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Thank you Chairwoman Maloney, Ranking Member Comer, and members of the Committee for inviting me to speak today.

My name is Michael Greenstone, and I am the Milton Friedman Distinguished Service Professor in Economics and Director of the Becker Friedman Institute and Energy Policy Institute at the University of Chicago. I also serve as co-director of the Climate Impact Lab, a multi-disciplinary collaboration of researchers working to quantify the long-term impacts of climate change. My own research focuses on estimating the costs and benefits of environmental quality, with a particular emphasis on the impacts of government regulations.

I appreciate the opportunity to speak with you today about the temperature impacts from climate change on public health and the economy.

This summer, the world is experiencing record hot temperatures: June continued a 2020 streak, ranking among the warmest months in history. A weather station in Death Valley, California, clocked a scorching 53°C (128°F) in July, one of the hottest temperatures ever observed on Earth. Officials from Delhi to Tokyo to Baghdad, cities where past heat waves have claimed hundreds of lives, are bracing for dangerously hot periods. And yet, this is nothing new. Year after year more heat records are broken all over the world.

Temperature's toll on public health, particularly the toll from extreme heat, is likely to be one of the dominant costs of climate change. And, because today's emissions will stay in the atmosphere for hundreds of years, knowing the damages they will cause will be essential to taking the action we need to prepare for future risks. So, what impact will temperature have on public health, and how much will it cost? My new paper, "Valuing the Global Mortality Consequences of Climate Change Accounting for Adaptation Costs and Benefits" that was published by the National Bureau of Economic Research this week, addresses these critical questions.

There are several results, but I want to emphasize two headlines up front. First, with continued high emissions of greenhouse gases, climate-induced changes in temperature will increase the global mortality risk by 85 deaths per 100,000 population.[1] This increase in mortality is comparable to that of all infectious diseases combined—outside of Covid-19—and almost as large as the current fatality rate from cancers.

Second, these results mean that the economic costs of climate-induced health risks are at least an order of magnitude larger than has previously been understood.

In the remainder of my statement, I will make the following points:

1. To measure the impact of climate-driven temperature changes on mortality risk, my colleagues and I compiled the largest sub-national vital statistics database in the world, detailing 399 million deaths across 41 countries accounting for 55% of the global population. We divided the world into more than 24,000 regions that are each about the size of a U.S. county.

2. We discovered that continuing a high emissions trajectory increases average global temperatures by around 4.8°C (8.6°F) relative to pre-industrial temperatures, raising global mortality risk by 85 deaths per 100,000 people by 2100. The mortality consequences will be largest in places that today are hot and/or poor.

3. In the United States, the mortality risk will be 10 deaths per 100,000, about on par with the current fatality rate from auto accidents in the United States. Many areas will experience mortality risks that are significantly higher. That includes areas represented by members of this committee, which I will detail.

4. Policy has the potential to deliver some of the most significant public health gains in human history. Bringing global emissions down to moderate levels—not even as low as the Paris Agreement's long-term targets—would reduce expected warming by around 2.2°C (4.0°F) at the end of the century and the attendant mortality risk by 84% compared to the high emissions pathway. Under this moderate emissions scenario, climate-induced temperature changes are projected to be responsible for 14 additional deaths per 100,000 globally at the end of the century. In the United States, that risk would be 1.3 deaths per 100,000, eliminating almost all of the mortality risk.[2]

5. We estimate that the release of an additional metric ton of CO_2 will cause about $37 worth of mortality damages. This finding suggests that both the Trump and Obama Administrations have underestimated the full social cost of carbon, in the former case dramatically so. Further, it underscores there is an urgent need to follow the National Academy of Science's 2017 recommendations and update the social cost of carbon so that it is on the frontier of scientific and economic understanding and can serve as a more accurate guidepost for climate policy.

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[1] Mortality risk is a measure that accounts for the increase in death rates and the costs of adaptation. Our research finds that climate-induced temperature changes raise global death rates by 73 deaths per 100,000 and will cost society 12 death-equivalents per 100,000 in adaptation expenditures, for an overall total of 85 deaths per 100,000.

[2] This value is an average of the impacts from 2095 to 2099.

