Testimony by Jodi Sherman, M.D.
Committee on Ways and Means
Hearing on "Preparing America's Health Care Infrastructure for the Climate Crisis"
September 15, 2022

Good Morning Chairman Neal, Ranking Member Brady, and Members of the Committee on Ways and Means. I sincerely appreciate the opportunity to testify today. My name is Jodi Sherman, and I am an Associate Professor of Anesthesiology at the Yale School of Medicine, Director of the Program on Health Care Environmental Sustainability at the Yale Center on Climate Change and Health. My work aims to mitigate health care pollution in a way that cuts costs and improves patient outcomes while protecting public health.

As a researcher on health care pollution and impacts on human health, I am honored to be here today to speak to issues and opportunities for preparing America's Health Care Infrastructure for the Climate Crisis, which is already upon us, and will get worse in the coming years and decades.

Ecosystem breakdown and climate change are adversely affecting human health and exacerbating existing inequities, and intensifying pressures on already strained health systems. Ironically, health care is a major polluting industry, responsible for nearly 5% of global greenhouse gas (GHG) emissions and a similar proportion of air pollutants[1]. Pollution is a leading cause of morbidity and mortality, globally responsible for 16% of all deaths[2], and climate change has undermined social and environmental determinants of health to the point that it is now recognized as the greatest global public health threat of the 21st century[3]. The Intergovernmental Panel on Climate Change—the most extensive climate science body—has repeatedly called upon the global community to halve GHG emissions by 2030 and achieve net zero carbon emissions by mid-century to slow climate change and avert the worst predicted harms to civilization.[4]

In response, at the United Nations Climate Change Conference (COP26) in 2021, the World Health Organization led an effort that saw more than 50 countries commit to achieving low-carbon, resilient health systems[5]. England's National Health Service (NHS)—a global exemplar--has committed to achieving net zero emissions by 2045,[6] and is well on their way to achieving this ambition, legally mandated to do so in accordance with the British Climate Act of 2008, and ascribed specific duties and powers through the Health and Care Act of 2022 to support their net zero efforts. The U.S. Department of Health and Human Services (HHS) has committed federal health systems to decarbonization in accordance with the scientific community and White House mandate, and launched a voluntary Health Sector Climate Pledge[7] to accelerate decarbonization and strengthen climate resilience within non-federal health systems.

The vast majority of U.S. health care organizations remain uncommitted to timely action[8]. Those that are committed lack policies and knowledge to support necessary changes; even worse, existing policies drive inappropriate consumption of resources and pollution[9,10]. Greenwashing by manufacturers, distributors, and health care companies and organizations is a growing concern[10].

Policies are required to compel rapid action, support standardized, transparent reporting methods of products and services, enable independent assurances, permit identification and sharing of best practices, and to reliably guide implementation strategies at the level of clinical care delivery to meet local needs and conditions, and to maintain quality and safety. Otherwise, we risk not going far enough, fast enough, and the costs of inaction to health and health care systems will inevitably rise.

I thank you for calling this hearing and issuing this long-overdue call to action—not only to this powerful committee, but to every member of Congress—to weigh the role that our health care system plays in mitigating harm to Americans and preparing for the climate crisis.

I am frequently asked why I care so deeply about this issue of health care and the climate crisis. As a practicing anesthesiologist, patient safety is a hallmark of my profession. I have served on the front lines of the COVID pandemic, and I routinely care for patients ravaged by pollution-related illnesses including cancer, strokes, heart and lung disease, and trauma. I use lots of high-tech devices, drugs and medical supplies, many of which are thrown away, unused, because of faults with our health care system, contributing to pollution and resource shortages. As we've learned from

the COVID pandemic, no nation, no health system, and no individual--no matter how wealthy--is immune to the realty that our natural and medical resources are finite. Whether a pandemic like COVID, or a natural disaster such as Hurricane Maria that crippled parts of the US medical supply chain, we are reminded that our health system is vulnerable to the consequences of ecosystem destruction and a rapidly changing climate. Each time I take care of a patient, which gives me great satisfaction and sense of purpose in life, I also suffer moral injury knowing I am also causing harm to someone else through health care pollution. Reconciling this incongruity, to abide by the Hippocratic Oath I swore to uphold to do no harm is what motivates me in my career, and to appear before you today.

