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Kidney Disease: Improving Global Outcomes Green Dialysis Controversies Conference: A Carbon Footprint and Sustainability Report

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INTRODUCTION

Scientific meetings and academic conferences are central to learning, knowledge sharing, networking, and scientific advancement. However, they also require substantial travel, consume large amounts of resources (materials, energy, and water), and generate significant waste. Although many of these impacts are local, their greenhouse gas burden is global.

Kidney Disease: Improving Global Outcomes (KDIGO) is a global, nonprofit foundation that develops and implements evidence-based clinical practice guidelines in kidney disease. Its work includes hosting controversies conferences that convene experts to discuss and debate areas of uncertainty in kidney care. These meetings clarify controversial issues, foster consensus, set research priorities, and often shape future guideline development. Recently, KDIGO convened a Controversies Conference on Green Dialysis: Environmentally Sustainable Care, Growth, and Innovation. Given the resource intensity and environmental impact of dialysis, this forum was both timely and necessary. At the same time, hosting an international in-person meeting on environmental sustainability highlighted an inherent contradiction and created tension for participants mindful of their own carbon footprint.

Against this backdrop, the primary aim of this study was to provide a transparent and reproducible quantification of greenhouse gas emissions associated with an international nephrology meeting, including identification of the relative contribution of key emission sources. In parallel, KDIGO sought to minimize the meeting's environmental footprint and to address residual emissions through carbon offsetting, an approach in which remaining greenhouse gas emissions are balanced by supporting projects that reduce or remove emissions elsewhere.

METHODS

The Methods section, as well as related Supplementary Tables 1 and 2, are provided in the Supplementary Materials.

RESULTS

The meeting was held from April 24, 2025 to April 27, 2025, with 82 attendees (72 participants and 10 KDIGO staff). Table 1 summarizes the measures undertaken to reduce the meeting's environmental impact. Total emissions were estimated at 224.08 tons of CO_2 equivalent (tCO_2e), with an uncertainty of $\pm$ 10%.

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Table 1. Measures undertaken to reduce the meeting's environmental impact and future opportunities

Category	Measures and opportunities
	Measures
Location	• Berlin selected to minimize overall travel distances for participants (50% of participants were from Europe) • Berlin Marriott chosen for central location and excellent public transport access
Travel	• Pre-conference email communication encouraging sustainable travel practices • Train route information from major European cities was compiled and shared to facilitate lower-carbon travel • Only economy flights reimbursed
Accommodations	• Berlin Marriott selected for its sustainability credentials • Meeting and hotel rooms co-located to avoid additional transport
Digital communication	• Dedicated website providing access to downloadable documents (scope of work, agenda, roster of attendees, program, and breakout group materials) • Printed materials kept to a minimum (3-page program, name tags, and badges)
Materials	• Event banners reused from previous meetings • Nearly 100% of plastic name badge holders collected for reuse
Catering	• Vegetarian lunches provided on 2 days; limited meat and fish on other 2 days • Information about the CO_2e emissions associated with food products provided to attendees at mealtimes to promote awareness • Leftover food donated to hotel staff • Off-site dinner hosted at a nearby restaurant within walking distance, serving a vegetarian menu
Beverages	• No plastic water bottles used
Hotel sustainability	• 100% of electricity supplied from renewable (green) sources • ∼ 90% of fixtures used LED technology • Card-activated power system to reduce unnecessary energy use • Bulk-size dispensers replaced single-use bottles • No single-use plastic portion packets at breakfast buffet • Back-of-house system with multiple bins for different waste streams • Guest plastic bottles collected and donated to a local food bank for recycling • ECO-label certified cleaning products • Recycled and ECO-label certified hygiene paper • Local laundry service to minimize transport emissions • On-site electric car charging stations • Bicycle rental service available for guests
	Opportunities
Communication	• Integrate sustainability information prominently on the event website, including a dedicated section listing all sustainability measures undertaken and encouraging attendees to conserve resources and be mindful of their consumption patterns • Expand on-site communication to highlight sustainability aspects of event operations (e.g., catering choices) • Provide educational materials on the environmental impact of attendee choices (e.g., a CO_2e emissions graph with travel-related emissions highlighted, displayed online and on-site) • Provide feedback to the venue on sustainability practices (e.g., ineffective towel reuse policy despite hotel signage)
Travel	• Review travel reimbursement policy to incentivize sustainable transport — e.g., fully cover first-class train travel as an alternative to air, continue covering local public transport in full, limit taxi reimbursement to exceptional circumstances. • Ensure official travel protocols explicitly include train travel, not only air travel • Offer incentives (e.g., small gifts, recognition, or contributions to environmental initiatives) for attendees who choose sustainable travel options such as trains
Food	• Consider offering a fully vegetarian or vegan menu for conference catering • Use anonymous attendee surveys to assess demand for nonvegetarian items and inform future menu planning
Waste	• Improve visibility and effectiveness of waste management by providing clear signage and instructions at collection points to support proper separation and higher-quality recycling

