority healthcare issues: Malaria, Diarrhoeal disease and Meningitis, June 12-16, 2012: Oak Plaza Hotel, Accra

<table>
<thead>
<tr>
<th>Tuesday (12th)</th>
<th>Wednesday (13th)</th>
<th>Thursday (14th)</th>
<th>Friday (15th)</th>
<th>Saturday (16th)</th>
</tr>
</thead>
</table>
| **08:00**     | Introduction to the training manual  
(30 minutes)  
The scientific evidence of link between climate change and health:  
- Malaria  
- Diarrhoeal disease  
- Meningitis  
- Other areas  
(45 minutes)  
What are the gaps between theory policy and practice?  
Gaps from literature  
theory (lack of evidence  
from Africa)/policy  
(local vs. national)  
Three principles for closing gaps between theory, policy and practice.  
(1.15hr) |
| **10:30**     | **TEA BREAK**    | **11:00**       | **Introduction to soft systems methodology** | **Closing remarks** |
| **11:00**     | Case studies from other countries  
Group work  
(45minutes)  
Questions:  
What is study about?  
CC Health risk identified?  
Attempt to prepare communities?  
What questions does it raise for us?  
(1.5h) feedback |
|               | **Introduction to district action plans**  
(45minutes)  
Discussion/feedback on district action plans  
(1.15 hours) |
<p>|               | Plenary |
|               | Plenary |</p>
<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
</table>
| 13:00 | **Welcome:** (15 minutes)  
Introductions: Ice break. Animal Game  
Participants introduce themselves.  
Expectations: Game.  
30 minutes  
Objectives of training.  
Ground rules.  
(30 minutes)  
An overview weather game |
| 14:00 | **Viewpoints on healthcare and climate change from three Health Districts:**  
Workshops in Keta, Gomoa and Bongo:  
Findings  
Group work  
What do we have in common?  
What are our key differences?  
What do we need to change?  
Feedback, (1.5hr) |
|       | **Group discussions on soft systems methodology:**  
Introduction to results chain  
Group discussions on results chain  
Link to skills needed discussion earlier  
Monitoring and evaluation tools  
Group work  
Link to indicators, embedded in models. |
|       | **Debriefing Team (1.30 hours)** |
|       | **Departure** |
| 16:30 | **DISCUSSIONS & TEA BREAK**  
Meeting and interaction and networking |
| 17:00 | **Meetings with other consultants** |
Integrating climate change into the management of priority health risks in Ghana

- TRAINERS’ GUIDE
Acknowledgements

Mike Walsh and Associates in collaboration with Conservation Foundation (A local NGO based in Ghana) acknowledge the contributions of the following individuals and organisations to the production of this training guide for healthcare practitioners and volunteers:

- Ministry of Health
- Regional Health Directorates (Central, Volta and Upper East)
- District Health Directorates (Gomoa West, Keta and Bongo)
- District Assemblies (Gomoa West, Keta and Bongo)
- Partners (UNDP), (GEF)
- Climate Change Project

Other resources that were used in the production of this document:

- World Health Organisation Resource materials on climate Change: Protecting health from Climate Change; World Health Day 2008
- Document from MOH/UNDP on the commissioning of Climate Change challenges in Ghana
Notes for Trainers

PURPOSE

This training guide is an extract of the training manual and it is designed to prepare trainers who already have skills as climate change agents to proceed to the level where they would be able to train other practitioners and volunteers. This guide prepares them to conduct a training needs assessment, develop detailed plans for training, develop and pilot test a training curriculum, conduct training using more advanced training techniques, conduct training follow up and evaluate training.

The guide is designed to actively involve participants in the learning process. Sessions include skills practice, discussions, case studies, power point presentations and objective knowledge, attitude and skills checklists. Competency-Based Training (CBT) skills checklists, bibliography and additional sources of reading information have been included in the guide.

THE TRAINING MODEL

The training model which has been recommended for trainers in the climate change project demonstrates an inter-related approach to systematic training as follows:

Aims and objectives of project
- It is important that trainers understand the aims and objectives of the project they embark on and how the aims are met by range of activities.
- Assessing and Analysing training needs:
  Finding out what people need to learn. This is done by:
  1. Assessing the degree of competence of people involved in the project to meet the needs that the project aims to address
  2. Analysing the knowledge, skills and attitudes/behaviours that the project seeks to achieve.
- Setting aims and learning objectives
- Specifying what trainees should be able to do as a result of training.
- Designing training strategy
- Deciding on a strategy to meet training needs, e.g., by designing courses / modules, suggesting various methodologies and deciding on key learning points trainees must know.
- Implementing training strategy
- This is the action part of the training, thus putting the training into practice.

TRAINING SESSIONS

Training is the process of acquiring the knowledge, skills, and attitude that are needed to fill the gap between what people know and want to do, and what they are able to do. It is "The systematic development of the knowledge, skills and attitudes required by an individual to perform adequately a given task or job". The process of transferring knowledge from one person to another at different levels very often takes the form of training. In order to teach a trainer to be able to train well, a 'learning by doing' approach is recommended for trainers in the climate change project.

Learning by doing enables the flow of training from one level to another. For example, participants in a workshop can learn skills in participatory learning and as soon as they acquire the practical skills can hold similar training workshops for colleagues working at district/local level. Training is more effective if visuals are used to communicate and if participants actively participate in the workshop proceedings. The training sessions for the climate change and health related risks are premised on these basic principles that underpin most training programmes. A good training session should therefore have the following indicators:
- A planning/preparation checklist for facilitators
- A good Techniques/Practices for Training
- A plan for attitude/behaviour for facilitators and participants

**GUIDELINES FOR TRAINING**

A series of pointers and considerations based on the above indicators have been provided for use in any training of trainers exercise to be conducted under the climate change and health project. The guidelines are intended to assist trainers in preparing and planning for training and also to help both trainers and trainees during the training (see box 1 below).

- **Box 1: Pointers for trainers/participants**

<table>
<thead>
<tr>
<th>Planning/preparation checklist for facilitators</th>
<th>Techniques/practices for training</th>
<th>Attitude/behaviour of facilitators/participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify your weak points as a facilitator and try to improve upon those areas.</td>
<td>Relax and energise participants by facilitating name-learning.</td>
<td>Be open, honest and a good listener; observe and if necessary record some proceedings.</td>
</tr>
<tr>
<td>Work as a training team, and assign roles based on strengths of individuals in the team.</td>
<td>Ensure all participants understand the aims and objectives of the workshop</td>
<td>Do not panic when the group is silent; wait patiently for them to think about what they want to say.</td>
</tr>
<tr>
<td>Arrange for an acceptable venue (light, electricity, convenient table setting where people can see each other).</td>
<td>Always introduce the key aims of the training, and use an ice-breaker if necessary.</td>
<td>Do not interrupt people or make judgements of people’s responses or humiliate anyone.</td>
</tr>
<tr>
<td>Make sure you have all the (visual) materials needed - paper, pens, flipcharts, tape, markers, etc.;</td>
<td>Ensure all the activities planned for the workshop are acceptable to the participants</td>
<td>Do not let arguments dominate the discussion; encourage participants to re-focus on the main topic.</td>
</tr>
<tr>
<td>Where appropriate invite particular project stakeholders to test the trainees during the training.</td>
<td>List expectations, and get a sense of the level of knowledge present among participants at the start of the training</td>
<td>Be aware of language barriers; let people talk in the language they are most comfortable with</td>
</tr>
<tr>
<td>Are dates for training sessions convenient for the local community and participants?</td>
<td>Adapt the programme to address the felt needs and make modifications to content or structure as requested by the group</td>
<td>Use visual aids and body language to help overcome language barriers.</td>
</tr>
<tr>
<td></td>
<td>Agree to ‘rules’ of the workshop (e.g. mutual respect, one speaker at a time, no mobile phones, etc.)</td>
<td>Have eye contact, stand up and move around, speak slowly and use your voice (intonation)</td>
</tr>
<tr>
<td></td>
<td>Emphasize ‘learning by doing’ as the approach that will be taken during training</td>
<td>Make the sessions as interactive as possible - involve and engage participants.</td>
</tr>
<tr>
<td></td>
<td>Start every day with a summary of the previous day. Then introduce the agenda for the day and seek inputs.</td>
<td>Ask questions and invite participants to tell their stories</td>
</tr>
<tr>
<td></td>
<td>Use a variety of communication methods: show a wide range of visual aids.</td>
<td>Use humor if natural for you, and smile where possible</td>
</tr>
<tr>
<td></td>
<td>Have a strong closing session where you review aims and expectations, summarize what was learnt, commit to action, and close with appreciation and congratulations</td>
<td>Choose words, stories, numbers to compliment your message</td>
</tr>
<tr>
<td></td>
<td>Always build in an evaluation of the training as improvements can always be made.</td>
<td></td>
</tr>
</tbody>
</table>
Introduction: TOT Materials and Planning for Training

TOT Materials
The TOT materials listed below are recommended for both trainers and participants of the climate change project:

- **Trainer’s Guide**
  - Notes for Trainers: You will find notes for trainers and the nature of training sessions in the Trainers Guide. The guide also provides pointers for trainers and participants.
  - Training Needs assessment: Here target groups, populations and institutions for training as well as strategies for the training needs assessment are identified.
  - Training Text: This section includes objectives, methods for delivery, talking points, activity instructions.
  - Training Methodologies: This unit examines the main methodology proposed for the TOT.
  - Appendices: The appendices include the evaluation forms and other guidelines to help you deliver the training.

- **Training Manual**
  - Scientific evidence on climate change and health related risks
  - The importance of climate change to Ghana
  - Evidence from three districts (Gomoa West, Keta and Bongo) in the Central, Volta and Upper East regions respectively
  - Knowledge gaps in the three priority health issues-malaria, meningitis and diarrhoea diseases as identified from the three health districts
  - Action research and soft systems methodologies
  - Monitoring and evaluation mechanisms
  - Roles and responsibilities of key stakeholders

- **Printable Materials**
  - Slides on power point presentations
  - Practice presentation and feedback form
  - Trainer evaluation form

- **Other Materials**
  - Flip Charts
  - Markers
  - Pens and exercise books

Planning for Training
After applicants have been selected to be Trainer Candidates, they are expected to be supplied with the following items:

- The Trainer’s Guide
- The Training manual
- Printed materials
- Additional reading materials where applicable
- Flip charts, markers, pens and exercise books for participants

Trainees should be informed about period of training, logistics and all administrative issues regarding the training two months before the training schedules.
One month before the Training, invitation letters should be sent out to both trainers and participants selected for the training.

Two weeks before the TOT, a pre-training meeting with all the trainers should be held. This meeting should focus on planned practice presentation assignments for the trainers. Suggested practice presentations guide should include:

- Practice on power point presentation skills and operations of projectors and other techniques
- Check with other members of the training team, if more than one trainer will be required
- Discuss any adjustments to the agenda of the training
- Provide directions to the TOT site and discuss any lodging or transportation needs.

One week before the training, trainers should confirm:

- conference rooms, accommodation, meals and equipment for the training with the District Health Directorates
- training materials such as training guides and manuals and other equipment have been sent

Three days to the training, trainers should make copies of items that need to be shared with the participants and make arrangements with other members of the training team to assist with room setup.

On the day of training Trainers should:

- Arrive at training site at least 1 hour before registration time with materials and equipment
- Complete room setup at least 30 minutes before registration begins. (If possible, complete room setup the night before the training.)
- Manage registration (handing out materials, name tags, etc.).

Trainers should make available the following equipment and materials for training. It is assumed that most of these materials would be supplied by the Climate Change Management Team:

- Name tags
- Training schedule or time table
- Computer projector/laptop computer and/or overhead projector/transparencies
- Flip chart/
- Markers
- Exercise books and pens
- Any materials needed to carry out assigned practice presentation
- Icebreaker and energizer resources if necessary

The room should be set up in a conference style:

- Round tables to accommodate small-group work and to give candidates a “feel” for participatory interactions.
- Provide drinking water at each table and a refreshment table at the back of the room.
- Place a small table for the computer or overhead projector at the front of the room. The projection screen should be large enough for all participants to see the slides.

Before training starts each day trainers should make sure that training equipment, participant materials and room are set up.

**Word sense**

Training Manual: this resource contains relevant literature on scientific evidence of climate change and health, action research and soft systems methodologies as well as monitoring and evaluation tools

Trainers Guide: this document contains the guidelines for trainers and participants for the climate change project

Icebreakers: are activities that are undertaken at the beginning of an exercise to help people feel at ease.

Energizers: are activities used to stimulate and motivate participants during training sessions
Capa City Building Strategy on Climate Change and Health Related Risks
Training Needs Assessment and Agenda for Training
1.1 Overview
The training should in the first place identify the target groups, population or institutions for training. This should then be followed by an assessment and analysis of their training needs. In the context of climate change and health related risks, the following groups of people and institutions have been identified as suitable targets for training:

- Policy-makers, planners and managers in the health sector
- District/Municipal/Metropolitan Assemblies
- Healthcare providers
- Meteorological department
- Volunteers

1.2 Objective

To prepare trainers to identify the needs of course participants and establish the proper setting for effective learning.

1.3 Specific Learning Objectives

1. By the end of the unit, trainers will be able to:

2. Define participants’ training needs.
3. Determine participants’ needs.
4. Review the exercises “Where Are We?” and “Reflections.”
5. Introduce the goal and specific objectives of the training.

1.4 Methodology for needs assessment

The training needs assessment is a field exercise and trainers are expected to conduct this assessment using field surveys and/or action research techniques. This training needs both at the individual and institutional level in the case of climate change is based on the relationship between evidence, policy and practice.

1.5 Training and Learning Gaps

Conceptual Framework

Three principles identified in the guide to aid learning

Word sense

Training Needs Assessment is the formal process of identifying the training gap and its related training need.

Agenda for Training is the schedule or plan for the TOT
1. “Make good the gaps” – there are always gaps between evidence, policy and practice – so it is important for policy makers, practitioners and researchers to try and understand what are important gaps, what are the causes of those gaps, and how to minimise or get rid of the gaps. Nothing made by people is ever free from maintenance – work is always needed to find and make good the gaps.

2. “Act on evidence” – evidence is produced all over the world in many countries but is useless unless put into practice locally and that means local knowledge and local know-how is vital.

3. “Communicate to coordinate” – while science often has to catch up with what healthcare practitioners and policy makers need, healthcare practitioners and policy makers also often need to catch up with the science and each other. To do that means we need to share information and coordinate our actions – that’s why we communicate. In this training guide we aim to help trainers make good the gaps, make better use of evidence and improve communication and coordination between practitioners, policy makers and researchers.

1.6 Time required for the training needs assessment:
We recommend 7-14 (depending on the particular context) days for the needs assessment, data coding, analysis and reporting of at the district level.

1.7 Additional reading resources
- Mike Walsh and Associates (2012) Training Manual for Climate Change and Health Related Risks; Accra
- Zuber-Skerritt, O (2009) Action Learning and Action Research; Sense, Rotterdam
1.8 The Agenda for Training:
A 5-day training schedule is proposed for the TOT at the District Level.

<table>
<thead>
<tr>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
<th>Day 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>08:00</td>
<td>Welcome:</td>
<td>Malaria</td>
<td>Identifying</td>
<td>District action</td>
</tr>
<tr>
<td></td>
<td>Introductions:</td>
<td>Diarrhoeal disease</td>
<td>skills needed to</td>
<td>plans continued</td>
</tr>
<tr>
<td></td>
<td>Expectations:</td>
<td>Meningitis</td>
<td>adapt to climate</td>
<td>(2.30hrs)</td>
</tr>
<tr>
<td></td>
<td>Objectives of training</td>
<td>Other areas</td>
<td>change issues</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ground rules</td>
<td>What are the gaps</td>
<td>Group work</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(20 minutes)</td>
<td>between theory,</td>
<td>(2.30hrs)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Introduction to the</td>
<td>policy and practice?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>training manual</td>
<td>(2.30hrs)</td>
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<td>for closing gaps</td>
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<td>10:30</td>
<td>TEA BREAK</td>
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<tr>
<td>11:00</td>
<td>“Make good the</td>
<td>Case studies from</td>
<td>Introduction to</td>
<td>Group work on</td>
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</table>
|       | gaps” Act on | other areas | soft systems | district imple-
|       | evidence” | (2hrs) | methodology | mentation plans |
|       | (2hrs) | (2hrs) | (2hrs) | (2hrs) |
| 13:00 | LUNCH | | | |
| 14:00 | The scientific | Viewpoints on | Group discussions | District implanta-
|       | evidence of link | healthcare and | on soft systems | tion plans con-
|       | between climate | climate change from | methodology | tinued |
|       | change and health: | three Health Districts | Introduction to | Continued |
|       | An overview | Workshops in Keta, | results chain | (2hrs) |
|       | (2hrs) | Gomoa and Bongo: | Group discussions | (2hrs) |
|       | | What do we have | on results chain | |
|       | | in common? | (2hrs) | |
|       | | What are our key | | |
|       | | differences? | | |
|       | | What do we need | | |
|       | | to change? | | |
|       | | (2hrs) | | |
| 16:00 | CASCADE DISCUSSIONS & TEA BREAK | | | |
| 16:30 | Networking (30 minutes) | | | |
Global significance of links between Climate Change and Health
2.1 Overview
In order to train district level practitioners in climate change and health related risks, it is necessary to have a climate change agent who can provide training on evidence and significance of the links between climate change and health issues, such as health and disease patterns, climate change and sanitation and climate change and links with other social issues. The purpose of global significance of links between climate change and health course is to prepare health professionals who have already acquired training in this module to fulfil the role of climate change agents in national or local service delivery systems. This unit introduces readers to the sources for global information on climate change and health related risks with special focus on Ghana.

