



# Towards Environmentally Sustainable Gastrointestinal Endoscopy

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See “Measuring Medical Waste from Gastrointestinal Endoscopies in South Korea to Estimate Their Carbon Footprint” by Da Hyun Jung, et al. on page 43, Vol. 19, No. 1, 2025

Climate change is considered one of the most serious global emergencies that can lead to irreversible changes worldwide. Greenhouse gases (GHGs) produced by various human activities, such as fuel burning and cement production, accumulate in the atmosphere and trap heat, thereby increasing global temperatures. Carbon dioxide (CO<sub>2</sub>) accounts for almost 80% of all GHG emissions; the total amount of GHG released directly and indirectly by an individual, event, organization, or product is defined as the carbon footprint, measured in CO<sub>2</sub> equivalent (CO<sub>2</sub>e).<sup>1,2</sup> The main goal for mitigating climate changes is to achieve carbon neutrality by 2050; this involves reducing carbon emissions through measures such as using electric vehicles, using renewable energy instead of fossil fuels, and reducing waste materials.<sup>1</sup>

The healthcare sector accounts for 5.5% of the total national carbon footprint on average globally and 5.3% in South Korea.<sup>1,3</sup> Furthermore, carbon emissions from the healthcare sector increased in all countries around the world from 2007 to 2016, with South Korea experiencing an increase of approximately 75%.<sup>4</sup> Therefore, there is an increasing need for environmentally sustainable healthcare. Gastrointestinal endoscopy (GIE), including esophagogastroduodenoscopy, colonoscopy, endoscopic retrograde cholangiopancreatography, endoscopic ultrasound, and other related procedures, is frequently performed in healthcare facilities, and the endoscopy unit is the third largest generator of medical waste in hospitals.<sup>1</sup> In addition to a large quantity of single-use devices and nonrenewable plastic wastes, carbon emissions from travel by patients and their relatives, energy consumption by electronic de-

vices, and reprocessing or decontamination processes can contribute to the carbon footprint of endoscopy.<sup>1,5</sup> Waste generated from a single GIE procedure ranges from 0.54 kg to 3.03 kg, which varies between centers and countries and may depend on the components of the endoscopic procedures captured during assessment.<sup>5-8</sup>

Recently, movement to reduce the environmental impact of GIE has been developed, which is known as “green endoscopy.”<sup>1,2,9</sup> For this purpose, the European Society of Gastrointestinal Endoscopy has recommended immediate actions such as raising awareness through education, implementing high-quality endoscopy, using accessories rationally, avoiding overheating and overcooling, utilizing renewable energies, and implementing adequate waste management.<sup>2</sup> However, a survey of healthcare professionals in South Korea revealed that only 16.3% of responders were aware of the concept of green endoscopy.<sup>9</sup> This indicates that greater emphasis should be placed on raising awareness of GIE-associated waste and the principles of green endoscopy to reduce the GIE carbon footprint.

In this issue of *Gut and Liver*, Jung *et al.*<sup>10</sup> analyzed the amount of medical waste generated by different GIE procedures at seven hospitals in South Korea. During a 5-day audit, a total of 3,922 endoscopies were performed across these hospitals and 4,558 kg of waste was generated. The mean weight of waste generated per endoscopy from each hospital ranged from 0.62 kg to 1.61 kg, with an overall mean weight of 1.34 kg. Esophagogastroduodenoscopy and colonoscopy generated a mean of 0.24 kg and 0.43 kg of waste per procedure, respectively. The mean weight of 1.34 kg identified here is relatively lower than figures reported in studies in the



United States,<sup>6-8</sup> but higher than those reported in Australia.<sup>5</sup> Based on 2022 Health Insurance Review and Assessment data, Jung *et al.* estimated that 13,704,453 kg of medical waste and 11,456,238 tCO<sub>2</sub>e of carbon footprint were generated annually from GIE procedures in South Korea. This amount of medical waste represents approximately 36.0% of that in the United States, assuming that 2.1 kg of disposable waste is generated per GIE procedure in the United States.<sup>6</sup> These figures are significant when compared to the United States in terms of population and economic size, and are likely attributed to the high GIE caseloads in South Korea owing to the national health surveillance program and low endoscopic fees. However, the estimate does not include non-reimbursed cases, suggesting that medical waste may be underestimated. These results highlight the significant environmental burden posed by routine medical practices, which is of grave concern.

Given the low awareness of GIE-induced carbon emissions and green endoscopy among healthcare professionals, this study is valuable in that it quantifies the amount of medical waste and carbon footprint generated from GIE procedures for the first time in South Korea, thereby increasing awareness of the GIE carbon footprint. Although this study was limited to seven university or tertiary hospitals over a 5-day period, did not quantify different types of waste materials generated during GIE, such as the recyclable portion, and did not include energy or water consumption as part of carbon footprint, it provides a foundation for a broader investigation into the environmental impact of GIE. These findings strongly support the need for green endoscopy practices, such as adhering to guidelines for appropriate endoscopy indications, digitalization, telemedicine, outpatient-based procedures, green accreditation, waste management through 3R (reduce, reuse, and recycle) and circular economy principles, and reducing the use of single-use devices and endoscopes.<sup>1,2</sup> However, as the authors note, sustainability measures must be balanced with patient safety. For example, reusable endoscopic instruments reduce waste, but can increase the risk of infection in the absence of rigorous reprocessing protocols. Addressing these issues requires a multidisciplinary approach that combines technological innovation, robust regulatory frameworks, and collaboration across stakeholders.

This study, which evaluated the environmental impact of GIE in South Korea, provides strong baseline data for integrating sustainability into routine healthcare practices. The introduction of green endoscopy is not only an ethical imperative but also a practical one for ensuring a sustainable future. Healthcare providers, policymakers, and the medical industry must act decisively to turn these insights into action.

## CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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