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Uptake and Outcomes of Peritoneal Dialysis among Aboriginal and Torres Strait Islander People: Analysis of Registry Data

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Introduction: Peritoneal dialysis (PD) enables people to use kidney replacement therapy (KRT) outside of healthcare-dependent settings, a strong priority of Aboriginal and Torres Strait Islander people.

Methods: We undertook an observational study analyzing registry data to describe access to PD and its outcome as the first KRT among Aboriginal and Torres Strait Islander people between January 1, 2004 and December 31 2020.

Results: Out of 4604 Aboriginal and Torres Strait Islander people, reflecting 10.4% of all Australians commencing KRT, PD was the first KRT modality among 665 (14.4%). PD utilization was 17.2% in 2004 to 2009 and 12.7% in 2016 to 2020 ($P = 0.002$); 1105 episodes of peritonitis were observed in 413 individuals, median of 3 (interquartile range [IQR], 2–5) episodes/patient. The crude peritonitis rate was 0.53 (95% confidence interval [CI], 0.50–0.56) episodes/patient-years without any significant changes over time. The median time to first peritonitis was 1.1 years. A decrease in the peritonitis incidence rate ratio (IRR) was observed in 2016 to 2020 (IRR, 0.63 [95% CI, 0.52–0.77], $P < 0.001$) compared to earlier eras (2010–2015: IRR, 0.90 [95% CI, 0.76–1.07], $P = 0.23$; Ref: 2004–2009). The cure rates decreased from 80.0% ($n = 435$) in 2004 to 2009, to 70.8% ($n = 131$) in 2016 to 2020 ($P < 0.001$).

Conclusion: Aboriginal and Torres Strait Islander people who utilized PD as their first KRT during 2004 to 2020 recorded a higher peritonitis rate than the current benchmark of 0.4 episodes/patient-years. The cure rates have worsened recently, which should be a big concern. There is an exigent need to address these gaps in kidney care for Aboriginal and Torres Strait Islander people.

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The island continent of Australia has always been known for its many diverse First Nation People. Aboriginal and Torres Strait Islander people have lived within cultural protocols for thousands of years and survived free of chronic noncommunicable diseases. Aboriginal and Torres Strait Islander people have traded, developed kinship, and lived alongside each

First Nation group within this continent. Those relationships extended to the First Nations people of Papua New Guinea, Indonesia (Macassar), the Pacific islander people of Melanesia, and the Māori of Aotearoa (New Zealand). More recent European contact is known; Louis de Torres, a Spanish navigator, "discovered" the passage of water separating Cape York Peninsula (Queensland, Australia) with Papua New Guinea and Torres Strait Islander people was the term subsequently attributed to the Zenadh people of that region. In the past 235 years, English control had systematically dispossessed people of their land and altered Aboriginal and Torres Strait Islander people's lives, autonomy,[1] health and well-being and survival, as observed today, resulting in a dramatic growth in chronic diseases, including kidney failure.

Although the population estimates for Australia before 1788 was 318,000 to 3 million[1,2] (100% First Nations peoples), the 2021 Australian Census recorded 812,728 Aboriginal and/or Torres Strait Islander people (3.2%). This includes 91.4% identifying as Aboriginal, 4.2% as Torres Strait Islander, and 4.4% as both.[3] The population distribution of First Nation people today is different to non-Indigenous Australians and is an important health care delivery consideration; 33% of Aboriginal and Torres Strait Islander people live in metropolitan cities (where 75% of non-Indigenous Australians reside), and a higher proportion elsewhere ("inner regional" areas (24% vs. 18%), "outer regional" (20% vs. 8%), "remote" or "very remote" areas (15% vs. 2%)[4] (the 2016 Australian Census). One hundred sixty-seven Aboriginal and Torres Strait Islander languages were used at home,[3] yet the Australian health system predominantly accommodates spoken and written English languages.[5] First Nations people employed and leading within kidney health care must systematically and strategically increase from its current low levels, because they are regarded as an essential workforce to support clinical knowledge exchange, health information, and culturally safe care.[6,7]

Fair access to and good quality outcomes from KRT are essential for all patients with kidney failure, including Aboriginal and Torres Strait Islander people. Hemodialysis (HD) is accessed as self-care or assisted by a family carer or a health care professional. HD is accessible within hospitals (hospital-based dialysis) or away from hospitals (satellite HD). HD requires reliable electricity and water supply (including approximately 300 L per treatment). In Australia, hospital-based assisted HD has been the predominant KRT modality utilized by Aboriginal and Torres Strait Islander people who have kidney failure and is usually prescribed 3 times a week for 3 to 5 hours each session, affording alternate-day clearance of excess water, waste removal, and solute balance.

In contrast, PD is portable, has lower water demands and is cost-effective, with an annual cost savings of up to 40% compared to in-centre HD.[8] In addition, PD offers multiple potential advantages compared to HD, including survival advantage in the first few years, better preservation of residual kidney function (RKF), a better quality of life, fewer dietary restrictions, uncomplicated technique, better outcomes following subsequent kidney transplantation, considerable ability to travel, and diminished risk of blood-borne viral infections.[9-13] Furthermore, PD enables Aboriginal and Torres Strait Islander people to access safe and quality KRT in nonmedicalized settings and at home, even in very remote locations of Australia, which is a consistently identified priority.[14]

Aboriginal and Torres Strait Islander people have a higher incidence rate of KRT than other Australians, and 86% access HD as their first KRT modality.[15-19] An annual survey by the Australian and New Zealand Dialysis and Transplant (ANZDATA) registry in 2021 reported a total of 2471 Indigenous Australians receiving KRT, with 1952 (79%) on HD, 146 (6%) on PD, and 373 (15%) who have undergone kidney transplantation.[20] The most common reasons for attrition in PD numbers in this group are death (11–16 per 100 patient-years)[21] and transfer to HD (31–46 per 100 patient-years).[21]

Peritonitis rates and outcomes have improved in the overall PD patient population in Australia and New Zealand[22,23]; however, PD uptake and outcomes among Aboriginal and Torres Strait Islander people and trends over time in these parameters have not been well-studied. The primary aim of this study was to examine trends in the uptake and outcomes of PD among Aboriginal and Torres Strait Islander people being treated for kidney failure in Australia.

METHODS

Study Population

Aboriginal and Torres Strait Islanders aged 18 years and over commencing KRT for kidney failure in Australia between January 1, 2004 and December 31, 2020 were included in this study. Data were obtained from the ANZDATA Registry, using real-time event-based reporting and an annual survey. Registry conduct was in accordance with the 2014 Australian Privacy Principles. The ANZDATA Aboriginal and Torres Strait Islander Health Working Group, the ANZDATA Registry Steering Committee, and the University of Queensland Human Research Ethics Committee (2021/HE002582) approved the study. The study was conducted in accordance with Strengthening the

Reporting of Observational Studies in Epidemiology (STROBE) guidelines.[24] We intentionally positioned the focus of the research discovery to advance the accessibility, quality of care, and health outcomes for Aboriginal and Torres Strait Islander people utilizing PD. The Centre of Research Excellence in Aboriginal Chronic Disease Knowledge Translation and Exchange quality appraisal tool guided the research. Aboriginal and Torres Strait Islander people contributed to developing this knowledge at all stages of the manuscript development (Supplementary Table S1).

