



DIALYSIS HOSPITAL REPORT

2017 - 2022

PUBLISHED October 2023
From the ANZDATA Database last surveyed on 31st December 2022

Contents

1	Introduction	2
2	Changes from Previous Reports	2
3	Standardised Mortality Ratios	3
3.1	SMRs	4
3.2	Funnel Plot	9
3.3	Poisson Model Coefficients	11

1 Introduction

This report is an abridged version of the dialysis hospital report, prepared for general distribution. Individual hospital reports are also created, which contain more detailed information about the characteristics and outcomes within each hospital.

The data are based on reports to the ANZDATA Registry. Interpretation of these results must take into account both the limitations of the methodology and the context. There is considerable literature about interpretation of results from many fields, and further information can be provided for those seeking to better understand the results.

The results presented here are estimates of true values and are subject to random variation. Confidence intervals are used to present this variability. To account for the multiple comparisons made between centres, 95% false discovery rate (FDR) confidence intervals are used.

Another key limitation is the potential for factors other than those measured, which may be outside the control of treating hospitals, to affect results. This is known as residual confounding. Despite the inclusion of many factors related to patients and their care, most models predict only around 70% of the variation in dialysis outcomes. ANZDATA results are consistent with international experience in this regard.

How then should results suggesting a hospital's results are inferior to expectation be interpreted? Perhaps the best approach is to consider them as signals for looking at a deeper level, bearing in mind that it may well be that the effects seen are driven by factors unrelated to the quality of care or beyond the control of individual hospitals (eg, chance, unmeasured confounders, or natural variation).

2 Changes from Previous Reports

Note the following change has been made for this report:

- The primary kidney disease categories have been updated to reflect the major headings used by the European Renal Association/European Dialysis and Transplantation Association (ERA/EDTA). From 2022, primary kidney disease in ANZDATA was collected according to the updated ERA/EDTA categories, with primary diseases reported prior to 2022 mapped to these categories.

3 Standardised Mortality Ratios

The standardised mortality ratio (SMR) is the ratio of observed deaths to expected deaths within each hospital. The expected deaths values for each hospital are obtained using multi-variate modelling and the characteristics of patients in each hospital. A Poisson regression, including a random effect for each hospital, was used to obtain the regression coefficients predicting death, and the predicted probability of death for each patient was calculated. The expected number of deaths was defined as the number of deaths expected if the patients treated at that hospital had instead been assigned at random to any hospital in Australia and New Zealand, with the random assignment weighted by hospital size. For each patient, predicted mortality probabilities had that patient been treated in each available hospital were calculated, then a weighted average was taken. These weighted average predicted probabilities were then summed over the patients within each hospital, resulting in the expected number of deaths. The standard error of the SMRs were estimated using 500 bootstrapped samples. The SMRs are presented with 95% false discovery rate (FDR) confidence intervals, that account for the multiple comparisons made between centres. The expected proportion of centres identified falsely by lying outside their confidence interval is 0.05. The impact of each variable in the Poisson model in contributing to the expected mortality across all hospitals (incidence rate ratios) are presented in section 3.3.

All patients aged ≥ 18 years who commenced dialysis during 2017-2022 and remained on dialysis for more than 90 days were included in the model. Follow-up continued until first transplant, recovery of renal function lasting >30 days, death or most recent date of follow-up. Missing values for comorbidities were recoded to the comorbidity being absent. Following the comorbidities being recoded, some observations still had missing values ($n=611$) for one or more predictor variables and these cases were excluded. Dialysis modality is defined at the 90th day of treatment. Hospital is defined as the last recorded hospital for each patient.

3.1 SMRs

The following tables present the standardised mortality ratios (SMRs) for all hospitals in Australia and New Zealand. The expected number of deaths was obtained from a Poisson regression adjusted for various demographic and health indicators.

