Climate Change & Health: vulnerability and adaptation assessment for Nepal

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Population: 26,494,504
Density: 180/km²
5 Developmental Region
3 Ecological Zones
Climate & Health Dynamics

- **Temperature Increase:**
  - Pathogens like bacteria favor warmer temperature
  - Favor parasites to grow in vector

- **Precipitation increase/extreme rainfall:**
  - Increase rainfall or snowmelt raises the risk of sewer overflows which might lead to water supply contamination
  - Runoff of human and animal excreta on soil and subsurface will increase, leading to higher concentrations of pathogens in surface waters
  - Increased precipitation causes turbulences and lead to sediment re-suspension, which disperse accumulated pathogens
Climate & Health Dynamics

- **Decreased precipitation/droughts:**
  - Decreased precipitation coupled to water scarcity limits dilution and, thus, increase the concentration level of pathogens in water and communities relying on these contaminated sources experiences increased outbreaks of water-borne diseases
  - Interrupted water availability contributes to poor hygiene - an important factor causing diarrhea

- **Humidity:**
  - Least evidences with unclear mechanisms
  - Plays role in survival and dissemination of viruses
  - Rotavirus can be aerosolized and exits and the respiratory route has been suggested as an additional pathway (Bishop, 1996; D’souza et al., 2008; Hashizume et al., 2008; Levy et al., 2009)
Objective

• To conduct vulnerability and adaptation assessment as evidence on how climate variability and climate change affects the health that will help to develop Nepal's Country Strategy for protecting health from climate change.
Methodology

• Followed WHO (PAHO) guidance:

• 2.2 Conducting the vulnerability and adaptation assessment
  – 2.2.1 Establish baseline conditions by describing the human health risks of current climate variability and recent climate change, and the public health policies and programs to address the risks
  – 2.2.2 Describe current risks of climate-sensitive health outcomes, including the most vulnerable populations and regions
    • 2.2.2.1 Identify vulnerable populations and regions
    • 2.2.2.2 Describe risk distribution using spatial
Methodology

– 2.2.3 Analyse the relationships between current and past weather/climate conditions and health outcomes
– 2.2.4 Identify trends in climate change-related exposures
– 2.2.5 Take account of interactions between environmental and socioeconomic determinants of health
– 2.2.6 Describe the current capacity of health and other sectors to manage the risks of climate-sensitive health outcomes
  • 2.2.6.1 Considering health system adaptive capacity and resilience
Frame and scope assessment

- Defining the geographical region and health outcomes of interest;
- Identifying the questions to be addressed and steps to be used;
- Identifying the policy context for the assessment;
- Establishing a project team and a management plan;
- Establishing a stakeholder process;
- Developing a communications plan.

Assess

- Vulnerability:
  - Current burden of disease
  - Current health protection programmes

- Future impacts:
  - Changing burden without climate change
  - Projected health impacts of climate change

- Adaptation:
  - Identify and prioritize additional interventions
  - Identify resources and barriers to implementation

Manage and monitor risks

- Health harms and benefits in other sectors

- Communicate plan and implement

- Monitor and evaluate
Steps in Vulnerability and Adaptation Assessment

• Determine the scope of the assessment
  – Communicable diseases (diarrhoea, vector borne disease)
  – Food and water security, malnutrition
  – Effects of extreme events (floods, heatwaves)
  – Assess vulnerable populations

• Identify the burden of climate sensitive diseases

• Evaluate current strategies, policies, and measures to reduce these (adaptation baseline)
Diseases and socio-economic status

• Incidence of diarrheal diseases and ARI are in increasing trend
• Malnutrition still remains a major problem
• Trend of child mortality is decreasing except for neonatal mortality
• Larger population of mid and far western region are without education
• Significant gain in poverty reduction
Vulnerability

<table>
<thead>
<tr>
<th>Cluster region</th>
<th>Mean</th>
<th>SD</th>
<th>Cluster region</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME</td>
<td>0.63</td>
<td>0.06</td>
<td>HMW</td>
<td>0.55</td>
<td>0.20</td>
</tr>
<tr>
<td>MC</td>
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<td>0.06</td>
<td>HFW</td>
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<tr>
<td>MW</td>
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<td>0.16</td>
<td>TE</td>
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<tr>
<td>MMW</td>
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<td>0.31</td>
<td>TC</td>
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<td>MFW</td>
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<td>TW</td>
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<td>0.21</td>
<td>TMW</td>
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<td>0.13</td>
<td>TFW</td>
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<tr>
<td>HW</td>
<td>0.48</td>
<td>0.21</td>
<td>Country</td>
<td>0.57</td>
<td>0.20</td>
</tr>
</tbody>
</table>

Figure: Spatial distribution of aggregate vulnerable values by district, Nepal

- There are 38 districts above the mean value, signifying more vulnerable and the rest 37 districts are less vulnerable.

- In terms of score, Rupandehi (WT) with 0.63 is the highest vulnerable district, which is followed by two districts such as Dang (MWT) and Kailali (FWT) with score 0.61.

