Evolving Technologies in the Future World of Green Nephrology

Robert J. Kossmann, MD, FACP, FASN

Senior VP & Chief Medical Officer
Fresenius Medical Care Renal Therapies Group
October 20, 2018
Disclosures

Chief Medical Officer and Senior Vice President, Renal Therapies Group, Fresenius Medical Care North America
Limited stock/options in Fresenius Medical Care
Member, Board of Directors, Advanced Renal Technologies
“…the healthcare sector should lead by example by greening itself and reducing its ecological footprint… to improve global health and the health of the planet.”

- Institute of Medicine Roundtable on Environmental Health Sciences, 2013
Environmental Impacts of Dialysis Today

- **Energy & Emissions**: 3.8 tons CO₂ emissions per patient per year for conventional HD

- **Water Utilization**: 500 L per HD treatment = ~165B L annual global usage

- **Waste Generation**:
  - HD: ~2.5 kg waste per treatment = 165M kg/year
  - PD: 1.25 kg per treatment = 21M kg/year

---

But, progress is being made…
Four Themes of Green Nephrology

- Energy
- Water
- Waste
- Patients
Clinic and home patients can utilize solar power to off-set energy requirements of their dialysis.
Re-Using Warm Dialysis Effluent

Heat recovery from spent dialysate using heat exchangers to warm incoming water to the RO system can reduce energy requirements
Low-Volume Dialysis System

NxStage System One

25 – 80 L dialysate per treatment, on-line generation or bags

Used mostly for Home HD
On-line regeneration of dialysate for both Home HD and PD is possible, reducing water utilization and transport costs for fluids.

PAK System from Fresenius

Carry Life Renal System from Triomed

*Products are experimental and not approved by the FDA
Repurposing RO Reject Water

60-70% Reject Rates with Typical RO Systems

High-Efficiency RO Systems
- Double-pass
- High recovery
- More expensive

Reusing RO Reject Water
- Use as “grey water” for flushing, landscaping, etc.
- Steam sterilization
- Infrastructure adjustments necessary
Pilot Waste Management Projects at RRI Clinics

On-site sterilization and shredding

Packing efficiency
Can regulated medical waste (RMW) be processed on site without additional costs?

- 2 Sterilis Machines were installed at single dialysis clinic
- All regulated medical waste (RMW) was processed with the machines and disposed of as sterile, solid trash
- Reduce RMW-associated costs
- Staff felt machines were easy to operate and required minimal time or training
RMW Sorting Project

Can sorting increase the efficiency and reduce the cost of processing RMW?

- Pilot at 7 dialysis clinics
- Dialyzers were packaged into sterilization boxes using separators to maximize efficiency
- No capital investment required
- Staff training and compliance was initially a issue
- Reduced costs

Without separators:
15 units per bag

With separators:
28 units per bag
Biofine PD Dialysate Bags

- Biofine is a multi-layer polymer container for solutions

- Some advantages:
  - PVC- and plasticizer-free
  - 60% thinner than PVC
  - Generates less waste
  - Does not release HCl upon incineration
  - Less energy required for production
  - Can be recycled

*Products are not approved by the FDA
An aspect that is often overlooked...

Better preventative care

Earlier interventions

Fewer ESRD patients

Lower environmental impact
More than 80% of UK Renal units have a Green Nephrology representative

- Infrastructure innovations
- Process innovations
- Model-of-Care innovations

Projected potential annual savings from widespread replication:

- £7 million
- 11K tons of CO₂ emissions
- 470M L of water
Initiatives for Green Nephrology

- Pioneers in reject water utilization
- Solar-assisted home and in-center programs
- Interesting projects in reusing dialysate effluent waste…
  - Effluent ≈ sea water → growing seaweed?

Prof. John Agar
Conclusions

Nephrology can lead the way in reducing healthcare-associated environmental impacts

New technologies can conserve energy, reduce waste, and repurpose water

Improving preventative care will have the greatest impact