Table 1: SMRs for Australian hospitals

	Hospital Name	No. Patients*	No. Deaths	No. Expected	SMR (95% FDR CI)
1	Access Nephrology	37 (0)	6	9.1	0.66 (0.20-2.21)
2	Alfred Hospital	351 (22)	97	81.5	1.19 (0.88-1.62)
3	Alice Springs Hospital	319 (31)	47	57.0	0.82 (0.55-1.23)
4	Austin Hospital	331 (1)	72	90.3	0.80 (0.55-1.15)
5	Bathurst Base Hospital	30 (0)	11	6.9	1.60 (0.71-3.60)
6	Bendigo Hospital	115 (1)	31	33.5	0.93 (0.55-1.56)
7	Bundaberg Hospital	90 (0)	19	26.3	0.72 (0.35-1.48)
8	Cairns Hospital	356 (4)	97	83.8	1.16 (0.86-1.55)
9	Cairns Private Hospital	23 (1)	9	8.8	1.03 (0.39-2.71)
10	Canberra Hospital	308 (1)	78	70.5	1.11 (0.82-1.49)
11	Central Northern Adelaide Renal Service	888 (9)	197	190.8	1.03 (0.84-1.27)
12	Chermside Dialysis Centre	64 (0)	23	16.6	1.38 (0.76-2.51)
13	Coffs Harbour Hospital	71 (16)	13	17.8	0.73 (0.29-1.82)
14	Concord Repatriation General Hospital	186 (2)	40	50.1	0.80 (0.48-1.33)
15	Diamond Valley B.Braun Renal Care Centre	37 (1)	9	13.1	0.69 (0.26-1.82)
16	Dubbo Base Hospital	71 (1)	18	24.6	0.73 (0.40-1.33)
17	Eastern Health Integrated Renal Services	296 (2)	51	86.2	0.59 (0.40-0.87)
18	Epworth Eastern Hospital	47 (0)	19	18.3	1.04 (0.48-2.24)
19	Epworth Geelong Hospital	19 (0)	6	6.8	0.89 (0.25-3.10)
20	Epworth Richmond Hospital	32 (2)	6	11.8	0.51 (0.14-1.90)
21	Fiona Stanley Hospital	723 (45)	170	157.0	1.08 (0.87-1.35)
22	Flinders Medical Centre	291 (6)	57	63.9	0.89 (0.60-1.33)
23	Forest Hill Dialysis Centre	61 (2)	12	25.8	0.46 (0.21-1.02)

continued on next page

* The number in brackets is the number of patients excluded from Poisson regression due to missing data

continued from previous page

	Hospital Name	No. Patients*	No. Deaths	No. Expected	SMR (95% FDR CI)
24	Gold Coast Private Hospital	65 (0)	23	22.3	1.03 (0.56-1.90)
25	Gold Coast University Hospital	294 (7)	61	87.6	0.70 (0.47-1.02)
26	Gosford Hospital	252 (1)	72	71.8	1.00 (0.71-1.42)
27	Gregory Hills B.Braun Renal Care Centre	24 (0)	0	4.1	0.00 (-.)
28	Henry Dalziel Dialysis Clinic - Greenslopes	138 (2)	38	30.2	1.26 (0.74-2.14)
29	Hervey Bay Hospital	95 (0)	23	23.9	0.96 (0.51-1.80)
30	Ipswich Hospital	71 (1)	15	16.6	0.90 (0.42-1.93)
31	John Flynn Private Hospital	55 (0)	23	15.6	1.47 (0.66-3.27)
32	John Hunter Hospital	358 (1)	98	93.6	1.05 (0.78-1.40)
33	Launceston General Hospital	178 (2)	39	32.8	1.19 (0.70-2.01)
34	Lismore Base Hospital	107 (0)	27	34.0	0.79 (0.46-1.37)
35	Lismore St Vincent's Private Dialysis Centre	19 (1)	3	9.6	0.31 (0.05-1.93)
36	Liverpool Private Dialysis Centre	28 (2)	6	8.3	0.73 (0.21-2.49)
37	Mackay Base Hospital	125 (1)	39	29.5	1.32 (0.89-1.95)
38	Malvern Dialysis Centre	86 (0)	27	29.5	0.91 (0.48-1.72)
39	Manning Rural Referral Hospital	66 (2)	13	14.0	0.93 (0.44-1.99)
40	Mater Hospital, Brisbane	85 (1)	19	22.0	0.86 (0.46-1.62)
41	Mater Hospital, North Sydney	35 (1)	5	17.5	0.29 (0.05-1.56)
42	Mater Hospital, Townsville	36 (1)	12	11.8	1.02 (0.40-2.57)
43	Mayo Private Hospital	21 (3)	7	5.9	1.18 (0.33-4.21)
44	Monash Medical Centre	844 (11)	160	196.6	0.81 (0.65-1.02)
45	Morayfield B.Braun Renal Care Centre	7 (0)	1	2.9	0.35 (0.09-1.39)
46	Mount Isa Base Hospital	44 (4)	6	11.7	0.51 (0.14-1.93)
47	Nambour Selangor Private Hospital	14 (2)	3	3.0	1.00 (0.23-4.30)
48	Newcastle Dialysis Centre	50 (1)	11	17.1	0.64 (0.29-1.41)
49	North Lakes Dialysis Centre	46 (0)	17	12.1	1.40 (0.66-3.01)
50	North Melbourne B.Braun Renal Care Centre	19 (0)	3	5.6	0.54 (0.07-4.31)
51	Northern Health Service Melbourne	219 (33)	51	44.9	1.14 (0.80-1.62)
52	Orange Health Service	59 (3)	13	11.6	1.12 (0.50-2.47)

