



Climate Change and Its Impact on Patient Health and the Health Care Ecosystem

CLIMATE CHANGE RESEARCH BRIEF

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EXECUTIVE SUMMARY

Poor air quality, heat waves, wildfires, drought, flooding, and extreme storms are adverse environmental catastrophes. These climatic events can have severe long-term health effects on chronic conditions, such as cardiovascular disease, kidney disease, respiratory disease, diabetes, and obesity. Addressing these conditions is often left to the discretion of underfunded state and territorial public health agencies who struggle to meet health infrastructure and community needs. Historically underrepresented racial and ethnic (HURE) populations with chronic disease also face difficult social and economic choices, which are exacerbated by perilous climatic events. In patient-focused research, climate is a factor not often considered when studying patient experience, which gives patient-centered organizations such as the National Health Council (NHC) an opportunity to spearhead novel research on cross-cutting climate issues.

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1 CLIMATE CHANGE AND NEGATIVE EFFECTS ON CHRONIC HEALTH OUTCOMES.

Weather-related environmental exposures are intensified by climate change. These in turn have long-term repercussions on various health outcomes, especially for people with chronic conditions. For example, extreme heat events are dangerous for both biological effects and changes in the environment people live in. A longitudinal study showed that heat strokes put patients at 17% higher risk for cardiovascular complications.¹ Other chronic conditions, such as kidney function can be impaired by fluctuating temperatures, leading to acute and chronic kidney disease, kidney stones, and renal disease.²⁻⁴

“Adaptation and mitigation of climate change is not a single disease problem and will take collaboration to **tackle the issues from a system perspective.**”

Additionally, extreme heat can also affect insulin activity in the body, which worsens and increases the incidence of type 2 diabetes.⁵⁻⁶ In a U.S. nationwide study, pregnant people exposed to extreme heat showed a projected increase of congenital heart disease in unborn children up to 34% in certain regions.⁷ Furthermore, higher ambient temperatures can intensify allergies through prolonged pollen seasons that can worsen the air quality in addition to pollutants and greenhouse gas emissions (GHG).⁸ As one of the more measurable and well-studied climatic effects, heat plays a large role in how bodies function. Translating this research is important to educate patients so they understand the risks and can properly account for heat when managing their health.

Poor air quality has severe consequences for chronic diseases. In 2019, a global increase in pediatric asthma rose to 64% in urban areas due to air pollutants

produced by human-made sources known as nitrous dioxide (NO₂).⁹ Due to the increase in the intensity of wildfires, high amounts of pollutants such as fine particulate matter (PM) are produced that can travel over long distances in smoke. When ingested or inhaled, PM can inflame and damage cells, putting people at higher risk for stroke, obesity, cardiovascular disease, and chronic obstructive pulmonary disease.^{10,11} The various sources of pollutants and GHG shift due to both environmental and human factors, which means there is a consistent need for evidence-based research to study how chronic diseases are affected and change over time.

While heat and air quality have notably direct biological effects, other catastrophic weather events, like hurricanes, have increased in frequency with indirect health consequences. After two consecutive level 5 hurricanes struck Puerto Rico in 2017, the rate of diabetes and heart disease rose to 7% higher than the U.S. national averages.¹² Dietary chronic diseases (i.e. obesity, diabetes, heart disease, and cancer) are affected when heat, storms, droughts, floods, and sea levels rise and consequently damage farms and crops, interfering with a patient’s ability to effectively manage dietary lifestyle changes.¹³ In a scoping review on patient experience of populations in the circumpolar regions, climate change was mentioned by Indigenous communities as a factor that changes animal migratory patterns, making it difficult to hunt food and maintain diabetes treatment plans.¹⁴ These are just several examples of the various environmental pathways (Figure 1) that worsen chronic disease. Adaptation and mitigation of climate change is not a single disease problem and will take collaboration to tackle the issues from a system perspective.¹⁵



