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Kidney Failure After Living Kidney Donation in Australia: A National Registry Linkage Study, 2004–2024

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ABSTRACT

National linkage of the Australia and New Zealand Living Kidney Donor Registry and the Australia and New Zealand Dialysis and Transplant Registry provides the first Australian estimates of kidney failure treated with kidney replacement therapy (KRT) after living kidney donation (2004–2024). Out of 5291 donors (56,962 person-years; median follow-up, 10.96 years), three donors underwent KRT (0.53 per 10,000 person-years). No events occurred within 10 years of donation. Australian clinicians can now counsel and guide potential donors using local data: risk of kidney failure requiring KRT is very low, but late events warrant lifelong follow-up.

JEL Classification: Urologic diseases

1 | Introduction

Living kidney donation is a cornerstone of transplantation in Australia and is associated with better graft and patient survival than deceased donor transplantation [1, 2]. Living donors undergo an irreversible procedure with no direct health benefit to themselves, and deserve contemporary and locally relevant estimates of long-term kidney failure risk to support informed decision-making. International cohort studies indicate that living donors have a higher relative risk of kidney failure than healthy non-donors, although the absolute risk remains low [3–6]. These estimates have been derived largely from data from the United States and Europe, where donor selection criteria, health system factors and population characteristics may differ substantially from Australia. To our knowledge, no national Australian estimates exist. We linked records from the Australia and New Zealand Living Kidney Donor Registry (ANZLKD) and the Australia and New Zealand Dialysis and Transplant Registry (ANZDATA) to address this gap and provide Australian estimates of the incidence of kidney failure treated with kidney replacement therapy (KRT) after living kidney donation.

2 | Methods

We conducted a population-based cohort study of Australian living kidney donors donating between 2004 (when the ANZLKD was established) and 2024. ANZDATA and ANZLKD receive demographic and clinical information through voluntary submissions from all renal units in Australia and New Zealand. Data collection and use is authorised through an opt-out consent process for all individuals who are included in the registries. Donor data were collected in ANZLKD and linked by ANZDATA to ascertain cases of KRT. Follow-up ran from donation to the earliest of KRT initiation, death (as recorded in ANZLKD) or 31 December 2024. The primary outcome was KRT initiation (dialysis or pre-emptive transplantation). Gender was recorded as reported by the patient to their treating unit. Before 2021, gender was recorded as a binary variable (male/female). From 2021, non-binary categories were available. Baseline characteristics were summarised using frequencies (%) and medians (interquartile ranges, IQRs). Proteinuria at donation was classified as abnormal if any available measure exceeded the normal thresholds (protein:creatinine ratio [PCR], ≥30 mg/mmol;

TABLE 1 | Baseline characteristics of Australian living kidney donors, 2004–2024.

Characteristic	*n* (%)
Age at donation (years)	
≤29	181 (3.42)
30–49	2158 (40.79)
50–64	2440 (46.12)
65–74	490 (9.26)
≥75	22 (0.42)
Median [IQR]	51 [43–59]
Gender	
Female	3026 (57.19)
Male	2265 (42.81)
Country of birth	
Australia	3800 (71.82)
Other	1406 (26.57)
Missing	85 (1.61)
Smoking status	
Current	201 (3.80)
Former	1739 (32.87)
Never	3194 (60.37)
Unknown	157 (2.97)
Fasting glucose at donation (mmol/L)	
Normal (≤6.0)	4012 (75.83)
Impaired (6.1–6.9)	52 (0.98)
Diabetes (≥7.0)	29 (0.55)
Missing	1198 (22.64)
2-h glucose tolerance test at donation (mmol/L)	
Normal (≤7.7)	3053 (57.70)
Impaired (7.8–11.0)	131 (2.48)
Diabetes (≥11.1)	9 (0.17)
Missing	2098 (39.65)
Body mass index (kg/m^2)	
Underweight (≤18.4)	36 (0.68)
Normal (18.5–24.9)	1789 (33.81)
Overweight (25.0–29.9)	2328 (44.00)
Obese (≥30.0)	939 (17.75)
Missing	199 (3.76)
Serum creatinine (μmol/L)	
Median [IQR]	71 [63–82]
Measured glomerular filtration rate (mL/min)	
Median [IQR]	106 [93–121]
Proteinuria[a]	
Normal	3888 (73.48)
Abnormal	487 (9.20)
Missing	916 (17.31)

Abbreviation: IQR, interquartile range (25th–75th percentile).
[a]Abnormal proteinuria is defined as any of protein:creatinine ratio ≥30 mg/mmol, albumin:creatinine ratio ≥3.4 mg/mmol or 24-h urine protein ≥150 mg/day. Donors were classified as abnormal if any available measure exceeded the threshold and classified as missing only if all three measures were unavailable.

albumin:creatinine ratio [ACR], ≥3.4 mg/mmol; or 24-h urine protein, ≥150 mg/day). Data were classified as missing for this variable only if all three measures were unavailable. Among donors who commenced KRT, we summarised time to KRT and primary kidney failure cause. Incidence rates were calculated per 10,000 person-years (Poisson 95% confidence intervals, CI). Analyses were performed in Stata 18. Ethics approval was obtained from the University of Sydney Ethics Committee (2024/HE001148).

