MEDICINE AND SOCIETY: PEER-REVIEWED ARTICLE
How Should We Respond to Health Care Generating Environmental Harm?

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Abstract
Clinicians and organizations in the health sector have healing missions, and physicians, specifically, take oaths to "do no harm." Yet, paradoxically, health care operations contribute to pollution and exacerbate environmental disease burden. This article offers a view of how health sector actions exacerbate climate warming and iatrogenically harm global public health and argues that clinicians and organizations have ethical responsibilities to respond.

Lessons From the Syringe Tide
Medical waste management ethics came into focus in the late 1980s, when HIV-contaminated syringes, needles, and other medical trash washed up on East Coast beaches.[1] Known as the Syringe Tide,[1] this environmental disaster led to awareness of improper disposal of sharps and infectious waste as exacerbating pollution and increasing pathogen exposure and needlestick injuries and prompted passage of the Medical Waste Tracking Act of 1988.[2] A movement to properly segregate and dispose of medical waste to protect human and planetary health had begun.

As this example illustrates, the health sector's waste management practices can have health impacts. Despite the age-old, ethical code of medicine to "do no harm," the health sector, through its direct and indirect emissions and waste management practices, contributes to many conditions that clinicians that aim to treat. Professionals and organizations have responsibilities to reconcile such ethical inconsistency and to better align their commitment to nonmaleficence with the consequences of their actions. In what follows, we discuss how health sector actions exacerbate climate warming and iatrogenically harm global public health and argue that clinicians and health organizations have ethical responsibilities to respond to the health sector's contribution to the climate crisis.

Organizational Nonmaleficence

In the 1990s, the US Environmental Protection Agency (EPA) identified medical waste incineration as a major source of emissions of carcinogenic dioxins[3] and mercury,[4] a potent neurotoxin. In response, 28 organizations came together to form Health Care Without Harm (HCWH), founded on the health sector's responsibility to reduce its environmental impact on health.[5] In 1998, the American Hospital Association, HCWH, and the EPA signed a memorandum of understanding agreeing to virtually eliminate mercury from waste streams by 2005.[6] Leveraging the do-no-harm message, HCWH led campaigns to eliminate mercury-containing thermometers and devices from hospitals and pharmacies and to close thousands of medical waste incinerators while promoting non-incineration technologies (eg, autoclaves, microwaves) to decontaminate infectious waste.[5] The campaigns led to near-elimination of the market for mercury-based measuring devices in the United States and eventually culminated in the Minamata Convention on Mercury, a global agreement to phase out mercury.[7] The coalition also identified ways to reduce waste and pollution,[5] and a sustainable health care movement was born.

Global Irony Management

Just as incineration of mercury-containing medical waste ironically poses a risk to public health, so does the industrialization of health service delivery, which contributes to the climate crisis and indirectly harms human health. US hospitals produce over 5 million tons of waste per year.[8] Fossil fuels are required to move regulated waste to facilities (eg, for incineration, chemical mitigation, or other energy-intensive treatment) before being landfilled, and the magnitude of such fossil fuel-dependent transportation and treatment contributes to health care's climate footprint. The World Health Organization has identified climate change as the "single biggest health threat facing humanity."[9] The global health community is united in its concern about the climate health crisis, delivering an unprecedented and powerful message calling for urgent climate action to protect health in an editorial simultaneously published in more than 200 journals[10] and in an open letter signed by more than 600 organizations representing 46 million health workers that urged world leaders at the Conference of the Parties (COP26) to commit to aggressive climate goals to avert the impending health catastrophe.[11] Health care leaders, in addition to policymakers, would be wise to heed such stark warnings from the world's doctors and nurses. Despite COVID-19 and the numerous challenges currently facing health care, the sector does not get a pass on climate action. Instead, it must urgently leverage its moral, political, and economic influence to lead climate solutions.

Resultant indirect public health harms of US health care emissions, which constitute 27% of the global health care footprint[12] and 8.5% of US greenhouse gas (GHG) and other toxic pollutant emissions,[13] are on the same order of magnitude as medical errors,[14] directly undermining the sector's aim to avoid harm. One must question why the sector has not addressed harms caused by its operations with the same urgency with which it has responded to some iatrogenic harms, such as medical errors.[15] To appreciate the myriad ways that health care activities generate emissions, it is important to understand the sources of GHG emissions, which are classified into 3 scopes. Scope 1 refers to emissions generated directly from a facility (eg, from on-site energy generation or fleet vehicles or from operating rooms' generation of waste anesthetic gases, such as desflurane and nitrous oxide[16,17]). Scope 2 refers to indirect emissions generated from energy purchased from a utility provider, such as electricity or steam.[18] The greatest source of emissions (62% in the National Health Service[16] and

82% in the United States[13]) are indirect Scope 3 emissions generated by activities such as product transport, employee commutes, business travel, waste generation, food and pharmaceuticals, and investments.[18] Every health care activity—from nonclinicial services, such as cooking, cleaning, and maintaining facilities, to performing surgeries—consumes energy, requires materials, and generates waste, all of which add to health care's climate impact.

