Global Science. Local Change.

KDIGO Controversies Conference on Green Dialysis: Environmentally Sustainable Care, Growth, and Innovation

April 24–27, 2025
Berlin, Germany

Scope of Work

Kidney Disease: Improving Global Outcomes (KDIGO) is an international organization whose mission is to improve the care and outcomes of people with kidney disease worldwide by promoting coordination, collaboration, and integration of initiatives to develop and implement clinical practice guidelines. KDIGO also regularly hosts Controversies Conferences on a focused subject pertaining to kidney disease to review state-of-the-art evidence, set priorities for improving patient care and outcomes, and highlight areas for which additional research is needed.

CONFERENCE BACKGROUND AND RELEVANCE

Climate change and kidney disease are interconnected, with each contributing to and worsening the other. Extreme heat elevates the risk of both acute kidney injury and chronic kidney disease (CKD), while higher ambient temperatures promote kidney stone disease.[1,2] Air pollution, largely driven by fossil fuel combustion, is associated with increased risk of incident CKD, CKD progression, kidney failure, and death due to kidney disease.[3]

At the same time, dialysis therapies are among the most carbon-intensive medical therapies, driven by their high energy consumption, heavy reliance on disposable materials, and frequent, recurring nature.[4] A substantial part of the carbon footprint of home dialysis (peritoneal dialysis and home hemodialysis) is the production and transportation of consumables to patients.[5] Beyond carbon emissions, both hemo- and peritoneal dialysis are associated with vast water usage and production of plastic waste, with their effects on other environmental parameters largely undescribed.[4]

There are both ethical and regulatory imperatives for the kidney care community to reduce its environmental footprint. Additionally, there is a practical necessity: in an increasingly resource-constrained world, global dialysis services must adopt targeted measures to reduce resource consumption and associated costs if the current quality of care is to be maintained or improved amid ever-growing demand. Similarly, increasing access to dialysis in underserved regions relies on developing sustainable, resource-efficient models of care that can be scaled to meet the needs of these populations without compromising the environment or incurring prohibitive costs.

Fortunately, many examples of where and how changes can be made already exist. Innovative "green dialysis" initiatives have been implemented successfully in the United Kingdom, European Union, Australia, and elsewhere.[4,6-9] The main challenge now lies in achieving rapid and widespread adoption of these practices across diverse regions. Additionally, there is an urgent need for new technologies and models of care. In hemodialysis, key areas for innovation include the development of more efficient water-purification systems and energy-saving equipment. For peritoneal dialysis, point-of-care dialysate generation could significantly reduce carbon emissions associated with transport. Across both modalities, innovations in sorbent, waste management, and recycling technologies and the introduction of novel bioplastics or other strategies to reduce harmful disposable materials could greatly mitigate environmental impact.

Previously KDIGO has addressed contemporary dialysis topics such as optimal dialysis prescription, blood pressure and volume management, home dialysis, and approaches for assessing and ameliorating symptom burden. This conference intends to be forward-looking, appraising novel green dialysis procedures and technologies.

By so doing, we acknowledge that broad efforts to reduce the environmental impact of kidney care must first and foremost focus on promoting health, recognizing early kidney disease, and slowing disease progression. Work is also required to improve access to and optimize non-dialysis kidney failure therapies (transplantation and supportive care) for appropriate patients. Nevertheless, given the disproportionately high environmental impact of dialysis, the growing number of individuals requiring this therapy, and the limited attention this field has received previously, the scope of this conference will be limited to dialysis.

CONFERENCE OVERVIEW

Drs. Katherine Barraclough (Royal Melbourne Hospital, Australia) and Jennifer Flythe (University of North Carolina, USA) will co-chair this conference. The format of the conference will involve topical plenary session presentations followed by focused discussion groups that will report back to the full group for consensus building. This highly interactive conference will invite key thought leaders and relevant stakeholders, including patients, and experts in nephrology (adult and pediatric) and other related disciplines (environmental science, epidemiology, ethics, nursing, social work, etc.) who will comprehensively review the literature and current state of understanding in this area and address clinical issues as outlined in the **Appendix: Scope of Coverage**. The conference output will include the publication of a position statement that will help guide KDIGO and others on setting priorities for improving dialysis sustainability and access.

APPENDIX: SCOPE OF COVERAGE

Breakout Group 1: Optimizing existing hemodialysis (HD) (in-center and home) and peritoneal dialysis (PD) practices to promote environmental sustainability

1. Using existing technologies, how can we optimize dialysis prescriptions to promote environmental sustainability?

a) How can HD (in-center and home) and PD prescriptions and schedules be tailored and/or personalized?
b) How can we tailor hemodiafiltration prescriptions to reduce environmental impact?
c) How should nutritional management be combined with the personalization of dialysis prescriptions?
d) What barriers limit the uptake of optimization strategies discussed in a) through c), and how might these barriers be overcome?

