Journal of Gastroenterology and Hepatology

WILEY

JGHF Journal of Gastroenterology and Hepatology Foundation

REVIEW ARTICLE

APAGE Position Statements on Green and Sustainability in Gastroenterology, Hepatology, and Gastrointestinal Endoscopy

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Received: 18 December 2024 | **Revised:** 13 January 2025 | **Accepted:** 18 January 2025

Funding: The authors received no specific funding for this work.

Keywords: climate change | endoscopy | gastroenterology | hepatology

ABSTRACT

Background and Aim: The APAGE Position Statements aimed to provide guidance to healthcare practitioners on clinical practices aligned with climate sustainability.

Methods: A taskforce convened by APAGE proposed provisional statements. Twenty-two gastroenterologists from the Asian Pacific region participated in online voting and consensus was assessed through an anonymized and iterative Delphi process.

Results: There were five sections that addressed the rationale for climate action, the importance of adopting principles of waste management, clinical practice, gastrointestinal endoscopy, and issues related to advocacy and research. Sixteen statements achieved consensus and included the following: 1. APAGE recommends adopting prompt measures to reduce the carbon footprint of clinical practice due to the importance of climate action and its health cobenefits. 5. APAGE recommends adherence to

https://doi.org/10.1111/jgh.16896

professional clinical guidelines to optimize clinical care delivery in gastroenterology and hepatology to avoid the environmental impact of unnecessary procedures and tests. 8. APAGE recommends an emphasis on health promotion, disease prevention, and appropriate screening and surveillance, when resources are available, to reduce the environmental impact of managing more advanced diseases that require more intensive resources. 12. APAGE recommends that technological advances in endoscopic imaging and artificial intelligence, when available, be used to improve the precision of endoscopic diagnosis to reduce the risk of missed lesions and need for unnecessary biopsies. 13. APAGE recommends against the routine use of single-use endoscopes.
Conclusion: The position statements provide guidance to healthcare practitioners on clinical practices in gastroenterology, hepatology, and endoscopy that promote climate sustainability.

1 | Introduction

Global warming due to greenhouse gas (GHG) emissions from human activities, and the concomitant pollution and environmental degradation, poses a significant threat to human health and well-being. The healthcare sector itself contributes to GHG emissions [1]. A zero-carbon transition will mitigate the worst health impacts of climate change and deliver major health and socioeconomic cobenefits [1, 2]. With health as the focus of climate change action, there is a need for healthcare leadership to provide direction and guidance to healthcare professionals. This is especially crucial for healthcare practitioners involved in the management of gastroenterological and liver disorders, which has a high global disease burden. Table 1 provides a glossary of the terminology used when discussing climate change [2].

Position statements on the issue of climate sustainability have been published by professional gastroenterological and endoscopy societies in the West [3–5]. However, there is a lack of such guidance within the Asian Pacific region, which is geographically and culturally diverse and with varying healthcare resource access and availability. The Asian Pacific Association of Gastroenterology (APAGE) is committed to the pursuit of excellence in clinical practice, education, and research towards the improvement of digestive health in the Asian Pacific region. The membership of APAGE comprised the national and regional gastroenterology societies within the Asian Pacific region. Recognizing the impact of climate change on human health and the significant carbon footprint of healthcare, APAGE set up a taskforce in March 2024 to promote advocacy, education, and research on green and sustainability practices. The APAGE Position Statements on Green and Sustainability in Gastroenterology, Hepatology, and Gastrointestinal (GI) Endoscopy aimed to provide guidance to clinicians and other healthcare practitioners in the Asian Pacific region on climate sustainability practices.

2 | Methods

A taskforce comprising gastroenterologists across the Asian Pacific region was appointed by APAGE. The taskforce, with endorsement from the APAGE Executive Committee, decided to formulate a set of position statements on climate sustainability in the context of clinical practice to convey the perspectives of APAGE, due to the strategic importance of climate action.

The taskforce held its first meeting online on April 23, 2024. Thereafter, a preliminary list of topics to be covered and provisional statements were drafted and circulated via email.

TABLE 1 | Glossary of terminology.

