CHAPTER 12

Paediatric Patients with End Stage Kidney Disease Requiring Renal Replacement Therapy

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

Contents

Executive Summary

The incidence of treated ESKD 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 ESKD treatment modality, whereas older children were more likely to have commenced haemodialysis. Over this time frame pre-emptive transplant was achieved for 21% of older patients, and 17% of younger patients. Overall prevalence of a functioning transplant for ESKD was 82% at the time of the 2018 survey in Australia and New Zealand.

In 2018, 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 2018 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 ESKD, 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 2018 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 2018. The majority of paediatric patients commence haemodialysis via a central line. In 2018 in Australia, 22% of prevalent paediatric haemodialysis patients were dialysing via a native arteriovenous fistula; this figure was 33% in New Zealand.

In 2014-2018, 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 0.24 peritonitis episodes per patient year of PD occurred in 2018.

Suggested citation

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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 (RRT) for incident data, or at the time of the annual survey (31 December 2018) 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 RRT for end stage kidney disease (ESKD) per million age matched population. There is no clear long-term trend in the incidence of RRT 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 RRT - Age 0-17 Years – Australia

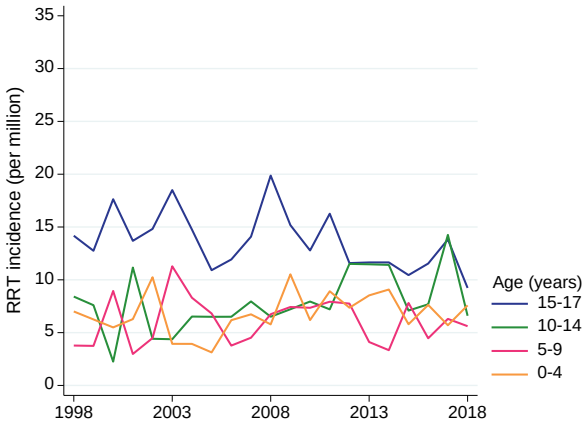
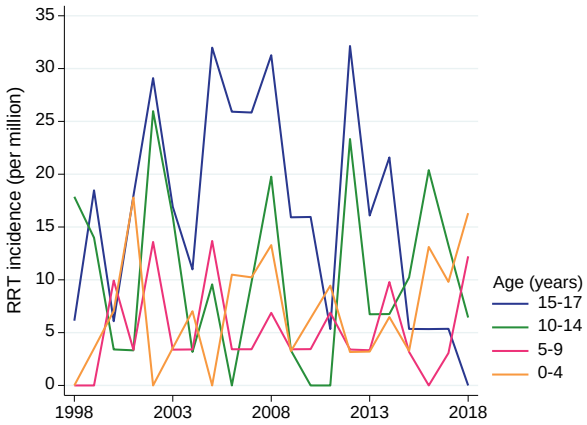


Figure 12.1.2 - Incidence of RRT - Age 0-17 Years – New Zealand



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

Figure 12.2.1 - Prevalence of RRT - Age 0-17 Years – Australia

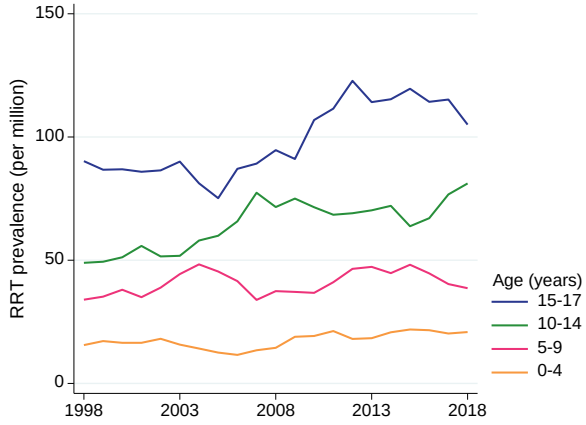
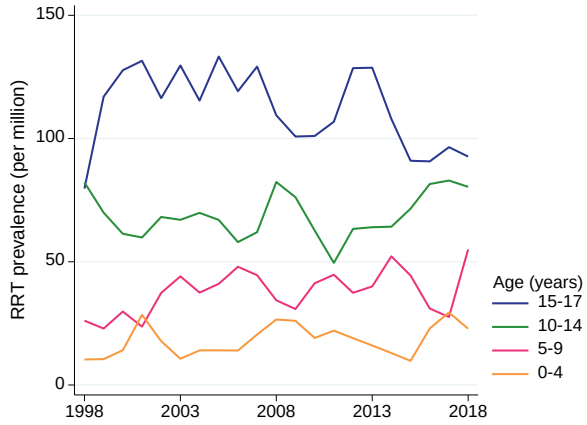


