Climate Change and Human Health

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In 2015, 186 countries signed the Paris climate agreement to limit global warming to "well below 2 degrees Celsius" and avoid the harmful impacts on human health. Integral to this goal was to reduce carbon emissions to near zero over the next several decades.

Unfortunately, carbon emissions have continued to rise, and the global average temperature has risen by 1.2 degrees Celsius, resulting in the five hottest years on record, all since 2015. The environmental impact is well documented and includes sea level rise, ocean acidification, ice melt, and loss of glacier mass. These changes have resulted in a 46% increase (since 1980) in extreme heat waves, flooding, droughts, forest fires, and intense weather events (hurricanes and cyclones).

The above weather events and air pollution lead to downstream consequences on human health. This article will focus on six health effects.

HEAT WAVES

The number and intensity of heat waves has increased significantly during the past 20 years. This burden is borne mostly by the elderly, children, those with cardiovascular and respiratory diseases, outside laborers, the homeless, and the poor. There has been a 53.7% increase in heat-related mortality for people over the age of 65. Heat waves and temperature rise increase the risk of myocardial infarction, stroke, and acute and chronic renal injury. Studies indicate for each day that the heat index is 95 degrees Fahrenheit (compared to 75 degrees F), emergency department visits increase by 6.6% over the following seven days, heat-related emergency department visits increase by 89% for seven days and death rates increase by 5.8% for each day.

Mitigation is essential and includes early warning systems and response plans, increased access to air conditioning, communication by clinical teams to reach vulnerable populations, and education about the risk of heat illness.

PARTICULATE MATTER AND RESPIRATORY DISEASES

The primary drivers of respiratory diseases are automobile, power plant emissions and forest fires. Measured particulate matter includes sulfates, nitrates, black carbon, and nitrous oxide.

Forty-three million people in the United States and 92% of the world live in areas in excess of the World Health Organization (WHO) particulate limit, and in 2019 there were eight million deaths worldwide attributable to air pollution.

Increased carbon dioxide production leads to increased growth of allergen-producing weeds, grasses, and trees with rain and floods leading to increased mold and fungal growth. The aeroallergen season has increased from 177 days in the 1970s to 190 days today and is projected to reach 214 days by mid-century. Allergy exacerbations lead to 11 million office visits per year at a cost of $11.2 billion per year and asthma and COPD exacerbations result in two million emergency department visits, 500,000 hospitalizations, and 3,600 deaths at a cost of $56 billion per year. Clinicians will need to educate patients about weather trends, knowledge about air pollution, early symptoms, and prevention.

VECTOR-BORNE AND WATER-BORNE DISEASES

The primary vectors in the United States are mosquitoes, sand flies, and ticks. There has been an increase in cases of dengue, Chikungunya, West Nile fever, Zika, and even malaria. The number of cases of Lyme disease has risen from 50,000 in the 1990s to over 400,000 in 2018 and is reported in most regions of the country.

Heavy rains and flooding lead to contamination of water systems, reservoirs, and surface water that increase risk for E. coli, Campylobacter, Leptospira, and Salmonella infection. Vibrio parahaemolyticus infection is a significant seafood-related public health concern. In addition, rates of parasitic infection have increased, in particular Cryptosporidium, Cyclospora, and Giardia Lamblia in contaminated drinking water and fresh produce. Globally, there are over one billion people that lack access to safe drinking water and 2.5 billion lack access to adequate sanitation, with an estimated five million deaths annually in children.

FOOD SECURITY

The food system involves a network of interactions with our physical and biological environments as food moves from

production to consumption, or from "farm to table." There has been an increase in crop losses from fungi, bacteria, and viruses. There has been a decrease in food production by 2% per year in the face of a 14% per year increase in global demand, with a projected further decline of 6% in global wheat and 10% in global rice production for each one degree rise in temperature.

The nutrient content (protein, iron, and zinc) has decreased from 20% to 17% with an increase in carbon dioxide concentration from 385 parts per million (ppm) to 450 ppm between 2008 and 2020. Carbon dioxide production is 10 times greater for the consumption of beef, lamb, and pork versus more plant, fish, turkey, and chicken-based diets.

MENTAL HEALTH

The impact on mental health is well established. Forty-nine percent of Hurricane Katrina victims reported increased stress, anxiety, and depression and one in six have been diagnosed with post traumatic stress disorder. Studies show an increased rate of strained interpersonal relationships, substance use disorder, interpersonal aggression, violence, crime, and decreased community cohesion.

There also appears to be a relationship between increased temperature and the number of suicides, and people who meet criteria for mental illness are more vulnerable to the effects of climate change on physical as well as mental health. Much more research is necessary on the impact of climate change and prioritizing mental health benefits with mitigation efforts.

MASS MIGRATION

Extreme weather, sea-level rise, floods, food insecurity, and drought have forced two hundred million people in the world to migrate from their homes between 2008 and 2018. Modeling predicts that one billion people will need to migrate by the end of the century for these same reasons. Without climate change mitigation, this rate will significantly outpace other causes of migration, such as interstate conflict, failure of national governance, and unemployment or underemployment.

CONCLUSION

The effects of climate change have been predicted since the 1970s. There were non-binding agreements in 1979, 1989, and 1997 that did not succeed in slowing carbon dioxide emissions. It is time for the United States to rejoin and strengthen the Paris Agreement of 2015 and actively engage in setting standards at the upcoming UN Climate Change Conference (COP26) this month.

If the United States health sector were a country, it would be the fifth largest emitter on the planet, with $9 billion annually in energy costs. A 30% cut in healthcare greenhouse gas emissions by 2030 would prevent an estimated 4,130 premature deaths, 85,000 asthma attacks, four million respiratory symptom events, and 3,750 hospital visit incidents and save about $1.2 billion in medical costs.

As a physician you have the gravitas to make a significant impact on your community by raising awareness through talks in town halls and community gatherings, in addition to educating your colleagues and patients. You can lobby your local, state, and national representatives to make climate change and health a high priority issue and you can engage in climate-healthy habits, including plant-based diets, electric cars, energy-efficient homes and work environments.

I have painted a sobering outlook with one last opportunity to mitigate the effects of climate change. A recent report by the United Nations Intergovernmental Panel on Climate Change (IPCC) stated that it is possible to limit global warming to 1.5 degrees Celsius, but only with large-scale reductions of all greenhouse gases immediately. If countries move slowly, the Earth could warm by four degrees Celsius (7.2 degrees F) by the end of the century. Experts predict that such a rise would make the Earth uninhabitable. Therefore climate change is the existential threat of our time and now is the moment for all of us to educate and amplify our voices to protect future generations and the planet.

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