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Food Insecurity, Climate Change, and Role of Physicians

Joe Bhagratie and Bashyam Iyengar

Climate change is defined as a long-term change or trend, generally driven by an external factor, persisting for decades to centuries or longer. Climate change is usually described statistically by changes in the mean or the variability of atmospheric properties such as temperature and precipitation.¹ It may be qualified as anthropogenic climate change, more generally known as "global warming" or "anthropogenic global warming".² While there are still those who dispute the existence of global warming, the data compiled by the Intergovernmental Panel on Climate Change is irrefutable and shows that anthropogenic global warming has been occurring as evidenced by increasing rising temperatures throughout the world.

Human influence on the climate system is apparent, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems.³ The warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia.

The atmosphere and ocean have warmed, snow and ice have diminished, and the sea level has risen.³ As a result, anthropogenic greenhouse gas emissions have increased since the pre-industrial era, primarily driven by economic and population growth, and are now higher than ever. This has led to atmospheric concentrations of carbon dioxide, methane, and nitrous oxide unprecedented in the last 800,000 years. Together with those of other anthropogenic drivers, their effects have been detected throughout the climate system and are extremely likely to have been the dominant cause of the observed warming since the mid-20th century.³

Not surprisingly, climate change affects ecosystems, water resources, food, and health.² Moreover, there is a direct link between climatic changes and global food insecurity, especially in developing countries where climate change compounded with poverty has exacerbated the impacts.²

Food Security

Food security is defined as the ability to obtain and use sufficient amounts of safe and nutritious food. Therefore, food security is a fundamental human need.¹ In 1996, the World Food Summit further defined food security by stating that food security exists when all people, at all times, have physical and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life.

Food insecurity is a growing problem. The United Nations estimated that 821 million people worldwide suffered from hunger in 2018.⁴ Considering all people in the

world affected by moderate levels of food insecurity together with those who suffer from hunger, it is estimated that over 2 billion people do not have regular access to safe, nutritious, and sufficient food, including 8% of the population in North America and Europe.⁴ The recent global COVID-19 pandemic and the social distancing efforts implemented to slow its spread have disrupted economies and food systems globally and locally, with extensive food security ramifications.⁵ Many of the effects are yet to be realized, but it is anticipated that food security issues will continue and most likely worsen.

Food-security challenges are widely distributed, afflicting urban and rural populations in wealthy and emerging nations alike. Moreover, food-security challenges are particularly acute for the very young because early life undernutrition results in measurably detrimental and lifelong health and economic consequences.¹

Food and nutrition security will be adversely impacted by climate change. Its impacts on global food production will put already vulnerable women and children at increased risk of malnutrition, thereby contributing to poor health, decreased educational performance, and poor productivity, all of which ultimately hamper sustainable development, including the well-being of populations.⁶

Food security, and consequently nutrition security, will come under additional pressure due to the adverse impacts of climate change on global food production (including crops, livestock, and fish products), thereby reducing food availability, stability of food supplies, and access to food.⁷⁻⁹

Food security, food systems, and climate change are multifaceted topics. Their interactions are likewise complex and are affected by a wide range of environmental and socioeconomic factors. It is nevertheless clear that there are multiple connections between changing climate conditions and food systems and that climate change affects food systems in ways that alter food-security outcomes.¹

Dimensions of Food Security

There are four dimensions of food security: availability of food, accessibility (economically and physically), utilization (the way it is used and assimilated by the human body), and stability of these three dimensions.¹⁰ For food security to be achieved, all four components must be attained and maintained simultaneously. In addition, each is sensitive to climate change.¹

Availability is the existence of food in a particular place at a specific time, while access is the ability of a person or group to obtain food. Utilization is the ability to use and get nourishment from food. This includes a food's nutritional value and how the body assimilates its nutrients. Finally, stability denotes the absence of significant fluctuation in availability, access, and utilization and points to the system's sustainability.¹⁰

The first component of food security, availability, addresses the question of whether food exists locally. Where food is or is not is a function of production types, rates, and locations.