2.2 Objective
The objective for this unit is to prepare trainers to understand issues regarding climate change and health related issues and establish the proper setting for effective learning.

2.3 Specific Learning Objectives
By the end of the unit, trainers will be able to:
1. Define the participants’ expectations of the course.
2. Provide suggestions for effective participation in the course.
3. Introduce the goal and specific objectives of the training.
4. Review the exercises “Where Are We?” and “Reflections.”
5. Participants will understand the significance of links between climate change and health.

2.4 Speaking points
- Explain how this unit will prepare climate change agents to understand scientific evidence of climate change and health related risks.
- Review session agenda, including time for breaks and meals.
- Explain logistics for breakout sessions.

2.5 Training/Learning Methodology
- Power Point Presentation
- Open Forum for questions and answers

2.6 Discussion questions
- What have you learn differently after this presentation?
- How does this presentation help your understanding about scientific evidence and climate change?
- Do you see the effect of climate change on health as something worrying?
- What role will you play to prepare communities against climate change effects on health?

2.7 Major Reference and Training Materials
- Preliminary Report of the Core Welfare Indicator Questionnaire Survey, quoted in the 2006-2010 UNDAF.
- Mike Walsh and Associates (2012) Training Manual for Climate Change and Health Related Risks; Accra

2.8 Resource Requirements:
- Peer Reviewed Journals
- Markers, pens and exercise books
- Overhead projector
- Flip charts

2.9 Evaluation Methods:
- Participant reaction form (end of module)
- Continuous assessment of objectives being learned
CAPACITY BUILDING STRATEGY ON CLIMATE CHANGE AND HEALTH RELATED RISKS
Why is Climate Change Important to Healthcare in Ghana?
3.1 Overview
To find out about the front line view of climate change and healthcare, workshops were carried out in Keta, Bongo and Gomoa to assess local healthcare practitioners concerns with climate change. These workshops applied an internationally renowned flexible approach (Soft Systems Methodology) to analyse local concerns and help indicate the kinds of activity needed to respond to the additional challenges posed by climate change for the people of Ghana. It should be emphasised that the effects of climate change and health in Ghana cut across communities, districts and regions and that the three selected districts are just indications of the broader picture. The findings of these workshops though focus on the three priorities of health concern; malaria, CSM and diarrhoea diseases, the principal application in planning to mitigate climate change effects as discussed in this guide apply to all other diseases related to climate change. The findings from the three health districts are in the training manual.

3.2 Training Objective
The objective for this unit is to prepare trainers to understand the importance of climate change to healthcare in Ghana.

3.3 Specific Learning Objectives
By the end of the unit, trainers will be able to:

1. Introduce participants to understand the importance of climate change and healthcare.
2. Define the priority healthcare needs.
3. Provide suggestions for effective participation in the course.
4. Introduce the goal and specific objectives of the training.
5. Review the exercises “Where Are We?” and “Reflections.”

3.4 Training/Learning Methodology
- Power Point Presentation
- Open Forum for questions and answers

3.5 Speaking points
- Explain how this unit will prepare climate change agents to understand the importance of climate change and healthcare in Ghana.
- Review session agenda, including time for breaks and meals.
- Explain logistics for breakout sessions.

3.6 Discussion questions
- What have you learnt differently after this presentation?
- How does this presentation help your understanding about climate change and healthcare in Ghana?

3.7 Major Reference and Training Materials:

3.8 Resource Requirements:
- Markers and Pens
- Overhead projector
- Flip charts
3.9 Evaluation Methods:
- Participant reaction form (end of module)
- Continuous assessment of objectives being learned
Capa City Building Strategy on Climate Change and health-related risks
Training Methodologies
4.1 Overview

This unit describes the action research approach to training in climate change and health related issues. The main instrument is the use of Soft Systems Methodology which has been proposed as an approach to providing solutions to healthcare and climate change related issues for Healthcare practitioners at district level to determine:

1. How evidence on climate change is accessed?

2. What barriers prevent access? In particular we will establish to what extent lack of intelligibility or acceptability (especially local social or cultural acceptability), perceived trustworthiness and scientific quality and relevance of evidence pose difficulties and challenges.

3. How clinical practitioners and community feedback any gaps in evidence to authorities, agencies, the Scientific Health community or other appropriate national ministry and local agencies. In addressing this question we aim at strengthening capacities individually, locally and nationally in Health Systems.

4. What activities are necessary to overcome these barriers?

5. How evidence is implemented (i.e. what use is actually made of evidence?)

6. What barriers prevent implementation? In particular we will establish to what extent lack of intelligibility or acceptability (especially local social or cultural acceptability), perceived trustworthiness and scientific quality and relevance of evidence pose implementation difficulties and challenges.

7. What activities are necessary to overcome these barriers?

8. To do this Trainers’ will adapt a world class problem structuring method, Soft Systems Methodology (Checkland and Porter, 2006), a general planning and approach to problem solving in organisations and communities. Soft Systems Methodology (SSM) has a strong track record of applications in Healthcare internationally (Walsh et al 2004, 2005, 2008). It is often characterised as a seven stage process (following the earlier representations of this methodology in Checkland and Scholes, 1991) but is better understood as an iterative learning process of “finding out”, analysis / conceptual modelling and action planning. A simple practical summary follows.
Suggested Framework for analysis

Analysis and modelling focuses on key activities ("root definitions") defined by participants as possible or hypothetical solutions or ways of responding to or overcoming barriers or difficulties they have identified earlier in “finding out”. For each proposed activity analysis focuses initially on CATWOE:

- **Customers:** the specific direct beneficiaries (or victims) of the activity
- **Actors:** the specific individuals, teams, groups or organisations who carry out the activity
- **Transformation:** the specific practical inputs into the activity, the practical outputs of the activity and the process that changes the inputs into outputs.
- **Worldview:** we interpret this as the justification of the activity to particular audiences. The search for a strong justification is an important learning step forcing participants to consider to whom they are accounting for activities and what kinds of justification are necessary for each stakeholder.
- **Owners:** those specific individuals, groups, organisations or cultures that pose a risk to the activity (but not any of the others already mentioned) usually meaning they can stop it.
- **Environment:** those constraints that cannot be changed in the short run. However consideration of these may lead to proposals as to how these constraints may be changed in the medium to long term.

When an activity and CATWOE is complete a Conceptual Model of the activity is built by the participants. This model aims at describing the activity typically in five steps with approximately two monitoring steps. These steps are expressed as simple sentences with verbs. The steps need to contain sufficient detail to make the activity practical and realistic. If there are more than five steps participants may need to consider breaking it down into smaller more discrete activities each with their own definition and CATWOE. This part of the analysis often also reveals hidden difficulties in the previous analysis including the expression of the pictures / narratives. Iteration between the rich pictures / narratives, activity definition, CATWOE and conceptual modelling enables participants to learn about the system.

- **Action planning** arises from discussion of the feasibility and desirability of the models when considered in relation to the original “finding out”. This avoids naive, idealistic proposals for action and instead focuses on what practically can be done to create an improvement in access to evidence, in implementing evidence and in influencing the generation of evidence.

- **Applying SSM** means that not only can the research questions be addressed the participants can identify practical steps to address and overcome the obstacles. The participants will also learn about the problem structuring / action research process and how it can be used to address climate change and healthcare issues.

The CATWOE analysis is an important reflective and learning process. Facilitation will focus on encouraging the addition of specific details because participants often tend to be relatively vague about these but the details increase the value of the analysis. Again as learning occurs through iteration participants will be able to improve their analysis over time. CATWOE often reveals that proposed activities need to be either discarded or redefined more carefully.
Capa City Building Strategy on Climate Change and Health Related Risk
Guidelines for Implementation
### 5.1 Overview

An action for results tool has been suggested for use to enable district level practitioners plan for activities in the districts.

#### Results chain tool

<table>
<thead>
<tr>
<th>Results chain</th>
<th>Needs situation</th>
<th>Desired 1</th>
<th>Desired 2</th>
<th>Desired (optimum)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WHY?</strong></td>
<td>End results</td>
<td>—</td>
<td>—</td>
<td>Implementing projects that are not capital intensive</td>
</tr>
<tr>
<td><strong>WHAT?</strong></td>
<td>Practice and behavior change, describe practices and behavior change; Knowledge; ability and skill of individuals</td>
<td>Establish the benefits of achieving the outcomes; situation considered as an important priority to respond positively to climate change health related issues</td>
<td>—</td>
<td>Increased basic interventions</td>
</tr>
<tr>
<td></td>
<td>Stakeholders in health care delivery. Engagement, using the communities and community leaders</td>
<td>Increased understanding and knowledge of problem</td>
<td></td>
<td>Increased in the number of now aware of climate change adaptive mechanisms</td>
</tr>
<tr>
<td><strong>WHOM?</strong></td>
<td>Engagement; involvement</td>
<td>Number of engagements</td>
<td>—</td>
<td>District Health Administrations and District Assemblies monitors outcomes and measures that created change</td>
</tr>
<tr>
<td><strong>HOW</strong></td>
<td>Activities and outputs. How will it be implemented; inputs/resources, who will benefit, cost of implementation, milestones</td>
<td>Current actions by the Ministry</td>
<td>Provide information, communication</td>
<td>Knowing and understanding adaptive mechanisms</td>
</tr>
</tbody>
</table>
UNIT 06

Stakeholders’ Roles and Responsibilities
6.1 Overview
Climate change issues in the health sector require a multi stakeholder approach in responding to the numerous risks and challenges. It is therefore important to assign specific roles and responsibilities to the various stakeholders in the district.

- **Ministry of Health**
  i. Facilitate regular reviews of climate change adaptive mechanisms and evaluate the level of impact on the entire health systems.
  ii. Ensure an enabling environment for climate change health related issues and facilitate the establishment of the necessary legal and policy frameworks.
  iii. Mobilise funding and other resources on climate change health related programmes at the national level.
  iv. Monitor the activities at the Regional and District level.

- **Ghana Health Service**
  i. Integrate action plans with other climate change related programmes in the region.
  ii. Develop and implement an effective performance measurement system.
  iii. Mobilise funds and budget for climate change health related programmes in the region and district.
  iv. Integrate climate change health related issues into existing health programmes.
  v. Monitor the activities at the Regional and District level.

- **Metropolitan, Municipal and District Assemblies**
  i. Disseminate district action plans to other MDAs in the district level.
  ii. Integrate action plans with other climate change related programmes in the district.
  iii. Develop and implement an effective performance measurement system.
  iv. Mobilise funds and budget for climate change health related programmes in the district.
  v. Monitor community participation in climate change health related programmes.
  vi. Monitor public education strategies on climate change and health prepared by the district health directorate.
  vii. Approve action plans on climate change and health prepared by the district health directorate.
  viii. Provide logistics/resources for climate change health related programmes.

- **District Health Directorates**
  i. Formulate action plans on climate change adaptation mechanisms for approval by the MMDAs.
  ii. Implement approved action plans on climate change adaptation mechanisms.
  iii. Collect, collate, analyse and prepare monitoring plans on climate change health related risks.
  iv. Disseminate key plans and activities on climate change adaptation mechanisms to district staff.
Appendix 1: Evaluation forms

Programme feedback/evaluation form (Note: Please tick the relevant evaluation option under all the heads)

1. How well has the programme achieved its objectives?

<table>
<thead>
<tr>
<th>Very Well</th>
<th>Reasonably Well</th>
<th>Averagely</th>
</tr>
</thead>
</table>

2. How would you rate the overall design of the programme?

<table>
<thead>
<tr>
<th>Subject coverage</th>
<th>Excellent</th>
<th>Very good</th>
<th>Good</th>
<th>Average</th>
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<tbody>
<tr>
<td>Conceptual frame-work</td>
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<td>Ground Rules</td>
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<td>Implementation of</td>
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<td>components of the course</td>
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<td>Sequencing</td>
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3. Would you like to recommend any additional topics for such training programmes or deletion of any of the existing topics?

<table>
<thead>
<tr>
<th>Contents</th>
<th>Excellent</th>
<th>Very Good</th>
<th>Good</th>
<th>Average</th>
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<tbody>
<tr>
<td>Presentation</td>
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<tr>
<td>Relevance</td>
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<tr>
<td>Resource Persons</td>
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4. Having attended this training programme, would you be able to organise similar training programmes in your organisation?

5. Would you be in a position to deliver a lecture/make a presentation on any of the training subjects? If so, specify.

6. Other observations/suggestions, if any.

Name and designation: (optional) ________________________________________________________

District: __________________________________________________________________________

Date: ____________________________________________________________________________
Integrating Climate Change Into The Management Of Priority Health Risks In Ghana

A Training Manual For Healthcare Providers And Volunteers
Foreword

Climate change is expected to impact on countries in different ways; ranging from more intense storms, increases or decreases in the annual rainfall to floods and droughts. Certainly the effect of climate change will affect peoples’ health, economies and the environment. In terms of health, the World Health Organization (WHO) estimates that between 1961 and 1990 – a global temperature increase of just 0.6 degrees centigrade – is causing, each year, 150,000 deaths and the loss of 5.5 million Disability-Adjusted Life Years.

As we examine our current knowledge of climate change it is clear that among health workers, there is a knowledge gap on scientific evidence of climate change and health imperatives in Ghana. Again, there is a weakened institutional capacity within the Ministry of Health to respond to challenges related to climate change. There is therefore the need to act now to develop capacities especially at the local level to address this knowledge gap and to allocate resources for climate change adaptation.

Designing and conducting training programs for health workers, on climate change and health are necessary for the country’s resiliency to the impacts of climate change. These training materials are intended to increase our understanding about climate change and to explore what we can do now and in the future. There are actions that can be taken to prepare for a more variable climate and we can make a case to our policy makers to prepare for change.

Improved understanding of climate change and health issues will allow for more efficient and flexible allocation and utilisation of health systems and better investment in interventions aimed at reducing risks from climate change. We can act now – and these training materials can help us to identify those actions. The trainers’ guide which is another useful resource is available for trainers’. The guide together with this manual are intended to prepare trainers’ to conduct a training needs assessment, develop detailed plans for training, develop and pilot a training curriculum, conduct training using more advanced training techniques, monitor and evaluate the entire project.

Hon Sherry Ayittey
Minister of Health
Acknowledgements

This training manual has been produced through the joint effort between the Ministry of Health, the Global Environmental Facility and the UNDP in Ghana. The consultants, Mike Wash and Associates in collaboration with Conservation Foundation (A local NGO based in Ghana) have benefited from the input of many people, organisations and institutions to enable the production of this training manual for healthcare practitioners and volunteers.

We are extremely grateful to the National Coordinator of the Climate Change and Health Project and the entire project management team members. We are also indebted to the three health districts (Gomoa West, Bongo and Keta) that provided case study evidence for the production of this resource. We also acknowledge the contributions of the following institutions:

- Regional Health Directorates (Central, Volta and Upper East Regions)
- District Assemblies (Gomoa West, Keta and Bongo)
- Partners (UNDP), (GEF)
- The regional meteorological services (Volta, Central and Upper East)

Other resources that were used in the production of this document include:

- World Health Organisation Resource materials on climate Change: Protecting health from Climate Change; World Health Day 2008
- Documents from MOH/UNDP on the commissioning of Climate Change challenges in Ghana
Notes for Trainers’

This Training Resource is based on the tensions, dilemmas and gaps between evidence, policy and practice. It is designed to prepare trainers’ who already have skills as climate change agents to proceed to the level where they would be able to train other practitioners and volunteers in the management of climate change and health related risks based on an approach to bridging gaps between evidence, policy and practice. This manual has been produced taken into account these three principles.

The Approach

The approach to managing climate change and health related risks stems from the understanding that gaps between evidence, policy and practice remain relatively unresolved. Management of climate change has become an important issue in recent times because scientific evidence shows that even if greenhouse gas emissions are cut to zero (an imaginary situation which is far from the up to 40% cuts (agreed by the United Nations Framework Convention on Climate Change (UNFCCC)) the world would still be on an inevitable course toward global climate change from the bequest of past emissions. The Health risks associated with climate change tend to reinforce the need to harmonise evidence, policy and practice and effort to manage these tensions will possibly accelerate plans and intentions to reducing health risks associated with climate change. The approach to managing health risks associated with climate change has been conceptualised into the framework below.

About Managing Climate change

Evidence

About processes and methods for planning, problem solving and implementation

Policy

What actually happens?

Practice

“Street level” policy

There are always gaps:

“The best-laid schemes o’ mice an’ men
Gang aft agley” (Burns, 1785)
There are three principles:

1. "Make good the gaps" – there are always gaps between evidence, policy and practice – so it is important for policy makers, practitioners and researchers to try and understand what are important gaps, what are the causes of those gaps, and how to minimise or get rid of the gaps. Nothing made by people is ever free from maintenance – work is always needed to find and make good the gaps.

