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COMMENTARY

Training Clinical And Public Health Leaders In Climate And Health

ABSTRACT The effects of climate change are accelerating and undermining human health and well-being in many different ways. There is no doubt that the health care sector will need to adapt, and although it has begun to develop more targeted strategies to address climate-related challenges, a broad knowledge gap persists. There is a critical need to develop and cultivate new knowledge and skill sets among health professionals, including those in public health, environmental science, policy, and communication roles. This article describes specific initiatives to train future leaders to be proficient in understanding the linkages between climate change and health. We present an agenda for expanding education on climate and health through health professional schools and graduate and postgraduate curricula, as well as in professional and continuing education settings. Our agenda also identifies ways to promote sustainability in clinical practice and health care management and policy. Throughout, we cite metrics by which to measure progress and highlight potential barriers to achieving these educational objectives on a larger scale.

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Climate change is jeopardizing humanity's health and well-being in many different ways. The manifestations of climate change that are evident today in record heat exposures, flooding episodes, wildfires, and hurricanes are also exacerbating existing health disparities in disadvantaged populations. Health care professionals are and will be a critical part of the solution to the climate crisis.

The health care sector is a major economic force in the US, responsible for 12 percent of all employment in the country.[1] In many regions, health care institutions are among the largest employers, helping shape the identity of local communities. Health care professionals are natural educators, caregivers, and respected communicators of scientific information.[2] In the midst of the ongoing coronavirus disease 2019 (COVID-19) pandemic, both public health officials on the podium and clinicians in emergency departments and COVID-19 hospital wards have been instrumental in accurately conveying health risks and earning the public's trust.[3] They have a similar role to play in the realm of climate and health. This article is meant to be both an inventory and a road map for individual providers, health educators, and health care systems alike to understand emerging trends and programmatic developments in climate and health.

Health care professionals have three primary roles in supporting broader societal efforts to address the climate crisis. First, they must protect both individual and community health from the increasingly severe health threats posed by climate change and weather extremes. Second, they can ensure that health care and public health systems are resilient in the face of climate change and weather extremes and, at the same time, are taking steps to become carbon-neutral

and optimally sustainable. And third, they bring their voices and scientific expertise to advocate for cross-sectoral solutions to the climate crisis, highlighting evidence for the health benefits of reducing greenhouse gas emissions in other sectors. Clearly, to be effective in these three areas, health care workers and leaders must have sufficient training and access to evidence-based guidance, which we describe in a broad educational agenda here.

The health care and public health workforce is diverse, with different levels of training and scientific expertise, different roles and responsibilities, and consequently different opportunities to influence change and facilitate solutions to the climate crisis. There is no one-size-fits-all curriculum or educational approach that should be applied to all health care workers. And in the absence of strong government or trans-sectoral policy initiatives and programs in climate change and health, climate and health educational programming in the US is heterogeneous and fragmented. This article strives to provide coherence to the current landscape, describing specific, mostly US-based initiatives in climate and health education by domain; articulating the specific goals of the different programs; and laying out a broader educational agenda for the health care workforce.

Although our examples emphasize training opportunities for physicians and nurses, many of them are available to a wider array of health care workers, and all help illustrate a pathway toward greater awareness of climate change and health throughout the profession. We divide climate and health activity into three broad domains: undergraduate, graduate, and postgraduate education; learning opportunities in professional and continuing educational settings; and promoting sustainability in clinical practice and health care management and policy.

We chose this agenda based on our overall knowledge and assessment of activities and because almost all examples could broadly fit into three categories: formal degree or graduate medical education, training for the individual health practitioner, and activity at the larger health system level. We cite specific cases to demonstrate feasibility and initiatives that offer innovative approaches or a degree of replicability. Our examples should not be interpreted as a definitive, comprehensive inventory of individuals and organizations engaged on climate and health issues. The article concludes with a discussion of barriers to implementing these educational objectives and suggests metrics for tracking progress.

