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Rising Incidence of End-Stage Kidney Disease and Poorer Access to Kidney Transplant Among Australian Aboriginal and Torres Strait Islander Children and Young Adults

Swasti Chaturvedi[1,2], Shahid Ullah[3,4], Amelia K. LePage[5] and Jaquelyne T. Hughes[2,6]

[1]Department of Pediatrics, Royal Darwin Hospital, Darwin, Northern Territory, Australia; [2]Menzies School of Health Research, Charles Darwin University, Darwin, Northern Territory, Australia; [3]Australia and New Zealand Dialysis and Transplant Registry, South Australian Health and Medical Research Institute, Adelaide, South Australia; [4]College of Medicine and Public Health, Flinders University, Adelaide, South Australia; [5]Department of Nephrology, Monash Children's Hospital, Melbourne, Victoria, Australia; and [6]Department of Renal Medicine, Royal Darwin Hospital, Darwin, Northern Territory, Australia

Introduction: Details of the pediatric population with end-stage kidney disease (ESKD) in Australia and New Zealand have been published previously. There is, however, a paucity of studies exploring the trends in incidence, etiology, renal replacement therapy (RRT) modality, and transplant access among the Aboriginal and Torres Strait Islander children and young adults (ATCYAs) residing in Australia.

Methods: An observational study was undertaken and data on Australian patients who commenced RRT at ≤24 years of age between 1963 and 2017 were extracted from the Australian and New Zealand Dialysis and Transplant Registry (ANZDATA). The incidence and prevalence rates were restricted from 1997 to 2017 because of the unavailability of Aboriginal– and Torres Strait Islander status–specific census data before 1997.

Results: A total of 3629 children and young adults received RRT during the observation period, including 178 (4.9%) who identified as ATCYAs and 3451 (95.1%) other children and young adults (OCYAs). Compared with OCYAs, incident rates have risen among ATCYAs since 2000, with the biggest rise for young adults 20 to 24 years of age. Fewer ATCYAs received a kidney transplant compared with OCYAs (56.2% vs. 89.3%, $P < 0.001$). Pre-emptive kidney transplants were less common in ATCYAs compared with OCYAs (3.4% vs. 16.8%, $P < 0.001$). Living related donor transplants were less common among ATCYAs than OCYAs (10.7% vs. 35.9%, $P < 0.001$).

Conclusions: Our study shows rising incident rates and poorer access to kidney transplantation among ATCYAs in Australia. The reasons for this health care disparity and barriers to transplantation need to be explored further and must be addressed.

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See Commentary on Page 1497

Aboriginal people have a 7 times higher incidence of initiating RRT while being 10 years younger on average than non-Aboriginal Australians.[1] However, despite significant knowledge development about the etiology of ESKD and modality options in Aboriginal adults there is little information describing ESKD among ATCYAs. Previous studies have shown that glomerulonephritis and congenital malformations of kidney and the urinary tract (CAKUT) are conditions commonly causative of ESKD in young people, and Aboriginal and Torres Strait Islander Australians have an emerging youth-onset diabetes burden.[2,3] Stewart *et al.*[4] did not find any differences in incidence among Australian children 0 to 14 years of age. Incidence rates in Aboriginal and Torres Strait Islander Australians 15 to 44 years of age were approximately 8 times those of "other" Australians.[4] The aims of this study were to describe trends in incidence, prevalence, etiology, and modality selection of RRT available for ATCYAs ≤ 24 years of age since RRT was available in Australia (beginning in 1963), using prospectively

Correspondence: Swasti Chaturvedi, Department of Pediatrics, Royal Darwin Hospital, Rocklands Dr., Tiwi, PO Box 41326, Casuarina, NT 0811, Australia. E-mail: swasti.chaturvedi@gmail.com
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collected data from the ANZDATA Clinical Quality Registry.

METHODS

Data Source

Deidentified prospectively collated data, including demographic details, primary disease, comorbidities, and treatment modality, were extracted from the ANZDATA registry. ANZDATA is a clinical quality registry that collects and procedures a wide range of data from all the renal units in Australia and New Zealand relating to the outcomes of ESKD treatment. The purpose of collecting information is to improve the quality of care and outcomes by providing accurate, appropriate, and comprehensive data.[5] The study was approved by a Human Research Ethics Committee (2019-3324) and by the ANZDATA Aboriginal and Torres Strait Islander Health Working Group.

