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FROM THE EDITOR

Mitigating the Impact of Climate Change on Human Health: The Role of the Medical Community

International health leaders have identified climate change as the greatest global health threat of the twenty-first century [1, 2]. Anticipated increases in extreme weather events, rising temperatures, food insecurity, and the predicted spread of waterborne diseases, among other consequences, have the potential to displace communities and increase associated morbidity and mortality around the globe [3]. For decades, the anticipated consequences of climate change have affected the discussions and actions of environmental scientists, policymakers, and others. The medical profession has recently vocalized its stance supporting climate change mitigation and adaptation [4, 5]. With severe, mounting risks to the health of individuals and populations worldwide, the medical community faces a patient population increasingly affected by climate change.

Voices from health professions communities can help motivate social change. The health of our nation and the world make discussion of the health impacts of climate change imperative for health professionals. Given that addressing health and climate change involves considerations as far-reaching as the global economy, displacement of populations, and bitter political disagreements, ethical questions and implications for individuals and communities are manifold and complex. For example, which ethical values and concepts should guide international responses to health-related relocation demands of climate change? How should nations best raise and allocate funds to ameliorate the health consequences of climate change, and what should be the roles of health professions and professionals in setting priorities for responding to public health needs? If genes that directly influence our ability to thrive in a changing climate could be identified and edited, what should be the role of gene editing in enhancing humans' adaptability to these new conditions?

Importantly, a variety of potential roles for health care professionals in mitigating the health risks of climate change have been proposed. The American College of Physicians (ACP) suggests that physicians should support policies that could help mitigate the health consequences of climate change and advocate for environmentally sustainable practices to be implemented in health facilities [4]. Abelson et al. add that family physicians should act as local translators of climate science and educate medical students on climate change [6]. Cindy L. Parker further suggests that practitioners can conduct health interventions to encourage patients to live "greener" lifestyles [7]. Despite this small and growing body of literature on possible roles of clinicians in

responding to health effects of climate change, ethical analysis of how these proposed roles and frameworks should guide professions' and professionals' actions are needed.

This issue of the *AMA Journal of Ethics* addresses an array of fundamental ethical issues regarding the effect of climate change on human health and the roles of medical professionals, organizations, and governments in confronting these effects. In particular, this issue aims to encourage conversation among clinicians, educators, health care leaders, and students regarding the difficult questions health professions communities might face as climate change influences patients' health and well-being. It also discusses an array of ethical challenges—from those that could arise in clinical encounters and within individual patient-clinician relationships to those more broadly related to international policies and technological innovation—each of which merits careful deliberation by health professions organizations and professionals.

The nature and scope of clinicians' roles in educating patients about health effects of climate change—either in providing proactive counseling or addressing questions raised by patients—is ripe for exploration. Commenting on a case in which a physician makes a controversial decision to [counsel patients](#) on the health impacts of climate change, Diana Alame and Robert D. Truog discuss the risks and benefits of confronting health-related yet politicized topics in clinical encounters and some community-based settings. They argue that the benefits of communication outweigh the risks and that clarifying boundaries between physicians' roles as clinicians and citizens help to reduce those risks. Benjamin P. Brown and Julie Chor consider the case of a patient presenting to an obstetric clinic who questions having another child in light of the effects of overpopulation on climate change. They show how, historically, population growth of certain marginalized groups led to [coercive sterilization campaigns](#) and paternalistic contraceptive policies. They also argue that clinicians should not impose environmental protection values in discussions of reproductive life planning and suggest that these discussions be guided by a patient-centered ethical framework.

One potential emerging role through which medical professionals could improve population health is advocacy for climate change mitigation and adaptation. Cheryl C. Macpherson and Jonathan Hill discuss a case in which a physician considers the short- and long-term costs and benefits of [pitching a sustainability initiative](#) to her organization's senior leadership. They argue that physicians, as individuals and as a profession, have an obligation to patient health that includes the care not only of individuals but also of communities at risk of climate-related morbidity and mortality. They also discuss how these obligations can be fulfilled by reducing health care systems' climate change footprint through hospital sustainability initiatives. Macpherson and Matthew Wynia discuss whether and to what extent physicians have an obligation to [advocate for climate change mitigation](#) in the context of past physician advocacy movements as well as many medical educators' largely positive views of advocacy

training. They propose seven criteria that can help define when and how health professionals should engage in specific advocacy efforts, including climate change and health.

Advocacy can take many forms, ranging from public or political efforts to one-on-one efforts to change the life of a patient, and clinicians are well positioned to engage in these efforts. Through his research and photography, Jordan Emont has brought to life the stories of immigrants forced to leave their home island of Tuvalu due to the damage that climate change has already wrought. He and Gowri Anandarajah explore concepts of justice and physician advocacy in the context of [displacement and immigration](#) related to climate change. In the podcast, three interviewees discuss their perspectives on [climate-related advocacy](#). Emont shares stories of communities facing displacement due to climate change and the challenges of communicating its global impact to the medical profession. Kate Weinberger shares her recent research on projected mortality from rising temperatures and the role of physicians in responding to data pertaining to climate and health. Finally, Louise Hobden discusses her experience living with chronic obstructive pulmonary disease (COPD), hot weather exacerbations, and the impact of climate change on persons living with COPD.

Based on an extensive review of the scientific literature, the Intergovernmental Panel on Climate Change asserts that climate change is occurring and poses grave risks to human health and that human activity is contributing to the process [3]. However, many people deny the existence of climate change or its human contributions. Physicians are often trusted in communities to be translators of scientific information to patient populations. Andrew Jameton confronts the topic of [climate change denial](#), arguing that denial of climate change science undermines physician advocacy efforts, which need to be extended and scaled.

The anticipated impact of climate change on human health raises challenges and possibilities in fields such as health policy, energy finance, and medical technology, along with related ethical questions. Ali A. Zaidi challenges the idea that public health and climate stabilization compete for [public spending](#), arguing that under three ethical frameworks spending on both public health and climate stabilization is justified. Focusing on technology, Lisa Soleymani Lehmann discusses the potential role of [gene editing](#) to enhance humans' adaptability to a changing climate. To analyze whether it would be ethical to proceed with gene editing for this purpose if environmental and public health measures prove inadequate, she introduces a "4-S framework" defined by considerations of safety, significance of harm to be averted, succeeding generations, and social consequences.

This issue of the *AMA Journal of Ethics* aims to stimulate discussion of climate change and health within health professions communities. The medical profession, in particular, has

the opportunity to define its role in the amelioration of climate-related suffering through everything from patient interactions to broader efforts such as advocating for health policies and technological advances. Through robust discussion, ethical analysis, and effective action, clinicians can help improve the lives of people around the globe in the face of climate change.

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ETHICS CASE

What Are Risks and Benefits of Not Incorporating Information about Population Growth and Its Impact on Climate Change into Reproductive Care?

Commentary by Benjamin P. Brown, MD, and Julie Chor, MD, MPH

Abstract

Fears about the impact of family planning decisions on the environment are not new. Concerns about population growth have often been conflated with concerns about the increasing demographic influence of specific feared or marginalized groups, leading to subsequent unjust treatment of those targeted populations. In clinical encounters such as this case, in which the patient expresses concerns about having another child in light of the effect of population growth on climate change, it is not appropriate for the clinician to impose environmental protection values on a patient's reproductive decision making, as this risks undermining her autonomy as well as perpetuating injustice. When a patient raises such worries, however, the physician's responsibility is to elicit and try to understand the patient's preferences and then to offer treatment choices that align with those values.

Case

Dr. Stuart is an obstetrician-gynecologist who has gained a positive reputation among her patients for providing nonjudgmental care. She provides obstetric and gynecologic care to a population that is particularly diverse in terms of religious beliefs and cultural norms. Today, her first appointment is with Emily, a healthy, young married woman with two children. For Emily, raising children is an extremely important part of life, and before entering the room, Dr. Stuart reads Emily's appointment was scheduled to discuss a third pregnancy.

Dr. Stuart enters and begins talking with Emily, who states, "I'm having second thoughts about getting pregnant again." "Why is that?" Dr. Stuart asks. Emily responds, "I've been doing a lot of reading recently about the impact of population growth on climate change. I'm concerned about contributing to overpopulation and the risk it poses to my and others' children. I know one baby doesn't make a big difference in the world population," Emily says, "but if everyone has three kids, we'd be in big trouble. We are already. I don't want to add to the problem."

Commentary

Concerns such as Emily's—about the relationship between family planning decisions, climate change, and the well-being of her family and the greater society—are not new. In the past, such concerns have led both researchers and clinicians to advocate for population control [1, 2]. In this paper, we will review some of the history of coercive family planning programs and of movements that have linked environmental and contraceptive concerns. We will then explore the ethical tensions between environmental policy and bedside contraceptive decision making. Finally, we will conclude with some examples of how a clinician can work to clarify patient needs and values in order to ensure ethical contraception counseling.

Historical Overview of Population Control Programs

Concerns about population growth have often been conflated with concerns about the increasing demographic influence of specific feared or marginalized groups, leading to subsequent unjust treatment of those targeted populations [1, 2]. Unfortunately, physicians, acting in accordance with government policies or independently, have been active participants in these harmful programs. One of the most striking domestic examples of this trend is the chilling history of [coercive sterilization](#) of women of color and people with mental illness in the United States. By the mid-1970s, it was estimated that physicians working for the federal government forcibly or surreptitiously sterilized between 100,000 and 150,000 persons annually [3]. Sadly, these unjust practices are not limited to the past. Between 2005 and 2013, 144 female inmates in California prisons were sterilized. Twenty-seven percent of these cases lacked adequate informed consent [4]. Such unethical programs have harmed patients directly and continue to engender distrust of the medical system in some communities [5].

Fears about the detrimental environmental impact of rampant population growth can be traced back to the 1960s and 1970s. Stanford professor Paul R. Ehrlich's well-known book, *The Population Bomb*, published in 1968, extrapolated from high population growth rates to argue that within the coming decades, the world's demand for food would outstrip supply and mass starvation would take hold across the globe [6]. One potential intervention he offered would be a combination of voluntary and heavy-handed means to tamp down fertility. Ehrlich himself went so far as to say in a 2015 interview that "Allowing women to have as many babies as they [want] ... is akin to letting everyone 'throw as much of their garbage into their neighbor's backyard as they want'" [7, 8]. Such attitudes had dangerous implications, especially for the developing world, whose high birth rates raised concerns in the US about national security and access to natural resources, leading policymakers to encourage sterilization and contraceptive use [9]. Perhaps the most infamous example of this trend, China's one-child policy, though no longer in effect, evolved in response to Communist Party leaders' fears about overpopulation and its effect on living standards and the economy [10].

In the ensuing years, however, the population bomb has not proven to be the disaster Ehrlich once feared, thanks to subsequent demographic shifts in the developing world. Indeed, the world population growth rate has decreased steadily since the 1980s [11]. The United Nations and the academic community more broadly now project that population growth will continue to slow over the coming decades [11].

As the case in question here suggests, however, contemporary environmental concerns have now come to overshadow concerns about sheer population size. The more pressing question today is how family size—and the added consumption that a large family implies—might impact global warming. Fertility control is seen by groups such as Population Action International as one aspect of a holistic approach to mitigating the effects of climate change in the short term and slowing the rate of global warming in the long term [12]. Individual patients (such as Emily) might also feel varying levels of personal responsibility for the impact of their families on a changing planet or fear the way global warming might affect the health of their children [13, 14].

Using Ethical Principles to Resolve Tensions between Policy and the Bedside

Although concerns about global trends might inform public policy, at the bedside, we are acting not as administrators of policy but as professionals caring for the patient in front of us. In doing so, our clinical decisions and actions are guided by the four key principles of respect for autonomy, beneficence, nonmaleficence, and justice [13]. While no framework can capture every nuance of a clinical scenario, this four-principle approach proves helpful to tease out the competing interests at play in this case.

Respect for patient autonomy is often upheld as the most important precept [15, 16]—if there is uncertainty about whether a course of action is ethical after balancing the four principles, we frequently defer to the patient’s decision or to that of her surrogate. With regard to Dr. Stuart’s response to Emily’s concerns, respect for her autonomy requires that Dr. Stuart elicit Emily’s values about having another pregnancy, including her thoughts about population growth and her responsibility to minimize her family’s ecological footprint. While no physician can be an expert on all factors that could affect a patient’s decision, physicians should be able to elicit such concerns and seek out additional information or expertise to best support a patient’s decision. In this scenario, if Emily needs more information about contraception and the environment to make a choice, Dr. Stuart should be willing to facilitate this research process. If Emily feels strongly that she cannot, in good conscience, have another child at this time because of that person’s impact on the environment, that might be reason enough for her to defer childbearing.

With regard to beneficence, Emily herself will not suffer obviously different effects from climate change based on whether she does or does not have another child at this moment, nor will having one additional person in the world appreciably shift the course

of global warming. However, helping Emily explore and resolve the emotional distress that she is experiencing as she considers the potential environmental impact of a subsequent pregnancy and whether it is acceptable to bring a new child into the world at this time is in accordance with the principle of beneficence. Conversely, not acknowledging and addressing Emily's deeply held concern would go against the principle of nonmaleficence.

