

The Response of Health Professional Education to Climate Change: A Narrative Review

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Abstract

Background: Climate change poses an increasingly severe threat to human health. Health care professionals and medical educators are in a unique position to provide impactful information on the health complications posed by climate change to their patient populations. We conducted a narrative review to characterize how climate change has been addressed by health professional schools. We sought to find the scope of climate-health awareness at health professional institutions as well as how climate-related implementations have changed or developed over time.

Methods: We searched PubMed as our primary database. We vetted health professional schools for curricular and sustainability campaigns such as recycling and sustainability campaigns, rationing use of energy and/or water, management of waste and/or pollution, transportation initiatives, or other initiatives to reduce or offset their carbon footprint. In addition to medical schools, we included schools of nursing, pharmacy, dentistry, nurse practitioner, optometry, osteopathy, podiatry, and chiropractic medicine. All levels of screening were done in duplicate. The results were summarized qualitatively.

Results: A select number of schools have implemented an elective course or two on climate-health and sustainability. We found several schools showing an awareness of climate-related issues through sustainability initiatives. A larger theme was that of the “call to action,” alerting the community to the increasing risk of climate-related health complications in patient populations.

Conclusion: By implementing more climate-health related curricula into higher health education, future health care providers will be better equipped to provide better care for communities impacted by climate change. The awareness of climate-related health issues has increased, although few institutions have implemented curricular changes or other sustainability initiatives into their programs.

Introduction

Climate change has increasingly been recognized as a global threat leading to damaging effects on human health. The 2020 Lancet Countdown on health and climate change indicated a rise in unhealthy diets and transmission of climate-sensitive infectious diseases in relation to environmental degradation (1). For example, from 2018 to 2020, malaria transmission in mountainous regions was 38.7% higher due to increasing temperatures eroding altitude barriers that once protected against malaria transmission (1). Additionally, lightning strikes, arid conditions, and consequent wildfires have been on the

rise. Firefighters and people living where wildfires commonly occur are subjected to direct and indirect health hazards such as burns, heat stroke, dehydration, smoke inhalation, PTSD, insomnia, and depression (2–3). In the context of health care, out of 2.5 million hospitalizations, patients recorded with cardiovascular events were identified as Medicare recipients (>65 years of age) who resided within 200 km of large wildfires of hazardous particulate matter caused by large wildfires (2). Climate-related issues exacerbate the debilitated health of the aging demographic, with a gradual increase in heat-related mortality for those 65 years of age and older (1). From an ecological lens, climate change can not only have deleterious effects on ecosystems but is also marked by temperature deregulation, which increases the likelihood of disease transmission between animals and humans. The increasing abundance of pollutants such as carbon monoxide, particulate matter, or sulfate particles from fuel combustion have placed more people at risk for developing respiratory illness, cardiovascular disease, or even cerebrovascular illness, and cancer (4–5). While temperature levels continue to rise globally, Europe and vulnerable regions in the eastern Mediterranean have sustained approximately 10% heat rise over the last three decades (1). Formulating protocols with assistance of public health guidelines for such circumstances can aid communities to recover or increase robust protection from climate-related events. The World Health Organization (WHO) estimated the annual death from air pollution to be approximately 7 million people per year (6). This does not include other causes of mortality associated with climate change such as heat and toxic related exposures, food insecurity, and mental health problems (7). As a central part of health care prevention and response efforts, the medical community is beginning to acknowledge and understand its role in addressing climate-related effects on the health of patients and communities (8).

A common misconception is that climate change is more of an environmental rather than a medical issue. In early September 2021, the same editorial was published in more than 200 medical and health journals. The editorial called the world to action to combat climate change (9). Despite an increasing focus in medical journals like The Lancet, the educational response to climate change by the United States (U.S.) health care system has been limited (1). Medical professionals have an obligation to become better educated on mitigating adverse health effects on patients. Health professional schools can equip communities to properly handle physiological ailments caused by exposure pathways. Currently, there is an ongoing effort to enforce climate-related coursework in medical education, but problems arise as students are unable to understand foundational concepts and professors struggle to properly convey relevant