Research Design and Relationship between Temperatures and Mortality Rates

Before detailing all of what we discovered, let me first explain how we produced our results. In the study, we use mortality records to quantify how death rates around the world have been affected by observed climate-induced temperature changes. We do so by compiling the largest sub-national vital statistics database in the world, detailing 399 million deaths across 41 countries accounting for 55% of the global population. We combine these records with decades of detailed daily and local temperature observations.

The data reveal a U-shaped relationship where extreme cold and hot temperatures increase mortality rates, especially for the elderly. Further, the effects of extreme cold and hot temperatures are attenuated by both higher incomes and adaptation to local climate (e.g., robust heating systems in cold climates and cooling systems in hot climates).

We then use these estimates of the mortality-temperature relationship to generate projections of the future impacts of climate-induced temperature changes on mortality rates, dividing the world into 24,378 regions containing roughly 300,000 people each—about the size of a U.S. county. With a new technique to measure the total cost of adaptive behaviors and technologies, these projections capture the full mortality risk of climate-induced temperature changes. In other words, this is the first study to account for direct mortality impacts and both adaptation benefits and costs.

These estimates include three projections for future income and population growth and simulations from 33 climate models, allowing for an assessment of the uncertainty surrounding any particular projection. The full estimates also reflect statistical uncertainty related to the underlying economic and health data.

Our findings present this data using two different trajectories of future greenhouse gas emissions. The first is a high emissions scenario, where our findings show temperatures would rise by around 4.8°C (8.6°F) by 2100 relative to pre-industrial levels. The second is a more moderate emissions scenario, where temperatures would rise by around 2.6°C (4.7°F). Ultimately, policy choices will determine which of these scenarios is more likely.

High Emissions Scenario

If we continue on a trajectory of high emissions, increasing average global temperatures by around 4.8°C (8.6°F) relative to pre-industrial temperatures, our research finds that temperature-related global mortality risk is projected to rise by the equivalent of 85 deaths per 100,000 people in 2100, compared to a world with no warming. I say full mortality risk, because our projections reflect changes in both the number of deaths and the resources people devote to protect themselves against high and low temperatures through adaptation. When this increase in mortality risk is monetized using standard techniques, the costs are equal to roughly 3.2% of global economic output in 2100.

As I noted in my opening, the projected impact of temperature on mortality at the end of the century is on par with the current death rate for all infectious diseases (except the novel coronavirus)—including tuberculosis, HIV, malaria, dengue, yellow fever, and diseases transmitted by ticks, mosquitos, and parasites—combined: approximately 74 deaths per 100,000 globally (See Figure 1). It is smaller, but comparable to, the overall cancer mortality rate, which is 126 deaths per 100,000 globally.[3]

The damages from climate-induced temperature changes discussed above will be unevenly distributed among populations on both a global and national scale, as illustrated in Figure 2. Globally, we find that the mortality risk of climate-induced temperature changes disproportionately falls on regions that are poorest and hottest today, exacerbating existing inequality. For example, Accra, Ghana, is projected to see an increase in days above 32°C (90°F) from one to 102 days per year by the end of the century under a continued high emissions scenario. This increase raises the city's mortality rate by about 19%. The climate-induced temperature-related mortality risk at the end of the century is projected at roughly 160 deaths per 100,000 people.

In contrast, colder and relatively wealthier Oslo, Norway, is projected to see benefits equivalent to *saving* approximately 230 lives per 100,000 people. These differences reflect Oslo's means to adapt to additional warm days, as a wealthy nation, and the benefit that the population experiences as climate change reduces the number of deadly cold days. In fact, in high-income places such as Oslo, the mortality-related risks of climate-induced temperature changes are mainly damages to the economy because of increased adaptation costs. In contrast, in low-income places like Accra, the damages of climate-induced temperature changes are projected to be felt as significant increases in death rates on hot days.

The United States is projected to see its mortality risk rise to 10 deaths per 100,000 by the end of the century under a high-emissions scenario. That's about on par with the current fatality rate from auto accidents in the U.S.—roughly 12 deaths per 100,000.[4]

Again, risk differs depending on where you live. I have included a table (See Table 1) with the data for each of Member of this committee's district to give you a sense of the risks your constituents could face. I will list some examples here.