Term	Definition
Greenhouse gases	Greenhouse gases are gases that cause energy retention in the atmosphere, thus contributing to global warming. Carbon dioxide (CO_2) is the major contributor of this "greenhouse effect." Other gases include methane, nitrous oxide, and fluorinated gases (including all anesthetic gases). The CO_2 equivalents (CO_2e) of a greenhouse gas reflects its global warming potential relative to CO_2.
Carbon footprint	A measure of the amount of greenhouse gas emissions caused directly and indirectly by an individual, event, organization, or product. It is quantified as kilogram of CO_2e released.
Scopes of greenhouse gas emissions	Scope 1 comprises direct greenhouse gas emissions from sources that are owned or controlled by the organization. Examples include emissions from fuel combustion in boilers, furnaces, vehicles, and chemical production. Scope 2 comprises greenhouse gas emissions from the generation of purchased electricity consumed by the organization that physically occur at the facility. Scope 3 comprises all indirect greenhouse gas emissions as a consequence of the activities of the organization but from sources not owned or controlled by the organization. Examples are manufacturing, processing, packaging, and transportation of purchased products.

(Continues)

TABLE 1 | (Continued)

Term	Definition
Life cycle assessment	This is an analytical tool that captures the overall environmental impact of a product, process, or human activity throughout its full life cycle and includes phases from raw material acquisition, through production and use to disposal in a "cradle-to-grave" model.

Three workgroups were established to cover the five sections that were proposed. A systematic literature search in PubMed and Google Scholar was conducted using search terms such as "sustainability," "carbon footprint," "gastroenterology," "hepatology," "gastrointestinal endoscopy," and "telehealth." Selected articles included original articles, review articles, and systematic reviews. For each selected article, the search was further expanded by reviewing references. Each workgroup refined the initial set of statements for consensus voting. Additional members were incorporated based on nominations from APAGE Council to form the final voting panel, which consisted of 22 gastroenterologists from Asian Pacific regions (China, India, Indonesia, Japan, Hong Kong SAR, China, Korea, Malaysia, New Zealand, Pakistan, the Philippines, Singapore, Sri Lanka, Taiwan, Thailand, and Vietnam) with diverse demographic profiles. The panel included gastroenterologists of both genders, senior clinicians from APAGE Council or nominated by national societies, emerging leaders, and young researchers. Consensus among panel members was assessed through an anonymized and iterative Delphi process. Statements were graded using a 5-point Likert scale (1 *strongly disagree*, 2 *disagree*, 3 *neither agree or disagree*, 4 *agree*, and 5 *strongly agree*) via a web-based platform. Consensus was defined as $\geq$80% agreement (*agree* and *strongly agree*). The first round of online voting was conducted from August 26 to September 30, 2024. As some of the statements could not achieve consensus, an online meeting was held on October 8, 2024, to review the results and discuss how to refine the statements that did not reach consensus. A second round of online voting was conducted from October 9 to November 1, 2024. Consensus was achieved in all statements. The manuscript was drafted by members of the taskforce, with additional input from an expert in sustainability medicine. The final manuscript was approved by members of the APAGE Executive Committee.

3 | Results

The APAGE Position Statements consisted of five sections with a total of 16 statements. Areas that were covered included the rationale for climate action and transitioning to low-carbon models of patient care, the importance of adopting principles of waste management, actual approaches in clinical practice, and issues related to advocacy and research. The results are summarized in Table 2. Although most of the published data focused on GI endoscopy, the scope of these Position Statements also included general gastroenterology and hepatology, as these areas have not been addressed by prior guidelines. The Position Statements highlight the importance of considering climate sustainability in all domains of our clinical practice as part of a holistic approach.

3.1 | Section 1. Impact of Healthcare on Environmental Sustainability and the Health Cobenefits of Climate Action

Statement 1. APAGE recommends adopting prompt measures to reduce the carbon footprint of clinical practice due to the importance of climate action, and its health cobenefits.

Level of agreement: 100%.

