Research in Climate change adaptation and human health: vulnerability assessment, health risk assessment, and health impact assessment

By Cordia Chu and Scott Baum
Centre for Environment and Population Health
Presentation outline

- Introduction: Research Gaps in CC and health
- Step-wise problem solving process from Scoping to adaptive planning
- Terms, methods, and issues in the health fields in dealing with climate change adaptation research
- Integration and knowledge sharing in ACCC Project
Presentation outline

- Introduction: Research Gaps in CC and health
- Step-wise problem solving process from Scoping to adaptive planning

**Terms, methods, and issues in the health fields in dealing with climate change adaptation research**

- From vulnerability assessment to health risk assessment, to health impact assessment

- Assessing vulnerability:
  - *physical, social and system (the health sector) vulnerability*,
  - *national, regional, and local measurements*

- Integration and knowledge sharing in ACCC Project
Interdisciplinary and integrative approach, involving multiple sectors and stakeholders for CC adaptation

- Health sectors must develop adaptive strategies to minimise adverse health impacts of climate change,
- Paying special attention to address the needs of the vulnerable populations,
- To assess and improve public health system response capacity, and
- To carry out adaptive measures.
Research into health impacts is very limited.
Emerging priority areas for future research include:

- **Identification** of risk by region,
- **Preparedness** of local primary health care services and occupational health services;
- And **integration** of climate-related health data across primary, secondary and tertiary health services.
Climate Change and Human Health

Management of the health effects of climate change will require inputs from all sectors of government and civil society, collaboration between many academic disciplines, and new ways of international cooperation that have hitherto eluded us.

-Lancet and University College London Institute for Global Health Commission vol 373, May 16, 2009

Involvement of local communities and relevant sectors in monitoring, discussing, advocating, and assisting with the process of adaptation will be crucial!

STAKEHOLDER Engagement is vital but challenging
An integrated and multidisciplinary approach is urgently needed to address the adverse health effects of climate change.

Crucially important is the need to build interdisciplinary research capacity, with a focus on the most vulnerable to the health effects of climate change.

Translational research to develop policy and strategies to meet the needs of users or decision-makers urgently needed.
Interdisciplinary research aims “to synthesize discipline-specific insights for the purpose of resolving problems ....” (Higginbotham et al., 2001)

Interdisciplinary work involves integration of ideas from different disciplines;

But communication across disciplines is difficult!!!
Presentation outline

• Introduction: Research Gaps in CC and health
• Step-wise problem solving process from Scoping to adaptive planning
• Terms, methods, and issues in the health fields in dealing with climate change adaptation research
  – From vulnerability assessment to health risk assessment, to health impact assessment
  – Assessing vulnerability:
    • physical, social and system (the health sector) vulnerability,
    • national, regional, and local measurements
• Integration and knowledge sharing in ACCC Project
ACCC Project Roadmap

Climate Science
- Global & regional Modeling
- Extremes modeling
- Provincial down-scaling

Integration for user-friendly output
- Dissemination
- Yellow River Basin WR
- NX: Agro eco-sys
- IM: Grassland
- GD: Health & disease risks

Evaluating Climate Risk
- Prov. V&C assessment
- Socio-econ. Scenarios
- NX: Agro industry & Farmer’s income
- IM: Livestock industry & herdsmen
- GD: risk loss of health; damages of extremes, etc.

Methodology & identify adapt. measures
- CBA analysis on adapt.
- NX: Agriculture
- IM: Livestock & herdsmen
- GD: Public health; DRR

Provincial APs in NX, IM, GD (Roadmaps)

Impact assessment (eco-sys)
- Risk loss assessment

Adaptation planning

Specific Reports
- Climate and Insurance
- ECM in River basin mangt
- Financing Mechanism

Financing Mechanism

Climate and Science
- Impact assessment (eco-sys)
- Adaptation planning

NX: Ningxia province
IM: Inner Mongolia province
GD: Guangdong province
AP: Adaptation Planning
WR: Water Resources
ECM: Eco-compensation Mechanism
V&C: Vulnerability & Capacity
DRR: Disaster Risk Reduction

Spiral Steps to climate change adaptation research

Building research team

Scoping

Vulnerability Assessment (VA)

Risk Assessment (VA)