In my home city of Chicago (which includes the districts of Representatives Kelly and Krishnamoorthi), the mortality risk decreases by about 34 lives per 100,000 by 2100. My city will see more hot days, and it will pay to adapt to them. But, it also typically sees a lot of extremely cold days. Over time, we'll see fewer of those cold days, decreasing mortality risk during the winter and—combined with the additional adaptation measures—giving Chicago a net benefit.

Orange County, California (which includes the districts of Representatives Porter and Rouda), on the other hand, doesn't have the chance to benefit from a reduction in cold days—there are few

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[3] World Health Organization. "Global Health Estimates 2016: Deaths by Cause, Age, Sex, by Country and by Region, 2000-2016". Geneva, 2018.

[4] World Health Organization. "Global Status Report on Road Safety 2018." Geneva, 2018.

already. People there can pay to adapt to additional hot days, but it won't be enough to offset the loss of life. There, temperature-related mortality risk is projected to increase by 38 deaths for every 100,000 people. That is on par with the current U.S. death rate for Alzheimer's disease (37 deaths per 100,000).[5]

Washington, DC (which includes the district of Representative Norton) is also projected to experience a higher mortality risk under this scenario—around 33 deaths per 100,000 by 2100. In Winston-Salem (which includes the district of Representative Foxx), it's 35 deaths per 100,000. Kenton County, Kentucky (which includes the district of Representative Massie) is projected to increase by about 28 deaths per 100,000. In all of these cases, the mortality risk is higher than the current U.S. mortality rate for diabetes (26 deaths per 100,000) and for the flu and pneumonia (17 deaths per 100,000).[5]

Here in the United States and around the world, climate-induced temperature changes will leave some regions as winners and others as losers—with more losers than winners. But the clear message from the data is that on net the world and the United States will lose.

Policy Delivers High Returns

The level of greenhouse gas emissions is not a law of physics, but rather reflects policy choices. It is therefore instructive to consider the benefits of policy that would lead to a moderate emissions path—reducing warming at the end of the century from 4.8°C to 2.6°C (or 8.6°F to 4.7°F).

This reduction in warming, which falls short of the Paris Agreement's long-term targets, would still lead to dramatically lower mortality risks compared to the high-emissions scenario. For example, the projected total global mortality impact of climate-induced temperature changes falls by 84% by the end of the century, relative to a scenario of continued high emissions. Under this moderate emissions scenario, projections show climate-induced temperature changes would be responsible for 14 additional deaths per 100,000 by the end of the century. Accra, Ghana would see its mortality risk sink from 160 deaths per 100,000 people to 29 deaths per 100,000 people.

In the United States, the risk to mortality would be almost completely eliminated, with just 1.3 deaths for every 100,000 people instead of 10 deaths per 100,000.[2] Looking around the country, Chicago sees a slight improvement. But the real gains happen in higher risk areas. Orange County reduces its temperature-related mortality risk from 38 deaths per 100,000 to 20 deaths. Washington, DC sees its mortality risk cut in half—from 33 deaths per 100,000 to 14. Same with Winston-Salem, with the risk sinking from 35 to 18 deaths. And, in Kenton County, the improvements from lower emissions are even more significant, with mortality risk falling from 28 deaths per 100,000 to just 9 deaths per 100,000.

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[5] Centers for Disease Control and Prevention. "Deaths: Final Data for 2017." National Vital Statistics Reports, 2019, 68(9).

It is apparent that reducing emissions offers substantial benefits both globally and in the United States. Put plainly, our research suggests that some of the most significant public health gains in human history could be achieved by cutting greenhouse gas emissions.

The Social Cost of Carbon as a Guidepost

How can these reductions be achieved? A key instrument for any climate policy is an estimate of the social cost of carbon (SCC) that is based on frontier understanding of climate science and economics. The SCC is the monetary cost of the damages caused by the release of an additional ton of carbon dioxide into the atmosphere. Simply put, it reflects the cost of climate change—accounting for elevated mortality rates as well as the destruction of property from storms and floods, declining agricultural and labor productivity, and so forth.

