



Environmentally Sustainable Opportunities for Health Systems

Sustainable Kidney Care

Dialysis therapies for end-stage kidney disease are associated with a significant environmental impact because they require large amounts of water, energy and single-use plastic materials.

Carbon Footprint of Hemodialysis per Treatment in North American Setting*

58.9 kg CO2 eq

This is equivalent to driving 238km¹



*The environmental impact of peritoneal dialysis are felt to be comparable to that of hemodialysis.²

Dialysis Treatments

account for 1.1% or approx. \$1.9 billion of Canada's total healthcare expenditure³

Life sustaining dialysis therapies are associated with significant symptom and financial burdens and poor patient outcome.⁴ Sustainable kidney care prioritizes interventions that improve patient access to preventative care, minimizing CKD onset and burden of disease.⁵

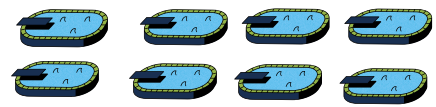


Kidney Care's Environmental Impact

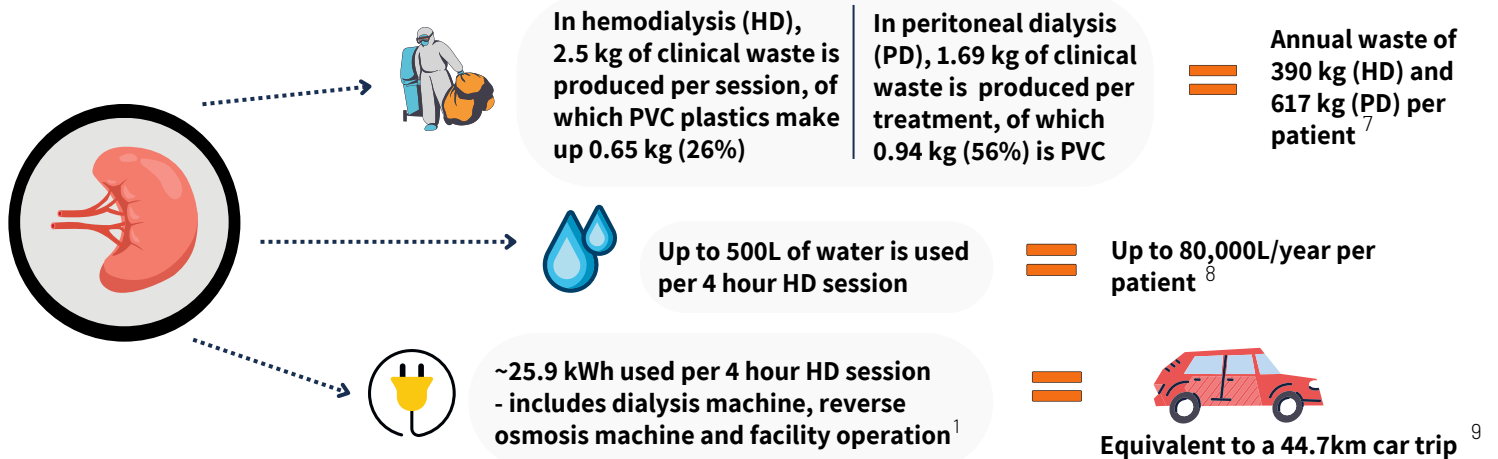
Global Recyclable Polyvinyl Chloride (PVC) waste from peritoneal dialysis



30 million kg of PVC plastic



Weight of full Olympic size pools⁶



Reducing The Environmental Impact of Kidney Care

There are many opportunities for members of the kidney care team to improve the sustainability of kidney care and reduce carbon emissions.

