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## ACTIONS FOR SUSTAINABLE HEALTHCARE

# Tackling climate change: the pivotal role of clinicians

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### What you need to know

- Healthcare systems are major emitters of greenhouse gases, but also have to manage increased demand for care as a consequence of the climate crisis
- Key sources of greenhouse gas emissions include energy generated from fossil fuels, running of services, and healthcare supply chains (transport, pharmaceuticals, equipment, and food)
- Reducing greenhouse gas emissions can be achieved through legislation and policy, effective leadership and management, and above all, promoting sustainable practice in front line care

### Sources and selection criteria

We searched Medline for articles, and the internet for publicly available reports of policy actions by healthcare services and institutions seeking to limit their greenhouse gas emissions. We also drew on our own expertise.

Every healthcare professional, manager, policymaker, politician, and patient has a role to play in securing net zero carbon emissions in healthcare, and front line clinicians can make a profound difference. This article offers an overview of the carbon footprint of healthcare, as a preview to the BMJ's Actions for Sustainable Healthcare series, which will highlight practical actions clinicians can take to support reaching the net zero goal. Key terms used in this article are defined in [box 1](#).

### Box 1: Definitions of key terms<sup>1-8</sup>

- Adaptation: Adjusting to and coping with present or future climate change
- Carbon dioxide equivalents (CO<sub>2</sub>eq): A metric derived from converting different types of greenhouse gases (eg, carbon dioxide, methane, nitrous oxide) to one standardised measure
- Carbon footprint: The total amount of greenhouse gases generated by human activity—expressed, for example, per person, or per institution such as a hospital or NHS trust
- Greenhouse gas emissions: Gases that trap heat in the Earth's atmosphere
- Hotspot: A zone or area which represents an intense concentration of greenhouse gas emissions, eg, hospital wards, laboratories, and operating theatres

- Life cycle assessment: A method of estimating the environmental impact generated across the life of a product, process, or service
- Low value care: Clinical treatment or services that provide minimal or no benefit to patients
- Mitigation: Measures to reduce greenhouse gas emissions from the atmosphere
- Net zero: When amounts of greenhouse gases produced and removed from the atmosphere are in balance
- Supply chain: The production flow of products and services to and from a provider—in the case of healthcare, for example, water, consumables, medical equipment, drugs, and food
- Scopes 1, 2, and 3:
  - Scope 1: emissions generated from directly running care services and facilities
  - Scope 2: emissions created through buying and consuming energy
  - Scope 3: emissions caused by the goods, materials and equipment healthcare facilities use and dispose of; including transport and services provided

## How large is the carbon footprint of healthcare?

Based on modelling of economic activity and carbon emissions projections, greenhouse gas emissions from healthcare (usually measured as carbon dioxide equivalents, or CO<sub>2</sub>eq) account for between 3% and 8.5% of a country's total emissions, depending on the health system, with the average at 4-5%.<sup>4,9</sup> On a global scale, this is the same as the total emissions of the African continent (almost 1.5 billion people across 54 countries).<sup>9,10</sup> Greenhouse gas emissions from healthcare vary depending on the wealth and relative carbon intensity of the country and its electricity grid.<sup>10</sup>

These differences can be considerable. Healthcare in the US, for example, accounts for 8.5% of the nation's carbon footprint in absolute terms and per capita, whereas in England it is less than 4.4% ([fig 1](#)).<sup>4,9-11</sup> While fewer reliable data are available on the emissions generated in lower resource settings, low and middle income countries contribute substantially fewer absolute carbon emissions than high income countries. However, estimates are more uncertain and these countries are sometimes reported to be more carbon intensive per unit of expenditure.<sup>12</sup>

