CHAPTER 4

Haemodialysis

Reporting the incidence, prevalence and survival of haemodialysis patients in Australia and New Zealand; summarising dialysis prescriptions, laboratory results, dialysis adequacy, vascular access and rates of home haemodialysis treatment.

Contents

Executive Summary

There were 10,624 people in Australia and 1,913 people in New Zealand receiving haemodialysis at the time of the 31 December 2017 survey. Of the 2,929 in Australia and 518 in New Zealand who commenced haemodialysis in 2017, approximately half were aged between 55-74 years. Survival of incident haemodialysis patients in both countries has not changed significantly in the past decade, and older age at commencement of dialysis was associated with poorer survival.

People receiving haemodialysis in New Zealand receive more hours per week of dialysis than Australian patients. In New Zealand, 69% of thrice weekly haemodialysis patients received more than 12 hours of haemodialysis per week, compared with 50% in Australia.

The proportion of haemodialysis patients receiving haemodiafiltration in Australia and New Zealand was 33% and 22%, respectively, in the last survey. It has continued to rapidly increase in Australia but not in New Zealand. The Australian state with the greatest proportion of patients receiving haemodiafiltration (54%) had a far greater proportion than the state with the lowest proportion (6%). New to this report, the major mode of delivery of substitution fluid in 2017 was post-dilution; the proportion was quite different between Australia and New Zealand (Table 4.14).

Establishing permanent vascular access (arteriovenous fistula or graft) before commencement of haemodialysis continues to be challenging: 43% of Australian patients and 26% of New Zealand patients who commenced haemodialysis in 2017 had permanent vascular access when they started haemodialysis. Within Australian states, this varied from 31% to 54%, and by caring hospital from 19% to 82%. For prevalent patients, 85% of Australian patients and 71% of New Zealand patients had haemodialysis through permanent vascular access.

The proportion of patients undertaking haemodialysis at home also varied by country (Australia 10% compared with New Zealand 23%), by state within Australia (from 4% up to 13%), and by caring hospital (from <1% to 26% in Australian hospitals and from 11% to 91% in New Zealand hospitals).

Suggested citation

ANZDATA Registry. 41st Report, Chapter 4: Haemodialysis. Australia and New Zealand Dialysis and Transplant Registry, Adelaide, Australia. 2018. Available at: http://www.anzdata.org.au

Stock and Flow

Table 4.1 presents the stock and flow of haemodialysis patients in Australia and New Zealand over 2013-2017. Note that dialysis modality changes lasting less than 30 days are not included. The number of incident patients in Australia is growing steadily, whereas in New Zealand the number remains approximately constant. In Australia, the number of patients ceasing HD is lower than the number of incident patients, leading to strong growth in prevalent numbers. In New Zealand these numbers are similar, leading to a relatively stable number of prevalent patients.

Table 4.1 Stock and Flow of Haemodialysis Patients in Australia and New Zealand 2013-2017

Country		2013	2014	2015	2016	2017
Australia	**All patients who commenced HD**					
	First dialysis treatment or returning after renal recovery	1854	1905	1902	2001	2151
	Transfer from PD (no prior HD)	323	299	361	411	401
	Transfer from PD (prior HD)	197	179	191	168	170
	Failed Transplant (no prior HD)	40	38	46	26	53
	Failed Transplant (prior HD)	131	144	154	159	154
	Total	**2545**	**2565**	**2654**	**2765**	**2929**
	All patients who ceased HD					
	Received kidney transplant	543	556	554	639	630
	Transfer to PD	336	347	321	310	310
	Renal recovery	64	56	59	72	75
	Deaths	1335	1361	1410	1511	1583
	Total	**2278**	**2320**	**2344**	**2532**	**2598**
	Total patients on HD at 31 December	**9566**	**9791**	**10086**	**10303**	**10624**
	Patients on HD at home at 31 December (% of all HD patients)	**1140 (11.9%)**	**1178 (12.0%)**	**1188 (11.8%)**	**1124 (10.9%)**	**1023 (9.6%)**
New Zealand	**All patients who commenced HD**					
	First dialysis treatment or returning after renal recovery	362	353	319	341	374
	Transfer from PD (no prior HD)	67	89	100	105	74
	Transfer from PD (prior HD)	48	57	77	60	43
	Failed Transplant (no prior HD)	4	5	7	9	6
	Failed Transplant (prior HD)	19	25	15	16	21
	Total	**500**	**529**	**518**	**531**	**518**
	All patients who ceased HD					
	Received kidney transplant	59	67	76	93	96
	Transfer to PD	141	124	111	130	119
	Renal recovery	6	10	9	8	17
	Deaths	227	225	278	285	294
	Total	**433**	**426**	**474**	**516**	**526**
	Total patients on HD at 31 December	**1763**	**1867**	**1913**	**1926**	**1913**
	Patients on HD at home at 31 December (% of all HD patients)	**479 (27.2%)**	**489 (26.2%)**	**483 (25.2%)**	**468 (24.3%)**	**436 (22.8%)**

Figures 4.1-4.2 and Table 4.2 present the age distribution of incident and prevalent haemodialysis patients in Australia and New Zealand.

Figure 4.1.1 - Age (%) of Incident Haemodialysis Patients - Australia 2017

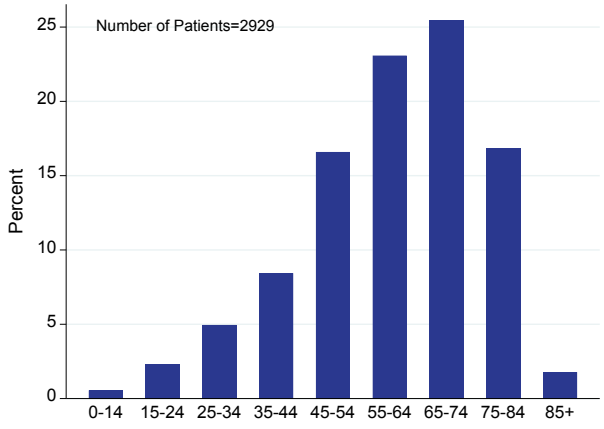


Figure 4.1.2 - Age (%) of Incident Haemodialysis Patients - New Zealand 2017

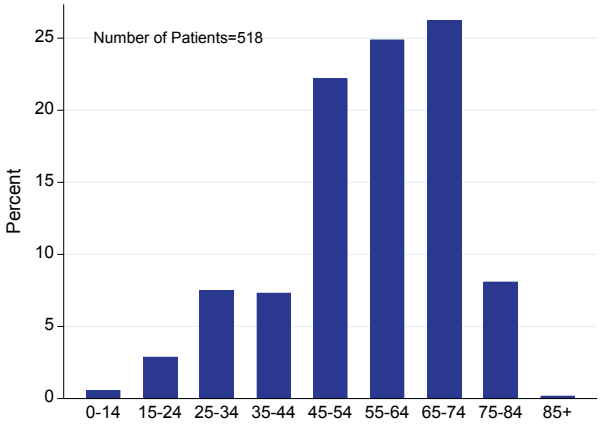


Figure 4.2.1 - Age (%) of Prevalent Haemodialysis Patients - Australia 31 Dec 2017

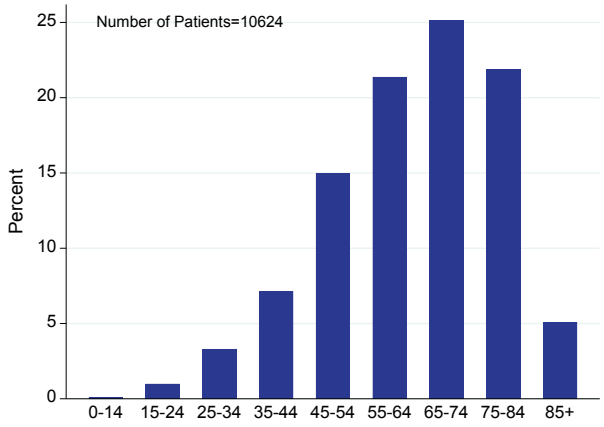


Figure 4.2.2 - Age (%) of Prevalent Haemodialysis Patients - New Zealand 31 Dec 2017

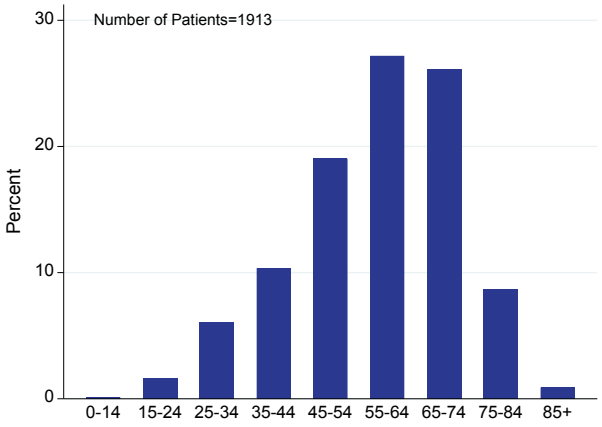


Table 4.2.1 Incident and Prevalent Haemodialysis Patients in Australia by Age Group 2013-2017

	Age group	2013	2014	2015	2016	2017
Incident Patients	**0-14**	18 (1%)	13 (1%)	12 (0%)	16 (1%)	16 (1%)
	15-24	61 (2%)	60 (2%)	49 (2%)	61 (2%)	68 (2%)
	25-34	121 (5%)	136 (5%)	127 (5%)	139 (5%)	145 (5%)
	35-44	228 (9%)	238 (9%)	239 (9%)	256 (9%)	247 (8%)
	45-54	419 (16%)	426 (17%)	435 (16%)	448 (16%)	486 (17%)
	55-64	578 (23%)	600 (23%)	569 (21%)	583 (21%)	676 (23%)
	65-74	622 (24%)	569 (22%)	704 (27%)	739 (27%)	746 (25%)
	75-84	446 (18%)	467 (18%)	467 (18%)	476 (17%)	493 (17%)
	85+	52 (2%)	56 (2%)	52 (2%)	47 (2%)	52 (2%)
	Total	**2545**	**2565**	**2654**	**2765**	**2929**
Prevalent Patients	**0-14**	10 (0%)	7 (0%)	7 (0%)	11 (0%)	10 (0%)
	15-24	105 (1%)	108 (1%)	108 (1%)	92 (1%)	105 (1%)
	25-34	308 (3%)	336 (3%)	332 (3%)	345 (3%)	351 (3%)
	35-44	737 (8%)	749 (8%)	764 (8%)	749 (7%)	758 (7%)
	45-54	1446 (15%)	1492 (15%)	1535 (15%)	1558 (15%)	1591 (15%)
	55-64	2034 (21%)	2075 (21%)	2113 (21%)	2162 (21%)	2271 (21%)
	65-74	2332 (24%)	2350 (24%)	2474 (25%)	2585 (25%)	2671 (25%)
	75-84	2138 (22%)	2179 (22%)	2232 (22%)	2282 (22%)	2327 (22%)
	85+	456 (5%)	495 (5%)	521 (5%)	519 (5%)	540 (5%)
	Total	**9566**	**9791**	**10086**	**10303**	**10624**

Table 4.2.2 Incident and Prevalent Haemodialysis Patients in New Zealand by Age Group 2013-2017

	Age group	2013	2014	2015	2016	2017
Incident Patients	**0-14**	0 (0%)	3 (1%)	3 (1%)	2 (0%)	3 (1%)
	15-24	8 (2%)	16 (3%)	15 (3%)	12 (2%)	15 (3%)
	25-34	34 (7%)	41 (8%)	23 (4%)	34 (6%)	39 (8%)
	35-44	63 (13%)	47 (9%)	50 (10%)	49 (9%)	38 (7%)
	45-54	108 (22%)	104 (20%)	112 (22%)	98 (18%)	115 (22%)
	55-64	130 (26%)	147 (28%)	149 (29%)	152 (29%)	129 (25%)
	65-74	115 (23%)	136 (26%)	117 (23%)	129 (24%)	136 (26%)
	75-84	40 (8%)	34 (6%)	48 (9%)	50 (9%)	42 (8%)
	85+	2 (0%)	1 (0%)	1 (0%)	5 (1%)	1 (0%)
	Total	**500**	**529**	**518**	**531**	**518**
Prevalent Patients	**0-14**	2 (0%)	2 (0%)	1 (0%)	1 (0%)	2 (0%)
	15-24	40 (2%)	37 (2%)	36 (2%)	32 (2%)	31 (2%)
	25-34	103 (6%)	119 (6%)	119 (6%)	116 (6%)	116 (6%)
	35-44	189 (11%)	186 (10%)	178 (9%)	201 (10%)	198 (10%)
	45-54	349 (20%)	380 (20%)	405 (21%)	366 (19%)	364 (19%)
	55-64	500 (28%)	510 (27%)	519 (27%)	536 (28%)	520 (27%)
	65-74	395 (22%)	450 (24%)	462 (24%)	491 (25%)	499 (26%)
	75-84	165 (9%)	163 (9%)	176 (9%)	168 (9%)	166 (9%)
	85+	20 (1%)	20 (1%)	17 (1%)	15 (1%)	17 (1%)
	Total	**1763**	**1867**	**1913**	**1926**	**1913**

Table 4.3 presents incident patients by primary renal disease. In both countries diabetic nephropathy is the leading cause of ESKD leading to haemodialysis.

Table 4.3.1 Incident Haemodialysis Patients in Australia by Primary Renal Disease 2013-2017

Primary Renal Disease	2013	2014	2015	2016	2017
Diabetic Nephropathy	922 (36%)	939 (37%)	996 (38%)	979 (35%)	1113 (38%)
Glomerulonephritis	522 (21%)	571 (22%)	532 (20%)	564 (20%)	546 (19%)
Hypertension	343 (13%)	303 (12%)	338 (13%)	373 (13%)	367 (13%)
Polycystic Disease	145 (6%)	155 (6%)	147 (6%)	156 (6%)	160 (5%)
Reflux Nephropathy	72 (3%)	67 (3%)	66 (2%)	68 (2%)	76 (3%)
Other	406 (16%)	361 (14%)	359 (14%)	390 (14%)	418 (14%)
Uncertain	114 (4%)	120 (5%)	118 (4%)	107 (4%)	163 (6%)
Not reported	21 (1%)	49 (2%)	98 (4%)	128 (5%)	86 (3%)
Total	**2545**	**2565**	**2654**	**2765**	**2929**

Table 4.3.2 Incident Haemodialysis Patients in New Zealand by Primary Renal Disease 2013-2017

Primary Renal Disease	2013	2014	2015	2016	2017
Diabetic Nephropathy	247 (49%)	274 (52%)	255 (49%)	261 (49%)	263 (51%)
Glomerulonephritis	104 (21%)	111 (21%)	105 (20%)	119 (22%)	121 (23%)
Hypertension	50 (10%)	43 (8%)	39 (8%)	37 (7%)	35 (7%)
Polycystic Disease	24 (5%)	18 (3%)	26 (5%)	23 (4%)	19 (4%)
Reflux Nephropathy	11 (2%)	16 (3%)	9 (2%)	8 (2%)	8 (2%)
Other	49 (10%)	50 (9%)	66 (13%)	64 (12%)	50 (10%)
Uncertain	15 (3%)	10 (2%)	15 (3%)	14 (3%)	16 (3%)
Not reported	0 (0%)	7 (1%)	3 (1%)	5 (1%)	6 (1%)
Total	**500**	**529**	**518**	**531**	**518**

Survival

Table 4.4 and figure 4.3 present unadjusted haemodialysis patient survival by era and country, censored at transplantation. Survival for all incident renal replacement therapy (RRT) patients who were treated with haemodialysis at 90 days is reported. There has been very little change over eras. Figure 4.4 presents survival curves by era, adjusted for a number of demographic and clinical characteristics.

