



CHAPTER 3

Mortality in End Stage Kidney Disease

Reporting the survival of patients on renal replacement therapy in Australia and New Zealand and causes of death in this population.

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Suggested citation

ANZDATA Registry. 41st Report, Chapter 3: Mortality in End Stage Kidney Disease. Australia and New Zealand Dialysis and Transplant Registry, Adelaide, Australia. 2018. Available at:
<http://www.anzdata.org.au>

Survival

Overall survival for patients who started renal replacement therapy (RRT) in the period 2008-2017 is shown in figure 3.1 using the Kaplan-Meier method to calculate survival curves. Table 3.1 shows the survival at 1, 2 and 5 years for incident renal replacement therapy patients by age group of the same period. These data are not censored at transplantation.

Figure 3.1.1 - Survival on Renal Replacement Therapy - Australia 2008-2017

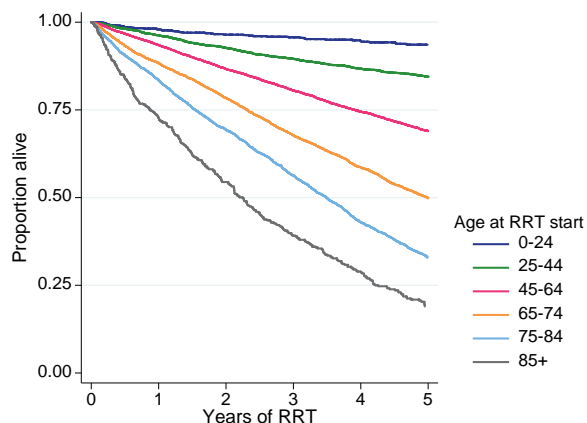


Figure 3.1.2 - Survival on Renal Replacement Therapy - New Zealand 2008-2017

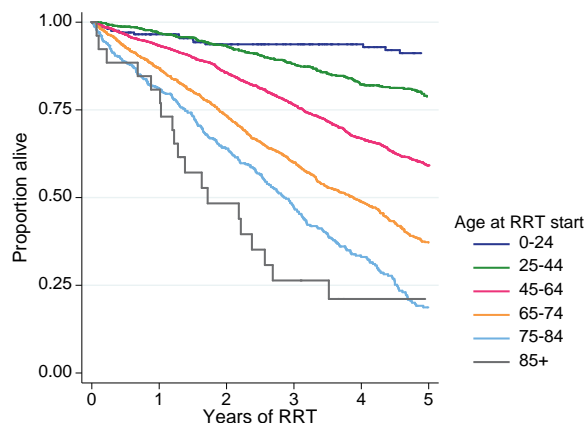


Table 3.1 Survival (95% CI) Among People Who Commenced Renal Replacement Therapy 2008-2017

Age at RRT start	Years	Australia	New Zealand
0-24	1	98 (97, 99)	97 (93, 98)
	2	96 (95, 98)	94 (89, 96)
	5	94 (91, 95)	91 (86, 95)
25-44	1	96 (96, 97)	97 (95, 98)
	2	93 (92, 94)	93 (91, 95)
	5	84 (83, 86)	79 (75, 82)
45-64	1	93 (93, 94)	93 (92, 94)
	2	87 (86, 87)	86 (84, 87)
	5	69 (68, 70)	59 (57, 61)
65-74	1	88 (87, 89)	87 (85, 89)
	2	78 (77, 79)	73 (71, 76)
	5	50 (48, 51)	37 (34, 40)
75-84	1	83 (82, 84)	81 (77, 84)
	2	69 (68, 71)	64 (59, 68)
	5	33 (31, 35)	19 (14, 24)
85+	1	73 (69, 76)	81 (60, 92)
	2	54 (50, 59)	48 (28, 66)
	5	19 (15, 23)	21 (7, 40)

To allow for international comparisons, survival of non-indigenous patients who commenced RRT with dialysis in 2008-2017, censored at transplantation, is shown in table 3.2. The Indigenous populations of Australia and New Zealand experience a unique burden of end stage renal disease that is explored in further detail in Chapter 10.