I have three key points to make today:

1. Pollution and climate change are harming health and health care delivery, increasing care requirements and costs, and depleting health care resources. Health care requirements are expected to worsen in the years and decades to come, and urgently improving the preparedness and resilience of our health care infrastructure is paramount.
2. Health care itself is a leading contributor to pollution and climate change, against the mission to first, do no harm, and mitigating health care pollution is a fundamental requirement for safe and high-quality health care delivery.
3. Voluntary measures are insufficient to transform the health care sector, and legislative action is urgently required to compel decarbonization in accordance with science-based targets and timelines, and to avoid greenwashing.

1. Pollution and climate change are harming health and health care delivery, increasing care requirements and costs, and depleting health care resources. Health care requirements are expected to worsen in the years and decades to come, and urgently improving the preparedness and resilience of our health care infrastructure is paramount.

The health care sector is highly energy intensive, with continuous operations 24/7, significant heating, ventilation, and air conditioning requirements, high tech diagnostic and therapeutic equipment, and a global supply chain of pharmaceuticals, medical equipment and supplies, and raw material precursors that must be extracted, manufactured, and transported at great distances. Health care's reliance on fossil fuel combustion for energy is threatening the fundamental mission of health care – to improve health and well-being –by creating and exacerbating illness, contributing to environmental degradation and climate change that is disrupting health care infrastructure, increasing care costs, and negatively impacting our ability to deliver high-quality health care.

The health care industry is among the most carbon-intensive service sectors in the industrialized world. Fossil fuel combustion is a primary driver of both air pollution and climate change, leading to the generation of a wide variety of air pollutants, including particulate matter (e.g., $PM_{2.5}$), nitrogen and sulfur dioxides, and ground level ozone, as well as GHGes.[2]Air pollution is associated with a range of health conditions including strokes, dementia, autism, type 2 diabetes, and adverse pregnancy outcomes including pre-term deliveries and low birthrates,[2] increasing human suffering, premature death, and health care costs.

In addition to air pollution, GHG emissions driving climate change also arises from burning fossil fuels, exacerbating existing conditions and risks to health. These risks include extreme heat stress, poor air quality from higher pollen counts and longer pollen seasons, wildfire smoke, impaired agricultural productivity, drought, harmful algae blooms, intensification of extreme weather events such as hurricanes, alterations in vector ecology for infectious diseases including tick-borne and mosquito-borne illnesses, and impairing social factors leading to displaced populations and political unrest.[11] More than one third of heat-related deaths worldwide are presently due to climate change, and is expected to worsen.[12]

The costs of inaction are high. A recent study by the Medical Society Consortium on Climate and Health and others concluded that the people of the United States are **already** burdened by health costs of air pollution and climate change that far exceed $800 billion per year, and this pollution burden on health is expected to become even more expensive in years to come without a stronger societal response to address this crisis.

While the health sector is caring for a rising burden of pollution and climate-related illness, its essential infrastructure is directly threatened by climate change, increasing health care costs and decreasing the ability of health systems to meet the needs of the patients and communities they serve. These threats stem from more frequent and severe flooding, increased wind stress and wildfires that damage health care facilities, disrupt transportation of medical supplies, patients and staff, and also disrupt power and water utility services needed to meet the needs of crisis surges in care as well as continuation of ongoing care. [13,14] (See figure.)

