CHAPTER 11

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 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 15% of younger patients. In 2016 however, only 11% of those between 10-17 years were pre-emptively transplanted. Overall prevalence of a functioning transplant for ESKD was 77% at the time of the 2016 survey in Australia and New Zealand.

There has been no clear change in haemoglobin, iron, calcium or phosphate levels at the time of 2016 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 2016. The majority of paediatric patients commence haemodialysis via a central line. In 2016 in Australia, 20% of prevalent paediatric haemodialysis patients were dialysing via a native arteriovenous fistula, this figure was 43% in New Zealand.

In 2012-2016, by 9 months of commencing PD, approximately a quarter of patients will have 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 0.50 peritonitis episodes per patient year of PD occurred in 2016.

This report presents for the first time a summary of paediatric survey data. In 2016, 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 2016 survey using age adjusted z scores, which demonstrates a higher prevalence of obesity in the young Australian transplant population versus the dialysis treated group

Suggested citation

ANZDATA Registry. 40th Report, Chapter 11: Paediatric. Australia and New Zealand Dialysis and Transplant Registry, Adelaide, Australia. 2018. 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 time of commencing renal replacement therapy (RRT) for incident data, or at time of survey (31st December 2016) for prevalence 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 11.1 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 11.1.1 - Incidence of RRT - Age 0-17 Years – Australia

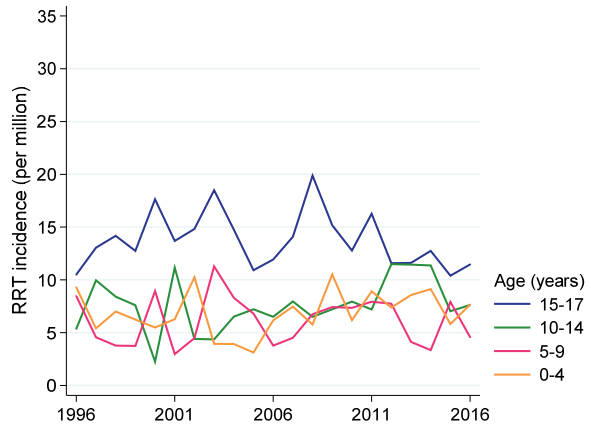
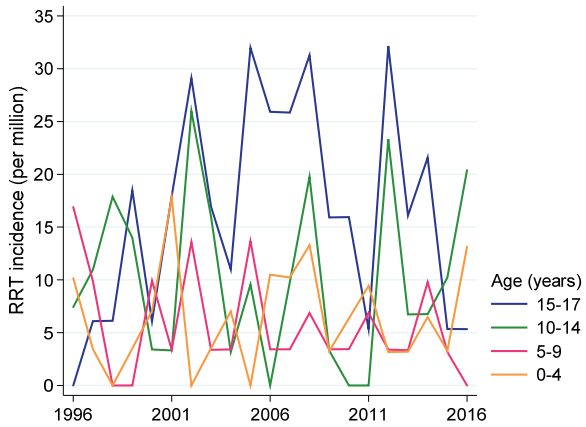


Figure 11.1.2 - Incidence of RRT - Age 0-17 Years - New Zealand



In Australia the prevalent numbers of treated ESKD have gradually increased across all age groups reflecting improved survival through increased duration of ESKD (figure 11.2); the trends are less clear in New Zealand.

Figure 11.2.1 - Prevalence of RRT - Age 0-17 Years – Australia

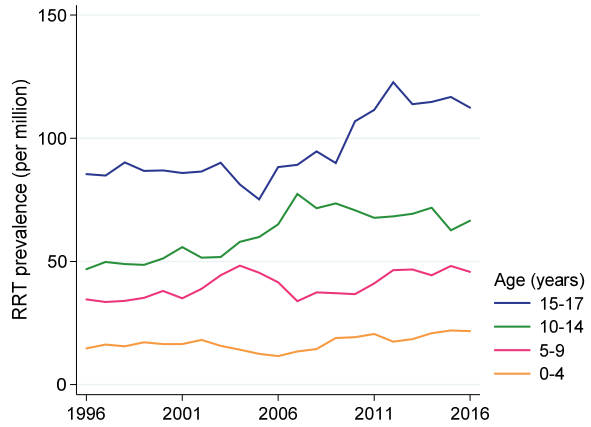
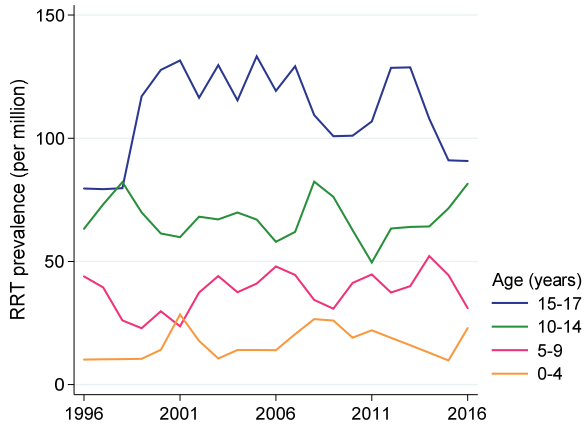


Figure 11.2.2 - Prevalence of RRT - Age 0-17 Years – New Zealand



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 11.1 Primary Renal Disease, Incident Patients by Age Category, Australia and New Zealand 2011-2016