Table 3.2 Survival (95% CI) Among Non-Indigenous People Who Commenced Dialysis 2008-2017

Age at start	Years	Australia	New Zealand
0-24	1	98 (96, 99)	95 (87, 98)
	2	96 (94, 98)	93 (82, 97)
	5	88 (80, 93)	85 (60, 95)
25-44	1	97 (96, 97)	97 (94, 98)
	2	93 (91, 94)	93 (88, 95)
	5	77 (74, 80)	72 (63, 80)
45-64	1	93 (92, 94)	92 (91, 94)
	2	85 (85, 86)	84 (81, 86)
	5	61 (59, 63)	53 (48, 57)
65-74	1	88 (87, 89)	87 (84, 89)
	2	78 (77, 79)	73 (70, 77)
	5	48 (46, 49)	35 (30, 40)
75-84	1	83 (82, 84)	80 (75, 84)
	2	69 (68, 71)	63 (58, 68)
	5	33 (31, 35)	18 (13, 24)
85+	1	73 (69, 76)	78 (55, 90)
	2	54 (50, 59)	46 (24, 65)
	5	19 (15, 23)	19 (5, 39)

Unadjusted death rates for dialysis and transplantation during 2017 are shown in table 3.3 for various groups. This table includes all episodes of dialysis and transplantation (i.e. analyses are not censored at first transplant date), and deaths are attributed to the modality in use at the time of death. For this table, episodes of treatment include all people treated in 2017, regardless of year of first treatment.

Mortality rates are generally higher with older age, diabetes and coronary artery disease. The comparison between indigenous rates (and some other comparisons) will be subject to several confounders. Comparisons of mortality rates with the general population (stratified by gender) are shown in figures 3.2 and 3.3.

Population and death estimates for Australia and New Zealand used for the calculation of mortality rates in this chapter were sourced from the Australian Bureau of Statistics (2017)^{1,2} and Stats NZ (2017)^{3,4}.

Table 3.3 Death Rates per 100 patient-years during Renal Replacement Therapy - 2017

Category	Level	Dialysis			Transplant		
		Rate	Lower CI	Upper CI	Rate	Lower CI	Upper CI
Country	Australia	14.4	13.7	15.1	1.9	1.7	2.2
	New Zealand	15.3	13.9	16.8	2.7	2.0	3.6
Age	<25	2.2	0.8	4.8	0.3	0.0	1.2
	25-44	5.4	4.4	6.6	0.4	0.2	0.7
	45-64	10.4	9.6	11.2	1.5	1.2	1.8
	65-84	19.6	18.6	20.7	4.8	4.0	5.6
	85+	35.3	30.4	40.7	27.3	11.0	56.2
Diabetes status	Non-diabetic	12.6	11.8	13.4	1.8	1.6	2.1
	Type 1 diabetes	14.0	11.2	17.3	2.3	1.3	3.7
	Type 2 diabetes	16.8	15.9	17.8	3.7	2.7	5.0
Coronary disease	No	11.9	11.2	12.5	1.9	1.6	2.1
	Yes	20.4	19.2	21.8	4.1	3.0	5.6
Ethnicity	Aus Non-Indigenous	15.3	14.5	16.0	1.9	1.7	2.2
	NZ Non-Indigenous	18.0	15.6	20.7	2.9	2.1	3.9
	Aus Indigenous	10.5	9.1	12.1	2.3	0.8	4.9
	Aus Māori	12.5	7.3	20.1	1.5	0.0	8.4
	NZ Māori	16.2	13.7	19.1	3.1	1.1	6.7
	Aus Pacific	10.4	7.7	13.8	1.5	0.2	5.5
	NZ Pacific	10.1	7.9	12.7	0.7	0.0	3.8

Figure 3.2.1 - Prevalent Dialysis Mortality - Australian Patients vs General Population

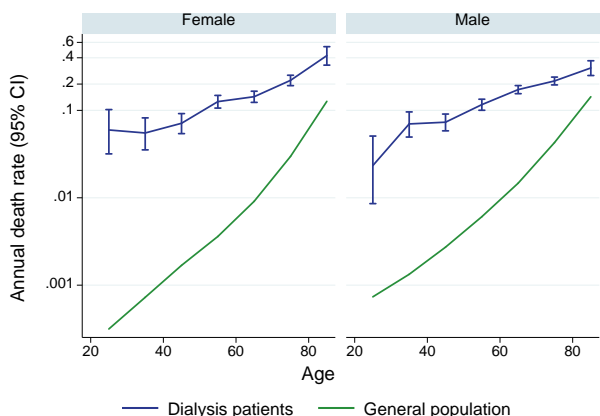


Figure 3.2.2 - Prevalent Transplant Mortality - Australian Patients vs General Population

