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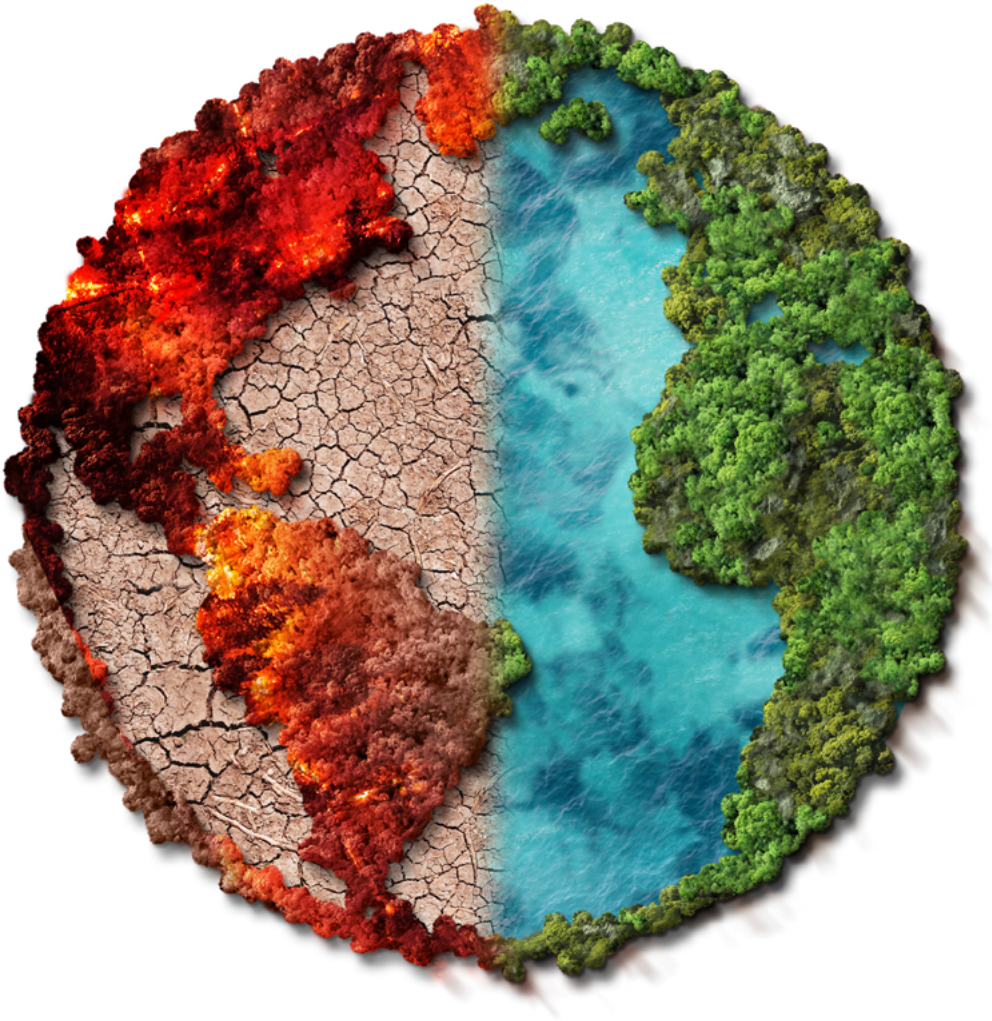

Uncovering the impact:
Climate change and its public health consequences during crises and disasters

March 2024

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Introduction

Health impacts from climate change are felt today and will likely continue to pose greater challenges over time. These impacts require urgent changes to how government agencies and communities prepare to protect the public's health. Climate change can be thought of as a threat multiplier, complicating response efforts and impacting health outcomes. It is also accelerating at an unprecedented rate,[1] and the human and economic toll of climate disasters is too costly to ignore. With global climate-related deaths reaching 2 million over the past 50 years, the impact of climate change is devastating.[2] From 2017 to 2021, every 18 days on average the United States experienced a billion-dollar disaster attributed to weather or climate events.[3] In the past year alone, the United States suffered more than $165 billion in costs from climate and weather disasters, and this number does not include costs of lives lost, the overall burden on health care, and the impact of displaced families due to climate.[4] Long-standing disinvested communities are hard hit by climate events, have the least infrastructure to mitigate their effects, and are often last to receive support to recover. However, there are actions that can be taken now to mitigate these impacts and better support affected communities across the United States.