The principle of justice also bears on this case. Upholding justice means treating patients fairly in spite of differences such as race, religion, sexual orientation, country of origin, or gender. As described above, people of color, the poor, and residents of the developing world historically have suffered most from population control programs mandating sterilization and contraception under the auspices of addressing environmental, social, and economic fears. Especially when such nonbiological concerns bear on a doctor-patient discussion, as they do in any case of contraception counseling, it is important for the physician to be self-reflective. Although Dr. Stuart happily has a reputation as a nonjudgmental clinician, she must still work to ensure that she is treating Emily in a similar fashion to her other patients. Dr. Stuart must be sure not to single out any patient for differential treatment because of race, age, or other demographic factors, given the fraught history of coercive sterilization of women of color and [women with disabilities](#) under the pretense of social or environmental concerns.

Strategies for Responding to Patient Values

To summarize the above analysis, Dr. Stuart should not preemptively impose her personal beliefs on Emily about the impact of population growth on climate change. If Emily raises such concerns, however, Dr. Stuart should strive to address them in a patient-centered manner. This case, therefore, underscores an important aspect of patient counseling: clinicians must be ready to receive and address difficult questions and to respond to patients' values. When patients raise challenging questions or potentially controversial topics, clinicians can benefit from having some approaches they can fall back on. Shared decision making (SDM) and [motivational interviewing](#) (MI) are two such approaches. Both of these counseling methods rely on a balance between providing concrete factual information and eliciting patient preferences to reach a patient-centered conclusion, although in a case such as Emily's, SDM is likely most appropriate [17].

SDM is ideal for helping patients choose between two or more medically appropriate options. In such situations (choosing a contraceptive method, for example), SDM techniques focus on eliciting patient preferences, providing relevant medical information, and facilitating access to the patient's preferred option [17]. In such encounters, the patient might note values that are firmly biomedical (e.g., efficacy of the method) and others that are more social (e.g., impact of family planning decisions on the environment). The clinician's job is to reflect these values back to the patient, help her to

prioritize them, and assist her in choosing a treatment course that meets her top priorities as best as possible. Physicians should recognize, however, that there are times when patient ambivalence makes it impossible to select a single option that aligns perfectly with all of the patient's values.

MI comes originally from the substance abuse literature and is intended for use when there is a clear treatment choice that maximizes health but to which the patient is not currently adherent (e.g., abstaining from cocaine) [17]. It is still a patient-centered approach inasmuch as MI involves eliciting patient preferences and values concerning the decisions in question. Instead of becoming confrontational when the patient resists recommended behavior changes, the clinician taking an MI approach works with the patient to help uncover discrepancies between the patient's values and behavior as a path toward adoption of healthier practices. For example, in working with the cocaine user, a motivational interviewer might uncover the fact that the patient wishes to be present for his daughter's graduation and might encourage the patient to think about how ongoing cocaine use raises the risk that he will not be able to attend that event due to illness or death.

Ultimately, either of these approaches involves eliciting the patient's preferences, which, in Emily's case, might include not only the efficacy and side effects of contraception but also noncontraceptive benefits such as the social value of contraception and, potentially, the environmental impact of a large family. In a case such as Emily's, the physician's responsibility is to elicit and try to understand the patient's preferences and then to offer treatment choices that align with those values. Dr. Stuart should counsel Emily with a shared decision-making approach. It is not appropriate for Dr. Stuart to impose environmental protection values on Emily's reproductive decision making, as this risks undermining her autonomy as well as perpetuating injustice.

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The people and events in this case are fictional. Resemblance to real events or to names of people, living or dead, is entirely coincidental.

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ETHICS CASE

Are Physicians Obligated to Lead Environmental Sustainability Efforts in Health Care Organizations?

Commentary by Cheryl C. Macpherson, PhD, and Jonathan Hill

Abstract

Climate change threatens health, health care, and the industries and resources upon which these depend. The growing prevalence and severity of its health consequences and economic costs are alarming health professionals and organizations as their professional obligations, grounded in the core value of health, include protecting against these harms. One means of fulfilling these obligations is to lead or support sustainability initiatives that are built upon current, reliable, accurate, and unbiased evidence and collaboratively tailored to meet specific needs and respond to specific contexts. We consider why and how health professionals and organizations should lead or support such initiatives.

Case

At an international conference on the impact of climate change on human health, Dr. Patel attends lectures given by physicians in a variety of specialties and by global public health experts. Over the course of the conference, Dr. Patel learns that the devastating effects of climate change on human health include infectious disease, flooding, drought, food insecurity, and extreme heat. One thing Dr. Patel hears over and over at the conference is the importance of physician leadership in responding to climate change. In particular, she learns that physicians can make a positive impact by leading sustainability initiatives at their organizations, especially hospitals, which are major commercial consumers of energy in the United States. In 2003, large hospitals (i.e., more than 200,000 square feet) made up less than 1 percent of all commercial buildings but used up 4.3 percent of all commercial energy consumed in the US [1]. In 2007, US hospitals produced the equivalent, in terms of global warming potential, of about 215 million metric tons of carbon dioxide [2].

One conference speaker, who works at a large health care network, explains that recently she's been spearheading a sustainability initiative. "We've made a lot of changes," she continues, "including some updates to our infrastructure and equipment. Our energy expenditure and waste have already decreased significantly. Plus, the communities where we have hospitals and offices have really rallied around these efforts, with many of those communities' members expressing appreciation for our

efforts to protect their future health and the health of people around the world.” Other speakers at the conference emphasized the importance of physician leadership as necessary for modeling to students and younger clinicians not only how to respond to the health hazards of climate change and reduce the carbon footprint of the health care sector, but also how to draw upon the social and cultural authority of medicine to prompt health care organizations and other industries to take action.

After the conference, Dr. Patel prepares to pitch a sustainability initiative to her organization’s senior leadership. Her main worry is that upfront financial costs of such an initiative could stifle support for it. Although there is limited data available on upfront cost and return on investment for such initiatives, Dr. Patel knows that some studies have found that capital cost premiums on LEED-certified hospital renovations total up to 5 percent but that well-planned initiatives can have a positive return on investment [3, 4]. Even with support from the organization’s senior leadership, upfront costs could be passed along to patients, some of whom already struggle to pay their health care bills. While Dr. Patel seeks to draw upon her status as a physician to advocate for patients’ and others’ health now and in the future, she worries about doing so at the expense of current patients and wonders how short- and long-term health costs and benefits should be considered from ethical, clinical, social, and fiscal points of view.

Commentary

Health professionals are troubled by the increasingly visible and harmful health consequences of climate change [5-7]. The growing prevalence and severity of these consequences over the past decade often involve extreme weather, challenging those positioned to care for the consequent injuries and infectious, respiratory, gastrointestinal, mental, vector-borne, and waterborne illnesses [8-10]. These health consequences are documented in many fields and highlighted on the websites of prominent health organizations [11-14], including the Centers for Disease Control and Prevention, whose website outlines its commitment to energy efficiency and informing health professionals of climate effects on health [11]. Dr. Patel’s sustainability pitch to her organization is one means of fulfilling her obligation to protect health. This commentary elucidates obligations of physicians and health organizations to protect health and examines proposals for sustainable business models, which suggest that organizations, rather than patients, should bear the associated costs. It also discusses different types of sustainability initiatives and strategies that Dr. Patel, and others like her, might use to successfully promote sustainability.

Professional Obligations

Protecting health is a professional obligation of physicians and health organizations. The strategies they adopt in doing so will vary with the nature of the health problem and the social and environmental contexts in which it emerges, increases, persists, decreases, or disappears over time. The health consequences of climate change are visible, often

measurable, pose serious threats everywhere, and offer opportunities to significantly improve health everywhere [8]. Embracing sustainability—at the individual or organizational level—thus helps to fulfill the professional obligation to protect health.

Physicians. Physicians accept an obligation to fulfill the goals of medicine when they join the profession. While these goals and approaches to meeting them vary with time and place, they broadly involve protecting health, alleviating suffering, improving knowledge and management of disease, educating new physicians, and upholding [public trust](#) [15]. Individually or collectively, physicians fulfill these goals by applying their knowledge and expertise to patient care, public health, research or scholarly work, education, public and policy dialogue, and so on. Individual and collective choices about which areas and actions to pursue, and when and how to become involved, vary with physician expertise and circumstances. Some choose to apply their professional influence to improve social or environmental conditions that affect health, such as climate change.

Physicians' socially and culturally privileged and influential position deepens their obligation to combat prevalent, severe, and preventable health threats, including climate change. Having attended the conference on climate and health, Dr. Patel's knowledge about the value and means of championing sustainability in health care make her more qualified than many physicians to pursue her plan and more aware of these obligations and opportunities. Recognizing that the scope of these obligations vary with temporal, social, and physical contexts, we apply seven criteria featured elsewhere in this issue [16] to illustrate the strength of Dr. Patel's obligation to pursue her plan: she has *expertise* in treating injuries, infections, and diseases caused or worsened by climate change; *proximity* to organizational leaders and those needing care; knowledge that makes her more *effective* than others; the ability to act without unreasonable *cost or risk* to herself; *unique* influence on health care; insight into the *severity* of the health consequences of doing nothing; and a duty to uphold *public trust*. These criteria are perhaps equally applicable to health organizations given their obligation to protect health.

Organizations. Health organizations are employers and consumers of large volumes of goods, services, and space, with considerable social and economic influence. Their missions and strategic plans typically center on patient health and sometimes broader goals like community service, public health, patient education, or environmental health. Mount Sinai Hospital in New York City, for example, recognizes the influences of its research, education, and patient care "on the environment, and the health and safety of patients, employees, students and the public. Mount Sinai values the people, land and natural resources that are part of the institution and the surrounding community" [17]; and it integrates sustainability into its housekeeping, transportation, and other services [18]. Such a [commitment to sustainability](#) stems from an organization's obligation to protect patient, staff, and community health; their socioeconomic influence and health-

oriented missions; and the community and environmental contexts in which they are embedded [19, 20]. Organizations can fulfill the commitment to protect health through energy-efficient operations, facilitating healthy choices in nutrition (e.g., increasing access to fresh locally produced food), exercise (e.g., establishing walking paths to and around their facilities), and other means.

An organization's commitment to embracing sustainability may increase proportionally to the probable health improvements of doing so, the decline in suffering of those affected, and the economic costs of failing to do so. Sustainability benefits organizations by reducing expenditures through [energy efficiency](#), generating publicity and marketing opportunities, and protecting against environmental disruptions that limit access to operational resources, increase costs, and reduce profits [18, 21]. England's National Health Service (NHS), for example, employs over 1.3 million people, is a major economic driver and consumer, emits 21 million tons of greenhouse gases annually, and is Europe's largest public sector contributor to climate change [21]. The NHS fulfills its obligation to protect health through its Sustainable Development Unit (SDU), which reduces emissions, saves money, and improves health through initiatives involving energy, travel, waste, procurement, water, infrastructure, and more [21]. Smaller British organizations, networks, and medical specialties also embrace sustainability [22, 23].

Unlike in the United Kingdom, health organizations in the US are either nonprofit or for-profit. Nonprofits tend to be privately and charitably funded, whereas for-profits are funded through fee-for-service and aim to provide patient care while earning commercial profit. Both nonprofit and for-profit organizations are obligated to manage resources in ways that fulfill their missions. Nonprofits have altruistic missions focused on providing patient and community care; they typically minimize costs—to patients and, to make resources go further, to themselves. The missions of for-profits focus on providing health care and generating profit. This dual goal poses conflicts of interest for organizational leaders who must weigh short- and long-term economic goals and outcomes against patient, staff, and community health initiatives requiring upfront expenditures.

Sustainable Business Models

Concerned that costs may be passed on to patients who cannot afford them, Dr. Patel wonders "how short- and long-term health costs and benefits should be considered from ethical, clinical, social, and fiscal points of view." In the absence of standards for determining what time frames to consider (e.g., weekly, quarterly, annually, or longer intervals), what costs (e.g., damaged or depleted natural resources) and benefits (e.g., health, well-being, averted suffering, morbidity, or mortality) to quantify and how to do so, and who to hold accountable for what, scholarly and policy deliberations provide no straightforward answers to Dr. Patel's questions.

In support of sustainability, the economist Juliet Schor documents and quantifies damages of economic growth to natural environments (e.g., through manufacturing, transportation, energy), proposing that prioritizing social and ecological well-being over economic growth will make individuals and populations “rich in the things that matter to us most, and the wealth that is available in our relations with one another” [24]. Similarly, the ethicist Dale Jamieson [25] asserts that instead of economic growth, organizations and governments should prioritize goals that integrate sustainability into international development; protect terrestrial carbon sinks; calculate costs by taking “into account the entire life cycle of producing and consuming a unit of energy” [26]; and design “new forms of decision-making, institutionalized in different ways, that will give us the flexibility to deal with change while enhancing our ability to commit to projects that extend far into the future” [27].

These proposals for sustainable business models and lifestyles also support the view that health organizations, given their resources and capacity, should absorb at least some upfront costs of sustainability and avoid transferring these costs to patients. Physicians and organizations should explore different types of sustainability initiatives and undertake only those most likely to succeed within their social and environmental contexts [20].

Types of Sustainability Initiatives

Before designing an initiative, Dr. Patel (and others like her) should anticipate likely costs to the organization, the types and durations of benefits to all stakeholders, and the probability of the organization adopting it. This type of planning would require her to examine architectural design or behavioral approaches used elsewhere or described in peer-reviewed journals and to consult relevant scientific and technical experts such as veterinarians, engineers, educators, and others [28, 29].