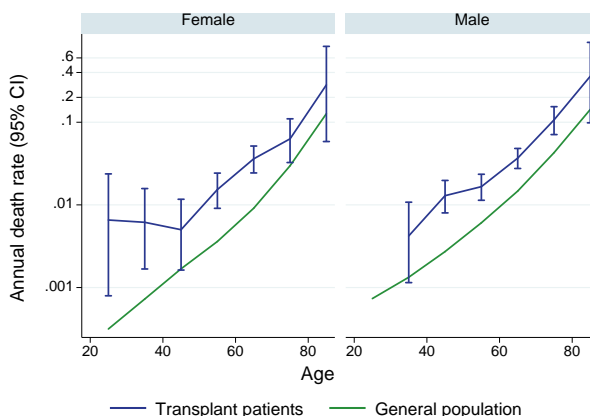


Figure 3.3.1 - Prevalent Dialysis Mortality - New Zealand Patients vs General Population

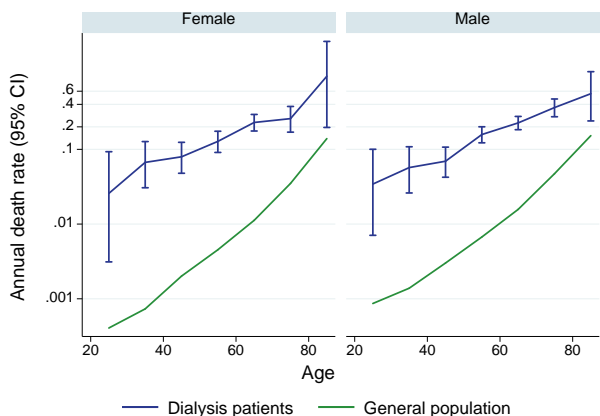
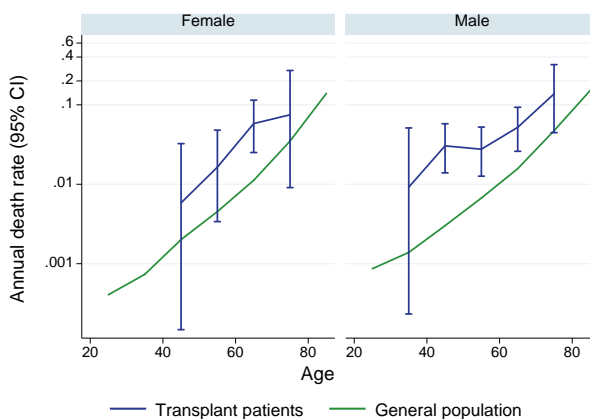


Figure 3.3.2 - Prevalent Transplant Mortality - New Zealand Patients vs General Population



The evolution of mortality rates over time is shown in figure 3.4. In Australia, there is steady improvement in most groups over time. For New Zealand, the trends are less clear, in part reflecting the lower precision with smaller numbers. Note the different y axis scales in each graph.

Figure 3.4.1 - Dialysis Mortality Rates in Australia - 2008-2017

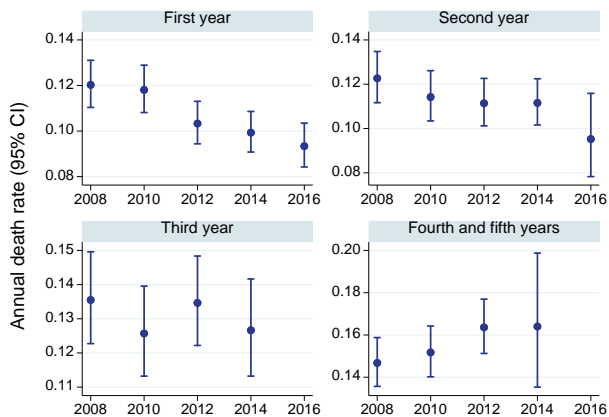
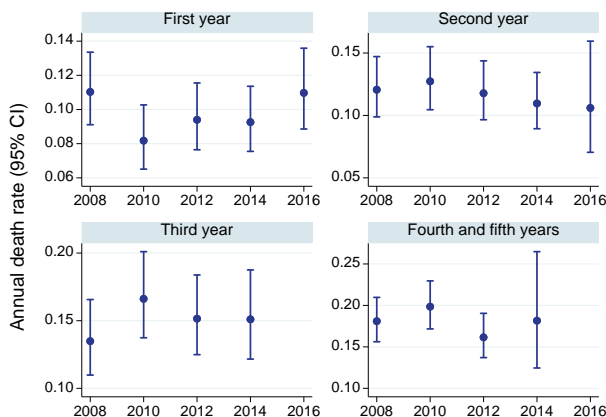