Federal, state, and local health agencies should plan for the future by investing in solutions to help mitigate and adapt to the impacts of climate change on emergency preparedness and response efforts. The variety and increasing severity of climate-driven crises is expected to fundamentally transform the health care delivery system by changing the care people need, where they need it, and how they receive it. Increasing the rate at which communities adapt and build resilience to the impacts of climate change will require a whole-of-government approach, built on strong interagency and public-private partnerships and robust community engagement, with equity at the forefront. There is an urgent need to both mitigate the threat of climate change and adapt existing efforts to build resilience as climate-related disasters continue to affect the health care and public health system. To advance preparedness for climate change and its impact on emergency preparedness and response, agencies can consider the following strategies:

1. Understand and prepare for the cascading effects of climate change on disasters and public health emergencies
2. Apply an equity lens across the health care delivery system to disaster preparedness, response, and recovery
3. Cultivate trusted public-private partnerships and strengthen response coordination
4. Build operational, infrastructural, and community resilience to minimize disaster impacts on the delivery of public health and health care

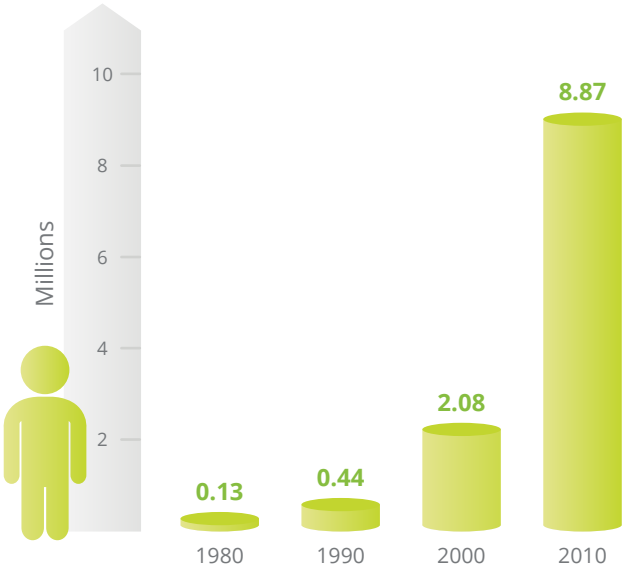
This paper will explore the intersection of climate change and emergency preparedness and response, highlighting prioritized actions that federal, state, and local health agencies can take to adapt and build resilience to climate challenges. At a time when the United States is faced with many convergent health challenges, our paper aims to highlight the need for action, as well as the steps and processes to make a positive impact on health outcomes.

Understand and prepare for the cascading effects of climate change on disasters and public health emergencies

The frequency and severity of climate disasters have dramatically increased over the past 10 years, including events such as drought, flooding, tropical cyclones, hurricanes, and wildfires. According to the World Meteorological Organization, "climate change has helped drive a fivefold increase in the number of weather-related disasters in the last 50 years."[5] These record-breaking hurricanes, wildfires, and heat waves are devastating communities throughout the United States on an increasingly frequent and catastrophic basis, "challeng[ing] response and recovery operations, strain[ing] surge capacity, and lead[ing] to competition for resources."[6] Beyond the economic toll, weather-related disasters have resulted in more than 16,000 deaths in the United States over the past 40 years.[7]

