
# 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*

# Contents



## Suggested Citation

ANZDATA Registry. 43rd Report, Chapter 3: Mortality in End Stage Kidney Disease. Australia and New Zealand Dialysis and Transplant Registry, Adelaide, Australia. 2020. Available at: http://www.anzdata.org.au

## Survival

Overall survival for patients who started renal replacement therapy (RRT) in the period 2010-2019 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 2010-2019***

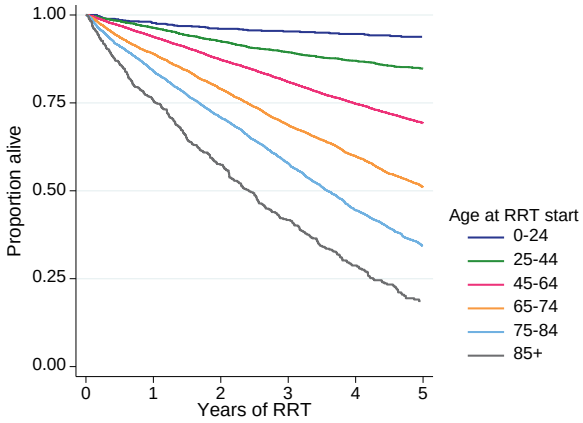



***Figure 3.1.2 - Survival on Renal Replacement Therapy - New Zealand 2010-2019***

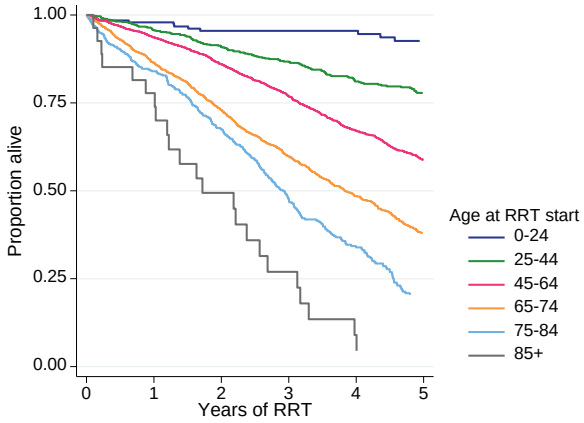



***Table 3.1 Survival (95% CI) Among People Who Commenced Renal Replacement Therapy 2010-2019***

| Age at RRT start | Years | Australia | New Zealand |
|---|---|---|---|
| 0-24 | 1 | 98 (96, 99) | 98 (95, 99) |
| | 2 | 96 (94, 97) | 95 (91, 98) |
| | 5 | 94 (92, 95) | 93 (87, 96) |
| 225-44 | 1 | 96 (96, 97) | 96 (94, 97) |
| | 2 | 93 (92, 93) | 91 (89, 93) |
| | 5 | 85 (83, 86) | 78 (74, 81) |
| 45-64 | 1 | 94 (93, 94) | 94 (93, 95) |
| | 2 | 87 (87, 88) | 86 (85, 87) |
| | 5 | 69 (68, 70) | 59 (56, 61) |
| 65-74 | 1 | 89 (88, 90) | 86 (84, 88) |
| | 2 | 79 (78, 80) | 73 (70, 75) |
| | 5 | 51 (49, 53) | 38 (35, 41) |
| 75-84 | 1 | 84 (83, 85) | 84 (80, 87) |
| | 2 | 71 (69, 72) | 68 (63, 72) |
| | 5 | 34 (33, 36) | 20 (16, 25) |
| 85+ | 1 | 76 (72, 79) | 78 (57, 89) |
| | 2 | 57 (53, 62) | 49 (29, 67) |
| | 5 | 18 (15, 23) | 4 (0, 19) |

Unadjusted death rates for dialysis and transplantation during 2019 are shown in table 3.2 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 2019, regardless of year of first treatment.

Mortality rates are generally higher with older age, diabetes and coronary artery disease. 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 (2019)[1,2] and Stats NZ (2019)[3,4].

