



Pollution and Climate Change's Effects on Health

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WEXNER MEDICAL CENTER

Objectives

- What is climate change?
- What is the difference between global warming, climate, and weather?
- What is global warming? What causes it?
- What is climate change? What causes it?
 - Focus on air pollution
- What are the effects of climate change?
- What are the impacts to human health from these effects?
 - Short term and long term
- What are the implications for clinical practice?



What is “Climate Change”?



Image by [geralt](#) from [Pixabay](#)

What is “Climate Change”?

- Extreme weather events?
- Melting sea ice?
- “Pollution”?
- Extreme heat?
- Health impacts?
 - Heat stroke? Cardiopulmonary disease? Asthma?
- Greenhouse gas?
- Heating of the planet?
- Rising sea levels?
- Global Warming?



<https://science.nasa.gov/climate-change/what-is-climate-change/>

<https://www.un.org/en/climatechange/science/key-findings>

What is the difference between climate, and weather?

- **Weather** refers to atmospheric conditions that:
 - occur locally over short periods of time
 - from minutes to hours or days.
- **Climate**, on the other hand, refers to:
 - the long-term (usually at least 30 years) regional or even global average



Pixabay



<https://science.nasa.gov/climate-change/what-is-climate-change/>

Author/Source: RavensfieldB
<https://www.youtube.com/watch?v=c7M3PSpsbqo>

What is Climate Change?

- A long-term change in the average weather patterns
- Defines earth's local, regional and global climates.
- These changes have a broad range of observed **effects**
- These **effects** are used synonymous with the term.



<https://science.nasa.gov/climate-change/what-is-climate-change/>

What is climate change?

- “Climate change” encompasses **(includes)** global warming
 - refers to the broader range of changes that are happening to our planet.



What is global warming?

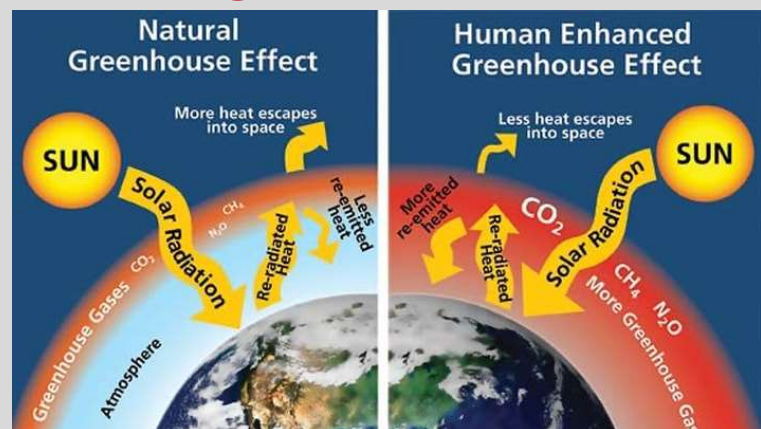
- **Global warming** is the long-term heating of Earth's surface
 - Since the pre-industrial period (between 1850 and 1900)
 - This term is not interchangeable with the term "climate change."



<https://science.nasa.gov/climate-change/what-is-climate-change/>

- Increasing greenhouse gas emissions from **human activity** act like a blanket wrapped around the earth, trapping the sun's heat and raising temperatures.
 - CO_2 , CH_4 , N_2O , SF_6
- **Carbon dioxide and methane** are the main greenhouse gases that are causing climate change

What causes global warming?



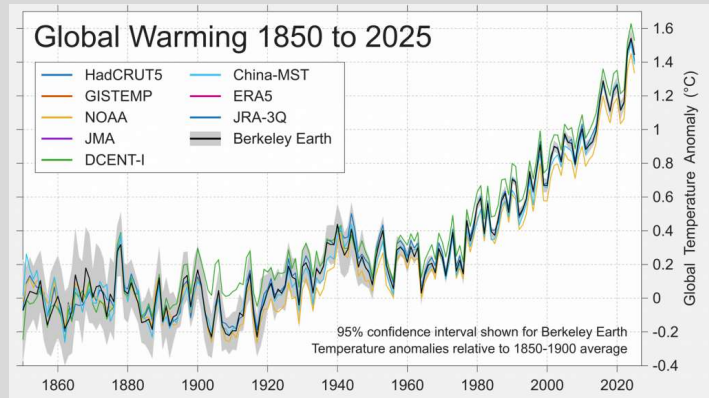
Source: W. Elder, NPS, EPA

Source: National Park Service -

<https://www.nps.gov/goga/learn/nature/climate-change-causes.htm>.

What is global warming?

- 2020 = 1.02°C above the 20th-century average
- 2024 = 1.28°C above the 20th-century average
- 2024 = 1.46°C above the pre-industrial average (1850 – 1900) and the world's warmest year since 1850
- 2025 Berkeley estimate = 1.44°C above the pre-industrial average (1850 – 1900)



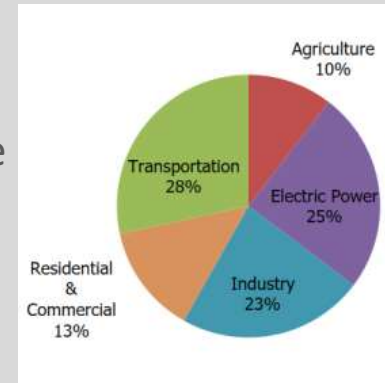
<https://berkeleyearth.org/global-temperature-report-for-2025/>

<https://www.climate.gov/news-features/understanding-climate/climate-change-global-temperature>

What are the causes climate change?

- **Human activities** causing **air pollution (greenhouse gases)** have been the **main drivers/causes** of climate change
 - burning fossil fuels for transportation
 - clearing land and forests, release CO₂
 - landfills for garbage are a source of methane
 - electric power production
 - industry burning fossil fuels
 - agriculture NO₂ emissions
 - livestock CH₄ emissions
 - human waste treatment
 - residential and commercial emissions
 - land use, land-use change, and forestry: a carbon “sink”

Total U.S. Greenhouse Gas Emissions by Economic Sector



<https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions#trends>

<https://www.epa.gov/ghgemissions/agriculture-sector-emissions>

What is the difference between climate change and global warming?

- Key concepts:

- 1. Climate change is **all** the side effects of global warming
- 2. Global warming is **one** symptom/side effect of human-caused climate change
- 3. Climate change was **caused naturally** throughout the planet's 4.54-billion-year history.
 - long cold periods ("ice ages") and warm periods ("interglacials") on 100,000-year cycles for at least the last million years.

<https://science.nasa.gov/climate-change/faq/whats-the-difference-between-climate-change-and-global-warming/>

<https://www.climate.gov/news-features/climate-qa/whats-difference-between-global-warming-and-climate-change>

What is the difference between climate change and global warming?

