



CHAPTER 12

Paediatric Patients with Kidney Failure Requiring Replacement Therapy

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Executive Summary

The incidence of treated Kidney Failure in patients under 18 years in both Australia and New Zealand fluctuates considerably from year to year, but the overall trend over the past 20 years is stable. The prevalent population of treated EKSD in Australia has increased over this time frame, which is a trend seen across all paediatric and adolescent age groups. No clear trend for prevalence is evident for New Zealand.

For the past 6 years those under 10 years of age were more likely to have initially commenced peritoneal dialysis as their initial Kidney Failure treatment modality, whereas older children were more likely to have commenced haemodialysis. Over this time frame pre-emptive transplant was achieved for 20% of older patients, and 21% of younger patients. Overall prevalence of a functioning transplant for Kidney Failure was 82% at the time of the 2020 survey in Australia and New Zealand.

In 2020, those on peritoneal dialysis or with a functioning transplant were more likely to attend unmodified schooling compared with those on haemodialysis. Body mass index was evaluated for the 2020 survey using age-adjusted z-scores, which demonstrates a higher prevalence of obesity in the young Australian transplant population versus the dialysis treated group.

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

There has been no clear change in haemoglobin, iron, calcium or phosphate levels at the time of 2020 survey for paediatric dialysis patients compared the prior 5 years. The mean number of haemodialysis sessions per week and hours of dialysis is similar across Australia and New Zealand, and also shows no clear change for 2020. The majority of paediatric patients commence haemodialysis via a central line. In 2020 in Australia, 27% of prevalent paediatric haemodialysis patients were dialysing via a native arteriovenous fistula; this figure was 0% in New Zealand.

In 2016-2020, by 9 months of commencing PD, approximately a quarter of patients had experienced peritonitis, which does not appear to be modified by age. A trend to a reduction in peritonitis rates is seen in the paediatric age group. A mean of 0.38 peritonitis episodes per patient year of PD occurred in 2020.

Suggested Citation

ANZDATA Registry. 44th Report, Chapter 12: Paediatric Patients with Kidney Failure Requiring Kidney Replacement Therapy. Australia and New Zealand Dialysis and Transplant Registry, Adelaide, Australia. 2022. 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 renal replacement therapy (KRT) for incident data, or at the time of the annual survey (31 December 2020) 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.

Figure 12.1 shows the annual incidence of KRT for kidney failure per million age matched population. There is no clear long-term trend 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

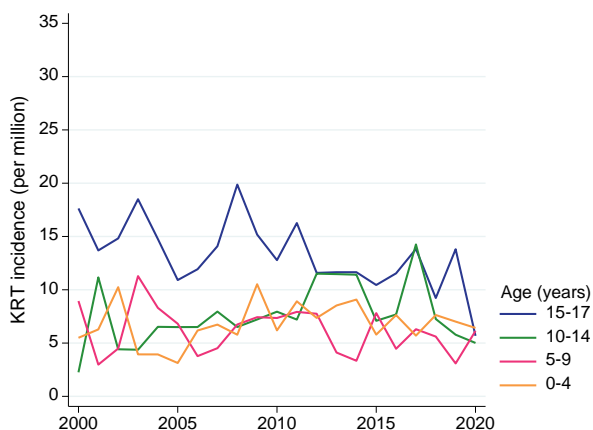
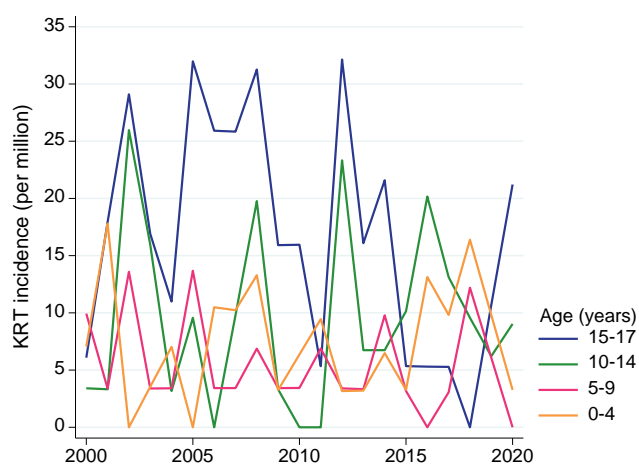


Figure 12.1.2 - Incidence of KRT - Age 0-17 Years - New Zealand



In Australia the prevalent numbers of treated Kidney Failure have gradually increased across all age groups (figure 12.2); the trends are less clear in New Zealand.

