



DIALYSIS HOSPITAL REPORT

2019 - 2024

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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 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 multivariate 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 2.3.

All patients aged ≥ 18 years who commenced dialysis during 2019-2024 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 ($n=534$) 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.

2.1 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	38 (0)	6	13.0	0.46 (0.12-1.83)
2	Alfred Hospital	266 (13)	73	58.7	1.24 (0.89-1.73)
3	Alice Springs Hospital	317 (6)	59	67.5	0.87 (0.61-1.26)
4	Austin Hospital	345 (1)	64	80.0	0.80 (0.57-1.12)
5	Bathurst Base Hospital	30 (0)	11	8.6	1.27 (0.50-3.26)
6	Bendigo Hospital	130 (1)	35	40.8	0.86 (0.52-1.42)
7	Bundaberg Hospital	84 (0)	22	26.0	0.85 (0.45-1.58)
8	Cairns Hospital	365 (0)	123	89.4	1.38 (1.06-1.79)
9	Cairns Private Hospital	22 (0)	10	7.3	1.37 (0.57-3.28)
10	Canberra Hospital	341 (1)	97	94.0	1.03 (0.79-1.34)
11	Central Northern Adelaide Renal Service	944 (9)	201	207.1	0.97 (0.80-1.18)
12	Chermside Dialysis Centre	57 (0)	21	16.3	1.29 (0.72-2.30)
13	Coffs Harbour Hospital	87 (19)	21	17.9	1.17 (0.60-2.30)
14	Concord Repatriation General Hospital	183 (1)	42	58.2	0.72 (0.45-1.17)
15	Diamond Valley B.Braun Renal Care Centre	33 (0)	11	18.4	0.60 (0.25-1.42)
16	Dubbo Base Hospital	76 (0)	18	20.1	0.90 (0.48-1.67)
17	Eastern Health Integrated Renal Services	304 (1)	54	87.5	0.62 (0.42-0.91)
18	Epworth Eastern Hospital	42 (0)	11	13.6	0.81 (0.31-2.09)
19	Epworth Geelong Hospital	22 (0)	11	9.4	1.18 (0.57-2.41)
20	Epworth Richmond Hospital	30 (1)	10	10.6	0.94 (0.37-2.39)
21	Fiona Stanley Hospital	772 (84)	175	175.8	1.00 (0.80-1.24)
22	Flinders Medical Centre	297 (1)	74	77.2	0.96 (0.70-1.31)
23	Forest Hill Dialysis Centre	41 (1)	21	19.4	1.08 (0.60-1.96)

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

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	Hospital Name	No. Patients*	No. Deaths	No. Expected	SMR (95% FDR CI)
24	Gold Coast Private Hospital	54 (0)	33	23.9	1.38 (0.87-2.20)
25	Gold Coast University Hospital	300 (3)	78	88.3	0.88 (0.63-1.23)
26	Gosford Hospital	237 (1)	78	70.0	1.11 (0.81-1.53)
27	Gregory Hills B.Braun Renal Care Centre	27 (1)	3	8.3	0.36 (0.06-2.20)
28	Henry Dalziel Dialysis Clinic Greenslopes	136 (0)	42	36.9	1.14 (0.77-1.68)
29	Hervey Bay Hospital	99 (0)	22	26.2	0.84 (0.43-1.62)
30	Ipswich Hospital	132 (1)	34	21.0	1.62 (1.02-2.58)
31	John Flynn Private Hospital	57 (0)	25	16.8	1.49 (0.81-2.75)
32	John Hunter Hospital	354 (1)	103	100.9	1.02 (0.78-1.34)
33	Launceston General Hospital	172 (1)	41	39.4	1.04 (0.65-1.67)
34	Lismore Base Hospital	116 (0)	24	36.2	0.66 (0.37-1.20)
35	Lismore St Vincent's Private Dialysis Centre	20 (0)	9	8.2	1.10 (0.33-3.69)
36	Liverpool Private Dialysis Centre	31 (1)	2	8.8	0.23 (0.04-1.17)
37	Mackay Base Hospital	124 (0)	37	32.0	1.16 (0.76-1.76)
38	Malvern Dialysis Centre	81 (0)	34	27.3	1.25 (0.80-1.95)
39	Manning Rural Hospital	64 (2)	15	16.2	0.93 (0.46-1.88)
40	Mater Hospital, Brisbane	87 (1)	18	24.6	0.73 (0.37-1.45)
41	Mater Hospital, North Sydney	35 (0)	7	9.8	0.72 (0.26-2.01)
42	Mater Hospital, Townsville	38 (1)	13	10.9	1.20 (0.56-2.53)
43	Mayo Private Hospital	21 (2)	6	10.2	0.59 (0.16-2.09)
44	Metro South Kidney and Transplant Services Brisbane	614 (2)	124	120.4	1.03 (0.82-1.30)
45	Monash Medical Centre	883 (14)	160	205.9	0.78 (0.62-0.97)
46	Morayfield B.Braun Renal Care Centre	7 (0)	3	3.8	0.79 (0.26-2.45)
47	Mount Isa Base Hospital	45 (2)	10	16.4	0.61 (0.25-1.51)
48	Nambour Selangor Private Hospital	14 (0)	3	4.4	0.68 (0.16-2.97)
49	Newcastle Dialysis Centre	45 (0)	21	15.1	1.39 (0.83-2.34)
50	North Lakes Dialysis Centre	49 (0)	12	13.3	0.90 (0.39-2.12)
51	North Melbourne B.Braun Renal Care Centre	18 (1)	5	3.3	1.54 (0.41-5.80)
52	Northern Health Service Melbourne	258 (33)	44	62.2	0.71 (0.48-1.05)

