Thieme

Sustainability in endoscopic medical congresses and courses: Position Statement from the European Society of Gastrointestinal Endoscopy and the European Society of Gastroenterology and Endoscopy Nurses and Associates

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ABSTRACT

Medical conferences and educational courses in gastrointestinal (GI) endoscopy are essential for training, quality improvement, and scientific exchange, but they are also associated with a substantial environmental footprint, largely driven by travel-related greenhouse gas emissions and resource consumption. While sustainability in endoscopic practice has gained increasing attention, the environmental impact of endoscopy congresses and courses has remained insufficiently addressed. This document outlines the official position of the European Society of Gastrointestinal Endoscopy (ESGE) and the European Society of Gastroenterology and Endoscopy Nurses and Associates (ESGENA). An international multidisciplinary panel of experts conducted a systematic literature review, expert narrative appraisal where evidence was limited, and an iterative Delphi consensus process. The resulting recommendations address key domains of conference organization, including event conception, scientific program design, transportation and participation models, faculty selection, venue and accommodation, catering, waste reduction, training formats, and collaboration with industry partners. Emphasis is placed on promoting virtual and hybrid conference formats, low-emission travel options, sustainable venues and catering, and the systematic measurement and transparent reporting of environmental impact. This ESGE–ESGENA Position Statement provides practical, consensus-based, evidence-informed guidance to support GI endoscopy societies, conference organizers, industry partners, and participants in reducing the environmental impact of endoscopy-related educational activities while preserving their scientific and educational quality.

ABBREVIATIONS

ESGE	European Society of Gastrointestinal Endoscopy
ESGENA	European Society of Gastroenterology and Endoscopy Nurses and Associates
GI	gastrointestinal
GRADE	Grading of Recommendations Assessment, Development and Evaluation
kgCO_2e	kilograms of carbon dioxide equivalent
PICO	population/problem, intervention, comparator, outcome

1. Introduction

The European Society of Gastrointestinal Endoscopy (ESGE) has embraced sustainability in gastrointestinal (GI) endoscopy as a strategic priority [1].

Medical conferences are resource-intensive events, associated with substantial greenhouse gas emissions, primarily driven by participant travel, but also by venue energy consumption, catering, conference materials, and industry exhibitions. The environmental impact of medical meetings has been documented in the scientific literature for more than two decades, and more recent analyses consistently demonstrate that conferences often represent the single largest contributor to the carbon footprint of scientific societies [2]. As awareness of climate change and planetary health increases, the sustainability of

traditional conference models has become a pressing concern across medical disciplines.

GI endoscopy societies face additional challenges, as educational activities frequently include live endoscopy sessions, hands-on training, and animal-based courses, all of which may further increase environmental impact. At the same time, these activities are central to education, training, and quality improvement, making a simple reduction in educational efforts neither feasible nor desirable. The challenge, therefore, lies in rethinking how such events are designed, organized, and delivered, with the aim of maximizing educational value while minimizing environmental harm.

This ESGE–ESGENA Position Statement reviews the available evidence on the environmental impact of GI endoscopy congresses, courses, live endoscopy events, and animal training programs, and provides practical, evidence-informed guidance to reduce the environmental footprint of GI endoscopy-related educational activities, while preserving scientific and educational excellence.

2. Methods

This document has been developed following the current ESGE Publications Policy [3]. A Position Statement was considered appropriate given the anticipated lack of high quality evidence and the strategic relevance of the topic.

In February 2025, the project leads (M.P. and E.R. de S.) issued an email invitation to the ESGE Green Endoscopy Working Group members, experts in sustainability research, and also to the ESGENA Governing Board requesting them to nominate ESGENA members with a particular interest in this topic. Final participant selection was conducted by the project leads, based on clinical and research experience, involvement in sustainability-related activities, and the principles of diversity, equity, and inclusion. The ESGE Executive Committee subsequently approved the final panel of 23 members.

The project leads then circulated a preliminary list of questions and topics to all panel members, who were organized into five taskforces (see Supplementary material, available online-only). Questions were structured using the PICO (population/problem, intervention, comparator, outcome) framework. Where a PICO structure was not feasible or appropriate, questions were addressed via expert-based narrative reviews. A virtual meeting was held on 24 February 2025, during which panel members provided input on the initial questions and the overall structure of the Position Statement. Panellists were then given 2 weeks to provide additional feedback, following which the final list of questions was approved.

A structured template was developed to standardize the literature search and methods. Subsequently, we conducted a systematic literature search in a minimum of two databases, using several PICO questions, from inception to June 2025 (see Supplementary material). Subsequently, each taskforce reviewed the available literature and drafted an initial list of statements. These drafts were reviewed by the project leads, who provided initial feedback. The GRADE (Grading of Recommendations Assessment, Development and Evaluation) system was not used as we anticipated a lack of evidence for most statements.

The first round of Delphi voting was conducted during July and August 2025, followed by a second round in October 2025. Statements were graded with a 5-point Likert scale (1, Strongly disagree; 2, Disagree; 3, Neither agree nor disagree; 4, Agree; 5, Strongly agree) via a web-based platform (Survey Monkey). Before voting, panellists received the evidence supporting each statement. Panellists were asked to consider clinical benefits and harms for patients and healthcare systems, costs, quality of the evidence, and the environmental impact. Consensus was defined as ≥80% agreement (the sum of Agree and Strongly agree). Statements were deleted or reformulated by the project leaders for the subsequent voting round if the agreement was <80%. In addition, panellists' comments were reviewed and, when considered relevant by the project leads, incorporated even for statements that reached the agreement threshold. The results of each voting round are detailed in the Supplementary material.

The manuscript was reviewed and approved by the ESGE Executive Committee. The final version of the Position Statement was approved by all authors. The final statements are summarized in ▶ **Table 1**.

3. What is the environmental impact of GI endoscopy congresses?

Our systematic search identified 17 studies assessing the environmental impact of medical conferences; these were predominantly retrospective and employed heterogeneous methodologies (see Supplementary material). To date, no conference focused on GI endoscopy has assessed its environmental impact.

Air travel contributes approximately 85%–99% of total greenhouse gas emissions (▶ **Fig. 1**) associated with medical conferences, with per-attendee contributions varying considerably depending on location and conference format [2, 4, 5]. Long-haul flights, in particular, are responsible for the highest emissions per attendee, and traveling in business class can result in up to three times the emissions compared to economy class [2, 6, 7]. For instance, the Canadian Association of Gastroenterology's annual meeting experienced a 41% increase in emissions, primarily due to longer average flight distances [7]. These findings highlight the substantial influence of conference location on overall environmental impact. This trend is consistent across medical specialties, with remote venues generating nearly twice the emissions of centrally located alternatives [8].

Accommodation at the destination contributes to the environmental burden to a lesser extent. Other factors – such as venue energy use, heating, and waste generation from conference materials and giveaways – are relatively minor contributors to the carbon footprint [2].

Fully virtual conferences can reduce emissions by 86%–99% compared to in-person meetings [9, 10]. Hybrid models, incorporating virtual participation alongside regional hubs, have achieved emissions reductions of 54%–71% [11]. However, careful planning is essential, as emissions from interhub travel

▶ **Table 1** Sustainability in endoscopic medical congresses and courses. ESGE and ESGENA Position Statement: final statements.

	Key domains	Statements
Sustainability in event conception and scientific program	4.1 Core principles	**1** ESGE and ESGENA recommend the establishment of a 'Green Plan' when starting to organize a GI endoscopy congress or course, taking the '5 Rs' (Reduce, Reuse, Recycle, Rethink, Research) into consideration. Level of agreement 100%
		2 ESGE and ESGENA support the educational role of medical conferences on environmental sustainability. Level of agreement 100%
	4.2 Dedicated sustainability sessions	**3** ESGE and ESGENA recommend dedicated green sessions during conferences to increase sustainability awareness and create common interest groups. Level of agreement 92%
	4.3 Live endoscopy events and hands-on training	**4** ESGE and ESGENA recommend that sustainability awareness should be included during hands-on training courses and live endoscopy events. Level of agreement 92%
		5 When practical hands-on training is included, ESGE and ESGENA recommend transitioning to non-live-animal training models except when a clear educational benefit has been demonstrated. Level of agreement 83%
Reducing transport-related emissions	5.1 Hybrid and online formats	**6** ESGE and ESGENA recommend that virtual and hybrid conference models should be encouraged. Level of agreement 100%
	5.2 Low-emission travel options	**7** ESGE and ESGENA recommend that conference organizers identify and promote climate-friendly travel alternatives to attendees. Level of agreement 96%
		8 ESGE and ESGENA recommend the use of less carbon-intensive modes of transport to reach the congress facility when in-person meetings are justified. Level of agreement 89%
	5.3 Selection of host city	**9** ESGE and ESGENA recommend that conference sites be carefully selected to minimize emissions, giving preference to locations with robust public transport and climate-friendly travel options. Level of agreement 96%
		10 ESGE and ESGENA recommend prioritizing low-carbon cities as host locations for congresses, with optional use of tools such as the Gridded Global Model of City Footprints or the Carbon Disclosure Project ratings to support this assessment. Level of agreement 96%
		11 ESGE and ESGENA suggest considering decentralized satellite meetings in multiple selected locations as they can minimize travel-related emissions. Level of agreement 92%
	5.4 Selection of faculty	**12** ESGE and ESGENA recommend adapting faculty selection to the conference location (e. g., giving preference to local experts or those able to travel by train). The carbon footprint of faculty attendance should be considered alongside scientific and educational merit. Level of agreement 87%
Venue and accomodation	6.1 Selection of venue	**13** ESGE and ESGENA recommend favoring venues with established sustainability policies and certifications, ensuring that environmental criteria are part of the venue selection process. Level of agreement 96%
	6.2 Onsite actions	**14** ESGE and ESGENA recommend the use of appropriate onsite recycling bins to help reduce the waste sent to landfills. Level of agreement 100%
		15 ESGE and ESGENA recommend that brochures or conference schedules should be provided in digital format or, if necessary, in products made from recycled, biodegradable, and sustainable materials. Level of agreement 93%