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

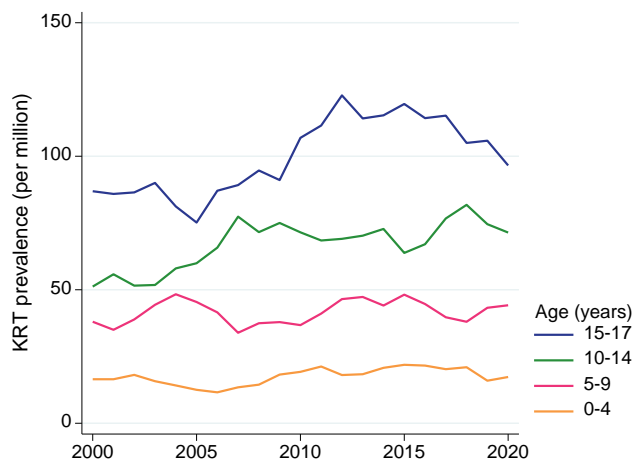
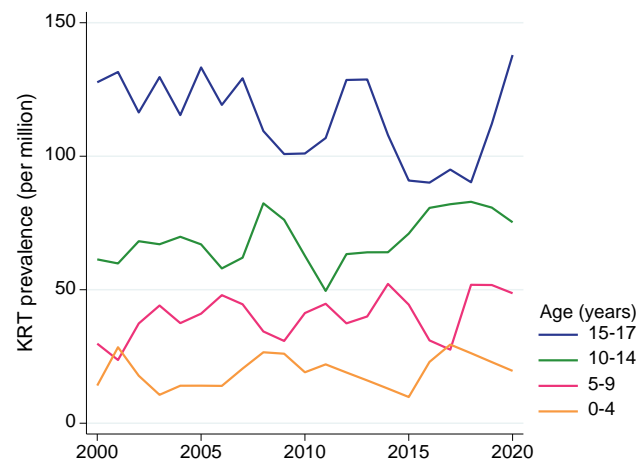


Figure 12.2.2 - Prevalence of KRT - Age 0-17 Years - New Zealand



Primary Kidney Disease

Collectively, congenital abnormalities of the kidney and urinary tract (CAKUT) are the predominant cause of Kidney Failure in younger children, with glomerulonephritis being the most common cause in adolescents.

Table 12.1 Primary Kidney Disease, Incident Patients Australia and New Zealand 2015-2020

Primary renal disease	0-4	5-10	10-14	15-17	Total
GN	4 (5%)	14 (19%)	17 (17%)	19 (26%)	54 (17%)
- FSGS	2 (2%)	11 (15%)	7 (7%)	8 (11%)	28 (9%)
Familial GN	1 (1%)	-	2 (2%)	1 (1%)	4 (1%)
Reflux Nephropathy	-	2 (3%)	7 (7%)	2 (3%)	11 (3%)
Polycystic Kidney Disease	5 (6%)	4 (6%)	4 (4%)	1 (1%)	14 (4%)
Medullary Cystic Disease	3 (4%)	6 (8%)	6 (6%)	2 (3%)	17 (5%)
Posterior Urethral Valve	12 (15%)	7 (10%)	6 (6%)	4 (5%)	29 (9%)
Haemolytic Uraemic Syndrome	-	-	4 (4%)	-	4 (1%)
Hypoplasia/Dysplasia	19 (23%)	9 (13%)	19 (19%)	9 (12%)	56 (17%)
Diabetes	-	-	-	1 (1%)	1 (0%)
Cortical Necrosis	-	1 (1%)	3 (3%)	-	4 (1%)
Interstitial Nephritis	-	1 (1%)	-	1 (1%)	2 (1%)
Cystinosis	-	-	2 (2%)	2 (3%)	4 (1%)
Uncertain	3 (4%)	-	4 (4%)	5 (7%)	12 (4%)
Misc/Other	32 (39%)	16 (22%)	16 (16%)	17 (23%)	81 (25%)
Not reported	1 (1%)	1 (1%)	1 (1%)	1 (1%)	4 (1%)
Total	82	72	98	73	297

Modality of Treatment

The modality of the first renal 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	2015	2016	2017	2018	2019	2020	Total
0-9 Years	23	23	23	30	21	21	141
HD	5 (22%)	5 (22%)	9 (39%)	7 (23%)	3 (14%)	4 (19%)	33 (23%)
PD	11 (48%)	15 (65%)	11 (48%)	14 (47%)	14 (67%)	14 (67%)	79 (56%)
Transplant	7 (30%)	3 (13%)	3 (13%)	9 (30%)	4 (19%)	3 (14%)	29 (21%)
10-17 Years	23	28	38	22	25	20	156
HD	6 (26%)	14 (50%)	15 (39%)	6 (27%)	9 (36%)	5 (25%)	55 (35%)
PD	11 (48%)	11 (39%)	16 (42%)	10 (45%)	12 (48%)	10 (50%)	70 (45%)
Transplant	6 (26%)	3 (11%)	7 (18%)	6 (27%)	4 (16%)	5 (25%)	31 (20%)
Total	46	51	61	52	46	41	297

For prevalent patients (table 12.3), a very different pattern is seen, with the great majority (82% in 2020) 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	2015	2016	2017	2018	2019	2020
HD	19 (5%)	27 (8%)	22 (6%)	21 (6%)	15 (4%)	16 (4%)
PD	42 (12%)	53 (15%)	54 (15%)	46 (12%)	46 (12%)	50 (13%)
Transplant	295 (83%)	277 (78%)	293 (79%)	310 (82%)	313 (84%)	305 (82%)
Total	356	357	369	377	374	371

Paediatric Assessment

The paediatric survey is collected on all children commencing renal 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.

