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## GREEN RECOVERY

# Decarbonising healthcare in low and middle income countries: potential pathways to net zero emissions

*Healthcare in low and middle income countries has a high carbon footprint. Reducing emissions should be integral to plans for universal health coverage, say* **Fawzia Rasheed and colleagues**

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Considerable attention has been paid to the role that healthcare systems have in combating climate change.[1] Recent analysis has calculated the global carbon footprint of healthcare as equivalent to 2-2.4 Gt of CO2, about 4-5% of total global emissions.[2,3]

The focus is often on reducing emissions in high income countries (HICs) and adaptation in low and middle income countries (LMICs).[4] Few LMICs are included in studies on carbon emissions from healthcare.

This imbalance is understandable, given the greater relative contribution to greenhouse gas emissions from health systems in HICs and the disproportionate burden of climate change impacts on LMICs.[5,6] Nevertheless, healthcare in LMICs is a carbon intensive activity and likely to grow with the delivery of commitments to universal health coverage (UN Sustainable Development Goal 3.8).

Table 1 shows emissions intensity data grouped by country economic classification.[4] All direct and indirect emissions from healthcare and the healthcare supply chains are included (Greenhouse Gas Protocol scopes 1 (healthcare operations), 2 (electricity), and 3 (supply chains)). This suggests, at least in economic terms, that healthcare in LMICs is more carbon intensive than that in HICs.

| Table 1 | Healthcare sector emissions by country economic classification[4] | | |
|---|---|---|
| Income group | No of countries with data | Average (range) CO2 intensity (kgCO2e/$) |
| Low income | 0 | 0 |
| Lower middle income | 7 | 1.44 (0.5-3.9) |
| Upper middle income | 17 | 0.87 (0.23-2.08) |
| Low and middle income | 24 | 1.03 (0.23-3.9) |
| High income | 37 | 0.38 (0.07-2.09) |

The UN 2025 target is for one billion more people to benefit from access to affordable healthcare.[7] Most LMICs haven't yet fully met basic needs for healthcare services. In 2017, the World Health Organization financing team estimated that by 2030 an additional $371bn (£262 bn; €303 bn) would need to be invested every year in 67 LMICs to meet the Sustainable Development Goal targets for universal health coverage.[8] Over two thirds of the additional resources were estimated to be for primary healthcare services, which currently receive 54% of healthcare spending in LMICs.[9]

If the carbon impact of this investment follows the average emissions intensity for the 24 LMICs in table 1, achieving universal health coverage could result in an additional 382 million tonnes of CO2 equivalent (tCO2e) a year. This would increase the global carbon footprint of healthcare by about 16% from 2.4 billion tonnes. This figure could be substantially higher if investment is weighted towards lower middle income countries.

Climate change may increasingly threaten the achievement of universal health coverage.[10] As such, to ensure gains in healthcare are sustainable in the long term, it is imperative that emissions reduction forms an integral part of the delivery of universal health coverage.

Conversely, measures to mitigate carbon emissions can also deliver cost savings (eg, energy efficiency), short term public health benefits (eg, reduced air pollution), and timely access to care (eg, telehealth). Integrating carbon mitigation investment into delivery of universal health coverage could leverage greater gains in health and healthcare coverage in LMICs. The 2017 WHO costings paper also broadly identified the critical importance of efficiency gains in reaching Sustainable Development Goal targets.

## Sources of carbon emissions

The quality of the care environment in many major hospitals in LMICs may be on a par with that in HICs; however, care in rural areas is often delivered in less well resourced facilities.[11] A study of 21 indicators compiled from 78 LMICs, representative of 129 557 healthcare facilities, showed that 50% of facilities lack piped water and 59% lacked reliable energy services. The study highlighted that poor

environmental quality increases risks to the health of patients and healthcare workers.