continued on next page

* The number in brackets is the number of patients excluded from Poisson regression due to missing data



continued from previous page

	Hospital Name	No. Patients*	No. Deaths	No. Expected	SMR (95% FDR CI)
53	Pindara Renal Unit	31 (0)	12	9.3	1.29 (0.60-2.78)
54	Port Macquarie Base Hospital	75 (1)	13	17.0	0.76 (0.36-1.63)
55	Port Macquarie Private Hospital	17 (0)	6	4.0	1.50 (0.55-4.09)
56	Princess Alexandra Hospital	599 (2)	134	121.7	1.10 (0.88-1.38)
57	Rockhampton Hospital	117 (4)	44	38.4	1.15 (0.74-1.77)
58	Royal Brisbane And Women's Hospital	388 (14)	87	85.2	1.02 (0.74-1.41)
59	Royal Darwin Hospital	380 (20)	99	78.1	1.27 (0.93-1.73)
60	Royal Hobart Hospital	141 (0)	38	30.3	1.25 (0.81-1.93)
61	Royal North Shore Hospital	323 (11)	56	80.2	0.70 (0.50-0.98)
62	Royal Perth Hospital	608 (14)	143	149.1	0.96 (0.75-1.23)
63	Royal Prince Alfred Hospital	271 (5)	45	67.2	0.67 (0.44-1.02)
64	Sir Charles Gairdner Hospital	564 (5)	143	142.8	1.00 (0.80-1.25)
65	South West Sydney Renal Service	779 (3)	177	192.4	0.92 (0.75-1.13)
66	St Andrew's Ipswich Private Hospital	43 (0)	14	11.8	1.19 (0.62-2.27)
67	St Andrew's Toowoomba B.Braun's Dialysis Clinic	22 (0)	6	4.4	1.35 (0.35-5.17)
68	St George Hospital	256 (0)	59	68.2	0.86 (0.59-1.26)
69	St Vincent's Hospital (NSW)	145 (1)	31	44.1	0.70 (0.42-1.18)
70	St Vincent's Hospital (VIC)	319 (1)	68	93.1	0.73 (0.50-1.06)
71	Sunshine Coast University Hospital	185 (1)	39	44.1	0.89 (0.57-1.39)
72	Sunshine Coast University Private Hospital (Ramsay)	25 (1)	4	7.1	0.56 (0.11-2.83)
73	Sunshine Private Dialysis Centre - Fresenius	29 (5)	7	8.9	0.78 (0.28-2.17)
74	Sydney Adventist Hospital	51 (0)	22	22.1	1.00 (0.51-1.93)
75	Tamworth Hospital	108 (3)	34	20.6	1.65 (0.98-2.79)
76	The Prince Of Wales Hospital	140 (10)	27	38.8	0.70 (0.38-1.29)
77	The Royal Melbourne Hospital	723 (53)	138	125.4	1.10 (0.87-1.39)
78	The Tweed Hospital	80 (4)	25	18.2	1.38 (0.78-2.43)
79	The Wesley Hospital Brisbane	85 (54)	2	5.4	0.37 (0.06-2.17)
80	Toowoomba Hospital	156 (6)	39	31.6	1.23 (0.76-1.99)
81	Torres & Cape Kidney Health	38 (0)	2	8.3	0.24 (0.03-1.91)

continued on next page

* The number in brackets is the number of patients excluded from Poisson regression due to missing data



continued from previous page

	Hospital Name	No. Patients*	No. Deaths	No. Expected	SMR (95% FDR CI)
82	Townsville University Hospital	238 (13)	53	55.9	0.95 (0.64-1.41)
83	University Hospital Geelong Barwon Health	152 (0)	37	43.2	0.86 (0.51-1.44)
84	Wagga Wagga Base Hospital	133 (8)	32	33.3	0.96 (0.55-1.67)
85	Western Health Service	388 (0)	73	99.0	0.74 (0.54-1.01)
86	Western Renal Service	1055 (3)	256	270.8	0.95 (0.80-1.12)
87	Wollongong Hospital	238 (10)	50	52.6	0.95 (0.62-1.45)

