ANZ DATA
AUSTRALIA & NEW ZEALAND DIALYSIS & TRANSPLANT REGISTRY

CHAPTER 12

Paediatric Patients with Kidney Failure Requiring Replacement Therapy

As well as a summary of current trends in the frequency and causes of Kidney Failure in paediatrics, this report focuses specifically on current trends in the epidemiology and outcomes of paediatric dialysis.

CONTENTS

SUMMARY AND HIGHLIGHTS

The incidence of kidney replacement therapy (KRT) among children in Australia and New Zealand has not changed over the last 20 years, stable at around 9 per million. In both Australia and New Zealand, the prevalence of KRT in children aged 0-17 is approximately 57 per million.

In terms of initial modality of KRT, the total numbers are small and year on year variation results in large changes in percentages, which are difficult to interpret with no clear trend. Over 2017-2022, only 20% of those under 10 years old and 19% of 10-17 year olds started KRT with a pre-emptive transplant, the majority starting with peritoneal dialysis (58% and 46% respectively). Within the prevalent paediatric population over 2017-2022, the number receiving KRT with a functioning transplant is stable at 79-83%.

Education participation remains stable from previous years. At the end of 2022, the percentage of children receiving modified schooling, among those at school, was dependant on age: 5-11yrs - 23%, 12-15yrs - 25%, 16-18yrs - 35%.

Obesity rates in the prevalent population stratified according to KRT modality demonstrate a significant difference with no patients receiving haemodialysis reported to be obese but 16% and 13% of transplant patients in Australia and New Zealand respectively.

This year, ANZDATA have employed the 2012 ERA EDTA diagnostic codes which has allowed for a much more nuanced coding of patients. Of the 284 possible diagnostic codes, only 63 were used to describe prevalent paediatric patients across Australia and New Zealand. The ERA-EDTA major headings that each of these diagnostic codes fall into were felt to not accurately reflect our diagnostic cohort e.g. hypoplasia/dysplasia falls under Tubulointerstitial Disease. Therefore, the categories used within this chapter reflect the categories used in previous reports but also real-world stratification e.g. reflux nephropathy now falls under congenital anomalies of the kidney and urinary tract (CAKUT). In this way, it is hoped the data provides a more accurate description of our patient cohort. This was most pertinent for nephronophthisis and autosomal dominant tubulointerstitial kidney disease (ADTKD) which previously was not well categorised e.g. cystic kidney disease.

It is perhaps most interesting that CAKUT which typically has been considered to explain 50% of paediatric kidney failure now represents 35% of the 2017-2022 incident cohort, and glomerular disease 29%. The new category of nephronophthisis/ADTKD accounts for 7%. 37 of the total 312 (12%) are still coded as uncertain or not reported suggesting there is room for even more accurate coding.

Following this major change to the diagnostic codes, the next year's data collection will see the addition of genetic information. This reflects the increasing implementation of genomics into general nephrology practice, particularly in paediatrics. Genetic data collection retrospectively i.e. for prevalent patients will be possible, and it will be interesting to measure data input for this cohort next year.

This year, as well as providing a summary of current trends in the frequency and causes of Kidney Failure, the paediatric report for 2022 data focuses on current trends in the epidemiology and outcomes of paediatric dialysis.

SUGGESTED CITATION

H McCarthy, C Davies, E Au, S Bateman, J Chen, K Hurst, G Irish, D Lee, S McDonald, W Mulley, M Roberts, T Sun, P Clayton. 46th Report, Chapter 12: Paediatric Patients with Kidney Failure Requiring Kidney Replacement Therapy. Australia and New Zealand Dialysis and Transplant Registry, Adelaide, Australia. 2023. Available at: http://www.anzdata.org.au

INCIDENCE AND PREVALENCE

The definition of paediatric used throughout this chapter is any patient below 18 years of age (at the time of commencing kidney replacement therapy (KRT) for incident data, or at the time of the annual survey (31 December 2022) for prevalent data). It is acknowledged that some of these patients may have been receiving their care in adult renal units, and some patients treated in paediatric units who are aged 18 years or older will not be included.

Population estimates for Australia and New Zealand used throughout this chapter for the calculation of incidence per million population were sourced from the Australian Bureau of Statistics (2022)[1] and Stats NZ (2022)[2], respectively.

Figure 12.1 shows the annual incidence of KRT per million age matched population. There is no change in the incidence of KRT in children and adolescents in either Australia or New Zealand. The small absolute numbers of incident patients produce large year to year fluctuations.

Figure 12.1.1
Incidence of KRT - Age 0-17 Years - Australia

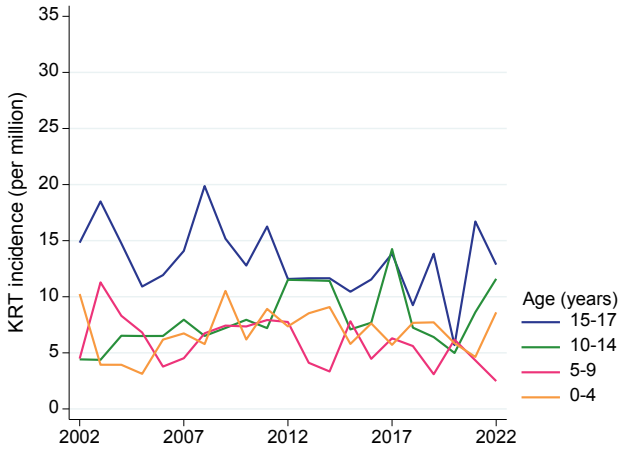
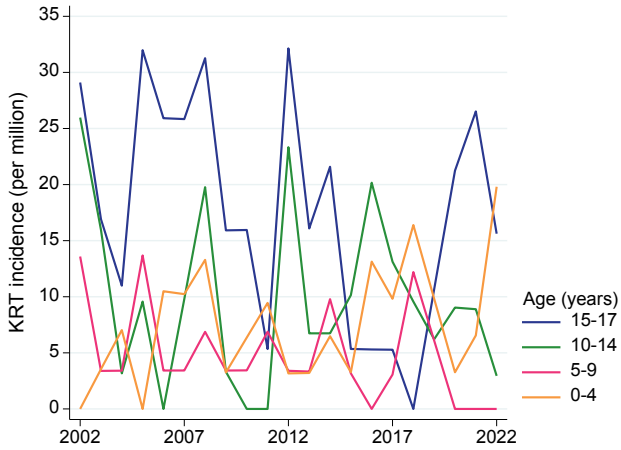


Figure 12.1.2
Incidence of KRT - Age 0-17 Years - New Zealand



In Australia the prevalent numbers of treated kidney failure have gradually increased in older age groups (figure 12.2.1); the trends are less clear in New Zealand (figure 12.2.2).