Table 4.4 Patient Survival by Era - Haemodialysis at 90 Days - Censored for Transplant 2006-2017; % [95% Confidence Interval]

Country	Era	Number of Patients	Survival			
			6 months	1 year	3 years	5 years
Australia	**2006-2008**	4636	96 [95, 96]	90 [89, 91]	69 [68, 71]	52 [50, 53]
Australia	**2009-2011**	4819	96 [96, 97]	91 [90, 92]	71 [70, 73]	55 [53, 56]
Australia	**2012-2014**	5021	97 [96, 97]	91 [90, 92]	71 [70, 73]	50 [48, 52]
Australia	**2015-2017**	5003	97 [96, 97]	92 [91, 93]	-	-
New Zealand	**2006-2008**	737	96 [95, 98]	92 [89, 94]	71 [67, 74]	52 [48, 57]
New Zealand	**2009-2011**	838	97 [96, 98]	94 [92, 95]	73 [70, 77]	55 [51, 59]
New Zealand	**2012-2014**	886	96 [95, 97]	92 [90, 94]	73 [70, 76]	55 [50, 59]
New Zealand	**2015-2017**	799	96 [94, 97]	90 [88, 92]	-	-

Figure 4.3.1 - Patient Survival by Era - Haemodialysis at 90 Days - Australia 2006-2017 Censored for Transplant

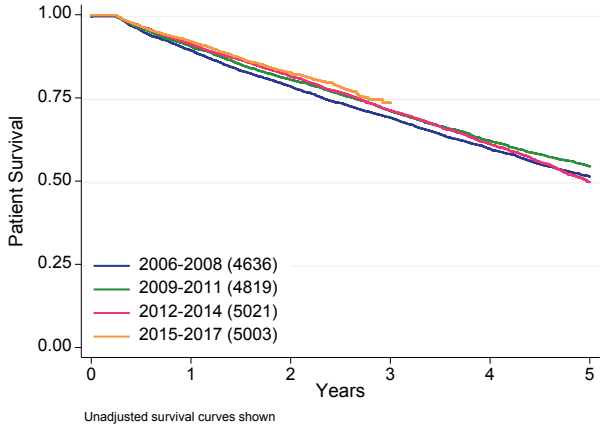


Figure 4.3.2 - Patient Survival by Era - Haemodialysis at 90 Days - New Zealand 2006-2017 Censored for Transplant

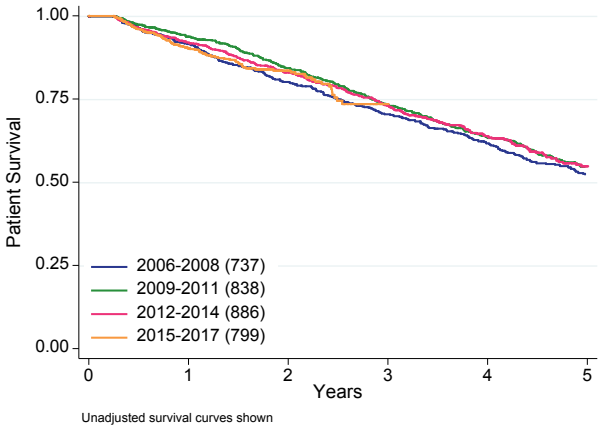


Figure 4.4.1 - Patient Survival by Era - Haemodialysis at 90 Days - Australia 2006-2017 Censored for Transplant Adjusted for Age, Ethnicity, Diabetic Nephropathy, Comorbidity and Gender

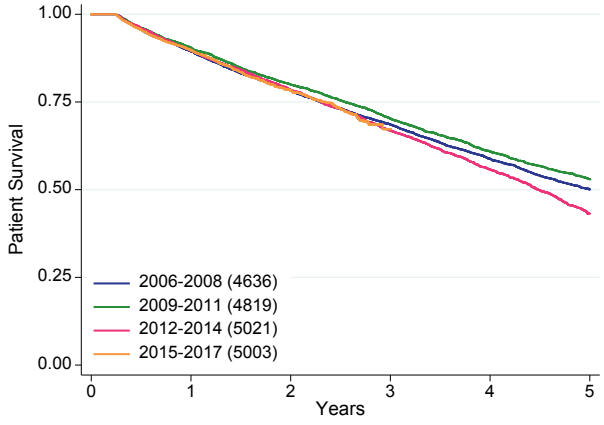


Figure 4.4.2 - Patient Survival by Era - Haemodialysis at 90 Days - New Zealand 2006-2017 Censored for Transplant Adjusted for Age, Ethnicity, Diabetic Nephropathy, Comorbidity and Gender

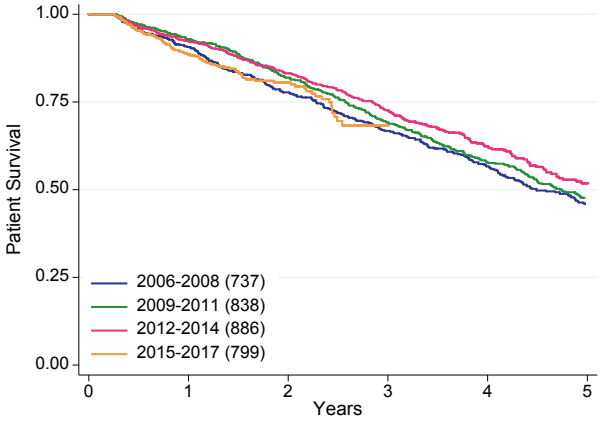
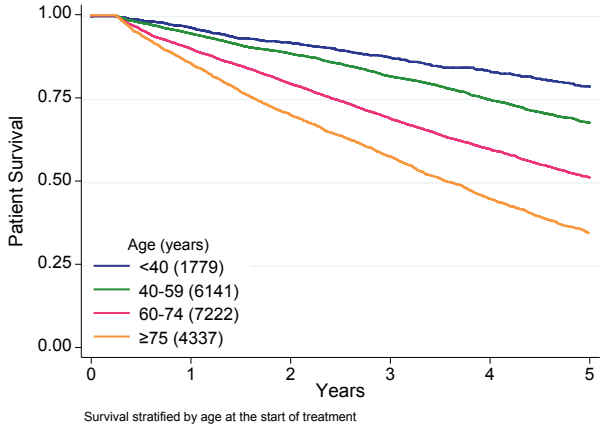


Table 4.5 and figure 4.5 present unadjusted patient survival stratified by age, and table 4.6 and figure 4.6 present the same data by diabetic status.

Table 4.5 Patient Survival by Age Group - Haemodialysis at 90 Days - Censored for Transplant 2006-2017; % [95% Confidence Interval]

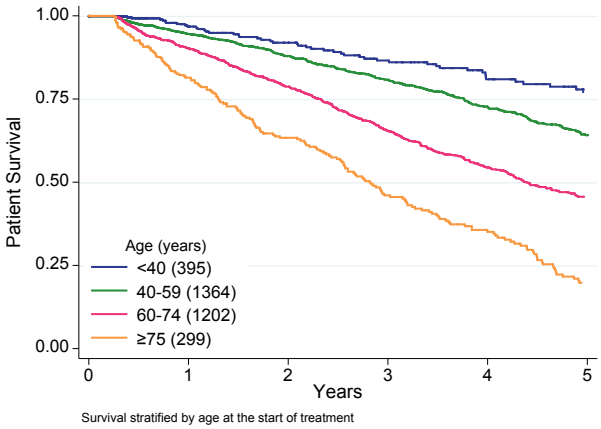
Country	Age Group	Number of Patients	Survival			
			6 months	1 year	3 years	5 years
Australia	**<40 years**	1779	99 [98, 99]	97 [95, 97]	88 [85, 89]	79 [75, 82]
Australia	**40-59 years**	6141	98 [98, 98]	95 [94, 95]	82 [81, 83]	68 [66, 69]
Australia	**60-74 years**	7222	96 [95, 96]	90 [89, 91]	69 [68, 70]	51 [50, 53]
Australia	**≥75 years**	4337	94 [93, 95]	85 [84, 87]	57 [56, 59]	34 [33, 36]
New Zealand	**<40 years**	395	99 [98, 100]	97 [94, 98]	87 [82, 90]	77 [70, 83]
New Zealand	**40-59 years**	1364	98 [97, 98]	95 [93, 96]	81 [78, 83]	64 [61, 68]
New Zealand	**60-74 years**	1202	96 [94, 97]	90 [88, 92]	65 [62, 69]	46 [42, 49]
New Zealand	**≥75 years**	299	93 [89, 95]	81 [76, 86]	46 [39, 52]	20 [14, 26]

Figure 4.5.1 - Patient Survival by Age Group Haemodialysis at 90 Days - Australia 2006-2017 Censored for Transplant



Survival stratified by age at the start of treatment

Figure 4.5.2 - Patient Survival by Age Group Haemodialysis at 90 Days - New Zealand 2006-2017 Censored for Transplant



Survival stratified by age at the start of treatment

Table 4.6 Patient Survival by Diabetes - Haemodialysis at 90 Days - Censored for Transplant 2006-2017; % [95% Confidence Interval]

Country	Diabetes	Number of Patients	Survival			
			6 months	1 year	3 years	5 years
Australia	**Non diabetic**	9578	96 [96, 97]	91 [91, 92]	74 [72, 75]	57 [56, 58]
Australia	**Diabetic**	9901	96 [96, 97]	91 [90, 91]	69 [68, 70]	50 [48, 51]
New Zealand	**Non diabetic**	1281	96 [95, 97]	92 [91, 94]	75 [72, 78]	59 [55, 62]
New Zealand	**Diabetic**	1979	97 [96, 97]	92 [90, 93]	70 [68, 73]	51 [48, 54]

Figure 4.6.1 - Patient Survival by Diabetes - Haemodialysis at 90 Days - Australia 2006-2017 Censored for Transplant

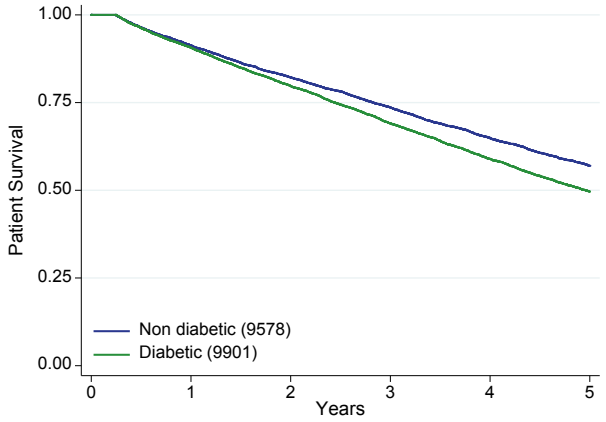


Figure 4.6.2 - Patient Survival by Diabetes - Haemodialysis at 90 Days - New Zealand 2006-2017 Censored for Transplant

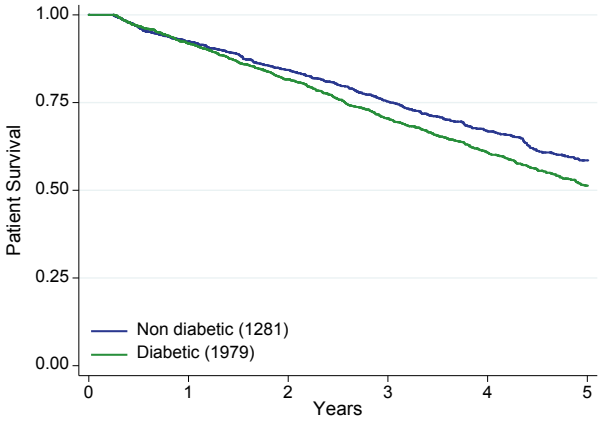
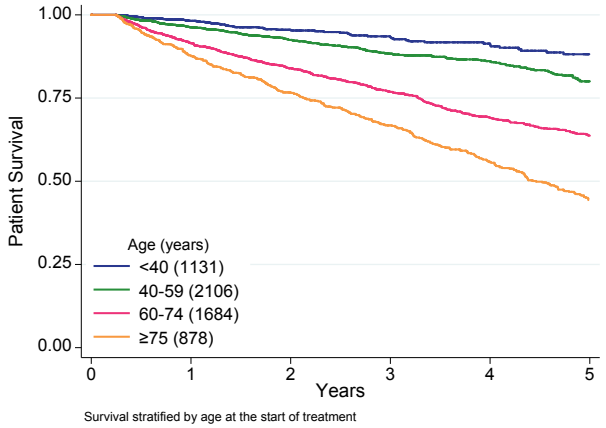


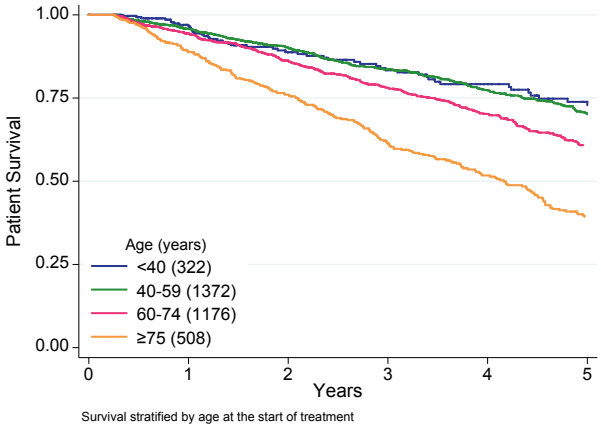
Figure 4.7 presents patient survival data for Australian haemodialysis patients by age, and by the presence of diabetes and/or cardiovascular disease. Figure 4.8 presents the same data for New Zealand.