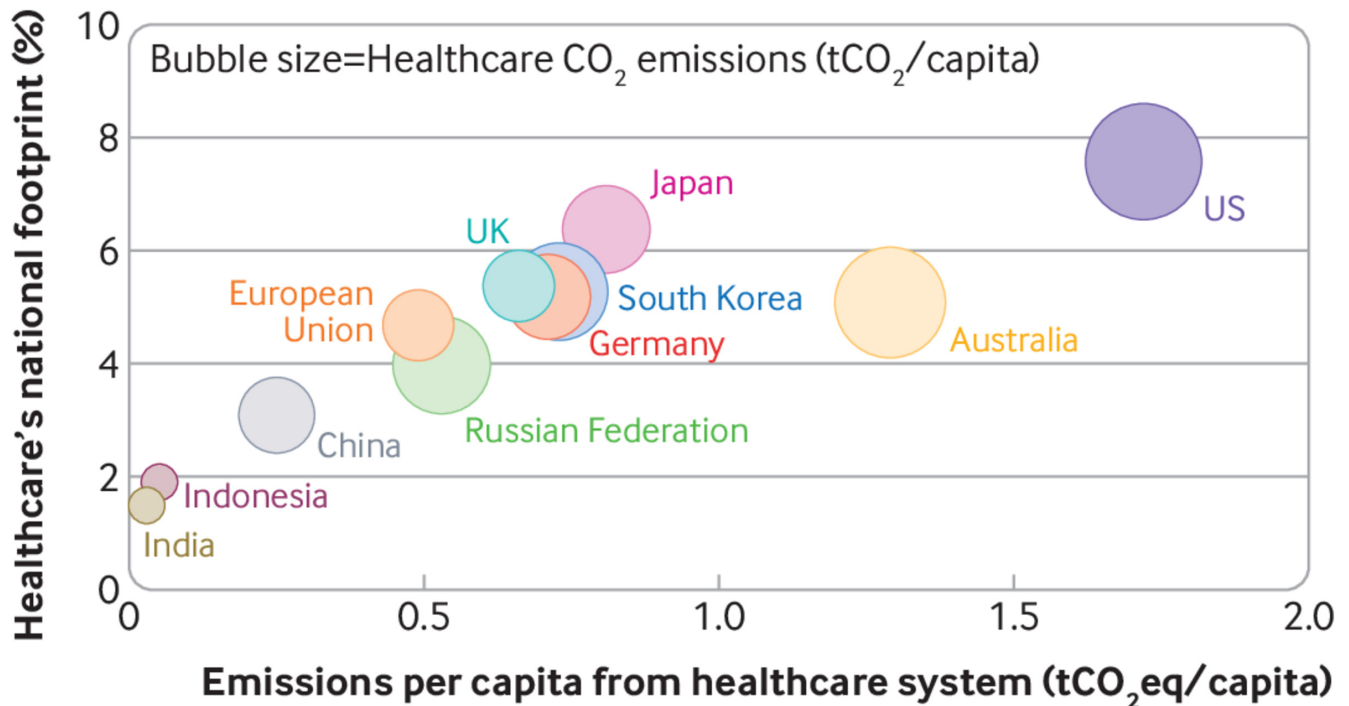


Fig 1 | National healthcare emissions and percentage carbon footprint of selected countries, 2019. Source: Adapted from Karliner et al.<sup>10</sup>

## Net zero commitments

In 2019, NHS England became the first health system in the world to commit to net zero emissions, vowing to reach the target by 2050. This has since been updated to a pledge to reach net zero completely by 2040, and for all the emissions it influences (eg, its supply chain) by 2045.<sup>1</sup> Since 2019, more than 60 countries have promised to develop climate-resilient health systems, embrace sustainable low carbon healthcare, get to net zero on or before 2050, or all three.<sup>13</sup>

## Why do we need to reduce healthcare's carbon footprint?

Healthcare has a unique climate problem. On one hand, it must significantly reduce its own substantial greenhouse gas emissions to help secure net zero carbon. On the other, it must manage, adjust to, or mitigate the clinical impacts of climate change, coping with the accelerating influx of additional patient needs associated with a warming planet. These include direct effects of extreme weather (mainly floods, heatwaves, droughts, wildfires), but also climate-associated effects (eg poor harvests, worsening pollution of air, ocean, and land, and greater numbers of climate refugees). Fossil fuel combustion contributes to particulate matter and air pollution (as well as climate breakdown),<sup>14 15</sup> which exacerbate cardiovascular disease, chronic obstructive pulmonary disease, childhood asthma, and respiratory allergies.<sup>14 16</sup>

