

Reproductive medicine in the face of climate change: a call for prevention through leadership

Leah Martin, B.S.,^{a,b} Yu Zhang, B.A.,^{a,b} Vicente Mustieles, Ph.D.,^{c,d,e} Irene Souter, M.D.,^f John Petrozza, M.D.,^f and Carmen Messerlian, Ph.D.^{a,b,f}

^a Department of Environmental Health, Harvard T.H. Chan School of Public Health, Boston, Massachusetts; ^b Department of Epidemiology, Harvard T.H. Chan School of Public Health, Boston, Massachusetts; ^c University of Granada, Center for Biomedical Research, Granada, Spain; ^d Instituto de Investigación Biosanitaria de Granada, Granada, Spain; ^e Consortium for Biomedical Research in Epidemiology and Public Health, Granada, Spain; ^f Department of Obstetrics and Gynecology, Massachusetts General Hospital Fertility Center, Boston, Massachusetts

Climate change has led to a multitude of ecological disruptions and downstream reproductive health consequences that impair our reproductive capacity and, in turn, harm the health and survival of future generations. Atmospheric changes, driven by anthropogenic emissions, expose global populations to droughts, heat waves, rising sea levels, and extreme weather events—posing major threats to public health and exacerbating environmental health disparities. Existing evidence demonstrates the potential for climate-driven events to impact reproductive health outcomes, yet very few studies have explored this relationship. Recently, the *American Society for Reproductive Medicine*, the *American College of Obstetricians and Gynecologists*, and the *International Federation of Gynecology and Obstetrics* released position statements regarding reproductive health and environmental exposures. Unfortunately, such initiatives have yielded little action within the health care system. To address this stagnation, health care workers must meld research findings into actionable preventive medicine strategies and transition to a more action-oriented approach to address the climate crisis. The objective of this article is to elucidate the urgency of the climate crisis in relation to reproductive health and push the health care workers to recognize their intrinsic opportunity as leaders in climate action at local, state, national, and international levels. We call on health care organizations and health care workers to leverage their inherent positions as climate action leaders to increase climate resilience and mitigate climate-related adverse reproductive health outcomes. (*Fertil Steril*® 2022;118:239–46. ©2022 by American Society for Reproductive Medicine.)

Key Words: Environmental health, reproductive health, climate change, climate action



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Climate change has impacted all facets of life on the earth. As our environment evolves at an unprecedented rate, our ability as a species to adapt to these changes has been universally compromised. The most precious and sensitive markers of human evolution include our reproductive capacity and the health and development of our offspring. Widespread population exposure to environmental pollutants and changing climate condi-

tions, including drought, floods, heat waves, and extreme weather events, coupled with our limited understanding of the impact on human reproductive health make this a critical area of research and clinical care with significant public health implications. However, we are also living in a time wherein technology is evolving rapidly, and our ability to study and identify the effects of our changing climate on reproductive health is unparalleled.

There is a tremendous opportunity to leverage knowledge and information to prevent and mitigate harm; to advocate for change at local, national, and international levels; and to urge our leaders, professional bodies, and institutions to act in the face of the growing climate crisis – a crisis that has clear and measurable consequences on the health and wellbeing of women, children, and families. What is more, the burden of harm disproportionately impacts women in ways that exacerbate the existing conditions – the risks and harms affect the marginalized, the vulnerable, and the poor within a given population more often, more deeply, and much longer.

Environmental justice issues are front and center in the climate crisis, and nowhere do we see these disparities intensify more than

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Supported by a grant (R01ES031657) from the National Institute of Environmental Health Sciences. Correspondence: Carmen Messerlian, Ph.D., Department of Environmental Health, Harvard T.H. Chan School of Public Health Building 1, 1310C, 665 Huntington Ave, Boston, Massachusetts 02115 (E-mail: cmesser@hsph.harvard.edu).

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those in reproductive health and the health and survival of our offspring.

The American Society for Reproductive Medicine (ASRM), the American College of Obstetricians and Gynecologists (ACOG), and the International Federation of Gynecology and Obstetrics (FIGO) recently published position statements on climate change (1–3). This is a first step in recognizing the significant impact that climate change has on reproductive medicine and the health of current and future generations. But we need more – more awareness, more attention, more knowledge, more evidence, and most importantly more resources infused into these climate change issues so we can move beyond being problem focused and descriptive, to action-oriented and solution driven. Herein, we illustrate stark examples to stir the urgency of climate action and provide additional imperatives as well as directions moving toward prevention of climate-related adverse health effects through leadership and clinical care.

