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PRACTICE POINTER

Towards net zero healthcare

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What you need to know

- Reduce use of health services and improve healthcare efficiency by integrating the following principles into daily clinical practice and quality improvement: prevention, patient empowerment, lean systems, and low carbon alternatives
- Encourage sustainable healthcare principles in all populations (including those currently under-served) to reduce health inequalities
- Consider strategies to reduce duplication and waste, for example, when booking appointments, requesting investigations, prescribing, allocating resources, and arranging patient or staff travel

Case—A 47 year old woman who takes metformin and amlodipine for type 2 diabetes and hypertension visits her GP to discuss her HbA1C levels, which have been steadily increasing. She is a single mother with two children at school and works full time in an office. They discuss the option of increasing her diabetes medication and how. High quality control of long term conditions with medication has a lower burden on patients' physical, mental, and social health—as well as a lower carbon footprint—than poor control, which may result in complications and admissions. However, the patient doesn't want to increase her medication as she experiences several side effects from the medicines she already takes.

Our essential life support systems—water, air, food, and a stable climate—are being destroyed by the global climate and ecological emergency. This is claiming millions of lives and its impacts are disproportionately felt by people who are poorer and more vulnerable.¹

A report from Health Care Without Harm suggests that the climate footprint of healthcare worldwide is equivalent to 4.4% of global net carbon emissions—ie, if the health sector were a country, it would be the fifth largest emitter on the planet.²

The authors of this article are based in the UK, but the content is relevant for all healthcare teams worldwide, providing sustainable clinical healthcare principles that can be integrated into daily practice, healthcare improvement activity, education, leadership, and research. It also introduces a series of papers, *Towards net zero healthcare*, written by groups in various countries and aimed more directly at specialty teams.

What is the problem?

The direct impacts of the climate emergency, such as heatwaves, wildfires, and flooding, affect human health through increased air pollution and by changing the distributions of vector-borne,

diarrhoeal, and other infections. Indirectly, climate instability (including fast rising temperatures and changing rainfall patterns) causes failed harvests, shortages of food and water, malnutrition, and increased conflict over scarce resources.³

The Intergovernmental Panel on Climate Change (IPCC)—the United Nations' body for assessing climate change science—predicts that, when average global temperatures reach 1.5°C above pre-industrial levels, risks for natural and human systems will include ice cap melting, sea level rises, drought in extended areas, mass displacement of populations, and insufficient food and drinking water.⁴ The IPCC special report, published in August 2021,⁵ stated that this threshold would be breached in less than a decade.

What is net zero?

Net zero is an internationally agreed goal for avoiding worsening global heating in the second half of the 21st century. As a concept, net zero aims to balance the quantities of greenhouse gases (also referred to as carbon emissions because they mostly comprise carbon dioxide) released into and removed from the atmosphere,⁶ ie, to achieve carbon neutrality or net zero.

Commonly used climate change terms

- Carbon emissions/greenhouse gases (GHGs): gases that are released into the atmosphere and absorb solar energy³⁵
- Carbon dioxide equivalent (CO₂e): equivalent mass of carbon dioxide used as a measurement unit of GHG release and removal
- Carbon/climate footprint: the measurement of how much carbon dioxide equivalent is generated by a particular object, pathway, operation, etc.
- Global warming potential (GWP): integrating the amount of energy a GHG absorbs (its radiative efficiency) with its atmospheric lifespan,³⁵ to compare the impact of atmospheric release of a substance with the release of an equivalent mass of carbon dioxide (CO₂e) over a specified time horizon (eg, GWP₁₀₀ is over 100 years)
- Climate mitigation: avoiding carbon emissions by changing practices
- Climate adaptation: adapting to the inevitable increases in temperature, flooding, diseases, etc, that are already happening because of climate change

An evidence based introduction to terms and methods is available³⁶

What is the evidence?

Evidence showing that climate change affects health was summarised over a decade ago.⁷ Now, we need research that prioritises solutions. Many studies for measuring and achieving sustainability in healthcare are still at the stage of defining frameworks and presenting data based on economic input-output methodology,^{2 8 -10} but more specific evidence is also available. Examples include studies of how one intervention differs from another in terms of carbon emissions, patient outcomes, and other factors, including several life cycle analyses^{11 -16} and systematic reviews.¹⁷

Limitations to evidence on sustainable healthcare

- A dearth of standards for measurement and reporting means that studies mostly use different boundaries and are of variable quality
- The contextual element of the evidence makes comparison between different interventions difficult. Because the result of interest is multi-faceted (at its simplest, patient outcome per resource input),

it is more difficult to measure than most clinical research, which focuses on outcomes alone. Sustainable healthcare research bears more resemblance to health economics research, but with the inclusion of environmental metrics alongside financial cost

- When studying an intervention or procedure, as well as assessing the material object itself (a drug or tool), assessment of its production and implementation—in terms of materials, people, energy use, water use, and staff and patient time—is also needed, which adds complexity

What can clinicians do?