Figure 4.7.1 - Patient Survival by Age Group Haemodialysis at 90 Days - Australia 2006-2017 Censored for Transplant: No Diabetes and No Cardiovascular Disease



Survival stratified by age at the start of treatment

Figure 4.7.2 - Patient Survival by Age Group Haemodialysis at 90 Days - Australia 2006-2017 Censored for Transplant: Diabetes but No Cardiovascular Disease



Survival stratified by age at the start of treatment

Figure 4.7.3 - Patient Survival by Age Group Haemodialysis at 90 Days - Australia 2006-2017 Censored for Transplant Cardiovascular Disease but No Diabetes

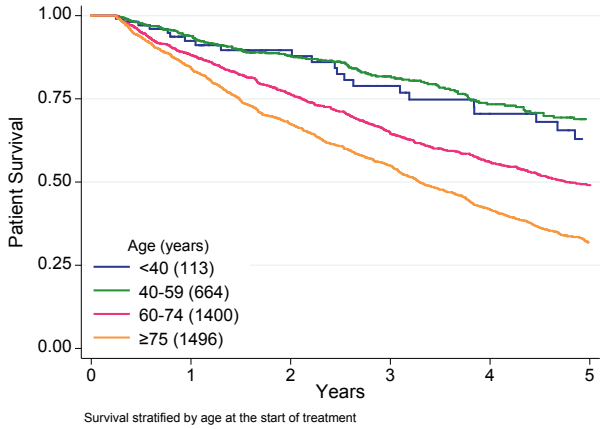


Figure 4.7.4 - Patient Survival by Age Group Haemodialysis at 90 Days - Australia 2006-2017 Censored for Transplant Both Diabetes and Cardiovascular Disease

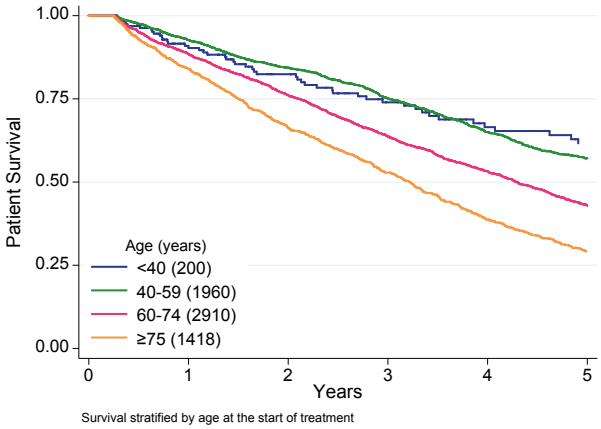


Figure 4.8.1 - Patient Survival by Age Group Haemodialysis at 90 Days - New Zealand 2006-2017 Censored for Transplant: No Diabetes and No Cardiovascular Disease

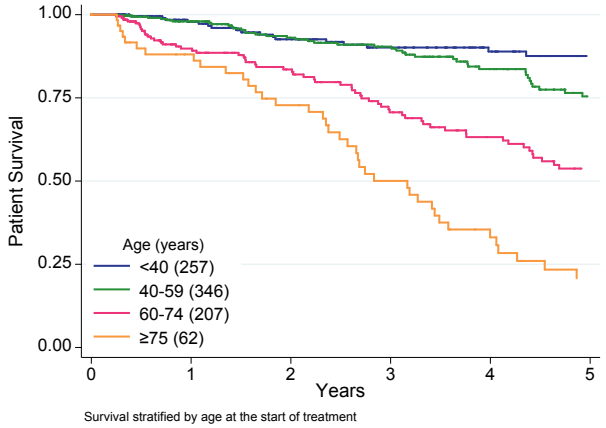


Figure 4.8.2 - Patient Survival by Age Group Haemodialysis at 90 Days - New Zealand 2006-2017 Censored for Transplant: Diabetes but No Cardiovascular Disease

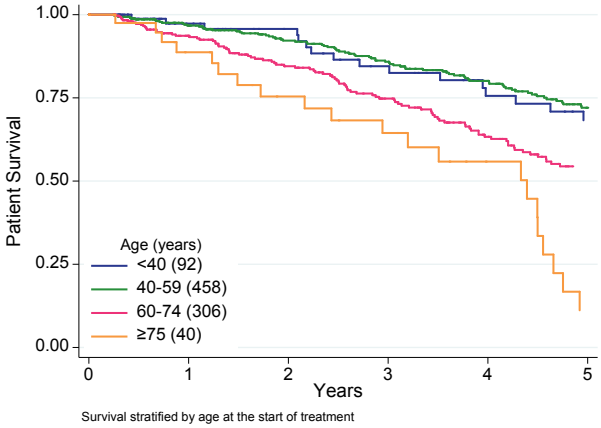


Figure 4.8.3 - Patient Survival by Age Group Haemodialysis at 90 Days - New Zealand 2006-2017 Censored for Transplant: Cardiovascular Disease but No Diabetes

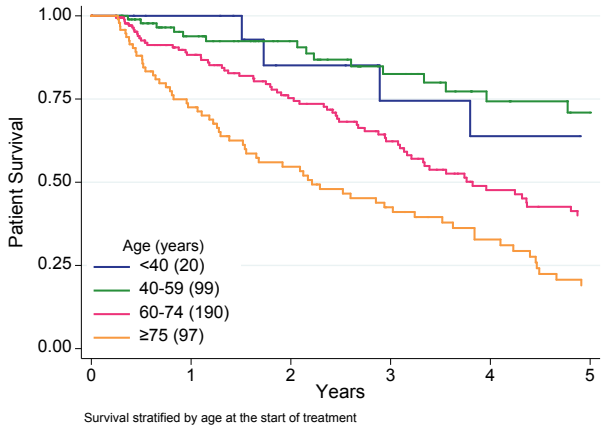
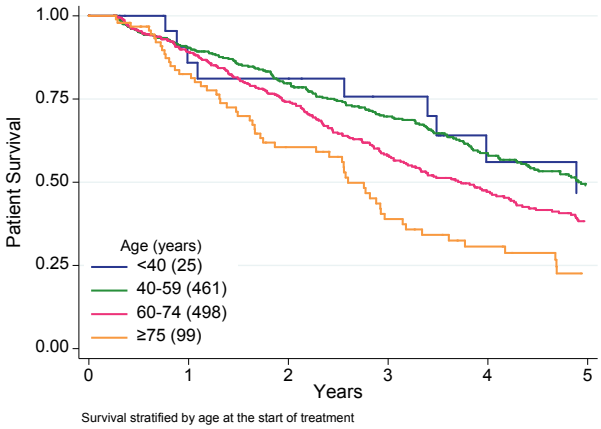


Figure 4.8.4 - Patient Survival by Age Group Haemodialysis at 90 Days - New Zealand 2006-2017 Censored for Transplant: Both Diabetes and Cardiovascular Disease



Dialysis Prescription

Table 4.7 shows the blood flow rates by year and country. Flows of 300-349mL/min were the most common in each country. Table 4.8 presents the same data by vascular access type for 2017; the distribution of blood flow rates was similar within each type of access, although slightly lower rates were seen in patients dialysing with a central venous catheter (CVC). The overall distribution of blood flow rates over 2015-2017 is shown in figure 4.9.

Table 4.7 Blood Flow Rates (mL/minute) 2013-2017

Country	Year	Total Patients*	NR**	<200	200-249	250-299	300-349	350-399	400+
Australia	2013	9562	157 (1.6%)	32 (0.3%)	222 (2.3%)	1317 (13.8%)	5673 (59.3%)	1915 (20.0%)	246 (2.6%)
	2014	9791	352 (3.6%)	25 (0.3%)	203 (2.1%)	1413 (14.4%)	5732 (58.5%)	1845 (18.8%)	221 (2.3%)
	2015	10082	540 (5.4%)	32 (0.3%)	214 (2.1%)	1437 (14.3%)	6000 (59.5%)	1664 (16.5%)	195 (1.9%)
	2016	10303	736 (7.1%)	28 (0.3%)	172 (1.7%)	1475 (14.3%)	6224 (60.4%)	1527 (14.8%)	141 (1.4%)
	2017	10624	371 (3.5%)	32 (0.3%)	192 (1.8%)	1545 (14.5%)	6895 (64.9%)	1462 (13.8%)	127 (1.2%)
New Zealand	2013	1763	8 (0.5%)	3 (0.2%)	106 (6.0%)	400 (22.7%)	956 (54.2%)	256 (14.5%)	34 (1.9%)
	2014	1867	27 (1.4%)	0 (0.0%)	108 (5.8%)	412 (22.1%)	1015 (54.4%)	263 (14.1%)	42 (2.2%)
	2015	1913	72 (3.8%)	1 (0.1%)	107 (5.6%)	410 (21.4%)	1066 (55.7%)	230 (12.0%)	27 (1.4%)
	2016	1926	43 (2.2%)	7 (0.4%)	119 (6.2%)	469 (24.4%)	975 (50.6%)	274 (14.2%)	39 (2.0%)
	2017	1913	31 (1.6%)	6 (0.3%)	119 (6.2%)	431 (22.5%)	1021 (53.4%)	258 (13.5%)	47 (2.5%)

* CVVHD Patients excluded from Total. ** Not Reported

Table 4.8 Blood Flow Rate by Type of Access - December 2017

Blood Flow Rate	Australia			New Zealand		
	AVF	AVG	CVC	AVF	AVG	CVC
<200	17 (0.2%)	0 (0.0%)	15 (0.9%)	0 (0.0%)	0 (0.0%)	6 (1.1%)
200-249	126 (1.5%)	10 (2.0%)	54 (3.4%)	75 (5.8%)	2 (3.3%)	42 (7.8%)
250-299	1019 (12.5%)	72 (14.6%)	450 (28.4%)	208 (16.2%)	23 (38.3%)	198 (36.9%)
300-349	5542 (67.9%)	333 (67.4%)	1010 (63.8%)	715 (55.7%)	33 (55.0%)	273 (50.8%)
350-399	1334 (16.3%)	77 (15.6%)	50 (3.2%)	239 (18.6%)	2 (3.3%)	17 (3.2%)
400+	123 (1.5%)	1 (0.2%)	3 (0.2%)	46 (3.6%)	0 (0.0%)	1 (0.2%)
Total	**8164**	**494**	**1584**	**1284**	**60**	**537**

* CVVHD Patients excluded from Total.
** Blood Flow Rate or Type of Access Not Reported for 388 Australian and 33 New Zealand patients.

Figure 4.9.1 - Distribution of Blood Flow Rates - Prevalent Haemodialysis - Australia

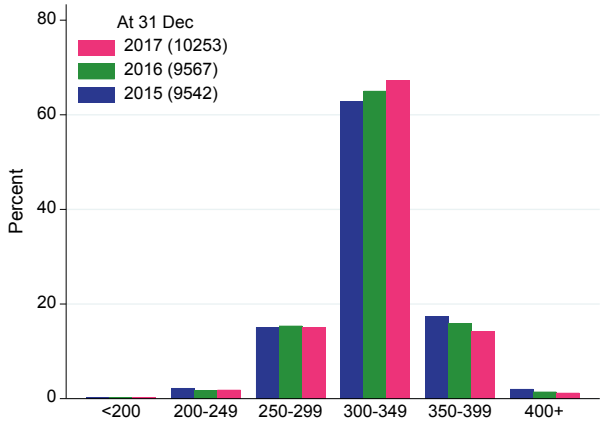


Figure 4.9.2 - Distribution of Blood Flow Rates - Prevalent Haemodialysis - New Zealand

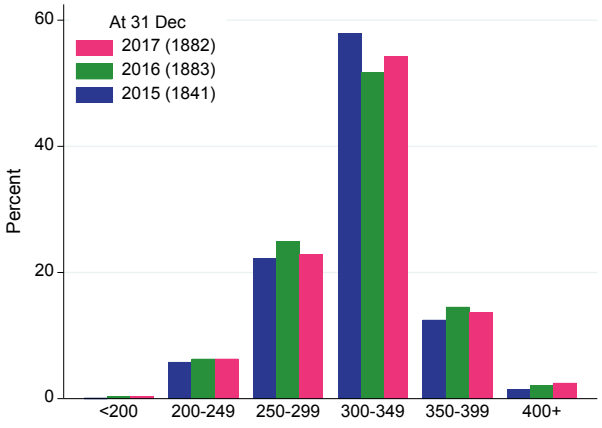


Table 4.9 shows the number of weekly sessions, and hours per session, at 31 December 2017. In each country the large majority were dialysing for ≤3 sessions per week, and for between 4-5 hours per session. Figure 4.10 shows the percentage of patients undertaking quotidian dialysis (>3 sessions per week OR >5 hours per session). Figures 4.11 and 4.12 show HD frequency and session length respectively over 2015-2017. Figure 4.13 combines sessions and session length to show the total number of weekly hours of HD over 2015-2017. New Zealand patients receive slightly more total hours of weekly HD compared with Australian patients.

Table 4.9 Duration and Number of Sessions per Week - December 2017

Country	Sessions per week	Hours of Each Treatment						
		<4	4	4.5	5	5.5	>5.5	Total
Australia	<3	41 (15.9%)	129 (50.0%)	48 (18.6%)	37 (14.3%)	2 (0.8%)	1 (0.4%)	**258 (100%)**
	3	364 (3.9%)	3814 (40.8%)	2246 (24.0%)	2577 (27.6%)	147 (1.6%)	203 (2.2%)	**9351 (100%)**
	3.1-4.9	27 (5.0%)	97 (17.9%)	52 (9.6%)	142 (26.2%)	12 (2.2%)	212 (39.1%)	**542 (100%)**
	5+	31 (31.0%)	23 (23.0%)	5 (5.0%)	10 (10.0%)	1 (1.0%)	30 (30.0%)	**100 (100%)**
	Total	**463 (4.5%)**	**4063 (39.6%)**	**2351 (22.9%)**	**2766 (27.0%)**	**162 (1.6%)**	**446 (4.4%)**	**10251 (100%)**
New Zealand	<3	2 (14.3%)	5 (35.7%)	0 (0.0%)	7 (50.0%)	0 (0.0%)	0 (0.0%)	**14 (100%)**
	3	40 (2.4%)	459 (28.1%)	463 (28.3%)	548 (33.5%)	51 (3.1%)	74 (4.5%)	**1635 (100%)**
	3.1-4.9	9 (4.1%)	44 (19.8%)	40 (18.0%)	70 (31.5%)	3 (1.4%)	56 (25.2%)	**222 (100%)**
	5+	5 (41.7%)	4 (33.3%)	0 (0.0%)	2 (16.7%)	0 (0.0%)	1 (8.3%)	**12 (100%)**
	Total	**56 (3.0%)**	**512 (27.2%)**	**503 (26.7%)**	**627 (33.3%)**	**54 (2.9%)**	**131 (7.0%)**	**1883 (100%)**

* Intermediate durations are rounded up, e.g. 4.25 is included in 4.5.
** Hours or number of sessions were not reported for 373 Australian and 30 New Zealand patients.