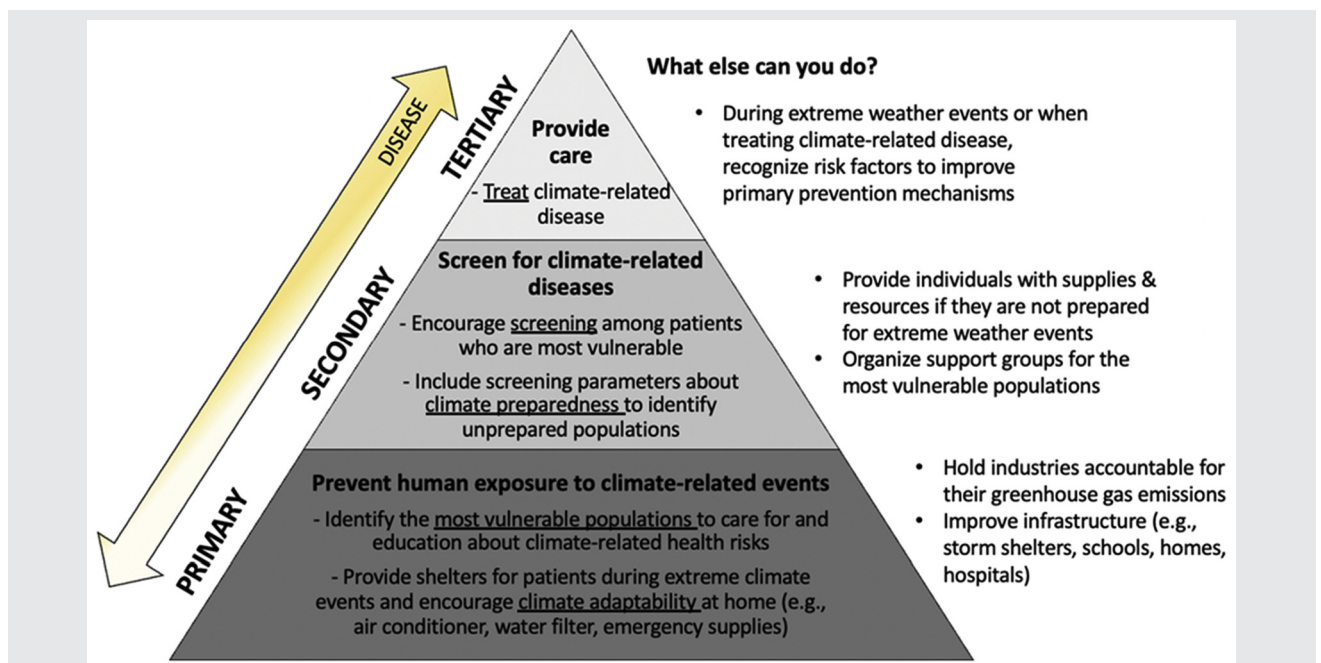
PREVENTION STRATEGIES TO SAFEGUARD REPRODUCTIVE HEALTH AND ADDRESS THE CLIMATE CRISIS

Fine tuning proven preventive medicine strategies to develop a multifaceted approach that expands on traditional methods and encapsulates the much evolving climate change related health concerns is a daunting but essential task to shift clinical practices to an action-oriented and solution-driven approach. Given that some of the consequences of climate change are difficult to precisely anticipate and that there

are likely unidentified penalties, we propose a loose climate-oriented framework that combines traditional high-risk preventive medicine approach with the seminal work by Rose et al. (4), *The Strategies of Preventive Medicine*, for future expansion (4). Traditional high-risk preventive medicine approach focuses on the individual characteristics of those at the greatest risk and includes primary, secondary, and tertiary levels, to address climate-related health outcomes before and after they occur (5). The work by Rose et al. (4) argues that prevention strategies that target population characteristics and alter lifestyle behavior are more effective and provide a long-term protection compared with traditional frameworks. Still, primary, secondary, and tertiary measures are easier to implement than population-based approaches and remain a reasonable framework to steer population-based approaches. Implementing population-based strategies is not always feasible, but given the widespread health effects of climate change, targeting individual characteristics alone is insufficient. Using this innovative approach, more soon-to-be high-risk populations, including pregnant women, developing fetus, and disadvantaged groups, will be protected from climate-driven events. The aim of this multidimensional prevention framework is to provide a foundation for the health care workers in reproductive medicine that can be used in their clinical practices and take action to protect their communities (Fig. 1).

Under the high-risk preventive medicine framework, primary prevention includes identifying vulnerable populations and providing resources to educate groups about the risk factors for potential adverse health outcomes which are related

FIGURE 1



Framework for preventive reproductive medicine with action areas.

Martin. Climate change and reproductive medicine. Fertil Steril 2022.

to climate change. Primary prevention is foundational to building climate resilience and includes creating initiatives and pushing policies to enhance infrastructure, support restoration projects, and increase emergency services during extreme weather events. Secondary prevention aims to reduce the health impacts of climate change through early disease detection and screening, such as screening for gestational hypertension or other risk factors that can increase the likelihood of heat stroke during heat waves. At this stage, screening methods should be developed to measure climate preparedness and to gauge which groups (vulnerable) lack vital resources and/or information if an extreme weather event occurs. Lastly, if a diagnosis of a climate-related disease occurs or if homes are damaged beyond repair, tertiary prevention includes providing care to these individuals with the belief of slowing disease progression or financial catastrophe and reducing the impact of such an event on their quality of life. Typically, primary, secondary, and tertiary prevention are small scale actions that target the highest risk groups; however, as temperatures continue to rise and the incidence of extreme weather events increase in frequency and strength, the most vulnerable groups will likely become interwoven with the general population and few, if any, individuals will be considered out of harm's way.