Overall, more children on PD and with functioning transplants attended unmodified school compared with children on haemodialysis (figure 12.3). Note that multiple categories of paediatric assessment have been collapsed into single groups for reporting purposes. and include multiple categories (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 2020

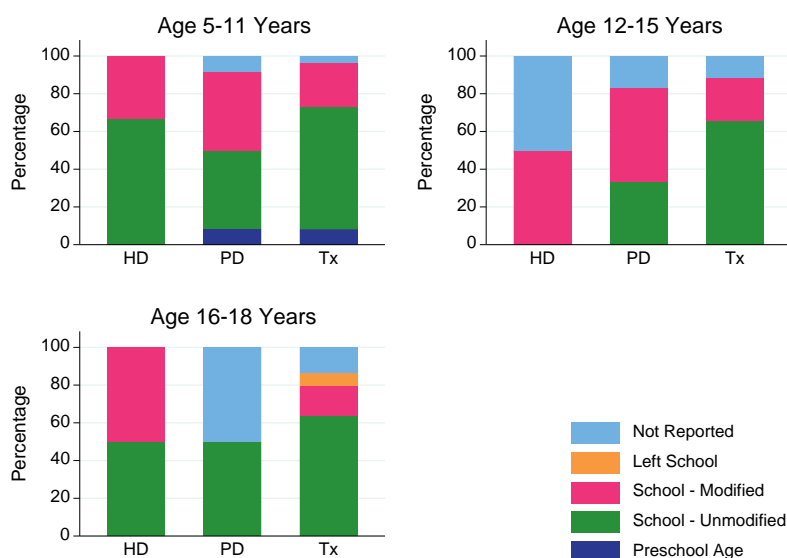
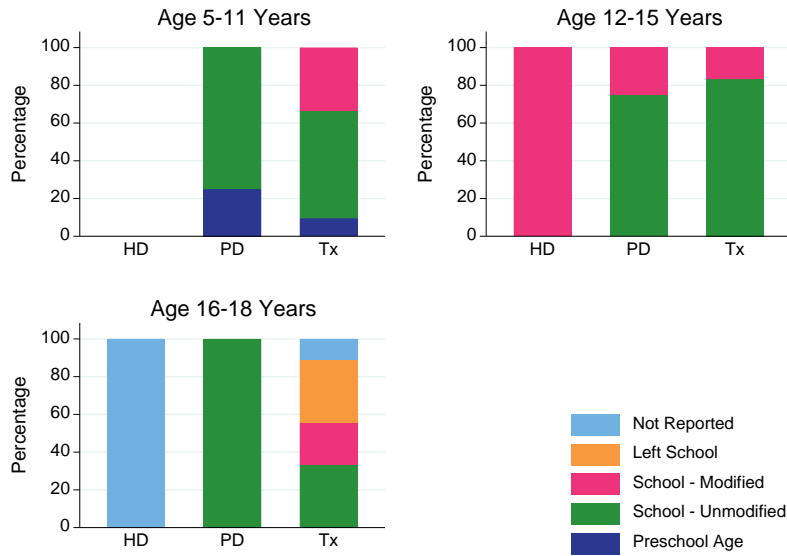


Figure 12.3.2 - Educational Participation by Age Group and Treatment Modality - New Zealand 2020



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 2020

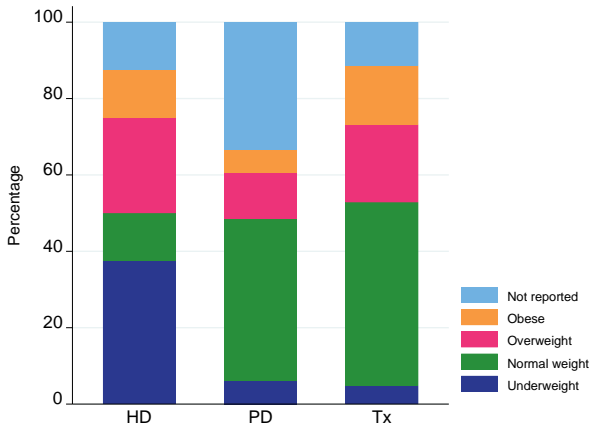
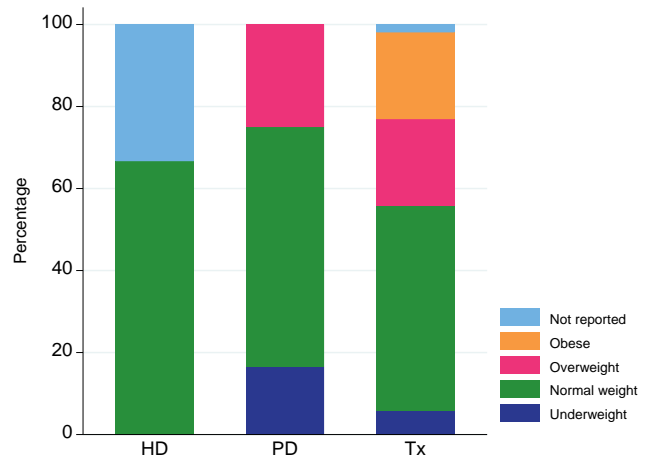