2 CLIMATE DISRUPTION OF THE HEALTH CARE ECOSYSTEM AND BARRIERS TO CARE FOR CHRONIC DISEASE POPULATIONS.

Over the years, external climate factors have consequently put stress on the health care ecosystem, creating unique challenges for chronic disease populations in terms of the quality of long-term care and access to treatment. Physical and environmental disruptions damage the interactions between various systems of care (self-care, clinical care, public health, and health policy) and patients, providers, caregivers, communities, etc.¹⁶ Quality of care is decreased when supply chain disruptions hinder medication access, hospitals are over-crowded leading to depleted resources, and extreme heat or precipitation creates occupational hazards for medical staff to provide adequate services.¹⁷ In the aftermath of severe weather events, patient communities face numerous challenges. For instance, electrical power outages can be detrimental to the storage of medications and therapies that may need refrigeration, such as insulin. Additionally, transportation for at-home care and treatments may be impeded due to torrential rain and floods.¹⁸ Despite federal initiatives from the Centers for Disease Control and Prevention (CDC) to assess, address, develop, and implement climate action plans, underfunded state and territorial health departments lack the proper support to invest in climate change adaptation and mitigation activities such as strengthening transportation infrastructure.¹⁹ In an assessment of climate health, it was found that only 5.1% of the state departments felt that they had adequate knowledge to address health concerns resulting from climate change.²⁰ This lack of knowledge, structure, and support within the health care ecosystem will become increasingly more relevant. Partnerships between vulnerable communities and health entities will require the patient voice to ensure that these challenges and any rising issues are addressed.¹⁶



3 CLIMATE EFFECTS AND HEALTH INEQUITIES WITHIN CHRONIC DISEASE POPULATIONS.

Within the chronic disease population, consequences of climate events are felt disproportionately among vulnerable populations such as HURE, lower-income individuals, older adults, and children. In the 2022 publishing of the American Lung Association (ALA) annual [State of the Air](#) report, it was found that HURE communities were 61% more likely to live in counties with at least one air pollutant.²¹ In the U.S., heat waves exacerbate birth outcome disparities. According to 2020 U.S. data, non-Hispanic Black babies were born preterm 50% more often than non-Hispanic White babies, a birth outcome that is attributed to chronic cardiometabolic disorders later in life.^{22,23} Older adults are at higher risk during heat events, leading to age-related chronic diseases such as cardiac dysfunction.⁶

"HURE communities were 61% more likely to live in counties with at least one air pollutant."

A 2022 systematic review on climate-related health effects and racial disparities found that adults and children of color are disproportionately affected with increased negative mental health, respiratory, and cardiovascular health outcomes.²⁴ (Figure 2) The most common climate and weather-related impacts studied were temperature, hurricanes, and floods while there was less literature on wildfires and droughts.²⁴ In addition, environmental destruction perpetuates economic disparities for people of low-income status. For example, damage from hurricanes and floods primarily affect non-White neighborhoods and are associated with higher rates of unemployment and poverty where limited finances inhibit preparation, recovery, and prevent people from moving away.²⁴ Although there have been strides towards inclusion of medications for chronic disease during emergency response, these environmental inequities require a more unified front for patient-focused organizations to take a stand to mitigate the severity of climate impact on the health ecosystem in the near and long-term future.¹⁷

4 THERE IS A KNOWLEDGE GAP ON THE ROLE OF CLIMATE IN THE PATIENT EXPERIENCE.

Literature on climate and health has limited focus on lived patient experience of chronic disease populations, and patient-centered organizations can help fill that gap. Some patient groups such as the [Asthma and Allergy Foundation of America](#) and the [American Lung Association](#) have extensive research and accessible patient education initiatives dedicated to climate change and its effect on respiratory disease. In a systematic mapping of global climate and health literature, it was noted that the connection between chronic disease and climate is a growing topic of research.²⁵ However, the research is mainly focused on impact of climate hazards and patient engagement rather than adaptation, mitigation, or patient experience.²⁵ As seen in the previous sections, climate has

an increasing impact on the development and exacerbation of chronic disease, but few mentioned engaging with patients in the past, asking for diagnostics and measurements. Most literature mentions patient experience in the context of persuading health entities to use more patient voice out of social responsibility rather than conducting research and direct communication with patient groups on their thoughts or needs.²⁶ This knowledge gap is an opportunity for patient-centered organizations and multilevel stakeholders to work together and expand research on patient perspectives and how climate plays a role in living with a chronic disease or condition.



