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Child Health in a Changing Climate

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Our Changing Climate

• Climate change is altering basic natural systems.

• The range, life cycle, growing pattern and disease dynamics of many plants and animals are changing.

• These changes must affect human health.

• Children are particularly vulnerable.
Child Health in a Changing Climate

Shifts in Range and Life Cycles

Extreme Weather

Plant Allergens

Rising Temperature

- Child
- Health
- Shifts in Range and Life Cycles
- Extreme Weather
- Plant Allergens
- Rising Temperature

- It’s Hot Outside!
- Extremely hot weather can cause sickness or even death.
- Stay Cool: Wear loose, lightweight, light-colored clothing.
- Stay Hydrated: Drink from two to four cups of water every hour while exercising.
- Stay Informed: Monitor a local weather forecast, and have someone do the same for you.
- Know when it’s hot!
- Check local news for extreme heat alerts and safety tips.
Children are More Vulnerable

Unique characteristics:

• ↑ minute ventilation
• ↑ food & water per weight
• physiologic/cognitive immaturity
• windows of vulnerability
• ↑ interaction with outdoors

Source: © UNICEF/NYHQ2009-1730/Alquinto
One of first medical organizations to address health impacts of climate change in 2007.

http://pediatrics.aappublications.org/content/120/5/1149

Updated Policy Statement and Technical Report
Pediatrics, November, 2015.
http://pediatrics.aappublications.org/content/136/5/992

Provided written and verbal testimony in support of Clean Power Plan.


Joined amicus brief in support of EPA’s Clean Power Plan regulations, April 2016.
http://edf.org/sites/default/files/content/2016.04.01_public_health_organizations_amicus_brief_for_epa.pdf
Climate Change affects Child Health

- Estimated > 88% of the global burden of disease due to climate change occurs in children under the age of 5. (Zhang, J Environ Health 2007)

- Children in low resource countries at highest risk.

- In the U.S., children are already experiencing:
  - 1. Increased severe heat events.
  - 2. Changes in pollen allergy season.
  - 3. Altered infectious disease patterns.
  - 4. Increases in some severe weather events.
Logan Johnson’s Story-August, 2010

- Practiced basketball in Arkansas gym without air conditioning.
- Developed unrecognized heat stroke, followed by rhabdomyolysis, kidney failure and pulmonary edema.
- Treated successfully in PICU with dialysis.
High School Athletes at Elevated Risk

- >9,000 illnesses/year in high school athletes (MMWR 2010)

- > 1/3 U.S. ED visits for exertional heat injury are in teenage male athletes (MMWR 2011)

- Football players at highest risk

- American high school and college football deaths due to heat stroke doubled in past decade.
  (Gottschalk, Sports Med Arthr Rev, 2011)

Heat Illnesses by month in high school athletes in 100 schools, 2005-2009
Source: MMWR 2010
Infants are uniquely vulnerable group to heat-related mortality. (Basagna, Epidemiology 2011; Basu, Am J Epidemiol 2008)

Infants suffer second-highest heat mortality rate among all groups; likely to experience greatest increase in mortality rates due to climate change. (Deschenes and Greenstone, American Economic Journal: Applied Economics, 2011)

2007 study: By end of 21st century, under “business as usual” scenario, infant mortality will increase by 5.5% in females and 7.8% in males due to heat-related deaths. (National Bureau of Economic Research, Deschenes, 2007)
“Sam’s” Story

- 9 year old boy in Virginia
- History of seasonal allergic rhinitis.
- Spring 2016, treated with oral antihistamine, nasal steroid, ocular antihistamine.
- Developed severe eye redness, drainage and irritation, and facial rash. Required treatment with ocular steroid.
1) Ragweed plants produce more pollen when grown in higher temperature and CO$_2$.  
(Singer, *Funct Plant Biol* 2005)

2) Plants grown in today’s CO$_2$ produced about twice as much pollen as in CO$_2$ of last century.  