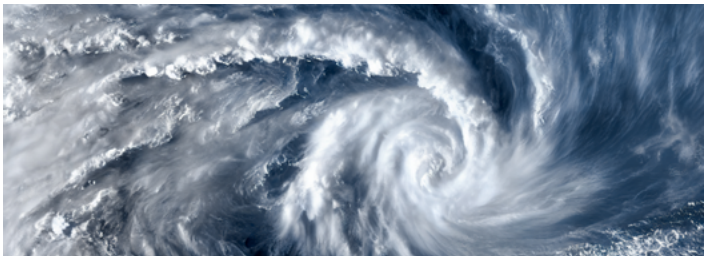
Figure 1 – Decadal average of annual number of people affected by disasters in the United States

Decadal figures are measured as the annual average over the subsequent 10-year period. Disasters include all geophysical, meteorological, and climate events including earthquakes, volcanic activity, landslides, drought, wildfires, storms, and flooding. The total number of people affected is the sum of those injured, requiring assistance and permanent or temporary housing.



Source: Our World in Data based on EM-DAT, CRED/UCLouvain, Brussels, Belgium www.emdat.be (D. Guha-Sapir)

Note: Decadal figures are measured as the annual average over the subsequent 10-year period. This means figures for 1980 represent the average from 1980 to 1989; 1990 is the average from 1990 to 1999, etc.



As the frequency of disasters increases, simultaneous disasters have also grown more common.[8] COVID-19 demonstrated the reality that areas can experience a confluence of disasters, with the pandemic coinciding with multiple natural disasters.[9] For example, in August 2021, Hurricane Ida caused crippling destruction and flooding in Louisiana and Mississippi. With close to 4,000 people hospitalized for COVID-19 at the time, the hurricane put additional pressure on a strained health care system.[10] In the coming years, this issue will likely only worsen. This not only affects government agencies coordinating response efforts, but also involves individual health care facilities and organizations. Concurrent disasters also have compounding effects on the public, influencing health outcomes, exacerbating disparities, and increasing utilization of health care resources. As they respond to concurrent disasters, already strained hospitals face additional surges of patients and increasingly face the risk of providing care in crisis conditions.

Most government agencies, communities, and health care organizations are conducting regular assessments to understand what disaster risks they may face. However, with climate change, those hazards are rapidly evolving, and it is critical to understand how climate change may have an impact on communities, including the type, frequency, and severity of disasters. Existing tools, such as community health needs assessments and hazard vulnerability analyses, can be better tailored to identify climate risks to communities. For example, one health system in Washington state developed a dashboard to identify patients most at risk of extreme weather events, linking weather, climate, and air quality data with electronic medical records to identify patients most at risk from heat waves and using that to inform upstream investments.[11]

Deloitte's **Climate Risk Profiler** is a risk assessment and visualization solution that can be used to identify critical assets and climate-related threats, tier and rank assets by vulnerability, and evaluate the annualized cost of inaction to prioritize risk mitigation and resilience investments.

Risk modeling, simulation, artificial intelligence (AI) prediction tools, and investments in early warning systems can help government agencies enhance their preparedness and planning to improve prediction of future events. Using predictive analytics and enhanced forecasting, government agencies can leverage analytics to better understand:

1. Which climate-related disasters to prepare for,
2. The scale of the human and economic impact of the potential disasters, and
3. Which individuals and communities are most at risk to be proactive about planning for their health care needs during a disaster.

Government agencies can then publish these tools and data so they can be widely used by private-sector health systems, community-based organizations, and individuals. The US Department of Health and Human Services (HHS) emPOWER Program is one such example, using federal data and AI tools to identify and map at-risk Medicare beneficiaries dependent on electricity for life-sustaining durable medical equipment to support these individuals during disasters.[12]

Government agencies at the federal, state, and local levels can also develop and exercise agency preparedness plans and support the development of these plans across the health care delivery system informed by climate data from these risk assessments and predictive tools. While predicting the impact of potential climate emergencies on communities is important, government agencies, communities, and health care organizations can also focus on building flexible response systems that can adapt to a variety of disaster types. These plans should account for patient surges to climate-related disasters and include patient movement plans to mitigate surge and strain on facilities. These plans should not only consider planning for acute care facilities and public health, but also include community-based organizations that will play a critical role in climate-related responses. Standing up regional approaches to help mitigate patient surges—such as Medical Operations Coordination Cells,[13] the Regional Disaster Health Response System,[14] or creating climate resilient health clinics as community hubs[15]—can be an effective way to not only prepare for the cascading effects of climate change, but also create innovative partnerships for collaboration.