Healthcare practitioners can participate in innovation, adoption, and embedding of low carbon practices. By openly framing the climate emergency as a health crisis, they can inspire sustainable practice in colleagues, the public,¹⁸ and leaders.

Apply sustainable clinical practice principles to daily clinical practice (table 1)

Table 1 | Principles of sustainable clinical practice with description of how it is relevant to the above fictional case, and other clinical examples⁹

Principle	Relevance to the fictional case example	Other clinical examples
Prevention	Reduced air pollution exposure ¹⁹ and increased physical activity in high quality green spaces ²⁰	Early identification of patients with declining kidney function can reduce the number of people going on to require carbon-intensive dialysis ²¹
Patient empowerment and self-care	Person centred discussion to discover what matters to patients helps to develop self-management approaches to long term conditions ²⁰	Patients with good inhaler technique need fewer inhalers and achieve better asthma control ²²
Lean care systems	Reducing the need for medical appointments and medicines saves healthcare resources; patients may instead draw upon wider support systems (eg, through a social prescriber, use of local green spaces, and social groups)	Adherence to prescribing guidelines for flupentixol decanoate depot antipsychotic by reducing the frequency of doses from 2 weekly to 6 weekly saves travel, equipment, money, and time ²³
Low carbon alternatives	Medicines are one of the most carbon intensive elements of the health system. ⁸ When clinically appropriate, ensure evidence-based non-medication alternatives are available for shared decision-making with patients, such as green social prescribing or brief advice on physical activity ^{24 25}	The carbon footprint of one hour of general anaesthetic using inhaled desflurane is equivalent to driving 190 miles, compared with only 4 miles using inhaled sevoflurane ²⁶

Healthcare professionals can use CSH's Principles of Sustainable Clinical Practice¹³ to improve patient outcomes while minimising the environmental, social, and financial costs:

- **Prevention**—eg, early identification of patients with declining kidney function can reduce the number of people going on to require carbon intensive dialysis²⁷
- **Patient empowerment and self-care**—eg, patients with good inhaler technique need fewer inhalers and achieve better asthma control²⁸
- **Lean care systems**—eg, adherence to prescribing guidelines for flupentixol decanoate by reducing the frequency of doses from two- to six-weekly, saves travel, equipment, money, and time²⁹
- **Low carbon alternatives**—eg, the carbon footprint of one hour of general anaesthetic is equivalent to driving 190 miles (300 km) using inhaled desflurane compared with only 4 miles (6.5 km) using inhaled sevoflurane.³⁰

Despite the research limitations outlined above, a growing evidence base supports the following widely applicable actions:

- Choose reusable instruments instead of single-use varieties³¹

- Use thorough handwashing instead of gloves for infection control when exposure to blood or other body fluids is not anticipated, in line with NHS guidelines³²
- When clinically appropriate and preferred by patients, arrange remote consultations for follow-up.²⁷

Agree standard metrics for measuring impacts over time

Clinicians can collaborate with those involved in carbon measurement to suggest and develop standard metrics that routinely measure environmental and social impacts (such as carbon footprint or waste produced per unit of care), and use these to make balanced decisions about progression towards net zero care.

Case continued—When asked what matters most to her, the patient says that she is currently inactive, with several barriers to everyday exercise—she drives to school and work and finds few opportunities or incentives to be active at work. With her permission, the GP discusses the benefits of physical activity and healthy eating. The patient decides that three times a week she will get up 20 minutes earlier than usual, park away from the children's school, and walk that distance through a park with her children.

The patient is pleased that she will spend less time in a car in traffic, and that she and her children will be exposed to less air pollution,

spend active time together in a green space, and experience benefits to their health.

The patient is referred to the practice's social prescriber, who further supports her, and shares information and maps of safe local walking routes through nature.

Table 1 (middle column) shows how the principles of sustainable clinical practice care have been applied to this case.

Figure 1 shows the wider population level benefits that may follow from this intervention.

