CLIMATE CHANGE AND DEVELOPMENT

CONSULTATION ON KEY RESEARCHABLE ISSUES

SECTORAL ISSUES
SECTION 2.5. HEALTH
HANNAH REID, LAUREL MURRAY AND SARI KOVATS

Saleemul Huq and Hannah Reid
Climate Change Group
International Institute for Environment and Development
3 Endsleigh Street, London WC1H 0DD, UK
Tel: (+44 20) 7388 2117
Fax: (+44 20) 7388 2826
Email: saleemul.huq@iied.org hannah.reid@iied.org
Climate Change and Health

The World Health Organization (WHO) has acknowledged that climate change may have major consequences for human health.

“We have evidence to state that climate change - by altering weather patterns and by disturbing life-supporting natural systems and processes - affects the health of human populations. There are many effects of these changes. And there is still discussion on the exact causality between human behaviour and climate change. But we know enough to take this very seriously and we have every reason to be concerned about adverse consequences for human health.”

Dr Gro Harlem Brundtland, Director-General, World Health Organization. Speech at Geneva, World Meteorological Day, 23 March 1999

“Although risk may be low compared with current acute health crises, the attributable burden of such a widespread global phenomenon may be quite high”

Patz and Kovats (2002)

Climate change may affect human health through a range of pathways (see table below). Reviews of the range of impacts and mechanisms (and current scientific evidence) have been conducted by the WHO (McMichael et al. 2003) and the IPCC, which has a dedicated chapter on health (McMichael and Githeko 2001). Information and research on ‘adaptation’ responses as they relate to public health policy has been less well developed (WHO 2000; Ebi et al. in press). However, this should be considered in the context of the wealth of research and policy activity in relation to climate-sensitive diseases, particularly malaria, dengue, diarrhoeal disease and undernutrition, that focuses on the development and implementation of cost-effective control measures. Currently, tuberculosis, HIV/AIDS and malaria dominate health and development policy on infectious diseases (Molyneux 2001).

Health adaptation to climate change should be part of integrated development policies designed to:

- manage ecosystems so that they continue to provide the goods and services on which health depends;
• build on current policies to protect health, the environment and economic
development against current climate variability and extremes (the ‘adaptation
baseline’); and
• make incremental changes to the adaptation baseline to reduce health
hazards from direct and indirect climate change (‘climate change adaptation’).

The impact of climate change on a given population will depend on the prevalence of
climate-sensitive diseases (e.g. malaria). Currently, the burden of these diseases is
large. WHO has recently estimated that 150,000 deaths per year are currently
attributable to climate change, and these deaths predominantly are in low- and
middle-income countries (Ezzati et al. 2002). Although development and
improvements in health care and other infrastructure will reduce some of this
attributable burden, there is a clear need to develop the most appropriate strategies,
policies and measures to improve adaptive capacity within the health sector.

Summary of the range of climate sensitive diseases

<table>
<thead>
<tr>
<th>Health outcome</th>
<th>Known effects of weather and climate variability</th>
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| Heat stress    | • Deaths from cardiopulmonary disease increase with high
|                |   temperatures                                   |
|                | • Heat-related illness and death increase during heat waves |
| Air pollution-related | • Weather affects air pollutant concentrations |
| mortality and  | • Weather affects distribution, seasonality and production of |
| morbidity      |   aeroallergens                                  |
| Health impacts of | • Floods, landslides and windstorms cause direct effects (deaths and |
| weather disasters|     injuries) and indirect effects (infectious disease, psychological |
|                |   morbidity)                                    |
|                | • Droughts are associated with increased risk of disease, and |
|                |   malnutrition                                  |
| Mosquito-borne | • Higher temperatures shorten the pathogen development time in the |
| diseases, tick  |   vectors and increase potential transmission to humans |
| borne diseases  | • Each vector species has specific climate conditions (temperature, |
| (e.g. malaria, dengue) |   humidity) necessary to be sufficiently abundant to maintain |
|                |   transmission                                   |
| Under nutrition | • Climate change may decrease food supplies (crop yields, fish stocks) |
|                |   or access to food supplies                     |
| Water / food-borne | • Survival of disease organisms is related to temperature |
| diseases        | • Water-borne diseases are most likely to occur in communities with |
|                |   poor water supply and sanitation                |
|                | • Increases in drought conditions may affect water availability |
|                | • Extreme rainfall can affect transport of disease organisms into water |
|                |   supply                                         |