Away from healthcare, electricity grids are decarbonising, manufacturing is being made more efficient, buildings being made more sustainable, and use of electric vehicles is increasing. But these supply side mitigations are only effective when clinicians, policymakers, and researchers support sustainable demand by

lowering usage in healthcare and switching to reusable items. Actionable plans to reduce emissions should be in place in every part of the health system, such as using power from renewable sources, reducing travel for patients, visitors, and staff, and building new energy efficient facilities while modernising or retrofitting existing stock. Healthcare must be a leader in environmental sustainability, and clinical leaders must be prominent advocates for urgent action. Many staff across healthcare systems are already involved, and if asked will willingly further embrace these challenges.<sup>1</sup>

## What contributes to healthcare's carbon footprint?

The Scopes framework (fig 2) identifies the major sources of greenhouse gas emissions within healthcare, and divides these into three categories. Scope 1 emissions come directly from running healthcare facilities that provide services, eg, from operating inpatient and outpatient facilities, using anaesthetic gases, and vehicle fleets. Scope 2 emissions reflect the health system's energy purchases and consumption. Shifting to or demanding renewable power sources and adopting energy efficiency measures can make a difference here. Goods and services that health systems consume in order to deliver care are key Scope 3 emissions. Scope 3, according to the World Resources Institute, includes purchased goods, purchased services, waste treatment, and employees' commutes. This Scope also represents the supply chains of healthcare, in which products such as medicines (around 12% of Scope 3 emissions), food (7.2%), and medical devices (3.3%) are used by health facilities (fig 2).<sup>15 17-19</sup> Scope 3 has by far the greatest contribution to healthcare's carbon impact.

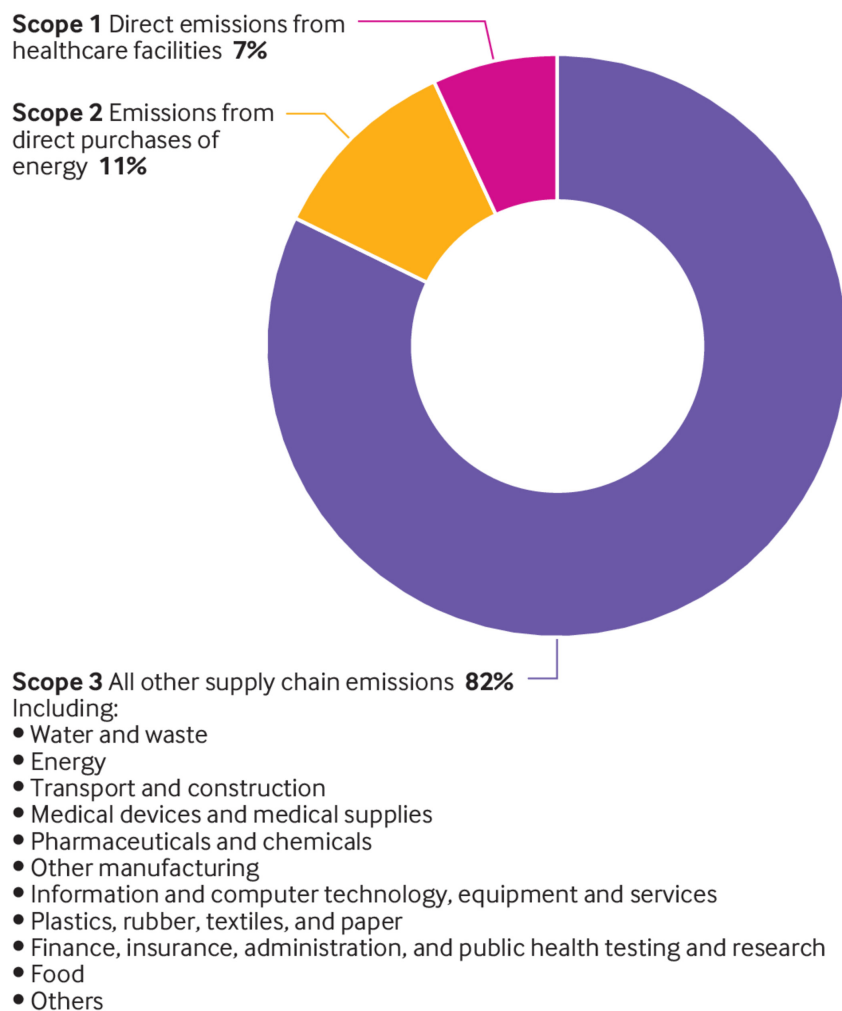


Fig 2 | Greenhouse gas emissions in 2018—proportions measured by the Scopes model for categorising healthcare's carbon emissions. Adapted from Eckelman et al.<sup>5</sup>

