VALUING THE HEALTH COSTS OF CLIMATE CHANGE

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May 16, 2012 Climate Change: Mastering the Public Health Role
2011: A Year of Extremes

- 14 “billion-dollar” events: heat, drought, floods, snow, winds
- *Estimated $53 billion* in damages
- Part of a trend:
  - 2000-2010: Warmest Decade on Record
  - 2010, 2005: hottest since 1880
  - 35 consecutive years with global temperatures >20th century average
NRDC’s Extreme Weather Map:
- record-breaking weather in 2011
- climate change connections
- health costs avoidable via preparedness

www.nrdc.org/extremeweather
Climate change threatens health

“Climate change is one of the most serious public health threats facing our nation. Yet few Americans are aware of the very real consequences of climate change on the health of our communities, our families and our children.”

– Dr. Georges Benjamin, Executive Director of the American Public Health Association
Connecting the Dots: Climate Change & Health

- Infrastructure damages previously the focus of climate change cost estimates
- **Health** damage costs have seldom been included
- Our method: Valuing current climate-sensitive event health costs via case studies, from event types expected to occur more frequently in future with climate change
## US climate-health cost case studies

<table>
<thead>
<tr>
<th>Climate – Sensitive Event Types</th>
<th>Case Study Examined</th>
<th>Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ozone Air Pollution</td>
<td>National</td>
<td>2002</td>
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<tr>
<td>Heat Wave</td>
<td>California</td>
<td>2006</td>
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<tr>
<td>Hurricanes</td>
<td>Florida</td>
<td>2004</td>
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<tr>
<td>Infectious Disease</td>
<td>Louisiana (West Nile virus outbreak)</td>
<td>2002</td>
</tr>
<tr>
<td>River Flooding</td>
<td>Red River, North Dakota</td>
<td>2009</td>
</tr>
<tr>
<td>Wildfires</td>
<td>Southern California</td>
<td>2003</td>
</tr>
</tbody>
</table>
Health Cost Assessment

CLIMATE-RELATED HEALTH STRESSOR e.g. Heat wave, Ozone pollution, Hurricane, River flood, Infectious disease, Wildfire

Human Health Effects: Mortality & Morbidity
- Short-term Physical & Mental Health Effects
  - Mortality: Premature Death
    - Value of a Statistical Life Approach
      - $7.9 million ($USD2008)
- Long-term Physical & Mental Health Effects
  - Morbidity: Hospitalizations, ED Visits, Outpatient Visits
  - Cost-Of-Illness Approach: Sum of medical costs, out of pocket expenses, and loss of work productivity

Effects on Environment & Health of Wildlife

Value of a Statistical Life Approach
- $7.9 million ($USD2008)

Cost-Of-Illness Approach:
- Sum of medical costs, out of pocket expenses, and loss of work productivity

Willingness To Pay Approach

Evaluations

INCIDENCES

HEALTH COST ASSESSMENT (WTP for a Sensitivity Analysis)
$14 billion in health-related costs from just six US climate change-related events, 2002-2009 (Knowlton et al., Health Affairs 2011)


- **Heat Wave, California, 2006**
  - Over a two-week heat wave, 666 deaths, 1,620 hospitalizations, and more than 16,000 excess emergency room visits resulted in nearly $5.4 billion in costs. Major heat waves such as this are expected to occur more frequently in the future.

- **Flooding, North Dakota, 2009**
  - During the Red River and associated floods, two deaths, 262 emergency room visits, and an estimated 3,000 outpatient visits resulted in nearly $20.4 million in health-related costs. Seasonal river flooding will increasingly affect many areas of the country, resulting in more injuries and deaths. Increased heavy downpours are projected from climate change as temperatures rise, raising levels of both evaporation and precipitation in many areas.

- **Wildfires, Southern California, 2003**
  - These fires burned more than 735,000 acres and resulted in 69 deaths, 770 hospitalizations, and more than 47,600 outpatient visits. Together, this resulted in health-related costs exceeding $376 million. Conditions continued to wildfires, including drought and extreme heat, are expected to worsen in many parts of the country due to climate change.

- **Smog Pollution, Nationwide, 2002**
  - Across the U.S. in 2002, nearly 298 million Americans were exposed to ozone smog levels 40% above the health-based standard, which was then 80 ppb. This exposure resulted in death for 725 people, and caused 4,163 hospitalizations and more than 360,000 outpatient visits, at a cost of $35.6 million. Smog levels are anticipated to rise in the coming years, in the absence of strategies to reduce precursor emissions, because as climate change increases temperatures, ozone-forming chemical reactions also increase.

- **Hurricanes, Florida, 2004**
  - Four major hurricanes caused 144 premature deaths, nearly 2,100 hospitalizations, 2,100 emergency visits, and $1.8 billion in health-related costs. Climate change is projected to increase the intensity of hurricanes, as sea surface temperature rise in the North Atlantic and provide more energy to drive storm systems. Some climate models project a doubling in the most intense hurricanes (Category 4 and 5) by late in this century.

- **West Nile Virus, Louisiana, 2002**
  - An outbreak of West Nile Virus in Louisiana in 2002 resulted in an estimated 34 premature deaths, 264 hospitalizations, and nearly 5,800 outpatient visits. Health-related costs totaled $207 million. Mosquito-borne diseases are expected to emerge and spread into more northern climates as temperatures increase and create more habitable environments for mosquitoes.

