Transplantation in Australia

The first living and deceased donor kidney transplants were performed in Australia in 1965. In the 56 years since, kidney transplantation has become a cornerstone of treatment for kidney failure in Australia and is performed in most capital cities. In 2019, the most recent year for which complete data are available, 1104 kidney transplants (44 per million population [pmp]) were performed, 16% growth (and an additional 4 pmp) from just 4 years prior (1). This reflects a transplantation rate of 7.1 transplants/100 dialysis-years (all patients on dialysis included in the denominator) or 11.6 transplants/100 dialysis-years (only patients on dialysis aged 15–64 years included in the denominator) (2).

Of the 1104 kidney transplants performed in 2019, 22% were from living donors, including 40 patients transplanted via paired kidney exchange (3). The total number of people living with a functioning transplant in Australia was 12,815 (505 pmp) in 2010 (1), 16%–22% were from living donors, including 40 patients transplanted via paired kidney exchange (3). The total number of people living with a functioning transplant in Australia was 12,815 (505 pmp) in 2010 (1), up from 10,479 (440 pmp) in 2015, and 8510 (386 pmp) in 2010 (1).

Despite annual growth in the number of transplants performed, similar increases in the number of candidates waitlisted have prevented any reduction in the size of the waitlist. In 2019 there were 1100 people active on the kidney transplant waitlist, largely unchanged from 1145 in 2014 (2).

Recognizing the importance of transplantation, in 2009 the Australian government established the Organ and Tissue Authority (OTA). The OTA was charged with maximizing the rate of organ donation from deceased donors for transplantation in Australia, which lagged international best practice at that point. To do this, the OTA adopted elements of the “Spanish model,” including the optimization of hospital infrastructure such that potential donors could be more easily recognized, establishing organ donor specialists in all major intensive care units, and improving donor and family consent rates through targeted training (4). By collaborating with specialist societies, particularly the Transplantation Society of Australia and New Zealand, transplant and organ donation specialists, data analysts, researchers, and the ANZDATA Registry, the OTA facilitated a 100% increase in the organ donation rate between 2009 and 2019, yielding an increase in deceased donor transplantation >100% in 10 years. A similar approach has been taken to address the effect of coronavirus disease 2019 (COVID-19) in Australia through the formation of the COVID-19 Rapid Response Taskforce (5).

Indigenous Australians

The dynamics of transplantation are significantly different in Australia’s indigenous population. Indigenous Australians are overrepresented in Australia’s dialysis units, due to a large burden of kidney disease and a lower rate of transplantation (6). Only 13% of Indigenous Australians on RRT are sustained by a kidney transplant, compared with 51% of non-Indigenous Australians (7). Because this inequity has been increasingly recognized, there have been some improvements. In 2019, 54 Indigenous Australians received a kidney transplant, up 50% from 36 in 2014 (2). Alongside the growth in transplantation, there has been growth in the number of Indigenous Australians who are active on the transplant waitlist, from 43 people in 2014 to 77 people in 2019 (2).

Despite this improvement, substantial disparities in access to transplants remain. In 2019, after a review into the care gaps and obstacles faced by indigenous patients with kidney failure, a government supported National Indigenous Kidney Transplantation Taskforce was established. The overarching aim of this taskforce is to improve equity and access to transplantation for Indigenous Australians. To this end, the National Indigenous Kidney Transplantation Taskforce is supporting a number of pilot projects including: (1) increased pretransplant data collection for indigenous patients to deepen the understanding of barriers to transplantation, (2) expansion of targeted health services areas including indigenous health workers, clinical champions, and transplant coordinators, and (3) programs that provide increased social, emotional, and health literacy support to indigenous Australians (8). The results of these projects will inform the ongoing efforts to further improve...
transplantation rates and outcomes for Indigenous Australians.

Kidney Transplant Outcomes in Australia

Australia is a global leader in graft and patient survival. In a recent study comparing transplant outcomes in the United States, United Kingdom, Australia, and New Zealand, Australia was found to have the lowest risk of graft failure with a short-term (1 year) hazard ratio of 0.90 (95% CI, 0.84 to 0.96), compared with the United States (P=0.001), and a long-term hazard ratio of 0.74 (P<0.001) (9). Median graft survival was >14.7 years compared with 11.2 years for the United States (9). This study specifically looked at case-mix and unmeasured confounders as a cause for such difference, and found these were unlikely drivers of the difference (9).

Current 1-year kidney transplant survival in Australia is 96% and 98% for deceased and living donors, respectively, whereas 5-year graft survival is 83% and 91% for deceased and living donors, respectively (1). Patient survival is similarly excellent, with 1-year patient survival rates of 98% and 100% for deceased and living donor transplants, respectively, and 5-year patient survival of 89% and 96% for deceased and living donors, respectively (1).

Delivery of Transplant Care

Transplant care in Australia is delivered via a hub-and-spoke model. Patients are referred to transplant centers by their local treating nephrologist. There are 19 adult kidney transplant centers in Australia. By state, New South Wales has six (32% of national transplant centers versus 32% of the Australian population), Victoria also has six (32% versus 26%), Western Australia has three (16% versus 10%), Queensland has one (5% versus 20%), and South Australia has two (11% versus 7%). There are no transplant centers in Tasmania (2% of the Australian population), the Australian Capital Territory (2% of the Australian population), or the Northern Territory (1% of the Australian population). Patients in these states must fly interstate to have a kidney transplant (10).

