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Child Health in a Changing Climate

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I have no relevant financial relationship in relation to this presentation.

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.

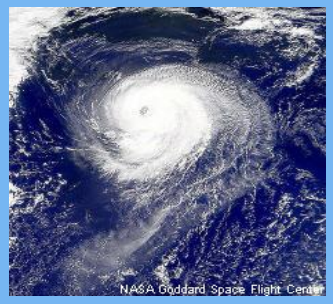
Child Health in a Changing Climate

Shifts in Range and Life Cycles

Extreme Weather

Plant Allergens

Rising Temperature



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

American Academy of Pediatrics

- 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.
- Participated in White House Expert Consultation on the Effects of Climate Change on Children's Health, 2014.
- 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's Story

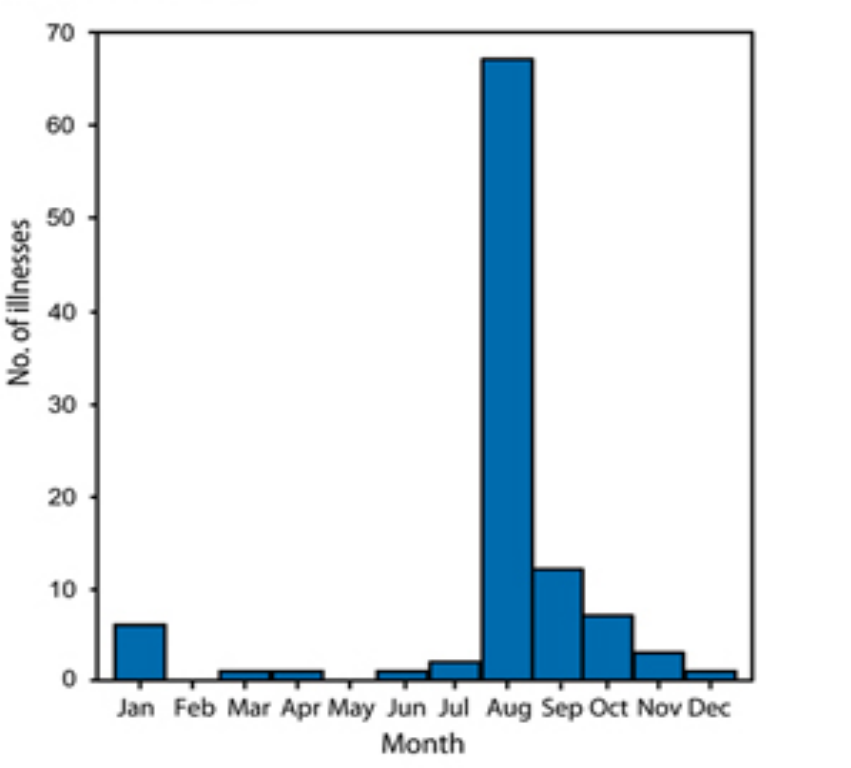
Logan Johnson's Story-August, 2010

Source: ksi.uconn.edu

- 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

Heat Mortality in Infants < 1 year

- 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

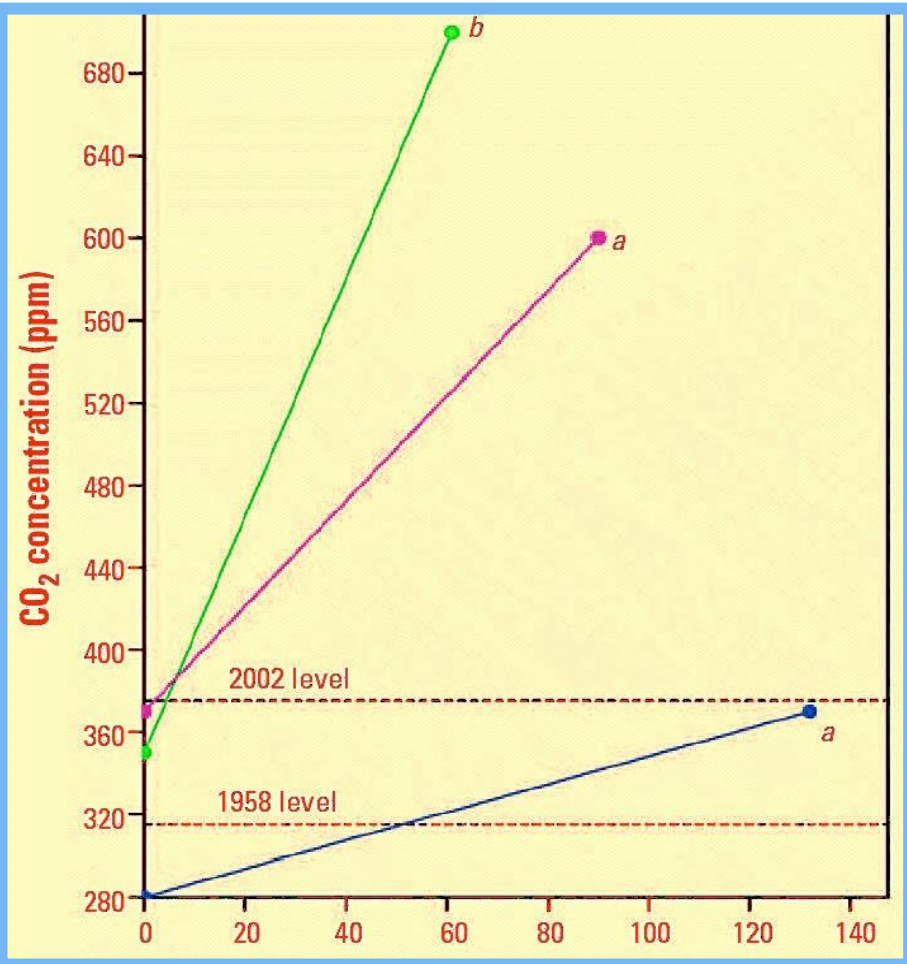
- 9 year old boy in Virginia
- History of seasonal allergic rhinitis.
- Spring 2016, treated with oral antihistamine, nasal steroid, ocular antihistamine.
- Developed severe eye redness, drainage and irritation, and facial rash. Required treatment with ocular steroid.

Elevated CO_2 and Pollen Counts

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.
(Ziska , *World Resource Rev* 2000)

