Climate change, extreme events and infectious disease emergence

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Conclusions

- Climate change and increasing extremes cannot help but influence infectious disease.
- Science suggests, and good management dictates, that we assume they tend to enhance risk.
- Other determinants are very large and interactive, uncertainty over climate timescales is huge.
- Climate/non-climate determinant either/or debates are pointless - comparative quantification (slightly) better.
- We should focus on improving current surveillance and response.
Temperatures will continue to rise
Climate models project more frequent hot days throughout the 21st century.

In many regions, the time between “20-year” (unusually) warm days will decrease.
Climate models project there will be more heavy rain events throughout the 21st century.

In many regions, the time between "20-year" (unusually intense) rainstorms will decrease.
Infectious disease outbreaks are affected by multiple climate factors

"It is very likely that mean sea level rise will contribute to upward trends in extreme coastal high water levels in the future". Draft SREX SPM, Pg 12

"It is likely that the frequency of heavy precipitation ... will increase in the 21st century over many areas of the globe. Draft SREX SPM, Pg 10

Cholera cases increased by 14% per 10-mm above average rainfall, and by 24% per 10-mm below, in Dhaka.
Increased risks of floods and drought threatens to overload health supporting systems.

"There is medium confidence that droughts will intensify in the 21st century in some seasons and areas, due to reduced precipitation and/or increased evapotranspiration."

Draft SREX SPM, Pg 11

"Major changes in policy and planning are needed if ongoing and future investments are not to be wasted."
Climate effects on non-emerging/epidemic diseases are probably as important

Checkley et al, Lancet, (2000). Data from Lima, Peru
Climate change undermines the environmental determinants of health

Projections in IPCC 4th assessment report:

- **Water quality and quantity**: Contributing to a doubling of people living in water-stressed basins by 2050.

- **Food security**: In some African countries, yields from rain-fed agriculture may halve by 2020.

- **Control of infectious disease**: Increasing population at risk of malaria in Africa by 170 million by 2030, and at risk of dengue by 2 billion by 2080s.

- **Protection from disasters**: Increasing exposure to coastal flooding by a factor of 10, and land area in extreme drought by a factor of 10-30.
Either/or formulations are unhelpful

Long history of disease specialists reacting against perceived over-simplification of climate effects, and high media attention:

"Scientific Nostradamuses"

"I would burn this book"

"These people know bugger all about dengue or malaria or anything"

Martens, 1995
Béguin et al, 2011: Projected effects of climate and GDP on malaria transmission by 2050:
Panel (a)= Climate change only; (b) GDP only, (c) Climate and GDP, (d) change in modelled transmission probability for panel c) with respect to panel b)
"Preoccupation with climate change harming efforts to control malaria"

Financial Post (Canada): Lawrence Solomon: 20/05/2010

Global warming is all-but irrelevant to the spread of malaria, according to a study released today in Nature. In contrast, global warming policies based on the belief that global warming promotes malaria are harming efforts to eradicate malaria.

…The [1995 IPCC report] fostered misinformation that then sent malaria prevention off on a wild goose chase… Models based on climate change redirected disease-prevention efforts away from regions where they were most needed to address the true health needs of Africa.
Does addressing climate change distract from disease control efforts?

Effects of climate change
- Extreme weather,
- Biodiversity loss,
- Sea level rise,
- Food and water insecurity,
- Migration,
- Malnutrition,
- Diarrhoea,
- etc.

Determinants of outbreaks
- Demography,
- Transport,
- Poverty,
- Drug resistance,
- Control efforts,
- Ecosystem change,
- etc.
"All scientific work is incomplete - whether it be observational or experimental. All scientific work is liable to be upset or modified by advancing knowledge. This does not confer upon us a freedom to ignore the knowledge that we already have, or to postpone the action that appears to demand at a given time”

Hill, A.B. The environment and disease: association or causation?
there will always be some element of unpredictability in climate variations and infectious disease outbreaks. Therefore, a prudent strategy is to set a high priority on reducing people's overall vulnerability to infectious disease through strong public health measures such as vector control efforts, water treatment systems and vaccination programmes.