Primary renal disease	0-4	5-10	10-14	15-17	Total
GN	6 (7%)	15 (22%)	26 (24%)	30 (34%)	77 (22%)
- FSGS	3 (3%)	7 (10%)	9 (8%)	7 (8%)	26 (7%)
Familial GN	3 (3%)	-	1 (1%)	2 (2%)	6 (2%)
Reflux Nephropathy	-	3 (4%)	8 (7%)	3 (3%)	14 (4%)
Polycystic Kidney Disease	7 (8%)	3 (4%)	1 (1%)	5 (6%)	16 (5%)
Medullary Cystic Disease	-	5 (7%)	11 (10%)	1 (1%)	17 (5%)
Posterior Urethral Valve	11 (13%)	3 (4%)	9 (8%)	5 (6%)	28 (8%)
Haemolytic Uraemic Syndrome	-	-	4 (4%)	1 (1%)	5 (1%)
Hypoplasia/Dysplasia	26 (30%)	12 (18%)	19 (18%)	6 (7%)	63 (18%)
Diabetes	-	-	-	2 (2%)	2 (1%)
Cortical Necrosis	1 (1%)	1 (1%)	2 (2%)	2 (2%)	6 (2%)
Cystinosis	-	1 (1%)	1 (1%)	-	2 (1%)
Uncertain	-	2 (3%)	-	4 (5%)	6 (2%)
Misc/Other	30 (34%)	14 (21%)	16 (15%)	18 (21%)	78 (22%)
Not reported	-	1 (1%)	1 (1%)	1 (1%)	3 (1%)
Total	87	67	108	87	323

Modality of Treatment

The modality of the first renal replacement treatment is shown in table 11.2. 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.

For prevalent patients (Table 11.3), a very different pattern is seen, with the great majority (79%) of children and adolescents with a functioning transplant. This reflects the relatively high rate of transplantation among children.

Table 11.2 Modality of Initial Renal Replacement Therapy by Year of First Treatment, Australia and New Zealand

Age group	2011	2012	2013	2014	2015	2016	Total
0-9 Years	**29**	**24**	**21**	**24**	**23**	**23**	**144**
HD	10 (34%)	7 (29%)	5 (24%)	6 (25%)	5 (22%)	5 (22%)	38 (26%)
PD	14 (48%)	13 (54%)	14 (67%)	17 (71%)	11 (48%)	15 (65%)	84 (58%)
Transplant	5 (17%)	4 (17%)	2 (10%)	1 (4%)	7 (30%)	3 (13%)	22 (15%)
10-17 Years	**25**	**39**	**31**	**33**	**23**	**28**	**179**
HD	8 (32%)	16 (41%)	13 (42%)	10 (30%)	5 (22%)	14 (50%)	66 (37%)
PD	12 (48%)	15 (38%)	12 (39%)	14 (42%)	11 (48%)	11 (39%)	75 (42%)
Transplant	5 (20%)	8 (21%)	6 (19%)	9 (27%)	7 (30%)	3 (11%)	38 (21%)
Total	**54**	**63**	**52**	**57**	**46**	**51**	**323**

Table 11.3 Modality of Prevalent Patients by Year of Treatment, Australia and New Zealand

Current treatment	2011	2012	2013	2014	2015	2016	Total
HD	29 (9%)	29 (8%)	27 (8%)	21 (6%)	18 (5%)	27 (8%)	151 (7%)
PD	53 (16%)	50 (14%)	47 (13%)	48 (13%)	42 (12%)	54 (15%)	294 (14%)
Transplant	250 (75%)	274 (78%)	277 (79%)	288 (81%)	292 (83%)	275 (77%)	1656 (79%)
Total	**332**	**353**	**351**	**357**	**352**	**356**	**2101**

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 records data on height, weight and an assessment of educational participation.

Overall, more children on PD and with functioning transplants attend unmodified school compared to children on haemodialysis (Figure 11.3). Note that multiple categories of paediatric assessment have been collapsed into a single group of 'School-Modified' for reporting purposes, see for details: http://www.anzdata.org.au/forms/8PaediatricForm2017.pdf.

Paediatric BMI categories are determined using age adjusted Z scores. In Australia, a larger proportion of transplant recipients are overweight or obese, compared to children and adolescents treated with dialysis. New Zealand data should be interpreted with caution due to low numbers of patients.

Figure 11.3.1 - Paediatric Assessment by Age Group and Treatment Modality - Australia 2016

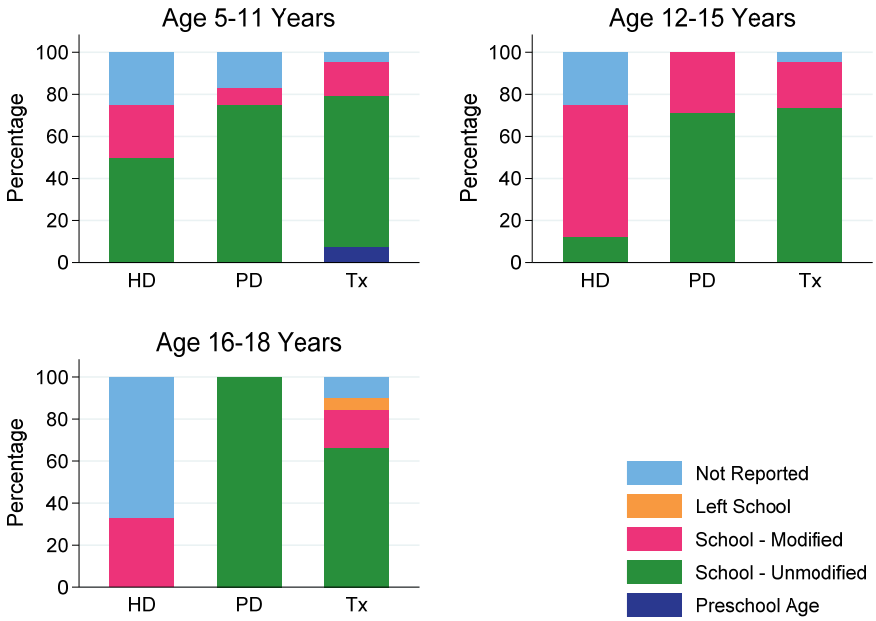


Figure 11.3.2 - Paediatric Assessment by Age Group and Treatment Modality - New Zealand 2016