Data Collection

Aboriginal and Torres Strait Islander participants in this analysis were identified if the ethnicity term for Aboriginal and Torres Strait Islander people was included within the data reporting at the time of KRT commencement. Other variables included were age at the commencement of KRT, sex (as recorded by ANZDATA registry), body mass index (BMI), primary kidney disease, comorbid conditions (diabetes mellitus, coronary artery disease, cerebrovascular disease, peripheral vascular disease, and chronic lung disease), hepatitis C status, late referral to a nephrologist (within 3 months of KRT commencement), date of initial KRT, initial PD modality (automated peritoneal dialysis [APD] or continuous ambulatory PD [CAPD]), completion of peritoneal equilibration test within 6 months of PD initiation, peritoneal membrane transport characteristics (low/low average/high/high average), RKF (creatinine clearance), residual urine volume, type of PD solution (glucose, icodextrin, low glucose degradation product, weekly Kt/V, Index of Relative Socioeconomic Advantage and Disadvantage (IRSAD), Accessibility and Remoteness Index of Australia, State territories characteristics (prevalent patients on KRT and incident number of PD and alternative modalities). The IRSAD and Accessibility and Remoteness Index of Australia were extracted from the ANZDATA registry; The IRSAD score was categorized into 3 groups [1–3, 4–6, and 7–10]. The follow-up period was categorized into 3 eras (2004–2009, 2010–2015, and 2016–2020). To examine the impact of PD-associated peritonitis on HD transfer, the following variables were also included: the number of peritonitis episodes, causative organism, antibiotic regimen, antifungal therapy administration, PD modality at the time of infection (APD/CAPD), and the outcomes of PD peritonitis as defined by the International Society for Peritoneal Dialysis guidelines, including cure, refractory peritonitis, relapsed peritonitis, repeat peritonitis, recurrent peritonitis, PD catheter removal, transfer to HD, peritonitis-related death (cause of death), and hospital length-of-stay.[25]

Primary Outcome

The primary outcome was the uptake of PD as the first KRT modality registered in ANZDATA among persons identified in the registry as Aboriginal and Torres Strait Islander people.

Secondary Outcomes

The secondary outcomes were to describe the patient-level and modality-level outcomes of Aboriginal and Torres Strait Islander people whose first KRT modality was PD. To do this, we examined patient survival, duration of PD modality, and cause of transfer to alternative KRT. We specifically examined peritonitis rate, time to first peritonitis, and peritonitis outcomes (medical cure, relapse, recurrence, peritonitis-associated PD catheter removal, peritonitis-associated HD transfer, peritonitis-associated death, and peritonitis-associated hospitalization). Medical cure was defined as complete resolution of peritonitis with none of the following complications: relapse or recurrent peritonitis, catheter removal, transfer to HD for $\geq$30 days, or death.[25] Refractory peritonitis was defined as an episode with persistently cloudy bags or persistent dialysis effluent leukocyte count 100/μl after 5 days of appropriate antibiotic therapy.[25] Recurrent peritonitis was defined as a peritonitis episode that occurred within 4 weeks of completion of treatment of a prior episode but with a different organism.[25] Relapsing peritonitis was defined as a peritonitis episode that occurred within 4 weeks of completion of treatment of a prior episode with the same organism or 1 sterile (culture negative) episode (i.e., specific organism followed by the same organism, culture-negative followed by a specific organism or specific organism followed by culture negative).[25] Repeat peritonitis refers to an episode that reoccurs more than 4 weeks after the completion of treatment of a prior episode with the same organism. Peritonitis-associated catheter removal was defined as the removal of a PD catheter as part of treating an active peritonitis episode.[25] Peritonitis-associated HD transfer was defined as a transfer from PD to HD for any period as part of the treatment for a peritonitis episode.[25] Peritonitis-associated death was defined as death occurring within 30 days of onset or death during hospitalization due to peritonitis. Peritonitis-associated hospitalization was defined as hospitalization precipitated by the occurrence of peritonitis for the purpose of peritonitis treatment delivery.[25]

Statistical Analysis

The results were expressed as frequency and percentages for categorical variables, mean±SD for normally distributed continuous variables, and median (IQR) for

nonnormally distributed continuous variables. Differences between categorical variables were assessed with the chi-square test, parametric continuous variables with the *t*-test, and nonparametric continuous variables with the Mann-Whitney U and Kruskal-Wallis tests. Multivariable logistic regression analysis assessed variables associated with PD uptake. The hazards of time-to-first peritonitis was evaluated by Nelson–Aalen's cumulative hazard function. A log-rank test assessed the difference between the groups. The predictors associated with peritonitis risk were assessed by multivariable Poisson regression modelling. Multivariable competitive risk regression modelling examined patient survival (competing events such as kidney transplant, HD transfer, and recovery of kidney function) and HD transfer (competing events such as death, kidney transplant, and recovery of kidney function). The variables with significantly missed data (more than 20%) were excluded from regression modelling. Results are presented as either sub-hazard ratios (sub-HRs, analogous to hazard ratios from Cox regression model) from competing risk survival models, IRR for the Poisson regression model, or odds ratio (OR) from multivariable logistic regression models, with 95% CI. All statistical analyses were performed using the STATA software package (version 15.0; STATA Corp LD, College Station, TX). P-values less than 0.05 were considered statistically significant.

RESULTS

Of 4604 Aboriginal and Torres Strait Islander people commencing KRT in Australia between January 1, 2004 and December 31, 2020, PD was the initial modality in 14.4% ($n = 665$) (Aboriginal 93%, $n = 619$ and Torres Strait Islanders, 7%, $n = 46$). At commencement, CAPD (as compared to APD) was the more common form of PD (CAPD 69.8%, APD 30.2%; Supplementary Figure S1). State-wise, Northern Territory, Queensland, and Western Australia each recorded over 1000 Aboriginal and Torres Strait Islander people commencing KRT ($n = 1391$, 1178 and 1017, respectively), with the highest proportion who started PD at the commencement of KRT were recorded in Queensland, Western Australia, and Northern Territory, respectively (22.4%, 13.3%, and 5.8%, respectively) (Table 1).

At the commencement of KRT, Aboriginal and Torres Strait Islander people commencing PD (compared to Aboriginal and Torres Strait Islander people commencing other KRT) were older, had a lower BMI, had higher RKF, were more likely to start KRT in an earlier era, were more likely to have lower IRSAD score, were less likely to be referred to a nephrologist late, were less likely to be living in a remote area, and were less likely to have diabetes mellitus as comorbidity or a cause of their kidney failure (Table 1).

PD Uptake

PD uptake was 17.2% in 2004 to 2009 but progressively decreased to 12.7% in 2016 to 2020 among Aboriginal and Torres Strait Islander people. In contrast, facility HD increased from 82.6% to 85.8% over the same time (Figure 1). PD uptake has not increased correspondingly with escalating KRT demands among Aboriginal and Torres Strait Islander people (Figure 2) and other ethnicities (Supplementary Figure S2).