Health Professional Schools And Professional Education

In response to greater awareness of climate and health linkages, there has been a notable increase in professional health education to train practitioners to contextualize climate change within their specific disciplines.[4,5] The best evidence of climate and health activity on campus is the implementation of dedicated climate and health curricula. This may be in the form of longitudinal curricula over the course of the degree, embedding climate and health issues within core physiologic systems–based or public health learning, or via intense two-to-four-week student electives. The Global Consortium on Climate and Health Education, an education resource collaboration administered by Columbia University's Mailman School of Public Health, published a set of core competencies for health professionals that are divided into five areas of practice: climate and health knowledge and analytic skills, climate change and public health practice, climate change and clinical practice, policy aspects of climate change and health, and climate and health communication. Although not all competencies are relevant for all categories of health care professionals, they represent an integrated approach to articulating the diverse body of knowledge and skills required for health professionals to become effective agents in the health sector's response to the climate crisis and serve as a guide for novel curricula.

The Global Consortium on Climate and Health Education recently surveyed 160 international consortium members to describe the current state of climate-health curricula among health professions institutions internationally.[4] The professional specialty breakdown is as follows: 70 percent of its membership comes from schools or programs of public health, as well as other health sciences schools (that is, dental or veterinary); 18 percent from schools of medicine; and 11 percent from nursing schools. Just over half of the member institutions responded to the survey. Among respondents, 63 percent offer climate-health education, most commonly as part of a required core course. Still, many reported that the addition of climate-health courses was under discussion at their institutions and concede that they had encountered challenges when trying to institute the curricula, such as a lack of available staff time, lack of funding and time to support development, and administrative or other skepticism about climate-health science.[4] Another study published in 2020 noted that only 15 percent of 2,817 medical schools in 112 countries have incorporated climate change and health into the curriculum,

Tracking progress on climate and health linkages is an important part of advancing science policy.

with an additional 12 percent reporting student-led climate-related programs.[6]

Many medical schools teaching climate and health curricula have gotten creative with their delivery. At the University of California San Francisco (UCSF), first-year medical students can take a two-week climate and health course as part of the UCSF School of Medicine Bridges curriculum, which centers on novel competencies needed by physicians to meet emerging health care challenges in the modern era.[7,8] The University of Illinois College of Medicine at Urbana-Champaign embedded climate-related health risk assessments into simulated case scenarios involving standardized patients, such as one with preexisting asthma suffering a severe exacerbation from wildfires.[5] The Icahn School of Medicine at Mount Sinai has integrated climate and health principles into an existing didactic curriculum. For example, microbiology lectures covering climate-sensitive vectorborne diseases now include material on how warming temperatures affect the spread of tick habitats. Similarly, in selected neurology and psychiatry lectures, students learn about research linking fossil fuel–related air pollutants and the neurodegenerative changes associated with Alzheimer disease.[5]

The University of Minnesota has integrated climate and health peer-reviewed slide decks into existing lectures for each of the university's health sciences programs, including the medical school and schools of nursing, public health, pharmacy, and dentistry.[9] The University of Colorado School of Medicine has a dedicated two-week elective on climate change and health. Students are exposed to core curriculum offerings from on-site faculty members, as well as numerous remote guest lectures from experts at other academic institutions and federal agency scientists working on climate and health policy. The elective has used pedagogical innovations through local field trips, including visits to the National Science Foundation Ice Core Facility, the National Oceanic and Atmospheric Administration, and the National Center for Atmospheric Research, as well as an op-ed writing project focused on core health science communication skills. The capstone experience included an overnight stay in Rocky Mountain National Park (recently ravaged by unprecedented late-season wildfires), where students contextualized their learning through exposure to an iconic ecosystem that is also under stress from climate change.[10]

Schools are also now offering distinction within a specific degree program to mark proficiency and expertise on this topic. The climate and health program at Columbia University's Mailman School of Public Health offers a master's-level certificate in climate and health that is popular among students studying environmental health sciences, epidemiology, population and family, and health policy and management.[11] It also offers a doctorate in climate and health. The University of Miami's Miller School of Medicine and Rosenstiel School of Marine and Atmospheric Sciences launched a new master of science in climate and health program in 2020.[12] The Yale School of Public Health launched a new climate change and health concentration for master of public health students in 2020. Many schools are now regularly sponsoring climate-themed lecture series and featured grand rounds speakers.

