Climate Change and Pediatric Health

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Objectives:

1. Describe the impacts of climate change on child health:


2. Identify the specific impact of climate change on child respiratory health:

3. Discuss how pediatric providers can incorporate climate change impacts into their practice:

Climate Science 101
What is Climate?
The statistical distribution of weather patterns over an extended period of time (decades to millions of years).

What is Global Warming?
A gradual increase in the average temperature of the Earth's atmosphere and its oceans caused predominantly by the greenhouse effect of rising levels of anthropogenic CO2.

Global Warming → Climate Change →??
Warming planet leads to climate changes more complex than warming alone.

IPCC 2007 Synthesis Report
Aug 2015 average on Mauna Loa Observatory = 398.82 ppm
Anthropogenic CO2 Sources

~8% of total US footprint!!
The Greenhouse Effect

Step 1: Solar radiation reaches the Earth's atmosphere - some of this is reflected back into space.

Step 2: The rest of the sun's energy is absorbed by the land and the oceans, heating the Earth.

Step 3: Heat radiates from Earth towards space.

Step 4: Some of this heat is trapped by greenhouse gases in the atmosphere, keeping the Earth warm enough to sustain life.

Step 5: Human activities such as burning fossil fuels, agriculture and land clearing are increasing the amount of greenhouse gases released into the atmosphere.

Step 6: This is trapping extra heat, and causing the Earth's temperature to rise.
Greenhouse Gases– Other Considerations

- Atmospheric lifespan of a gas
  - CO2 survives in atmosphere 50-200 years

- Different gases have varying contributions to greenhouse effect based on volume + potency

- Methane, NO (i.e., from livestock)– lower atmospheric concentration than CO2 but higher GHG potency

- Water Vapor– high concentration and potency, but shorter atmospheric lifespan than CO2. Positive feedback loop with warming.

Source: IPCC
IPCC: RCP Scenarios for Warming

Global Temperature Projections for various RCP Scenarios

Source: Architecture 2030; Adapted from IPCC Fifth Assessment Report, 2013
Representative Concentration Pathways (RCP), temperature projections for SRES scenarios and the RCPs.
Global warming: Greater frequency and intensity of heat waves

IPCC 2007
Urban Heat Islands: 10-15° F warmer

EPA.gov
Intensification of the Water Cycle

= increased floods and droughts
= increased storm frequency and severity
Loss of Snowpack: PacNW and California
Rising temps and changing winter precipitation

Data for Olympic National Park in Washington State
Health Impacts of Climate Change: Asthma Case Study
Climate Change Worsens Asthma

1. Increased pollen levels + longer pollen seasons

2. Ground level ozone increases during heat waves
   → Ozone increases bronchial inflammation

3. Climate change fosters conditions favorable to forest fires which generate air pollutants

1 in 10 children with asthma

Bernstein et al, *Chest*. 2013
1. Increased CO2 levels → increased pollen production

What is Ground Level Ozone?

Ozone formation

Sunlight

Oxygen ($O_2$) + Volatile Organic Compounds (VOC) + Nitrogen Oxides (NOx) → Ozone ($O_3$)
Wildfire Smoke and Respiratory Health

- Burning forests
  - particulate matter, acrolein (a resp irritant)
  - carcinogens: formaldehyde and benzene
- Smoke can travel long distances
Sea Otter in Seattle develops asthma from wildfire smoke in Summer 2015
Health Impacts of Climate Change
Current Global Burden of Climate Related Disease on Children

- Malnutrition
- Changing rates of infectious disease
- Allergic and non-allergic respiratory disease
- Increased extreme heat
- Increased storm frequency and severity
- Sea level rise
- Food and human insecurity
- Toxic Exposures

Climate Refugees

Sheffield et al, 2011
Deaths Attributable to Climate Change 2004

Figure 1. Deaths attributable to global climate change: 2004 annual data in total numbers divided by age categories (adapted from WHO 2008).

Sheffield et al. 2011
“Climate change is expected to act primarily as an effect modifier in exacerbating existing health disparities, and thus it’s inclusion in planning is essential for the success of the global health movement.”

Sheffield et al 2011
Changing Patterns of Vector Borne Diseases

- longer warm seasons, increased temps at high altitude
  = altered insect life cycles

- malaria reaching to higher altitudes in endemic regions
- expanding range of dengue and lyme disease
- mountain pine beetle overburden in West
Increased burden of diarrheal illness:

- warmer water temperatures
- infrastructure damage from storms and floods
- heavy rains overwhelming CSOs
Malnutrition:
1. Floods, droughts, storms, extreme heat
2. Increased CO2 levels
   → lower grain protein, zinc, and iron content

Climate Refugees

UNHCR 2005
Adaptation, Resilience, Mitigation
What can providers do?
“Tackling climate change could be the greatest health opportunity of the 21st century.”

-The Lancet 2015

Mitigation

- Atmospheric Lifetime of Carbon = 100 yrs +

- Advocacy to mitigate greenhouse gas emissions is essential but not enough

- Mitigation advocacy comes with many health co-benefits

- Be Green and advertise what you are doing as critical to the future of children’s health in your practice
Adaptation and Resilience

- Climate change curriculums
  - medical school, residency, public health
- Educate families on health impacts of climate change.
- Scenario based preparedness
Adaptation and Resilience

- Incorporate climate change studies into existing fields of expertise—build on foundations that are already in place

- Developing new CEHIs
Discussion Points

What next?

- Training in climate communication—people are not motivated by guilt or fear, so how do we talk to young people and families about climate change?