"Pregnant people exposed to extreme heat showed a **projected increase** of congenital heart disease in unborn children **up to 34%** in certain regions."

ROLE OF THE NATIONAL HEALTH COUNCIL

With the relevance of climate in both research and policy, the NHC, in partnership with its membership, will explore how climate change impacts health from a patient-focused perspective. Peripheral climate issues such as telehealth have been focused on in previous research and policy, which can benefit patient communities in accessibility to care and has a co-benefit of climate resilience.²⁷ The NHC supports the integration of climate-focused efforts in organizational activities to provide members with evidence-based information to encourage and engage in cross-cutting climate issues.

RECOMMENDATIONS FOR NHC MEMBERS

As a membership organization, the NHC promotes the advancement of patient-centered health policy as a way of improving health outcomes for patients across many issues and underscores the importance of science-based communication to counter climate change misinformation. Patient groups, advocates, researchers, and other health stakeholders play a pivotal role in the development and dissemination of resources to educate and engage policymakers on climate change and its adverse effect on health. Thus, the NHC has set forth the following recommendations at increasing levels of engagement:

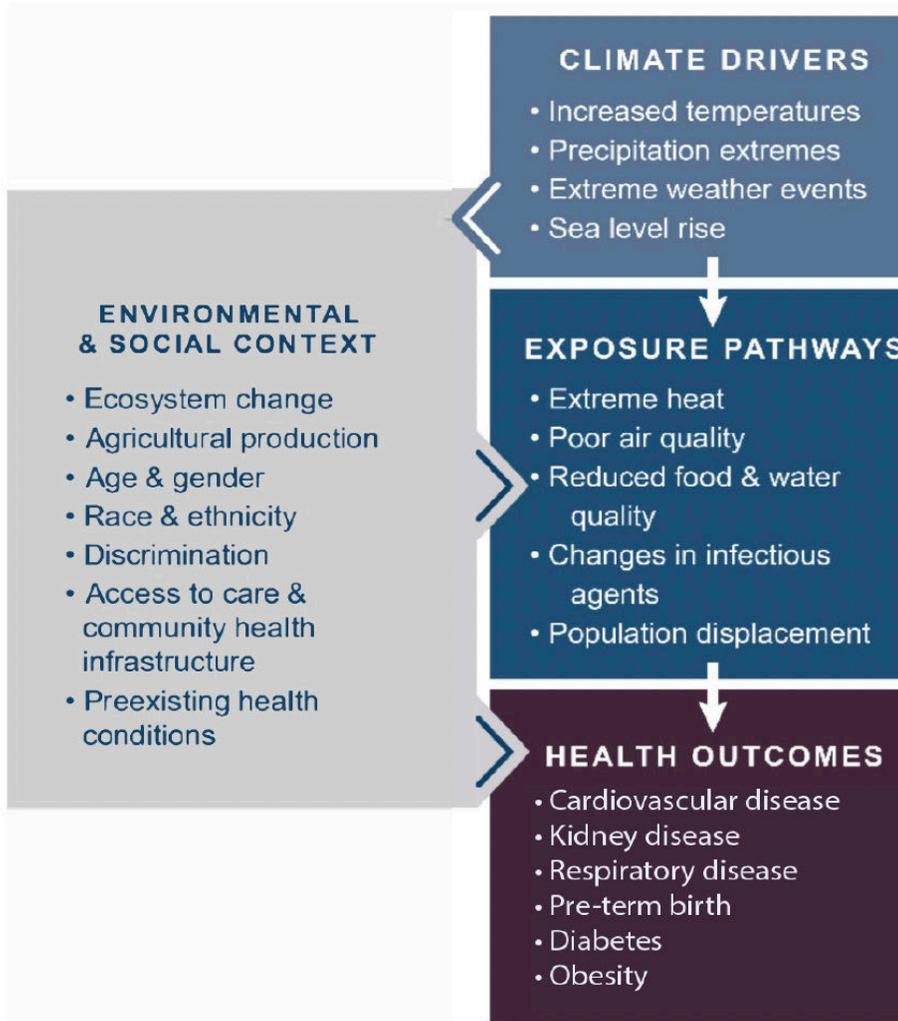
- Utilize newsletters and journals to stay up to date on new evidence-based research for communication on climate and health. As new peer-reviewed literature is published, health journalism and newsletters translate the science into engagement opportunities for patients to better understand how climate relates to health conditions.
- Connect with local environmental leaders and foster relationships with environmental organizations to support patient groups to act on environmental exposure pathways that affect certain chronic diseases and influence public policy.
- Advocate for inclusion of the patient voice in climate action plans. The CDC and the American Public Health Association have worked together on the Building Resilience Against Climate Effects (BRACE) initiative to help cities and states create action plans against regional climate and weather effects. This is an opportunity for organizations to engage in community/government partnerships that encourage patients to have a say in emergency and long-term climate response.



