

Global Dialysis Perspective: Australia

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Hemodialysis (HD) was first introduced to Australia in the late 1950s to support patients with AKI, with subsequent establishment of maintenance HD by 1962 (1). Since then, like many other developed countries, Australia has seen an exponential rise in the incidence and prevalence of dialysis-treated ESKD (2). Below we provide a snapshot of the current state of the delivery of dialysis in Australia.

Treated ESKD in Australia

An accurate record of the incidence, outcomes, and practice patterns of all patients treated with KRT in Australia has been available since the early days of dialysis through the establishment of the Australian and New Zealand Dialysis and Transplant (ANZDATA) registry (3). The core functions of the registry are funded by the Australian and New Zealand Governments and Kidney Health Australia, a nongovernment organization. This funding covers the costs of the registry infrastructure, personnel and production of registry reports. Data collection is not funded and provided to the registry with “in kind” support of all contributing renal units. Operations are overseen by an Executive Group and a Steering Committee, which reports to the funding bodies, and the Australia and New Zealand Society of Nephrology.

Registry data is collected in real time for key events (such as dialysis initiation, kidney transplantation or death) and a more comprehensive cross-sectional survey is conducted yearly on December 31. Areas covered include demographic details, primary renal disease, type of KRT, process measures, and a variety of outcomes. For patients on dialysis, this includes type and location dialysis, dialysis prescription, dry weight, type of dialysis access, and basic biochemistry (hemoglobin, calcium, and phosphate). The registry does not routinely collect data on hospitalizations, although linkage to state-based hospitalizations data has been performed as part of separate research projects.

As of December 31, 2018, there were 13,399 people with ESKD on dialysis treatment in Australia, a prevalence rate of 536 per million population (4), with center-based HD as the predominant therapy at 75% and home-based therapy at 25% (30% of which are on home HD and 70% of which are on home peritoneal dialysis [PD]). An overall summary of the demographics of the incident Australian dialysis population is

given in Table 1. Like the majority of other countries, the most common cause of ESKD was diabetic nephropathy (38%), followed by GN (17%) and hypertension (12%), with these rates being relatively stable over the past 5 years (5). The unadjusted overall mortality rate for individuals on dialysis in Australia during 2017 was 14.4 per 100 patient-years (95% confidence interval, 13.7 to 15.1), with dialysis withdrawal and cardiovascular disease being the leading causes of death. Compared to their non-Indigenous counterparts, Indigenous patients on dialysis have a 40% increased risk of death after adjusting for differences in comorbidity, a significant disparity in survival that has remained unchanged since 1995 (6).

The majority (90%) of HD is delivered as high-flux conventional, thrice weekly, in a dialysis facility (7). Treatment times are typically (for 92% of patients) between 4 and 5 hours (42%, 24%, and 28% for 4, 4.5, and 5 hours, respectively) with dialysis blood flows of 300–349 ml/min. The arteriovenous fistula is the predominant form of permanent vascular access with a prevalence of 80%, with catheters at 16% and arteriovenous graft at 4%. The incident arteriovenous fistula rate remains much lower at 40%, and has not changed substantially over the past 10 years. The proportion of patients on facility-based HD who are treated with hemodiafiltration is currently 33% and has been increasing markedly over the past 10 years. However, the use of hemodiafiltration varies considerably across different treating centers and states (from 6% to 54%) (7,8). The proportion of patients treated with home HD has declined in recent years and sits at 10%, although this varies by state from 4% to 13% (7). Patients treated with home HD generally have longer treatment times and/or more frequent weekly sessions compared to those on conventional HD. For example, 40% of patients dialyze for ≥ 20 hours per week and 55% dialyze more than three times per week (most commonly, strictly alternate day schedules) (7).

