By Matthew J. Eckelman, Kaixin Huang, Robert Lagasse, Emily Senay, Robert Dubrow, and Jodi D. Sherman

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Health Care Pollution And Public Health Damage In The United States: An Update

ABSTRACT An up-to-date assessment of environmental emissions in the US health care sector is essential to help policy makers hold the health care industry accountable to protect public health. We update national-level US health-sector emissions. We also estimate state-level emissions for the first time and examine associations with state-level energy systems and health care quality and access metrics. Economywide modeling showed that US health care greenhouse gas emissions rose 6 percent from 2010 to 2018, reaching 1,692 kg per capita in 2018—the highest rate among industrialized nations. In 2018 greenhouse gas and toxic air pollutant emissions resulted in the loss of 388,000 disability-adjusted life-years. There was considerable variation in state-level greenhouse gas emissions per capita, which were not highly correlated with health system quality. These results suggest that the health care sector's outsize environmental footprint can be reduced without compromising quality. To reduce harmful emissions, the health care sector should decrease unnecessary consumption of resources, decarbonize power generation, and invest in preventive care. This will likely require mandatory reporting, benchmarking, and regulated accountability of health care organizations.

Matthew J. Eckelman is an associate professor in the Department of Civil and Environmental Engineering at Northeastern University, in Boston, Massachusetts.

Kaixin Huang is a PhD candidate in the Department of Civil and Environmental Engineering at Northeastern University.

Robert Lagasse is a professor and vice chair for quality and regulatory affairs, Department of Anesthesiology, Yale School of Medicine, Yale University, in New Haven, Connecticut.

Emily Senay is an assistant professor in the Department of Environmental Medicine and Public Health at the Icahn School of Medicine at Mount Sinai, in New York, New York.

Robert Dubrow is a professor of epidemiology in the Department of Environmental Health Sciences at the Yale School of Public Health, Yale University.

Jodi D. Sherman (jodi.sherman@yale.edu) is an associate professor of anesthesiology at the Yale School of Medicine and the Yale School of Public Health, Yale University.

The health care industry is among the most carbon-intensive service sectors in the industrialized world.[1] It is responsible for 4.4–4.6 percent of worldwide greenhouse gas emissions and similar fractions of toxic air pollutants, largely stemming from fossil fuel combustion.[1–3] These emissions arise directly from health care facilities, 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 greenhouse gas emissions, which is more than the health care system of any other nation.[1–3] Health damages stemming from US health care pollution in 2013 (the most recent study) were on the same order of magnitude as deaths from preventable medical errors.[4,5] These indirect health damages are largely unrecognized, leading to calls for expansion of the definition of patient safety to include safeguarding public health from health care pollution.[4,6,7] Financial costs associated with the disease burden from health care emissions have not yet been calculated, but they must include expenses related to increasing demand for health services and for relief and recovery from climate disasters. Higher emissions from health care may be an acceptable tradeoff if more spending brings better health outcomes while the world transitions to a clean energy economy. However, the US spends more on health care than any other high-income nation without seeing commensurate health benefits.[8]

There are growing efforts internationally to measure and mitigate health care emissions, with particular emphasis on greenhouse gas accountability.[1–6,9–15] Calculating total health care greenhouse gas emissions requires accounting for those emitted directly from health care facilities, such as from on-site boilers and certain medical gases (referred to as Scope 1), those emitted indirectly through purchased electricity (Scope 2), and those emitted in the supply chain through the production of goods and services procured by health systems (Scope 3). Describing the totality of health care emissions can be done using economywide or facility-level accounting methods. Economywide approaches are comprehensive in that they include all emissions that are induced in the supply chain, but these approaches present average results that do not pertain to individual facilities. This approach is commonly used to estimate national-level health-sector emissions.[3,5,6,8–14] In contrast, accounting for emissions at the facility level where resource consumption occurs is essential for comparisons across health care organizations and for institution-specific interventions.[6] Facility-level data are largely unavailable in the US, where reporting is not mandated.