information (10). Medical students at institutions like Emory University have voiced their concerns for lack of education in this regard and have become leading pioneers in bringing awareness to climate-health and its effects (11). The effective implementation of climate-related educational practices by the medical community can lead to the delivery of medical services that are coherent with the environmental conditions affecting patients, thus prompting our investigation. Although climate change continues to be of concern, medical schools around the world have also been slow to respond to this health care threat (6). There appears to be a knowledge gap regarding climate change in all stages of medical education. A study published in 2021 surveyed practicing physicians and other health care professionals on different topics related to climate change (12). Although 95% of the health care professionals surveyed acknowledged that climate change is an ongoing crisis, approximately 41% stated that they haven't educated the public about climate change as they are unaware of the full scope of the topic (12). A 2019 systematic review of peer-reviewed literature also showed that while health practitioners and other health care professionals are aware of their duty to advocate and educate on climate change, efforts to do so are fragmented and insufficient (13). While there was a strong emphasis for educational strategies (92%) and developing curricula to teach future providers about climate change, the initiative to implement these changes is still under progress (13). If medical professionals can be better educated on climate-health and its effects, they can better respond to and educate individuals in their communities about the ongoing crisis. Having limited knowledge of how health science schools have been responding to climate change, our team aimed to dive deeper into this topic. Physicians, along with other health care providers, have been encouraged to become educated about climate change and its effect on human health. To effectively treat a population that is increasingly falling victim to environmental dangers, it is imperative to prepare health professionals for the evolving challenges posed by climate change. Therefore, health science institutions and continuing medical education providers should incorporate climate change-related coursework into curricula (14).

The greatest population at risk of climate-health related complications are working-class individuals and those that are below the poverty line (2). Those living in poverty have difficulty recovering from climate change related events. For instance, those who rely on agriculture or fishing as a main food source are greatly affected by natural disasters, such as droughts and hurricanes (15). In particular, African American patients tend to suffer from injuries due to severe flooding and develop chronic illnesses from air pollutants (16). The lack of knowledge surrounding climate change as it relates to medical practice impairs a provider's ability to recognize and anticipate conditions that may be a result of the patient's surroundings, thereby resulting in a less impactful treatment plan. Bridging clinical practice and climate-health awareness will most benefit patients who are directly exposed to climate change, as well as guide health care professionals in building progressive models of medical care. Research and education in this area can potentially have a significant, long-term, community-based effect that will improve health outcomes. Currently, medical schools are realizing that there is a deficit in institutional efforts

and educational materials to train future medical professionals on how to respond to climate change-related health threats (17). Thorough assessment of how we can adopt beneficial lesson plans and curricular resources, will lead us in the direction of progress. For instance, providing specific learning objectives on how to diagnose and manage climate-related conditions can help students understand the relationship between climate change and health outcomes. Student assessments on skills like clinic energy audits can improve both human and planetary health (8). Implementing curricula will aid students develop critical thinking strategies, multidisciplinary perspectives, and public health literacy which are essential skills for future physicians to have when operating in a changing environment (3). By analyzing this gap, the medical community will directly benefit in being able to identify next steps in educating students about climate change and in turn leading to well-informed patient care.

In this narrative review, we sought to identify the prevalence of climate-health-related initiatives being implemented at health professional educational institutions and their associated health systems. Specifically, we pursued the following questions: Are health professional schools addressing climate change with curricular changes and other sustainability initiatives such as recycling and sustainability campaigns, rationing use of energy and/or water, management of waste and/or pollution, transportation initiatives, or other initiatives to reduce or offset their carbon footprint? Have health professional institutions voiced their awareness of climate-related health issues with a "call to action"? How have climate-related measures undertaken by health professional schools changed over the years? Determining the scope of climate change awareness within health professional institutions and the climate management strategies the institutions have or will be implementing will inform climate-health initiatives to ultimately combat climate-related health complications in patient populations. Further, the information gathered will assist the health professional community in making decisions about climate-health curriculum implementation and other sustainability initiatives on their campuses.

Methods

To explore this topic, peer-reviewed reports were characterized in English from 1999 to 2021. We chose to start with 1999 for a date range due to the limited climate change-related material prior to 1999. We searched for terms synonymous with climate change, global warming, planetary health, programs, courses, and curriculum. We met again during the charting process to include search terms that captured the sustainability initiatives related to climate change. The PubMed database was queried for these terms. We did not search any gray literature and did not do any hand searching. The regions we searched included primarily the United States as well as Western Europe. In our study, Western Europe is defined as any European country west of Germany and Austria, including Mediterranean countries and regions such as Greece and Cyprus respectively.

We included studies related to schools of medicine, nursing, pharmacy, dentistry, nurse practitioner, optometry, osteopathy, podiatry, physician assistant, physical therapy, occupational therapy, and chiropractic medicine, and public health. We

excluded studies on veterinary medicine as we are interested in the effects climate change education would have on the health of humans. As we wanted to keep the aims of this review closely associated with medical education and health professionals with prescribing authority, we excluded studies related to undergraduate and K-12 programs. We showed the selection of the articles using a flow chart (Figure 1). The final protocol was registered prospectively with the Open Science Framework.

Citations for all articles reviewed were stored in EndNote. Articles were vetted by title and abstract to identify those relevant to the study. This initial review was completed in duplicate. Articles were then advanced to full-text review, which was also conducted in duplicate. Next, articles were coded by the type of initiatives that implementations were proposed by the educational institutions. Implementations were defined as the addition of climate change material into curriculum; this also included proactive implementations such as recycling and sustainability campaigns, rationing use of energy and/or water, management of waste and/or pollution, transportation initiatives, or other initiatives to reduce or offset their carbon footprint. We illustrated the number of relevant articles published annually and frequency of the previously described curricular and sustainability implementations with figures generated using GraphPad Prism (Figure 2). Individual sources of evidence are presented as well as a synthesis of the results (Figure 3).

