Green-directed research projects

The UK has led the way in the formalisation of green practice in nephrology. Much of the green-directed, green-practice research done in UK renal services would be worth emulating and/or adopting here in ANZ. A list of some of the UK projects performed to date has been included below. In addition, GNAT has generated a list of other potential research ideas, going forward. Some of these are very simple, while others are relatively major tasks that may need funding streams.

Both lists are given to indicate the breadth and scope of useful research. But, you may equally develop your own project.

It is important, where possible, to evaluate/estimate the carbon savings and cost benefits of each research project. There are several online standardised greenhouse gas emission tools available to assist with this (we suggest https://carbonneutral.com.au/carbon-calculator/). If applied to all projects, the relative value in terms of both carbon footprint and dollar savings of each intervention can be determined and better understood.

So, to summarise…. we encourage individuals and/or units to either:

(a) Reproduce a UK project but in an Australian and/or New Zealand setting.
(b) Consider new and innovative projects that will expand our green experience – either from the list developed by GNAT, or one you have come up with yourself.
(c) Use a standardised greenhouse gas emission tool to achieve comparability.

Most importantly of all, we simply encourage you to give it a go!

Examples of Green Nephrology Case studies from the UK

1. Royal Cornwall Hospital Renal Unit

Using the Sustainable Action Planning tools (http://sap.sustainablehealthcare.org.uk **http://sap.sustainablehealthcare.org.uk/tools**), carbon reduction opportunities were identified, prioritised, and enacted:

- The team worked with the ambulance service to synchronise treatment times and reduce aborted ambulance bookings. The cost of aborted journeys were reduced from £1,500 a month to £400 (annual savings £13,200).
- Patients were actively involved in establishing new menus to improve food choice. This reduced food waste from 35% to <5% (annual savings £4,000).
- After patient engagement, linen use was reduced by 70%. Some patients preferred their own blankets, while white sheets for patient's chairs were abandoned (annual savings £4,800.
- An analysis of the balance between staff availability and patient activity led the release of more time to care and improved staff attendance through smart re-scheduling/re-rostering.
- By changing bicarbonate cartridges, packaging and chemical use was reduced (cost avoidance now running at £11,000 p.a.).

Implementation costs: £0

Savings per year: £32,200

CO_2 savings per year: 33,000kg CO_2e

2. Kent and Canterbury Hospital Dialysis Unit

As large volumes of "reject" water are commonly discarded to drain, the unit introduced a simple system capable of recycling 800 litres/hour. The salvaged reject water is directed to a recovery tank which supplies the water to the hospital toilets. This is saving £7,500/year on mains water and sewerage costs.

Implementation costs: £15,000

Savings per year: £7,500

ROI (5 years): 250%

CO_2 savings per year: 530kg CO_2e

3. Ashford Dialysis Unit

A similar system was included in a new-build satellite dialysis unit in Ashford, where the conserved water was fed into the local laundry room. Because water recovery was designed in from the start, the costs were much lower.

Implementation costs: £2,500

Savings per year: £10,558

ROI (5 years): 2112%

CO_2 savings per year: 750kg CO_2e

4. **East Kent Hospital**

The unit investigated retrofitting of all its 83 Braun Dialog+ haemodialysis machines with heat exchangers. Heat exchangers* can be fitted by most renal technicians in less than half an hour to existing machines. This was shown to reduce the average power required per treatment session by 0.86kWh. This represented an 18% increase in energy efficiency.

Implementation costs: £15,687

Savings per year: £3,998

ROI (5 years):127%

CO_2 savings per year: 22,603kg

**** This project is included in the list to show the sort of things that can be done. Now-a-days, machines have built-in heat exchangers, and thus, this specific piece of work would now be redundant … but it is included to have you think/wonder about system changes that could offer smarter, more efficient dialysis programs.***

5. **Queen Margaret Hospital Renal Unit, Dunfermline**

The unnecessary use of bags of normal saline, together with priming sets and drainage bags, in readiness for emergency infusion during haemodiafiltration has been discontinued on the Dunfermline dialysis unit. The bags were not needed, since the newer haemodiafiltration machines produce their own sterile substitution fluid for infusion. The measure has avoided the costs of both procurement and disposal, and has reduced clinical waste.

Implementation costs: £0

Savings per year: £18,594

CO_2 savings per year: 5,300kg CO_2

6. **Queen Margaret Hospital Renal Unit, Dunfermline**

Diversion of bicarbonate bags and NaCl from clinical to domestic waste has reduced disposal costs. Each of the 13,794 dialysis treatments/year had previously generated 2.9kg of clinical waste for incineration, but the diversion measure has reduced clinical waste production by 0.9kg/treatment = 12.4 tonnes per year. As £400 per tonne is charged for the removal of clinical waste, and £85 per tonne of domestic waste, this has resulted in significant savings and a significant reduction in clinical waste generation.

Implementation costs: £0

Savings per year: £4,138

CO_2 savings per year: 6,800kg CO_2

7. **Runcorn Road Dialysis Unit, Birmingham**

Purchase of a baling machine has allowed the compaction of large volumes of cardboard and plastic waste (e.g. from plastic acid cartridges). This has enabled waste to be stored for recycling on a weekly basis, free of charge. The accumulation of cardboard waste had previously presented a fire hazard and had increased insurance premiums. Previously collected as domestic waste, 4.2 tonnes of plastic/year had been entering the clinical waste stream at a cost of around £750 per tonne.