Another recent study showed that less than two thirds of hospitals providing surgical care in 21 LMICs had a continuous electricity source or a generator.[12] Health outcomes are linked to sustainable power supply.[13 14]

Fossil fuelled emergency generators are found in hospitals worldwide. In LMICs, unreliable electricity grids leave facilities dependent on expensive and polluting generators daily or as their primary power supply. In January 2021, for example, a country-wide power cut in Pakistan, where power cuts are common, left hospitals and health facilities running on fossil fuelled generators. Essential facilities such as hospitals often use diesel generators as a back-up power supply; many areas have no electricity for several hours a day.[15]

Where grid power is available, it may be more carbon intensive than in HICs. In India, in 2017 each unit of grid supplied electricity resulted in 743 g $CO_2$, compared with an average of 303 g per unit across 27 EU states.[16 17]

Typically, emergency, non-emergency, and public health outreach vehicles in LMICs have to navigate poor and dangerous roads. Vehicles may be old and public transport options limited, exacerbating accessibility for remote communities.[18]

Many suppliers of pharmaceuticals and medical devices in LMICs are the same ones that supply higher income countries. Many, but by no means all, multinational companies already report their emissions publicly.[19] Where available, corporate carbon reports for these global brands show that emissions from their supply chain are considerably higher than those from their own operations.[20] For many products, particularly personal protective equipment and generic drugs, LMICs are significant manufacturers and exporters.[21 22] Manufacturers in these countries are likely to share some of the emissions challenges and opportunities faced by LMIC healthcare providers.

Although some multinationals have set net zero targets, the emissions intensity of the pharmaceutical sector is about 55% higher than that of the automotive sector.[19] It is time that this sector is scrutinised more closely, by HICs and LMICs alike.

## Healthcare models

Healthcare provision in LMICs can be highly fragmented.[23] The need to work across public, private, and third sector providers increases coordination challenges to effect system-wide changes. These are issues being explored widely in the delivery of universal health coverage.

Current trends of building hospitals with an over medicalised, fragmented approach to healthcare, which forfeits efficiency, must change. Care that doesn't improve health, admission of patients to carbon intensive hospitals when they could have equally been managed at home, and occurrence of avoidable illnesses should be seen as systemic and moral failures.[24]

The most rational and cost effective way to achieve universal access and reduce emissions is to invest in keeping people healthy[24 25]—that is, promoting health literacy, facilitating healthier lifestyles, detecting cases earlier, and bringing services closer to patients' homes. This principle, central to universal health coverage, would yield all-round gains for patients, the planet, and healthcare costs.[26 27] It also underlines the importance of prioritising primary care.

Covid-19 has increased incentives to invest in universal health coverage to deliver less fragmented and more digitally enabled health systems.[28] Digital care and telehealth have proved indispensable during the pandemic, increasing access in LMICs while reducing costs and carbon emissions.[29 -31]

WHO projects that delivery of universal health coverage will require the construction of at least 415 000 new health facilities, 378 000 of which would be primary health centres.[8] This presents a unique opportunity to build zero carbon facilities, which in our experience is particularly feasible for these smaller facilities.

Achieving net zero across all sectors is one of the most important global health interventions.[23 32] We argue that healthcare leadership in decarbonisation in LMICs would be a public good in itself, under the maxim "first do no harm."

## Measuring the carbon footprint of healthcare

Reducing a healthcare provider's carbon footprint begins with robust baseline calculations. In many HICs, regulatory requirements on carbon reporting are supported with government endorsed tools and methods, developed in line with international protocols. As with other areas of systematic data collection and measurement,[9] healthcare providers in LMICs have had limited access to carbon footprinting tools.

Deficits in data to drive investment in improvement, sector specific expertise, national carbon footprinting guidance, and uneven regulations may all have delayed progress.

Recently, several agencies have started filling this gap. An expert meeting hosted by WHO in February 2021 discussed tools and approaches to calculate the footprint of health operations.[33] These included those used by the Aga Khan Development Network, the NHS in England, and the international non-governmental organisation Health Care Without Harm. This is an area in which WHO seems poised to provide guidance.

