Net zero healthcare: a call for clinician action

Health professionals are well positioned to effect change by reshaping individual practice, influencing healthcare organisations, and setting clinical standards, argue **Jodi Sherman and colleagues**

Achieving net zero emissions in healthcare will be possible only with radical and immediate engagement of the clinical community. The covid-19 pandemic has served as a wake-up call for high income health systems that resources are finite and globally interdependent, vulnerable to massive surges in demands and simultaneous infrastructure disruption, and that inequities in access to care threaten health and wellbeing for everyone.

During the first months of the pandemic, the medical community united at a historic pace, rapidly sharing information, redesigning models of care, conserving and innovating resources, and moving towards a circular economy. In comparison, the task of transforming healthcare culture and practice to halve healthcare emissions by 2030 as recommended by the Intergovernmental Panel on Climate Change[1] seems entirely feasible.

Planetary healthcare

Planetary healthcare requires embracing an expanded notion of the principle "first do no harm," beyond care for individual patients to a duty to protect the Earth's natural systems on which intergenerational health and wellbeing depend.[2] This planetary health lens acknowledges crucial links between ecological change, human health, and our ability to thrive.[2]

Planetary accountability encompasses actions taken by individual health professionals within the clinical setting, collective actions of clinicians in healthcare organisations with the communities they serve, and interactions of individuals and collectives in professional societies with regulatory and oversight bodies.

For clinicians, this means recognising that healthcare consumes finite resources and produces harmful pollution, accepting that environmental stewardship is integral to our fundamental duty of care, and that we are quickly approaching a climate tipping point.

Healthcare is one of the largest polluting industries, responsible for nearly 5% of total global greenhouse gases.[3] Like all industries, healthcare must rapidly and substantially reduce its greenhouse gas emissions to avoid the most catastrophic outcomes to health and wellbeing from climate change.

Achieving net zero emissions—that is, reducing carbon output until it is in balance with natural and engineered means of absorption—necessitates optimising the efficiency and environmental performance of healthcare delivery. However, these alone are insufficient. We must also work to reduce the incidence and severity of disease to decrease the amount and intensity of care required. Furthermore, we must match supply of health services to their need, by ensuring appropriate care and avoiding unnecessary investigations and treatments. In this way, absolute emissions can be reduced while expanding access to healthcare and achieving co-benefits from mitigating harm and costs from healthcare pollution.

Health professionals are well positioned agents of change at many levels, from shaping individual clinical practices to influencing healthcare organisations and setting standards and policy. We have previously published a planetary healthcare framework setting out three strands of action: reducing emissions from healthcare services, matching supply and demand, and reducing demand for healthcare.[4] Here we provide practical suggestions to help clinicians enact that framework (table 1).

Reducing emissions from supply of health services

Reducing emissions from healthcare services encompasses all activities that consume materials and energy. Most healthcare sustainability initiatives focus on large scale facility operations, such as improving hospital energy performance and sourcing renewable electricity, which typically are not under the control of clinicians. However, clinicians influence building use through decisions on care settings—for example, whether to administer monitoring or treatment in the home, clinic, or hospital (which has the highest resource and emissions intensity).[5] Virtual care for patient-provider interactions that do not require in-person examination reduces travel and clinic emissions, obviating the need for some clinical spaces, as seen in the covid-19 pandemic.

Coordination between care providers, such as through arranging multidisciplinary consultations and services on the same day, and proximal diagnostic testing, can further minimise emissions from patient travel. Such changes often require reorganisation of processes and commitment, which can be hindered by lack of understanding of the need for coordination.

