Climate Change, Indoor Environments and Health: Identifying and Protecting Vulnerable Populations

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We are the National Institute of Environmental Health Sciences

• One of the National Institutes of Health, but located in Research Triangle Park, NC
• Primary focus on understanding and preventing environmental exposures that harm human health
• Multiple programs: Intramural, National Toxicology Program, Worker Environmental Training Program, Superfund Research Program
NIEHS Role in New and Ongoing Initiatives on Climate Change and Human Health

NIEHS Internal Efforts
- Formation of an NIEHS Climate Change team of relevant and interested staff from all divisions
- American Recovery and Reinvestment Act grants funded by NIEHS:
  - Trans-NIH Working Group on Climate Change and Human Health
    - Co-chaired by NIEHS and the Fogarty International Center
  - Interagency Crosscutting Group on Climate Change and Human Health
    - New group formed by the Global Change Research Program (GCRP)
    - Looking to health sector for a model of translation of new science to population-based implementation strategies
    - Scope includes both climate impacts and health impacts of climate policies, including adaptation
    - Greater engagement and participation by stakeholder communities
    - Co-chaired by NIEHS, EPA, and Office of Science and Technology Policy
  - Interagency Climate Change Adaptation Task Force (Science and Health Workgroups)
    - Led by the Council on Environmental Quality, the Office of Science and Technology Policy, and NOAA

A Human Health Perspective on Climate Change: A Report Outlining the Research Needs on the Human Health Effects of Climate Change
Overview

• Why is the indoor environment relevant to climate change?

• What interactions between climate change and the indoor environment might be relevant to health and well-being?

• Which populations are most vulnerable to climate change health impacts?
Climate-health linkages

• Direct impacts of climate change, weather, and sea level rise on humans
  – Heat stress
  – Weather-disease curves
  – Storms, weather extremes

• Impacts of climate change on physical and chemical agents
  – Air pollution effects
  – Fate and transport of toxic chemicals
  – Ozone depletion interactions

Climate-health linkages

• Impacts of climate change on biological agents
  – Microbes (including algae)
  – Plants (pollens, poisons)
  – Zoonoses, including VBD’s

• Impacts of climate change and sea level rise on fundamental life support
  – Water availability
  – Food/crop productivity
  – Shelter
Indoor Environments, Climate Change and Health

• Climate and weather impacts
  – Heat
  – Moisture and molds
  – Transport of outdoor air pollutants
• Health effects of mitigation measures
  – Fuel substitution for biomass cookstoves
  – Energy efficiency- “tight buildings”
• Health effects of adaptation measures
  – Energy efficiency; novel materials
  – Potential increased pesticide use
  – Indoor vs. outdoor environmental contact

Identifying vulnerability

“Vulnerability” is the summation of all risk and protective factors that ultimately determine whether a subpopulation experiences adverse health outcomes
Reasons for heightened vulnerability

• Biological sensitivity
  – Developmental stage
  – Pre-existing chronic medical conditions
  – Immunity (population and individual)
  – Genetic Factors (e.g., differences in metabolism)

Reasons for heightened vulnerability

• Geographic factors
  – Baseline climate
  – Abundance of natural resources
  – Elevation
  – Proximity of coastline or floodplains
Reasons for heightened vulnerability

- Socioeconomic factors
  - May increase likelihood of exposure to harmful agents/high risk geography
  - Associated with underlying diseases that mediate risk
  - Lead to differences in ability to adapt or respond

Climate-Sensitive Health Outcomes and Particularly Vulnerable Groups

<table>
<thead>
<tr>
<th>Health Outcome</th>
<th>Vulnerable Groups</th>
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</thead>
<tbody>
<tr>
<td>Heat Stress</td>
<td>Elderly, chronic medical conditions, infants and children, pregnant women, urban and rural poor, outdoor workers</td>
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<tr>
<td>Air Pollution Effects</td>
<td>Children, pre-existing heart or lung disease, diabetes, athletes, outdoor workers</td>
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<tr>
<td>Extreme Weather Events</td>
<td>Poor, pregnant women, chronic medical conditions, mobility and cognitive constraints</td>
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<tr>
<td>Water- and Foodborne Illness</td>
<td>Immunocompromised, elderly, infants;</td>
</tr>
<tr>
<td>Vectorborne Illness</td>
<td>Children, pregnant women, outdoor workers</td>
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</tbody>
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Urban Heat Islands

- Often combine vulnerability factors:
  - Geographic/infrastructure
  - Socioeconomic
  - Age, isolation

Special environments

- Schools
- Day care facilities
- Hot/stressful workplaces
- Prisons
- Emergency shelters
Developing world: indoor air quality and pesticide use

THANK YOU!