Figure 3.4.2 - Dialysis Mortality Rates in New Zealand - 2008-2017



Another perspective on survival during dialysis is presented in table 3.4. Median survival is the time to which 50% of people can expect to survive. Table 3.5 shows the median survival of older people who started dialysis treatment, by various categories. These survival data are censored at the time of transplantation, and include those who started dialysis in the period 2008-2017. In addition to the median, the 25th and 75th centiles are included to give an indication of the range of observed survivals. Some figures are not observed - for example if half of a cohort have not yet died it is not possible to observe a median survival. These occurrences are indicated by * in the tables. The survival times amongst younger people are likely to be strongly affected by the selection bias (fitter people will be progressively transplanted and not be included in the analysis from that point).

Table 3.4 Median Survival on Dialysis by Age 2008-2017

Country	Age at start	Median (25th and 75th centiles), years
Australia	0-24	* (6.4, *)
	25-44	* (5.2, *)
	45-64	6.4 (3.3, *)
	65-74	4.7 (2.3, 7.9)
	75-84	3.5 (1.5, 6.0)
	85+	2.2 (0.9, 4.3)
New Zealand	0-24	* (6.5, *)
	25-44	8.3 (4.9, *)
	45-64	5.4 (2.9, 8.6)
	65-74	3.7 (1.9, 6.2)
	75-84	2.9 (1.4, 4.5)
	85+	1.7 (1.0, 3.5)

Table 3.5 Survival on Dialysis by Age and Comorbidity Amongst Older People; Years (Median, 25th and 75th centiles) 2008-2017

Age at Start	Any Vascular Disease	Diabetes	Australia	New Zealand
65-69	No	No	7.0 (3.1, *)	4.6 (2.7, 7.3)
	No	Yes	5.6 (3.2, 8.4)	4.6 (2.4, 6.9)
	Yes	No	4.4 (1.8, 7.9)	4.4 (1.9, 6.9)
	Yes	Yes	4.3 (2.3, 7.1)	3.0 (1.5, 5.6)
70-74	No	No	6.0 (2.7, 9.2)	4.7 (2.3, 8.4)
	No	Yes	5.5 (2.6, 9.1)	4.5 (2.2, 7.0)
	Yes	No	4.1 (1.8, 7.7)	2.8 (1.5, 5.2)
	Yes	Yes	3.8 (1.7, 6.0)	2.9 (1.7, 4.8)
75-79	No	No	4.9 (2.4, 8.2)	4.0 (1.8, 5.3)
	No	Yes	4.2 (2.3, 7.4)	3.9 (2.7, 4.6)
	Yes	No	3.7 (1.6, 6.1)	2.4 (1.2, 4.2)
	Yes	Yes	3.3 (1.4, 5.7)	2.6 (1.2, 3.8)
80-84	No	No	3.6 (1.8, 6.2)	2.8 (1.9, 4.3)
	No	Yes	3.3 (1.5, 5.4)	2.4 (0.7, 4.7)
	Yes	No	3.0 (1.3, 5.3)	2.2 (1.0, 4.4)
	Yes	Yes	2.7 (1.2, 4.5)	2.8 (1.4, 5.5)
85+	No	No	3.2 (1.2, 5.0)	2.4 (1.0, 2.6)
	No	Yes	2.8 (1.2, 5.2)	1.0 (0.9, 1.6)
	Yes	No	2.1 (0.8, 3.8)	1.4 (1.2, 2.2)
	Yes	Yes	1.9 (0.8, 3.9)	2.7 (1.7, 5.2)

Cause of Death

The focus of this section is on deaths reported during 2017. The cause of death reported to ANZDATA is not necessarily the same as that reported on the death certificate⁵. In particular, ANZDATA specifically records a range of reasons for “withdrawal from treatment”. The cause of death in these instances is a person’s underlying renal failure, however, these data help to understand the reasons why individuals choose to cease renal replacement therapy. This often relates to an underlying comorbidity and is further explored in table 3.7.