- Key concepts

- 3. Global warming **is not the only** side effect of excess heat absorbed by greenhouse gases.
- 4. If climate change is the **illness**, global warming is a **symptom**
 - Norovirus is the illness
 - Vomiting, stomach cramps, and diarrhea are the symptoms

<https://www.globalgiving.org/learn/cost-to-end-climate-change/> <https://www.climate.gov/news-features/climate-qa/whats-difference-between-global-warming-and-climate-change>

<https://www.ideastream.org/environment-energy/2023-08-28/climate-question-whats-the-difference-between-global-warming-and-climate-change>

What is the difference between climate change and global warming?

Causes and Effects of Climate Change

Causes

- Rapid industrialization
- Energy use
- Agricultural practices
- Deforestation
- Consumer practices
- Livestock
- Transport
- Resource extraction
- Pollution




Effects

- Rising temperatures
- Rising sea levels
- Unpredictable weather patterns
- Increase in extreme weather events
- Land degradation
- Loss of wildlife and biodiversity

What are the social impacts of climate change?

Displaced people. Poverty. Loss of livelihood. Hunger. Malnutrition.
Increased risk of diseases. Global food and water shortages.

 GlobalGiving

<https://www.climate.gov/news-features/climate-qa/whats-difference-between-global-warming-and-climate-change>

<https://www.globalgiving.org/learn/cost-to-end-climate-change/>

What are the effects of climate change?