Scenario development & testing

Adaptation planning
Spiral Steps to Traditional Health Risk Assessment (HRA)

Risk management Planning (adaptation)

An expert scientist (or a group of scientists)

Health Risk Assessment (HRA):
- Exposure identification
- Hazard assessment
- Risk characterization

Approve/modify/reject project
Trends and development from environmental health risk to health impacts assessments (HIA)

<table>
<thead>
<tr>
<th>Environmental Disasters and risk assessments</th>
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</thead>
<tbody>
<tr>
<td><strong>1950s</strong></td>
</tr>
<tr>
<td>1969 - Santa Barbara Channel (USA)</td>
</tr>
<tr>
<td>1972 - Lake Pedder controversy</td>
</tr>
<tr>
<td>1978 - Love Canal (USA)</td>
</tr>
<tr>
<td>1979 - Ottawa Charter</td>
</tr>
<tr>
<td>1984 - Bhopal disaster, Union Carbide Factory (India)</td>
</tr>
<tr>
<td>1986 - Ottawa Charter</td>
</tr>
<tr>
<td>1984 - Bhopal disaster, Union Carbide Factory (India)</td>
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</tbody>
</table>

Inequalities

- Environmental Health in EIAs
- Regulatory Environmental Impact Assessment

HIA

2001 - Environment Protection & Biodiversity Act
2001 - Conceptual Framework for HIA
2001 - Equity-Focused HIA Framework
2002 - NSW Health & Equity Statement
2002 - HIA Project
2003 - NSW HIA Project
2003 - EnHealth HIA guidelines
2003 - Environment Protection & Biodiversity Act
2004 - Equity-Focused HIA Framework
2005 - Environment Protection & Biodiversity Act
Climate change and human health
RISKS AND RESPONSES

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WORLD HEALTH ORGANIZATION
GENEA
2003
Chapter 9. National assessments of health impacts of climate change: a review

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Spiral Steps to WHO CC Response: from HIA to integrative adaptation planning

Health Impact Assessment (HIA):
- Screening
- Scoping
- Integrated Risk assessment

Scenario development with stakeholders

Adaptation assessment

Multi-disciplinary team involving stakeholders
Spiral Steps to climate change health adaptation research

- Building CC HIA research team
- Screening
- Scoping
- Integrative Risk Assessment
- Scenario development & testing
- Adaptation planning
<table>
<thead>
<tr>
<th>Climate Change terminology</th>
<th>Standard environmental health/other health discipline terminology</th>
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<td>Vulnerability assessment</td>
<td>Health risk assessment</td>
</tr>
<tr>
<td>Risk assessment</td>
<td>Health impact assessment</td>
</tr>
<tr>
<td>Climate change adaptation</td>
<td>Risk management</td>
</tr>
<tr>
<td>Adaptive capacity</td>
<td>Coping capacity</td>
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</tbody>
</table>
Terms, methods, and issues in the health fields in dealing with climate change adaptation research
Introduction to HRA
Introduction to HIA
Comparison of HRA and HIA
Role of Risk Assessment

“To provide complete information to risk managers, specifically policymakers and regulators, so that the best possible decisions are made”

(Paustenbach, 1989)
How does HRA fit into the decision making process?

Risk Assessment
- science

Risk Management
- politics
- economics
- public perception
- technology
Risk assessments: different frameworks, similar processes

(adapted from ILSI, 1996 with permission)
Application of Environmental Health Risk Assessment Model to climate change and health – assessment and adaptation

Hazard Assessment
- Hazard Identification
- Dose-response

Exposure Assessment

Risk Characterisation

Risk Management

Issue Identification

Features:
- Systematic and logical step-wise approach
- Increasing emphasis on stakeholder engagement
- Explicit consideration of uncertainties
- Can use qualitative and quantitative methods

Usually limited to:
- Single physical hazards (e.g., Chemicals, biologicals)
Health Impact Assessment

- Includes social dimensions not usually included in HRA
- Systematic, logical and transparent approach
- Facilitates the assessment of the distribution of impacts within a population – considers inequality
- Considers interactions between physical, social, biological, political dimensions
- Has a strong emphasis on stakeholders and community engagement
HIA is

A combination of procedures, methods and tools by which a policy, program or project may be assessed for its potential and often unanticipated effects on the health of the population and the distribution of these impacts within the population.

