

The Costs of Inaction:

The Economic Burden of Fossil Fuels and Climate Change on Health in the United States



Overview

Fossil fuel combustion and global climate change are harming our health on multiple fronts. Air pollution from burning fossil fuels is one of the leading causes of illness and premature deaths in the United States and the world.¹ Beyond air pollution, the burning of fossil fuels is changing our climate by increasing levels of heat-trapping pollution such as carbon dioxide in the Earth's atmosphere. Those rising temperatures are fueling more extreme weather and contributing to dangerous heat waves, dramatic spikes in air pollution, and increases in tick and mosquito-borne infectious disease outbreaks. These impacts are projected to increase in frequency, intensity, duration, and/or geographic range in the decades to come, with the potential to trigger profound increases in harm to public health in the U.S.²

The climate crisis is a dangerous and costly problem, and it threatens much more than just property values and infrastructure: it's fueling substantial and sometimes irreversible damage to public health in terms of illnesses, injuries, expensive medical bills, and deaths. A wealth of scientific research indicates that this problem will contribute to an extraordinary rise in a wide variety of health problems and demand for medical care if we don't take action to avert the climate crisis. The growing burden of health harms and healthcare costs is already straining people and communities,³ which is especially worrisome given that more than half of U.S. adults currently report medical financial hardship⁴ — that is, the inability to afford medical care, no matter how necessary it is. Climate change is a “threat multiplier”⁵ that is worsening existing health and economic burdens, particularly for the most vulnerable among us, including children, low-income communities, and people of color.⁶

In this report, we conclude that the health costs of air pollution and climate change already far exceed \$800 billion per year and are expected to become even more expensive in years to come without a stronger societal response to address this crisis. This price tag most likely vastly underestimates the true total costs of these problems, due to limited available health data. These large and growing *financial* costs—as well as the major health harms of air pollution and climate change—are often overlooked. Now is the time to recognize how much these linked problems are costing us.

Reducing heat-trapping pollution and investing in community preparedness can provide valuable immediate and long-term safeguards to our health and wellbeing. These actions can be supported by fully accounting for the sizeable financial and health costs of climate inaction. This report summarizes scientific evidence of the large health burden of recent climate change-related events in the United States, describes how those health problems trigger large treatment costs that burden people and families *right now*, and offers recommendations for ways to weave health and economic arguments into advocacy for climate action.



How do fossil fuels and climate change harm health?

Coal, oil, and natural gas are major types of fossil fuels — energy sources derived from burning the remains of prehistoric plants and animals.⁷ The extraction, refining, transport, and combustion of fossil fuels release toxic pollution into the air, soil, and water.⁸ The combustion emission components with the greatest impact on human health which are the focus of this report include sulfur oxides, nitrogen oxides, and microscopic particle pollution. These pollutants can each harm health directly, while also contributing to the formation of additional particle pollution and ground-level ozone smog -- further amplifying the potential health harms of these emissions.

The climate crisis fuels dangerous environmental changes that are harming people and families across the country, like more extreme weather and stronger hurricanes, increasingly severe wildfires, intense heat waves, more dangerous air pollution episodes, an expanded range for insect-borne infectious diseases, and longer allergy seasons.⁹ These climate change-related events are expected to increase in frequency, intensity, duration, and/or geographic range in the future, absent strong reductions in greenhouse gas pollution.² The health consequences of a rapidly changing climate are here and now, and they are dangerous and costly for people to treat and recover from.



What are the types of health costs from fossil fuels and climate change?

Medical treatment and recovery from the many types of health problems worsened by climate change is expensive and burdens patients, employers, public and private insurers, and health system operators. Extreme weather events commonly require people to seek medical care in emergency rooms, hospitals, and non-emergency healthcare settings. When patients are admitted to a hospital to treat severe illnesses and injuries, they may also forego income at work, triggering hardship for themselves and their families. The costs can continue to add up once patients are discharged from hospitals, because of the possible need for ongoing outpatient care and medications. Research on the health costs of climate change related-events categorizes how these staggering costs add up:



PREMATURE DEATHS

Climate change-related events like heat waves, wildfires, and hurricanes are often deadly. To assign value to the economic risk of premature deaths, the U.S. federal government applies a metric called the Value of a Statistical Life. The economic burden of early deaths is typically the major driver of costs in climate and health cost assessments.