Food production occurs through crops and livestock, fishing, and hunting outside cultivated systems.¹ Production forms the foundation of food availability, providing calories and nutrients for human consumption.¹ The processing, packaging, and storage of food also contribute to food availability to make the trade and the transportation systems that enable it. Climate change influences food availability and stability through each food-system activity.¹

The second component of food security is access--whether an individual or community has the resources necessary to acquire food. Access involves prices (trading); proximity to food (availability); retail outlets (wholesaling/retailing) or farmable lands (producing); and the social and cultural norms that shape food distribution and preference.¹

Food utilization is the ability of individuals to make use of the food otherwise available and accessible to them. Nutritional outcomes are frequently measured in malnutrition, which manifests as undernutrition or overnutrition.¹ The prevalence of child stunting in the developing world decreased from approximately 47% in 1980 to 29.2% in 2000 and was expected to further decline to 23.7% by 2020. Those estimates are now tempered due to the recent COVID-19 pandemic and are expected to be much more significant. The prevalence of obesity since 1970 has increased for all developed countries and several developing countries, with the most significant increases seen in urban populations and the lowest income groups.

Climate has many potential and observed effects on food utilization, including contamination of the food supply, the nutritional composition of food, and a body's ability to assimilate available nutrients. In addition, climate change affects food safety by influencing vectors of food contamination and levels of toxins in food. Elongated supply chains expose food products to a greater risk of contamination and make it harder to verify food quality at various stages. On the other hand, it also allows more diversity in consumption and more stability over time.¹ The fragility of these elongated food supply chains has been demonstrated during the COVID-19 crisis.

The food supply chain, on initial inspection, may appear robust. However, it is actually quite susceptible to perturbations in the system and is quite brittle. This fragility is threatened by climate change and can affect all aspects of the food supply chain.

Agricultural production is governed in large part by climate conditions and is a central consideration for food availability. It is less widely appreciated that climate conditions also affect access to food, its utilization, and the overall stability of each. Violent storm activity increases as temperatures rise and more water evaporates from the oceans. This includes more powerful hurricanes, Pacific typhoons, and an increased frequency of severe localized storms and tornadoes. These storms often result in

flooding and farmland damage, causing food insecurity. Warming also causes faster evaporation on land, leading to drought-induced famine.² Ironically, changes in the climate due to excess greenhouse gases are causing both increased drought and increased flooding. Shocks and crises caused by climate extremes, such as drought, floods, and hurricanes, destroy crops, livestock, and fish resources. Additionally, agriculture, livestock, and fishing/aquaculture infrastructure and productive assets such as irrigation systems, livestock shelters, docks, fish landings, and post-harvest facilities are impacted by climate change, which in turn causes a reduction in overall food production capacity.

The effects of climate change can interrupt market access, trade, and food supply; reduce income; deplete savings; erode livelihoods; and increase hunger. At the same time, disasters contribute to ecosystem degradation and loss, including increased soil erosion, declining rangeland quality, and salinization of soils. In turn, increasing environmental degradation reduces the availability of goods and services and shrinks economic opportunities and livelihood options.¹⁰ These effects occur through the climate's influence on global food-system activities, including food processing, packaging, transportation, storage, waste, and consumption.¹

The recent COVID-19 pandemic has exposed many vulnerable areas in the food chain. Using the framework of food availability and accessibility, we see that our attempts to mitigate the worldwide pandemic and their associated strategies to reduce and control infection rates have had a massive impact on economic markets (ie, production, processing, transportation; trade/export restrictions, etc).¹¹ The recent pandemic illustrated how tenuous our food supply system is. Overall, we have seen more than 6 million people enrolled in food stamps in the first 3 months of the coronavirus pandemic.¹² Even with that expansion, surveys are continuing to show high rates of food insecurity. Even though we have not entirely determined the full impact of the COVID-19 pandemic, preliminary data suggest that food insecurity is on the rise.¹³ Further evidence is a study conducted at Northwestern University that determined that the rate of food insecurity for households with children more than tripled to 29.5% during the pandemic.¹⁴

Diminished food access, availability, utilization, or stability can result when the food system fails to adapt to changes in climate. Food safety and vulnerabilities are particularly apparent during extreme weather events when time is critical.¹

Vulnerability

When exploring food security, we cannot overlook those who are the most vulnerable as the most susceptible. Vulnerability can further be expounded by three primary coordinates: exposure, sensitivity, and adaptive capacity. Exposure is the degree to which people and the things they value could be affected or "touched" by environmental hazards. Vulnerable populations are at increased risk of exposure to

crises, stress, and shocks. Sensitivity is the degree to which that exposure could harm them. These pose an increased risk of severe consequences and the attendant risk of slow or limited recovery from crises, risks, and shocks. From this vantage point, the most vulnerable individuals, groups, classes, and regions are those most exposed to perturbations, who possess the most limited coping capacity and suffer the most from the impact of a crisis or environmental concerns such as climate change.