Gothenburg Consensus Paper

Distribution of Impacts
socioeconomic position
locational disadvantage
Ethnicity & culture
HIA for decision-making regarding policies, programs or projects
From impact assessment → adaptation planning

Impact Assessment
Focus on identifying health impacts and vulnerabilities

Adaptation planning
Need for integration of understanding of health impacts and vulnerabilities into adaptation (risk management) strategy development

*This shift mirrors the changing paradigm in traditional health risk assessment Which now requires greater inclusion of risk management into the overall assessment process*
Lots of different models, but essentially same steps:
- Screening
- Scoping
- Identification
- Integrative Appraisal/Assessment
- Decision-making and recommendations
- Monitoring and evaluation

-Lots of different tools and guides available to assist with each step
<table>
<thead>
<tr>
<th>Steps of HIA Model</th>
<th>PURPOSE</th>
<th>TASK</th>
</tr>
</thead>
</table>
| **SCREENING**      | Determine whether HIA is appropriate and required | + Pre-screening tasks  
|                    | Set out the parameters of the HIA | + Set up a steering committee  
|                    | Identify potential health impacts | + Choose the appropriate level of depth of HIA that needs to be undertaken  
|                    | | + Set the scope of gathering the evidence  
|                    | | + Design a project plan  
| **SCOPING**        | Develop a community/population profile and collect information to identify potential health impacts | + Develop a community/population profile  
|                    | | + Collect primary and secondary, qualitative and quantitative information  
| **IDENTIFICATION** | Synthesise and critically assess the information in order to prioritise health impacts | + Assess the information on the impacts collected from the different sources.  
|                    | | + Deliberate on the impacts to assess their significance and prioritise them  
| **ASSESSMENT**     | Make decisions to reach a set of final recommendations for acting on the HIA’s findings | + Develop a draft set of concise and action-oriented recommendations  
|                    | | + Write a final recommendations report for implementation and action  
| **DECISION MAKING & RECOMMENDATIONS** | Evaluate the processes involved in the HIA and its impact, and follow up the HIA through monitoring and a health impact management plan | + Conduct process and impact evaluation  
|                    | | + Set up monitoring the impacts  
|                    | | + Develop a health impact management plan  
| **EVALUATION & FOLLOW-UP** | | |
If you implement the proposal, these will be the impacts. If you make these changes, these will be the gains.

HIA functions to assist decision making and can influence policy.
<table>
<thead>
<tr>
<th><strong>Traditions</strong></th>
<th>HRA</th>
<th>HIA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Focus</strong></td>
<td>Chemical, biological, physical hazards (sometimes mixtures)</td>
<td>Broader – environmental, social and other determinants of health</td>
</tr>
<tr>
<td><strong>Application</strong></td>
<td>Single agents: Standard setting, retrospective or prospective assessment of health risk</td>
<td>Prospectively carried out for a program, project, policy</td>
</tr>
<tr>
<td><strong>Data collection</strong></td>
<td>Mainly quantitative data – toxicological and epidemiological data</td>
<td>Mixture of quantitative and qualitative data collection</td>
</tr>
<tr>
<td><strong>Assessment</strong></td>
<td>Usually quantitative – probabilities through probability of risk may be qualitatively assigned</td>
<td>Mainly qualitative with prioritization of impacts and recommendations for decision making</td>
</tr>
<tr>
<td><strong>Community participation</strong></td>
<td>Limited</td>
<td>Important part of process</td>
</tr>
<tr>
<td><strong>Framework</strong></td>
<td>Systematic, transparent</td>
<td>Systematic, transparent</td>
</tr>
<tr>
<td><strong>Decision-making (risk management)</strong></td>
<td>Informs decision-making, but often very separate</td>
<td>Through a set of recommendations as an outcome, aims to influence decision making</td>
</tr>
</tbody>
</table>
The need for health impact assessment in China: Potential benefits for public health and steps forward

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b Center for Environment and Population Health, Griffith University, Nathan 4111, Australia
# A comparison of Chinese EIA and PaOHCP and HIA

