Techniques and Innovations in Gastrointestinal Endoscopy 2021; 1–7

The Case for Sustainable Endoscopy as a Professional Priority

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Abstract

Climate change represents a major threat to health now and in the future and must be at the forefront of healthcare planning and delivery. Endoscopy has a bigger environmental impact than many other areas of healthcare. Endoscopists and other healthcare professionals should lead the way in healthcare sustainability for the benefit of our patients and the future of the planet. The principles of sustainable healthcare among others may help us reduce the environmental impact of endoscopy and be beneficial for patients. Individual and profession-wide efforts will be needed to progress and achieve this goal.

Keywords: Endoscopy; Climate change; Carbon footprint; Healthcare sustainability.

What Does the Climate Crisis Mean for the Health of Our Patients?

Climate change is one of the greatest threats to humanity and mitigation of climate change must be at the forefront of healthcare planning and delivery. The dual challenge for healthcare is that healthcare must be prepared to manage increasing climate impacts on health, while also reducing emissions in line with the Paris agreement, which the USA re-joined in January 2021.[1] All healthcare sectors have a duty to contribute by reducing their environmental impact. A procedure dominated field such as endoscopy may have a larger environmental impact than other areas of healthcare, therefore it is even more essential that we evaluate and address this. Endoscopy emits the third highest amount of waste in hospital, estimated at 3.09 kg or waste per bed day.[2] Gayam[3] estimated CO_2 emissions from endoscopic procedures in the USA is equivalent to burning 39 million pounds of coal, and plastic waste to be over 13,500 tons per year.

Climate change affects the many health determinants such as clean air, safe drinking water, sufficient food and shelter.[4] Average global temperatures have risen by almost 1°C/1.8°F in the last century, and despite efforts to curb emissions we are still on a trajectory that is far from the 2°C/3.6°F limitation set out in the Paris agreement.[5] The current temperatures are already affecting large parts of the world, leading to more extreme weather events such as wildfires and flooding. In the USA, events like the California wildfires, the recent freezing temperatures in Texas leading to widespread power shortages and similar extreme weather events may become a more common occurrence. Heavy rain has increased across most of the USA and is predicted to increase further, warming may increase the risk of rapidly intensifying hurricanes across the US East Coast.[6-8] Climate change is also changing the burden of disease around the world, such as increased pulmonary diseases from air pollution, heat stroke and dehydration from rising temperatures and increased vector-borne diseases.[4] Due to the impact of environmental degradation and loss of habitat, the world is potentially at increased risk of future pandemics such as COVID-19. In short, climate change is a major threat to health and threatens to undermine the last 50 years of public health gains.

While climate change is relevant to many disease systems and is well documented, for example, air pollution causing respiratory disease and cardiac disease, there is less research into the impact of climate change on gastrointestinal diseases. Certainly higher temperatures have been associated with a higher rate of gastrointestinal infection.[9] Flooding and higher water temperatures may increase the likelihood of enteric pathogens and viral hepatitis infections via contaminated water supply. Malnutrition is a major risk with extreme weather events disrupting movement of food and changing temperatures disrupting global production of some crops, causing an increase in price. More research is certainly required to understand the risk that climate poses to gastrointestinal and liver disease. It seems a little unlikely that the organs which we are interested as gastroenterologists and hepatologists are largely exempt from the direct effects of

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2590-0307

https://doi.org/10.1016/j.tige.2021.05.004

hotter temperatures, when every other human organ system appears to be affected almost without exception.

