Gastroenterology climate action opportunities via education, empowerment of trainees and research

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Climate change poses significant threats to our planet's ecosystems, public health and current and future well-being.[1] Several professional gastroenterology society guidelines and position statements highlight the importance of education and research in mitigating the detrimental consequences of the climate crisis on digestive health.[2–4] In addition, trainees and early career gastroenterologists, being the future of our specialty, are in unique and important positions to make a positive and lasting impact on sustainability efforts related to climate change, and the health of our patients, communities and planet. We highlight in this commentary relevant opportunities related to education, empowerment of trainees and the multitude of research areas to support and pursue. This is the final of a nine-commentary series published by *Gut* that provides a primer on climate change and gastrointestinal (GI) health.[5]

EDUCATION BENEFICIARIES AND IMPLEMENTATION OF EDUCATIONAL EFFORTS

The clear recipients of a broad-based educational effort are the patients, trainees and gastroenterology providers (gastroenterologists, GI nurses) (figure 1). In terms of patient education, there are several resources that are already being provided by GI societies to their members, but these are disease-specific or general GI health resources. Such existing resources could easily be expanded to build on a wide range of available resources on 'climate and health patient education' that are catalogued by Healthcare Without Harm[6] and the Medical Society Consortium on Climate & Health,[7] including the impact of global warming on our food supply and the relationship of air quality to health.

Education to GI fellows and GI nurses can be provided by their respective professional organisations, for example, in the form of society symposia sponsored by their trainee committee or the creation of curricular materials for use locally. Currently, the accrediting body of graduate medical education in the USA, Accreditation Council for Graduate Medical Education and the American Board of Internal Medicine, have no requirements of teaching climate change outside of the normal teaching of environmental toxin exposure as relates to the pathophysiology and management of such exposure. Notably, several institutions are integrating the topic of climate and health into resident education,[8 9] which can be extended into adult and paediatric GI fellowship training. The tide could quickly change should accreditation bodies make this a requirement.

Education for GI providers can take place via multiple venues presented by GI societies, and publications that can provide specific guidelines or best practice approaches. For example, many GI providers are not sure what are the best climate-friendly approaches they can undertake in their endoscopy practice, but guidance with specific approaches and recommended tools are becoming available.[10 11] Health systems and hospital accreditation bodies can also play critical roles in providing guidance and expectations. For health systems, we envisage that this will become widespread in the next

Figure 1 Climate change-related education beneficiaries and facilitators of the educational implementation efforts, with advocacy playing a critical supportive role. Advocacy by providers, trainees and patients would be directed to policy-makers and government bodies, and potentially the public. The three beneficiaries of education are patients, trainees and providers. The facilitators of the educational implementation efforts are listed in the outer circle. Regulatory agencies include accreditation and governmental bodies. Climate foundations include non-profit organisations such as Healthcare Without Harm, Practice Greenhealth and My Green Doctor. Although the figure focuses on GI societies, the paradigm shown in this figure may be applied to other medical specialties and subspecialties. GI, gastrointestinal.