Figure 4.10 - Haemodialysis Conventional/Quotidian - 2015-2017

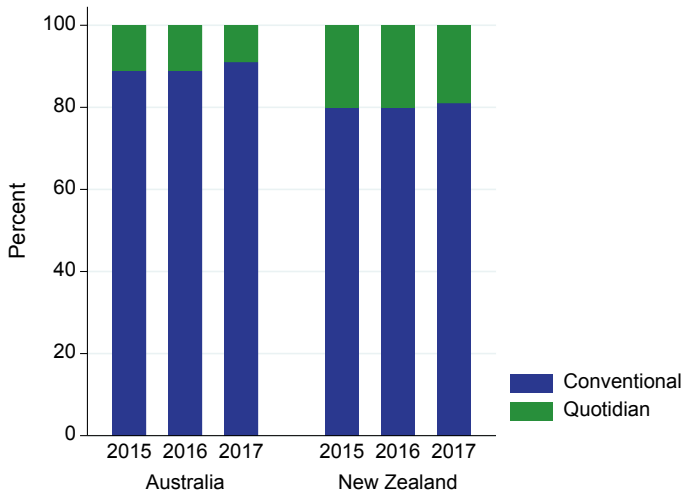


Figure 4.11 - Haemodialysis Frequency Per Week - 2015-2017

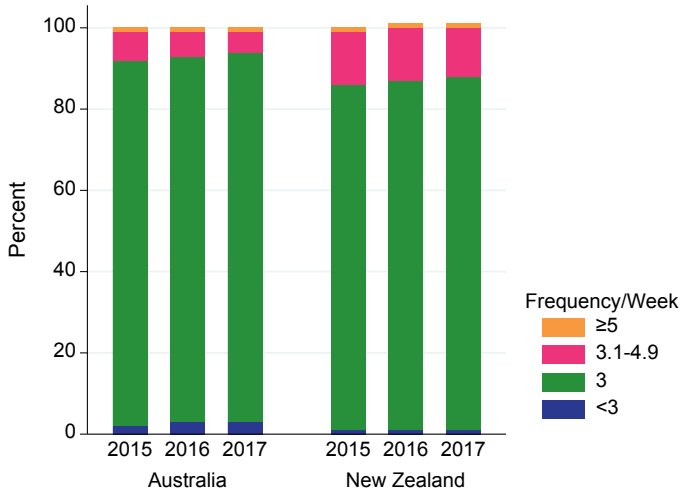


Figure 4.12 - Haemodialysis Session Length (Hours) - December 2015-2017

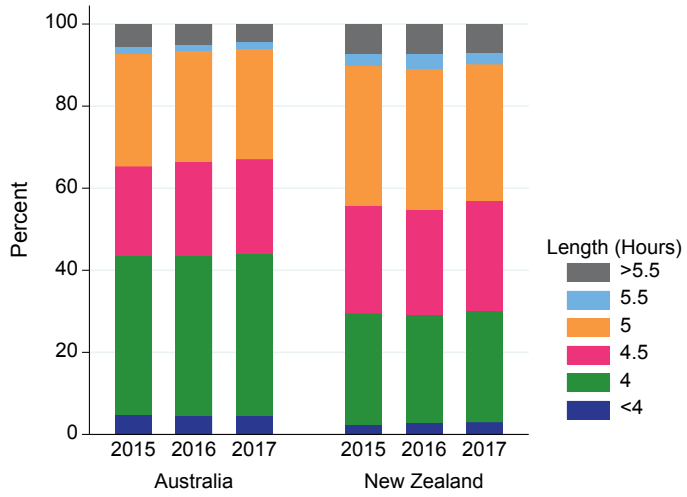
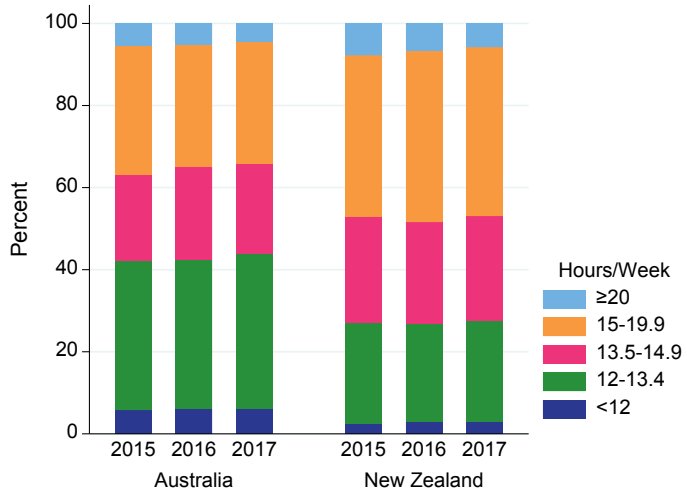


Figure 4.13 - Haemodialysis Duration (Hours Per Week) - December 2015-2017



Figures 4.14-4.16 show trends in dialysis prescription. The proportion of patients dialysing five days or more per week continues to fall in both countries. Amongst the patients dialysing three times per week, the previously increasing proportion dialysing 4.5 hours or longer has plateaued, as has the proportion dialysing >12 hours per week. Tables 4.10-4.12 present these same data for 2014-2017 by state and country.

Figure 4.14 - Percentage of HD Patients Dialysing Five or More Days Per Week

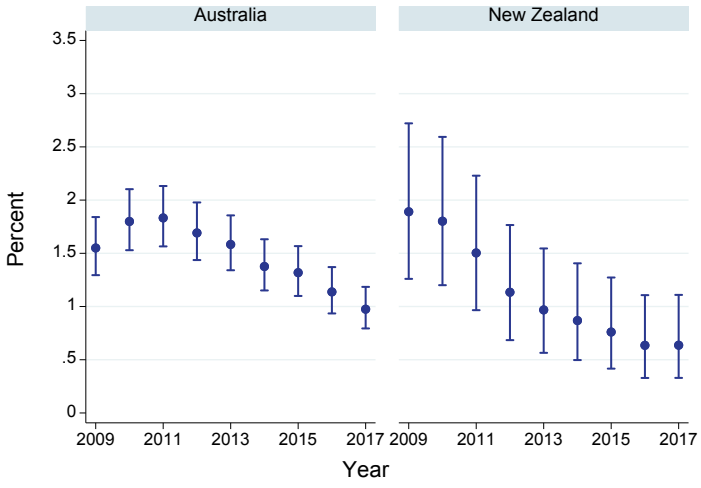


Figure 4.15 - Percentage of HD Patients Dialysing 3 Days Per Week Dialysing 4.5 Hours or Longer Per Session

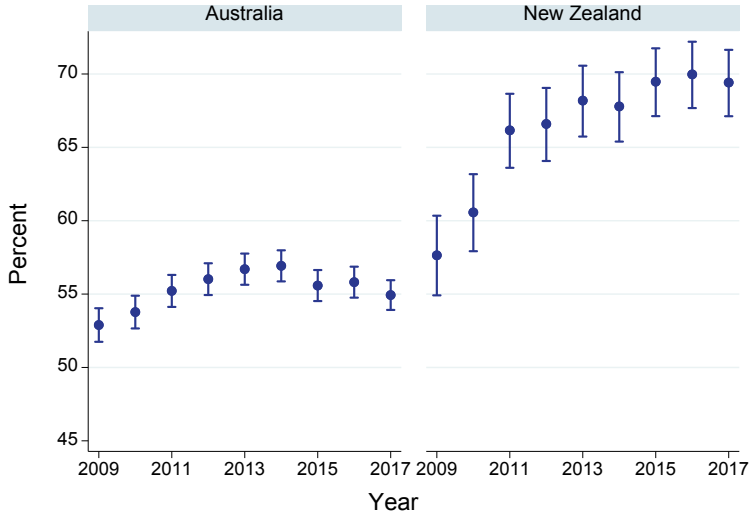


Figure 4.16 - Percentage of HD Patients Dialysing >12 Hours Per Week

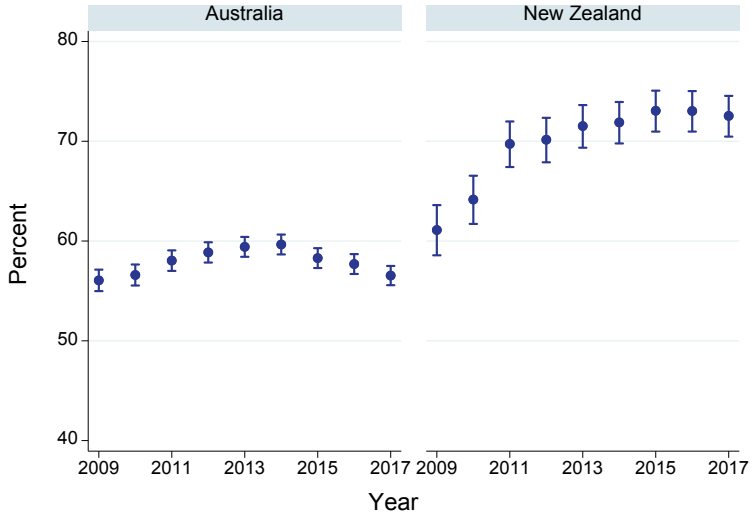


Table 4.10 Haemodialysis ≥5 Sessions per Week by Australian State and Country 2014-2017

State	2014	2015	2016	2017
QLD	43 (2.4%)	47 (2.5%)	38 (2.1%)	33 (1.7%)
NSW/ACT	19 (0.6%)	15 (0.5%)	12 (0.4%)	14 (0.4%)
VIC	48 (2.0%)	42 (1.8%)	43 (1.9%)	37 (1.5%)
TAS	3 (1.6%)	3 (1.5%)	3 (1.7%)	2 (1.1%)
SA	6 (1.0%)	7 (1.1%)	6 (0.9%)	4 (0.5%)
NT	2 (0.4%)	1 (0.2%)	1 (0.2%)	1 (0.2%)
WA	9 (1.0%)	11 (1.2%)	6 (0.7%)	9 (0.8%)
Australia	**130 (1.4%)**	**126 (1.3%)**	**109 (1.1%)**	**100 (1.0%)**
New Zealand	**16 (0.9%)**	**14 (0.8%)**	**12 (0.6%)**	**12 (0.6%)**

Table 4.11 Haemodialysis ≥4.5 Hours per Session - Three Sessions per Week by Australian State and Country 2014-2017

State	2014	2015	2016	2017
QLD	877 (57.7%)	912 (56.4%)	915 (56.9%)	983 (55.4%)
NSW/ACT	2047 (73.0%)	1957 (70.4%)	1919 (68.8%)	2018 (70.4%)
VIC	1036 (48.9%)	1027 (49.3%)	1039 (50.7%)	1127 (50.5%)
TAS	100 (62.9%)	105 (64.8%)	101 (62.7%)	105 (66.5%)
SA	171 (29.2%)	179 (30.1%)	200 (31.6%)	215 (30.2%)
NT	374 (73.8%)	370 (72.5%)	422 (73.8%)	451 (71.4%)
WA	223 (28.3%)	213 (25.8%)	203 (25.9%)	238 (24.4%)
Australia	**4828 (56.9%)**	**4763 (55.6%)**	**4799 (55.8%)**	**5137 (54.9%)**
New Zealand	**1044 (67.8%)**	**1088 (69.5%)**	**1135 (70.0%)**	**1135 (69.4%)**

Table 4.12 Haemodialysis >12 Hours per Week by Australian State and Country 2014-2017

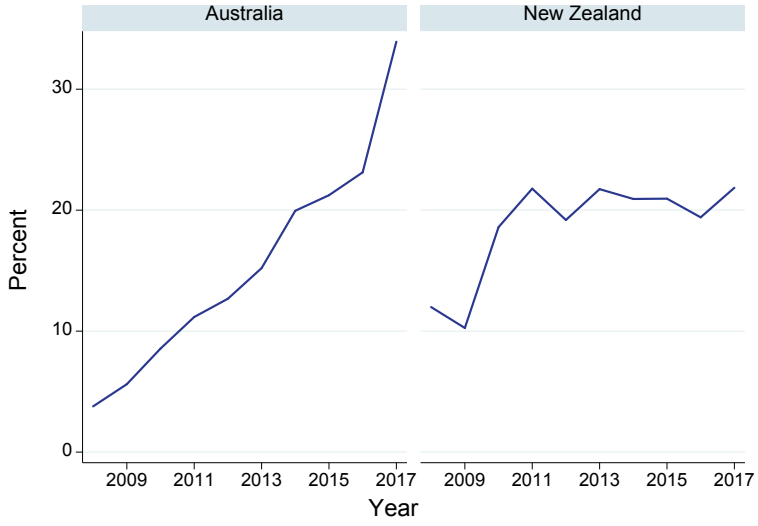
State	2014	2015	2016	2017
QLD	1088 (61.3%)	1096 (59.2%)	1090 (59.3%)	1124 (56.5%)
NSW/ACT	2275 (73.4%)	2191 (70.6%)	2130 (68.0%)	2205 (69.5%)
VIC	1272 (53.6%)	1261 (53.8%)	1257 (54.6%)	1322 (53.9%)
TAS	128 (67.4%)	131 (67.5%)	119 (66.5%)	119 (68.0%)
SA	204 (33.0%)	218 (34.5%)	235 (34.9%)	243 (32.7%)
NT	382 (73.6%)	388 (73.6%)	429 (73.8%)	463 (71.9%)
WA	285 (32.9%)	286 (31.5%)	261 (30.3%)	320 (29.7%)
Australia	**5634 (59.7%)**	**5571 (58.3%)**	**5521 (57.7%)**	**5796 (56.5%)**
New Zealand	**1325 (71.9%)**	**1345 (73.1%)**	**1376 (73.0%)**	**1366 (72.5%)**

Table 4.13 shows the use of high-flux dialysis and haemodiafiltration by state and country in 2017. There are substantial differences across states and countries. Figure 4.17 shows the rapid growth in the use of HDF in Australia, in contrast to New Zealand where its use has been steady since 2010.

Table 4.13 Number of Patients Receiving Standard Haemodialysis (and Membrane Type), Haemofiltration and Haemodiafiltration - December 2017

HD Modality	QLD	NSW/ACT	VIC	TAS	SA	NT	WA	Australia	New Zealand
Haemodialysis	1227	2081	2063	165	450	495	537	**7018**	**1495**
High Flux	1130	1968	1948	160	447	465	477	**6595**	**1361**
Non-High Flux	12	21	37	5	1	4	0	**80**	**109**
Unreported	85	92	78	0	2	26	60	**343**	**25**
Haemofiltration	47	76	3	0	2	0	0	**128**	**1**
Haemodiafiltration	800	1116	464	10	293	174	618	**3475**	**417**
Percent HDF of Total	38.6%	34.1%	18.3%	5.7%	39.3%	26%	53.5%	**32.7%**	**21.8%**
Total	**2074**	**3273**	**2530**	**175**	**745**	**669**	**1155**	**10621**	**1913**

Figure 4.17 - Use of Haemodiafiltration - Prevalent Haemodialysis Patients 2008-2017



In the 2017 survey, the mode of delivery of substitution fluid for haemodiafiltration was recorded for the first time (table 4.14). In Australia and New Zealand, the predominant mode of delivery of substitution fluid for HDF was post-dilution, however pre-dilution was more common in New Zealand than in Australia.

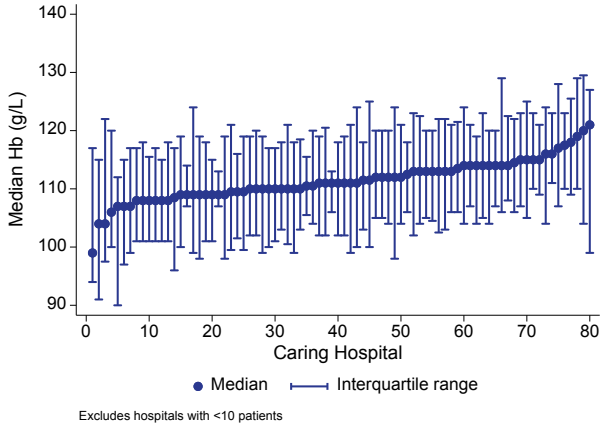
Table 4.14 Mode of delivery of substitution fluid in patients using haemodiafiltration - December 2017

HDF Type	Australia	New Zealand
Predilution	199 (6%)	148 (35%)
Mixed Dilution	60 (2%)	2 (0%)
Postdilution	3190 (92%)	263 (63%)
Not Reported	26 (1%)	4 (1%)
Total	**3475**	**417**

Anaemia

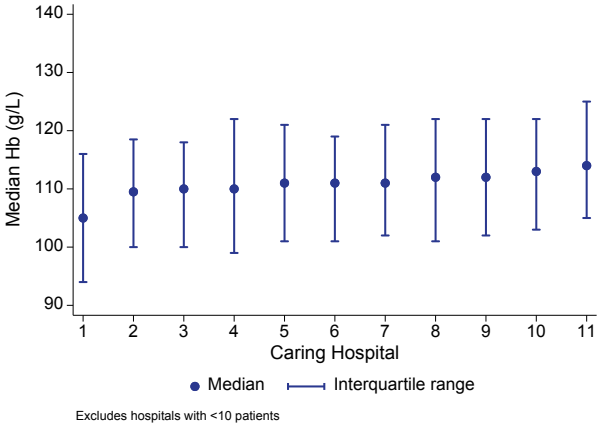
Figure 4.18 shows the variation in Hb between treating hospitals; median Hb ranged from 99 to 121g/L in Australia and 105 to 114g/L in New Zealand.