* The number in brackets is the number of patients excluded from Poisson regression due to missing data

Table 2: SMRs for New Zealand hospitals

	Hospital Name	No. Patients*	No. Deaths	No. Expected	SMR (95% FDR CI)
88	Auckland City Hospital	374 (3)	76	94.9	0.80 (0.58-1.10)
89	Christchurch Hospital	201 (3)	45	31.6	1.42 (0.95-2.14)
90	Dunedin Hospital	128 (0)	50	22.4	2.23 (1.50-3.32)
91	Hawkes Bay Hospital	106 (14)	35	18.5	1.89 (1.18-3.02)
92	Middlemore Hospital	749 (43)	152	135.9	1.12 (0.90-1.40)
93	Palmerston North Hospital	167 (26)	10	36.8	0.27 (0.10-0.73)
94	Taranaki Hospital	73 (0)	29	17.7	1.64 (1.02-2.61)
95	Waikato Hospital	740 (28)	221	157.7	1.40 (1.16-1.69)
96	Waitemata Renal Service	343 (12)	74	81.3	0.91 (0.65-1.29)
97	Wellington Regional Hospital	414 (2)	133	67.9	1.96 (1.51-2.54)
98	Whangarei Hospital	188 (0)	60	51.0	1.18 (0.85-1.63)

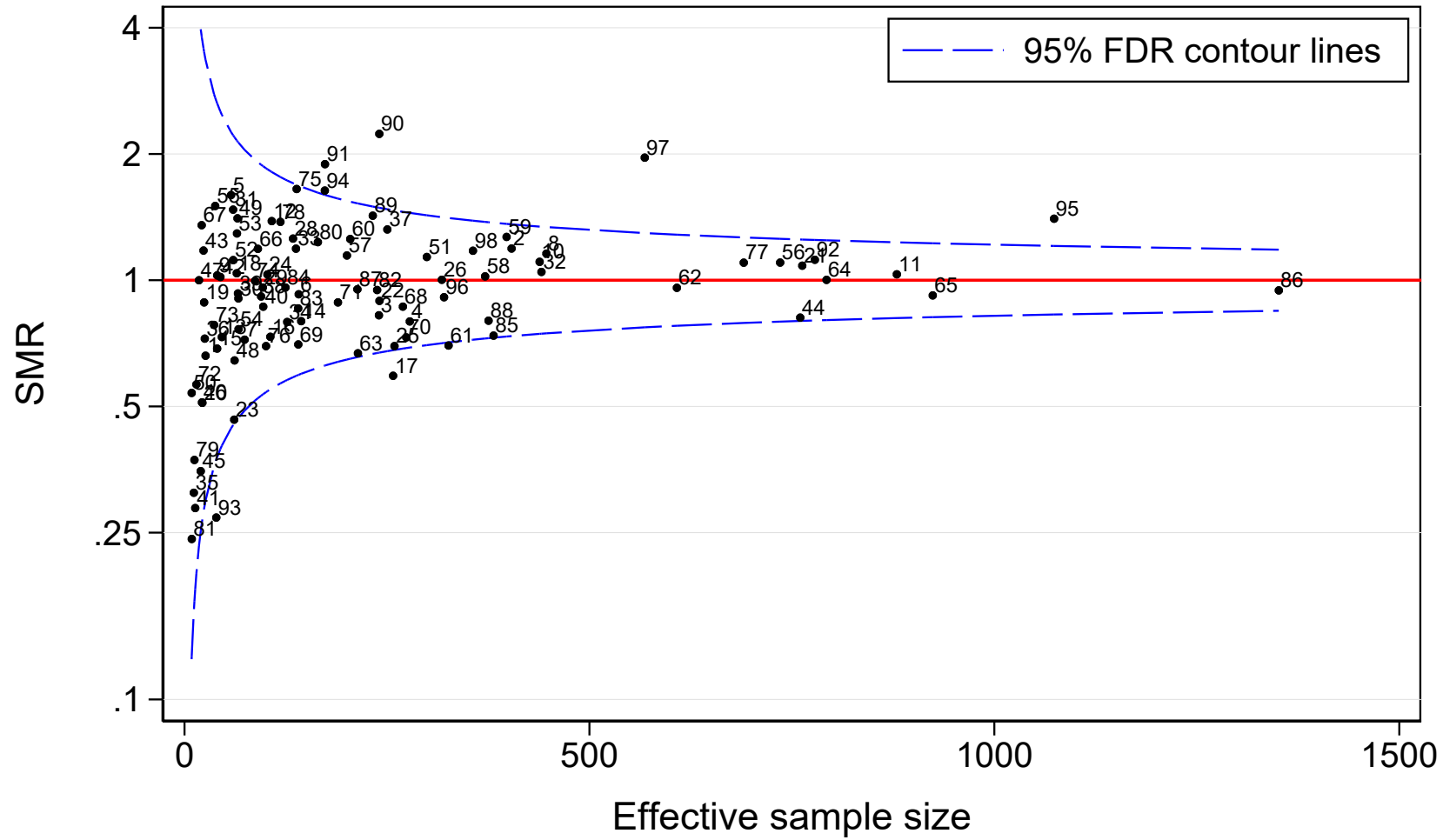
* The number in brackets is the number of patients excluded from Poisson regression due to missing data