***Table 3.2 Death Rates per 100 patient-years during Renal Replacement Therapy - 2018***

| | Level | Dialysis | | | Transplant | | |
|---|---|---|---|---|---|---|---|
| | | Rate | Lower CI | Upper CI | Rate | Lower CI | Upper CI |
| **Country** | **Australia** | **13.7** | **13.1** | **14.3** | **1.9** | **1.7** | **2.2** |
| | **New Zealand** | **15.7** | **14.3** | **17.3** | **3.0** | **2.3** | **3.8** |
| **Age** | **<25** | 3.6 | 1.6 | 6.8 | 0.0 | 0.0 | 0.5 |
| | **25-44** | 5.4 | 4.5 | 6.6 | 0.3 | 0.1 | 0.6 |
| | **45-64** | 10.1 | 9.3 | 10.9 | 1.4 | 1.2 | 1.7 |
| | **65-84** | 18.4 | 17.4 | 19.4 | 4.7 | 4.1 | 5.5 |
| | **85+** | 36.2 | 31.5 | 41.5 | 25.2 | 11.5 | 47.7 |
| **Diabetes status** | **Non-diabetic** | 11.9 | 11.2 | 12.8 | 1.5 | 1.3 | 1.7 |
| | **Type 1 diabetes** | 16.9 | 13.9 | 20.3 | 2.5 | 1.6 | 3.9 |
| | **Type 2 diabetes** | 15.9 | 15.0 | 16.8 | 3.6 | 3.0 | 4.2 |
| **Coronary disease** | **No** | 9.8 | 9.1 | 10.4 | 1.5 | 1.3 | 1.7 |
| | **Yes** | 19.8 | 18.8 | 20.9 | 4.1 | 3.4 | 4.9 |