ONEARTHONECHANCE.COM

10 EFFECTS OF CLIMATE CHANGE



Rising Temperatures

Drought

Melting Ice

Changes to Ecosystems

Extreme Weather

Sea Level Rise

Wildfires

Poor Air Quality

Wildfires

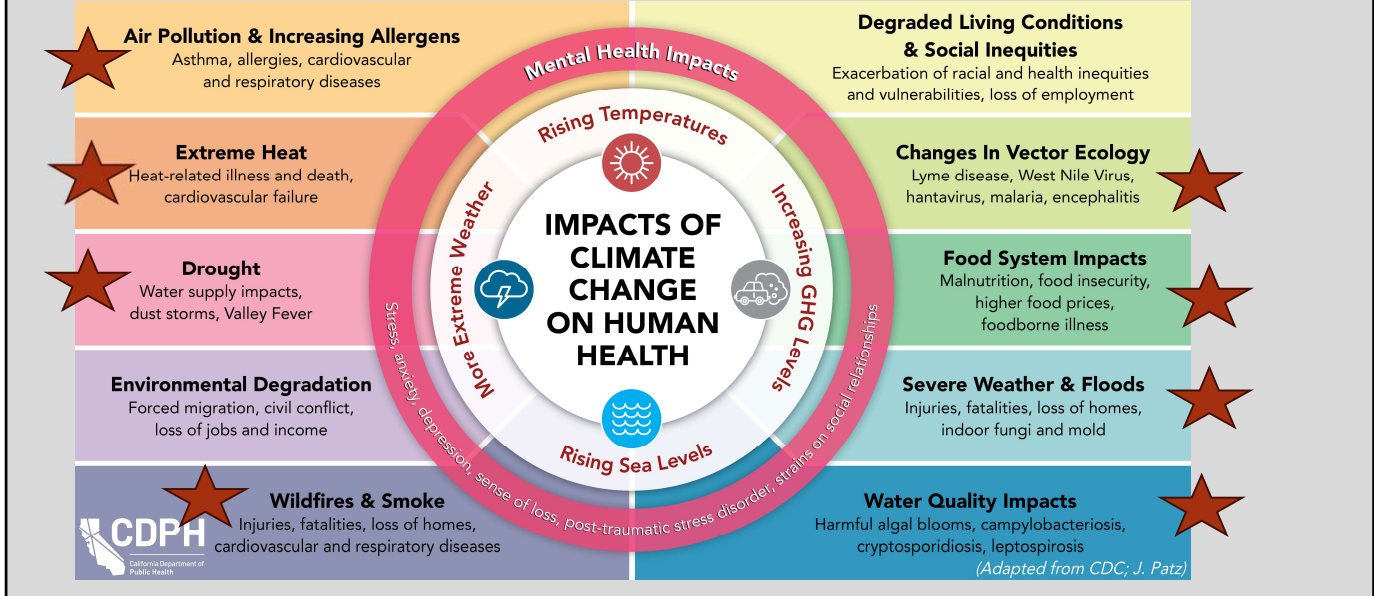
Health Risks

Economic Impacts

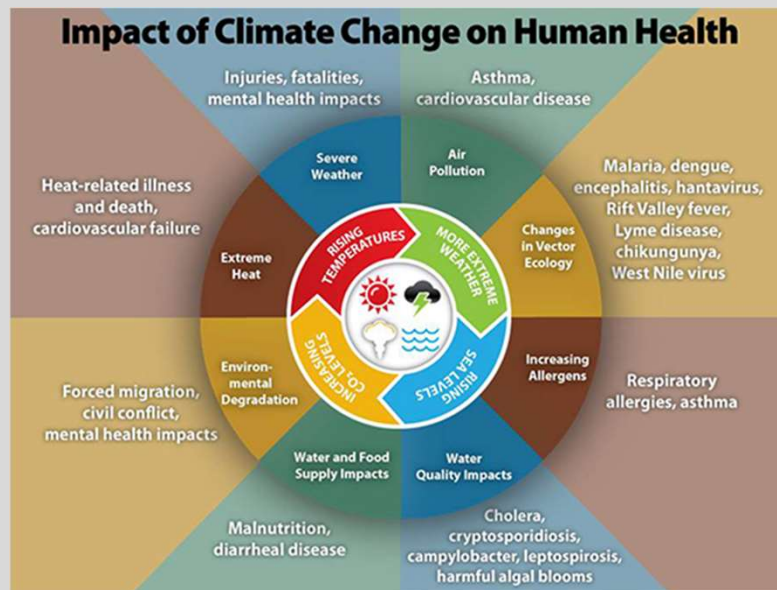
Poor Air Quality

Share link:
<https://www.oneearthonechance.com/>

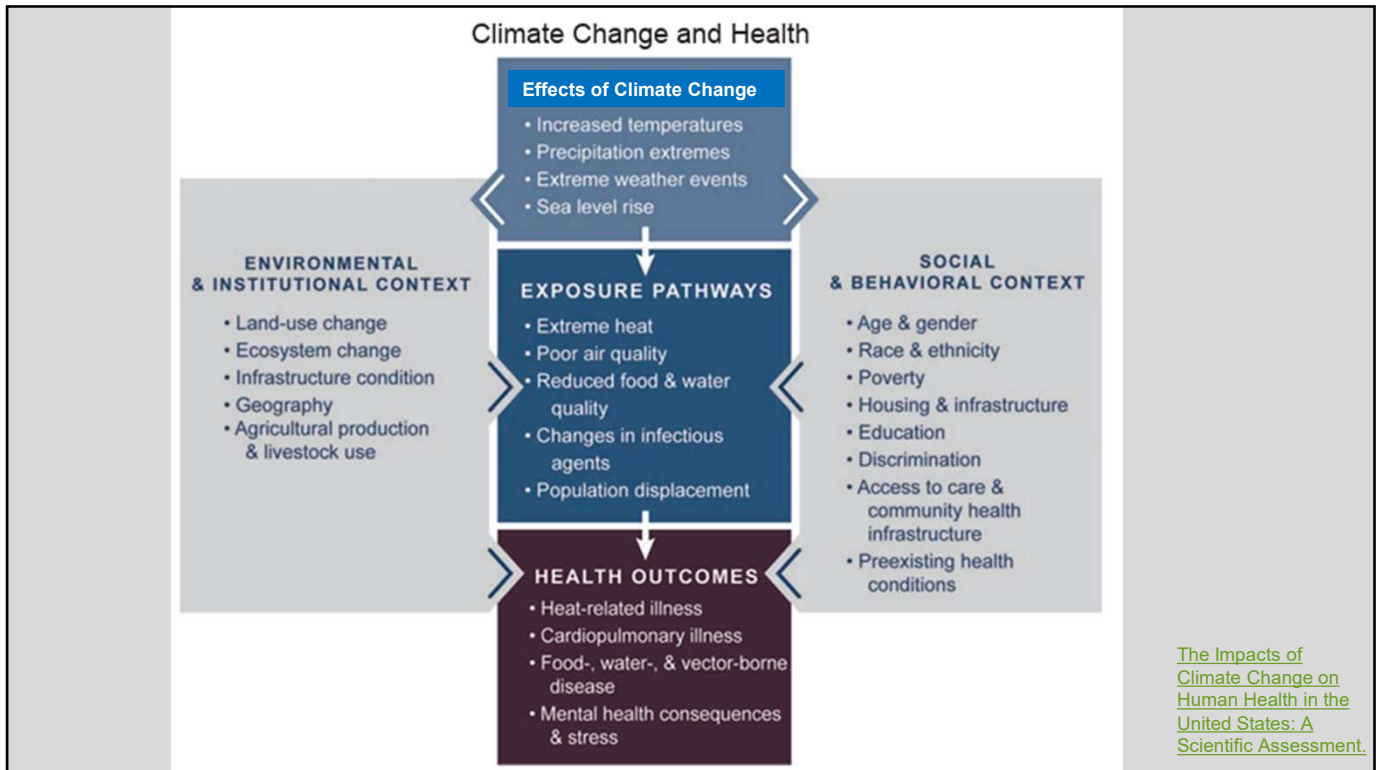
What are the impacts to human health from these effects?



What are the effects of climate change impacting human health ?



Source: CDC Climate Effects on Health



Climate change impacts to human health: Air Quality



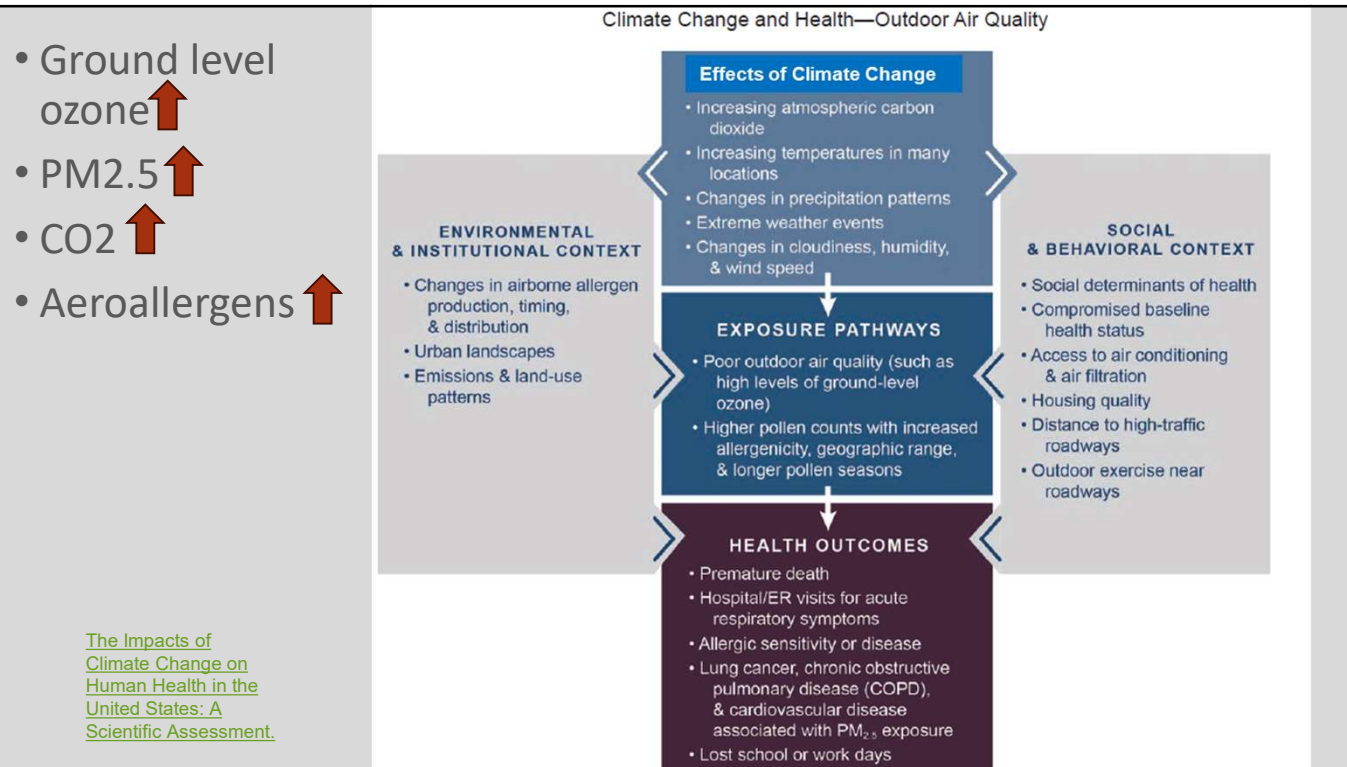
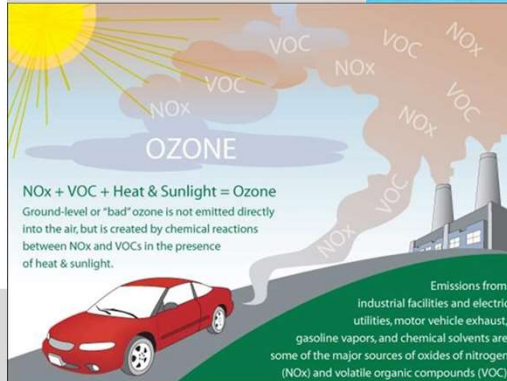
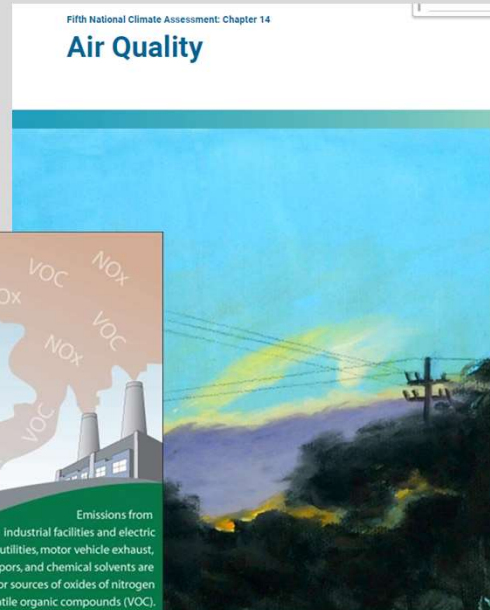
[Fifth National Climate Assessment](#), 2023