The SCC is arguably the most important component of regulatory policy in this area because, by calculating the costs of climate change, the social cost of carbon allows for the calculation of the monetary benefits of regulations that reduce greenhouse gases. So, for example, a regulation that reduces carbon dioxide emissions by 10 tons would have societal benefits of $510 if the value of the social cost of carbon were $51, as the Obama Administration set it. These benefits can then be compared to the costs that the regulation imposes to determine whether the regulation is socially beneficial on net.

Since the establishment of the United States Government's SCC in 2010, it has been used to guide the design of more than 80 regulations. These regulations have resulted in more than $1 trillion of gross benefits.[6]

Critically, the SCC can also be used to determine an efficient price for market-based policies for combatting climate change, such as a carbon tax or cap-and-trade system. If set at the value of the SCC, these pricing approaches will ensure that we are pursuing policies where the benefits exceed their costs. A great appeal of these approaches is that they unleash market forces to uncover the least expensive ways to reduce emissions, thereby minimizing the costs to the economy, and do not require the ex-ante knowledge of which sector they will emerge from.

Regardless of the policy approach used, a social cost of carbon based on the best available peer-reviewed research is a key ingredient in beneficial policy. To detail how we get there, it's important to first understand where the SCC came from and how it has evolved.

The development of the social cost of carbon has a history that goes back to my time as the Chief Economist for President Obama's Council of Economic Advisors. In 2008, the 9th Circuit Court of Appeals ruled[7] that the Department of Transportation needed to update its regulatory impact analysis for fuel economy rules with an estimate of the SCC. The court directed that, "while the record shows that there is a range of values, the value of carbon emissions reduction is certainly not zero." So, the Department of Energy, the Department of Transportation and EPA began to

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[6] Nordhaus, William D. "Revisiting the social cost of carbon." *Proceedings of the National Academy of Sciences* 114, no. 7 (2017): 1518-1523.

[7] *Center for Biological Diversity v. National Highway Traffic Safety Administration*, 538 F. 3d 1172 (9th Cir. 2008).

incorporate a variety of individually developed estimates of the SCC into their regulatory analyses. These estimates were derived from academic literature and ranged from zero—which they were instructed by the court to no longer use—to $159 per metric ton of carbon dioxide emitted.[8]

To improve consistency in the government's use of the SCC, I, along with Cass Sunstein, then the Administrator of the White House Office of Information and Regulatory Affairs and now a professor at Harvard, assembled and co-led an interagency working group to determine a consistent government-wide SCC. The team consisted of the top economists, scientists and lawyers from four other offices in the Executive Office of the President and six federal agencies, including the EPA and the Departments of Agriculture, Commerce, Energy, Transportation and Treasury.

The process for developing the SCC took approximately a year and included an intense assessment of the best available peer-reviewed research, and significant debate and discussion amongst the team of climate scientists, economists, lawyers and other experts across the federal government. It also included a careful consideration of public comments on the interim values that agencies had been using and an interim value determined by the interagency group. Ultimately, the interagency working group determined a central estimate of $21 per metric ton. That estimate has since been revised to reflect scientific advances and as of 2016 was about $51.

To ensure that the next SCC update keeps up with the latest available science and economics, in 2015 the Office of Management and Budget directed the National Academies of Sciences (NAS) to help in providing advice on the pros and cons of potential approaches to future updates, informed by ongoing public comments and the peer-reviewed literature. In 2017, the NAS released its recommendations after a comprehensive assessment, for which I served as a reviewer. The NAS report identified important ways to take advantage of improved understanding of the social and economic impacts of climate change. It proposed a new framework that strengthened the scientific basis of the calculation, provided greater transparency in the process, and improved characterization of the uncertainties of the estimates.

In March of 2017, President Trump's Executive Order 13783 disbanded the Interagency Working Group on Social Cost of Greenhouse Gases, withdrawing its official estimates of the SCC. In 2018, the EPA released a regulatory impact analysis for greenhouse gas emission guidelines that established a new SCC between $1 and $7. To arrive at this number, the EPA made methodological changes that in my judgment cannot be justified by science or economics and in this respect moved the SCC away from the frontier of understanding.

In the absence of federal leadership, I joined with Trevor Houser from the Rhodium Group, Solomon Hsiang from the University of California, Berkeley, and Robert Kopp from Rutgers University to co-founded a multi-disciplinary research institute, the Climate Impact Lab (CIL). The CIL includes more than 20 climate scientists, economists, data engineers, and other experts. We are producing the world's first empirically derived estimate of the social cost of carbon.