Design changes. Using architectural design to increase proximity of patients and staff to green spaces can accelerate recovery; reduce pain, aggression, mental fatigue, staff burnout, and health care costs; and increase cognitive function [30-33]. Other sustainability initiatives safely and effectively reduce large amounts of energy and landfill waste by modifying procedures for hospital-based cannulation and intravenous antibiotic preparation [31] and for disposal of unused pharmaceuticals [32] and medical devices, which, when replaced with reprocessed devices, saved over 24 million pounds of waste and \$1 billion over 20 years at 1,700 health care facilities nationwide [34]. Energy efficiencies saved one health system \$47 million over five years, and requisition of energy-efficient computers saved another health system \$4 million annually [35]. Still other initiatives facilitate [recycling](#) [36] or procuring environmentally friendly housekeeping supplies [18]. Sustainability initiatives in hospitals are fiscally sound, support their missions, create healthier environments, lower operational costs, and can

maximize benefits “by combining multiple projects and taking advantage of the wide range of sustainability opportunities” [37].

Behavior changes. Initiatives involving education or behavior changes may require little upfront expenditure. Given their social and cultural authority, physicians are visible and influential role models for patients, students, colleagues, and the public. They can, at no cost, highlight the value of embracing sustainability. One approach is to motivate patients with cardiovascular disease risk factors to reduce dietary consumption of red and processed meats, thereby reducing both their risk and agriculturally generated greenhouse gases [38]. Other educational and behavioral approaches have been used in medical practice, education, research, policy, and public health [29, 39-45].

Which Type of Initiative Should Dr. Patel Pursue?

The success of any sustainability initiative depends on its grounding in accurate and objective evidence and models and its contextual relevance to the organization implementing it. Dr. Patel and other physicians have the capacity to access evidence about health consequences of climate change, assess their magnitude and severity, and highlight the value of sustainability to the organizations and local communities they serve. They are positioned to obtain expert opinions across disciplines, serve as consultants themselves, and, at the very least, reduce their own carbon footprint and encourage their organizations and colleagues to do the same. Dr. Patel has commendably gone further by planning an initiative and pitch.

She also should have consulted with colleagues, community members, and organizational administrators about how best to proceed and, in partnership with them, explored initiatives and publications like the Green Guide for Health Care™. This guide describes how sustainable hospital design, construction, and operations improve profits, health, and patient satisfaction while helping attract and retain staff and reducing climate change impacts [46]. Collective efforts are needed to obtain a breadth of information and perspectives and to develop an approach appropriate to an organization’s mission and context. A team might decide to target its medical boards, associations, or specialties instead of, or in addition to, its organization.

Dr. Patel should identify and focus her team on an initiative that is feasible and compatible with her organization’s mission, anticipating organizational objections. Objections might be overcome by highlighting her partners’ and others’ support for the initiative; its advantages in terms of probable financial gain and growth in patient satisfaction, staff productivity, and organizational publicity; and its health benefits to staff, patients, and local and global communities. Highlighting examples of other organizations’ sustainability initiatives might help win the organization’s support and willingness to absorb at least some upfront costs and would maximize chances of success.

Suggestions for Physicians

Physicians and health organizations have obligations to use their influence, expertise, and resources to protect health, which include promoting sustainability. Successful sustainability initiatives are designed in consultation and partnership with a range of stakeholders, grounded in accurate information, aligned with an organization's mission, and responsive to organizational, community, and environmental needs and contexts. Physicians and organizations can promote sustainability by organizing multidisciplinary teams charged with:

- Obtaining information about successful initiatives in contexts similar to their own;
- Consulting their communities about needs and priorities;
- Designing initiatives that address community needs, include mechanisms for auditing and reporting climate change-related health consequences and outcomes, and align with the organization's mission;
- Anticipating costs, benefits, and probable objections; and
- Developing arguments with which to counter objections.

By catalyzing dialogue about sustainability within organizations and communities and among health professionals, physicians can further fulfill their obligation to protect health.

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ETHICS CASE

How Should Clinicians Weigh the Benefits and Harms of Discussing Politicized Topics that Influence Their Individual Patients' Health?

Commentary by Diana Alame, MD, MBE, and Robert D. Truog, MD

Abstract

Health implications of politically charged phenomena are particularly difficult for physicians to discuss with their patients and communities. Addressing climate change and its associated health effects involves trade-offs between health and economic prosperity, necessitating that physicians weigh the potential benefits and risks of discussing climate change health effects. We argue that the potential benefits of physician communication and advocacy ultimately outweigh the potential risks. Therefore, physicians should be supported in their efforts to educate their patients and communities about climate change health effects. Furthermore, democratic deliberation could prove helpful in addressing disagreements among physicians within a practice about such politicized health topics.

Case

Dr. Schwartz is one of four family medicine physicians at a rural, private group practice. He has been part of the practice for more than three decades and has developed strong relationships with many local families. One of his major areas of interest is preventative medicine, and he is viewed as a local expert. He has been instrumental in many community health initiatives, including the creation of smoking cessation and weight loss programs for patients in his practice.

One of Dr. Schwartz's biggest concerns in his community is a large coal-burning power plant located about a mile outside of the town center. Generally, other community members don't seem to mind the power plant, and many are grateful for the employment it brings to their remote region. However, Dr. Schwartz has recently been concerned by rising rates of respiratory illnesses, such as asthma, among his patients. He is aware that living in a zip code containing a fossil fuel-fired power plant is associated with higher rates of respiratory disease including asthma, chronic obstructive pulmonary disease, and acute respiratory infection [1]. Moreover, he knows that coal-fired power plants are the largest source of toxic substances in the air in the United States and that exposure to pollutants from power plants is associated with asthma, low infant birth weight, and premature mortality in adults [2]. Dr. Schwartz is worried about

how his town's power plant is contributing to his patients' poor health as well as the plant's contribution to climate change, which harms human health worldwide.

In the past, Dr. Schwartz has avoided educating patients on the detrimental health effects of the power plant, because he knows that many local families rely on its employment. However, the incidence of respiratory disease among his adult and pediatric patients has reached a level at which he feels he must speak up. He hopes that, by raising awareness, he might influence community members to advocate for pollution-reducing measures at the power plant, such as the installation of additional filters that reduce toxins released into the air by burning coal. The filters could reduce pollution-related illness in the short term and might even benefit his patients' health in the long term by reducing the plant's impact on climate change.

During the clinic's monthly business meeting, in which all physicians gather to discuss best practices and the clinic's finances, Dr. Schwartz announces that respiratory illnesses have risen enough among his adult and pediatric patients that he intends to start briefly counseling them on the potential impact of the power plant on their health, both directly through local pollution and indirectly through the plant's contribution to climate change.

His announcement receives mixed responses from the other physicians, including some nods of approval and scattered grumbling. Dr. Rizzo, in particular, appears opposed. "I'm not comfortable with that," she replies. "These topics are too political in our community. There's risk for us if we're perceived as fighting the coal plant, particularly if our patients who work there lose their jobs."

"I understand your hesitation," Dr. Schwartz replies, "but our patients' health is at risk. I feel that, as physicians, we have an obligation to educate our patients on serious dangers to their health, particularly when patients could reduce or avoid risk by pressing that plant to change how it generates power in this community. Patients here are in a position to advocate for changes that can benefit them now and in the future, and we should help them do that."

Dr. Rizzo sighs. "We also have obligations to provide a nonjudgmental setting in which patients trust that we are giving them unbiased advice. I could maybe get on board with advising patients about pollution from the power plant, but talking about its impact on climate change and health is going too far. If you bring such a politicized topic into the conversation with a patient, particularly when its impact on that particular patient's health is uncertain, you overstep your role as a physician."

There is murmuring around the table as the physicians continue to discuss the issues.

Commentary

Physicians are experienced in discussing sensitive issues with their patients. However, some topics are particularly difficult to discuss when they are politically charged or involve broad matters outside the scope of an individual physician's area of expertise. In the case presented here, a group of physicians comes together to decide how best to approach the influence of climate change on human health. The physicians are aware of the health risks of working and living near the local coal-burning power plant but are also sensitive to the larger economic and political forces at play. In the US, opinions about the scientific consensus regarding climate change and whether to legislate a solution fall along a marked partisan divide [3, 4], potentially posing difficulty for physicians attempting to provide patient education and community advocacy.

The case presented here illustrates how the tension between health and economic prosperity, in addition to the partisan divide, necessitates that physicians weigh the potential benefits and risks of discussing the health effects of climate change with their patients and communities. In this article, we will examine these potential benefits and risks, arguing that despite the politicized nature of climate change and the trade-offs in addressing it, the potential benefits of discussion outweigh potential risks. Physicians should thus work to educate their patients and advocate for ways to mitigate the effects of climate change on health and be supported in such efforts by their colleagues and professional societies. In situations in which disagreements arise within a practice regarding how to approach the health effects of climate change, democratic deliberation could prove helpful and will be briefly described.

Risks and Benefits of Discussing the Health Risks of Climate Change

Because addressing climate change involves a substantial trade-off between health and economic prosperity, discussing the topic creates an ethical dilemma for physicians. On the one hand, physicians such as Dr. Schwartz feel compelled to speak out about the [adverse health effects of climate change](#). Indeed, one of the most compelling drivers in physician advocacy is the duty to promote public health and safety [5]. Physicians witness the downstream effects of social and environmental factors on the health of their patients and, by extension, should seek to mitigate those upstream determinants for the benefit of the broader population. On the other hand, some might feel, as expressed by Dr. Rizzo, a deep sense of unease at being perceived as biased, politically motivated, or judgmental—and hence as overstepping their role as physicians—if they speak out. Negative impressions of this nature could be detrimental to the therapeutic relationship between the physician and patient or to the community's view of the trustworthiness and objectivity of the physician-advocate.

In contrast to this worry, however, are the benefits of discussing the health risks of the coal plant in this case and of climate change generally. These benefits include fostering

transparency and patient education, which serve to promote knowledge and empowerment; upholding the physician's broader role in both prevention and treatment; and, in some cases, enhancing a sense of social responsibility and motivating [advocacy for population health](#). Discussions between patients and physicians of politicized topics such as climate change thus can serve to strengthen the therapeutic relationship and inform the public debate about these critically important issues.

Nevertheless, the nature of acceptable advocacy is limited by the roles that individuals play within society. When acting in the role of a health care professional, physicians must limit their advocacy to matters clearly related to promoting the health and well-being of their patients and communities. In certain circumstances it might be possible for physicians to step outside of their role as health care professionals and engage in advocacy as a private citizen—a role that would not fall under the constraints of acting as a member of the medical profession. Clear boundaries between these two forms of advocacy would help to diminish potential risks identified by Dr. Rizzo.

The Role of the Physician-Advocate

One of Dr. Rizzo's chief concerns is whether physicians would be overstepping their role should they begin counseling patients and informing the community about the health effects of climate change. While in some ways the topic of climate change health effects is distinct, it nonetheless shares certain qualities with other public health and safety concerns, such as vaccine hesitancy or firearm safety, for which political viewpoints sometimes overtake health concerns. In these contentious and politicized public health areas, physicians must contend not only with whether but also how to communicate and advocate. Especially in politically volatile arenas, how should physicians delimit their role as patient and public health advocates?

Dr. Rizzo, presumably, is not questioning the appropriateness of physician advocacy in general, nor has she taken issue with other community health initiatives conducted by Dr. Schwartz. Rather, she appears to be concerned about the highly [political nature of climate change](#) and physicians' subsequent political entanglement in the course of their clinical work, which she sees as a threat to maintaining the trust of community members who rightly expect medical professionals to be objective and politically neutral. One scholar, Thomas Huddle, is sympathetic to this view [6], stating that "traditional norms of scholarship: accuracy, objectivity, and truth" are "often, if not always, incompatible" with political advocacy [7], which encompasses "advocacy on behalf of societal goals, even those goals as unexceptionable as the betterment of human health" [8]. Furthermore, he insists that "the medical profession has no special authority or insight into ... how far societal resources should support communal health rather than other priorities" [9].

Nevertheless, insofar as physicians are in fact experts on matters of health, Mark Earnest and colleagues [10] argue that physicians are “uniquely positioned” and “understand the medical aspects of issues better than any sector of society” [11]. They define physician advocacy as “action by a physician to promote those social, economic, educational, and political changes that ameliorate the suffering and threats to human health and well-being that he or she identifies through his or her professional work and expertise” [11]. This definition of advocacy recognizes that while the scope of acceptable actions to be taken by physicians might be broad, the focus is necessarily limited to those topics relevant to health and well-being and that are within the realm of the given physician-advocate’s area of expertise.

On such matters pertaining to health, therefore, physicians should be supported by their colleagues and professional societies in their efforts to inform their patients and communities about the health effects of even politicized phenomena such as climate change. As advocates, physicians can strive to shed light on the health effects of climate change while acknowledging that greenhouse gas-emitting activities involve a [trade-off between values](#)—economic prosperity versus health—that are to be ultimately weighed collectively by society as a whole. We agree with Huddle that physicians’ health expertise does not necessarily “privilege their assessment of those [health care] needs in relation to other societal needs” [12]. Yet it is well within the duties of the medical profession to ensure their knowledge enters the public domain where weighing of values can properly take place and the debate can be better informed.

Of course, physicians, like other citizens, have a right to be civically engaged within their communities and to hold political views. Notwithstanding, they have a professional obligation to give unbiased medical advice that is both in the best interest of their patients and based on sound evidence. Therefore, it is important to be clear when a physician is acting as an expert on health matters or as a citizen on general civic matters. This distinction earns and protects the trust given to physicians by society and reduces the threat of personal bias that undermines neutrality and objectivity.