Using multivariable logistic regression analysis (Table 2), PD uptake by Aboriginal and Torres Strait Islander people was independently associated with lower BMI (OR, 0.97 [95% CI, 0.96–0.99]; $P = 0.001$), absence of diabetes (type 1: OR, 0.37 [95% CI, 0.15–0.84], $P = 0.03$; type 2: OR, 0.63 [95% CI, 0.43–0.89], $P = 0.01$), hepatitis C (negative) (OR, 2.47 [95% CI, 1.03–5.94], $P = 0.04$), early referral (OR, 2.42 [95% CI, 1.84–3.20], $P < 0.001$), earlier era (2010–2015: OR, 0.63 [95% CI, 0.49–0.82], $P < 0.001$; 2016–2020: OR, 0.59 [95% CI, 0.46–0.76], $P < 0.001$; Ref: 2004–2009), lower IRSAD (score 1–3: OR, 1.78 [95% CI, 1.27–2.49], $P = 0.001$; score 4–6: OR, 1.69 [95% CI, 1.17–2.41], $P = 0.005$; Ref: score 7–10), remoteness (major city center: OR, 1.05 [95% CI, 0.77–1.49], $P = 0.76$; regional centers: OR, 0.57 [95% CI, 0.43–0.76], $P < 0.001$; Ref: remote centers), and States (Northern Territory: OR, 0.15 [95% CI, 0.11–0.22], $P < 0.001$; South Australia: OR, 0.26 [95% CI, 0.15–0.44], $P < 0.001$; Western Australia: OR, 0.40 [95% CI, 0.30–0.53], $P < 0.001$; Ref: Queensland).

PD Peritonitis

During the study period, Aboriginal and Torres Strait Islanders recorded 1105 episodes of peritonitis in 413 individuals, a median of 3 peritonitis episodes per patient (IQR, 2–5). The crude peritonitis rate was 0.53 (95% CI, 0.50–0.56] episodes per patient-years There was no statistically significant difference in the crude peritonitis rates over time (2004–2009: IRR, 0.56 [95% CI, 0.51–0.61]; 2010–2015: IRR, 0.49 [95% CI, 0.45–0.55]; and 2016–2020: IRR, 0.52 [95% CI, 0.45–0.60] per patient-years, respectively (relative risk, 0.95, [95% CI, 0.87–1.03], $P = 0.17$).

Multivariable Poisson regression modelling of the risk of peritonitis showed a lower risk of peritonitis in later eras (2010–2015: IRR, 0.90 [95% CI, 0.76–1.07], $P = 0.23$; and 2016–2020: IRR, 0.63 [95% CI, 0.52–0.77], $P \leq 0.001$; Ref: 2004–2009) (Table 3).

The median time to first peritonitis among Aboriginal and Torres Strait Islanders was 1.1 years (IQR, 0.46–2.13). Era-wise median times to first peritonitis

Table 1. Baseline demographic and clinical characteristics of Aboriginal and Torres Strait Islander people starting kidney replacement therapy

Variables	Peritoneal dialysis	Other KRT	All	
	665 (14.4)	3939 (85.6)	4604 (100)	*P*-value
Age, yr	52.4 ± 12.7	51.6 ± 11.8	51.7 ± 11.9	0.05
Male sex	314 (47.2)	1746 (44.3)	2060 (44.7)	0.17
BMI	28.5 ± 5.8	29.3 ± 7.7	29.2 ± 7.5	0.004
Smoking status				0.54
Current	181 (27.2)	1072 (27.2)	1253 (27.2)	0.50
Former	237 (35.6)	1298 (32.9)	1535 (34.2)	0.21
Causes of kidney failure				<0.001
Diabetes mellitus	414 (62.3)	2777 (70.5)	3191 (69.3)	0.0004
Glomerular disease	99 (14.9)	419 (10.6)	518 (11.2)	0.11
Hypertensive kidney disease	61 (9.2)	266 (6.7)	327 (7.10)	0.68
ADPKD	6 (0.90)	20 (0.51)	26 (0.56)	0.32
Reflux nephropathy	12 (1.8)	48 (1.2)	60 (1.3)	0.43
Others	73 (10.9)	409 (10.4)	482 (10.5)	0.45
Comorbidities				
Cardiovascular disease	220 (33.1)	1258 (31.9)	1478 (32.1)	0.36
Cerebrovascular disease	57 (8.6)	351 (8,9)	408 (8.9)	0.47
Chronic lung disease	67 (10.1)	556 (14.1)	623 (13.5)	0.18
Peripheral vascular disease	102 (15.3)	655 (16.6)	757 (16.4)	0.37
Diabetes mellitus				<0.001
Type 1	11 (1.7)	95 (2.4)	106 (2.3)	0.44
Type 2	467 (70.2)	3132 (79.5)	3599 (78.2)	<0.001
Hepatitis C (positive)	9 (1.4)	90 (2.3)	99 (2.2)	0.43
Kidney replacement therapy				
Satellite / In-center hemodialysis		3900 (99.0)		
Home hemodialysis		28 (0.71)		
CAPD	464 (69.8)			
APD	201 (30.2)			
Kidney transplantation		11 (0.28)		
Era				0.002
2004–2009	227 (34.1)	1089 (27.6)	1316 (28.6)	0.02
2010–2015	224 (33.7)	1374 (34.9)	1598 (34.7)	0.36
2016–2020	214 (32.2)	1476 (37.5)	1690 (36.7)	0.06
Late referral	97 (14.6)	922 (23.4)	1019 (22.1)	0.02
IRSAD				0.002
1–3	394 (59.2)	2024 (51.4)	2418 (52.5)	0.002
4–6	187 (28.1)	944 (23.9)	1131(24.6)	0.11
7–10	80 (12.0)	900 (22.8)	980 (21.3)	0.01
ARIA				0.004
Major city centers	121 (18.2)	596 (15.1)	717 (15.6)	0.38
Regional centers	245 (36.8)	1276 (32.4)	1521(33.0)	0.09
Remote centers	295 (44.4)	1996 (50.7)	2291(49.8)	0.02
State, *n/N* (%)				<0.001
Northern Territory	80/1623 (4.9)	1311 (80.8)	1391 (85.7)	<0.001
New South Wales	128/13651 (0.94)	405 (2.9)	533 (3.9)	0.10
Victoria	28/10752 (0.26)	138 (1.3)	166 (1.5)	0.31
Queensland	264/8811 (3.0)	914 (10.4)	1178 (13.4)	<0.001
South Australia	21/3215 (0.65)	250 (7.8)	271 (8.4)	0.11
Western Australia	135/4890(2.8)	882 (18.0)	1017 (20.8)	<0.001
Tasmania	2/842 (0.24)	13 (1.5)	15 (1.8)	0.44
Australian capital territory	7/962 (0.73)	26 (2.7)	33 (3.4)	0.38
Residual urine volume,[a] median (IQR)	1.0 (0.6–1.7)	0.8 (0.2–1.6)	1.0 (0.5–1.7)	0.5
Residual kidney function,[b] median (IQR)	36.8 (12.9–66.2)	21.5 (2.7–42.2)	31.9 (9.5–59.3)	<0.001

(), %; ±, SD from mean; ADPKD, autosomal dominant polycystic kidney disease; ARIA, accessibility and remoteness index of Australia; BMI, body mass index; IRSAD, index of relative socio-economic advantage and disadvantage; IQR, interquartile range; KRT, kidney replacement therapy; n, patients on PD or alternate therapy; N, total prevalent KRT patients in the State

[a]Residual urine volume (L/d)

[b]At the commencement of KRT,[b]Residual kidney function (L/wk) = creatinine clearance