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[8] United States Government Accountability Office, "Social Cost of Carbon: Identifying a Federal Entity to Address the National Academies' Recommendations Could Strengthen Regulatory Analysis," 2020.

Combining an immense body of historical data on social, economic and climate indicators with climate models, we develop projections of the long-term effect of a “high emissions” climate change scenario in five core sectors—labor productivity, coastal vulnerability, energy, agriculture, and mortality—in each of about 25,000 local regions spanning the globe. These sector-specific projections are then monetized and aggregated across all regions to determine the cost that emitting an additional ton of carbon imposes on a future society and economy.

The mortality findings detailed today are the first sector-specific projections we have thus far. From them we learn that when mortality costs around the world are totaled, the present-day value of emitting an additional ton of CO_2 is $36.60 under a scenario of continued high emissions. This estimate applies a 2% discount rate, consistent with U.S. Treasury rates over the last few decades, and a method of valuing death risk that takes age into account. Different assumptions lead to higher and lower values, but our judgment is that these assumptions are merited scientifically.

If we were to mimic the Obama Administration’s assumptions and assume that mortality risk is valued equally across ages, but varies across countries, and use a 3% discount rate, then this would lead to an estimate of $22.10 per ton of damages.

It is instructive to compare these estimates of the mortality-only SCC to the overall or total SCC used by the Trump and Obama Administrations. The Trump Administration has set the total SCC at $7. This is substantially below the Obama Administration’s central value of $51. It is noteworthy that full mortality risk in the Obama number was only worth about $2.[9]

The study that we released on Monday, showing a mortality-only SCC of $36.60, suggests that both the Trump and Obama Administration’s estimates of the total SCC are too low. In the case of the former, the mortality risk from climate-induced temperature changes in our study is more than three to five times that of the Trump administration’s *full* SCC. With respect to the latter, our mortality risk estimate amounts to 73% of the full Obama SCC. This is especially striking because prior to our findings the available evidence said all mortality risk only accounted for 4% of the Obama SCC of $51.

Another clear conclusion is that there is an urgent need to bring the SCC and policy in line with the latest evidence in climate science and economics. The NAS has outlined how to do this and the Climate Impact Lab is following their guidance in the absence of federal leadership. Within the coming year, the Climate Impact Lab will calculate the full social cost of carbon by aggregating empirically grounded cost estimates across the key sectors mentioned.

Conclusion

Climate-induced temperature changes will have dramatic impacts on human life, raising global mortality risk by 85 deaths for every 100,000 people by the end of the century. That’s comparable to the impacts of all infectious diseases, outside of Covid-19. The United States is

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[9] Carleton, Tamma, et al. "Valuing the global mortality consequences of climate change accounting for adaptation costs and benefits." No. w27599. National Bureau of Economic Research, 2020.

projected to see its temperature-related mortality risk increase by 10 deaths for every 100,000 people by 2100, on par with the U.S. fatality rate from auto accidents today.

Yet, robust climate policy can change our trajectory, delivering some of the greatest public health gains in human history. Bringing emissions down to moderate levels is projected to virtually erase the mortality risk from climate-induced temperature changes in the United States and bring the projected risk down substantially globally to just 14 deaths for every 100,000 people. A key guidepost to setting climate policy will be a scientifically validated social cost of carbon, like the one that Climate Impact Lab is constructing.

Thank you for the opportunity to share my views with the Committee.