APPENDIX

Figure 1

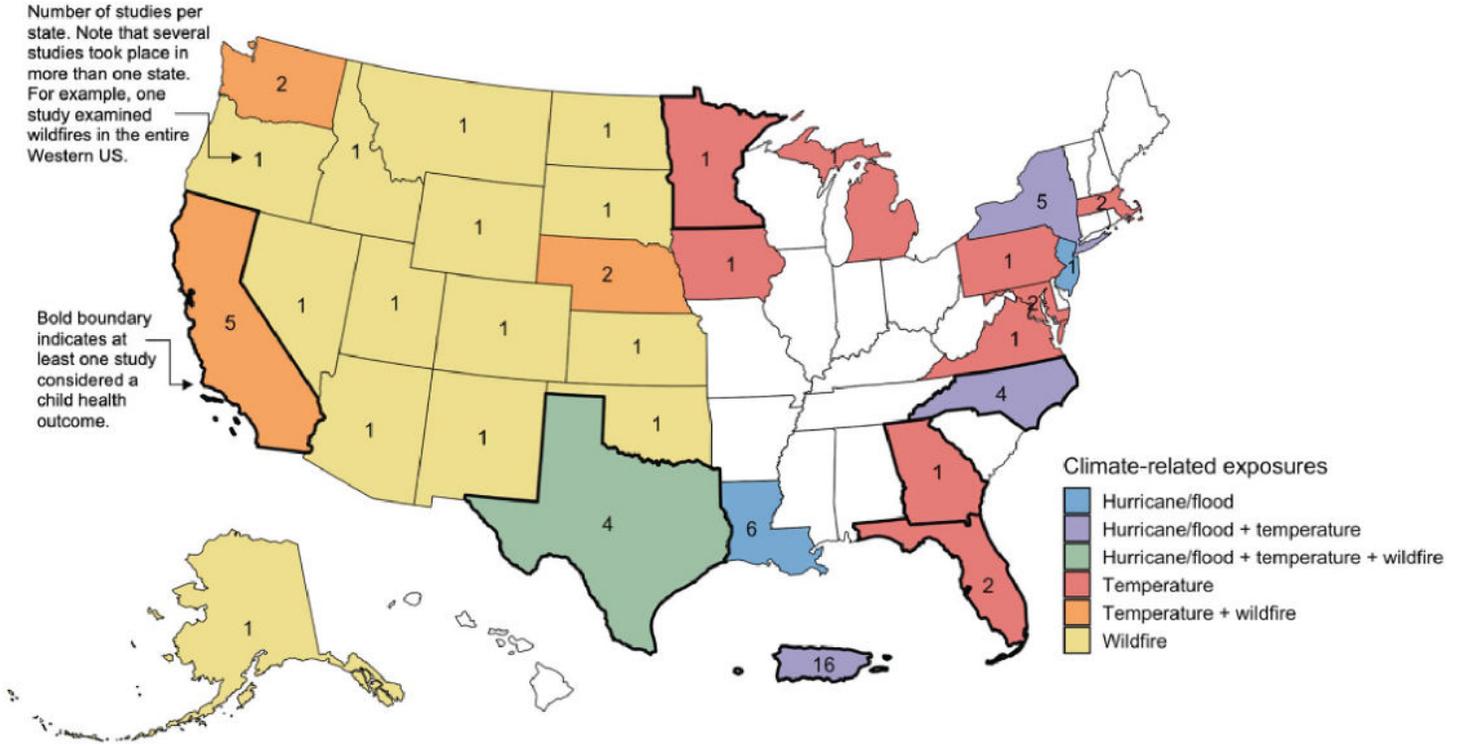
Link between climate and chronic health outcomes