Dialysis Logistics and Infrastructure

Nephrology and hence dialysis services are primarily delivered *via* large metropolitan and rural, publicly funded (not for profit) health care networks (Table 2). Specialist tertiary centers provide access to dialysis and transplantation (described as a “hub”) while supporting smaller “spoke” facilities that are located at a range

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Table 1. Demographics of incident patients receiving KRT in Australia (2017) (5)

Characteristic	N (%)
Incident patients on KRT, <i>n</i> (pmp)	3056 (124)
Age, yr	
0–14	37 (1)
15–24	79 (3)
25–34	155 (5)
35–44	270 (9)
45–54	492 (16)
55–64	734 (24)
65–74	751 (25)
75–84	485 (16)
≥85	53 (2)
Male	1899 (62)
Primary renal disease	
Diabetic nephropathy	1159 (38)
GN	523 (17)
Hypertension	380 (12)
Polycystic disease	203 (7)
Reflux nephropathy	72 (2)
Other	413 (14)
Unknown/not reported	306 (10)
Diabetic status	
Type 1	179 (6)
Type 2	1357 (44)
No	1467 (48)
Not reported	53 (2)
Smoking status	
Current	326 (11)
Former	1085 (36)
Never	1508 (49)
Not reported	137 (4)
Vascular disease	
Coronary artery disease	900 (29)
Peripheral vascular disease	442 (14)
Cerebrovascular disease	234 (8)
Chronic lung disease	313 (10)

pmp, rate per million population.

of distances from the main tertiary facility. Facility-based HD is delivered across such a network at either centers colocated within hospital grounds or as stand-alone “peripheral satellite” dialysis centers. Home dialysis services (HD and PD) are provided from dedicated training centers within the health care networks.

Facility dialysis centers are staffed by specialized dialysis nurses, with a nurse-to-patient ratio of 1:3–1:4. The use of “patient care dialysis technicians” instead of trained dialysis nursing staff is uncommon. Medical supervision is provided by a nephrologist, with weekly visits to the center, with the aim of each dialysis shift being reviewed at least once per month, although in practice these visits tend to target challenging patients and any acute issues. The parent hospital provides 24-hour support and all patients attend a separate routine medical outpatient review two or three times per month (more frequently if medically indicated). Routine dialysis laboratory results are reviewed monthly for all patients. In the past decade there has been the creation of, and increase in, the number of renal nurse practitioners who provide support in many of the roles traditionally reserved for medical staff (laboratory review, medication review and prescribing, patient reviews and referrals). There is a variable input from allied health services such

as dietitians, social work, physiotherapy, and exercise physiology; the availability of these varies markedly between and within the health care networks.

Both home HD and PD are an important part of dialysis provision in all units. Each unit or network has a dedicated home PD and HD training center, which is staffed by specialized home dialysis nursing staff with dedicated physician support. The nursing staff are responsible for day-to-day training of the patients as well as home visits to ensure technique compliance and safety. For patients on home HD, conventional HD machines are used. The required modifications to the home (piping, water filtration, reverse osmosis equipment, and backflow prevention) are performed by dialysis technicians associated with each unit. There are no specific modifications made to the machines, although moisture leak detectors are also used both at the needle site and under machine. Remote monitoring for HD is not routinely practiced, whereas for PD it is becoming increasingly available and utilized in some units. In general, patient empowerment, with dedicated nursing and dialysis technician support, remains the key to the success of dialysis at home in Australia.

The past decade has seen many changes to the more traditional dialysis provision model described above. There has been an increase in private dialysis centers, which are generally either managed by one of the major dialysis companies or are part of a private hospital network. These centers have similar logistics and structure to public dialysis centers, although medical reviews tend to be more frequent and there is more direct communication with the patient’s own nephrologist. The main differences are in the provision of funding, which is discussed in the next section. Private–public partnerships are also increasingly considered and vary markedly between states. These can involve the tendering of dialysis provision for an entire hospital health care network, construction of new dialysis centers that treat public and private patients, and the provision of specific dialysis services such as in-center nocturnal dialysis, or assisted home dialysis.

Finally, in a country as large as Australia, remote dialysis centers provide a specific challenge. These commonly treat a large number of Indigenous patients who have strong affinity to their home and culture and often cannot or refuse to travel long distances for dialysis treatment. The importance of these clinics has been acknowledged with a recent program aimed at setting up nurse practitioner–managed remote dialysis centers, providing \$A590 (approximately \$US 382) per dialysis treatment, at a total cost to the federal budget of \$A34.8 million (approximately \$US 22.5 million) by 2022. These can perhaps be seen as an evolution of the community house dialysis provision model, which is not commonly utilized in Australia. Furthermore, fully integrated dialysis buses, such as the Purple House (9) or Big Red Kidney Bus (10), allow Indigenous patients to return to their remote communities, or for patients on dialysis to undertake holidays in rural areas devoid of a fixed dialysis infrastructure.