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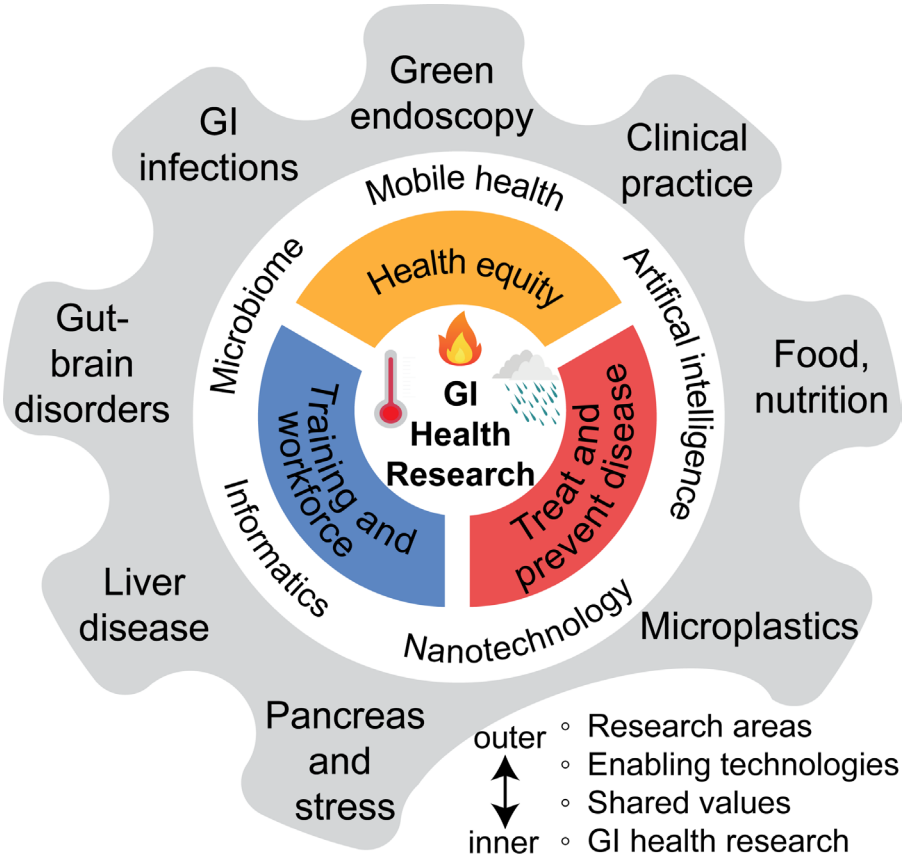

Figure 2 Research areas, enabling technologies and shared values that advance GI health research to sustainably combat the climate crisis. These categories are listed in order, starting with the outer serrated circle then moving to the inner circles (see also key in the right lower portion of the figure). The GI-related research areas in need of targeting are broad and are directed at greening endoscopy, clinical practice, food and nutrition, microplastics, GI infections, gut–brain disorders, liver disease and pancreatic disorders that are exacerbated or precipitated by stress that is tightly linked with climate change. These research areas are enabled by a variety of tools such as robotics and sensors (mobile health), artificial intelligence, nanotechnology, informatics and manipulation of the microbiome. The shared values and principles to achieve planetary health include having a well-trained workforce that promotes health equity and is prepared to prevent and treat human disease that is compounded by the climate crisis. GI, gastrointestinal.

few years as naming and empowering of sustainability officers in health systems continues to grow.[12]

EMPOWERMENT OF TRAINEES

Although education is intimately linked with trainees, we specifically highlight the empowerment of trainees and early career gastroenterologists because they are motivated and recognise that their generation have the most at stake. Several GI societies have within their committee structure a 'Trainee and Early Career Committee'. This committee can play a critical role in guiding their GI society to pay close attention to sustainability efforts and to impact the other traditional committees that pertain to clinical practice, education, research, industry collaborations and advocacy by taking active measures related to sustainability efforts and implementing specific strategic goals that have been approved[4] but not actively pursued. Predictably, success is likely within reach. For example, empowering medical students is already taking place in Canada, and the integration of planetary health education into the curriculum has been driven in large part by the students,[13 14] an approach that can be equally successful in fellowship programmes driven by GI fellows and in GI practices driven by early career gastroenterologists. This can be coupled with educating the educators (in this case fellowship programme directors, division chiefs and accreditation bodies), which is similarly important. Examples of efforts that may be driven by trainees and early career gastroenterologists are summarised in online supplemental table 1. Furthermore, trainees, providers and their patients, coupled with entities they interface with (eg, GI societies, health systems, regulatory agencies), can collectively also play a critical role in shaping policy and helping create resources via advocacy (figure 1).