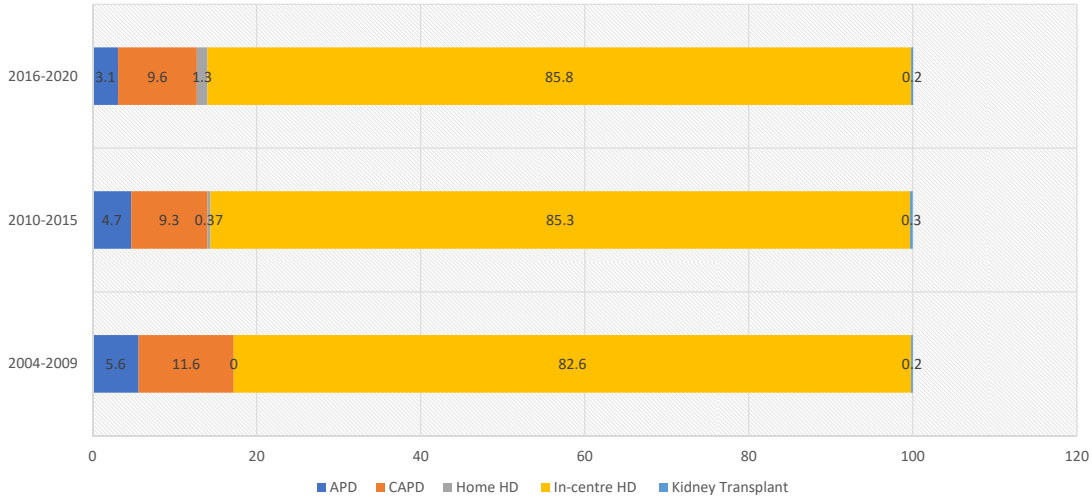

Figure 1. First kidney replacement therapy by era in Aboriginal and Torres Strait Islander people. APD, automated peritoneal dialysis; CAPD, continuous ambulatory peritoneal dialysis; HD, hemodialysis.

among Aboriginal and Torres Strait Islander people were 1.12 years (IQR, 0.43–2.25) in 2004 to 2009, 1.37 years (IQR, 0.48–2.35) in 2010 to 2015, and 0.99 years (IQR, 0.45–1.73] in 2016 to 2020 years ($P = 0.03$) (Figure 3).

Peritonitis was culture-negative in 16.1% ($n = 187$) episodes, *and Staphylococcus epidermidis* was the most common organism isolated in 12.4% ($n = 144$) peritonitis episodes (Supplementary Table S2).

Vancomycin coadministered with gentamicin was the most common antibiotic combination prescribed in 54% ($n = 534$) episodes, followed by cefazolin coadministered with gentamicin in 18% ($n = 178$) peritonitis episodes (Supplementary Table S3). Antifungal prophylaxis was coadministered in 45.6% ($n = 503$) of peritonitis episodes. Of the 1105 episodes of peritonitis recorded during the study period, medical cure was achieved in 78.4% ($n = 866$) episodes, recurrent peritonitis occurred in 2.4% ($n = 27$) episodes, and relapsing peritonitis in 3.7% ($n = 41$) episodes.

The proportion of peritonitis cured by medical treatment alone decreased in the more recent era of 2016 to 2020 at 70.8% ($n = 131$), compared to 80.0% in 2004 to 2009 ($n = 435$) and 79.4% in 2010 to 2015 ($n = 300$) ($P < 0.001$). In contrast, the rates of recurrent and relapsing peritonitis have increased in the later era (1.3% [$n = 7$] and 1.5% [$n = 8$] in 2004–2009; 3.5% [$n = 13$] and 5.0% [$n = 19$] in 2010–2015; and 3.8% [$n = 7$] and 7.6% [$n = 14$] in 2016–2020, respectively).

Peritonitis resulted in overnight hospitalization in 2.7% ($n = 30$) episodes, with 37% ($n = 411$) admitted for more than a day. The median duration of hospitalization was 6 days (IQR, 3–10).

PD catheter was removed in 8.1% ($n = 197$) episodes due to peritonitis, with an increase in PD catheter removal rates in recent eras (2004–2009: 17.9% [$n = 96$]; 2010–2015: 17.0% [$n = 63$]; and 2016–2020: 21.1 % [$n = 38$]). Peritonitis resulted in permanent HD transfer in 17.0% ($n = 185$) episodes, with higher HD transfer rates due to peritonitis in the later era; (2004–2009: $n =$

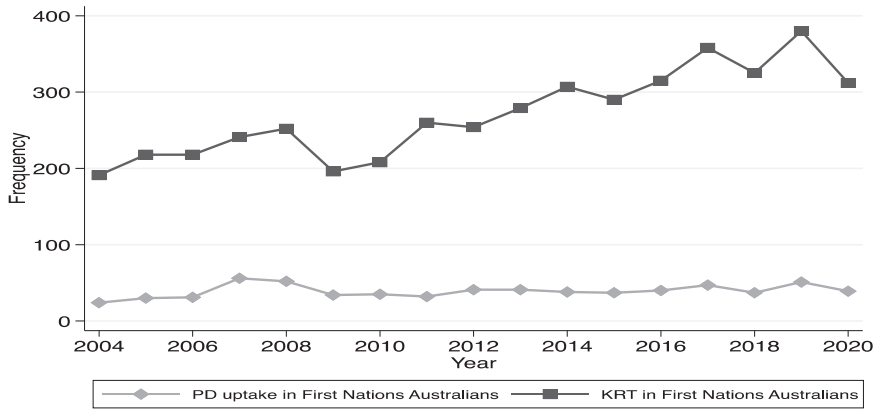

Figure 2. Kidney replacement therapy and peritoneal dialysis uptake by year in Aboriginal and Torres Strait Islander people. PD, peritoneal dialysis; KRT, kidney replacement therapy.

Table 2. Multivariable logistic regression modelling of odds of peritoneal dialysis as the first kidney replacement therapy compared to alternative modalities in Aboriginal and Torres Strait Islander people

Variables	Odds ratio	95% CI	*P*-value
Age, yr	1.00	0.99–1.01	0.99
Male sex	0.97	0.79–1.19	0.77
BMI	0.97	0.96–0.99	0.001
Current smokers	0.87	0.67–1.14	0.33
Causes of kidney failure			0.99
Diabetes mellitus	1		
Glomerular disease	1.12	0.75–1.67	0.55
Hypertensive kidney disease	1.17	0.74–1.85	0.49
ADPKD	1.03	0.33–3.22	0.95
Reflux nephropathy	0.87	0.37–2.04	0.76
Others	1.06	0.71–1.59	0.76
Diabetes	0.56	0.42–0.75	<0.001
Type 1	0.37	0.15–0.84	0.03
Type 2	0.63	0.43–0.89	0.01
Comorbidities			
Cardiovascular disease	1.09	0.86–1.38	0.44
Cerebrovascular disease	0.79	0.54–1.17	0.25
Chronic lung disease	0.66	0.46–0.93	0.02
Peripheral vascular disease	0.85	0.64–1.14	0.30
Hepatitis C (Negative)	2.48	1.03–5.94	0.04
Era			0.002
2004–2009	1		
2010–2015	0.63	0.49–0.82	<0.001
2016–2020	0.59	0.46–0.76	<0.001
Early referral	2.42	1.84–3.20	<0.001
IRSAD			<0.001
1–3	1.78	1.27–2.49	0.001
4–6	1.69	1.17–2.41	0.005
7–10	1		
Remoteness			<0.001
Major city centers	1.05	0.77–1.49	0.76
Regional centers	0.57	0.43–0.76	<0.001
Remote centers	1		
State			<0.001
Tasmania	0.78	0.15–3.70	0.73
Northern Territory	0.15	0.11–0.22	<0.001
New South Wales	1.02	0.73–1.43	0.91
Victoria	0.83	0.50–1.38	0.47
Queensland	1		
South Australia	0.26	0.15–0.45	<0.001
Western Australia	0.40	0.30–0.54	<0.001
Australian Capital Territory	1.27	0.43–3.68	0.66

ADPKD, autosomal dominant polycystic kidney disease; ARIA= accessibility and remoteness index of Australia; BMI, body mass index; CI, confidence interval; IRSAD, socio-economic advantage and disadvantage.