Figure 12.2.2 - Prevalence of RRT - Age 0-17 Years - New Zealand



Primary Renal Disease

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

Table 12.1 Primary Renal Disease, Incident Patients Australia and New Zealand 2013-2018

Primary renal disease	0-4	5-10	10-14	15-17	Total
GN	4 (5%)	12 (18%)	21 (19%)	24 (31%)	**61 (18%)**
- FSGS	2 (2%)	9 (13%)	9 (8%)	8 (10%)	**28 (8%)**
Familial GN	3 (3%)	-	1 (1%)	1 (1%)	**5 (1%)**
Reflux Nephropathy	-	4 (6%)	9 (8%)	2 (3%)	**15 (4%)**
Polycystic Kidney Disease	7 (8%)	3 (4%)	3 (3%)	2 (3%)	**15 (4%)**
Medullary Cystic Disease	1 (1%)	6 (9%)	11 (10%)	2 (3%)	**20 (6%)**
Posterior Urethral Valve	11 (13%)	5 (7%)	7 (6%)	4 (5%)	**27 (8%)**
Haemolytic Uraemic Syndrome	-	-	4 (4%)	1 (1%)	**5 (1%)**
Hypoplasia/Dysplasia	19 (22%)	10 (15%)	24 (21%)	6 (8%)	**59 (17%)**
Diabetes	-	-	-	2 (3%)	**2 (1%)**
Cortical Necrosis	-	1 (1%)	2 (2%)	1 (1%)	**4 (1%)**
Interstitial Nephritis	-	-	-	1 (1%)	**1 (0%)**
Cystinosis	-	1 (1%)	1 (1%)	1 (1%)	**3 (1%)**
Uncertain	2 (2%)	-	3 (3%)	4 (5%)	**9 (3%)**
Misc/Other	38 (44%)	15 (22%)	17 (15%)	17 (22%)	**87 (25%)**
Not reported	-	2 (3%)	-	1 (1%)	**3 (1%)**
Total	**87**	**68**	**112**	**77**	**316**

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 Renal Replacement Therapy by Year of First Treatment, Australia and New Zealand

Age group	2013	2014	2015	2016	2017	2018	Total
0-9 Years	**21**	**24**	**23**	**23**	**23**	**30**	**144**
HD	5 (24%)	6 (25%)	5 (22%)	5 (22%)	9 (39%)	7 (23%)	**37 (26%)**
PD	14 (67%)	17 (71%)	11 (48%)	15 (65%)	11 (48%)	14 (47%)	**82 (57%)**
Transplant	2 (10%)	1 (4%)	7 (30%)	3 (13%)	3 (13%)	9 (30%)	**25 (17%)**
10-17 Years	**31**	**32**	**23**	**28**	**38**	**20**	**172**
HD	13 (42%)	10 (31%)	6 (26%)	14 (50%)	15 (39%)	5 (25%)	**63 (37%)**
PD	12 (39%)	14 (44%)	11 (48%)	11 (39%)	16 (42%)	9 (45%)	**73 (42%)**
Transplant	6 (19%)	8 (25%)	6 (26%)	3 (11%)	7 (18%)	6 (30%)	**36 (21%)**
Total	**52**	**56**	**46**	**51**	**61**	**50**	**316**

For prevalent patients (table 12.3), a very different pattern is seen, with the great majority (82% in 2018) 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	2013	2014	2015	2016	2017	2018
HD	27 (8%)	21 (6%)	19 (5%)	27 (8%)	23 (6%)	21 (6%)
PD	47 (13%)	48 (13%)	42 (12%)	53 (15%)	54 (15%)	45 (12%)
Transplant	279 (79%)	289 (81%)	295 (83%)	277 (78%)	293 (79%)	310 (82%)
Total	**353**	**358**	**356**	**357**	**370**	**376**

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 RRT 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 a single group of 'School - Modified' for reporting purposes; see the survey form for details: https://www.anzdata.org.au/wp-content/uploads/2016/10/8PaediatricForm2017.pdf

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 12.4). New Zealand data should be interpreted with caution due to low numbers of patients.