Climate change is an existential threat to humanity. It results in heat-related morbidity and mortality and heat-related labor loss, worsens the risk of malnutrition, and increases the spread of life-threatening infections due to the impact on ecosystems [1]. The use of fossil fuels, the major cause of GHG emissions and global warming, causes air pollution and increases the risk of respiratory and cardiovascular diseases, cancer, diabetes mellitus, neurological disorders, and adverse pregnancy outcomes [1]. The healthcare sector has been reported to have an annual carbon footprint of two billion carbon dioxide equivalents (CO_2e), 4.6% of global GHG emissions [1]. The clinical burden of GI and liver disorders is high, and management often involves radiology, endoscopy, and surgery, contributing to a significant carbon footprint [6–8]. Prompt actions at the level of individuals and organizations are needed to transition to low-carbon models of patient care. Effective climate action would reduce GHG emissions and mitigate the adverse health impacts of global warming. Health cobenefits will be achieved through improvement of air quality, healthier low-carbon diets, and increased physical activity. Such gains would in turn reduce healthcare demand and minimize healthcare-related emissions and the associated health impacts [1].

Statement 2. APAGE recommends promoting the concept of climate sustainability into training curricula and daily clinical practice.

Level of agreement: 100%.

Clinical practices are often ingrained from early exposure. Introducing the concept of climate sustainability such as the nature of climate change and ways of reducing carbon footprint into medical education, be it at the undergraduate or postgraduate level, is important to raise awareness and help inform future practice [9]. Surveys indicated that even gastroenterologists would like further education to enhance awareness and provide practical solutions on sustainability in clinical practice [10, 11]. The 5R's principles, which will be further discussed in Section 2, is a useful framework to guide clinical practice. Targeted interventions that included staff education within the endoscopy center have been found to be useful in achieving waste reduction during endoscopy [12] and in reducing Scope 3 GHG emissions that are related to the supply of goods (including medical equipment and pharmaceuticals) and services [13].

TABLE 2 | Summary of position statements.

Impact of healthcare on environmental sustainability and the health cobenefits of climate action
Statement 1. APAGE recommends adopting prompt measures to reduce the carbon footprint of clinical practice due to the importance of climate action, and its health cobenefits. Statement 2. APAGE recommends promoting the concept of climate sustainability into training curricula and daily clinical practice.
Adoption of 5R's principles in routine clinical practice
Statement 3. APAGE recommends adopting 5R's principles (reduce, reuse, recycle, rethink, and research) to guide clinical practice and reduce the environmental impact of healthcare delivery. Statement 4. APAGE recommends efficient use of energy resources within healthcare infrastructure, such as heating, ventilation, and air-conditioning (HVAC) setbacks when rooms are not utilized and switching off noncritical electrical appliances when not in use.
Clinical practice in gastroenterology and hepatology
Statement 5. APAGE recommends adherence to professional clinical guidelines to optimize clinical care delivery in gastroenterology and hepatology to avoid the environmental impact of unnecessary procedures and tests. Statement 6. APAGE recommends the use of validated less resource-intensive, noninvasive biomarkers and tests as an alternative to endoscopy/imaging for disease monitoring, stratification, and surveillance, when clinically appropriate. Statement 7. APAGE recommends the use of efficient clinic workflows and telehealth, when available, to reduce the environmental impact arising from repeat clinic visits. Statement 8. APAGE recommends an emphasis on health promotion, disease prevention, and appropriate screening and surveillance, when resources are available, to reduce the environmental impact of managing more advanced diseases that require more intensive resources.
Clinical practice in gastrointestinal endoscopy
Statement 9. APAGE recommends endoscopy procedures should be performed based on clear clinical indications. Statement 10. APAGE recommends that when appropriate, combined procedures should be scheduled on the same day to reduce the carbon footprint from repeat visits. Statement 11. APAGE recommends a thoughtful approach to using endoscopic accessories, emphasizing that their application be carefully planned before procedures to reduce waste. Statement 12. APAGE recommends that technological advances in endoscopic imaging and artificial intelligence, when available, be used to improve the precision of endoscopic diagnosis to reduce the risk of missed lesions and need for unnecessary biopsies. Statement 13. APAGE recommends against the routine use of single-use endoscopes. Statement 14. APAGE recommends that endoscopy units have a clear waste management strategy to ensure contaminated, noncontaminated, and recyclable waste are appropriately segregated.
Advocacy, education, and research
Statement 15. APAGE recommends that member societies advocate, encourage, and facilitate the adoption of green and sustainable clinical practices. Statement 16. APAGE recommends that further research be conducted in the Asian Pacific region to clarify the carbon footprint and environmental impact of clinical and endoscopic practices for countries with different healthcare resources to guide future strategies in mitigation.