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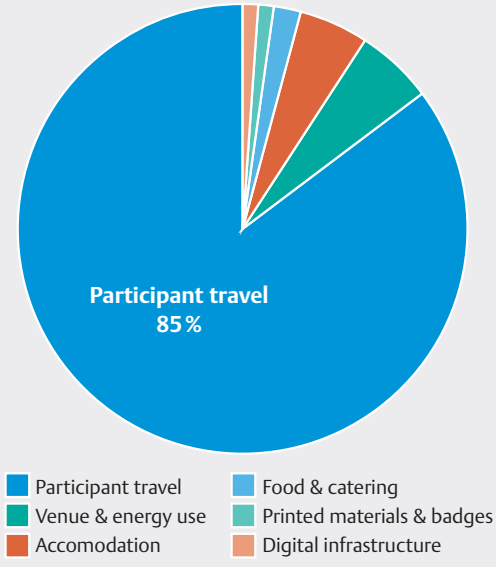
▶ **Table 1** (Continuation)

	Key domains	Statements
	6.3 Catering	**16** ESGE and ESGENA recommend vegetarian event catering whenever possible to reduce environmental burden. Level of agreement 92%
		17 ESGE and ESGENA recommend favouring locally farmed, seasonal and fresh food, and using reusable dishes, cups, and cutlery. Level of agreement 96%
	6.4 Accommodation	**18** ESGE and ESGENA recommend the prioritization of accommodation with certified sustainable policies. Level of agreement 86%
		19 ESGE and ESGENA recommend the selection of accommodations with good access to the conference venue (i. e., via public transportation or within walking distance). Level of agreement 96%
Benchmarking green performance	7.1 Should GI endoscopy conferences assess their environmental impact?	**20** ESGE and ESGENA suggest considering that GI endoscopy congresses and courses assess their environmental impact. Level of agreement 100%
		21 ESGE and ESGENA recommend producing a sustainability report following each event, highlighting areas for improvement for the next edition. Level of agreement 96%
	7.2 Should GI endoscopy conferences offset their carbon footprint?	**22** ESGE and ESGENA recommend that GI endoscopy congresses and courses implement direct emission reduction strategies or carbon-offsetting initiatives to minimize the environmental impact and promote sustainability. Level of agreement 96%
Recommendations for industry partners		**23** ESGE and ESGENA recommend that industry partners supporting meetings adopt low-waste and low-carbon practices. Level of agreement 100%

ESGE, European Society of Gastrointestinal Endoscopy; ESGENA, European Society of Gastroenterology and Endoscopy Nurses and Associates; GI, gastrointestinal.



▶ **Fig. 1** Main sources of environmental impact associated with medical conferences: relative contributions.

can offset some of the sustainability gains achieved through local hosting [12].

Although data specific to GI meetings are lacking, existing evidence suggests that these conferences face environmental challenges similar to those encountered in other medical fields.

4. Sustainability in event conception and scientific program

4.1 Core principles

STATEMENT 1

ESGE and ESGENA recommend the establishment of a 'Green Plan' when starting to organize a GI endoscopy congress or course, taking the "5 Rs" (Reduce, Reuse, Recycle, Rethink, Research) into consideration.
Level of agreement 100%

STATEMENT 2

ESGE and ESGENA support the educational role of medical conferences on environmental sustainability.
Level of agreement 100%

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Conferences should be an opportunity to set an example of sustainable practices, showing participants how small efforts can lead to significant changes [13, 14, 15].

ESGE and ESGENA recommend implementing a 'Green Plan' from the earliest stages of organizing a GI endoscopy congress or course. The structured approach of the '5 Rs' – Reduce, Reuse, Recycle, Rethink, Research – provides a practical framework to decrease CO_2 emissions, waste generation, and resource consumption in line with healthcare sustainability goals. Recent analyses have shown that medical conferences contribute substantially to emissions related to travel [2, 16], promotional materials, and logistical operations, underscoring the need for more resource-efficient and circular strategies [17]. Integrating a Green Plan therefore promotes organizational practices that are consistent with European environmental commitments and with the principles of more sustainable endoscopy [13].

4.2 Dedicated sustainability sessions

STATEMENT 3
ESGE and ESGENA recommend dedicated green sessions during conferences to increase sustainability awareness and create common interest groups.
Level of agreement 92%

Literature still lacks solid studies focusing on the actual impact of dedicated green sessions at conferences, in terms of both environmental outcomes and participant satisfaction. What is clear, however, is that all major European gastroenterology conferences have allocated more space to green sessions than in the past. One of the most important outcomes is that scientists with a shared interest in this topic have been brought closer together, enabling the formation of working groups focused on environmental sustainability. Thanks to the creation of common interest working groups, the quality of research has improved, resulting in national and international position papers [1, 18, 19] and a growing body of literature on 'green endoscopy' aimed at promoting more sustainable practices, including research methodology [20].

4.3 Live endoscopy events and hands-on training

STATEMENT 4
ESGE and ESGENA recommend that sustainability awareness should be included during hands-on training courses and live endoscopy events.
Level of agreement 92%

In a recent survey conducted by the ESGE Green Endoscopy Working Group, lack of knowledge from staff was considered one of the main barriers to sustainable endoscopy [21]. By educating healthcare professionals, especially those in training, on sustainable practices, the development and adoption of new technologies that are both effective and environmentally conscious should be encouraged. This could include the indication, discussion of noninvasive alternatives, combination of examinations, the choice of medical devices, greener sterilization techniques, and waste management strategies [22].

This is in line with a growing number of sustainability education programs around the world, which aim to integrate climate and health teaching into curricula to recognize, prevent, and treat the increasing burden of the climate crisis on public health, and to deliver sustainable healthcare solutions [23].

A greater understanding of sustainability could lead to practices that contribute not only to local healthcare improvements but also to global health goals, such as reducing carbon emissions [24].

STATEMENT 5
When practical hands-on training is included, ESGE and ESGENA recommend transitioning to non-live-animal training models except when a clear educational benefit has been demonstrated.
Level of agreement 83%

Modern nonanimal training models (mechanical simulators, ex vivo phantoms or virtual reality) have proven effective for teaching both basic and advanced techniques in GI endoscopy [25, 26, 27, 28, 29]. Evidence from biomedical research indicates that live animal experimentation is associated with significant resource use, pollution, energy consumption, waste generation, and impacts on biodiversity [30]. Given the additional ethical, logistical, and cost constraints – not to mention animal welfare – of live-animal training (which also requires special facilities, veterinary care, and regulatory oversight) [31], it appears both feasible and justified to prioritize nonanimal or isolated ex vivo methods in endoscopy training.

5 Reducing transport-related emissions

5.1 Hybrid and online formats

STATEMENT 6
ESGE and ESGENA recommend that virtual and hybrid conference models should be encouraged.
Level of agreement 100%

One way to reduce the transport burden, that accounts for about 90% of the carbon emission impact [32], is by implementing virtual learning [2, 9, 10, 33, 34, 35, 36]. With 25% virtual attendees, the carbon footprint drops approximately 13%, although 87% could be reached with 75% virtual attendees [2]. Hybrid models, incorporating virtual participation alongside regional hubs, have achieved emissions reductions of

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54%–71% [11]. Concurrent use of digital sobriety measures, such as optimizing streaming quality and minimizing non-essential data transmission, may lower the carbon footprint of virtual participation by as much as 80% [37].

5.2 Low-emission travel options

STATEMENT 7
ESGE and ESGENA recommend that conference organizers identify and promote climate-friendly travel alternatives to attendees.
Level of agreement 96%

STATEMENT 8
ESGE and ESGENA recommend the use of less carbon-intensive modes of transport to reach the congress facility when in-person meetings are justified.
Level of agreement 89%

Switching to train travel or providing remote participation options (hybrid or virtual formats) can reduce the carbon footprint of a conference by 78%–97% [38]. For those reasons, travel mode incentives (reduced fees, train ticket support, public transport access), carbon footprint calculators for participants, or hybrid conference formats are advisable.

5.3 Selection of host city

STATEMENT 9
ESGE and ESGENA recommend that conference sites be carefully selected to minimize emissions, giving preference to locations with robust public transportation and climate-friendly travel options.
Level of agreement 96%

STATEMENT 10
ESGE and ESGENA recommend prioritizing low-carbon cities as host locations for congresses, with optional use of tools such as the Gridded Global Model of City Footprints or the Carbon Disclosure Project ratings to support this assessment.
Level of agreement 96%

Choice of location determines delegate transport emissions, especially air travel as discussed above. Choosing a host city geographically optimal for total attendee travel can reduce emissions by nearly 20% [39]. Prioritizing centrally located and easily accessible venues can significantly reduce overall travel-related emissions, particularly when attendee origins are geographically clustered [11].

Beyond geography and urban planning, income levels are the most significant predictors of a city's carbon footprint [40]. The Carbon Disclosure Project, a nonprofit carbon overseer, provides insight into local waste and water management [41].