- It means the Tarai districts are relatively more vulnerable to health. Lalitpur (CH) with 0.11 is the least vulnerable district.
Relationship between climate change and health outcome

Diarrhea and Maximum Temperature

Diarrhea and tmax
A) Temperature increase

Change in diarrhoea incidences in % per 1 degree change in temperature

For every increase of 1 °C above 29 °C, a 40.2% increase in incidences (d)

In one Chinese city, a 1°C rise in maximum temperature led to a 16% increase in incidences, while a 1 °C rise in minimum temperature led to a 14% increase. In another city, a 1 °C rise in maximum temperature (17 °C) led to an 11% increase, while a 1 °C increase in minimum temperature (8 °C) led to a 12% increase (j)

Nonlinear relationship: Increase of 1 °C below the threshold of 19 °C decreases incidence rates, but 1 °C above 19 °C increases them (e)

For every increase of 1 °C an increase of 7.7% (j)

For every increase of 1°C, an increase of 3% (a); 5.6% (b); 8% (c), 11.3% (k)

An increase of 1 °C six weeks before onset of the outbreak explained a 5.2% increase in incidences (n)

For every increase of 1°C, a decrease of 1.3% [0.7%-2.2%, differs per climate region] (g); 2% - 5% [differs per city] (f); 10% (h)
Terai monthly rainfall and diarrhoea: 2004-2008

series starts July 2004: diarrhoea peak preceeds rainfall peak in Terai ?water scarcity ?temperature
Conclusion

• Magnitude of the health problem and climate pattern assessed
  – Some diseases are in increasing trend while others are not in decreasing trend
  – Climate is changing

• Vulnerability assessment
  – Many areas and population are vulnerable

• Relationship between climate and disease
  – It exists
Recommendations
<table>
<thead>
<tr>
<th>Exposure</th>
<th>Health issue</th>
<th>Health Impact/CC effect</th>
<th>Ability to affect outcome by public health adaptation?</th>
<th>Policy recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Water supplies, quantity and quality threatened by changing rainfall patterns, glacial melting</td>
<td>Water borne diseases</td>
<td>+++/++</td>
<td>+++Improve water supply, treatment, sanitation</td>
<td>Water quality enforcement, integrate testing with climate forecasts, EWS, Climate resilient technology Ecosan, Biogas</td>
</tr>
<tr>
<td>Exposure</td>
<td>Health issue</td>
<td>Health Impact/CC effect</td>
<td>Ability to affect outcome by public health adaptation?</td>
<td>Policy recommendations</td>
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<tr>
<td>2. Progressive temperature increase</td>
<td>Communicable disease (VBD, foodborne)</td>
<td>+++/+++</td>
<td>Surveillance Food safety</td>
<td>Regulation: veterinary, urban standards (standing water/vector breeding sites) Training, awareness</td>
</tr>
<tr>
<td>Exposure</td>
<td>Health issue</td>
<td></td>
<td></td>
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<td>-------------------------------------------------------------------------------</td>
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<tr>
<td>3. Heatwave/coldwave, air pollution</td>
<td>Heatstroke, heat stress, Cardio-respiratory mortality, ARI, COAD, Reduction in cold stress?</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Health Impact/CC effect</th>
<th>Ability to affect outcome by public health adaptation?</th>
</tr>
</thead>
<tbody>
<tr>
<td>++/+++</td>
<td>Urban policies</td>
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<table>
<thead>
<tr>
<th>Policy recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupational standards, community awareness, Co benefits (air pollution, transport, cooking fuel)</td>
</tr>
<tr>
<td>Exposure</td>
</tr>
<tr>
<td>----------------------------------</td>
</tr>
<tr>
<td>4. Riverine floods, landslides, GLOF</td>
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<tr>
<td>Exposure</td>
</tr>
<tr>
<td>--------------------------------</td>
</tr>
<tr>
<td>5. Drought/food security</td>
</tr>
<tr>
<td>Generic issues, ecological impacts</td>
</tr>
</tbody>
</table>
Adaptation Options

• Reactive Actions (rely on awareness)
  – Treatment of diarrhea by ORS is known
  – Adding zinc reduce the severity
  – Early and exclusive breastfeeding and Vit A supplementation reduce risk of severe diarrhea

Ref: Eddy Moors et al: climate change and water borne diarrhea in northern India: impacts and adaptation strategies
• Preventive actions:
  – Hand washing with soap, improving water quality and safe excreta disposal
  – Rotavirus vaccination
• Policy choices:
  – NAPA enlist specific mission targeting human health
Future impacts

- Projected future health impacts of climate change (analysis is in process)
  - Qualitative methods
  - Quantitative methods
Malaria risk area will be increased
Challenges

• We know from IPCC report that:
  – Effective adaptation planning requires reliable and high quality data
  – And stakeholder engagement
Health Data

• Underestimation of diseases due to less access and unavailability of services
• Poor quality of health data
• Old data stored in different format
• Difficulties accessing the data
Data analysis

• Lack of experts at local level to analyze the quantitative and qualitative data and run modeling
Stakeholder engagement

- Lack of interest due to less knowledge on the impact of climate change
- Lack of fund to include all stakeholders
- Lack of interest at higher level - wait for many years to get the desired outcome
Further

- Draft final report is in the process
  - Along with DLN Modeling
  - Analysis of temperature and daily mortality
- MoHP Strategic working group will meet and discuss on the recommendations
- Stakeholders meeting
- Development of draft strategy
- Strategy Finalization workshop
Acknowledgement

• MoHP
• WHO
• Dr. Simon Hales
• Consultants
  – Gajananda Prakash Bhandari
  – L N Thakur
  – Bandana Pradhan
  – Rupak Rajbhandari
  – Dhruba Gautam
Thank you
Recent climate trends in Nepal

Average distribution of annual rainfall

Variation in Maximum and Minimum T
Trend in Climate Change in Nepal


Minimum Temperature
## Extreme Events – Heat Waves

<table>
<thead>
<tr>
<th>Year</th>
<th>Events (no.)</th>
<th>Deaths (no.)</th>
<th>Injured (no.)</th>
<th>Affected (no.)</th>
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<tbody>
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<td>2010</td>
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<tr>
<td>Grand Total</td>
<td>25</td>
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<td>8</td>
<td>280</td>
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</table>

Impact of Heat Waves 2001-2010

### Health Impact
- Increase in vector-borne diseases
- Heat stroke
- Hyperthermia
- Eye-related diseases
- Water-borne communicable diseases
- Mental health problems