



Impact of Climate Change on the Gut and Liver Health: Focus on the Role of Gastroenterologists in Mitigating the Impact

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Introduction

Gradual changes in temperature and precipitation patterns over long stretches of time are referred to as "climate change." These alterations most likely result from natural occurrences like solar cycle oscillations. But since the 1800s, human activity has been the primary cause of climate change. This has a lot to do with burning fossil fuels like gas, oil, and coal.

Greenhouse gas emissions result from the usage of fossil fuels. Temperatures rise as a result of these emissions because they act as a blanket covering the Earth, retaining solar heat [1].

Two examples of greenhouse gas emissions that are causing the current state of the climate are carbon dioxide and methane. They result from activities like burning coal to heat a building or running a car on gasoline, for example. Removing land and forests can also release carbon dioxide into the atmosphere. One significant source of methane released into the environment is garbage landfills.

Land use, buildings, industry, transportation, energy, and agriculture are some of the main factors influencing greenhouse gas emissions.

Right now, greenhouse gas concentrations are at their highest points in two million years and emissions are still rising. As a result, Earth's temperature is around 1.1 degrees Celsius higher [2].

There is a common misperception that rising temperatures are the main consequence of climate change. Still, a rise in temperature is only the start of the tale. Because the earth is a system in which everything is interconnected, changes that take place in one area may have an impact on changes that happen in every other zone [2].

Severe droughts, a scarcity of water, destructive fires, rising sea levels, flooding, melting polar ice, catastrophic storms, and a decline in the number of species on Earth are just a few of the current repercussions of climate change.

Role of climate changes in disease production

Climate change can have an impact on our physical health as well as our ability to grow food, build new houses and workplaces, and more. Some of us, such those who reside in developing nations or in smaller island nations, are already more vulnerable to the consequences of climate change than others. Conditions like saltwater intrusion and increasing sea levels have gotten worse to the point that entire communities have had to be evacuated [2].

As the issue worsens, medical professionals are already acting to lessen the detrimental consequences that climate change is having on people's health all around the world. The single biggest danger to human health is climate change [3].

The average global temperature needs to be prevented from rising by more than 1.5 degrees Celsius, according to the Intergovernmental Panel on Climate Change (IPCC), if the world is to avoid disastrous health effects and millions of fatalities linked to climate change.

Certain global temperature increases and other climatic changes are already unavoidable due to the emissions that have already been produced. But even 1.5 degrees Celsius of global warming is not seen to be safe; every extra tenth of a degree of heat will have a detrimental effect on people's lives and health [4,5].

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In addition to increasing zoonoses and other food-, water-, and vector-borne illnesses, disruption of food systems, and mental health problems are just a few ways that climate change is already affecting people's health.

Heatwaves, storms, and floods are examples of extreme weather phenomena that are occurring more frequently, which is leading to an increase in the number of fatalities and diseases they cause.

Furthermore, a number of socioeconomic factors that support good health such as livelihoods, egalitarianism, and access to social networks and medical care are being undermined by climate change.

The most vulnerable and disadvantaged people women, children, ethnic minorities, impoverished communities, migrants or displaced people, older populations, and those with previous health conditions are disproportionately affected by these climate-sensitive health concerns [6].

Impact of climate changes on gastrointestinal health

When considering the effects of climate changes on health, their impact on the Gastrointestinal (GI) system is underappreciated in comparison to other systems like cardiovascular and respiratory systems [7].

Gastrointestinal health is vulnerable to climate change in several ways including effects on food, water, changes in disease patterns from migration, and infrastructure damage [8]. Environmental factors could potentially have an important role in changing the patterns of gastrointestinal diseases including functional GI disorders, Inflammatory Bowel Disease (IBD) and GI cancers [9].