Climate change impacts to human health: Air Quality



Ragweed pollen frequently triggers hay fever and asthma episodes during the fall.

Fifth National Climate Assessment, 2023

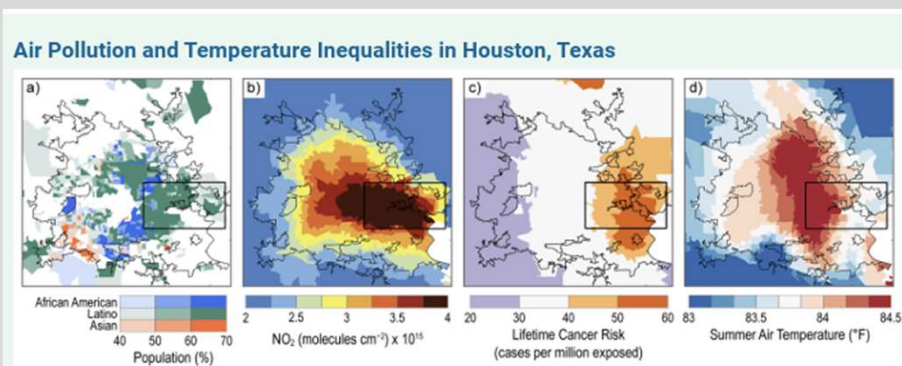


Climate change impacts to human health: Air Quality



Fifth National Climate Assessment, 2023

Climate change impacts to human health: Air Quality



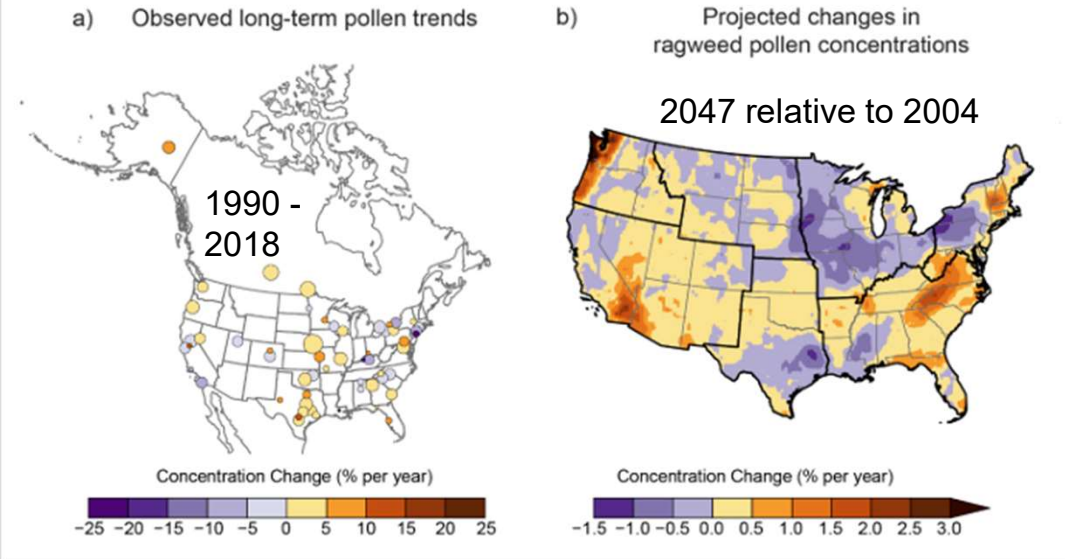
Air pollution, its health impacts, and temperatures are unequally distributed across Houston, Texas.

Figure 14.5. Air quality and temperatures vary across Houston, Texas (urbanized area outlined in black). (a) For each neighborhood, the largest racial or ethnic group is shown: African American (blue), Latino (green), and Asian (orange). Higher-than-average levels of (b) nitrogen dioxide (NO_2 ; in 2019), (c) lifetime cancer risks associated with chronic air pollution exposure per million equally exposed people (2018), and (d) summer (June–August) air temperatures (2020) are found in neighborhoods that are primarily African American and Latino, especially those surrounding the Ship Channel (black box). There is variability in time and at very fine spatial scales that may not be captured here. Figure credit: University of Virginia, Columbia University, and Montana State University.

Fifth National Climate Assessment, 2023

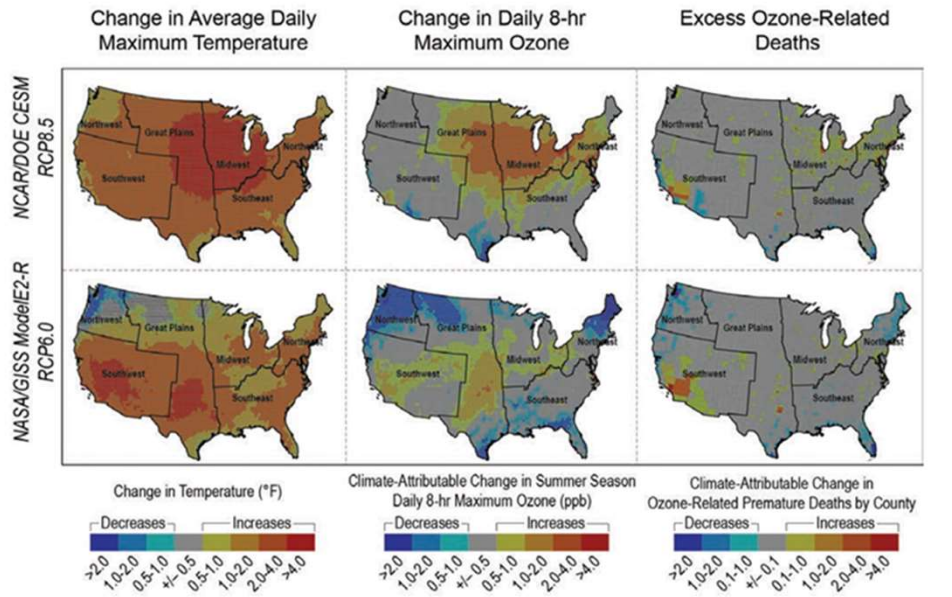
Climate Change Is Worsening Pollen Exposures and Adversely Impacting Health