The majority of health sector emissions are embedded in the supply chain, including pharmaceuticals and medical devices.[5] Embedded emissions are dictated by materials and design, as well as production and distribution practices. Use of organisational purchasing power and regulatory reform to influence manufacturers to reduce product emissions is critical but takes time. Clinicians have an immediate role through preferential use of lower emissions supplies (such as choosing reusable rather than single use medical devices,[6] and dry powder

KEY RECOMMENDATIONS

- Clinicians must work to reduce the incidence and severity of disease to decrease the amount and intensity of care required
- Use of resources must be optimised by ensuring appropriate care and avoiding unnecessary investigations and treatments
- Coordination of care between different providers should be promoted to avoid duplication of services and reduce travel emissions and unnecessary building use
- Health professionals should encourage change through individual practice, influencing healthcare organisations, and contributing to standards and policy

Table 1 | Examples of how clinicians can act to achieve sustainable healthcare systems under a planetary health framework[4]

Intervention category	Level of action		
	Individual practice	Healthcare organisation	Professional/regulatory/government
Reduce emissions from supply of health services			
Green infrastructure and operations	• Paperless operations • Optimise environmental performance of office/clinic space (energy conservation, source renewable energy, safe chemicals and cleaning supplies) • Recycling	• Adhere to highest green building/retrofitting standards (eg, Leadership in Energy and Environmental Design) • Green roofs and natural lighting • Optimise efficiency of clinical infrastructure (eg, reduce medical imaging devices' standby mode time) • Food services: healthy diet options, reusable containers, waste reduction strategies (eg, people to help feed patients, just-in-time meal ordering) and waste management (biodigesters and composting) • Renewable energy sourcing •Fossil fuel divestment	•Mandatory, standardised reporting of greenhouse gas and other emissions by healthcare organisations, reductions targets and timelines, public transparency •Ambitious building construction and performance standards •Solid waste reduction policies, zero waste targets •Accelerated clean energy transition
Coordinated care delivery, integrated technology systems, and virtual care	• Offer virtual communications; select appropriate/lowest tech level • Offer multidisciplinary consultations, coordinate care with other providers to minimise patient travel • Coordinate care delivery as close to home as possible	• Multidisciplinary clinics, co-locate providers and allied health/support staff resource allocation • Information technology infrastructure and support, including integration with outside health systems to improve safety and reduce waste • Access to translation services	• Universal broadband • Financial incentives for integration of electronic health records, information sharing, and coordination • Regulation of safe adoption and use of virtual care
Circular supply chains	• Prescribe lowest carbon drug options • Select reusable or environmentally preferable materials where choices exist • Avoid excess material consumption • Adhere to evidence based infection control guidelines • Innovate and redesign greener products	• Environmentally preferable procurement and contracting policies • Maximise medical device reprocessing programmes • Institute recycling programmes • Evidence based infection prevention and control policies • Policies for rational use of single use devices	• Professional guidance and facilitation to support low carbon treatments • Policies to support keeping materials in use at highest value • Manufacturer demonstration of need for single use devices • Producer responsibility for take- back programmes (eg, packaging, electronics) • Mandate manufacturing of appropriately sized drug vials and comparably priced prefilled syringes • Revise infection control regulations and professional guidelines to incorporate public health harms from healthcare pollution • Accreditation policies that support environmental stewardship
Decarbonised transport	• Select active or low carbon transport options, encourage patients and staff to do likewise	• Provide commuter centres, carpool schemes, and subsidised public transport • Electrify vehicle fleet (owned and contracted) with renewable sources • Support structures for electric vehicles (eg, parking spaces with free charging)	• Large scale renewable energy installations/low carbon grids • Safe cycling and pedestrian infrastructure • Green active transport corridors • Bike share schemes • Designated carpool parking • Robust public transportation systems
Match supply of health services to demand			
Appropriateness of care and resource stewardship	• Shared decision making and education (articulation of harms and benefits, distinguish appropriate care from rationing, beware hidden curriculum/biases) • Avoid indication/technology creep • Avoid defensive medicine • Bayesian decision making (potential benefits should outweigh potential harms; ensure test will change management) • Maximise non-pharmacological and non-invasive treatment options • Care coordination to avoid duplication of tests and treatments • Adherence to up-to-date evidence based guidelines • Comprehensive, continuous resource conservation efforts • End-of-life acceptance and palliative care optimisation • Research and quality improvement project leadership around resource conservation and emissions reductions	• Decision making aids and policies to support individual providers, facilitate shared decision making • Technology support for care coordination • Limit conditions of use, such as through restricted ordering and automatic stop orders • Provider-level quality improvement feedback on resource use (cost and emissions) • Policies and institutional barriers to indication creep • Protocols for de-adoption of low value care and health technologies • Support structures for multidisciplinary care	• Guidelines for shared decision making • Professional guidelines that include resource stewardship and prevention of healthcare pollution • Policies to prevent indication creep • Incentives to drive de-adoption of low value care and health technologies • QI requirements around resource stewardship and emissions reductions for professional education and board recertification • Regulatory requirements and oversight of emissions reporting and reduction • Payment models that discourage low value care and link stewardship with accreditation

