Build for Resilience: A Plan to Drive Value and Tackle the Climate Crisis*

Vivian S. Lee, MD, PhD, MBA Executive Fellow, Harvard Business School Senior Lecturer, Harvard Medical School Author of The Long Fix: Solving America's Health Care Crisis with Strategies that Work for Everyone

*Content of this presentation is based on a forthcoming publication: Lee VS, Gerwig K, Hough E, Mate K, Biggio R, Kaplan RS. **Decarbonizing Health Care: Engaging Leaders in Change.** NEJM Catalyst 2023; Grateful acknowledgements also to Hardeep Singh and Emily Mediate







Emissions & Atmospheric CO₂

Atmospheric carbon dioxide amounts and annual emissions (1750-2021)



	C	2
h	a l	
	ŋ	1
	Ξ	ł
	Ξ	ŀ
	ŝ	i
	õ	ï
	ž	į.
	S	ł
1	ĉ	ì
1	H	é
1	10	1
	H	Ļ
	0	į
	2	5
	Un	1





Levels of carbon dioxide in the atmosphere have corresponded closely with temperature over the past 800,000 years. Although the temperature changes were touched off by variations in Earth's orbit, the increased global temperatures released CO₂ into the atmosphere, which in turn warmed the Earth. Antarctic ice-core data show the long-term correlation until about 1900. (Graphs by Robert Simmon, using data from Lüthi et al., 2008, and Jouzel et al., 2007.)

https://earthobservatory.nasa.gov/features/CarbonCycle/page4.php



Unprecedented

2022 2021 was the 6th warmest on record

Over the past 100 years, global temperatures have risen ~**1°C** (1.8°F)

Sea level response to that warming totals about **160-210 mm** (6 to 8 in).

CARBON DIOXIDE OVER 800,000 YEARS



Preparing to Support our Communities

Strengthening infrastructure

- Utilities, especially electricity
- Communications
- Transportation
- Supply chain
- Employees & their families
- Financial stability
- AND also care for our communities who face the health consequences

The New York Times

U.S. Hospitals Wrestle With Shortages of Drug Supplies Made in Puerto Rico







https://www.nytimes.com/2017/10/23/health/puerto-rico-hurricane-maria-drug-shortage.html



Impact of Climate Change on Human Health

Asthma, Injuries, fatalities, mental health impacts cardiovascular disease

Heat-related illness and death, cardiovascular failure

Severe Weather

Extreme Heat

Forced migration, civil conflict, mental health impacts

Environmental Degradation

> Water and Food **Supply Impacts**

Malnutrition, diarrheal disease



Malaria, dengue, encephalitis, hantavirus, **Rift Valley fever,** Lyme disease, chikungunya, West Nile virus

Increasing Allergens

Respiratory allergies, asthma

Water **Quality Impacts**

Cholera, cryptosporidiosis, campylobacter, leptospirosis, harmful algal blooms https://www.cdc.gov/climateandhealth/effects/default.htm

Heat

- Heat exhaustion/Heat stroke
- Dehydration exacerbates asthma, COPD, HF, DM
- Harder to think (school, work)
- Higher mortality due to organ failure
 - 1980 heat wave: 5300 excess US deaths \bullet
 - 1995 heat wave 2800 excess US deaths
- Risks in pregnant women
- Especially susceptible: elderly, young children







Kilbourne EM 1999 The spectrum of illness during heat wave Am J Prev Med 16(4):359-360



Air

- Ground-level ozone (smog)
- Wildfires & PM
- More pollen, longer season









Water

- Combined sewers: after extreme rainfall, more E Coli contaminated water and ER visits
 - Reduce with more vegetation and fewer ulletpaved surfaces
- Algal blooms
- Water scarcity affects 2/3 globally
- Groundwater salinization: more salt in drinking water, bad for irrigation

Combined Sewer Overflow System



Separated (Sanitary) Sewer Overflow System



Water

 Groundwater salinization: Sea levels rise and groundwater depletion leads to more salt in drinking water, bad for irrigation