Figure 12.3.1 - Paediatric Assessment by Age Group and Treatment Modality - Australia 2018

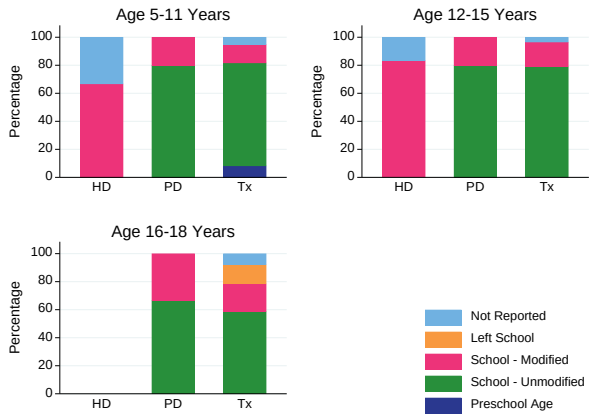


Figure 12.3.2 - Paediatric Assessment by Age Group and Treatment Modality - New Zealand 2018

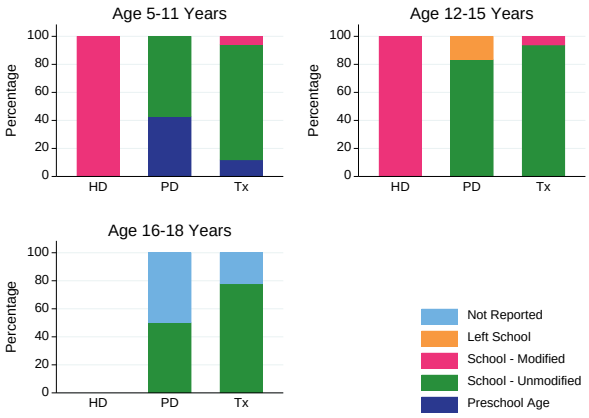


Figure 12.4.1 - Body Mass Index of Prevalent Paediatric Patients by Treatment Modality - Australia 2018

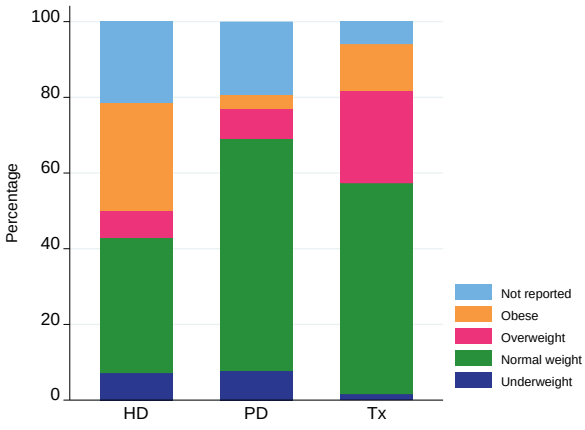
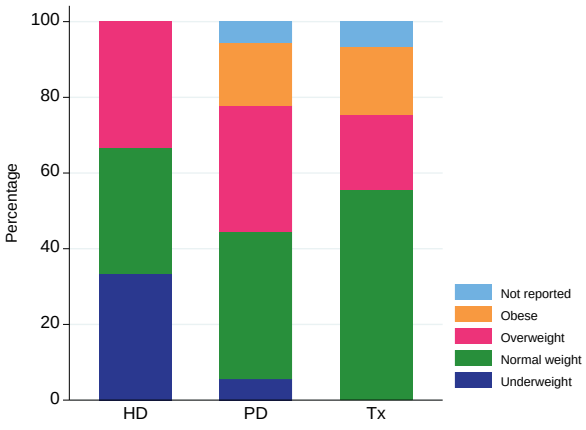


Figure 12.4.2 - Body Mass Index of Prevalent Paediatric Patients by Treatment Modality - New Zealand 2018



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, December 2014-2018 – Australia