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

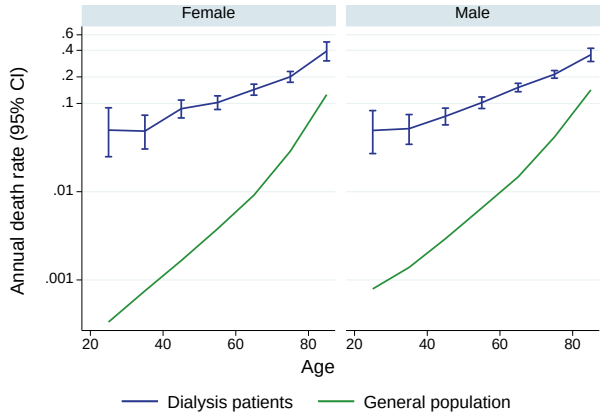



***Figure 3.2.2 - Prevalent Transplant Mortality - Australian Patients vs General Population***

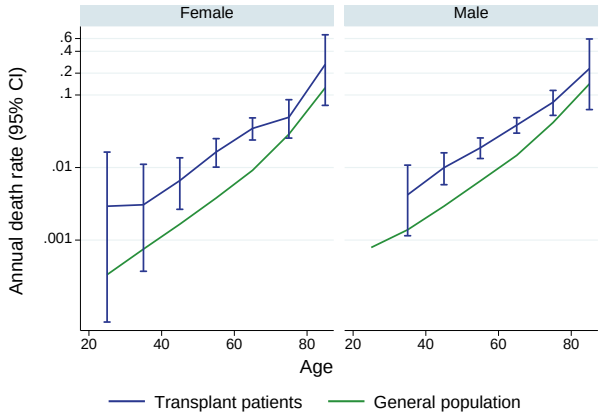



***Figure 3.3.1 - Prevalent Dialysis Mortality - New Zealand Patients vs General Population***

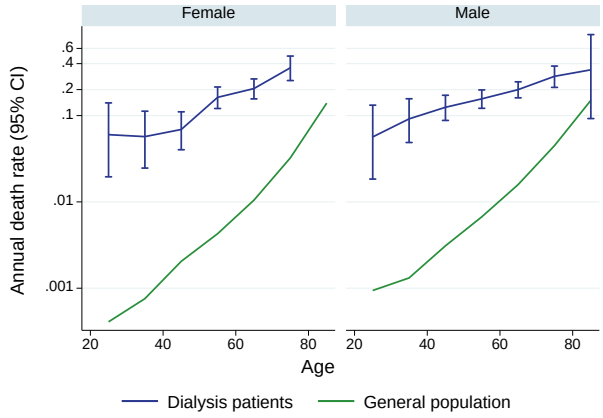
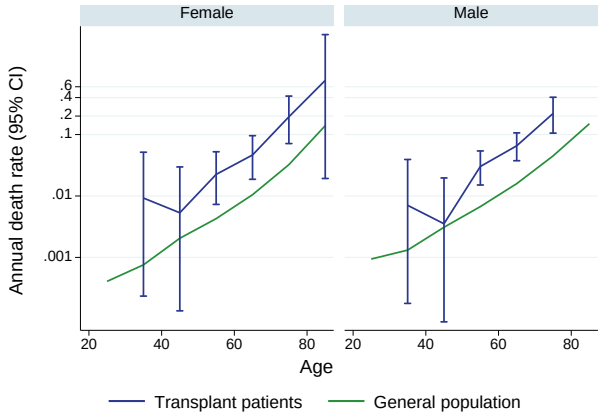



***Figure 3.3.2 - Prevalent Transplant Mortality - New Zealand Patients vs General Population***




The evolution of mortality rates over time is shown in figure 3.4. In Australia, there has been a steady improvement in first-year mortality. 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 - 2010-2019***

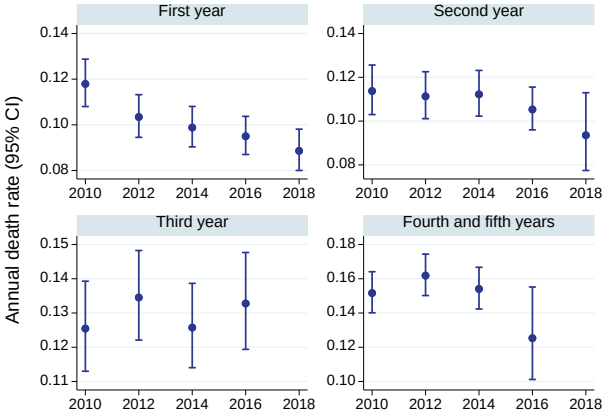
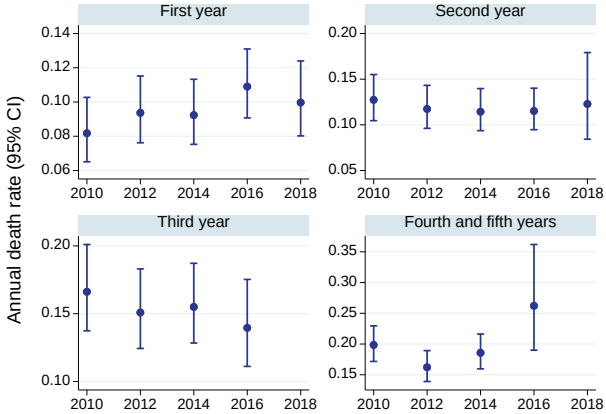



***Figure 3.4.2 - Dialysis Mortality Rates in New Zealand - 2010-2019***



Another perspective on survival during dialysis is presented in table 3.3. Median survival is the time to which 50% of people can expect to survive. Table 3.4 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 2010-2019. 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 3.3 Median Survival on Dialysis by Age 2010-2019***

| Country | Age at start | Median (25th and 75th centiles), years |
|---|---|---|
| Australia | 0-24 | * (6.1, *) |
| | 25-44 | 9.1 (5.2, *) |
| | 45-64 | 6.3 (3.3, 9.8) |
| | 65-74 | 4.8 (2.3, 8.0) |
| | 75-84 | 3.6 (1.7, 6.0) |
| | 85+ | 2.4 (1.0, 4.3) |
| New Zealand | 0-24 | * (*, *) |
| | 25-44 | 7.6 (4.4, *) |
| | 45-64 | 5.3 (3.0, 8.9) |
| | 65-74 | 3.6 (1.8, 6.5) |
| | 75-84 | 2.9 (1.6, 4.6) |
| | 85+ | 1.7 (1.0, 3.1) |