Figure 12.4.2 - Body Mass Index of Prevalent Paediatric Patients by Treatment Modality - New Zealand 2020



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 2016-2020

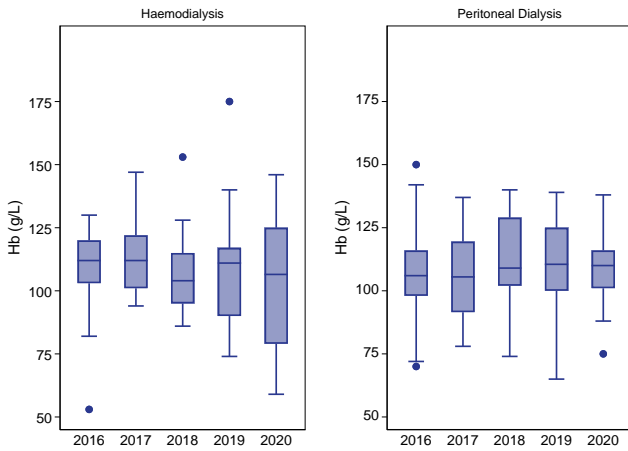


Figure 12.5.2 - Haemoglobin, Paediatric Dialysis Patients - New Zealand, December 2016-2020

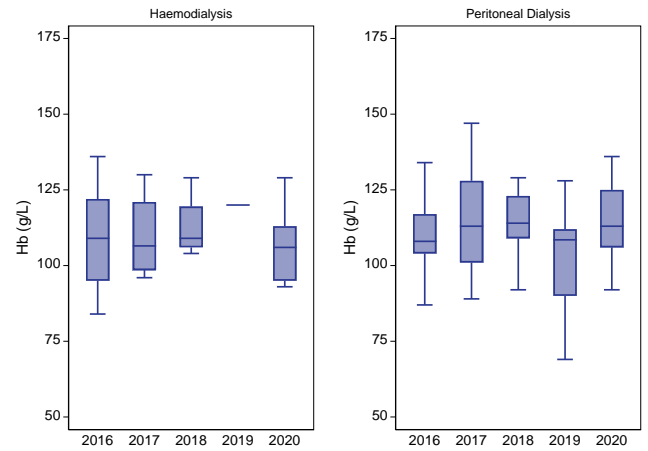


Figure 12.6 - Use of Erythropoietic Agents in Paediatric Dialysis Patients (95% CI) - December 2016-2020

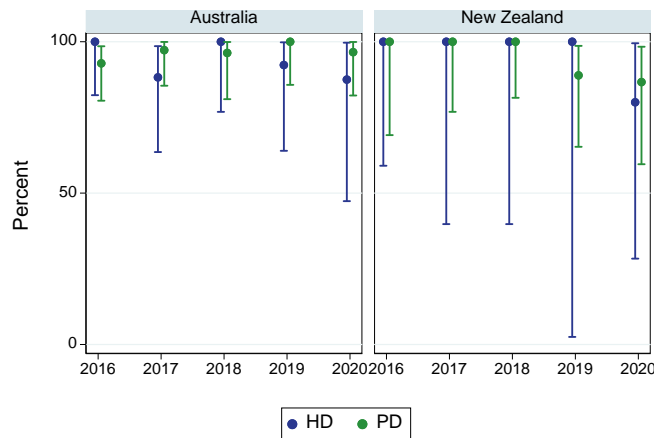


Figure 12.7.1 - Ferritin, Paediatric Dialysis Patients - Australia, December 2016-2020

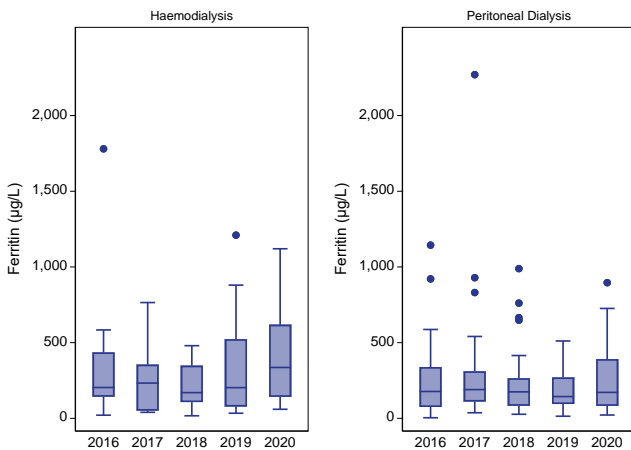


Figure 12.7.2 - Ferritin, Paediatric Dialysis Patients - New Zealand, December 2016-2020

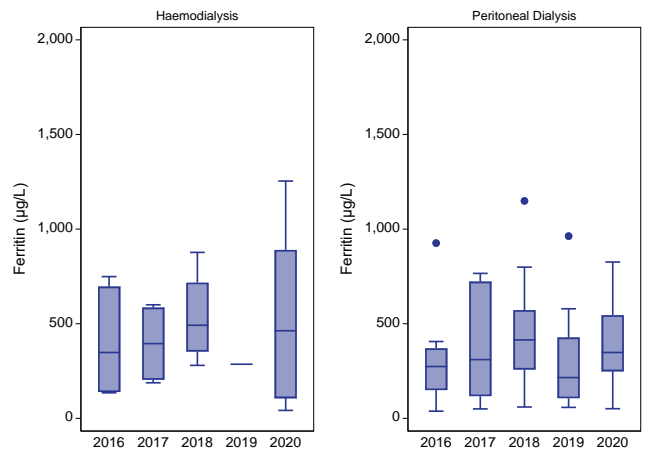


Figure 12.8.1 - Transferrin Saturation, Paediatric Dialysis Patients - Australia, December 2016-2020