## Pre-assessment occupation health hazard for construction projects

<table>
<thead>
<tr>
<th>Items</th>
<th>Chinese EIA</th>
<th>Chinese PaOHCP</th>
<th>HIA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assessment objectives</strong></td>
<td>Policy (land planning and developing), program, and Project</td>
<td>Construction projects and programs</td>
<td>Any project, program, and policy</td>
</tr>
<tr>
<td><strong>Steps</strong></td>
<td>Screening</td>
<td>Screening</td>
<td>Screening</td>
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<td>Scoping</td>
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<td>Assessment</td>
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<td></td>
<td>Decision-making</td>
<td>Decision-making</td>
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<td></td>
<td>Mitigation</td>
<td>Recommendation</td>
<td>Recommendation</td>
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<td></td>
<td>Follow-up</td>
<td>Monitoring</td>
<td>Monitoring</td>
</tr>
<tr>
<td><strong>Assessment methods</strong></td>
<td>Quantitative</td>
<td>Quantitative</td>
<td>Mixed methods: quantitative and qualitative</td>
</tr>
<tr>
<td><strong>Focus of effect of impact</strong></td>
<td>Negative</td>
<td>Negative</td>
<td>Positive and negative</td>
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<tr>
<td><strong>Target and breadth of assessment</strong></td>
<td>General population and environment</td>
<td>Occupational groups</td>
<td>General population</td>
</tr>
<tr>
<td><strong>Determinants considered</strong></td>
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<td></td>
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<tr>
<td>Individual</td>
<td>–</td>
<td>–</td>
<td>√</td>
</tr>
<tr>
<td>Physical environmental</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>(including chemical, physical, radioactive, and biological)</td>
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<td></td>
<td></td>
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<tr>
<td>Social</td>
<td>–</td>
<td>–</td>
<td>√</td>
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<tr>
<td>Cultural</td>
<td>–</td>
<td>–</td>
<td>√</td>
</tr>
<tr>
<td>Accessibility of health services</td>
<td>–</td>
<td>–</td>
<td>√</td>
</tr>
</tbody>
</table>
Application of HIA to climate change and health – assessment and adaptation

- Screening – Is HIA the most appropriate method?

- Scoping – project governance, who will be involved in the assessment, temporal and geographical scope, methods to use, resources

- Identification and assessment/appraisal of health impacts – community profile (vulnerability assessment), collection of information to identify the potential health impacts, method for analysing and prioritizing impacts, use of both qualitative and quantitative methods dependent on data availability

- Risk Management/Decision making and recommendations – Adaptation strategy development – recommendations must be practical, socially acceptable, consider the cost of implementation, consider the opportunity cost, include preventative as well as curative measures, be prioritised: short, medium and long-term, identify a lead agency or individual, identify the drivers and barriers to change

- Monitoring and evaluation – particularly important given the increasing and changing knowledge relating to environmental impacts and subsequent health changes
Application of HIA to climate change and health – assessment and adaptation – Western Australia example

- Method: 2 step process
  - Step 1: Identification of health impacts, vulnerable groups and current coping/adaptive capacity
  - Step 2: Qualitative risk assessment + identification of risk management/adaptation measures

- Primarily qualitative methods using expert workshops and qualitative risk assessments, indicating next step would involved more quantitative assessment

- A simple, easy to follow application of the HIA method to assess and develop adaptation strategies for health which uses health terminology in the climate change and adaptation context
• Phase 1
  – **Identification of health impacts** – identification ‘health impact pathways’ for both extreme and gradual impacts METHOD: expert workshops with experts drawn from physical, built environment, social environment and food areas
  – **Identification of vulnerable groups** – regional, economic, social, infrastructure and services AND some specific target populations
  – **Identification of current coping/adaptive capacity** with consideration of existing: technology, services, projects and programs, legislation and regulation, surveillance and monitoring, warnings and alerts, research
Phase 2
- Qualitative risk assessment using Australian Standard for Risk Management
  - *Uses criteria for consequence and likelihood to assign a risk priority level*
  - *Uses expert opinion panels*