Study Population

We included data for all registered persons ≤24 years of age who commenced RRT in Australia between 1963 and 2017. Population data were provided by the Australian Bureau of Statistics. Data from each age group were obtained for single year of the study period.[6] The incidence and prevalence rates were restricted from 1997 to 2017 because Aboriginal and Torres Strait Islander identity was not recorded before 1997 in the Australian Bureau of Statistics database.

Study Variables

Age of RRT commencement, gender, primary renal disease, initial treatment, duration on dialysis, and live versus deceased donor kidney were analyzed for ATCYAs and OCYAs. Age group categories were defined in 5-year intervals. Primary renal disease was defined according to ANZDATA standard codes.[5] Patients classified as having glomerulonephritis included those with familial and nonfamilial glomerulonephritis. Uncertain, other, and not reported causes were included in the other/not reported group. Initial treatment modality is defined within ANZDATA as the mode of RRT used on day 90 after commencement of RRT and allows for early changes and maturation of dialysis access. Transplantation occurring either preemptively or within 90 days of RRT commencement is referred to as pre-emptive transplantation. Children who regained native function, those that died before day 90, and those that had been lost to follow-up within 90 days of commencement of RRT were excluded from the analysis of modality outcome. The status at transition is defined as either receiving a transplant, death, on dialysis, own kidney function recovered, or date of last visit if lost to follow-up.

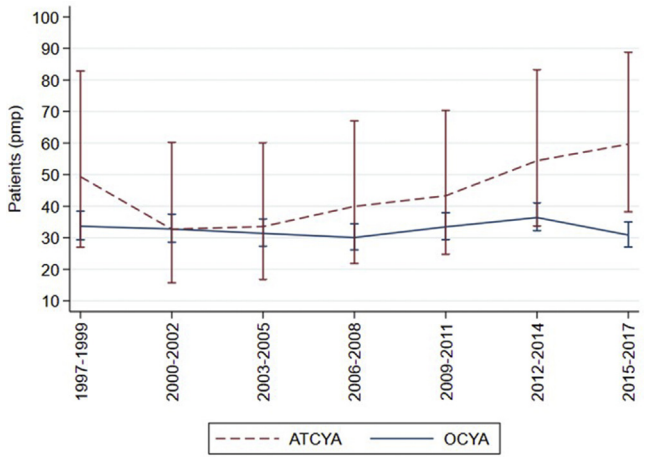

Figure 1. Incidence of treated end-stage kidney disease among Aboriginal and Torres Strait Islander Children and young adults (ATCYAs) and other children and young adults (OCYAs) (1997–2017).

Comorbidities were reported to ANZDATA beginning in 1991. Specific comorbidity definitions are not provided by ANZDATA. Clinicians report either present, suspected, or absent comorbidity. In this study a comorbidity was considered as any report of present or suspected disease.

Analysis

Incidence and prevalence rates were calculated by 5-year age groups and 3-year calendar years. In particular, the age-specific incidences for ATCYAs were calculated by taking the total number of ATCYAs who commenced RRT over each 3-year period (1997–2017) and each 5-year age group and dividing it by the age-specific Aboriginal and Torres Strait Islander population at the midyear for each of 3-year calendar years. The prevalence was taken as the point prevalence value at the end of each 3-year period, beginning in 1997. Incidence and prevalence rates were plotted over time for each age category. Primary renal disease and initial treatment modality were also plotted over time and separately by age group for ATCYAs and OCYAs. To identify changes in incidence and prevalence rate trends, join point regression was applied for ATCYA and OCYA groups using Poisson regression with linear splines. The Poisson regression models enable the analysis of a constant percentage change in rate over time between groups.