Figure 12.2.1
Prevalence of KRT - Age 0-17 Years - Australia

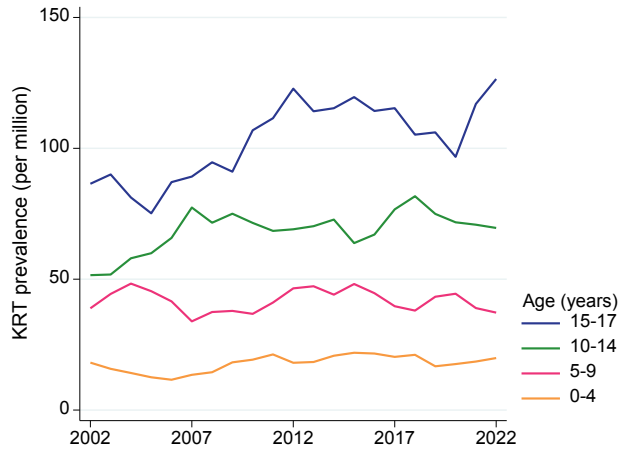
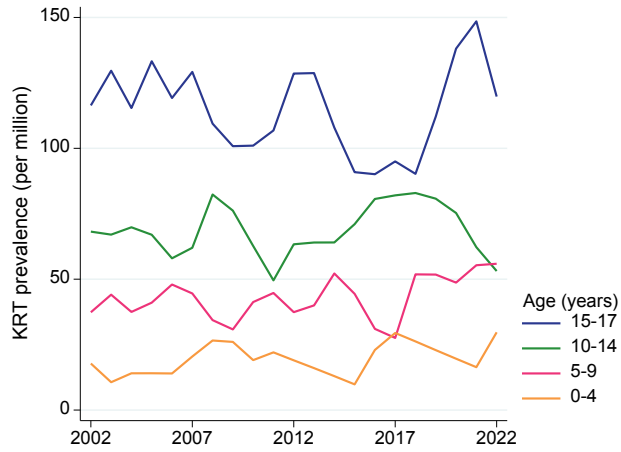


Figure 12.2.2
Prevalence of KRT - Age 0-17 Years - New Zealand



BACK TO CONTENTS

PRIMARY KIDNEY DISEASE

The primary kidney disease of new patients over 2017-2022 are shown by age group in table 12.1. From 2022, primary kidney disease was collected according to the updated European Renal Association/European Dialysis and Transplantation Association categories, with primary diseases reported prior to 2022 mapped to these categories. Collectively, congenital abnormalities of the kidney and urinary tract (CAKUT) are the predominant cause of kidney failure in younger children, with glomerular disease being the most common cause in adolescents.

Table 12.1
Primary Kidney Disease by Age, Incident Patients Australia and New Zealand 2017-2022

Primary kidney disease	0-4	5-10	10-14	15-17	Total
CAKUT	34 (41%)	18 (35%)	41 (41%)	17 (22%)	**110 (35%)**
- Hypodysplasia/Dysplasia	21 (26%)	12 (23%)	30 (30%)	10 (13%)	**73 (23%)**
- Reflux Nephropathy	-	2 (4%)	5 (5%)	5 (6%)	**12 (4%)**
- Posterior Urethral Valves	13 (16%)	4 (8%)	6 (6%)	2 (3%)	**25 (8%)**
Glomerular Disease	17 (21%)	17 (33%)	26 (26%)	30 (38%)	**90 (29%)**
- Congenital Nephrotic Syndrome	14 (17%)	2 (4%)	-	2 (3%)	**18 (6%)**
- FSGS	1 (1%)	8 (15%)	10 (10%)	8 (10%)	**27 (9%)**
- Alport Syndrome	-	1 (2%)	1 (1%)	2 (3%)	**4 (1%)**
Polycystic Kidney Disease	4 (5%)	3 (6%)	4 (4%)	1 (1%)	**12 (4%)**
Nephronophthisis/ADTKD	6 (7%)	5 (10%)	6 (6%)	4 (5%)	**21 (7%)**
Haemolytic Uraemic Syndrome	3 (4%)	-	1 (1%)	1 (1%)	**5 (2%)**
Diabetic Kidney Disease	-	-	-	1 (1%)	**1 (0%)**
Cortical Necrosis	2 (2%)	1 (2%)	2 (2%)	1 (1%)	**6 (2%)**
Interstitial Nephritis	1 (1%)	1 (2%)	-	2 (3%)	**4 (1%)**
Cystinosis	-	-	3 (3%)	2 (3%)	**5 (2%)**
Uncertain	9 (11%)	3 (6%)	10 (10%)	11 (14%)	**33 (11%)**
Misc/Other	5 (6%)	4 (8%)	5 (5%)	7 (9%)	**21 (7%)**
Not reported	1 (1%)	-	1 (1%)	2 (3%)	**4 (1%)**
Total	82	52	99	79	312

CAKUT - Congenital anomalies of the kidneys and urinary
FSGS - Focal segmental glomerulosclerosis
ADTKD - Autosomal Dominant Tubulointerstitial Kidney Disease

BACK TO CONTENTS

MODALITY OF TREATMENT

The modality of the first kidney replacement treatment is shown in table 12.2. Although numbers are small and therefore fluctuate from year to year, around 15-20% of children and adolescents receive pre-emptive kidney transplants. Of the remainder, PD is more common in younger patients (<10 years), and for older patients similar numbers start on HD and PD.