For the purposes of these analyses, deaths were attributed to the modality in use at the time of death. In both Australia and New Zealand, a greater proportion of deaths due to cancer is seen among patients with kidney transplants, whereas among dialysis patients, deaths to cardiovascular causes and withdrawal from treatment predominate (figure 3.5). Figure 3.6 and table 3.6 show the relationship between cause of death and age at death.

Figure 3.5 - Cause of Death by Modality - Deaths Occurring During 2017

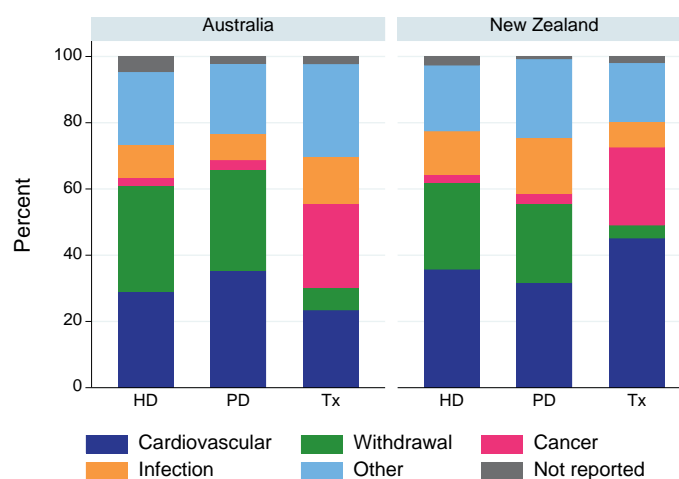


Figure 3.6 - Cause of Death by Modality and Age at Death - Deaths Occurring During 2017

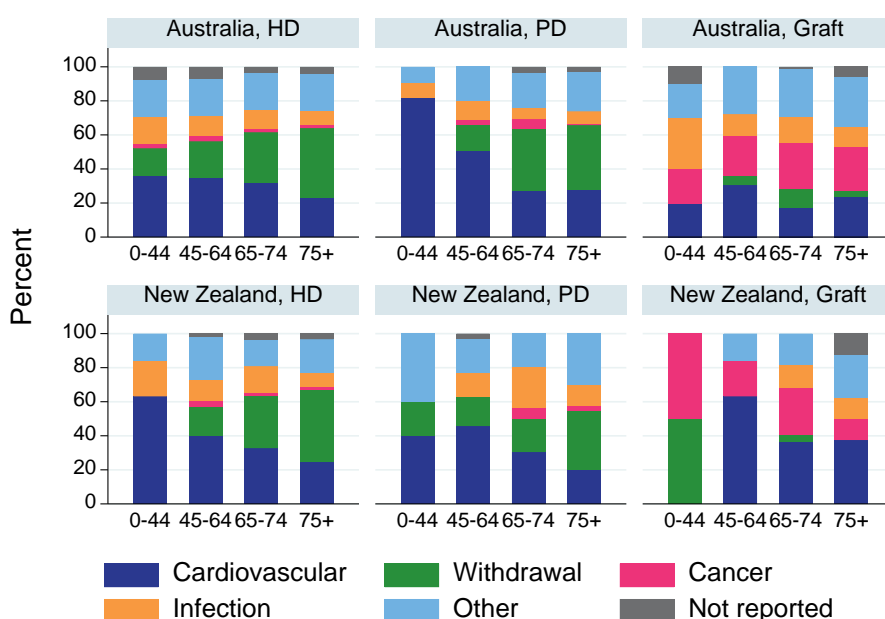


Table 3.6 Cause of Death by Modality and Age at Death - Deaths Occurring During 2017