All statistical analyses were conducted using Stata software (version 15.1; StataCorp LP, College Station, TX). Patients' demographics, etiology, and treatment modality at RRT commencement were expressed as absolute and relative frequencies for categorical variables, which were compared between the ATCYA and OCYA groups using standard χ^2 test for association

Table 1. Demographic characteristics and the etiology of ESKD among ATCYAs and OCYAs, Australia (1963–2017)

Characteristic	ATCYAs	OCYAs	*P* value
Total, *n* (%)	178 (4.9)	3451 (95.1)	
Age, yr, median (IQR)	19.5 (15–23)	18 (13–22)	<0.01
Age group, yr, *n* (%)			0.03
0–4	3 (1.7)	270 (7.8)	
5–9	14 (7.9)	297 (8.6)	
10–14	23 (12.9)	486 (14.1)	
15–19	49 (27.5)	916 (26.5)	
20–24	89 (50)	1482 (42.9)	
Gender, *n* (%)			<0.001
Male	79 (44.4)	2064 (59.8)	
Female	99 (55.6)	1387 (40.2)	
Primary renal disease, *n* (%)			<0.001
Diabetic nephropathy	14 (7.9)	38 (1.1)	
Glomerulonephritis	84 (47.2)	1462 (42.4)	
Hypertension	8 (4.5)	36 (1.0)	
Polycystic kidney disease	—	61 (1.8)	
CAKUT	41 (23.0)	1258 (36.5)	
Other/uncertain	30 (16.9)	574 (16.6)	
Missing	1 (0.6)	22 (0.6)	
Remoteness, *n* (%)			<0.001
Major city	38 (21.3)	1804 (52.3)	
Regional	59 (33.1)	659 (19.1)	
Remote	59 (33.1)	40 (1.2)	
Missing	22 (12.4)	948 (27.5)	
Comorbidities, *n* (%)			
Diabetes	20 (11.2)	65 (1.9)	<0.001
Missing	15 (8.4)	355 (10.3)	
Coronary artery disease	6 (3.4)	33 (1.0)	<0.01
Missing	15 (8.4)	401 (11.6)	
Cerebrovascular disease	2 (1.1)	27 (0.8)	0.65
Missing	15 (8.4)	396 (11.5)	
Peripheral vascular disease	4 (2.2)	31 (0.9)	0.09
Missing	15 (8.4)	400 (11.6)	
Chronic lung disease	11 (6.2)	88 (2.5)	<0.01
Missing	15 (8.4)	399 (11.6)	
Initial treatment, *n* (%)			<0.001
Haemodialysis	113 (63.5)	1639 (47.5)	
Peritoneal dialysis	59 (33.1)	1232 (35.7)	
Transplant (pre-emptive)	6 (3.4)	580 (16.8)	
RRT duration before primary transplant, months, median (IQR)	22.3 (11.4–51.5)	10.6 (3.6–24.5)	<0.001
Primary transplant, donor type, *n* (%)			<0.001
Living	19 (10.7)	1239 (35.9)	
Deceased	81 (45.5)	1840 (53.3)	
No transplant	78 (43.8)	369 (10.7)	
Missing	—	3 (0.1)	
Status at transition, *n* (%)			<0.001
On dialysis	106 (59.6)	940 (27.2)	
Transplants	45 (25.3)	2084 (60.4)	
Deaths	26 (14.6)	382 (11.1)	
Own kidney function recovered	—	15 (0.4)	
Lost to follow-up	1 (0.6)	30 (0.9)	

ATCYAs, Aboriginal and Torres Strait Islander children and young adults; CAKUT, congenital anomalies of the kidney and urinary tract; ESKD, end-stage kidney disease; IQR, interquartile range; OCYAs, other children and young adults; RRT, renal replacement therapy.
IQR (25th–75th percentile), medians, and percentages were compared using the Mann-Whitney *U* and Pearson χ^2 tests, respectively. Some characteristics do not add up to 100% because of missing cases for that characteristic.

with continuity correction, where appropriate. Age and duration on dialysis were expressed as median and interquartile ranges (IQRs). Mann-Whitney *U* tests were conducted to test the difference of these 2 variables between groups given the skewed nature of the data.

RESULTS

A total of 3629 children and young adults ≤24 years of age received RRT between 1963 and 2017 in Australia (Figure 1). Of these, 178 (4.9%) were ATCYAs and 3451 (95.1%) were OCYAs. The ATCYA group was older, with a median age of 19.5 years (IQR 15–23 years) compared with OCYAs who had a median age of 18 years (IQR 13–22, $P < 0.01$; Table 1). Females constituted 55.6% of the ATCYA group and 40.2 % of OCYA cohort ($P < 0.001$).