Source: Adapted from Balbus et. al.

Figure 2

Studies on climate related health effects and racial disparities by state



Source: Adapted from Berberian et. al.

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REFERENCES

1. Wang JC, Chien WC, Chu P, Chung CH, Lin CY, Tsai SH. The association between heat stroke and subsequent cardiovascular diseases. *PLoS One*. 2019;14(2):e0211386. doi:10.1371/journal.pone.0211386
2. Barraclough KA, Blashki GA, Holt SG, Agar JWM. Climate change and kidney disease—threats and opportunities. *Kidney Int*. 2017;92(3):526-530. doi:10.1016/j.kint.2017.03.047
3. Sasai F, Roncal-Jimenez C, Rogers K, et al. Climate change and nephrology. *Nephrol Dial Transplant*. Published online September 2, 2021:gfab258. doi:10.1093/ndt/gfab258
4. He L, Xue B, Wang B, et al. Impact of high, low, and non-optimum temperatures on chronic kidney disease in a changing climate, 1990–2019: A global analysis. *Environ Res*. 2022;212:113172. doi:10.1016/j.envres.2022.113172
5. Natur S, Damri O, Agam G. The Effect of Global Warming on Complex Disorders (Mental Disorders, Primary Hypertension, and Type 2 Diabetes). *Int J Environ Res Public Health*. 2022;19(15):9398. doi:10.3390/ijerph19159398
6. Meade RD, Akerman AP, Notley SR, et al. Physiological factors characterizing heat-vulnerable older adults: A narrative review. *Environ Int*. 2020;144:105909. doi:10.1016/j.envint.2020.105909
7. Zhang W, Spero TL, Nolte CG, et al. Projected Changes in Maternal Heat Exposure During Early Pregnancy and the Associated Congenital Heart Defect Burden in the United States. *J Am Heart Assoc*. 2019;8(3):e010995. doi:10.1161/JAHA.118.010995
8. Pacheco SE, Guidos-Fogelbach G, Annesi-Maesano I, et al. Climate change and global issues in allergy and immunology. *J Allergy Clin Immunol*. 2021;148(6):1366-1377. doi:10.1016/j.jaci.2021.10.011
9. Achakulwisut P, Brauer M, Hystad P, Anenberg SC. Global, national, and urban burdens of paediatric asthma incidence attributable to ambient NO2 pollution: estimates from global datasets. *Lancet Planet Health*. 2019;3(4):e166-e178. doi:10.1016/S2542-5196(19)30046-4
10. Kim JB, Prunicki M, Haddad F, et al. Cumulative Lifetime Burden of Cardiovascular Disease From Early Exposure to Air Pollution. *J Am Heart Assoc*. 2020;9(6):e014944. doi:10.1161/JAHA.119.014944
11. Reid CE, Maestas MM. Wildfire smoke exposure under climate change: impact on respiratory health of affected communities. *Curr Opin Pulm Med*. 2019;25(2):179-187. doi:10.1097/MCP.0000000000000552
12. Chandra A, Marsh T, Madrigano J, et al. Health and Social Services in Puerto Rico Before and After Hurricane Maria. *Rand Health Q*. 2021;9(2):10.
13. Binns CW, Lee MK, Maycock B, Torheim LE, Nanishi K, Duong DTT. Climate Change, Food Supply, and Dietary Guidelines. *Annu Rev Public Health*. 2021;42(1):233-255. doi:10.1146/annurev-publhealth-012420-105044
14. Ingemann C, Hansen NF, Hansen NL, Jensen K, Larsen CVL, Chatwood S. Patient experience studies in the circumpolar region: a scoping review. *BMJ Open*. 2020;10(10):e042973. doi:10.1136/bmjopen-2020-042973