STATEMENT 11
ESGE and ESGENA suggest considering decentralized satellite meetings in multiple selected locations as they can minimize travel-related emissions.
Level of agreement 92%

The adoption of a hub-and-spoke framework can substantially reduce the need for long-haul travel by decentralizing attendance across regional hubs [11]. Satellite meeting formats – where a limited number of speakers travel long distances while most participants attend locally – can markedly reduce travel-related emissions. Available data suggest that decentralized satellite-style meetings may reduce overall emissions by up to 38% [39].

However, this model also presents relevant challenges. Decentralized meetings need complex organizational and technical coordination, including reliable audiovisual infrastructure, synchronization across time zones, and consistent educational quality across sites. In addition, local logistics, costs, and the carbon footprint associated with operating multiple venues must be carefully considered. Further experience and real-world evaluations are needed to determine the feasibility, scalability, and overall sustainability of satellite meeting formats in different settings.

5.4 Selection of faculty

STATEMENT 12
ESGE and ESGENA recommend adapting faculty selection to the conference location (e.g., giving preference to local experts or those able to travel by train). The carbon footprint of faculty attendance should be considered alongside scientific and educational merit.
Level of agreement 87%

Scientific and educational excellence (respecting equity and inclusivity), must remain the primary criteria for selecting external speakers [42,43]. However, these criteria must be balanced against the environmental cost of travel. Favoring local experts, prioritizing speakers who can travel by train, or offering virtual participation to distant faculty can significantly reduce the carbon footprint of conferences and signal a strong commitment to sustainable event organization [2,14].

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6 Venue and accommodation

6.1 Selection of venue

STATEMENT 13
ESGE and ESGENA recommend favoring venues with established sustainability policies and certifications, ensuring that environmental criteria are part of the venue selection process.
Level of agreement 96%

Selecting a conference venue with a recognized sustainability policy or certification can significantly reduce the environmental impact of medical meetings. Certified venues include, for instance, those endorsed through programs such as Green Key [44] or those complying with the international standard ISO 20121. Such venues also often promote sustainable procurement, encourage reuse of materials (e.g., signage, marketing stands), avoid single-use plastics, and support low-impact catering and resource-efficient catering practices.

6.2 Onsite actions

STATEMENT 14
ESGE and ESGENA recommend the use of appropriate onsite recycling bins to help reduce the waste sent to landfills.
Level of agreement 100%

The "5 Rs" for green endoscopy noted by ESGE suggest recycling in addition to rethink, reduce, reuse, and research [15,45,46]. Therefore, we recommend the introduction of an easily comprehensible waste segregation and recycling system. These measures can further reduce the CO_2 emissions caused by waste incineration and landfill [2,14]. In addition, it is also recommended that delegates receive training on waste separation [15].

STATEMENT 15
ESGE and ESGENA recommend that brochures or conference schedules should be provided in digital format or, if necessary, in products made from recycled, biodegradable, and sustainable materials.
Level of agreement 93%

Printed conference programs generate avoidable waste and rely on resource-intensive paper production, which is associated with deforestation, high water consumption, and CO_2 emissions. Life cycle assessments have shown that shifting from printed documents to digital formats can significantly reduce greenhouse gas emissions and solid waste generation in scientific events [47]. Sustainable paper alternatives – recycled fibres or compostable materials – also have a markedly lower environmental impact compared with conventional paper.

6.3 Catering

STATEMENT 16
ESGE and ESGENA recommend vegetarian event catering whenever possible to reduce environmental burden.
Level of agreement 92%

STATEMENT 17
ESGE and ESGENA recommend favoring locally farmed, seasonal, and fresh food, and using reusable dishes, cups, and cutlery.
Level of agreement 96%

Catering represents a significant component of the carbon footprint of medical conferences, accounting for approximately 16%–30% of all nontravel CO_2 emissions, largely due to food production, transport, and consumption [15]. Animal-based products – particularly red meat and fish – are major contributors to these emissions [48]. Replacing standard menus with vegetarian options can reduce catering-related emissions by around 30%, while fully vegan menus may achieve reductions of up to 60% [49].

6.4 Accommodation

STATEMENT 18
ESGE and ESGENA recommend the prioritization of accommodation with certified sustainable policies.
Level of agreement 86%

According to current studies, hotel overnight stays of delegates, contribute to 4%–15% of CO_2 emissions from medical congresses [2,8,32,47,50]. The emissions are location-dependent (e.g. 7.2 $kgCO_2e$ per room-night in France, 17.6 $kgCO_2e$ per room-night in Spain, 36.2 $kgCO_2e$ per room-night in the US [32]), and depend on the sustainability policies of the hotels. In order to reduce hotel-related emissions, accommodations that implement sustainable measures should be selected [2,14,50]. Available eco-certificates specifically for hotels can provide guidance [50].

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STATEMENT 19
ESGE and ESGENA recommend the selection of accommodations with good access to the conference venue (i. e., via public transport or within walking distance).
Level of agreement 96%

In addition to the selection of sustainable hotels, current studies recommend choosing hotels based on their distance to the conference venue. Preference should be given to hotels within walking distance or with good access to the venue via public transport [2, 15].

7 Benchmarking green performance

7.1 Should GI endoscopy conferences assess their environmental impact?

STATEMENT 20
ESGE and ESGENA suggest considering that GI endoscopy congresses and courses assess their environmental impact.
Level of agreement 100%

Our search did not reveal any published studies analyzing the benefits, costs, or harms of measuring the carbon footprint of scientific conferences. Nevertheless, the rationale for implementing such assessments is compelling. They facilitate informed decision-making, demonstrate accountability, and support a culture of sustainability. Integrating environmental impact assessments into conference planning can drive meaningful change [2, 14, 47]. Tracking metrics such as carbon emissions, energy consumption, and waste production offers clear benchmarks for sustainable improvement and for future editions.

Challenges include the lack of standardized methodologies, the need for dedicated resources, and potential organizational burdens – especially for international, multi-institutional events.

STATEMENT 21
ESGE and ESGENA recommend producing a sustainability report following each event, highlighting areas for improvement for the next edition.
Level of agreement 96%

Producing a post-event sustainability report is increasingly regarded as a best practice for scientific societies and conference organizers.

A formal report allows organizers to benchmark performance, identify strengths and gaps, and set measurable targets for subsequent editions. Such transparency builds credibility and accountability, demonstrating that the society not only aspires to sustainability in theory, but tracks its real-world footprint and commits to continuous improvement.

Empirical research confirms that significant gains in sustainability can be achieved when conferences adopt a holistic, data-driven approach [51].

Thus, requiring a dedicated sustainability report after each event would: (i) provide objective data and transparency; (ii) help track progress over time; (iii) inform and motivate future improvements (e. g. reducing CO_2 emissions, waste, energy, and social impact); and (iv) symbolically commit the society to embedding sustainability into its core mission.

7.2 Should GI endoscopy conferences offset their carbon footprint?

STATEMENT 22
ESGE and ESGENA recommend that GI endoscopy congresses and courses implement direct emission reduction strategies or carbon-offsetting initiatives to minimize the environmental impact and promote sustainability.
Level of agreement 96%

Carbon offsetting should be implemented alongside direct reduction strategies. By offsetting unavoidable emissions through verified carbon credits (e. g., Gold Standard [52]), conferences can neutralize these impacts once all feasible reductions – such as virtual participation, hybrid formats, and regional satellite sessions – have been implemented [1]. The European Green Deal aims for at least a 55% emissions reduction by 2030 and climate neutrality by 2050, embedding event-level sustainability into broader policy frameworks [53].

On the other hand, offsets do not yield immediate benefits; many projects deliver avoided emissions only years later. Critics also caution about the risk of greenwashing and that over-reliance may distract from systemic solutions such as reduced flying or improved logistics. Furthermore, offsetting should never replace rigorous emissions reduction at source.

8 Recommendations for industry partners

STATEMENT 23
ESGE and ESGENA recommend that industry partners supporting meetings adopt low-waste and low-carbon practices.
Level of agreement 100%

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By favoring low-carbon transport (e.g., train instead of flights) or virtual attendance for some of their staff, industry partners can drastically lower travel-related emissions. Moreover, promotional materials, giveaways ('goodies'), packaging, single-use plastics, and other waste linked to industry booths or sponsorship contribute significantly to the event's waste burden [15].

9 Conclusions

Medical conferences and educational courses are fundamental to progress in GI endoscopy, enabling innovation, training and international collaboration. However, the evidence reviewed in this Position Statement demonstrates that traditional conference models are associated with a substantial environmental burden, driven predominantly by travel-related emissions, but also by venue operations, catering, accommodation, and resource consumption. In the context of climate change and planetary health, improving the sustainability of professional education has become an ethical responsibility for scientific societies.

This ESGE–ESGENA Position Statement provides a pragmatic, evidence-informed framework to reduce the environmental impact of GI endoscopy congresses and courses while preserving their educational and scientific value. Key strategies include promoting virtual and hybrid formats, optimizing conference location and accessibility, encouraging low-carbon travel, adapting faculty selection, prioritizing sustainable venues and accommodation, reducing waste and printed materials, improving catering practices, and favoring nonanimal training models when educationally appropriate. Systematic assessment and transparent reporting of environmental impact are essential to support accountability and continuous improvement.

ESGE and ESGENA will engage to progressively implement these recommendations in their own congresses, courses, and endorsed events in the coming years. By embedding sustainability into event planning and fostering shared responsibility among organizers, faculty, industry partners, and participants, both societies aim to deliver high quality education while contributing to more sustainable healthcare and scientific practice.

Disclaimer

The legal disclaimer for ESGE guidelines as described in the 2020 Publications Policy Update [3] applies to this Position Statement.