Apply an equity lens across the health care delivery system to disaster preparedness, response, and recovery

Disasters affect people, households, and communities differently, often exposing and worsening existing inequities.[16] While climate crises have implications for us all, populations facing concurrent health disparities and those who have been systemically underserved by health and economic systems are experiencing disproportionate impacts.[17] People from racial and ethnic minority groups, people with low incomes, those living with disabilities, the elderly, and other communities with less power and access to resources are disproportionately affected by the physical, economic, and social harm caused by disasters,[18] yet they are also more likely to face systemic discrimination when accessing the resources necessary to protect themselves from disasters or recover in the aftermath.[19]

Studies have illustrated the prevalence of inequities in emergency management. An *E&E News* study examining the impacts of urban flooding found flooding in the United States disproportionately harms Black communities, and "Black neighborhoods are less likely to receive flood protection."[20] Another study found that "white families in communities with significant damage from natural disasters saw an increase in wealth due to generous reinvestment, while minority families saw a smaller increase in wealth or actually saw a decrease,"[21] revealing the impact of natural hazards on widening racial wealth gaps over time.[22] Systemic inequities leave communities less prepared for, less resilient to, and requiring additional support to recover from disasters, resulting in worse health outcomes for these communities and further exacerbating health and economic disparities. Deloitte found that health inequities cost the United States $320 billion a year,[23] and—as disasters increase in number and severity—the financial cost of inequities in disaster management will likely only increase. If left unaddressed, health inequities could add $1 trillion to overall health spending by 2040.[24]

Given the cost and consequences of inequities, it is imperative that federal, state, and local government agencies and health care organizations apply an equity lens to their disaster management efforts. From strategy design and execution to partner engagement and community needs assessments, agencies can pursue a variety of mechanisms to advance equity across the disaster life cycle, from prevention and mitigation to recovery. Externally, agencies can actively engage leaders, organizations, and individuals from diverse communities throughout the emergency management life cycle, involving them in decision-making, planning, and policy development through various mechanisms such as community advisory boards. Through community partnerships, agencies can likely develop more effective place-based and population-specific approaches that can address particular needs in the community. Building community resilience—defined as the ability of a community to prepare for, adapt to, and recover rapidly from disruptions—is a critical part of mitigating adverse and inequitable impacts of disasters on communities.[25] Integrating equity into emergency preparedness and response policies includes incorporating social determinants of health, addressing potential systemic inequities (e.g., access to care, economic security), and targeting interventions to reduce disparities. Internally, agencies can embed equity into organizational initiatives; identify targeted strategies for partnerships, funding, and emergency communications during a disaster; and strengthen the ability of their workforces to support equitable response efforts. By approaching disaster management with an equity lens, agencies can begin to take steps to mitigate potential inequities and build community resilience.

Cultivate trusted public-private partnerships and strengthen response coordination