Together with networks such as the World Organization of Family Doctors (WONCA), efforts to embed related training into accredited continuing medical education could also be transformative.[34] Indeed, enabling health workers to understand their own footprints is already helping drive changes in practice, as well as resulting in partnerships with professional networks and governments to widen impact (box 1).

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**Box 1: Carbon footprinting for healthcare professionals**

Aga Khan Health Services developed its own carbon footprinting tool in 2020.[35] The tool was deployed for use by healthcare professionals across operations in nine LMICs.

Within months of initial orientation, after identification of anaesthetics and propellant inhalers as product carbon hotspots, clinicians took action to reduce impacts.

Aga Khan Health Services' anaesthesiologists established plans to make recommended substitutions to lower carbon gases and reduce volumes overall, and pharmacists did the same with respect to inhalers.

In Kenya, anaesthesiologists started working with professional networks including the Kenyan Society of Anaesthesiologists to influence change. Through the opportunity of a government collaboration and multinational pharmaceutical companies in Kenya, pharmacists negotiated to make propellant-free inhalers cheaper. This helped encourage their use throughout the country. They also worked with the government to raise awareness to help change policies and practices.[36]

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Health professionals are seen as particularly credible advocates, and leveraging their potential can provide substantial impetus to efforts to reduce carbon emissions. This is particularly the case in

LMICs, where they form a larger part of the economic and political elite. As has been shown in the covid response, health workers can work with researchers, media, and policymakers, as well as communities, to co-produce plans.[37] This same thinking must be applied in embedding carbon reduction into the wider approach to universal health coverage.

## Achieving net zero

Achieving net zero in the provision of essential healthcare, while achieving universal health coverage, will require action on many fronts, although three hotspots constitute the bulk of the emissions challenge: energy, travel, and the supply chain (table 2).

**Table 2 | Examples of opportunities to act to reduce emissions**

| Area of focus | Initiative | Financial value | Environmental value | Health value |
|---|---|---|---|---|
| Planning and strategy | Calculate carbon footprint using newly available tools | Investment cost in staff time | Essential first step to targeted action and initiation of cross-organisational and systemic engagement | |
| | Further strengthen WHO support for environmental sustainability[38] | Improve evidence informed policy | Efficiently and effectively coordinate global efforts to decarbonise healthcare | |
| | Shift from hospital centric to community and preventive care[7] | Lower healthcare costs | Fewer emissions associated with healthcare facilities | Increased focus on prevention and timely access to care |
| | Comply with the healthcare professionals' call for a healthy recovery from covid 19[39] | Cumulative global gross domestic product gains of $98tn between now and 2050[40] | Reduced carbon emissions, air pollution, water pollution, and nature degradation | Respiratory, cardiovascular, cancer, foetal development, infant birth outcomes, and more |
| Act on energy (design of new and retrofit of existing healthcare facilities) | LED (light emitting diode) lighting and lighting controls[41] | Up to 85% less expensive to run | Up to 85% less CO2. Avoids use of mercury in fluorescent lights | Emit less UV, attract fewer insects, less vector borne illness risk[42] |
| | Battery power (on-grid sites)[43] | Lower cost to run than petrol generators[44 45] | Less CO2, air pollution, and noise Although mining impacts LMICs[46] | Less air pollution, noise, occupational health risk |
| | Efficient cooling[7-49] | Inverter driven AC units can cost 50% less to run | Less CO2 from electricity use and refrigerants leaks | Essential cooling becomes more affordable |
| | Solar photovoltaic (off-grid sites)[50] | Lower running cost than off-grid petrol generators | Far fewer carbon emissions, air pollution, and noise | Less air pollution, noise, occupational health risk |
| Act on transport | Optimise video conferencing post-covid 19 | Efficient use of staff time, healthcare facilities, lower fuel costs[29] | Lower CO2 from transport and healthcare facilities | Less burden to staff from travel. More time for healthcare |
| | Accelerate shift to telehealth post-covid 19[27-29] | | | Improved healthcare access and quality; less infection, accident risk, travel burden |
| | Move to plug-in hybrid electric vehicles and car pooling[51] | Lower fuel and maintenance costs | | Less noise and air pollution |
| Act on procurement and product choice | Reduce overprescribing, increase non-pharma options[52-54] | Drugs and devices costs | Fewer emissions associated with pharma and supply chain | Reduced health risk of adverse drug reactions and antimicrobial resistance |
| | Low carbon inhalers. Favour propellant-free devices and better condition management[55] | Dependent on product | Avoided emissions of high carbon propellants[56 57] | Improved management of respiratory conditions |
| | Low carbon anaesthetics and replacing surgical N2O with medical air/O2[58] | Dependent on product | Less CO2 and ozone depletion impact from anaesthetics[36] | Less risk to healthcare staff from occupational exposure to gases[59] |
| | Geographical sourcing to favour lower carbon country of origin[60] | Potential to stimulate industry and governments to invest in sustainability and green growth[61 62] | Some LMICs and specific companies are already decarbonising Accounting and valuing CO2 in procurement can reduce supply chain emissions and encourage wider change | Stimulating growth in cleaner, more environmentally responsible suppliers creates employment, reduced pollution, and supports the wider determinants of health |
| | Favour low CO2 suppliers | | | |
| | Favour low CO2 products, packaging, and logistics | | | |
| Advocacy | Visible standards, targets, and public reporting of progress in decarbonised healthcare | Wider scale of uptake and impact from measures such as those identified above Wider understanding and appreciation among the public and policy makers of the need to factor carbon and environmental issues into public planning and investment, in healthcare and beyond Safeguarding the environmental determinants of health | | |
| | Health professional's engagement with national and regional professional and media networks, encouraging clear commitments with practical actions[37 38] | | | |
| | Health providers' engagement with governments encouraging policy and financial incentives for carbon reduction[3 33 36] | | | |