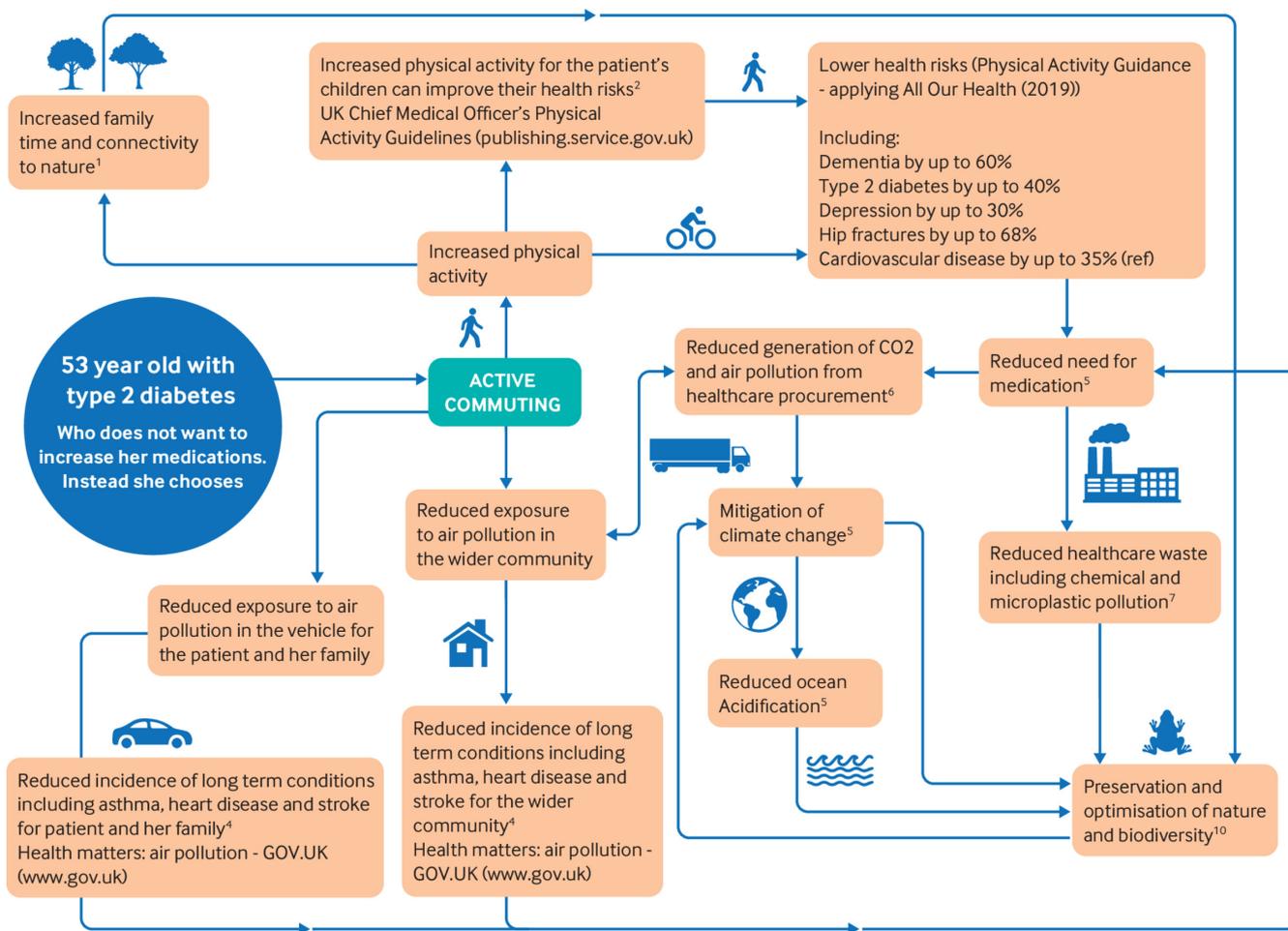


Fig 1 | Potential benefits to patient, public, and environmental health in the fictional case described

Link sustainability to quality improvement

Actively address sustainability as part of healthcare quality improvement (QI) activities. The Centre for Sustainable Healthcare

(CSH) has developed a sustainable QI approach (see example, fig 2) that allows assessment of sustainable value on potential service changes.^{33 28}

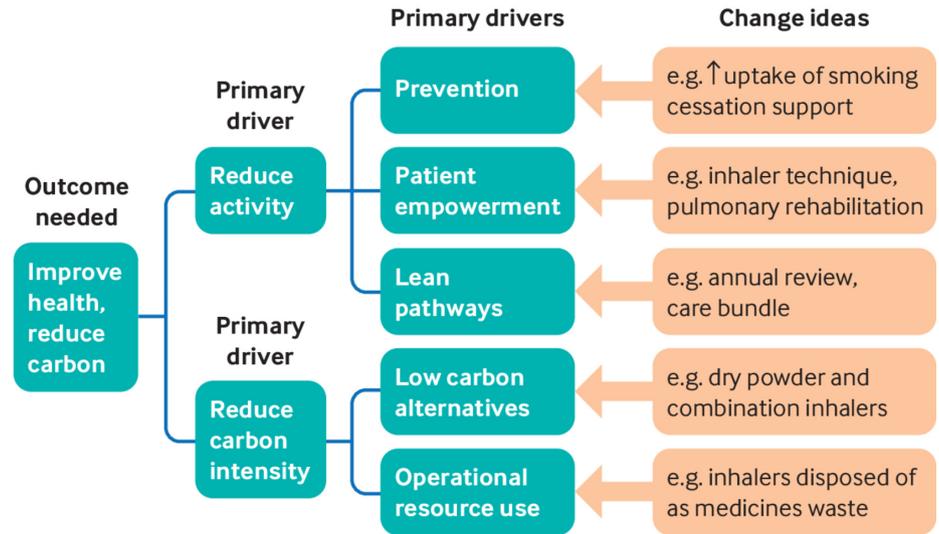


Fig 2 | Sustainability in quality improvement (SusQI): example of how principles of sustainable clinical practice may be applied to improve the care of people with chronic obstructive pulmonary disease