***Table 3.4 Survival on Dialysis by Age and Comorbidity Amongst Older People; Years (Median, 25th and 75th centiles) 2010-2019***

| Age at Start | Any Vascular Disease | Diabetes | Australia | New Zealand |
|---|---|---|---|---|
| 65-69 | No | No | 7.5 (3.3, *) | 4.7 (2.7, 8.4) |
| | No | Yes | 5.6 (3.0, 8.2) | 4.6 (2.4, 7.1) |
| | Yes | No | 4.4 (1.6, 7.9) | 4.4 (2.0, 6.5) |
| | Yes | Yes | 4.3 (2.2, 7.2) | 2.9 (1.5, 5.3) |
| 70-74 | No | No | 6.6 (2.8, *) | 4.0 (1.5, 6.6) |
| | No | Yes | 5.2 (2.6, *) | 4.8 (2.7, 7.3) |
| | Yes | No | 4.1 (2.0, 7.4) | 2.7 (1.3, 4.6) |
| | Yes | Yes | 3.9 (1.8, 6.4) | 2.9 (1.5, 4.8) |
| 75-79 | No | No | 4.7 (2.6, 7.7) | 3.6 (2.1, 5.7) |
| | No | Yes | 4.4 (2.4, 6.8) | 3.5 (2.6, 5.7) |
| | Yes | No | 3.7 (1.7, 6.1) | 3.0 (1.4, 4.6) |
| | Yes | Yes | 3.3 (1.5, 5.6) | 2.8 (1.3, 3.8) |
| 80-84 | No | No | 3.6 (1.8, 5.9) | 2.7 (1.9, 4.8) |
| | No | Yes | 3.2 (1.5, 5.7) | 2.4 (0.7, 4.7) |
| | Yes | No | 3.3 (1.4, 5.9) | 2.4 (1.5, 4.2) |
| | Yes | Yes | 3.0 (1.4, 4.8) | 2.0 (1.2, 5.3) |
| 85+ | No | No | 3.3 (1.4, 4.9) | 2.4 (1.0, 2.6) |
| | No | Yes | 2.8 (1.3, 5.1) | 1.0 (0.9, 1.6) |
| | Yes | No | 2.2 (0.8, 3.8) | 1.4 (0.7, 3.1) |
| | Yes | Yes | 2.3 (1.0, 3.9) | 2.7 (1.7, 5.0) |

## Cause of Death

The focus of this section is on deaths reported during 2019. The cause of death reported to ANZDATA is not necessarily the same as that reported on the death certificate[5]. 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 3.6.