In this article we update national-level US health care–sector emissions using the US Environmentally-Extended Input-Output model (USEEIO), developed by the Environmental Protection Agency (EPA), covering the years 2010–18 and classified into Scopes 1, 2, and 3. We also estimate state-level emissions for the first time, and we examine their association with various state-level energy systems as well as health care quality and access metrics. Finally, we suggest emissions reporting frameworks and accountability mandates that would align the US health care sector with sustainability programs globally and leverage its power toward achieving a rapid transition to a renewable energy economy while promoting population health, maintaining quality of care, and reducing per capita health care expenditures.

Study Data And Methods

ANALYTIC APPROACH Health care–related emissions arise both directly from health care facilities and indirectly from supply-chain activities associated with expenditures in the health care sector. We estimate emissions using an EEIO approach, wherein health care expenditures (both national and by state) are inputted into a sector-based model of the US economy that represents economic interlinkages among sectors and the quantities of various emissions (including greenhouse gases) that arise from each sector.[4] Of note, this method does not account for waste anesthetic gas or metered dose inhaler propellents.

DATA SOURCES National health expenditure data were extracted from the National Health Expenditure Accounts of the Centers for Medicare and Medicaid Services (CMS) for the period 2010–18 for sixteen categories of expenditures, including personal health care (covering all clinical goods and services), investment, government administration, insurance, public health, and capital investments.[16] State data (including for Washington, D.C.) were extracted from National Health Expenditure Accounts from the period 2010–14 that covered only personal health care expenditures.[16] State data for later years and other expenditure types were not available. All expenditures were converted to 2012 dollars on the basis of National Health Expenditure Accounts price indexes.[16]

ANALYSIS Health expenditure categories were mapped to corresponding economic sectors from the US Environmentally-Extended Input-Output model (USEEIOv2)[17,18] (mapping shown in online appendix exhibit A1).[19] The model is built on 2012 benchmark input-output data of monetary flows from the Bureau of Economic Analysis[20] and can evaluate both direct and indirect environmental and resource impacts associated with expenditures in 405 US economic sectors. The model incorporates greenhouse gas emissions factors for 2010–16 from the Inventory of U.S. Greenhouse Gas Emissions and Sinks,[21] which we extended to 2018, using the same data source,[22] by applying 2016–18 reductions in greenhouse gas emissions to specific model sectors (mapping shown in appendix exhibit A2).[19]

We then categorized emissions into Scopes 1, 2, and 3 at the national scale (mapping shown in appendix exhibit A3).[19] Scope 1 emissions are calculated as the total direct emissions originating from hospitals and other health care sectors. Scope 2 emissions are calculated from direct expenditures on electricity by hospitals and other health care sectors. Scope 3 emissions are calculated from all health care expenditures, adjusted by subtracting Scope 1 and Scope 2 emissions from hospitals and other health care sectors.

State-level personal health care greenhouse gas emissions for 2010–14 were calculated in the same manner using the USEEIOv2 model. To adjust for differences in the carbon intensity of electricity consumed in each state, emissions from purchased electricity were adjusted using data from the Emissions and Generation Resource Integrated Database (eGRID) from the EPA.[23] eGRID data are published every two years; factors for intermediate years were estimated by linear interpolation (appendix exhibit A4).[19] The percentage deviation from the US average emissions rate for each state and year was applied to emissions factors of the electric power generation, transmission, and distribution sector in the model (mapping shown in appendix exhibit A4).[19] All upstream electricity (for example, electricity used in the production of medical supplies) was left unadjusted, as the geographic locations of suppliers are not specified in the model. In an alternative analysis considering variations in purchasing power, we further normalized state-level greenhouse gas emission factors on the basis of retail electricity prices from the Energy Information Administration[24] (price data shown in appendix exhibit A14).[19]

Comparing states by total or per capita emissions does not account for important differences among state health systems. Instead, we correlated per capita greenhouse gas emissions with per capita health expenditures, total population, greenhouse gas emissions factors, uninsurance rates, the Health Access and Quality Index (a composite measure of personal health care access and quality across nations and subnational geographies), and state health system performance. Uninsurance rates by state were obtained from Census Bureau Small Area Health Insurance Estimates program.[25] Health Access and Quality Index values by state for 2015 were obtained from the Global Burden of Disease Study 2016.[26] State health system performance rank and quartile were obtained from the Commonwealth Fund.[27] All statistical analysis was performed in R studio.