Results

During the screening process, 530 articles were identified. After duplicates were removed, 39 articles were advanced to full-text screening. Those that failed the title and abstract screening usually did not contain any information about climate change or health education. Articles that did not pass the full-text screening largely did not include any sort of implementation. Although “calls to action” were recorded, they were not included in the synthesis if they did not include one of the aforementioned implementations. For data extraction, 19 articles were moved forward and included in the synthesis if they contained any sort of implementation (Figure 1).

An overarching theme we found in the literature was a “call to action” and other similar editorial pieces. These were not necessarily reporting implementations or curricular changes but instead reported on the need for such changes. Additionally, we found the most practiced implementation was that of curricular changes. Institutions such as Stanford University, the University of Minnesota Medical School, Carle Illinois College of Medicine, and the Icahn School of Medicine at Mount Sinai have developed curricular material aimed at tackling climate change-related health complications and increasing awareness of such complications (6). However, these courses have been incorporated into the curricula as electives and were not required at any of the mentioned institutions.

Discussion

A theme that emerged from the literature was that of cutting carbon emissions from health care systems. According to *The New York Times*, the health care industry accounts for 5% of carbon emissions globally; if it were a country, it would be the

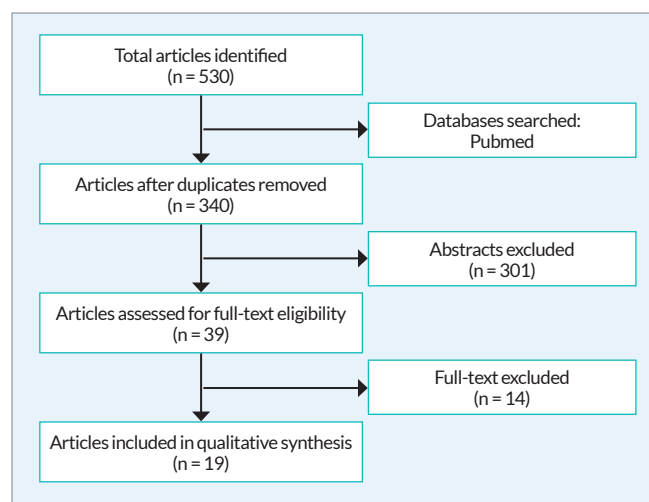


Figure 1. Selection flowchart denoting number of articles passing each stage of charting process.

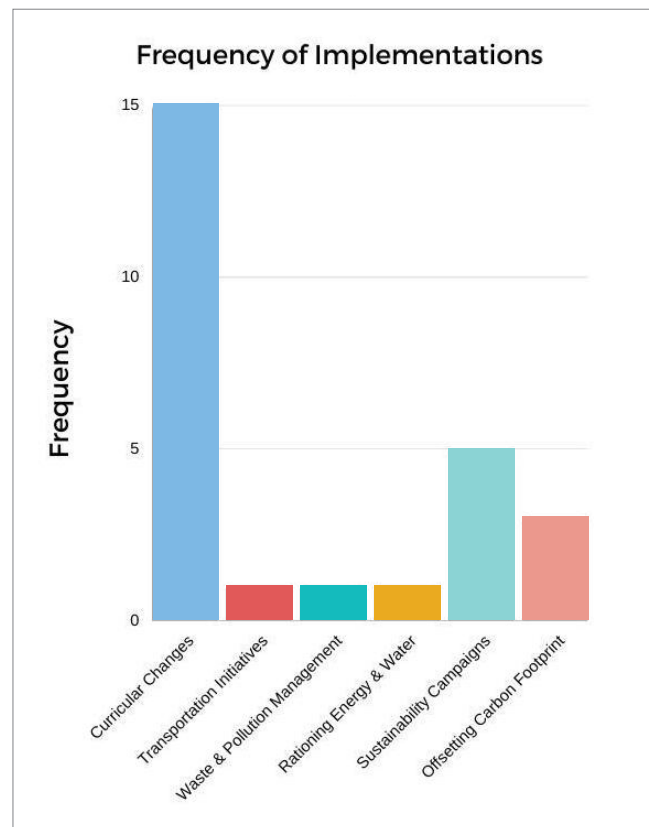


Figure 2. Frequency of the implementations found within articles qualifying for full-text review.

fifth-largest producer of carbon emissions (19). In answering our question about whether health professional schools are addressing climate change with curricular and other sustainability measures, our results indicate that there has been little movement. A handful of schools have been proactive about implementing elective courses for their students but