Students at UCSF have collaborated with students throughout the US to rate medical schools' activity through a Planetary Health Report Card. Planetary health is a related concept that incorporates climate change impacts in a larger holistic system that encompasses the "health of human civilisation and the state of the natural systems on which it depends."[13] The report card's rubric consists of four elements: existence of a planetary health curriculum, interdisciplinary research in health and the environment, community outreach and advocacy in environment and health, and university support for student-led planetary health initiatives.[14] The tool's emphasis on health equity reflects an emerging theme within climate and health education as it relates to issues of climate justice, specifically the notion that climate change imparts disproportionate social, economic, and public health impacts on vulnerable populations. We foresee climate justice as an increasingly important part of a climate and health curriculum as schools integrate this concept with existing global health equity, social justice, and diversity and inclusion initiatives.

Advancing postgraduate climate and health education, the first graduate medical education

fellowship in climate and health started in 2017 at the University of Colorado, followed by Harvard University in 2019. The two fellowships partnered on shared curricula, research projects, and off-campus preceptorships and have a mutual strategic goal: to train physicians in climate education, meaningful engagement, and effective communication to create leaders in the field of climate change and health.[15]

Professional Learning, Practice, And Advocacy

In the clinical setting, nurses—widely considered one of the most trusted professions in health care—have been active leaders on this issue.[16] The Nurses Drawdown initiative is a project to draw attention to five actionable areas: clean energy, food systems and cooking practices, transportation and mobility, gender equity, and nature-based solutions. The initiative is supported by the Alliance of Nurses for Healthy Environments, a national organization aimed at empowering nurses to act on environmental challenges. The alliance also co-created the Nurses Climate Challenge, the nation's first nurse-led campaign to educate health professionals about the human health impacts of climate change. Within twenty months of the campaign's launch in 2018, nearly 1,000 nurses from forty-seven US states and twenty countries registered to become Nurse Climate Champions seeking to educate their colleagues about the impacts of climate change on human health. By signing on, they gain access to free resources for planning educational events, including sample outreach messages, templates for educational presentations, and other communication tools.[17]

Professional medical societies have also been increasingly active in mobilizing their memberships and specialties to have greater awareness of climate and health impacts on their patients. The Medical Society Consortium on Climate and Health, housed at and affiliated with George Mason University, has become a focal point for intersocietal engagement. Its twenty-nine constituent medical societies represent, by membership, more than half of the physicians in the US.[18] Its inventory of individual, medical society, and health care system activities showcases a robust spectrum of climate and health involvement. Most educational opportunities for providers exist in discrete, stand-alone special topic conferences accredited by the Accreditation Council for Continuing Medical Education. Many medical society gatherings are now offering individual continuing medical education lectures on climate and health as it pertains to that particular specialty, but these lectures represent a small percentage of the overall conference educational content. In the past few years dedicated courses and conferences on this topic have emerged. The Medical Society Consortium on Climate and Health has an annual two-day conference—available to both individual providers and representatives from its constituent medical societies—each spring in the Washington, D.C., area.[18] Conference content includes one day of updates from climate and health leaders, many of whom represent the consortium's member medical societies. As societies and individual clinicians have been more interested and active in putting forth expertise in testifying to lawmakers, as well as undertaking advocacy and lobbying efforts on climate and health issues, the second day of the conference offers experiential training through lobbying workshops and meetings with legislators on Capitol Hill.

Other activities are happening at scale at the societal level. Many medical specialties have formally published policy statements on climate and health.[19] Most statements affirm guiding principles—that is, that climate change is caused by humans and that it will increasingly have health impacts on patients. Others go farther to advocate for greater engagement on this issue, including educational programmatic development and even financial portfolio divestment of fossil fuels.[20] Others have dedicated space within their peer-reviewed journals to address climate issues, created continuing medical education lectures for their members to give, published patient-centered communications for provider dissemination, and established portals for dedicated member resources on this topic. The American College of Physicians offers members regional grand rounds presentations to disseminate climate and health education and a toolkit with actionable strategies to reduce energy use and greenhouse gas emissions in medical practice. One recent initiative by members of Columbia University's Global Consortium on Climate and Health Education involved pushing medical specialty boards to include climate and health–related questions on board exams as a way to reinforce specialty-specific concepts.