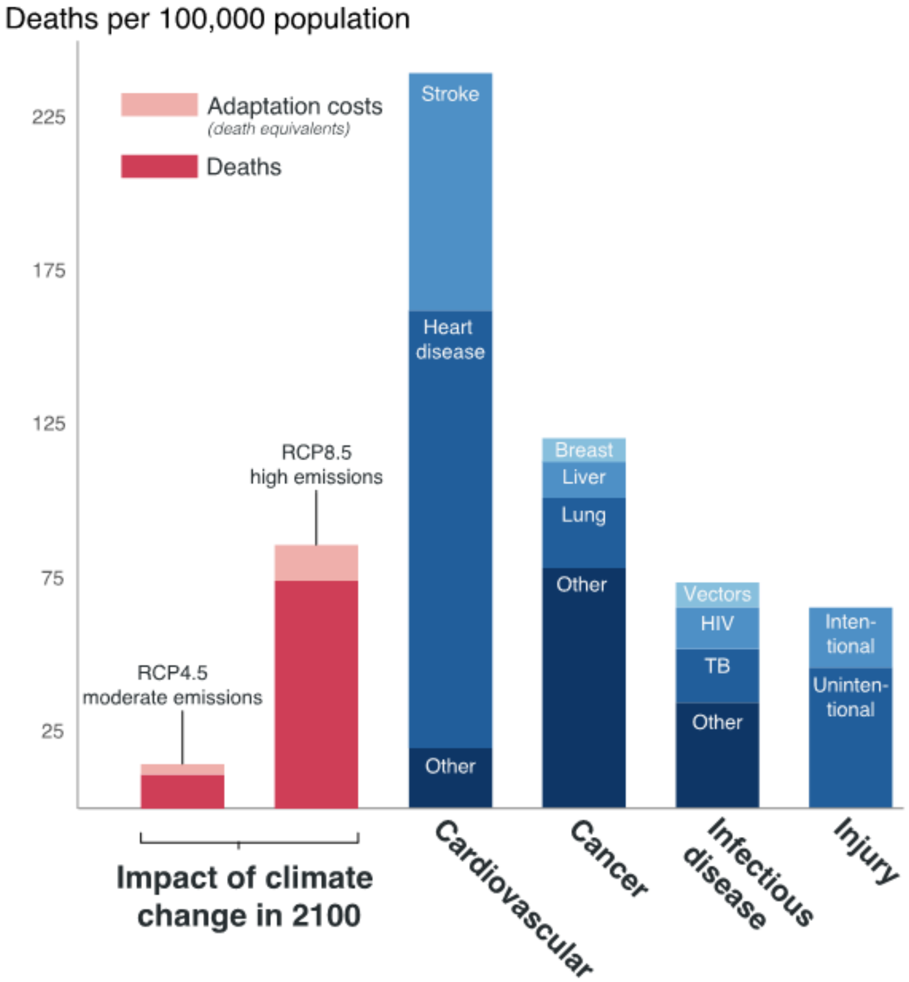
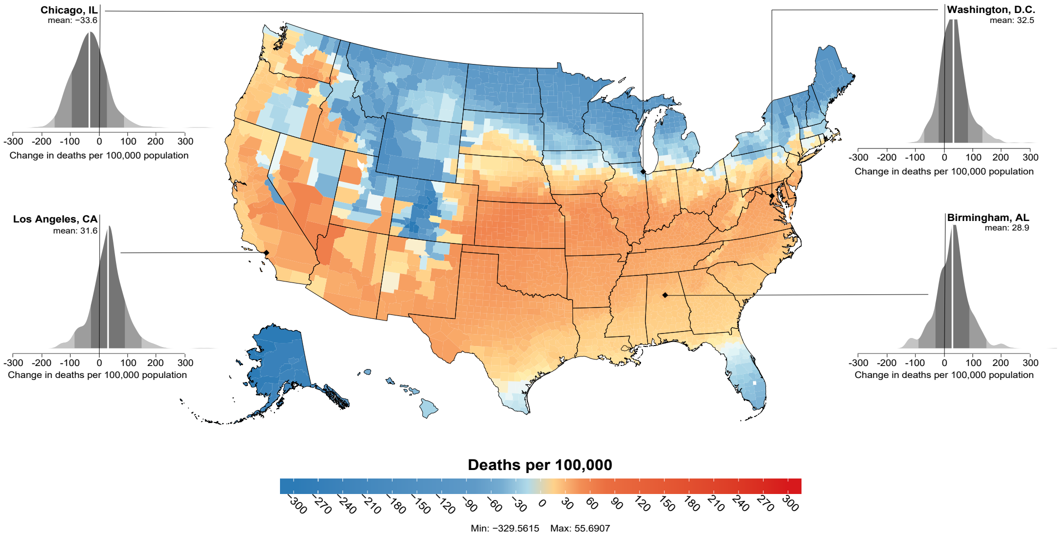
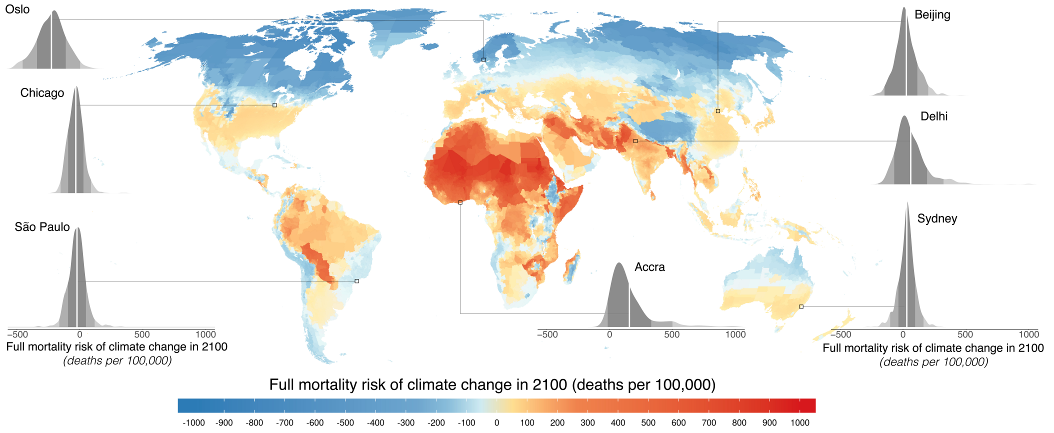