Direct emissions from healthcare operations (scope 1), together with electricity (scope 2), typically comprise just over a quarter of the carbon footprint of healthcare. Energy and fuel use are also major sources of air pollution.[3 63] Progress in reducing emissions from energy and fuel will require healthcare providers to invest in energy efficiency as well as zero carbon energy sources, in new and existing

facilities. Net zero will require the addition of renewables and government policies for national grid and vehicle fleet decarbonisation (box 2).[65]

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**Box 2: Examples of decarbonisation projects**

- *Bamyan hospital*—In 2016 a 400 kW solar electric system was installed at a hospital in Bamyan, Afghanistan. It provides 50-60% of the power to the 141 bed hospital, with diagnostics and surgery.[64]

- *India* has committed $1.4bn towards electrifying the transportation sector: policies include public fleet procurement, charging points for electric vehicles, financial incentives (and disincentives for polluting vehicles), bulk procurement for cost reductions, and an overarching goal of 30% penetration by 2030.[51]

- *Santa Izabel Hospital*—The main challenges in delivering a carbon reduction programme for this hospital in Salvador, Brazil, were related to sourcing funds and negotiation of prices. Actions implemented in 2019, such as efficient lighting, solar water heating, and improvements to heating, ventilation, and air conditioning resulted in a 2% reduction in total greenhouse gas emissions compared with 2018. Overcoming funding barriers left a portfolio of potential investors. Emissions savings were calculated using a greenhouse gas inventory tool from the Healthy Hospitals Project.[3]

- *Valle del Lili Foundation University Hospital* in Colombia established a sustainable purchasing programme. Purchasing processes were created and strengthened, which, among other actions, prioritised reducing the use of toxic substances, replacing disposable materials with reusable ones, and promoting the use of energy efficient equipment. By 2019, the programme was achieving annual savings of around $700 000.[3]

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As with other consumption intensive sectors,[66] the remaining bulk of most health providers' emissions can be attributed to the supply chain (scope 3), most notably from the manufacture and supply of essential pharmaceuticals and medical devices.[3 33] Progress in reducing emissions from procurement will require governments and health networks to wield their purchasing power. Suppliers will need to be persuaded to reduce their own emissions and the emissions associated with their products.