Table 12.2
Modality of Initial Kidney Replacement Therapy by Year of First Treatment, Australia and New Zealand

Age group	2017	2018	2019	2020	2021	2022	Total
0-9 Years	23	30	22	20	16	23	134
HD	9 (39%)	7 (23%)	3 (14%)	4 (20%)	5 (31%)	1 (4%)	**29 (22%)**
PD	11 (48%)	14 (47%)	15 (68%)	13 (65%)	8 (50%)	17 (74%)	**78 (58%)**
Transplant	3 (13%)	9 (30%)	4 (18%)	3 (15%)	3 (19%)	5 (22%)	**27 (20%)**
10-17 Years	38	22	26	20	37	35	178
HD	15 (39%)	6 (27%)	10 (38%)	5 (25%)	15 (41%)	12 (34%)	**63 (35%)**
PD	16 (42%)	10 (45%)	12 (46%)	10 (50%)	14 (38%)	20 (57%)	**82 (46%)**
Transplant	7 (18%)	6 (27%)	4 (15%)	5 (25%)	8 (22%)	3 (9%)	**33 (19%)**
Total	61	52	48	40	53	58	312

For prevalent patients (table 12.3), a very different pattern is seen, with the great majority (79% in 2022) of children and adolescents with a functioning transplant. This reflects the relatively high rate of transplantation among children.

Table 12.3
Modality of Prevalent Patients by Year of Treatment, Australia and New Zealand

Current treatment	2017	2018	2019	2020	2021	2022	Total
HD	22 (6%)	21 (6%)	16 (4%)	17 (5%)	20 (5%)	15 (4%)	**63 (35%)**
PD	54 (15%)	46 (12%)	47 (13%)	50 (13%)	53 (14%)	66 (17%)	**82 (46%)**
Transplant	293 (79%)	310 (82%)	313 (83%)	305 (82%)	310 (81%)	309 (79%)	**33 (19%)**
Total	369	377	376	372	383	390	312

BACK TO CONTENTS

PAEDIATRIC ASSESSMENT

The paediatric survey is collected on all children commencing kidney replacement therapy before the age of 15 and collection continues until they reach 18 years of age (children aged 15 years and older at time of starting KRT are excluded from the data presented below). This survey records data on height, weight and an assessment of educational participation.

Amongst those 12 years or older, modified schooling (within an additional needs class, school, requirement for a teacher's aid or home schooling) was undertaken for a substantial percentage of dialysis recipients (figure 12.3). Note that multiple categories of paediatric assessment have been collapsed into single groups for reporting purposes (see the survey form for details: (https://www.anzdata.org.au/wp-content/uploads/2020/11/PaediatricForm.pdf)

Figure 12.3.1
Educational Participation by Age Group and Treatment Modality - Australia 2022

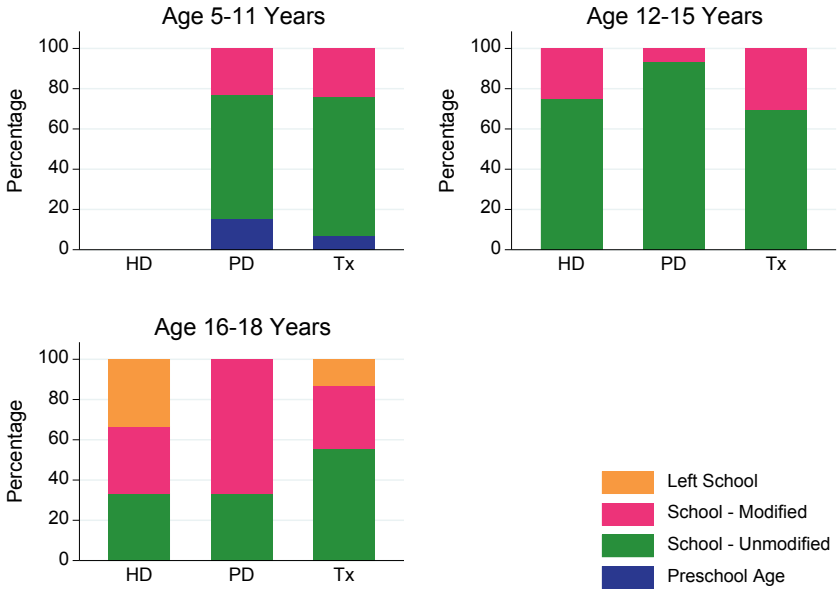
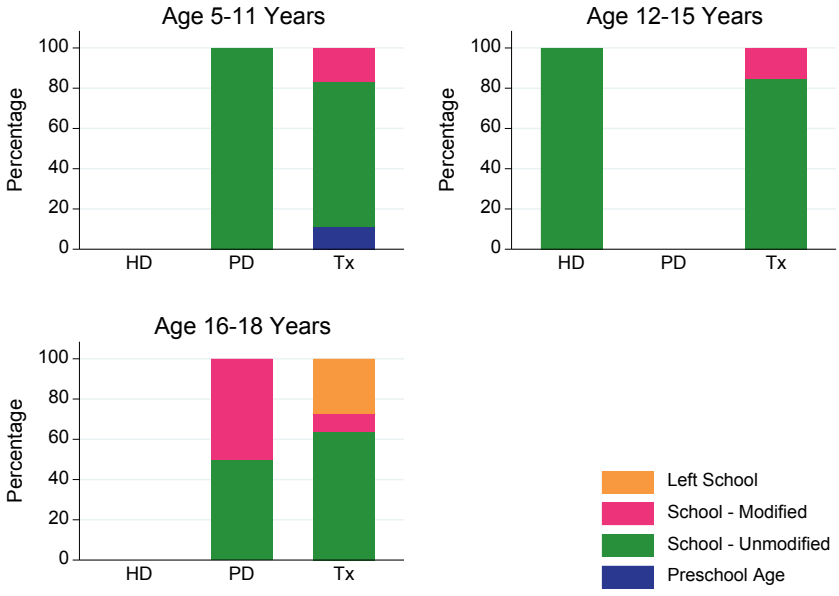


Figure 12.3.2
Educational Participation by Age Group and Treatment Modality - New Zealand 2022



BACK TO CONTENTS

Paediatric BMI categories are determined using age adjusted z-scores. In Australia, a higher proportion of transplant recipients and haemodialysis patients were overweight or obese, compared with children and adolescents treated with peritoneal dialysis (figure 12.5). New Zealand data should be interpreted with caution due to low numbers of patients.