Build Individual and Organizational Capacity to Mitigate Kidney Care's Impact

1 UNDERSTAND THE CONNECTIONS BETWEEN KIDNEY DISEASE AND CLIMATE CHANGE KIDNEY DISEASE AND CLIMATE CHANGE EACH WORSEN THE OTHER¹⁰



Extreme heat, particle pollution, and other climate change effects have been associated with increased incidence of chronic kidney disease (CKD) globally.¹¹⁻¹² The resulting increased need for kidney care services, with high resource use including water, energy, single use plastics, and medications contribute to health care's significant environmental impact.¹³⁻¹⁶



End-stage kidney disease (ESKD) onset is increasing in Canada at an annual rate of 1.1% which is equivalent to about 208 people per million population. More than 20,000 patients currently require dialysis in Canada, a prevalence that has doubled over the past 20 years.¹⁷

ESTABLISH A SUSTAINABILITY ROLE OR TEAM WITHIN EVERY KIDNEY CARE PROGRAM

2



Formalizing a sustainability team or position helps instill the concept of sustainability as a core value and provides a sustainability lens to shape organizational decisions.

Imbed a Culture of Sustainability in the Organization by:

- Scanning/surveying clinical and non-clinical care areas to evaluate where potential sustainable interventions can be implemented
- Assessing existing policies and practices to establish sustainable goals for potential projects
- Conducting an audit and collecting baseline data to measure the impact of sustainable initiatives
- Assessing for barriers and developing strategies to overcome them
- Engaging in ongoing assessments to explore if sustainable initiatives and solutions maintain efficiencies in patient care and operation of the unit

18,19



CLINICAL

Clinical interventions to foster sustainability may include:²⁰

- CKD Prevention and Disease Progression Management
- Medication Stewardship
- Green Dialysis Prescribing

NON-CLINICAL

Non-clinical interventions to foster sustainability may include:²⁰⁻²²

- Office Greening
- Socially Responsible Banking for Program Resources*



*Socially responsible banking is committed to creation of social and environmental good without an exclusive focus on profits and without funding or investing in causes that harm people or the planet

Optimize CKD Prevention and Slow Disease Progression to Reduce End-Stage Kidney Disease

3 PROMOTE EARLY RECOGNITION OF CKD RISK FACTORS AND TIMELY DIAGNOSIS, AND OPTIMAL UPTAKE OF PREVENTATIVE THERAPIES

A robust primary care system can work upstream of and with kidney care programs to prevent CKD, slow its progression and reduce incidence of ESKD; all are sustainable approaches to reduce the burden of CKD therapies on healthcare systems.²³ Despite insufficient data, carbon emissions associated with pre-dialysis CKD care are presumed to be significantly less compared to ESKD therapies due to lower costs and resource use.²⁴



Screening for CKD in high-risk populations (i.e. hypertension, diabetes and cardiovascular disease) can improve early detection of CKD and enable timely initiation of treatment.^{23,25}



CKD Risk Factors:²⁶

- Hypertension
- Diabetes
- Cardiovascular disease
- Family history of CKD
- Prior acute kidney injury
- Genetic risk factors
- Other system diseases that impact kidney function
- Older age
- Environmental exposure

Management Strategies for Prevention and Treatment of Early CKD:^{26, 27}

- Smoking cessation
- Regular exercise
- Balanced diet [low sodium intake; adequate dietary vegetable and potassium intake]
- Management of pre-existing chronic conditions
- Moderate alcohol intake
- Pharmacotherapies



OPTIMIZE UPTAKE OF KIDNEY TRANSPLANTATION TRANSPLANTATION IMPROVES SURVIVAL AND OFFERS PATIENTS A BETTER QUALITY OF LIFE

4

While studies are ongoing, early evidence suggests that the environmental impact of kidney transplantation may have 90-95% lower greenhouse gas emissions than dialysis therapies.²⁸



5-YEAR SURVIVAL RATE FOR A KIDNEY TRANSPLANT IS 90% FOR A LIVING DONOR TRANSPLANT WHEREAS THE 5-YEAR SURVIVAL RATE FOR PATIENTS ON DIALYSIS IS 43.9%.²⁹

Other Benefits of Kidney Transplantation



Improved Quality of Life



Lower Long-Term Costs



Lower Therapy-Associated Emissions



28, 30,31

5 ENGAGE IN MEDICATION STEWARDSHIP MEDICATION STEWARDSHIP PRACTICES IN KIDNEY CARE CAN PROMOTE SAFER PRESCRIBING PRACTICE AND REDUCE PHARMACEUTICAL RELATED CARBON EMISSIONS