We also estimated health care–related emissions of toxic air pollutants and their associated health damages. At the time of writing, the USEEIOv2 model included only greenhouse gas emissions; to estimate other emissions, we used an earlier version of the EEIO model (USEEIOv1.1), which is based on the 2011 National Emissions Inventory compiled by the EPA. USEEIOv1.1 uses factors from the EPA's Tool for the Reduction of Chemical and Other Environmental Impacts v2.1 life cycle impact assessment model to quantify all primary and secondary pollutants in terms of fine particulate matter (expressed as $PM_{2.5}$) and ozone equivalents.[28] To capture dynamic effects, emissions intensities are adjusted for 2010–18 from the National Emissions Inventory 2011 baseline, using national air trend data for primary $PM_{2.5}$ and ozone ambient concentrations.[29,30] Finally, emission-equivalent values are translated to disability-adjusted life-years (DALYs), using health damage factors from Rosalie van Zelm and colleagues[31] (factors shown in appendix exhibit A6).[19] Health damages from greenhouse gas emissions, including from malaria, flooding, malnutrition, diarrhea, and cardiovascular disease, are then translated to DALYs following our previous work.[5]

LIMITATIONS This analysis was subject to systematic limitations deriving from the aggregate nature and static economic structure of the USEEIOv2 national model. For example, we applied national Consumer Price Indexes from National Health Expenditure Accounts for the state-level analysis, but purchasing power for health care services differs among states, which may lead to bias in results for particularly high-cost or low-cost states. Only state-level differences in the carbon intensity of electricity have been accounted for. Most important in terms of policy actions, the use of economywide economic data produces national and state averages that are not representative of any single health care organization.

There is also uncertainty in the concordances among model sector classifications that map National Health Expenditure Account expenditures, Inventory of U.S. Greenhouse Gas Emissions and Sinks, National Emissions Inventory, and Greenhouse Gas Protocol Scopes to USEEIO economic sectors, although these are fully documented in the appendix exhibits.[19]

Study Results

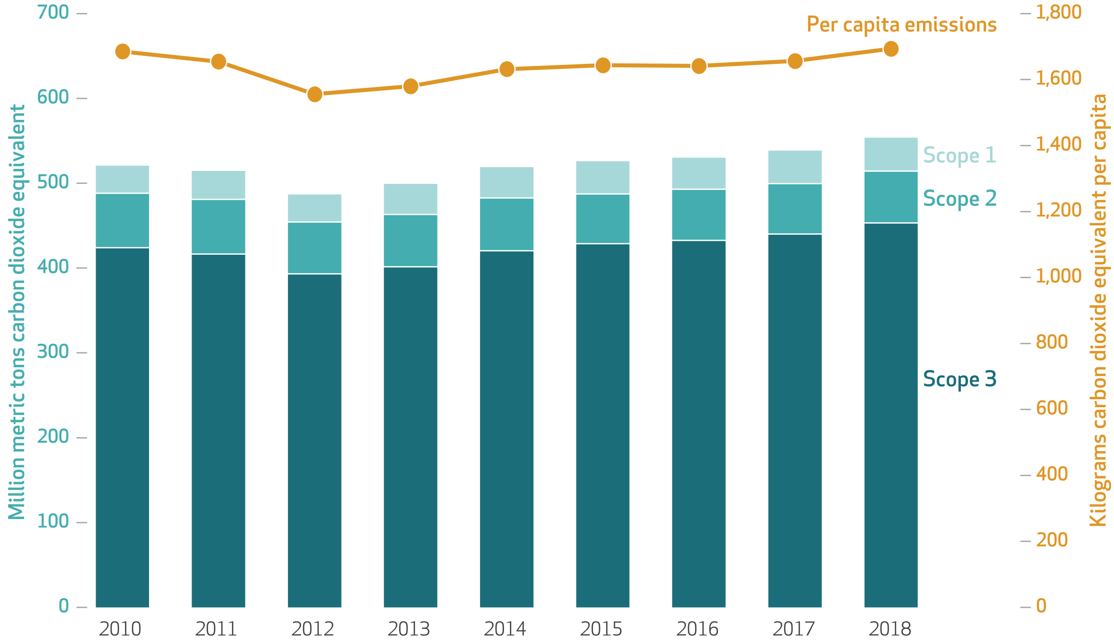
NATIONAL-LEVEL GREENHOUSE GAS EMISSIONS US health care greenhouse gas emissions show an overall 6 percent increase from 2010 to 2018, with two distinct periods (exhibit 1; additional results in appendix exhibits A7 and A8).[19] From 2010 to 2012, reductions in emissions factors (especially for electricity; appendix exhibit A4)[19] outpaced increases in real expenditures, and health care emissions fell from 520 to 486 million metric tons of carbon dioxide equivalents (Mt CO_2e), or from 1,685 kg to 1,555 kg CO_2e per capita. After 2012, emissions factors fell more slowly, and emissions rose after increases in real expenditures to 554 Mt CO_2e, or 1,693 kg CO_2e per capita, in 2018.