Figure 12.4.1

Body Mass Index of Prevalent Paediatric Patients by Treatment Modality - Australia 2022

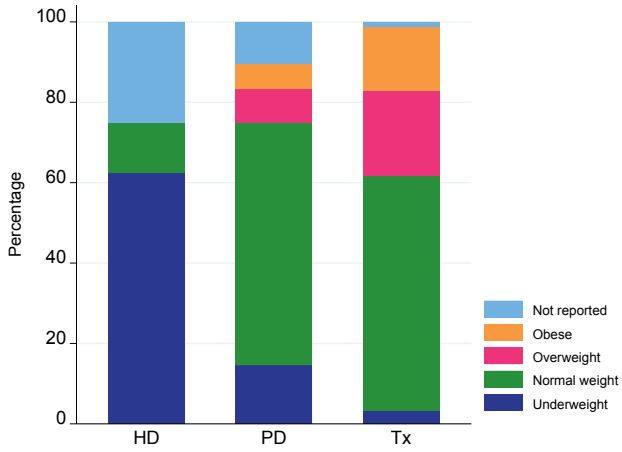
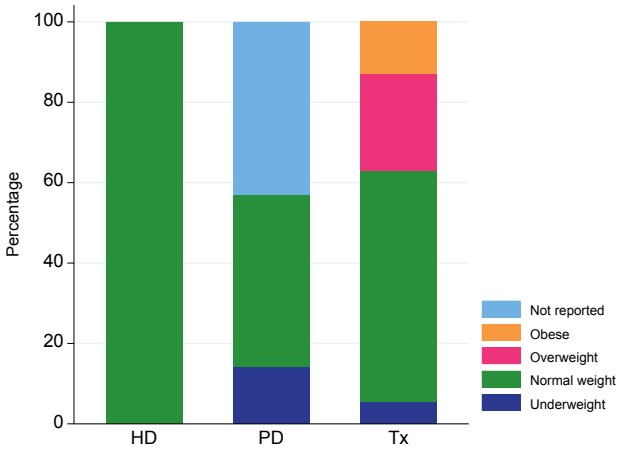


Figure 12.4.2

Body Mass Index of Prevalent Paediatric Patients by Treatment Modality - New Zealand 2022



BACK TO CONTENTS

DIALYSIS DELIVERY AND ADEQUACY

Various dialysis process indicators are summarized in Figures 12.5 to 12.14. For all of these graphs, the box indicates the 25th, 50th, and 75th centiles. The "whiskers" indicate the 95th centiles for each category.

Figure 12.5.1
Haemoglobin, Paediatric Dialysis Patients - Australia, December 2018-2022

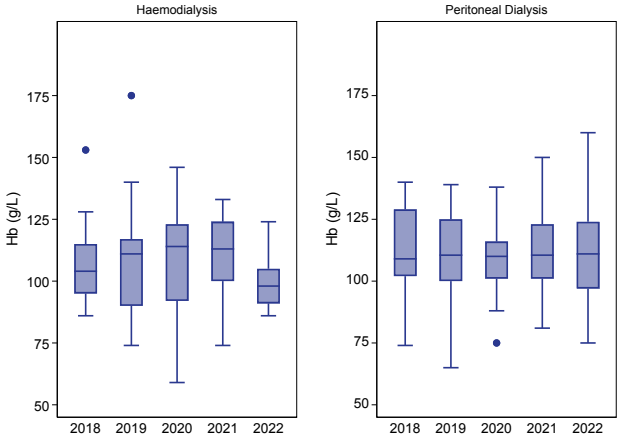


Figure 12.5.2
Haemoglobin, Paediatric Dialysis Patients - New Zealand, December 2018-2022

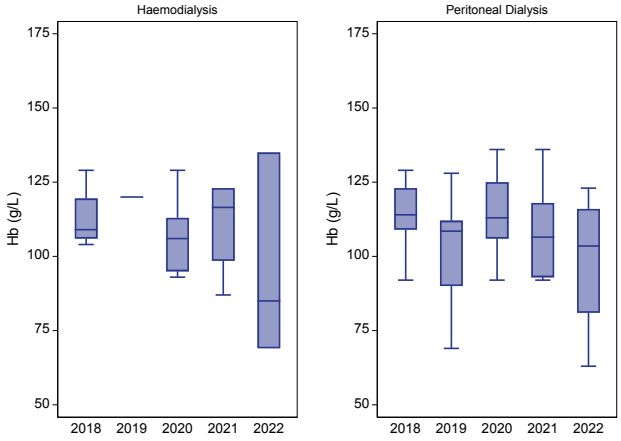
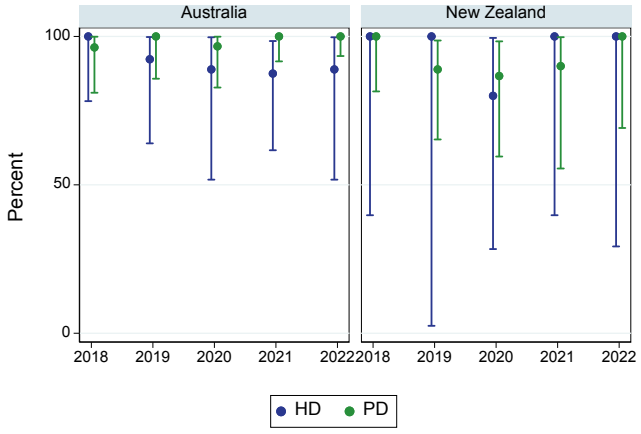


Figure 12.6
Use of Erythropoietic Agents in Paediatric Dialysis Patients (95% CI) - December 2018-2022



BACK TO CONTENTS

Figure 12.7.1
Ferritin, Paediatric Dialysis Patients - Australia, December 2018-2022