2. "Act on evidence" – evidence is produced all over the world in many countries but is useless unless put into practice locally and that means local knowledge and local know-how is vital.

3. “Communicate to coordinate” – while science often has to catch up with what healthcare practitioners and policy makers need, healthcare practitioners and policy makers also often need to catch up with the science and each other. To do that means we need to share information to coordinate our actions – that’s why we communicate.

In this training resource we aim to help practitioners, policy makers and researchers make good the gaps, make better use of evidence and improve communication and coordination between themselves.

In general, a useful training session will help participants:

i. Identify important gaps, contradictions, tensions and dilemmas both within and between evidence, policy and practice.

ii. Define feasible and desirable actions needed in response to, reduce or eliminate the gaps.

iii. Plan for implementation to turn words into actions.
Organisation of the Manual

This manual is organised into seven main sections as follows:

Section one introduces the reader to the scientific evidence of climate change. It provides the synthesis of scientific reports on climate change and outlines the problem with scientific evidence on climate change.

Section two provides the global significance of links between climate change and health with particular focus on Ghana.

Section three examines the disease patterns of cerebrospinal meningitis, malaria and diarrhoea diseases in Ghana and introduces the reader to the importance of climate change to healthcare in Ghana.

Section four presents the priority health needs; view points from three districts in Ghana (Gomoa West in the central region, Keta in the Volta region and Bongo in the upper east region).

Section five outlines the training needs of climate change and health related issues for healthcare practitioners especially at the district level.

Section six provides activities and indications for measures needed for adaptive mechanisms for trainers and describes the training methodologies recommended for this project. The section provides examples of rich narratives and rich pictures as case studies to guide trainees and trainers. The section also provides examples of conceptual models.

Section seven provides the monitoring and evaluation framework for the entire climate change project at the district level. The annexes section that provides further information on the training manual is also included.
Introduction

The Evidence is Clear: Our Climate is Changing

- Erosion caused by changing climatic conditions at Bongo in Upper West Region of Ghana

Global warming is the change in the location and incidence of extreme weather events—heat waves or cold snaps, severe storms and droughts.

Our earth is becoming warmer and warmer leading to changing climatic conditions.

In addition to the warming trend, changes in precipitation and an increase in extreme weather events are further warnings of climate change.

Trend analysis shows an average annual global temperatures increase from 2001 – 2007 (an increase of 0.74ºC in global surface temperatures).

There are additional worrying signs of global warming: A decline in arctic sea ice; the retreat of alpine glaciers; a decline in Northern Hemisphere snow cover; and a rise in sea level.

A global temperature increase of just 0.6 degrees centigrade – is causing, each year, 150,000 deaths and the loss of 5.5 million Disability-Adjusted Life Years.
Change in Annual Average Temperature (1901-2007)

-2.3 -2.0 -1.7 -1.4 -1.1 -0.8 -0.5 -0.2 0.0 0.2 0.5 0.8 1.1 1.4 1.7 2.0 2.3

Higher latitude regions in North America, Europe and Asia are experiencing greater warming.


Scientific Evidence

The Synthesis Report on Climate Change; Global Risks, Challenges and Decisions during the Copenhagen conference from 10-12 March 2009 shows that;

1. The scientific evidence has now become overwhelming that human activities, especially the combustion of fossil fuels, are influencing the climate in ways that threaten the well-being and continued development of human society. (see image 1 below)
1. Greenhouse gas emissions and many aspects of the climate are changing near the upper boundary of the IPCC range of projections as shown in image 2 below.

![Temperature rise vs. CO₂ and CO₂-eq](image2)

2. Increasing risk of abrupt or irreversible climatic shifts. (See image 3 below).

![Sea Level Change vs. Year](image3)

3. Poor nations and communities, ecosystem services and biodiversity are particularly at risk. This may likely affect the production of certain crops like groundnut, yam, cassava, millet, rice and maize that are common and serve as the main sources of food both for export and for local consumption. (see image 4 below)

![Crop Production vs. Year](image4)
1. Temperature rises above 2°C are likely to cause major societal and environmental disruptions through the rest of the century and beyond as indicated in image 5 below.

The problem with evidence

Scientific publications indexed under Climate Change are relatively small - only 6813 articles since 1981.

Only 177 have been indexed under Climate Change and Africa compared with 883 indexed under Climate Change and Europe.

Disturbing but not surprising indication of a general lack of evidence.
Global significance of links between climate change and health

Tackling climate change is important to enhancing socioeconomic development and equity throughout the world.

Linking climate change with broader sustainable consumption and production concerns, human rights issues and democratic values ... are shifting societies towards more sustainable development pathways.
2.1 Background Information

Climate change has been identified as “the biggest global health threat of the 21st Century” (Lancet/UCL, 2009) with most national governments accepting the report of the Secretary General to the General Assembly of the United Nations that there are grave implications of climate change for health, wealth, peace and security (United Nations, 2009). Richardson et al’s (2009) synthesis report paints a worrying picture for all nations stating “inaction is inexcusable.” They state that climate trends are at upper boundaries of predictions and that poor nations and communities are particularly at risk (Richardson et al, 2009). There are apparently credible predictions of a 2°C rise in global temperature occurring before 2050 and 4°C by 2100 (IME, 2009, p.7). From the viewpoint of the United Nations (2009) climate change threatens supplies of food, water and habitable land and this coupled with bigger populations and increasing industrialization mean that around the world competition for resources and demand for equitable distribution of both resources and risks will grow.


2.2 The example of health, water and sanitation

Life depends on water. The single most important contribution to human health in history probably has been and remains clean water and good sanitation. According to the UN poor sanitation and hygiene “are either the chief or the underlying cause in over half of the annual 10 million child deaths ... Access to a toilet alone can reduce child diarrhoeal deaths by over 30% and hand washing by more than 40%” (UN – Water, 2008, fact sheet 1). In addition there are parasitic worms, acute respiratory infections and concomitant mental health problems.
Figure 1 is a mind map summary of the UN fact sheets on water, sanitation and health. Sanitation and water are linked to a complex web of pathological causality. There is much to be gained by focusing on improvement to sanitation but each minute that passes on average, 19 children will have died from bad water, poor hygiene and poor sanitation.

Figure 1: Water, sanitation and health based on UN Water fact sheets

Yet climate change means a change to distribution of water. Sea level rise, increasing desertification, episodes of flooding and drought mean there will be far greater stress on populations and communities and greater difficulty in achieving improvements to the picture in figure 1 above.

The literature identifies several issues on the links between climate and health. These are:

- Climate change
- Climate variability
- Factors that influences climate change and health are multi-dimensional
- Direct and indirect impacts expected from climate change issues

- Alterations in the geographic range and intensity of transmission of vector, tick, and rodent-borne diseases food- and waterborne diseases changes in the prevalence of diseases associated with air pollutants and aeroallergens.
- Disruptions in natural systems, the spread of diseases or emergence of diseases in areas where they had been limited or had not existed, and issues for diseases to disappear by making areas less hospitable to the vector or the pathogen.2
- Issues on vulnerable population groups
- Adaptive mechanisms to cope with climate change effects

2 UNDP (2009) Project Document: Piloting climate change adaptation to protect human health (PIMS 3248) Global GEF-funded project to be executed by WHO.
The World Health Organization (WHO) estimates that climate change may already be causing over 150,000 deaths globally per year. Areas identified to have contributed to these deaths include:

- deaths in heat waves and floods
- most important long-term influences will likely act through changes in natural ecosystems and their impacts on disease vectors, waterborne pathogens, and contaminants.
- extremely high burden of climate-sensitive diseases, such as malaria which is estimated to contribute to about 90% of the global burden of diseases.
- highest per capita burden of malnutrition and diarrhoea.\(^3\)

The critical determinant of the degree to which climate hazards are translated into impacts on human wellbeing is the resilience of the health and related sectors to deal with climate-related diseases. The general capacity (e.g. as shown by generally higher disease rates in countries with lower investment in health)\(^4\), and the presence or absence of long-term planning, conferring the flexibility to deal with extreme, unprecedented, or rapidly changing health risks are amongst others concerns facing countries today.

**Summary of facts to note**

- Climate change is the global health threat in the 21st century with grave implications on wealth, peace and security. It threatens supply of food, water, vegetation and habitable lands.
- There are apparently credible predictions of a 2°C rise in global temperature occurring before 2050 and 4°C by 2100.
- Sea level rise, increasing desertification, episodes of flooding and drought mean there will be far greater stress on populations and communities and greater difficulty in achieving improvements to sanitation levels.
- The World Health Organization (WHO) estimates that climate change may already be causing over 150,000 deaths globally per year.
- Water for instance contributes to human health and clean water and good sanitation is important to the health of populations. Any cut to the supply of water is detrimental to the health of populations yet climate change means a change to distribution of water.
- Poor sanitation from faecal–oral cycle is dangerous to health and it mainly affects poorer communities by spreading diseases.
- Access to a toilet alone can reduce child diarrhoeal deaths by over 30% and hand washing by more than 40%\(^t\).
- There is much to be gained by focusing on improvement to sanitation but each minute that passes on average, 19 children will have died from bad water, poor hygiene and poor sanitation.
- Links between climate change and health have been identified to include climate variability, multidimensional factors influencing climate change and health, disruptions in natural systems that spread diseases, issues with vulnerable populations and adaptive mechanisms to deal with climate change and health.
- Poor nations and developing countries are at the highest risk and it is therefore important that something is done about this threat.

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\(^3\) WHO (2009) Climate change is affecting our health: something should be done now. Geneva: World Health Organisation.

The importance of climate change to healthcare in Ghana
3.0 Background

There are many uncertainties about what climate change means for health, illness and healthcare in Africa, and for Ghana in particular. The country is being affected by an increasing incidence of climate-related natural disasters. The various climatic zones range from dry Savannah to wet forest and which run in east-west bands across the country and the ill-impact of climate change is being experienced across many parts of the country. The image below is the Keta sea defence which protects the land from the sea rises - a typical effect of climate change on the land.

The Sea Defence at Keta in the Volta Region of Ghana

- Showing the effects of climate change on the land

The basis for Ghana’s economic growth is being achieved only at high cost to the environment. Conservatively estimated at around 6% of GDP. For example, increasing natural disasters include the 2007 floods which struck the three Northern regions and parts of the Western region. Major incidence of disasters in Ghana is from floods, epidemics, fire, pests and diseases and conflicts. Being highly dependent on rain fed agriculture for food security in Ghana, drought is a top natural disaster risk. The sources of vulnerability include poverty and development pressures (including rising population pressures and unplanned urbanisation). Other factors include fragile and degraded environments, epidemics and governance issues. These factors can interact with climate change to exacerbate current disease burdens.

3.2 Health and disease patterns

The health burden in Ghana falls significantly on children under five years of age. While this age group comprises approximately 20% of the population they contribute over 50% of all recorded deaths. Neonatal mortality (death occurring among infants aged less than 28 days) is particularly significant as it contributes over 50% of all infant deaths.¹ Under-five mortality rates are three times as high in the northern regions (at 177 per 1000) than in the Greater Accra Area.² By comparison, the mortality rate for under-five in Japan is 4 per 1000.³ The pattern of disease in Ghana demonstrates a preponderance of communicable diseases, under-nutrition, and poor reproductive health. Epidemics of

¹Routine data from health facilities indicates that the major causes of neonatal deaths are asphyxia, low birth weight, birth injuries, neonatal tetanus, neonatal infections, and severe congenital abnormalities.
²2003 Preliminary Report of the Core Welfare Indicator Questionnaire Survey, quoted in the 2006-2010 UNDAF.
cerebrospinal meningitis (CSM), yellow fever and diarrhoeal disease remain a significant threat. Emerging and re-emerging diseases of increasing magnitude and threat include the HIV/AIDS menace, tuberculosis, buruli ulcer and filariasis. Malaria has been identified as one of the leading causes of death in Ghana. Diarrhoeal disease a major cause of childhood mortality and morbidity.

Malaria

Malaria is still the leading cause of outpatient morbidity in all ages and sex groups, and the cause of 20% of all deaths in children under five. The disease is responsible for a substantial number of miscarriages among pregnant women and low birth weight babies. Malaria accounts for 13.8% of out-patient department (OPD) attendance among pregnant women, 10.6% of admissions and 9.4% of deaths.

Map 1 Malaria prevalence in Ghana

Source: Strategic Plan for Malaria Control in Ghana, 2008-2015

Non-communicable diseases such as cardiovascular disorders, neoplasm and diabetes are emerging threats, while trauma and other injuries are the fifth most common outpatient condition.
Malaria is hyper-endemic in all parts of the country, with the entire population of 22.4 million people at risk. Transmission occurs all year round with slight seasonal variations during the rainy season from April to July. There is marked seasonal variation in the northern parts of Ghana where there is a prolonged dry season from September to April.

- **Figure 1** Trend of reported outpatient malaria cases in Ghana, 2001-2007

![Trend of reported outpatient malaria cases in Ghana, 2001-2007](image)

Despite intensive interventions to combat malaria in Ghana, spearheaded by the National Malaria Control Programme, the reported episodes of malaria continue to be high, as indicated in Figure 1.

**Meningitis**

The following map illustrates the distribution of meningitis cases in Ghana in 2009, showing clearly the preponderance of the disease in the northern parts of the country.

- **Map 2** Distribution of Meningitis cases by district, 2009

![Map 2 Distribution of Meningitis cases by district, 2009](image)
Outbreaks of CSM are concentrated in the northern parts of Ghana, but are not exclusive to these regions. The highest incidences have been in the Upper East and Upper West regions. Pockets of outbreaks occur in the Ashanti, Volta, Central and Greater Accra regions. Surveillance systems need to be strengthened to be able to manage the projected increases in CSM, related to the increased number of months in which possible outbreaks will occur.

- Figure 2 shows high case fatality rates even when the number of cases is not so high.

- Figure 2   Cases of Meningitis and CFR, 2000 – 2009

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- Figure 3 indicates cases of cholera between 2000 and 2009 in Ghana, with related case fatality rates.

**Diarrhoea diseases**

Diarrhoeal diseases continue to remain a disease of public health importance in Ghana. Outbreaks of cholera are cyclical and the frequency of these outbreaks is increasing. Scenario analysis carried out in the early 2000s in Ghana indicates the possibility of diarrhoeal diseases increasing due to water scarcity and contamination. The following chart illustrates the incidence of cholera cases in Ghana in from 2000 to 2009. Again it shows high case fatality even when cases are low.

- Figure 3   Cases of Cholera with case fatality rate (CFR) (%), 2000 - 2009

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3.3 Gender

Empirical evidence reveals that although there are higher levels of utilization of health facilities by women because of their care giving roles, travelling to health facilities is an added burden to their already heavy domestic schedules. This is even worse in the rural areas where women’s higher levels of poverty and lower literacy levels compared to men affects them adversely. Additionally, negative socio-cultural practises and non-involvement in decision-making regarding their health and that of their families tends to compound this situation. These factors cause women to delay seeking health care, and in turn contribute to high maternal mortality. The main gender issues in health service provision concern overall low levels of expenditure and provision, the lack of priority accorded to women’s health in its own right, biases in expenditure towards urban, curative facilities, and the negative effects of recent cost recovery policies on certain social groups.

3.4 Climate risks and impacts on health sector

Based on an analysis from the World Health Organization, climate change could increase the number of cases of malaria and diarrhoeal diseases by 5% and 3% worldwide (Table 1).

Table 1: Comparison of current diarrhoeal disease, malnutrition, and malaria cases with estimated climate change impacts in 2030 assuming the 750 ppm of CO2 scenario (thousands of cases)

<table>
<thead>
<tr>
<th></th>
<th>Diarrhoeal diseases</th>
<th>Malnutrition</th>
<th>Malaria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>4,513,981</td>
<td>46,352</td>
<td>408,227</td>
</tr>
<tr>
<td>Climate change impacts</td>
<td>131,980</td>
<td>4,673</td>
<td>21,787</td>
</tr>
<tr>
<td>% increase</td>
<td>3%</td>
<td>10%</td>
<td>5%</td>
</tr>
</tbody>
</table>


DIARRHOEA

Studies in Peru1 and Fiji4 found that the incidence of diarrhoeal diseases increase by 5% for each 1°C increase in temperature.

MALARIA

- Climate and anomalous weather events have a direct influence on malaria transmission by either hindering or enhancing vector and parasite development and survival. Numerous laboratory and field studies have documented that:
- Climate is a primary determinant of whether the conditions in a particular location are suitable for stable *Plasmodium falciparum* malaria transmission.
- A change in temperature may lengthen or shorten the season during which mosquitoes or parasites can survive.

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Changes in precipitation or temperature may result in conditions during the season of transmission that are conducive to increased or decreased parasite and vector populations.

Small changes in precipitation or temperature may cause previously inhospitable altitudes or ecosystems to become conducive to transmission by rendering hospitable higher altitudes that were formerly too cold or desert fringes that previously were too dry for mosquito populations to develop.