Observed and Projected Pollen Changes Under Climate Change



[Fifth National Climate Assessment, 2023](#)

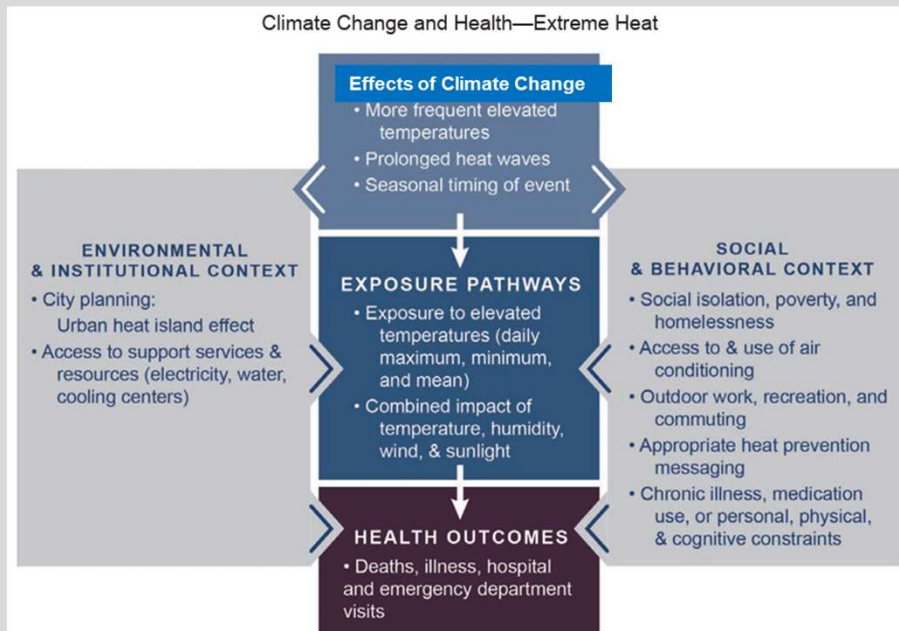
Projected Change in Temperature, Ozone, and Ozone-Related Premature Deaths in 2030



Fann, N., A.D. Lamson, S.C. Anenberg, K. Wesson, D. Risley, and B.J. Hubbell, 2012: Estimating the national public health burden associated with exposure to ambient PM2.5 and ozone. *Risk Analysis*, 32, 81-95. <http://dx.doi.org/10.1111/j.1539-6924.2011.01630.x>

[The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment.](#)

Climate change impacts to human health: Extreme Events



[The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment.](#)

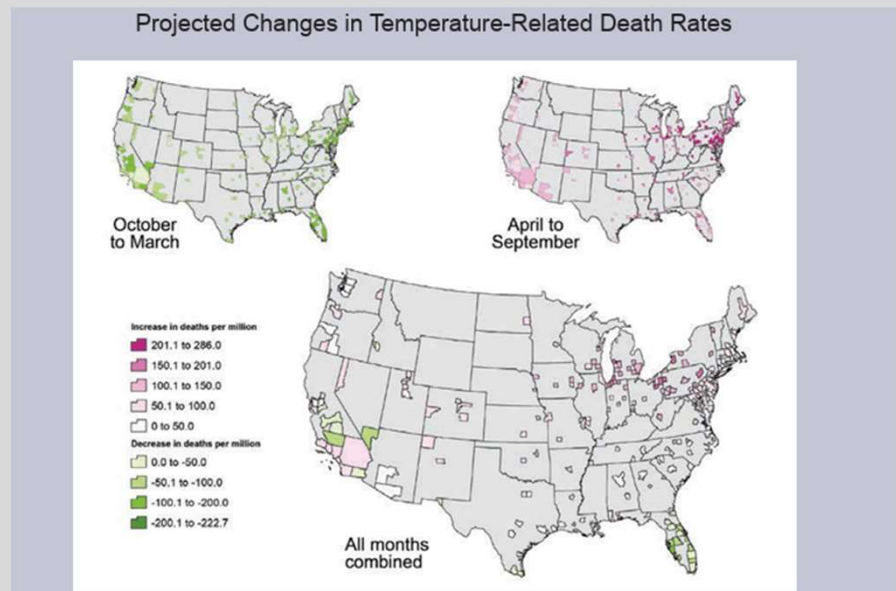
Climate change impacts to human health: Extreme Heat or Cold

- Loss of internal temperature control
 - Heat cramps, heat exhaustion, heatstroke, hyperthermia,
 - hypothermia and frostbite in the presence of extreme cold,
 - cardiovascular disease, respiratory disease, cerebrovascular disease,
 - diabetes-related conditions,
 - increased hospital admissions for cardiovascular, kidney, and respiratory disorders.
 - Adverse pregnancy outcomes
 - Electrolyte imbalance

[The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment.](#)

Comparing results for 2100 to those for a 1990 baseline period in 209 U.S. cities.

Schwartz, J.D., M. Lee, P.L. Kinney, S. Yang, D. Mills, M. Sarofim, R. Jones, R. Streever, A. St. Juliana, J. Peers, and R.M. Horton, 2015: Projections of temperature-attributable premature deaths in 209 U.S. cities using a cluster-based Poisson approach. *Environmental Health*, 14. <http://dx.doi.org/10.1186/s12940-015-0071-2>



[Fifth National Climate Assessment, 2023](#)