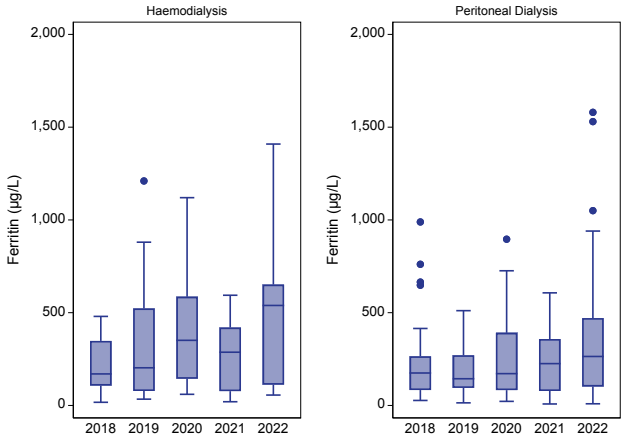


Figure 12.7.2
Ferritin, Paediatric Dialysis Patients - New Zealand, December 2018-2022

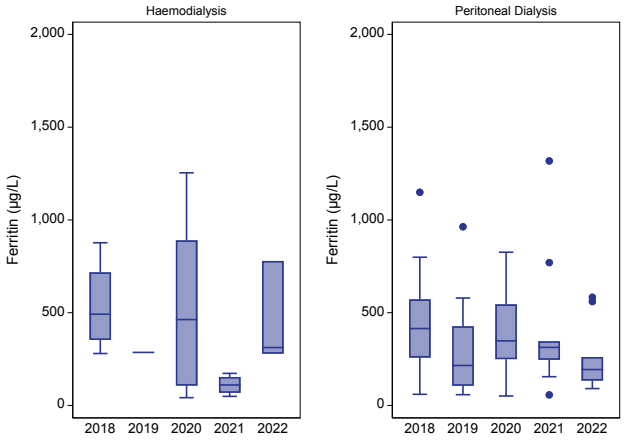


Figure 12.8.1
Transferrin Saturation, Paediatric Dialysis Patients - Australia, December 2018-20222022

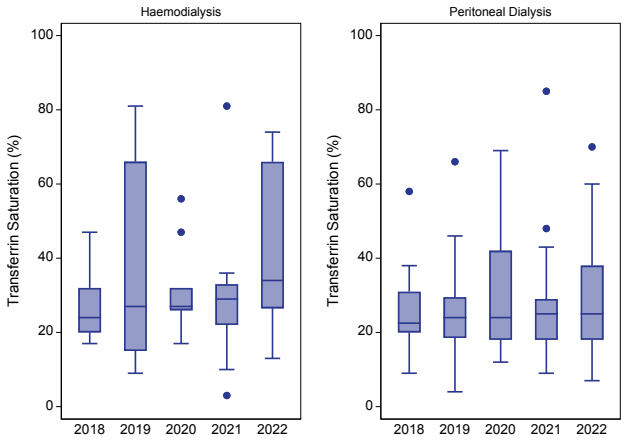
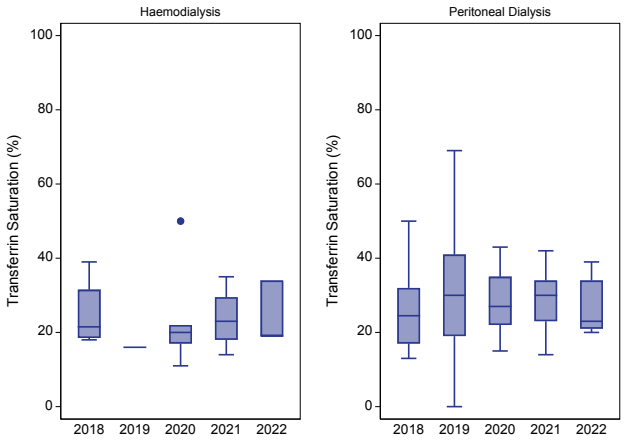


Figure 12.8.2
Transferrin Saturation, Paediatric Dialysis Patients - New Zealand, December 2018-2022