2. Using existing technologies, how can we reduce dialysis-associated water and energy consumption?

a) How can reverse osmosis (RO) settings and reject water recycling be optimized**?**
b) How can HD machine disinfection be optimized**?**
c) How can dialysate and reinfusion flows be optimized?
d) How can centralized delivery of acid concentrate contribute?
e) What factors should be considered when selecting an RO plant for a dialysis facility (e.g., efficiency, size, placement relative to dialysis chairs)?
f) What barriers limit the uptake of the optimization strategies discussed in a) through e), and how might these barriers be overcome?

3. Using existing technologies, how can we optimize waste management?

a) How can we reduce HD and PD treatment-associated consumables?
b) What factors should be considered during product/equipment selection or procurement to minimize waste generation and optimize waste management?
c) How can we improve waste management in dialysis facilities and at home?
d) How could PD effluent drainage systems be improved to reduce waste management?
e) Is there a role for dialyzer re-use?
f) How can we optimize management of waste from electronic equipment?
g) How can we better take advantage of existing recycling options (paper, glass, plastics)?
h) What barriers might limit the uptake of the optimization strategies discussed in a) through g), and how might these barriers be overcome?

4. How can health system and policy initiatives support environmentally sustainable dialysis (HD and PD)?

a) How should health systems integrate environmental considerations when prioritizing dialysis modalities?
b) What are the economic implications of transitioning to greener HD and PD practices, and how can these be leveraged to accelerate adoption?
c) What role do regulatory bodies play in encouraging and enforcing environmentally sustainable practices in HD and PD?
d) What unit- and system-level metrics should be monitored and reported to evaluate the impact of a policy/practice change aimed at lowering environmental impact of dialysis?

e) What specific challenges do low-resource settings face (e.g., lack of waste management infrastructures leading to on-site burning vs. centralized, controlled incineration or disposal; unreliable power and water supply)?

Breakout Group 2: Identifying and developing green innovations in HD (in-center and home)

1. What equipment innovations could enhance the environmental sustainability of home and in-center HD?

a) What role could shorter bloodlines play?
b) Is there a role for bio-based and biodegradable plastics in HD?
c) What is the role for sorbent technologies?
d) What potential does forward osmosis have in reducing HD water usage?
e) What role might reusing spent dialysate play, and what are the technological, microbiological, financial, and environmental barriers to reuse?
f) What improvements are needed to enhance the innovations discussed in a) through e) and increase their likelihood of success?
g) What barriers could hinder the development and adoption of these innovations, and how can they be addressed?

2. Can wearable and implantable dialysis devices contribute to improving the environmental sustainability of HD?

a) In what ways might wearable and implantable kidneys improve environmental sustainability compared to traditional HD?
b) How can environmentally friendly materials be incorporated into wearable and implantable kidneys?
c) How can we ensure that these technologies are developed with environmental sustainability in mind?
d) What barriers exist in the development and adoption of wearable and implantable kidneys, and how might they be overcome?

3. What innovations in waste processing and management are needed to promote the environmental sustainability of HD?

a) Is there a role for on-site waste management? If so, what?

b) Are particular on-site waste management technologies more environmentally friendly than others?

c) What are the barriers to implementation of green waste management innovations, and how might they be overcome?

Breakout Group 3: Identifying and developing green innovations in peritoneal dialysis (PD)

1. **What innovations are needed to reduce the environmental impact associated with the production and transport of PD fluids and consumables?**
   a) How could packaging be redesigned or eliminated?
   b) How could local or regional production of dialysate offer environmental benefits compared with centralized manufacturing?
   c) What technological or system advances are required to support point-of-care dialysate generation? How does patient acceptability factor into these advances?
   d) What is the role for sorbent technologies?
   e) What innovations in effluent drainage systems could reduce waste of PD systems?
   f) What are the barriers to realizing the technologic advances discussed in a) through e), and how might these barriers be overcome?

2. **What innovations and end-use management innovations are required to make PD plastics more environmentally sustainable?**
   a) What role could the development of bioplastics, reusable or reprocessable materials, and alternative solutions like non-physical vapor deposition coatings play?
   b) What innovations are required to enhance the recycling or processing of PD plastics (e.g., excluding adhesives, inks, and other residues or optimizing local or regional recycling infrastructure)?
   c) How might PD plastic waste be monetized?

d) What are the barriers to realizing the technologic advances discussed in a) though c), and how might they be overcome?

3. **How might operational innovations reduce the environmental impact of PD?**
   a) How might delivery systems and home storage be reconceived?
   b) What innovations in cycler functionality, design, and servicing are needed to reduce energy and consumable use, emissions, and waste production?
   c) How do factors such as geographic location, urban vs. rural settings, and resource availability influence opportunities to improve the resilience and environmental sustainability of PD and dialysis systems more broadly (including, for instance, balancing PD with HD in water-scarce regions)?

References

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