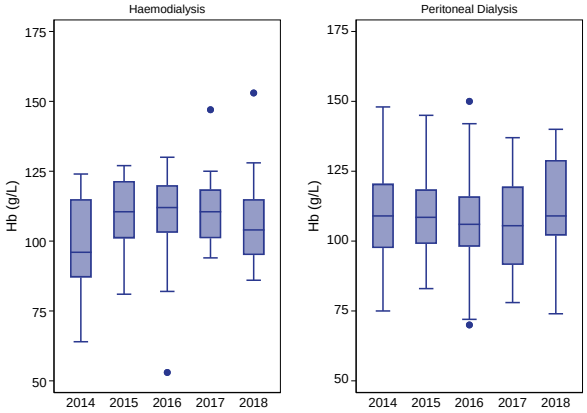


Figure 12.5.2 - Haemoglobin, December 2014-2018 - New Zealand

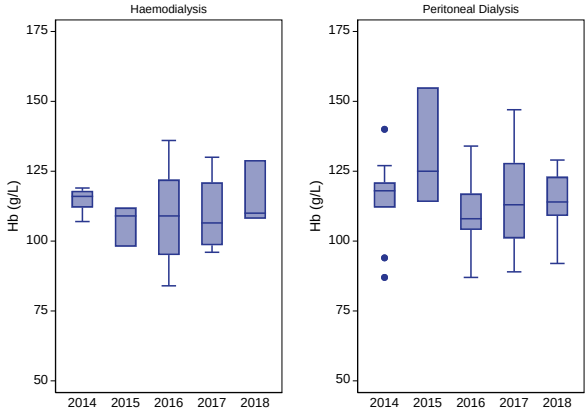


Figure 12.6 - Use of Erythropoietic Agents (95% CI) - December 2014-2018

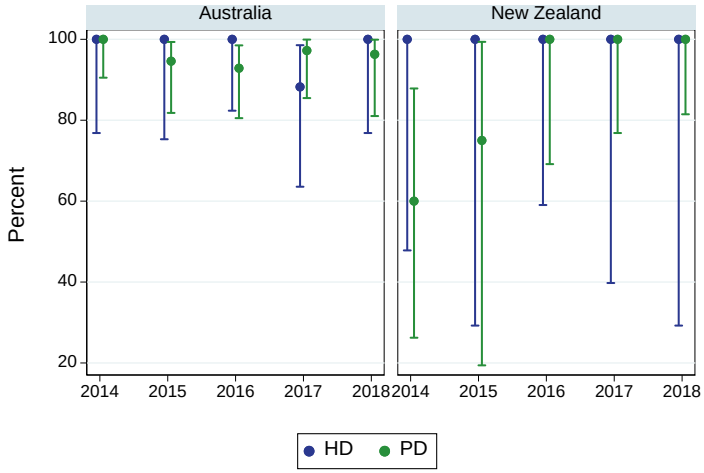


Figure 12.7.1 - Ferritin, December 2014-2018 – Australia

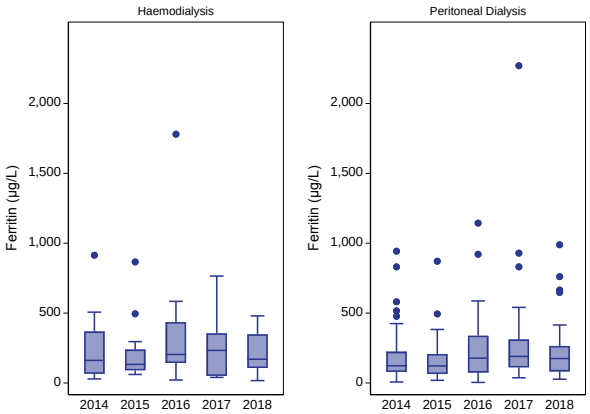


Figure 12.7.2 - Ferritin, December 2014-2018 - New Zealand

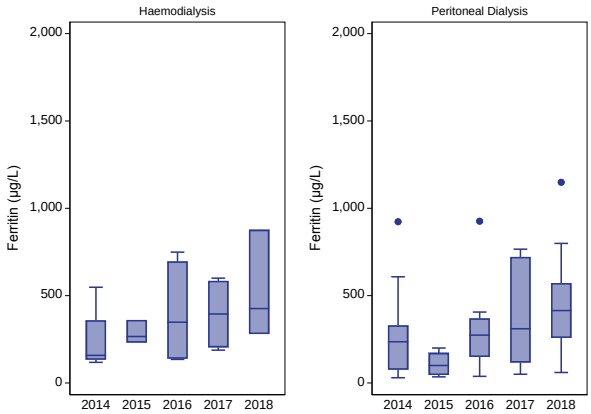


Figure 12.8.1 - Transferrin Saturation, December 2014-2018 - Australia