3.2 | Section 2. Adoption of 5R's Principles in Routine Clinical Practice

Statement 3. APAGE recommends adopting 5R's principles (reduce, reuse, recycle, rethink, and research) to guide clinical practice and reduce the environmental impact of healthcare delivery.

Level of agreement: 100%.

The 5R's principles of effective waste management are "reduce, reuse, recycle, rethink, and research" [6], and these principles have been used to reduce the environmental impact of clinical care delivery and manage waste production [14]. Such principles can serve as a guide for clinicians to align all aspects of healthcare delivery with environmental sustainability [2]. "Reduce" can be applied by ensuring every step of the patient journey adds value to the patient, such as replacing unnecessary physical visits with telehealth, avoiding unnecessary tests by adhering to clinical guidelines, and avoiding the opening of items "just in case." "Reuse" of devices and equipment has been associated with significant reductions in carbon footprint across a range of healthcare products. "Recycling" may reduce emissions associated with the disposal of waste, although applications for the recycled materials are often in products outside of the healthcare setting and greater reductions of emissions can be achieved through clinically appropriate rationalization and switching to reusable alternatives. "Rethink" can be applied to work processes, such as careful weighing of benefits to patient, costs, and carbon burden when selecting the modality of surgical and endoscopic interventions. "Research" is needed to better understand the environmental impact of specific processes in complex systems, to guide decisions and evaluate ways to provide high-quality, low-carbon models of patient care [8].

Statement 4. APAGE recommends efficient use of energy resources within healthcare infrastructure, such as heating, ventilation, and air-conditioning (HVAC) setbacks when rooms are not utilized and switching off noncritical electrical appliances when not in use.

Level of agreement: 100%.

HVAC within healthcare facilities provide a comfortable environment and reduce bioaerosols concentration [15]. Continuous and extensive use of HVAC and electrical equipment contributes substantially to GHG emissions [16]. HVAC setbacks are a strategy to save energy by reducing airflow and adjusting the temperature or humidity in a room when it is not in use. A study from Thailand reported that HVAC of hospitals consumed 51.36% of electrical energy [17]. Moreover, energy consumption has increased in response to the effect of global warming [18]. Studies have demonstrated the impact of thermostat setting of air-conditioning on reducing energy usage and CO_2 emission. When adjusted according to the monthly change in external environment, it reduced energy use by up to 33% [19]. Every 1°C increase in the setpoint of thermostat setting resulted in 6% reduction of energy use for HVAC [20]. It was estimated that 5.33% energy and 0.081 kg of CO_2 emission could be saved hourly when the temperature setpoint was changed from 23°C to 25°C [21]. An efficient building envelope to insulate against heat or heat loss [22] and appropriate clothing choice [23] are important in reducing energy consumption. The utilization of energy-efficient HVAC [24] and the cogeneration/trigeneration system in buildings that use natural gas [25] can further contribute to energy conservation.

3.3 | Section 3. Clinical Practice in Gastroenterology and Hepatology

Statement 5. APAGE recommends adherence to professional clinical guidelines to optimize clinical care delivery in gastroenterology and hepatology to avoid the environmental impact of unnecessary procedures and tests.

Level of agreement: 100%.