BACK TO CONTENTS

Figure 12.9.1

Serum Calcium, Paediatric Dialysis Patients - Australia, December 2018-2022

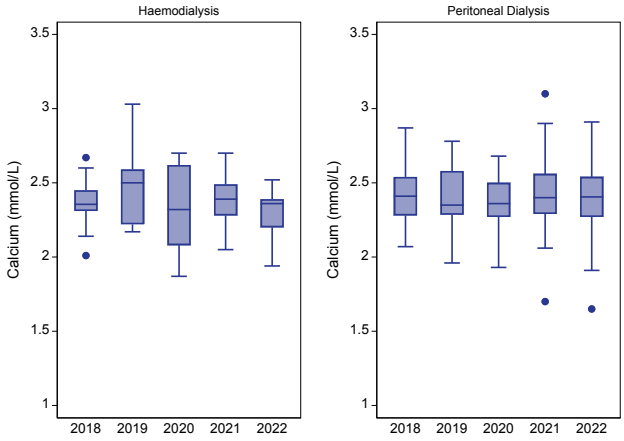


Figure 12.9.2

Serum Calcium, Paediatric Dialysis Patients - New Zealand, December 2018-2022

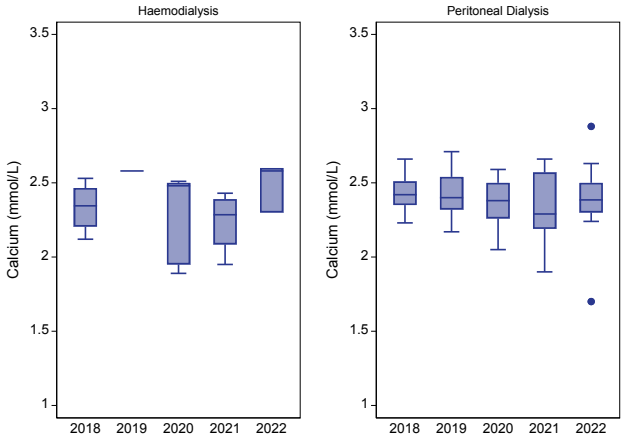


Figure 12.10.1

Serum Phosphate, Paediatric Dialysis Patients - Australia, December 2018-2022

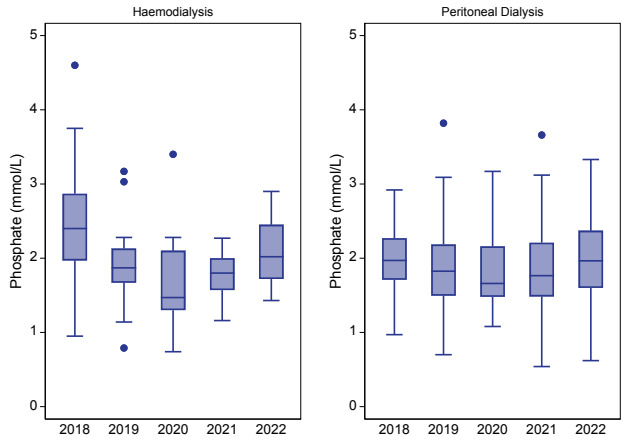
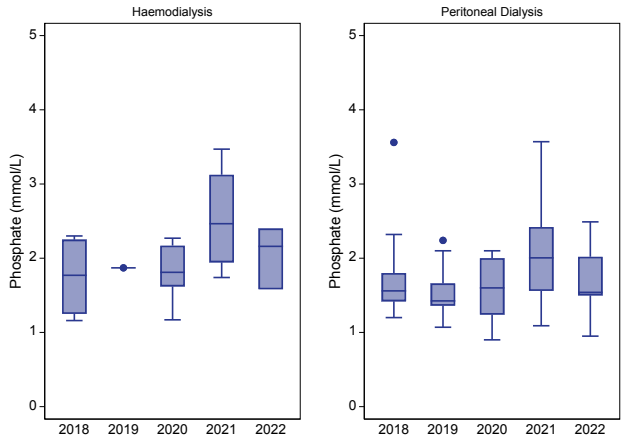


Figure 12.10.2

Serum Phosphate, Paediatric Dialysis Patients - New Zealand, December 2018-2022



BACK TO CONTENTS

Figures 12.11 and 12.12 summarise the recent trends in HD prescription among paediatric patients.

Figure 12.11
Mean Sessions per Week (95% CI) - Among Paediatric Haemodialysis Patients, December 2018-2022

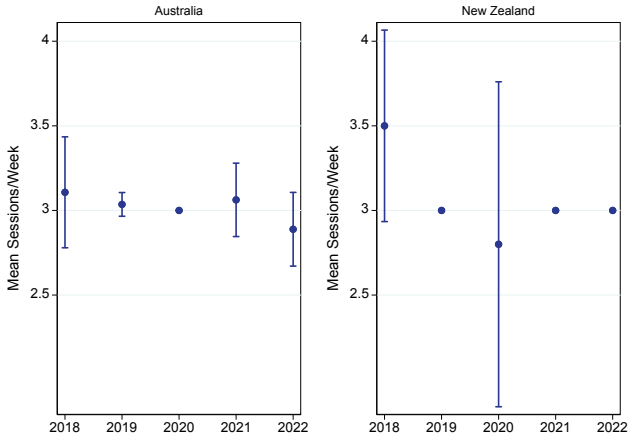
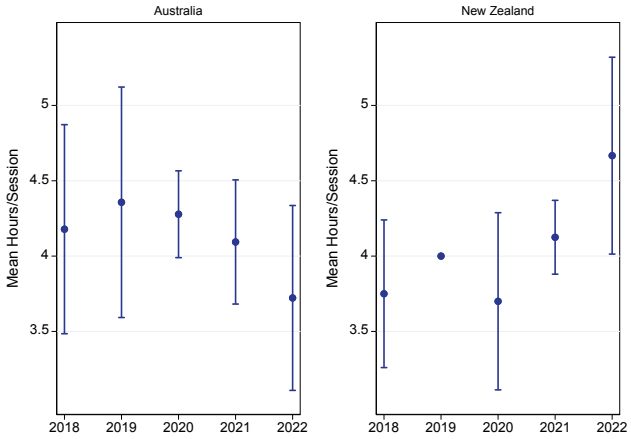
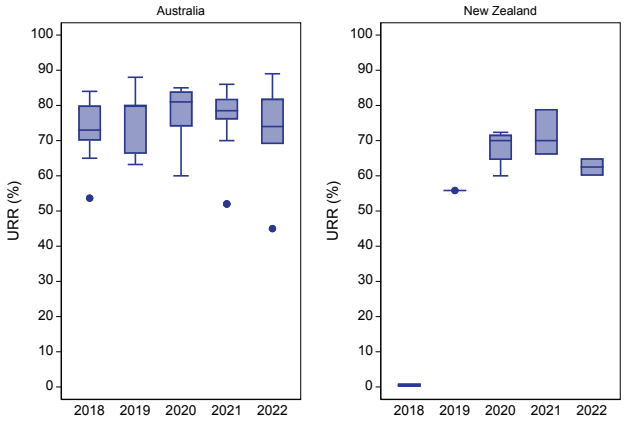


Figure 12.12
Mean Hours per Session (95% CI) - Among Paediatric Haemodialysis Patients, December 2018-2022



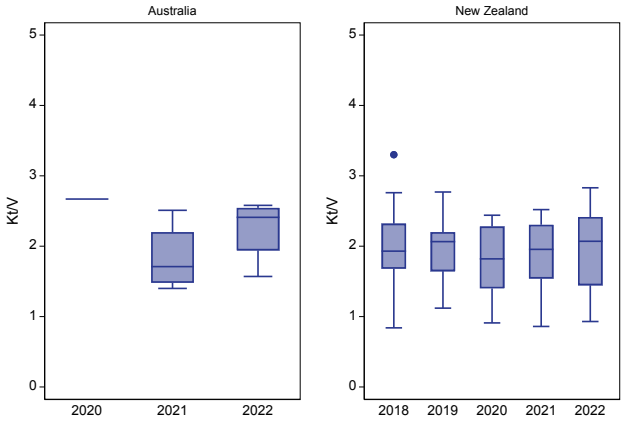
Figures 12.13 and 12.14 show measures of dialysis adequacy for Australia and New Zealand. Note that very few units in Australia report Kt/V for paediatric patients on peritoneal dialysis.