3.2 Funnel Plot

This funnel plot shows the SMRs for all hospitals on a logarithmic scale (y-axis) plotted against the effective sample size (x-axis). Hospitals with an SMR of 0 are not shown. The red line indicates an SMR of 1, and the contours indicate 95% FDR confidence intervals. If a hospital lies within the confidence intervals then that hospital has an observed to expected ratio that is statistically consistent (at a 5% FDR level) with 1 (i.e. there is no statistical difference in the number of observed and expected events). If a hospital lies above the upper control lines, this indicates that the number of observed deaths is statistically greater than the number expected under the model. Conversely, if a hospital lies below the lines, this indicates statistically fewer observed deaths than expected under the model. The SMR is presented on a logarithmic scale as confidence intervals for the logarithm of the SMR (log-SMR) have better coverage properties. The effective sample size measures the variability of each log-SMR relative to the overall variability of all log-SMRs.

In interpreting the SMR and funnel plots it should be borne in mind that the precision of these estimates is strongly influenced by the number of patients in a hospital. As such, smaller hospitals will have less precise estimates and greater uncertainty about where the true effect lies. This is shown in wider confidence intervals for the SMR estimates and likely greater change in these estimates as they are updated over time.

Note that the numbers identifying hospitals in the funnel plot below correspond to the first column in SMR tables.



Missing comorbidities are recoded to being absent
 Observations with other missing values are dropped from the model

3.3 Poisson Model Coefficients

Table 3: Poisson regression model incidence rate ratios (IRR)

	IRR	95% CI
Era of Treatment Start		
2017-2018	ref.	
2019-2020	1.043	(0.977-1.113)
2021-2022	1.052	(0.956-1.158)
Time Since Beginning Dialysis		
0-0.99 years	ref.	
1-1.99 years	1.234	(1.144-1.330)
2-2.99 years	1.549	(1.424-1.686)
3+ years	1.949	(1.783-2.130)
Age	1.029	(1.027-1.032)
Male	1.013	(0.952-1.078)
Diabetes (as comorbidity)	1.259	(1.148-1.380)
Chronic Lung Disease	1.281	(1.192-1.376)
Peripheral Vascular Disease	1.278	(1.192-1.370)
Cerebrovascular Disease	1.167	(1.075-1.268)
Coronary Artery Disease	1.394	(1.309-1.484)
Current or Former Smoker	1.174	(1.106-1.246)
Late Referral	1.302	(1.207-1.405)
BMI		
Underweight	1.216	(1.009-1.464)
Normal	ref.	
Overweight	0.828	(0.768-0.893)
Obese	0.768	(0.713-0.827)
Primary Kidney Disease		
Glomerular Disease	ref.	
Diabetic kidney disease	1.748	(1.576-1.939)
Hypertension / Renal vascular disease	1.209	(1.073-1.361)
Familial / hereditary kidney diseases	0.655	(0.531-0.809)
Tubulointerstitial disease	1.413	(1.226-1.628)
Other systemic diseases affecting the kidney	2.644	(2.226-3.139)
Miscellaneous kidney disorders	1.486	(1.310-1.685)