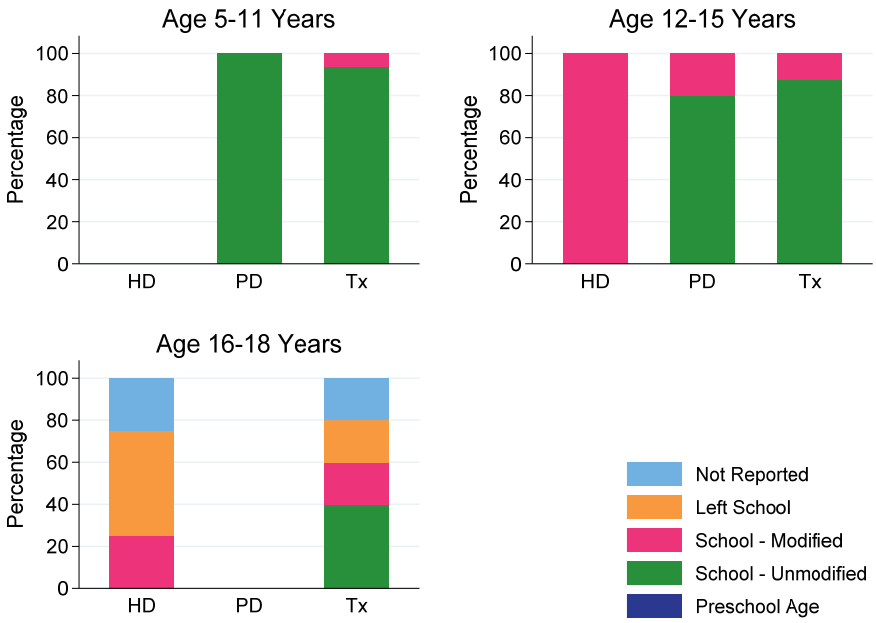


Figure 11.4.1 - Body Mass Index of Prevalent Paediatric Patients by Treatment Modality - Australia 2016

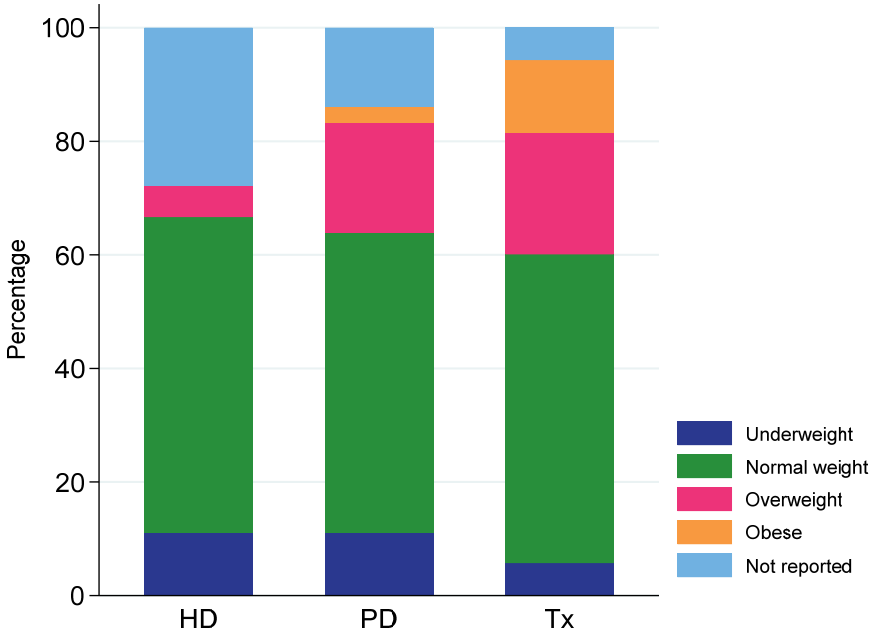
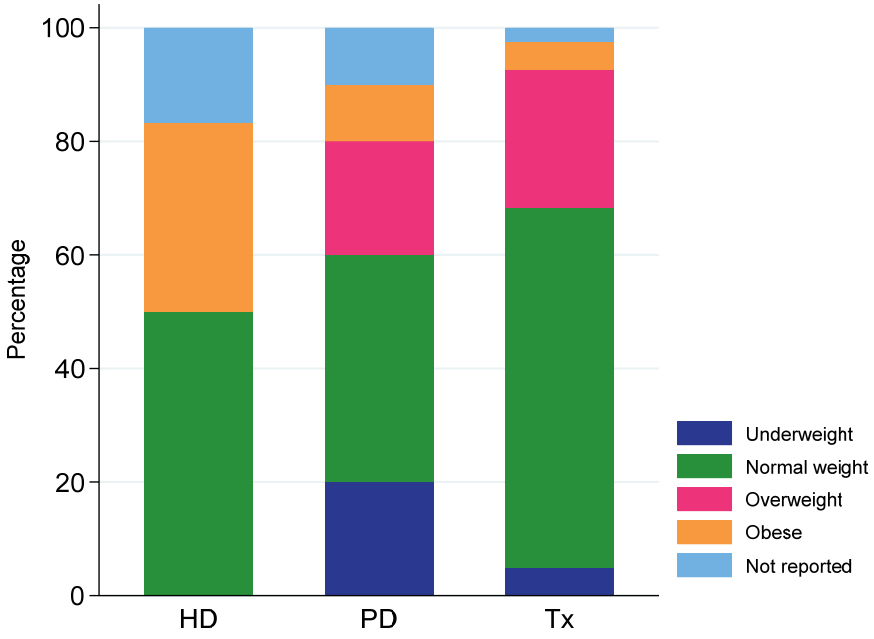


Figure 11.4.2 - Body Mass Index of Prevalent Paediatric Patients by Treatment Modality - New Zealand 2016



Dialysis Delivery and Adequacy

Various dialysis process indicators are summarized in Figures 11.5 to 11.14. For all of these graphs, the box indicates the 25th, 50th, and 75th centiles. The “whiskers” indicate the 95th centiles for each category.