Figure 12.13
Urea Reduction Ratio (Paediatric HD Patients) - December 2018-2022



URR ≥90% excluded as non-physiological

Figure 12.14
Kt/V (Paediatric PD Patients) - December 2018-2022



Kt/V >4 excluded as non-physiological

Table 12.4
Proportion of Prevalent Paediatric Dialysis Patients for whom URR or Kt/V was reported 2018-2022

Country	Modality	2018	2019	2020	2021	2022
Australia	HD	76%	80%	67%	88%	58%
	PD	0%	0%	3%	14%	11%
New Zealand	HD	50%	100%	80%	75%	67%
	PD	100%	89%	73%	80%	80%

BACK TO CONTENTS

VASCULAR ACCESS

Vascular access for haemodialysis is summarised in Figures 12.15 and 12.16. The majority of paediatric patients commence haemodialysis via a central line. In 2022 in Australia, 25% of prevalent paediatric haemodialysis patients were dialysing via a native arteriovenous fistula; this figure was 0% in New Zealand.

Figure 12.15.1
Incident Haemodialysis Access, Paediatric HD Patients - Australia 2018-2022

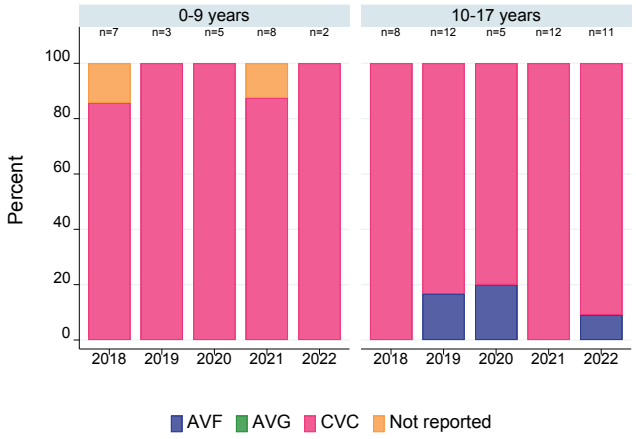


Figure 12.15.2
Incident Haemodialysis Access, Paediatric HD Patients - New Zealand 2018-2022

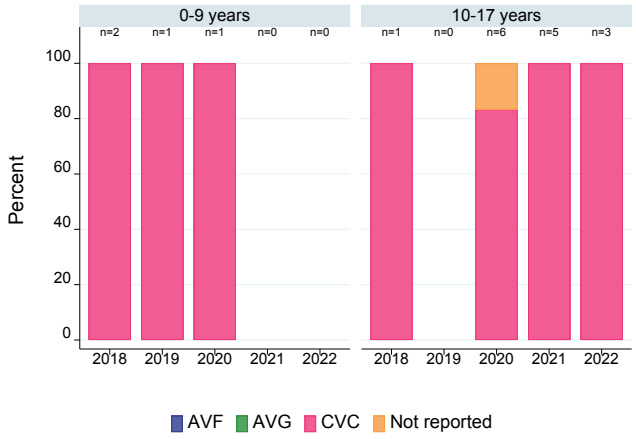


Figure 12.16.1
Prevalent Haemodialysis Access, Paediatric HD Patients - Australia 2018-2022

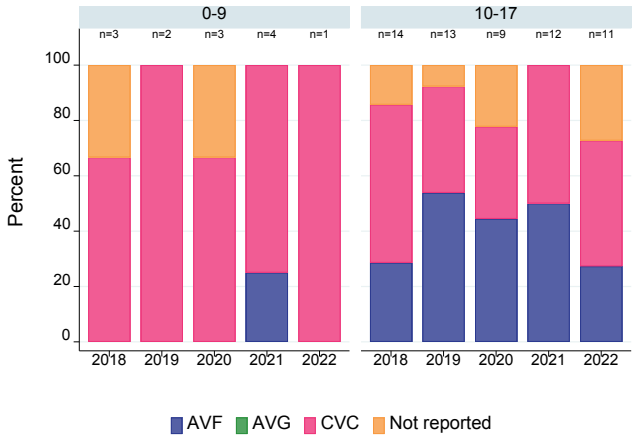
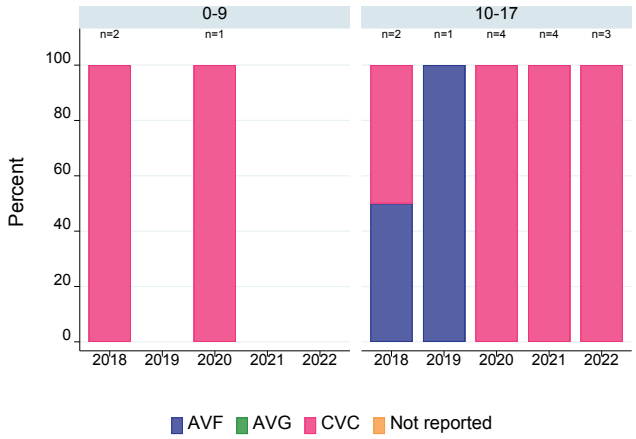


Figure 12.16.2
Prevalent Haemodialysis Access, Paediatric HD Patients - New Zealand 2018-2022



BACK TO CONTENTS

PERITONEAL DIALYSIS

Time on peritoneal dialysis (previously known as technique survival), censored for transplantation, loss to follow-up and recovery of renal function is presented below. Only patients initiating PD within the first 365 days of KRT commencement are included. Patients commencing PD after a transplant are excluded. The numbers available for analysis after the first year drop significantly in each group in both countries, due to transplantation. Of the 228 patients, 55 (24%) received a transplant within one year of commencement of KRT. By two years a total of 105 (46%) of patients had received transplants.