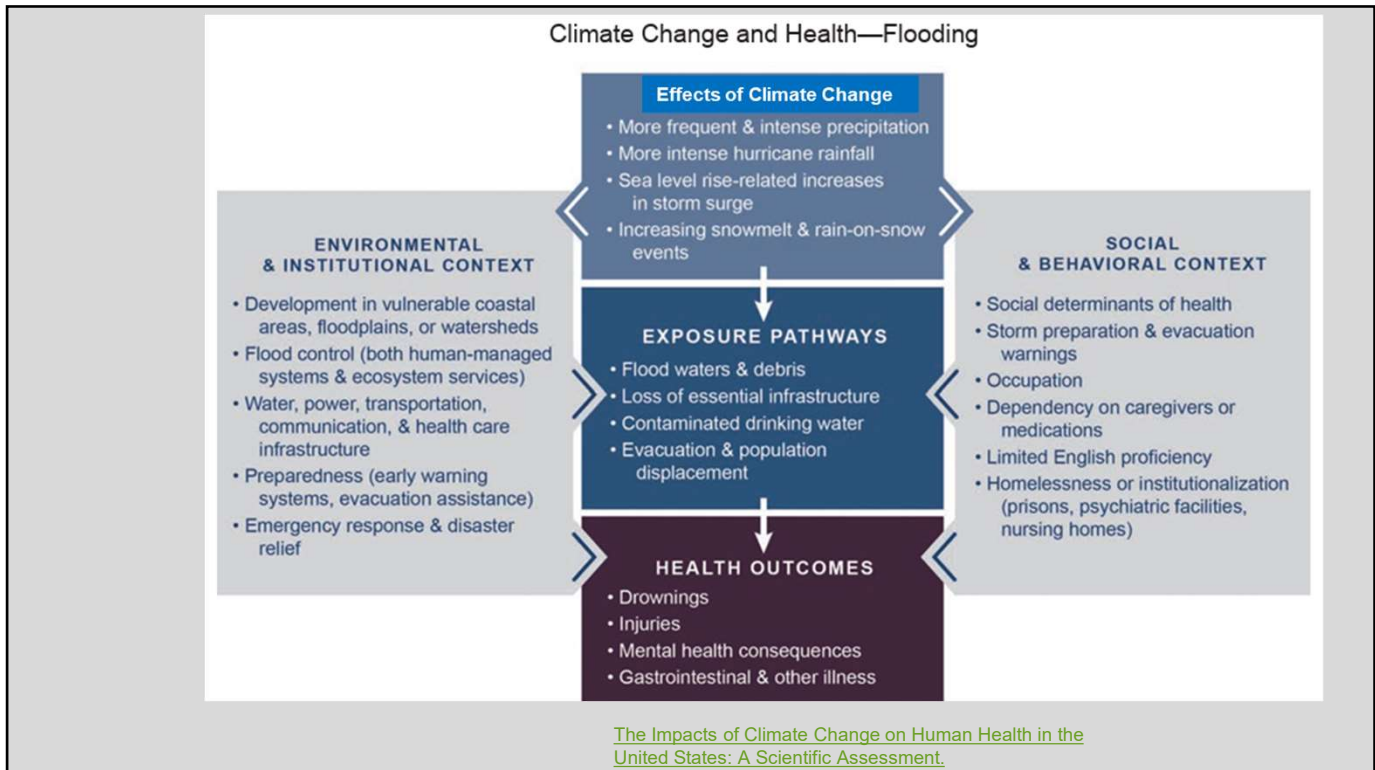
[The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment.](#)

Climate change impacts to human health: Extreme Events

- Flooding Related to Extreme Precipitation, Hurricanes, Coastal Storms, and Winter Storms and Severe Thunderstorms
 - Traumatic injury and death (drowning)
 - Mental health impacts
 - Preterm birth and low birth weight
 - Infrastructure disruptions and post-event disease spread
 - Carbon monoxide poisoning related to power outages
 - Hypothermia and frostbite

[Fifth National Climate Assessment, 2023](#)

[The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment.](#)



Climate change impacts to human health: Extreme Events

- Droughts
 - Heat related mortality and morbidity
 - Reduced water quality and quantity
 - Respiratory impacts related to reduced air quality
 - Mental health impacts for rural farmers
- Wildfires
 - Smoke inhalation
 - Burns and other traumatic injury, and adverse reproductive outcomes
 - Asthma exacerbations
 - Mental health impacts

[Fifth National Climate Assessment, 2023](#)

[The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment.](#)