Emissions by Greenhouse Gas Protocol Scopes were fairly stable over the study period and are shown in detail for 2018 in exhibit 2 (numerical results in appendix exhibit A9).[19] Scope 3 indirect emissions contribute about 82 percent, followed by Scope 2 indirect emissions from purchased energy (about 11 percent) and Scope 1 direct emissions from health care operations (about 7 percent). Among Scope 3 sectors, pharmaceuticals and chemicals is the largest group, contributing nearly 20 percent of total emissions.

Based on where emissions occur in the economy, the electricity sector is the largest source of US health care greenhouse gas emissions, contributing 29 percent of their total in 2018

EXHIBIT 1

US national health care greenhouse gas (GHG) emissions, 2010–18



SOURCES National health expenditure data extracted from National Health Expenditure Accounts from 2010 to 2018 (Centers for Medicare and Medicaid Services, note 16 in text); and dynamic GHG emission factors extracted from the Environmental Protection Agency's US Environmentally-Extended Input-Output model (USEEIOv2) for 2010–16 and extended to 2018 by mapping 2016–18 changes in the Inventory of U.S. Greenhouse Gas Emissions and Sinks (note 22 in text) to specific sectors in the USEEIOv2. **NOTES** Scope 1 is direct emissions from health care facilities, Scope 2 is emissions from direct purchases of energy, and Scope 3 is all other supply-chain emissions. Health care–related GHG emissions are listed for the nation (left *y* axis) and per capita (right *y* axis) in carbon dioxide equivalents (CO_2e).

(appendix exhibit A10),[19] which is nearly six times higher than the second-largest contributing sector of basic organic chemical manufacturing; other important contributing sectors were truck transportation, beef production, waste management, grain cultivation, and plastics manufacturing.

STATE-LEVEL GREENHOUSE GAS EMISSIONS State-level health care greenhouse gas emissions trends are similar to national trends (appendix exhibits A11 and A12);[19] median per capita values decreased from 2010 to 2012 and increased thereafter. Midwestern and Northeastern states have generally higher per capita emissions than Western or Southern states (exhibit 3). This trend can also be seen in the eGRID–unadjusted results (appendix exhibit A13),[19] implying that regional differences in emissions are largely driven by differences in per capita health expenditures and not electricity emissions intensities. Washington, D.C., has the highest per capita health care emissions in the US, stemming from its having by far the highest per capita health care expenditures. Normalizing by state retail electricity prices, as shown in appendix exhibit A15,[19] further increases emissions in low-cost states, most notably the fossil energy–producing states of North Dakota, West Virginia, and Wyoming.