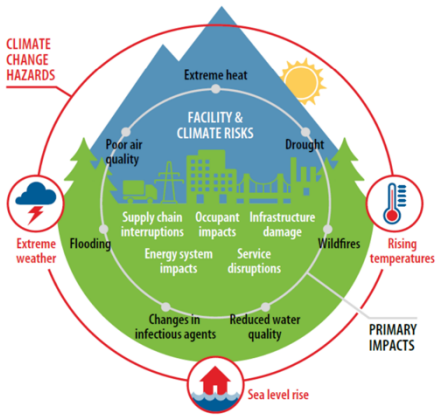

Figure . Healthcare System Climate Risks. From Brown, et al. (10)

Costs surge from climate related damages, displaced populations, and from inability to delivery routine care. After Hurricane Harvey, hospital emergency departments in Dallas-Fort Worth saw a 6-fold increase in visits due displaced Houston-area evacuees.[15] Due to both damaged infrastructure and avoided services, New York University Langone Medical Center suffered $1.4 billion after Hurricane Sandy. Climate risks to health care infrastructure are understudied, under-recognized and insufficiently addressed.[16]

Environmental degradation and climate disasters are also disrupting health care supply chains. Medical supplies often have complex, globally interconnect supply chains, and each component material has its own sourcing and manufacturing processes.[17] Disruptions affecting any single stakeholder in a supply chain, including material suppliers, labor for production and transport as seen with the COVID pandemic, or facilities and machinery for assembly, can lead to supply not meeting demand. Climate change events pose serious risks to public health if they disrupt the supply chains of essential products that are produced by industries that have limited incentives to assure supply continuity.

In 2017, Hurricane Maria hit Puerto Rico, shutting down the electricity grid, damaging roads and airports, and disrupting medical supply manufacturing.[18] At the time, half of US hospital saline bags were produced there by Baxter, resulting in critical shortages, [19,20] and forcing delay of elective procedures.[21] Shortages in 2 milliliter (ML) vials of bupivacaine used for spinal anesthesia for women requiring emergency Caesarean section to safely delivery babies led to unsafe practices of splitting larger vials such as 30 ML vials between patients at the point of care, increasing risk of dosing errors as 2ML vials are designed to prevent, and perversely led to throwing away of large quantities of drugs to remain compliant with United States Pharmacopeia compounding standards.[22]

The COVID-19 pandemic has resulted in similar supply chain issues.[23] For example, the tremendous surge in the need for personal protective equipment led to shortages that harmed frontline workers, including my specialty of anesthesiologists. Such shortages reveal the importance of a resilient health care supply chain, and ways to mitigate risk. Those health care facilities that relied on reusable supplies, and those that reprocessed single-use devices, were able to serve as their own suppliers, suggesting lessons for climate change preparedness and also pollution mitigation.

Measures to mitigate supply chain disruptions due to climate change can be generalized from overall supply chain resilience strategies. These begin with reducing demand for medical supplies and equipment in the first place, through disease prevention, robust preventive, primary care and public health services. This includes relying on durable medical equipment of modular design to facilitate disassembly, cleaning and repair, and reassembly for safe reuse. Wasteful, inappropriate consumption of resources must also be addressed, including those drivers that lead to discarding unused or partially used supplies, manufactured obsolescence that drives the uptake of single-use disposable supplies, and arbitrary “use-by” dates.[10] Such measures will improve supply chain resilience, decrease costs and pollution.[9]

2. **Health care delivery itself is a leading contributor to pollution and climate change, against the mission to first, do no harm, and mitigating health care pollution is a fundamental requirement for safe and high-quality health care delivery.**

The health care industry is among the most carbon-intensive service sectors in the industrialized world. It is responsible for 5% of global GHG emissions, and similar fractions of toxic air pollutants, largely stemming from fossil fuel combustion.[24] These emissions arise directly from health care facilities, purchased electricity, as well as indirectly from the supply chain of health care goods and services. The US health care system is responsible for about a quarter of all global health care GHG emissions, despite accounting for only 4% of the global population. (See figure 1.) The United States has the highest per-capital health care GHG emissions of any nation at about 1700 kg CO2e.[24,25]