Medication stewardship focuses on sustainable, safe and appropriate use of medications by prescribers and all other healthcare staff. This practice prioritizes prescribing clinically necessary medications to patients, discontinuing their use when of no benefit, and prescription renewal or extension only if reasonable benefit and/or ongoing clinical indication. Medication stewardship practices can also reduce costs and resources associated with administering certain drugs. For example, the use of Intravenous (IV) medications are associated with hidden costs such as increased use of single-use plastic materials and increased healthcare staff time to prepare, deliver the medication and monitor its effects. ^{32, 33}

Increased symptom burden from ESKD and dialysis is associated with polypharmacy in HD and PD patients. In one study, 25% of medications prescribed to patients on either dialysis modality are considered 'potentially inappropriate medications (PIMs)'. ³⁴

Pharmaceuticals are a major contributor (~30%) to kidney care's total carbon footprint, owing to the significant use of single-use, pre-packaged medications and polypharmacy. ^{35,36}



Medication Stewardship in Kidney Care ^{32,33,37}



- Regularly review patient's medication history to ensure it is up-to-date and deprescribe PIMs
- Substitute IV medications with oral alternative when appropriate, given lower single-use materials (i.e. diluents, needles, syringes, tubing and saline bags)
- Avoid the use of NSAIDs in CKD patients
- Avoid concurrent use of ACE inhibitors and ARBs as it can increase risk of acute kidney failure and hyperkalemia
- Prescribe ESAs* ONLY when clinically indicated

*Erythropoietin Stimulating Agent (ESA)

6 CONSIDER CONSERVATIVE MANAGEMENT OF CKD CHOOSING CONSERVATIVE MANAGEMENT OVER DIALYSIS OR A KIDNEY TRANSPLANT SHOULD INVOLVE A COMPREHENSIVE DISCUSSION BETWEEN A PATIENT, THEIR FAMILY AND THEIR HEALTHCARE TEAM

6

CKD patients approaching ESKD are faced with choosing which type of kidney replacement therapy (KRT) to select. The kidney care team may initiate conversations on conservative care with sensitivity, providing patients time and resources to determine if conservative care aligns with their goals of care. ³⁸



Conservative Management Care Pathway:

- Ongoing supportive care and continual discussion of advanced care plan
- Pain and symptom management
- Referral to palliative care team
- Bereavement support for family ³⁹

In some cases, KRTs may not be clinically beneficial for the patient - it may not improve health outcomes or quality of life and unnecessary treatments and hospitalizations could be avoided. For chronic dialysis patients, the kidney care team can also support the patient's choice to discontinue treatment. ³⁸

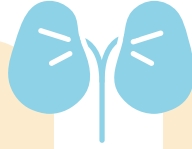
7 CONSIDER CLINICALLY APPROPRIATE PRESCRIPTION MODIFICATIONS FOR END-STAGE DISEASE THERAPIES

THE KIDNEY CARE TREATMENT PLAN SHOULD BE INDIVIDUALIZED TO EACH PATIENT. ADJUSTING PRESCRIPTION WHERE CLINICALLY APPROPRIATE MAY YIELD MODEST CARBON REDUCTIONS

Opportunities to Incorporate Green Dialysis Prescribing

Hemodialysis ^{20,40-43}

- Consider dialysate flow (Qd) reduction, where clinically appropriate
- Consider Incremental/decremental prescribing (based on clinical parameters)
- Consider the use of NxStage for home dialysis patients when clinical equipoise exists between differing home hemodialysis systems



Peritoneal Dialysis ^{44,45}

- Consider use of Continuous Ambulatory Peritoneal Dialysis (CAPD) over Automated PD when patient preference and clinical equipoise exist for PD prescription
- Consider Incremental/decremental prescribing (based on clinical parameters)

Choosing Wisely

Under close supervision of the kidney care team, dialysis can be safely deferred in patients with stage 5 CKD in the absence of clinical symptoms. The Canadian Society of Nephrology recommends initiating dialysis in patients with stage 5 CKD only in the presence of uremic symptoms and/or Cr other clinical indicators.