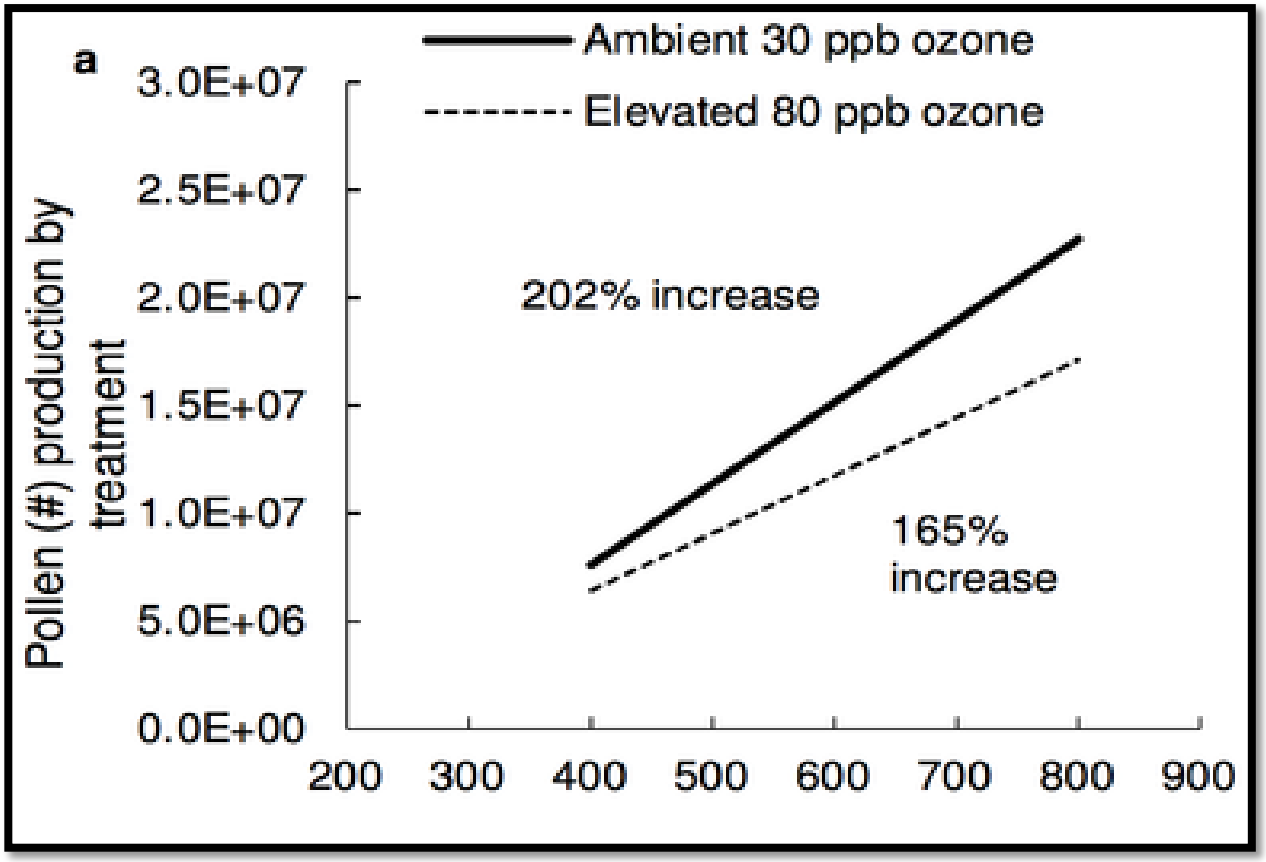
3) Average U.S. pollen count increased by 42-46% in 2000's relative to 1990's.
(Zhang et al, *Global Change Biology*, 2015)



(Beggs PJ, Bambrick HJ. *Environ Health Perspect*, 2005)

Predicted Increases in Grass Pollen and Allergen.

Timothy grass grown at 800 ppm CO_2 concentration produced 200% more pollen than plants grown at 400 ppm.



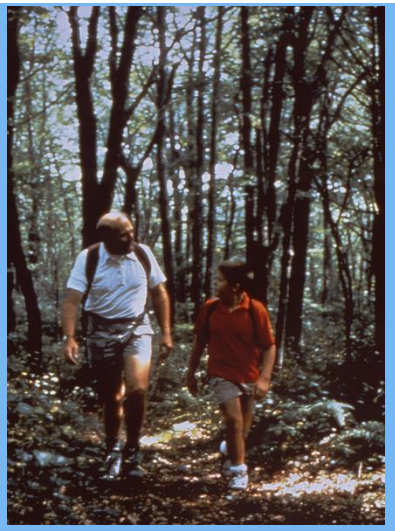
Albertine JM, et al. (2014) PLoS ONE 9(11)