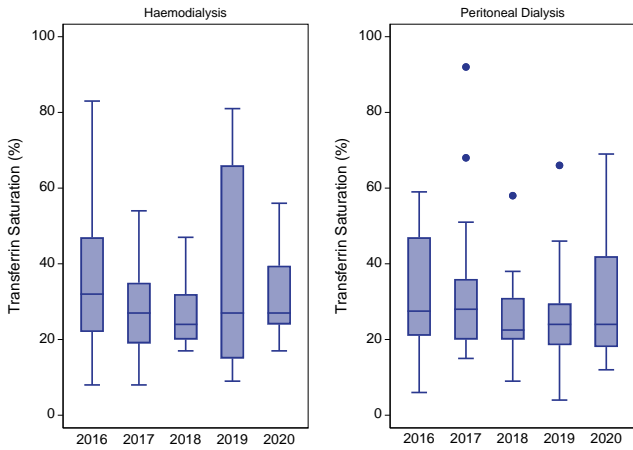


Figure 12.8.2 - Transferrin Saturation, Paediatric Dialysis Patients - New Zealand, December 2016-2020

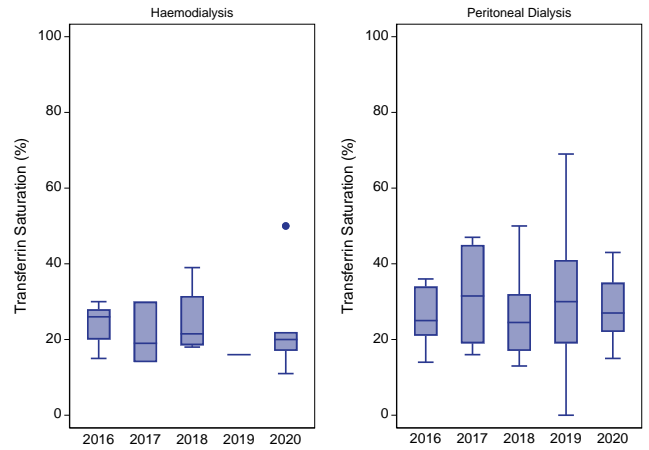


Figure 12.9.1 - Serum Calcium, Paediatric Dialysis Patients - Australia, December 2016-2020

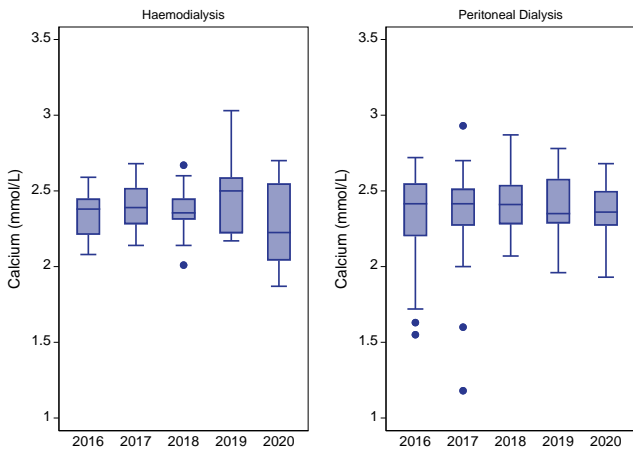


Figure 12.9.2 - Serum Calcium, Paediatric Dialysis Patients - New Zealand, December 2016-2020

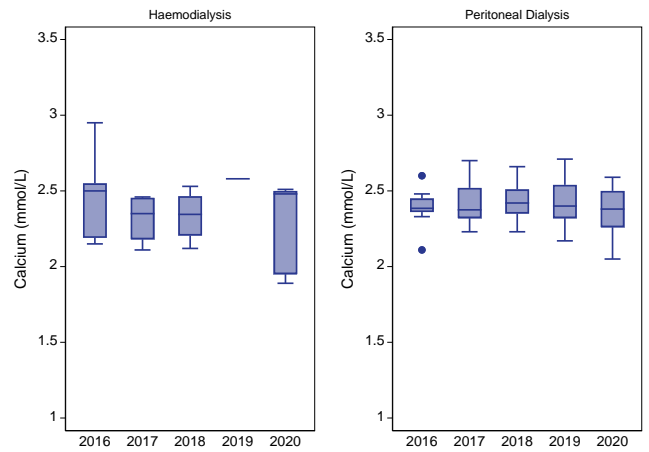


Figure 12.10.1 - Serum Phosphate, Paediatric Dialysis Patients - Australia, December 2016-2020