Maximise the theoretical sustainable value of a service or care pathway

In partnership with management colleagues, when improving or redesigning systems (eg, concerning energy or water use, lower emission transport, home visiting strategies, procurement of low carbon treatments or technologies), weigh up the outcomes for patients and populations against the environmental, social, and financial costs.^{33 34}

Use decarbonisation actions to help address health inequality

As outlined in the 2020 Marmot Review, prioritising preventive health, encouraging the growth of food locally, and encouraging access to green space can all contribute to reducing inequalities. The principles are applicable globally.

What support is needed?

Incorporating planetary health into medical education

Policy makers, educators, and students support incorporating planetary health into healthcare curricula, and several usable frameworks have been published.^{29 30 37}

Clinical leadership

Clinical leaders can examine speciality pathways and lobby for prevention funding. By linking with public health, GPs, and local authorities, they can also advocate for and implement societal changes through policy development and commissioning, eg, reducing air pollution to help reduce respiratory conditions; ensuring green walking and cycling routes for staff and patients^{38 39}

Research

Urgent research on solutions and further collaboration with health economists will enable consideration of carbon in resource modelling, health technology assessments, and clinical guidelines

Patient involvement

Patients are entitled to be informed about the connections between climate and health, and be given the chance to advocate for change. They can contribute to sustainability as well as their own care through lifestyle measures, treatment adherence, early identification of deteriorations or complications (leading to swifter interventions), and, with shared decision making, can help providers to avoid enforcing low value, unwanted procedures.

Considerations specific to the UK

- The UK Health Alliance on Climate Change (UKHACC) includes more than 900 000 UK healthcare professionals who are members of organisations acting on climate change⁴⁰
- The 2020 Marmot Review from the UCL Institute of Health Equity outlines how decarbonisation actions such as improved housing and heating can reduce health inequalities⁴¹
- The Greener NHS team has committed to achieving net zero carbon emissions by 2045, and is supporting NHS action in several areas (via integrated care systems, provider organisations, and including clinical practice, buildings, and supply chain)⁴²
- Since 2008, the UK’s Centre for Sustainable Healthcare has worked to expand the meaning of sustainable healthcare beyond buildings to include clinical care, developing sustainable healthcare frameworks, influencing medical school curricula, training specialists and front line teams in measuring carbon, and contributing to sustainable healthcare research⁴³
- The UK charity Medact has outlined and advocated for a healthy green recovery from the covid-19 crisis, including a rapid energy transition away from fossil fuels and shifting agricultural subsidies towards healthy sustainable food production⁴⁴

- The NHS in England and Wales is starting to reward operational changes such as reducing energy usage. Procurement policy now applies higher weighting to environmental factors when awarding tenders (ie, where sustainability contributes at least 10% of a procurement proposal in in England, 15% in Wales).^{45 46} Scotland and NI are also prioritising the environment via different mechanisms.
- Research councils and funders are beginning to fund sustainable healthcare work⁴⁷ and organisations such as the National Institute for Health and Care Excellence and the Good Clinical Trials Collaborative are starting to include sustainability in their research and frameworks.⁴⁸

Education into practice

- What changes can you make to empower patients in caring for their health?
- Which clinical activities in your day-to-day practice are wasteful or have little benefit to your patients?

How patients were involved in the creation of this article and the Towards net zero healthcare series

In this article, the authors are writing as patients, healthcare professionals, and sustainability experts. Patients have been involved in the work of The Centre for Sustainable Healthcare in developing better patient pathways and sustainable practice, and will be involved in the creation of each of this series' specialty based articles, either as co-authors or contributors.

How this article was created

This article was written after discussion with Fiona Godlee, Sabreena Malik, and the Education team at *The BMJ*. It is an introduction to a series on lower carbon healthcare for healthcare professionals in different specialty areas. It draws on the authors' experience, accumulated since 2008, in working to engage clinicians in sustainable healthcare.

Contributorship and guarantor: Rachel Stancliffe and Frances Mortimer conceived the article and are guarantors. All authors wrote and reviewed the article. Georgie Sowman provided the fictionalised case story and figure 1.

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