Clinical Care and Emissions

Clinical care is the single largest contributor to health care emissions.[14] Clinicians order tests and treatments, perform procedures and surgeries, and prescribe pharmaceuticals daily. However, such interventions can be overused and may not always add value, with a low-value test or procedure delivered to an older adult every 80 seconds in a US hospital.[19] Factors that promote low-value care include fear of litigation, payment systems, pharmaceutical and device production, and a culture of intention to do everything possible for a patient.[20] While previous calls for reducing low-value care have focused on cost reduction and patient safety, reducing overdiagnosis, overprescribing, and overtreatment can also help reduce emissions. Clinicians have an ethical responsibility to evaluate clinical care choices through a climate lens and to minimize unnecessary surgeries, tests, interventions, and medications to help reduce health care's environmental impact without compromising patient safety and quality.

Clinicians also have an ethical responsibility to reduce the demand for health care services and keep people out of the hospital. Our current health care system functions as a "sick care" system,[21,22] with a reimbursement model designed to incentivize resource-intensive health care utilization, not prevention. The result is an unsustainable cycle: acute and chronic illness lead to health care utilization, which leads to emissions and pollution, which in turn leads to increased burden of disease. For health care to become more sustainable, there must be a focus on preventive care, which would reduce the demand for health care utilization, lessen emissions, and help realign health care with its mission.

Slow Response

Given the toll that climate is having on human health and that extreme weather events can impair health care access and delivery, one would think that health care would be at the forefront of climate solutions. Ironically, that isn't the case, and while some health systems are making significant progress, US health care emissions overall rose between 2010 and 2018.[13] Thus, the medical community has been slow to recognize connections among climate, health, and health care. Perhaps the health harms from climate change feel distant and abstract compared to the immediacy of patient care. Quite possibly, health professionals believe they are already doing enough "good" and don't need to do more. The majority of health professionals haven't received education on health care emissions or training on how to implement sustainable solutions,[23] and there has not been enough research conducted to understand the magnitude of the problem or enough data disseminated to allow health professionals to make evidence-based interventions. Finally, there is often a lack of awareness of the strong business case for sustainable health care and a misperception that "greening" is costly.[24]

There are currently no comprehensive regulatory or sector-wide mandates for sustainable health care or sustainability reporting, and health care organizations lag behind other sectors in sustainability reporting, a common practice among large businesses.[25] Moreover, there is a stark contrast between traditional and sustainability

hospital committees. Hospital committees related to quality, value analysis, and ethics are often required by regulators or hospital administration. Such committees play a critical role in management and decision making and are bolstered by oversight, staffing, and resources. In contrast, hospital sustainability committees or "green teams" are often initiated by employees, led by volunteers, and without oversight or accountability. While a few health systems have staffed sustainability programs, most do not have a full-time employee dedicated to the role, and some sustainability leaders have been charged with embedding an entire facility's sustainability work within another role, such as facilities director or executive chef (Janet Howard, personal communication, November 2021).

Oversight and Transformation

Historically, the nation's guiding bodies that provide oversight of the health sector have neglected to meaningfully account for environmental performance and emissions in metrics or reporting requirements. However, in November 2021, the Biden administration committed to decarbonizing US health care through the COP26 Health Programme,[26] with Assistant Secretary for Health for the US Department of Health and Human Services (HHS), Admiral Rachel Levine, announcing that the United States would start by decarbonizing federal health care facilities.[27] This announcement was followed by President Biden signing an executive order in December 2021 requiring all federal facilities to decarbonize in alignment with the national GHG reduction commitment by achieving a 50% reduction in federal building emissions by 2032 and net-zero federal buildings by 2045, including Veterans Health Administration and Defense Health Agency facilities.[28] Moreover, in 2021, the National Academy of Medicine formed the Action Collaborative on Decarbonizing the US Health Sector, a partnership of health sector leaders—including leaders from the Joint Commission, HHS, and the Centers for Medicare and Medicaid Services[29]—committed to reducing the sector's climate impact while strengthening its resilience.[30] Finally, on Earth Day 2022, HHS and the White House issued a call to action to the health care sector to commit to tackling the climate crisis by reducing its GHG emissions and increasing its climate resilience.[31] They asked health organization stakeholders to sign a pledge committing to reducing their organization's emissions by 50% by 2030 and to net zero by 2050, completing an inventory of Scope 3 emissions, developing climate resilience plans, and designating an executive lead for this work.[31,32]