As the United States faces an increase in the frequency and severilty of disasters, the effects on the health care delivery system will likely continue to multiply. Government agencies cannot address these challenges in a vacuum and should consider continuing to build upon innovative partnerships and increasing coordination with other entities and organizations. One example that highlights the need for such partnerships is the impact of climate change on mental health. As noted in a recent issue of *The Dialogue*, "While a great deal of attention has been given to the impact climate change has on physical health, both through catastrophic events and chronic disease, associated mental health and behavioral health risks are also very significant, particularly for disadvantaged and vulnerable populations."[26] Behavioral health and individual mental health have been influenced by the increase in climate-related disasters, creating both human and economic costs. Anxiety, trauma, and chronic stress due to climate change negatively damage people's lives and livelihoods. Additionally, the long-term impact on health from climate change indirectly compounds existing behavioral health challenges. Climate-related heat waves have been linked to an increase in anxiety, stress, mood disorders, substance abuse, and increased rates of suicide. In regions with severe weather climate-related events, populations face disaster-related post-traumatic stress disorder, or PTSD.[27] As climate change worsens and vulnerable populations face diminishing economic resources, individual anxiety and stress levels can increase.

Another example that underscores the need for partnerships is the emergence and reemergence of infectious diseases due to climate-related impacts on species' habitats. As the climate warms and habitats are altered, vector-borne diseases have spread into new geographic areas. For example, warming temperatures allow mosquitos to expand their range into regions where they haven't been found before.[28] As the climate changes, there is an increased risk of infectious disease well beyond existing capacity that will require expanding health and human services functions.[29]

Enhancing capacity through partnerships with non-organized entities

Recent trends have highlighted the vital role of non-organized entities in emergency management and underscored the importance of building these types of partnerships. Informal volunteers or non-organized entities (e.g., citizens who volunteer their time, knowledge, skills, and resources to help others in times of crisis) often play a critical role in disaster response efforts, including search and rescue, first aid, food and water distribution, and debris cleanup. Engaging with non-organized entities as partners in emergency management can facilitate greater success in achieving the shared goal of saving lives, bettering disaster management efforts, and strengthening our nation's security and resilience. By harnessing the skills and resources of non-organized entities, government agencies can enhance current emergency management systems to significantly reduce disaster risks and strengthen disaster response and recovery.[30]

To enhance emergency preparedness and response for climate change and weather-related disasters and address these multifaceted challenges such as mental health and emerging infectious diseases, it is imperative that government agencies utilize a Whole Community[31] approach and invest in public-private partnerships across government agencies, community-based organizations, and private health care organizations to strengthen coordination and maximize impact. As large-scale emergencies and disasters have demonstrated, "being able to function effectively in a crisis is challenging for even the most prepared health care systems, communities, and jurisdictions."[32] Adapting and building resilience to climate change requires collective action. During emergency response, public-private partnerships made up of government agencies, community-based organizations, and private health care organizations enable these various organizations to leverage collective strengths; enhance coordination; and share resources, capabilities, and expertise. Formalized partnerships with established processes ahead of a response can expand overall response capacity during emergencies while also facilitating coordination and information sharing among entities involved. These long-term partnerships and collaboration can also help communities become more resilient and better equipped to respond to future emergencies. Moreover, public-private partnerships that meaningfully engage affected communities and local organizations as equal partners can help agencies understand specific community needs and tailor their efforts accordingly.

Leveraging specialized knowledge through a collaboration to bolster wildfire preparedness and response

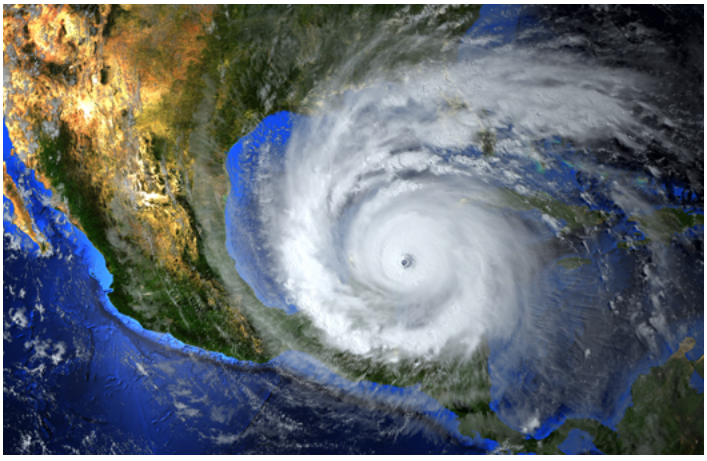
Deloitte and the University of Colorado (CU) Boulder formed the Climate Innovation Collaboratory to expand access to climate data science and applied research. The Collaboratory's work includes deploying groundbreaking wildfire analytics to solve unmet needs in wildfire preparedness and response. This project combines CU Boulder's geospatial and wildfire modeling expertise with Deloitte's human-centered design approaches and experience managing sustainability-related risk to unlock new opportunities to strengthen responses to natural disasters.