Figure 4.18.1 - Haemoglobin in Haemodialysis Patients - Australia 31 December 2017



Excludes hospitals with <10 patients

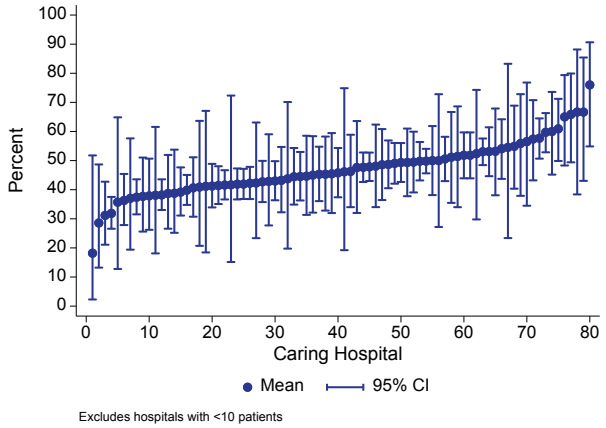
Figure 4.18.2 - Haemoglobin in Haemodialysis Patients - New Zealand 31 December 2017



Excludes hospitals with <10 patients

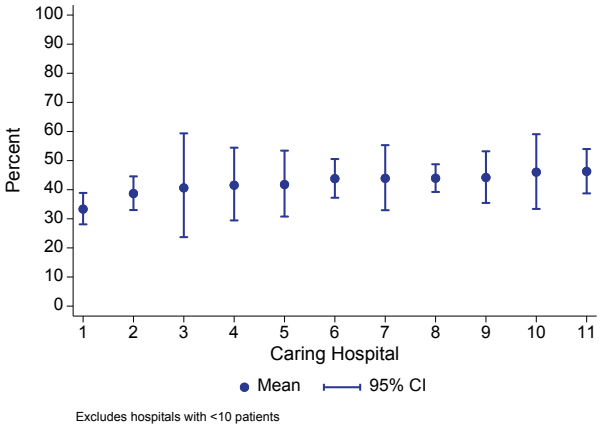
Figure 4.19 shows the proportion of patients with Hb between 110-129g/L; the proportion ranged from 18-76% in Australia and 33-46% in New Zealand.

Figure 4.19.1 - % Haemodialysis Patients with Hb 110-129 g/L - Australia 31 December 2017



Excludes hospitals with <10 patients

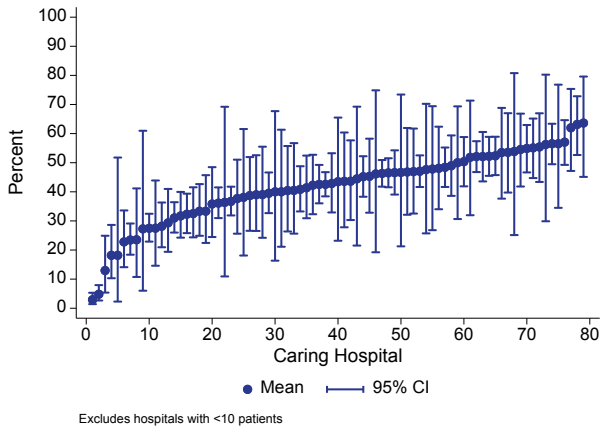
Figure 4.19.2 - % Haemodialysis Patients with Hb 110-129 g/L - New Zealand 31 December 2017



Excludes hospitals with <10 patients

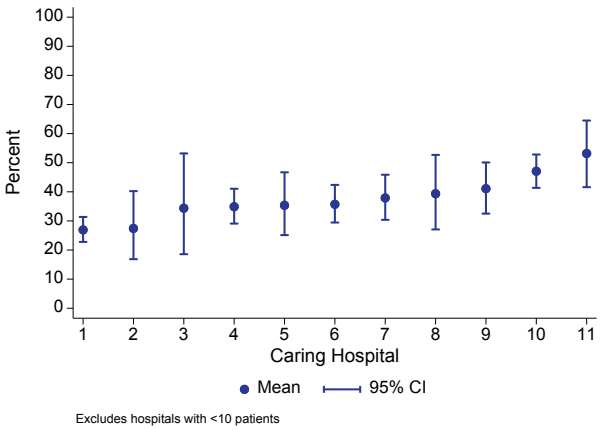
The proportion of patients with ferritin between 200-500µg/L ranged from 3-64% in Australia and 27-53% in New Zealand (figure 4.20). Figure 4.21 presents equivalent data for transferrin saturation.

Figure 4.20.1 - % Haemodialysis Patients with Ferritin 200-500 µg/L - Australia 31 December 2017



Excludes hospitals with <10 patients

Figure 4.20.2 - % Haemodialysis Patients with Ferritin 200-500 µg/L - New Zealand 31 December 2017



Excludes hospitals with <10 patients

Figure 4.21.1 - % Haemodialysis Patients with TSat>20% - Australia 31 December 2017

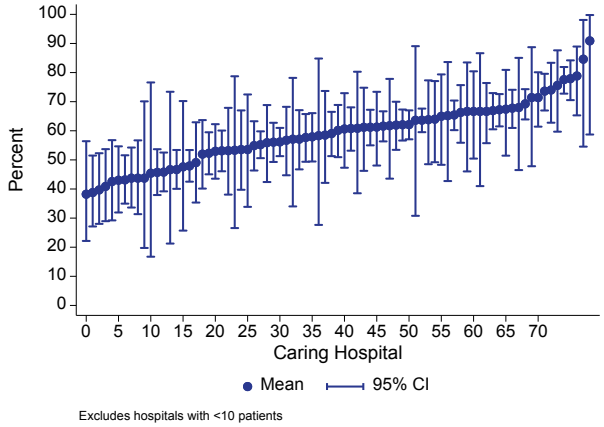
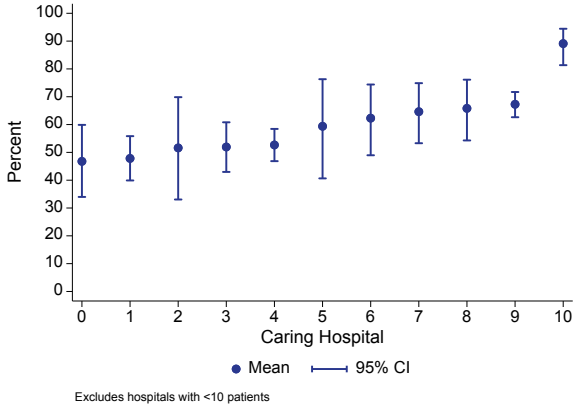


Figure 4.21.2 - % Haemodialysis Patients with TSat>20% - New Zealand 31 December 2017



Biochemistry

Figures 4.22 and 4.23 show the proportions of patients with calcium between 2.1-2.4mmol/L and phosphate between 0.8-1.6mmol/L respectively.

Figure 4.22.1 - % Haemodialysis Patients with Calcium 2.1-2.4 mmol/L - Australia 31 December 2017

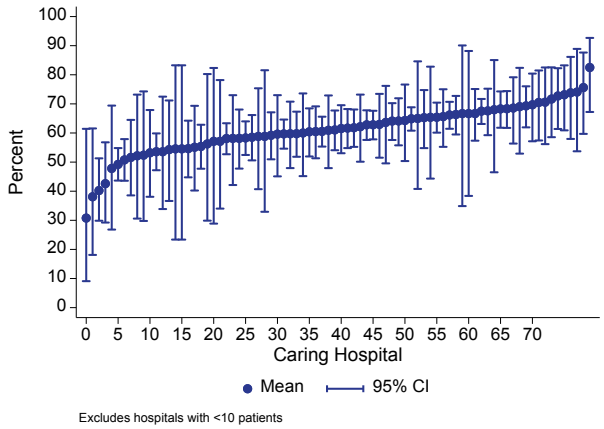


Figure 4.22.2 - % Haemodialysis Patients with Calcium 2.1-2.4 mmol/L - New Zealand 31 December 2017

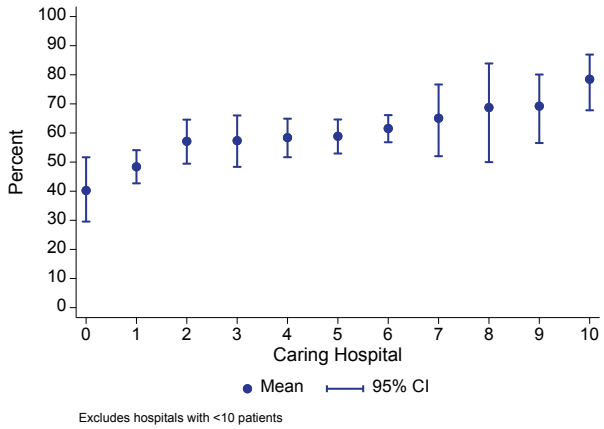


Figure 4.23.1 - % Haemodialysis Patients with Phosphate 0.8-1.6 mmol/L - Australia 31 December 2017

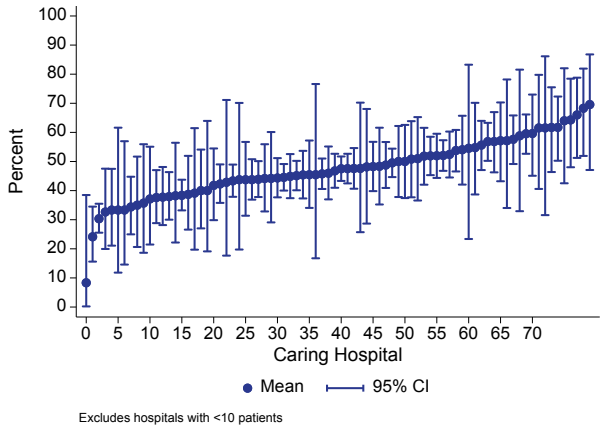
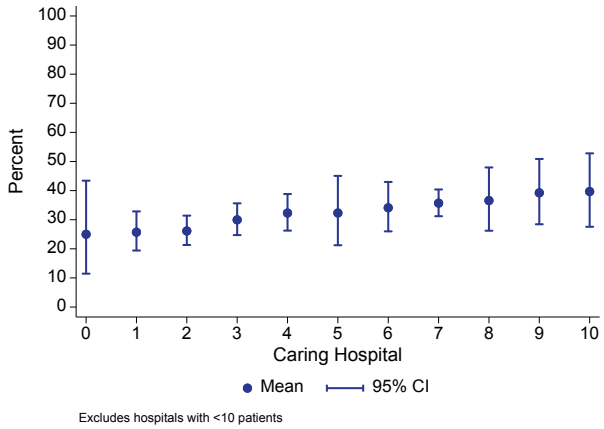


Figure 4.23.2 - % Haemodialysis Patients with Phosphate 0.8-1.6 mmol/L - New Zealand 31 December 2017



Dialysis Adequacy

Figure 4.24 shows the distribution of urea reduction ratio (URR) by country over 2015-2017; there is little change from year to year, and clearances are lower in New Zealand than in Australia. Figure 4.25 presents the 2017 data stratified by vascular access type.

Figure 4.24 - Urea Reduction Ratio - HD Three Sessions Per Week

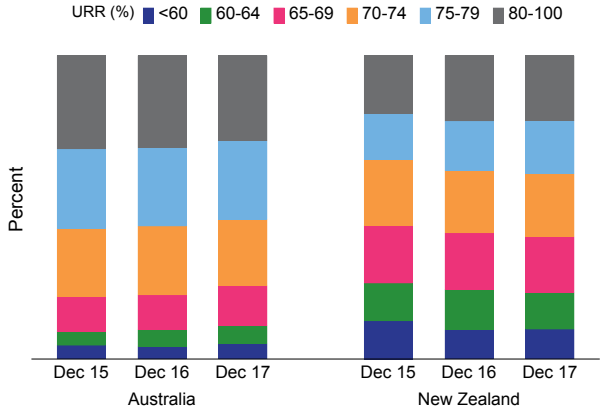


Figure 4.25 - Urea Reduction Ratio - By Type of Access, 2017 HD Three Sessions Per Week

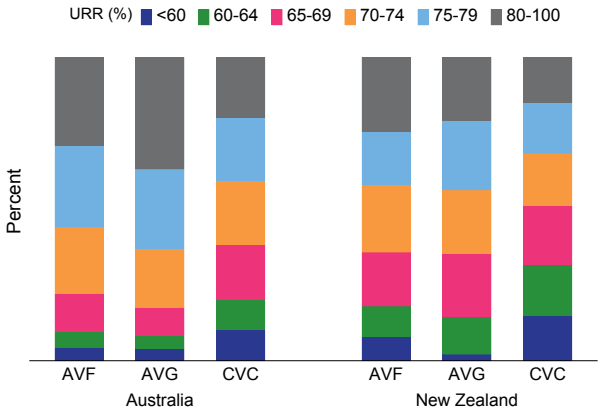


Table 4.15 presents URR by dialysis session duration. In general, as expected, the proportion of patients with a URR >70% typically increases with longer session duration.

Table 4.15 Urea Reduction Ratio - Prevalent Patients Three Sessions per Week - December 2017

Country	Hours per Session	Urea Reduction Ratio %		
		≤70	>70	Total
Australia	**<4 hours**	131 (38.5%)	209 (61.5%)	**340**
	4 hours	1018 (28.5%)	2548 (71.5%)	**3566**
	>4-5 hours	1149 (25.8%)	3304 (74.2%)	**4453**
	>5 hours	83 (27.4%)	220 (72.6%)	**303**
	Total	**2381 (27.5%)**	**6281 (72.5%)**	**8662**
New Zealand	**<4 hours**	14 (45.2%)	17 (54.8%)	**31**
	4 hours	172 (42.0%)	238 (58.0%)	**410**
	>4-5 hours	372 (42.9%)	495 (57.1%)	**867**
	>5 hours	37 (37.0%)	63 (63.0%)	**100**
	Total	**595 (42.3%)**	**813 (57.7%)**	**1408**

Figure 4.26 shows the distribution of median URR by treating hospital for patients dialysing three times per week. In Australia the median ranged from 65-88%, and in New Zealand it ranged from 67-81%.