Creating a low carbon, climate-smart health care sector will require transformational change. A climate lens must be applied to every aspect of health care decision making: facility operations, food services, supply chain, employee commutes, waste management, clinical care, and financial investments (see Table for suggestions). Moreover, we must move toward preventive health care and efficient, value-driven care. To avert the most devastating health effects of climate change, the health sector must join other sectors in halving emissions by 2030 and achieving net-zero emissions by 2050. If the sector continues on a business-as-usual path, health care emissions are predicted to triple by 2050.[33] Health care has 2 choices: urgent mitigation or further contribution to suffering. Only one choice is moral. The only ethical future is one in which health care does not cause harm to patients and the planet.

Table. Operationalizing Sustainable Health Care With an Ethical Focus on Climate

Issue	Ethical Tension	Climate-Centered Ethical Choice
COVID-19 accelerated rapid expansion of telehealth services.	Barriers to telehealth (eg, lack of internet access or digital literacy, regulatory and reimbursement requirements) can prevent realization of benefits (eg, reduced exposure, utilization of PPE and other resources, and emissions reduction).[34,35]	• Explore opportunities to further expand and improve telehealth services as part of an overall strategy to reduce health care's transportation footprint.
Sustainability directors and committees set goals, prioritize initiatives, and make program decisions.	Tensions can exist between environmental stewardship and infection control, cost, return on investment, and other health care priorities.	• Encourage hospital ethicists or members of the ethics committee to join the sustainability committee and participate in ethical decision making with a climate change lens.
Health care institutions hold investments in fossil fuel companies.	Health care institutions' investments, including in fossil fuels, contribute to Scope 3 emissions, and emissions from fossil fuels contribute to air pollution, disease burden, and the climate crisis.	• Divest or freeze portfolio fossil fuel holdings and invest in clean technologies. • Consider offering fossil fuel-free retirement funds. • Use guidance from the *BMJ*'s divestment campaign.[36]
Health care uses large amounts of single-use medical devices and disposable supplies, often plastic.	Single-use supplies' convenience and perceived infection control benefits can weigh against reusable devices and supplies' safety, efficacy, and reduction in medical waste, emissions, and costs.	• Educate clinicians about environmental benefits of reusables, along with their safety, efficacy, and potential cost savings. • Transition to reusable devices whenever possible, using guidance from relevant life cycle assessments.[37] • Consider single-use device reprocessing.
Hospitals serve large quantities of meat and animal products.	Patients', staff members', and visitors' perceived preference for meat and animal-based products may weigh against their contribution to global GHG emissions, which is twice that of plant-based foods.[38]	• Reduce the amount of meat served in facilities and emphasize plant-based patient and retail menus. • Educate patients and staff about the health and climate benefits of plant-based diets.
Anesthesiology providers select anesthetic agents during surgeries and procedures.	Anesthesiologists' preference for anesthetic agents based on induction and recovery times, adequate amnesia and anesthesia, patient condition, and surgery type can contribute significantly to an OR's climate footprint.[17]	• Consider total intravenous anesthesia when possible. • Transition from desflurane and nitrous oxide and consider less environmentally damaging anesthetics (eg, isoflurane and sevoflurane). • Optimize fresh flow rates. • Review nitrous oxide equipment for leaks. • Use guidance from the American Society of Anesthesiologists.[39]
Ambulances often idle outside emergency departments during handoffs.	Ambulances' need to idle to maintain communication systems, refrigeration for medication, life support equipment, and climate control can weigh against fuel waste and generation of air pollutants that can cause cardiorespiratory problems.[40]	• Encourage ambulance companies and EMS units to consider auxiliary power units to avoid idling.[41] • Provide education about the link between idling, climate change, air pollution, and adverse health effects and about how limiting idling can reduce fuel costs.

Abbreviations: EMS, emergency medical services; GHG, greenhouse gases; OR, operating room; PPE, personal protective equipment.