MEDICAL CARE FOR TREATMENT OF PHYSICAL AND MENTAL HEALTH CONDITIONS

Direct treatment costs in hospitals, emergency rooms, and clinics can come with a steep price tag for patients. Mental health treatment for people experiencing conditions like post-traumatic stress disorder (PTSD) after a disaster is another component of these costs.



REHABILITATION AND HOME HEALTH CARE

Even after completion of immediate treatment, some patients require continuing medical care to manage and recover from their health problems, including mental health counseling or physical therapy.



PRESCRIPTION MEDICATIONS

Filling prescriptions for medications (sometimes more than once) can be costly for patients.



LOST WAGES AND WORKER PRODUCTIVITY

While patients are receiving necessary medical care, they may lose wages at work. Unscheduled medical absences and stress-related lack of productivity tied to healthcare needs also affect worker productivity and business operations.



DOWNSTREAM HEALTH COSTS

Climate events can harm health and trigger other costs in complex ways by destabilizing individuals, families, and communities. People can suffer from other health problems after climate disasters, including those linked to delayed care and homelessness.

Who is paying these health costs from fossil fuels and climate events?

According to the U.S. Global Change Research Program,¹⁰ populations at higher risk of climate harms (and associated health costs) include economically disadvantaged groups, some communities of color, immigrant groups (especially those with limited English proficiency), Indigenous peoples, children and pregnant women, older adults, outdoor workers, persons with disabilities, and persons with preexisting or chronic medical conditions. These vulnerabilities stem from a combination of factors, including lack of access to affordable health insurance and care, systemic racism, longstanding and inequitable land use and zoning rules, the concentration of polluting facilities in economically marginalized areas, health status, and occupational risks.

Additionally, many people lack the resources to prepare for and adapt to the multiple, sometimes cascading and compounding health risks of a changing climate.¹¹ Research indicates that Medicare and Medicaid patients are not only among the most vulnerable groups to the health effects of climate change, but also shoulder the highest share of climate-sensitive health costs to treat illness.¹² Because these public health insurance programs are funded by taxpayer dollars, we are all shouldering the health costs of climate change. The climate crisis could also trigger a demand for more home health care needs, an essential function that is often performed by women, people of color, and often inadequately compensated.¹³ In short, the health costs of the climate crisis widen existing economic inequality.

How much are these air pollution- and climate change-fueled health costs?

Estimating the national health cost of fossil fuels and climate change is challenging because of limited data availability on injuries and illnesses resulting from specific weather extremes.¹⁴ As a result, U.S. government estimates of the cost of climate/weather disasters tend to omit the health-related costs altogether.¹⁵ Importantly, existing cost estimates often focus on impacts that are immediate and most easily quantified, underestimating the total health impacts (and costs) of the long-term disease burden.¹⁶

Despite this gap, peer-reviewed scientific literature shows that people in the United States are already burdened by health costs of air pollution and climate change that far exceed \$800 billion per year. Unfortunately, many Americans likely experience multiple climate change-related events and associated costs simultaneously. The following set of tables provides a list of major health threats linked to fossil fuel-triggered air pollution and climate change-related events, along with a sample of cost estimates for these types of health harms, if available (normalized to 2020 USD).¹⁷



Health Costs of Poor Air Quality



PARTICULATE MATTER

Fossil fuel burning (coal in particular) releases deadly particulate matter (PM) and PM precursors, and climate change affects PM through increases in airborne dust and wildfires in parts of the United States.¹⁸ PM and PM precursors are the most deadly and costly major components of air pollution.¹⁹ PM_{2.5} exposure is associated with cardiovascular disease and respiratory conditions such as lung cancer. It is also associated with altered nervous system, metabolic, reproductive, and developmental outcomes.²⁰

GROUND-LEVEL OZONE (SMOG)