Dr. Schwartz demonstrates medical expertise about respiratory disorders and specifically limits his professional expression of concern to such health impacts of climate change, whether his concerns regarding climate change as a private citizen might be broader. Therefore, Dr. Schwartz, in this case, models the appropriate scope of physician advocacy.

Benefits of Physician Advocacy

Physician values such as trustworthiness, integrity, honesty, and transparency, while intrinsically valuable, also serve to reduce unnecessary paternalism and promote patient knowledge and self-advocacy. Dr. Schwartz and his colleagues hesitated in the past to discuss the health effects of the coal-burning power plant for fear of influencing the

politics and economy of the community, especially because the power plant is a major employer. However, physicians are unable to predict what decisions patients and communities will make based on such information. It is safe to assume that everyone wants clean air and water and good health, although no assumptions can be made regarding people's awareness of health issues related to pollution and climate change. Ultimately, avoidance of important topics does not serve patients or the community. Withholding health information for nonhealth reasons disempowers patients and hampers them from making their own value choices. Even if well intentioned, physicians should not decide what trade-offs are acceptable to patients and the community when health and economics conflict. Howard Koh gives compelling reasons why physician communication about the health effects of climate change is vital to both individuals and communities [13]. Such communication can help communities develop adaptation and preparedness strategies to reduce vulnerabilities in the presence of climate change, lead to [mitigation strategies](#) to reduce greenhouse gas emissions and other pollutants, help educate those with cardiopulmonary disease to look for indicators of poor air quality and environmental triggers, and identify those vulnerable to heat waves and other extreme weather events and help them find ways to manage the risks [13].

Some have framed the issue of climate change mitigation as one of "climate justice" and cite rurality and socioeconomic status as additional vulnerabilities [14]. Climate change is predicted to drastically worsen regional and international health inequities [14-16]. Rural physicians, like Dr. Schwartz and Dr. Rizzo, are crucial in mobilizing their knowledge of health disparities and health needs of their communities to help mitigate climate change, and all physicians are well positioned to understand the health effects of climate change related to their area of expertise, to raise awareness, and to advocate for their patients.

When Disagreements Exist within a Practice

In addition to raising concerns about how individual physicians should manage issues like health effects of climate change, this case also presents the challenge of how a physician group practice should respond when there is disagreement among members of the group. One view would be that group practices are simply composed of individuals who cooperate primarily in terms of financial and administrative matters and that each member should be free to respond to issues like health effects of climate change in whatever way is most consistent with his or her values. Another view would hold that group practices ideally reflect a shared approach to the practice of medicine overall and that patients should be able to expect the same general philosophical approach to care regardless of which physician they happen to see. In reality, most group practices probably adopt an approach that is somewhere between these two extremes. In this way, they have an opportunity to model the principles of "deliberative democracy," a strategy endorsed by many political scientists for society as a whole [17-19]. This approach emphasizes the importance of authentic deliberation on areas of disagreement

rather than more mechanistic approaches to conflict resolution such as voting and majority rule [17, 18].

In adopting this approach, the physicians in the group practice might augment their personal conversations with patients with either a letter that could be sent to all of their patients or a pamphlet that could be placed in the office waiting room that mirrored the principles of deliberative democracy by describing the known medical facts about climate change and health while acknowledging that ultimate decisions about the trade-offs between community health and economic viability are questions that need to be determined by the community at large. Such a letter or pamphlet would indicate that while the practice was speaking with “one voice” about the medical aspects of climate change, it was not taking a stand with regard to the broader questions of how best to manage the trade-off between economic, cultural, and health-related risks and benefits.

Conclusion

Although difficult, discussion of the health implications of certain politicized topics, such as climate change, has potential benefits that outweigh potential risks. Potential benefits include the promotion of knowledge and empowerment of individuals and communities to make their own value choices, as well as advancement of public health initiatives such as preparedness and climate change mitigation strategies. However, there is a distinction between physician advocacy and civic engagement as a private citizen. Maintaining a clear boundary between these two roles serves to diminish threats to neutrality and objectivity that would undermine patient and community trust. Physician-advocates should remain focused on areas directly relevant to health and well-being and acknowledge that value trade-offs are to be weighed by society. Because physician-advocates benefit patients and communities, they should be supported by their colleagues and professional societies. When disagreements exist within group practices regarding how to approach politicized health topics, the principles of deliberative democracy could prove especially useful for resolution.

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THE CODE SAYS

The AMA *Code of Medical Ethics*' Opinions Related to Climate Change

Annalise Norling

Although climate change has a negative effect on public health [1], health care professionals' perceived role in [educating patients](#) about climate change is often overlooked [2]. However, the American Medical Association (AMA) recognizes the importance of climate and health. The AMA adopted a policy ("Global Climate Change and Human Health," H-135.938) that underscores the reality and urgency of climate change and the necessity for a physician role in protecting public health as it relates to climate change. The policy states that the AMA "supports educating the medical community on the potential [adverse public health effects](#) of global climate change" and "encourages physicians to assist in educating patients and the public on environmentally sustainable practices, and to serve as role models for promoting environmental sustainability" [3]. While the *Code of Medical Ethics* does not outline specific plans of action for physicians to address climate change, it does provide guidance for physician involvement in public health concerns, specifically in preventive care and disaster response and preparedness.

Opinion 8.11, "Health Promotion and Preventive Care" [4], states that physicians should "consider the [health of the community](#) when treating their own patients and identify and notify public health authorities if and when they notice patterns in patient health that may indicate a health risk for others." Physicians can utilize this guidance to observe and [report patterns of illnesses](#) for which climate change poses increased risk, such as asthma, respiratory allergies, skin cancers, cataracts, food and waterborne illnesses, cardiovascular disease, and stroke, among others [1]. Opinion 8.11 continues with guidance stating that physicians should "recognize that modeling health behaviors can help patients make changes in their own lives" [4], which suggests that physicians should make a serious effort to model environmentally conscious behaviors that promote health, such as wearing sunscreen, in order to encourage patients to make behavioral changes and also states that physicians should advocate for healthier communities and the resources to make this happen.

Another piece of guidance, Opinion 8.3, "Physicians' Responsibilities in Disaster Response and Preparedness" [5], discusses the role of physicians in responding to large-scale public health crises. The opinion states, "individual physicians should: Take appropriate advance measures, including acquiring and maintaining appropriate knowledge and skills to ensure they are able to provide medical services when needed" [5]. This points to the need for physicians to gain knowledge and tools to effectively

manage and prevent disease outbreaks like Zika, to which climate change contributes [6].

Potential public health concerns such as those related to climate change should be carefully analyzed by physicians and other health care workers in order to ensure that education, treatment, and relief is available if and when it is needed. Physicians can also play a role in the education and dissemination of important health-related information concerning environmental degradation and climate change [3].

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STATE OF THE ART AND SCIENCE

Is Editing the Genome for Climate Change Adaptation Ethically Justifiable?

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Abstract

As climate change progresses, we humans might have to inhabit a world for which we are increasingly maladapted. If we were able to identify genes that directly influence our ability to thrive in a changing climate, would it be ethically justifiable to edit the human genome to enhance our ability to adapt to this new environment? Should we use gene editing not only to prevent significant disease but also to enhance our ability to function in the world? Here I suggest a “4-5 framework” for analyzing the justifiability of gene editing that includes these considerations: (1) safety, (2) significance of harm to be averted, (3) succeeding generations, and (4) social consequences.

Introduction

Gene editing is no longer a theoretical possibility. It is a stark reality that raises vexing ethical and regulatory questions for scientists and society. Scientists have successfully edited a human preimplantation embryo to repair a mutation in the *MYBPC3* gene that is associated with hypertrophic cardiomyopathy (HCM) [1]. HCM is a serious disease that is the most common cause of sudden death in otherwise healthy young athletes. Using CRISPR (clustered regularly interspaced short palindromic repeats)/Cas9 (CRISPR-associated nuclease 9) to recognize specific genome sequences, scientists were able to efficiently target cells and activate DNA repair to correct a mutation in the gene that is responsible for approximately 40 percent of all genetic defects causing HCM [1]. CRISPR/Cas9 technology is a powerful editing tool to disrupt any gene. To create gene disruptions, a single guide RNA (sgRNA) directs the Cas9 nuclease to cut through a specific sequence of DNA. (The cell's native DNA repair mechanism typically mends the damage, but it is error prone and insertions and deletions can be introduced that disrupt gene function.) This technique has revolutionized genome editing, allowing for targeted editing of genes and the ability to manipulate many genes at once. While the technology for gene editing has rapidly advanced and continues to improve, scientists are marching ahead without clear guidelines on the use of the technology.

The ability to use gene editing to prevent the development of a life-threatening genetic disease that arises from a single gene mutation raises the possibility of using gene editing for other purposes. While we are likely to achieve a consensus on the ethical

permissibility of using gene editing to prevent life-threatening diseases, there is an urgent need to clarify the boundaries for which the technology should be used and who should decide when it is used. Should we use gene editing not only to prevent significant disease but also to enhance (i.e., modify, with the goal of improving) our ability to function in the world? Should we enhance human beings so they are more resistant to disease? Who has the authority to make these decisions? Should parents be allowed to decide to use gene editing on behalf of their children and future generations? These questions will be explored in considering the potential use of gene editing to enhance humans' adaptability to climate change, and a general framework for making decisions about the use of CRISPR/Cas9 will be presented.

A recent international report on the state of climate change by the American Meteorological Society found that the year 2016 was the earth's warmest year on record. Our sea levels also reached a record high in 2016, and the concentration of carbon dioxide at the earth's surface is the highest it has been in 800,000 years, which is as far back as ice records extend [2]. As climate change progresses, we humans might have to inhabit a world for which we are increasingly maladapted. If we were able to identify genes that directly influence the ability to thrive in a changing climate, would it be ethically justifiable to edit the genome to enhance the ability to adapt to new environmental conditions? As will be discussed in what follows, this question has been affirmatively answered by some agricultural and animal geneticists, with sparse societal deliberation. Answering this question for human beings will surely be next, but given the differences in the potential risk—physical and ethical—of using this new technology in plants, animals, and human beings, we need robust societal deliberation and a systematic framework for deciding when to proceed. Here I suggest a “4-5 framework” for analyzing whether to proceed with human gene editing. To determine when gene editing is ethically justified, we need to consider: (1) safety, (2) significance of harm to be averted, (3) succeeding generations, and (4) social consequences.

Precedents for Editing the Human Genome

We have already begun to see the benefits of gene editing. Genome editing of crops provides opportunities to increase productivity by introducing traits such as disease resistance, drought tolerance, and nutrient-use efficiency. CRISPR/Cas9 has been used to improve climate-related agronomic traits, such as pathogen resistance in crops, and to create new varieties that are high yielding with high nutritional value [3]. Gene editing has produced pigs that are resistant to porcine reproductive and respiratory syndrome, one of the most significant diseases in this animal [4]. In addition to preventing disease, however, the technique is being used to introduce desirable genetic variations into livestock such as dairy cows without horns (relieving them of the pain associated with routine dehorning to prevent injuries) [5] or super dogs with double the normal muscle mass who are stronger runners and can be used for hunting or military applications [6]. Our experience with gene editing in plants and animals not only to prevent disease but

also to enhance traits might persuade some that the technology would be safe in human beings and that it is ethically justified to use gene editing to both prevent disease in and enhance human beings.

Engineering the human genome for purposes of human enhancement, however, is ethically contentious. The ease with which the technology can be employed and its use in human embryos has stirred wide debate and concern that it will be used to create designer babies [7]. While genome editing has the potential to obliterate serious life-limiting diseases, it can also potentially be used to improve human characteristics such as intelligence and appearance. Whether such power is used to shape humanity for good or bad, what impact gene editing to enhance humanity will have on our understanding of what is normal, and whether we will create a segment of society that is genetically superior are open questions that should give us pause.

The 4-S Framework

The potential use of gene editing to enhance our ability to thrive in a changing climate requires consideration of what I refer to as the 4-S framework for analyzing whether to proceed with gene editing: (1) safety, (2) significance of harm to be averted, (3) succeeding generations, and (4) social consequences.

Safety. The safety of gene editing is a foundational factor in the assessment of whether to proceed with CRISPR/Cas9 in human beings. The challenge is that the technique's safety ultimately needs to be assessed through evaluation of the resulting product, not the process itself. While CRISPR/Cas9 is elegant in its simplicity, efficiency, and high specificity, there is the risk of off-target cleavage in gene edits. Preliminary studies suggest that the incidence of off-target mutations is low [8], but further research is needed to characterize this risk and ensure that the benefits of gene editing outweigh the consequences of off-target mutations. Even if the incidence of off-target mutations is very low, it will be difficult to predict all of the salient consequences of editing the human genome. For example, a gene may be associated with a serious illness but also confer some advantages in terms of preventing disease. Gene editing may therefore result in our trading one known disease for another unknown disease. Establishing the safety of gene editing in animals is a first step toward greater confidence that the benefits are likely to outweigh the risks of the technique in human beings. Much animal research has the goal of providing insights that are useful for understanding human biology and the response of human beings to particular interventions. While cross-species translation has limitations, it can also provide us with valuable information on the technical possibilities and potential complications of interventions [9].