Figure 11.5.1 - Haemoglobin, December 2012-2016 - Australia

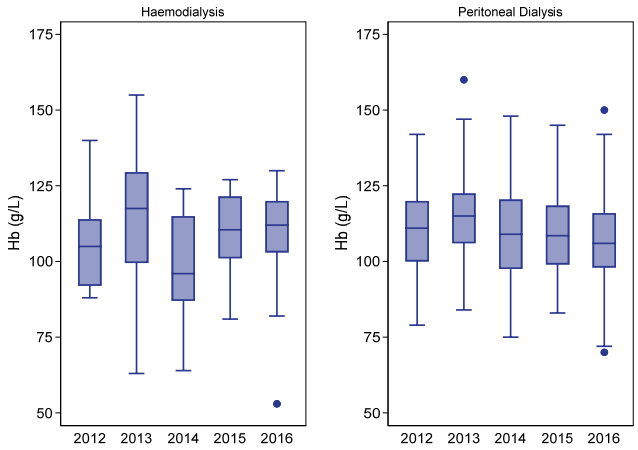


Figure 11.5.2 - Haemoglobin, December 2012-2016 - New Zealand

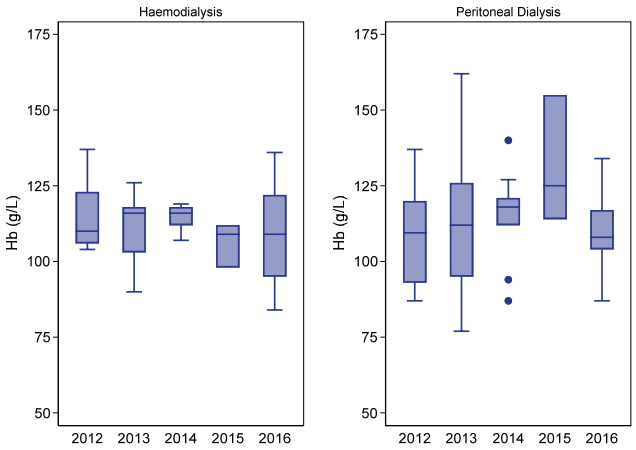


Figure 11.6 - Use of Erythropoietic Agents - December 2012-2016

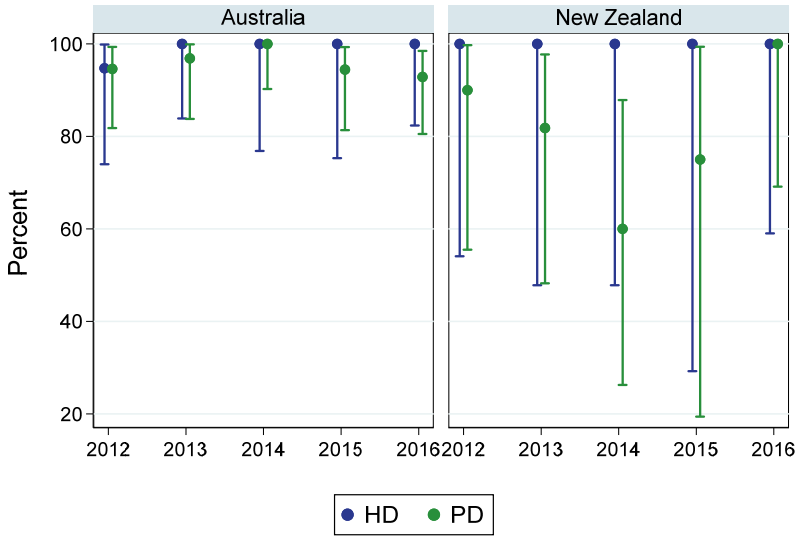


Figure 11.7.1 - Ferritin, December 2012-2016 - Australia

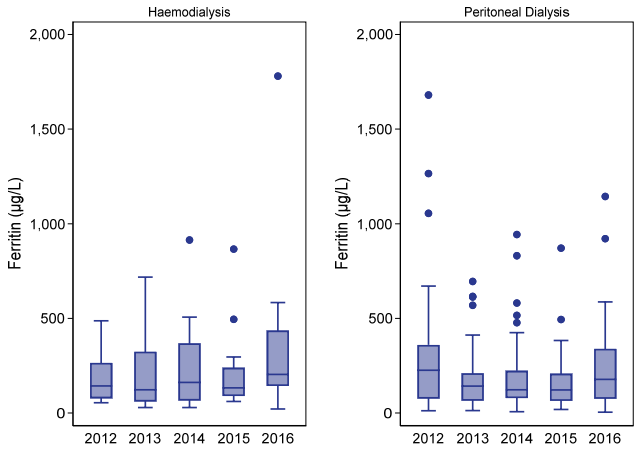


Figure 11.7.2 - Ferritin, December 2012-2016 - New Zealand

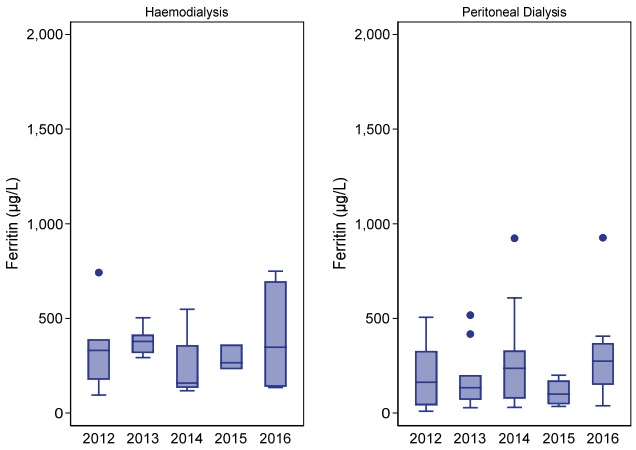


Figure 11.8.1 - Transferrin Saturation, December 2012-2016 - Australia

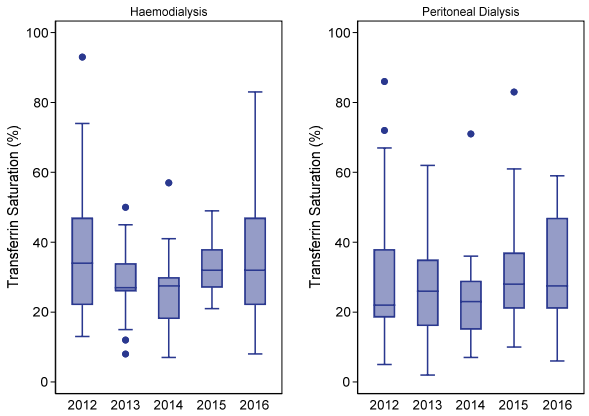