Climate Change and the Contribution of Healthcare

There is a strong moral argument for healthcare to reduce its carbon footprint. Not only because healthcare is contributing directly to climate change with consequent ill health of current and future generations but also healthcare standards will increasingly suffer from the use of fossil fuels, climate change and environmental breakdown.[10] It is a paradox that healthcare is both affected by, and contributing to the problem. Transport associated with healthcare contributes significantly to air pollution,[11] if healthcare were a country it would be the fifth largest emitter on the planet. About 75% of healthcare carbon emissions are produced by just 10 countries (including the USA).[12] In 2014, Pichler et al analyzed the carbon footprint associated with healthcare in 36 OECD countries. The average per capita health carbon footprint varies substantially. High-income countries tend to have higher per capita health carbon footprint, for example, India has 0.06 tons of CO_2 per capita compared to 1.51 tons of CO_2 per capita in the United States. In addition, the US healthcare system is also the second largest, with a footprint of 480 Mt CO_2, which is equivalent to the entire United Kingdom's 2017 CO_2 emissions. There are multiple reasons why the healthcare carbon footprint varies so significantly between countries; some of the differences may, for example, simply arise through variations in healthcare coverage. The fact remains that the US healthcare carbon footprint is significant, contributing 7.9% of the national carbon footprint.[12]

Detailed data on healthcare related carbon emissions are difficult to obtain for many countries, one exception is The National Health Service (NHS) in the UK. The NHS has also established ambitions to become a net-zero healthcare system, where emissions are reduced as much as possible and the remaining emissions are offset. The mechanisms to achieve offsetting of future NHS emissions are unclear at this time. Progress on reducing NHS emissions is already significant, with a 61% reduction of carbon equivalent emissions in 2020 compared with 1990 levels. However, the remaining estimated NHS carbon footprint of 6.1 million tons of carbon dioxide equivalent emissions ($MtCO_2e$) is still a long way from net-zero.[13]

Carbon emissions and plastics are not the only aspect of healthcare which damage the environment. Endoscopy is resource intensive and requires quantities of elements such as Molybdenum as a component of endoscopes, and Nickel and Titanium as components of nitinol for stents as well as copper, steel and others. The associated extractive and mining industries are often highly destructive, causing water pollution, soil contamination and can also be associated with human rights abuses.[14] Yet at the end of a procedure, products containing these valuable resources may be discarded rather than being recycled or reconditioned where possible.

While other sectors in the USA such as transport (28%) and agriculture (10%) contribute more to national CO_2 equivalent emissions,[15] healthcare has a duty to reduce its carbon emissions, both because of the medical imperative to "do no harm" but also due to the health benefits of reducing carbon emissions. It is possible to create a more circular healthcare system where re-use or recycling is the norm rather than the exception.

Healthcare as an Anchor Institution

Healthcare institutions through their size and position as mass employers, as procurers of goods and services, and owners of assets and land can have a significant positive impact on their surrounding communities if their policies are aligned with social and environmental values.[16] These large institutions can be known as "Anchor Institutions," rooted in place and with power and influence in the community to reduce their impact on the local environment. Healthcare has an intrinsic stake in ensuring that local communities remain healthy, there is a strong moral argument that all healthcare institutions should use this leverage for the good of the community.[17] Unfortunately, only a minority of healthcare institutions are using this influence for positive change and that needs to change rapidly.

Healthcare institutions should be the drivers of positive change, demonstrate good practice and act as a role model for other sectors.

What Is Sustainable Healthcare and What Strategies Can We Employ Within Endoscopy to Reduce Our Environmental Impact?

A low carbon sustainable healthcare system is characterized by high-quality healthcare with improvements in public health without exhausting natural resources or damaging natural systems as set out by Mortimer et al.[18] Figure 1 sets out the key pillars of sustainable healthcare: Patient empowerment, prevention, lean services and low carbon alternatives. These changes are potentially

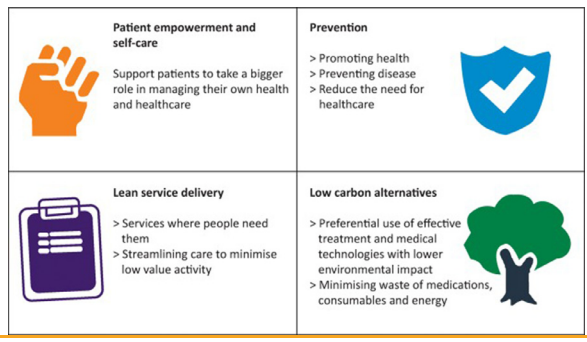

Figure 1. Center for sustainable healthcare "Principles of sustainable clinical practice."[18]

considerable, but we would suggest so are the potential benefits. We will consider some possible examples of each of these in turn.