Significance of harm. The significance of the harm to be averted by gene editing should help guide our assessment of the technique's risks and benefits. Rarely is an intervention completely safe, so our threshold for embracing a novel technique is dependent on

whether the potential benefits outweigh the risks. To make this assessment with regard to enhancing our ability to adapt to new environmental conditions, we would need to understand the consequences of being maladapted to a changing climate. If the health effects of climate change are significant in terms of morbidity and mortality and cannot be adequately addressed through other medical and public health interventions, then we should have a lower threshold for using gene editing than we would to ameliorate a mild illness. The significance of medical need should guide our decision making.

A recent UN report highlights the rising [impact of climate change](#) on human health [10]. The effects of climate change will be increasingly prevalent, and we are likely to see direct effects on health resulting from heat-related mortality and increased disease transmission, particularly from the spread of infectious diseases that are sensitive to climate. We will also see indirect effects of climate change resulting from its impact on food production, which might cause malnutrition and the inability of people to work in extreme weather conditions. Efforts are underway to explore mechanisms for adapting to climate change [11]. We should embark on interventions that are effective but pose the lowest risk to humanity. Given the uncertain consequences of gene editing to improve our ability to thrive in a changing climate, it is prudent to pursue this option only when the consequences of not intervening with gene editing are significant and after other options have been tried and failed.

Some might argue that using gene editing to improve our ability to adapt to climate change is a form of [enhancement](#) and, like any genetic enhancement, is therefore ethically unjustified [12]. Underlying this argument are concerns about eugenics, playing God, a slippery slope toward designer babies, opposition to the desire for genetic perfectionism, and an extreme emphasis on individual autonomy. Enhancement per se, however, is not ethically unjustified. In fact, in some cases it is not only ethically permissible, but morally required. For example, vaccines are enhancements that our society has mandated. What matters is why we are trying to enhance a person, who is deciding to proceed with enhancement (i.e., the government, the individual who would be the subject of enhancement, or another person, such as a parent on behalf of a child), and what are the associated risks. Caffeine, braces, LASIK eye surgery, as well as vaccines, are all forms of "enhancement" that in some cases can have effects on a cellular level and that most of our society has accepted as ethically permissible. Claiming that gene editing to improve our ability to adapt to climate change is a form of enhancement and therefore ethically unjustified is not a compelling argument. While it might not be medically necessary right now to edit the human genome to improve our ability to thrive in a changing climate (and we should refrain from proceeding until it is medically necessary), there may be a pressing need to do so for some segment of our population in future decades. It would therefore make more sense for us to consider whether gene editing is intended to significantly improve human health or not and

whether the benefits outweigh the risks overall, as opposed to whether it is considered “enhancement.”

Succeeding generations. We are on the threshold of overcoming the safety concerns raised by gene editing, and there are surely clinical situations in which the benefits would outweigh the uncertain risks. Nevertheless, many may have a lingering apprehension about the use of gene editing. Underlying this uneasiness is, I think, a worry about the unknown consequences not only for the individual subject of gene editing but also for succeeding generations. The distinction between editing the human germline (the effects of which are passed onto future generations) and editing somatic cells (the effects of which are limited to individual patients and not inherited by their offspring) is important. Because the former has implications for succeeding generations is not sufficient reason to claim that under no circumstances would editing the human germline be permissible. Why should we not want to alleviate the burden of life-threatening illnesses in future generations? In some cases, the severity of an illness may justify eradicating it from future generations. For example, there are likely women who carry a mutation associated with Huntington’s disease who would, reasonably, embrace opportunities to safely prevent their future generations from having the mutation. Tampering with our genes is complex, and we might not be aware of advantages conferred by a gene that we are cleaving. As a safeguard, human germline editing should be first explored in animal models and used only when there is no other way to prevent a devastating genetic disease in the offspring.

Social consequences. In addition to considering safety, significance of medical need, and succeeding generations, we should also consider the social consequences of gene editing. As we begin to employ a new technology that confers benefits to individuals, we need to be mindful of how we can ensure a just distribution of this resource. Concerns for fairness necessitate that gene editing is available not only to those who have the ability to pay but also to all of those who are in need and would benefit from the intervention. If genes that directly influence our ability to thrive in a changing climate could be identified and edited, we would want to ensure that those individuals—including children—and communities who are most susceptible to the harmful consequences of climate change have access to this intervention.

Conclusion

Gene editing has unprecedented potential to improve human health. CRISPR/Cas9 has a specificity and simplicity that opens up wide possibilities. If we are unable to prevent serious negative health consequences of climate change through environmental and public health measures, gene editing could have a role in helping human beings adapt to new environmental conditions. Any decision to proceed should apply the 4-S framework. The outcome of gene editing must on balance be safe; the technique should only be used when there is significant medical need; the impact on succeeding generations should be

considered; and concerns about a fair distribution of benefits should be addressed. By applying this framework and developing a national and international regulatory oversight process for gene editing, we will be able to realize the potential of this disruptive innovation for improving human health.

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POLICY FORUM

The “Buy One, Get One Free” Ethics of Investing Public and Philanthropic Funds in Health and Climate

Ali A. Zaidi

Abstract

This article applies various ethical frameworks to inform decision making about investment in two specific goods—strengthening public health and stabilizing the global climate. I begin by outlining how these goods traditionally competed for common and constrained resources. I then discuss how this view of competition has been rendered more problematic by emerging and compelling ethical justifications for investment in both goods based on utilitarian, Rawlsian, and communitarian analyses. I conclude by showing that these goods no longer compete head-to-head in a zero-sum way. Changes in science, technology, and society mean that investment in either good has the potential to advance both goods—that is, the goods have become synergistic. As a result, the case for investing in both is better.

Introduction

Public funds can buy public goods. But given finite public funds, we must ask: Which goods are better? Certainly, economics can support this inquiry. Ethics, too, plays a role—and a very central one. Seeking insights into this calculus, this article applies various ethical frameworks to inform decision making about investment in two specific public goods—strengthening public health and stabilizing the global climate. I begin by defining the goods and outlining the initial apparent conflict (i.e., competition) between them. I then explain that this conflict, or competition, only becomes more difficult to resolve because of the emerging and compelling ethical justifications for investment in both goods. With such compelling ethical explanations, how does one allocate the next incremental public or philanthropic dollar? I argue that changes in science, technology, and society mean that investment in either good now has the potential to advance both goods—that is, the goods have become synergistic. To be sure, investing in this synergistic overlap will not fully realize all of the objectives associated with either public health or global climate stabilization. And ethics-based evaluation of investment alone does not form a sufficient analytical basis for the allocation of funds. However, alongside other important tools such as rigorous, evidence-based assessment of comparative economic costs and benefits, the ethical calculus provides valuable input into allocation of public and philanthropic capital.

Two Goods Competing for Common and Constrained Resources

Strengthening public health. [Global public health](#) is a long-established public good [1]—and costly to procure. In 2016, development assistance supporting public health capacity worldwide was nearly \$37 billion, yet that amount remains insufficient [2]. In part, the funding gap is for emergencies; the World Health Organization identified shortfalls in the hundreds of millions of dollars [3]. But the gap extends beyond emergencies. A 2011 World Economic Forum report projected costs of \$30 trillion over the next 20 years associated with noncommunicable diseases alone [4]. Public health capacity is not designed to prevent all these costs, as it cannot prevent every endemic or epidemic. Rather, public health capacity encompasses the preventative and reactive capabilities of a society, including the infrastructure that shrinks, slows, or swells these costs.

One element of this infrastructure is energy. The ONE Campaign offers several tangible ways in which energy poverty adversely affects public health: “doctors struggle to provide clinical services after sunset”; “vaccines, blood work and medications are not stored in proper conditions”; and “health care facilities cannot power laboratory equipment such as ultrasound and X-ray machines as well as incubators” [5]. To avoid such issues, public funds have procured lowest-cost energy poverty reduction measures—as a means of strengthening public health capacity. In the past, the lowest-cost energy, when computed without accounting for externalities such as environmental degradation or the social cost of carbon, came from fossil fuels with limited or no control on emissions. Ironically, this meant that the energy poverty reduction came at some cost to public health—the public health costs associated with air pollution. Yet today, the reality is that the lowest-cost energy in many countries comes from renewable sources, like solar and wind [6], even if fossil fuels continue to be *promoted* as the “cheapest” solution to energy poverty reduction [7]. Energy poverty reduction, then, can finally be decoupled from increases in air pollution.

Stabilizing the global climate. Stabilizing the global climate is a public good with implications across geographic borders and time horizons for all people [8]. Costs associated with stabilizing the global climate primarily involve investments to reduce the pollution—emissions of greenhouse gases—associated with global productivity, principally by [changing the way productivity is powered](#). Hundreds of billions of dollars have been mobilized for this purpose [9], but far more will be required. The International Energy Agency anticipates that \$16.5 trillion, of which a nontrivial share will involve public funds, will be needed by 2030 in order to hit the target set in the Paris climate agreement of limiting the increase in global average temperature to below 2 degrees Celsius [9]. While not directly related to global climate *stabilization*, public funds will also be required to address the unavoidable impacts of climate change—potential agricultural losses associated with droughts, real property losses associated with floods

and storms, and human health losses associated with heat waves. In a way, these so-called adaptation or resilience expenditures are part and parcel of the same public good.

Failure to invest could undermine economies and create instability. An annual survey by the World Economic Forum found “failure of climate change mitigation and adaptation” to be at the top of perceived economic risks [10]. One study pegged the potential loss of global financial assets at \$24.2 trillion in the worst case [11]. The economic risk does not stand alone; geopolitical risk also flows from failure to act. Last year, the National Intelligence Council issued a paper titled “Implications for US National Security of Anticipated Climate Change” [12], which traces the potential pathways of this geopolitical risk over the next 20 years based on the best available science and climate modeling. The paper shows how climate change can affect geopolitics by increasing the risk of disputes between countries over resources like water, mass migrations “that exacerbate social and political tensions,” and economic shock to already vulnerable countries [13]. The conclusion is harsh: destabilization of the global climate destabilizes the global peace [12].

Competing for common and constrained resources. Limited public funds are available to secure these two public goods. Although these fiscal constraints have been partially ameliorated by public and private sector innovations—ranging from governments pioneering high-leverage funding mechanisms to corporations considering their environmental impacts—the magnitude of the fiscal constraints makes them unlikely to disappear altogether. To take one example: the United Nations projects a \$2.5 trillion annual investment gap between 2015 and 2030 for achievement of its sustainable development goals, which include health, sanitation, and climate change mitigation and adaptation [14].

An unavoidable tension flows from funding gaps of this size. Conventional wisdom set strengthening public health and global climate stabilization against each other. One was forced to evaluate the merits of each in relative terms in allocating funds. And the conflict extended beyond competition over funds to potential impacts of the activities funded. Specifically, where energy poverty reduction was achieved through deployment of polluting energy, any net public health gains—the residual benefit after subtracting the public health costs of polluting energy from the public health benefits of energy poverty reduction—came paired with global climate losses.

Assessment of the Emerging Ethical Justifications for Public Health and Climate Stabilization

The allocation of public funds involves “many values, competing and clashing over common currency” [15] and a calculus driven by ethical principles—named or unnamed, deliberately or inadvertently applied—as much as by economics. This section examines three philosophical frameworks—utilitarian, Rawlsian, and communitarian—to study

the ethical dimension of that calculus. I show that under each framework, strengthening public health and stabilizing global climate have powerful ethical justifications. This result makes the task of prioritizing one or other public good challenging.

Utilitarian analysis. At its simplest, the utilitarian framework demands *the best for the most* [16]. Bentham provides the core heuristic for comparing “pains” and “pleasures” or what might be called costs and benefits: applying this heuristic to the two public goods, we must compare them in terms of “intensity” (magnitude of costs or benefits), “duration” (period of time over which those costs or benefits will accumulate), “certainty or uncertainty” (likelihood of the costs or benefits materializing), and “propinquity or remoteness” (time until the costs or benefits manifest) [17]. Under this framework, public health has long possessed a compelling ethical justification for public funding; now, global climate stabilization is justified, too. We know that weak public health can entail suffering of great *intensity* for many people over a long *duration*—put starkly, public health can be a life or death issue for millions. Fortunately, the evidence base for public health interventions has grown along with epidemiological sophistication. Together, these developments have added *certainty* and *propinquity*: we know investment in X can reduce risk of Y over a time horizon of Z. By comparison, pain associated with global climate change has long been portrayed as *uncertain* and *remote*, creating a less compelling rationale for public funding under this framework. And even when it “arrives,” how harsh would be the effects? Our improved scientific understanding has shattered this conventional wisdom, given that the effects of climate change are being felt today—from more frequent drought to more intense hurricanes—and that climate change models are getting more sophisticated all the time. We know more greenhouse gas emissions lead to greater climate destabilization and worse outcomes for the environment and economy; and those worse results, as with public health, are now properly understood—that is, more *certain*—to be matters of life and death or very intense and long duration costs [10, 12]. As a result, the utilitarian argument for investments in global climate stabilization has become more compelling and achieved “categorical parity,” or equal footing as a generic investment purpose, with the argument for public health investment.

Rawlsian analysis. The next framework trades focus on ends for focus on means. Specifically, the “egalitarian liberalism” introduced by John Rawls gives primacy to autonomy and agency and their animating conditions [18]. The animating question is this: Behind Rawls’s “veil of ignorance” where we do not know our specific lot in life [19], what is just? Under this framework, moral value attaches to public action—including allocation of funds—aimed at reducing the threats to individuals’ autonomy and agency. Material to ethicists in the Rawlsian tradition is that weak public health capacity was long seen as posing such a threat. As Moskop details, building public health capacity was thus justified under the Rawlsian framework [20]. Given the now established science and modeling of global climate change [21-23], investment in climate stabilization, too,

should be seen as compelling under this framework. After all, we know now that similar to public health, global climate change threatens to limit severely and, in certain cases, existentially, individuals' autonomy and agency by threatening either their livelihoods or lives. Surely, if behind the veil of ignorance the world appears to be extensively—though not uniformly—vulnerable to climate catastrophe, we will shout for public action to secure a stable climate. Such public action, which we call for behind the veil of ignorance, carries moral weight and—as it did for public health earlier—provides a compelling, Rawlsian basis for investment in stabilizing the global climate.

