Incorporating sustainability, eco-responsibility, and educational equity in the medical curriculum
L'intégration de la durabilité, de l'écoresponsabilité et de l'équité en matière d'éducation dans les programmes d'études en médecine

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The healthcare sector generates a climate footprint that in turn contributes to environment-related threats to human health.[1] This will continue to pose health risks in the future in the absence of sector-specific carbon emission reduction goals. Hospitals are one of the most energy-intensive economic sectors.[1] The healthcare sector's climate footprint has recently been reported to be equivalent to 4.4% of global net emissions (or 2 gigatons of carbon dioxide equivalent).[1,2] By comparison, commercial aviation produced 2.4% of global carbon emissions (or 918 million tons) from fossil fuel use in 2018.[3] Yet healthcare lags behind other sectors in the reduction of carbon emissions.[1] As such, in addition to caring for individuals and communities, the healthcare sector also contributes to environmental pathology, and thus to sicker communities.

Although healthcare has not traditionally been viewed as a key target for carbon footprint attenuation and climate protection, this is rapidly changing. Lenzen et al.[1] recently reported on the global environmental footprint of healthcare, and suggested that it is vital for clinicians to take initiative in mitigating the adverse health implications. They proposed that healthcare organizations must take action to identify, incentivize, and promote climate-safe models of care through resource conservation and the adoption of sustainable practices.

Health services can add both health and social benefits to local communities by addressing the climate's impact on health as a catalyst to advocating for change. Reducing unnecessary procedures and thus reducing resource consumption can simultaneously reduce harm to patients whilst also optimizing the use of health system resources, thus promoting a more sustainable healthcare system. Physicians are ideally positioned to play a leadership role in promoting a more sustainable practice of medicine. For example, Choosing Wisely Canada (www.choosingwiselycanada.org), a campaign designed to support physician efforts to help patients make effective choices to ensure high-quality care, may create an opportunity for physicians to lead the effort for valuable healthcare resources to be used more optimally, thus potentially reducing the sector's carbon footprint.

Although quality healthcare may come at an environmental cost, there is room to minimize this impact. To this end, virtual medicine has already demonstrated many advantages that predate the COVID-19 pandemic.[4] Studies have unanimously reported on the use of telemedicine to reduce carbon footprints, thus advancing the potential for a "greener" sector.[4,5] The COVID-19 pandemic has certainly expedited this trajectory through the acceleration of telehealth integration in healthcare delivery.[6] There is also evidence that this pandemic has led to experimentation

with educational innovations, many of which can be developed or leveraged further.[7] Virtual healthcare delivery models can serve to reduce the healthcare sector's footprint while concurrently shaping a future health workforce that is better informed about climate effects on health.

Teaching hospitals have a unique mandate in the Anthropocene: environmental stewardship in light of the magnitude of anthropogenic climate change. Today's medical learners should graduate with a keen sense of fiduciary duty towards patients and the environment alike, given the interdependency between human health and environmental sustainability.[1] To this end, redesigning medical education to address the intertwined issues of anthropomorphic activity, ecological footprints, and human health is essential to contemporary health needs. Although quality, value, and equity are essential components to healthcare, the health sector must find solutions to limit its ecological footprint. This underscores the urgent need to incorporate sustainability and stewardship in medical education.[8] Thus, adapting the CanMEDS leader role to include collective responsibility and environmental stewardship is imperative.

As role models and curriculum developers, medical educators have an ethical responsibility to advance climate action. Moreover, medical faculties and training programs have a mandate for social accountability and health equity. Educational equity is closely intertwined with health equity and must be addressed concurrently with efforts to promote health equity.

Addressing climate change in the context of educational equity requires transformational change in the approach to resource utilization. In an era of limited resources, especially in small subspecialty residency training programs, innovation is essential to sustainability, particularly in more traditional educational institutions. One example of educational innovation is evident in McMaster University's development of a digital curriculum on resident physician wellness in 2018; this collaborative digital platform promotes sustainable and equitable sharing of electronic resources, with uptake at the national and international level.[9] Subsequently, in early 2020, geriatric psychiatry educators at McMaster University, Ontario, partnered with Dalhousie University, Nova Scotia, to implement a new core, digital curriculum shared between the two training programs. This new curriculum is based on foundational learning objectives aligned with national core competencies. The two sites will pilot this learning platform during the 2021-22 academic year. The participating programs believe that this shared digital curriculum ensures a consistent, accessible educational experience for trainees. It grants a blended model or "flipped classroom," where self-directed learning of asynchronous digital learning modules is supplemented by other educational models such as digital coaching and/or instructor-led training.

These innovative program collaborations illustrate methods by which modern educators can collaborate to pool resources, minimize resource consumption, and steer the transformation to a more sustainable future in medical education. Such digital projects have the potential to reduce the environmental footprint by reducing travel, human capital resources, and the administrative burden without compromising quality. It is feasible to scale up and spread this format of curriculum within national medical institutions, and beyond. A broad adoption of digital medical education has the potential to bridge the access gaps for those living in rural/remote medical settings, whilst also providing the opportunity for high income-low-income country resource sharing and partnering on curriculum development among institutions with varying resource levels. Reaching large, even global, audiences through digital platforms has the potential to pave the way to an ecologically friendlier medical education and training system grounded in educational equity.

We believe that a digital medical curriculum offers advantages in terms of reducing the carbon footprint and its negative impact on the health of our planet, while also providing opportunities to support educational equity; this is in addition to embedding environmental education in the program structure. Adequate internet connectivity, technological infrastructure, and digital literacy remain challenges that require reconciliation. Research is needed to evaluate the future impact of such digital solutions on carbon emissions, concurrent with examining the feasibility of digital technology integration as a standard feature of medical education and training activities. A paradigm shift is required so that digital medical education is regarded as an essential component of the medical education and training curriculum, and as a pathway and platform for reducing access and equity gaps for resource-poor settings, from the local to global level. Further research should also characterize the carbon cost-effectiveness and modes of maximizing environmental benefits at the local level, whilst concurrently striving to

achieve equity globally in healthcare education and practice.

New digital curriculum models should emphasize the incorporation of climate leadership into the CanMEDS leader role given the direct health effects of anthropogenic climate change. In keeping with the CanMEDS leader role, the curriculum should also adopt initiatives such as Choosing Wisely Canada. Ultimately, such approaches have the potential to inspire and engage our future health workforce to commit to generating a low carbon footprint and optimizing environmental sustainability.

Conflicts of Interest: Dr. Ana Hategan and Dr. Mariam Abdurrahman declare that they have no competing interests.

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