To cope with the overwhelming number of individuals at risk or that are anticipated to be at risk as climate change persists, a population-based approach that expands on the high-risk approach is necessary. Rose et al. (4) consider the most effective preventive medicine strategies to be those that incorporate population characteristics that are essential determinants of the societal health (i.e., small changes in a total population produce a greater net benefit than large alterations in a small subset of the population) (4). The preventive medicine framework by Rose et al. (4) is particularly useful when considering reproductive health and climate change because of rapidly evolving global health consequences and downstream impacts that remain unknown and difficult to mitigate, especially the effects that impact the life course. Population-based approaches that expand on primary prevention could include improving green space, which reduces the heat island effect, increases mental health, and air quality; transitioning to electric appliances and vehicles; improving infrastructure and shelters; consuming organic foods; improving water filtration, and various other community and lifestyle alterations. Secondary and tertiary-styled population-based approaches may include encouraging patients to increase their personal climate preparedness and demanding policy changes to further enhance population-based climate preparedness and resilience (e.g., mapping or modeling environmental pollutants, increasing efforts to survey homes without air conditioning before heat waves, and/or monitoring medical records to track the progression of vector-borne illnesses). Because the climate change disproportionately impacts poor populations, clinicians play a key role in implementing nearsighted strategies that protect high-risk populations and farsighted population-based approaches to safeguard human health and our reproductive capacity and future well-being.

AREAS TO TARGET: CLIMATE CHANGE ASSOCIATED ADVERSE REPRODUCTIVE HEALTH OUTCOMES

Climate-driven events, including increased temperatures, air pollution (greenhouse gases), water and food insecurity, environmental toxicants, and vector-borne illnesses, are anticipated to have lasting impacts on reproductive health, especially among pregnant women and the developing fetus—making climate change an issue that clinicians should immediately heed. In their latest report, the *Intergovernmental Panel on Climate Change* affirmed numerous looming public health consequences if global warming exceeds the 1.5 °C climate model (6). Insufficient adaptability to the rising temperatures will lead to many adverse health outcomes, the most extreme being death. Across 297 counties in the United States (representative of approximately 61% of the United States), the attributable number of annual heat-related deaths was estimated to be 5,608 (95% CI: 4,748–6,291) (7). The *US Global Change Research Program* posits that sensitivity to heat disparities and chronic illnesses, among other risk factors, will result in tens of thousands of premature deaths during the summer months alone (8). Gradual increases in average temperatures cause heat-related illness (e.g., heat exhaustion and heat stroke), in addition to drowning, increased response times to accidents, increased transmission of food or waterborne pathogens, decomposition of medications, barriers to ambulatory care, and harmful algal blooms that also impact health. Urban heat islands and warmer temperatures that facilitate the expansion of vector-borne illnesses further exacerbate the health effects of global warming.

Although global populations remain at risk for adverse health effects from rising temperatures, pregnant women, children, older people, individuals with preexisting illnesses, and lower socioeconomic communities are particularly vulnerable. For pregnant women with compromised thermoregulation, heat waves and rising temperatures may precipitate premature labor and adverse birth outcomes (e.g., still births, low birthweight) (9,10). Additional reproductive health consequences include disruption of spermatogenesis, oocyte development and maturation, premature embryonic development, and other biological factors that impact the reproductive health for both sexes (11). Wildfires and air pollution (PM_{2.5}) are also a concern with the rising temperatures because associations between the toxicity of wildfires and increased odds of preterm birth, reduced birth weight, and other adverse birth outcomes (12,13) have been postulated. Clarifying potential windows of susceptibility is a crucial area for research to protect reproductive health, maternal health, and fetal development, especially because of the nearly inescapable feature of heat and air pollution. Given these consequences, health care workers in the field of reproductive medicine must take action to increase health care services, especially during heat waves and wildfire events as well as ensure that patients have cool or air-conditioned shelters and access to clean air.

Aside from the direct health effects of global warming, increased temperatures contribute to deglaciation and, in

turn, sea level rise—a pressing public health concern. The *2022 Sea Level Rise Technical Report by the National Oceanic and Atmospheric Administration* predicted that coastal sea levels in the United States will rise an average of 10–12 inches, over the next 30 years (14). This increase will cause major flooding, increased storm surge distances, disruptions in the hydrological cycles, population displacement, and economic losses (billions of dollars) among other downstream consequences in several regions with unfavorable landscapes, unprotected infrastructure, and unprepared communities. Although there are immediate dangers during storm surges, such as drowning or injury, sea level rise can foment excess dampness in homes and structures, which facilitates microbial growth and increased risk of respiratory disease. Several sewage systems are also unprepared for increased water volumes and are prone to overflowing, resulting in contaminated drinking water and intensification of waterborne illnesses. Water incursion has already impacted reproductive health around the globe. For example, pregnant women in Bangladesh who drank water with higher levels of salinity resulting from elevated saltwater concentrations (i.e., sea level rise) were more likely to experience gestational hypertension (15). To protect the reproductive health of coastal communities, health care workers need to support coastal restoration, educate populations in flood zones or other perilous areas, increase access to filtered water, prepare emergency services, and advocate for further reduction in greenhouse gas emissions.