To tackle Scope 3 emissions, NHS England has published a net zero supplier roadmap which indicates that providers and vendors must publicly commit to and publish a carbon reduction plan across the three Scopes by April 2027, and by 2030 cannot receive NHS contracts unless they have demonstrated progress in reducing greenhouse gas emissions.<sup>3</sup> Suppliers can use the Evergreen Sustainable Supplier Assessment to benchmark themselves for sustainability against NHS requirements. NHS organisations (eg, trusts and integrated care boards) are asked to show understanding of the emissions burden of their own supply chains and take actions to meet NHS priorities and key performance indicators.<sup>2</sup>

### What can be done to reduce healthcare's carbon footprint?

Table 1 gives examples of areas to target to reduce emissions, and shows how responsibility crosses all levels of the system.

Doctors and health professionals can lead by example and influence others. We do not advocate that every medical team undertake the strenuous efforts required to perform a life cycle assessment of the CO<sub>2</sub>e in their own practice area.<sup>22 23</sup> Instead, they may refer to support mechanisms such as the Eyefficiency tool for surgical processes<sup>24</sup> and the Pollard model for patient treatment pathways<sup>25</sup> to understand the approximate environmental burden of specific services, decisions, or care options. With limited time, clinicians

must focus attention on the best payoffs (eg, carbon intense areas ("hotspots") such as wards, laboratories, and operating theatres) where they have the ability to influence change. For example, using nitrous oxide or desflurane during one hour of surgery is equivalent to driving a small car 106 km and 200-400 km, respectively.<sup>26</sup> Substituting sevoflurane is the equivalent of driving 5-10 km.<sup>26</sup>

### What roles do clinicians play?

#### Public health and advocacy

The adaptation and mitigation measures in table 1 go hand in hand with a public health approach (box 2) and apply to all settings, including low and middle income countries (boxes 2, 3).

#### Box 2: Public health measures to address climate change<sup>27 28</sup>

Actions clinicians can take to mitigate the health impacts of climate change often target high income settings, but tried-and-tested public health practices that promote carbon efficiency apply equally in lower and middle resource settings. For example:

- Addressing the impact of the health sector on climate change
- Promoting public health education and awareness
- Overseeing disease surveillance and responses
- Building capacity and training staff

- Advocating for policy changes
- Conducting research and applying evidence
- Collaborating with other stakeholders and knowledge sharing

### Box 3: Healthcare climate action examples from India

The Chhattisgarh State Renewable Energy Development Agency and State Health Department have collaborated to pursue climate smart strategies, including education, training and development of staff, installing solar panels in 900 health centres and district hospitals, building workforce resilience, and reducing the carbon footprint of participating organisations.<sup>4</sup>

A Green and Digital Hospital project in Delhi is encouraging hospitals and public buildings to conserve energy and generate and use renewable power, substantially reducing carbon emissions.<sup>29</sup>

The Agha Khan Development Network, which provides care across 30 low and middle income countries in 700 health facilities, studied its carbon footprint and found that four hotspot areas (medical and surgical supplies, laboratories and lab-associated supplies, laboratory equipment, and pharmaceuticals) contributed on average 86% of the total carbon burden of its provider organisations. Some two thirds of the footprint was contributed by 65 suppliers. The network has made its calculating tool available to other providers interested in carbon footprinting in low and middle income countries, and work is under way to reduce greenhouse gas emissions via multiple strategies including quarterly reporting of progress.<sup>12</sup>

Clinicians' involvement in lower resource settings—individually, or as part of a public health initiative—can inspire others, build climate resilience, protect vulnerable minorities, and promote sustainable healthcare practices in the face of growing climate liabilities and inequitable consequences.