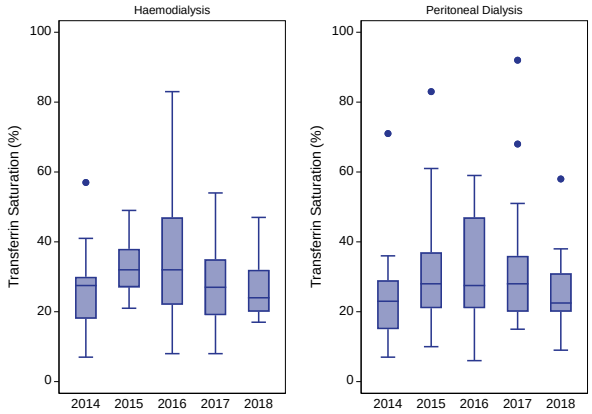


Figure 12.8.2 - Transferrin Saturation, December 2014-2018 - New Zealand

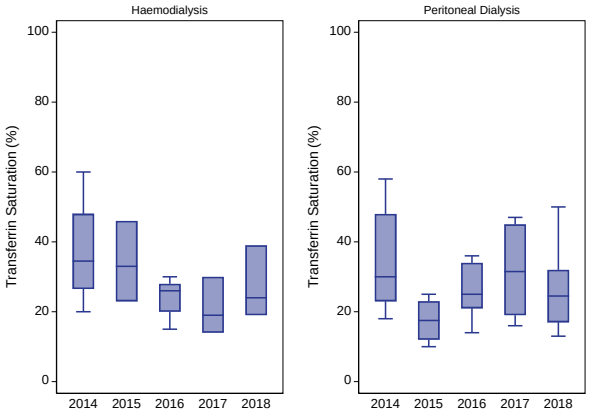


Figure 12.9.1 - Serum Calcium, December 2014-2018 – Australia

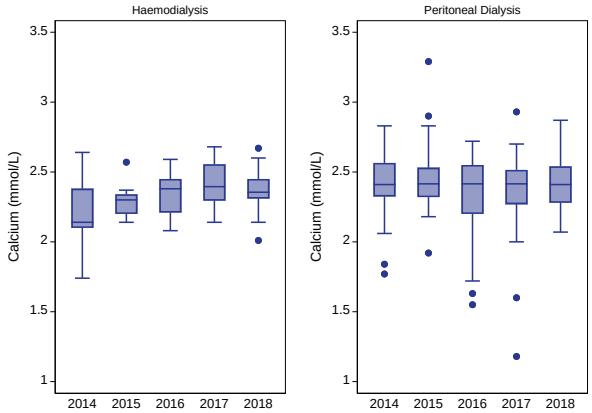


Figure 12.9.2 - Serum Calcium, December 2014-2018 – New Zealand

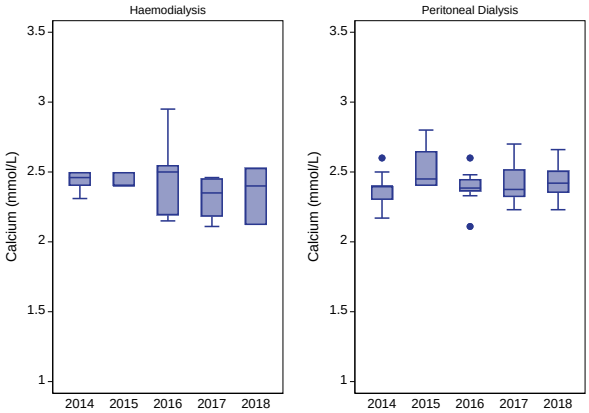


Figure 12.10.1 - Serum Phosphate, December 2014-2018 – Australia

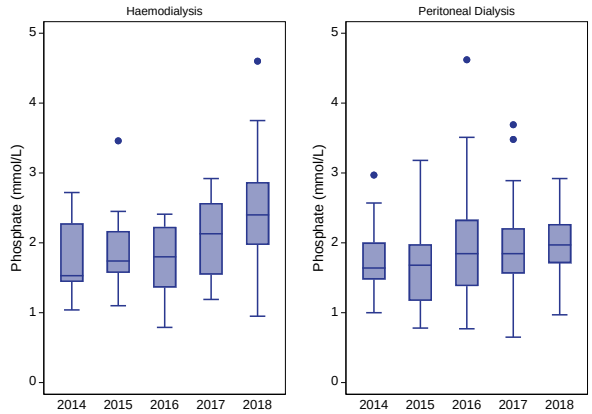
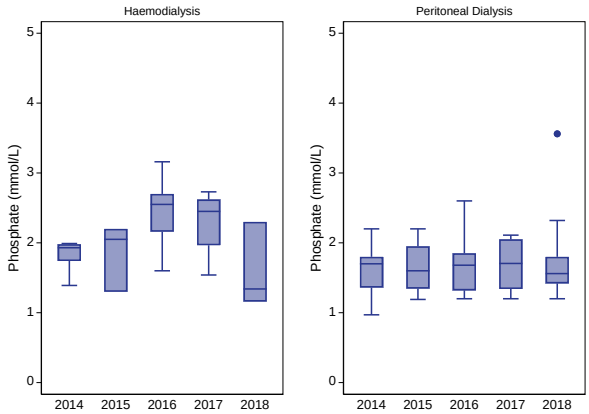