Patient Empowerment

Shared decision making between the patient and clinician, for example, patient led follow up for patients with inflammatory bowel disease, management of achalasia, GERD or end stage liver disease.[19]

Lean Service Delivery

1. Providing endoscopy services closer to the patient.
2. Maintaining/ expanding "virtual" healthcare.
3. Minimize low-value activity by ensuring rigorous adherence to guidelines to avoid unnecessary procedures such as gastroscopy for simple dyspepsia or "second look" gastroscopy following gastrointestinal (GI) bleeding.
4. Using "office-based" endoscopy such as trans-nasal endoscopy, capsule endoscopy or cytosponge.

Prevention—Promoting Health, Preventing Disease, Reducing Need for Healthcare

Reducing harmful alcohol use using minimum-unit pricing. This strategy in place in Scotland sets a minimum price for a specified quantity of alcohol and initial studies show this may reduce hospital alcohol related admissions and the number of patients presenting an acute upper GI bleeding.[20]

Low Carbon Alternatives—Low Impact Technologies and Treatments, Minimize Waste and Consumables

1. Within endoscopy suites reduce water usage, transfer to electricity use to renewables, organize recycling streams. Liaise with industry to move to re-use of devices rather than single-use where appropriate.
2. Expand the use of low carbon technologies such as fibroscan, immunochemical testing, fecal immunochemical testing (FIT), enhanced liver fibrosis (ELF), and fecal calprotectin.

Telemedicine in general is undergoing a revolution in the post COVID 19 era and addresses a number of these pillars. A systematic review unanimously reported the benefits of telemedicine in reducing the carbon footprint of healthcare.[21] Asynchronous interactions could enhance patient empowerment. Reduction in car travel could reduce health harms from road traffic accidents and air pollution, preventing disease and reducing need for healthcare.

In conclusion, the healthcare sector should not be exempt from reducing emissions. Such a policy would deny patients the potential benefits of a move toward a sustainable healthcare model (Figure 1) and deny medical institutions the opportunity to wield influence as anchor institutions. Furthermore, if healthcare continues with "business as usual," that puts yet more onus on other sectors to reduce emissions yet further. No sector of the economies of Developed Nations can be exempt if the goal of the Paris treaty is to be met and the accompanying health benefits realized.

How Do We Do Fewer, Less Resource Intensive Procedures While Maintaining Quality of Care?

A sustainable healthcare system maintains population health, reduces disease burden and minimizes use of healthcare resources. Medical excess—or overuse of medical care with no benefit to the patient—threatens the health of individuals and poses challenges for healthcare sustainability.[22] Serious problems associated with medical excess are already very evident and these include antibiotic resistance and the US opioid crisis.[23]

Overuse of endoscopic procedures is a concern from a health, financial and environmental perspective. We suspect that doing fewer endoscopic procedures will ultimately have the biggest impact on carbon emissions, rather than making the procedures themselves "greener." The safety and effectiveness of this approach and the possible risks in doing so requires a rigorous evidence base to convince practitioners and patients of the benefits.

We need to recognize that some of the procedures we perform may add little or no value to the patient journey. Low-value healthcare is defined as practices providing minimal or no benefit to recipients.[24] Identifying (and eliminating) such practice requires research and implementation, this should be a priority area to address as a means of reducing waste. A Canadian study found 5% of adults seeing a physician at least once received a low-value health intervention.[25] A study by Badgery-Parker et al examining 27 low-value procedures identified increasing trends in endoscopy for dyspepsia, and in colonoscopy for constipation.[26] Reducing low-value endoscopy is beneficial for the patient, the finances of healthcare institutions, and our planet.