Figure 12.17.1
Time on Peritoneal Dialysis by Age Category Peritoneal Dialysis within 365 days of KRT start - Australia 2016-2022 Censored for Transplant

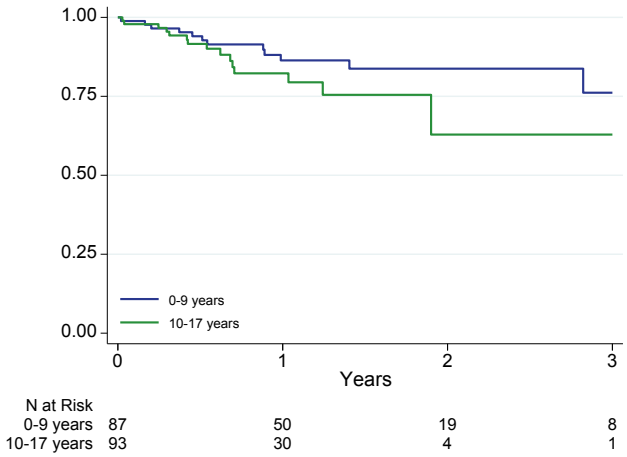
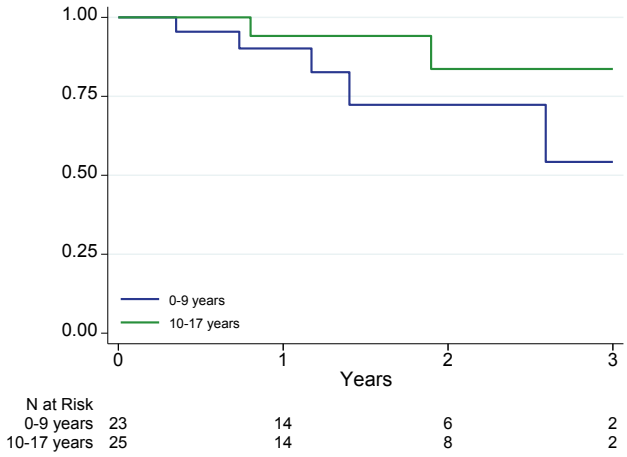


Figure 12.17.2
Time on Peritoneal Dialysis by Age Category Peritoneal Dialysis within 365 days of KRT start - New Zealand 2016-2022 Censored for Transplant



The use of PD solutions is shown in Table 12.5. There is considerably more use of icodextrin in paediatric patients in 2022 in Australia (41%) compared with New Zealand (10%).

Table 12.5
Use of PD Solutions 2019-2022

Solution	Australia				New Zealand			
	2019	2020	2021	2022	2019	2020	2021	2022
	(n = 29)	(n = 35)	(n = 43)	(n = 56)	(n = 18)	(n = 15)	(n = 10)	(n = 10)
Icodextrin	7 (24%)	10 (29%)	13 (30%)	23 (41%)	1 (6%)	2 (13%)	2 (20%)	1 (10%)
Low GDP	15 (52%)	13 (37%)	21 (49%)	17 (30%)	15 (83%)	13 (87%)	8 (80%)	7 (70%)

BACK TO CONTENTS

PERITONITIS

The last few years have seen an improvement in peritonitis rates, as also seen in the adult population (chapter 5).

Figure 12.18
First PD Treatment to First Peritonitis - by Age at First PD Australia and New Zealand 2018-2022

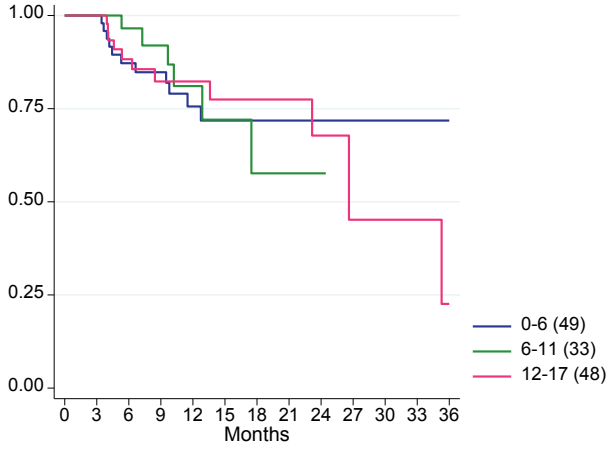
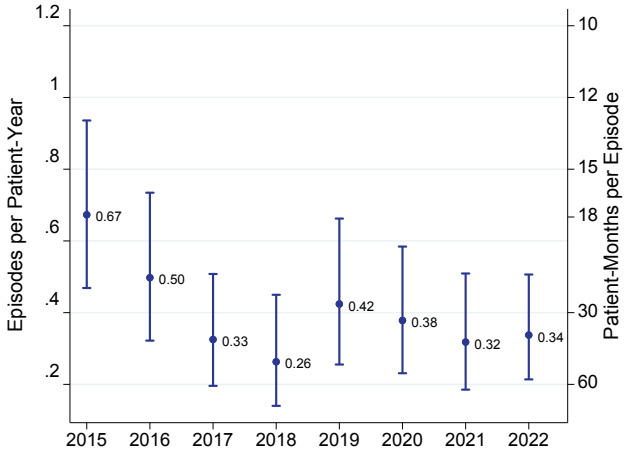


Figure 12.19
Peritonitis rate, Paediatric PD Patients - Australia and New Zealand 2015-2022



BACK TO CONTENTS

REFERENCES

1. Australian Bureau of Statistics, 2022, Quarterly Population Estimates (ERP), by State/Territory, Sex and Age, Jun 2022, viewed 20 Dec 2022, https://www.abs.gov.au/statistics/people/population/national-state-and-territory-population/jun-2022
2. This work is based on/includes Stats NZ's data which are licensed by Stats NZ for re-use under the Creative Commons Attribution 4.0 International licence. Stats NZ, 2022, Estimated Resident Population by Age and Sex (1991+) (Annual-Jun), NZ Infoshare, viewed 20 Dec 2022, http://infoshare.stats.govt.nz/

CHAPTER 12

Paediatric Patients with Kidney Failure Requiring Replacement Therapy