Table 3. Poisson regression modelling of risk of peritonitis in Aboriginal and Torres Strait Islander people

Variables	IRR	95% CI	*P*-value
Age, yr	1.00	0.99–1.01	0.48
Male sex	0.96	0.83–1.12	0.62
BMI	0.99	0.98–1.01	0.92
Current smokers	1.05	0.88–1.28	0.56
Causes of kidney failure			0.93
Diabetes mellitus	1.00		
Glomerular disease	1.11	0.84–1.48	0.44
Hypertensive kidney disease	1.10	0.79–1.52	0.56
ADPKD	1.21	0.72–2.04	0.47
Reflux nephropathy	1.24	0.66–2.32	0.50
Others	1.05	0.79–1.39	0.74
Diabetes			0.89
Type 1	1.20	0.60–2.31	0.57
Type 2	1.06	0.82–1.37	0.65
Comorbidities			
Cardiovascular disease	0.91	0.77–1.08	0.30
Cerebrovascular disease	0.89	0.65–1.22	0.47
Chronic lung disease	0.91	0.71–1.18	0.50
Peripheral vascular disease	1.07	0.90–2.64	0.11
Hepatitis C (negative)	0.78	0.41–1.51	0.47
Era			<0.001
2004–2009	1		
2010–2015	0.90	0.76–1.07	0.23
2016–2020	0.63	0.52–0.77	<0.001
Late referral	0.89	0.72–1.12	0.34
IRSAD			0.86
1–3	1.00		
4–6	1.01	0.77–1.32	0.62
7–10	1.03	0.72–1.05	0.17
Remoteness			
Major city centers	1		0.23
Regional centers	0.93	0.72–1.22	0.62
Remote centers	0.87	0.72–1.06	0.17
State			0.84
Tasmania	-		
Northern Territory	1.00		
New South Wales	0.97	0.69–1.35	0.86
Victoria	0.87	0.54–1.40	0.57
Queensland	1.05	0.82–1.34	0.68
South Australia	0.96	0.53–1.71	0.89
Western Australia	1.00	0.77–1.28	0.93
Australian Capital Territory	0.89	0.34–2.34	0.82

ADPKD, autosomal dominant polycystic kidney disease; BMI, body mass index; CI, confidence interval; IRR, incidence rate ratio; IRSAD, socio-economic advantage and disadvantage.

90 [16.8%]; 2010–2015: $n = 59$ [16%]; and 2016–2020: $n = 36$ [19.6%]).

The most common organisms leading to PD catheter removal were Gram-negative organisms ($n = 46$, 23%), and most patients were on CAPD ($n = 339$, 50.8%), compared to APD ($n = 313$, 48.3%) ($P = 0.26$). Peritonitis-related death occurred in 2.8% ($n = 28$) episodes. Out of 28 deaths related to PD peritonitis, 28.6% ($n = 8$) were culture-negative, 21.4% ($n = 6$) yielded Gram-positive organisms, and 17.9% ($n = 5$) yielded Gram-negative organisms.

HD Transfer

Among Aboriginal and Torres Strait Islander people starting PD as a first KRT, 366 (55%) transferred to HD. The crude HD transfer rate was 28.9 (95% CI, 26–32) per 100 patient-years. The median time to HD transfer was 1.42 years (IQR 0.60–2.57). Crude HD transfer rates decreased over time from 32.1 (95% CI, 27.3–37.6] in 2004 to 2009; 28.1 (95% CI, 23.7–33.2) in 2010 to 2015,

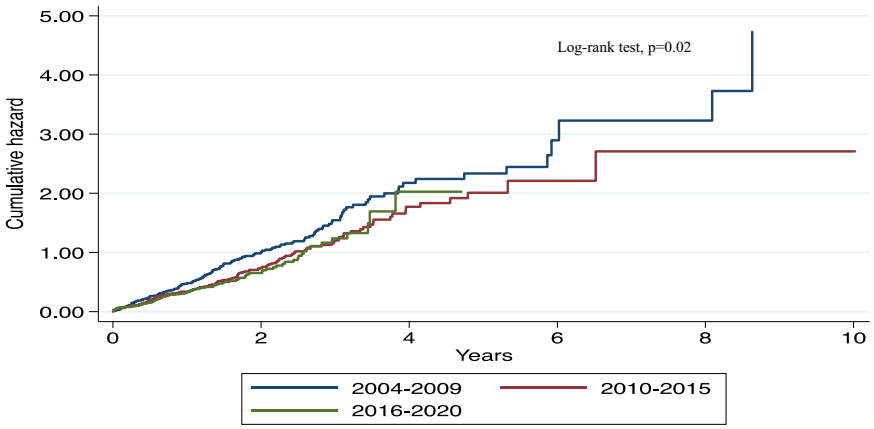

Figure 3. Nelson-Aalen cumulative hazard plot of time to first peritonitis by era in Aboriginal and Torres Strait Islander people.

and 25.4 (95% CI, 20.3–31.7) in 2016 to 2020, per 100 patient-years (relative risk 0.89, $P = 0.08$).

The competing risk regression model observed that HD transfer was independently associated with younger age (sub-HR, 0.99 [95% CI, 0.97–0.99]; $P = 0.02$) and earlier era (2004–2009: sub-HR, 1.63 [95% CI, 1.16–2.30], $P = 0.005$; 2010–2015: sub-HR, 1.53 [95% CI, 1.08–2.19], $P = 0.02$; Ref: 2016–2020) (Table 4).

Patient Survival

During the study, 20.8% ($n = 151$) of Aboriginal and Torres Strait Islander people whose first KRT was PD died. The median survival was 2.1 years (IQR, 0.92–3.1) with a crude death rate 12.2 per 100 patient-years (95% CI, 10.5–14.4). The primary cause of death was cardiovascular disease ($n = 54$, 34.6%). Compared to PD, 44.9% ($n = 1770$) of Aboriginal and Torres Strait Islander people who started with alternative KRT died. The primary cause of death was also cardiovascular disease ($n = 640$, 36.2%), and the median time to death was 3.2 years (IQR, 1.4–6.2).

Using multivariable competing risk regression modelling, death was independently associated with older age (sub-HR, 1.04 [95% CI, 1.02–1.06], $P < 0.001$), with diabetes mellitus (sub-HR, 2.10 [95% CI, 1.12–3.95], $P = 0.02$), with causes of kidney failure (glomerulonephritis: sub-HR, 0.34 [95% CI, 0.11–0.98], $P = 0.05$; and reflux nephropathy: sub-HR, 0.01 [95% CI, 0.01–0.01], $P < 0.001$; Ref: diabetic nephropathy), with earlier era (2004–2009: sub-HR, 1.91 [95% CI, 1.0–3.66], $P = 0.05$; 2010–2015: sub-HR, 1.67 [95% CI, 0.88–3.15], $P = 0.11$; Ref: 2015–2020), and with State territories (Tasmania: sub-HR, 0.01 [95% CI, 0.01–0.01], $P < 0.001$; Australian Capital Territory: sub-HR, 0.01 [95% CI, 0.01–0.01], $P < 0.001$; Ref: Northern Territory) (Supplementary Table S4).

