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It's Time for Medical Schools to Introduce Climate Change into Their Curricula

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Abstract

Climate change presents unprecedented health risks and demands universal attention to address them. Multiple intergovernmental organizations, health associations, and health professions schools have recognized the specific importance of preparing physicians to address the health impacts of climate change. However, medical school curricula have not kept pace with this urgent need for targeted training.

The authors describe the rationale for inclusion of climate change in medical education and some potential pathways for incorporating this broad topic into physician training and continuing medical education. Reasons include the magnitude and reach of this transboundary issue, the shared responsibility of the U.S. health care sector as a major contributor to greenhouse gas emissions, and the disproportionate effects of climate change on vulnerable populations. The integration of climate-change-related topics with training of essential physician skills in a rapidly

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changing environment is feasible because many health topic areas already exist in medical school curricula in which climate change education can be incorporated. To fully integrate the health topics, underlying concepts, and the needed clinical and system-wide translations, content could be included across the scope of training and into continuing medical education and faculty development. The authors provide examples of such an approach to curricular inclusion.

Global environmental changes driven by human activities are altering natural processes to such an extent that the present era has been defined as a new geologic age known as the Anthropocene.¹ The loss of biodiversity, the spread of toxins and pollutants, and planetary warming due to greenhouse gas emissions cannot be fully understood without also accounting for their profound impact on human health.² Direct exposure to extreme temperatures (particularly extreme heat), severe weather, and heavy precipitation are leading to premature mortality and injury,³ especially in vulnerable populations, including young children, the elderly, people with lower incomes, and those who are already dealing with the burden of chronic disease, health inequities, and cultural and economic barriers such as lack of access to air conditioning.⁴ Additionally, climate change has many indirect burdensome effects on food and water security, air quality, and infectious disease distribution. All these factors further exacerbate inequalities, vulnerabilities, and social disruptions that adversely affect health.^{5–7} The World Health Organization⁸ has predicted that by 2030 there will be an estimated 250,000 additional deaths per year attributable to climate change, which is likely conservative, as currently 23% of all deaths globally are the result of environmental factors that, while multi-factorial, are subject to the influence of climate change, which could drive the estimated number of additional deaths even higher.

Many countries, intergovernmental organizations, health associations, and some health professions schools have recognized the importance of preparing physicians to address the health impacts of climate change and have made commitments towards that worthy goal. In 2007, *The Lancet*, with support from the Rockefeller Foundation, created a commission on health and climate change with a goal of publishing a triennial report on climate change and health. These reports⁹ track scientific progress while disseminating public policy information and medical perspectives on the health effects of climate change. In 2008, the American Medical Association adopted an organizational policy to support the training of physicians on the health effects of climate change and actively encouraged physicians to get involved.¹⁰ In 2015, the United Nations Paris Agreement to combat climate change¹¹ inspired the Health Educator's Climate Commitment—a pledge to ensure that the next generation of health professionals is prepared to effectively address the health impacts of climate change. The deans from 118 health professions schools across fifteen countries committed their schools to such training.¹²

In spite of these efforts, medical school curricula have not kept pace with environmental changes. While no reliable mechanism exists for estimating the prevalence of curricular content addressing the health effects of climate change, the Association of American Medical Colleges (AAMC) supports a database in its Curriculum Inventory (CI) that aggregates institution-reported curricular activity and allows queries through specific search terms. We queried the CI database with the assistance of AAMC staff using key terms

related to climate change, environment, climate change actions/solutions, and meteorology. The CI database search indicated that schools do not report any explicit inclusion of climate change education in their curriculum.¹³ This finding is unsurprising but does reinforce the necessity for articulating the reasons why climate change should be at the forefront of our curricular efforts. Here, we aim to describe the rationale for including climate change in medical education and illuminate some potential pathways for doing so. Our arguments are all the more urgent as current U.S. policy is aimed at supporting fossil fuel extraction and deregulation of carbon emissions, all of which will accelerate the multiple threats to global health and survival in spite of increasing public acceptance of the human contributions to climate change.