Figure 4.26.1 - Median URR in Haemodialysis Patients - Three Sessions Per Week Australia 31 December 2017

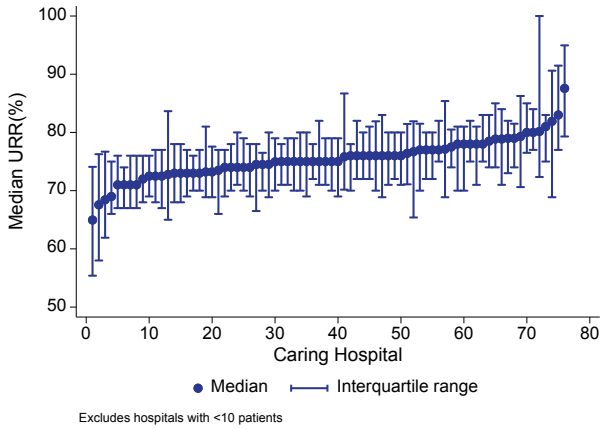


Figure 4.26.2 - Median URR in Haemodialysis Patients - Three Sessions Per Week New Zealand 31 December 2017

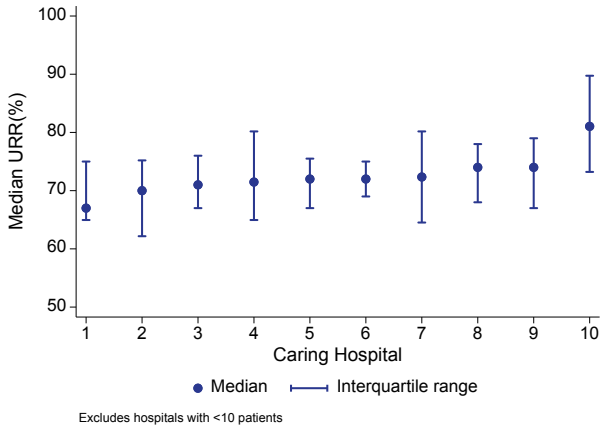


Figure 4.27 shows the proportion of patients with a URR >70%. In Australia this proportion ranged from 36-93%, and in New Zealand from 41-83%.

Figure 4.27.1 - % Haemodialysis Patients with URR>70% - Three Sessions Per Week Australia 31 December 2017

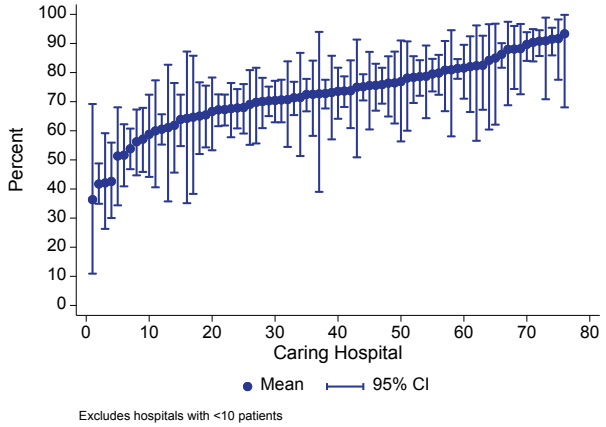
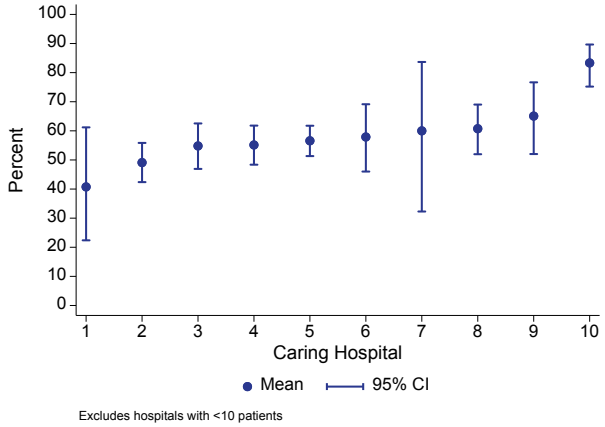


Figure 4.27.2 - % Haemodialysis Patients with URR>70% - Three Sessions Per Week New Zealand 31 December 2017



Vascular Access

Incident Patients

As shown in figures 4.28 to 4.31 and table 4.16, the majority of patients commenced haemodialysis as their first RRT with a catheter; tunnelled catheters were more common than non-tunnelled. Young (age <25 years) patients and those patients who were first seen by nephrologists <3 months before starting haemodialysis (“late referrals”) were less likely to start with an AVF or AVG.

ANZDATA does not collect information about indication for HD catheter usage, hence the reason that around half of non-late referred patients commenced with a central venous catheter is not known.

Figure 4.28 - Vascular Access - Initial RRT - Haemodialysis as Initial Modality

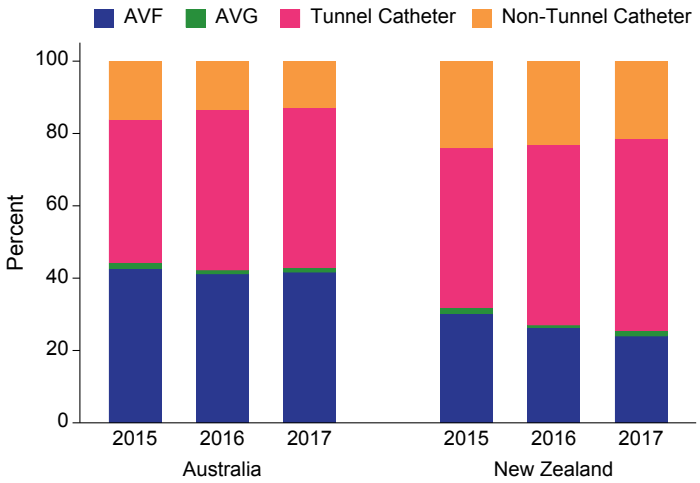


Figure 4.29 - Vascular Access - Initial RRT - By Age Group 2017

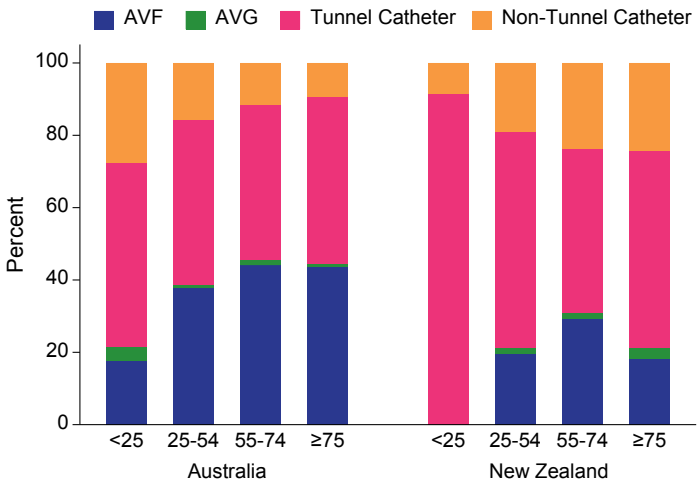


Figure 4.30.1 - Vascular Access - Initial RRT - By Gender - Australia

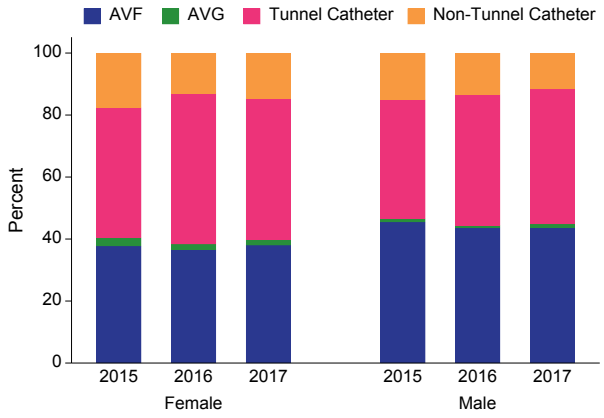


Figure 4.30.2 - Vascular Access - Initial RRT - By Gender - New Zealand

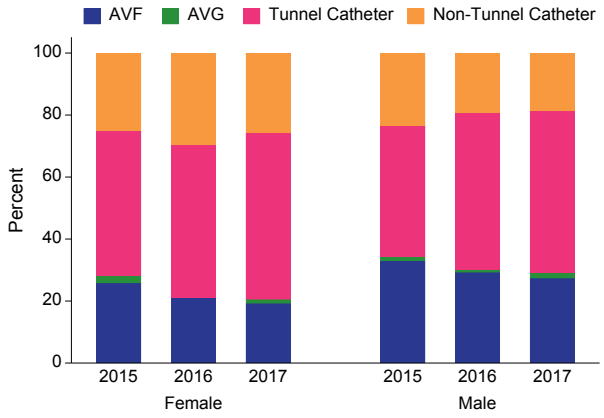


Figure 4.31.1 - Vascular Access - Initial RRT - By Referral Time - Australia

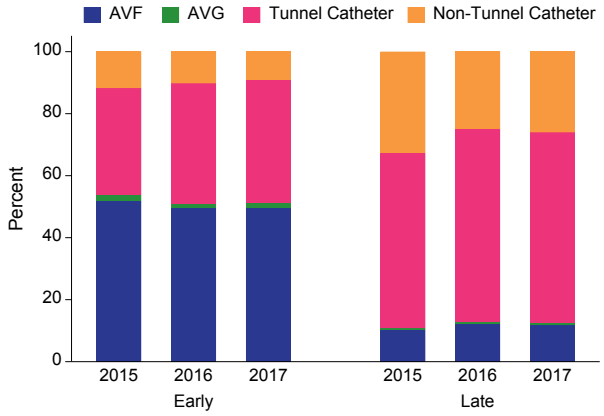


Figure 4.31.2 - Vascular Access - Initial RRT - By Referral Time - New Zealand

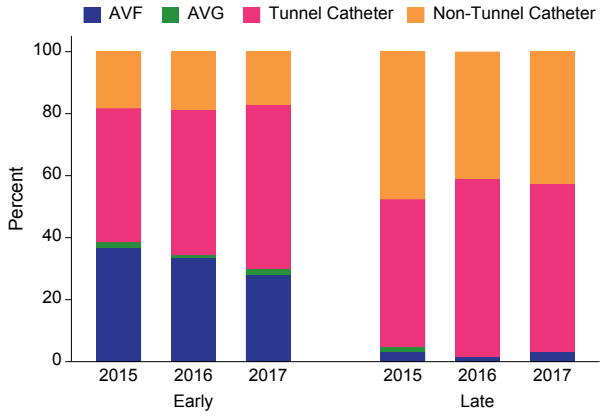
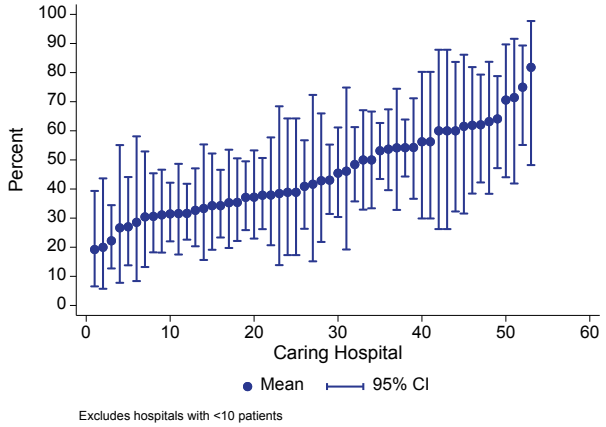


Table 4.16 Incident Vascular Access by Australian State and Country 2015-2017

State/Country	2015		2016		2017	
	AVF/AVG	CVC	AVF/AVG	CVC	AVF/AVG	CVC
QLD	168 (48%)	185 (52%)	150 (42%)	210 (58%)	201 (44%)	252 (56%)
NSW/ACT	237 (43%)	317 (57%)	237 (41%)	345 (59%)	259 (43%)	341 (57%)
VIC	193 (45%)	240 (55%)	214 (45%)	257 (55%)	224 (44%)	280 (56%)
TAS	14 (37%)	24 (63%)	25 (57%)	19 (43%)	12 (31%)	27 (69%)
SA	79 (60%)	52 (40%)	79 (48%)	84 (52%)	77 (54%)	66 (46%)
NT	46 (38%)	74 (62%)	33 (44%)	42 (56%)	48 (43%)	64 (57%)
WA	80 (37%)	135 (63%)	80 (33%)	164 (67%)	84 (33%)	172 (67%)
Australia	**817 (44%)**	**1027 (56%)**	**818 (42%)**	**1121 (58%)**	**905 (43%)**	**1202 (57%)**
New Zealand	**98 (32%)**	**210 (68%)**	**89 (27%)**	**241 (73%)**	**94 (26%)**	**274 (74%)**

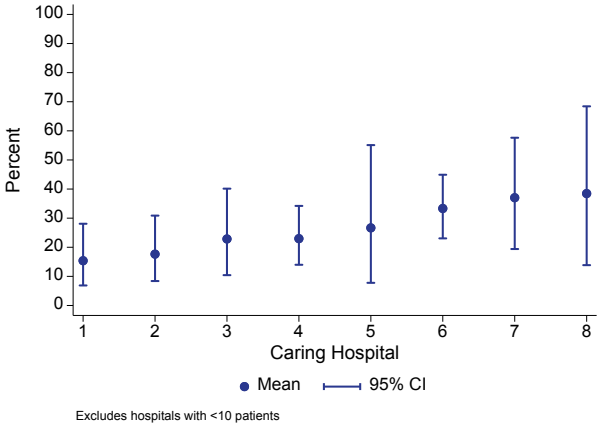
Figure 4.32 shows the proportion of patients in each hospital starting haemodialysis as their first RRT with an AVF/AVG, arranged from the lowest to the highest. In Australia, this ranged widely from 19-82%. The corresponding range in New Zealand was 15-38%. This wide variation reflects differences in practices, protocols, resources and patient case-mix among centres.

Figure 4.32.1 - % Initial RRT HD Patients Starting with AVF/AVG - Australia 2017



Excludes hospitals with <10 patients

Figure 4.32.2 - % Initial RRT HD Patients Starting with AVF/AVG - New Zealand 2017



Excludes hospitals with <10 patients

Prevalent Patients

Figures 4.33 to 4.36 and table 4.17 show dialysis access among prevalent (rather than incident) patients (those receiving haemodialysis at 31 December 2017). In Australia, the proportions of patients dialysing with AV grafts and fistulae at 31 December were stable, whereas in New Zealand there is a slight downward trend. Female patients in both countries, young (age <25 years) in Australia and old (age ≥75 years) patients in New Zealand were less likely to be dialysing with an AVF or AVG. Patients on home haemodialysis had the highest rate of AVF use in both Australia and New Zealand.