Acknowledgement

The Working Group sincerely thanks Jennifer Haas and Françoise Heidenreich for their help in organization and follow-up for this Position Statement

Contributors' Statement

Mathieu Pioche: Conceptualization, Investigation, Methodology, Project administration, Supervision, Writing - original draft, Writing - review & editing. João A. Cunha Neves: Conceptualization, Investigation, Supervision, Writing - original draft, Writing - review & editing. Luca Elli: Formal analysis, Investigation, Project administration, Supervision. Lars Aabakken: Formal analysis, Investigation, Writing - original draft. Eduardo Albéniz: Formal analysis, Investigation, Writing - review & editing. Marianna Arvanitakis : Formal analysis, Investigation, Validation, Writing - review & editing. Robin Baddeley: Formal analysis, Investigation, Writing - original draft. Bridget Barbieri: Formal analysis, Investigation, Project administration, Resources. Purnima Bhat: Formal analysis, Investigation. Michael Bretthauer: Formal analysis, Investigation, Methodology, Supervision, Validation, Writing - review & editing. Leigh Donnelly: Formal analysis, Investigation, Writing - original draft. Antonio Facciorusso: Formal analysis, Investigation, Methodology. Ian M Gralnek: Formal analysis, Investigation. Cesare Hassan: Formal analysis, Investigation, Methodology, Validation. Dorothea Henniger: Formal analysis, Investigation, Writing - original draft. Kareem Khalaf: Formal analysis, Investigation. Michelle Klose: Formal analysis, Investigation. Vicente Lorenzo-Zúñiga: Formal analysis, Investigation. Alexander Meining: Formal analysis, Investigation. Neil Robert O'Morain: Formal analysis, Investigation. Maria Pellisé: Formal analysis, Investigation. Heiko Pohl: Formal analysis, Investigation, Writing - original draft, Writing - review & editing. Christoph Römmele: Formal analysis, Investigation. Keith Siau: Formal analysis, Investigation. Reena Sidhu: Formal analysis, Investigation, Writing - review & editing. Matilde Topa: Formal analysis, Investigation. Anastasia Tsalouka: Formal analysis, Investigation. Ariane Vienne: Formal analysis, Investigation. Enrique Rodriguez de Santiago: Conceptualization, Formal analysis, Investigation, Project administration, Supervision, Validation, Writing - original draft, Writing - review & editing.

Conflict of Interest

L. Aabakken contributes annually to the Endoscopy Masters Forum associated with Olympus (2020–2026). E. Albéniz has consulting agreements with Creo Medical and AGS MedTech; he has received honoraria for lectures, teaching activities, or as travel grants from Olympus, Boston, Fujifilm, Norgine, Casen Recordati, and 3D Matrix. R. Baddeley has provided paid consultancy to Boston Scientific (April 2025). B. Barbieri is a volunteer member (no remuneration) of the Sustainability Task Force of the Associations and Conferences Forum (AC Forum). P. Bhat is a member of the Gastroenterology Society of Australasia Sustainability Network and does unpaid work preparing national guidelines and advocating for green endoscopy (2023, ongoing). J.A. Cunha Neves has provided consultancy to Boston Scientific (2025). L. Donnelly is Chair of the Nursing Section of the British Society of Gastroenterology; she is Consultant Editor for the journal Gastrointestinal Nursing. I.M. Gralnek has provided consultancy to the following: Olympus (2025–present), Medtronic (2024–present), GistMD (2026), ERGO GI (2025–present), Viatris (2024–present), Magentiq Eye (2026), Motus GI (>10 years); he has also received research support from Medtronic, research funding from Motus GI, and has stock options in GistMD, Magentiq Eye. and Motus GI. E. Rodríguez de Santiago has had research support from AGS (2025); he has provided consultancy to Olympus (2017–present), Boston Scientific (2025), and Adacyte Therapeutics (2023); he has provided educational activities to Apollo Endosurgery (2022) and Olympus; he has received a research grant from 3D Matrix; and has received congress/speaker fees from 3D Matrix, Casen Recordati, Norgine, and Izasa. C. Römmele is a member of the German Society for Gastroenterology, Digestive and Metabolic Diseases (DGVS) (2014–present). M. Arvanitakis, M. Bretthauer, L. Elli, A. Facciorusso, C. Hassan, D. Henniger, K. Khalaf, M.A. Klose, V. Lorenzo Zuñiga, A. Meining, N. O'Morain, M. Pellisé, M.

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Pioche, H. Pohl, K. Siau, R. Sidhu, M. Topa, A. Tsalouka, and A. Vienne declare no competing interests.

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Thieme

SUPPLEMENTARY MATERIAL

Sustainability in endoscopic medical congresses and courses: European Society of Gastrointestinal Endoscopy (ESGE) and European Society of Gastroenterology and Endoscopy Nurses and Associates (ESGENA) Position Statement

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1. TASKFORCES

Project leaders

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- Mathieu Pioche

Taskforce leaders

- Mathieu Pioche
- Luca Elli
- Enrique Rodríguez de Santiago
- Lars Aabakken
- Dorothea Henniger

Taskforce 1: Introduction, Transportation, Animal Training

- **Mathieu Pioche**
- Reena Sidhu
- Heiko Pohl
- Alexander Meining
- Ariane Vienne

Taskforce 2: Transportation, Sustainability in the Scientific Programme

- **Luca Elli**
- Eduardo Albéniz
- Matilde Topa
- Robin Baddeley
- Michele Klose

Taskforce 3: Methods, Literature review (What is the environmental impact of GI endoscopy Congresses and Courses?)

- **Enrique Rodríguez de Santiago**
- Neil O'Morain
- Kareem Khalaf
- João A. Cunha Neves

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Taskforce 4: Transportation, Venue and Accomodation

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Taskforce 5: Venue and Accomodation

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- Alexander Meining

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2. PICO questions and bibliographic searches

SECTION 1 - Review of the literature: what is the environmental impact of GI endoscopy Congresses and Courses?

Q0: What is the environmental impact of GI endoscopy Congresses and Courses?

No PICO question format.

BIBLIOGRAPHIC SEARCH

Bibliographic search strategies were performed in PubMed and Web of Science from the last 10 years, given the lack of evidence prior to 2015. References of the included articles were also reviewed manually.

PUBMED SEARCH – 27/04/25

#1 (("carbon dioxide"[MeSH Terms]) OR ("carbon footprint"[MeSH Terms]) OR ("greenhouse gases"[MeSH Terms]) OR ("global warming"[Title/Abstract]) OR ("CO2"[Title/Abstract]) OR ("carbon emissions"[Title/Abstract]) OR ("climate change"[Title/Abstract]) OR ("carbon costs"[Title/Abstract]) OR ("sustainable"[Title/Abstract]) OR ("sustainability"[Title/Abstract]))

RESULTS: 473,979

#2 (("conferenc*"[Title]) OR ("congress*"[Title]) OR ("meeting*"[Title]) OR ("course*"[Title]) OR ("summit*"[Title]))

RESULTS: 210,968

#1 AND #2

RESULTS: 1,503

#1 AND #2 AND (y_10[Filter])

RESULTS: 917

WEB OF SCIENCE SEARCH – 27/04/25

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#1 TS=(("carbon dioxide" NEAR/2 emission*) OR ("CO2" NEAR/2 emission*) OR ("carbon footprint") OR ("greenhouse gas*" NEAR/2 emission*) OR ("global warming") OR ("carbon emissions") OR ("climate change") OR ("carbon costs") OR ("sustainable") OR ("sustainability"))

RESULTS: 1,422,301

#2 TI=("conferenc*" OR "congress*" OR "summit*"OR "meeting*"OR "course*")

RESULTS: 412,639

#1 AND #2

RESULTS: 4,719

#1 AND #2 AND (y_10[Filter])