DISCUSSION

This registry-based study examined PD uptake and outcomes among Aboriginal and Torres Strait Islander people from 2004 to 2020. The key findings were a statistically significant decline in PD uptake from 17.2% to 12.7%, with a reciprocal increase in facility HD from 83% to 86% between 2004 and 2009 and between 2016 and 2020. Although a minimal decrease in PD peritonitis rates was noted in Aboriginal and Torres Strait Islanders over the past 2 decades, this remains much higher than the International Society for Peritoneal Dialysis standards. This study further reports a statistically significant decline in the rates of medical cure of peritonitis from 80% to 71% in the recent era (2016–2020), with an increase in relapsing and recurrent peritonitis rates resulting in permanent HD transfer.

The current study noted that low socioeconomic status, regional centers, late referral, diabetes, higher BMI, and some Australian states (Northern Territory, South Australia, and Western Australia) were associated with reduced PD uptake among Aboriginal and Torres Strait Islander people. Multiple factors have been associated with poor PD uptake, including disinterest in home-based therapies,[26] burden on family members, lack of confidence in the quality of PD care, fear of peritonitis,[27] patient burnout,[28] and inadequate educational programs to support patients choosing their treatment modality.[29–31] Insufficient PD training for nephrology fellows[32] and less experienced PD centers hinder PD initiation and retention.[33] It is plausible that some of these factors might have played a pivotal role in reducing PD uptake among Aboriginal and Torres Strait Islander people. Furthermore, this study suggests Aboriginal and Torres Strait Islander people living remotely are not pursuing PD, possibly related to late referral, lack of PD education programs,

Table 4. Multivariable competing risk regression model of transfer to hemodialysis in Aboriginal and Torres Strait Islander people starting kidney replacement therapy

Variables	Sub-HR	95% CI	*P*-value
Age, yr	0.99	0.97–0.99	0.02
Male sex	0.88	0.68–1.13	0.33
BMI	1.02	0.99–1.04	0.12
Current smokers	1.07	0.79–1.46	0.65
Causes of kidney failure			0.78
Diabetes mellitus	1		
Glomerular disease	1.08	0.68–1.70	0.74
Hypertensive kidney disease	1.07	0.65–1.75	0.79
ADPKD	1.58	0.52–4.80	0.42
Reflux nephropathy	0.82	0.35–1.91	0.65
Others	1.19	0.71–2.01	0.73
Diabetes	1.30	0.87–1.97	0.20
Type 1	0.86	0.20–3.72	0.88
Type 2	1.32	0.88–1.98	0.18
Comorbidities			
Cardiovascular disease	1.07	0.79–1.45	0.64
Cerebrovascular disease	0.98	0.55–1.72	0.94
Chronic lung disease	1.21	0.79–1.88	0.38
Peripheral vascular disease	0.87	0.59–1.25	0.42
Hepatitis C (negative)	1.07	0.44–2.63	0.87
Era			0.01
2004–2009	1.63	1.16–2.30	0.005
2010–2015	1.53	1.08–2.19	0.02
2016–2020	1		
Late referral	0.92	0.63–1.34	0.67
IRSAD			0.26
1–3	1		
4–6	1.13	0.84–1.51	0.43
7–10	1.17	0.73–1.88	0.50
Remoteness			0.12
Major city centers	1		
Regional centers	1.04	0.70–1.54	0.85
Remote centers	1.26	0.81–1.95	0.30
State			0.40
Tasmania	3.31	1.00–10.81	0.05
Northern Territory	1		
New South Wales	1.21	0.72–2.00	0.46
Victoria	1.00	0.51–1.96	0.99
Queensland	0.80	0.53–1.21	0.29
South Australia	0.60	0.27–1.33	0.21
Western Australia	0.91	0.57–1.44	0.68
Australian Capital Territory	3.08	0.93–10.09	0.06

ADPKD, autosomal dominant polycystic kidney disease; BMI, body mass index; CI, confidence interval; IRR, incidence rate ratio; IRSAD, socio-economic advantage and disadvantage; sub-HR, subhazard ratio.

infrastructure shortages, low staff level PD experience, and fear of peritonitis.

Although adjusted peritonitis rates decreased over time (using multivariable regression modelling), crude peritonitis rates remain consistently and appreciably above the target benchmark of 0.4 episodes per patient-year recommended by International Society for Peritoneal Dialysis.[25] The decrease in peritonitis rates in Aboriginal and Torres Strait Islanders is lower than that for the overall Australian PD population (which has decreased by more than two-thirds simultaneously).[34] Better understanding the cause, addressing factors promoting infection burden, and consulting the community to implement acceptable and evidence-informed strategies will be important.

Improvements in PD training, techniques, equipment, prophylaxis, and early treatment of infectious complications of PD[35,36] have substantially decreased PD-associated peritonitis rates globally over the years. However, higher PD peritonitis rates continue to be associated with Black race,[37] Aboriginal race,[38] diabetes,[39–41] obesity,[38,42] hypoalbuminemia,[41,43] and lack of RKF.[40]

Modifiable factors are present and associated with less-than-optimal outcomes among Aboriginal and Torres Strait Islander patients in the more recent era of 2016 to 2020 (and likely also explained in minoritized communities internationally). Poor outcomes in patients on PD are associated with suboptimal patient selection, social factors, patient literacy, prophylaxis and early treatment of PD-related infections, clinical governance, patient support, and adherence to professional standards.[44,45] Multiple studies and community voices have identified Aboriginal and Torres Strait Islander people with CKD as having experienced institutional racism in their health care. Furthermore, the intergenerational and intragenerational trauma of colonization, including the role of health care professionals in dislocating children from their parents due to the implementation of bad policy, is recognized to impact Aboriginal and Torres Strait Islanders' access and trust in mainstream health services.[46]

Broadly, to improve PD-related outcomes, it is important that health services are redesigned to be First Nations-led to address institutional racism and other effects of ongoing colonization faced by Aboriginal and Torres Strait Islander people accessing health services. Rigid mainstream health services contribute to the disparity in health outcomes for Aboriginal and Torres Strait Islander people on dialysis. Empowering Aboriginal and Torres Strait Islander people communities to incorporate dialysis services within community-controlled health services aligns with the "Well-being model" for Aboriginal and Torres Strait Islander people living with chronic diseases that "Well-being is supported by best-practice care that addresses the particular needs of the community."[47]

We recommend a comprehensive evaluation of current models of care and consideration of direct clinical resourcing, intervention, and support. This is achievable by developing culturally appropriate high quality PD programs; and implementing targeted efforts to improve PD-related outcomes, including reinforcing PD-related education in PD techniques, preventing and timely treating PD-related infections, and rectifying

social disparities contributing to poor outcomes. Strengthening and establishing formal partnerships with Aboriginal and Torres Strait Islander working groups, sharing and access to data information, shared decision-making, and having Aboriginal and Torres Strait Islander-led KRT programs will bolster the trust and confidence in the system, enabling them to make informed decisions.

