Greener Nephrology Essential in the Face of Climate Change

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https://doi.org/10.62716/kn.000382024

With a growing proportion of the world facing water shortages, energy costs on the rise, and more frequent violent weather events disrupting access to the resources needed for dialysis, there is a pressing need for more sustainable approaches to care, said Suzanne Watnick, MD, FASN, professor of medicine at the University of Washington; a practicing nephrologist with the Veterans Affairs Puget Sound Health Care System, WA; and ASN Health Policy Scholar in Residence.

Watnick joined a panel of speakers during the Kidney Week 2024 Green Nephrology: Innovations That Address the Carbon Footprint Conundrum in Dialysis session on October 24, 2024. The group addressed potential ways to make kidney care more sustainable. She noted a bidirectional relationship between kidney care and the environment. Extreme heat events can contribute to acute kidney injury, kidney stones, and increased hospitalizations. Hurricanes and other extreme weather events can cut off access to dialysis and other forms of care and lead to shortages of supplies.

Often, climate change disproportionately affects patients who are already at greater risk of kidney diseases because of social determinants of health in the United States and globally, noted speaker Mukta Baweja, MD, an assistant clinical professor at the Icahn School of Medicine at Mount Sinai in New York, NY, and a former medical officer with the United Nations. She noted that middle- and lower-income countries that produce the lowest greenhouse gas emissions often face the worst effects of climate change and have the least resources for health care and resilience measures. "Climate change is an environmental and social justice issue," Baweja said. "Climate change, or the involuntary exposure of climate change, exacerbates existing inequities and creates new ones."

Watnick and other speakers at the session highlighted promising approaches to curbing unnecessary waste and increasing the sustainability of kidney care to help reduce contributions to climate change and its harmful effects. Many of those approaches start with simple steps by frontline and behind-the-scenes staff at dialysis facilities.

Carbon footprint

Overall, health care contributes about 10% of US greenhouse gas emissions, Watnick noted. She explained that the average dialysis facility produces greenhouse gas emissions comparable to 93 homes, and a single hemodialysis session produces an equivalent amount of emissions to a 149-mile drive in a gas-powered vehicle.

"The sustainability of our practice and our ability to take care of patients and provide these life-saving treatments depend on our understanding of the carbon footprint and minimizing the carbon footprint where we can," said Anne Huml, MD, MS, a transplant nephrologist in the Department of Kidney Medicine at the Cleveland Clinic, OH. With about 3.3 million patients receiving dialysis 3 times per week globally, the impact of dialysis-related carbon emissions is substantial, noted Huml.

In 2022, Huml and her colleagues analyzed the carbon footprint of dialysis in collaboration with a small dialysis organization in Ohio that runs 15 dialysis centers (1). They analyzed the use of electricity; waste production and recycling; and transportation of staff, patients, and supplies. They found that each treatment for a patient at a dialysis facility had an estimated carbon footprint of 58.9 kg of carbon dioxide (CO_2). The main contributors to that carbon footprint were staff and patient transportation, electricity, and natural gas use. Varying distances that staff and patients had to travel for care contributed to differences in the carbon footprint across facilities, Huml noted.

Annually, Huml noted that global carbon emissions for each patient undergoing in-center hemodialysis vary widely from country to country, from about 3000 CO_2 equivalents per year to about 10,000 CO_2 equivalents per year. Peritoneal dialysis also has a smaller but substantial carbon footprint ranging from about 1200 to 1900 CO_2 equivalents per year (2). "Transporting the peritoneal solutions from where they are produced to the endpoint where the patient uses them has a significant emission footprint," she explained.

Huml explained that the carbon footprint of kidney transplantation has not been analyzed. However, an analysis of the carbon footprint of liver transplants suggests that the carbon footprint of chartered flights to transplant organs is substantial, resulting in an estimated 815 million tons of carbon emissions at one center over the course of a year (3). She noted that the amount of recycling or reforestation necessary to offset that is prohibitively large. "It is not necessarily a problem that we can recycle our way out of," Huml said. "It is not a problem that we can reforest our way out of."

Water hungry

In addition to requiring large amounts of energy, hemodialysis and peritoneal dialysis both use large amounts of water. Watnick noted that a single hemodialysis session could use an entire bathtub's worth of water. However, variation in use by facility or machine suggests room for improvement. She stated that more efficient water treatment systems at dialysis facilities discard about half of the water used, compared with 70% waste in less efficient systems. "Still, inordinate amounts of water are being wasted," Watnick said. She suggested first working with facility staff to identify and rectify faults in the system or purchase more efficient systems.

Rejected reverse osmosis system water, which is highly purified and filtered, may also be reused for steam generation, landscaping, janitorial purposes, cleaning, or potentially as water for animals. Amy Yau, MD, FASN, clinical assistant professor of medicine at The Ohio State University, highlighted a study conducted in Malaysia that used nitrogen- and phosphorus-rich spent effluent in an aquaponics system to grow fish and produce for staff and patients. The system generated 50–150 tilapia every 6 months and 3–8 kilos of produce each month (4). She said the system provided a return on investment for the facility within 2 years.

Changes in nephrology practice may also help reduce water use, Watnick said, such as starting dialysis later in a patient's kidney disease development and starting dialysis incrementally. She also noted studies demonstrating success with reduced flow rates for dialysis and that some machines can facilitate slower flow rates. Yau agreed, noting recent studies support lower flow rates.