RESULTS: 3,289

RETRIEVED MANUALLY

1. Virtual Learning Decreases the Carbon Footprint of Medical Education

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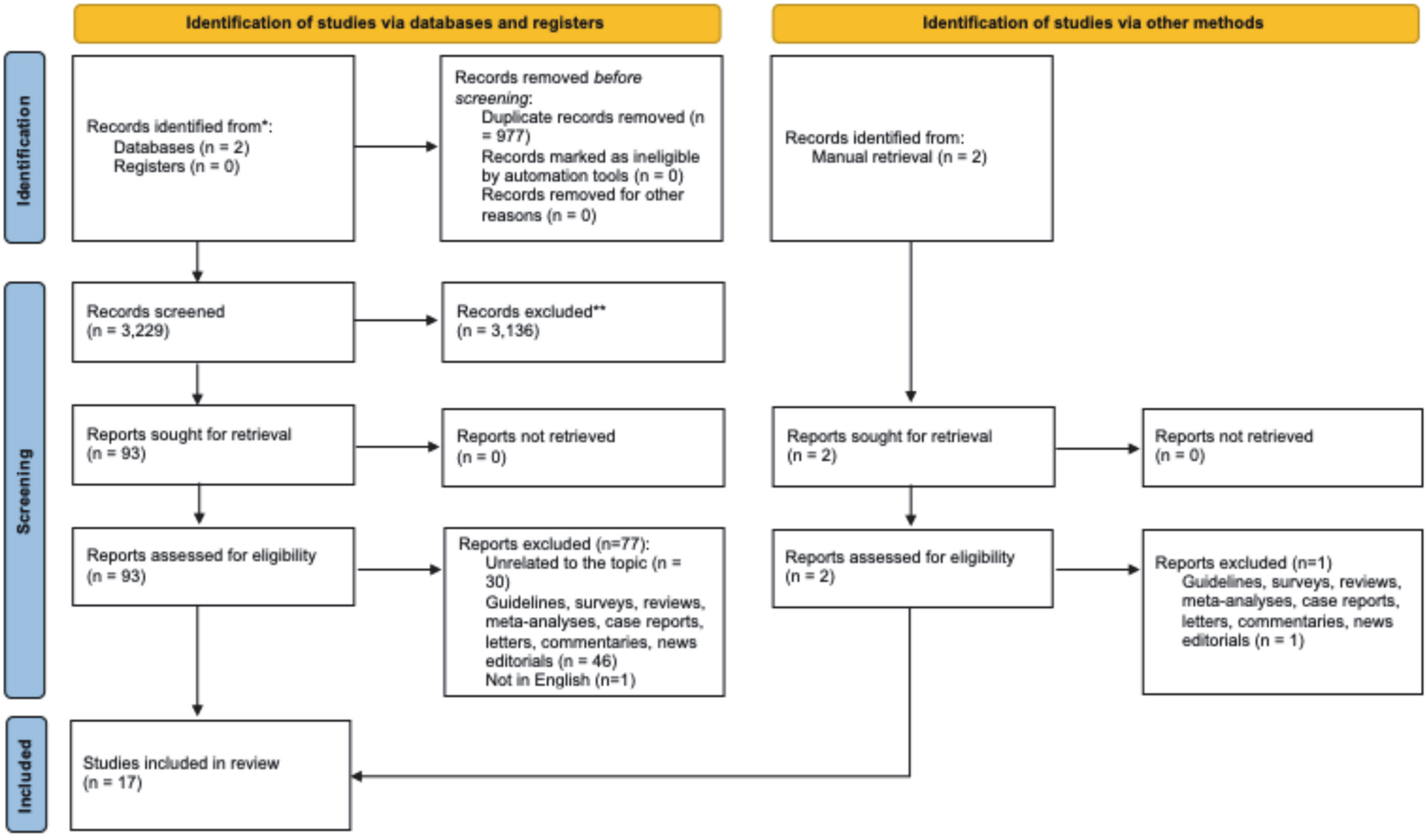

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INCLUDED STUDIES

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Q1: Should GI endoscopy conferences assess their environmental impact?

PICO question:

P: The environmental impact of GI endoscopy conferences is significant but largely unknown

I: Measuring the environmental impact

C: Not measuring the environmental impact

BIBLIOGRAPHIC SEARCH

Bibliographic search strategies were performed in Embase and PubMed from inception.

O: Carbon footprint, other environmental outcomes, cost

BIBLIOGRAPHIC SEARCH

Bibliographic search strategies were performed in Embase and PubMed from inception.

EMBASE SEARCH – 17/04/25

('gastrointestinal endoscopy conference' OR (('gastrointestinal'/exp OR gastrointestinal) AND ('endoscopy'/exp OR endoscopy) AND ('conference'/exp OR conference)) OR (endoscopy AND conference)) AND 'environmental impact')

RESULTS: 64

INCLUSION CRITERIA – studies assessing the environmental impact/carbon footprint of gastrointestinal endoscopy conferences, English language, any study type

EXCLUSION CRITERIA – study not related to GI endoscopy conference and/or environmental impact assessment

0/64 studies met the inclusion criteria

PUBMED SEARCH – 17/04/25

Endoscopy conference AND **environmental impact**

RESULTS: 42

INCLUSION CRITERIA – studies assessing the environmental impact/carbon footprint of gastrointestinal endoscopy conferences, English language, any study type.

EXCLUSION CRITERIA – study not related to GI endoscopy conference and/or environmental impact assessment.

0/42 studies met the inclusion criteria

Q2: Should GI endoscopy conferences offset their carbon footprint?

PICO question:

P: The environmental impact of GI endoscopy conferences is significant but largely unknown

I: Carbon offsetting initiatives

C: No carbon offsetting initiatives

O: Carbon footprint, cost

BIBLIOGRAPHIC SEARCH

Bibliographic search strategies were performed in Embase, EBM Reviews – Cochrane Central Register of Controlled Trials and Ovid MEDLINE from inception. References of the included articles were also reviewed manually.

EBM Reviews – Cochrane Central Register of Controlled Trials SEARCH – 18/03/25

(endoscop* conference* or gastro* conference* or endoscop* procedure* conference* or medical conference* or endoscop* meeting* or gastro* meeting or endoscop* procedure* meeting* or medical meeting* or endoscop* symposium* or gastro* symposium* or endoscop* procedure* symposium* or medical symposium) AND (carbon* or environment* or sustainab* or greenhouse* or climate*) in Title Abstract Keyword – Word variations have been searched)

RESULTS: 42

EMBASE and OVID MEDLINE SEARCH – 18/03/25

#1 (carbon* or environment* or sustainab* or greenhouse* or climate*).mp. [mp=ti, ab, hw, tn, ot, dm, mf, dv, kf, fx, dq, bt, nm, ox, px, rx, ui, sy, ux, mx]

RESULTS: 6.147.244

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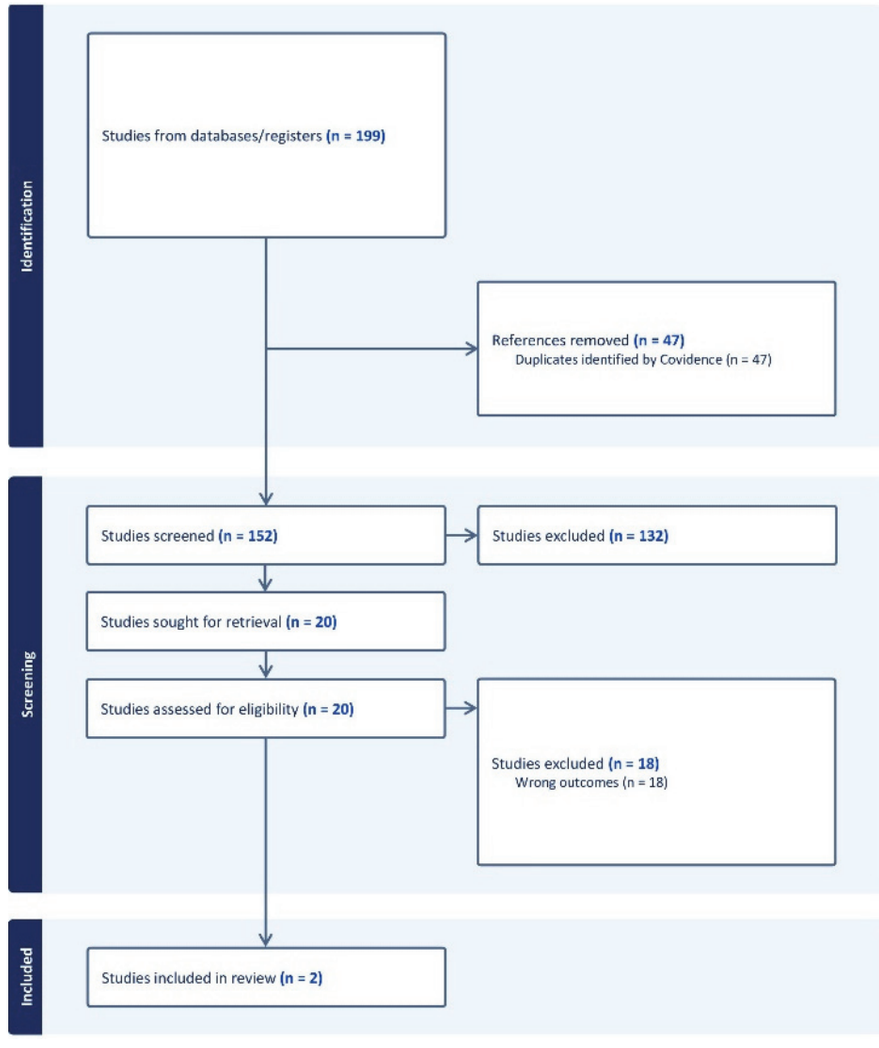
#2 (Endoscop* conference* or gastro* conference* or endoscop* procedure* conference* or medical conference* or endoscop* meeting* or gastro* meeting* or endoscop* procedure* meeting* or medical meeting* or endoscop* symposium* or gastro* symposium* or endoscop* procedure* symposium* or medical symposium*).mp. [mp=ti, ab, hw, tn, ot, dm, mf, dv, kf, fx, dq, bt, nm, ox, px, rx, ui, sy, ux, mx]

RESULTS: 2560

#1 AND #2

RESULTS: 154



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INCLUDED STUDIES

1.

2.

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SECTION 2 - Transportation

Q3: Can virtual participation/hybrid format to conferences reduce the environmental impact of medical conferences and increase inclusion?

PICO question:

P: Transport is the main source of impact/carbon footprint for medical conferences

I: Virtual participation

C: With 100% face to face meeting OR hybrid

O: Carbon footprint, satisfaction, quality of education (test), inclusion and equity (pregnancy, distance, reduced cost of inscription, benefits of in person meetings)

BIBLIOGRAPHIC SEARCH

PUBMED SEARCH 21/01/2026

“Virtual conference and carbon footprint” - 26 results

“virtual learning and carbon footprint” 15 results

“Hybrid conference and carbon footprint” 11 results

“eco-friendly medical conferences” 3 results

“virtual education and carbon footprint” 49 results

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13. Warner LM, Fleiner R, Sproesser G, *et al*. A little more conversation, a little more action, please: the carbon footprint of travelling to conferences of the European Health Psychology Society. *Health Psychol Behav Med* 2025; 13: 2447454.

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Q4: Can the choice of mode transportation reduce the environmental impact?