Figure 4.33 - Prevalent Haemodialysis Access

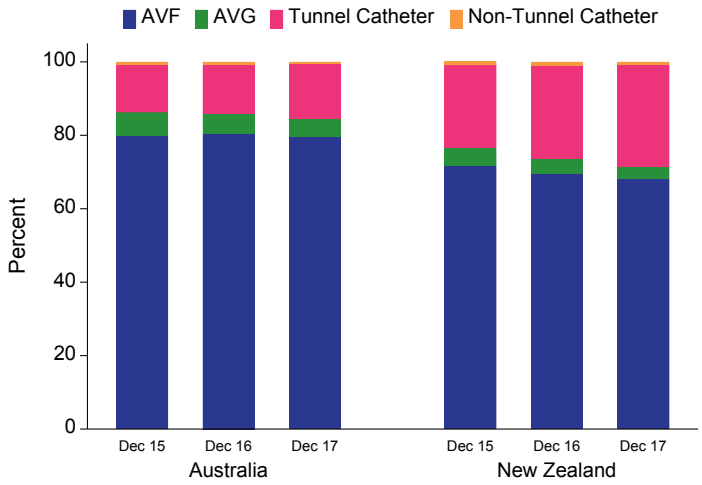


Figure 4.34 - Prevalent Haemodialysis Access - By Age Group 2017

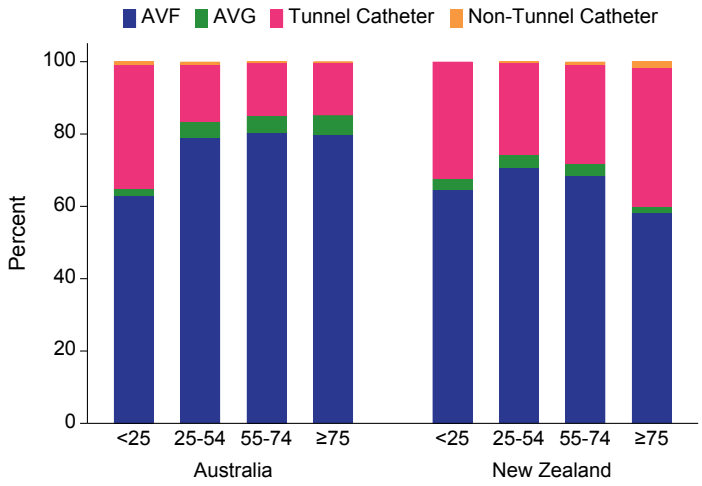


Figure 4.35.1 - Prevalent Haemodialysis Access - By Gender - Australia

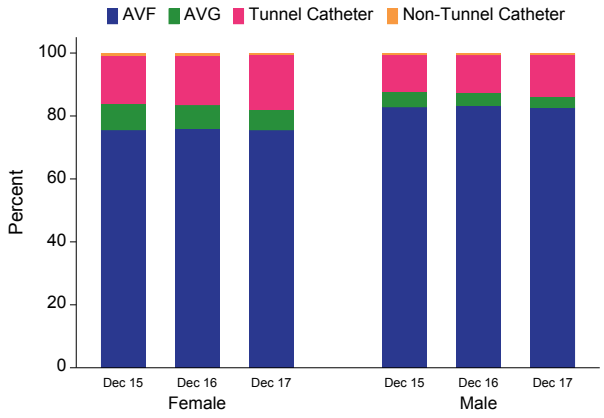


Figure 4.35.2 - Prevalent Haemodialysis Access - By Gender - New Zealand

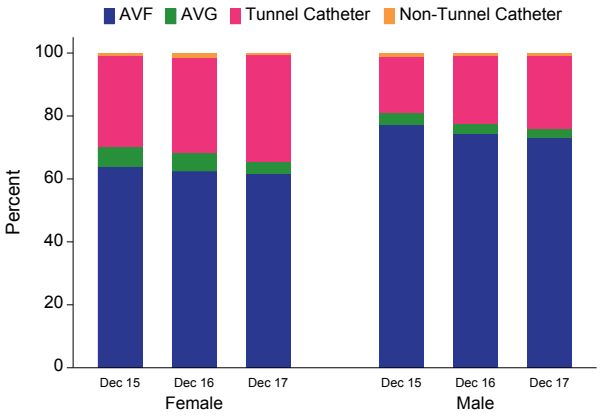


Figure 4.36 - Prevalent Haemodialysis Access - By Location 2017

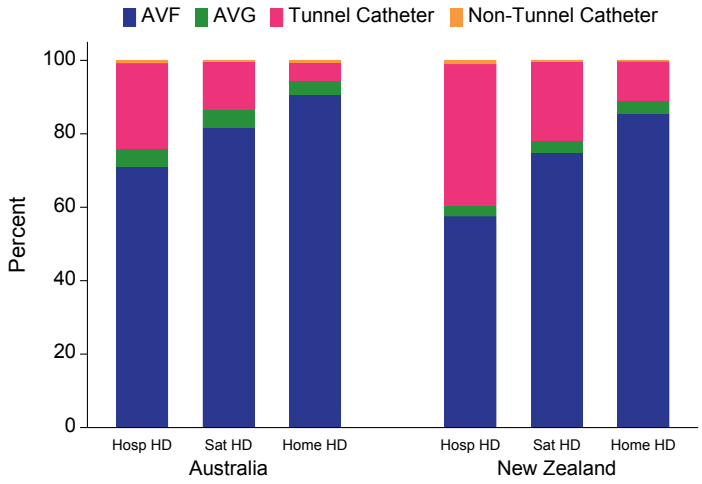


Table 4.17 Prevalent Vascular Access by Australian State and Country at 31 December 2017

State/Country	2015		2016		2017	
	AVF/AVG	CVC	AVF/AVG	CVC	AVF/AVG	CVC
QLD	1617 (88%)	224 (12%)	1591 (87%)	245 (13%)	1707 (86%)	279 (14%)
NSW/ACT	2620 (85%)	469 (15%)	2650 (85%)	464 (15%)	2658 (84%)	514 (16%)
VIC	2046 (88%)	284 (12%)	1980 (86%)	320 (14%)	2099 (86%)	352 (14%)
TAS	153 (79%)	41 (21%)	149 (83%)	30 (17%)	133 (76%)	42 (24%)
SA	577 (91%)	54 (9%)	607 (90%)	66 (10%)	669 (90%)	73 (10%)
NT	459 (87%)	66 (13%)	524 (90%)	58 (10%)	567 (89%)	73 (11%)
WA	738 (81%)	168 (19%)	684 (80%)	171 (20%)	825 (77%)	251 (23%)
Australia	**8210 (86%)**	**1306 (14%)**	**8185 (86%)**	**1354 (14%)**	**8658 (85%)**	**1584 (15%)**
New Zealand	**1403 (77%)**	**430 (23%)**	**1388 (74%)**	**496 (26%)**	**1344 (71%)**	**537 (29%)**

Figure 4.37 shows the proportion of haemodialysis patients at each hospital dialysing with an AVF/AVG on 31st December 2017, arranged from the lowest to the highest. In Australia, these proportions varied widely from 54-100%. The corresponding range in New Zealand was 34-92%.

Figure 4.37.1 - % Prevalent HD Patients Dialysing with AVF/AVG - Australia 31 December 2017

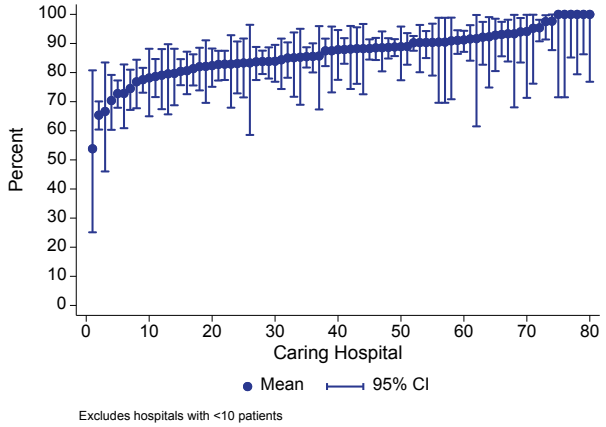
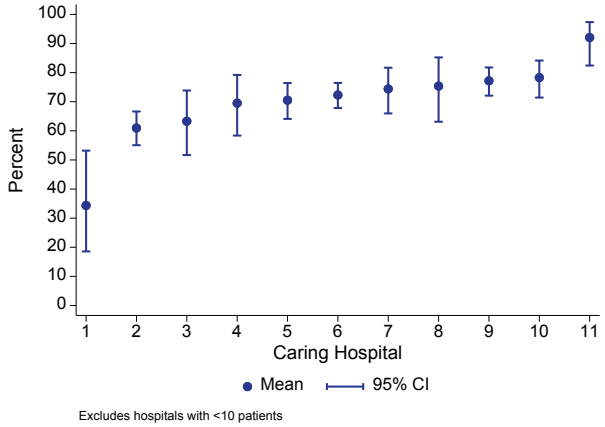


Figure 4.37.2 - % Prevalent HD Patients Dialysing with AVF/AVG - New Zealand 31 December 2017



Home Haemodialysis

The distribution of prevalent home haemodialysis patients by state is shown in table 4.18. The 2017 data are further stratified by age in figure 4.38, and the distribution of patients aged 65 and older is shown in table 4.19.

Table 4.18 Number (%) of Prevalent Haemodialysis Patients Treated with Home Haemodialysis 2013 - 2017

State	2013	2014	2015	2016	2017
QLD	270 (15.0%)	287 (15.6%)	282 (14.6%)	258 (13.0%)	235 (11.3%)
NSW/ACT	518 (16.4%)	498 (15.5%)	502 (15.5%)	478 (14.6%)	426 (13.0%)
VIC	200 (8.4%)	216 (9.0%)	216 (8.9%)	202 (8.2%)	191 (7.5%)
TAS	17 (9.6%)	23 (12.1%)	23 (11.9%)	18 (10.1%)	8 (4.6%)
SA	32 (5.1%)	33 (5.3%)	34 (5.2%)	30 (4.4%)	29 (3.9%)
NT	39 (8.0%)	46 (8.7%)	42 (7.2%)	41 (6.7%)	41 (6.1%)
WA	64 (7.0%)	75 (7.5%)	89 (8.5%)	97 (8.7%)	93 (8.1%)
Australia	**1140 (11.9%)**	**1178 (12.0%)**	**1188 (11.8%)**	**1124 (10.9%)**	**1023 (9.6%)**
New Zealand	**479 (27.2%)**	**489 (26.2%)**	**483 (25.2%)**	**468 (24.3%)**	**436 (22.8%)**

Figure 4.38 - Home HD by Age Group - at 31 Dec 2017

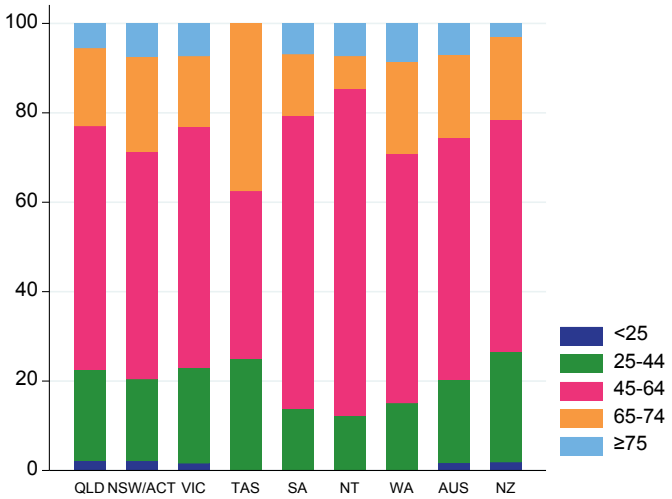


Table 4.19 Number (%) of Prevalent Haemodialysis Patients Aged >=65 Years Treated with Home Haemodialysis 2013 - 2017

State	2013	2014	2015	2016	2017
QLD	66 (7.6%)	77 (8.7%)	73 (7.6%)	60 (6.1%)	54 (5.3%)
NSW/ACT	121 (6.9%)	124 (7.0%)	121 (6.7%)	132 (7.1%)	122 (6.5%)
VIC	50 (3.6%)	53 (3.8%)	52 (3.6%)	51 (3.4%)	44 (2.9%)
TAS	6 (7.0%)	7 (8.0%)	6 (6.2%)	4 (4.2%)	3 (3.3%)
SA	10 (2.8%)	5 (1.4%)	8 (2.2%)	9 (2.5%)	6 (1.5%)
NT	4 (6.1%)	6 (8.0%)	6 (6.0%)	5 (5.0%)	6 (4.6%)
WA	11 (2.6%)	14 (3.1%)	16 (3.5%)	25 (5.0%)	27 (5.2%)
Australia	**268 (5.4%)**	**286 (5.7%)**	**282 (5.4%)**	**286 (5.3%)**	**262 (4.7%)**
New Zealand	**80 (13.8%)**	**85 (13.4%)**	**91 (13.9%)**	**93 (13.8%)**	**94 (13.8%)**

The trends in the proportion treated with home HD in different age groups are illustrated in figure 4.39. In general home haemodialysis has become less common as a proportion of all haemodialysis patients, especially for younger patients.

Figure 4.39.1 - Home HD Percent of all HD by Age at 31 Dec 2017 – Australia

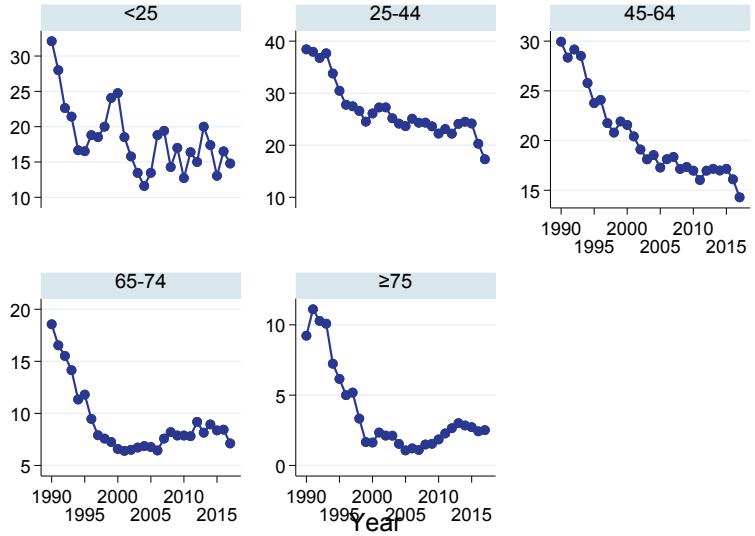
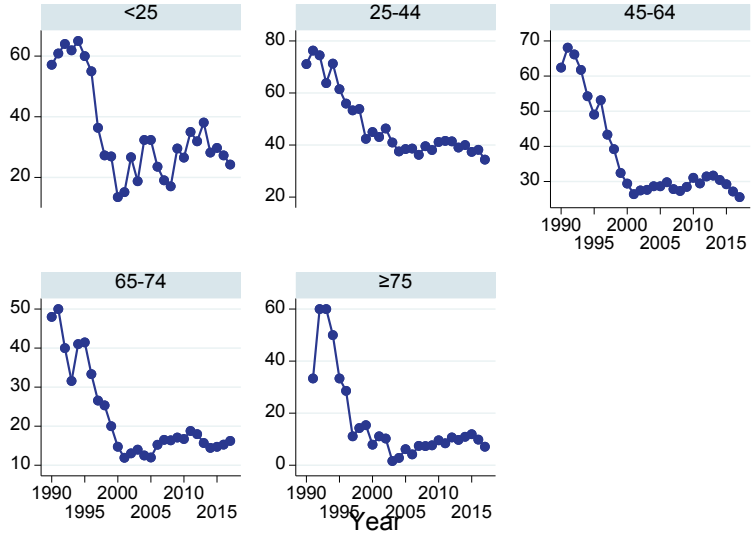


Figure 4.39.2 - Home HD Percent of all HD by Age at 31 Dec 2017 - New Zealand



There is substantial variation between hospitals, and between countries, in the proportion of haemodialysis patients who dialyse at home (figure 4.40).