In the context of gastroenterology, reducing unnecessary diagnostic endoscopy [26, 27] is an effective way of reducing carbon footprint. Oversurveillance has been reported for Barrett's esophagus (BE) [28] and colonic polyps [29]. Clinicians should ensure that the indication of the procedure is valid [30]. Strategies to reduce inappropriate endoscopies include active guideline implementation [31], screening of referrals [32], and triaging of waiting lists [33]. Inadequate patient preparation is a common reason for incomplete endoscopic procedures, which may lead to delays in diagnosis and avoidable repeat patient visits. Clinicians should follow guidelines on procedure preparation [34–36]. Patient education could enhance the completion rate of endoscopic procedures, ensuring that associated carbon emissions contribute towards patient care [37]. Environmental sustainability in hepatology has yet to be recognized, partly because its carbon emission is relatively small compared to endoscopy but also because the environmental impact of practice of hepatology is challenging to quantify. Efforts to reduce the carbon emission of hepatology are being proposed, like promoting telehealth, shifting towards ambulatory care, and choosing low-carbon clinically appropriate alternatives for diagnosis [38].

Statement 6. APAGE recommends the use of validated less resource-intensive, noninvasive biomarkers and tests as an alternative to endoscopy/imaging for disease monitoring, stratification, and surveillance, when clinically appropriate.

Level of agreement: 100%.

Several validated and less resource-intensive tests are available for disease monitoring, stratification, and surveillance. Fecal immunohistochemical test (FIT) is an alternative to colonoscopy for colorectal cancer (CRC) screening in average-risk patients and has been shown to reduce CRC incidence and mortality [39]. As many patients prefer noninvasive screening modalities [40], using FIT may improve compliance with screening programs and reduce the burden of screening colonoscopy. Liver stiffness measurement, such as transient elastography (TE), is another validated noninvasive test [41]. Among patients who met the Baveno VII criteria for screening upper endoscopy, TE can identify patients with a low probability of high-risk varices in whom endoscopy is not needed [42]. Tests such as the "ABC method" [43] and serum microRNA [44, 45] for gastric cancer screening, and cytosponge for surveillance of BE [46], may potentially help to risk stratify patients for endoscopy. For patients with inflammatory bowel diseases (IBD), the Selecting Therapeutic Targets in Inflammatory Bowel Disease (STRIDE) II guidelines recommended using biomarkers as intermediate- and medium-term treatment goals. Fecal calprotectin has been correlated with endoscopic and histological indices in ulcerative colitis [47]. Intestinal ultrasound has gained popularity as a cost-effective means to monitor intestinal inflammation in IBD [48]. Machine learning with nonendoscopic-based algorithms have been studied for diagnosing and monitoring GI diseases such as gastric cancer [49].

Statement 7. APAGE recommends the use of efficient clinic workflows and telehealth, when available, to reduce the environmental impact arising from repeat clinic visits.

Level of agreement: 85%.

An efficient workflow could reduce repeated clinic visits by optimizing the number of tests performed on the same day, using one-stop clinic models. Telehealth is a broad term, including telemedicine, eHealth, remote patient monitoring, and asynchronous and synchronous care [50]. Telehealth activities were promoted during the COVID-19 pandemic, bringing benefits in rationalizing access to healthcare services, reducing the number of clinic visits, and showing potential for development in the postpandemic era [51]. Telehealth can reduce the number of visits for low-risk procedures or appointments to discuss endoscopy results that do not significantly affect disease management [52]. Studies have reported a significant reduction of GHG emissions, primarily from reduced travel [53]. The emissions from using remote healthcare systems are significantly lower than the emissions saved by reducing travel. Appropriate patient selection is important to avoid healthcare inequalities and maintain treatment efficacy [3, 4, 54].

Statement 8. APAGE recommends an emphasis on health promotion, disease prevention and appropriate screening and surveillance, when resources are available, to reduce the environmental impact of managing more advanced diseases that require more intensive resources.

Level of agreement: 95%.