Lastly, adaptive capacity is the degree to which a vulnerable population could mitigate the potential for harm by reducing exposure or sensitivity. Further, vulnerable populations are at risk for inadequate coping with stress, crises, and shocks, which implicitly subsumes timely and effective external interventions.¹⁵⁻¹⁷

Vulnerability can be, in other words, defined in terms of exposure, capacity, and potentiality.^{15,16}

Given the framework mentioned above, it becomes clearer to show the areas where vulnerabilities can be exposed when confronted with climate change—the most obvious one observed in human ecology and food availability. We monitor the ecosystem needed to produce food that requires prime environmental conditions. When these conditions are threatened in the form of extremes of heat, changes in water availability, and other atmospheric conditions, this poses a threat to farm crops and livestock. Thus, climate change and increasing climate variability and extremes affect agricultural productivity, food production, and natural resources, impacting food systems and rural livelihoods.¹⁸

Despite technological advances, food insecurity continues to be a significant issue both domestically in the United States and internationally. The promises of increased production leading to decreases in food insecurity have yet to be realized. Climate change poses a significant risk to global food security.

The Role of the Physician

Our role is multiple. We act as clinicians, healers, citizens, and advocates.

Physicians see the direct impacts on individuals' health when they are food insecure. Manifestations of food insecurity are abundant, and there is a direct causal link between individuals' health and their access to healthy food. Many studies suggest that food insecurity among children has adverse health effects, including increased rates of iron-deficiency anemia, developmental health, mental health, acute infection, and chronic illness, including cardiovascular risk factors, such as hypertension, hyperlipidemia, and diabetes.¹⁹ Physicians see the downstream effects of food insecurity and the consequences of climate change on food security. While physicians are engaged in mitigating the downstream effects, it is essential to turn some attention to the upstream causes of food insecurity. Physicians must address climate change and its attendant risks.

Physicians can improve the health of patients who experience food insecurity by following the SERC (screen, educate, recognize, connect) mnemonic.²⁰

- Screen--Screen all patients for food insecurity. Use 2-item questionnaire: 1) "We worried whether our food would run out before we got money to buy more" and 2) "The food we bought just didn't last, and we didn't have money to get more." Respondents were prompted to endorse these items as "Often True," "Sometimes True," "Never True" in the last 12 months, or "Don't Know". An affirmative response ("often true" or "sometimes true" vs. "never true") to either of the following statements can identify food insecurity with 97% sensitivity and 83% specificity. It is crucial to identify those individuals vulnerable to food insecurity.²¹
- Educate--Physicians have the unique advantage of having a captive audience, especially regarding health education. Thus, physicians are poised to show the link between obesity, heart disease, diabetes, etc, and the link to food insecurities. Further, we can highlight climate change and food insecurity.²²
- Recognize--Recognize that food insecurity is typically recurrent but is usually not chronic. Patients should be screened at each visit to ensure appropriate evaluation and management of intermittent or recurrent food insecurity.²⁰
- Connect--Physicians' offices should connect food-insecure individuals to food banks or have services available to help patients obtain supplemental nutrition assistance program benefits.²⁰

While most of the work of physicians is done within the confines of the examination room, physicians can exert their influence beyond those clinic walls. The famed Rudolf Virchow noted that physicians are the attorneys of the poor, and social problems should largely be solved by them. This illustrates that the physician's role and influence can be felt beyond the usual confines of the examination room, and there is a profound role that the physician can play in advocacy.

These are global issues that affect the world. Thus, the solutions are the responsibility of us all, regardless of professional or social rank. It is the duty of all to raise awareness and call action to these issues. It should not be construed that all of these issues are under the sole purview of the physician. Instead, it highlights potential areas where physicians can collectively leverage their considerable influence.

As citizens and advocates, it is important to continue to uphold and strengthen the Intergovernmental Panel on Climate Change stance, demonstrating that anthropogenic climate change has adverse effects on health, including food insecurities. Advocate for reducing the carbon impact of our behaviors and encourage others, including our patients, to do the same, mainly by choosing active transport, such walking and stairs, and a plant-based diet. Advocate for more social services, including

more funding for critical social services programs such as the Supplemental Nutrition Assistance Program (SNAP). In addition, advocate for 100% renewable energy.

As highlighted, there are profound linkages between food insecurity, climate change, and its downstream effects on health. Understanding these connections will allow the clinician to better understand and treat illness and promote wellness at the clinical level. Further, the influence of physicians can be leveraged at the societal and policy level. Goal to create systemic change in the health care delivery model, rooted away in delivering health from a biomedical perspective, but rather in a biopsychosocial model.

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