Figure 12.10.2 - Serum Phosphate, December 2014-2018 – New Zealand



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 Haemodialysis Patients December 2014-2018

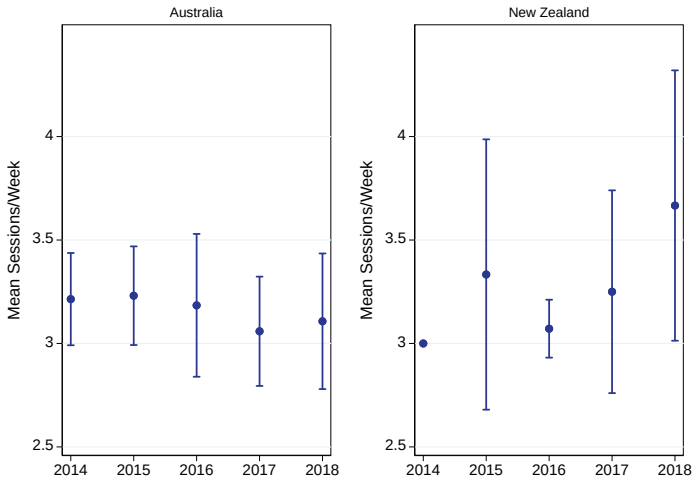
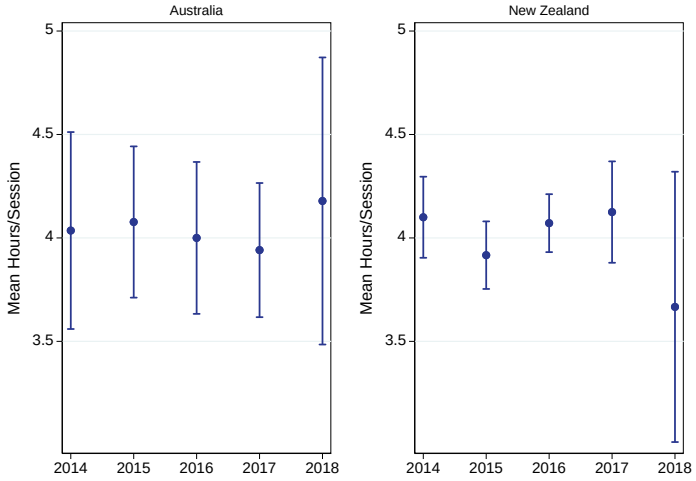
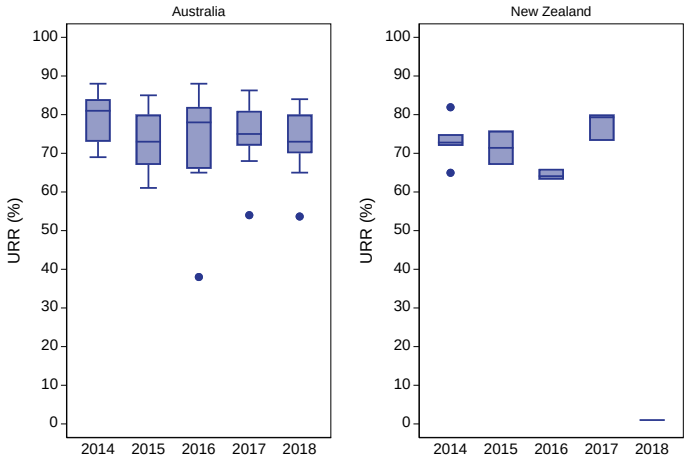


Figure 12.12 - Mean Hours per Session (95% CI) - Among Haemodialysis Patients December 2014-2018



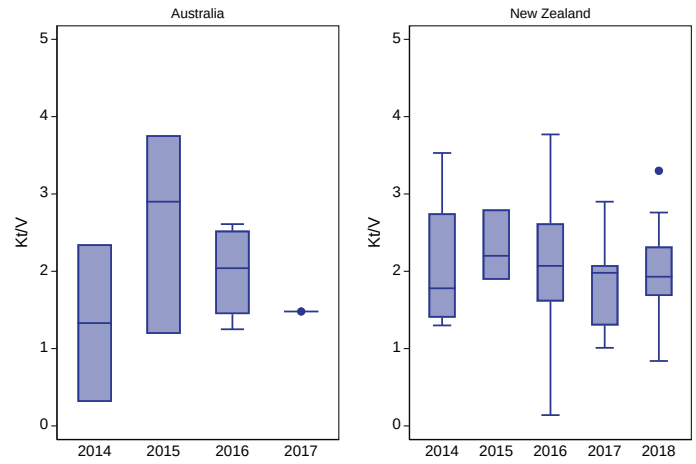
Figures 12.13 and 12.14 show measures of dialysis adequacy for Australia and New Zealand. Note that very few units in Australia report Kt/V for paediatric patients on peritoneal dialysis.