Communitarian analysis. The communitarian framework finds moral value through moral dialogue [24]. This is a project that seeks “a good in common that we cannot know alone” [25]. Long before global climate change entered the dialogue, strengthening public health was established as such a good *in common*. Through institutions like the World Health Organization, the world's people—through their countries' representatives—had come together and concluded that public health was a virtue worth cherishing. The imperative for investment followed. Yet such a moral global consensus, borne from vigorous dialogue and understood unambiguously and ubiquitously, did not exist for stabilizing the global climate as a good in common—until the Paris climate agreement was reached in December 2015, with almost 200 countries committing to collective action to address global climate change [26]. At earlier points, even when global climate change entered the global dialogue, it provoked distributive conflicts—conflicts about how the costs of securing global climate stabilization would be borne—between north and south, developed and developing countries. Yet, by the date of the Paris climate agreement, the situation had changed: a moral consensus emerged, and the distributive conflicts were overwhelmed by the needs of the collective. Perhaps the consensus owed less to the two weeks of the Paris Conference of the Parties than the moral dialogue that took place in the run up [27]. Academics, businesses, religious leaders—the full breadth of civil society—had publicly voiced its desire to act, to attach moral value to climate action. As a result, the consensus that was reached defined not only the particulars of the agreement but also the position of the world's people—through their countries' representatives. This consensus now attaches moral value to the allocation of public funds for global climate stabilization. Thus, under yet another framework, the ethical basis for global climate investment has grown to be just as compelling as that for public health investment.

Changing Dynamic: From Competition to Synergy

Changes in science, technology, and society mean that both public health and global climate stabilization now command a compelling ethical justification under the utilitarian, Rawlsian, and communitarian frameworks; but those same changes also mean the dynamic between these goods is transformed: competition is surrendering to a new synergy—and this transformation adds urgency. Investment in one good can pay dividends towards the other.

Two types of synergies are surfacing. First, a positive synergy is forming as common solutions or opportunities for investment are able to promote both goods at once. This change is rooted in the dramatic cost declines associated with clean and distributed energy, which are rapidly becoming more competitive than polluting and centralized energy [6]. Strengthening public health through energy poverty reduction need not add costs to the climate change ledger. Second, a negative synergy is forming as common side effects arise from failure to invest in both goods at once. This change is rooted in improved understanding of the connection both between [polluting energy and public health](#) and between spread of infectious disease and global climate. We now know that polluting energy contributes trillions of dollars to the global health burden through illnesses like asthma and heart attack [28], and that infectious disease, especially vector-borne diseases like Zika, malaria, and Lyme disease, is dramatically worse under unmitigated climate change scenarios—increasing the risk exposure for hundreds of millions of people [29]. Together, these synergies are dismantling the old-world competition between these goods.

Conclusion

Competition between our public health and global climate aspirations has surrendered to synergy—that is, we have gone from zero-sum competition to “buy one, get one free.” To be sure, investment in this synergistic overlap will not fully realize these aspirations. But advisors to and administrators of public and philanthropic funds now find themselves able to advance both goods with common or complementary investments. Why does this matter? It matters for three reasons: First, we can lay to rest the myth that these goods are locked in a zero-sum competition for common and constrained resources. Second, we can focus on the increasing set of investments that advance both goods, as those likely form some substantial portion of the best potential investments. Finally, we can appreciate that the synergy between these goods means that the investment case for each has become more compelling—and more urgent.

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MEDICINE AND SOCIETY

Should Health Professionals Speak Up to Reduce the Health Risks of Climate Change?

Cheryl C. Macpherson, PhD, and Matthew Wynia, MD

Abstract

Should physicians take action in the political realm to address climate change? There are many historical examples of physician advocacy in the political sphere, both individually and as a collective, and many have argued that it is important for health professionals to advocate on a variety of issues. But which criteria should be used to determine when and how health professionals should take on particular advocacy issues, and is climate change an appropriate—or even obligatory—arena for physician advocacy? We propose a seven-part deliberative framework for making this determination.

Introduction

It's not controversial to claim that all physicians should dedicate themselves to certain core values and behaviors, including providing effective care for patients, promoting health within communities, and upholding professional integrity. It's also not particularly controversial to note that many environmental factors, including the effects of climate change, affect both individual and population health outcomes [1, 2]. And there is no doubt that environmental factors often pose risks to health and well-being over which individual patients have little or no control. Taken together, these facts strongly suggest that effective approaches to mitigating environmental health risks would require policy-level interventions and also that physician participation in such policymaking—as advisors to policymakers or in other capacities—could be useful in bringing attention to short- and long-term health consequences that might otherwise be overlooked. Indeed, many physicians have chosen to learn about and work to change environmental conditions that can undermine health—from the dangers of lead-based paint to the global health impacts of climate change—and to speak out about these issues in public.

But does the fact that physicians can be effective advocates on environmental issues mean that advocacy to address climate change is an *ethical obligation* for physicians or other health professionals? Recently, a number of medical schools have added the teaching of advocacy skills to their core curriculum [3], implicitly answering one aspect of this question in the affirmative: advocacy *per se* is increasingly recognized as a professional responsibility. But how is advocacy defined, why should it be taught, and

how might a general responsibility to advocate for health apply to climate change mitigation or any other health concern?

Physicians and Professional Advocacy

To advocate, from the Latin *vocare* (to call), has been defined as “to speak in favor of; recommend publicly” [4]. Many different personal, professional, or other factors might influence whether, when, and how a physician chooses to speak up publicly. We focus here on advocacy about health-related issues, which can be considered *professional* advocacy and distinct from advocacy pursued out of personal interests unrelated to one’s profession. In addition, we focus here on advocacy related to populations, rather than advocacy in service of a specific individual patient (which is clearly an important, but less controversial, responsibility of health professionals). For our purposes, therefore, we define a health professional advocate, following Earnest and Wong [5], as one who promotes “those social, economic, educational, and political changes that ameliorate the suffering and threats to human health and well-being that he or she identifies through his or her professional work and expertise” [6].

There is a long history of [physician advocacy](#) addressing population health risk factors. The British physician, John Snow, famously advocated in 1854 to disable a water pump that he correctly suspected was the source of a cholera outbreak in London [7]. More recently, pediatrician Richard Pan, a state senator in California, successfully advocated strengthening vaccination mandates for school children [8], and physician leaders in the American Medical Association (AMA) have publicly urged policymakers to implement taxes on sugar-sweetened beverages to address obesity [9]. In fact, there are many examples of physicians, both individually and in groups, taking public stands to promote the health of populations. In one survey of 1,662 US physicians, more than 90 percent of respondents said they believe that community participation, political involvement, and collective advocacy are “important” activities for physicians; and two-thirds of responding physicians reported taking part in one or more of these activities in the last three years [10].

Advocacy Skills Education

In recent years, North American medical curricula have been introducing students to social determinants of health, often emphasizing the harms, inequities, and social justice issues that arise from unequal exposure to a variety of social risk factors [11]. In this light, accrediting bodies have encouraged medical schools to teach advocacy skills, because “teaching the social determinants of health is incomplete without the provision of [tools for students](#) to address those determinants” [12]. Some skills proposed for effective advocacy include “identifying a problem amenable to advocacy, defining the problem and its scope, identifying and engaging strategic partners, developing a strategic action plan, [and] communicating an effective message” [13].

Remarkably, scholars in medical education have almost unanimously supported the addition of advocacy skills to an already-packed curriculum [3, 6, 14-17]. Reasons given include that developing advocacy skills is a means of exercising critical thinking and communication skills—recognized as core competencies for physicians that are necessary for history taking, handovers, and informed consent conversations [18]—and that giving clinicians advocacy skills might empower them in other realms and reduce burnout in the face of multiple systemic problems in health care [6, 12, 19]. In addition, advocacy training would support efforts to motivate civic learning and democratic deliberation, as called for by Solomon and Jennings [20]. The decline of productive civic engagement threatens not only health care but also democratic freedoms [20, 21]. In particular, health-related advocacy that is grounded in objectively obtained, analyzed, and reported evidence—and that prioritizes public and patient interests over personal or ideological interests—is a potential means of counterbalancing politicization, including partisan affiliations and biases that can challenge objectivity, undermine [public trust](#), and threaten health.

The limited opposition to integrating advocacy into medical curricula has centered on the claim that physicians should not be expected to hold or act on political positions and that there are other, nonpublic means of fulfilling civic responsibilities in medicine [22]. It is true that health advocacy can become politicized—in a particularly extreme example, Dr. Pan was personally threatened following his sponsorship of a bill to mandate childhood vaccination [23]. It's also the case that physicians have nonpublic opportunities to fulfill their civic responsibilities. But neither of these claims is an effective argument against including advocacy skills in medical curricula. First, advocacy skills can be taught and pursued without alignment to any political or ideological position (except, perhaps, a commitment to improving human health through evidence-based and contextually responsive policy); and second, abdicating any role in public discussion is contrary to the very notion of a profession. After all, the word *profession*, like advocacy, is built on a Latin root (*profess*) that means “to declare aloud or publicly” [24].

Responsibility to Advocate

If advocacy skills are worth teaching and using, a logical next question is, When does it become more-or-less *obligatory* for physicians to use these skills? After all, there are an extremely large number of issues in which any given physician, or physicians as a group, might invest. Yet a limitless responsibility for advocacy would clearly be untenable. How should physicians determine whether a specific issue merits professional advocacy?

We propose that a professional responsibility to advocate is rarely dichotomous (entirely present or totally absent) but is acquired as certain criteria are met; and when more of these criteria are met, the duty to act becomes increasingly strong [25]. An example from outside of medicine can help to describe these criteria. Consider the case of a lifeguard, who has a clear responsibility to act to save a drowning swimmer when she is

on duty. This clear obligation is called a “role responsibility” [26, 27], and it’s derived from an explicit relationship that very often includes a written or implied legal contract. But what if the lifeguard is not on duty but simply walking along the beach and spots a swimmer in distress? Or what if, when off duty, she notes a rip tide that poses a risk to swimmers? Does she still have a special duty to act, above and beyond the responsibility any of us might have to help someone in trouble? There are several reasons why the answer might be yes.

Even when the lifeguard is not obliged to act by an explicit work contract, we suggest that when seven criteria are met, she would still have some responsibility to do so. These proposed criteria are not weighted, and they might not be exhaustive, but as more of them are met, her special role-related responsibility to act can become very strong, perhaps even becoming an obligation. These seven criteria are:

1. *Expertise.* Her particular expertise makes her actions more likely to be beneficial than if others were to try to act.
2. *Proximity.* She is close to the event; her obligation would be altered if she were a mile away, watching from her deck through a telescope.
3. *Effectiveness.* Her obligation to act is greater if there is a greater likelihood her actions will make a difference.
4. *Low risk or cost.* Her obligation to act is greater if acting does not jeopardize her safety or pose an unsupportable cost to her. Note that her training and expertise might make the actions she undertakes less dangerous or costly than if they were undertaken by someone without training.
5. *Unique.* If she is the only available rescuer, her duty is greater than if others are available to act.
6. *Severity.* How severe will be the outcome if she fails to act? Her duty to act is greater when failing to do so might cause a much worse outcome.
7. *Public trust.* As someone who has public trust (lifeguards are certified), she has a greater responsibility to act when failure to do so might harm that trust.

These seven criteria provide a useful framework for considering when any specially trained individual or group should, or even must, engage in advocacy. Using this framework suggests that many advocacy actions will not be required in an absolute sense (in philosophy talk, most advocacy will be “superogatory”—i.e., praiseworthy, but not mandatory) [28]) but that advocacy becomes closer to obligatory when more of these seven criteria are met. Furthermore, these criteria can be applied by physicians who might face analogous instances of deciding whether they have some responsibility to act to protect people who are not under their direct care—i.e., by serving as advocates for population health.

How might these criteria be applied by a physician? Imagine, for instance, a hypothetical health threat to a population that a physician has special training to detect and manage

and that directly affects many of the physician's patients, that addressing the threat poses no risk and no cost to the physician, that the physician's action has a strong likelihood of being effective, and that the outcome of failure to act will be severe suffering or death. Even if most of those suffering and dying were not the physician's patients, if that physician failed to act in such a circumstance, public trust in the profession would presumably be sharply eroded. In this (admittedly extreme) hypothetical case, this physician would have a very strong professional duty to act to address the threat.

What happens when we use this framework to help us determine whether acting to address climate change is a professional responsibility for physicians?

Physician Advocacy and Climate Change

Many have detailed the health threats posed by climate change. Decades of evidence from diverse disciplines confirms that atmospheric accumulation of greenhouse gases are the primary drivers and that climate change is already causing adverse health effects through its impacts on agricultural production and food and water scarcity: respiratory illnesses (e.g., asthma), mental illnesses (e.g., depression), and novel infectious and zoonotic diseases such as Chikungunya and Zika that emerge or re-emerge in new locations [1, 2].