Figure 1: The impact of climate change in 2100 is comparable to contemporary leading causes of death. Impacts of climate change (coral) are calculated for the year 2100 under the high emissions scenario (SSP3-RCP8.5) and moderate emissions scenario (SSP3-RCP4.5) and include changes in death rates (solid colors) and changes in adaptation costs, measured in death-equivalents (light shading). Blue bars on the right indicate average mortality rates globally in 2018, with values from WHO (2018). Figure from Carleton, Tamma, et al. "Valuing the global mortality consequences of climate change accounting for adaptation costs and benefits" (2020).



(a) National



(b) Global

Figure 2: The mortality risk of future climate change. The maps indicates the full mortality risk of climate change, measured in units of deaths per 100,000 population, in the year 2100. Panel A displays risk results for the United States, while Panel B displays results for the world. Estimates come from a model accounting for both the costs and the benefits of adaptation, and the map shows the climate model weighted mean estimate across Monte Carlo simulations conducted on 33 climate models; density plots for select regions indicate the full distribution of estimated impacts across all Monte Carlo simulations. In each density plot, solid white lines indicate the mean estimate shown on the map, while shading indicates one, two, and three standard deviations from the mean. All values shown refer to the RCP8.5 emissions scenario and the SSP3 socioeconomic scenario. Figure adapted from Carleton, Tamma, et al. “Valuing the global mortality consequences of climate change accounting for adaptation costs and benefits” (2020).