Figure 12.13 - Urea Reduction Ratio (HD Patients) - December 2014-2018



URR ≥90% excluded as non-physiological

Figure 12.14 - Kt/V (PD Patients) - December 2014-2018



Kt/V >4 excluded as non-physiological

Table 12.4 Proportion of Prevalent Patients for whom URR or Kt/V was reported 2014-2018

Country	Modality	2014	2015	2016	2017	2018
Australia	**HD**	63%	53%	70%	79%	72%
	PD	5%	11%	9%	3%	0%
New Zealand	**HD**	100%	75%	43%	75%	33%
	PD	80%	75%	90%	87%	100%

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 2018 in Australia, 22% of prevalent paediatric haemodialysis patients were dialysing via a native arteriovenous fistula; this figure was 33% in New Zealand.

Figure 12.15.1 - Incident Haemodialysis Access - Australia 2014-2018

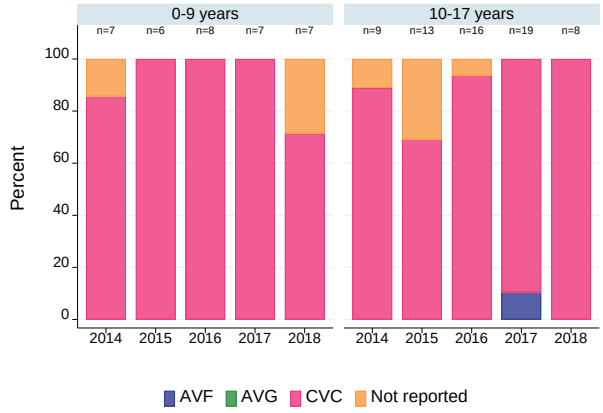


Figure 12.15.2 - Incident Haemodialysis Access - New Zealand 2014-2018

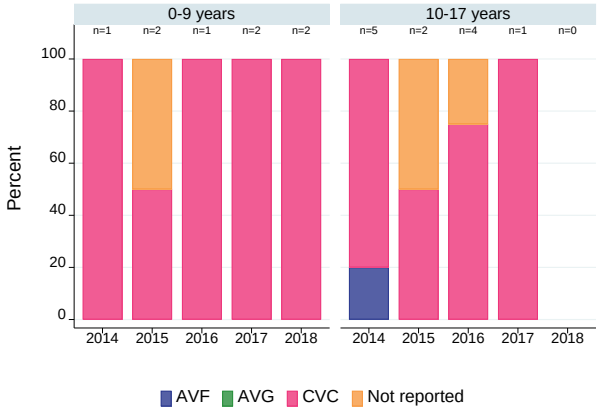


Figure 12.16.1 - Prevalent Haemodialysis Access - Australia 2014-2018

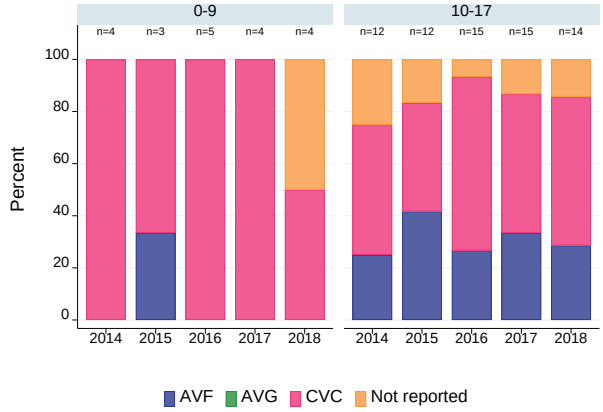
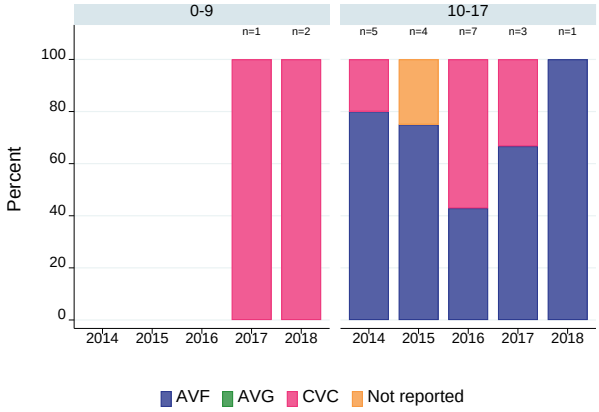


Figure 12.16.2 - Prevalent Haemodialysis Access - New Zealand 2014-2018



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 RRT 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 227 patients, 65 (29%) received a transplant within one year of commencement of RRT. By two years a total of 120 (53%) of patients had received transplants.