- Identification of appropriate risk management/adaptation measures
  - *Uses public health concept of primary, secondary and tertiary measures and applies these to the health impact pathways previously identified*
  - *Criteria for consideration included: relevance to Western Australia, current capacity, how adaptation could be implemented (eg new or modification of existing), identification of section involved in the development and implementation of measures*
  - *Measures considered included: legislative or regulatory, public education or communication, surveillance and monitoring, ecosystem intervention, infrastructure development, technology/engineering, medical intervention, research/further information*
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  – Assessing vulnerability:
  • physical, social and system (the health sector) vulnerability,
  • national, regional, and local measurements
• Integration and knowledge sharing in ACCC Project
Integrated health assessment

- Initial and ongoing stakeholder engagement
- Health sector vulnerability assessment
- Regional and Local vulnerability assessment
- Locally focused stakeholder scenario workshops: Vulnerabilities, Risks, Opportunities
- Multiple methods and approaches
- Adaptation plans and approaches
Sector vulnerability

- Identified health sector or systems coping capacity
- How will a sector cope or be vulnerable to climate change
• i.e. for health what are the issues/challenges faced by the health sector in the face of climate change
  • Patterns of disease
  • Workforce issues
  • Patterns of surveillance

• Stakeholders important for information

• Epidemiological studies on potential disease patterns
Regional and local health vulnerability assessment

• to identify *who* & *what* are vulnerable to *what* and help identify the reasons *why* they are vulnerable.

• What are the broad regional level issues
  – Climate issues
  – Health issues

• What are the local vulnerability issues
  – For health local level impacts important
  – Vulnerability will not be even
Local level VA
Local spatial vulnerability assessment

- Exposure
- Sensitivity
- Potential impact
- Adaptive capacity

Vulnerability
• Local VA a combination of these factors (E, S, AC)
• May be some question in health about the separate nature of sensitivity and adaptive capacity
• Choice of indicators driven by existing literature, expert stakeholders etc
The individual variables for sensitivity and adaptive capacity are:

- % of population older than 64 years of age
- % of population who live alone
- % of population less than 5 years of age
- % population completing year 12
- % households with internet access
- Medium household income
- Labour force participation rate
- Average household size
- % of single parent families
- % of public housing
- % of households who are outright owners
- Unemployment rate
- % of people who need assistance
- % of people living at the same address as 1 year ago
- % population doing voluntary work
- % of people who are not Australian citizens
- % of people born overseas
- % of recent arrivals (arrived in Australia between 2001 and 2006)
- % of people with poor English skills
Different conception about scenario development & testing

- Scoping
  - Literature review
  - Stakeholder analysis

- Vulnerability Assessment (VA)
  - Broad sectoral VA
  - Regional & local VA
  - Household VA

- Scenario development & testing
  - Future scenarios tested against current policies and planning

- Adaptation planning
  - Synthesise lessons learned
Canada-China CC Collaboration
Scenario modelling March 2011
Scenario planning

• **What is it?**
  – Scenarios: structured accounts of possible futures; **not** predictions of a particular future
  – Scenario planning: method for thinking creatively about possible complex and uncertain futures

• **Why use it for climate change adaptation?**
  – Most useful when high level of uncertainty
  – Creative, flexible way of preparing for uncertain future
  – Exploration of possible futures rather than a single predicted future
  – Provide framework for development & assessment of policies & strategies
  – Works best when participants are key decision makers
Scenario Planning Approach – Key Steps

1. Define Focal Question
2. Identify certain & uncertain drivers of change
3. Develop Scenarios based on drivers
4. Develop Adaptation Options
5. Test existing policies against scenarios
6. Develop storylines to communicate & assess adaptation options
7. Produce synthesis for general adaptation plan
From Scenario development to adaptation planning

Scoping
- Literature review
- Stakeholder analysis

Vulnerability Assessment (VA)
- Broad sectoral VA
- Regional & local VA
- Household VA

Scenario development & testing
- Future scenarios tested against current policies and planning

Adaptation planning
- Synthesise lessons learned
An interdisciplinary and integrative framework is necessary to bridge disciplines and facilitate climate change research collaborations towards:

- **Dealing with Uncertainty**
- **Improving data availability**
- **Addressing complexity** – multiple determinants with multiple pathways of causality and interactions between determinants
- **Enabling systematic assessment** – need for assessment tools that are logical and transparent and stepwise
- **Understanding and engaging existing community**
- **Influencing decision-making and policies**
- **Taking actions** – to meet the needs of users and to affect changes