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 2019***

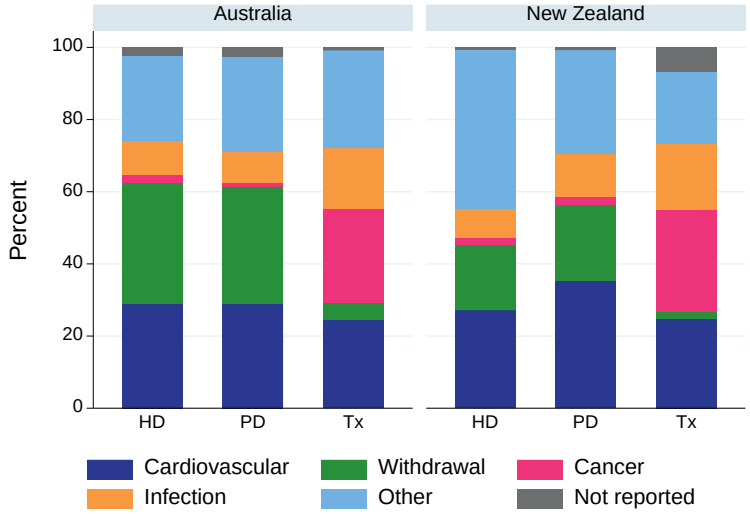



***Figure 3.6 - Cause of Death by Modality and Age at Death - Deaths Occurring During 2019***

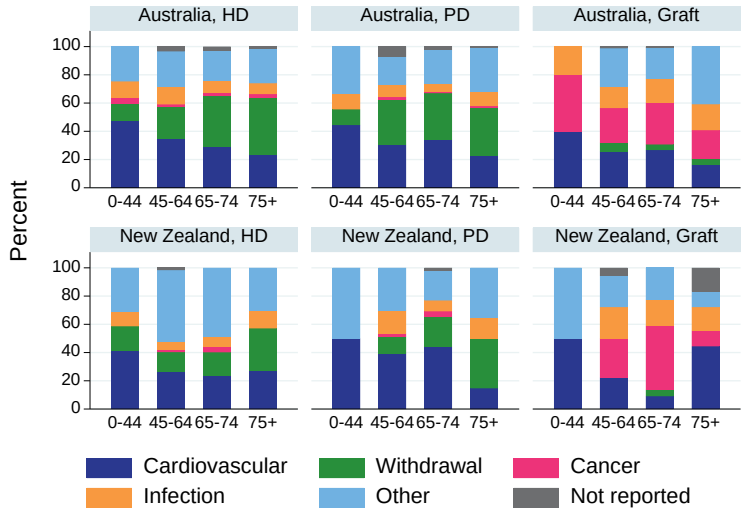



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*Table 3.5 Cause of Death by Modality and Age at Death - Deaths Occurring During 2019*

| 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** | 33 | 135 | 125 | 169 | **462** | 4 | 17 | 31 | 26 | **78** | 2 | 22 | 27 | 8 | **59** |
| | **Withdrawal** | 8 | 86 | 153 | 289 | **536** | 1 | 18 | 30 | 39 | **88** | 0 | 5 | 4 | 2 | **11** |
| | **Cancer** | 3 | 7 | 10 | 18 | **38** | 0 | 1 | 1 | 1 | **3** | 2 | 21 | 30 | 10 | **63** |
| | **Infection** | 8 | 49 | 36 | 55 | **148** | 1 | 5 | 5 | 12 | **23** | 1 | 13 | 17 | 9 | **40** |
| | **Other** | 17 | 96 | 91 | 175 | **379** | 3 | 11 | 22 | 35 | **71** | 0 | 23 | 22 | 20 | **65** |
| | **Not reported** | 0 | 13 | 12 | 11 | **36** | 0 | 4 | 2 | 1 | **7** | 0 | 1 | 1 | 0 | **2** |
| | **Total** | 69 | 386 | 427 | 717 | **1599** | 9 | 56 | 91 | 114 | **270** | 5 | 85 | 101 | 49 | **240** |
| New Zealand | **Cardiovascular** | 12 | 33 | 23 | 17 | **85** | 2 | 17 | 23 | 5 | **47** | 1 | 4 | 2 | 8 | **15** |
| | **Withdrawal** | 5 | 17 | 16 | 19 | **57** | 0 | 5 | 11 | 12 | **28** | 0 | 0 | 1 | 0 | **1** |
| | **Cancer** | 0 | 2 | 4 | 0 | **6** | 0 | 1 | 2 | 0 | **3** | 0 | 5 | 10 | 2 | **17** |
| | **Infection** | 3 | 7 | 7 | 8 | **25** | 0 | 7 | 4 | 5 | **16** | 0 | 4 | 4 | 3 | **11** |
| | **Other** | 9 | 63 | 47 | 19 | **138** | 2 | 13 | 11 | 12 | **38** | 1 | 4 | 5 | 2 | **12** |
| | **Not reported** | 0 | 2 | 0 | 0 | **2** | 0 | 0 | 1 | 0 | **1** | 0 | 1 | 0 | 3 | **4** |
| | **Total** | **29** | **124** | **97** | **63** | **313** | **4** | **43** | **52** | **34** | **133** | **2** | **18** | **22** | **18** | **60** |