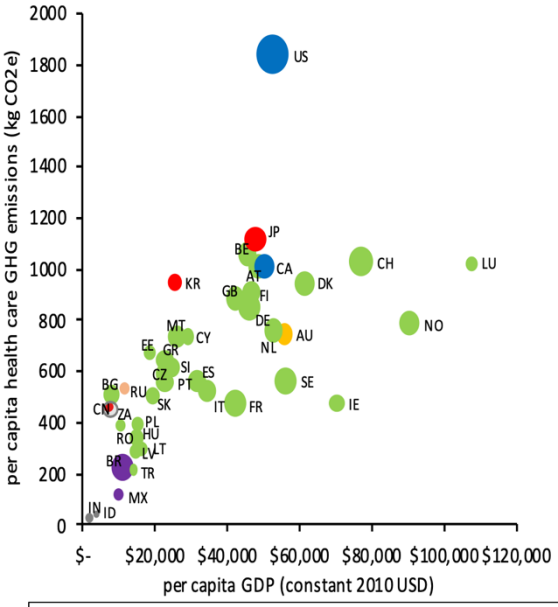

Figure 1. Health care sector GHG emissions as a function of GDP per capita (bubble widths indicate the proportion of national spending on health care). Watts, *et al*, *The Lancet* Countdown, 2019

Health care is an enormous industry, accounting for $4.1 trillion dollars or 20% of the United States economy. At the same time, one third of U.S. health care services are deemed inappropriate or low value,[26] 10% of the United States population is uninsured, and half of U.S. adults currently report medical financial hardship, meaning they cannot afford care no matter how necessary it is.[27] Meanwhile, other high income nations' health systems perform better, with longer healthy life expectancies, at a fraction of U.S. health care costs. The point between maximal health system performance, and minimal health care costs and GHG emissions is about 400 kg CO2e per-capita—one fourth that of the US. (See figure 2.) This suggests considerable opportunity for the U.S. to reduce its health care emissions and costs, while improving access and quality of care.[28]

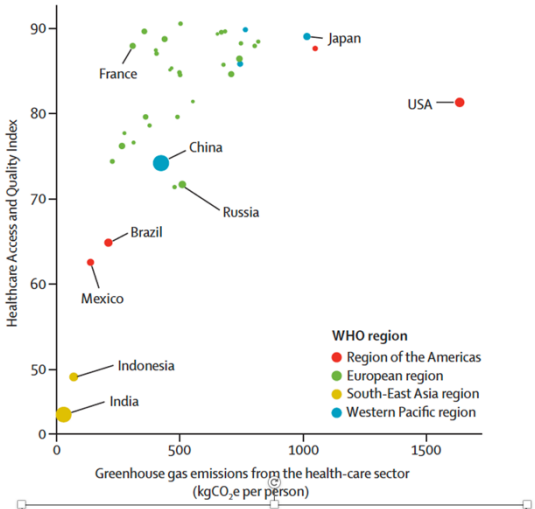

Figure 2. National per-capita GHG emissions from the health care sector against Healthcare Access and Quality Index for 2015. Watts, *et al*, *The Lancet* Countdown, 2020.

The United States health care sector is responsible for 8.5% of national GHG emissions, and similar fractions of air pollution such as particulate matter ($PM_{2.5}$) that are themselves harming health. Overall, U.S. health care-related pollution--GHG and non-GHG emissions--is estimated to be responsible for 244,000–531,000 disability-adjusted life years (DALYs) annually, which is on the same order of magnitude as deaths due to preventable medical errors as first reported by the Institute of Medicine (IOM, now the National Academy of Medicine) in the landmark report, To Err is Human: Building a Safer Health System This IOM report sparked the entire patient safety movement,[25,29,30] and brought the issues of medical error to the forefront of national concern. Not only must we keep the patient in front of us safe, we must also protect the entire communities we serve. Health care pollution prevention is the new patient safety movement that Congress must support.