3) Average U.S. pollen count increased by 42-46% in 2000’s relative to 1990’s.  
Predicted Increases in Grass Pollen and Allergen.

Timothy grass grown at 800 ppm CO2 concentration produced 200% more pollen than plants grown at 400 ppm.

Albertine JM, et al. (2014) PLoS ONE 9(11)
Sophia’s Story

- Seven year old girl in suburban Virginia.
- Plays in backyard and wooded school playground.
- Presented in June 2015 with rash on arm.

- Diagnosed with Lyme Disease, treated successfully.
Lyme Disease Range Expansion

- Boys 5-9 years at greatest risk.
- Carried by Ixodes Scapularis tick.
- Northward expansion of Ixodes Scapularis has been documented in North America.
- This has occurred coincident to, or after, rise in temperature in these regions, but not before.

(Ogden, *Int J Health Geogr* 2008; Ogden, *Environ Health Perspect* 2014)
Lyme Disease in the U.S.

Among the states where Lyme disease is most common, New Hampshire and Vermont have experienced the largest increases in reported cases.
Beginning week of Lyme disease season across all states and years as a function of the cumulative growing degree days (GDD) above 10°C. Moore, SM et al. *Am J Trop Med Hyg* 2014
Elevated temperature has a positive effect on mosquito population, survival, viral replication and WNV disease transmission. (Anyamba A, *PLoS One* 2014)

Rate of virus replication for WNV as a function of temperature

Reisen WK, *Journal of Medical Entomology* 2006
Some Like it Hot

Aedes Mosquitoes

- Primary vectors for Dengue, Chikungunya and Zika

- Currently widest distribution ever recorded, extensive in all continents
  (Kramer M et al, eLife, 2015)

- Climate change can:
  - expand vector range
  - extend the transmission season
  - shorten mosquito life cycle
  - reduce time to mosquito infectivity
  (Sirisena P, Int Journal of Inf Dis, 2014)

Increased temperature speeds Aedes albopictus immature development
Waldock J, Pathogens and Global Health 2013

![Graph showing the effect of temperature on development times of Aedes albopictus immature stages.](image)
Climate Policy is Health Policy

Public health initiatives have played a tremendous role:

- Vaccination programs
- Water sanitation systems
- Tobacco legislation
- Removal of lead from paint and gasoline

Providers can play unique role in climate change adaptation and mitigation strategies.
Green Your Facility

- Incentivize active and public transportation for employees

- Reduce Energy Usage
  - Efficient buildings and products
  - On-site Renewable Capability or Green Power Purchase

- Reduce Waste/Reuse/Recycle

- Improve Food Service
  - Increase plant-based protein options
  - Compost
  - Eliminate bottled water

Resource: Health Care without Harm

Bike Shop at Seattle Children’s Hospital
Source: http://pulse.seattlechildrens.org

Wind Turbines Help Power Gundersen Health System
Source: http://www.gundersenhealth.org
In Your Practice

Use existing anticipatory guidance framework to discuss climate change with families

1) Encourage walking/biking as way to promote fitness and reduce emissions.
2) Promote consumption of plant-based proteins to improve cardiovascular health and reduce agricultural pollutants.
3) Discuss with families financial and ecologic benefits of fuel-efficient vehicles and public transportation use.

Source: CDC.gov
Advocate

- Become a voice in the climate change discussion:
  - Support policies that reduce greenhouse gas emissions
  - Write op-eds and letters to the editor
  - Share stories through social media
  - Educate elected officials
  - Provide expert testimony

Samantha Ahdoot, MD: Pediatrician and advocate
A Safer Climate Future for Children

- Climate change affects the health of every human
- Children are at higher risk
- Climate policy presents an unprecedented opportunity to protect child health
Climate Change and Health

Resources:

- American College of Physicians-Climate Change and Health.
- American Public Health Association– Climate Change
- UNICEF- Climate Change and Children
- WHO- Climate Change and Human Health