Figure 11.8.2 - Transferrin Saturation, December 2012-2016 - New Zealand

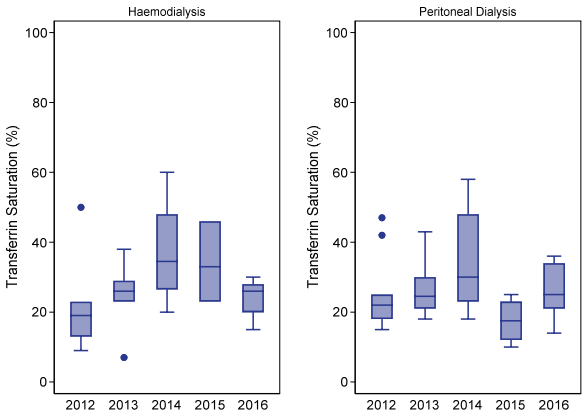


Figure 11.9.1 - Serum Calcium, December 2012-2016 - Australia

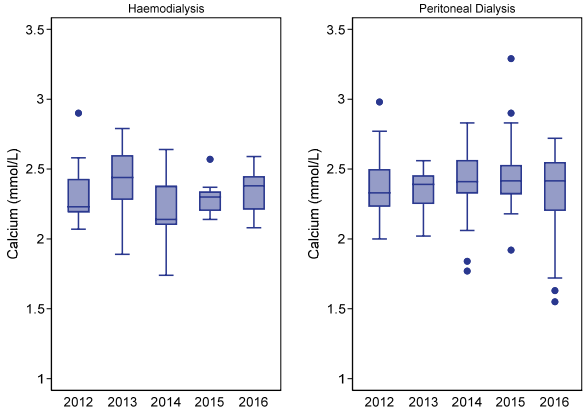


Figure 11.9.2 - Serum Calcium, December 2012-2016 - New Zealand

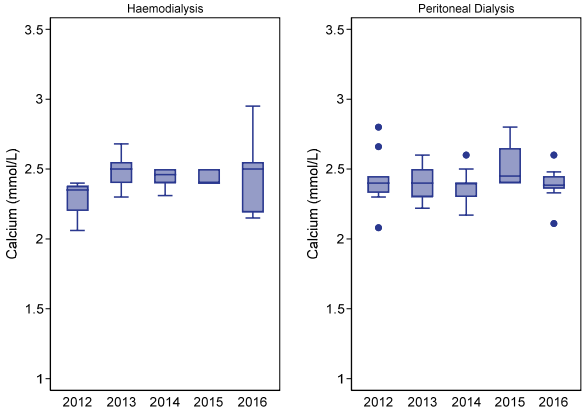


Figure 11.10.1 - Serum Phosphate, December 2012-2016 - Australia

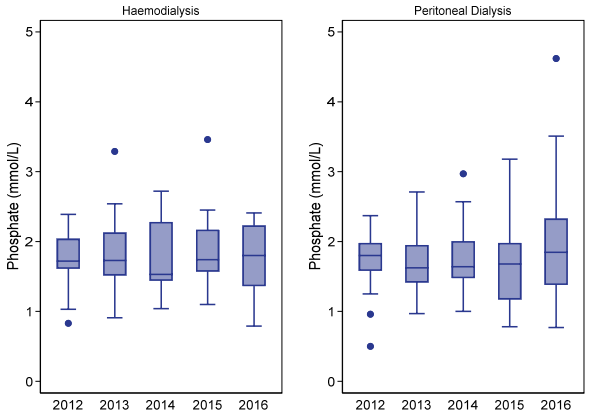
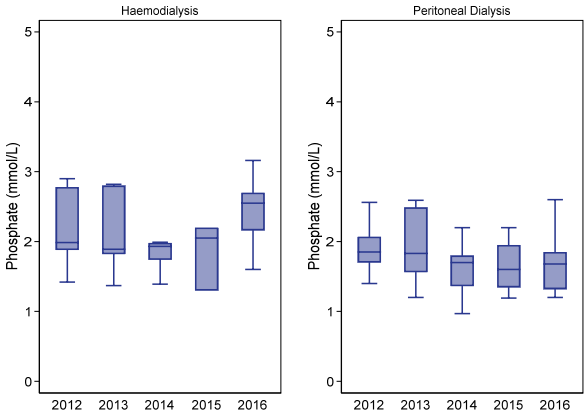


Figure 11.10.2 - Serum Phosphate, December 2012-2016 - New Zealand



Figures 11.11 and 11.12 summarise the recent trends in HD prescription among paediatric patients.