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



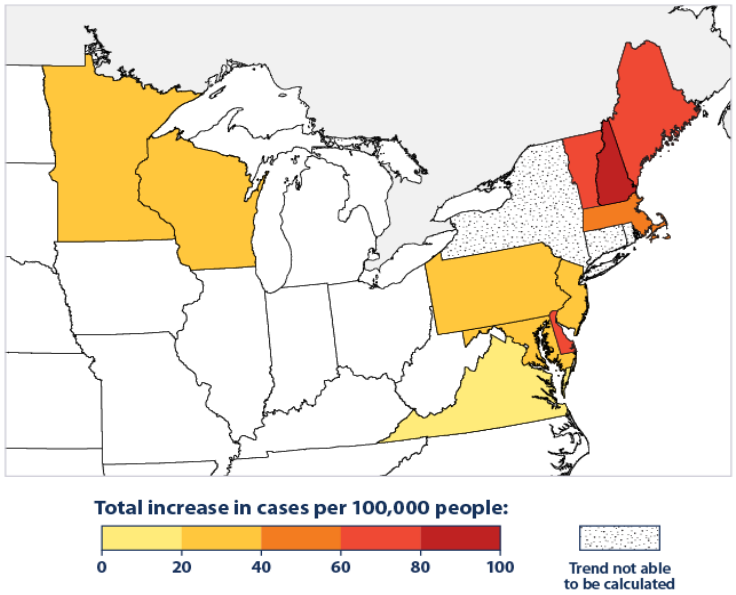
Source: phil.cdc.gov

- 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.

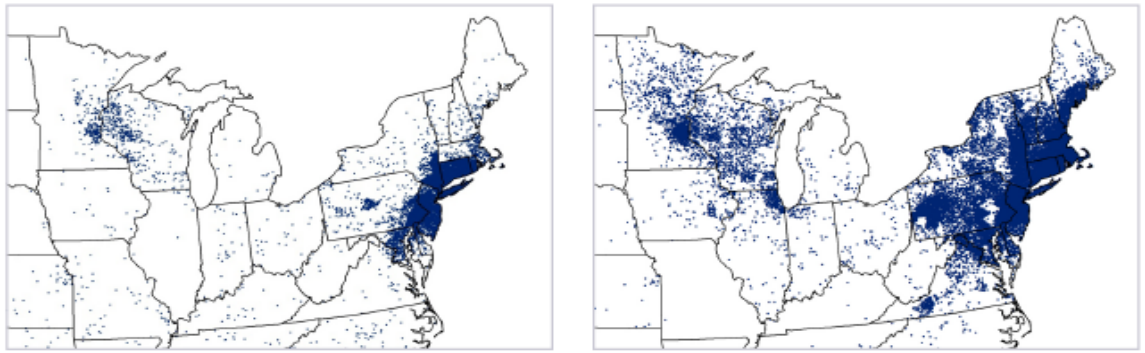
Figure 2. Change in Reported Lyme Disease Incidence in the Northeast and Upper Midwest, 1991–2013



Data source: CDC (Centers for Disease Control and Prevention). 2015. Lyme disease data and statistics. www.cdc.gov/lyme/stats/index.html. Accessed March 2015.

For more information, visit U.S. EPA's "Climate Change Indicators in the United States" at www.epa.gov/climatechange/indicators.