The main environmental variables that influence transmission of malaria include rainfall, temperature and humidity. It is estimated that the costs of malaria care can consume 30% of the income of poor people. By 2080, projections indicate that in all months of the year, the mean air temperature will be 27.6 degrees centigrade and above, which is likely to significantly increase the malaria burden in the absence of adaptation actions. Reductions in rainfall and other factors mean that coastal towns are facing severe water shortages during the dry season, and hydropower capacity is dropping rapidly. There is anecdotal evidence that climate change may be exacerbating existing instabilities in northern Ghana. These long-term changes to climatic variables impact human health by mostly acting as a “stress-multiplier” to existing climate-sensitive burden of disease.

The projected reduction in available irrigation water, symptomatic of reduced rainfall and increased demand in warming regions, will directly affect already vulnerable vector-disease habitats, food crop production, and quantities of safe water for drinking and washing. Expected sea-level rise will not only likely require movement of coastal populations and infrastructure due to land-loss, but will also increase the salinity of groundwater sources, affect fishing industries, and decrease resiliency to flooding and storm damage. With such impacts, the potential for exacerbating existing Ghana disease burdens of malaria, diarrhoeal illness, meningitis, respiratory diseases, and malnutrition, is very large.

Additional analysis will be needed on the specific correlation between changes in agricultural productivity for food security and nutrition, but it is likely that these will be significant. Expected climate change impacts such as increased temperatures, reduced water availability, increased intensity and frequency of droughts and floods, and coastal erosion will have adverse effects on human well-being and activities, food insecurity and reduced water availability.

**Climate-induced problem and root causes**

Increasing migration in search of economic opportunities, better land, and safer environments are the effects of changes in climatic conditions. Migration and relocation of population has risks associated with reduced economic growth and development. Migration is expected to occur not only within the country but also from countries in the Sahel region, which will also become hotter and drier. While the primary causes of the increased health impacts may be related to global climate change, these causes act as risk multipliers upon existing health problems and weaknesses in the health sector. Some of these are related to the country’s location and climate, such as the already high burden of malaria and its position in the “meningitis belt”, running from Senegal in the west to Ethiopia in the east, in which large epidemics of meningococcal meningitis occur in the dry season, with annual rates of 500 cases per 100,000 being commonly encountered in this area. While it is clear that, in the absence of adaptation, climate change will exacerbate the health burden for key climate-sensitive diseases, the predominant health sector response is mostly reactive and ad hoc. The health effects of climate change projections have not yet been integrated into health sector planning and response. The goal is to shift the current response towards being more anticipatory, deliberate and systematic, with regard to climate change impacts on the health sector. Other existing risk factors are the still poor health services in many parts of the country, despite advances in the health sector over the years, as is further discussed below, in the barrier analysis section.
Malaria

Since 1998 Ghana has committed itself to the Roll Back Malaria (RBM) Initiative of WHO, which builds on the Global Malaria Strategy with a focus on Africa. The goal of the Roll Back Malaria Initiative was to halve the world’s malaria burden by 2010. Consequently the country drew up a ‘Medium Term Strategic Plan for Malaria Control in Ghana’ (1998-2002), which sought to improve the coverage of malaria control activity by adopting an inter-sectoral approach involving other government sectors and partnership with the private sector and the community. It has also committed itself to the Abuja Declaration on Malaria Control in Africa, which similarly seeks to achieve specific targets on malaria prevention and control with time limits. The RBM plan is in line with the objectives of MDG 6. The following priority interventions in the RBM plan will be promoted and strengthened in Ghana: improve malaria case management; multiple prevention (including promotion and use of insecticide treated bed-nets, especially by children and pregnant women; encourage drainage, mosquito proofing and general sanitation; promote limited application of indoor and outdoor residual spraying; and promote chemoprophylaxis for pregnant women); improved partnership; and focused research. In improving malaria case management, primary interventions include ensuring early case recognition, ensuring appropriate response and referral and improving access to prevention and treatment services. The Ministry of Health is also embarking on massive immunization campaigns for high risk infections such as CSM along with public education on environmental health issues related to reducing the risk of malaria infection. Treatment accessibility for other diseases such as guinea worm is being increased.1 RBM has developed Country Roadmaps that identify what is needed to achieve the 2010 goals.

To date, Ghana’s approach to climate change in relation to human health vulnerability has been reactive, and is characterised by an absence of a well-defined strategic policy and plan for both the medium and long-term. The Ministry of Health has recently identified a number of key questions to explore in terms of the impact of climate change on the health sector. These are:

- Will the geographic range and incidence of malaria, diarrhoeal diseases, and CSM be affected?
- What changes will occur in respect of the existing disease burden?
- Who will be most affected?
- What kinds of investments will be needed to maintain desired levels of health status?
- What systemic changes are needed and when?
- What indicators will best measure performance in the implementation of adaptation plans to reduce current and future health burdens?

Underlying cause 1: There are inadequate systems for surveillance, early warning and response to key climate-related diseases such as malaria, diarrhoeal diseases and meningococcal meningitis; and the links between national and district health structures for the management of climate-related diseases are weak because of late release of national funding, donor influence and poor communication channels.

Underlying cause 2: Information management and dissemination of climate change-related health risks is not carried out systematically and lessons learned are not captured in a way that facilitates broader sharing.

Data on climate change-related risks of diarrhoeal disease, malaria, and CSM from surveillance systems are not well integrated into health information management systems. Therefore it is difficult to carry out regular evaluation of the distribution and incidence patterns of climate sensitive diseases, or to monitor outcomes systematically. This situation also militates against an effective response. Redressing these knowledge gaps will become increasingly important with the expected increased burden of priority diseases as climate change impacts unfold further.
The choice of the three selected regions - the Upper East region, Central region and the Volta region – was made on the basis of criteria agreed with key stakeholders. The criteria included the following:

- **Prevalence of relevant diseases** – Upper East Region: high prevalence of CSM and Malaria; Central Region: high incidence/epidemics of diarrhoeal disease, with endemic malaria.
- **Climate change impacts**: the Upper East Region and Volta Region are projected to experience significant climate change impacts such as flooding.
- **Poverty incidence**: the incidence of poverty is higher than the national average in the Upper East and Central regions (as is the case in the Upper West and Northern regions).

### Meningitis

Meningitis is one of the most feared diseases in West Africa because of the speed with which it develops and the severity of after effects. At least 10% of infected individuals die during the acute episode, and 10-20% of survivors develop permanent resultant conditions such as epilepsy, hearing loss and mental affects. The meningitis belt cuts across Ghana, with outbreaks known to occur during the dry season. Absolute humidity, dust and rainfall profiles, land cover type and population densities are independently associated with meningitis epidemics in Africa; however, an analysis found that absolute humidity profiles and land cover type were the best predictors of risk for the continent in a multivariable model. For North and West Africa, absolute humidity and rainfall profiles predicted similar risks. Evidence suggests that meningitis epidemics are extending south of the Sahel, consistent with environmental changes in the region. Projected decreases in rainfall and increased frequencies of droughts in Ghana may further aggravate the CSM outbreaks and possibly increase the geographical range of the disease in Ghana.

According to the 2009 World Bank Economics of Adaptation to Climate Change (EACC) Ghana Country Case Study, there will be fairly wide fluctuations in annual temperatures in all Ghana regions for all the scenarios considered. The trend over the period 2006 to 2050 indicates warming in all regions, with temperatures increasing the most in the three regions of the North, where the forecast suggests temperature rise in the order of 2.2 to 2.3°C. This is above the threshold for dangerous climate change defined under the UNFCCC.

This will impose considerable strain on the system for health service delivery, with implications for the cold chain for drugs, blood supply and vaccination, which are key elements of the national health system. While the 2008 assessments projected that rainfall would decrease on average by 2.8%, 10.9% and 18.6% by 2020, 2050 and 2080 respectively in all agro-ecological zones except the rainforest zone, where rainfall may increase, the EACC study indicates that rainfall will follow a cyclical pattern over the period 2006 to 2050 for all regions, with high rainfall levels followed by a drought every decade or so. The wettest parts will be the Ashanti and Western regions, while all other regions will be relatively dry. However, increased precipitation may not compensate for reductions in soil moisture due to higher evapotranspiration under warmer conditions. There will be considerable variation in stream flow, with areas in the Volta basin experiencing significant reduction in runoff, while the southwestern part of the country will experience increased flows. These fluctuations will increase the risk of floods and/or droughts.

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1 The study used four climate change scenarios to project future climate change for the period of 2010 to 2050. Climate moisture index was used as criteria to cover the spectrum of climate variations. The scenarios were Global Dry and Global Wet (both SRES A2), Ghana Wet (SRES A1B) and Ghana Dry (SRES B1).
2 Data from “Ghana climate change impacts, vulnerability and adoption assessment” (2008), and based on two General Circulation Models. See Section 1.2 on Methods for additional information. This data is refined from the data in Ghana’s First National Communication. Note that according to analysis of available data by the University of Oxford (http://country-profiles.geog.ox.ac.uk/), projections of mean annual rainfall averaged over the country from different models are for a wide range of changes in precipitation for Ghana, with around half the models projecting increases and half projecting decreases.
and intense rainfall events, in both rural and urban areas. Flooding poses risks of disruption to health service delivery and damage to supporting and healthcare infrastructure. The variation in river flows outside of the country’s borders will be greater than that in river flows in Ghana, raising implications for the management of shared regional water resources, particularly with Burkina Faso.

A projected sea level rise of 1m by 2100 could see the loss of over 1,000km² of land, with 132,000 people likely to be affected. The east coast is particularly vulnerable to flooding and shoreline recession. Climate change poses the greatest challenges for people living in the drought and flood-prone northern regions of the country; people living in slums; and people living in eroding coastal areas. The urban poor in many cases have fewer resources to adapt to climate change – for example, people living in large settlements on flood plains around Accra are extremely vulnerable to natural disasters. Ecological zones in the country with relatively high temperatures and relatively low rainfall tend to have higher poverty incidences.

**Consistency with the Libreville Declaration**

The proposed project is in accord with the Libreville Declaration, to which Ghana is a signatory. Action point six of the Declaration seeks to “establish and strengthen systems for health and environment surveillance to allow for measurement of interlinked health and environment impacts and to identify emerging risks in order to manage them better.” In response to this, a network for Health and Environment Integrated Surveillance and the mechanisms for attaining this has been proposed by the Joint Task Team (WHO/UNEP) and endorsed by the meeting of partners (including the UNFCCC).

**Summary of the importance of Climate Change to Ghana**

- Ghana is being affected by an increasing incidence of climate-related natural disasters. The various climatic zones range from dry Savannah to wet forest which run in east-west bands across
- the country and the ill-impact of climate change is being experienced across many parts of the country
- The major incidence of disasters in Ghana is from floods, epidemics, fire, pests and diseases and conflicts.
- Epidemics of cerebrospinal meningitis (CSM), yellow fever and diarrhoeal disease and prevalence of malaria remain a significant threat in Ghana.
- Empirical evidence reveals that although there are higher levels of utilization of health facilities by women because of their care giving roles, travelling to health facilities is an added burden to their already heavy domestic schedules and effects of climate change may likely worsen the situation for women in Ghana.
- While the primary causes of the increased health impacts may be related to global climate change, these causes act as risk multipliers upon existing health problems and weaknesses in the health sector.
- While it is clear that, in the absence of adaptation, climate change will exacerbate the health burden for these key climate-sensitive diseases, the predominant health sector response is mostly reactive and ad hoc.
- Ghana’s approach to climate change in relation to human health vulnerability has been reactive, and is characterised by an absence of a well-defined strategic policy and plan for both the medium and long-term.
- The underlying causes include inadequate systems for surveillance, early warning and response to key climate-related diseases such as malaria, diarrhoeal diseases and meningococcal meningitis, weak information management and dissemination of information on climate change-related health risks.
Priority Health Needs: Case studies from three health districts
What are the health priorities for Ghana?

To find out about the front line view of health priorities for Ghana, healthcare workshops were carried out in Keta, Bongo and Gomoa West Districts. These workshops applied an internationally renowned flexible approach (Soft Systems Methodology) to analyse local concerns and help indicate the kinds of activity needed to respond to those concerns. Tables 1-3 show the viewpoints on priority health needs (not necessarily in order of higher priority) from participants engaged in workshops in the three health districts (Gomoa, Keta and Bongo).

Table 1 Priority health needs - Gomoa District

<table>
<thead>
<tr>
<th>Gomoa Viewpoint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family planning (increase accepted rate)</td>
</tr>
<tr>
<td>Reducing teenage pregnancy</td>
</tr>
<tr>
<td>Reducing maternal mortality</td>
</tr>
<tr>
<td>Supervised delivery (improvement)</td>
</tr>
<tr>
<td>IPT1/IPT 2 (increase)</td>
</tr>
<tr>
<td>Improving financial management</td>
</tr>
<tr>
<td>Improve or increase up I (expanded programme immunisation) coverage</td>
</tr>
<tr>
<td>Promoting the use of ITN through IE/C</td>
</tr>
<tr>
<td>Stressing surveillance systems</td>
</tr>
<tr>
<td>Improving primary Healthcare (increasing CHP’s, FP sites)</td>
</tr>
<tr>
<td>Improved access to health</td>
</tr>
<tr>
<td>Increase supervise delivery and reduce maternal deaths</td>
</tr>
<tr>
<td>Increase the uptake of family planning and other services</td>
</tr>
<tr>
<td>Reduce the incidence of HIV, malaria, chronic diseases e.g. hypertension and diarrhoeal diseases</td>
</tr>
<tr>
<td>Reduce malnutrition</td>
</tr>
<tr>
<td>Emergency/breakthrough diseases, caused by climate change</td>
</tr>
</tbody>
</table>

Source: Survey data (2012)

Table 2 Priority health needs - Keta District

<table>
<thead>
<tr>
<th>The Keta Viewpoint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to specific disease and local variation in Ghana.</td>
</tr>
<tr>
<td>Malaria increase</td>
</tr>
<tr>
<td>Increasing the diarrhea diseases</td>
</tr>
<tr>
<td>Increase of communicable diseases for example URTI</td>
</tr>
<tr>
<td>Maternal mortality increase</td>
</tr>
<tr>
<td>Neonatal deaths</td>
</tr>
<tr>
<td>Increase in upper respiratory tract infection.</td>
</tr>
<tr>
<td>Climate change issues</td>
</tr>
<tr>
<td>Inadequate Financial Resources.</td>
</tr>
<tr>
<td>The increase in non-communicable diseases e.g. hypertension, diabetes, asthma, etc.</td>
</tr>
<tr>
<td>Malnutrition</td>
</tr>
<tr>
<td>Poor road networks</td>
</tr>
</tbody>
</table>

Source: survey data (2012)
### Table 3 Priority health needs - Bongo district

<table>
<thead>
<tr>
<th>The Bongo viewpoint</th>
<th>Severe acute mal-nutrition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaria</td>
<td>Meningitis</td>
</tr>
<tr>
<td>Diarrhoea</td>
<td>Diarrhoeal diseases</td>
</tr>
<tr>
<td>Acute respiratory tract Infection (ARTI)</td>
<td>Teenage Pregnancy</td>
</tr>
<tr>
<td>Road traffic accidents (RTA)</td>
<td>Low Expanded Programme of Immunisation (EPI)</td>
</tr>
<tr>
<td>Mental illness</td>
<td>Low Motivation of human resources</td>
</tr>
<tr>
<td>Malnutrition</td>
<td>Maternal mortality</td>
</tr>
<tr>
<td>Anaemia</td>
<td>Malaria</td>
</tr>
<tr>
<td>Epilepsy</td>
<td>Carrier development</td>
</tr>
<tr>
<td>Alcoholism</td>
<td>HIV/AIDS</td>
</tr>
<tr>
<td>Dental problems</td>
<td>Teenage pregnancy</td>
</tr>
<tr>
<td>Hypertension</td>
<td></td>
</tr>
<tr>
<td>Cerebro-spinal meningitis</td>
<td></td>
</tr>
<tr>
<td>Maternal health issues</td>
<td></td>
</tr>
<tr>
<td>Bilharzia</td>
<td></td>
</tr>
<tr>
<td>Skin infection</td>
<td></td>
</tr>
</tbody>
</table>

**Survey data (2012)**

**Why is climate change important to healthcare in Ghana?**

Climate change does not impact on only the three priority diseases of health: malaria, CSM and diarrhoea diseases but on broader health issues. This manual recognises the importance of other diseases related to climate change. However, examples for training are based on the three health areas identified. Trainers are advised to cite as an example any diseases that locally affect the communities which are related to climate change in their training. In our assessment we found that local practitioners had immediate local priorities but there was a degree of awareness of climate change issues in both the short and longer term and of the possible impact of this on local healthcare. For example respondents from the three health districts were asked to explain why certain diseases were considered a climate change health risk and their responses are shown as citations below:

**Question 1: Why is malaria considered a climate change health risk?**

**Citation 1**

‘Malaria is a climate change health concern because malaria used to come only in the rainy season but due to climate change, mosquitoes are now present all year round and the rains nowadays are torrential, so pools of water is collected in many places that help the mosquitoes to breed easily and spread malaria’ (Participant at a climate change workshop, April 2012)

**Question 2: Why is meningitis considered a climate change health risk?**

**Citation 2**

‘It is a disease that occurs in the dry season usually during crowd scenes especially funerals. It spreads faster because of human activities during hot/dry season’ (Participant at a climate change workshop, April, 2012)

Analysis from the case studies and existing literature however demonstrates gaps in scientific knowledge on climate change and health imperatives. The table below presents the knowledge gaps and training needs.
Table 4: Knowledge gaps and training needs of local health practitioners

<table>
<thead>
<tr>
<th>Priority area</th>
<th>Knowledge gaps and training needs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaria</td>
<td>Given the potential for significant increases in the burden of malaria as a result of climate change, public health preparation is required.</td>
</tr>
</tbody>
</table>

**Training needs on climate change effect on malaria include:**

- Increased understanding of malaria transmission cycles and the impact of ecological management and disruption on malaria transmission, including the impact of new and intensified pressures due to climate change.
- Health workers/stakeholders ability to develop methods to detect, quantify, characterize, and monitor potential malaria transmission associated with environmental changes such as rainfall patterns.
- Health workers/stakeholders ability to develop and validate existing models of vector distribution and link that to establish datasets of malaria transmission, identify relevant climate-related patterns, and integrate projections of likely impacts of climate on malaria transmission.
- Health workers/stakeholders awareness of secondary effects of climate change such as increased malnutrition, conflict, and population displacement on malaria incidence and evaluation of the effectiveness of prevention strategies.
- Health workers/stakeholders awareness on malaria prevention methods including repellents, bed nets, chemoprophylaxis, and others.
- Enhance health workers/stakeholders ability to identify existing public health surveillance infrastructure to include longitudinal surveillance focused on the periphery of endemic areas to detect range expansion.
- Health workers/stakeholders to be able to develop early warning systems that integrate public risk assessments and mitigation and adaptation strategies related to malaria transmission.
- Enhance health workers ability to understand risks associated with climate change and communicate prevention strategies related to malaria transmission and other response mechanisms as well as evaluation of their effectiveness.
Climate change will likely intensify the spur of heat related effects in certain parts of the country resulting in more severe and regular disease occurrences like cerebrospinal meningitis and an increase in the overall burden of these conditions. Thus, continued training on climate change effect on alterations in the composition of heat related conditions and their consequent effects on health is essential.