RESEARCH AREAS

The research areas involving GI health and disease perspectives cover the entire translational research spectrum of basic biomedical; translation to humans; and translation to patients, practices and communities. This is predicated on intervening to disrupt the vicious feed-forward cycle of climate change that negatively impacts human health which, in turn, increases the demand and utilisation of healthcare systems and consequently worsens the detrimental effects of climate change.[15] The research areas that are in immediate need for discovery and innovation and ripe for the picking are displayed in figure 2 (outer serrated circle, although this list can be readily expanded). These research areas are enabled by several technologies that, in turn, are also wide-open additional research opportunities, including robotics and sensors (mobile health), artificial intelligence, nanotechnology, informatics and manipulation of the microbiome.

Examples of research opportunities include elucidating evidence-based approaches to limit the environmental impact of endoscopy, particularly as related to reduce/reuse/recycle programmes given the resource-intensive nature of endoscopy.[10] For this, working with industry partners is clearly needed.[4 10] Studies pertaining to clinical practice outcomes from disease prevention, access to care (eg, telehealth, use of sensors, drones) and cost-effectiveness be it GI, liver and pancreas disorders are needed. In addition, further understanding of the impact of climate change on GI infections, given what appears to be differences in bacterial and viral infections[16] is warranted. The importance of stress and the gut–brain axis in precipitating or exacerbating GI (and non-GI) disorders cannot be overstated.[17] In addition, there is a major knowledge gap in our understanding of the health hazards of microplastics and nanoplastics that we ingest from food and beverages.[18] Indeed, microplastics can be readily detected in human stool,[19] and humans may ingest 0.1–5 g of microplastics weekly through several sources.[20] Normal intestine, or impaired intestinal barrier in patients with inflammatory bowel disease, may experience uptake and retention of microplastics from stool as noted by their detection in liver tissue of patients with cirrhosis.[21]

FUNDING OPPORTUNITIES

Research support requires funding that may be sought from local (eg, health system, medical school, university), state or national government, foundations (digestive and non-digestive health focused), industry or philanthropy sources. Several potential funding sources are summarised in online supplemental table 2. For the listed digestive health GI societies, there are no directed funding opportunities that are specific to a climate change related project. This is an important area that industry can support in their specific disease areas or intervention category such as endoscopy by supporting GI society grants, as many of them do, for specific GI diseases.

Most of the GI society grants are not earmarked to specific subject areas, and currently none are climate change focused grants. However, climate change grants, like any other investigator-initiated grant, will be reviewed competitively, so it is an excellent opportunity for trainees to consider if they are interested in research training and a climate change topic related to GI health. Similarly, the National Institutes of Health has several career development investigator-initiated funding opportunities to support such research efforts. Potential projects may also be proposed by GI practices (ie, not necessarily based in an academic setting per se) to funding agencies for projects such as developing or testing 'green endoscopy' or 'green practice' approaches. For such projects, it may be helpful to include in the grant proposal an academic investigator with content expertise or access to research infrastructure that may not be available in a GI practice setting. Another funding source is philanthropy from which giving to climate change mitigation efforts has increased 25% (between 2020 and 2021), which is three times faster than overall philanthropic giving.[22]

SUMMARY

Several of the elements highlighted here, as do the remaining commentary series articles,[5] apply not only to sustainability of GI-centric mitigation of climate change detrimental effects, but also to efforts that may be undertaken by other medical specialties and subspecialties. There are numerous opportunities in gastroenterology climate action to be an educator, trainer, researcher, advocate or any combination of the four. The laboratory, where we can carry out our research projects and testing of hypotheses to advance discovery and innovation in climate change mitigation and sustainability efforts, can be the hospital, clinic, endoscopy unit, 'wet' or 'dry' research laboratory we work at, or a community location we serve. As US past president Barack Obama highlighted in his 2016 State of the Union address 'We are the first generation to feel the impact of climate change and the last to be able to do anything about it'. The opportunities to make an impactful advance to planetary health are boundless and need to be pursued and addressed urgently.