PICO question:

P: Transport is the main source of impact/carbon footprint for medical conferences

I: Plane

C: Private vehicle, public transportation (train, bus)

O: Carbon footprint, satisfaction, quality of education (test), inclusion and equity (pregnancy, distance, reduced cost of inscription, benefits of in person meetings)

BIBLIOGRAPHIC SEARCH

PUBMED SEARCH (June 2025)

Bibliographic searches were conducted in PubMed in June 2025 using a combination of MeSH terms and free-text keywords related to medical conferences, environmental impact, transportation, and virtual or hybrid meeting formats.

Search terms included: “Congresses as Topic”[MeSH], “Conferences”, “Meetings”, “Symposia”, “Environmental Pollution”[MeSH], “Carbon Footprint”[MeSH] (if available; otherwise used as a keyword), “Greenhouse Gases”[MeSH], “Climate Change”[MeSH], “Environmental Impact”, “Emissions”, “Transportation”[MeSH], “Travel”, “Air Travel”, “Rail Travel”, “Active Transportation”, “Telemedicine”[MeSH], “Distance Education”[MeSH], “Virtual Reality”[MeSH], “Online Meetings”, “Hybrid Conferences”, “Professionalism”[MeSH], “Identity Formation”, and “Medical Education, Continuing”[MeSH].

Articles were limited to the English language. Reference lists of relevant publications were screened to identify additional eligible studies.

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Q5: How virtual supervision reduce the environmental impact of medical conferences?

PICO question:

P: Transport of participants/lecturers and animal models present a relevant environmental impact

I: Augmented or virtual reality

C: Physical training

O: carbon footprint, satisfaction, quality of education (test), inclusion (pregnancy, distance, cost of inscription)

BIBLIOGRAPHIC SEARCH

INCLUDED STUDIES

1. Koikkara KA, Pendharkar H, Irodi A, *et al*. Eco-Friendly Medical Conferences: From Principle to Practice. *Indian J Radiol Imaging*. 2024 Dec 11;35(2):242-245.

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Endoscopy | DOI 10.1055/a-2857-9380 | © European Society of Gastrointestinal Endoscopy. All rights reserved.

Q6: Can the choice of the city conference reduce the environmental impact?

PICO question:

P: Transport is the main source of impact/carbon footprint for medical conferences

I: Choice of the conference site without considering sustainability criteria (travel distance and public transportation)

C: Prioritizing sustainability criteria

O: Carbon footprint, satisfaction, quality of education

BIBLIOGRAPHIC SEARCH

INCLUDED STUDIES

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Q7: Can the choice of the faculty reduce the environmental impact of the conference?

PICO question:

P: Transport is the main source of impact/carbon footprint for medical conferences

I: Choice of the faculty without considering sustainability criteria (travel distance and favoring eco-friendly transportation)

C: Prioritizing sustainability criteria

O: Carbon footprint, satisfaction, quality of education

BIBLIOGRAPHIC SEARCH

INCLUDED STUDIES

1. Bousema T, Selvaraj P, Djimde AA, *et al*. Reducing the Carbon Footprint of Academic Conferences: The Example of the American Society of Tropical Medicine and Hygiene. *Am J Trop Med Hyg* 2020; 103: 1758–1761.

2. Monahan S, Monahan K. The potential environmental impact of external speakers' airplane travel to grand rounds conferences. *Environ Health* 2023; 22: 34.

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SECTION 3 – Venue and accommodation

Q8: Should ESGE-ESGENA favor eco-friendly venues?

PICO question:

P: Venues have a significant environmental impact

I: Standard venue

C: Eco-friendly venue

O: Energy consumption, CO2, waste production, transport access, sustainability certification

BIBLIOGRAPHIC SEARCH

INCLUDED STUDIES

Q9: How can we reduce waste during medical conferences?

No PICO question format.

BIBLIOGRAPHIC SEARCH

INCLUDED STUDIES

1. Cai M, Tang JN, Griese KM. Green meeting: a sustainable event. 9 *Adv Mat Res* 2014;1073–1076:2815–2821.

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Q10: Should all medical conferences incorporate recycling bins?

PICO question:

P: Recycling bins are often unavailable in medical conferences, which may increase the carbon footprint

I: Recycling bins

C: No recycling bins

O: Carbon footprint

BIBLIOGRAPHIC SEARCH

INCLUDED STUDIES

1. Koikkara KA, Pendharkar H, Irodi A, *et al*. Eco-Friendly Medical Conferences: From Principle to Practice. *Indian J Radiol Imaging*. 2024 Dec 11;35(2):242-245.

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Q11: How may the choice of conference catering reduce the environmental impact?

PICO question:

P: Food and catering are an important source of environmental burden for medical conferences

I: Selected catering

C: Standard conference with non-selected food, non-selected tableware

O: Carbon footprint, waste weight, water saving

BIBLIOGRAPHIC SEARCH

INCLUDED STUDIES

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Q12: Can the choice of accommodation reduce the environmental impact? Should 'green' certified hotels be prioritized?

PICO question:

P: Accommodation suggested by the organizing scientific society

I: 3-star hotels

C: 4-star hotels vs. 5-star hotels vs. sustainability certification

O: CO2, liters of water, energy consumption

BIBLIOGRAPHIC SEARCH

INCLUDED STUDIES

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SECTION 4 – Sustainability in the scientific programme

Q13: How can environmental education during medical conferences can increase people awareness and reduce environmental impact?

PICO question:

P: Knowledge about environmental impact of endoscopy and consequences on the environment are not well known

I: Dedicated green sessions (green research session, plenary session, inspiring conferences, etc.)

C: Congress without any dedicated symposium

O: Satisfaction, knowledge improvement, consequences ecologically

BIBLIOGRAPHIC SEARCH

INCLUDED STUDIES

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Q14: Should sustainability education be included during hand-on training courses and live endoscopy events?

PICO question:

P: Knowledge about environmental impact of endoscopy and consequences on the environment are usually not considered during hand-on training courses or live endoscopy events

I: Incorporating sustainability concepts during hand-on training and live endoscopy events

C: Not discussing sustainability point

O: Knowledge improvement, satisfaction, consequences ecologically

BIBLIOGRAPHIC SEARCH

Bibliographic search was performed manually and continuously in PubMed.

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Q15: Is it justified the number of GI endoscopy events with overlapping scientific programme?

No PICO question format.

BIBLIOGRAPHIC SEARCH

INCLUDED STUDIES

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SECTION 5 – Animal Training

Q16: Can we still justify hands on training on living animal models from an ethical and sustainability perspective?

PICO question:

P: Using living animals for endoscopy training is source of animal sacrifice and environmental impact of those living animals

I: Non-living animals training

C: Hands on training with isolated animal models or non-animal models

O: Education quality, saved lives, carbon footprint, duration of animal breeding

BIBLIOGRAPHIC SEARCH

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3. Summary of the included studies

1. Review of the literature: what is the environmental impact of GI endoscopy congresses and courses?

AUTHOR	YEAR	DESIGN	AIMS	OUTCOMES	RESULTS
Richards *et al.* [1]	2024	Retrospective	1. Estimate GHG emissions from two academic events. 2. Identify main contributors to emissions. 3. Compare financial costs of attendance. 4. Propose behavior change strategies to reduce emissions.	**Primary:** GHG emissions per event and per participant. **Secondary:** Financial costs, behavior change strategies.	Ghent event: 41 tonnes CO_2e (0.334 tonnes/participant). Lisbon event: 99 tonnes CO_2e (0.724 tonnes/participant). Air travel was the largest contributor (95-99% of travel emissions). Financial costs were similar (€761–€825 per participant). Proposed strategies: venue selection, sustainable transport,

					education, incentives.
Sharma *et al.* [2]	2024	Cross-sectional	Estimate CO2 emissions avoided by virtual dermatology webinar *vs.* theoretical in-person event.	**Primary:** CO_2e emissions saved. **Secondary:** Emissions per attendee by travel mode (drive/fly).	Virtual attendance saved 370 metric tons CO_2e. Driving emitted 42.7 kg CO_2e/attendee; flying emitted 4.5 kg CO_2e/attendee (adjusted for shared flights). Hybrid models recommended for balance.
Lichter et al. [3]	2024	Retrospective	Examine GHG emissions of ASCO conference formats (in-person, virtual, hybrid) and recommend sustainable	**Primary:** Total CO_2e emissions by format. **Secondary:** Emissions by	2019 in-person: 37,251t CO_2e 2020-2021 virtual: ~100t CO_2e 2022 hybrid: 20,190t CO_2e. Hub-and-spoke reduced emissions

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			options.	attendee origin, simulations of alternative models (hub-and-spoke, hybrid).	by 54-59%. Hybrid formats reduced emissions by up to 86%. International attendees contributed >50% of emissions.
Lalor *et al.* [4]	2024	Prospective observational	Minimize carbon footprint of a 2500-person hybrid anesthesia conference in Sydney.	**Primary:** On-site carbon footprint. **Secondary:** Delegate engagement and sustainability strategies.	On-site footprint: 232.85 t CO_2e (reduced by 136.18 t CO_2e). Excluded travel, which likely negated savings.
Fitzpatrick *et al.* [5]	2024	Retrospective observational	Quantify GHG emissions from travel to the 2023 APSA annual meeting.	**Primary:** CO_2, CH_4, and N_2O emissions from attendee	Total emissions: 267,279 kg CO_2e, 1,222 gm CH_4, 8,486 gm N_2O. Equivalent to annual emissions of 60