Some programs offer longer, more comprehensive educational experiences for professional learners seeking to gain expertise. The Yale School of Public Health offers an eighteen-week online certificate program for a diverse group of professionals, covering climate change health impacts, mitigation, adaptation, and communication.[21] Harvard University, Johns Hopkins University, the University of Wisconsin, and Yale University all post publicly available climate and health–related courses through online learning platforms.[22,23] The University of Colorado School

of Medicine will launch an intensive, short-duration health care professional continuing medical education course in 2021, modeled after the core content and pedagogy of its fellowship.

Measuring Progress On Health Care System Sustainability And Resilience

Tracking progress on climate and health linkages is an important part of advancing science policy. Although to date most data are aggregated and presented in disparate reports by individual investigators or institutions, there is an emerging collaboration that promises to serve as an annual "gold standard" inventory on climate and health activity.

THE LANCET COUNTDOWN Under the auspices of the Lancet Group, the Lancet Countdown draws on a multidisciplinary group of scientists (including climate scientists, engineers, energy specialists, economists, political scientists, public health professionals, and doctors) to publish a recurring assessment of the state of climate change and human health, seeking to provide decision makers with access to high-quality, evidence-based policy guidance.[24] The annual report tracks the relationship between health and climate change across five domains and forty-one indicators. Indicators offer more granular metrics, such as energy usage (for example, carbon based versus renewable); health condition–specific data (for example, extreme heat vulnerability, food insecurity); economic losses due to climate-related extreme events (for example, reinsurance company data); and public and political engagement, stratified by media, government, corporate-sector, and individual engagement. As part of this process, there is a concomitant report specific to the US with distilled data from the Lancet Countdown focusing on nationally relevant findings on the health of Americans (for example, case studies on hurricanes, wildfires, and vectorborne disease and *Vibrio* outbreaks).[25]

Recognizing a lack of evidence on the economic toll of climate-sensitive public health impacts, the Lancet report has quantified much of its data in dollar figures, ostensibly as a way to better translate opportunity costs to a wider range of policy makers.[24,25] Another recent study provided an excellent conceptual framework for broader estimation of climate-sensitive health-related costs. By examining ten climate-sensitive case study events spanning eleven US states in 2012 (for example, wildfires in western states, ozone air pollution in Nevada, extreme heat in Wisconsin), the authors estimated $10 billion in total health-related costs from 917 deaths, 20,568 hospitalizations, and 17,857 emergency department visits.[26]

GREENING THE HOUSE OF MEDICINE Beyond educating and sharing risk assessments with providers and patients, there is another movement gaining momentum within health care, which is to consider how US health care operations and "cradle to grave" supply chains contribute to global carbon emissions. The contribution to these emissions is substantial. Health care spending in the US accounts for roughly 18 percent of the gross domestic product, and by one estimate, the US health care system contributes 10 percent of the nation's carbon emissions and 9 percent of harmful non-greenhouse air pollutants.[27,28] "Climate-smart health care" is a term defined in a 2017 joint report by the World Bank Group and Health Care Without Harm, citing a variety of low-carbon, resilient health care strategies. Key features of this plan include waste minimization and sustainable waste management; low-carbon procurement policies for products, supplies, and pharmaceuticals; energy and water efficiency; sustainable transportation policies; and resilience strategies to withstand extreme weather events.

Global Green and Healthy Hospitals is an initiative of Health Care Without Harm that aspires to create a network of member health care facilities, hospitals, health systems, and organizations dedicated to environmental sustainability. Launched in 2011, the network has grown to more than 1,350 members in 72 countries representing more than 43,000 hospitals and health centers.[29] Members support specific sustainability goals from a ten-item framework (for example, leadership in environmental health, waste management, and hospital design and construction).[30] Health Care Without Harm's partner organization, Practice Greenhealth, was established in 2008 to assist health care facilities in navigating and creating sustainable health care solutions in the US. Partner hospitals voluntarily report metrics such as existing climate and health education for hospital staff, the percentage of generated or purchased renewable energy, cost savings attributed to these initiatives, green building design or construction commitments, and the percentage of its health facilities with full-time sustainability leads.[31]

SUSTAINABILITY AND POLICY Sustainability benchmark reports record the impact of interventions by participating organizations.[32] One additional metric that is gaining traction is the copious amount of air travel logged each year by academic medical faculty. This has led to pressure to participate in carbon offset travel programs, in which a portion of an academic unit's aggregate carbon expenditure cost is allocated toward carbon offsets or toward a targeted sus-

tainability program.[33,34] Although such programs have yet to be widespread on medical campuses, university campuses have been successful in achieving carbon-neutrality within academia, a construct readily translatable to health care faculty and organizations.[35]