In addition to water quality, several related ecosystems and natural resources of economic importance (e.g., fisheries, agriculture) that are paramount to public health are being threatened by climate change. According to the US Department of Agriculture, crop quality, food availability, and overall agricultural productivity are expected to decrease with warmer temperatures and extreme weather (16). Food insecurity contributes to the global burden of disease (e.g., malnutrition, diabetes, obesity, heart disease), but current climate mitigation policies may also intensify nutritional disparities among the most vulnerable, low-income communities in Africa and Asia (17). In these regions, and in general, food insecurity and nutritional deficiencies lead to several adverse reproductive health outcomes including increased gestational hypertension, preterm birth, and pre-eclampsia, in addition to poor fetal development and subpar birth outcomes (18). Although potential solutions remain controversial and sustainable agricultural practices prove politically elusive (e.g., water conservation, crop rotation), the imminent agricultural impacts of climate change will endure. In preparation for the expansion of food insecurity, health care workers need to support sustainable agricultural practices, promote the consumption of organic produce and further advancement of agricultural research (e.g., improved fumigation strategies and resilient crop management techniques), and demand further action to secure access to food services for pregnant women, the developing fetus, infants, and others that remain vulnerable to food insecurity.

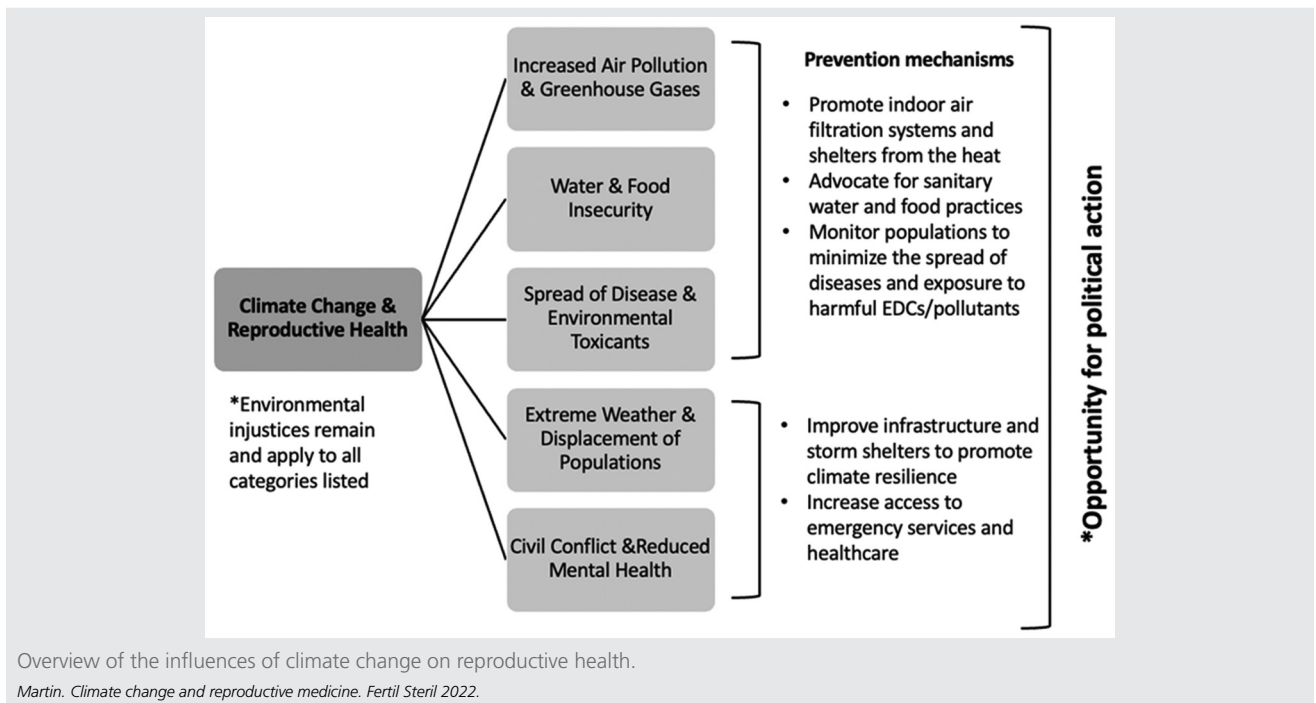
When natural resources that economies and populations rely on are threatened, population migration and civil conflict often ensues, creating violent, stressful environments that