Figure 11.11 - Mean Sessions per Week (95% CI) - Among Haemodialysis Patients December 2012-2016

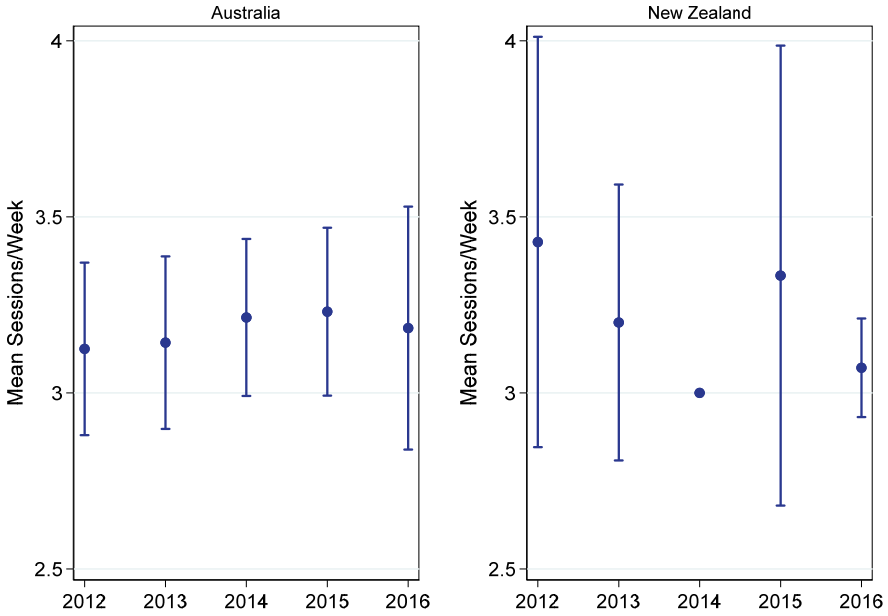
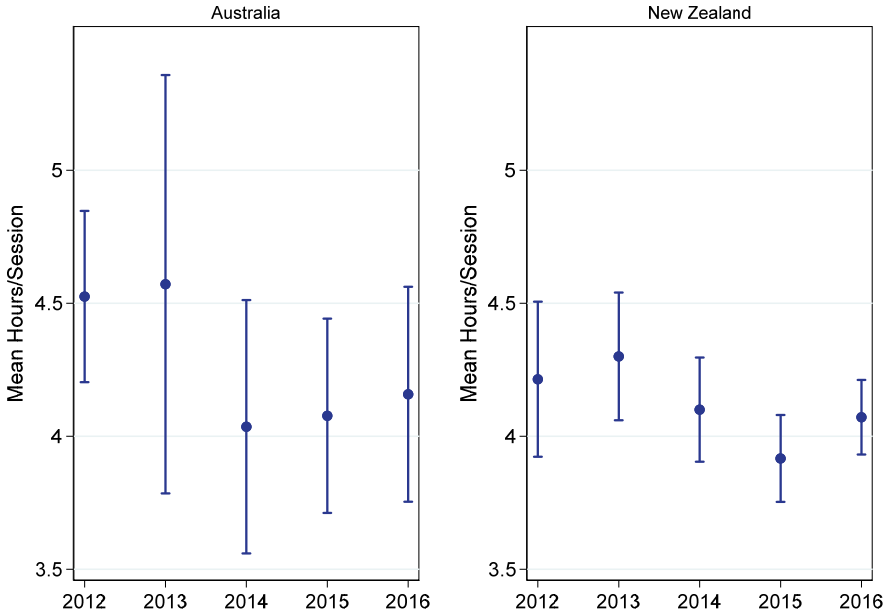
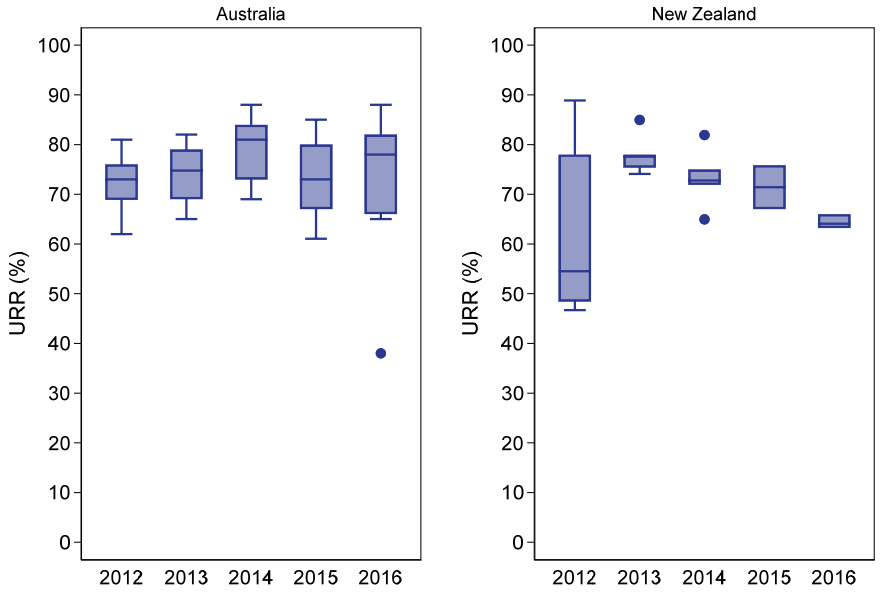