Correlations between health care greenhouse gas emissions per capita and other state-level metrics are presented in appendix exhibit A16.[19] As expected, electricity emissions factors ($R = 0.30$) and per capita health expenditures ($R = 0.87$) have statistically significant positive correlations with health care greenhouse gas emissions because both are direct inputs to the EEIO model. States with higher uninsurance rates tended to spend less on health care services ($R = -0.55$) and to have lower per capita greenhouse gas emissions ($R = -0.53$). Although the correlation between the Health Access and Quality Index and per capita greenhouse gas emissions was not significant, the state health system performance rank had a borderline significant positive correlation with per capita greenhouse gas emissions ($R = 0.26$; $p = 0.071$; appendix exhibit A16).[19] Boxplots of state health system performance quartiles (appendix exhibit A16)[19] also indicate that health systems with better performance tend to have higher per capita health care emissions.

HEALTH DAMAGES Health care–related $PM_{2.5}$ and ozone pollution are estimated to have caused the loss of 133,000–188,000 DALYs in 2018 (numerical results for all years in appendix exhibit A17),[19] dominated by damage from $PM_{2.5}$ emissions. From 2010 to 2016, increases in health care–related emissions were largely offset by decreasing national trends in primary $PM_{2.5}$ emissions. Between 2016 and 2017, national primary $PM_{2.5}$ emissions jumped more than 12 percent, which caused a concomitant jump in health damages from health care of approximately 20,000 DALYs in that year. Additional health damages associated with greenhouse gas emissions (that is, future climate change) are estimated at 111,000–343,000 DALYs in 2018. Thus, total health damages are estimated at 244,000–531,000 DALYs (median, 388,000 DALYs).