**The training needs on climate change effect on cerebrospinal meningitis include:**

- Standard definition of heat-related health outcomes, focusing on cerebrospinal meningitis as well as standard methodologies for surveillance of outcomes and evaluation of adaptations.
- Increased understanding of risk factors for illness and death associated with both acute exposure to extreme heat events and long-term, chronic exposure to increased average temperatures.
- Enhanced health workers/other stakeholders ability to identifying which temperature-related metrics are most strongly connected to increased hospitalization and mortality during hot climatic conditions.
- Increase Health workers/stakeholders ability to conduct comparative analyses of heat-related death risks for application to national level analyses.
- Enhanced Health workers/stakeholders ability to determine attributes of communities, social groups and seasonal differences, that are more resilient or vulnerable to adverse health impacts from hot climatic conditions.
- Health workers/other stakeholder groups ability to assess the health benefits of the appropriate use of the environment to reduce the factors that contribute to high mass heat characterizing the likelihood and nature of multi-system failures, such as power grid failure, that could lead to significant morbidity and mortality during a heat wave.
- Enhanced health workers ability to identify current climate models to capture the observed frequency and intensity of heat waves across various timescales to understand weather-climate predictions and use of heat early warning systems in decision making at the district level.
- Increased capacities to evaluate heat response plans, focusing on environmental risk factors, identification of high-risk populations, vulnerable groups, effective communications strategies, and rigorous methods for evaluating effectiveness of strategies at the district level.
## Diarrhoea

There is a clear association between increases in rainfall, sewage and waste water systems leading to contaminated drinking water and outbreaks of diarrhoea disease country wide. Climate change is expected to produce more frequent and severe extreme rainfall events in the country and this may affect the absorptive capacity of the sewage systems in the country, resulting in frequent diarrhoea disease in the country. Thus, continued training on climate change effect on alterations in rainfall patterns and their consequent effects on health is essential.

**The training needs on climate change and effect on diarrhoea diseases include:**

- Assisting health workers/stakeholders to understand the likelihood and potential magnitude of diarrhoea disease outbreaks due to climate change including increases in the frequency and intensity of precipitation, temperature changes, extreme weather events, and storm surges.
- Health workers/stakeholders realisation of the effects and vulnerability of water systems to sewer overflow or flooding caused by extreme weather events and how this can contaminate drinking water sources and possible outbreak of diarrhoea diseases.
- Health workers/stakeholders realisation of public health importance on how toxins, pathogens, and chemicals in land-based runoff and water overflow.
- Health workers/stakeholders ability to develop means of identifying guidelines for types of diarrhoea disease and understanding how they may provide early warning of human health threats.
- Health workers/stakeholders understanding of existing systems and structures in detecting early signs and working with such systems to address the issues.
- Health workers/stakeholders to develop systems for improvement in childhood vaccination programmes at both local and national levels, improvements in antibiotics and other preventive strategies to prevent and reduce the health consequences of diarrhoea disease on a national scale.
- Health workers/stakeholders ability to understand the epidemiology, occurrence and severity of diarrhoea diseases among humans, especially high risk populations, vulnerable groups in relation to climate change.
- Health workers/stakeholders to understand and detect, quantify, and forecast rainfall patterns and health threats including improved surveillance and monitoring of disease-causing agents.
- Health workers/stakeholders to be able to assess the capacity of the nation's public health infrastructure to detect and respond to increased outbreaks of diarrhoea disease.
- Health workers/stakeholders to develop measures and evaluation tools to address identified public health capacity gaps.
Knowledge Gaps and Training Needs Assessment

It is important that trainers' fully understand the training, learning and educational needs of their organisations and staff to be able to conduct effective training models for them. An effective training needs assessment will assist an organisation to develop the capability of people it requires in order to achieve the needed results. This section provides an overview of the core concepts and steps involved in conducting a training needs assessment for trainers involved in climate change and health issues.

What is training needs assessment?

Knowledge gaps are often determined by reviewing extant literature on a particular subject matter and also conducting individual/organisational training needs assessment. A training needs assessment provides some certainty that the time, money and resources used to develop and conduct training will deliver desired performance-based results. It is an “on-going process of gathering data to determine what training needs exist so that training can be developed to help the organization accomplish its objectives” (Brown, 2002, p. 569). In this way, training needs assessment is a critical activity for the training and development function of individuals and organisations. Barbazette, (2006) indicates that training needs assessment is the “process of collecting information about an expressed or implied organizational need that could be met by conducting training” (Barbazette, 2006, p. 5). This process determines the need for the training; identifies training needs; and examines the type and scope of resources needed to support training (Sorenson, 2002).

For trainers' our prime objective is to conduct training. The approach to our training, the model of training and the relevance of training depend to a large extent on our initial preparations towards the training programme. Designing a training and development program involves a sequence of steps that can be grouped into five phases: The first step is to determine whether the training is needed through a training needs assessment/analysis. This is followed by the identification of instructional objectives and design of the training programme. Implementation of the training and evaluation of the training to identify strengths and weaknesses in the training constitute the final components of the training. The identification of instructional objectives, training design and implementation has been provided in the trainers' guide. This section only demonstrates how training needs assessment is conducted.

Why Conduct a Training Needs Assessment?

A training needs assessment provides an opportunity to consult with a variety of people in the organization. The information collected, ideas generated, and the conversations that take place when people discuss their work lives lend enthusiasm to the process. The data collected whether obtained through interviews, observations, focus groups, performance data, questionnaires or tests, can clarify issues and provide a focus on performance. Training needs assessment therefore helps:

- To determine what training is relevant to your employees' jobs
- To determine what training will improve performance
- To determine if training will make a difference
- To distinguish training needs from organizational problems, and
- To link improved job performance with the organization's goals

What are the steps involved in conducting training needs assessment?

How is a training needs assessment conducted? What model can be followed? Does the selected model work across different disciplines or industries? To be effective and efficient, all training programs must start with a needs assessment. Long before any actual training occurs, the trainer must determine who, what, when, where, why and how the training will be conducted. To do this, the trainer must analyze as much information as
possible about the following: Organization and its goals and objectives.

- Jobs and related tasks that need to be learned.
- Competencies and skills that are needed to perform the job.
- Individuals who are to be trained.

The training needs analysis involves:

- Examining current programmes
- Identifying the purpose of the programmes
- Understanding organisational and individual priorities
- Developing collection methods
- Gathering and reviewing data
- Recommending strategies for training

All these levels of needs analysis are interrelated and the data collected from each level is critical to a thorough and effective needs assessment.

Models for assessing training needs at the health district level

1. Soft Systems Methodology (Checkland and Porter, 2006)

2. Barbazette’s (2006) five-question approach that identifies the why, who, how, what and when.

McClelland (1993) open-systems model for conducting training needs assessments.

In our approach to understanding training needs and knowledge gaps among local health practitioners in the three districts we adopted the use of soft systems methodology. The description of this method and the relevance of using this approach are shown in subsequent sections. We recommend the use of this approach to trainers’ involved in climate change and health issues.

How to conduct training needs assessment

Exercise:

Session 1: Have participants from the groups complete the Knowledge Check activity (this is to identify participants level of knowledge about the subject) on individual basis. Ask them to compare answers and then discuss their answers as a group.

Notes for Trainers’

- Needs assessment assures that training is the most appropriate intervention to address a particular problem.
- The first activity measures participants’ knowledge of the key terms and theories on the particular subject. The 20 question sample interview guide below can be used in this particular case.
Interview guide on training needs assessment

1. Describe the situation in your district/community as far as climate change is concerned?
2. What do you observe that indicates there is a problem?
3. Do you know anything about climate change?
4. Probe knowledge on climate change: What exactly do you know about climate change?
5. Is there a link between climate change and health? Yes/No
6. Probe type: What link can you identify?
7. What specifically is climate change causing to your community?
8. Probe frequency: How often does it occur?
9. Probe location: Where does it occur?
10. Probe timing: When is it a problem?
11. Probe longevity: How long has it been a problem?
12. Probe identity: what or Who is the climate change directly affecting?
13. Probe who else is affected: What or who else is affected by climate change?
14. Probe desired performance: What do you think should be done to improve the situation?
15. Probe cost value of discrepancy: How much is the problem costing the community or district if unresolved?
16. Probe gaps: Do you see any gaps between evidence, policy and practice as far as climate change management is concerned?
17. Probe extent: Can you identify those gaps?
18. What are some of the reasons you think training is needed?
19. What is the end result you are seeking from a training intervention?
20. If I were to go out and talk to other staff, what would they say?

The next session focuses on the three steps to conduct a training needs assessment

Session 2: Ask participants to share what they learned from the first session. Clarify and extend participants comments.

Notes for Trainers’
- Identify three learning points from the previous session of identifying issues related to the particular topic and try to link those concerns to priority healthcare issues in the district or community. The role of needs assessment in the training process model will be exemplified after this exercise. Trainers’ can get participants to discuss the three learning points based on guiding questions like:
1. What are our current high health priority concerns?
2. Which of these concerns do you think will be affected by climate change?

Sample of guiding questions used in similar situation at Keta

- Discuss these learning points during the plenary.

The last session looks at feedback to questions during plenary

Session 3: Ask for participant feedback to questions raised during the plenary. Ask participants to provide examples.

Notes for Trainers’
- Participants may provide varied views. Views should be accommodating since they all tend to shape discussions.

Making sense of results from training needs assessment

We assume that the needs assessment identifies more than one training need. In this particular context, the trainer working with the management of the organisation needs to prioritize the training based on the urgency of the need (timeliness), the extent of the need (how many employees need to be trained) and the resources available. Based on this information, the trainer can develop the instructional objectives for the training and development program.
UNIT 05

Training on Climate Change and Health Risks
5.1 Training methodologies

This manual provides a mixed approach to training in climate change and health related issues both didactic and action oriented approaches are recommended.

- Didactic Approach

The didactic approach to adult teaching primarily involves lecturing and is essentially facilitator-led. It can provide a framework for ideas and theories (Fry, et al. 2003) and continues to be a useful approach to teaching especially when the subject is new to majority of participants (Walking, 2000). Yet, effective didactic adult teaching needs to be supported by frequent interaction since it could lead to boredom and limits reflection on the part of participants.

- Action research approach

We recommend the use of community-based participatory or action research methodologies to the training of trainers’ programmes on climate change and health related issues. These approaches have been in use since it was first designed by Kurt Lewin in 1946. The use of action research or community-based participatory research makes communities and individuals the source of change in any intervention or programme. It enables them to contribute to the philosophical development of their communities and their personal development. It has widely been used in public health and community-based research (Israel, 1994). Internationally, the work of the World Health Organization-sponsored Alma Ata Declaration (WHO-UNICEF, 1978) ignited efforts to organize communities and community health workers to mobilize on behalf of their own health care.

In considering how to establish principles for a Community Based Participatory Research (CBPR) or Action Research (AR) projects, Wallerstein and Duran (2003) propose some critical concepts.

- Participation between community members and researchers, the type of knowledge produced and what is done with it, the power relations and the contexts that influence participants whether public or hidden, and the goals based on the reflective process and outcomes.

Seattle Partners for Healthy Communities provide three key principles from CBPR (Krieger et al, 2002).

- Participation: Community partners assume influence on Center-direction and activities. Community involvement in specific projects with shared ownership, from objective setting to dissemination.

- Equal power: Values, perspectives, contributions, rewards, and confidentiality of people in the community is respected. It develops community capacity for research as well as training and jobs. It encourages an ecological approach to health and disease, acknowledging social determinants of health.

- Joint planning: The involvement of all stakeholders starts from the beginning of the project. Projects produce long-term benefits and represent a long-term commitment if all stakeholders are involved right from the beginning.

A mixed action research methods comprising the use of case study informed by quasi – experiments, a soft systems approach, applying problem structuring and interactive planning using results chain are envisaged in the training programmes and in all district level projects. Again action research methods will be used to analyse access to evidence and implementation problems, model potential solutions and develop action plans.

Soft Systems methodology

Soft systems methodology has been proposed as an approach to providing solutions to healthcare and climate change related issues for Healthcare practitioners at district level to determine:

1. How evidence on climate change is accessed?

2. What barriers prevent access? In particular we will establish to what extent lack of
intelligibility or acceptability (especially local social or cultural acceptability), perceived trustworthiness and scientific quality and relevance of evidence pose difficulties and challenges.

3. How clinical practitioners and community feedback any gaps in evidence to authorities, agencies, the Scientific Health community or other appropriate national ministry and local agencies. In addressing this question we aim at strengthening capacities individually, locally and nationally in Health Systems

4. What activities are necessary to overcome these barriers?

5. How evidence is implemented (i.e. what use is actually made of evidence?)

6. What barriers prevent implementation? In particular we will establish to what extent lack of intelligibility or acceptability (especially local social or cultural acceptability), perceived trustworthiness and scientific quality and relevance of evidence pose implementation difficulties and challenges.

7. What activities are necessary to overcome these barriers?

Soft systems methodology was developed in the 1970s by Peter Checkland from Lancaster University in the UK and is often used in solving complex problems in organisations and community development projects (Checkland and Poulter, 2006). The method evolved from the traditional action research approach where problems have been known to be difficult to describe and complex to resolve through operation research. The focus of soft systems methods is not on the problem itself but on how the stakeholders involved in the problem-solving approach the task. Soft Systems Methodology (SSM) has a strong track record of applications in Healthcare internationally (Walsh et al 2004, 2005, 2008) in the context of the UK National Health Service.

Applying SSM means that not only can the research questions be addressed through data generation participants can also identify practical steps to address and overcome the obstacles. The participants will also learn about the process itself and how it can be used. SSM is often characterised as a seven stage process (Checkland and Scholes, 1991) but is better understood as an iterative learning process of “finding out”, analysis / conceptual modelling and action planning. A simple practical summary follows:
“Finding Out” is the local process by which participants (in this case from each District) identify health risks associated with climate change and express barriers and problems to accessing relevant evidence and to implementation of evidence. SSM often utilises “rich pictures” for this but from experience “rich narratives” are more acceptable and more productive to climate change training programmes. So we expect to have a mixture of rich pictures and narratives. These are produced by asking small sub groups of participants to discuss the issues (in response to the questions posed by the facilitators) and represent their responses on flipcharts. Participants are then asked to feedback to the whole group explaining the meaning of their pictures. Narratives do not have to be complete but can be amended and added to during the course of the project as subsequent analysis and modelling leads to qualification of and the discovery of new difficulties and challenges. Thus the picture / narratives are expected to attenuate over time more closely to a consensus view of the nature of the problems faced by the participants in accessing and implementing evidence.

The key aim is to enable all the voices that have a view to be able to voice this and therefore enrich the general process of analysis and learning. Individual interviews with key participants at convenient times will help to verify the meaning and validate the contents of the pictures and narratives and to test their veracity. Similarly, other documents and sources will also be checked, where possible, to verify or challenge content in the pictures / narratives.
5.3 Suggested Framework for analysis

Analysis and modelling focuses on key activities ("root definitions") defined by participants as possible or hypothetical solutions or ways of responding to or overcoming barriers or difficulties they have identified earlier in "finding out". For each proposed activity, analysis focuses initially on CATWOE:

- **Customers**: the specific direct beneficiaries (or victims) of the activity.
- **Actors**: the specific individuals, teams, groups or organisations who carry out the activity.
- **Transformation**: the specific practical inputs into the activity, the practical outputs of the activity and the process that changes the inputs into outputs.
- **Worldview**: we interpret this as the justification of the activity to particular audiences. The search for a strong justification is an important learning step forcing participants to consider to whom they are accounting for activities and what kinds of justification are necessary for each stakeholder.
- **Owners**: those specific individuals, groups, organisations or cultures that pose a risk to the activity (but not any of the others already mentioned) usually meaning they can stop it.
- **Environment**: those constraints that cannot be changed in the short run. However, consideration of these may lead to proposals as to how these constraints may be changed in the medium to long term.