CO_2e, CO_2 equivalent.

Participant travel dominated the carbon footprint, contributing 219.1 tCO_2e (97.76% of total emissions; Figure 1). The majority arose from long-haul international flights to Berlin, particularly from the US, Australia, the UK, and Canada. Travel by train (13 participants, from Germany, the Netherlands, Belgium, and the UK), car (3 participants, all from Germany), and local transport within Berlin (taxi and public transit) together contributed less than 1% of travel emissions, reflecting both their low carbon intensity and the relatively short distances involved.

Nontravel sources were comparatively minor (Figure 1). Accommodation generated 1.72 tCO_2e (0.77%), catering 1.95 tCO_2e (0.87%), materials 1.05 tCO_2e (0.47%), and venue operations 0.12 tCO_2e (0.06%). Preparatory activities (e.g., laptop work and virtual meetings), waste management, digital infrastructure (website hosting and email), and transport of goods together contributed less than 0.1% of total emissions. On a per-participant basis, emissions equated to 3.11 tCO_2e.

Residual emissions were offset through Project Togo in West Africa,[1] a certified reforestation and community development initiative. Beyond reforestation, Project Togo also supports sustainable agriculture, clean water access, energy-efficient cooking stoves, women-led cooperatives, education, healthcare, and waste management. Offsetting was undertaken for 300 tCO_2e, inclusive a 10% uncertainty margin, at a cost of €30 (∼ $35.3) per tCO_2e, corresponding to a total of

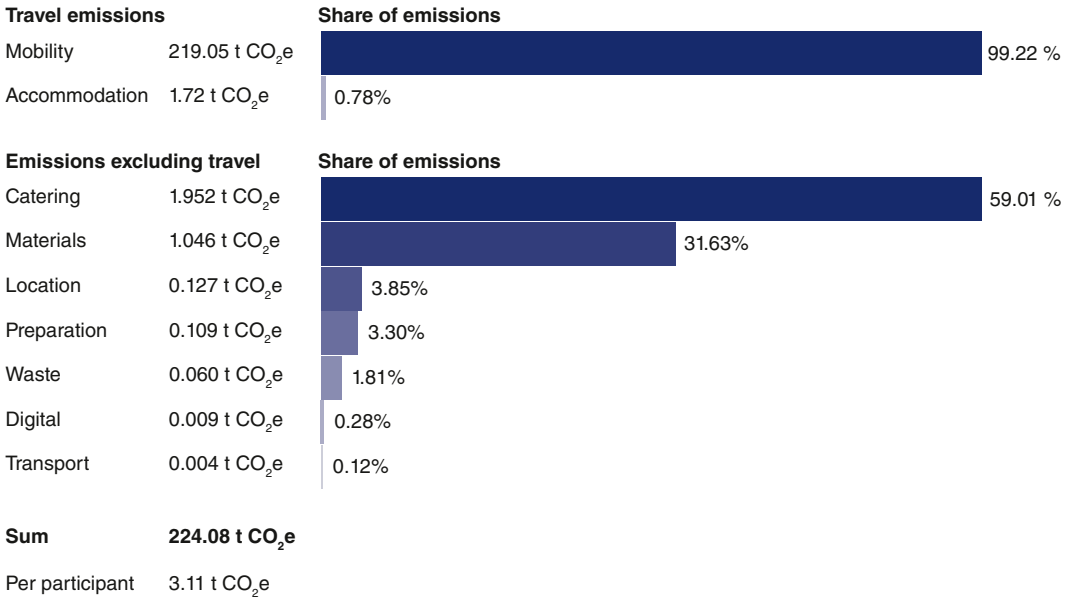

Figure 1. Allocation of conference-related emissions. This figure expresses values in CO_2 equivalents (CO_2e), encompassing the impacts of water vapor, methane (CH_4), nitrous oxide (N_2O), and other greenhouse gases, thereby accounting for total greenhouse gas emissions.