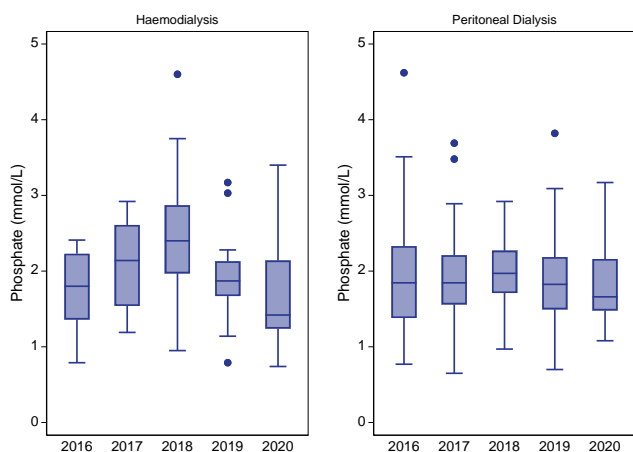
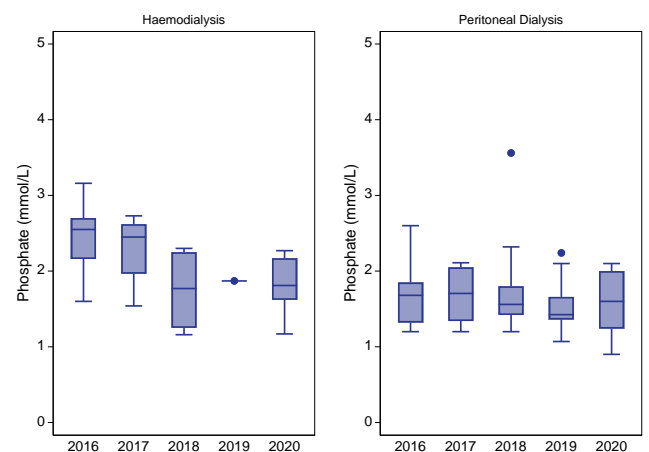


Figure 12.10.2 - Serum Phosphate, Paediatric Dialysis Patients - New Zealand, December 2016-2020



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 2016-2020

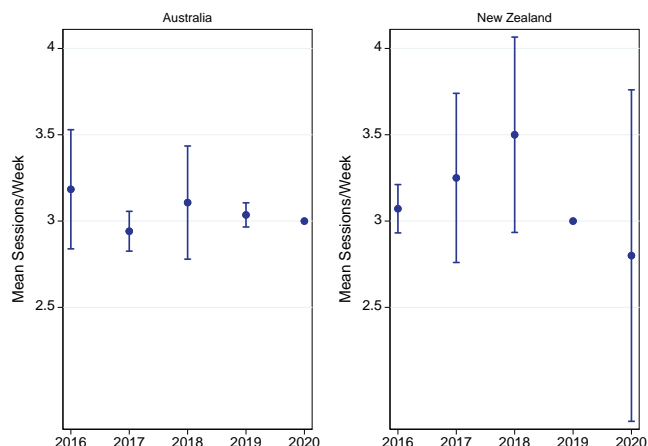
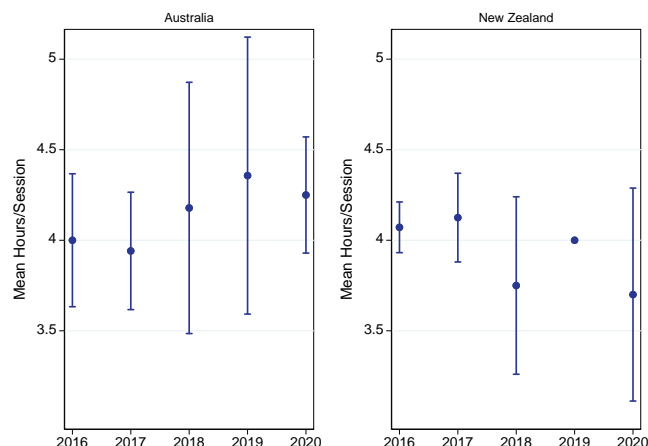
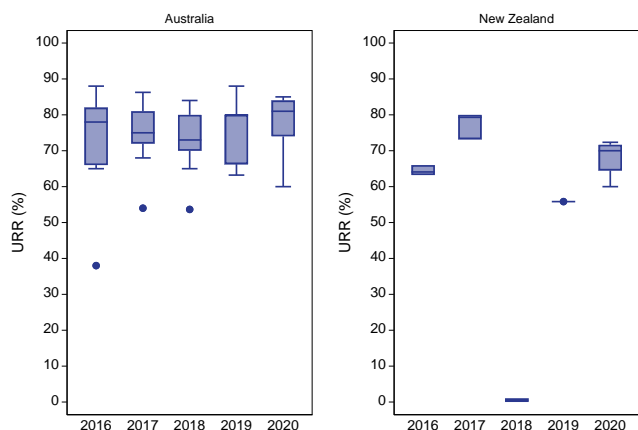


Figure 12.12 - Mean Hours per Session (95% CI) - Among Paediatric Haemodialysis Patients December 2016-2020