Consider how our seven criteria might help to evaluate the extent to which a physician has a special obligation to advocate for actions that could reduce health threats related to climate change. Physicians often have (1) *expertise* in treating climate-related injuries, infections, and diseases that are increasingly prevalent and severe in diverse locations [29]. They are often first responders with (2) *proximity* to those who need related care. Physicians might be more likely than others to be (3) *effective* in related advocacy aimed at health officials, the news media, local school boards, or the public, especially when their advocacy is based in scientific evidence and expertise and if they have been trained in advocacy skills. Such advocacy seldom poses unreasonable (4) *cost or risk* to the physician, although advocates addressing politically charged issues often run the risk of being criticized for speaking up. Countering this risk, if physician advocacy helps reduce harmful impacts of climate change, then advocacy to address climate change might directly benefit physicians themselves as well as their families and communities.

While physicians are not the only professional group with a special role to play in addressing climate change, physicians are (5) *unique* among potential climate change advocates in having medical expertise and experience in treating the health effects of climate change and in their influence over the distribution of health care resources [30]. The (6) *severity* of the potential health consequences of climate change should concern all physicians, given realistic models suggesting more frequent extreme heat if current trends continue unabated [1, 2].

Finally, physicians' silent acceptance of ongoing rates of greenhouse gas emissions risks undermining their ability to uphold (7) *public trust*. In failing to speak out, physicians risk being seen as complicit or out of touch. This risk is perhaps especially great in countries like the United States where there is significant public concern about climate change and where a relatively large percentage of global emissions is produced. In this regard, US physicians could take a lesson from physicians in Britain who have long engaged with climate change; they have significantly reduced emissions from their health system and medical facilities by conserving energy in various ways and promoted patient education about healthy lifestyles that also conserve energy [31].

These seven criteria provide reasonable grounds for claiming that advocacy addressing climate change is professionally appropriate for all physicians. We believe it is obligatory for those with unique expertise (such as those specializing in pulmonary diseases, infectious diseases, and so on) practicing in affected regions (which, increasingly, are everywhere). In addition, climate change surely merits strong advocacy on the part of groups of physicians, such as professional societies, which might have a particularly effective voice in altering organizational practices to achieve reduced emissions, waste reduction, and energy conservation. Additional advocacy by individuals or groups could promote healthy, climate-friendly behaviors, such as walking or cycling rather than driving, and increasing consumption of fresh, unprocessed, and locally produced food. These behaviors have direct health benefits to those who practice them and indirect health benefits by reducing the carbon emissions that drive climate change.

Conclusion

We conclude that physicians as a group, and many individual physicians, have a professional responsibility to speak out about the health impacts of climate change and that including advocacy-related skills in medical curricula would better equip them to speak out constructively on this and other health threats. Our seven-criterion framework that supports this conclusion also provides a strong argument in favor of the 2016 American Medical Association policy that calls for "aiding physicians in adopting environmentally-sustainable programs in their practices and sharing these concepts with their patients and communities" [32].

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IMAGES OF HEALING AND LEARNING

Rising Waters and a Smaller Island: What Should Physicians Do for Tuvaluans?

Jordan Emont, MPH, and Gowri Anandarajah, MD

Abstract

Residents of the island nation of Tuvalu will be among the first of the 1.7 million Pacific Islanders to be displaced by the effects of climate change (including rising sea levels, changing distributions of agriculture, and unpredictable weather patterns). Already 3,500 Tuvaluans live in New Zealand (approximately 25 percent of the world's Tuvaluan population), some of whom moved due to climate change. Immigrating to New Zealand presents several challenges for Tuvaluans, including limited job opportunities, health care disparities, and dietary changes. Nevertheless, Tuvaluans in New Zealand continue their culture as they redefine their identity in a new country. Given the growing effects of climate change, physicians around the world will soon care for a new generation of immigrants and will play an important role in advocating for health equity and self-determination among climate-sensitive populations. This article uses personal stories and photographs of Tuvaluans and photographs of Tuvalu and New Zealand to present Tuvaluans' struggles and ethical issues pertaining to health that arise in relocating Tuvaluans.

Introduction



Figure 1. *Vaioleta*. Photo: Jordan Emont.

In 1997, when Vaioleta (not her real name) was five, she and her parents left their house on the small atoll of Funafuti, the capital of Tuvalu, and moved to Auckland, New Zealand. The contrast between their lives in these two places is striking. Beyond moving from an island of roughly 5,000 to a city of 1.1 million [1, 2], Vaioleta and her family now found themselves crammed into a small barn, where they remained for two years with 20 other Tuvaluan families, all of whom had come to New Zealand on temporary visitors' visas that they intended to overstay. For some, it might be 15 years before they were granted permanent residence, and thus 15 years without access to affordable health care or social services. Others were deported back to Tuvalu, their hopes for a better future in New Zealand forever destroyed. Vaioleta's story mirrors that of many immigrants worldwide. However, what distinguishes the now 3,500 Tuvaluans living in New Zealand from other migrants is the growing awareness that soon their country of origin might no longer exist, one of the first lost due to the effects of climate change [3]. Many Tuvaluans in Auckland know that they may never see their beloved islands again.

If the effects of climate change continue as predicted, physicians will soon be caring for a new generation of immigrants. Ethical principles such as the [physician's obligation to advocate](#) for patients' best interests and public health, respect for patient autonomy, and beneficence are intertwined in this complex issue and can guide how individual

physicians approach caring for populations affected by climate change, such as Tuvaluans. The stories and photographs in this article are drawn from the experience of the first author (JE), who lived in Tuvalu for two months in 2014 and in New Zealand for two months in 2017.

The Story of Tuvalu

Tuvalu is an island nation in the South Pacific of roughly 11,000 people divided into nine atolls [4], united by their ethnicity and language but each with their own distinct cultures and traditions. With the highest point around 16 feet above sea level [4], Tuvalu is eroding away under a rising ocean [5, 6].



Figure 2. *Funafuti from the Air.* Photo: Jordan Emont.

Already the [health effects of climate change](#) are visible in Tuvalu. The destruction of fresh groundwater in Funafuti has made it nearly impossible to grow the food staple, taro, in some places [7], leading to increased reliance on imported food. And in 2011, a severe drought—one of many increasingly severe weather events—precipitated an outbreak of diarrhea [8]. Every year, the islands are inundated by incrementally higher “king tides,” causing destruction and contamination of water resources [9]. For now, the effects are not severe enough to cause an exodus of the entire population from the islands, but the countdown has begun.

Where will Tuvaluans go? There is no consensus. New Zealand seems a likely destination given the already large Tuvaluan community living there. However, given their proximity,

Fiji and Australia remain possibilities; Fiji also currently hosts a large population of Tuvaluans who are living and studying there. Neither Tuvalu nor any foreign states have devised a comprehensive resettlement plan for Tuvaluans when that fateful day does arrive. The reality is that in the future, the Tuvaluan community is likely to be fragmented among many different countries.

Tuvaluan Immigrant Health Disparities in New Zealand

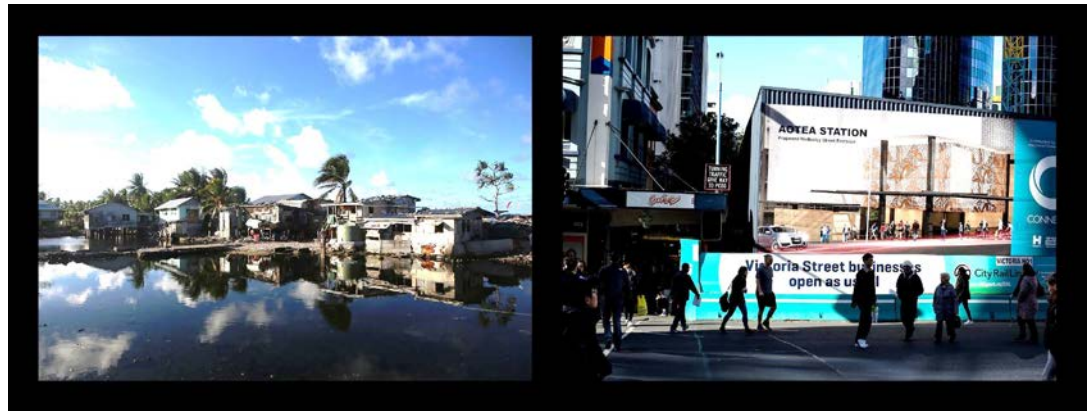


Figure 3. *The Contrast between Tuvalu and Auckland.* Photo: Jordan Emont.

Immigration to New Zealand presents several health problems that are exacerbated by social disparities. Like Vaoleta's family, many Tuvaluans when they arrive are immediately confronted with overcrowding, leading to the spread of tuberculosis and rheumatic fever, a notorious problem among Pacific Islanders in New Zealand [10]. In interviews the first author conducted with community members in June and July 2017, Tuvaluan immigrants reported that due to the high cost of food, their diet changed from mostly fish to one of significantly more chicken and rice, few fruits and vegetables (though slightly more than in Tuvalu due to increased availability), and many more processed and fast foods. In addition, they stated that portion sizes in New Zealand are larger than in Tuvalu, possibly due to the more ready availability and better taste of food. This dietary change is not unique to Tuvaluan immigrants and, as a result, Pacific Islander immigrants have a significantly higher prevalence of obesity and diabetes compared to New Zealanders overall [11, 12]. Walking was common on the islands; in New Zealand, Tuvaluans reported that they must drive everywhere and that with the exception of periodic sports events organized by the community, their level of physical activity is low. These concerns are magnified by the fact that many immigrants find themselves unqualified for work outside of farms, leading to precarious month-to-month incomes as laborers [1].

Accessibility of health care also differs in the two countries. In Tuvalu, health care is provided free to patients either at small clinics on the outer islands or at the one hospital on Funafuti, the main island. However, throughout Tuvalu, medical facilities function as

urgent care clinics, and there is no significant primary care presence. Similarly, in New Zealand, Tuvaluans with permanent residence interviewed by the first author reported generally only seeking health care when a problem arises. Unlike in Tuvalu, however, in New Zealand there is a need for an appointment and a copay to see primary care physicians for both residents and nonresidents. Therefore, many Tuvaluan immigrants reported either delaying care until illness sequelae become worse or presenting to emergency rooms for free care. Awareness among immigrants of the value of primary care, chronic disease management, and prevention are largely absent—leaving aside the several hundred nonresident “visa overstayers” who pay up to 8 times more for health care than registered patients and are even more removed from the health care system [13]. The end result of social disparities in diet, health care access, health literacy, and employment opportunities is significant health inequalities. Among other differences, Pacific Islanders have a roughly five-year shorter life expectancy compared to New Zealanders overall [11].

Physician advocacy can play a significant role in supporting solutions to toxic [social determinants of health](#) and in improving health literacy in this vulnerable population. A good example is a recent campaign by New Zealand Pacific clinics—primary care clinics that specifically serve Pacific Islanders—to raise awareness about the danger of rheumatic fever [14]. Through the use of consistent, translated, and culturally appropriate messaging, a number of the Tuvaluans and clinicians interviewed by the first author reported that this campaign had changed how many Pacific Islanders viewed not only rheumatic fever but also the role of primary care more generally in promoting wellness. If accessible, the health care Tuvaluans receive in New Zealand is superior to that in Tuvalu, making not only primary care but also early detection and treatment for serious conditions like cancer and chronic kidney disease finally possible.



Figure 4. *The Faces of Tuvaluans in Auckland.* Photo: Jordan Emont.

Moving to New Zealand provides benefits for Tuvaluans besides improved health education and superior health care quality. If they are able to leave their homeland in a planned manner, they can optimize preservation of their economic, social, and cultural assets. Given the limited employment opportunities in Tuvalu, many Tuvaluans who immigrate are able to find work for the first time in their lives, even if those jobs are primarily on farms. In addition, Tuvaluan culture in Auckland is robust, with community gatherings occurring near daily. These events provide opportunities to speak the native language, wear island attire, share a communal song and dance called a *fatele*, and feast on many tables-worth of traditional dishes.

The Ethics of Climate Change-Induced Relocation



Figure 5. *Tuvaluan High Tide.* Photo: Jordan Emont.

The problem with Tuvalu, as with any other community faced with climate change relocation, is that it is a disaster in slow motion. The insidious nature of the effects of climate change makes it possible for life to persist on the islands for a long time before it suddenly becomes inhospitable, requiring emergent evacuation. The ethics of relocation is complex because we must account for affected persons' varying means and knowledge about effects of climate change and how these factors inform the motivation of some to leave their homeland. Although many who choose to remain in Tuvalu do so out of pride in their land and culture, some do so because they lack the money to pay for immigration or lack awareness of the fact that the sea will overtake the island. While

individuals have the right to remain in their homeland if they wish, optimally this decision should be well informed regarding the risks and benefits of staying.

One hurdle to overcome in Tuvaluans' climate change relocation is getting the Tuvaluan government to understand its role in facilitating immigration. Many Tuvaluan immigrants to New Zealand who came using a visa program known as the Pacific Access Category Scheme reported in interviews with the first author that they received no information or aid from the government about immigration options. Some even described loved ones whose applications were denied due to misinformation or errors on the part of the government. One interviewed immigrant who was formerly a Tuvalu government employee described the Tuvalu government as quelling concerns over and education about climate change out of a fear that a mass exodus would trigger a decrease in international aid, a major source of government revenue [15].