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				travel. **Secondary:** Equivalency metrics (e.g., car/house emissions).	cars or 34 homes in the U.S.
Vanin Moreno *et al.* [6]	2023	Cross-sectional study	Compare travel-related carbon emissions of Canadian Urological Association conferences in Vancouver (2016), Halifax (2018), and Quebec City (2019).	**Primary:** CO_2e emissions per attendee. **Secondary:** Impact of location on emissions.	Vancouver: 1.08t CO_2e/attendee (highest). Halifax: 0.52t, Quebec City: 0.62t. Vancouver emissions > Halifax + Quebec City combined. 85-90% of emissions from flights.
Parker *et al.* [7]	2023	Retrospective observational	1. Quantify GHG emissions from the 2019 in-person	**Primary:** Total CO_2e emissions per	2019 in-person: 1,565 tonnes CO_2e (0.61 tonnes/attendee).

		study	American Orthopaedic Foot and Ankle Society meeting. 2. Compare emissions with the 2020 virtual meeting. 3. Model emissions reductions using hub-based meeting alternatives.	meeting format. **Secondary:** Per capita emissions, regional contributions, and potential reductions from hub models.	2020 virtual: 34 tonnes CO_2e (97.8% reduction). Four-hub model reduced emissions by 54%; seven-hub by 71%. 19% of attendees exceeded annual CO_2e budget (2.5 tonnes) by attending the in-person meeting.
McClintic *et al.* [8]	2023	Cross-sectional study	1. Estimate emissions for 2019 in-person and 2020 virtual American Academy of Ophthalmology meetings. 2. Propose strategies (location selection, hybrid formats) to reduce	**Primary:** Total and per capita CO_2e emissions. **Secondary:** Emissions reductions from alternative locations and multi-	2019 in-person: 39,910 tonnes CO_2e (1.73 tonnes/attendee). 2020 virtual: 38.6 tonnes CO_2e (99.8% reduction). Chicago location reduced emissions by 19%. Two-meeting format reduced

			emissions.	meeting formats.	emissions by 34%; three-meeting by 38%.
Kay *et al.* [9]	2023	Cross-sectional	Estimate carbon emissions from the 2018 Society for Neuroscience annual meeting and propose alternative meeting modes.	**Primary:** Carbon emissions from travel, hotel stays, and venue operations. **Secondary:** Equity and inclusivity impacts.	Travel-related emissions: 17,298–8690 t CO_2e (faculty), 69,592–38,010 t CO_2e (registrants). Hybrid/virtual models reduced emissions by 23–99%.

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Leddin *et al.* [10]	2022	Retrospective	Estimate and compare travel-related carbon emissions of the CAG annual meeting in Toronto vs. Banff.	**Primary:** CO_2e emissions per attendee. **Secondary:** Impact of travel mode (flight, car, train) on emissions.	Toronto meeting: 0.540t CO_2e per attendee. Banff meeting: 0.760t CO_2e per attendee (41% higher). 92-96% of emissions from flights. Choice of location significantly impacts emissions.
Periyasamy *et al.* [11]	2022	Cross-sectional	Compare carbon emissions of a virtual vs. physical conference and assess prospects for carbon neutrality.	Primary: Carbon emissions of virtual vs. physical conference. Secondary: Impact of digital sobriety on CE reduction.	Virtual conference emitted 6.44 MT CO_2e (HD streaming) vs. 355.85 MT CO_2e for physical (55× higher). Digital sobriety could reduce virtual CE by 80.3% (to 1.27 MT CO_2e)

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Gattrell *et al.* [12]	2022	Retrospective	Compare carbon costs of in-person vs. virtual attendance at pharmaceutical industry conferences.	Primary: CO_2 emissions from travel, accommodation, and virtual platforms. Secondary: Cost savings of virtual formats.	In-person: 1894 $kgCO_2e$/attendee (91–96% from travel). Virtual: 10.4 $kgCO_2e$/attendee (93–94% from internet use). Virtual emissions were 0.3–1.1% of in-person.
Duane *et al.* [13]	2021	Comparative lifecycle assessment	Compare environmental footprint of a pediatric cardiology webinar vs. hypothetical in-person conference.	**Primary:** CO_2 equivalent emissions. **Secondary:** 16 environmental impact categories	Virtual conference: 4 tons CO_2e. In-person conference: 192 tons CO_2e (98% reduction). In-person conference impacts: 250x climate change, 400x resource use, 225x eutrophication vs. average

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				(e.g., resource use, eutrophication).	person's annual impact.
Milford *et al.* [14]	2021	Retrospective	Estimate carbon footprint of presenter flights to pediatric urology conferences (2013–2019).	**Primary:** CO_2 emissions from travel. **Secondary:** Mitigation strategies (e.g., virtual conferences).	Median CO_2e per presenter: 0.61 metric tons. Total CO_2e for 6 conferences: 912.47 metric tons.
Yakar *et al.* [15]	2020	Retrospective	Quantify airplane travel-related carbon footprint of the Radiological Society of North America annual meeting and assess health	**Primary**: CO_2e emissions from attendee travel. **Secondary**: Health burden (DALYs) and	Total CO_2 emissions: 39,506,038 kg (39,506 MT). Health burden: 51.4–79.0 DALYs. Offset cost: $474,072 ($6,001–9,223 per DALY averted).

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			burden & offset costs.	cost-effectiveness of carbon offsets.	
Bousema *et al.* [16]	2020	Cross-sectional	Estimate carbon emissions from the 2019 ASTMH conference and propose alternative meeting models.	**Primary:** Carbon emissions from air travel. **Secondary:** Equity and accessibility impacts.	Total emissions: 8,646 metric tons CO_2e. Decentralized conferences could reduce emissions by 58%.
Astudillo *et al.* [17]	2018	Retrospective	Quantify CO_2 emissions of the ACLCA conference and assess impact of connecting flights.	**Primary:** CO_2e emissions per attendee. **Secondary:** Effects of transport modes and food choices.	Average emissions: 952 kg CO_2e/attendee. Connecting flights increased emissions by 32%. Vegetarian menu reduced emissions by 46% vs. omnivorous.

ASCO - American Society of Clinical Oncology, ASTMH - American Society of Tropical Medicine and Hygiene, CO2e – carbon dioxide equivalents; GHG – greenhouse gas; DALY - Disability-Adjusted Life Year

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2. Transportation

AUTHOR	JOURNAL	MAIN RESULTS	QUALITY
Bousema T *et al.* [16]	Am J Trop Med Hyg 2020	Congress = 58 round trip to moon - Reduction with virtual participation - Choice of the location	Descriptive
Duane B *et al.* [13]	Card in the Young 2021.	- Congress = 400 x one person impact/year - 98% of reduction with virtual	Descriptive, no intervention LCA
Milford K *et al.* [14]	J Ped Surg 2021.	- No statistical difference between locations of conferences	Descriptive
Donahue L *et al.* [18]	J Grad Med Educ 2021.	- Carbon footprint medical conferences	Descriptive
Lewy JR *et al.* [19]	Environmental Health 2022.	- Carbon footprint medical conferences	Descriptive
Li M *et al.* [20]	Ann Glob Health 2022.	- Virtual education is effective	Descriptive
West C *et al.* [21]	J AAPOS 2022	- Description of benefits of virtual meetings	Descriptive
Lichter KE *et al.* [22]	Jama Oncol 2022	- Carbon footprint of conference	Descriptive
McClintic S *et al.* [8]	Jama Ophtalm 2023	- Multiple sites meetings reduce the carbon footprint of medical conferences - Choice of the city - Virtual < In person	Comparison virtual versus in person meeting

Monahan S *et al.* [23]	Environmental Health 2023	- External speakers should be selected depending on their travel distance - External speakers far from the congress could be encouraged to participate virtually	Descriptive
Parker E *et al.* [7]	Clin Orthop Realt Res 2023.	- Participants have more than 2.5 tons due to the meeting	Descriptive
Lalor F *et al.* [4]	Anesth Inten Care 2024.	- Return to in person meeting with ecoresponsability	Descriptive
Sharma D *et al.* [2]	Dermatol Ther 2024.	- Warning on cars, driving can be more impactful than flying.	Descriptive
Warner L *et al.* [24]	Health Pychol Behav Med 2025	- Improving interaction of hybrid format	Descriptive

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AUTHOR, PUBLICATION YEAR	TITLE	STUDY TYPE	STUDY OBJECTIVE	PARTICIPANTS (N)/ SETTINGS	INTERVENTION	COMPARISONS	OUTCOMES	MAIN RESULTS	CONCLUSION	QUALITY ASSESSMENT (HIGH/MOD/LOW QUALITY)
Koikkara KA *et al.,* 2024 [25]	Eco-Friendly Medical Conferences: From Principle to Practice	Review	To highlight possible steps toward achieving eco-friendly events, such as conducting hybrid events, locally sourcing products, and avoiding single-use plastic	N/A	N/A	Different ways of organising medical conferences	To outline a few practical steps toward organizing an eco-friendly medical conference	Suggesting more susteinable practice in the three different phases of a medical conference: before, during and after the event.	Medical conferences are essential to our academic growth; however, they can involve poor sustainability practices. We therefore must strive to do better when organizing such events. We must find alternative	Moderate

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									methods and improve practices as suggested above, to have a positive environmental and social impact.	
Zotova O *et al.*, 2020. [26]	Carbon-neutral medical conferences should be the norm.	Comment	To challenge the status quo, we propose a new model for international conferences.	IFMSA August Meeting 2018	N/A	N/A	To outline that an international event can be organised in a responsible and sustainable manner	Key interventions checklist for a sustainable and carbon-neutral event	The environmentally responsible and carbon-neutral IFMSA August Meeting 2018, successfully organised by students, sets a new standard for medical conferences worldwide.	Moderate/low