result in negative mental health outcomes, such as depression, or even death. In addition to poor mental health, and according to ACOG, women face disproportionate threats during conflict, including sexual violence, lack of reproductive control, and negative obstetric outcomes that have lasting mental health impacts. In addition, women also face disproportionate risks and abuse during conflict and displacement as noted by FIGO (19). Specific to climate change, conflict is often driven by water and/or crop shortages within or between geographic regions. Increased stress and poor mental health have been associated with several adverse reproductive health outcomes, including miscarriage and stillbirth—demonstrating the immense impact that climate conflict has on women's health (20,21). To minimize such stressors, clinicians in reproductive health will need enhanced mental health resources and provide shelters to protect women from violence. To minimize future conflict, health care workers must become leaders to facilitate alliances, cooperation, and movements to establish food and water security among the local, national, and global populations.

Ecological disruption is partially driven by toxic chemical pollution, including the burning of fossil fuels and wildfires. Some pollutants are synthetic, such as endocrine-disrupting chemicals that leach from plastic products and directly impair reproductive health, whereas others are bacterium or viruses, including vector-borne illnesses that can adapt to temperature fluctuations and enter newfound regions to infect naïve populations (e.g., Zika, malaria). To address synthetic chemicals, FIGO established a global Working Group focused on *reproductive and developmental environmental health*, which aims to mitigate toxic exposures among women (1). Additionally, ACOG and ASRM joined together to petition for expanded protection against environmental toxicants. Health care workers in reproductive medicine need to exercise the *precautionary principal*, which suggests that there is a social responsibility to protect human health if there is scientific evidence of a plausible risk and inform patients about potentially harmful consumer products and pollutants to minimize personal exposure through inhalation, dermal absorption, or consumption of these toxicants (Fig. 2).

One of the most infrequently mentioned sources of environmental toxicants are the noxious spoils emanating from thawing permafrost. Permafrost is any ground that has been continually frozen for a minimum of two years. Soils frozen for thousands of years since the *Pleistocene epoch* cover nearly one-quarter of the Northern Hemisphere, including Alaska, Siberia, the Canadian Arctic, and Tibetan Plateau. Researchers estimate permafrost stores of approximately 1.5 trillion metric tons of organic carbon and methane (22). The gradual release of these gases has the potential to accelerate climate change models exponentially. Although permafrost is in relatively isolated regions, it is expected to contribute to sea level rise and water contamination (i.e., trace metal toxins such as nickel and manganese) that would further impact global populations. Additionally, relic permafrost is anticipated to store anthrax, undiscovered viruses, antibiotic resistant bacteria, and other historical public health threats, such as smallpox and (potentially) the Spanish flu virus. Although the direct impacts of thawing permafrost on public

FIGURE 2



health are still being studied, thawing permafrost undoubtedly contributes to the rising levels of greenhouse gases (i.e., carbon dioxide and methane) and exacerbates existing climate-driven public health concerns. Thawing permafrost is just one example of an emerging health concern that demonstrates the ever-evolving landscape of climate change consequences that clinicians must be aware of and continue to research.

PERSISTENT HEALTH DISPARITIES TO INCORPORATE IN PREVENTIVE MEDICINE AND POLICY ACTION

Although some populations are undoubtedly braving the unequal consequences of climate change, ecological disruptions have pervasive effects that will have lasting impacts on the global climates, economies, and populations regardless of economic stability or social class. Despite the global impacts of climate change, it is not a mystery that some vulnerable populations will disproportionately suffer, such as the disadvantaged ethnic groups, populations living in poverty, and women (23). In a 2019 study by Song et al. (24), a high household income was shown to be associated with greater individual carbon footprint. Conversely, lower income populations tend to be the least responsible for climate change, yet suffered the most from its harms, and had fewer resources to withstand extreme weather events and climate emergencies (25). For example, people living in poverty suffer more from heat waves because they cannot afford air conditioning and lack access to cool shelters. These disadvantaged groups are often already at elevated risks for adverse reproductive health

because of historic trauma and stress, reduced health care access, and indigent living conditions. Climate change exacerbates health disparities for individuals predisposed to disease—contributing to lasting generational detriments.

As health care workers in reproductive medicine, we need to first acknowledge that climate change is associated with adverse health outcomes and that injustice exists. We must then recognize that climate change exacerbates health disparities in which certain vulnerable groups are at higher health risk whereas others have low access to resources and resilience to cope with the consequences. In daily practice, we should be aware of climate injustices and engage in activities to mitigate it, such as increasing health care access in poor neighborhoods, promoting infrastructure bills or other efforts to improve climate resilience among these populations, and educating medical professions, especially younger generations, about climate injustice through additional medical school or training curriculum to raise awareness of this issue (26,27). In clinical settings, when treating patients impacted by climate emergencies or disasters, medical workers need to be aware of the potential trauma entailed by climate emergencies as well as the historic trauma because of the long-existing social injustices and civil conflict. Ultimately, additional support and care need to be provided to vulnerable individuals who suffer from historic injustices.