Figure 11.12 - Mean Hours per Session (95% CI) - Among Haemodialysis Patients December 2012-2016



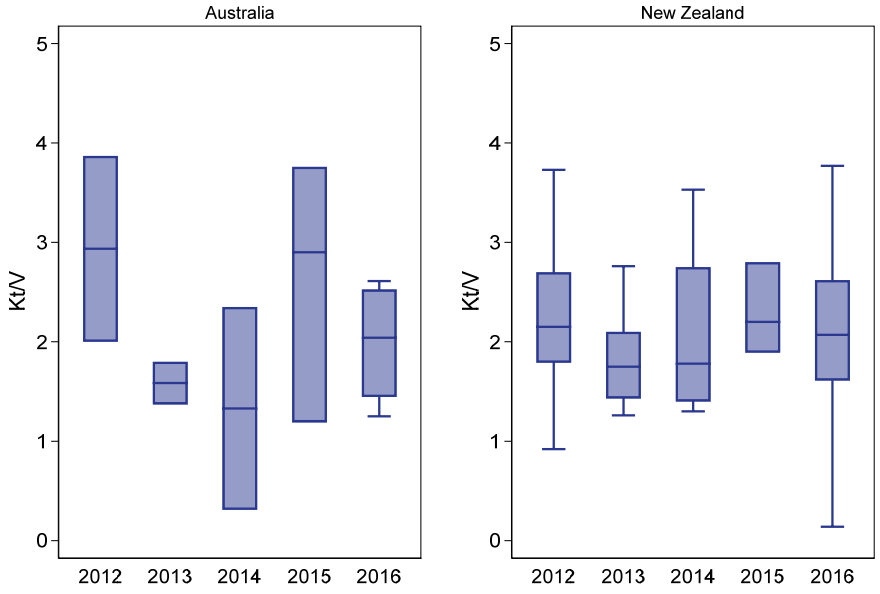
Figures 11.13 and 11.14 show measures of dialysis adequacy for Australia and New Zealand. Note that very few units in Australia report Kt/V for paediatric patients on peritoneal dialysis.

Figure 11.13 - Urea Reduction Ratio (HD Patients) - December 2012-2016



URR ≥90% excluded as non-physiological

Figure 11.14 - Kt/V (PD Patients) - December 2012-2016



Kt/V >4 excluded as non-physiological

Table 11.4 Proportion of Prevalent Patients for whom URR or Kt/V was reported 2012-2016

Country	Modality	2012	2013	2014	2015	2016
Australia	**HD**	68%	73%	63%	57%	70%
	PD	5%	6%	5%	11%	9%
New Zealand	**HD**	86%	100%	100%	75%	43%
	PD	80%	64%	80%	75%	90%

Vascular Access

Vascular access for haemodialysis is summarised in Figures 11.15 and 11.16. The majority of paediatric patients commence haemodialysis via a central line. In 2016 in Australia, 20% of prevalent paediatric haemodialysis patients were dialysing via a native arteriovenous fistula, this figure was 43% in New Zealand.