Reported Lyme Disease Cases in 1996 and 2013

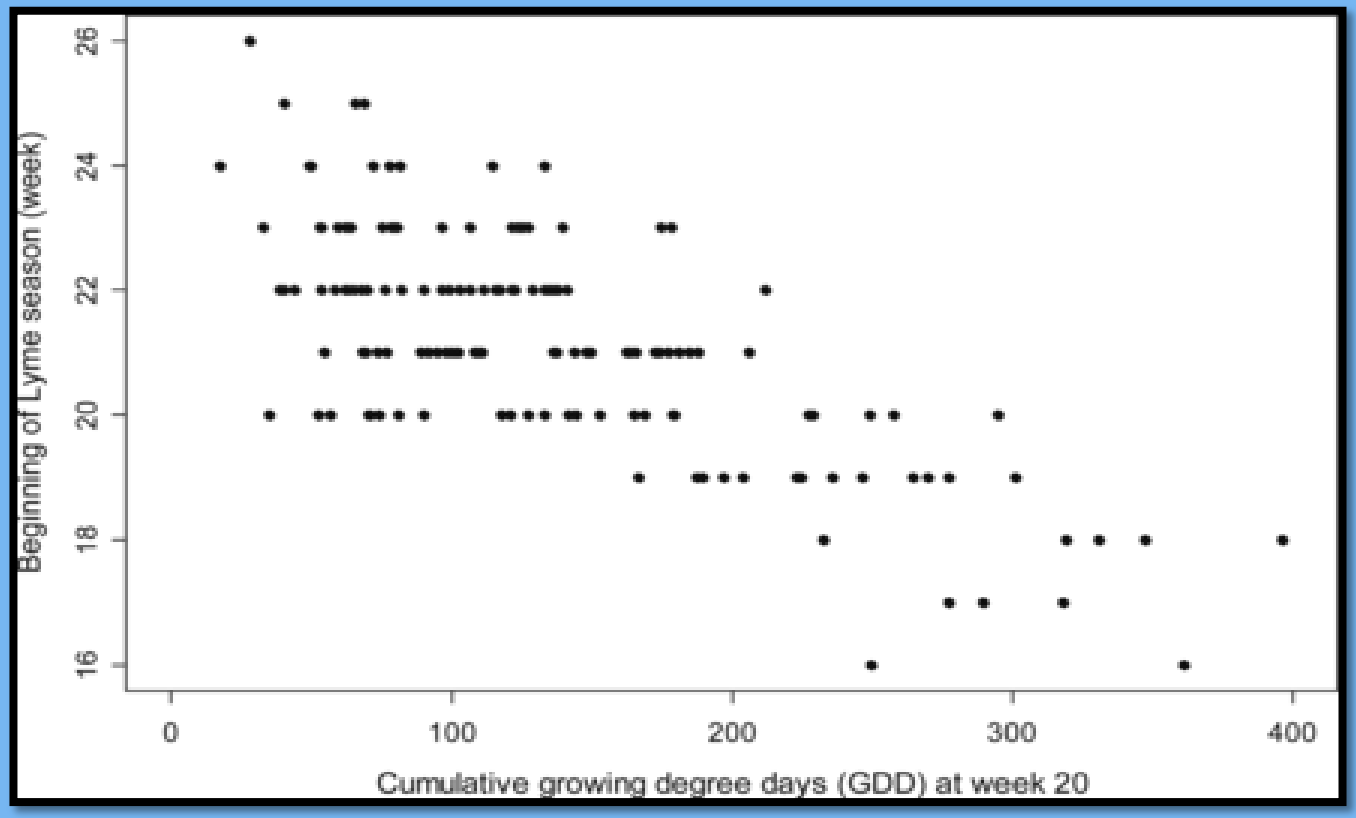


Data source: CDC (Centers for Disease Control and Prevention). 2015. Lyme disease data and statistics. www.cdc.gov/lyme/stats/index.html. Accessed March 2015.

For more information, visit U.S. EPA's "Climate Change Indicators in the United States" at www.epa.gov/climatechange/indicators.

Among the states where Lyme disease is most common, New Hampshire and Vermont have experienced the largest increases in reported cases.