Transplant centers conduct the candidate assessment, assessment of any potential living donors, waitlist management, transplant surgery, and post-transplant care (see Figure 1). Once this is complete, usually between 1 and 3 months post-transplant, patients are referred back to their treating nephrologist for ongoing care. At this time, the treating nephrologist is provided with a discharge letter and summary of investigations. A strong link to the transplant center remains. Protocolized follow-up at the transplant center is offered by most services at 12 months post-transplant, and at any time to evaluate clinical problems.

Figure 1. Simplified process map of Transplantation in Australia.
The transplant assessment process in Australia mirrors that performed internationally and is largely consistent with Kidney Disease Improving Global Outcomes Guidelines (11), with a focus on a patient’s physical and psychological suitability for transplantation. In Australia, only patients who have started dialysis are eligible for deceased donor transplantation, whereas pre-emptive transplantation may be conducted if a suitable living donor is available. In accordance with the Transplantation Society of Australia and New Zealand guidelines, eligibility for deceased donor listing requires that patients have a high likelihood of significant benefit from kidney transplantation. Concurrent with the assessment for transplant suitability is a review of whether the patient would be eligible for a deceased donor, a living donor and/or for entry to the Australia and New Zealand Paired Kidney Exchange. The Australian kidney exchange program was established in 2010, and joined with New Zealand in 2019, matching incompatible kidney donors with recipient pairs with other incompatible donor/recipient pairs across Australia and New Zealand.

When a patient undergoes kidney transplantation, they are admitted under a (transplant) nephrologist, who manages the immunosuppression, medications, and medical care. Most acute post-transplant care occurs on the transplant ward, rather than the intensive care unit. Transplant surgeons perform deceased donor retrieval surgery, living and deceased donor kidney transplant surgery, and manage post-transplant surgical issues, including wound management and decisions around the in-dwelling catheter. Urologists typically perform the living donor retrieval surgery. Pre- and post-transplant nursing teams and specialized social workers, dieticians, pharmacists, and psychiatrists also play critical roles in patient care.

Patients are admitted for a minimum of 4 days post-transplant, by which time time induction immunosuppression is complete and the in-dwelling catheter has been removed. The length of stay post-transplant is generally between 6 and 9 days, but may be longer in elderly and multimorbid recipients who comprise a growing portion of Australia’s transplant population.

The Costs of Transplant Care

Australian citizens enjoy government-funded universal health care, hence kidney transplantation is publicly funded, and patients have no out-of-pocket costs for the transplant surgery and associated hospitalization. There are indirect costs, however. Australia is geographically dispersed, and transplants are only performed in capital cities. Many patients must travel for transplantation and incur travel and accommodation costs. Although these costs are often reimbursed by the Australian government, paying the up-front cost can be an issue for many patients.

Immunosuppression is often provided at no charge from transplant hospitals in an effort to remove any financial barriers to adherence. For those who choose to get their prescription (script) from private pharmacies, or whose transplant hospitals do not offer such a service, a copayment is required. This is set at a maximum of AUD$6.60 per script for those with a concession card (welfare recipients), or AUD$41.30 per script for those not eligible for a concession card (12). There is also a medication spend “safety net,” which sees families with a concession card spending a maximum of AUD$316.80 (after which all medications are free), and all other families spending a maximum of AUD$1497.20 (after which medications cost the concessional rate) (12). Despite these efforts to remove financial barriers to adherence, a single-center survey of 156 patients who had received a transplant found that 55% were not adherent due to dose timing errors (30%) or skipped doses (25%) (13).

Discussion

Transplantation in Australia has a long history of success, with world-leading graft and patient survival. Underpinning this success is a commitment to basic and clinical research in transplantation and immunology, with strong regional and global collaborations, yielding pivotal publications in transplant pathology (14) and immunosuppression (15). Although conducting <2% of global transplants, Australian sites have participated in most major multinational studies in transplantation immunosuppression. Australia has been at the forefront of developing Standardized Outcomes in Nephrology and Patient Reported Outcome Measures in transplantation.

Australia has benefited from the most complete and longest-running transplant registry, ANZDATA. ANZDATA has a number of unique aspects including (1) it is a complete inception cohort from the start of RRT (be that pre-emptive transplant or dialysis) to death, which enables the observation of treatments and outcomes after graft loss, (2) it records outcomes such as acute rejection episodes and cancer that are not recorded in other registries, (3) complete (>98%) population-based coverage of the ESKD population since inception in 1977, and (4) the data collection is clinician driven, with decisions about which data to collect (or not) made by clinicians, not administrators. These unique aspects of ANZDATA have been pivotal to landmark publications defining the outcomes of pediatric transplantation and the effect on transplant outcomes of recurrent disease, acute rejection, cancer, and pregnancy (16–19).

Despite this success, there are areas where ongoing improvement is required. As with many countries, access to transplantation, particularly for indigenous and rural/remote populations, is a persistent issue (6). Although Australia has, thus far, fared better than many countries with COVID-19, there have been 22 cases (including two deaths) in kidney transplant recipients (20). COVID-19 was also associated with a 30% reduction in transplantation rates in 2020, further exacerbating the failure of supply to meet demand for organs. A living donor registry was established in 2004, and although donor data are universally supplied at baseline, provision of follow-up data is incomplete, which limits our ability to ascertain long-term donor outcomes. Movement to virtual crossmatching and refinement of pharmacological and technical strategies to improve organ preservation and transplant outcomes remain key challenges.
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Author Contributions
M. Wyld wrote the original draft; and all authors conceptualized the study and reviewed and edited the manuscript.

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