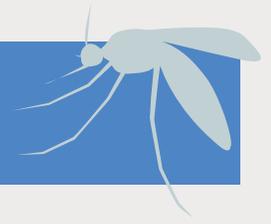
Precursors emitted by fossil fuel combustion, combined with higher temperatures fueled by climate change, increase ozone production.²¹ Ozone is known to cause harmful respiratory outcomes such as asthma exacerbation, and may also worsen cardiovascular, metabolic, nervous system, and reproductive outcomes.²²

AIRBORNE ALLERGENS

Rising temperatures and higher carbon dioxide concentrations are increasing the duration, geographic extent, and intensity of pollen seasons. Fossil fuel pollution exposure in humans can worsen allergic responses. These factors can exacerbate allergic diseases such as asthma, hay fever, rhinitis, and atopic dermatitis.²³

EXPOSURE/EVENT	HEALTH IMPACTS MEASURED	ESTIMATED HEALTH COSTS (2020 USD)
PM_{2.5} AIR POLLUTION AND PRECURSORS (Nationwide, 2011)	107,000 premature deaths	\$820 billion ²⁴
GROUND-LEVEL OZONE (SMOG) (Nationwide, 2002)	795 premature deaths, 4,150 respiratory-related hospitalizations, 485 asthma-related ER visits 365,468 other outpatient encounters	\$7.9 billion ²⁵
ALLERGENIC OAK POLLEN (Southeast, Northeast, and Midwest, 2010)	21,200 asthma-related ER visits	\$11.4 million ²⁶

Health Costs of Vector-Borne Infectious Diseases



TICKS

Changing seasonal and geographic activity of ticks may increase human exposure to tick-borne illnesses such as Lyme disease.²⁷ Tick-borne illnesses can evolve into long-term neurologic, cardiac, and rheumatologic conditions.²⁸

MOSQUITOES

Changing seasonal and geographic activity of mosquitoes (vector) and birds (hosts) may increase human exposure to mosquito-borne illnesses such as West Nile Virus.²⁷ These illnesses often cause acute febrile illness, and may cause severe neurologic and developmental abnormalities in rare cases.²⁹

EXPOSURE/EVENT	HEALTH IMPACTS MEASURED	ESTIMATED HEALTH COSTS (2020 USD)
<p>LYME DISEASE (Nationwide, 2008)</p>	<p>Diagnosis, treatment, & management of 240,000–440,000 new cases (inpatient, outpatient, and pharmacy costs)</p>	<p>\$860 million - \$1.6 billion³⁰</p>
<p>WEST NILE VIRUS (Texas, 2012)</p>	<p>89 premature deaths, 1,628 hospital admissions, 2,680 ER visits, 28,303 other outpatient encounters, lost wages from hospital and ER visits</p>	<p>\$1.1 billion¹²</p>



Health Costs of Extreme Climate Events



WILDFIRES

Rising temperatures, drought conditions, and insect outbreaks linked to climate change are projected to increase the frequency and intensity of large wildfires.³³ From 1984 to 2015, climate change doubled the area of burned land from forest fires in the Western United States.³⁴ Wildfires can cause premature death and injuries, and endanger respiratory and cardiovascular health through the generation of toxic air pollution.³³

HEAT

Climate change drives higher average temperatures and more intense heat waves.² Climate change has at least doubled the likelihood of record-breaking hot summer days in the United States between 1961-2010.³¹ Heat stress leads to hyperthermia-related conditions such as heatstroke, can worsen existing cardiovascular, respiratory, cerebrovascular, and diabetes-related conditions, and can harm perinatal outcomes.³²

EXTREME PRECIPITATION, HURRICANES, AND COASTAL STORMS

Climate change has contributed to increases in the frequency and intensity of heavy rainfall, North Atlantic hurricanes, and flooding over the past several decades.² These disasters cause trauma and death directly and can exacerbate chronic conditions. Infrastructure loss after a disaster can lead to pathogenic food and water-borne infections.³⁵ In the aftermath, the recovery process poses a heavy toll on the mental health of survivors, particularly for those who are already vulnerable, such as pregnant women.³⁶