(*Continued*)

doi: 10.1136/bmj.n1323 | *BMJ* 2021;374:n1323 | the bmj

Table 1 | Continued

Intervention category	Level of action		
	Individual practice	Healthcare organisation	Professional/regulatory/government
Primary and community care services	• Connect patients with primary and community care, ensuring access for centralised, lifelong continuity • Shift care to home services	• Expand home care services (remote monitoring, virtual care when appropriate) • Develop technology to facilitate communication between acute, primary, and community services	•Improve remuneration for primary care providers and reduce workforce shortages • Universal healthcare
Reduce demand for health services			
Social determinants of health	• Support an anchor mission through connecting patients with community and social services (eg, food banks, churches, homeless shelters, home energy retrofit schemes, income assistance, and vocational training) • Volunteer with free, affordable clinics • Social and nature prescribing	•Adopt anchor mission mandate; establish community networks and tools that support clinicians in connecting patients with them • Provide food and transportation vouchers • Develop free, affordable clinics for the uninsured and underinsured	• Promote anchor mission model; work with local governments to establish affordable housing and public transportation • Address food deserts (eg, establish farmers' markets and new business incentives) • Universal healthcare • Climate change mitigation and resilience
Health promotion, disease prevention, and chronic disease management	• Exemplify and promote clinician wellness (eg, healthy diet, exercise, and stress reduction) • Prescribe integrative therapies (eg, yoga, meditation, chiropractic, and massage) •Social and nature prescribing •Violence screening • Provide preventive services (smoking, alcohol, and illicit drug screening, counselling and cessation aids; vaccination education and provision; reproductive health) •Person centred care, co-production/patient empowerment as active partners in care	•Offer healthy diet options • Allocate resources (funding, staff and space) for preventive services (smoking, alcohol, and illicit drug cessation; vaccinations; reproductive health) • Identification and targeting of at risk groups for major diseases • Early diagnosis and intervention in chronic/progressive disease • Secondary and tertiary prevention (such as falls prevention services) • Promote staff health and wellbeing (eg, through mental health awareness training, ethical employment practices, access to green space, encouraging active travel and healthy diets)	• Fair compensation of health professionals for health promotion and preventive services • Urban infrastructure to promote health and wellbeing (pedestrian and cycling lanes; green spaces) • Taxation to discourage unhealthy behaviours • Gun control policies •Infectious disease/zoonosis prevention and control •Clean air quality standards • Heat and air quality index alerts • Air conditioner vouchers • Professional guidance and facilitation to support low carbon care

inhalers over metered dose inhalers), and especially through reducing unnecessary consumption of supplies and treatments in their clinical practice.

Matching supply to demand of health services

Inappropriate or low value care, in which harms or costs outweigh benefits, is ubiquitous in health systems in both high and low income settings. It includes overuse and underuse of healthcare services, which often coexist in the same health system (and even for the same patient). Mismatches between supply and demand of health services occur because of health system structure and funding and behaviours of clinicians and patients that drive misuse.

Underuse of necessary services leaves patients vulnerable to avoidable disease. Overuse results in harms to patients from adverse events and exposures, financial harms to health systems and possible supply shortages, and population level disease burden from pollution generated by healthcare. Appropriate care optimises health and wellbeing by delivery of what is needed, wanted, clinically effective, affordable, equitable, and responsible in its use of resources.[7] High value care also maximises environmental performance, avoiding harm to public health.

A robust primary care system is foundational to appropriate care and provides a platform for overcoming barriers to change.[8] In high income countries, lack of access to, or inadequate primary and preventive care services results in patients interacting with more resource intensive health services such as hospital based treatment. For example, patients may present with advanced disease that would have been preventable or manageable if detected earlier.