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REFERENCES

1 Romanello M, McGushin A, Di Napoli C, *et al*. The 2021 report of the Lancet Countdown on health and climate change: code red for a healthy future. *Lancet* 2021;398:1619–62.
2 Leddin D, Omary MB, Veitch A, *et al*. Uniting the global gastroenterology community to meet the challenge of climate change and non-recyclable waste. *Gut* 2021;70:2025–9.
3 Veitch AM. Greener Gastroenterology and Hepatology: the British Society of Gastroenterology strategy for climate change and sustainability. *Frontline Gastroenterol* 2022;13:e3–6.
4 Pohl H, de Latour R, Reuben A, *et al*. GI multisociety strategic plan on environmental sustainability. *Gastroenterology* 2022;163:1695–701.
5 Omary MB, Leddin D, Metz G, *et al*. World Gastroenterology Organisation - *Gut* commentary series on digestive health and climate change. *Gut* 2023.
6 Climate and health patient education, Available: https://noharm-uscanada.org/content/us-canada/climate-and-health-patient-education
7 The Medical Society Consortium on Climate & Health. For your Patients' information, Available: https://medsocietiesforclimatehealth.org/educate/patients/
8 Kuczmarski TM, Fox J, Katznelson E, *et al*. Climatizing the internal medicine residency curriculum: A practical guide for integrating the topic of climate and health into resident education. *The Journal of Climate Change and Health* 2021;4:100067.
9 Philipsborn RP, Sheffield P, White A, *et al*. Climate change and the practice of medicine: Essentials for resident education. *Acad Med* 2021;96:355–67.
10 Rodríguez de Santiago E, Dinis-Ribeiro M, Pohl H, *et al*. Reducing the environmental footprint of gastrointestinal endoscopy: European Society of Gastrointestinal Endoscopy (ESGE) and European Society of Gastroenterology and Endoscopy Nurses and Associates (ESGENA) position statement. *Endoscopy* 2022;54:797–826.
11 Sebastian S, Dhar A, Baddeley R, *et al*. Green endoscopy: British Society of Gastroenterology (BSG), joint accreditation group (JAG) and centre for sustainable health (CSH) joint consensus on practical measures for environmental sustainability in endoscopy. *Gut* 2023;72:12–26.
12 Understanding the role of a sustainability officer, Available: https://www.healthcare-spaces.com/2022/11/23/sustainability-officer-in-a-hospital-environment/
13 Luo OD, Carson JJK, Sanderson V, *et al*. Empowering health-care learners to take action towards embedding environmental sustainability into health-care systems. *Lancet Planet Health* 2021;5:e325–6.
14 Affleck A, Roshan A, Stroshein S, *et al*. Accelerating the implementation of planetary health medical curricula to prepare future physicians to work in a climate crisis. *Can Med Educ J* 2022;13:89–91.
15 Setoguchi S, Leddin D, Metz G, *et al*. Climate change, health, and health care systems: A global perspective. *Gastroenterology* 2022;162:1549–55.
16 Colston JM, Zaitchik BF, Badr HS, *et al*. Associations between eight earth observation-derived climate variables and enteropathogen infection: An independent participant data meta-analysis of surveillance studies with broad spectrum nucleic acid diagnostics. *Geohealth* 2022;6:e2021GH000452.
17 Ballou S, Feingold JH. Stress, resilience, and the brain-gut axis: Why is psychogastroenterology important for all digestive disorders? *Gastroenterol Clin North Am* 2022;51:697–709.
18 van der Laan LJW, Bosker T, Peijnenburg WJGM. Deciphering potential implications of dietary microplastics for human health. *Nat Rev Gastroenterol Hepatol* 2023;20:340–1.
19 Schwabl P, Köppel S, Königshofer P, *et al*. Detection of various microplastics in human stool: A prospective case series. *Ann Intern Med* 2019;171:453–7.
20 Senathirajah K, Attwood S, Bhagwat G, *et al*. Estimation of the mass of microplastics ingested - A pivotal first step towards human health risk assessment. *J Hazard Mater* 2021;404(Pt B):124004.
21 Horvatits T, Tamminga M, Liu B, *et al*. Microplastics detected in cirrhotic liver tissue. *EBioMedicine* 2022;82:104147.
22 Inside philanthropy, Available: https://www.insidephilanthropy.com/fundraising-for-climate-change