EXPOSURE/EVENT	HEALTH IMPACTS MEASURED	ESTIMATED HEALTH COSTS (2020 USD)
EXTREME HEAT (Wisconsin, 2012)	27 deaths, 155 hospital admissions, 1,620 ER visits, 57 other outpatient encounters	\$263 million ¹²
WILDFIRE SMOKE (Nationwide, 2010)	6,200 annual respiratory hospital admissions, 1,700 PM2.5-related deaths from short term smoke exposures	\$16 billion ³⁷
HURRICANE SANDY (New York and New Jersey, 2012)	273 premature deaths (in NY, NJ and nearby states), 6,602 hospital admissions, 4,673 ER visits, 2,444 outpatient encounters	\$3.3 billion ¹²

Additional Health Costs



Beyond these documented costs, other climate change-related health problems likely burden people with additional health-related costs. These costs include:

HEALTH PROBLEMS LINKED TO FOOD AND WATER

Atmospheric carbon dioxide, rising temperatures, and extreme climate/weather events increase risk of (1) pathogenic and chemical contamination of food and water, (2) decreased protein and mineral content in some crops, and (3) disruption of critical supply chains.³⁸ Despite health threats from gastrointestinal illness (e.g. harmful algal blooms), neurological damage (e.g. methylmercury in seafood), and food insecurity, the health cost implications have only been estimated in a few instances.

MENTAL HEALTH PROBLEMS

Climate/weather-related disasters, extreme heat, and climate change-associated anxiety (“ecological grief”) can have far-reaching mental health implications.³⁹ However, few studies estimate the associated costs. Mental health issues are a highly costly medical condition in the United States,⁴⁰ so the mental health costs of climate change-related events are an important area for future investigation.

Decarbonizing Our Energy, Transportation, and Food Systems Improves Health and Reduces Costs

The existing evidence is clear: the climate crisis and fossil fuel use are extremely costly, both in terms of damage to human health and economic hardship on vulnerable communities. But smart climate actions now to reduce fossil fuel emissions and prepare communities for climate change-related health harms can reduce suffering and transform health costs into major financial savings.¹⁴ The following recommendations identify climate solutions for public health across three groups: individuals, health professionals, and policymakers.

What Many of Us Can Do

Most everyone can engage in climate solutions by making small, health-positive improvements to their daily habits.

USE ACTIVE TRANSPORTATION

Substituting active transportation (walking and biking) and public transportation (bus, subway, trains) for car use, when possible, reduces pollution emissions and improves people’s health. Ridesharing when active and public transportation options are unavailable can cut costs and emissions as well.

- Physical inactivity costs the United States an estimated \$27 billion annually in productivity losses and healthcare for preventable conditions such as coronary artery disease and type II diabetes.⁴¹



ADOPT SUSTAINABLE AND HEALTHY DIETS

Eating healthy foods, reducing meat consumption, and increasing consumption of fruits, vegetables and whole grains can improve people's health, reduce healthcare costs, and reduce food-related climate pollution.

- Global adoption of the low carbon planetary health diet (reduces animal-source foods in lieu of plant-based foods) would prevent about 11 million deaths globally each year.⁴²



What Health Professionals Can Do

As trusted messengers on health issues, health professionals can communicate the health risks and costs of climate change and fossil fuel use to patients and colleagues. Health professionals can help to strengthen climate action through specific efforts:

PUSH TO DECARBONIZE THE HEALTH SECTOR

In the United States, health care produces a large and growing amount of heat-trapping pollution, but the healthcare sector's large climate footprint can be reduced without compromising quality.⁴³

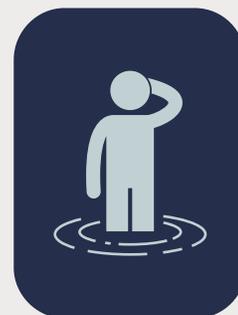
- In 2018, U.S. healthcare sector greenhouse gas emissions made up 8.5% of total countrywide domestic greenhouse gas emissions. Emissions from the U.S. healthcare sector are among the highest (in absolute and per capita terms) of any healthcare sector in the world.^{44,45}



ADVOCATE FOR CLIMATE READY HEALTH SYSTEMS

Building resilience to climate/weather-related disasters in the healthcare sector and beyond will help treat patients more effectively and reduce health problems and costs in a warming world.