Clinicians can mitigate unnecessary use of hospital services by facilitating access to primary and community care services. This includes identifying and targeting underserved groups, moving beyond treating the results of ethnic and economic disparities and seeking to tackle the root cause of inequities by building community wealth (the "anchor mission"). Screening patients for the social determinants of health can identify those at risk and guide health systems to influence community investments. Clinicians can also engage in innovative delivery models that allow care historically offered in the acute setting to be delivered in the community (for example, using remote physiological monitoring and mobile apps.)

In light of the many harms resulting from inappropriate delivery of health services, clinical decision making should be viewed through a stewardship lens—that is, the careful and responsible management of healthcare resources entrusted to providers. Instead, evidence indicates widespread overuse of resources such as medical supplies, medications (beyond opioids and antibiotics),[9] and laboratory and radiological investigations.[10]

Globally, a quarter of the total volume of healthcare services is low value.[7] Solutions include clinician education and empowerment, development of and adherence to evidence based standards of care that incorporate environmental harms, de-adoption[11] of low value care, shared decision making, care coordination, and continuous quality improvement, all grounded in a fundamental duty of resource stewardship and care for planetary health.

Evidence and education

Formal education should include training in planetary health and stewardship principles.[12] Continuing education is required to remain up to date on best practices, as well as indications for specific tests and interventions. The ability to critically appraise evidence, extrapolate findings to appropriate patient populations, and identify industry influence or conflicts of interest is essential to providing high value care.

By keeping their knowledge thorough and current, health professionals can protect against "technology creep"—the application of technologies or treatments to expanded indications without supporting evidence. New evidence or alternative technologies can also result in existing technologies or practices becoming inappropriate or obsolete, necessitating de-adoption strategies.[11] A core driver of resource misuse is ignorance of the evidence and failure to change practice.[13] This is compounded by ethical failures around resource stewardship and lack of appreciation of the rapid rate of environmental degradation and healthcare's contribution to it.

It is also important to understand the risks and benefits of different options, including non-pharmacological and non-invasive approaches. This knowledge can help patients to have appropriate expectations of what is knowable and treatable. Rather than striving for "zero harm," which is unattainable and results in unintended consequences, clinicians should embrace risk reduction.[14] A risk reduction approach considers implications for both the individual patient and society, including from consumption of finite resources and pollution generation.

Health professionals must apply current evidence, critically evaluating the likelihood that results of available tests will inform management decisions or that treatments will achieve desired outcomes. If early detection has no benefit, patients should be spared the inconvenience and anxiety of close screening or surveillance and the potential harm from treating false positive findings. Effective communication is essential to dispel mistaken notions that resource stewardship is synonymous with withholding care.

Shared decision making

Shared decision making involves clinicians helping patients incorporate personal values and preferences into the weighing of risks and benefits to arrive at tailored solutions that best meet their needs. This requires an appreciation of the harms of overdiagnosis and overmedicalisation. Shared decision making embraces a biopsychosocial approach to care and honours patient goals, tending to result in less inappropriate disease focused treatment (for example, chemotherapy at end of life, and stenting in stable coronary artery disease).[13] Studies of shared decision making aids have shown that 20% of elective procedures would be unwanted if patients had access to understandable, relevant clinical information.[13]

Care coordination

Inadequate communication and coordination between providers lead to duplicated and unnecessary services because of incomplete information about a patient's history and current circumstances. Seamless and adequate communication between primary care providers and specialists, and between specialty services such as in multidisciplinary cancer teams, avoids unnecessary care, improves safety, and provides a better patient experience. Barriers to this coordination can be reduced by dedicated staff and supporting technology such as shared access to electronic health records among different healthcare organisation networks and non-affiliated practices.

Institutional structures to drive high value care

Clinicians can work with their healthcare organisations to develop and implement structures that promote adherence to evidence based best practices and discourage wasteful practices. Restrictions on antibiotic and opioid ordering,[15] automatic stop dates on laboratory investigations, and alerts for high fresh gas flow during anaesthesia embed stewardship into electronic health records.