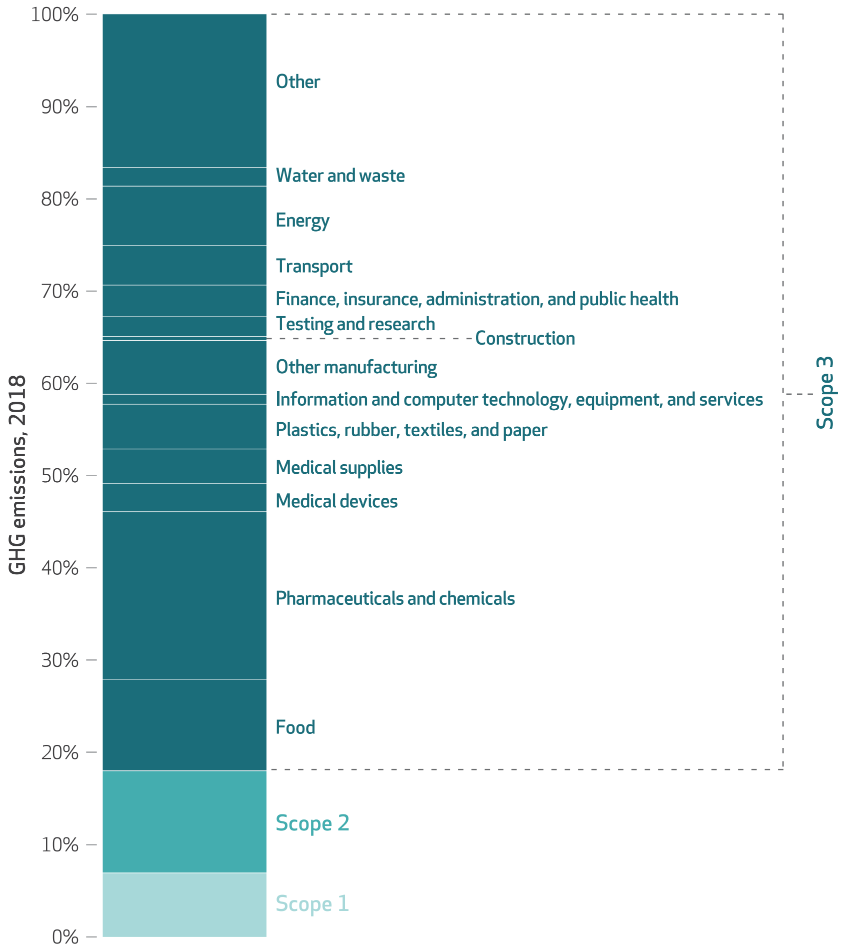
Discussion And Policy Implications

NATIONAL-LEVEL HEALTH CARE EMISSIONS AND DISEASE BURDEN Economywide investigations such as this are critically important to help understand the magnitude of health care–sector pollution and disease burden on a national scale, to identify hot spots, guide policy and mitigation efforts, and benchmark progress. Country-level health care–sector studies have been conducted for a handful of nations, including Australia,[11] Austria,[14] Canada,[10] China,[15] England,[13] Japan,[12] and the US.[9,10] To date, only England's National Health Service has a mandated, government-sponsored carbon reduction initiative that tracks greenhouse gas progress over time.[13] We previously estimated that in 2013 the US health care sector was responsible for 9–10 percent of domestic greenhouse gas emissions (615 Mt CO_2e), as well as for the loss of 614,000 DALYs primarily from greenhouse gas, $PM_{2.5}$, and ozone pollution damage.[4,5]

In this update, we found that US health care greenhouse gas emissions overall rose 6 percent from 2010 to 2018, with a decline in 2012, eventually reaching about 553 Mt CO_2e in 2018, or approximately 8.5 percent of domestic US greenhouse gas emissions. Our greenhouse gas estimates for 2013 are lower than in the previous study as a result of model updates for 2007 to 2012 expenditure-to-emissions conversion and model updates that capture annual shifts across the economy. Although previous estimates of greenhouse gas emissions were adjusted to account for decarbonization of electricity generation, in this article we capture shifts across other emissions-intensive sectors as well. Our updated 2018 result of 1,693 kg CO_2e per capita is still the highest value for any country.[2]

EXHIBIT 2

US national health care greenhouse gas (GHG) emissions by GHG Protocol Scope, 2018



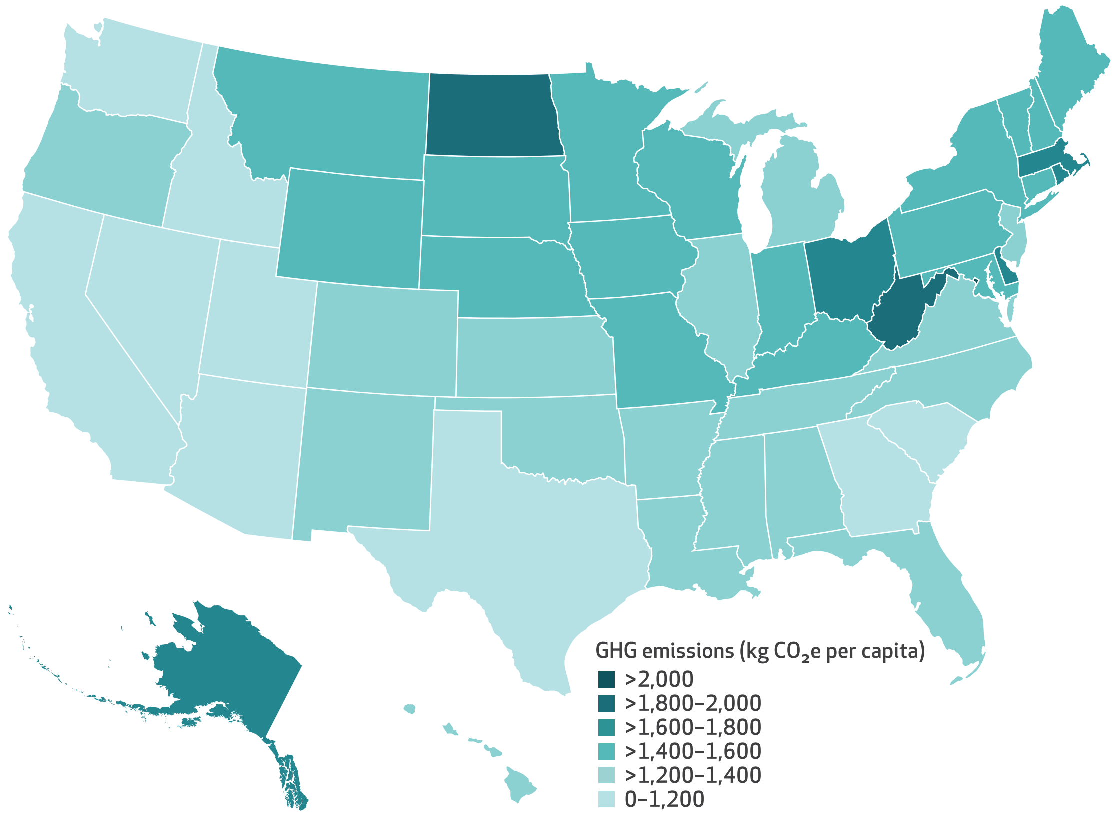
SOURCES See sources to exhibit 1. **NOTE** Scopes 1–3 are defined in the notes to exhibit 1.