Only 21% of the ATCYA cohort were recorded as living in major cities compared with 52% of the OCYA cohort. Overall, the ATCYA cohort had a higher burden of comorbidities (Table 1). Diabetes mellitus as a comorbidity was present in 11.1% compared with 1.1% in the OCYA group ($P < 0.01$). Similarly, chronic lung disease and coronary artery disease were more common among the ATCYA cohort ($P < 0.01$).

The outcome/status at transition is defined as either receiving a transplant, death, on dialysis, own kidney function recovered, or date of last visit if lost to follow-up (Table 1).

Incidence of ESKD

The overall incidence rate of treated ESKD in the ATCYA cohort was 15.1 (12.4–18.2) per million population (PMP). This was significantly higher than the OCYA cohort at 10.9 (10.3–11.4) PMP ($P < 0.01$).

The incidence rate of treated ESKD among the ATCYA cohort declined from 49.4 PMP in 1997 to 1999 to 32.7 PMP in the 2000 to 2002 period. Since 2002, there is a trend of steady rise in incidence rate rising to 59.6 PMP in 2015 to 2017 (Figure 1).

From 2000 to 2002 and from 2015 to 2017, the incidence rates have significantly increased by 4.5% (95% confidence interval 0.4%–8.8%, $P = 0.03$) in the ATCYA group. Although rates dropped by 14.6% between 1997 to 1999 and 2000 to 2003, the insignificant change ($P = 0.17$) was related to the small number of time points. The percentage change for OCYAs was almost stable over time.

This increased incidence among the ATCYA cohort is most evident in the 20- to 24-year-old age group, with a smaller contribution from the 10- to 14-year-old age group (Figure 2). In the most recent 3-year period

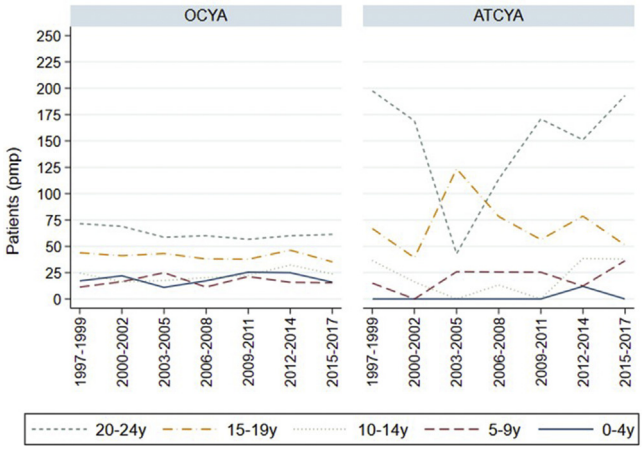

Figure 2. Incidence of end-stage kidney disease by age group and Aboriginal and Torres Strait Islander status in Australia (1997–2017).

(2015–2017), the age-specific incidence rates (in PMP) were 0 (0–4 years), 36.3 (5–9 years), 37.7 (10–14 years), 51.2 (15–19 years), and 192.9 (20–24 years), respectively (Figure 2). Among the OCYA cohort, incidence rates have been more stable with fewer changes over time. The incidence rate was 33.6 PMP in 1997 to 1999 and declined to 30.1 PMP in 2006 to 2008 (Figure 2). The incidence rate then rose and peaked in 2012 to 2014 at 36.4 PMP. More recently, it has shown a decreasing trend with incidence rate of 30.9 PMP in the 2015 to 2017 period. In the most recent 3-year period (2015–2017), the age-specific incidence rates (in PMP) were 15.9 (0–4 years), 15.3 (5–9 years), 23.7 (10–14 years), 35.2 (15–19 years), and 61.3 (20–24 years; Figure 2).