- Advocate for strong emergency preparedness protocol within healthcare facilities, to ensure swift adaptation to the devastating health and infrastructure damage from climate/weather-related disasters such as wildfires, floods, and hurricanes.
- Be aware of local health-promoting adaptation measures such as early heat warning systems and public cooling centers, and share this information with patients.



INTEGRATE CLIMATE CHANGE INTO HEALTHCARE AND PUBLIC HEALTH PRACTICE

We must factor in the changing climate into our diagnostic and treatment plans, and teach our trainees to do the same, to reduce the severity of climate-fueled health harms.

- Whenever appropriate, provide patients with health-positive recommendations that are climate-positive as well — such as using active transport when possible, and reducing consumption of meat and processed foods.
- Incorporate environmental/occupational health into history taking, including attention towards air conditioner access and vulnerable workers (including outdoor laborers) during the summer months.
- Understand the effects of climate change on medication — for example, the impact of certain antipsychotics, beta-blockers, and antihistamines on heat intolerance.⁴⁶



What Policymakers Can Do

Elected leaders at the local, state, and federal levels have an important role to play in reducing systemic environmental inequality and ensuring that climate and health solutions are accessible to everyone. Climate policy should include measures to reduce climate change-related health problems and their high costs. Specifically, policymakers and policy advocates can advance policy changes on several fronts:

IMPLEMENT POLICIES THAT SUPPORT CLEAN, LOW-CARBON ENERGY, TRANSPORTATION, AND FOOD SYSTEMS.

A just transition away from fossil fuel use in energy, transportation, and food systems (while increasing reliance on renewable energy sources such as wind, solar, and geothermal energy) will curb harmful and costly emissions. Building resilience against climate change-related events will reduce damage in the future.



ENERGY

From 2007 to 2015, wind energy avoided 6,700 premature deaths from air pollution, with an estimated value of \$59.1 billion.⁴⁷ Equitable access to clean energy will curb the toxic effects of fossil fuel emissions, particularly in disenfranchised communities where emissions take the largest toll.⁴⁸



TRANSPORTATION

Nationwide zero-emission transportation would reduce air pollution and avoid up to an estimated \$76.7 billion in health costs in 2050 from 6,300 averted premature deaths, 93,000 averted asthma attacks, and 416,000 averted missed work days.⁴⁹ Particular attention is needed to ensure a just transition and improve safe access to zero-emission transportation options, including sidewalks, bike lanes, and zero-emission public transportation.



DIETS

Improving access and demand for affordable, high-quality planet-friendly foods can support the health of communities and the climate. Solutions include expanding food waste reduction efforts, community composting programs, and local food production, and incentivizing the purchase of planet-friendly foods.⁵⁰



BUILDING HEALTH RESILIENCE

Invest more aggressively in climate change preparedness efforts at the local level, including heatwave and wildfire smoke early warning systems, cooling centers, and other health-centered climate adaptation programming.

The climate crisis is extremely costly, in terms of both damage to human health and the economic hardship that climate-fueled problems impose on vulnerable individuals and communities. By recognizing the dangerous and expensive health consequences of climate change, we can make the case for climate policies that will reduce costly suffering — now, and for years to come.

A Deeper Look at Our Reporting Methods

We would like to provide some more information to further clarify the methods we used in our climate-health cost valuation report so that its findings are more clearly interpreted, summarized, and reported.

Headlines and stories generated from the report's initial release suggested or directly stated that climate change is tied to more than \$820 billion in health care costs per year. This prompted us to provide the following, in which we highlight four points with a more detailed description of the cost estimates and clarification on the nature of the costs we report.