Country	Cause of death	Haemodialysis					Peritoneal Dialysis					Graft				
		0-44	45-54	65-74	75+	Total	0-44	45-54	65-74	75+	Total	0-44	45-54	65-74	75+	Total
Australia	Cardiovascular	25	136	141	159	461	9	33	24	31	97	2	22	15	12	51
	Withdrawal	11	84	130	277	502	0	10	32	42	84	0	4	9	2	15
	Cancer	2	13	10	14	39	0	2	5	1	8	2	17	23	13	55
	Infection	11	46	48	56	161	1	7	6	8	22	3	9	13	6	31
	Other	15	86	96	147	344	1	13	18	26	58	2	20	24	15	61
	Not reported	5	26	15	28	74	0	0	3	3	6	1	0	1	3	5
	Total	69	391	440	681	1581	11	65	88	111	275	10	72	85	51	218
New Zealand	Cardiovascular	12	43	36	15	106	2	16	14	8	40	0	12	8	3	23
	Withdrawal	0	18	34	26	78	1	6	9	14	30	1	0	1	0	2
	Cancer	0	4	2	1	7	0	0	3	1	4	1	4	6	1	12
	Infection	4	13	17	5	39	0	5	11	5	21	0	0	3	1	4
	Other	3	27	17	12	59	2	7	9	12	30	0	3	4	2	9
	Not reported	0	2	4	2	8	0	1	0	0	1	0	0	0	1	1
	Total	19	107	110	61	297	5	35	46	40	126	2	19	22	8	51

Withdrawal from Renal Replacement Therapy

During 2017 there were 601 deaths in Australia and 110 in New Zealand attributed to withdrawal from therapy (table 3.7). The vast majority of these were among patients receiving dialysis therapy. “Psychosocial” reasons were the most commonly cited reasons for withdrawal in patients receiving all modalities. However, the coding of these categories is clearly somewhat subjective.

Table 3.8 shows a breakdown of patients who withdrew and died in 2017 by age and duration of RRT.

Table 3.7 Reason for Withdrawal from Renal Replacement Therapy - 2017

Country	Reason for withdrawal	HD	PD	Graft
Australia	Withdrawal-Psycho Social Reasons	162	36	6
	Patient Refused Treatment (Specify)	18	4	2
	Withdrawal-Cardiovascular Comorbid Conditions	126	14	0
	Withdrawal-Cerebrovascular Comorbid Conditions	46	9	2
	Withdrawal-Peripheral Vascular Comorbid Conditions	56	11	2
	Withdrawal-Malignancy	71	9	3
	Withdrawal-Dialysis Access Difficulties	23	1	0
New Zealand	Withdrawal-Psycho Social Reasons	19	10	1
	Patient Refused Treatment (Specify)	3	1	0
	Withdrawal-Cardiovascular Comorbid Conditions	29	9	1
	Withdrawal-Cerebrovascular Comorbid Conditions	3	5	0
	Withdrawal-Peripheral Vascular Comorbid Conditions	9	1	0
	Withdrawal-Malignancy	10	3	0
	Withdrawal-Dialysis Access Difficulties	5	1	0

Table 3.8 Time from Renal Replacement Therapy Start to Death, in Patients Who Withdrew and Died in 2017

Time from first RRT (years)	Australia					New Zealand				
	0-44	45-64	65-74	75+	Total	0-44	45-64	65-74	75+	Total
<1 year	4	17	22	30	73	0	3	3	7	13
1-2 years	1	13	22	29	65	2	2	4	6	14
2-5 years	4	26	49	118	197	0	6	19	13	38
5+ years	2	42	78	144	266	0	13	18	14	45
Total	11	98	171	321	601	2	24	44	40	110

References

¹ Australian Bureau of Statistics, 2017, Australian Demographic Statistics, Jun 2017, time series spreadsheets, cat. no. 3101.0, viewed 27 Dec 2017,

<http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/3101.0Jun%202017?OpenDocument>

² Australian Bureau of Statistics, 2017, Deaths, Australia 2017, cat. no. 3302.0, viewed 28 Sep 2018,

<http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/3302.02017?OpenDocument>

³ This work is based on/includes Stats NZ’s data which are licensed by Stats NZ for re-use under the Creative Commons Attribution 4.0 International licence. Stats NZ, 2017, Estimated Resident Population by Age and Sex (1991+) (Annual-Jun), NZ Infoshare, viewed 27 Dec 2017, <http://archive.stats.govt.nz/infoshare/>

⁴ This work is based on/includes Stats NZ’s data which are licensed by Stats NZ for re-use under the Creative Commons Attribution 4.0 International licence. Stats NZ, 2017, Deaths by Age and Sex (Annual-Dec), NZ Infoshare, viewed 28 Sep 2018, <http://archive.stats.govt.nz/infoshare/>

⁵ Sypek MP, Dansie KB, Clayton P, Webster AC, McDonald S. Comparison of cause of death between ANZDATA and the Australian National Death Index. *Nephrology*. 2018 Mar 1. doi: 10.1111/nep.13250.