Source: Kovats et al. in press

An important impact of health will be via extreme events (floods, storms and heat
waves). The heat waves in 2003 in Europe overshadowed the occurrence of serious
heat waves in India and elsewhere. Floods are the most frequent disaster events and are associated with mortality, and an unknown burden of morbidity, including effects on mental health (Few et al. 2004; Ahern et al. 2005). The effects result from inadequate water and sanitation infrastructure, as well as disturbances to more complex ecological processes and include the spread of vector-borne diseases such as malaria.

Changes in animal health will affect human welfare and health (Jonsson and Reid 2000). For example, important livestock diseases will have knock on effects for human health. And diseases such as Rift Valley Fever affect both cattle and humans. It has been suggested that climate change may affect important vector borne diseases. “Medical, agronomic and livestock scientists have traditionally taken different approaches to the development of first-generation assessments of possible global change impacts within their disciplines. However, holistic, integrated assessments are necessary to provide advice in a form that is suitable for use by policy makers” (Sutherst et al. 1998).

Studies that focus on a single disease or health outcome provide an incomplete picture of the impacts of climate change on human health. Robust health impact assessments for climate change are needed at the national or regional level. WHO has recently launched guidance for climate change health impact assessment (WHO 2003), and has organized several workshops in small island states to support capacity building for climate and health.

Some industrialized countries have undertaken health focused national assessments of impacts and adaptation, e.g. Australia (McMichael et al. 2002), the UK (by the Department of Health in 2002), Portugal (Calheiros and Casemiro 2002) and the US (Patz et al. 2000). These assessments have quantified or qualitatively assessed the effects of climate change on heat-related and air pollution related mortality and morbidity, and on flood and windstorms. Although there are concerns about the emergence of new vector-borne diseases in these countries, the effects are likely to be small and localized. However, there are serious concerns about dengue becoming established in Australia and New Zealand (de Wet et al. 2001).

Poor countries and low-income populations are most vulnerable to the health impacts of climate change (Bloom 2004). “Any region or population with concurrent environmental or socioeconomic stresses will be at risk” (Patz and Kovats 2002).
Molyneux (2003) states, “studies suggest that infectious diseases will contribute a proportionately smaller burden of disease over the next two decades as non-communicable diseases emerge as public health problems. However, infectious diseases contribute proportionately more in the poorest quintile of the population.”

Epidemiological studies of population level impacts of current climate variability is an important first step in describing current and future vulnerability to climate change. Studies of the impact of El Niño Southern Oscillation (ENSO) events as a determinant of interannual climate variability have provided strong evidence for certain local effects of inter-annual climate variability on malaria in Venezuela (Bouma 2003) and coastal cholera in Bangladesh (Pascual et al. 2002), as assessed in a systematic review by Kovats et al. 2003a.

Malaria is probably the most important climate sensitive infectious disease, and this has been reflected in the research activity. There have been several studies, using a range of methods, to quantify the impact of climate change on malaria in terms of the global or regional population at risk (van Lieshout et al. 2004; Tanser et al. 2003; Martens et al. 1999, Rogers and Randolph 2000). Estimates based on the validated MARA model for Africa, indicate that the densely populated East African highlands are most at risk of climate change related increases in malaria transmission. Since the late 1980s, epidemics of malaria in the African highlands have become more widespread and occur more frequently, probably due to increased drug resistance rather than observed climate change. Studies of malaria epidemics in particular localities have suggested strongly that at the local level a number of non-climatic factors are significant in explaining increases in malaria transmission, such as changes in water management and land use. There is little reliable malaria information that goes back a sufficient number of years to examine historical links between climate and malaria (Rogers and Randolph 2000).