The CATWOE analysis is an important reflective and learning process. Facilitation will focus on encouraging the addition of specific details because participants often tend to be relatively vague about these but the details increase the value of the analysis. Again as learning occurs through iteration participants will be able to improve their analysis over time. CATWOE often reveals that proposed activities need to be either discarded or redefined more carefully.

When an activity and CATWOE is complete, a Conceptual Model of the activity is built by the participants. This model aims at describing the activity typically in five steps with approximately two monitoring steps. These steps are expressed as simple sentences with verbs. The steps need to contain sufficient detail to make the activity practical and realistic. If there are many more than five steps, participants may need to consider breaking it down into smaller more discrete activities each with their own definition and CATWOE. This part of analysis often also reveals hidden difficulties in the previous analysis including the expression of the pictures/narratives.

Iteration between the rich pictures/narratives, activity definition, CATWOE and conceptual modelling enables participants to learn about the system.

- **Action planning** arises from discussion of the feasibility and desirability of the models when considered in relation to the original "finding out". This avoids naïve, idealistic proposals for action and instead focuses on what practically can be done to create an improvement in access to evidence, in implementing evidence and in influencing the generation of evidence.

- **SSM** will help participants to improve their personal learning skills – this will be certified for continuous professional development (CPD) by the Ministry of Health/Ghana Health Service as part of their in-service training programme. This is the first step in the organisational learning process that SSM engenders.

### Using rich narratives and rich pictures

Soft Systems Methodology begins with participants “finding out” about a situation using pictures and word (often termed “rich pictures” and “rich narratives”). These help participants to communicate with each other – to share opinions and feelings – to summarise what participants think they know about a situation and what the problems are and to see problems in context, to get the bigger picture.
There are no rules for this, other than the picture or narrative is meaningful and useful to the participants. What follows is an illustration based on diarrhoea.

**Case 1: Problems with water ...**

This is a Mind Map using boxes and words to summarise information about water and sanitation. This information came from WHO fact sheets coupled with professional experience. This can be treated as a rich picture or rich narrative.

This picture could make much more specific and local statements – using local knowledge about local behaviours and amenities that may, in some way, be part of the problem. Each one of these can be the basis for a number of activities. The task is to define the activities needed to tackle the problems, analyse these using CATWOE and then build conceptual models – as many as needed.

For example:

- We need a way of reducing diarrhoea caused by food contaminated by human waste;
- We need a way of educating people in the village about how to stop diarrhoea;
- Another picture may concern monitoring disease incidence and prevalence.

And so on.
“all levels of the health system are involved in conducting surveillance activities for detecting and responding to priority diseases and conditions (even though the different levels do not perform identical functions)”

**WHAT IS THE LOCAL DEFINITION?**

- **Customers** (anyone who benefits *directly* from the activity and anyone who is disadvantaged by it)
  
  **WHO?**

- **Actors** (anyone who carries out any step of the activity)
  
  **WHO?**

- **Transformation** (the way inputs of people and materials and other things are turned into outputs)
  
  **WHAT?**

- **Worldview** (the justification of the activity to someone else that is significant)
  
  **WHY?**

- **Others** (who are not involved directly but who can stop the activity)
  
  **WHO?**

- **Environment** (what cannot be changed in the short term and must simply be accepted, for now)
  
  **WHAT?**

An example of a conceptual model (one based on a general WHO surveillance model) is given below. These models should have one or more monitoring steps but none appear in the WHO general model. What should be useful monitoring steps?

Step 1 - Identify cases and events. Use standard case definitions, identifying priority diseases, conditions and events.

Step 2 - Report suspected cases or conditions or events to the next level.

Step 3 - Analyze and interpret findings. Compile the data, and analyze it for trends. Compare information with previous periods and summarize the results.

Step 4 - Investigate and confirm suspected cases, outbreaks or events. Take action to ensure that the case, outbreak or event is confirmed including laboratory confirmation wherever it is feasible.

Step 5 - Prepare. Take steps in advance of outbreaks or public health events so that teams may respond quickly and essential supplies and equipment are available for immediate action.

Step 6 - Respond. Coordinate and mobilize resources and personnel to implement the appropriate public health response.

Step 7 - Provide feedback. Encourage future cooperation by communicating with levels that provided data, reported outbreaks, cases and events about the investigation outcome and success of response efforts.

Step 8 - Evaluate and improve the system. Assess the effectiveness of the surveillance and response systems, in terms of timeliness, quality of information, preparedness, thresholds, case management and overall performance. Take action to correct problems and make improvements.
• The case study aspect

Adapting the procedures set out by Eisenhardt (1987; 2007) is suggested the use of case studies during training programmes. The purpose of the case studies is to provide a rich description of practical examples and the nature of barriers to accessing evidence. Again case studies enable a strong understanding of the nature of the barriers to implementation of evidence in practice and the way these barriers can be addressed by development of actions. This will help to identify gaps between evidence, policy and practice impacting the significance of climate change and health and the way these gaps might be filled most effectively. Case studies ensure case separation which lead to:

1. A more diverse profile of climate change and health imperatives in Ghana with an estimate of the degree of variation between districts providing the basis for subsequent research to focus on specific evidence generation, access and implementation problems.

2. A degree of quasi experimental control enabling a fairer comparison of the evidence needs, learning curves and action trajectory created by each health district. From this it can be determined to what extent the problem structuring / action research approach is efficacious and what then might be expected from transfer to other areas.

3. The case studies will allow evaluation of the way that issues, learning, and action varies in each case providing a much stronger basis for understanding the relationship between evidence and practice.

• The Results Chain approach

Theoretically several models have been designed to transform the process of change - from evidence to practice. Some of these models include: results chain approach, logic frameworks, theoretical models and outcome framework (Cattaneo et al. 2009). These models incorporate systems of theory and process of change to address causal change, external and internal influences and assumptions.

The results chain is a model that can transform evidence into practice through interactive planning mechanisms (Bennett, 1979). It is proposed as a planning tool in this project because it appears simpler and clearer and outlines the change process in a more systematic way. A results chain identifies the logical and reasonable outline of order of inputs, activities and outputs for a particular project. Logically, the causal inferences of a particular project from beginning to the end are some of the elements of results chain. The results chain has three components:

• Implementation
• Inputs and outputs
• Results

A well expressed results chain provides a useful map for selecting the indicators that will be measured along the chain. They include indicators used both to monitor program implementation and to evaluate results. The indicators should be specific, measurable, linked to the project and realistic.
A basic results chain includes the following:

- **Inputs**: Resources at the disposal of the project, including staff and budget
- **Activities**: Actions taken or work performed to convert inputs into outputs
- **Outputs**: The tangible goods and services that the project activities produce
- **Outcomes**: Results likely to be achieved once the beneficiary population uses the project outputs (short to medium term outcomes)
- **Final outcomes**: The final project goals
- **Assumptions and risks**
### Using results chain to plan climate change and health programmes at the district level

**Example**

<table>
<thead>
<tr>
<th>Assumptions</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Ministry of Health intends to develop capacity of local volunteers in your district for climate change and health related issues.</td>
<td>The outputs are the number of volunteers trained.</td>
</tr>
<tr>
<td>The aim of this project is to develop local champions to educate communities on climate and health risks.</td>
<td>The short term outcomes include the adaptation of new competencies and skills by the volunteers.</td>
</tr>
<tr>
<td>As indicated above:</td>
<td>The long-term outcomes consist of volunteers’ use of the new skills.</td>
</tr>
<tr>
<td>The inputs to this programme will include facilitators, volunteers, a budget for the programme, facilities for the training and teaching and learning materials.</td>
<td>The overall outcomes are increased awareness about climate change in the communities and how that can impact on health, reducing the incidence of climate related diseases in the communities</td>
</tr>
<tr>
<td>The activities consist of conducting training needs assessment to identify training gaps, designing the training programmes, curriculum; developing a facilitator training guide; training the volunteers; and reporting on the training.</td>
<td>Notes</td>
</tr>
</tbody>
</table>

1. |
2. |
3. |
4. |
UNIT 06

Activities and adaptive mechanisms for trainers’
This section demonstrates the practical approach to the use of Soft Systems Methodologies for trainers'. The section provides a number of activities with examples which are expected to guide practitioners and trainers' in further activities in their district training programmes.

**Exercise 1:**
- **Malaria and Climate Change in Ghana**

**Objective:**

Reducing climate change risk to malaria incidence in the locality.

**Possible guiding questions:**

1. What do you want to achieve under this objective?
2. What measures will you adopt to achieve this objective?

**a. Activity definition for reducing malaria**

The activity definition in this case may include the following:

1. A way of increasing use of ITNs to reduce malaria
2. A way of promoting environmental hygiene to reduce malaria
3. A way of increasing the uptake of SP especially IPT 1 and IPT 2 in pregnant women to reduce malaria in pregnancy

**The approaches under the above activities include:**

- Sleeping under ITNS
- Education on clean surroundings
- Intensify bed net distribution and usage
- Treatment adherence
- Seeking early treatment
- Infrastructure to provide clean environment
- SP intake for pregnant mothers
- Carry out research on ITN usage

**Customers:** mothers, fathers, husbands, assemblymen, religious leaders, chiefs, CHN, health promoters

**Actors:** Community Health Nurses, Health Promoters, Community-Based Volunteers, Traditional Birth Attendants’, Midwives, Traditional Healers, Nurses, Doctors, the District Chief Executives’.

**Worldview:** We justify this activity by showing evidence of malaria cases and how the measures defined under activity (a) above could be used to reduce the cases. We justify this to institutions and individuals such as the Ghana Health Service, the Ministry of Health, Non-Governmental Organisations, the local community, Traditional Leaders and Health Partners’.

**Owners:** Rumour mongers, traditional authorities, religious leaders, politicians and ethnic cultural practices may serve as barriers to the implementation of the activities identified above.

**b. Explaining CATWOE - in this case........**

After defining the activities, the facilitator or the trainer helps participants to identify variables within CATWOE. Using root activity 1- a way of increasing the use of ITN to reduce malaria cases we provide some of the possible variables as follows:
Environmental: natural and environmental constraints likely to affect the activities include: flooding, constraint resources, routine protocols and poor road network.

The next stage is the transformation which involves designing a conceptual model as adaptive mechanism against climate change risks to malaria prevalence. Trainers’ should assist participants to plan for activities identified above. Basically the Transformation is about. **A way of doing X to achieve Y**

b. A conceptual model and adaptive mechanism

Example, planning for the activity for ITN utilisation may include:

1. Organising resources for the education. What resources are needed?
2. Training persons to carry out the activity. Who should be trained to carry out health education, frequency and periods?
3. Coordinating with other stakeholders for supervision during the activity. Who else should be involved? Stakeholder and role mapping?
4. Implementing the planned activities for an effective outcome. What is the anticipated outcome? How urgent is it? {Timelines}
5. Monitoring and evaluation of activities. How do we measure the outcome and by what standard?

**CONCEPTUALLY THE TRANSFORMATION ABOVE COULD BE REPRESENTED AS:**

- Defining education and training needs
- Mobilising necessary resources
- Identifying and collaborating with key stakeholders
- Training educators
- Sensitising communities and rolling out project

- Monitoring
- Reports, supervision, support visits, steering committee
- Performance indicators
- Evaluation
UNIT 07

Monitoring and Evaluation
Ultimately the climate change and health programmes are designed to reduce illnesses and risks of ill health as a result of climate. The questions in most peoples’ minds are; how do we know that those changes have occurred? Have we been able to reduce the risk of illnesses as a result of climate? Basically, the answers to these questions are crucial for public policy. Monitoring and evaluation become critical components and useful tools to explore and provide answers to the above questions.

Monitoring and evaluation of the capacity development project at the district level forms part of the broader agenda of efforts to enhance evidence-based policy development within the health sector. In general evaluation of projects enables policy makers to concentrate efforts on outcomes and results instead of inputs (World Bank, 2012). In effect monitoring and evaluation provide the means for policy makers to reshape their thinking around policy development, how the policies are being implemented, how the project managers account for resources and how budget allocations are utilised. All these inputs help to guide policy decisions.

Monitoring and evaluation provide a core set of tools that stakeholders can use to verify and improve the quality, efficiency, and effectiveness of interventions at various stages of implementation. They also provide information and evidence to facilitate public awareness and promote transparency and accountability.

Boxes 1 and 2 below describe how monitoring and evaluation could be conducted at the district levels.

Box 1: Monitoring the capacity development project: The soft systems approach

The capacity development strategy project incorporates monitoring tools where project objectives are measured using an activity based approach to project monitoring and evaluation (soft systems methodology and results chain). In this approach performance indicators for each activity is outlined and progressive assessment of the activity is incorporated into the project. Monitoring procedures are initiated at the outset of the project. The use of Soft Systems Methodology builds monitoring steps into activities and that these steps are encouraged right from the onset of the project. A Project Steering Group with membership from all partner and stakeholder groups should be established. The Steering Group usually convene formal meetings during the project period, to monitor progress and provide expert guidance and establish potential risks associated with the project e.g. ICT, communication, cultural, policy, training and governance issues. The Steering Group reviews the budget at regular intervals formally, every year during the project period and with periodic spot checks throughout the project term.

The Project Steering Group assures the quality of measurement criteria and pro - actively manage deviation from expected progress in sensitive ways by seeking always to find a constructive way forward and facilitating team learning cycles. The Steering Group supervises the activities with a clear understanding that the project is implemented within general resource constraints of the local and national economy and that scarce resources will generally be allocated where the overall benefit for the community is maximised. Technical groups are supposed to be formed to implement
specific activities under each objective. The technical teams report progress of their respective activities to the Steering Group monthly. Budget statements are generated and circulated for discussion at Steering Group meetings.

The PPME at the national level may assume responsibility for operational developments, implementation, and coordination of the project locally “on the ground”; liaising with local project teams and stakeholders; and communicating with the wider Steering Group. The team may meet with other partners formally (virtually by telephone conferencing as necessary) on a monthly basis and will provide written reports for discussion at formal Steering Group meetings. Field visits by the stakeholders will facilitate understanding and enable direct assessment of progress towards project goals.

**Notes!** ..............................................

**Box 2: Project evaluation integrated into national evaluation framework: Results chain approach**

Evaluation of capacity development project will be integral and on-going throughout the project period and incorporated into the national evaluation framework of the Ministry of Health. The use of Results Chain builds in performance measures against end results that are envisioned and defined precisely by the Steering Group. Plans and responsibilities are defined at the outset and research instruments designed and piloted before usage. The Pre-intervention evaluation forms the basis of the initial project analysis. It uses a questionnaire survey and interviews (telephone and or direct) to explore user needs and expectations surrounding the project.

A Pre-intervention evaluation report is usually produced and this informs finalisation of the technical development of the entire project. The Post-intervention evaluation is done a month after the project and reports produced for stakeholders. A post-intervention survey and interviews to explore participants’ use and perceived usefulness of the entire project are recommended in this exercise. This is augmented by actual utilisation statistics. Evaluation methods involving pluralistic qualitative and quantitative methods e.g. participatory action learning, focus group discussions, interview, questionnaires, process and impact assessment will be used to evaluate the project. The Steering Group will provide guidance, including commenting on and contributing to data analysis and reporting, shaping of recommendations and dissemination as reports, publications, podcasts etc.
Barriers to the project and measures to address those barriers

A possible turnover of volunteers and other personnel is envisaged in any project: The main mitigation factor will be the participants perceiving high personal benefits from involvement in the project. Therefore great effort should be focused on achieving results valued by the participants. The Project Steering Group will have identified highly active and committed members and ensuring regular contacts. Technical teams should be clearly identified and project partner Awards – such as additional skills training, citations – be given to team members who complete projects.

Communication difficulties (distance, poor telephone links). Maximise use of visits for face to face discussions on location: To reduce possible communication barriers, the Project Steering Group will have to provide motivation for local support and the use of email, Skype and alternatives should be encouraged to enhance feedback communication among project team members.

Resource constraints from potential donor partner’s: The strategic value of any project to each partner lies in practical benefits, prestige, public relations improvement and good will, publication and dissemination of important evidence and the use of project opportunities. Importance of benefits to each stakeholder organisation, volunteer and staff should be reiterated as an ongoing exercise throughout the project period.

Effect of unstable economy (inflation) on budget: The budget for climate change and health programmes at the district level should consider the rate of inflation.

Change to the National Programme of work for the Ministry of Health and other stakeholder Organisations: This challenge is addressed by focusing on the priority health areas of the Ministry of Health which incorporates climate change integration into the broader management of health priorities.

NOTES!
References


*Journal of European Industrial Training, 17*(1), 12-17.
The annexes contain peer reviewed studies conducted on climate change and health. The studies provide supplements and support information in the main text.