15. Balbus J, Crimmins A, Gamble JL, et al. Ch. 1: Introduction: Climate Change and Human Health. The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment. *U.S. Global Change Research Program*. 2016. doi:10.7930/JOVX0DFW
16. Boivin A, Dumez V, Castonguay G, Berkesse A. The Ecology of Engagement: Fostering cooperative efforts in health with patients and communities. *Health Expect*. 2022;25(5):2314-2327. doi:10.1111/hex.13571
17. Salas RN, Friend TH, Bernstein A, Jha AK. Adding A Climate Lens To Health Policy In The United States. *Health Aff (Millwood)*. 2020;39(12):2063-2070. doi:10.1377/hlthaff.2020.01352
18. Horn RB, Kirsch TD. Disaster Response 2.0: Noncommunicable Disease Essential Needs Still Unmet. *Am J Public Health*. 2018;108(S3):S202-S203. doi:10.2105/AJPH.2018.304604
19. Erret NA, Dolan K, Hartwell C, Vickery J, Hess JJ. Adapting by Their Bootstraps: State and Territorial Public Health Agencies Struggle to Meet the Mounting Challenge of Climate Change. *Am J Public Health*. 2022;112(10) doi:10.2105/AJPH.2022.307038
20. Mallen E, Joseph HA, McLaughlin M, et al. Overcoming Barriers to Successful Climate and Health Adaptation Practice: Notes from the Field. *Int J Environ Res Public Health*. 2022;19(12):7169. doi:10.3390/ijerph19127169
21. Liu J, Clark LP, Bechle MJ, et al. Disparities in Air Pollution Exposure in the United States by Race/Ethnicity and Income, 1990–2010. *Environ Health Perspect*. 2021;129(12):127005. doi:10.1289/EHP8584
22. Clougherty JE, Burriss HH. Rising global temperatures is likely to exacerbate persistent disparities in preterm birth. *Paediatr Perinat Epidemiol*. 2022;36(1):23-25. doi:10.1111/ppe.12852
23. de Mendonça ELSS, de Lima Macêna M, Bueno NB, de Oliveira ACM, Mello CS. Premature birth, low birth weight, small for gestational age and chronic non-communicable diseases in adult life: A systematic review with meta-analysis. *Early Hum Dev*. 2020;149:105154. doi:10.1016/j.earlhumdev.2020.105154
24. Berberian AG, Gonzalez DJX, Cushing LJ. Racial Disparities in Climate Change-Related Health Effects in the United States. *Curr Environ Health Rep*. 2022;9(3):451-464. doi:10.1007/s40572-022-00360-w
25. Berrang-Ford L, Sietsma AJ, Callaghan M, et al. Systematic mapping of global research on climate and health: a machine learning review. *Lancet Planet Health*. 2021;5(8):e514-e525. doi:10.1016/S2542-5196(21)00179-0
26. Johnson SS. Knowing Well, Being Well: well-being born of understanding: Creating Shared Value to Advance Racial Justice, Health Equity, and Meaningful Action on Climate Change. *Am J Health Promot*. 2022;36(6):1045-1067. doi:10.1177/08901171221092576
27. Calyx C, Weerasuriya R, White SJ. Embedding telehealth for sustainable health services linking Oceania. *Fam Pract*. Published online November 2, 2022:cmac123. doi:10.1093/fampra/cmac123



ABOUT THE NHC: Created by and for patient organizations more than 100 years ago, the National Health Council brings diverse organizations together to forge consensus and drive patient-centered health policy. We promote increased access to affordable, high-value, sustainable health care.

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