Other national initiatives are promoting health care system sustainability. The Association for the Health Care Environment, a professional membership group of the American Hospital Association, has an environmental sustainability certificate program in which members (aspiring toward silver, gold, or platinum levels) track the presence and activities of a dedicated sustainability committee, environmentally focused policies and reports, hazardous chemicals and waste management, pest management, and environmentally preferable purchasing practices.[36] Health Care Without Harm and Practice Greenhealth host an annual CleanMed conference for health care sustainability, convening health system leaders beyond those involved in direct clinical care, including administrators, plant engineers, supply-chain representatives, food services professionals, and purchasers, in addition to clinical providers.[37]

Not only do large health care organizations need to reflect on their own contributions to a changing environment, but they also must prepare for challenges affecting their continuity of operations and patient care delivery in the setting of climate-exacerbated extreme weather events. Hospital resilience and disaster planning are a key aspect of risk assessment and mitigation. The Department of Health and Human Services has published a comprehensive toolkit for health care system leaders to use in conducting vulnerability assessments of their institutions confronting severe weather events.[38]

BARRIERS TO CHANGE As the science on climate change has advanced markedly in the past decades and the world has seen firsthand the devastation of climate-fueled extreme weather events in US communities, there has still been a conspicuous absence of health policies on operational resilience, patient care continuity, and sustainable practice. We believe that the educational initiatives and proactive policies inventoried in this article represent foundational steps toward addressing this gap, but formidable barriers remain that impede real-world progress in transforming the health sector. This discordance has many roots.

There remains a great deal of climate science skepticism within the public at large, and even among health care leadership. Although there is excellent evidence to suggest that attitudes are changing to accept that climate change is indeed caused by humans, the need for specific actions remains highly contentious.[39] And although those in health care are trained to incorporate scientific data on health risks into practice, this general public skepticism also pervades health care institutions.

Public health policy does matter, as is now more evident than ever, and is at the absolute heart of societal discourse.

There are additional barriers. The reliance on public funds for medical education and health care delivery still tempers any bold action on climate and health initiatives that may run counter to extant political priorities. Medical school and residency curricula are already jampacked, with little room to add topics on climate and health. There are few accessible funding sources to underwrite educational programmatic development and faculty time. Greening hospital infrastructure and system processes, which have been proven to save money over time, nevertheless necessitate front-end commitments and investment that decision makers may easily eschew.

Perhaps the biggest obstacle is the desultory feeling that nothing can be done to effect change.[40] Lack of faith in the collective ability to achieve policy change disincentivizes action and entrenches a fear of commitment to any particular strategy, leaving inaction as the default choice. If nothing else, the past year of the global collective crisis around COVID-19 may shake health care professionals out of that notion. Public health policy does matter, as is now more evident than ever, and currently is at the absolute heart of societal discourse. COVID-19 has held a mirror up to the inherent injustices of US society. The frightening reality is that too large a swath of US policy makers do not believe in investing in public health, appear indifferent to science, eschew public education, and allow the most vulnerable to suffer from an indiscriminate disease—all to avoid what they view as impositions on the rights of individual citizens.[41,42]

Conclusion

If we as a society wish to thrive in the face of the next great public health crisis resulting from a changing climate, we owe it to ourselves and to future generations to change our collective risk assessment and reassess the policies and practices that got us here in the first place. Health care providers understand better than most the effects of cruel, societal dynamics and careless policies that disenfranchise the most vulnerable citizens. COVID-19 disproportionately affects people of color,[43] and climate change similarly preys on those with socioeconomic or physiologic vulnerabilities.[44] The education initiatives cited in this article represent pioneering efforts to train future leaders to be facile in these health linkages; articulate the risks; and influence decisions on energy use, public health initiatives, and legislation.

Consider that even during the height of discord about the governmental response to the pandemic, our public health officials and health care workers were universally praised for their professionalism and indefatigable support of their communities under threat.[45,46] The voices of health care workers cannot fade away with the end of the pandemic. There is too much at stake, and the crisis of climate change will need even more from everyone, for a much longer time. ■

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