Figure 4.40.1 - % Haemodialysis Patients on Home HD by Caring Hospital - Australia 31 December 2017

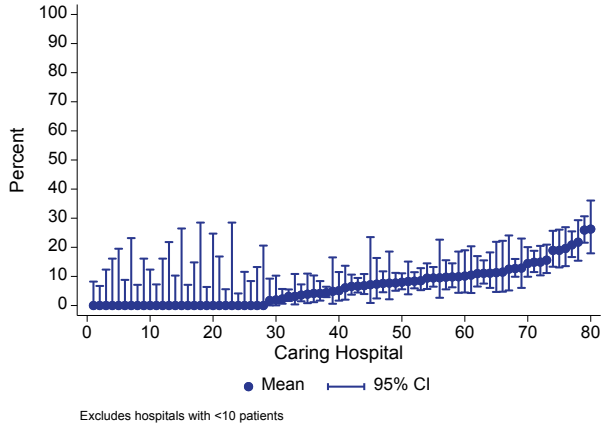
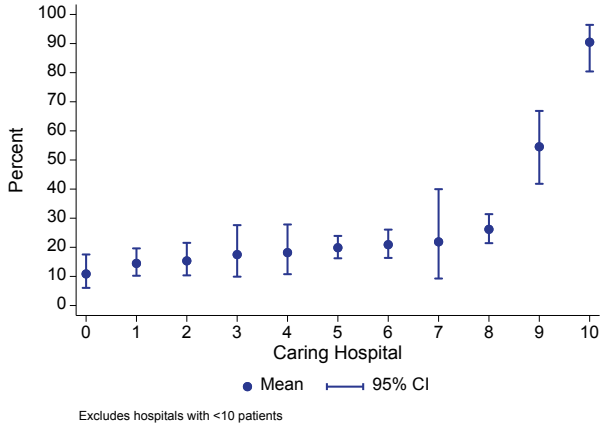


Figure 4.40.2 - % Haemodialysis Patients on Home HD by Caring Hospital - New Zealand 31 December 2017



The following figures explore the concept of technique failure as applied to home haemodialysis. Each treatment episode can end in a variety of ways. Changes to another dialysis modality (either institutional haemodialysis or peritoneal dialysis) for 30 or more days are considered a “failure”, as is death. Follow-up is censored at transplantation, or 31 Dec 2017. When death of a patient is counted as a censoring event (rather than “failure”), the differences between the age groups become less apparent (figure 4.43).

Figure 4.41 - Technique Survival - Home Haemodialysis 2007 – 2017

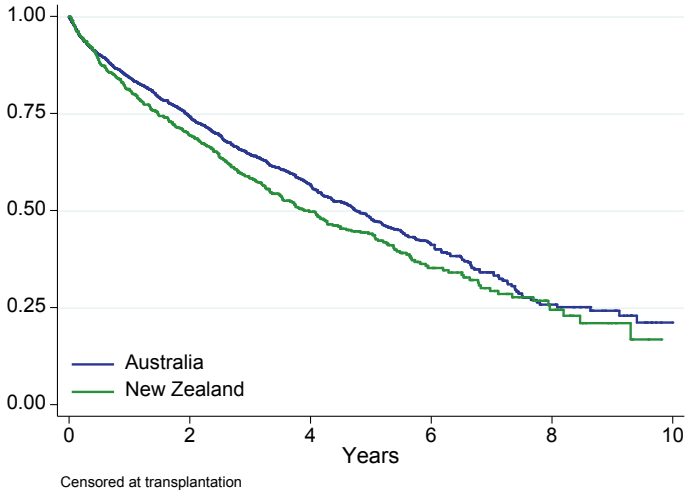


Figure 4.42 - Technique Survival by Age Group - Home Haemodialysis 2007 – 2017

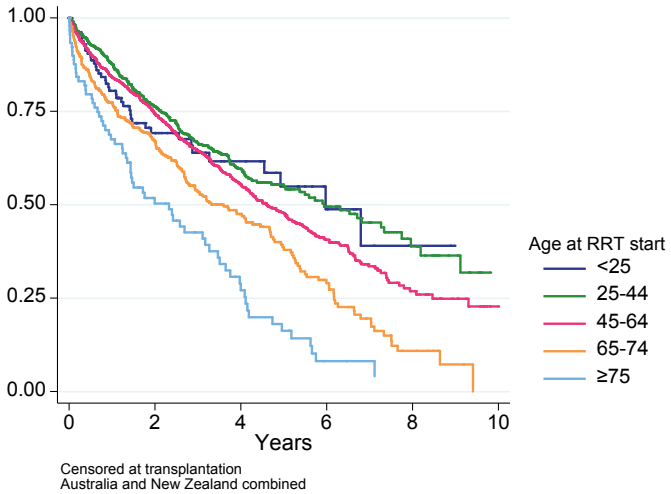


Figure 4.43.1 - Death-Censored Technique Survival by Age Group - Home Haemodialysis 2007 - 2017 Australia

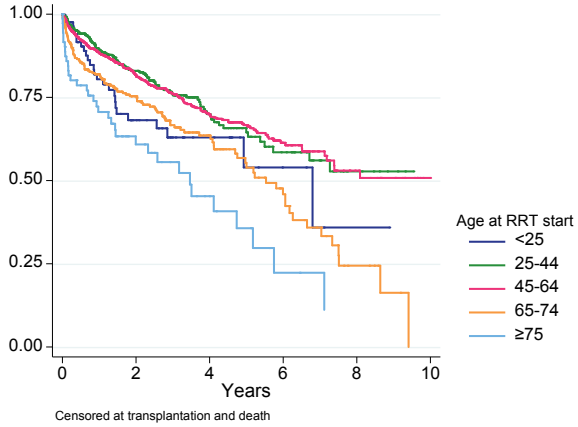


Figure 4.43.2 - Death-Censored Technique Survival by Age Group - Home Haemodialysis 2007 - 2017 New Zealand

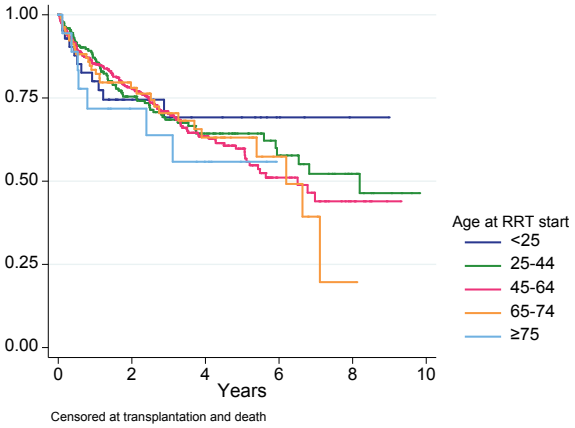
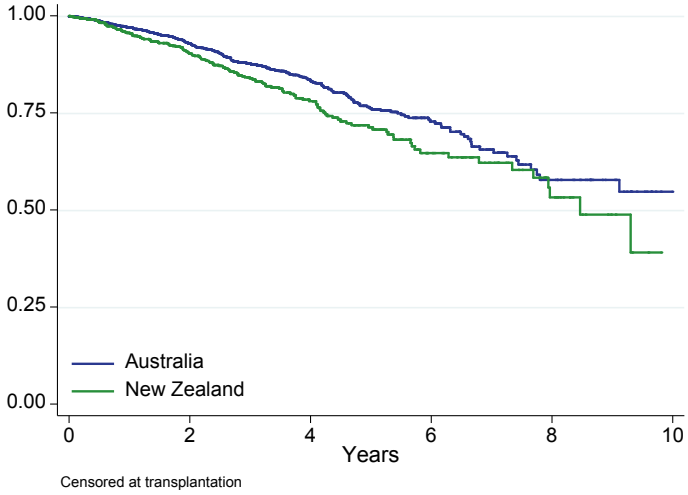


Figure 4.44 - Patient Survival - Home Haemodialysis 2007 – 2017



The following figures explore trends in home haemodialysis prescriptions. In general prescriptions are either stable or moving towards less frequent, shorter sessions. Quotidian dialysis is defined as >3 sessions per week OR >5 hours per session.

Figure 4.45 - Home Haemodialysis Conventional/Quotidian - 2015-2017

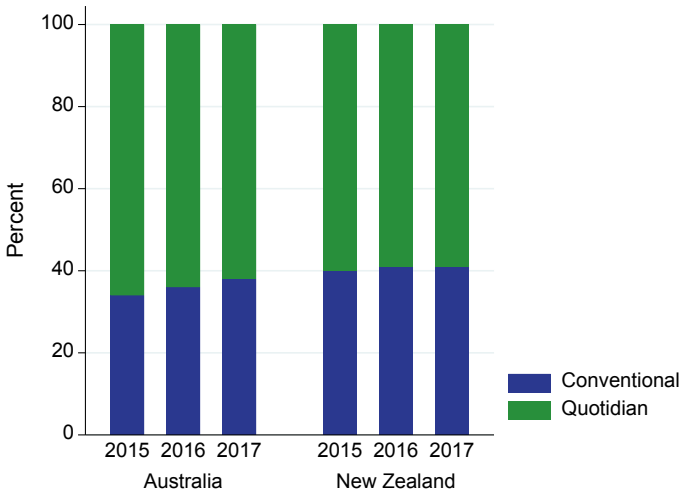


Figure 4.46 - Home Haemodialysis Frequency Per Week - 2015-2017

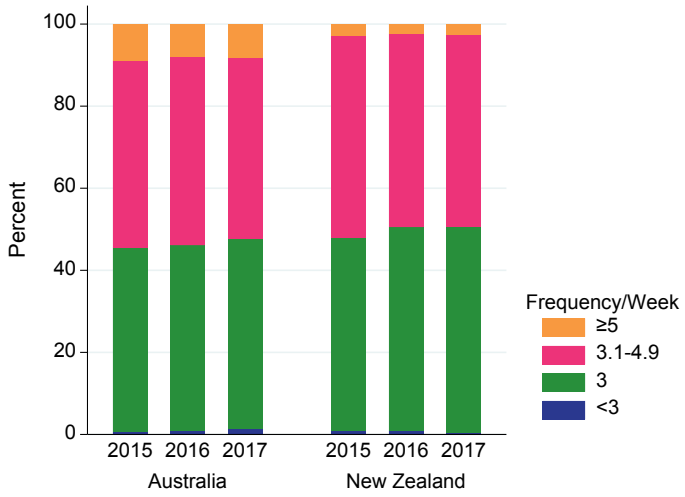


Figure 4.47 - Home Haemodialysis Session Length (Hours) - December 2015-2017

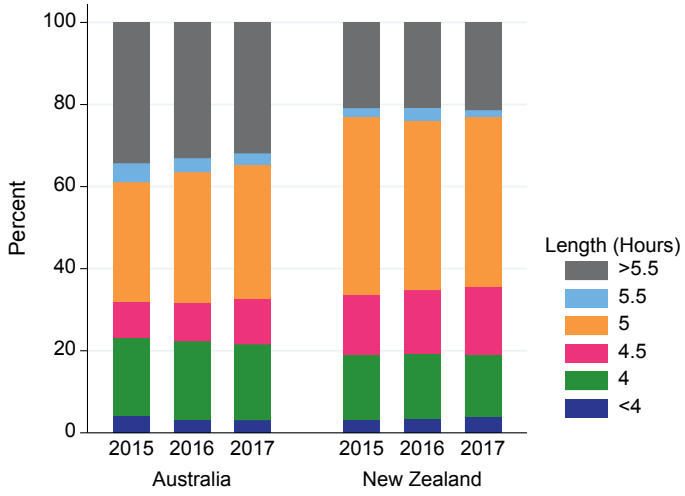


Figure 4.48 - Home Haemodialysis Duration (Hours Per Week) - December 2015-2017

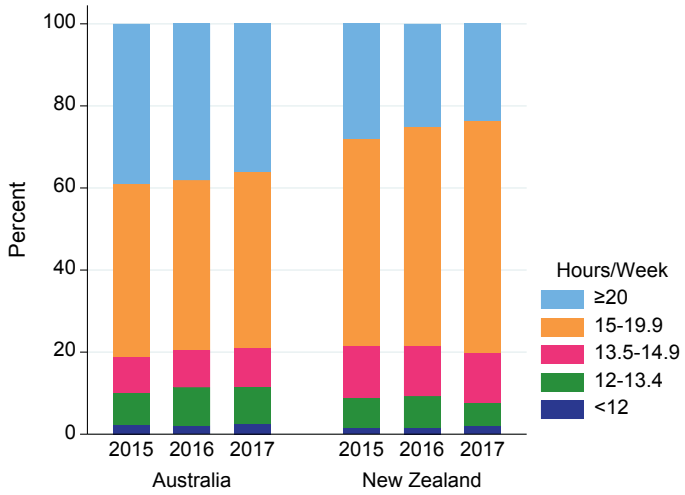


Figure 4.49 - Percentage of Home HD Patients Dialysing Five or More Days Per Week

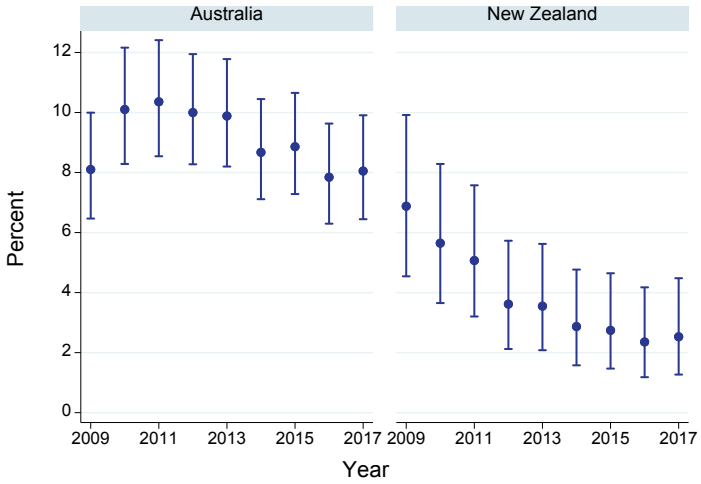


Figure 4.50 - Percentage of Home HD Patients Dialysing 3 Days Per Week Dialysing 4.5 Hours or Longer Per Session

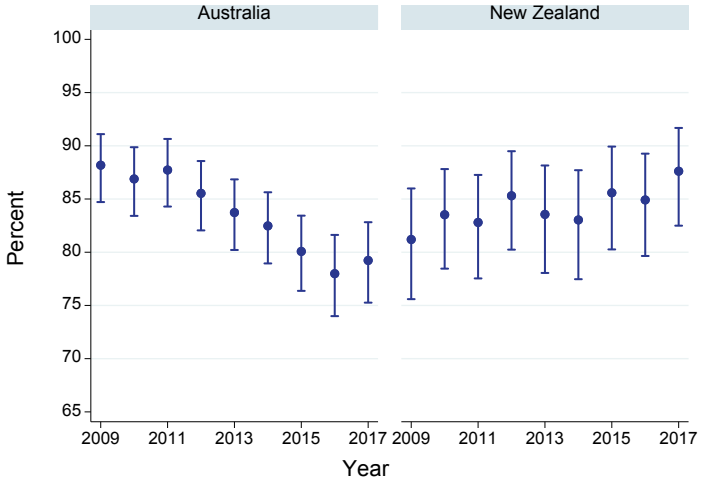


Figure 4.51 - Percentage of Home HD Patients Dialysing >12 Hours Per Week