

GREENER NEPHROLOGY

A Strategic Imperative for Sustainable Kidney Care

By Clara García-Carro and Prakash Gudsoorkar

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Nephrology is uniquely positioned at the nexus of life-preserving therapy and environmental accountability. Dialysis—essential for people with kidney failure—is among the most resource-intensive therapies in modern medicine, with a substantial environmental footprint. As climate change intensifies, the nephrology community must lead a shift toward environmentally sustainable practices. This issue of *Kidney News* brings together insights from experts advocating responsible innovation in kidney care, balancing clinical efficacy with ecological stewardship.

Dialysis and environmental burden

In-center hemodialysis (HD) is associated with high water consumption—up to 500 L per session—and annual carbon emissions reaching 10 tons of CO₂ per patient. The cumulative environmental cost of dialysis is equivalent to thousands of vehicle miles driven annually.

Home HD systems that use low-flow technology reduce water and energy consumption by up to 75%. Facilities can also invest in reverse osmosis water reuse systems, dialysate flow optimization, and energy-efficient equipment to mitigate the environmental burden while maintaining quality care.

Peritoneal dialysis: A scalable model for sustainable innovation

While less centralized, peritoneal dialysis (PD) introduces its own sustainability challenges, particularly in dialysate manufacturing, packaging, and transport. Innovations such as Baxter's on-demand dialysate generation systems and Ellen Medical's solar-powered portable units present viable alternatives by minimizing supply-chain dependencies and enabling care in resource-constrained settings. These models offer scalable, cost-effective solutions aligned with the sustainability goals of both high-income and low- and middle-income countries.

However, long-term data on outcomes and material durability are essential to ensure patient safety while promoting adoption.

Medical waste management: An overlooked opportunity

Dialysis therapies generate significant volumes of plastic and pharmaceutical waste. In PD, more than 50% of household waste is nonrecyclable plastic, complicated by ink labeling and material mixing. HD facilities face similar challenges, particularly with expired medications and packaging.

Effective waste management requires clearer waste classification guidelines, staff and patient education, and partnerships with manufacturers for recycling initiatives. Successful models in Thailand and Australia underscore the feasibility of structured waste-segregation protocols and local infrastructure engagement.

Energy use in dialysis facilities

Dialysis centers are among the highest energy consumers in health care. Transitioning to renewable energy—particularly solar—has demonstrated dramatic benefits. In one Australian initiative, solar-panel installation reduced grid reliance by 91% and energy costs by 76%.

Strategic facility-level upgrades, such as optimizing heating, ventilation, and air conditioning systems; automating lighting; and aligning machine operation schedules with energy demand, can produce measurable environmental and financial returns.

Climate change and kidney health

The link between environmental degradation and kidney diseases is now well established. Air pollution contributes to chronic kidney disease progression; heavy metal contamination in water sources increases nephrotoxicity. Heat-related acute kidney injury is rising globally, disproportionately affecting vulnerable populations, including outdoor workers in low-income regions.

Policymakers must recognize kidney health as a climate-sensitive domain and integrate environmental risk factors into public health planning.

Policy and practice: A coordinated response

Sustainable nephrology demands integrated action across clinical practice, health policy, and industry. Key priorities include:

- ▶ **Investment in green dialysis infrastructure**, including support for PD and home HD innovations that reduce resource consumption
- ▶ **Embedding environmental education** within medical training to foster long-term culture change
- ▶ **Regulatory frameworks** to standardize waste management and incentivize sustainable procurement
- ▶ **Support for early detection and prevention of kidney diseases** to reduce downstream dialysis demand

The pathway to environmentally responsible kidney care is clear and achievable. For physicians, this means rethinking care-delivery models. For policymakers, it necessitates creating environments that reward sustainability without compromising patient outcomes. The time to act is now. ■

Clara García-Carro, MD, PhD, is a nephrologist at San Carlos University Clinical Hospital, Madrid, Spain. Prakash Gudsoorkar, MD, FASN, is an associate professor of medicine in the Division of Nephrology at the University of Cincinnati, OH, and serves as a deputy editor for Kidney News.

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