Meteorological Influences on the Seasonality of Lyme Disease in the US

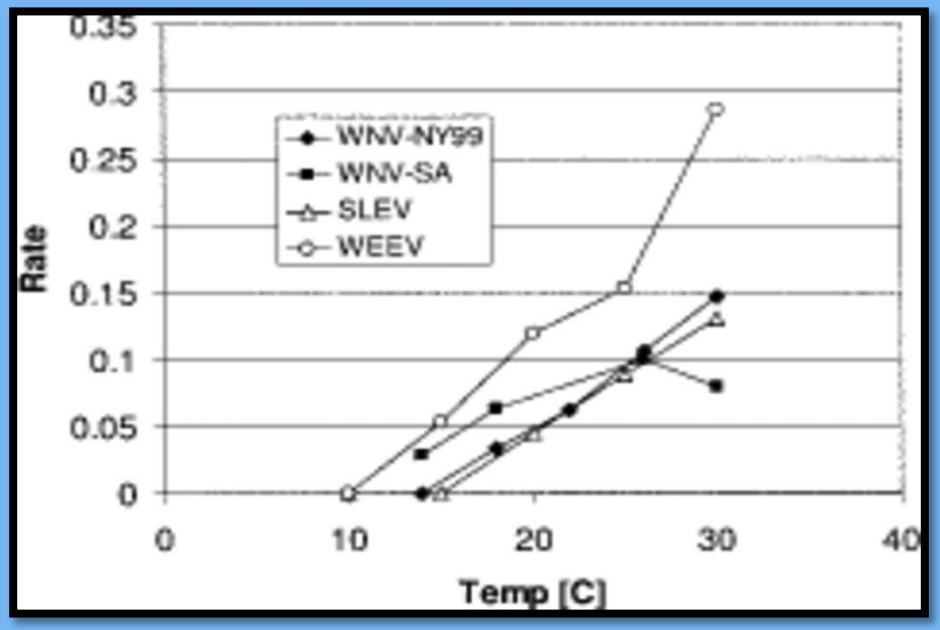


Beginning week of Lyme disease season across all states and years as a function of the cumulative growing degree days (GDD) above 10°C. Moore, SM et al. *Am J Trop Med Hyg* 2014

Temperature Affects Viral Replication

Elevated temperature has + 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

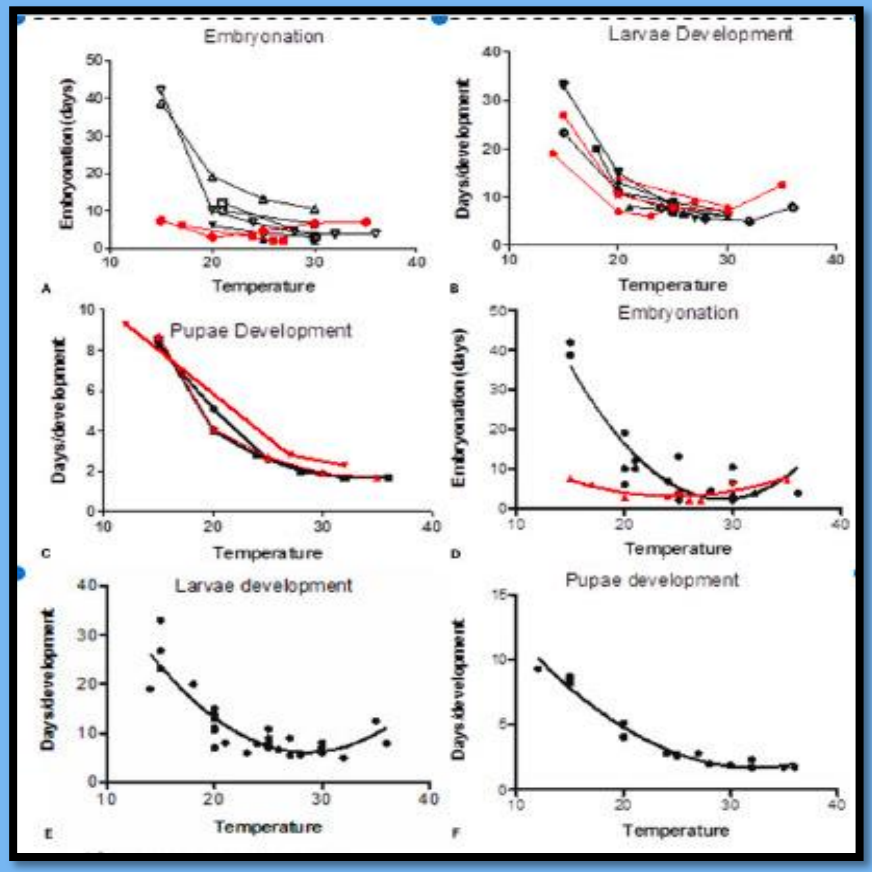
Some Like it Hot

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



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*

Source: Thester11/Creativecommons

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

Source: CDC.gov

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.

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:

- US Global Change Research Program, Climate and Health Assessment. https://health2016.globalchange.gov
- American Academy of Pediatrics-Global Climate Change and Children's Health. Policy Statement and Technical Report, November 2015.
- American College of Physicians-Climate Change and Health.
- American Public Health Association– Climate Change
- Lancet Commission on Health and Climate Change, 2015.
- UNICEF- Climate Change and Children
- WHO- Climate Change and Human Health