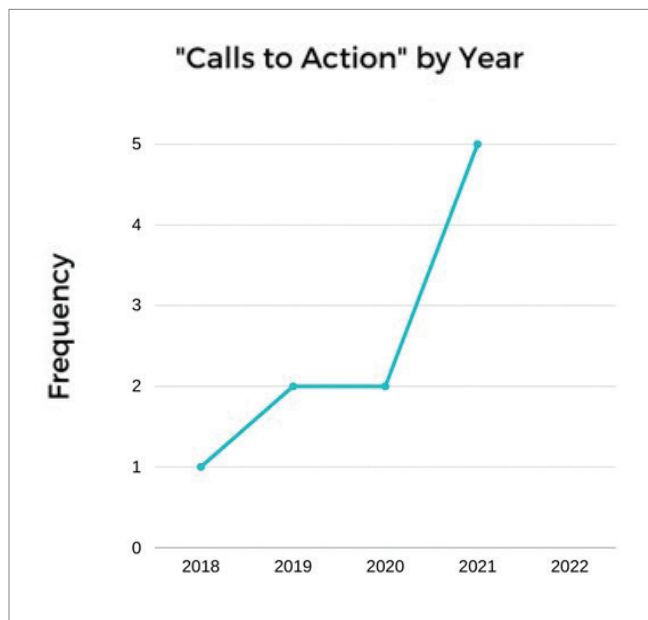


Figure 3. The number of “calls to action” with and without an accompanying implementation described in the article including “letter to the editor” publications.

have offered little in the way of an incorporation into the overall required curriculum. The implementation of curricular changes takes time, resources, and energy. This may be a major reason for the delay in health professional schools developing robust climate-sensitive protocols to match the quickly worsening climate condition. Nevertheless, as cited earlier in our paper, the health effects of worsening planetary health are daunting and as a result, we expected to see more substantive documentation of initiatives taking place.

For the limitations of this project, a major limitation we faced was the fact that institutions could be implementing proactive measures but have not published any literature describing such an implementation. For example, an institution could have a longstanding recycling program but make no mention of it in any sort of literature. A second limitation was that we decided to not conduct a gray literature search. We acknowledge that there may have been key omissions of useful initiatives in the implementation of climate-health in medical curricula. A proposed gray literature search through the websites of respective medical schools to find any potentially sustainability initiatives was proposed but ultimately scrapped. Due to time constraints, we had to make several decisions in an attempt to optimize our search. Searching gray literature would be a recommended step for further research. We chose just one database, PubMed, to search at this time rather than the several we would have liked to utilize. It may also be the case that some of the climate-related curricula being implemented by institutions are simply not published in papers, thereby preventing us from quantifying such actions. In the future, this research could be expanded upon in several ways. First, we covered a narrow range of literature pertaining to the U.S. and Western Europe. Any further research could encompass the rest of the world in addition to the locations we researched.

Second, we only used a single database to conduct our search. As we continue our research, we intend to search more extensive databases such as EMBASE, which may provide a more holistic search of the literature.

Conclusions

Our results indicated that curricular changes were the most frequent implementation that was noted in the literature. From our findings, this appears to be the most prevalent means of addressing the increasing issue of climate change in the medical community. Additionally, the number of articles seemed to sharply increase in the last three years. This would signify the increased awareness of climate-related health implications. Our project objective was to explore how health care professional schools are adapting to climate-change. From our analysis, we can conclude that health professional schools agree that they play a role in mitigating climate-related health impacts. While schools have been implementing some programs, such as elective courses, we hope to see more institutions creating courses that educate and train professionals to better address the overlap of health and environmental factors. Still, there have been numerous health-related organizations stating “call to action” plans which emphasize the urgency of handling climate change in the medical sphere. Our results show that the current state of health care is gradually moving toward better readiness for issues stemming from climate change. We hope our research emphasizes the importance of including climate in future discussions relating to health and medicine and provides an outline of what has been done so far at an organizational level.

Other notable implementations have been made by a proactive group of medical students. Hampshire et al. have made strides when it comes to quantifying the efforts of medical schools to be more environmentally cognizant. The group of medical students at the University of California, San Francisco (UCSF) has created a scorecard initiative to grade medical schools around North America and the British Isles on their environmental implementations. This initiative took place over the course of two years with surprising results. The pooled North American schools received an overall score of B-, with a C in the curriculum and an A- in the research categories (20). This shows that medical schools are aware of the environmental implications on human health but have yet to take those first steps to enact implementations that will lessen the impact of poor planetary health on community health. The results of our review support that conclusion. Very little literature was uncovered in the search. While it is exciting to be at the forefront of this relatively novel topic of research, we must reiterate the importance of acknowledging the impact of planetary health on human health.

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Disclosures

We have no financial conflicts of interest to disclose for this research.

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