### Legislative change

All healthcare stakeholders have a responsibility to act on and advocate for sustainability as good citizens. This includes patients and the public, and in particular policymakers and lawmakers, managers and leaders, and clinicians. Parliaments, under concerted pressure from clinicians and others, have mandated society-wide change, such as via the US' Inflation Reduction Act 2022,<sup>30</sup> and the UK's Environment Act 2021<sup>31</sup> and Health and Care Act 2022.<sup>32</sup> Policymakers, acting on clinical advice, have published influential procedures, guidelines, and documents in support of greenhouse gas emissions reductions. These include the Irish Climate Action Strategy 2023<sup>33</sup> and NHS England's Delivering a 'Net Zero' National Health Service.<sup>1</sup>

### Influencing healthcare leaders and managers

Clinicians can influence managers and leaders across all settings: in hospitals, age care facilities, social care providers, general practices, and other healthcare organisations. They can advocate for the purchase of more sustainable products as they come to market, support budgetary incentives for less carbon inducing care, and identify alternatives to carbon intensive goods and equipment (which often have a short payback period, and thereby liberate more resources for high value care).

### Promoting preventive healthcare

Focusing on preventive healthcare strategies helps to reduce high levels of energy and emissions from acute healthcare. The least costly and most climate friendly intervention is when no care, especially expensive acute care, is required. Such initiatives can create a virtuous cycle. For instance, using active transport (eg, walking or cycling) reduces greenhouse gas emissions and air

pollution, which may encourage exercise and promote fitness. Eating a plant based diet, which is often healthier and less carbon intensive than alternatives, can lead over time to improved population health and fewer hospital admissions. By commuting on public transport, by bicycle or walking, clinicians can inspire other staff to do the same. If these methods of travel are not available, advocating for their introduction is the next best thing.

### Reducing low value care

It has been estimated across several studies that up to 30% of healthcare is of low value, or represents waste and misused resources.<sup>7</sup> Reducing overprescribing, overtreatment, and over testing will lower the environmental footprint of healthcare, while costing less and not adversely affecting patient care. Some examples include better stewardship of antibiotics, cutting unneeded blood, screening, imaging, or other tests, and curtailing unnecessary procedures or operations, such as not offering disc replacement for low back pain and avoiding duplicate testing in inpatient settings. Some specific programmes, such as Choosing Wisely and Getting It Right First Time, have aimed to decrease unwarranted care and variation.<sup>34-36</sup> The approaches they advocate can lead to patient-clinician conversations that reduce tests, treatments, and procedures of questionable value, and the programmes are now working in more than 30 countries. Repeatedly doing procedures and tests that provide no net benefit to a patient's wellbeing not only adds risk, misuses scarce resources and misses opportunities to use these more productively, but also makes it cumulatively harder to get to net zero.

### Education into practice

- What specific changes could you make in your practice to help reach zero carbon targets?
- Using the interactive guide from the BMJ Actions for Sustainable Healthcare series, identify three projects or changes in practice that will reduce greenhouse gas emissions
- How do you engage with your patients in a shared decision model about the appropriateness of potential tests, treatments, or procedures for them, for which there are low-cost alternatives with a lesser carbon burden?

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Table 1 | Selected target areas for healthcare to contribute to zero carbon