Climate change impacts to human health: Climate – Sensitive Infectious Diseases

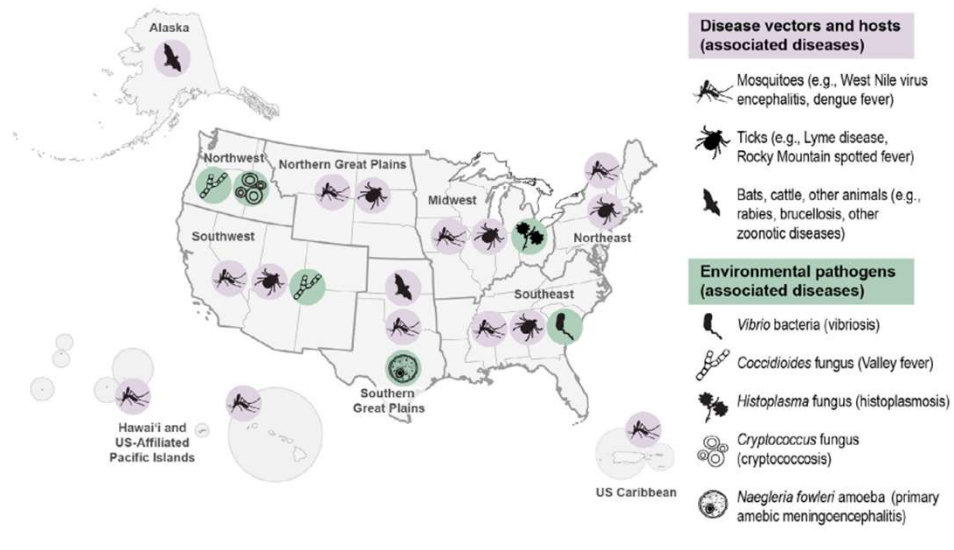


Fifth National
Climate
Assessment, 2023

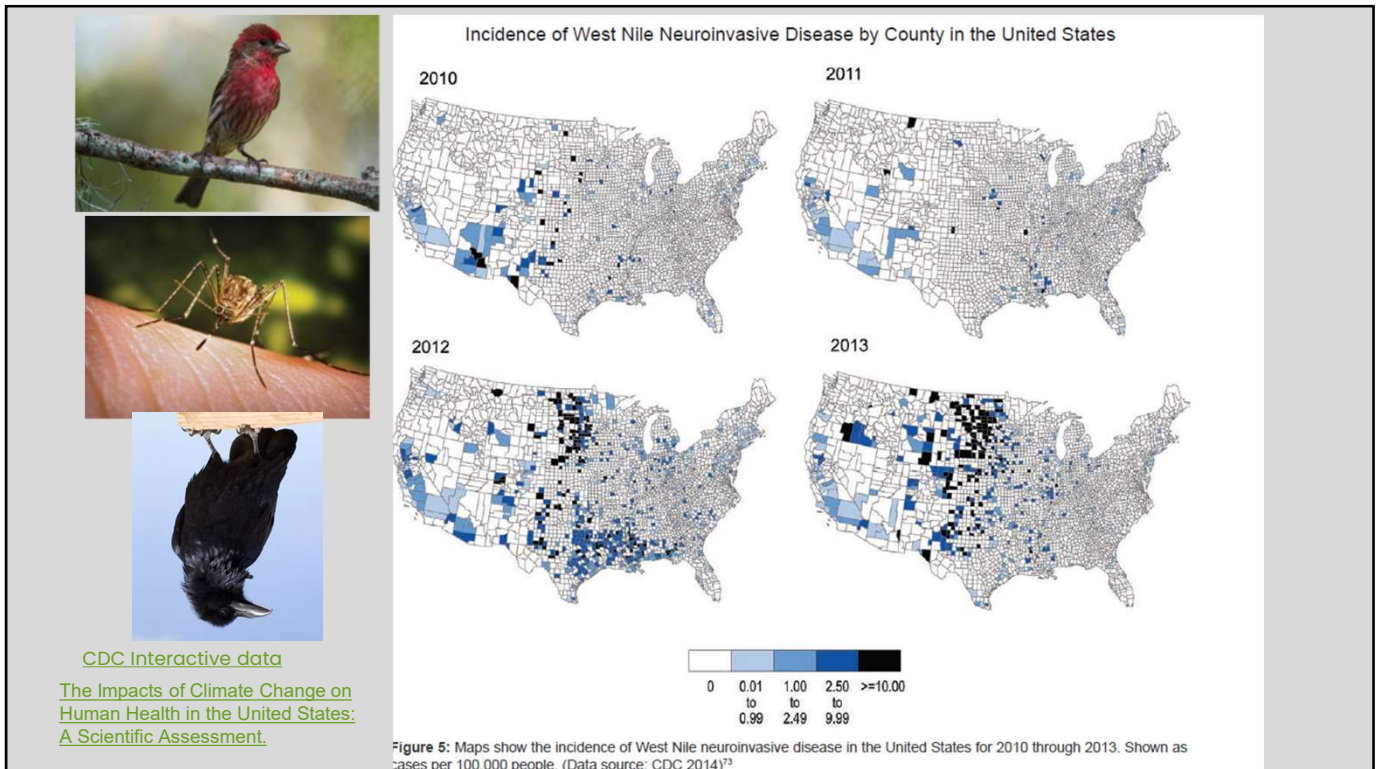
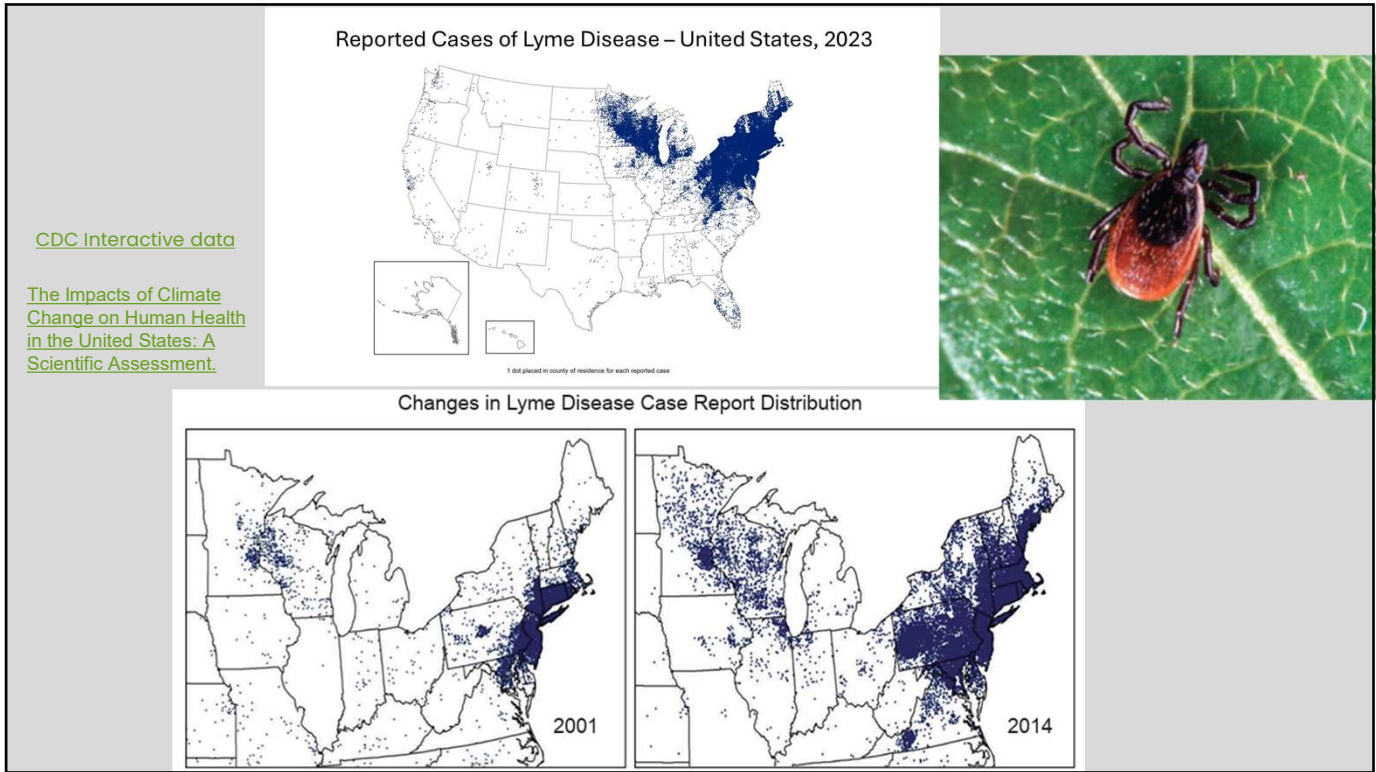
[The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment.](#)

Climate change impacts to human health: Climate – Sensitive Infectious Diseases

Regional Examples of Climate-Sensitive Infectious Diseases



Fifth National
Climate
Assessment, 2023



What are the effects of climate change impacting mental health?

Climate change and mental health

Climate change affects mental health both directly and indirectly.



Centre for
Climate and
Health
Security

Direct impacts, e.g.

- exposure to flooding
- exposure to extreme heat
- stress

Indirect impacts, e.g.

- vulnerabilities due to food insecurity
- housing instability
- eco-anxiety

<https://www.gov.uk/guidance/overview-of-the-climate-change-and-mental-health-report>

What are the effects of climate change impacting mental health?