"There are a lot of things that we do that haven't been updated in decades," Watnick said. "A lot of the dialysis software [developers] for hemodialysis machines haven't thought about how you can match blood flows and dialysate flows to make things more efficient and more effective."

Developing more water-efficient peritoneal dialysis would also benefit patients. Watnick noted, for example, that point-of-care dialysate production could help prevent the need to transport large amounts of dialysis across long distances to patients in rural areas. KidneyX (Kidney Innovation Accelerator), a public-private partnership between ASN and the US Department of Health and Human Services, will award $7.25 million early this year for its Sustainability Prize to support projects to reduce water or power usage in dialysis care. "Kidney care solutions that reduce the water and power used during dialysis can improve resiliency during disasters and make ongoing care more sustainable," said Admiral Rachel Levine, MD, assistant secretary of the US Department of Health and Human Services, in a video shared during the session. "New solutions may also promote more equitable access to kidney care."

Solid waste

In addition to emissions and water use, kidney care generates enormous amounts of solid waste. Yau noted that each hemodialysis session generates 2.5 kg of solid waste, and peritoneal dialysis generates about 1.7 kg of plastic waste daily.

Yau said that several approaches to reducing solid waste and emissions from the transportation of dialysis supplies had been successfully implemented in other countries. She described a UK study, which found that having dialysis acid delivered in bulk instead of individual containers would reduce 4.2 tons of plastic waste, eliminate 16 tons of carbon emissions annually, and provide a return on investment in 5 years (5).

She also highlighted a nurse-led initiative in Canada that reduced solid waste by increasing the recycling of recyclable materials (6). The initiative focused on education for clinicians and use of separate bags to help with sorting. It also saved their unit $2000 per year in biohazard waste costs by ensuring that biohazard wastes were sorted more carefully from other forms of waste. "If we can better identify what our waste is, we can better recycle it," Yau said.

Prevention is key

Many speakers emphasized that the most potent approaches to reducing the environmental impact of kidney diseases may be focusing on prevention and curative therapies, like transplants. Watnick said nephrologists should concentrate on catching kidney diseases early, slowing progression, and reducing the demand for dialysis. She noted that this is consistent with the Advancing American Kidney Health initiative, which aims to reduce the number of patients progressing to dialysis by one-quarter.

Yau agreed, adding that currently, only 50% of patients with chronic kidney disease (CKD) are treated with renin-angiotensin-aldosterone system inhibitors as indicated, and only 10% of patients with diabetes and CKD are treated with sodium-glucose cotransporter-2 inhibitors as guidelines recommend. She noted that there are challenges that prevent more patients from receiving appropriate preventive therapies, including delayed diagnosis and the need for referral to a nephrologist from primary care. However, she suggested more collaboration with primary care to address these issues. She also emphasized the need to increase transplants and reduce discarded kidneys.

Baweja expressed that prevention and preparation are also key when trying to mitigate the impact of extreme weather like flooding or hurricanes on patients with kidney diseases. She said that such events can cut off vulnerable patients' access to medical care and medications and make it difficult for patients to reach dialysis centers. Patients on home dialysis may also experience electrical outages, lack of water, or delayed supply deliveries. "There's a demonstrated increase in mortality from kidney failure even 30 days after a climate event like hurricanes," she said. "It can also have a direct impact by increasing the risk of CKD death and disability."

Baweja noted that providing early dialysis sessions prior to extreme weather events has been shown to reduce emergency department visits, hospitalizations, and mortality for patients on dialysis. Additionally, the Centers for Medicare & Medicaid Services has issued a preparedness rule requiring dialysis facilities to have preparedness plans for emergencies. "We should also prepare the emergency room for increased visits, including for acute kidney injury, especially during hot weather," she said. Baweja also recommended steps to prevent intravenous fluid shortages and the spread of vector-borne diseases, particularly in lower-income countries.

Working toward solutions

Political leaders and professional organizations are already banding together on solutions. Watnick noted that the past three presidential administrations have worked bipartisanly and bicamerally to improve and modernize kidney care. Yau highlighted that ASN released a statement on climate change calling for steps to reduce the impact on patients and the environmental impact of kidney care (7). Similarly, the International Society of Nephrology has a GREEN-K initiative (Global Environmental Evolution in Nephrology and Kidney Care) to promote environmentally sustainable kidney care (8).

There are also many steps that dialysis centers can take to become more sustainable. Watnick suggested that dialysis facilities form collaboratives to identify and share successful sustainability initiatives. Building more eco-friendly dialysis centers or retrofitting existing ones may also help, Yau suggested. She recommended using motion-sensor lights, installing solar or high-efficiency bulbs, increasing natural light, or adding more heating and cooling efficiency measures. Upgrading to newer dialysis machines that are 70% to 85% water efficient may also help. She noted that these upgrades can reduce costs in addition to reducing carbon emissions and electricity use.

Watnick emphasized the importance of identifying local sustainability champions to lead efforts to reduce local contributions to climate change and help educate other staff. "Think about the frontline people who might have great ideas to decrease the impact on the environment," Watnick urged. "Not just nurses, physicians, and dialysis techs, but the people managing the facility practices, hospitals, patients, [and] the people in the chairs receiving dialysis or doing it themselves at home sometimes are the people that have the best ideas." ■

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