Prevalence of ESKD

The prevalence rate of RRT has increased across all ages over the past 20 years among the ATCYA group though it did not reach statistical significance (Supplementary Figure S1). By 2017, there were 90.5 PMP ATCYAs <24 years of age with ESKD currently being treated in Australia. The increased prevalence is most significant in the 20- to 24-year-old age group (Supplementary Figure S2). Among OCYAs, the prevalence rates of RRT have been relatively stable across all ages over the past 20 years (Supplementary Figure S1). By 2017, there were 83.9 PMP OCYAs <24 years with ESKD currently being treated in Australia (Supplementary Figure S1).

Primary Renal Disease

The most common cause of ESKD among the ATCYA group was glomerulonephritis ($n = 84$; 47.2%) followed by CAKUT ($n = 41$; 23.0%) and other causes ($n = 30$; 16.9%; Table 1). The etiology of ESKD was similar in the OCYA group with glomerulonephritis being the most common cause ($n = 1462$; 42.4%) followed by CAKUT ($n = 1258$; 36.5%) and other causes ($n = 574$; 16.6%; Table 1). Diabetic nephropathy leading to ESKD was more common in the ATCYA group ($n = 14$; 7.9%) compared with the OCYA group ($n = 38$; 1.1%, $P < 0.001$%). Similarly, hypertension leading to ESKD was more common among the ATCYA ($n = 8$; 4.5%) compared with the OCYA cohort ($n = 36$; 1.0%).

Among the ATCYA cohort, glomerulonephritis declined as a proportion of causes of ESKD and hypertension and diabetic nephropathy increased from 1963 to 2017 (Supplementary Figure S3). Diabetic nephropathy accounted for 4.5% cases of ESKD in the 1982 to 1986 period and has since increased to 17.9% cases of ESKD in the 2013 to 2017 period. Hypertension has also become a significant cause of ESKD in recent years and accounted for 14.8% of cases in 2008 to 2012 and 7.7% of cases in 2013 to 2017. Females in the ATCYA cohort had an increased burden of diabetic ESKD compared with males (13.1% vs. 1%, $P = 0.06$).

Among both the ATCYA and OCYA cohort, ESKD caused by glomerulonephritis increased until 19 years of age and then declined, whereas CAKUT declined with age (Supplementary Figure S4). Diabetes mellitus and hypertension increased with age among the ATCYA cohort.

Treatment

Dialysis

ATCYA patients spent more than double the time on dialysis before receiving a kidney transplant—an average of 22.3 months (range 11.4–51.5 months) versus 10.6 months (range 3.6–24.5 months) compared with OCYA patients ($P < 0.001$).

Among both the ATCYA cohort and OCYA cohort, hemodialysis was the most common form of RRT, followed by peritoneal dialysis (Table 1). Among both the cohorts, peritoneal dialysis was more common in younger children and hemodialysis in older children (Supplementary Figure S5).

Transplantation

A much higher proportion ($n = 78$; 43.8%) of the ATCYA cohort did not receive a kidney transplant compared with the OCYA cohort ($n = 369$; 10.7%, $P < 0.001$). Overall, 59.6% of the ATCYA group transitioned into adulthood on dialysis versus 27.2% of the OCYA group ($P < 0.001$).

Pre-emptive kidney transplant was performed in 6 patients (3.4%) in the ATCYA group (Table 1). This was significantly lower than the OCYA cohort, where 580 patients (16.8%) received a pre-emptive kidney transplant ($P < 0.001$). Living related kidney donor transplant was performed in 10.7 % ($n = 19$) of ATCYA

cohort compared with 35.9% ($n = 1239$) of the OCYA cohort ($P < 0.001$).

DISCUSSION

To our knowledge, this is the first comprehensive exploration of ESKD data and RRT provision among ATCYAs in Australia. Our study shows that like adults, the overall incidence rate of ESKD is significantly higher in ATCYAs compared with OCYAs. In addition, over the last 2 decades, there was a steady rise in incidence rate among ATCYAs, most evident in the 20- to 24-year-old age group with a smaller contribution from the 10- to 14-year-old age group. Similarly, a Canadian study found that the incidence of treated ESKD was higher among Aboriginal children and young adults compared with white children and young adults.[7] Stewart *et al.*[4] found that the incidence of treated ESKD among the Maori and Pacific Islander children in New Zealand 0 to 14 years of age did not differ; however, the rates were significantly higher in the 15- to 44-year-old age group compared with "other" racial groups.