## Withdrawal from Renal Replacement Therapy

During 2019 there were 635 deaths in Australia and 86 in New Zealand attributed to withdrawal from therapy (table 3.6). The vast majority of these were among patients receiving dialysis therapy. “Psychosocial” reasons were the most commonly cited reasons for withdrawal. However, the coding of these categories is clearly somewhat subjective.

Table 3.7 shows a breakdown of patients who withdrew and died in 2019 by age and duration of RRT.

*Table 3.6 Reason for Withdrawal from Renal Replacement Therapy - 2019*

| Country | Reason for withdrawal | HD | PD | Graft |
|---|---|---|---|---|
| Australia | **Withdrawal-Psycho Social Reasons** | 210 | 28 | 2 |
| | **Patient Refused Treatment (Specify)** | 18 | 0 | 0 |
| | **Withdrawal-Cardiovascular Comorbid Conditions** | 123 | 17 | 1 |
| | **Withdrawal-Cerebrovascular Comorbid Conditions** | 42 | 14 | 1 |
| | **Withdrawal-Peripheral Vascular Comorbid Conditions** | 38 | 17 | 1 |
| | **Withdrawal-Malignancy** | 84 | 8 | 5 |
| | **Withdrawal-Dialysis Access Difficulties** | 21 | 4 | 1 |
| New Zealand | **Withdrawal-Psycho Social Reasons** | 10 | 10 | 1 |
| | **Patient Refused Treatment (Specify)** | 2 | 0 | 0 |
| | **Withdrawal-Cardiovascular Comorbid Conditions** | 19 | 7 | 0 |
| | **Withdrawal-Cerebrovascular Comorbid Conditions** | 7 | 4 | 0 |
| | **Withdrawal-Peripheral Vascular Comorbid Conditions** | 10 | 3 | 0 |
| | **Withdrawal-Malignancy** | 7 | 2 | 0 |
| | **Withdrawal-Dialysis Access Difficulties** | 2 | 2 | 0 |

*Table 3.7 Time from Renal Replacement Therapy Start to Death, in Patients Who Withdrew and Died in 2019*

| Time from first RRT (years) | Australia | | | | | New Zealand | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0-44 | 45-54 | 65-74 | 75+ | Total | 0-44 | 45-54 | 65-74 | 75+ | Total |
| **<1 year** | 2 | 16 | 39 | 34 | **91** | 1 | 4 | 9 | 3 | **17** |
| **1-2 years** | 3 | 11 | 28 | 28 | **70** | 0 | 0 | 1 | 4 | **5** |
| **2-5 years** | 1 | 26 | 57 | 94 | **178** | 1 | 7 | 8 | 9 | **25** |
| **5+ years** | 3 | 56 | 63 | 174 | **296** | 3 | 11 | 10 | 15 | **39** |
| **Total** | **9** | **109** | **187** | **330** | **635** | **5** | **22** | **28** | **31** | **86** |

## References


[1] *Australian Bureau of Statistics, 2019, Australian Demographic Statistics, Jun 2019, time series spreadsheets, cat. no. 3101.0, viewed 19 Dec 2019, http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/3101.0Jun%202019?OpenDocument*

[2] *Australian Bureau of Statistics, 2019, Deaths, Australia 2019, viewed 24 Sep 2020, https://www.abs.gov.au/statistics/people/population/deaths-australia/2019*

[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, 2019, Estimated Resident Population by Age and Sex (1991+) (Annual-Jun), NZ Infoshare, viewed 19 Dec 2019, 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, 2019, Deaths by Age and Sex (Annual-Dec), NZ Infoshare, viewed 24 Sep 2020, 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.*