The annexes have been grouped into three disease areas:

1. Malaria
2. Meningitis
3. Diarrhoea

Annex 1: Malaria

MEDLINE via PUBMED search: “Malaria” AND Climate Change (MESH), last updated 07/06/06

100 hits, Selected abstracts:


The ecology of Anopheles mosquitoes under climate change: case studies from the effects of deforestation in East African highlands. Afrane YA, Githeko AK, Yan G.

Climate and Human Health Research Unit, Centre for Global Health Research, Kenya Medical Research Institute, Kisumu, Kenya. yaw_afrane@yahoo.com

Climate change is expected to lead to latitudinal and altitudinal temperature increases. High-elevation regions such as the highlands of Africa and those that have temperate climate are most likely to be affected. The highlands of Africa generally exhibit low ambient temperatures. This restricts the distribution of Anopheles mosquitoes, the vectors of malaria, filariasis, and O’nyong’ nyong fever. The development and survival of larval and adult mosquitoes are temperature dependent, as are mosquito biting frequency and pathogen development rate. Given that various Anopheles species are adapted to different climatic conditions, changes in climate could lead to changes in species composition in an area that may change the dynamics of mosquito-borne disease transmission. It is important to consider the effect of climate change on rainfall, which is critical to the formation and persistence of mosquito breeding sites. In addition, environmental changes such as deforestation could increase local temperatures in the highlands; this could enhance the vectorial capacity of the Anopheles. These experimental data will be invaluable in facilitating the understanding of the impact of climate change on Anopheles.


PMID: 22320421 [PubMed - indexed for MEDLINE]


Progress towards understanding the ecology and epidemiology of malaria in the western Kenya highlands: opportunities and challenges for control under climate change risk. Githeko AK, Ototo EN, Guiyun Y.

Kenya Medical Research Institute, Centre for Global Health Research, Climate and Human Health Research Unit, Kisumu, Kenya. githeko@yahoo.com

Following severe malaria epidemics in the western Kenya highlands after the late 1980s it became imperative to undertake eco-epidemiological assessments of the disease and determine its drivers, spatial-temporal distribution and control strategies. Extensive research has indicated that the major
biophysical drivers of the disease are climate change and variability, terrain, topography, hydrology and immunity. Vector distribution is focalized at valley bottoms and abundance is closely related with drainage efficiency, habitat availability, stability and productivity of the ecosystems. Early epidemic prediction models have been developed and they can be used to assess climate risks that warrant extra interventions with a lead time of 2-4 months. Targeted integrated vector management strategies can significantly reduce the cost on the indoor residual spraying by targeting the foci of transmission in transmission hotspots. Malaria control in the highlands has reduced vector population by 90%, infections by 50-90% in humans and in some cases transmission has been interrupted. Insecticide resistance is increasing and as transmission decreases so will immunity. Active surveillance will be required to monitor and contain emerging threats. More studies on eco-stratification of the disease, based on its major drivers, are required so that interventions are tailored for specific ecosystems. New and innovative control interventions such as house modification with a one-application strategy may reduce the threat from insecticide resistance and low compliance associated with the use of ITNs.

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Regime shifts and heterogeneous trends in malaria time series from Western Kenya Highlands.

Chaves LF, Hashizume M, Satake A, Minakawa N.

Graduate School of Environmental Sciences and Global Center of Excellence Programon Integrated Field Environmental Science, Hokkaido University, Sapporo, Japan. lchaves@ees.hokudai.ac.jp

Large malaria epidemics in the East African highlands during the mid and late 1990s kindled a stream of research on the role that global warming might have on malaria transmission. Most of the inferences using temporal information have been derived from a malaria incidence time series from Kericho. Here, we report a detailed analysis of 5 monthly time series, between 15 and 41 years long, from West Kenya encompassing an altitudinal gradient along Lake Victoria basin. We found decreasing, but heterogeneous, malaria trends since the late 1980s at low altitudes (<1600 m), and the early 2000s at high altitudes (>1600 m). Regime shifts were present in 3 of the series and were synchronous in the 2 time series from high altitudes. At low altitude, regime shifts were associated with a shift from increasing to decreasing malaria transmission, as well as a decrease in variability. At higher altitudes, regime shifts reflected an increase in malaria transmission variability. The heterogeneity in malaria trends probably reflects the multitude of factors that can drive malaria transmission and highlights the need for both spatially and temporally fine-grained data to make sound inferences about the impacts of climate change and control/elimination interventions on malaria transmission.

PMCID: PMC3252560 PMID: 21996447 [PubMed - indexed for MEDLINE]


Climate change and vector-borne diseases: an economic impact analysis of malaria in Africa.

Egbendewe-Mondzozo A, Musumba M, McCarl BA, Wu X.

Department of Agricultural, Food, and Resource Economics, Michigan State University, 86 Agriculture Hall, East Lansing, MI 48824, USA. aklesso@msu.edu

A semi-parametric econometric model is used to study the relationship between malaria cases and climatic factors in 25 African countries. Results show that a marginal change in temperature and precipitation levels would lead to a significant change in the
number of malaria cases for most countries by the end of the century. Consistent with the existing biophysical malaria model results, the projected effects of climate change are mixed. Our model projects that some countries will see an increase in malaria cases but others will see a decrease. We estimate projected malaria inpatient and outpatient treatment costs as a proportion of annual 2000 health expenditures per 1,000 people. We found that even under minimal climate change scenario, some countries may see their inpatient treatment cost of malaria increase more than 20%.

PMCID: PMC3083677 PMID: 21556186 [PubMed - indexed for MEDLINE]


Disease appearance and evolution against a background of climate change and reduced resources

Yacoub S, Kotit S, Yacoub MH.

Department of Infectious Diseases, Imperial College, London, UK. myacoub@imperial.ac.uk

Global health continues to face increasing challenges owing to a variety of reasons that include the almost constant changes in disease appearance and evolution. Most, but not all, of these changes affect low-income countries and are influenced by climate change. Tracking the recent and anticipated changes in the demographics and global distribution of these changes is essential for evolving effective new methods for dealing with the problems. The recent recognition by the United Nations of the importance of non-communicable diseases is a major positive step. For the sake of this paper, the following diseases were chosen: dengue and malaria, to highlight the role of climate change on vector-borne diseases. Drug-resistant tuberculosis illustrates the role of globalization and reduced resources on disease evolution. The continuing rise in cardiovascular mortality and morbidity, particularly in resource-poor countries is largely attributed to lack of preventive and therapeutic measures against such conditions as hypertension, diabetes, atherosclerosis and congenital heart disease as well as neglected diseases, of which Chagas and rheumatic heart disease will be discussed further.

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PMID: 21464067 [PubMed - indexed for MEDLINE]


Influence of climate on malaria transmission depends on daily temperature variation.

Paaijmans KP, Blanford S, Bell AS, Blanford JI, Read AF, Thomas MB.

Department of Entomology, Center for Infectious Disease Dynamics, Penn State University, University Park, PA 16802, USA.

Malaria transmission is strongly influenced by environmental temperature, but the biological drivers remain poorly quantified. Most studies analysing malaria-temperature relations, including those investigating malaria risk and the possible impacts of climate change, are based solely on mean temperatures and extrapolate from functions determined under unrealistic laboratory conditions. Here, we present empirical evidence to show that, in addition to mean temperatures, daily fluctuations in temperature affect parasite infection, the rate of parasite development, and the essential elements of mosquito biology that combine to determine malaria transmission intensity. In general, we find that, compared with rates at equivalent constant mean temperatures, temperature fluctuation around low mean temperatures acts to speed up rate processes, whereas fluctuation around high mean temperatures acts to slow processes down. At the extremes (conditions representative of the fringes of malaria transmission, where range expansions or contractions will occur), fluctuation makes transmission possible at lower mean temperatures than currently predicted and can potentially block transmission at higher mean temperatures. If we are to optimize
control efforts and develop appropriate adaptation or mitigation strategies for future climates, we need to incorporate into predictive models the effects of daily temperature variation and how that variation is altered by climate change.

PMCID: PMC2930540 PMID: 20696913 [PubMed - indexed for MEDLINE]

Modelling climate change and malaria transmission.
Parham PE, Michael E.
Grantham Institute for Climate Change, Department of Infectious Disease Epidemiology, Imperial College London, St. Mary's Campus, Praed Street, London W21PG, UK. paul.parham@imperial.ac.uk

The impact of climate change on human health has received increasing attention in recent years, with potential impacts due to vector-borne diseases only now beginning to be understood. As the most severe vector-borne disease, with one million deaths globally in 2006, malaria is thought most likely to be affected by changes in climate variables due to the sensitivity of its transmission dynamics to environmental conditions. While considerable research has been carried out using statistical models to better assess the relationship between changes in environmental variables and malaria incidence, less progress has been made on developing process-based climate-driven mathematical models with greater explanatory power. Here, we develop a simple model of malaria transmission linked to climate which permits useful insights into the sensitivity of disease transmission to changes in rainfall and temperature variables. Both the impact of changes in the mean values of these key external variables and importantly temporal variation in these values are explored. We show that the development and analysis of such dynamic climate-driven transmission models will be crucial to understanding the rate at which P. falciparum and P. vivax may either infect expand into or go extinct in populations as local environmental conditions change. Malaria becomes endemic in a population when the basic reproduction number $R_0$ is greater than unity and we identify an optimum climate-driven transmission window for the disease, thus providing a useful indicator for determining how transmission risk may change as climate changes. Overall, our results indicate that considerable work is required to better understand ways in which global malaria incidence and distribution may alter with climate change. In particular, we show that the roles of seasonality and variability in environmental variables, as well as ultimately anthropogenic effects, require further study. The work presented here offers a theoretical framework upon which this future research may be developed.

PMID: 20632538 [PubMed - indexed for MEDLINE]

Relevant micro-climate for determining the development rate of malaria mosquitoes and possible implications of climate change.
Paaijmans KP, Imbahale SS, Thomas MB, Takken W.
Laboratory of Entomology, Wageningen University, PO Box 8031, 6700EH Wageningen, The Netherlands. krijn@paaijmans.nl

BACKGROUND: The relationship between mosquito development and temperature is one of the keys to understanding the current and future dynamics and distribution of vector-borne diseases such as malaria. Many process-based models use mean air temperature to estimate larval development times, and hence adult vector densities and/or malaria risk. METHODS: Water temperatures in three different-sized water pools, as well as the adjacent air temperature in lowland and highland sites in western Kenya were monitored. Both air and water temperatures were fed into a widely-applied temperature-dependent development model for Anopheles gambiaei matures, and subsequently their impact on predicted vector abundance was assessed. RESULTS: Mean water temperature in typical mosquito breeding sites was 4-6 degrees C higher than
the mean temperature of the adjacent air, resulting in larval development rates, and hence population growth rates, that are much higher than predicted based on air temperature. On the other hand, due to the non-linearity's in the relationship between temperature and larval developmental, together with a marginal buffering in the increase in water temperature compared with air temperature, the relative increases in larval development rates predicted due to climate change are substantially less.

CONCLUSIONS: Existing models will tend to underestimate mosquito population growth under current conditions, and may overestimate relative increases in population growth under future climate change. These results highlight the need for better integration of biological and environmental information at the scale relevant to mosquito biology.

PMCID: PMC2912924 PMID: 20618930 [PubMed - indexed for MEDLINE]


Loha E, Lindtjørn B.
Department of Public and Environmental Health, Hawassa University, Ethiopia.eskindir_loha@yahoo.com

BACKGROUND: Malaria transmission is complex and is believed to be associated with local climate changes. However, simple attempts to extrapolate malaria incidence rates from averaged regional meteorological conditions have proven unsuccessful. Therefore, the objective of this study was to determine if variations in specific meteorological factors are able to consistently predict P. falciparum malaria incidence at different locations in south Ethiopia. METHODS: Retrospective data from 42 locations were collected including P. falciparum malaria incidence for the period of 1998-2007 and meteorological variables such as monthly rainfall (all locations), temperature (17 locations), and relative humidity (three locations). Thirty-five data sets qualified for the analysis. L. Jung-Box Q statistics was used for model diagnosis, and R squared or stationary R squared was taken as goodness of fit measure. Time series modelling was carried out using Transfer Function (TF) models and univariate to-regressive integrated moving average (ARIMA) when there was no significant predictor meteorological variable.

RESULTS: Of 35 models, five were discarded because of the significant value of Ljung-Box Q statistics. Past P. falciparum malaria incidence alone (17 locations) or when coupled with meteorological variables (four locations) was able to predict P. falciparum malaria incidence within statistical significance. All seasonal ARIMA orders were from locations at altitudes above 1742 m. Monthly rainfall, minimum and maximum temperature was able to predict incidence at four, five and two locations, respectively. In contrast, relative humidity was not able to predict P. falciparum malaria incidence. The R squared values for the models ranged from 16% to 97%, with the exception of one model which had a negative value. Models with seasonal ARIMA orders were found to perform better. However, the models for predicting P. falciparum malaria incidence varied from location to location, and among lagged effects, data transformation forms, ARIMA and TF orders.

CONCLUSIONS: This study describes P. falciparum malaria incidence models linked with meteorological data. Variability in the models was principally attributed to regional differences, and a single model was not found that fits all locations. Past P. falciparum malaria incidence appeared to be a superior predictor than meteorology. Future efforts in malaria modelling may benefit from inclusion of non-meteorological factors.

PMCID: PMC2898788 PMID: 20553590 [PubMed - indexed for MEDLINE]

Climate change and the global malaria recession.
The current and potential future impact of climate change on malaria is of major public health interest. The proposed effects of rising global temperatures on the future spread and intensification of the disease, and on existing malaria morbidity and mortality rates, substantively influence global health policy. The contemporary spatial limits of Plasmodium falciparum malaria and its endemicity within this range when compared with comparable historical maps offer unique insights into the changing global epidemiology of malaria over the last century. It has long been known that the range of malaria has contracted through a century of economic development and disease control. Here, for the first time, we quantify this contraction and the global decreases in malaria endemicity since approximately 1900. We compare the magnitude of these changes to the size of effects on malaria endemicity proposed under future climate scenarios and associated with widely used public health interventions. Our findings have two key and often ignored implications with respect to climate change and malaria. First, widespread claims that rising mean temperatures have already led to increases in worldwide malaria morbidity and mortality are largely at odds with observed decreasing global trends in both its endemicity and geographic extent. Second, the proposed future effects of rising temperatures on endemicity are at least one order of magnitude smaller than changes observed since about 1900 and up to two orders of magnitude smaller than those that can be achieved by the effective scale-up of key control measures. Predictions of an intensification of malaria in a warmer world, based on extrapolated empirical relationships or biological mechanisms, must be set against a context of a century of warming that has seen marked global declines in the disease and a substantial weakening of the global correlation between malaria endemicity and climate.
CONCLUSIONS: Disease emergence, extinction, and transmission all depend strongly on climate. Mathematical models offer powerful tools for understanding geographic shifts in incidence as climate changes. Nonlinear dependences of transmission on climate necessitate consideration of both changing climate trends and variability across time scales of interest.

PMCID: PMC2866676 PMID: 20435552 [PubMed - indexed for MEDLINE]

Predicting and mapping malaria under climate change scenarios: the potential redistribution of malaria vectors in Africa.
Tonnang HE, Kangalawe RY, Yanda PZ.
Institute of Resource Assessment, University of Dar Es Salaam, PO Box 35097, Dar es Salaam, Tanzania. htonnang@gmail.com.

BACKGROUND: Malaria is rampant in Africa and causes untold mortality and morbidity. Vector-borne diseases are climate sensitive and this has raised considerable concern over the implications of climate change on future disease risk. The problem of malaria vectors (Anopheles mosquitoes) shifting from their traditional locations to invade new zones is an important concern. The vision of this study was to exploit the sets of information previously generated by entomologists, e.g. on geographical range of vectors and malaria distribution, to build models that will enable prediction and mapping the potential re-distribution of Anopheles mosquitoes in Africa. METHODS: The development of the modelling tool was carried out through calibration of CLIMEX parameters. The model helped estimate the potential geographical distribution and seasonal abundance of the species in relation to climatic factors. These included temperature, rainfall and relative humidity, which characterized the living environment for Anopheles mosquitoes. The same parameters were used in determining the ecoclimatic index (EI). The EI values were exported to a GIS package for special analysis and proper mapping of the potential future distribution of Anopheles gambiae and Anophelis within the African continent under three climate change scenarios. RESULTS: These results have shown that shifts in these species boundaries southward and eastward of Africa may occur rather than jumps into quite different climatic environments. In the absence of adequate control, these predictions are crucial in understanding the possible future geographical range of the vectors and the disease, which could facilitate planning for various adaptation options.

CONCLUSION: Thus, the outputs from this study will be helpful at various levels of decision making, for example, in setting up of an early warning and sustainable strategies for climate change and climate change adaptation for malaria vectors control programmes in Africa.