To guide health care pollution mitigation, its vital to understand where emissions come from. (See Figure 3). About 20% of emissions arise directly from health care facilities such as from on-site boilers, and indirectly from purchased electricity. The vast majority of emissions, around 80%, stem from the supply chain of goods and services—especially from pharmaceuticals and chemicals, medical devices and supplies, and food.[25] (See figure 3.) Clinicians, administrators, regulators, and oversight bodes control consumption of resources—both appropriate and inappropriate. Manufacturers and regulators control embedded emissions, what goes to marketplace.

Achieving net zero emissions requires optimizing the efficiency and environmental performance of health care delivery. Inappropriate or low value care, in which harms or costs outweigh benefits, is ubiquitous. It includes overuse and underuse of health care services, driven by health system structure and funding mechanisms, and behaviors of clinicians and patients that drive misuse.

Underuse of necessary services leaves patients vulnerable to avoidable disease. Overuse results in harms to patients from adverse events, lost wages, and health care costs; financial harms to health systems and potential supply shortages; and population level disease burden from avoidable pollution generated by health care. **Appropriate care optimizes health and wellbeing by delivery of what is needed, wanted, clinically effective, affordable, equitable, and responsible in its use of resources**.7 High value care also maximizes environmental performance, avoiding harm to public health.[31] Addressing inappropriate care can lead to reducing absolute emissions while expanding access to health care and achieving co-benefits from mitigating harm and costs from health care pollution.[31]

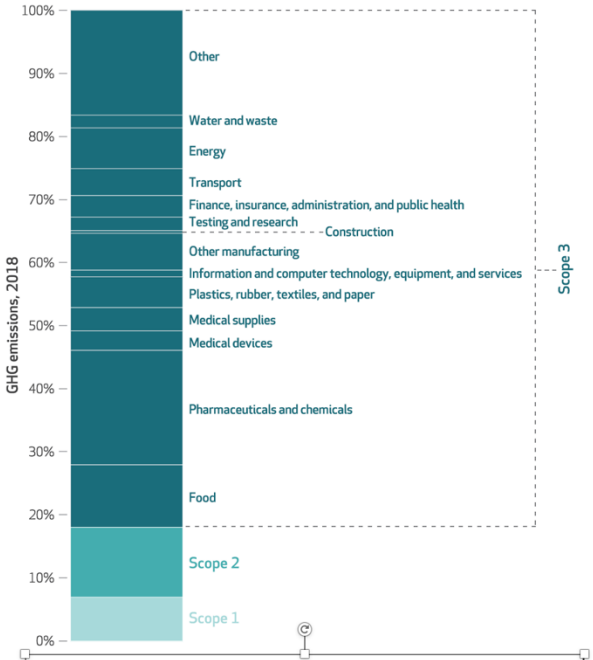

Figure 3. US national health care GHG emissions by Greenhouse Gas Protocol Scope. Eckelman, *et al., Health Affairs* 2020

We must also work to reduce the incidence and severity of disease to decrease the amount and intensity of care required. A robust primary and community care system is foundational to appropriate care.8. This requires identifying and targeting underserved groups, moving beyond treating the results of ethnic and economic disparities and seeking to tackle the root cause of inequities by building community wealth and addressing the social determinants of health.