The application of principles of "parsimonious medicine," where patient management is decided by physician judgment and within context of patients' needs,[27] is also an area which may reduce procedure burden. The "Choosing Wisely" campaign is used in a number of countries including the USA. This initiative seeks to advance the national dialogue between medical practitioners and patients around avoiding unnecessary medical investigations.[28]

Wilson and Junger in 1968 established the principle of "screening as a method for combating disease,"[29] This concept needs to be challenged for certain patient groups to reduce resource use, unnecessary procedures and environmental harm, for instance, limiting screening options for frail elderly or where life expectancy is less than that of screening intervals. Indeed, the AGA has already highlighted potential overused investigations such as screening colonoscopy in average risk individuals, surveillance colonoscopy in low risk polyps and surveillance OGD in Barrett's oesophagus.[30] The European Society of

Gastrointestinal Endoscopy has also produced guidance to reduce endoscopic surveillance,[31] persisting with such practices is harmful, and needs to recognized as such.

How Can We Make Better Use of Finite Resources in Endoscopy?

Endoscopy generates the third highest amount of waste in healthcare facilities[32] after surgery and critical care. We need to consider our resource use better, whether investigations are necessary or not as well all improving processes during and after procedures in order to curb carbon emissions and waste. Exactly how to deliver on reducing the environmental footprint of endoscopy urgently requires more research, as information about which procedures or devices are more environmentally friendly is scarce and often confusing.

The best way we know at this point to reduce the environmental impact of endoscopy is to do fewer procedures. However, this requires significant shifts in behavior, referral patters, education, and culture which will take time. In the meantime, we have highlighted a number of different procedural considerations to potentially reduce the environmental impact of endoscopy now.

Preprocedure

- "Enhanced"/senior clinician vetting or robust internal audit of procedures with appropriate remediation measures such as CME.
- Sustainable procurement (supply chain related emissions account for over 50% healthcare emissions).
- Renewable energy suppliers to power hospitals/ endoscopy units.
- Using anchor institution status as leverage to mandate suppliers to disclose carbon status and apply sustainable practices.

Procedure Related

- Consider less invasive alternatives, such as Cytosponge or FIT.
- Compostable or recyclable plastic.
- Recyclable equipment.
- Multiple use/easily repairable equipment.
- Consider the whole lifecycle of procured items when considering single use vs reusable devices.
- Minimize use of nitrous oxide (which is a very harmful greenhouse gas) and maintain equipment to minimize leaks.[33]
- Reduce resources required for decontamination.

Postprocedure

- Waste segregation—infectious waste requiring (carbon intensive) incineration makes up typically no more than 10%-25% of hospital waste, in many hospitals a far greater percentage is treated as such.[31]
- Develop multiple recycling streams.

What Is a Circular Economy and How Can It Help Us Improve Resource Use in Endoscopy?

To an extent we are all familiar with a "take, make and dispose" industrial model with high inputs and high outputs. In contrast a circular economy in some respects mimics natural systems with continual re-use of finite resources while limiting inputs and outputs,[34] Figure 2. This model has a huge number of potential applications and is now in use around the world, from a garden to a factory or city for instance. The principle of the circular economy is wholly applicable to healthcare systems.[35]

The principal of the Circular Economy within healthcare is sound, however within healthcare it is in its infancy, vision and imagination will be required as well as collaboration with industry and academia to make it a reality. Again, there are barriers to implementing this such as embedded financial interests, infection control concerns and start-up costs, however its use within healthcare he is already underway in a limited fashion.[35]

The Importance of Local/Individual and Profession-Wide Efforts When Moving to a More Sustainable Future for Endoscopy

Efforts to change practice must be both local and profession wide, both can have a measurable impact. Clearly individual and local efforts can be more achievable in a shorter time frame. Profession-wide efforts will ultimately require evidence-based guidelines, protocols, education and ultimately, a culture change. Moving endoscopy services to a more sustainable future is not going to be straightforward and there are multiple potential barriers to change. None of these, are however, insurmountable (Figure 3).

