How does climate change affect air quality?

Fossil fuels

CO2

Pollutants

PM
SO2
NO2
CO
O3

Temperature

Shifting seasons

Pollen amount and allergenicity

Wildfires

DISEASE

CLIMATE DRIVERS
- Increasing atmospheric carbon dioxide
- Increasing temperatures in many locations
- Changes in precipitation patterns
- Extreme weather events
- Changes in cloudiness, humidity, & wind speed

ENVIRONMENTAL & INSTITUTIONAL CONTEXT
- Changes in airborne allergen production, timing, & distribution
- Urban landscapes
- Emissions & land-use patterns

EXPOSURE PATHWAYS
- Poor outdoor air quality (such as high levels of ground-level ozone)
- Higher pollen counts with increased allergenicity, geographic range, & longer pollen seasons

HEALTH OUTCOMES
- Premature death
- Hospital/ER visits for acute respiratory symptoms
- Allergic sensitivity or disease
- Lung cancer, chronic obstructive pulmonary disease (COPD), & cardiovascular disease associated with PM_{2.5} exposure
- Lost school or work days

SOCIAL & BEHAVIORAL CONTEXT
- Social determinants of health
- Compromised baseline health status
- Access to air conditioning & air filtration
- Housing quality
- Distance to high-traffic roadways
- Outdoor exercise near roadways
Some communities of color living in risk-prone areas face cumulative exposure to multiple pollutants. Adaptation plans that consider these communities and improve access to healthcare help address social inequities.

Older adults are vulnerable to extreme events that cause power outages or require evacuation. Checking on elderly neighbors and proper emergency communication can save lives.

Children have higher risk of heat stroke and illness than adults. Adults can lessen risk by monitoring exertion and hydration.

Low income families are at risk of physical and mental illnesses during flooding and in crowded shelter conditions. Comprehensive disaster management can improve resiliency for people with limited resources.

https://nca2018.globalchange.gov
HISPANICS IN THE US (2018)

- Close to 60 million
- Group members living below the poverty line: 10.5 million
- Group poverty rate: 17.6%
- Children living in poverty: 16.25 (11.9 million kids)

Note: Population estimates for 1990-2018 are as of July 1 for each year. Hispanics are of any race.

PEW RESEARCH CENTER

https://www.povertyusa.org/facts
Health insurance

Figure 4

Uninsured Rates among the Nonelderly Population by Selected Characteristics, 2018

NOTE: Includes nonelderly individuals ages 0 to 64. AIAN refers to American Indian and Alaska Native. NHOPi refers to Native Hawaiians and Other Pacific Islanders.


Figure 4: Uninsured Rates among the Nonelderly Population by Selected Characteristics, 2018
Greater Exposure to PM2.5 Pollution for Asians, Latinos, and African Americans (cars, trucks, buses)

Asian Americans: exposed to 34% higher PM2.5 concentrations than the average US person.

African Americans: 24% higher concentration than average.

Latinos: 23% higher than the US population as a whole.

“More than 32.5 million children live in counties that received an F for at least one pollutant.

“Nearly 4.9 million children live in counties failing all three tests”.

Air pollution effects in the health in children and adults.

American Lung Association
Air pollution: Multi-systemic Injuries in Children
Climate change increases frost-free days, shifting flowering time and pollen initiation from allergenic plant species.

Higher concentrations of pollen and longer pollen seasons lead to increased allergic sensations and asthma episodes.

CDC
More CO2

↓

Temperature

↓

Longer seasons, more pollen, more allergenicity
# ASTHMA

<table>
<thead>
<tr>
<th>Globally</th>
<th>U.S</th>
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<tbody>
<tr>
<td>300 million</td>
<td>20 million</td>
</tr>
<tr>
<td>250,000 deaths/year</td>
<td>6.2 million – children</td>
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<tr>
<td></td>
<td>13.8 million adults</td>
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</tbody>
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Most common chronic disease among children
750,000 summertime asthma attacks in children and 500,000 missed school days.

Adults: 2,000 asthma related ER visits, 600 hospital admissions and 1.5 million reduced activity days.
Wildfires are increasing and wildfire season is getting longer in the Western U.S.

Average number of large wildfires per year bigger than 1,000 acres:
- 1980-1989: ~140
- 1990-1999: ~160
- 2000-2012: ~250

Average length of wildfire season:
- Early 1970s: 5 months
- Today: 7+ months

© Union of Concerned Scientists 2013; www.ucsusa.org/westernwildfires
California wildfires: Air quality rated “world’s worst”

16 November 2018 (BBC News) – Northern California’s air quality
WILDFIRE POLLUTION HARMs HEALTH
Fine particle (PM$_{2.5}$) effects

- Asthma attacks, breathing problems
- Eye, lung, throat irritation
- Heart disease effects worsened
- Premature death
The Effects of Air Pollution can be More Detrimental in Children

- Asthma risk during the pre-school years was increased by early exposure to traffic-related air pollution

- Long term exposure to O3, PM10 and NO2 is associated with decreased lung growth

- Disproportionate effect on *children* ages 6-18, causing more hospitalizations and ICU admissions, *even at exposure levels below current EPA standards*

*Sbihi, 2016, Silverman 2010, Rojas-Martinez 2007*
Exposure to Air Pollution During Pregnancy is Associated to Autistic Spectrum Disorder

• Exposure to TRAP, NO2, PM2.5, PM10 during pregnancy and/or the first year of life.

• Exposure to mercury, in the form of elemental mercury, (e.g., coal burning for power).

Texas: “For each 1000 lb of environmentally released mercury, there was a 43% increase in the rate of special education services and a 61% increase in the rate of autism”.

Palmer et al., 2006; Flores-Pajot et al., 2016; Pagalan et al., 2019; Volk et al., 2013; Windham et al., 2006;
Brains of children, and children with long-term exposure to air pollution in Mexico City had cognitive deficits associated to neuroinflammation and neurodegeneration, structural and volumetric changes and tissue changes seen in patients with Parkinson and Alzheimer’s disease

(Calderón-Garcidueñas et al., 2015, Calderón-Garcidueñas et al., 2016).
You’ve only got three choices in life:
Give up, give in, or give it all you’ve got