ADVOCACY AT THE LOCAL, STATE, NATIONAL, AND INTERNATIONAL LEVELS

Following in the footsteps of FIGO, ACOG, and ASRM, we urge clinicians, especially those that support women's health

services, to sound the alarm and step forward as leaders to address the climate crisis and protect the reproductive health of those who remain the most vulnerable (pregnant women and the developing fetus) and those that face disproportionate effects to safeguard current and future generations (1–3). Although some clinicians are aware of climate change and some potential health effects, little action has been taken by the health care workers to mitigate these impending consequences. The health care system has seemingly left environmental issues for politicians and ecologists or other natural scientist to control and debate. Outside of the health care system, individuals can have a significant impact on local movements by supporting local environmental groups (e.g., trail restoration groups and water quality groups), reducing their personal carbon footprint, limiting their waste production, including wastewater, and sustainably sourcing products or produce that are organic (Fig. 3). At the state and national level, clinicians must petition for cleaner air and water (reduced pollution), in addition to promoting alliances to secure food and water resources which, in turn, decrease civil conflict.

Clinicians have the chance to serve as community leaders for climate preparedness by increasing emergency services and access to health care; demanding funds for improved infrastructure and storm shelters; spearheading survey efforts to identify populations that lack resources for climate adaptability; endorsing and purchasing products from sustainable companies, including organic produce, to limit pesticides for their clinic; and other potential actions. Beyond the national level, health care workers remain respected role models and should leverage their societal positions to push for international change. Whether international action includes advising global partnerships, voicing public health concerns, supporting movements to minimize greenhouse gas emissions or civil conflict, or demanding that waste management is sustainable and ethical, there are countless ways in which the health care workers in reproductive medicine can take action to foster a cleaner environment through preventive medicine strategies for the current and future populations. Lastly, additional research models and mapping to better anticipate climatic changes (i.e., extreme weather events) and research that focus on climate change and reproductive health need to be increased.

THE HEALTH CARE SYSTEM: PHYSICIANS' VOICE AND OPPORTUNITY TO INTERVENE

Although every individual can attempt to reduce their carbon footprint and engage in environmental movements, clinicians have the novel opportunity to become leaders in climate action and voice the urgency of the climate crisis on behalf of women's health and our reproductive capacity. Despite the existing groups, such as FIGO, additional obstetricians and gynecologists as well as other health care workers need to place pressure on the stakeholders and government organizations to mitigate climate change and the impending health effects that will undeniably impact global reproductive health. First, clinicians should consider their personal carbon footprint, including the care they provide, and then move on to

evaluate contributions from their community, state, country, and beyond. The health care sector contributes to nearly 4.4% of carbon dioxide emissions, globally, and further exacerbates the climate crisis with poor waste management and biohazard production (28). Although 4.4% of carbon dioxide emissions might seem insignificant, it is equivalent to roughly two gigatons of carbon dioxide a year and does not include other greenhouse gases or contributions from related industries (i.e., pharmaceutical, or biomedical companies). Within the health care system, physicians can voice their concerns and engage in public comment periods in courthouses to push policies that protect our environment and slow the progression of climate change (Fig. 3). Additionally, clinicians must push for climate change to be added to the curriculum to educate younger generations and adapt clinical practices to decelerate climate change.

Policies should be developed and publicly advertised to showcase climate preparedness. For example, in preparation for extreme weather events, contingency plans need to be formulated to protect embryos in in vitro fertilization clinics and reproductive health clinics. With these guidelines in place, pressure is then placed on competing clinics to increase their climate-oriented policies to protect embryos and reproductive health outcomes. Additionally, physicians can advise their patients to adapt lifestyle changes (e.g., consume organic foods, use public transit to increase exercise, join environmental groups to decrease stress and become engaged with the community, and other potential recommendations) and can lead by example by joining community groups and adapting a more sustainable lifestyle. At the local level, clinical research should be increased and funded to continue to study climate change and human health, with an emphasis on women's health and vulnerable racial/ethnic populations. Whether action is taken inside or outside of the health care system at the local, state, national, or international level, clinicians in reproductive medicine must recognize the strong connection between climate change and adverse reproductive health outcomes, urgently lobby for more stringent environmental policies to limit environmental exposures, protect communities seeking obstetric and gynecologic care through climate preparedness efforts, and continue to bring awareness to the climate crisis (29).