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									Every event within the health-care community is an opportunity to go a step further and push environmental sustainability to the top of the medical agenda	
Storz MA, 2019, [27]	Medical Conferences and Climate Change Mitigation: Challenges, Opportunities, and Omissions	Letter to the editor	The main challenge will be to significantly reduce the huge amounts of greenhouse gas emissions resulting from traveling international	Medical conferences	N/A	Different ways to organize medical conferences	To define the options to reduce the greenhouse gas emission resulting from traveling to international medical conferences.	List of opportunities to make medical events more sustainable (e.g., traveling, combination of conference activities and	This manuscript adds to a better understanding of the environmental impact of international medical conferences	low

			medical conferences and continuing medical education events.					personal recreation such as holidays, long-haul overseas journeys to remote locations for a short event should be critically questioned)	and symposia. Carbon footprint estimations of medical conferences are rarely reported in the literature as identified by this article.	
Rodríguez de Santiago E *et al.,* 2022 [28]	Reducing the environmental footprint of gastrointestinal endoscopy: European Society of Gastrointestinal Endoscopy (ESGE) and European Society of Gastroenterol	Position statement	To raise awareness of the ecological footprint of GI endoscopy and provides guidance to reduce its environmental impact.	N/A	N/A	N/A	The main aims of this document are to raise awareness of the ecological footprint of GI endoscopy and to provide guidance to reduce its environmental impact in	39 statements	To provide short- and long-term actionable strategies for more sustainable GI endoscopy	high

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	ogy and Endoscopy Nurses and Associates (ESGENA) Position Statement						clinical practice, education, and research			
Bortoluzzi F et al., 2022 [29]	Sustainability in gastroenterology and digestive endoscopy: Position Paper from the Italian Association of Hospital Gastroenterologists and Digestive Endoscopists (AIGO).	Position statement	To provide information on the carbon footprint of gastroenterology and digestive endoscopy and outline a set of measures that the sector can take to reduce the emission of greenhouse gases while improving patient outcomes.	N/A	N/A	N/A	The AIGO study group reinforces the role of gastrointestinal endoscopy professionals as advocates of sustainability in digestive endoscopy. The "green endoscopy" can shape a more sustainable health service	Raising awareness of the environmental impact of several everyday activities and providing ways to reduce the carbon footprint of gastroenterology and digestive endoscopy	Growing awareness about climate change and the carbon footprint of digestive endoscopy will help identify strategies to increase the sustainability of gastroenterology and endoscopy services	moderate

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							and lead to an equitable, climate-smart, and healthier future		across the world.	
Maida M et al., 2024, [30]	Green endoscopy, one step toward a sustainable future: Literature review.	Literature review	To summarize current data regarding the impact of endoscopy on GHG emissions and possible strategies to mitigate this phenomenon. Further, we aim to promote the evolution of a more sustainable "green endoscopy"	The primary sources MEDLINE, Scopus, and the Cochrane Library were searched for studies assessing GHG emission in endoscopy facilities, through December 2023.	N/A	N/A	Reporting the impact of endoscopy on GHG emissions according to Scope 1, 2 and 3. Describing possible strategies involving the Inappropriatn ess of procedures, biopsy sampling, minimization of procedures reschedule, resource	Estimated energy consumption and carbon emissions in endoscopy units	In conclusion, it is time to act at multiple levels to ensure green endoscopy worldwide. No more theoretical studies on the environmental impact, but rather practical studies to improve sustainability	moderate

							optimization, waste minimization, reuse and recycling, telemedicine, role of institutions and scientific societies			

3. Venue and Accommodation

AUTHOR	JOURNAL	MAIN RESULTS	QUALITY
Koikkara K *et al.* [25]	*Indian J Radiol Imaging*.	- Digital versions of brochures/shedules (e.g. QR-code) - Bags made from recycled, jute or biodegradable and sustainable materials and reusable water bottles - At registration, delegates may be given the option to opt out of receiving such material, and instead donate in kind to a declared charity or world conservation organization. - Reusing lanyards - Education of delegates	Descriptive
Cai M. *et al.* [31]	Adv Mat Res	- "4Rs" Principles for Green Meetings (rethink, reduce, reuse, recylce) - Establishment for a "Green Plan" - On site managment and implemention - The Climate Change and Sustainability Global Summit 2013 held in February in New York saved $10,000 by reducing bottle water, $37,000 by using electronic materials and mobile apps instead of paper materials	Descriptive
Lichter *et al.* [3]	JCO Glob Oncol 10	- Use the appropriate onsite recycling bins to help reduce the waste sent to landfills - Prioritize digital rather than paper-based posters. If printed materials are	Descriptive, LCA

		needed, select more sustainable options (FSC certified paper, soy-based ink, double-sided printing, etc.) - Consider digital alternatives to paper business cards. - Choose sponsor gifts wisely. Take only what you will need and use.	
Zotova *et al.* [26]	The Lancet Planetary Health	- Prohibit disposable bottles, cans, cups, plates, and cutlery. Ask attendees to bring their own cup, and provide washable plates and cutlery on site - Limit merchandise to none, or one souvenir item per attendee - Reuse materials from previous conferences or local education institutions - Request minimal packaging from suppliers - Provide waste sorting bins (including recycling and compost) with clear sorting instructions, and volunteers to assist in sorting at highly attended events - Ask venue staff to record the amount of waste generated.	Descriptive
Gadsen *et al.* [32]	British Journal of Anaesthesia	- The total cost of the bags was estimated at £209.42 ($265.36), and the related emissions were 153.79 kgCO2e, or 395 miles (636.6 km) driven by an average passenger car - If 90% of attendees used one paper coffee cup (with a lid) and one plastic water cup daily, we estimated the total cost of these disposable items to be £1188.62 ($1506.16), and the corresponding emissions as 804.35 kg CO2e, or 2061 miles (3317 km) driven in the average Passenger car	Descriptive

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		- Availability of wáter fountains or a water filtration system for reusable container refilling	
Avesani, C. M *et al.* [33]	Journal of nephrology	- The commission recommends a plant-based diet with a 50% reduction in meat and refined sugars and a 100% increase in fruits, vegetables, grains, legumes, and nuts in order to achieve the goal for a healthier planet [8]. - Food donation program - Locally farmed --° transport, local economy	Descriptive
Neugebauer, S [34]	Journal of Cleaner Production	- We further revealed that non-vegetarian meals perform worse in all impact categories and dominate most of the catering impacts (compare Fig. 4 and Fig. 5). Significant shares of ADP fossil and GWP are further resulting from the thermal energy and electricity used for preparing the meal - switch from an omnivore menu to a vegetarian menu is assumed, as meat and fish meals showed to be negative compared to vegetarian food options in all impact categories	Descriptive
González-García S *et al.* [35]	Sci Total Environ	- Since the composition of diets has a significant influence on carbon footprint values, - The shift from animal to plant products is considered by numerous studies to be the best option - According to the literature review, estimates of the carbon footprint of diets can vary considerably up to four times (e.g., S4 and S5) even considering the same system boundaries - the carbon footprint can be reduced by 30% by changing from an established dietary pattern in a society to a healthy diet - a reduction of 60% could be achieved by switching from diets rich in meat products such as S13 to vegan diets	Descriptive, LCA
Gattrell WT	Pharmaceut	- Hotel accommodation was the next largest contributor to total carbon emissions per congress, accounting for 4–9%	Descriptive, LCA

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et al. [12]	Med.	- Local dependent: with hotel emissions at 7.2 kgCO2e per room-night in France and 17.6 kgCO2e per room-night in Spain, compared with 36.2 kgCO2e per room-night in the US	
McClintic *et al.* [8]	JAMA Ophthalmol	- 16 555.5 category 3 and 16 555.5 category 2 room-nights. Utility use was estimated at 3 399 513kWh and 9478 MMBtu (1000000 British thermal units), emitting 837 metric tons of CO2.	Descriptive, LCA
Parker *et al.* [7]	Clin Orthop Relat Res	- - Hotel 5% of all CO2e (86tCo2e)	Descriptive

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4. Sustainability in the Scientific Programme

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5. Animal training

Author	Journal	Main Results	Quality
Yzet C *et al.* [36]	EIO 2025	- Ex-vivo model of bovine colon is more discriminant than non-animal model and pig stomach. - Slight preference of trainees for living animals	Comparative
Masunaga T *et al.* [37]	EIO 2024	- Bleedings of living pigs is unsatisfactory (low number of bleedings) and strategies to simulate bleedings are needed (e.g.: heparinization)	Comparative
De Cristofaro E *et al.* [38]	Endoscopy 2023	- Solutions appear with non-animal training models	Descriptive
Maiss J *et al.* [39]	Eur J Gastro 2006	- Simulation on ex vivo model is effective to improve training compared to solely education.	Randomized
Maiss J *et al.* [40]	Dig Liv DIs 2007	- Simulation on ex vivo model is effective to improve training compared to solely education.	Randomized

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4. Results of the voting rounds

ROUND 1

27 statements were voted:

- 10 reached consensus and included in the final version of the manuscript
- 11 reached consensus but was refined based on comments (nº 1, 2, 3, 5, 6, 9, 15, 18, 20 , 21 and 22)
- 6 did not reached consensus. These statements (nº 4, 8, 10, 11, 12 and 27) were refined and voted in round 2.

ROUND 2

- All 17 statements reached consensus regarding sentence structure.
- The following sentences were merged due to information overlapping
    - Sentences: 3 and 5
    - Sentences: 4, 5 and 8
    - Sentences: 13 and 14

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