As other studies have found,[1–5,9–15] greenhouse gas emissions are concentrated in the supply chain, with Scope 3 emissions contributing approximately four-fifths of the total greenhouse gas emissions from the health care sector in the US. Scope 2 emissions from direct purchases of electricity contribute approximately 11 percent of the total, but this is only a fraction of the health-sector greenhouse gas emissions from the electric power sector (29 percent across all Scopes). Thus, efforts to fully decarbonize the electricity grid have the potential to bring Scope 2 emissions to zero but will have an even greater absolute effect on Scope 3 emissions, which include electric power–sector emissions resulting from the production of goods and services in the supply chain.

We found that the total disease burden from US health care pollution resulted in a loss of about 388,000 DALYs in 2018. Moving away from fossil fuel–based electricity generation will reduce emissions of harmful air pollution that cause the majority of near-term health damages

EXHIBIT 3

State-level per capita greenhouse gas (GHG) emissions from personal health care expenditures, 2014



SOURCES Personal health care expenditure care data by state (including Washington, D.C.) extracted from National Health Expenditure Accounts for 2010–14; state-level GHG emissions factors of grid electricity from the Emissions and Generation Resource Integrated Database from the Environmental Protection Agency. **NOTE** GHG emissions were adjusted for state-specific differences in the carbon intensity of electricity; results are presented in kilograms carbon dioxide equivalent per capita (kg CO_2e per capita) by state.

from health care, in addition to reducing long-term harms from the effects of climate change. Estimates of harms to global health from US health care greenhouse gas emissions vary by a factor of about three, depending on the global emissions pathway,[5] indicating that future impacts of climate change can be substantially reduced through current actions to cut emissions. Health damage estimates are lower than previously found[4,5] as a result of a combination of energy decarbonization, improved pollution controls, and methodological updates to the EPA's Tool for the Reduction of Chemical and Other Environmental Impacts v2.1 model treatment of particulate matter.[28,32] Despite some improvement, this disease burden is still within the same order of magnitude as years of life lost as a result of deaths from preventable medical errors,[4,5] and it remains a concerning issue for health care safety, quality, and cost containment efforts.

STATE-LEVEL HEALTH CARE EMISSIONS AND HEALTH CARE ACCESS AND QUALITY For the first time, we also evaluated emissions at the state level, exploring the relationships between greenhouse gas emissions, health care expenditures, energy intensity of the electricity grid, and health care access and quality. Overall, per capita greenhouse gas emissions were much higher in states with higher per capita health care expenditures. Interventions aimed at decreasing health care spending, notably through reducing unnecessary care[33] and shifting spending away from high-resource and energy-intensive tertiary care through greater investment in disease prevention and public health efforts,[34] would significantly reduce health care–related pollution, its secondary disease burden, and costs.

We further explored associations between state-level greenhouse gas emissions and measures of health care access and quality. Most money for uncompensated care for uninsured patients goes to hospitals, which deliver about two-thirds of such care.[35] Despite the higher emissions intensity and health care costs for hospital services compared with non-hospital-based care, we found a strong negative correlation between the percentage of the uninsured and per capita emissions. However, the Health Access and Quality Index and state health system performance rank were only weakly associated with emissions. Of course, reducing health care pollution must never be achieved at the expense of equitable access to high-quality care, but these results suggest that costs and greenhouse gas emissions can be reduced without compromising quality. Future work should further explore specific dimensions of the quality of and access to care and at what point health expenditures and emissions are excessive with respect to health outcomes gains.