PMCID: PMC2873524 PMID: 20416059 [PubMed - indexed for MEDLINE]

Climate change and altitudinal structuring of malaria vectors in south-western Cameroon: their relation to malaria transmission.
Tanga MC, Ngundu WI, Judith N, Mbuh J, Tendongfor N, Simard F, Wanji S.
Department of Zoology and Entomology, University of Pretoria, 0002 Pretoria, South Africa. tangambi@yahoo.com

An entomological survey was conducted in Cameroon between October 2004 and September 2005, in nine localities targeted for malaria vector control based on adult productivity and variability. Mosquitoes were collected by human-landing catches (HLCs) and pyrethrum spray catches. A total of 12,500 anophelines were collected and dissected: Anopheles gambiae s.l. (56.86%), An. funestus s.l. (32.57%), An. hancocki (9.38%), and An. nili (1.18%). Applying PCR revealed that specimens of the An. funestus group were An. funestus s.s. and An. gambiae complex were mostly An. melas and An. gambiae s.s. of the M and S molecular forms with the M forms being the most predominant. The natural distribution patterns of Anopheles species
were largely determined by altitude with some species having unique environmental tolerance limits. A human blood index (HBI) of 99.05% was recorded. Mean probability of daily survival of the malaria vectors was 0.92, with annual mean life expectancy of 21.9 days and the expectation of infective life was long with a mean of 7.4 days. The high survival rates suggest a high vector potential for the species. This information enhances the development of a more focused and informed vector control intervention.

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PMID: 20346477  [PubMed - indexed for MEDLINE]

Climate change and highland malaria: fresh air for a hot debate.

Chaves LF, Koenraadt CJ.
Department of Environmental Studies, Emory University, Atlanta, GA 30322, USA. LFCHAVE@EMORY.EDU

In recent decades, malaria has become established in zones at the margin of its previous distribution, especially in the highlands of East Africa. Studies in this region have sparked a heated debate over the importance of climate change in the territorial expansion of malaria, where positions range from its neglect to the reification of correlations as causes. Here, we review studies supporting and rebutting the role of climatic change as a driving force for highland invasion by malaria. We assessed the conclusions from both sides of the argument and found that evidence for the role of climate in these dynamics is robust. However, we also argue that over-emphasizing the importance of climate is misleading for setting a research agenda, even one which attempts to understand climate change impacts on emerging malaria patterns. We review alternative drivers for the emergence of this disease and highlight the problems still calling for research if the multidimensional nature of malaria is to be adequately tackled.

PMID: 20337259  [PubMed - indexed for MEDLINE]

Assessment of the impact of climate shifts on malaria transmission in the Sahel.

Bomblies A, Eltahir EA.
University of Vermont, 221 Votey Hall, 33 Colchester Ave., Burlington, VT, USA. abomblie@uvm.edu

Climate affects malaria transmission through a complex network of causative pathways. We seek to evaluate the impact of hypothetical climate change scenarios on malaria transmission in the Sahel by using a novel mechanistic, high spatial- and temporal-resolution coupled hydrology and agent-based entomology model. The hydrology model component resolves individual precipitation events and individual breeding pools. The impact of future potential climate shifts on the representative Sahel village of Banizoumbou, Niger, is estimated by forcing the model of Banizoumbou environment with meteorological data from two locations along the north-south climatological gradient observed in the Sahel—both for warmer, drier scenarios from the north and cooler, wetter scenarios from the south. These shifts in climate represent hypothetical but historically realistic climate change scenarios. For Banizoumbou climatic conditions (latitude 13.54 N), a shift toward cooler, wetter conditions may dramatically increase mosquito abundance; however, our modelling results indicate that the increased malaria transmissibility is not simply proportional to the precipitation increase. The cooler, wetter conditions increase the length of the sporogonic cycle, dampening a large vectorial
capacity increase otherwise brought about by increased mosquito survival and greater overall abundance. Furthermore, simulations varying rainfall event frequency demonstrate the importance of precipitation patterns, rather than simply average or time-integrated precipitation, as a controlling factor of these dynamics. Modelling results suggest that in addition to changes in temperature and total precipitation, changes in rainfall patterns are very important to predict changes in disease susceptibility resulting from climate shifts. The combined effect of these climate-shift-induced perturbations can be represented with the aid of a detailed mechanistic model.

PMID: 20111887 [PubMed - indexed for MEDLINE]


Development, malaria and adaptation to climate change: a case study from India.

Garg A, Dhiman RC, Bhattacharya S, Shukla PR.

Indian Institute of Management Ahmedabad, Vastrapur, Ahmedabad, India.amitgarg@iimahd.ernet.in

India has reasons to be concerned about climate change. Over 650 million people depend on climate-sensitive sectors, such as rain-fed agriculture and forestry, for livelihood and over 973 million people are exposed to vector borne malarial parasites. Projection of climatic factors indicates a wider exposure to malaria for the Indian population in the future. If precautionary measures are not taken and development processes are not managed properly some developmental activities, such as hydro-electric dams and irrigation canal systems, may also exacerbate breeding grounds for malaria. This article integrates climate change and developmental variables in articulating a framework for integrated impact assessment and adaptation responses, with malaria incidence in India as a cases study. The climate change variables include temperature, rainfall, humidity, extreme events, and other secondary variables. Development variables are income levels, institutional mechanisms to implement preventive measures, infrastructure development that could promote malarial breeding grounds, and other policies. The case study indicates that sustainable development variables may sometimes reduce the adverse impacts on the system due to climate change alone, while it may sometimes also exacerbate these impacts if the development variables are not managed well and therefore they produce a negative impact on the system. The study concludes that well-crafted and well managed developmental policies could result in enhanced resilience of communities and systems, and lower health impacts due to climate change.

PMID: 19127377  [PubMed - indexed for MEDLINE]

Annex 2: Meningitis

MEDLINE via PUBMED search:
“Meningitis” (including all MESH headings with Meningitis but excluding viral and immune suppression) AND Climate Change (MESH), last updated 07/06/06


Modelled response of the West Nile virus vector Culex quinquefasciatus to changing climate using the dynamic mosquito simulation model.

Morin CW, Comrie AC.

School of Geography and Development, University of Arizona, 409 Harvill Building, Tucson, AZ 85721, USA. cmorin@email.arizona.edu

Climate can strongly influence the population dynamics of disease vectors and is consequently a key component of disease ecology. Future climate change and variability may alter the location and seasonality of many disease vectors, possibly increasing the risk of disease transmission to humans. The mosquito species Culex quinquefasciatus is a concern across the southern United States because of its role as a West Nile virus vector.
and its affinity for urban environments. Using established relationships between atmospheric variables (temperature and precipitation) and mosquito development, we have created the Dynamic Mosquito Simulation Model (DyMSiM) to simulate Cx. Quinquefasciatus population dynamics. The model is driven with climate data and validated against mosquito count data from Pasco County, Florida and Coachella Valley, California. Using 1-week and 2-week filters, mosquito trap data are reproduced well by the model (P < 0.0001). Dry environments in southern California produce different mosquito population trends than moist locations in Florida. Florida and California mosquito populations are generally temperature-limited in winter. In California, locations are water-limited through much of the year. Using future climate projection data generated by the National Center for Atmospheric Research CCSM3 general circulation model, we applied temperature and precipitation offsets to the climate data at each location to evaluate mosquito population sensitivity to possible future climate conditions. We found that temperature and precipitation shifts act interdependently to cause remarkable changes in modelled mosquito population dynamics. Impacts include a summer population decline from drying in California due to loss of immature mosquito habitats, and in Florida a decrease in late-season mosquito populations due to drier late summer conditions.

PMID: 20683620  [PubMed - indexed for MEDLINE]


Soverow JE, Wellenius GA, Fisman DN, Mittleman MA.

New York University School of Medicine, New York, New York, USA.

Comment in Environ Health Perspect. 2009 Jul; 117(7):A311.

BACKGROUND: The effects of weather on West Nile virus (WNV) mosquito populations in the United States have been widely reported, but few studies assess their overall impact on transmission to humans. OBJECTIVES: We investigated meteorologic conditions associated with reported human WNV cases in the United States. METHODS: We conducted a case-crossover study to assess 16,298 human WNV cases reported to the Centers for Disease Control and Prevention from 2001 to 2005. The primary outcome measures were the incidence rate ratio of disease occurrence associated with mean weekly maximum temperature, cumulative weekly temperature, mean weekly dew point temperature, cumulative weekly precipitation, and the presence of > or = 1 day of heavy rainfall (> or = 50 mm) during the month prior to symptom onset. RESULTS: Increasing weekly maximum temperature and weekly cumulative temperature were similarly and significantly associated with a 35-83% higher incidence of reported WNV infection over the next month. An increase in mean weekly dew point temperature was significantly associated with a 9-38% higher incidence over the subsequent 3 weeks. The presence of at least 1 day of heavy rainfall within a week was associated with a 29-66% higher incidence during the same week and over the subsequent 2 weeks. A 20-mm increase in cumulative weekly precipitation was significantly associated with a 4-8% increase in incidence of reported WNV infection over the subsequent 2 weeks.

CONCLUSIONS: Warmer temperatures, elevated humidity, and heavy precipitation increased the rate of human WNV infection in the United States independent of season and each-others’ effects.

PMCID: PMC2717128 PMID: 19654911 [PubMed - indexed for MEDLINE]


[ Epidemiology of emerging and resurfing vector-borne diseases with special attention to climate change in Germany (review).]
Vector-borne diseases gained importance in Germany during the past years. Borreliosis and tick-borne encephalitis are already well-known infectious diseases, transmitted by Ixodes ricinus. But reports on severe diseases, formerly only known as so-called “travel sickness” from tropical countries, markedly increased in the recent years. Several climate models predict a global warming of 1.4 degrees C up to 5.8 degrees C until the year 2100, and as climate-typical temperature barriers restrict the distribution of the vectors, especially arthropod-borne diseases are strongly influenced by the climate. Due to the growing clinical importance, the present state of information concerning the epidemiological situation of all known vector-borne diseases in Germany is summarized in this review.

PMID: 19517928  [PubMed - indexed for MEDLINE]


Chikungunya and West Nile virus outbreaks: what is happening in north-eastern Italy?

Rezza G.

Epidemiology Unit, Department of Infectious, Parasitic and Immuno mediated Diseases-Istituto Superiore di Sanità, Roma, Italy. g.rezza@iss.it

PMID: 19158099  [PubMed - indexed for MEDLINE]


Disease emergence from global climate and land use change.

Patz JA, Olson SH, Uejio CK, Gibbs HK.
first step is to identify the diseases whose incidence and geographical distribution could be affected by the changes taking place, and the second step is to evaluate the risk of each of these diseases. As a result of this process, six priority diseases were selected: bluetongue, Rift Valley fever, West Nile fever, visceral leishmaniasis, leptospirosis and African horse sickness. The main recommendations were: to develop epidemiological surveillance, to increase knowledge of epidemiological cycles, to develop research into these diseases and to pool cross-border efforts to control them.

PMID: 18819676  [PubMed - indexed for MEDLINE]


Impact of climate change and other factors on emerging arbovirus diseases.

Gould EA, Higgs S.

Unité des Virus Emergents, Faculté de Médecine Timone, 13385 Marseille, Cedex 05, France. eag@ceh.ac.uk

While some sceptics remain unconvinced that global climate change is a reality, there is no doubt that during the past 50 years or so, patterns of emerging arbovirus diseases have changed significantly. Can this be attributed to climate change? Climate is a major factor in determining: (1) the geographic and temporal distribution of arthropods; (2) characteristics of arthropod life cycles; (3) dispersal patterns of associated arboviruses; (4) the evolution of arboviruses; and (5) the efficiency with which they are transmitted from arthropods to vertebrate hosts. Thus, under the influence of increasing temperatures and rainfall through warming of the oceans, and alteration of the natural cycles that stabilise climate, one is inevitably drawn to the conclusion that arboviruses will continue to emerge in new regions. For example, we cannot ignore the unexpected but successful establishment of chikungunya fever in northern Italy, the sudden appearance of West Nile virus in North America, the increasing frequency of Rift Valley fever epidemics in the Arabian Peninsula, and very recently, the emergence of Bluetongue virus in northern Europe. In this brief review we ask the question, are these diseases emerging because of climate change or do other factors play an equal or even more important role in their emergence?

PMCID: PMC2915563PMID: 18799177  [PubMed - indexed for MEDLINE]


Global climate change and the emergence/re-emergence of infectious diseases.

Zell R.

Institute for Virology and Antiviral Therapy, Medical Center at the Friedrich Schiller University, Jena, Germany. i6zero@rz.uni-jena.de

Variation in the incidence of vector-borne diseases is associated with extreme weather events and annual changes in weather conditions. Moreover, it is assumed that global warming might lead to an increase of infectious disease outbreaks. While a number of reports link disease outbreaks to single weather events, the El Niño/Southern Oscillation and other large-scale climate fluctuations, no report unequivocally associates vector-borne diseases with increased temperature and the environmental changes expected to accompany it. The complexity of not yet fully understood pathogen transmission dynamics with numerous variables might be an explanation of the problems in assessing the risk factors.

PMID: 15146981  [PubMed - indexed for MEDLINE]


[Global warming: trailblazer for tropical infections in Germany?].

[Article in German]

Hemmer CJ, Frimmel S, Kinzelbach R, Gürtler L, Reisinger EC.
Since 1850, the CO (2) content of the atmosphere has increased from 280 to 360ppm, and the average surface temperature has risen from 14.6 to 15.3 C . A further increase between 1.8 and 4.0 C is expected for the 21st century. Temperate and cold climate zones are affected predominantly, but tropical regions are not spared. At the same time, the world wide climate effects of the “El Niño Southern Oscillation” are amplified. Global warming enhances the growth of tropical pathogens (malarial plasmodia, leishmaniasis, yellow fever virus, dengue virus, West Nile virus, Vibrio cholera) and vectors (anopheles, aedes, culex, and phlebotomus mosquitos; hard ticks). Global warming may lead to the emergence of diseases which at present are not endemic in Germany, like West Nile fever, Dengue fever, or Leishmaniasis, and to enhanced transmission of borreliosis and tick-borne encephalitis. Malaria and cholera, in contrast, are influenced more strongly by socioeconomic factors. Improved surveillance and intensified research on the relationship between climate change and infectious diseases is needed.

PMID: 18033654  [PubMed - indexed for MEDLINE]

**Annex 3: Diarrhoea**

**MEDLINE via PUBMED search:**“diarrhoea” OR “diarrhoea, infantile”AND Climate Change (MESH), last updated 07/06/06


Department of Biomedical Engineering and Environmental Sciences, National TsingHua University, Hsinchu, Taiwan.

Diarrhoea is an important public health problem in Taiwan. Climatic changes and an increase in extreme weather events (extreme heat, drought or rainfalls) have been strongly linked to the incidence of diarrhoea-associated disease. This study investigated and quantified the relationship between climate variations and diarrhoea-associated morbidity in subtropical Taiwan. Specifically, this study analyzed the local climatic variables and the number of diarrhoea-associated infection cases from 1996 to 2007. This study applied a climate variation-guided Poisson regression model to predict the dynamics of diarrhoea-associated morbidity. The proposed model allows for climate factors (relative humidity, maximum temperature and the numbers of extreme rainfall), auto regression, long-term trends and seasonality, and a lag-time effect. Results indicated that the maximum temperature and extreme rainfall days were strongly related to diarrhoea-associated morbidity. The impact of maximum temperature on diarrhoea-associated morbidity appeared primarily among children (0-14years) and older adults (40-64years), and had less of an effect on adults (15-39years). Otherwise, relative humidity and extreme rainfall days significantly contributed to the diarrhoea-associated morbidity in adult. This suggested that children and older adults were the most susceptible to diarrhoea-associated morbidity caused by climatic variation. Because climatic variation contributed to diarrhoea morbidity in Taiwan, it is necessary to develop an early warning system based on the climatic variation information for disease control management.

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PMID: 20947136  [PubMed - indexed for MEDLINE]


Uncertainties associated with quantifying climate change impacts on human healthcare: A case study for diarrhoea.

Kolstad EW, Johansson KA.
BACKGROUND: Climate change is expected to have large impacts on health at low latitudes where droughts and malnutrition, diarrhoea, and malaria are projected to increase. OBJECTIVES: The main objective of this study was to indicate a method to assess a range of plausible health impacts of climate change while handling uncertainties in an unambiguous manner. We illustrate this method by quantifying the impacts of projected regional warming on diarrhoea in this century. METHODS: We combined a range of linear regression coefficients to computer projections of future climate change-induced increases in diarrhoea using the results from five empirical studies and a 19-member climate model ensemble for which future greenhouse gas emissions were prescribed. Six geographical regions were analyzed. RESULTS: The model ensemble projected temperature increases of up to 4°C overland in the tropics and subtropics by the end of this century. The associated mean projected increases of relative risk of diarrhoea in the six study regions were 8-11% (with SDs of 3-5%) by 2010-2039 and 22-29% (SDs of 9-12%) by 2070-2099. CONCLUSIONS: Even our most conservative estimates indicate substantial impacts from climate change on the incidence of diarrhoea. Nevertheless, our main conclusion is that large uncertainties are associated with future projections of diarrhoea and climate change. We believe that these uncertainties can be attributed primarily to the scarcity of empirical climate-health data. Our results therefore highlight the need for empirical data in the cross section between climate and human health.

PMCID: PMC3059990 PMID: 20929684 [PubMed - indexed for MEDLINE]
CAPACITY BUILDING STRATEGY ON CLIMATE CHANGE AND HEALTH RELATED RISKS