Alarmingly, diabetic nephropathy and hypertension leading to ESKD are significantly more common among the young Aboriginal and Torres Strait Islander people. This is in keeping with increased type 2 diabetes burden among Aboriginal adult ESKD population reported previously in the literature.[8,9] Previous studies have also highlighted that the antecedents of chronic kidney disease start early at birth or even antenatally in Aboriginal and Torres Strait Islander children and is likely contributed to by a complex interplay of maternal factors, low birth weight, reduced nephron mass, socioeconomic disadvantage, and lifestyle factors.[1,10,11] Our study confirms that increased incidence starts early in life. We recommend early preventative measures as a key aspect of reducing the CKD and ESKD burden.

The results of our study revealed a slight female preponderance among the ATCYA ESKD population. This was similar to the trend seen among Aboriginal adults.[8,12] While the reasons for this preponderance are not entirely clear, one of the reasons could be the increased burden of diabetic ESKD among females compared with males in the ATCYA cohort (13.1% vs. 1%, $P = 0.06$).

Our article confirms the significant issue of kidney health care access for ATCYAs, as has been previously highlighted for the Aboriginal and/or Torres Strait Islander adults in Australia. Our study also provides important insights regarding RRT provision and access to kidney transplantation among the ATCYA cohort. First, the ATCYA cohort had more than a 2-fold longer dialysis duration compared with the OCYA cohort. Second, a much higher proportion of the ATCYA cohort did not receive a kidney transplant compared with the OCYA cohort (43.8% vs. 10.7%). Third, living related donor transplant was less common among the ATCYA cohort. Fourth, pre-emptive kidney transplants were significantly less common among the ATCYA cohort. Further, we also observed that there has been no pre-emptive transplant among the ATCYA cohort since the 1993 to 1997 period. This is even more striking because the proportion of patients who underwent pre-emptive transplant since the 1973 to 1992 period among the OCYA cohort has risen steadily and was 22% in the 2015 to 2017 period. We explored some of the factors that could potentially contribute to the poor access to transplants among the ATCYA cohort. The ATCYA cohort had a higher burden of comorbidities, including diabetes mellitus, chronic lung disease, and coronary artery disease. In addition, the ATCYA cohort was more likely to reside in a remote location, limiting access to tertiary care transplant centers. These factors could lead to delayed waitlisting for transplant among the ATCYA cohort and should be formally evaluated in future.[13]

Our findings of longer dialysis waiting times and poorer access to transplant are similar to previously published studies of adult patients in Aboriginal and/or Torres Strait Islander peoples. In 2009, Yeates *et al.*[14] compared the demographics of renal transplantation of indigenous and white adult patients in Australia, New Zealand, Canada, and the United States. They reported a lower adjusted likelihood of receiving a transplant for Aboriginal and/or Torres Strait Islander patients with significantly longer waiting times than seen in the other 4 countries.[14] Previous pediatric studies from the United States, Canada, Europe, and New Zealand have also found racial disparities in access to the waiting list and overall transplantation rates.[15–18] An earlier Australian study looking at pediatric data from 1990 to 2011 in children < 18 years of age found that white patients were more likely to receive a kidney transplant than were Aboriginal children or those from other races.[19]

Importantly, Australia has a universal health care system that enables financial provision of dialysis and kidney transplant. Furthermore, Australian patients who begin dialysis at <18 years of age are eligible for pediatric prioritization under the National Interstate Exchange and State-based protocols. These pediatric deceased donor allocation bonuses were implemented for national allocation in 2000, with different jurisdictional state–based bonuses used since that time.[20]

Our study shows that despite these policies nationwide, the disparities remain in transplantation across all ages for the Aboriginal population. These differences in access to transplant, pre-emptive transplant,

and living related donor transplant are particularly concerning given the improved long-term outcome associated with living related donor transplant and shorter dialysis waiting times.[21]