3 | Results

There were 5291 Australian living kidney donors recorded during the study period, contributing 56,962 person-years of follow-up. The median follow-up was 10.96 years (IQR, 5.83–15.98 years). Median age at donation was 51 years (IQR, 43–59 years) and 57.2% of donors identified as female (Table 1). The median serum creatinine level at donation was 71 μmol/L (IQR, 63–82 μmol/L) and the median measured glomerular filtration rate was 106 mL/min (IQR, 93–121 mL/min). Abnormal proteinuria was reported in 487 donors (9.2%).

Three donors commenced KRT during the follow-up period, with all three initiating haemodialysis at a median of 13.27 years (IQR, 11.02–15.31) after donation. The age at donation ranged from 53 to 60 years. The primary cause of kidney failure was renal cell carcinoma in two donors and hypertensive nephropathy in one donor. One donor subsequently received a deceased donor kidney transplant.

The incidence rate of KRT was 0.53 per 10,000 person-years (95% CI, 0.11–1.54).

4 | Discussion

Using national linkage of the ANZLKD and ANZDATA registries, we provide the first Australian estimates of kidney failure treated with KRT after living kidney donation. Of the 5291 Australian living kidney donors (median follow-up of 10.96 years), three commenced KRT at a median of 13.27 years after donation, which is an incidence rate of 0.53 per 10,000

person-years. No events occurred within 10 years of donation. Although the small number of events limits precision, these data provide contemporary, locally relevant risk estimates to inform donor counselling and reinforce the importance of lifelong follow-up. The very low incidence is consistent with the extremely careful donor selection criteria applied in Australia during the study period and the inherent healthy donor effect whereby living donors are among the healthiest individuals in the population.

Our findings align with international evidence that the absolute risk of kidney failure after donation is low. In the United States, the 15-year cumulative incidence among 96,217 donors was 30.8 per 10,000 donors (95% CI, 24.3–38.5) [4], which is higher than our estimate, although cumulative incidence and incidence rates are not directly comparable and populations differ substantially. The closest comparator is Aotearoa New Zealand where KRT incidence among 1339 living donors (1988–2018) was 3.0 per 10,000 person-years (95% CI, 1.3–7.4) [7] compared with our 0.53 per 10,000 person-years (95% CI, 0.11–1.54). These differences likely reflect donor demographics, baseline risk, era effects and evolving donor selection criteria rather than true population-level differences. All estimates, including ours, reflect the donor acceptance practices of their era, and as criteria evolve, so too may the incidence of post-donation kidney failure.

Two of the three donors underwent KRT following discovery of renal cell carcinoma in the remaining kidney more than a decade after donation. Such events are not predictable at the time of donation and cannot be prevented by donor selection alone. With only two renal cell carcinoma events, formal comparison with population incidence rates is not possible; however, the crude observed rate of about 3.5 per 100,000 person-years is lower than the Australian age-standardised kidney cancer rate of 17 per 100,000 person [8], consistent with the healthy donor selection effect. Because renal cell carcinoma is frequently asymptomatic until advanced, a low threshold for investigating urological symptoms or incidental findings in living donors is warranted. Earlier detection may enable nephron-sparing options such as partial nephrectomy, preserving function in single-kidney individuals. Alongside this, conventional cardiovascular and metabolic risk management should continue throughout the donor's life.

Key limitations of this study include (i) the small number of outcomes (precluding subgroup analysis or multivariable modelling); (ii) the absence of a non-donor comparator group meaning relative risk attributable to donation within Australia cannot be estimated; (iii) potentially incomplete death ascertainment [9]; (iv) donations before 2004 were not captured in the ANZLKD (some of these donors may have subsequently developed kidney failure, potentially leading to under-ascertainment of very late post-donation KRT events); and (v) it is not possible to determine whether any donors died with untreated kidney failure identified only on a death certificate, which would represent under-ascertainment of the true burden of post-donation kidney disease.

For the first time, Australian clinicians can use local data to inform counselling and consent for living donation. KRT after donation is rare, but late events can occur, reinforcing the need for lifelong follow-up.

Author Contributions

Melanie Wyld: conceptualisation, formal analysis, writing – original draft, writing – review and editing. **Kate Wyburn:** conceptualisation, writing – review and editing.

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Disclosure

Not commissioned; externally reviewed.

Conflicts of Interest

Melanie Wyld is the chair of the Transplant Society of Australia and New Zealand (TSANZ) Donation Clinical Working Group and the Australia and New Zealand Living Kidney Donor Registry (ANZLKD) Living Kidney Donor Working Group. Kate Wyburn is a member of the TSANZ Donation Clinical Working Group and is a past president of TSANZ.

Data Availability Statement

The data reported here have been supplied by the Australia and New Zealand Dialysis and Transplant Registry (ANZDATA). The interpretation and reporting of these data are the responsibility of the authors and in no way an official policy or interpretation of the Australia and New Zealand Dialysis and Transplant Registry. Requests for access to ANZDATA should be directed to ANZDATA.

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