The strengths of this study lie in its large size and inclusion of all patients on incident PD in Australia and New Zealand during the study period. The study provided a detailed analysis of its association through multivariable competing-risk modelling. Despite these strengths, the registry data was limited by a lack of collected information on many demographics (proximity of patients' residence to the dialysis unit and family support), clinical (e.g., RKF and comorbid conditions, dialysis parameters), and laboratory variables. Individual unit management protocols and training practices, use of disconnect systems, catheter type, and the timing between catheter insertion and therapy start were also unavailable. Residual confounding, coding or reporting bias cannot be excluded. The reliance on registry variables cannot contextualize the sociopolitical environments of the local health services, and lower IRSAD among Aboriginal and Torres Strait Islander people has been an intentional outcome of racism and colonization in Australia. For a similar reason, we did not think it relevant to compare our results with other Australian ethnic groups due to marked social inequity. In addition, none of the variables collected were specific to Aboriginal and Torres Strait Islander people. Finally, there is a risk of lead-time bias when comparing outcomes among different eras, as each had different lengths of follow-up periods.

CONCLUSION

PD uptake has recently decreased among Aboriginal and Torres Strait Islander people, who often reside in remote and regional communities where home-based dialysis is advantageous. In addition, outcomes remain poor and unacceptable compared to international standards. Issues underpinning these problems are likely significant, from distrust, reducing PD expertise and fear of failure, and needs further research. Community-led champions supported by field experts must address these barriers through education, training, and supportive care to demonstrate the ability to succeed and instill confidence and reassurance in end-users.

DISCLOSURE

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SUPPLEMENTARY MATERIAL

Supplementary File (PDF)

Figure S1. Flow diagram of kidney replacement therapy in Aboriginal and Torres Strait Islanders.

Figure S2. Kidney replacement therapy and peritoneal dialysis uptake among Aboriginal and Torres Strait Islander people and other ethnicities.

Table S1. The Centre of Research Excellence in Aboriginal and Torres Strait Islanders Chronic Disease Knowledge Translation and Exchange quality appraisal tool.

Table S2. Description of organisms causing peritoneal dialysis-related peritonitis comparing Aboriginal and Torres Strait Islander people with other ethnicities commencing peritoneal dialysis as the first dialysis modality.

Table S3. First line antibiotic combinations or single antibiotic usage in peritoneal dialysis-related peritonitis in Aboriginal and Torres Strait Islander people.

Table S4. Multivariable competing risk regression modelling of death among Aboriginal and Torres Strait Islanders starting peritoneal dialysis as a first kidney replacement therapy.

REFERENCES

1. 1301.0 – Year Book Australia, 2012. Australian Bureau of Statistics. Published 2002. Accessed November 1, 2023. https://www.abs.gov.au/ausstats/abs@.nsf/mf/1301.0
2. Bradshaw C, Williams A, Saltré F, Norman K, Ulm S. The First Australians grew to a population of millions, much more than

previous estimates. The Conversation. Published 2021. Accessed November 1, 2023. https://theconversation.com/the-first-australians-grew-to-a-population-of-millions-much-more-than-previous-estimates-142371

3. Census. Aboriginal and Torres Strait Islander People. Australian Bureau of Statistics. Published 2022. Accessed November 1, 2023. https://www.abs.gov.au/statistics/people/aboriginal-and-torres-strait-islander-peoples
4. Estimates of Aboriginal and Torres Strait Islander Australians, Australian Bureau of Statistics. Published September 2018. Accessed November 1, 2023. https://www.abs.gov.au/statistics/people/aboriginal-and-torres-strait-islander-peoples/estimates-aboriginal-and-torres-strait-islander-australians/latest-release
5. Kerr M, Jaure A, Stephens JH, et al. Experiences of indigenous patients receiving dialysis: systematic review of qualitative studies. *Am J Kidney Dis*. 2023;83:139–150.e1. https://doi.org/10.1053/j.ajkd.2023.07.014
6. Indigenous health statement. Australia and New Zealand Society Nephrology. Published 2022. Accessed November 1, 2023. https://nephrology.edu.au/int/anzsn/uploads/Position%20Statements/Indigenous%20Health%20Statement%20March%202022.pdf
7. CARI Guidelines. Caring for Australians and New Zealanders with Kidney Impairment. Published 2022. Accessed November 1, 2023. https://www.cariguidelines.org/
8. Shih YC, Guo A, Just PM, Mujais S. Impact of initial dialysis modality and modality switches on Medicare expenditures of end-stage renal disease patients. *Kidney Int*. 2005;68:319–329. https://doi.org/10.1111/j.1523-1755.2005.00413.x
9. Schaubel DE, Morrison HI, Fenton SS. Comparing mortality rates on CAPD/CCPD and hemodialysis. The Canadian experience: fact or fiction? *Perit Dial Int*. 1998;18:478–484. https://doi.org/10.1177/089686089801800504
10. Mendelssohn DC, Pierratos A. Reformulating the integrated care concept for the new millennium. *Perit Dial Int*. 2002;22:5–8. https://doi.org/10.1177/089686080202200101
11. Foley RN, Parfrey PS, Harnett JD, et al. Mode of dialysis therapy and mortality in end-stage renal disease. *J Am Soc Nephrol*. 1998;9:267–276. https://doi.org/10.1681/ASN.V92267
12. Yeates K, Zhu N, Vonesh E, Trpeski L, Blake P, Fenton S. Hemodialysis and peritoneal dialysis are associated with similar outcomes for end-stage renal disease treatment in Canada. *Nephrol Dial Transplant*. 2012;27:3568–3575. https://doi.org/10.1093/ndt/gfr674
13. Weinhandl ED, Wetmore JB, Peng Y, Liu J, Gilbertson DT, Johansen KL. Initial effects of COVID-19 on patients with ESKD. *J Am Soc Nephrol*. 2021;32:1444–1453. https://doi.org/10.1681/ASN.2021010009
14. McDonald S, Hoy W. Kidney disease among aboriginal and Torres Strait Islander people in Australia. In: *Chronic Kidney Disease Disadvantaged Populations*. Elsevier; 2017:167–180.
15. Barrett E, Salem L, Wilson S, O'Neill C, Davis K, Bagnulo S. Chronic kidney disease in an Aboriginal population: a nurse practitioner-led approach to management. *Aust J Rural Health*. 2015;23:318–321. https://doi.org/10.1111/ajr.12230
16. Hughes JT. Kidney health equity for Indigenous Australians: an achievable goal. *Nat Rev Nephrol*. 2021;17:505. https://doi.org/10.1038/s41581-021-00412-8
17. Hughes JT, Dembski L, Kerrigan V, Majoni SW, Lawton PD, Cass A. Gathering perspectives - finding solutions for chronic and end stage kidney disease. *Nephrol (Carlton)*. 2018;23(suppl 1):5–13. https://doi.org/10.1111/nep.13233
18. Hughes JT, Freeman N, Beaton B, et al. My experiences with kidney care: a qualitative study of adults in the Northern Territory of Australia living with chronic kidney disease, dialysis and transplantation. *PLoS One*. 2019;14:e0225722. https://doi.org/10.1371/journal.pone.0225722
19. McDonald SP, Russ GR, Kerr PG, Collins JF. Australia and New Zealand Dialysis and Transplant Registry. ESRD in Australia and New Zealand at the end of the millennium: a report from the ANZDATA registry. *Am J Kidney Dis*. 2002;40:1122–1131. https://doi.org/10.1053/ajkd.2002.36943
20. ANZDATA annual report. 2021 -Chapter 10 – End Stage Kidney Failure in Aboriginal and Torres Strait Islander Australians; 2021.
21. Marley JV, Moore S, Fitzclarence C, Warr K, Atkinson D. Peritoneal dialysis outcomes of Indigenous Australian patients of remote Kimberley origin. *Aust J Rural Health*. 2014;22:101–108. https://doi.org/10.1111/ajr.12086
22. Nataatmadja M, Cho Y, Johnson DW. Continuous quality improvement initiatives to sustainably reduce peritoneal dialysis-related infections in Australia and New Zealand. *Perit Dial Int*. 2016;36:472–477. https://doi.org/10.3747/pdi.2016.00114
23. See EJ, Johnson DW, Hawley CM, et al. Early peritonitis and its outcome in incident peritoneal dialysis patients. *Perit Dial Int*. 2017. https://doi.org/10.3747/pdi.2017.00029
24. von Elm E, Altman DG, Egger M, et al. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *Ann Intern Med*. 2007;147:573–577. https://doi.org/10.7326/0003-4819-147-8-200710160-00010
25. Li PK-T, Chow KM, Cho Y, et al. ISPD peritonitis guideline recommendations: 2022 update on prevention and treatment. *Perit Dial Int*. 2022;42:110–153. https://doi.org/10.1177/08968608221080586
26. Zhang AH, Bargman JM, Lok CE, et al. Dialysis modality choices among chronic kidney disease patients: identifying the gaps to support patients on home-based therapies. *Int Urol Nephrol*. 2010;42:759–764. https://doi.org/10.1007/s11255-010-9793-9
27. Tungsanga K, Kanjanabuch T, Mahatanan N, Praditpornsilp K, Avihingsanon Y, Eiam-Ong S. The status of, and obstacles to, continuous ambulatory peritoneal dialysis in Thailand. *Perit Dial Int*. 2008;28(suppl 3):S53–S55S8. https://doi.org/10.1177/089686080802803s11
28. Chaudhary K. Peritoneal dialysis drop-out: causes and prevention strategies. *Int J Nephrol*. 2011;2011:434608. https://doi.org/10.4061/2011/434608
29. Wu IW, Wang SY, Hsu KH, et al. Multidisciplinary predialysis education decreases the incidence of dialysis and reduces mortality-a controlled cohort study based on the NKF/DOQI guidelines. *Nephrol Dial Transplant*. 2009;24:3426–3433. https://doi.org/10.1093/ndt/gfp259