Those most at risk:



Children and young people



Socioeconomically disadvantaged groups



Some occupational groups, e.g. farmers and front line responders



People with mental or physical health conditions

Key messages for policymakers:

1

Climate change is impacting mental health

- largely through extreme weather
- impacts include suicide, depression and anxiety
- more research is needed but impacts are likely to worsen as the climate warms further

2

There is evidence for interventions to protect population health

- both individual and community resilience is needed
- taking part in environmental action can help
- targeted support for communities affected by adverse weather can be beneficial

3

There is more that can be done to protect our mental health

- long-term and acute health impacts should be considered
- more research is needed to evaluate interventions
- cost effective analyses are needed

<https://www.gov.uk/guidance/overview-of-the-climate-change-and-mental-health-report>

What are the effects of climate change impacting mental health ?



Addressing the Climate Crisis An Action Plan for Psychologists

REPORT OF THE APA TASK FORCE ON CLIMATE CHANGE

APPROVED BY APA COUNCIL OF REPRESENTATIVES, FEBRUARY 2022



<https://www.apa.org/science/about/publications/climate-crisis-action-plan.pdf>

CLIMATE CHANGE MENTAL HEALTH FACT

People with mental health conditions are more likely to be affected by extreme weather and subsequent disruption in health services.

Psychiatric medications can interfere with a person's ability to regulate heat and their awareness that their body temperature is rising, which is associated with injury and death.

APHA AMERICAN PUBLIC HEALTH ASSOCIATION
Climate Change & Mental Health
AMERICAN PSYCHIATRIC ASSOCIATION

Source: American Psychiatric Association

What are the effects of climate change impacting mental health?

CLIMATE CHANGE MENTAL HEALTH FACT

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Climate Change & Mental Health

CLIMATE CHANGE MENTAL HEALTH FACT

Extreme heat affects more than just your body.

Exposure to extreme heat may lead to increases in hospital and emergency room admissions for people with mental health or psychiatric conditions, an increase in suicide, and increased use of alcohol to cope with stress.



Climate Change & Mental Health

CLIMATE CHANGE MENTAL HEALTH FACT

Protecting our climate isn't just good for our bodies, it's good for our brains too.



Spending more time in nature has been shown to lower stress levels and reduce stress-related illness.



Climate Change & Mental Health



Source: American Psychiatric Association

What are the implications for clinical practice? Climate and Health History-Taking

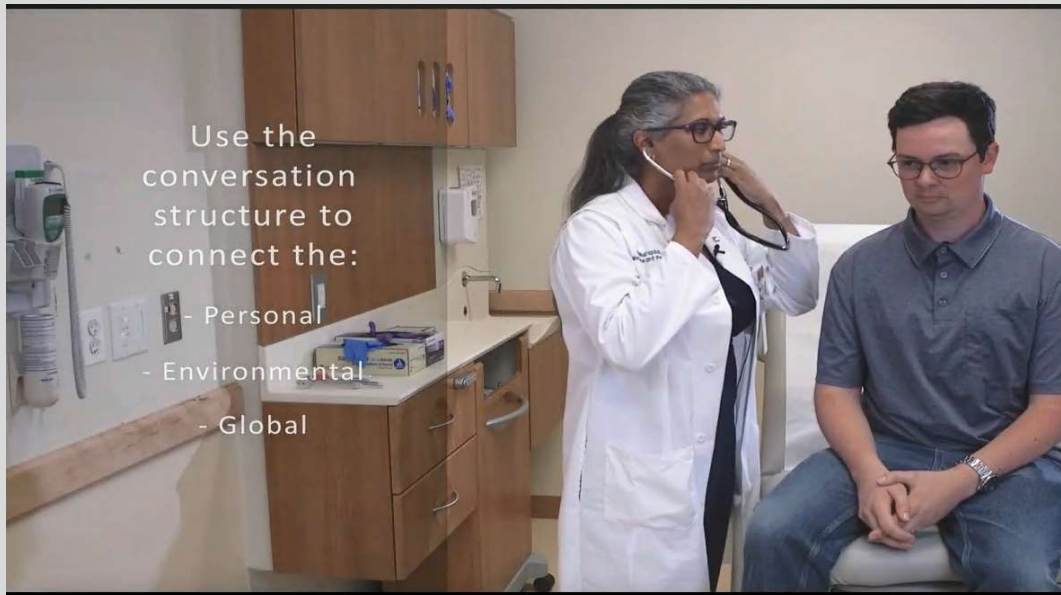
- Environmental Exposure: Where does the patient live and work? What are typical daily temperatures? Is there access to cooling (e.g., shade, fans, air conditioning)?
- Occupation: Does their work involve heat-exposed outdoor (e.g., agriculture, construction) labor, or indoor (e.g., manufacturing plants, commercial kitchens) labor?
- Housing Conditions: Is their home constructed to withstand extreme heat or flooding? What materials are used?
- Animal and Vector Exposure: Are there animals nearby (e.g., livestock, domestic pets) that may also experience heat-related stress or contribute to zoonotic risks?

<https://pmc.ncbi.nlm.nih.gov/articles/PMC12785772/#abstract1>

What are the implications for clinical practice? Climate and Health History-Taking

- Social Determinants: Does the client have reliable transportation, access to clean water, and economic stability to adapt to extreme weather events? Does the client have access to healthy and affordable food, particularly during climate-related disruptions that affect supply chains and local markets?
- Health History: Are there pre-existing conditions (e.g., diabetes, hypertension, kidney disease), mental health conditions, pregnancy, and medications that increase susceptibility to heat or dehydration, such as diuretics, beta-blockers, antipsychotic medications, and certain stimulants?

Video - How to discuss the health impacts of climate change with patients in a clinical setting



Use the conversation structure to connect the:

- Personal
- Environmental
- Global

Source: Minnesota Department of Health

What are the implications for clinical practice?

► J Eval Clin Pract. 2024 Jul 30;31(1):e14103. doi: [10.1111/jep.14103](https://doi.org/10.1111/jep.14103)

Climate change and the pivotal role of health professionals

[Patricia Huston](#)^{1,2,✉}

► Ochsner J. 2023 Spring;23(1):7-8. doi: [10.31486/toj.23.5033](https://doi.org/10.31486/toj.23.5033)

The Era of Climate Change Medicine—Challenges to Health Care Systems

[Kevin Conrad](#)¹

Climate Change and Health Systems: A Scoping Review of Health Professionals' Perceptions and Readiness for Action

by Vasileios Gkouliaveras^{1,*} , Stavros Kalogiannidis¹ , Dimitrios Kalfas^{1,*} , Apostolia Papaklonari²  and Stamatias Kotsas¹ 

¹ Department of Business Administration, School of Economic Sciences, University of Western Macedonia, 51100 Grevena, Greece

² Pedagogical Department of Primary Education, School of Social Sciences and Humanities, University of Western Macedonia, 53100 Florina, Greece

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Climate 2026, 14(1), 12; <https://doi.org/10.3390/cli14010012>

**How will climate change affect
your clinical practice?**



Image by [geralt](#) from [Pixabay](#)