Public Health Concerns
Southern Arizona Regional Climate Summit
for Municipal Leaders

Sharon L. Harlan
Arizona State University
November 14, 2013
How Climate Change Affects Human Health
IPCC Working Group II, 2007

Figure 8.1. Schematic diagram of pathways by which climate change affects health, and concurrent direct-acting and modifying (conditioning) influences of environmental, social and health-system factors.
Ten Ways that Climate Change Affects Global Health (IPCC 2007)

**Direct pathways:**
- Heat and cold extremes
- Wind, storms, and floods

**Indirect pathways:**
- Drought, nutrition and food security
- Food safety
- Water and disease
- Air quality and disease
- Aeroallergens and disease
- Vector-borne, rodent-borne and infectious diseases
- Occupational health
- Ultraviolet radiation
Six Key Health Messages from the Climate Change Assessment for the Southwest, 2013

Climate change is expected to:

1. Exacerbate heat-related morbidity and mortality. (high confidence)

2. Increase particulate matter levels from wildfires with subsequent effects on respiratory health. (medium-high confidence)

3. Influence vector-borne disease prevalence (medium-high confidence)

4. Increase health burdens disproportionately on disadvantaged populations. (high confidence)

5. Mitigation strategies have costs and benefits relevant to public health. (medium-high confidence)

6. Mitigation and adaptation plans tailored to the specific vulnerabilities of cities and states will lessen the impacts of climate change. (medium-high confidence)
Social Factors Present Different Risks to Climate and Climate Change for Vulnerable People and Places

1. Socioeconomics of individuals – poverty, lack of adequate shelter, underlying medical conditions and disability, lack of health insurance, undocumented migrants, ethnic/racial minorities

2. Age of individuals – Advanced age and social isolation, children

3. Exposure in high risk environments – urban core neighborhoods, tribal areas, border area, remote areas, outdoor workplaces
Why Are Heat-Health Effects Critical in Arizona?

1. The effects of local climate on health are important right now.

2. Mortality and morbidity from heat-related causes are chronic and predictable. Normal daily temperatures are extreme and seasonal and diurnal hours of exposure are long compared to temperate climates.

3. Projected increases in temperature as well as frequency and intensity of heat waves will cause additional deaths and illnesses from heat-related causes due to climate change.

4. Temperature mitigation and adaptation strategies in Arizona may be an indicator of how humans can or will adapt physiologically, behaviorally, and technologically to living a warmer world.
Heat and Health Outcomes in Arizona

• Human heat hazards in Arizona
  *Hot arid climate*
  *Warming faster than the rest of the USA*
  *Extreme heat events*
  *Urban heat island – distribution of the heat burden*

• Maricopa County, Arizona, 2008-2012:
  - over 400 heat-related deaths (MCDPH)
  - 2,012 heat-related hospitalizations
  - 8,298 heat-related visits to hospital emergency rooms

• Morbidity and mortality during hot weather are also increased by heat-sensitivity to coronary and respiratory diseases.
Temperature-mortality relationship for Maricopa County residents: 2000-2008 (May-October)

Direct exposure to environmental heat

- Average daily deaths at $AT_{max}$

10% days $> 109 \degree$ C
38% days $> 104 \degree$ C
Index Factors
• Socioeconomic Status
• Elderly / Living Alone
• Unvegetated Land Cover

Harlan, Declet, Stefanov, Petitti, 2013
Potential Effects of Air Quality on Respiratory and Cardiovascular Diseases

• Ozone and PM 2.5 are the greatest threats to human health related to air quality.

• The two major metropolitan areas in Arizona do not meet EPA standards for safe levels.

• Climate change is expected to increase wildfire frequency and size and PM 2.5.

• Respiratory and eye symptoms and asthma hospitalizations associated with wildfires in California.

Figure 15.6 Dust storm on I-10 near Phoenix, July 8, 2007. Climate Assessment for Southwest.
Vector-Borne Diseases in the Southwest: Climate Sensitivity

Southwest Regional Climate Assessment Figure 15.3. Incidence of selected diseases in the Southwest as a percent of total for the United States. Data from cases reported to CDC.
Dengue Fever: Arizona and the Border Region Are at Risk

Aedes aegypti

Infectious Disease Vulnerability in the US, 1995-2005: Areas Vulnerable to Dengue Fever

http://www.nrdc.org/health/climate
Medical Anthropologists Study Spread of Dengue Mosquito in the Border Region

Dr. Mary Hayden examines waste tires for immature *Aedes aegypti*, the dengue virus vector, in Brownsville, TX and field activities in Mexico.

Imported cases of Dengue in the U.S. USGS mapping CDC data, cumulative as of 11/05/13
How can we minimize negative human health impacts of climate change?

1. Public health measures
   - Surveillance systems
   - Warnings systems, water stations, AC shelter, emergency response
   - Vector control
   - Workplace regulation
   - Public climate education
   - Better health data and more research

2. Broader changes
   - Improve green infrastructure
   - Improve air quality
   - Integrated risk management plans for climate change
Considering Equity in Long-Term Climate Mitigation and Adaptation

1. Access to health care

2. Housing quality and food security

3. Water: How should we distribute limited water resources to achieve outdoor cooling with vegetation?

4. Energy: How can indoor cooling be achieved with non-polluting, affordable energy?

- Unaffordability of AC for low-income populations
- AC is major contributor to global warming through GHG emissions.
- Southwest water and energy supply may falter in a warmer climate