30. Manns BJ, Taub K, Vanderstraeten C, et al. The impact of education on chronic kidney disease patients' plans to initiate dialysis with self-care dialysis: a randomized trial. *Kidney Int*. 2005;68:1777–1783. https://doi.org/10.1111/j.1523-1755.2005.00594.x

31. Mehrotra R, Marsh D, Vonesh E, Peters V, Nissenson A. Patient education and access of ESRD patients to renal replacement therapies beyond in-center hemodialysis. *Kidney Int*. 2005;68:378–390. https://doi.org/10.1111/j.1523-1755.2005.00453.x

32. Lameire N, Van Biesen W. Epidemiology of peritoneal dialysis: a story of believers and nonbelievers. *Nat Rev Nephrol*. 2010;6:75–82. https://doi.org/10.1038/nrneph.2009.210

33. Afolalu B, Troidle L, Osayimwen O, Bhargava J, Kitsen J, Finkelstein FO. Technique failure and center size in a large cohort of peritoneal dialysis patients in a defined geographic area. *Perit Dial Int*. 2009;29:292–296. https://doi.org/10.1177/089686080902900313

34. ANZDATA [annual report]. Chapter 5 peritoneal dialysis. Published 2021. Accessed November 1, 2023. https://www.anzdata.org.au/wp-content/uploads/2021/09/c05_peritoneal_2020_ar_2021_Chapter_v1.0_20220530_Final.pdf

35. Figueiredo AE, Bernardini J, Bowes E, et al. A syllabus for teaching peritoneal dialysis to patients and caregivers. *Perit Dial Int*. 2016;36:592–605. https://doi.org/10.3747/pdi.2015.00277

36. Piraino B, Bernardini J, Brown E, et al. ISPD position statement on reducing the risks of peritoneal dialysis-related infections. *Perit Dial Int*. 2011;31:614–630. https://doi.org/10.3747/pdi.2011.00057

37. Golper TA, Brier ME, Bunke M, et al. Risk factors for peritonitis in long-term peritoneal dialysis: the Network 9 peritonitis and catheter survival studies. Academic subcommittee of the steering committee of the Network 9 peritonitis and catheter survival studies. *Am J Kidney Dis*. 1996;28:428–436. https://doi.org/10.1016/s0272-6386(96)90502-8

38. Lim WH, Johnson DW, McDonald SP. Higher rate and earlier peritonitis in Aboriginal patients compared to non-Aboriginal patients with end-stage renal failure maintained on peritoneal dialysis in Australia: analysis of ANZDATA. *Nephrol (Carlton)*. 2005;10:192–197. https://doi.org/10.1111/j.1440-1797.2005.00374.x

39. Oo TN, Roberts TL, Collins AJ. A comparison of peritonitis rates from the United States Renal Data System database: CAPD versus continuous cycling peritoneal dialysis patients. *Am J Kidney Dis*. 2005;45:372–380. https://doi.org/10.1053/j.ajkd.2004.10.008

40. Han SH, Lee SC, Ahn SV, et al. Reduced residual renal function is a risk of peritonitis in continuous ambulatory peritoneal dialysis patients. *Nephrol Dial Transplant*. 2007;22:2653–2658. https://doi.org/10.1093/ndt/gfm242

41. Chow KM, Szeto CC, Leung CB, Kwan BC, Law MC, Li PK. A risk analysis of continuous ambulatory peritoneal dialysis-related peritonitis. *Perit Dial Int*. 2005;25:374–379. https://doi.org/10.1177/089686080502500413

42. McDonald SP, Collins JF, Rumpsfeld M, Johnson DW. Obesity is a risk factor for peritonitis in the Australian and New Zealand peritoneal dialysis patient populations. *Perit Dial Int*. 2004;24:340–346. https://doi.org/10.1177/089686080402400408

43. Wang Q, Bernardini J, Piraino B, Fried L. Albumin at the start of peritoneal dialysis predicts the development of peritonitis. *Am J Kidney Dis*. 2003;41:664–669. https://doi.org/10.1053/ajkd.2003.50128

44. Chow KM, Li PK, Cho Y, et al. ISPD catheter-related infection recommendations: 2023 update. *Perit Dial Int*. 2023;43:201–219. https://doi.org/10.1177/08968608231172740

45. Jose MD, Johnson DW, Mudge DW, et al. Peritoneal dialysis practice in Australia and New Zealand: a call to action. *Nephrol (Carlton)*. 2011;16:19–29. https://doi.org/10.1111/j.1440-1797.2010.01390.x

46. Australian Human Rights Commission. Bringing them home: report of the national inquiry into the separation of Aboriginal and Torres Strait Islander children from their families. Published 1997. Accessed November 1, 2023. https://humanrights.gov.au/our-work/projects/bringing-them-home-report-1997

47. Davy C, Kite E, Sivak L, et al. Towards the development of a wellbeing model for aboriginal and Torres Strait Islander peoples living with chronic disease. *BMC Health Serv Res*. 2017;17:659. https://doi.org/10.1186/s12913-017-2584-6