GI cancers are among the most common malignancies [55]. In many resource-limited countries in the Asian Pacific region, there is a lack of national programs for screening and surveillance [56, 57]. Hence, the proportion of advanced-stage cancers remains high with correspondingly greater treatment burden and environmental impact. For instance, surgical units are estimated to be three to six times more energy-intense than other units of hospitals [58], and radiotherapy requires multiple treatment sessions [59]. The production of anticancer drugs contributes to environmental pollution and proper waste disposal remains challenging [60]. Promoting public awareness about risk factors and preventive measures are crucial to improve disease outcomes and minimize resource-intensive interventions. Lifestyle modifications help to reduce the risk of disease, such as metabolic dysfunction-associated steatotic liver disease and alcoholic liver disease [61]. This will reduce the environmental impact of having to manage more advanced disease states such as cirrhosis and liver cancer. Screening and surveillance are essential for early cancer detection. In the Asian Pacific region, colonoscopy and FIT are recommended for CRC screening [57], while ultrasound is used for liver cancer screening [62]. Although tests contribute to environmental waste [63] and energy consumption [64], appropriate use of screening tests can facilitate early diagnosis, and reduce the resources needed for treatment. A modeling study estimating GHG emissions related to screening colonoscopy concluded that diagnosing CRC at an earlier stage reduced CRC-related GHG emissions and minimized the environmental impact of CRC management [65].

3.4 | Section 4. Clinical Practice in GI Endoscopy

Statement 9. APAGE recommends endoscopy procedures should be performed based on clear clinical indications.

Level of agreement: 100%.

Endoscopy may be performed for diagnostic evaluation of symptoms, screening, surveillance of at-risk individuals, and treatment. Esophagogastroduodenoscopy and colonoscopy are regarded as the gold standard tests for evaluation of the GI mucosa. The level of image resolution that is achieved by endoscopic ultrasound (EUS) is higher than that of cross-sectional imaging, and its diagnostic capability is further expanded by EUS-guided tissue acquisition which has a very high diagnostic yield. Therapeutic procedures such as endoscopic resection, third space endoscopy, endoscopic retrograde cholangiopancreatography (ERCP), and EUS-guided therapeutic interventions provide patients highly effective minimally invasive treatment options. However, such diagnostic and therapeutic endoscopy procedures should be performed only when there is an anticipated positive impact on patient management [30]. Inappropriate procedures or procedures that are not expected to alter the treatment strategy or clinical outcome will result in unnecessary risk and cost for patients, and increase environmental waste and GHG emissions, without providing any benefit to patients [7, 8, 66, 67].

Statement 10. APAGE recommends that when appropriate, combined procedures should be scheduled on the same day to reduce the carbon footprint from repeat visits.

Level of agreement: 100%.

Performing esophagogastroduodenoscopy and colonoscopy on the same day, performing EUS and ERCP in the same session, or performing polypectomy during diagnostic endoscopy can reduce the frequency of hospital visits and the procedure-related carbon footprint. Reducing the number of visits decreases the use of resources such as personal protective equipment and the need for transportation. GHG emissions from transportation to and from the hospital have been estimated to account for 45% of the total carbon footprint of these procedures [68]. Energy savings are also realized by reducing the repetitive use of endoscopy rooms and sterilization equipment. The reuse of endoscopic equipment and the reduction in medical plastic consumables further contribute to energy conservation [4, 67–69]. Patients save on transportation costs, medical fees, and time. Hospitals can allocate medical personnel and resources more efficiently, reducing operational and staffing costs. Completing multiple procedures in a single visit can shorten the overall treatment and recovery period [70, 71]. This approach provides economic and time-saving benefits to both patients and hospitals and contributes to more sustainable healthcare services.

Statement 11. APAGE recommends a thoughtful approach to using endoscopic accessories, emphasizing that their application be carefully planned before procedures to reduce waste.

Level of agreement: 90%.

Most endoscopic accessories are now single use, and reuse may not be feasible due to loss of functionality. Namburar et al. reported that single-use disposable endoscopic supplies generated approximately 2 kg of waste per procedure [7]. In another study, Lacroute et al. reported consumables contributed to 7% of GHG emissions from an endoscopy center [68]. By evaluating the necessity of each item before a procedure, healthcare providers can minimize the use of unnecessary accessories [3, 4]. Ideally one should attempt to quantify the anticipated clinical impact of interventions to reduce endoscopic accessories usage [72]. However, the potential benefit of such reductions is already clear on a qualitative basis, and lack of data should not prevent a change in practice. A prospective study evaluating measures to reduce Scope 3 emissions found that when staff members were requested to limit the number of examinations including devices as much as possible without changing the usual workflow, the number of instruments used decreased by 10.0% and there was 11.5% less carbon emissions [13].