There is a strong link between the occurrence of functional GI disorders- the most common gastrointestinal disorders- and mental health. Exposure to acute stress because of natural disasters caused by climate change like floods, and wildfires are exacerbated by struggling to obtain shelter, food, and water [10]. In addition, it is important to understand how climate change can impact gut microbiota, the changes in which can be linked to gastrointestinal disease patterns. Acute dysbiosis could present with mild symptoms including diarrhea and abdominal pain but more importantly, chronic dysbiosis could lead to an increase in the risk of IBD, celiac disease, and other autoimmune diseases [11,12].

Rising temperatures and flooding events destroy infrastructure and drainage systems and contaminate water supplies increasing risk for water-borne diseases such as hepatitis A and E, cholera, and other diarrheal diseases that are one of the leading causes of death in children [13]. In addition, outbreaks of *Salmonella* and *Campylobacter* can be attributed to elevated temperatures [14]. Climate change will increase migration, thus increasing the burden on the health care system. Due to cultural differences, GI healthcare providers will require training in the diagnosis and treatment of diseases they have not encountered before. Crowding may also be a significant issue with multiple health effects [15].

Although not well understood, some associations have been reported between exposure to air pollution and various GI diseases. A possible link with IBD remains controversial, with a study showing an association between some air pollutants and early-onset Crohn's disease and ulcerative colitis [16]. The incidence of IBS could be increased by exposure to some micropollutants [17]. Previous studies have shown an association between air pollution and GI cancer, especially stomach, and colon cancer [18]. Finally, climate change

could lead to metabolic liver disease secondary to dietary changes as well as increase the risk of hepatitis A, E, and other liver infections like schistosomiasis. Moreover, increased exposure to toxins like aflatoxin is another possible consequence [19].

How can gastroenterologists mitigate the effect of climate changes?

Translating the concern about the effects of climate change into action is of utmost importance and gastroenterologists have a clear responsibility to address this challenge [20].

Fortunately, the momentum for environmental sustainability in gastroenterology is growing, with multinational gastroenterology societies worldwide highlighting these issues and raising awareness. For example, the World Gastroenterology Organization developed a climate change working group. After distributing a survey questionnaire among gastroenterologists, about 75% believed that climate change was a crisis and most of them believed that climate change mostly occurs due to human activities [21]. British Society of Gastroenterology (BSG) climate change and sustainability strategy was launched in November 2021, coinciding with the COP26 global climate change conference in Glasgow, aiming for a program of green gastroenterology and hepatology, as well as green endoscopy [22]. Similarly, collaboration between the American Gastroenterology Association, American Society for Gastrointestinal Endoscopy, American College of Gastroenterology and American Association for the Study of Liver Disease is taking place to develop a sustainability strategy [23].

In addition to previous efforts, national gastrointestinal societies need to get involved, and to support local medical leaders with an interest in the topic to use their knowledge to educate colleagues in their areas and also to advocate for change [8].

As a community, gastroenterologists can contribute to mitigating climate change by raising the awareness of the carbon footprint concept among staff, and patients and by attempting to reduce the carbon footprint in clinics, offices, and endoscopy rooms. This can be achieved by emphasizing energy conservation and renewable power sources in the work environment including waiting areas and parking lots [24]. Other ways to reduce climate change include adjusting the indoor temperature to reduce energy consumption by resetting thermostats to avoid overcooling in summer and overheating in winter [25].

Special attention should be paid to medical waste in gastroenterology facilities and gastroenterologists should try to reduce their solid waste contribution by making every attempt to limit laboratory and radiological investigations producing solid waste without compromising the patients' safety or quality of medical services. As for endoscopy procedures, minimizing the number of incomplete procedures owing to poor preparation and combining procedures when more than one is needed can substantially reduce the solid waste [26]. On the academic level, replacing face-to-face conferences with virtual conferences negates a great deal of the associated carbon footprint [24].

Conclusion

Climate change has adverse effects on various gastroenterological diseases that may be potentially impacted by climate change. Even though there may be little evidence to support these hypotheses, studies are currently in progress, and additional evidence is anticipated to

accumulate soon. Although it may already be late, it is time to change personal and professional activities of gastroenterologists to take more steps toward a greener future and national gastroenterology organizations should formulate their plans with regard to the issue.

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