Vector-borne disease control programmes have been initiated in several poor countries and regions. These include mosquito control units, tsetse control units, and regional multi-country/multi-donor control programmes such as the Onchocerciasis Control Programme and Chagas Disease Control Programme of the Southern Cone, South America.
Droughts unfold over longer periods than floods, and their impacts tend to be on livelihoods and human health rather than infrastructure. Infectious diseases are a major cause of illness and death during famines. Malnutrition increases the risk of dying from an infectious disease, particularly diarrhoea. Outcomes associated with drought are crop failure, large-scale loss of livestock and famine. These are in turn associated with factors such as migration, in particular of the rural poor to cities, which can lead to increased urban poverty and associated problems including increased transmission of HIV/AIDS. The recent food crisis in Southern Africa, which was in part due to drought, was made much worse because HIV/AIDS has created a new class of vulnerable households, increased the population at risk and changed the course of recovery (de Waal and Whiteside 2003). It is therefore important the health interventions for drought are not confined to food aid (Griekspoor et al. 2004).

Climate change related health problems in urban areas are a growing concern. Rapidly expanding urban populations are a feature of many low-income countries. Populations in informal settlements have poor housing and limited access to improved water and sanitation. Water supplies in poor cities can be sensitive to relatively small decreases in supply. The implications of climate change on the operation of drainage systems and adverse changes caused by changes in flood frequencies have not been addressed in the literature. Climate change may also increase heat stress and exacerbate urban outdoor air pollution. Mortality due to heat waves in India was reported to be mainly among the poor, elderly and labourers such as agricultural workers and rickshaw pullers.

**Using climate information to reduce the burden of disease**

The Disability Adjusted Life Year (DALY) accounts for years of life lost to premature death and/or morbidity, and can thus be used to rank risks and to motivate and target risk management efforts (Nelson 2003). Mapping ‘hotspots’ of risk may prove useful for prioritizing and focusing resources for health planning (Patz and Kovats 2002). These tools can help improve methods for health impact assessment, but new approaches to surveillance (such as those that have been supported through the DFID Malaria Knowledge Programmes) are needed in order to allow monitoring of vector-borne diseases in sensitive areas.

Epidemic preparedness for malaria and other diseases may benefit from recently developed tools that predict the seasonality and risks of epidemics using satellite or
ground-based meteorological data (WHO 2004). New approaches to mapping the
distribution of disease vectors over large areas will facilitate species-specific vector
control activities for malaria (Tanser and le Sueur 2002) and other vector-borne
diseases, including guinea worm, onchocerciasis, lymphatic filariasis and African
typanosomiasis (sleeping disease) (Molyneux 2001).

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**Research Needs on the Health Impacts of Floods**

Few et al. (2004) “make the following recommendations for the design of
epidemiological studies that investigate the health impacts of floods: control groups
for comparison with non-flooded populations; use of longitudinal data, or routine data
in order to gain information on pre-flood levels of disease; use of objective measures
of disease outcome; and improved use of routine surveillance information. Priorities
for future research include: the impacts of flooding on long-term mental health in both
industrialised and developing countries; the impact of flooding and heavy rainfall on
diarrhoeal disease, and the main routes of transmission; indirect mortality attributable
to flooding (in addition to immediate deaths from drowning); and impacts on health
from the disruption of health services and other life supporting systems.”

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**Challenges for Research**

Although health surveillance data in low-income countries is limited, there have been
several recent initiatives to improve the situation, and implement long term
sustainable monitoring activities. It is important that surveillance is supported and
maintained in order to detect the early effects of climate change (Kovats et al. 2001).

Improved research methods and skills are also needed. Nelson (2003) states that
“improved methods are needed to predict and quantify health impacts, so that
appropriate risk management strategies can be focused on vulnerable areas”.  Technical skills in vector biology and control, at all levels, have been declining in less
developed countries (Molyneux 2001).

Poverty, lack of funding and limited capacity to introduce required health precautions
are also major challenges. There is much current work focussed on the scaling up of
interventions, such as the use of social marketing to distribute insecticide treated
bednets to reduce malaria.
The use of clean energy in poor communities offers opportunities to both reduce greenhouse gas emissions and reduce indoor air pollution and subsequent health impacts. There is much scope for research on this issue.
Climatic hazards such as flood, drought, thermal extremes and storm events bring widespread impacts on health in developing countries. The prospect of changes in the extent, magnitude and distribution of climatic hazards as a result of climate change therefore compounds an already severe public health problem that tends to impact most heavily on low-income and marginalised groups (McMichael et al. 2003). The health risks tend to be magnified in contexts where the state’s capacity to provide protection measures against disease is relatively weak, where environmental health conditions are often poor, and where poverty and vulnerability to hazards may reinforce one another in a cyclical relationship. Yet, despite the often grave concerns for public health expressed in the aftermath of hazard events - highlighted again after the 2004 tsunami disaster - insufficient research attention is directed to the means by which vulnerable populations and the institutions charged with health protection respond to those risks.