Work in HICs, equally relevant to LMICs, has identified a few particularly environmentally damaging clinical products. Pressurised metered dose inhalers and anaesthetics merit specific focus, owing to the direct release of potent greenhouse gas emissions in their use.[67 68] Progress in reducing emissions from these high carbon products will require clinicians to apply an understanding of their environmental impact in condition management, clinical practice, and product choice.

## Conclusions

Much of the road to net zero healthcare is possible with transferable knowledge and technology already available in LMICs. The barriers are likely to be in the priorities set by healthcare providers, the general public, and lawmakers to implement effective targeted action, and most critically in access to the necessary financial resources to act.

Failure to integrate carbon reduction with the investment required to deliver universal health coverage and stimulus packages for covid recovery could undermine prospects for sustainability. Conversely, we have an opportunity to increase the efficiency, effectiveness, and equity of health systems through actively aligning all universal health coverage investment and programme management expectations with the global fight against climate change. Options for decarbonising health align perfectly with reinvigorating the evidence based primary healthcare movement.[69]

The abilities of health workers in LMICs to innovate, build strategic south-south alliances, and secure the necessary political buy-in should not be underestimated. With effective leadership, coordination, and financing, charting a plan for health sector decarbonisation in LMICs is eminently feasible. This is a fast changing field where changes in technology, healthcare delivery, and products can transform what can and should be attempted. All engaged will have much to learn and share through WHO. The health sector in LMICs will be no exception.

**the bmj** Visual summary

# Net zero healthcare
Strategies for sustainable healthcare during the climate emergency

The climate emergency is forcing the medical community to think beyond care for individual patients - expanding our duty of care to protecting the Earth's natural systems on which intergenerational health and wellbeing depend. This graphic presents twelve strategies out of more than 100 presented in two papers published in *The BMJ* for the COP26 climate conference in 2021. It uses the metaphor of a stylised town to visualise what these changes could look like. Such changes are now needed in towns and cities across the world.

**1 Clean energy transition**
Renewable energy sourcing and low carbon grids

**2 Warning systems**
Heat and air quality index alerts delivered via mobile devices

**3 Low carbon prescribing**
Mandate low carbon products, packaging, and logistics, from low carbon suppliers with visible carbon reporting and net zero targets

**4 Battery power**
Use battery power to expand electricity supply from renewable sources and reduce the need for fossil fueled generators

**5 Distributed health care**
Offer multidisciplinary consultations, co-locate providers and allied health staff to minimise patient travel

**6 Device reprocessing**
Implement medical device reprocessing programmes, keeping materials in use at highest value

**7 Primary health shift**
Shift from hospital-centric care to community-based health promotion and disease prevention

**10 Efficient energy use**
Use of systems such as LED lighting and lighting controls

**8 Encourage active transport**
Provide safe cycling and pedestrian infrastructure, and encourage patients and staff to use it

**11 Encourage healthy eating**
Provide healthy plant-based diet options, reusable containers, and minimise waste

**9 Telehealth**
Optimise video conferencing and accelerate shift to telehealth

**12 Move to electric vehicles**
Electrify vehicle fleet, and improve support structures for electric vehicles such as charging points

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## Key recommendations

- Healthcare providers in LMICs should be expected by ministries of health to calculate the carbon footprints of their organisations and to embed action in the delivery of universal health coverage to reduce emissions.

- Donors and healthcare providers should ensure that virtuous circles in efficiency and health are maximised.

- Healthcare providers should seek opportunities to increase energy efficiency and move rapidly away from a reliance on fossil fuels and generators.

- Providers and ministries of health must identify and act on opportunities to reduce emissions in the supply chain.
- Clinicians should seek to understand which products have already been identified as particularly damaging and the possible mitigation measures.

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