The Rationale for Climate Change in Medical Education

First, today's medical students and residents belong to a generation that has an increasingly large stake in developing a strategic response to the many deleterious impacts of climate change. Of the 18 hottest years on record worldwide since record keeping began in 1880, 17 have occurred since the year 2000.¹⁴ It is becoming increasingly clear that every sector needs to do its part to address climate change. As Jim Yong Kim, President of the World Bank, stated in a 2015 address at Georgetown University, "Just about everything we do has to be focused on tackling climate change, both in terms of mitigation and adaptation."¹⁵

Second, the scope of the health effects of climate change is unprecedented. New data on the cardiovascular and pulmonary impacts of air pollution are of particular concern, because climate change potentiates the damage caused by air pollution while, conversely, air pollution accelerates climate change.^{16,17} According to a recent study, air pollution was implicated in 6.5 million deaths in 2015.¹⁸ The magnitude of such impacts present, and will present, substantial challenges and opportunities for health care professionals.¹⁹ In addition, temperature rise and greater frequency of extreme heat events will place a significant health burden on the global population. Currently, about a third of the world's population is exposed to a lethal combination of heat and humidity conditions for at least 20 days per year, and projections indicate that the proportion of the world's population with such exposure will increase to 48–74% by the end of this century.²⁰ In the United States, populations most vulnerable to detrimental effects of heat include young children, the elderly, patients with co-morbid conditions, socially- and linguistically-isolated groups, and those without air conditioning.⁵

Third, physicians, nurses and administrators all bear some responsibility for spearheading efforts to reduce health care's environmental footprint. The U.S. health care sector itself contributes to U.S. greenhouse gas emissions at an estimated 9–10% per year.²¹ If the U.S. health care system were a country, it would rank 13th in the world for greenhouse gas emissions.²² Reduced medical waste, energy conservation, and locally sourced, plant-based diets are potential areas where health care professionals can participate in mitigation processes and can support health care centers to engage with their communities in a collaborative effort to promote a healthier local environment.²³

Fourth, health care systems oversee medical care of large segments of vulnerable populations experiencing the health impacts of climate change. As previously mentioned, certain groups such as young children, pregnant women, patients with chronic pulmonary conditions, and the elderly are amongst the most vulnerable.⁵

Last, inclusion of climate change curricula into undergraduate medical education fosters necessary critical thinking, participation in global health and sustainability initiatives, multidisciplinary perspectives, and public health literacy—all essential physician skills in a rapidly changing environment.²⁴

These reasons support the need to invite medical students and residents to reflect on their role and responsibility in combatting the health effects of climate change, both with respect to the health care sector they are part of and the patients they serve. At the same time, these reasons provide the foundation for curricular interventions—discussed below—that build on current teaching on the determinants of health.

Current Curricular Interventions

The global, interdependent, and complex nature of climate change necessitates a rethinking of traditional divisions between public and individual health. The prolongation of the allergy season; increased intensity of allergens; and the potentiation of lung irritants through the interaction of heat, sunlight, and fossil fuel combustion are just a few of the macrocosmic effects that manifest as symptoms in the microcosm of individual patient care. Adapting to this complexity, which entails many political, social, scientific and economic factors that are beyond the scope of medical education, is an important challenge. Consideration should also be given to the multi-decades efforts to date of incorporating environmental health more broadly into medical curricula.²⁵ Here, we briefly present the current curricular state of climate change in medical education and provide examples of some relevant educational interventions.

Fortunately, many health topic areas already exist in medical school curricula where climate change education can be incorporated into the discussion simply by broadening the horizon within which these topics are taught. The querying of the AAMC's database described above did reveal educational activities that touched on topics of concern to climate change education, including basic disease entities such as asthma and Lyme disease. While we do not know whether the health topics identified in the database were taught making any explicit connection to climate change, their ubiquity in the medical curriculum indicates that there is a potential base for integrating climate and health topics into existing medical school curricula. Climate-relevant examples and the overarching macrocosmic mechanisms linking them to individual disease processes could broaden discussions of such topics as cardiovascular health (related to changing air quality), sexually transmitted infections (related to displaced populations), and mental health disorders (related both to displaced populations and also to extreme weather). To fully integrate the health topics, the underlying concepts, and needed clinical and system-wide translations, content could be included across the scope of training and into continuing education and faculty development (see Table 1).