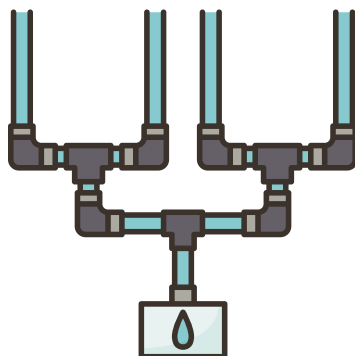
Explore Climate Conscious Infrastructure Investments

INVEST IN SUSTAINABLE TECHNOLOGIES

KIDNEY CARE HAS AN EVOLVING LIST OF SUSTAINABLE TECHNOLOGIES

8

There are many opportunities to implement sustainable technologies, both small and large. Some investments are suitable as part of new facility builds; others can be implemented as retrofits to existing infrastructure. ^{8, 46,47}



EXAMPLES OF SUSTAINABLE TECHNOLOGIES

- PVC plastics recycling of non-biohazard materials
- Retrofit older equipment with energy efficient upgrades (heat exchangers retrofit)
- Centralized acid loop distribution system
- RO waste water capture system (water diverted to flush toilets, laundry and other uses)
- Automatic lighting controls and temperature controls within the facility
- Use of renewable energy where possible
- Water efficient Reverse Osmosis (RO) systems
- Energy efficient dialysis machines

9 ADVOCATE FOR LOW CARBON TRANSPORTATION

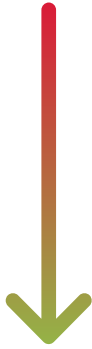
INTEGRATING LOW CARBON TRANSPORT CAN HELP REDUCE CARBON EMISSIONS IN NEPHROLOGY CARE

28.3% of hemodialysis facility's total emissions originate from patient and staff transportation¹



870 909km car journey/year⁹

218,015 kg CO₂ eq/year¹



REDUCE ENVIRONMENTAL IMPACT OF TRANSPORTATION^{24,57,58}

- Consider implementing low-cost or free electric vehicles (EV) charging stations for staff and patients/visitors
- Advocate for the use EV or hybrid vehicles in the accessible transport system (i.e. Wheel-trans, TransLink etc)
- Encourage public transportation
- Increase bicycle infrastructure and parking

BUILD CLIMATE RESILIENT INFRASTRUCTURE

PREPARE HEALTHCARE SYSTEMS FOR EFFECTS OF CLIMATE CHANGE AND EXTREME WEATHER

10

Extreme weather events can affect road networks, supply chains, communications and electricity needed to support our patients. With increasingly frequent extreme weather, it is vital that healthcare infrastructure is built and maintained with climate change effects at the forefront. This includes developing strategies to respond to increased demand for hospital capacity due to climate threats while maintaining patient access to life sustaining care needs.^{2,59}

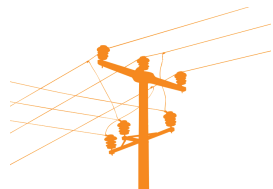


- Engage in disaster planning
- Establish contingency plans to protect vulnerable patients from extreme events associated with climate change - including heat warnings and air quality warnings⁶⁰⁻⁶²

Dialysis patients rely on timely treatments; climate change is already impacting infrastructure and access in already vulnerable zones in Canada and the United States.⁶³⁻⁶⁶



Water loss



Power loss



Transportation Failure



Flood



Forest Fire

There are many opportunities to reduce kidney care's impact on climate change. Everyone can contribute, whether by starting a sustainability team, improving your institution's climate resiliency or just informing yourself and those around you of opportunities to act on nephrology's climate impact and its detriments. See links below for more information.



Resource Links

<https://cascadescanada.ca/>

<https://www.csnsn.ca/csn-committees/sustainable-nephrology-snap-committee/>

<https://www.csnsn.ca/>

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*This is an area of active research and practice evolution; this infographic may not reflect all the current literature available on this topic area and is not intended to be exhaustive. This document will be updated as further information becomes available.



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