Statement 12. APAGE recommends that technological advances in endoscopic imaging and artificial intelligence, when available, be used to improve the precision of endoscopic diagnosis to reduce the risk of missed lesions and need for unnecessary biopsies.

Level of agreement: 95%.

Surveillance endoscopy contributes to GHG emissions due to energy consumption in endoscope reprocessing, processing of histological specimens, and generation of nonrecyclable and biohazardous waste. The carbon footprint from the processing of tissue samples has been estimated to increase from 0.29 to 0.79 kg CO_2e for one- versus three-specimen jars, and combining specimens when clinically appropriate should be considered [73]. Surveillance endoscopy [74, 75] is often characterized by protocol-based biopsies that result in multiple biopsies being taken and sent for histological assessment in separate specimen containers. Image-enhanced endoscopy (IEE) may potentially help reduce the need for biopsies by improving the precision of endoscopic diagnosis. The endoscopic grading of gastric intestinal metaplasia (EGGIM) using narrow-band imaging (NBI) [76] was proposed as an alternative to the operative link on gastric intestinal metaplasia (OLGIM) classification which required multiple gastric biopsies [74]. Artificial intelligence has demonstrated promising results for detection of dysplasia in BE [77]. IEE has been validated for the optical diagnosis of polyp histology during colonoscopy [78]. Diminutive (≤ 5 mm) polyps form the majority of polyps resected and usually do not harbor advanced histology such as high-grade dysplasia or carcinoma [79]. The American Society for Gastrointestinal Endoscopy Preservation and Incorporation of Valuable Endoscopic Innovations (PIVI) initiative has recommended thresholds for the "diagnose and leave" and "resect and discard" strategies [80], which can decrease the need for polypectomies for diminutive rectosigmoid polyps (DRSP) and formal histological assessment of resected diminutive adenomas. Among endoscopists with adequate training in NBI, the concordance between optical diagnosis-based and histology-based surveillance recommendations exceeded 90% [81]. Computer-aided diagnosis (CADx) provides endoscopists with automated characterization of polyp histology during colonoscopy. Several studies have demonstrated that CADx can meet the PIVI thresholds for the "resect and discard" strategy [82–84]. However, recent studies suggested that the performance of CADx did not meet PIVI requirements completely [85, 86]. A meta-analysis reported that CADx provided no incremental benefit or harm in the management of such polyps during colonoscopy [87]. More studies are needed to confirm the role of CADx in decreasing unnecessary polypectomies and avoiding the need for polyp retrieval after resection for histological evaluation.

Statement 13. APAGE recommends against the routine use of single-use endoscopes.

Level of agreement: 100%.

Single-use duodenoscopes (SUD) were introduced in response to reports of multidrug-resistant organism (MDRO) infections after ERCP. This was attributed to inadequate reprocessing of duodenoscopes due to the elevator mechanism at the scope tip [88]. Studies have shown that SUD are similar to reusable duodenoscopes (RUD) in terms of usability and maneuverability [89], but the difference in rate of infection between SUD and RUD has not been evaluated in a clinical trial. To perform a study with infection as an endpoint, the sample size required will be very large due to the low rate of infection even with RUD (0.4%–1%), and it would be impractical to perform such a study [90]. While enhanced surveillance and reprocessing methods can be adopted for RUD, their superiority over standard high-level disinfection is not established and may increase operational costs [91]. The use of SUD results in increased cost and environmental impact. A study from the Netherlands performed a break-even cost analysis of performing ERCP in patients with MDRO infections [92]. Their assessment was that the scenario of using SUD only in patients carrying MDRO could be an economically viable alternative to a complete transition to SUD. However, SUD had to be priced much lower to reach a per-procedure cost comparable with a scenario using RUD exclusively. A life cycle assessment (LCA) of standard RUD, RUD with disposable endcaps, and SUD reported that performing ERCP with SUD generated 24–47 times more CO_2e (36.3- to 71.5-kg CO_2e) than RUD (1.53-kg CO_2e) or RUD with disposal endcaps (1.54-kg CO_2e) [93]. Another LCA demonstrated the sustainability of RUD, with a carbon footprint 62–82 times lower than universal use of SUD and 10 times lower than occasional use of SUD. This was due mostly to end-of-life incineration emissions for SUD [94]. A cost analysis concluded that partially disposable duodenoscopes with disposable endcaps represented the most favorable option from a cost-utility standpoint, with low infection transmission and low-cost disposable element as compared to SUD [95]. Single-use gastroscopes and colonoscopes have been developed. However, their value proposition and cost-utility remain uncertain [90].