For example, at Georgetown University School of Medicine, third-year medical students review a series of modules focusing on asthma in their family medicine clerkship. These include a short integrated climate change module, where students investigate the connection between air pollution and climate change, identify specific lung irritants, look up current air quality data, and apply recommendations to advise a patient with asthma. By locating curricular elements focusing on such entities as heat injuries, asthma, allergies, infectious diseases, and cardiovascular health, thematically relevant materials on environment and sustainability can be integrated without adding substantially to time constraints in an already overpacked curriculum. Because repetition and longitudinal emphasis are likely needed to support such teaching, Georgetown also recently introduced a foundational required workshop for all first-year students linking environmental health, climate change, air pollution, and respiratory disease. Ideally, the many interconnected threads introduced in this workshop can be woven into a wide array of course materials in the future, with a reach well beyond that of the third-year clerkship module just described.²⁶

In another example, at the Icahn School of Medicine at Mount Sinai, first-year students receive a lecture followed by elective small-group discussions, all focused on climate change and other global environmental changes, as part of a global health module.²⁷ However, given the myriad disease-relevant interconnections and input from some Sinai medical students requesting that more climate and health linkages be woven throughout curricular coursework, an expanded initiative aims for cross-curricular infusion through the introduction of vignettes into multiple lectures across multiple courses in the preclinical curriculum. Ultimately, validation through development and implementation of expected competencies will be needed to support these curricular innovations.²⁶

What Must Be Done

Climate change will increasingly be a determinant of health and must be included in medical schools' curricula so that students understand the role of the changing environment as a risk factor and the part it plays in the pathophysiology of disease. Including climate change will also help students see themselves as self-efficacious actors in this global challenge that is unfolding. By incorporating climate and health into their curricula, medical schools will not only prepare their students for the inevitable reality of illness and life circumstances affected by climate change but will also add to and solidify the crucial skills needed by the modern-day physician to address the growing health burdens of non-communicable disease, an aging population, systemic socioeconomic disadvantage, and the structural changes to the upstream determinants of health. Integrated curricular changes and advocacy training will better equip and inspire students as they embark on their future careers.

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Table 1**Practical Tips for Advancing a Climate Change and Health Curriculum in Medical Schools**

Area of curriculum development	Examples
Preclinical physical diagnosis	<ul style="list-style-type: none"> • Incorporate patient's environmental history.
Preclinical sciences	<ul style="list-style-type: none"> • Incorporate relevant climate change content into cardiopulmonary, microbiology, and other courses, and • integrate environmental vulnerabilities into social determinants of health curriculum.
Clerkships (pediatrics, family medicine, emergency medicine, infectious disease)	<ul style="list-style-type: none"> • Work with clerkship directors to include climate change content, communication skills, and patient education approaches.
Curricular enhancement	<ul style="list-style-type: none"> • Use available published objectives,^{28,29} • offer electives, • create practicum and research opportunities, • create environmental health fellowships with a concentration on health effects of climate change, and • use Web sites presenting postcurricular models of educational resources such as MedEdPORTAL.
Advocacy	<ul style="list-style-type: none"> • Liaise with affiliated hospital to explore green energy and related initiatives, • identify and liaise with social justice clubs and tracks, • create and mobilize student groups, and • use advocacy talking point resources, such as EcoAmerica's Climate for Health talking points.³⁰
Faculty development	<ul style="list-style-type: none"> • Offer training to junior faculty, • identify/create continuing medical education for faculty, and • work with chair/administrators to create engagement incentives for faculty.
Patient/public communication	<ul style="list-style-type: none"> • Discuss communication techniques with learners using available models, and • engage learners to design and implement research projects aimed at developing best practices at the point of care and when communicating with other stakeholders.
National and international learning communities	<ul style="list-style-type: none"> • Liaise with, and provide similar opportunities for trainees to connect with groups that transcend traditional professional and geographic silos, such as Columbia University Mailman School of Public Health Global Consortium on Climate and Health Education³¹ and the U.K. Center for Sustainable Healthcare Network on Sustainable Healthcare Education.³²