Figure adapted from <u>Climate Adaptation and Saltwater Intrusion External link</u> at EPA.gov. Image from My Job Depends on Ag Magazine, Jan 2, 2020, Victor Martino





Mental Health

- Trauma of extreme climate events
- Climate refugees
- Climate anxiety
- Children's mental health and well-being

A family in Barataria, Louisiana, returns to their home after it flooded during Hurricane Ida in August 2021. Photographer: Brandon Bell/Getty Images Bloomberg News March 7, 2023

Climate anxiety in children and young people and their beliefs about government responses to climate change: a global survey

Caroline Hickman*, Elizabeth Marks*, Panu Pihkala, Susan Clayton, R Eric Lewandowski, Elouise E Mayall, Britt Wray, Catriona Mellor, Lise van Susteren



Figure 1: Worry about climate change and impact on functioning

Lancet Planet Health 2021; 5: e863–73



Hitting the Poorest the Hardest The Climate Gap

Number of months/year when water consumption exceeds availability



Figure from *Four billion people facing severe water scarcity* External link, Mesfin M. Mekonnen and Arjen Y. Hoekstra, Science Advances 12 Feb 2016: Vol. 2, no. 2, e1500323 <u>https://doi.org/10.1126/sciadv.1500323 External link</u>

Housing and Land Use Policies Rooted in Structural Racism

Discrimination in real estate and lending industries (e.g., redlining) Dispossession of Indigenous communities from land Racial segregation Wealth and income inequality

Inequities in political power

Disparities in exposures to fossil fuel-related pollution

Higher pollution levels overall

Sacrifice Zones

- Disproportionate siting of industrial facilities and highways in communities of color and low-income communities
- Privileged communities benefit most from industrial pollution as producers and consumers, while avoiding exposures

Regulatory abandonment of racially and socioeconomically marginalized groups

Climate Gap

Racial and class-based disparities in the effects of extreme heat, precipitation, drought, wildfire, housing loss, sea-level rise, and displacement

Unequal Health Effects

Figure 1. How Structural Racism and Inequality Drive the Climate Gap.

Morello-Frosch R, Obasogie OK. The Climate Gap and the Color Line– Racial Health Inequities and Climate Change NEJM 2023;388(10):943-9



Two-front Battle: Adaptation & Mitigation

• You've got to adapt (bail)

- Prepare for climate events
- Ensure secure energy sources, transportation, supply chain, financial resources
- Build resilience

• You've got to mitigate (plug holes)

- Reduce greenhouse gas emissions by switching to clean technologies to power vehicles and produce electricity
- Reduce waste



Figure from LinkedIn Steward Bond. Data Quality: Plug the Holes before bailing the Boat 2014 https://www.linkedin.com/pulse/20140826143308-16074186-data-quality-plug-theholes-before-bailing-the-boat





US Health Care

- Top in the world, accounting for **27%** of the global health care footprint
- Responsible for 8.5% of US greenhouse gas emissions
- Emissions rose 6% from 2012-2018
- Resulted in the loss of 388,000 disability-adjusted life-years in 2018

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 DECEMBER 2020 VOL. 34 NO. 12

LEADING TO MEALTH Medical Schools Grapple With Climate Climate Migration Made Them My Change - Michele Cohen Morill

SARBATIVE MATTERS. Patients - Kethorine Lewrence

60VID-18 Emergency Sick Leave Flattens The Curve - Stefen Pichler et el.

AT THE INTERSECTION OF HEALTH, HEALTH CARE, AND POLICY lealth Attairs Health-Sector Health Risks Pollution **Due To Climate** Change 388.000 Life-Years Lost In 2018

Kristie L. Ebi & Jeremy J. Hess PLUS Adding A Climate Lens To US Mealth Policy Renee N. Solas et al.

Jodi D. Sharmon et al.

A Sustainable Health Care System Mortin Hansher & Farbes McGoin

7 m 20

Waste In Medical Devices Andrea J. MocNeill et al.