Statement 14. APAGE recommends that endoscopy units have a clear waste management strategy to ensure contaminated, noncontaminated and recyclable waste are appropriately segregated.

Level of agreement: 100%.

Waste can be classified as nonregulated medical waste (NRMW) and regulated medical waste (RMW) or biohazard waste. RMW is treated by incineration, which is environmentally costly [96]. Within the endoscopy unit, where both NRMW and RMW are generated, a strict waste hierarchy should be adhered to, such that contaminated, noncontaminated, and recyclable waste are appropriately segregated [4]. Kojima et al. reported that 25.8% of "infectious waste" was in fact noninfectious and should not be treated by incineration [97]. Correct identification of recyclable waste will reduce the ecological impact of endoscopy [67]. Cunha Neves et al. demonstrated that staff education reduced mean total waste and RMW by 12.9% and 41.4%, respectively, and reduced CO_2e by 31.6% [12].

3.5 | Section 5. Advocacy, Education, and Research

Statement 15. APAGE recommends that member societies advocate, encourage, and facilitate the adoption of green and sustainable clinical practices.

Level of agreement: 100%.

Surveys conducted in Asia [10] and Europe [11] indicated that while there was a general awareness of the impact of climate change and the need for sustainable practices, there were gaps in knowledge and lack of awareness of the key drivers of GHG emissions in clinical practice. Potential barriers to the implementation of sustainable practices included lack of institutional support, healthcare cost increment, infection risk, inadequate awareness, and lack of policy and industrial support. APAGE member societies are uniquely placed to engage clinicians in their respective countries and to provide leadership for climate action by promoting research and education in environmental sustainability. Unlike Statement 2 which relates specifically to clinical training curriculum, Statement 15 relates to the importance of top-down leadership from member societies.

Statement 16. APAGE recommends that further research be conducted in the Asian Pacific region to clarify the carbon footprint and environmental impact of clinical and endoscopic practices for countries with different healthcare resources to guide future strategies in mitigation.

Level of agreement: 100%.

Studies from the West have highlighted the amount of waste and GHG emissions generated from endoscopy [13, 67, 68] and the possibility of successful intervention [12]. Even implementing simple measures such as turning off the light source on the endoscope while waiting and shutting down the endoscopy tower during off-hours could reduce GHG emissions without affecting work efficiency [98]. There is a lack of data regarding the environmental footprint and the impact of interventions within the Asian Pacific region. Further research is needed to achieve a better understanding and to guide sustainable practices.

4 | Conclusion

The APAGE Position Statements provide guidance to healthcare practitioners on practices that promote climate sustainability. Climate action does not mean doing less for patients and lowering the quality of healthcare. It is about more effective use of existing resources and technology to reduce waste and avoidable repeat visits and to prevent disease progression to a more advanced stage which would require more resources to manage. Climate action must be driven by science, and decisions undertaken must weigh the pros and cons from perspectives of clinical effectiveness, as well as financial and environmental cost. APAGE will work with member societies to promote these guidelines and collaborate on educational symposia to raise awareness of climate sustainability issues, equip healthcare practitioners with the skillsets to conduct research, and implement effective strategies for climate action.

Conflicts of Interest

Tiing Leong Ang and James Weiquan Li are Editorial Board members of JGH and co-authors of this article. To minimize bias, they were excluded from all editorial decision-making related to the acceptance of this article for publication.

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