Institutional policies—for example, those that recommend against routine prophylaxis for stress ulcers (which data show is harmful[16]) or restrict access to desflurane (because of its disproportionate climate impact[17]), hasten the uptake of knowledge of harms and facilitate de-adoption of low value care. Specialist teams can standardise aspects of inpatient care and ensure up-to-date best practice through electronic decision support and benchmarking tools.

Developing clinical practice guidelines through professional societies lessens the responsibility on individual clinicians and confers a degree of medicolegal protection. Similarly, hospital policies and procedures can diffuse decision making responsibility, removing pressure that drives clinicians to practise defensive medicine or relieving ethical dilemmas around appropriate allocation of limited resources and end-of-life care, as happened in the covid-19 pandemic.[18]

Continuous quality improvement

Environmental performance should be integrated into the core definition of quality care, with best practices established for clinicians and health systems and reinforced through regulatory and oversight processes that overcome obstacles to change. Investigations of appropriateness of care and resource consumption lend themselves to quality improvement initiatives, which can be designed, initiated, and carried out by individual clinicians within their professional settings. Electronic health records can provide feedback to clinicians on resource use, costs, and emissions, to gauge performance and drive quality improvement.[19]

Reducing demand for health services

Reducing demand for health services requires tackling drivers of poor health. In the United States, over 50% of healthcare services are devoted to the 5% of the population with advanced chronic disease.[20] Most advanced disease develops in people who had risk factors or early stages of illness that were preventable or reversible, often through behavioural and lifestyle approaches alone.[21] Furthermore, healthcare services contribute to only 20% of health and wellbeing, with the remain-

der being the result of broader social, economic, ecological, and political factors.[22] However, current healthcare strategies routinely neglect social determinants of health, missing opportunities to reduce the burden, expense, and environmental effect of chronic disease. An integrative healthcare framework offers a potential solution.[23]

Integrative healthcare is the delivery of non-pharmacological and lifestyle approaches to disease prevention and treatment in coordination with conventional treatments of chronic disease.[24] Smoking cessation, reducing use of drugs (including alcohol), and better dietary habits, activity levels, and stress management can prevent or mitigate many chronic diseases.[7] Evidence based approaches such as yoga, acupuncture, massage, and mind-body practices are particularly useful for pain reduction and more appropriate than medications (especially opioids) for chronic pain.[25] As part of primary care, these approaches offer opportunities to intervene upstream in health promotion and disease prevention.[23] While these behavioural and social determinants are not the sole responsibility of healthcare services, helping patients better engage and manage them could go a long way towards reducing the need for more expensive and environmentally damaging interventions later.

Prescribing nature based interventions and activities such as local walking groups, community gardening, and food growing projects can help meet health needs. Benefits of green time are most researched in mental health, with protected areas worldwide estimated to be worth the equivalent of $6tn (£4tn; €5tn) annually in mental health services.[26] Recommending patients engage socially in local community services can help tackle some of the social determinants of health such as food insecurity and social isolation.

Closing the information and practice gap

Environmental engineering tools and methods to quantify carbon and other environmental emissions are well established, and life cycle assessment is the gold standard in healthcare sustainability research.[27] Although the emissions and public health damages from low value care are not yet known, it stands to reason that reducing unnecessary care would reduce emissions and costs, provided that the emissions intensity of required care is simultaneously reduced.

The process of mobilising the clinical community around planetary healthcare requires a concomitant investment in knowledge generation to identify environmentally preferable practices, establish evidence around high value care, and guide public policy for optimal population health. Clinicians should take the lead in advancing this research agenda, while healthcare institutions, universities, and funding bodies must support the work by prioritising planetary health mandates and providing appropriate resources.

Competing interests: We have read and understood BMJ policy on declaration of interests and have no interests to declare.

Provenance and peer review: Commissioned; externally peer reviewed.

This article is part of a series commissioned by The BMJ for the World Innovation Summit for Health (WISH). The BMJ peer reviewed, edited, and made the decisions to publish. The series, including open access fees, is funded by WISH.

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Cite this as: *BMJ* 2021;374:n1323
http://dx.doi.org/10.1136/bmj.n1323