US School

Contribute To

Poor Planetary

Mory Kethryn Puole et ol.

Lunches

Health

Economic Effects

Climate

& Health

Costs Of Inaction & Benefits Of Action Vijey S. Lineye et cl.

Ethical Issues In Valuation Noeh Scewroekk et el.

Couts Of Air Pollution Howard G. Birnbeum et al.

Adapting To Climate Change

n. 2098

Insights From Indigeneus Communities: Paul J. Schromm et al. Opportunities For Pacific Island Countries **Christopher J. Bager et al.**

Hurricanes

Mental Health Consequences Jomes M. Shultz et al.

Mitigating Disparities Ethan J. Raker et al.

Managing Chronic Diseases Sovie Nesson et al.

Attributing Health Effects To **Climate Change**

Kristie L. Ebi et al.

PUCS Gaining Public Support For Solutions James W. Dearing 6 Maria Lapinuki

PEUS:

Building Climote & Health Literocy Vjoy S. Linoye et al.

Training Clinicians In Climate & Health Joy Lemery et al.

WINDOW ANTWATTANKS ORS

Pres 2144

Slide courtesy of Emily Mediate, Health Care Without Harm https://noharm-uscanada.org/ClimateFootprintReport



What is producing all those emissions?

- 7% is direct emissions (fossil fuels, anesthetic gases)
- 11% is from purchased energy
- 82% comes from choices: pharmaceuticals, medical devices & supplies, food, transportation, other purchased services, investments

CO,

Onsite energy

Fleet vehicles

Waste anesthetic gas

Refrigerants

Carbon dioxide (CO_), methane (CH_), nitrous oxide (N_O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), nitrogen trifluoride (NF_), and sulphur hexafluoride (SF_)

Scope 3 Other: These are the most common emissions for health care, but there are other relevant categories in Scope 3. To review all 15 categories covered in Scope 3, visit the GHG Protocol Scope 3 Guidance.

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



https://practicegreenhealth.org/ghg-reduction-toolkit

Some Recommendations National → Hospital → Informatics

AHRQ Primer

- 1. Set net zero goals
- 2. Establish structural enablers
 - Executive leadership team
 - Data collection & management
 - Educate, Empower the workforce
 - Procurement policies
- 3. Understand emissions (DATA)
 - Inventory facility/energy emissions
 - Inventory supply chain, travel
 - Use benchmarks
- 4. Prepare & execute your plan
 - Reduce energy (LEED), EV, anesthetics
 - Influence suppliers, reduce waste
 - High VALUE care

Reducing Healthcare Carbon Emissions

A Primer on Measures and Actions for Healthcare Organizations to Mitigate Climate Change





AHRQ Publication No. 22-M011 September 2022 www.ahrq.gov

https://www.ahrq.gov/healthsystemsresearch/decarbonization/index.html



A Health System's Response **CASE STUDY: Kaiser Permanente**

- Achieved carbon neutral in 2020
 - Partially through purchased offsets
- Installed solar power 100 sites
- Solar power purchasing, plus battery storage, new renewable microgrid
- EV charging, fleet electrification
- Telemedicine
- Data services: EPEAT-registered computers, servers, phones, TVs
- Reprocessed surgical devices, reduce single use devices
- Reduce food waste





Greening Health Care

Kathy Gerwig

HOW HOSPITALS CAN HEAL THE PLANET

OXFORD

2022 Inflation Reduction Act Unlocks key opportunities

- New financial incentives for energy efficiency
 - Investment tax credits = direct cash payments cover at least 30% and as much as 50-60% of costs
 - Upgrades/retrofits are highly incentivized
- New access to tax equity market via transferability to monetize any solar projects we develop
- Benefit from broader solar development incentives (that will reduce costs)
- By offsetting capital costs, hospitals and benefit from LOWER costs of solar, wind energy and Strengthen Resilience



NAVIGATING THE NEW ENERGY LANDSCAPE WEBINAR SER

Hospitals and Rener Energy: New Financon Incentives and Opport Lies in the Inflation Reduction Act