Figure 12.17.1 - PD Technique Survival by Age Category Peritoneal Dialysis within 365 days of RRT start - Australia 2012-2018 Censored for Transplant

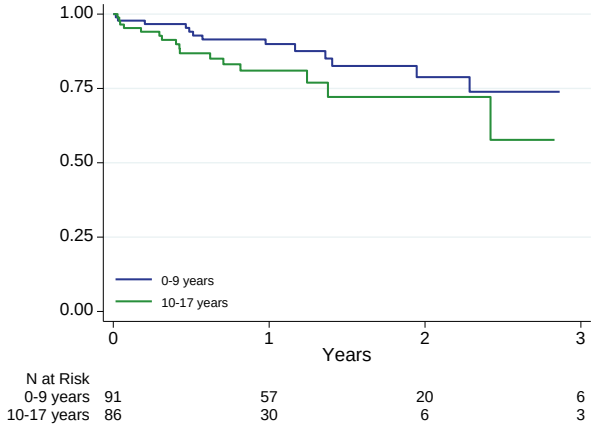
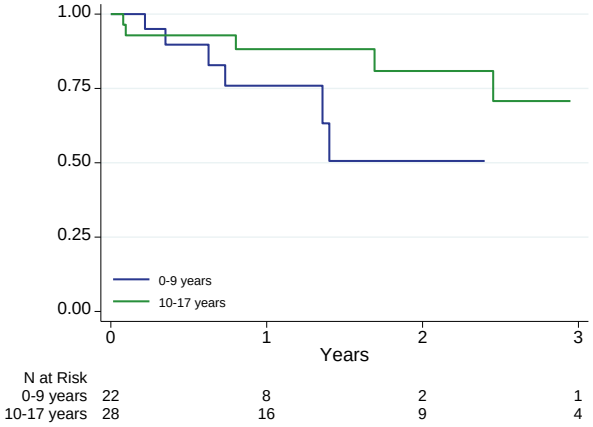


Figure 12.17.2 - PD Technique Survival by Age Category Peritoneal Dialysis within 365 days of RRT start - New Zealand 2012-2018 Censored for Transplant



The use of PD solutions is shown in Table 12.5. There is considerably more use of icodextrin in paediatric patients in 2018 in Australia (41%) compared with New Zealand (17%).

Table 12.5 Use of PD Solutions 2015-2018

Solution	Australia				New Zealand			
	2015	2016	2017	2018	2015	2016	2017	2018
	(n = 38)	(n = 43)	(n = 39)	(n = 27)	(n = 4)	(n = 10)	(n = 15)	(n = 18)
Icodextrin	9 (24%)	13 (30%)	9 (23%)	11 (41%)	0 (0%)	0 (0%)	1 (7%)	3 (17%)
Low GDP	13 (34%)	9 (21%)	14 (36%)	12 (44%)	4 (100%)	10 (100%)	13 (87%)	17 (94%)

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 2014-2018

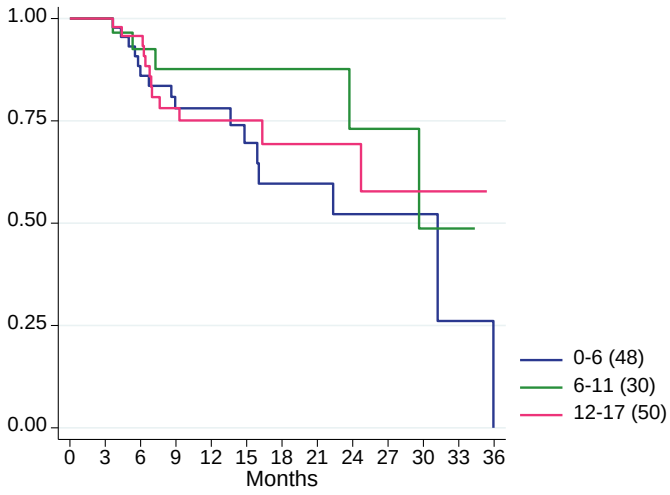


Figure 12.19 - Peritonitis rate - Australia and New Zealand 2011-2018