MANDATORY REPORTING Activities that reduce harm from health care pollution should be mandatory for all health care organizations. Health care systems should be required to measure and report greenhouse gas emissions and provide plans for reductions over time in alignment with science-based targets. This requires a unified and systematic reporting structure that would allow performance tracking over time. In contrast to national- and state-level greenhouse gas estimates, this would capture emissions and waste at the facility level, where energy and resource consumption occur, and would enable the implementation of mitigation practices that are locally feasible and effective.

Numerous environmental reporting frameworks, including the Global Reporting Initiative and the Carbon Disclosure Project, are in wide use by private, public, and governmental organizations and have set precedent for measuring

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; Noncapital medical products, devices, equipment; Capital goods; Waste generated in facilities operations	Material consumption (quantities, CO_2e, and cost) per procedure or diagnostic code and associated health outcomes	VBP, CFC	Facility level	Hospital Compare
	Integration of electronic health record and procurement data for public reporting	QPP, promoting interoperability	Provider, group, aAPM level	Physician Compare
	Percent purchased goods and services supplied by companies with an approved Science Based Target for emissions reduction	VBP, CFC	Facility level	Hospital Compare
	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.

and sharing organizational sustainability performance. It has been previously proposed that health systems should use existing corporate social responsibility frameworks for greenhouse gas reporting, yet very few US health care organizations do so.[36,37] Mandated reporting would require further steps, including, first, designation of an oversight body with regulatory authority; second, determination of key environmental metrics appropriate for the health care sector; third, determination of enhanced Scope 3 measurements that better reflect the supply-chain emissions that make up the majority of health care's environmental footprint; fourth, a timeline for greenhouse gas and pollutant reductions consistent with international scientific community recommendations; and fifth, a centralized data repository connecting environmental reporting with existing quality measures of cost and health outcomes to facilitate comparisons of similar sizes and types of health care facilities, identify best practices, and correlate results with existing health care quality domains.[29,37]

OVERSIGHT OF SUSTAINABILITY The only nationally mandated health system carbon accounting in the world occurs in England, overseen through the National Health Service.[13] Similar oversight could be accomplished through the Department of Health and Human Services, using infrastructure established by CMS.[37] Integrating accountability for environmental sustainability into the existing CMS framework will require valid performance metrics, acknowledgment of performance gaps, technology to promote data sharing and implementation of evidence-based guidelines, and payment reform to financially reward outstanding performance. Given the large number of variables that contribute to carbon emissions of health care organizations, comparison of environmental performance will require that facilities and their clinical activities be peer-matched.[6,7] 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.[37] A CMS working group of experts from the fields of health care operations, policy, sustainability, and medical device and pharmaceutical manufacturers and suppliers should oversee the development of standardized metrics.[6,7,38]

Linking sustainability measures to payment could occur in several ways. First, CMS-certified facilities are required to comply with the Conditions for Coverage related to their physical environments, which could include limits on the amount of facility-level emissions. Second, the Hospital Value-Based Purchasing Program links payments to inpatient health care quality. Quality can include integrating emissions metrics with existing population health metrics to incentivize Medicare-participating organizations to lower emissions, with the likely added benefit of improved population health and lowered costs. Third, state governments receive federal assistance in the form of grants-in-aid for Medicaid beneficiaries. Payments to states with higher per capita health-sector emissions or higher-emissions-intensity electricity grids could be reduced to incentivize more sustainable operations. Fourth, provider accountability for resource conservation can be incentivized through the Quality Payment Program to reduce waste, costs, and emissions associated with clinical care.[6,7]

Conclusion

US health care activities contribute to substantial quantities of environmental emissions and disease burden, contrary to the mission to "First, do no harm." Health care organizations should take concrete steps to measure and reduce their carbon pollution. Mandated emissions reporting would inform science-based interventions and facilitate rapid adoption of sustainable health care practices that could dramatically reduce health care pollution and improve public health. ■

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