McDermott Will & Emery

November 1, 2022 mwe.com energy.mwe.com

plants, BNEF survey finds.

https://www.mwe.com/events/hospitals-renewable-energy-new-financialincentives-opportunities-in-the-inflation-reduction-act/

Bloom	berg									US	Edition •	Sign In	Su
● Live Now	Markets	Economics	Industries	Technology	Politics	Wealth	Pursuits	Opinion	Businessweek	Equality	Green	CityLab	Cr
Green New Energy Costs to build and run new solar and wind facilities are still cheaper tha							an gas	s or					

Bloomberg News June 30, 2022







Some Recommendations National → Hospital → Informatics

Clinical Climate Informatics i-CLIMATE Framework

- Computers, data centers, ME
 - Replacing computers every 2-4 yrs?
 - 50% of all office computers on 24/7 lacksquare
- Measure, display, monitor perf
 - Anesthetic gases: monitoring flow
 - Medical equipment use
 - Supply chain management
 - Reduce waste in care delivery
- Mobilize workforce, Inform patients

Sitting DF, Sherman JD, Eckelman MJ, Draper A, Singh H, I-CLIMATE: a "clinical climate informatics" action framework to reduce environmental pollution from healthcare. JAMIA 2022 Nov 14;29(12):2153-2160

Create a Circular Economy for Health IT

Inform Policies and Regulations for Change

Mobilize the

Healthcare

Workforce

Consumption

Control

Solitor 8

Mitigate healthcarerelated environmental pollution and climate change

Reduce Energy Consumption

Support **Clinician and** Administrator **Decision-**



One Path Forward Reforming Health Care

Adaptation

- More prevention & primary care
- Reducing unnecessary care and procedures
- Reducing waste, including tech waste • Effective back-up energy (microgrids)
- Lower energy bills (renewables)
- Telehealth
- Digital health & home-based care with remote patient monitoring
- Palliative care
- Stronger, more resilient communities with robust social infrastructure and support

Tackling Climate Change

gati 0



Resources

- health-care (last accessed October 10, 2022).
- decarbonization/index.html (last accessed October 10, 2022)
- going-carbon-neutral (last accessed October 10, 2022)

- framework to reduce environmental pollution from healthcare. JAMIA 2022 Nov 14;29(12):2153-2160
- 8. edX: HarvardX PH278.Ax The Health Effects of Climate Change

1. Health Care Without Harm. The Green Guide for Health Care. https://noharm-global.org/issues/global/green-guide-

2. Sampath B, Jensen M, Lenoci-Edwards J, Little K, Singh H, Sherman JD. Reducing Healthcare Carbon Emissions: A Primer on Measures and Actions for Healthcare Organizations to Mitigate Climate Change. (Prepared by Institute for Healthcare Improvement under Contract No. 75Q80122P00007.) AHRQ Publication No. 22-M011. Rockville, MD: Agency for Healthcare Research and Quality; September 2022. https://www.ahrq.gov/healthsystemsresearch/

3. Practice Green Health. A Guide for Going Carbon Neutral. https://practicegreenhealth.org/tools-and-resources/guide-

4. National Health Service (UK). Delivering a 'Net Zero' National Health Service. July 2022. https://www.england.nhs.uk/ greenernhs/publication/delivering-a-net-zero-national-health-service/ (last accessed October 10, 2022)

5. US Health and Human Services. Federal Resources to Support Emissions Reduction and Climate Resilience for Healthcare Stakeholders. https://www.hhs.gov/climate-change-health-equity-environmental-justice/climate-changehealth-equity/actions/health-care-sector-pledge/federal-resources/index.html (last accessed October 10, 2022)

6. National Academy of Medicine. Action Collaborative on Decarbonizing the U.S. Health Sector. https://nam.edu/ programs/climate-change-and-human-health/action-collaborative-on-decarbonizing-the-u-s-health-sector

7. Sitting DF, Sherman JD, Eckelman MJ, Draper A, Singh H, I-CLIMATE: a "clinical climate informatics" action