Initiative	Responsibility
Macro level actions—policymakers, lawmakers, central authorities, integrated care boards, NHS trusts	
Enact legislation for a carbon neutral health system	Parliament, lawmakers
Promote societal awareness of sustainable practices and health promoting practices	All stakeholders, especially those in positions of influence
Green the healthcare estate, promoting biodiversity, eg by planting trees, and creating green spaces	Policymakers, site CEOs
Make it easy to walk, run, or bicycle to and from work—by providing cycling paths, walking tracks, cycle racks (active transport)	Estate staff running and maintaining buildings and grounds in collaboration with local planning authorities
Reduce funding or incentives for overprescribing, overtreatment, and low value care	Policymakers, clinician leaders supporting Choosing Wisely programmes
Ensure the greenest materials, designs, and energy consumption are promoted when rebuilding or relocating facilities	Policymakers, planners, designers, architects
Reduce waste wherever possible—use less paper, buy sustainable products, recycle Shift to energy efficient devices, and less consumptive equipment and supplies Motivate hard-to-convince members of the workforce through discussion and involvement in order to support the delivery of sustainable healthcare	Responsible policymakers, senior managers, estate staff
Assess the contribution of emergency medical services, including ambulances, general use vehicles, on-site energy usage, and aviation fuel (consider, for example, recommendations from the Carbon Trust: <a href="https://semspubb.epa.gov/work/09/1142510.pdf">https://semspubb.epa.gov/work/09/1142510.pdf</a> )	Hospital and healthcare system leadership, national policymakers
Tackle procurement supply chain emissions. Review procurement policies for greener alternatives when contracting, eg, for food, pharmaceuticals, and equipment in terms of production sustainability and transport of final products	Policymakers and national procurement staff, with collaboration between trusts
Phase out high carbon pharmaceuticals when lower carbon ones are available, such as metered dose inhalers	Policymakers, trusts and integrated care boards in conjunction with pharmacists and suppliers
Standardise life cycle assessments; facilitate carbon footprint assessments of products, procedures, care pathways	Policymakers and experts on life cycle assessments in conjunction with clinicians
Meso level actions—leaders and managers of facilities	
Raise awareness and engage colleagues everywhere Hold sustainability fairs, green-themed days, and celebrate World Environment Day	All staff
Form and empower a sustainability committee Appoint one or more workplace sustainability leads	Involve as wide a range of stakeholders as possible
Optimise surgical schedules and admission and discharge procedures to promote efficiency	Leaders, managers, surgeons, staff in operating theatres
Reuse and sterilise equipment wherever possible Adopt and implement operating theatre checklists focused on sustainability	Procurement staff, operating theatre staff, sterilisation department staff
Shift to models of care that reduce travel, eg, telemedicine, teleconsultations, ambulatory, outpatient-based, community and home care wherever possible	Senior managers, clinicians
Appoint prominent opinion leaders as sustainability ambassadors	Leaders, managers, doctors, other clinical team members
Use a carbon calculator (eg, <a href="https://www.epa.gov/energy">https://www.epa.gov/energy</a> and <a href="https://healthcareclimateaction.org/checkup">https://healthcareclimateaction.org/checkup</a> )	Managers in conjunction with clinicians
Put sustainability and the environment at the heart of medical education	Medical teachers, nurse educators, allied health educators, and course directors
Educate leaders and staff in CO <sub>2</sub> e and greener policies and alternatives	Human resource staff
Fund more health promotion and disease prevention—the best form of care is requiring no care	Senior managers in consultation with GPs and clinical teams
Micro level actions—clinical teams, doctors, individuals	
Widely discuss lifestyle alternatives for patients—plant-based diets, walking wherever feasible, using public transport, minimising waste, reducing water usage	Doctors, dieticians, GPs
Engage with patients in a co-production model following Choosing Wisely principles ( <a href="https://choosingwisely.co.uk/about-choosing-wisely-uk/">https://choosingwisely.co.uk/about-choosing-wisely-uk/</a> ) to reduce or eliminate low value care	Doctors, other clinicians
Take individual responsibility for more efficient, sustainable care at every level—eg, food and water waste reductions and preservation, eliminating use of plastic wherever possible	Individuals, clinical team members
Look across the patient journey to smooth out or eliminate inefficiencies	Clinical teams
Identify as early as possible patient deterioration or complications to facilitate swifter, less costly interventions	Specialist consultants, rapid response systems, ward staff
Use alternatives to current anaesthetic gases, eg, reduce or eliminate the use of desflurane and nitrogen dioxide, and resolve gas leaks	Anaesthetists with the support of healthcare managers
Replace metered dose inhalers	Respiratory teams, family doctors, pharmaceutical companies
Help people adapt to the potential for harm or harm already done, eg, use of sunscreen for skin cancer prevention	Doctors, GPs
Evaluate wasteful clinical practices, research and identify best practice clinical carbon reduction	Medical researchers and funding agencies
Key sources: Karliner et al., <sup>4</sup> <sup>10</sup> NHS England, <sup>1</sup> Philipsborn et al., <sup>20</sup> Skinner. <sup>21</sup>	