1. DIFFERENTIATING BETWEEN THE ECONOMICS OF REDUCING MORTALITY RISK VS. HEALTH CARE COSTS TO TREAT ILLNESS

Overall, the vast majority of the health costs identified in our report come from a method that provides a valuation of reducing premature mortality risk, known as the “Value of a Statistical Life (VSL).”⁵¹ These mortality-related cost estimates are not the same as those related to traditional health care that are typically incurred to treat illnesses.

The VSL estimates comprise the vast majority of the total damages identified in our report and provide an important way to represent premature loss of life in economic terms.

When we discuss the costs of premature mortality measured by this VSL, our cited publications applied an estimation method for the economic valuation of premature death, rather than an out-of-pocket cost or medical bill for health services. For example, one could say that the VSL indicates how much a large group of people would be willing to pay to avoid or reduce the risk of premature death from health harms caused by environmental conditions.

To emphasize this distinction again: the overwhelming majority of the costs estimated in our report are those associated with premature mortality, via the VSL method.

For More Information on the VSL Method Visit:

<https://www.epa.gov/environmental-economics/mortality-risk-valuation#means>

2. WHO IS PAYING FOR THE HEALTH CARE COSTS WE IDENTIFIED?

For the illness-related costs, the expected payer can sometimes be determined from the datasets used to assemble the cost estimates. The report does not intend to imply that all of the estimated costs are borne by vulnerable people, nor by the general public through Medicare and Medicaid premiums, to which taxpayers contribute. The VSL estimates associated with premature deaths are not out-of-pocket expenses being directly paid by individuals, and those costs comprise the vast majority of the total economic burden identified in the report.

3. THE DIFFERENCE BETWEEN FOSSIL FUEL-GENERATED AIR POLLUTION AND CLIMATE CHANGE-RELATED COSTS

This report includes both the health costs of fossil fuel-related air pollution and the health costs related to events sensitive to climate change, to varying degrees. Today, fossil fuel-related air pollution generates the majority of these costs, largely derived from the economic value of air pollution-related premature deaths. For example, the \$820 billion figure highlighted in our report refers exclusively to the economic impact of premature deaths associated with fossil fuel-generated air pollution. Other cost estimates identified in our report (above and beyond the \$820 billion) encompass both premature mortality and illness-related costs for specific types of climate-related events. We did not sum together the other cost estimates presented in each exposure category, because they are derived from different studies over different years that employed distinct methodologies.

But in the future, say 30 years from now when today's children are middle-aged, and assuming that cleaner, non-polluting energy sources are more prevalent, fossil fuel-related health harms would decline. However, climate change-related health costs are projected to rise to tens to hundreds of billions annually by the end of this century,⁵² greater than those same costs today. The good news is, if we move away from reliance on fossil fuels now, we can limit both types of costs – both today's fossil fuel air pollution costs; and the future costs from a range of climate change-sensitive health hazards exacerbated by the impact of fossil fuel-related greenhouse gas emissions on climate change.

4. THE DIFFERENCE BETWEEN CLIMATE CHANGE-RELATED AND CLIMATE CHANGE-CAUSED HEALTH IMPACTS

The report might seem to suggest that people are paying out over \$800 billion dollars from their pockets every year, for health costs caused by climate change. This interpretation, however, blurs the distinction between climate-attributable (caused) health outcomes and what the report identifies as "climate change-related" (elsewhere referred to as "climate-sensitive"⁵³) health outcomes. To help avert confusion, we're providing this clarification.

The report combined findings from prior studies that were not causal climate change "attribution" analyses. Climate attribution studies apply statistical modeling techniques in order to quantitatively examine the link between climate change's influence on a particular event and associated health harms. Rather, this report compiled information from prior studies on a range of climate-sensitive health problems -- those expected to worsen in frequency, intensity, duration, or areal extent in the future, due to climate change. For example, in the report, substantial costs are associated with vector-borne diseases whose climate change attribution is unknown, and likely limited at this time.⁵⁴ To be clear, climate change is not currently responsible for 100% of the costs that were tallied in the report. While research in attributing climate change's contribution to specific environmental events is advancing rapidly,⁵⁵ that attribution is not the focus of the studies compiled in this report.



References & Acknowledgements

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PHOTOGRAPHS

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