References

1. Syringe Tide. Recycling of Medical Waste. Accessed July 3, 2022. https://recyclingofmedicalwaste.weebly.com/history.html#:~:text=The%20Syringe%20Tide%20caused%20a,headlines%20in%20the%20United%20States

2. Medical Waste Tracking Act, Pub L No. 100-582, 102 Stat 2950 (1988).

3. Office of Health and Environmental Assessment. *Estimating Exposure to Dioxin-Like Compounds. Volume III: Site-Specific Assessment Procedures*. US Environmental Protection Agency; 1994. EPA/600/6-88/005Cc. Accessed July 5, 2022. https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=20009A83.PDF

4. Office of Air Quality Planning and Standards; Office of Research and Development. *Mercury Study Report to Congress. Volume II: An Inventory of Anthropogenic Mercury Emissions in the United States*. US Environmental Protection Agency; 1997. EPA/452/R-97-004. Accessed December 8, 2021. https://www.epa.gov/sites/default/files/2015-09/documents/volume2.pdf

5. History and victories. Health Care Without Harm. Accessed December 8, 2021. https://noharm-europe.org/content/europe/history-and-victories

6. Sanders WH, Ullrich DA, Lord JT. Memorandum of understanding between the American Hospital Association and the US Environmental Protection Agency. Health Care Without Harm; October 2001. Accessed December 3, 2021. https://practicegreenhealth.org/sites/default/files/upload-files/mou101501_0.pdf

7. Minamata Convention on Mercury. United Nations Environment Programme; 2019. Accessed August 10, 2022. https://www.mercuryconvention.org/sites/default/files/documents/information_document/Minamata-Convention-booklet-Sep2019-EN.pdf

8. Waste. Practice Greenhealth. Accessed November 28, 2021. https://practicegreenhealth.org/topics/waste/waste-0

9. Wyns A, Maiero M, Egorova A, Campbell-Lendrum D. *COP26 Special Report on Climate Change and Health: The Health Argument for Climate Action*. World Health Organization; 2021. Accessed December 3, 2021. https://apps.who.int/iris/rest/bitstreams/1378263/retrieve

10. Atwoli L, Baqui AH, Benfield T, et al. Call for emergency action to limit global temperature increase, restore biodiversity, and protect health. *N Engl J Med*. 2021;385(12):1134-1137.

11. #HealthyClimatePrescription: an urgent call for climate action from the health community ahead of COP26. Healthyclimateletter.net. Accessed December 3, 2021. https://healthyclimateletter.net/

12. Karliner J, Slotterback S, Boyd R, Ashby B, Steele K. Health care's climate footprint: how the health care sector contributes to the global climate crisis and opportunities for action. Health Care Without Harm; Arup; 2019. Accessed December 3, 2021. https://noharm-global.org/sites/default/files/documents-files/5961/HealthCaresClimateFootprint_092319.pdf

13. Eckelman MJ, Huang K, Lagasse R, Senay E, Dubrow R, Sherman JD. Health care pollution and public health damage in the United States: an update. *Health Aff (Millwood)*. 2020;39(12):2071-2079.

14. Eckelman MJ, Sherman J. Environmental impacts of the US health care system and effects on public health. *PLoS One*. 2016;11(6):e0157014.

15. Leape LL, Berwick DM. Five years after *To Err Is Human*: what have we learned? *JAMA*. 2005;293(19):2384-2390.

16. Tennison I, Roschnik S, Ashby B, et al. Health care's response to climate change: a carbon footprint assessment of the NHS in England. *Lancet Planet Health*. 2021;5(2):e84-e92.

17. MacNeill AJ, Lillywhite R, Brown CJ. The impact of surgery on global climate: a carbon footprinting study of operating theatres in three health systems. *Lancet Planet Health*. 2017;1(9):e381-e388.

18. Ranganathan J, Corbier L, Bhatia P, et al. *The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard*. Revised ed. World Business Council for Sustainable Development; World Resources Institute; 2004. Accessed March 7, 2022.
https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf

19. Lown Institute Hospitals Index. Lown Institute. Accessed May 16, 2022.
https://lowninstitute.org/projects/lown-institute-hospitals-index/

20. Verkerk E, Van Dulmen S, Born K, Gupta R, Westert G, Kool R. Key factors that promote low-value care: views of experts from the United States, Canada, and the Netherlands. *Int J Health Policy Manag.* Published online June 19, 2021.

21. Marvasti F, Stafford R. From "sick care" to health care: reengineering prevention into the US system. *N Engl J Med*. 2012;367(10):889-891.

22. Schimpff SC. A sick care system instead of a health care system. *MedPage Today*. March 1, 2012. Accessed May 16, 2022.
https://www.kevinmd.com/2012/03/sick-care-system-health-care-system.html

23. Gandhi V, Al-Hadithy N, Gopfert A, Knight K, van Hove M, Hockey P. Integrating sustainability into postgraduate medical education. *Future Healthc J*. 2020;7(2):102-104.