Figure 11.15.1 - Incident Haemodialysis Access - Australia 2012-2016

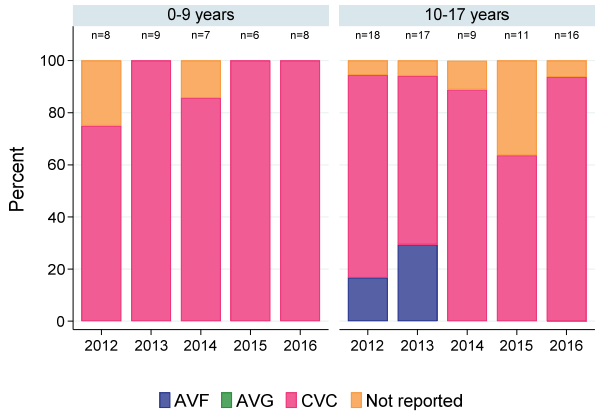


Figure 11.15.2 - Incident Haemodialysis Access – New Zealand 2012-2016

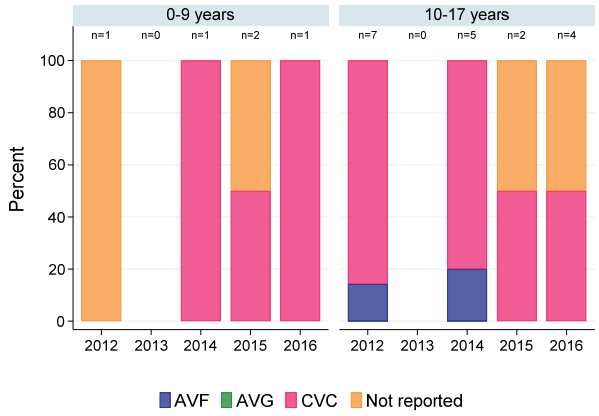


Figure 11.16.1 - Prevalent Haemodialysis Access - Australia 2012-2016

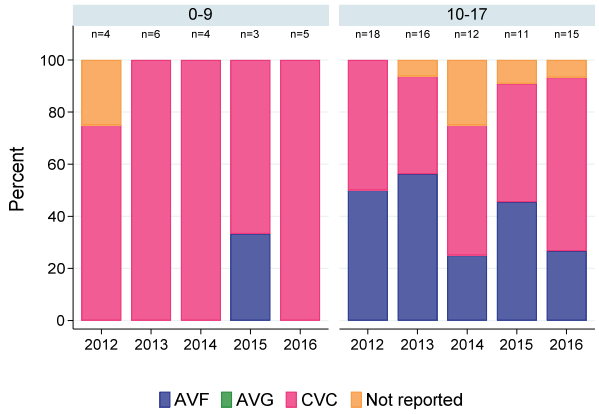
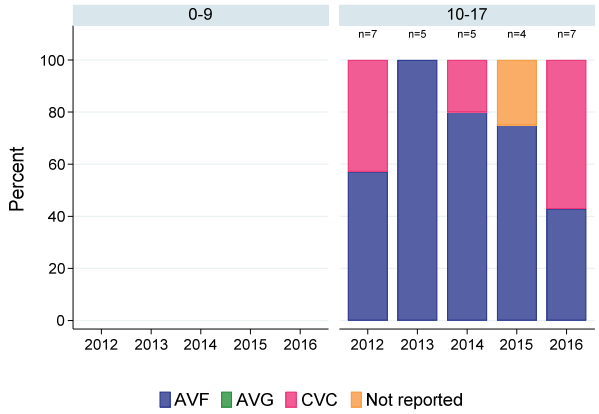


Figure 11.16.2 - Prevalent Haemodialysis Access – New Zealand 2012-2016



Peritoneal Dialysis

PD technique survival, censored for transplantation, loss to follow-up and recovery of renal function is presented below. The numbers available for analysis after the first year drop significantly in each group in both countries, due to transplantation. Of the 231 patients, 68 (29%) received a transplant within one year of commencement of RRT. By two years a total of 110 (48%) of patients had received transplants.

Figure 11.17.1 - PD Technique Survival by Age Category - Australia 2010-2016

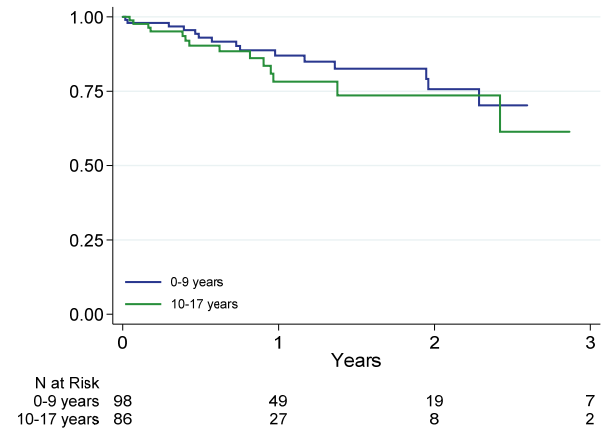
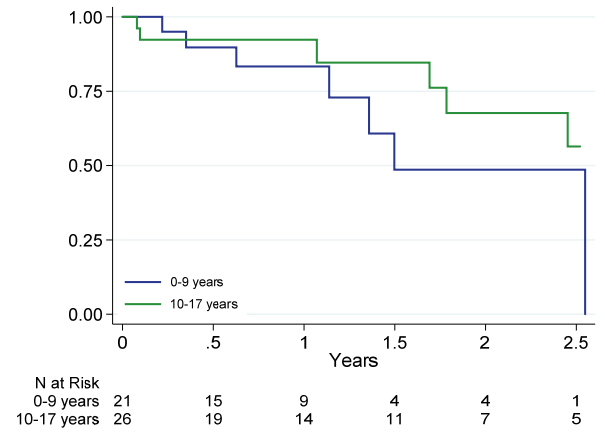


Figure 11.17.2 - PD Technique Survival by Age Category - New Zealand 2010-2016



The use of PD solutions is shown in Table 11.5. There is considerably more use of icodextrin in paediatric patients in Australia (30%) compared with New Zealand (0%).

Table 11.5 Use of PD Solutions 2013-2016

Solution	Australia				New Zealand			
	2013	2014	2015	2016	2013	2014	2015	2016
	(n = 36)	(n = 38)	(n = 38)	(n = 44)	(n = 11)	(n = 10)	(n = 4)	(n = 10)
Glucose	8 (22%)	8 (21%)	9 (24%)	13 (30%)	2 (18%)	1 (10%)	0 (0%)	0 (0%)
Icodextrin	5 (14%)	10 (26%)	12 (32%)	9 (20%)	5 (45%)	9 (90%)	4 (100%)	10 (100%)

Peritonitis

The last few years have seen an improvement in peritonitis rates, although it has not been as great as seen in the adult PD population (chapter 5).

Figure 11.18 - First PD Treatment to First Peritonitis - by Age at First PD Australia and New Zealand 2012-2016

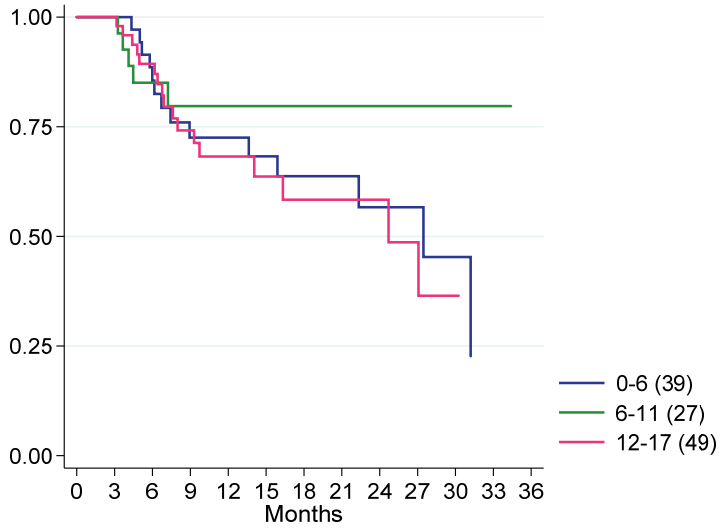


Figure 11.19 - Peritonitis rate - Australia and New Zealand 2009-2016