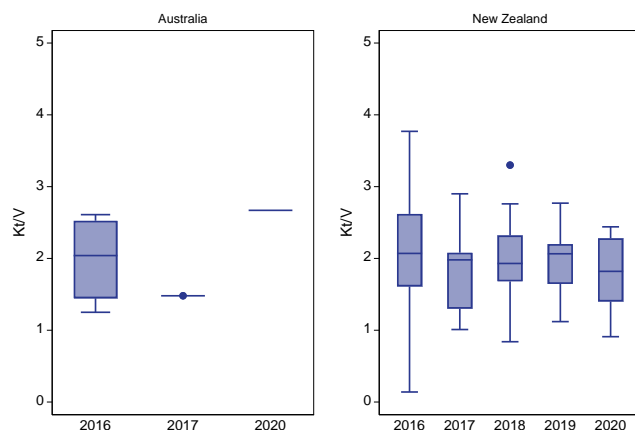
Figures 12.13 and 12.14 show measures of dialysis adequacy for Australia and New Zealand. Note that very few units in Australia report Kt/V for paediatric patients on peritoneal dialysis.

Figure 12.13 - Urea Reduction Ratio (Paediatric HD Patients) – December 2016-2020



URR ≥90% excluded as non-physiological

Figure 12.14 - Kt/V (Paediatric PD Patients) December 2016-2020



Kt/V >4 excluded as non-physiological

Table 12.4 Proportion of Prevalent Paediatric Dialysis Patients for whom URR or Kt/V was reported 2016-2020

Country	Modality	2016	2017	2018	2019	2020
Australia	HD	70%	83%	76%	86%	73%
Australia	PD	9%	3%	0%	0%	3%
New Zealand	HD	43%	75%	50%	100%	80%
New Zealand	PD	90%	87%	100%	89%	73%

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 2020 in Australia, 27% 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 2016-2020

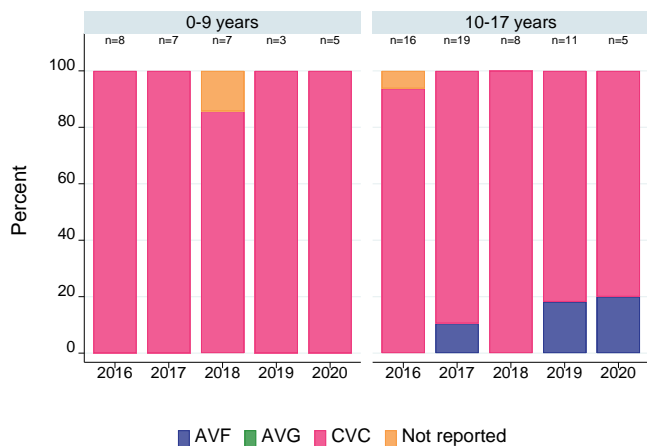


Figure 12.15.2 - Incident Haemodialysis Access, Paediatric HD Patients - New Zealand 2016-2020

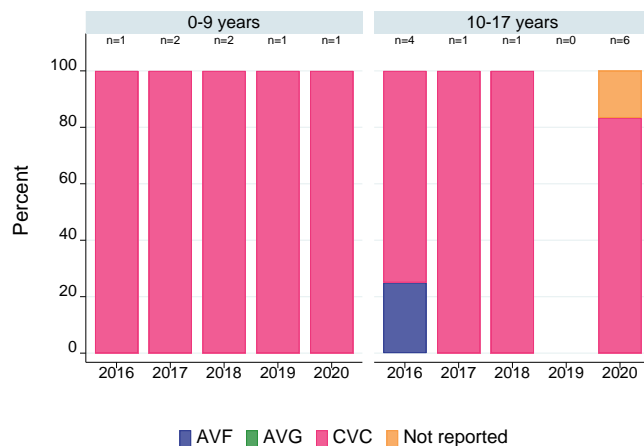


Figure 12.16.1 - Prevalent Haemodialysis Access, Paediatric HD Patients - Australia 2016-2020

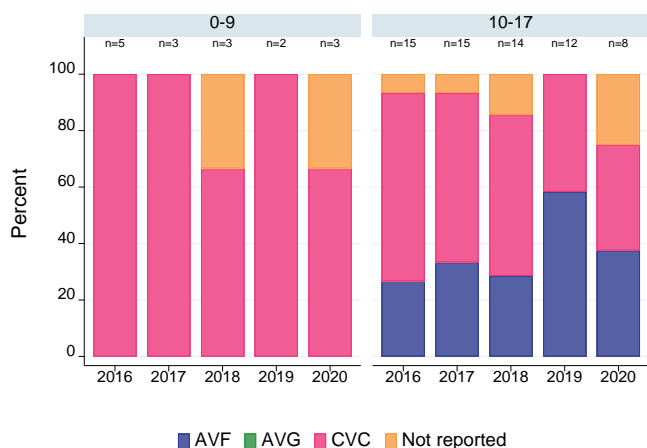
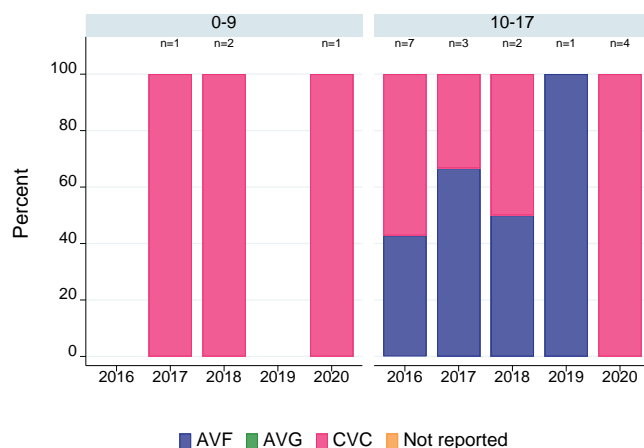