We must also address our problem of disposability. Plastics, which are derived from fossil fuels, are ubiquitous. Microplastics are routinely found in table salt and tap water, and are detectable in our stool, blood and lungs, the harms of which are not yet fully understood. Plastics are laden with chemicals, many of which disrupt endocrine systems, and developing fetuses and small children suffer higher risks.[9] Medical devices, from simple items like blood pressure cuffs and bed linens, to complex surgical devices costing hundreds of dollars each, are now routinely single-use disposable. Disposable medical supplies routinely cost more and are more polluting compared with reusable alternatives, without supporting evidence of improved health outcomes, and our dependence on them leaves our health system vulnerable to supply chain interruptions as we've already seen with the COVID pandemic and climate-related events.[10]

Drug vials are routinely larger than required, and regulations prevent their routine splitting between patients. For example, I may require 5 units of insulin to treat a patient in the operating room. However, a typical vial is 3000 or 10000 units, which I must throw away--95-99% unused. At the same time there is more global need for insulin than there is manufacturing capacity.[27] Americans are rationing their supplies due to sky-rocketing costs, which has resulted in deaths.[32] Waste of cancer drugs alone due to oversize vials cost the U.S. health system $3 billion dollars in 2016.[33]

Regulatory and oversight drivers of manufactured obsolescence must be addressed.

3. Voluntary measures are insufficient to transform the health care sector, and legislative action is urgently required to compel decarbonization in accordance with science-based targets and timelines, and to avoid greenwashing.

There are growing efforts internationally to measure and mitigate health care emissions and climate-related risks. Describing the totality of emissions can be done using economywide or facility-level accounting methods. Top-down economywide approaches using economic input-output modeling are comprehensive, in that they include all emissions that are induced in the supply chain, and are important to understand the magnitude of emissions and their sources. However, these approaches present average results that do not pertain to individual health care organizations. Bottom

up emissions accounting at the facility level where resource consumption occurs is essential to guide institution-specific interventions and to enable comparisons across health care organizations to identify best practices and incentivize progress. Facility-level data are largely unavailable in the US, however, where reporting is not mandated.[25]

Standardized, transparent reporting of GHG emissions is essential to ensure accountability, guide strategic interventions and quantify progress, identify best practices, and prevent greenwashing.[16] The Greenhouse Gas Protocol of the World Resource Institute and the World Business Council for Sustainable Development is the international standard framework,[34] and should be used by U.S. health care organizations to align with carbon accounting bodies. Whole organization accounting is essential to monitor and achieve decarbonization goals. As the supply chain accounts for 80% of health care emissions, it must be accounted for to achieve effective and urgent decarbonization.

Health care quality measures are routinely used for both accountability and performance improvement. Because climate change and health care pollution harm health, health care decarbonization efforts should be considered an additional dimension of quality of care. GHG accounting should be incorporated into existing health care organization quality infrastructure, and performance measures incorporated into existing quality dimensions including health care outcomes, efficiency of care, costs, and equity, to ensure that decarbonization efforts are patient-centered.[16] To incentivize performance improvement exhibit 4 suggests metrics consistent with the CMS Hospital Value-Based Purchasing Program, which links hospital payments to inpatient health care quality, Medicaid grants-in-aid, and the Quality Payment Program established for clinicians to reward value under the Merit-based Incentive Payment System.[25]

Health care organizations are already reporting many quality measures.[17] They face numerous competing priorities and challenges, particularly in the face of pandemic recovery, with budget shortfalls, inflation, ongoing supply chain and staff shortages, and they already spend considerable resource to comply with performance reporting requirements. Most health care leaders will perceive decarbonization reporting and mitigation efforts as burdensome. Outside of the mandates of the federal health systems, GHG emissions reporting is voluntary in the US and very few health care organizations measure and strategically mitigate their emissions.[8] For this reason, standardized carbon reporting and decarbonization targets and timelines must be mandated for all health care organizations, and guidance and support provided.

Many health care organizations are already measuring emissions stemming from energy consumption and purchased electricity, and 3500 health care organizations are already reporting these emissions through the EPA's ENERGY STAR® program. Building on this, HHS should be supported to develop a centralized national carbon reporting database that encompasses all organizational emissions, including the supply chain, as well as to develop decarbonization management tools and guidance, through an inter-agency federal partnership. Existing electronic data management systems can used to promote interoperability and reduce measurement burden,[27] while standardized reporting methods can help avert greenwashing.