NRC: "Under the weather", 2001
Protect populations with a "minimum package" for health resilience to climate change

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<thead>
<tr>
<th>Multisectoral Governance and coordination:</th>
<th>Baseline Capacity and Risk Assessments:</th>
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<tbody>
<tr>
<td>Health input on env., climate, devp., Policy, and vice versa.</td>
<td>• Climate and health vulnerability and adaptation assessments</td>
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<td>• Assessments of programme capacity</td>
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<td>• Definition of monitoring and evaluation frameworks</td>
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<th>Capacity building:</th>
<th>Integrated Environment and Health Surveillance:</th>
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<tr>
<td>• Institutional, professional capacity, and resource mobilization in response to local assessment</td>
<td>• Risk mapping and establishment of early warning systems for climate sensitive risks:</td>
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<td>• Integration of environment and health monitoring, and response plans</td>
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<th>Research:</th>
<th>Environmental Management:</th>
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<td>• Stakeholder driven research, focusing on cost effectiveness</td>
<td>• Health impact assessment for decisions in other sectors</td>
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<td>• Management of ecosystem services, and risk factors to health</td>
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<th>Awareness raising and social mobilization:</th>
<th>Scale-up and climate proofing of interventions for climate-sensitive health impacts:</th>
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<tr>
<td>• Communication for behavioural impact from national to community level</td>
<td>• Integrated vector management for vector-borne disease</td>
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<td>• Water treatment and safe storage</td>
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<td>• Legislation and enforcement for air quality</td>
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<th>Strengthening of health capacities in disaster management</th>
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<td>• Inclusion of health in DRR and response plans</td>
<td>• Resilient and sustainable provision of energy and water to health facilities</td>
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</table>
Global Framework for Climate Services as support to infectious disease surveillance

GFCS will support operational partnerships in health, disaster risk reduction, food and agriculture, water.

Climate information feed for:

- Spatial mapping of health risks
- Early warning systems for hazardous weather and disease outbreaks
- Planning health adaptation to climate change.
Health surveillance is always incomplete.

Adding meteorology enhances detail

Interactions of climate and social determinants of disease transmission

Temperature and precipitation

Vector ecology
- Aquatic breeding sites
- Vector capacity and feeding opportunities

Vector density (& fitness & longevity)

Dengue transmission

Vector control

Social & ecological context
- Population size and distribution
- Community infrastructure and behaviour

Community action

Individual virological and immunological factors

Epidemiology
- Dengue disease
  - Clinical severity
- Epidemic or endemic disease

Herd immunity
The need for demand-driven meteorological support to disease surveillance

"Forecasts based entirely on scientific objectives have little impact on policy because there is no stakeholder." Clark et al, Ecological forecasts: an Emerging Imperative, Science, 2001

"......The published literature to date, however, includes no full descriptions of climate-based early warning systems being used to influence control decisions for infectious disease." (WHO, 2005)
Need for careful consideration of where and when meteorological information adds value.
In December 2010, developed countries committed to mobilize US$ 100 billion annually from 2020 into a ‘green fund’ to support climate adaptation and mitigation.

Using WHO estimates of small proportional increases in malnutrition, malaria and diarrhoea burden due to climate change, UNFCCC and WB estimated additional treatment costs of US$ 4-12 billion in 2030.
Health needs to be better represented in climate policy: Adaptation

LDCs identifying health as adaptation priority

- Identifying health
- Not identifying health

Number of adaptation projects submitted

- Health projects
- Other sectors

Funds requested for health

- Health projects
- Other sectors

Funds awarded for health

- Health projects
- Other sectors
Health needs to be better represented in climate policy: mitigation

Child deaths avoidable through clean household energy

Data from WHO. Map from WMO/WHO 2012

% of total childhood mortality
- ≤0.5
- 0.6 - 2
- 2.1 - 5
- 5.1 - 8
- 8.1 - 10
- >10
- Data not available
- Not applicable
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More information:

World Health Organization
http://www.who.int/

Public Health and Environment
http://www.who.int/phe/en/

Global Environmental Change
http://www.who.int/globalchange/

Climate Change
http://www.who.int/globalchange/climate/

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