CONCLUSION AND CALL TO ACTION: ACOG, ASRM, FIGO, AND BEYOND

The ACOG, ASRM, and FIGO (and health care workers not directly associated with these organizations) should hold industries responsible for their carbon footprint and advocate for more sustainable practices (1–3). In all the position statements published by the ACOG, FIGO, and ASRM, policy, education, and advocacy were the cornerstones in their proposals to protect women's health from the climate crisis and further climate destabilization (1–3). These organizations, and likely others, view climate change as a global health emergency that requires immediate action. Yet, little action has been taken among health care workers to further these proposals. Thus, we suggest an innovative preventive medicine framework for clinicians to implement

FIGURE 3

Local	State	National	International
Action Areas - General Policies			
<ul style="list-style-type: none"> • Support local environmental groups and restoration projects • Reduce individual carbon footprint (e.g., take public transit, eat organic produce/less meat, electric cars and appliances, shop sustainably, recycle, and reduce personal waste) • Limit wastewater production 	<ul style="list-style-type: none"> • Regulate greenhouse gas emissions and reduce air pollution (PM_{2.5}) and ozone • Increase greenspace • Form alliances, support sustainable agriculture and water consumption to increase food/water security • Fund climate preparedness projects and improve infrastructure 	<ul style="list-style-type: none"> • Minimize health disparities by addressing food deserts, heat islands, and redlining • Regulate air pollution and hold large industries accountable • Demand increased healthcare services and protect communities from extreme weather events • Increase climate adaptability 	<ul style="list-style-type: none"> • Encourage global partnerships to minimize global warming (Paris Agreement) and pollution • Track waste management and demand sustainable disposal (and consumption) • Support movements that promote cooperation concerning natural resources to avoid conflict
Action Areas - Healthcare System			
<ul style="list-style-type: none"> • Encourage proper waste management and recycling • Increase public transit options to medical clinics • Limit biohazard production 	<ul style="list-style-type: none"> • Increase emergency services and shelters for extreme weather events • Advocate for policies (public comment periods) 	<ul style="list-style-type: none"> • Hold industries who contribute substantial greenhouse gas emissions and waste accountable • Increase healthcare access 	<ul style="list-style-type: none"> • Increase clinical awareness of climate-related diseases • Track the movement of climate-related diseases • Encourage global change

Examples of potential political actions (general and health care oriented).

Martin. *Climate change and reproductive medicine. Fertil Steril* 2022.

and take up leadership roles to increase awareness, research, policy action, and, most importantly, climate adaptability (including resilience and preparedness) at local, national, and global levels. However, for this framework to be successful, clinicians must engage in climate action, implement preventive medicine strategies, and learn to cooperate across sectors within and beyond the health care system to increase public awareness, decrease worsening inequalities, and pressure key stakeholders. It is incumbent on all health care workers in reproductive medicine to mitigate climate change and invest in the health of current and future generations that will inherit the burden of a significantly transformed climate.

National and international leaders were called on by the ACOG to regulate and decrease greenhouse gas emissions and promote a proactive approach; the potential for health care workers in reproductive health to fulfill these demands was overlooked. Every clinic and health care worker can initiate change at their own institutions and become community leaders. Health care workers must suggest solutions to control air pollution, water contamination, and other climate issues that remain a major threat to public health (30). Additionally, systems need to be developed to increase climate preparedness and prioritization of resources during extreme weather events. Instead of pointing fingers, pressure needs to be created on both ends of the issue to drive change and grassroots action. Meaning additional pressure needs to be placed on ACOG, FIGO, and ASRM to act and create a top-down

movement. Likewise, physicians must place upstream pressure on the clinics resistant to adopting sustainable practices and educate other health care workers or patients to generate a bottom-up force. As regions slowly become uninhabitable because of anthropogenic-driven climate change, we call on clinicians and reproductive health organizations (FIGO, ACOG, ASMR, and others) to take responsibility, become trailblazers, and demand more stringent policies to lessen the mortality and morbidity burden that will continue to intensify if ignored.



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REFERENCES

1. FIGO (International Federation Gynecology and Obstetrics). COVID-19 contraception and family planning. <https://www.figo.org/sites/default/files/2020-05/COVID%20contraception.pdf>.
2. The American College of Obstetricians and Gynecologists. Addressing climate change. Available at: <https://www.acog.org/clinical-information/policy-and-position-statements/position-statements/2021/addressing-climate-change>. Accessed May 19, 2022.
3. Exposure to toxic environmental agents. *Obstet Gynecol* 2013;122:931–5.
4. Rose G, Khaw KT, Marmot M. *Rose's strategy of preventive medicine*. United Kingdom: Oxford University Press; 2008.
5. Centers for Disease Control and Prevention. Prevention: picture of America. Available at: https://www.cdc.gov/pictureofamerica/pdfs/picture_of_america_prevention.pdf.