The Joint Commission and other oversight bodies should create a new environmental sustainability standard that includes decarbonization metrics, and they should address existing standards that drive disposability and waste, increase costs and pollution, and reduce supply chain resilience. [6,16] They must also simultaneously reduce regulatory burdens.

Federal research organizations, such as the Agency for Health care Research and Quality and the NIH should support decarbonization and pollution mitigation through health care delivery system science and discovery.[6,16] Presently, there is a dearth of funding for the intersection of health system science and climate change, in both the public and private spheres, and policy changes are needed to ensure scientific progress.

EXHIBIT 4

Proposed health system carbon emissions performance metrics and potential performance incentives, by Greenhouse Gas Protocol Scope

Emissions categories	Performance indicators	Applicable CMS infrastructure	Measure level	Public reporting tool
SCOPE 1				
Stationary combustion	Energy use intensity (BTU per square foot) of health care facilities	VBP, CFC	Facility level	Hospital Compare
	Energy Star score of health care facilities	VBP, CFC	Facility level	Hospital Compare
Mobile combustion	Greenhouse gas intensity (CO_2e per vehicle-mile) of owned or leased vehicles	VBP, CFC	Facility level	Hospital Compare
Anesthetic gases	Waste anesthetic gas intensity (CO_2e per anesthetic hour)	QPP, performance improvement	Provider, group, aAPM level	Physician Compare
		VBP, CFC	Facility level	Hospital Compare
SCOPE 2				
Purchased electricity	Energy use intensity (BTU per square foot) of health care facilities	VBP, CFC	Facility level	Hospital Compare
	Energy Star score of health care facilities	VBP, CFC	Facility level	Hospital Compare
SCOPE 3				
Purchased goods and services: Pharmaceuticals	Material consumption (quantities, CO_2e, and cost) per procedure or diagnostic code and associated health outcomes	VBP, CFC	Facility level	Hospital Compare
Noncapital medical products, devices, equipment	Integration of electronic health record and procurement data for public reporting	QPP, promoting interoperability	Provider, group, aAPM level	Physician Compare
Capital goods	Percent purchased goods and services supplied by companies with an approved Science Based Target for emissions reduction	VBP, CFC	Facility level	Hospital Compare
Waste generated in facilities operations	Percent overall spending on medical products, devices, and equipment devoted to items that were reused, reprocessed, or refurbished	VBP, CFC	Facility level	Hospital Compare
	Waste intensity (pounds of municipal solid waste per patient day)	VBP, CFC	Facility level	Hospital Compare
	Metered dose inhaler prescriptions as a percentage of all inhaler prescriptions	VBP, CFC	Facility level	Hospital Compare
SCOPES 1–3				
Total	Greenhouse gas emissions (metric tons CO_2e) per facility	VBP, CFC	Facility level	Hospital Compare
	Health care–sector carbon emissions per capita	GIA	Statewide	Medicaid and CHIP scorecard

SOURCE Authors' analysis. **NOTES** Scopes 1–3 are defined in the notes to exhibit 1. CMS is Centers for Medicare and Medicaid Services. VBP is Hospital Value-Based Purchasing Program. CFC is Conditions for Coverage. CO_2e is carbon dioxide equivalent. QPP is Quality Payment Program (cost, performance improvement, promoting interoperability, quality). aAPM is Advanced Alternative Payment Model. GIA is grants-in-aid for Medicaid beneficiaries. CHIP is Children's Health Insurance Program.

Chairman Neal, Ranking Member Brady and the rest of the Committee members, thank you for allowing me to share my testimony on the health care system's contribution to pollution and climate change, and required actions to mitigate pollution as fundamental to our duty to prevent harm and aid health and wellbeing, and to bolster the United States' health care system's resiliency in the face of a rapidly changing climate.

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