Figure 2. Principles of a circular economy.

- Economy driven- free market healthcare can incentivise more investigations
- Education related- incorrect requesting of investigations and inappropriate surveillance
- Administrative- incorrect booking of procedures eg surveillance endoscopy
- Behavioural - resistance to change and defensive practice.
- Financial- lack of funding to facilitate change

Figure 3. Barriers to change in moving towards a more sustainable endoscopy service.

Support of national bodies and institutions is vital if we are to achieve the changes we need for the future. There are multiple possible courses of action that such institutions could take outside the narrow field of endoscopy to lead the way. National bodies could potentially signal their concern by declaring climate emergencies, encouraging healthcare institutions to divest from fossil fuels, and create sustainability committees to lead and drive change within the healthcare sector and beyond. There are other actions that we could take, for instance medical conferences have a very large carbon footprint and are directly contributing to the climate crises, online conferences, meetings and networking have become the norm during the COVID-19 pandemic[36] and this should continue. National bodies could and should support campaigns to reduce medical excess and adapt or develop guidelines focusing on reducing unnecessary investigations. It also needs to be recognized that harmful perverse incentives exist within healthcare and the associated industries and these need to be recognized and confronted.

Incentivizing development of "greener" more sustainable endoscopy units is another possible method of promoting profession-wide change set out by Maurice et al.[37] A small number of healthcare professionals in the UK and USA have formed a "Green Endoscopy Network" and are looking to embed more sustainable endoscopy standards and approaches into national guidance and frameworks using the principles of sustainable healthcare.

We need an evidence base better suited to support sustainable healthcare, there is an urgent unmet need for this. For example, increased focus on studies tackling medical excess, including primary research, evidence synthesis, guideline and policy development and communication with the public. Cochrane Sustainable Healthcare[22] is a new Cochrane Group focused on addressing medical excess. This group is seeking collaboration and novel approaches to build on existing work of many people and organizations around the world.

Clinicians should lead by personal example, for example, promoting active travel, moving to a predominantly plant-based diet and reducing personal air travel. On a management level it would be beneficial to support hospital wide initiatives such as "Sustainability Champions"—professionals in healthcare committed to leading change to embed sustainability into day-to-day practice, or "Green ward" competitions[38] could be initiated and encouraged.

Conclusion

During the onset of the COVID-19 pandemic a substantial proportion of endoscopy practice was halted and pathways rapidly reconfigured. We should continue with that same "can-do" attitude to move to a more sustainable future for our specialty. We are used to being advocates for health in a range of domains; climate change needs to rapidly become a priority area for us. Despite the sequelae of the climate crisis not being apparent to us in our everyday work in endoscopy, we have a moral and ethical duty to our patients and the wider public to push for a more sustainable future in our everyday lives, as well as at work. There is an urgent need for more research, not only addressing how we make endoscopy procedures themselves more sustainable, but also into safely reducing unnecessary procedures. Environment costs should also be included in cost effectiveness analyses

Using the principles of sustainable healthcare, a low-carbon healthcare service is possible with its associated benefits for our patient and for our wonderful, unique planet. This should be at the forefront of future healthcare planning. Can we seize this opportunity when planning healthcare services fit for the future?

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Ethical Statement
The study did not require the approval of an institutional review board.

Conflicts of Interest
The authors disclose no conflicts.

Authors' Contributions
Rosemary Haddock: Involved in drafting of manuscript, analysis and interpretation of studies, revision of manuscript for important intellectual information.
Anya Gopfert: Involved in drafting of manuscript, analysis and interpretation of studies, revision of manuscript for important intellectual information.
Maria van Hove: Involved in drafting of manuscript, analysis and interpretation of studies, revision of manuscript for important intellectual information.
William Stableforth: Involved in drafting of manuscript, analysis and interpretation of studies, revision of manuscript for important intellectual information.