6. Masson-Delmotte V, Zhai P, Pirani A, Connors SL, Péan C, Berger S, et al. Climate change 2021: the physical science basis. Contribution of working group I to the sixth assessment report of the intergovernmental panel on climate change Cambridge, United Kingdom and New York, NY, United States of America: Cambridge University Press. In press.
7. Weinberger KR, Harris D, Spangler KR, Zanolotti A, Wellenius GA. Estimating the number of excess deaths attributable to heat in 297 United States counties. *Environmental Epidemiol* 2020;4:e096.
8. Sarofim MC, Saha S, Hawkins MD, Mills DM, Hess J, Horton R, et al. Ch. 2: Temperature-related death and illness. the impacts of climate change on human health in the United States: a scientific assessment. Available at: https://health2016.globalchange.gov/low/ClimateHealth2016_02_Temperature_small.pdf.
9. Chersich MF, Pham MD, Areal A, Haghghi MM, Manyuchi A, Swift CP, et al. Associations between high temperatures in pregnancy and risk of preterm birth, low birth weight, and stillbirths: systematic review and meta-analysis. *BMJ* 2020;371:m3811.
10. Kuehn L, McCormick S. Heat exposure and maternal health in the face of climate change. *Int J Environ Res Public Health* 2017;14:853.
11. Hansen PJ. Effects of heat stress on mammalian reproduction. *Philos Trans R Soc Lond B Biol Sci* 2009;364:3341–50.
12. Requia WJ, Papatheodorou S, Koutrakis P, Mukherjee R, Roig HL. Increased preterm birth following maternal wildfire smoke exposure in Brazil. *Int J Hyg Environ Health* 2022;240:113901.
13. Padula AM, Benmarhnia T. Wildfires in pregnancy: potential threats to the newborn. *Paediatr Perinat Epidemiol* 2022;36:54–6.
14. Amjad S, Chojecki D, Osornio-Vargas A, Ospina MB. Wildfire exposure during pregnancy and the risk of adverse birth outcomes: a systematic review. *Environ Int* 2021;156:106644.
15. Sweet WV, Hamlington BD, Kopp RE, Weaver CP, Barnard PL, Bekaert D, et al. Global and regional sea level rise scenarios for the United States: updated mean projections and extreme water level probabilities along U.S. coastlines. Available at: <https://oceanservice.noaa.gov/hazards/sealevelrise/noaa-nostechrpt01-global-regional-SLR-scenarios-US.pdf>.
16. Khan AE, Ireson A, Kovats S, Mojumder S, Khusru A, Rahman A, et al. Drinking water salinity and maternal health in coastal Bangladesh: implications of climate change. *Environ Health Perspect* 2011;119:1328–32.
17. Brown ME, Antle JM, Backlund P, Carr ER, Easterling WE, Walsh MK, et al. Climate change, global food security, and the U.S. food system. Available at: <https://www.usda.gov/sites/default/files/documents/FullAssessment.pdf>.
18. Hasegawa T, Fujimori S, Havlik P, Valin H, Bodirsky BL, Doelman JC, et al. Risk of increased food insecurity under stringent global climate change mitigation policy. *Nature Clim Change* 2018;8:699–703.
19. United States Agency for International Development. Role of nutrition in preventing child and maternal deaths. Available at: <https://www.usaid.gov/sites/default/files/documents/1864/role-of-nutrition-preventing-child-maternal-deaths.pdf>.
20. Olson DM, Metz GAS. Climate change is a major stressor causing poor pregnancy outcomes and child development. *F1000Res* 2020;9:F1000, Faculty Rev-1222.
21. Keasley J, Blickwedel J, Quenby S. Adverse effects of exposure to armed conflict on pregnancy: a systematic review. *BMJ Glob Health* 2017;2:e000377.
22. Wilkerson J. How much worse will thawing Arctic permafrost make climate change?. Available at: <https://www.scientificamerican.com/article/how-much-worse-will-thawing-arctic-permafrost-make-climate-change/>. Accessed August 11, 2021.
23. Krieger N. ENOUGH: COVID-19, structural racism, police brutality, plutocracy, climate change-and time for health justice, democratic governance, and an equitable, sustainable future. *Am J Public Health* 2020;110:1620–3.
24. Song K, Qu S, Taiebat M, Liang S, Xu M. Scale, distribution and variations of global greenhouse gas emissions driven by U.S. households. *Environ Int* 2019;133:105137.
25. Rouf K, Wainwright T. Linking health justice, social justice, and climate justice. *Lancet Planet Health* 2020;4:e131–2.
26. Gutschow B, Gray B, Ragavan MI, Sheffield PE, Philipsborn RP, Jee SH. The intersection of pediatrics, climate change, and structural racism: ensuring health equity through climate justice. *Curr Probl Pediatr Adolesc Health Care* 2021;51:101028.
27. Morris E, Voltaire C, Goodall H, Rabin B, Densen S, Peters N, et al. Reflections from medical education in the climate crisis. *Curr Probl Pediatr Adolesc Health Care* 2021;51:101030.
28. Budd K. Hospitals race to save patients - and the planet. Available at: <https://www.aamc.org/news-insights/hospitals-race-save-patients-and-planet>. Accessed May 19, 2022.
29. Giudice LC, Llamas-Clark EF, DeNicola N, Pandipati S, Zlatnik MG, Decena DCD, et al. Climate change, women's health, and the role of obstetricians and gynecologists in leadership. *Int J Gynaecol Obstet* 2021;155:345–56.
30. Watts N, Amann M, Arnell N, Ayeb-Karlsson S, Beagley J, Belesova K, et al. The 2020 report of the Lancet Countdown on health and climate change: responding to converging crises. *Lancet* 2021;397:129–70.