HOW CLIMATE IMPACTS HEALTH: MICHIGAN PERSPECTIVE

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Asthma Initiative of Michigan
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Michigan Climate & Health Adaptation Program

**MICHAP**

- Federal/State/Local Partnership
- Integrating Climate Adaptation into Public Health Practice
- Promote Adaptation Strategies to Protect Public Health
Outline

• Michigan’s Climate Basics

• How Climate Change Affects Health

• Public Health Response
Michigan’s Current and Projected Climate

Laura Briley and Daniel Brown

GLISA
GREAT LAKES INTEGRATED SCIENCES + ASSESSMENTS
Definitions

- **Weather** - Short-term conditions at a location (temperature, wind, rain, etc)

- **Climate** - Long-term average of weather for an extended period of time at a certain location

- **Climate change** - Long-term continuous increase or decrease to average weather conditions or range of weather.
Observed Michigan Temperature

Michigan has warmed faster than the global and national rates.

Source: Third National Climate Assessment, GLISA Analysis of nClimDiv climate divisional data.
Projected Temperature Changes, 1971-2000 to 2041-2070

Winter temperatures to increase the most in the North, and Summer temperatures to increase the most in the South.

1.5–4.5°F (annual)
More Extreme Heat by 2070

Most of Michigan: Modest increases in number of days/year over 95°F

Southern Michigan may see greatest increase

Possible slight increase in number of heat waves
Climate Change in Context

Michigan's climate could look similar to these locations by the end of the 21st century.

Courtesy GLISA, 2005, modified from Hayhoe et al.
Precipitation is variable. Northwestern UP has seen declines while Michigan has seen an overall increase.

Source: Third National Climate Assessment, Weighted averages of nClimDiv divisional data from 8 U.S. Great Lakes States.
Projected Precipitation Change from 1971-2000 to 2041-2070

- **Winter**: +10 to 20%
- **Spring**: +0 to +15%
- **Summer**: -5 to 0%
- **Fall**: +0 to +15%

3-6% state yearly average
Extreme Precipitation > 1in/day (EP)

Projected change (1971-2070)

- Number of days/yr. with EP

10% south - 30% north

Following methodology from Groisman et al, 2005, updated.
Climate Change is Bad for People

“We need to... convince the world that humanity really is the most important species endangered by climate change.”

Margaret Chan, MD
Director-General,
World Health Organization

“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.”

Georges Benjamin, MD,
Executive Director
American Public Health Association
Health Impacts from Climate Change
(adapted from Frumkin et al 2008, Luber et al 2014)

- Extreme Weather Events
  - Heat waves, storms, floods, droughts, wild fires

- health impacts:
  - Injuries, heat-related illnesses, death
  - Worsening of chronic heart & lung conditions
  - Anxiety, depression, mental stress
  - Social disruption, housing displacement

- Environmental Disruption
  - Degraded water & air quality; Sewage/septic breakdown
  - Habitat changes

- health impacts:
  - Vector-borne diseases
  - Water- and food-borne diseases
  - Asthma and allergic conditions
Who is affected by Climate Change?

*Everyone* is impacted; however, some more likely to be harmed than others.

**Vulnerable People:**
- Elderly and very young children
- Persons with pre-existing conditions
- Persons taking certain medications
- Socially isolated
- Low income

**In Vulnerable Places:**
- Urban, failing infrastructure, poor housing
- High storm risk, flood plain
 HOW CLIMATE CHANGE AFFECTS YOUR HEALTH

AIR QUALITY

5% INCREASE IN HOSPITAL VISITS due to asthma following the southern California wildfires of 2003.

More Intense Wildfires

UP TO 15% INCREASE in cardiovascular disease mortality risk with increased particulate matter.

Increased Pollution & GHG Emissions

3,600 EMERGENCY ROOM VISITS for asthma in adults due to particulate matter exposure in New York City.

Increased Allergens

The length of RAGWEED SEASON increased by:

- Minneapolis, MN: 21 days
- Fargo, ND: 19 days

Aggravated Cardiovascular Illnesses

Aggravated Respiratory Illnesses

Increased Allergy-Related Illnesses

Climate Change Affects Air Pollutants

- Directly affects wind patterns, leads to more air stagnation events
- Increases temperatures which . . .
  - Increase pollution from fossil fuel combustion to meet electricity demand for increased air conditioner use
  - Increase production of natural sources of air pollutant emissions
  - Increase formation of ozone
- Lengthens the allergy season and fosters growth of allergenic plants (ragweed)
- Increases heavy rainfall and flooding, fostering mold, also allergenic

Image from the Metropolitan Design Center Image Bank. Used with permission.
Projected Change in Ozone-related Premature Deaths from 2000-2030

Crimmins et al 2016
Distribution of Poor Air Quality by County

Average number of days above ozone regulatory standard
- 0 Days
- 0.1 - 2.9 days
- 3.0 - 6.1 days
- 6.2 - 10.0 days

Average ambient concentration of PM2.5 (micrograms per cubic meter)
- Average above NAAQS
- 6.79 - 8.87
- 8.88 - 10.67
- 10.68 - 13.59

Source: Environmental Health Tracking Network (2005-2011)
*Includes both counties with monitors and counties which values were mathematically modelled
**Ozone regulatory standard changed from 80 ppb to 75 ppb in 2008

Source: Environmental Health Tracking Network (2005-2011)
*Includes both counties with monitors and counties which values were mathematically modelled
National Ambient Air Quality Standard = 12 micrograms PM2.5 per cubic meter
Distribution of Vulnerability by County