24. Kaplan S, Sadler B, Little K, Franz C, Orris P. Can sustainable hospitals help bend the health care cost curve? *Issue Brief (Commonw Fund)*. 2012;29(29):1-14.

25. Senay E, Landrigan PJ. Assessment of environmental sustainability and corporate social responsibility reporting by large health care organizations. *JAMA Netw Open*. 2018;1(4):e180975.

26. Countries commit to develop climate-smart health care at COP26 UN climate conference. World Health Organization. November 9, 2021. Accessed December 3, 2021. https://www.who.int/news/item/09-11-2021-countries-commit-to-develop-climate-smart-health-care-at-cop26-un-climate-conference

27. Marabito M. Dozens of countries promise to lower carbon intensity of health systems. *Healio*. November 9, 2021. Accessed May 17, 2022.
https://www.healio.com/news/primary-care/20211109/dozens-of-countries-promise-to-lower-carbon-intensity-of-health-systems

28. Fact sheet: President Biden signs executive order catalyzing America's clean energy economy through federal sustainability. News release. The Whitehouse; December 8, 2021. Accessed March 7, 2022.
https://www.whitehouse.gov/briefing-room/statements-releases/2021/12/08/fact-sheet-president-biden-signs-executive-order-catalyzing-americas-clean-energy-economy-through-federal-sustainability/

29. Climate Collaborative members 2021-2023. National Academy of Medicine. Accessed May 16, 2022. https://nam.edu/programs/climate-change-and-human-health/climate-collaborative-members/

30. Action collaborative on decarbonizing the US health sector. National Academy of Medicine. September 2021. Accessed March 7, 2022.
https://nam.edu/programs/climate-change-and-human-health/action-collaborative-on-decarbonizing-the-u-s-health-sector/

31. HHS launches press initiative to mobilize health care sector to reduce emissions. News release. US Department of Health and Human Services; April 22, 2022. Accessed May 16, 2022. https://www.hhs.gov/about/news/2022/04/22/hhs-launches-pledge-initiative-mobilize-health-care-sector-reduce-emissions.html

32. Health care sector commitments to emissions reduction and resilience. US Department of Health and Human Services. June 30, 2022. Accessed August 10, 2022. https://www.hhs.gov/climate-change-health-equity-environmental-justice/climate-change-health-equity/actions/health-care-sector-pledge/index.html

33. Karliner J, Roschnik S, Boyd R, Ashby B, Steele K. *Global Road Map for Health Care Decarbonization: A Navigation Tool for Achieving Zero Emissions With Climate Resilience and Health Equity*. Health Care Without Harm; Arup; 2021. Accessed May 16, 2022. https://healthcareclimateaction.org/sites/default/files/2021-08/Global%20Road%20Map%20for%20Health%20Care%20Decarbonization.pdf

34. Dacones I, Cave C, Furie G, et al. Patient transport greenhouse gas emissions from outpatient care at an integrated health care system in the Northwestern United States, 2015. *J Climate Change Health*. 2021:3:100024.

35. Wang E, Zafar J, Lawrence C, et al. Environmental emissions reduction of a preoperative evaluation center utilizing telehealth screening and standardized preoperative testing guidelines. *Resour Conserv Recycl*. 2021;171:105652.

36. Abbasi K, Godlee F. Investing in humanity: the *BMJ*'s divestment campaign. *BMJ*. 2020;368:m167.

37. Sherman JD, Thiel C, MacNeill A, et al. The green print: advancement of environmental sustainability in healthcare. *Resour Conserv Recycl*. 2020;161:104882.

38. Xu X, Sharma P, Shu S, et al. Global greenhouse gas emissions from animal-based foods are twice those of plant-based foods. *Nat Food*. 2021;2(9):724-732.

39. Environmental sustainability. American Society of Anesthesiologists. Accessed March 7, 2022. https://www.asahq.org/about-asa/governance-and-committees/asa-committees/environmental-sustainability

40. Gateley R. Ambulance exhaust: exhausting our lungs. *J Emerg Nurs*. 2006;32(1):65-67.

41. Argonne National Laboratory. Idling reduction for emergency and other service vehicles. US Department of Energy. May 2015. Accessed December 3, 2021. https://afdc.energy.gov/files/u/publication/idling_emergency-service_vehicles.pdf

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Drs Collins and Demorest work with Practice Greenhealth, a fee-based vendor to health care organizations interested in promoting their roles in sustainability, and its associated organization, Health Care Without Harm.

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