Build operational, infrastructural, and community resilience to reduce disaster impacts on the delivery of public health and health care

Climate change is disrupting supply chains and, as a result, having an impact on health infrastructure. Extreme weather has increasingly harmed ports, highways, and factories worldwide. Large, recent climate events such as Hurricane Ida in the Gulf of Mexico (2021) and the Texas freeze (2021), as well as flooding in central China (2021), have disrupted supply chains.[33] Port authorities do not have adequate ways to deal with sea-level rise and resulting bottleneck effects.[34] Climate-related disruptions are bound to intensify in the coming years as global warming continues. Pharmaceutical supply chains have been especially challenged due to these events affecting public health and access to medications. The health care delivery system, inclusive of federal, state, and local health agencies, has felt the indirect impact of climate change through supply chain issues and the direct impact of storms and weather events on facilities.

Federal, state, and local health agencies can evaluate not only the ways climate change is affecting the populations they serve, but also how they and the broader health care delivery system are contributing to the negative impacts of climate change. The majority of carbon emissions produced by health care comes from indirect emissions through production and transportation of goods and services through supply chains.[35] To mitigate these emissions, the health care delivery system should increase visibility in their supply chains and increase reporting. Organizations can develop long-term relationships with their suppliers and build trust to achieve high transparency and increase reporting.[36] This can be done by identifying sustainable sourcing alternatives and improving traceability through digital platforms and partnerships. Health care facilities can work toward being environmentally sustainable by reducing emissions through supply chains and optimizing consumption of resources and properly managing waste. Additionally, organizations should look toward adaptation and transformation strategies for leveraging innovative technology to reduce environmental impact.

With the acceleration of the climate crisis, government agencies face new challenges with the impact on human health as well as challenges in the delivery of health services. Extreme weather events have put stressors on existing health infrastructure, and long-standing underserved populations are bearing the brunt of these negative health impacts. The health care delivery system can work to help communities that are most impacted and build resilient delivery of services while simultaneously mitigating their own emissions and impact on the climate crisis. A first step toward achieving these objectives is the creation of tailored, cost-effective resiliency plans specific to the health sector that consider impacts not only on delivery of health services but also on the health of affected communities.



A reason to act

HHS agencies have a mandate to address climate change as called for in multiple executive orders[37] as well as in the National Health Security Strategy Objective 1.2—*Improve readiness of HPH systems and infrastructure to mitigate the adverse effects of concurrent threats and climate change impacts*. Additionally, recent funding programs—including the Inflation Reduction Act and the Infrastructure Investment and Jobs Act and new initiatives such as Justice40—underscore significant opportunities for the health sector to advance climate action through investments to "improve care, increase preparedness;"[38] enhance "clean energy transmission and electric vehicle infrastructure;"[39] "build efficient and resilient infrastructure that can better handle climate-related threats to operations;"[40] and invest in "disadvantaged communities that are marginalized, underserved, and overburdened by pollution."[41]

With climate change continuing to accelerate, government agencies should consider investing in solutions to build resilience to its impacts. Deloitte's climate action approach balances both mitigation and adaptation through services including risk assessment and modeling; operational support across the emergency management life cycle; climate equity; sustainable procurement and supply chain; resilience and sustainability; and training and exercises. Health agencies can be better positioned to prevent further environmental harm while increasing resilience to withstand anticipated changes, potentially reducing the impact of these crises on communities and reducing the loss of life and property.

About the authors

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