Michigan Climate and Health Vulnerability Assessment
Respiratory Diseases

Legend
- County Boundaries
- Composite Vulnerability Index Sensitivity
  - 01
  - 02
  - 03

State Variables

Asthma Hospitalization Rates
2008 - 2012

Hospitalizations per 10,000 people
- 3.5 - 6.7
- 6.8 - 10.1
- 10.2 - 16.1
- 16.2 - 30.1

Proportion of population that is minority
Proportion of population in poverty
Proportion of non-Hispanic white population
Proportion of population over 65 years of age
Proportion of population under 18 years of age
Proportion of population with less than a high school diploma
Proportion of population with less than a high school diploma

Source: Michigan Department of Community Health
Change in Length of Ragweed Pollen Season, 1995–2013

Data source: Ziska et al., 2014
Public Health Strategies

**Mitigation:** Reduce, Prevent GHG Emissions

- Reduce energy consumption
- Use fossil fuel alternatives
- Reduce fossil fuel combustion
- Control emissions

**Adaptation:** Actions that Moderate Harm

- Monitor conditions, inform the public
- Community, infrastructure planning
- Emergency preparedness
Strategies We Can Do Now

• Encourage monitoring of AQ Alerts, Heat warnings; use AirNow app
• Promote pollen monitoring stations
• Support emission restriction policies on ozone action days
• Incorporate low-allergen plants in public landscaping
• Mow/repurpose vacant lots to reduce ragweed
• Support Clean Power Plant legislation
For further information:

APHA Climate Change
www.apha.org/topics-and-issues/climate-change

CDC Climate and Health Program
www.cdc.gov/climateandhealth/

National Climate & Health Assessment
health2016.globalchange.gov/

Contact Us: CameronL@Michigan.gov
www.Michigan.gov\climateandhealth
## Prediction for Michigan

<table>
<thead>
<tr>
<th>Key Health Outcome</th>
<th>Biophysical Parameter Changes</th>
<th>Predicted Change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Respiratory Diseases</strong></td>
<td>Air Pollutants increase with high temps; Pollen, Mold levels increase with longer growing season &amp; more moisture</td>
<td>![Up Arrow]</td>
</tr>
<tr>
<td><strong>Heat Morbidity, Mortality</strong></td>
<td>More frequent, longer Heat Events; Warmer minimum temperatures</td>
<td>![Up Arrow]</td>
</tr>
<tr>
<td><strong>Injury, CO Poisoning</strong></td>
<td>More frequent Ice Storms, Extreme Rain leading to more Power Outages &amp; Cleanup; changes in other storm types unclear</td>
<td>![Up Arrow] ?</td>
</tr>
<tr>
<td><strong>Waterborne Diseases, Toxins</strong></td>
<td>Algal blooms, other Flood-related contaminations more frequent</td>
<td>![Up Arrow]</td>
</tr>
<tr>
<td><strong>Vector borne Diseases</strong></td>
<td>Impact on Mosquito &amp; Tick lifecycle unclear</td>
<td>?</td>
</tr>
</tbody>
</table>
Priority Climate-Related Health Impacts

1. Respiratory conditions
2. Heat Illness
3. Storm–related Injury, CO poisoning
4. Water–borne diseases
5. Vector–borne diseases
<table>
<thead>
<tr>
<th>Climate Driver</th>
<th>Exposure</th>
<th>Health Outcome</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extreme Heat</td>
<td>More frequent, severe, prolonged heat events</td>
<td>Elevated temperatures</td>
<td>Heat-related death and illness</td>
</tr>
<tr>
<td>Outdoor Air Quality</td>
<td>Increasing temperatures and changing precipitation patterns</td>
<td>Worsened air quality (ozone, particulate matter, and higher pollen counts)</td>
<td>Precipitation-driven health outcomes, acute and chronic respiratory illnesses and death</td>
</tr>
<tr>
<td>Flooding</td>
<td>Rising sea level and more frequent or intense extreme precipitation, hurricanes, and storm surge events</td>
<td>Contaminated water, debris, and disruptions to essential infrastructure</td>
<td>Increased coastal and inland flooding exposes populations to a range of negative health impacts before, during, and after events.</td>
</tr>
<tr>
<td>Vector-Borne Infection (Lyme Disease)</td>
<td>Changes in temperature extremes and seasonal weather patterns</td>
<td>Earlier and geographically expanded tick activity</td>
<td>Lyme disease</td>
</tr>
<tr>
<td>Water-Related Infection (Vibrio vulnificus)</td>
<td>Rising sea surface temperature changes in precipitation and runoff affecting coastal salinity</td>
<td>Recreational water or shellfish contaminated with Vibrio vulnificus</td>
<td>Vibrio vulnificus induced diarrhea and intestinal illness, wound and bloodstream infections, death</td>
</tr>
<tr>
<td>Food-Related Infection (Salmonella)</td>
<td>Increases in temperature, humidity, and season length</td>
<td>Increased growth of pathogens, seasonal shifts in incidence of Salmonella exposure</td>
<td>Salmonella infection, gastrointestinal outbreaks</td>
</tr>
<tr>
<td>Mental Health and Well-Being</td>
<td>Climate change impacts, especially extreme weather</td>
<td>Level of exposure to traumatic events, like disasters</td>
<td>Distress, grief, behavioral health disorders, social impacts, resilience</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>Changes in exposure to climate- or weather-related disasters cause or exacerbate stress and mental health consequences, with greater risk for certain populations.</td>
</tr>
</tbody>
</table>

Crimmins et al. 2016