Previous studies have recognized multiple barriers that contribute to longer waiting times and poorer transplant access among Aboriginal and Torres Strait Islander Australians. These include language barriers, remoteness, poor access to health care, especially tertiary dialysis and transplant center access, and health care practitioner's attitudes.[22] Aboriginal and Torres Strait Islander families often have to relocate from their remote homes to be closer to health care when a family member develops ESKD,[13] which is recognized to lead to considerable social hardship and social isolation. Another issue identified is poor communication between health care practitioners and the patient and family, and the need for culturally appropriate educational programs to sensitize health practitioners and to help Aboriginal and/or Torres Strait Islander patients make informed choices needs to be addressed.[23,24] Aboriginal and/or Torres Strait Islander adults often have a higher burden of comorbidities, in particular diabetes.[13] This was also seen in our study where the ATCYA cohort had a higher burden of diabetes, chronic lung disease, and peripheral vascular disease.

The significant strengths of our study are the comprehensive nature of the data and tracking of ESKD in all children from the inception of pediatric RRT in Australia. One limitation is that the incidence and prevalence rates are restricted to the last decade (from 1997–2017) because Aboriginal/Torres Strait Islander heritage details were not available before 1997 in the Australian Bureau of Statistics database. Another potential limitation is that it is likely that some Aboriginal children may not have chosen or been offered RRT and therefore there may be some underreporting of ESKD data, especially in earlier decades.

Our study findings underscore the considerable work that needs to be done to address the disparities in transplant access among ATCYAs in Australia. The Transplantation Society of Australia and New Zealand published a position paper in 2018 that elucidates a multipronged approach to address some of these issues.[25] The article identified research gaps as well as policy initiatives that need to be undertaken. A few of its recommendations include: training of the renal health workforce to deliver patient-centred care for Aboriginal and/or Torres Strait Islander peoples patients, establishing an Aboriginal and/or Torres Strait Islander peoples reference group in every transplant unit to help design models and pathways of culturally appropriate care, effective use of telehealth in completing pretransplant workup and posttransplant follow-up, and evaluating and leveraging existing initiatives that target cultural bias in health services. Future studies should also investigate the time to waitlisting and identify barriers to waitlisting among the ATCYA group. Furthermore, future studies should analyze the posttransplant outcomes among the ATCYA cohort who received transplants. Every effort should be made to provide access to culturally appropriate information to the Aboriginal and/or Torres Strait Islander peoples parents and children. Each pediatric transplant unit should try to engage with Aboriginal health practitioners and patient navigators to help Aboriginal patients and their families navigate the health care system. With a better understanding of the lives, culture, and difficulties Aboriginal and/or Torres Strait Islander patients face, health care professionals can improve their access to health care and hopefully eliminate the disparity that currently exists.

In conclusion, we showed higher rates of ESKD between Aboriginal and/or Torres Strait Islander peoples and non-Aboriginal and/or Torres Strait Islander groups. ATCYAs recorded more than twice the duration of RRT with dialysis, lower access to renal transplantation, significantly lower rates of pre-emptive kidney transplantation, with higher need uptake of deceased donor kidney transplantation. The reasons for these differences in access to kidney transplant require further research and strong policy initiatives.

DISCLOSURE

All the authors declared no competing interests.

ACKNOWLEDGMENTS

We acknowledge the efforts of the staff of renal units throughout Australia in submitting information to ANZDATA, and the staff of ANZDATA for maintaining the database. The abstract of the study was accepted at the International Society of Pediatric Nephrology Meeting in 2019 and at the Annual Society Meeting of Australia and New Zealand Society of Nephrology.

SUPPLEMENTARY MATERIAL

Supplementary File (PDF)

Figure S1. Prevalence of ESKD between Aboriginal and Torres Strait Islander Children and young adults (ATCYAs) and other children and young adults (OCYAs) in Australia (1997–2017).

Figure S2. Prevalence of ESKD by age group and Aboriginal and Torres Strait Islander status in Australia (1997–2017).

Figure S3. Etiology of ESKD by Aboriginal and Torres Strait Islander status in Australia during 1963 to 2017.

Figure S4. Etiology of ESKD by age group and Aboriginal and Torres Strait Islander status in Australia (1963–2017).

Figure S5. Initial treatment modality of ESKD by age group and Aboriginal and Torres Strait Islander status in Australia during 1963 to 2017.
STROBE statement.

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