Implementation costs: £4,087

Savings per year: £4,150

ROI (5 years): 322%

CO_2 savings per year: 8,110kg CO_2e.

8. **Countess of Chester Hospital Renal Unit**

To reduce, reuse and recycle paper: (1) paper copies of blood results are no longer sent from Pathology; (2) all printers have been set to default to double sided printing; (3) patient care plans were reduced from 14 to 6 pages; (4) the improvements in paper recycling by staff and patients were measured by a reduction in recycle bin collection from twice weekly to fortnightly; (5) overall paper consumption was reduced by 75% from ~10,000 sheets to ~2,500 sheets every 8 weeks. Future plans included: the development of a secure system for email correspondence with GPs; the purchase of a scanner to enable paperless correspondence with other units; and a move from fax to email in correspondence with transport control.

Implementation costs (to date): £0

Savings per year (to date): £140

CO_2 savings per year: 231kg CO_2e.

9. **University Hospital of Coventry and Warwickshire**

A twice-monthly telephone clinic has been used to follow up transplant recipients. Patients were offered to continue traditional follow up or to switch to quarterly telephone clinic review + a single annual 'face-to-face' outpatient appointment. The telephone service now follows ~125/360 stable transplants of >1 year's standing. No adverse incidents have occurred in a >4 year evaluation period. Benefits include (1) more convenient patient access to healthcare; (2) reduced travel and waiting times; (3) a patient-reported sense of empowerment in the

self-management of their medical problems.

Implementation costs: minimal

Savings per year: dependent on local tariff negotiations

CO_2 savings per year: 2000kg.

10. **Bradford and Airdale NHS**

A CKD e-consultation service using a centralised IT system allowed GPs to forward electronic referrals + share patient e-health records with renal specialists (with verbal patient consent). GPs use criteria agreed in local guidelines to 'request advice' or to 'question the need for hospital clinic review'. In a pilot with 17 GP practices, both GPs and patients reported the service to be convenient and avoided unnecessary referral to the hospital clinic, while nephrologists reported that e-consultations permitted a detailed and efficient review of the patient record. Patients in need of renal outpatient clinic assessment were readily identified, and others benefited from the provision of timely advice. The ratio of paper referrals made post- vs pre-introduction of the service was 0.54 for the implementation practices compared to 0.98 for the non-implementation practices. Further evaluation is planned to determine whether the service will displace outpatient clinic activity or create additional work for nephrologists because of previous unmet need.

CO_2 savings: an estimated 40kg CO_2e.

Full case studies available from **www.greenerhealthcare.org/nephrology-resources**

GNAT-generated research ideas

Suggested research priorities:

- Baseline practice and attitudes towards green nephrology
    - Replicate the Victorian Green Nephrology survey in other states and territories in ANZ to establish a national picture of baseline environmental practice
    - Examine the attitudes of renal patients towards environmental sustainability in renal care delivery

- Carbon footprint
    - Extend the carbon footprint of dialysis research pioneered in Geelong (see https://www.ncbi.nlm.nih.gov/pubmed/23731962)
    - Determine the carbon footprint of PD in Australia with the different PD modalities and treatment regimens

- RO reject water reuse
    - Evaluate water quality from a variety of RO systems (home and facility; newer vs. older systems) – i.e. is all RO reject water the same?
    - Establish limits for suitability for re-use
        - Potentials here might include things like reject water (RW) chemical analyses: Is all RW the same? What 'level' of RW re-use (potable uses, animal use, cleaning use) might RW be suited for?
    - Determine the potentials for R/O reject water (RW) re-use – both in the home and at/near your facility
        - Who nearby, or what industry, facility, business etc. might benefit from access to your RW?
        - Is your inpatient facility R/O RW near wards, or areas where simple plumbing might allow access for toilet flushing, floor mopping, garden use, sterilizer steam generation in sterilizing departments, autoclave water, even re-presentation circuiting back to the R/O (see schematic diagram ... Agar et al. Hemodialysis International 13(1):32-37, January 2009).

- Energy usage

    - Measure the power draw of a variety of home and facility systems, machines, ROs etc.
    - Explore of the potential for solar to offset the energy used and energy costs paid for haemodialysis with currently available PV systems and feed in tariffs

- Waste
    - Accurately classify the waste components of dialysis waste (HD and PD) by plastic type
    - Establish weight and volume of waste generated per treatment for the different machines and consumables used (HD and PD)
    - Determine the potential (or otherwise) for recycling or reuse of waste

- Assess the impact of SteriMed or a similar waste processing machine on dialysis waste volume and cost; explore opportunities for reuse of the sterile end product

- Telemedicine
    - Investigate the utility of telemedicine for follow up renal patients

- 'Apps'
    - While 'Apps' are ubiquitous in other fields, the iPhone or iPad Apps search function yields surprisingly few useful educational, management or communication apps in dialysis or renal medicine. There is significant room for the development of apps that improve unit-with-home-patient communication, lessen travel, reduce paper record warfare, and strengthen home patient education and support.

- Miscellaneous
    - Repeat previously performed light exposure/oxidative stress research (see https://www.ncbi.nlm.nih.gov/pubmed/16306109); if previously obtained results are confirmed, then examine the relative oxidative stress exerted on extracorporeal blood by exposure to various light wavelengths: fluorescent, tungsten, LEDs etc.
    - Reusing caps etc for innovative purposes ... see amazing work by a nurse from Toronto General @ the safe video site below ... https://www.facebook.com/torontostar/videos/10155336411601151/