It's Too Darn Hot!
Arizona Climate & Health Effects

2012 Arizona Infectious Disease Training & Exercise
Arizona State University
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Leadership for a Healthy Arizona
Extreme Weather and Public Health Program

• Created to develop capacity and adaptations to reduce the health effects of extreme heat on Arizonans

• Develop climate change programs

• Increase knowledge of healthy responses to excessive heat situations
Program Goals

• Identify risk factors and adaptation strategies to improve healthy environments
• Enhance current surveillance systems
• Promote awareness of climate implications on public health
Population Risk Factors for Heat-Illness

- **Age**
  - Children under 5 years old and adults over 65 years old are most vulnerable

- **Obesity**

- **Chronic conditions**

- **Recent Illness**
  - GI and Respiratory

- **Dehydration**

- **Certain medications**

- **Heat Acclimatization**
Co-morbidities

- Respiratory conditions
- Cardiovascular disease
  - Hypertension
- Depression or other psychiatric illness
- Obesity
  - Fat layer decreases the ability to release heat
- Diabetes Mellitus
  - Type I and II
- Hyperthyroidism

(Kenny, Yardley, Brown, Sigal, & Jay, 2010)
Health Outcomes

• Heat-illnesses
  – Heat cramps
  – Heat exhaustion
  – Heat stroke
**Heat Illness Morbidity**

<table>
<thead>
<tr>
<th>Year</th>
<th>Statewide</th>
<th>Apache</th>
<th>Cochise</th>
<th>Coconino</th>
<th>Gila</th>
<th>Graham</th>
<th>Greenlee</th>
<th>La Paz</th>
<th>Maricopa</th>
<th>Mohave</th>
<th>Navajo</th>
<th>Pima</th>
<th>Pinal</th>
<th>Santa Cruz</th>
<th>Yavapai</th>
<th>Yuma</th>
<th>Unknown</th>
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</thead>
<tbody>
<tr>
<td>2010</td>
<td>399</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>269</td>
<td>28</td>
<td>0</td>
<td>36</td>
<td>33</td>
<td>0</td>
<td>5</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>2009</td>
<td>338</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>222</td>
<td>15</td>
<td>3</td>
<td>38</td>
<td>31</td>
<td>0</td>
<td>1</td>
<td>15</td>
<td>2</td>
</tr>
</tbody>
</table>

**INPATIENT DISCHARGES BY INTENT & MECHANISM FOR SELECTED EXTERNAL CAUSES BY COUNTY OF RESIDENCE IN ARIZONA**

**EMERGENCY ROOM VISITS BY INTENT AND MECHANISM OF EXTERNAL CAUSES & COUNTY OF RESIDENCE IN ARIZONA**

(ADHS Bureau of Public Health Statistics, 2012)
Heat Illness Mortality

- 1,485 Deaths from (1992-2009)
- 225 Deaths in 2005
- 73.4% of Deaths were Male
- 54.6% of Deaths were Hispanic/Latino

(Mrela & Torres, 2010)
Heat-Related Deaths By County Time Series Map (1992-2009)
Health Effects of Climate Change

- **Direct consequences**
  - Heat-related mortality and hospitalizations.
  - Injuries (e.g., due to hurricanes, tornadoes and fires).
  - Displacement of populations (coastal flooding, desertification).
- **Indirect consequences**
  - Changes in the incidence and distribution of infectious diseases.
  - More complex causal pathways: enhanced infectious disease transmission due to displacement of populations.
Potential Health Effects of Climate Change

Climate Change:
- Temperature rise
- Sea level rise
- Hydrologic extremes

- Heat
- Severe weather
- Air pollution
- Allergies
- Vector-borne diseases
- Water-borne diseases
- Water and food supply
- Mental health
- Environmental refugees

- Heat stress, cardiovascular failure
- Injuries, fatalities
- Asthma, cardiovascular disease
- Respiratory allergies, poison ivy
- Malaria, dengue, encephalitis, hantavirus, Rift Valley fever
- Cholera, cryptosporidiosis, campylobacter, leptospirosis
- Malnutrition, diarrhea, harmful algal blooms
- Anxiety, despair, depression, post-traumatic stress
- Forced migration, civil conflict

Adapted from J. Patz
## Vulnerability and Climate Change

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

(Fisman, 2012)
Rising Temperatures

(Fisman, 2012)
Potential Impacts on Infectious Disease

- **Vector-borne disease**: changing ecosystems, ranges of amplifying hosts and insect vectors.
- **Diseases with environmental reservoirs**: Effects on food, water sources; “innoculation” via extreme weather events (e.g., melioidosis).
- **Communicable diseases (esp. respiratory pathogens)**: perturbations of seasonal patterns of transmission (environmental change); mass movement and crowding of populations via social disruption.
Water and Foodborne Diseases

• An important source of morbidity in North America

• Viral, bacterial and protozoan agents of gastroenteritis (e.g. *Salmonella* and *Shigella* species and toxin elaborating *E-coli*).

• Marked summertime (bacterial and protozoan pathogens)
### Infectious Disease Pattern in Arizona

<table>
<thead>
<tr>
<th></th>
<th>2011</th>
<th>2010</th>
<th>5 year median (2006-2010)</th>
</tr>
</thead>
<tbody>
<tr>
<td>West Nile Virus</td>
<td>69</td>
<td>166</td>
<td>113</td>
</tr>
<tr>
<td>Hantavirus</td>
<td>3</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Campylobacteriosis</td>
<td>933</td>
<td>954</td>
<td>940</td>
</tr>
<tr>
<td>Legionellosis</td>
<td>46</td>
<td>65</td>
<td>40</td>
</tr>
<tr>
<td>Coccidioidomycosis (Valley Fever)</td>
<td>16,472</td>
<td>11,884</td>
<td>5,535</td>
</tr>
</tbody>
</table>

*No Lyme Disease Has Been Detected*

(ADHS, 2012)
Prolonged Transmission Cycle

(Fisman, 2012)
Response of pathogen growth rate to annual temperature and 1.5 degree average warming

(Fisman, 2012)
References


Balbus, J. Institute of Medicine, (2012). *Panel on IAQ and climate change*. Washington, DC.


References


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