Figure 12.16.2 - Prevalent Haemodialysis Access, Paediatric HD Patients - New Zealand 2016-2020



Peritoneal Dialysis

PD 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 217 patients, 62 (29%) received a transplant within one year of commencement of KRT. By two years a total of 109 (50%) of patients had received transplants.

Figure 12.17.1 - PD Technique Survival by Age Category Peritoneal Dialysis within 365 days of KRT start - Australia 2014-2020 Censored for Transplant

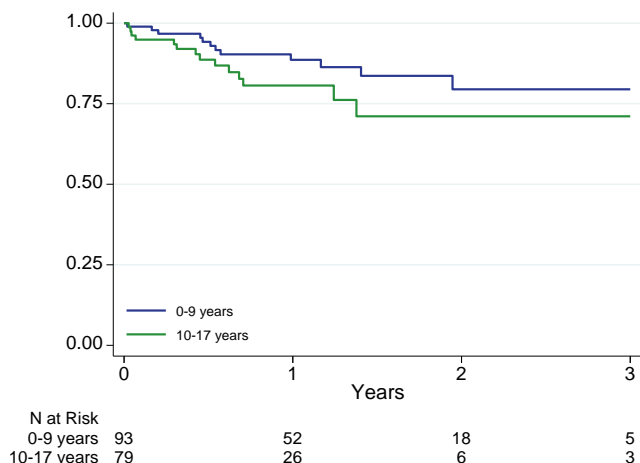
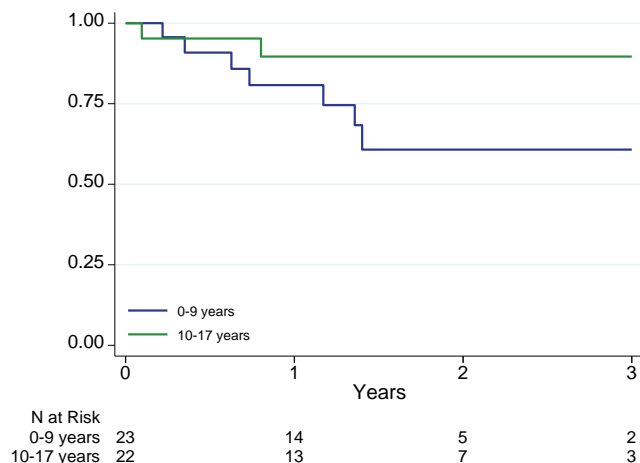


Figure 12.17.2 - PD Technique Survival by Age Category Peritoneal Dialysis within 365 days of KRT start - New Zealand 2014-2020 Censored for Transplant



The use of PD solutions is shown in Table 12.5. There is considerably more use of icodextrin in paediatric patients in 2020 in Australia (29%) compared with New Zealand (13%).

Table 12.5 Use of PD Solutions 2017-2020

Solution	Australia				New Zealand			
	2017	2018	2019	2020	2017	2018	2019	2020
	(n = 39)	(n = 28)	(n = 28)	(n = 35)	(n = 15)	(n = 18)	(n = 18)	(n = 15)
Icodextrin	9 (23%)	11 (39%)	7 (25%)	10 (29%)	1 (7%)	3 (17%)	1 (6%)	2 (13%)
Low GDP	14 (36%)	12 (43%)	15 (54%)	13 (37%)	13 (87%)	17 (94%)	15 (83%)	13 (87%)

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 2016-2020

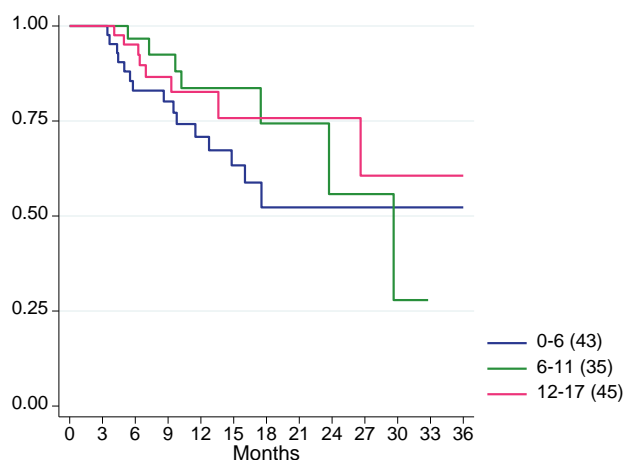


Figure 12.19 - Peritonitis rate, Paediatric PD Patients - Australia and New Zealand 2013-2020