Dialysis Funding

Dialysis (and kidney transplantation) is available to all patients without cost, through the taxpayer-funded Medicare

Table 2. Summary of dialysis delivery in Australia

Characteristic	
No. of patients on dialysis (per 1000 people) ^a	13,399 (0.536)
Percentage of patients treated with home dialysis ^a	25% (30% home HD, 70% PD)
Dialysis centers	Public, not for profit Private, for profit
Location of dialysis centers	Mixture of hospital-based and free-standing
Dialysis session cost	Public system (majority): free, no out-of-pocket expense Private system: covered by insurance, may incur out-of-pocket fees
Reimbursement per dialysis session	Public (Victoria): \$A510 (approximately \$US 330)
Dialysis delivery staff	Dialysis RN
Ratio of RN to patients	1:3–1:4
Dialysis session length (h)	4–5 h (92% of patients)
Nephrologist review (times per mo)	Public: 1–2 Private: 4
Incident dialysis access (%) ^b	AVF: 41 Central venous catheter: 57
Prevalent dialysis access (%) ^b	AVG: 2 AVF: 80 Central venous catheter: 16 AVG: 4

HD, hemodialysis; PD, peritoneal dialysis; RN, registered nurse; AVF, arteriovenous fistula; AVG, arteriovenous graft.
^aAs at December 31, 2018.
^bAs at December 31, 2017.

system. Actual funding is provided from both state and federal governments, with some variation from state to state on how it is delivered and administered to the dialysis providers (the tertiary health care networks); however, at the patient level the principles are the same. The only direct costs incurred by patients are part prescription costs for medicines, which include those needed for dialysis such as erythropoietin and anticoagulants. For the purposes of this review we will use our home state of Victoria as the exemplar.

In Victoria, dialysis is funded through an activity-based funding stream that covers numerous expenses, including equipment and consumables, power and waste management, specialist medical services, nursing care, and routine laboratory tests. This payment is paid to the provider of the public dialysis service and generally does not apply to a patient undergoing dialysis while hospitalized for other conditions. In 2018–2019 this payment was \$A510 (approximately \$US 330) per dialysis session. Patients on home dialysis are currently funded through a capitation payment to the patient's specialist renal service, currently \$A56,649 (approximately \$US 36,646) per patient per year *pro rata*. Health services are required to make a mandatory payment to each patient managing their own dialysis in the home, as partial reimbursement for costs incurred by the patient. Current payments in 2018–2019 for home HD \$A2120 (\$US 1371) were per patient per year *pro rata*. In private dialysis centers, the private health care funds pay for treatments costs, equipment and consumables, and nursing staff. Exact payments differ between health care funds and may be negotiated between the private dialysis provider and the specific health care fund. Medical reviews are billed separately and generally billed directly by the doctor to the health fund.

Conclusions and Future Challenges

The provision of dialysis in Australia is free to all patients and generally of a high standard. However, there are increasing pressures on the public health care system that present significant challenges for the future. The increasing numbers of patients on dialysis, and especially older patients, have increased the demand for dialysis spots, with infrastructure funding and maintenance currently not keeping up with demand. Numerous solutions have been proposed and implemented (in addition to the need for increased funding), including increasing home dialysis numbers, twilight dialysis shifts, and private–public partnerships. Environmental concerns, in particular reducing water and electricity usage, continue to highlight the need for purpose-built modern dialysis centers rather than the repurposing of existing health care infrastructure. Rural and remote regions will continue to face additional challenges posed by limited infrastructure and distance.

Author Contributions

M. Damasiewicz and K. Polkinghorne wrote the original draft, and reviewed and edited the writing.

Disclosures

M. Damasiewicz and K. Polkinghorne have nothing to disclose.

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