Climatic hazards impact on health both in a direct sense via injury and exposure, and in an indirect sense via changes in exposure to vectors and pathogens, psychosocial disturbance, impacts on food supply and impacts on health care services themselves. Often, these indirect health consequences arise via complex pathways associated with environmental disturbance and human behavioural change (Wisner & Adams 2002). The outcomes of these health risks are mediated by a range of coping responses, within households, communities, health systems and associated sectors such as environmental health and emergency services. In the context of additional threats posed by climate change, it is vital to improve our understanding of health-related response to hazards and, in particular, to analyse the challenges, constraints and opportunities for enhancing resilience and preparedness at all levels (Few et al. 2004). Greater preparedness within health systems, for example, can play a crucial role in health risk reduction in two senses: by reducing public vulnerability to short- and long-term health impacts of hazards; and by reducing vulnerability of health systems themselves to damage and disruption caused by severe climatic events.

In addition to further research on the epidemiology of hazard risk and the health
implications of climate change, there is a need for cross-disciplinary work to examine
the processes that shape differential vulnerability and response in developing
countries, and thereby to assess the prospects for adaptation to health risks from
future hazards:

1. Understanding present-day vulnerability and response

- How do people and institutions in low-income societies perceive and respond to
current health impacts of climatic hazards?
- How do responses to different forms of hazard vary?
- What role does difference in policy environment, health system organisation and
  wider structural context play in defining individual/institutional response
capacities?
- What role does differential entitlement to resources and livelihood assets play in
  shaping individual response capacities and decision-making?

2. Assessing adaptation options

- What are the most effective and feasible modes of response to climatic hazard
  health risks identified in low-income countries?
- What are the implications for response effectiveness of future levels of risk
  related to climate change?
- Can positive lessons be replicated through communication and intervention to
  enhance adaptation to future climate risks?
- What changes at structural and agency levels can most enhance capacity to
  adapt?

This work should seek to identify key loci for adaptive response within the social and
environmental processes that generate health vulnerability – opportunities through
which resilience to health risks can be most effectively enhanced. Such efforts will in
most cases bring contemporary benefits for present hazard-prone populations, as
well as promote anticipatory adaptation to the potential impacts of climate change.

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There are many uncertainties in assessing the potential health impacts, as climate change scenarios are highly uncertain at the spatial and temporal resolution most appropriate for health impact assessment. Research activities have shifted towards identifying those populations most vulnerable to the health impacts of climate change, and the development of effective adaptation strategies.

Health impact assessment (which includes both environmental and social assessment) should be a dominant feature of policy development. Public health and disease prevention measures are often not given the attention they deserve. Health researchers generally accept that many diseases are climate-sensitive, and therefore potentially affected by climate change. The frameworks that are used to assess climate change risks to health, and the way that the results are presented, are therefore critical for a potentially difficult dialogue between health and climate change researchers and policy-makers, stakeholders and the general public (Kovats et al. 2005).

‘Adaptation’ measures can be used effectively to greatly reduce many of the potential health impacts of climate change. Environmental interventions are nearly always cost-effective, and have widespread benefits beyond the immediate health effects (e.g. improved access to water in the home frees up the time of women for education). Many diseases and public health problems that may otherwise be exacerbated by climate change could be substantially prevented with adequate financial and human public health resources. These resources would encompass public health training programs, research to develop and implement more effective surveillance and emergency response systems, and sustainable prevention and control programs (DFID 2000). Low-income countries already have spending well below that required to control infectious disease.

**Key researchable issues**

- Capacity building through national climate change impact and adaptation assessment, with research to improve methods for quantifying the burden of
disease due to climate variability and climate change.

- Research on the effectiveness (and cost-effectiveness) of adaptation strategies (including both those delivered through the health sector and those through other sectors), particularly the use of seasonal forecasts to provide early warning of epidemics or disasters.
- Potential impacts of climate change on the achievement of the Millennium Development Goals, especially nutrition and child mortality.
- The implications for public health of climate change – via changes in disaster frequency and intensity, and the development of appropriate response strategies.

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