NRDC
The Law’s Best Defender
Table 1. Health costs in climate change-related case study areas, with costs per health effect, 2002 through 2009.

<table>
<thead>
<tr>
<th>Climate Change-Related Case Study</th>
<th>Premature Death</th>
<th>Illness</th>
<th>Total Health Cost by Case Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ozone smog pollution</td>
<td>$6.3 Billion</td>
<td>$254 Million</td>
<td>$6.5 Billion</td>
</tr>
<tr>
<td>Heat wave</td>
<td>$5.2 Billion</td>
<td>$179 Million</td>
<td>$5.3 Billion</td>
</tr>
<tr>
<td>Hurricane</td>
<td>$1.1 Billion</td>
<td>$255 Million</td>
<td>$1.4 Billion</td>
</tr>
<tr>
<td>Wildfire</td>
<td>$545 Million</td>
<td>$34 Million</td>
<td>$578 Million</td>
</tr>
<tr>
<td>Mosquito-borne infectious disease</td>
<td>$190 Million</td>
<td>$18 Million</td>
<td>$207 Million</td>
</tr>
<tr>
<td>River flooding</td>
<td>$16 Million</td>
<td>$5 Million</td>
<td>$20 Million</td>
</tr>
<tr>
<td>Total costs (in U.S. dollars, 2008)</td>
<td><strong>$13.3 Billion</strong></td>
<td><strong>$744 Million</strong></td>
<td><strong>$14.1 Billion</strong></td>
</tr>
</tbody>
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http://www.nrdc.org/health/accountingforcosts/
Challenges in estimating health costs

- Lack of access to basic surveillance and morbidity data at consistent national scale
- No uniform method of assigning costs to different health effects from different events, regions
- Attribution: was event’s occurrence (intensity, frequency, extent/duration) affected by climate change?
- The Big Challenge:

  Half-dozen current case studies ➔ Hundreds of events in future
Climate-Health Impacts

- Extreme Storm Events
- Heat Waves
- Air Pollution
- Pollens and Allergy
- Water-borne Diseases
- Food-borne Diseases
- Vector-Borne Diseases
- Ecosystem Impacts
- Food & Water Supply Insecurity
- Mental Health Impacts
- Environmental Refugees
Other climate-related costs

- More climate-health effects to value
  - Other vector-borne diseases
  - Waterborne illnesses
  - Allergies
  - Mental health
  - Food insecurity

- Insurance
  - Travelers - illnesses contracted in US
  - Farmers - crop insurance
  - Homeowners - flood insurance
  - Businesses – liability insurance

- Preparedness costs
  - Will likely bring net benefits

*Source: The Climate Institute (2011)*
NRDC’s Climate Change Threatens Health website: local climate-health threats, and adaptation actions

www nrdc org/climatemaps
Two Strategies for Climate Solutions

**Mitigation**
- interventions to reduce emissions of carbon pollution

**Adaptation**
- measures to reduce the vulnerability of natural & human systems against climate change’s effects
EPA’s Proposed Power Plant Rule

- US Environmental Protection Agency (EPA) has proposed first national limits on carbon pollution from new power plants
- Sets emission rate standard for new power plants
- In proposing new safeguards, EPA is following the Clean Air Act and two Supreme Court decisions.
4 Key Elements of Adaptation: Climate-Health Preparedness Strategies

- Identify Local Vulnerabilities
- Track Environmental Changes & Health Threats
- Build Resilient Communities
- Promote Education & Public Dialogue
Example: Heat-Health Warning Systems

- **Identifying Vulnerabilities** - City worked with agencies to identify where elders live; Neighbors check on elderly via “buddy system” in heatwaves.

- **Tracking** - National Weather Service, Dept of Public Health, Corporation for Aging, News Media are in contact when heat wave is predicted, and public is alerted frequently; free “Heatline” info.

- **Climate-Smart Design** Cool Homes Program encourages energy-efficient design; free energy audits.

- **Public Education** Cooling centers opened; no utility service suspensions; more Fire, EMS, Homeless svc staff; Public education about protecting health, getting info during heat wave.

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*HEAT WATCH/WARNING SYSTEMS SAVE LIVES*
*Estimated Costs and Benefits for Philadelphia 1995–98*


The cost of running a heat wave warning system for Philadelphia were practically at the “noise” level compared to the economic benefits of saving 117 lives in three years.

Ebi et al. (BAMS 2004)
Future Directions in Valuing Health

- **Better Climate Cost Analyses** - including health costs as key economic damages.
  - *Scientific Consensus on Valuation Methods*
  - *Greater Focus on Morbidity Analyses*
  - *Improved Tracking* - monitor climate-sensitive health outcomes & environmental indicators related to climate change
- **More Support for Preparedness in Communities**
- **Limit Climate Change**
Conclusions

- Climate change harms health
- Action is needed to reduce carbon pollution & limit its most severe health effects
- We can create healthier, more secure communities by preparing for climate change’s effects on health
I wonder if this is god punishing us for not passing a climate bill.

No, it's us punishing ourselves.

People work in mysterious ways.
“We know enough now to act”

*Thank you*

kknowlton@nrdc.org

www.nrdc.org/climatemaps

Link to health costs of climate change paper in Health Affairs at:

http://www.nrdc.org/health/accountingforcosts/