€9000, or approximately €110 (~ $129.5) per attendee.

DISCUSSION

This analysis demonstrates that even relatively small international scientific meetings can generate a substantial carbon footprint. Despite extensive mitigation efforts, emissions remained material when viewed against global per-capita benchmarks. On a per-participant basis, attendance was associated with emissions equivalent to approximately one-fifth of an average American's annual footprint[2] or more than 10 years of per-capita emissions for an individual living in a low-income country.[3]

Participant air travel accounted for more than 96% of total emissions. Although the meeting's overall impact was smaller than recent estimates for larger nephrology conferences[4,5] owing to fewer attendees, the per-participant impact was higher, driven by a greater proportion of long-haul international travel. The overwhelming contribution of flights is consistent across event audits[4–7] and highlights that the greatest opportunity for meaningful reduction lies in rethinking how, when, and where travel occurs.

Hybrid and virtual models offer considerable potential for emissions reduction. Strategies such as regional hubs linked by digital platforms may reduce long-haul travel while preserving opportunities for interaction. Beyond environmental benefits, these formats may advance equity by facilitating participation among individuals constrained by caregiving responsibilities, employment demands, financial limitations, or disability. Survey data indicate that a majority of clinicians now favor hybrid designs, largely for their flexibility and accessibility.[8] Nonetheless, such approaches may attenuate opportunities for networking and immersive engagement, particularly for working meetings that are focused on consensus-building, such as the one described herein.

In this context, the concept of a carbon "handprint" provides a useful framework for weighing the scientific and educational benefits of meetings against their environmental costs. The handprint represents the downstream emission reductions and broader gains catalyzed through knowledge exchange, collaboration, and policy change. A conference dedicated to "green dialysis" has the potential to influence global practice, where cumulative savings in energy, water, waste, and carbon emissions may ultimately outweigh the 1-time footprint of the meeting itself. Importantly, the handprint concept extends beyond environmental outcomes to encompass gains in patient care, health equity, and professional development. Nevertheless, assessments of a meeting's handprint are inherently subjective, shaped by assumptions about how knowledge is translated into practice and policy. Credibility can be enhanced through transparent evaluation frameworks that incorporate measurable indicators where feasible—for example, the number of guidelines influenced or produced, implementation of new sustainability initiatives, uptake of practice changes, or the formation subsequent research collaborations.

Despite substantial prospective planning, post-meeting evaluation identified further opportunities to reduce emissions in future events (Table 1). These

included practical measures such as revisiting travel reimbursement policies to incentivize more sustainable choices, as well as proactive communication strategies to increase participant awareness and engagement. Collectively, these findings underscore that environmental sustainability requires ongoing refinement as expectations, technologies, and norms evolve.

Carbon offsetting serves as an important interim tool for addressing unavoidable emissions, but is not a substitute for direct reductions. Offsetting is subject to well-recognized concerns about permanence (the durability of carbon storage), additionality (ensuring benefits beyond what would have occurred anyway), and verification (independent confirmation of genuine reductions), and poorly designed or insufficiently verified schemes risk overstating climate benefits and eroding trust. Professional guidance in selecting reputable, accredited providers is therefore essential to ensure that investments deliver genuine, measurable, and lasting emissions reductions.

CONCLUSION

Overall, these findings highlight the importance of deliberate, transparent decision-making around scientific meetings. Where in-person attendance is necessary to achieve meeting objectives, emissions should be minimized, quantified, and addressed through credible offsetting. For future meetings, an explicit assessment should be undertaken at the planning stage to determine whether anticipated benefits justify the environmental impact, or whether lower-impact formats could achieve similar outcomes.

DISCLOSURE

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SUPPLEMENTARY MATERIALS

Supplementary File (PDF)

Supplementary Methods.

Supplementary References.

Table S1. Data sources for emission calculations.

Table S2. CO2 emissions factors for meeting components (uncertainty factor 10%).

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