What, then, is the role of physicians and the international community in mitigating knowledge and opportunity gaps? Since the majority of Tuvaluans currently remain in Tuvalu, the focus of physicians both in Tuvalu and abroad must be on the health risks facing the island population as climate change worsens. In particular, Tuvaluan medical practitioners can play a crucial role in educating those in Tuvalu who are less aware of the effects of climate change about the risks and benefits of staying in the country as the seas rise. These education and advocacy efforts might place physicians in the role of mediator between the government and those who might wish to leave Tuvalu. By assuming this role, physicians can help bridge these opposing sides and help foster the self-determination of the Tuvaluan people, allowing them to decide for themselves their future course as a nation. On the contrary, a paternalistic approach that either "protects" Tuvaluans from knowledge of impending climate disaster or imposes "benevolent" relocation, forced relocation, or refugee status poses substantial ethical challenges.

Effective international interventions will depend on an intimate knowledge of Tuvaluan culture, language, and norms. Tuvaluans are proud of their heritage and culture, and any perceived unwanted intrusion into their close community by foreigners would only be met with apathy.

Conclusion

Ethical issues surrounding climate change relocation are complex and varied. Physicians can play many roles, including mediation between Tuvaluans and policymakers and addressing health disparities resulting from relocation. Fulfilling such roles will require physicians to become educated about the health risks of climate change and associated relocation. Tuvaluans are only one of many communities who will be displaced by the effects of climate change. Understanding the culture and history of such communities and the socioeconomic challenges of immigration will be crucial in bettering the lives of those who will bear the greatest burden of climate change. As physicians grapple with

the social and health concerns of these new populations, the case of Tuvaluan immigration provides lessons regarding adapting care delivery to different levels of health literacy and health-seeking behaviors, modifying messaging to be culturally and linguistically appropriate, and expressing structural competency in caring for populations facing climate change-induced immigration and social and health disparities in a new country.



Figure 6. *Vaioleta Visits Her First New Zealand Home.* Photo: Jordan Emont.

When future Tuvaluan migrants arrive in New Zealand, some will experience journeys similar to that of Vaioleta. As she visited the now abandoned and dilapidated farm where she spent the first two years of her life in Auckland, she reflected that, overall, the move to New Zealand had been positive for her. She is now 24 years old, has studied social work at the university, and works at a local health clinic that serves Pacific Islanders in Auckland. She is married and is involved in her Tuvaluan church youth group in Auckland. She is Tuvaluan to the core, even identifying herself first as Tuvaluan, despite growing up most of her life in New Zealand and speaking with a New Zealand accent. When asked about what it means to be a Tuvaluan when the islands disappear, she said “Tuvalu is in my heart, and I’ll always have that.” Tuvaluan culture in New Zealand appears to be not only existing but thriving, as Tuvaluans are coming to terms with how to exist in a future where being Tuvaluan is different than being from Tuvalu. Although nostalgia for their former island life is palpable, very few regret moving, but all do worry about those still at home who have not yet left. Physicians are tasked with helping to ensure that the health of Tuvaluans and the community of Tuvalu outlasts the islands themselves.

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SECOND THOUGHTS

The Importance of Physician Climate Advocacy in the Face of Political Denial

Andrew Jameton, PhD

Abstract

Most physicians accept the general scientific discoveries about anthropogenic global warming and its dangers. Occasional denial by individual physicians of climate change can be readily answered by reference to the scientific consensus. But widespread, organized, political denial of climate change is hazardous to physicians' advocacy for an effective public health and health care response to climate change. This article assumes that physician climate advocacy is ethical and celebrates the many forms of health climate advocacy already under way. It concludes by drawing attention to measures that can scale up and strengthen the health care system's organized response to growing climate health hazards.

Introduction

During the last half century and even before, the globe has been warming rapidly while climate science has grown in precision and evidentiary support [1-5]. Meanwhile, physicians and health care organizations have been advocating policies to respond to climate change. However, there remain some clinicians who deny the science and consequential implications of climate change, which raises questions about how to handle climate denial by physicians and others. I first outline some issues in identifying climate denial and responding to it. I then examine and celebrate climate advocacy by physicians. A third section identifies a type of denial—"political denial"—inimical to progress in mitigating climate change. Finally, I note a few action items for strengthening health care climate advocacy and response.

Climate Change Denial

The main conclusions of scientific climate theory and observation are straightforward [6-9]:

1. Average global atmospheric, ocean, and soil temperatures are rising rapidly.
2. This warming is almost entirely attributable to human activity.
3. As emissions continue, rising temperatures are causing increasingly widespread and harmful consequences. Among the consequences that have been identified and attributed to climate change are: ocean level rise and acidification, strong storms, floods, epic excessive heat events, drought and famine, forest fires,

spreading vectors and diseases, human and other migration, armed conflicts, governance crises, and species extinctions [10-19]. Climate and health disasters in recent years show that health consequences are significant and growing [11, 17, 18].

Climate skeptics and denialists claim that at least one of the three elements of the scientific consensus is false. Very few still claim that temperatures are not rising [20]. A few others deny that science proves that temperatures will continue to rise. Others understand that the warming is real but think it has not been shown to have a significant anthropogenic component. Still others admit that scientists are right on both points but claim that the warming is inconsequential, in the balance beneficial, easily manageable, or unfixable [21, 22]. I don't count among denialists those who hold that it is unreasonable to try to do much about climate change at present because our energies should be devoted to more immediate priorities including social justice and international poverty [23]. Similarly, some think that continued economic growth will solve the problem and that environmental harms far in the future should not be regarded as significant now. Such arguments have been refuted [24-27], but they go beyond the science of climate change.

Are there denialists among physicians? The George Mason University Center for Climate Change Communication 2014 and 2015 surveys of physicians in three national medical organizations showed that most physicians accept all three consensual points about climate change; few physicians confidently deny elements of climate science [28]. Notably, one such denialist was Michael Crichton [29]. The *Journal of American Physicians and Surgeons* published a notorious denialist article by four nonmedical scientists that was widely circulated [30]. When *American Family Physician* published an article on [physician climate communication with patients](#) [31], several physicians replied with fierce denial [32-36]. One physician leads organizations that have posted denialist materials [37]. Several physician denialists are named on websites [22, 38, 39].

Since most physicians accept the scientific consensus and medicine is a scientific profession, it is not difficult to reply to deniers when addressing medical audiences. In my experience, physician denial of the third conclusion of climate science is rare. Once the first two points are grasped—that warming is occurring and is manmade—the connections to health and welfare follow readily. For those who assert skepticism, probably all that is needed is to remind the audience that the consensus is well established and has only increased over the decades [2, 3, 40-42]. It might also be useful to compare the functions of skepticism in medical practice with skepticism regarding climate science. Imbued with their everyday need to consider nuanced human bodily, social, and moral complexities when treating individual patients, some clinicians and medical educators maintain a spirit of doubt and uncertainty in clinical reasoning and evidence [43-46]. They might then transfer their habitual skepticism to climate science. But the main points of climate science are based on fundamental thermodynamic and

geophysical principles and supported by a vast body of evidence from many scientific disciplines [1, 7]. Weather forecasting is analogous to cancer survival prediction in that prediction is uncertain for a given scenario [47, 48], but the three main points of climate science listed above, much like some of the basics of physiology, describe reliable categories of evidence [2, 7].

As far as the ethics of denial goes, a personal reaction of denial by individual physicians, if transient, is ethically unproblematic. Such a reaction warrants compassion rather than criticism, because the three points of climate science constitute very bad news indeed [4, 49-52]. Physicians, like patients, might react to bad news with denial. Later, we move on through other psychological stages toward acceptance and hope [53, 54]. There remains, however, a dangerous form of denial that I call here political denial. Before discussing it, I outline the good news about medical [advocacy for climate change mitigation](#).

Medical Advocacy

The health professions have been proactive regarding climate change since 1989 [55, 56]. The American Medical Association (AMA) issued a 2008 statement, "Global Climate Change and Human Health," supporting climate science; it recommends research regarding health impacts of climate change, climate education in medical school curricula, physician policy advocacy, public and patient education, role modeling, and cooperation with public health agencies and officials [57]. In the decade since, the World Medical Association, various medical specialty organizations, and others have made statements underlining the urgent need to reduce fossil fuel consumption, to switch to alternate energy sources, and to take additional climate change mitigation steps [58-68]. Activist health professional organizations, such as Physicians for Social Responsibility, the Medical Society Consortium on Climate and Health, the Center for Climate Change and Health, Health Care Without Harm, and others [69-76] are advocating for urgent mitigation of what the *Lancet* and University College London Institute for Global Health Commission termed "the biggest global health threat of the 21st century" [77].

Prominent climate change mitigation activities undertaken by health professions organizations and others include:

- Promoting public and legislative support for international, national, and regional policies to mitigate climate change [57, 63-76, 78];
- Promoting a "co-benefits" approach, which promotes policy and lifestyle measures that improve public health while reducing carbon dioxide emissions [79-81];
- Promoting the use of the social costs of carbon in decisions to estimate climate change costs [81-84];
- Expanding medical school curricula on climate and global change [65, 85, 86];
- Promoting climate awareness among health professionals [76];

- [Greening health care facilities](#), especially with regard to energy efficiency, and switching from fossil fuels to alternative energy sources at these facilities [87-90];
- Preparing health care facilities to withstand extreme weather events [91].

Health professions climate advocacy organizations have developed an extensive body of expertise, evidence, measures, efficiencies, communication techniques, tools, designs, and the like. Any organization new to these issues will find ample resources for moving ahead [65, 92-95].

Political Denial of Climate Science

Political denial is the denial of climate science by business, government, and policy organizations for political and economic reasons. This denial is sometimes intended to hinder the development of alternative energy sources and to promote continuing use of fossil fuels, that is, to defend vested interests [21, 22, 96-101]. Sometimes these organizational views are associated with political and economic ideologies that require local, national, and international management regimes to solve problems [97, 100, 102, 103]. Some of these organizations have been aggressive in their attacks on scientists and in their propaganda efforts [103-108].

Also dangerous are the current US administration's moves to close down government climate science research programs and remove posted evidence [109-112]. Some recent high-level cabinet appointees are deniers (and among them the physician Ben Carson) [113]. This process echoes George Orwell's *1984* dystopia, which featured the "memory hole" as a major tool for destroying information to maintain political oppression [114, 115]. These Orwellian practices, together with the president's announced plan to withdraw the US from the United Nations 2015 Paris climate change mitigation agreement [116-118], constitute a highly dangerous political configuration. Since climate change mitigation and adaptation are urgently needed, and failure to act is likely to kill millions of people over the next decades, some term current US climate policy a "crime against humanity" [119].

Political denial threatens the commitment of health professionals to widen and strengthen their advocacy because:

- Administrators and legislators are more likely to avoid mentioning climate change and to withhold support from policies to prepare for and mitigate climate change.
- Health care advocates, administrators, lobbyists, and fund-raisers who promote improvements in access, funding, and public resources for health care are less likely to dilute the immediacy of their primary message with long-term climate concerns [120].
- Preparations for the climate disasters ahead require foresight and investment. If an agency denies climate change, it can allow [disaster preparation](#) to slide. When

the disaster comes, administrators can say, “Who knew?” Denial thus prepares the irresponsible to shrug off blame [36, 121].

More Work to Do

There is so much research and advocacy regarding climate and health that it is impossible for anyone to keep track of it all. One might then ask, If health care professionals are committed to advocating for mitigating and adapting to climate change, why does more need to be done? Unfortunately, the high level of activism among health professionals may foster unwarranted optimism.

For all the efforts of activists globally, business and government efforts are far from on track to achieve sufficient emission reductions [122-124]. Moreover, despite the good examples and leadership of some health care systems [86, 125, 126], the vast majority of health care systems have a long way to go to implement similar policies [127]. Bringing good ideas up to scale is challenging. And when challenging measures are needed, denial takes its toll by weakening our resolve [21, 99].

What more needs to be done? Here are a few concrete suggestions:

- If they have not done so already, the academic accrediting and examining agencies can review medical curricula for climate content.
- Hospitals and clinics can examine the range of their offerings to emphasize therapies that have the best ratio of patient benefit to environmental and climate cost. They can also begin to eliminate environmentally costly therapies with significant side effects, controversial efficacy, or overly wide and unproven indications [128-133].
- Physicians who wish to lead as role models can move into smaller quarters, live nearer work, and bicycle or walk to work [57].
- Those in health care philosophy and ethics can connect and harmonize principles of environmental ethics with those of health care ethics [134-137].
- Associations can hold more virtual national meetings (this includes ethics associations [138]) and, in any case, limit professional air travel [139].
- Innovative research can engage in precautionary prior evaluation of its likely environmental impact once scaled up to widespread use [140].

The AMA, like other medical associations, can devote more attention to promoting climate change mitigation. The AMA should appoint at least one climate sustainability specialist to coordinate work on scaling up the health care system’s response to climate change. Its sustainability division could include climate change in its existing programs on practice sustainability and physician satisfaction. It could advocate reducing environmental, material, and energy costs in specifying its responsibilities to promote scientific knowledge, competent practice, and public health improvement as expressed in its *Code of Medical Ethics* [141]. And it could cooperate regionally, nationally, and locally with other appropriate medical professional organizations in devoting resources to

climate change mitigation advocacy.

Political denial creates obstacles, but political winds shift over time while climate change is here to stay. Physicians should remain hopeful about fulfilling their strong ethical obligation to address public health risks [142-144]. There is much good work under way, and exciting endeavors remain ahead for those concerned about the health hazards of climate change [145, 146].

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