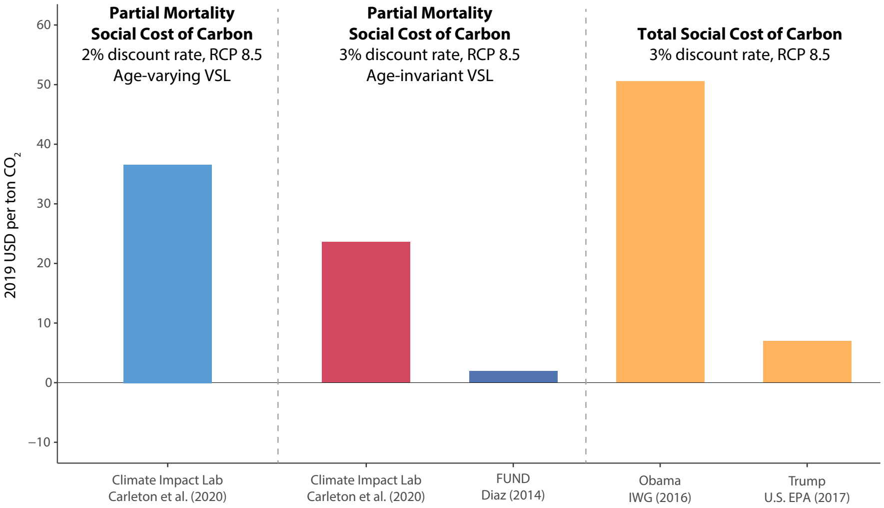


Figure 3: Estimates of a partial Social Cost of Carbon (SCC) for excess mortality risk from the Climate Impact Lab, compared to existing partial and full SCC estimates. Climate Impact Lab and FUND estimates account only for mortality-related costs; Obama administration and Trump administration estimates account for all sectors of climate change impacts. Trump Administration SCC values include only damages within the United States, while all others shown reflect global damages. Figure adapted using results from Carleton, Tamma, et al. "Valuing the global mortality consequences of climate change accounting for adaptation costs and benefits" (2020).

				Mortality Risk Per 100,000	
Representative	State	District	County	RCP8.5	RCP4.5
Armstrong	North Dakota	At Large	Cass County	-75.7	-52.1
Clay	Missouri	1	St. Louis City	29.9	9.8
Cloud	Texas	27	Nueces County	-0.7	4.6
Comer	Kentucky	1	McCracken County	38.5	18.4
Connolly	Virginia	11	Fairfax County	33.5	15.0
Cooper	Tennessee	5	Davidson County	34.3	16.8
DeSaulnier	California	11	Contra Costa County	34.2	17.2
Foxx	North Carolina	5	Forsyth County	34.6	17.7
Gibbs	Ohio	7	Stark County	-1.1	-11.6
Gomez	California	34	Los Angeles County	31.6	16.1
Gosar	Arizona	4	Maricopa County	34.0	18.4
Green	Tennessee	7	Williamson County	35.0	17.8
Grothman	Wisconsin	6	Winnebago County	-62.6	-49.6
Hice	Georgia	10	Walton County	27.6	16.4
Higgins	Louisiana	3	Lafayette Parish	18.8	13.0
Jordan	Ohio	4	Allen County	9.0	-9.1
Keller	Pennsylvania	12	Lycoming County	9.7	-7.7
Kelly	Illinois	2	Cook County	-33.6	-31.6
Khanna	California	17	Alameda County	32.1	16.3
Krishnamoorthi	Illinois	8	Cook County	-33.6	-31.6
Lawrence	Michigan	14	Wayne County	-29.7	-30.7
Lynch	Massachusetts	8	Norfolk County	-19.1	-20.5
Maloney	New York	12	New York County	15.7	2.4
Massie	Kentucky	4	Kenton County	28.3	8.8
Mfume	Maryland	7	Baltimore County	25.3	8.3
Miller	West Virginia	3	Raleigh County	27.0	9.9
Norman	South Carolina	5.	York County	29.2	17.0
Norton	District of Columbia	At Large	-	32.5	14.1
Ocasio-Cortez	New York	14	Bronx County	15.8	2.5
Palmer	Alabama	6	Jefferson County	28.9	16.5
Plaskett	Virgin Islands	At Large	-	-6.4	-6.6
Porter	California	45	Orange County	38.1	20.1
Pressley	Massachusetts	7	Suffolk County	-24.4	-23.8
Raskin	Maryland	8	Montgomery County	33.4	14.6
Rouda	California	48	Orange County	38.1	20.1
Roy	Texas	21	Comal County	24.1	13.8
Sarbanes	Maryland	3	Baltimore City	25.3	8.3
Speier	California	14	San Mateo County	28.4	14.9
Steube	Florida	17	Sarasota County	-22.2	-4.8
Tlaib	Michigan	13	Wayne County	-29.7	-30.7
Wasserman Schultz	Florida	23	Broward County	-39.1	-13.9
Welch	Vermont	At Large	Chittenden County	-65.3	-53.1
	United States			10.1	1.3

Table 1: Climate-Induced Mortality Risk Impacts for Select Counties at End of Century. Table includes the county with the greatest number of constituents in each Representative's congressional district. Impacts of climate change are calculated for the year 2100 for RCP8.5, and are averaged across the five end-of-century years for RCP4.5. Impacts include changes in mortality risk accounting for adaptation costs and benefits. The columns compare the effect of increased temperatures on mortality risk for SSP3 under emissions scenario RCP 8.5 and RCP 4.5, respectively.