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

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	Hospital Name	No. Patients*	No. Deaths	No. Expected	SMR (95% FDR CI)
53	Orange Health Service	76 (2)	14	16.2	0.87 (0.41-1.84)
54	Peninsula Health Renal Services	73 (1)	5	26.1	0.19 (0.04-0.96)
55	Pindara Renal Unit	31 (0)	13	11.0	1.18 (0.57-2.43)
56	Port Macquarie Base Hospital	73 (1)	14	19.4	0.72 (0.34-1.51)
57	Port Macquarie Private Hospital	21 (0)	11	5.8	1.88 (0.89-3.97)
58	Rockhampton Hospital	160 (3)	35	47.4	0.74 (0.46-1.19)
59	Royal Brisbane and Women's Hospital	405 (30)	90	91.6	0.98 (0.74-1.31)
60	Royal Darwin Hospital	379 (17)	109	76.4	1.43 (1.11-1.84)
61	Royal Hobart Hospital	135 (3)	39	29.4	1.33 (0.84-2.08)
62	Royal North Shore Hospital	362 (6)	58	87.7	0.66 (0.46-0.95)
63	Royal Perth Hospital	635 (7)	156	166.1	0.94 (0.74-1.19)
64	Royal Prince Alfred Hospital	247 (4)	51	64.9	0.79 (0.53-1.17)
65	Sir Charles Gairdner Hospital	617 (7)	167	165.2	1.01 (0.83-1.24)
66	South Eastern Private Hospital Dialysis Centre	36 (4)	3	10.1	0.30 (0.05-1.62)
67	South West Sydney Renal Service	861 (2)	197	229.2	0.86 (0.71-1.04)
68	St Andrew's Ipswich Private Hospital	55 (0)	17	17.5	0.97 (0.52-1.80)
69	St Andrew's Toowoomba B.Braun's Dialysis Clinic	27 (0)	9	7.9	1.15 (0.40-3.31)
70	St George Hospital	251 (0)	67	69.0	0.97 (0.71-1.34)
71	St Vincent's Hospital (NSW)	118 (0)	33	45.3	0.73 (0.44-1.20)
72	St Vincent's Hospital (VIC)	336 (0)	81	101.2	0.80 (0.58-1.10)
73	Sunshine Coast University Hospital	202 (1)	40	52.1	0.77 (0.50-1.18)
74	Sunshine Coast University Private Hospital (Ramsay)	22 (1)	6	7.2	0.83 (0.27-2.54)
75	Sunshine Private Dialysis Centre Fresenius	26 (5)	4	9.4	0.43 (0.08-2.22)
76	Sydney Adventist Hospital	52 (0)	19	22.3	0.85 (0.43-1.71)
77	Tamworth Hospital	126 (3)	31	26.4	1.17 (0.71-1.94)
78	The Prince of Wales Hospital	135 (9)	31	36.5	0.85 (0.50-1.45)
79	The Royal Melbourne Hospital	742 (38)	151	142.7	1.06 (0.86-1.31)
80	The Wesley Hospital Brisbane	79 (31)	7	7.1	0.98 (0.34-2.87)
81	Toowoomba Hospital	173 (4)	49	35.1	1.40 (0.94-2.07)

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

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	Hospital Name	No. Patients*	No. Deaths	No. Expected	SMR (95% FDR CI)
82	Torres & Cape Kidney Health	39 (0)	8	10.5	0.76 (0.31-1.85)
83	Townsville University Hospital	243 (6)	51	58.5	0.87 (0.58-1.31)
84	Tweed Valley Hospital	71 (1)	23	19.3	1.19 (0.68-2.10)
85	University Hospital Geelong Barwon Health	178 (1)	38	37.3	1.02 (0.63-1.66)
86	Wagga Wagga Base Hospital	163 (9)	36	44.3	0.81 (0.50-1.31)
87	Western Health Service	459 (2)	87	116.4	0.75 (0.56-1.00)
88	Western Sydney Renal Health Service	1100 (2)	275	280.3	0.98 (0.82-1.17)
89	Wollongong Hospital	233 (6)	65	58.3	1.11 (0.78-1.59)

* 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)
90	Auckland City Hospital	396 (4)	77	102.2	0.75 (0.54-1.05)
91	Bay of Plenty Renal Unit	168 (3)	32	34.7	0.92 (0.57-1.50)
92	Christchurch Hospital	226 (2)	57	35.9	1.59 (1.16-2.18)
93	Dunedin Hospital	120 (0)	51	20.9	2.44 (1.63-3.65)
94	Hawkes Bay Hospital	125 (6)	41	23.4	1.75 (1.19-2.59)
95	Middlemore Hospital	860 (45)	186	154.9	1.20 (0.99-1.46)
96	Palmerston North Hospital	197 (27)	39	43.0	0.91 (0.58-1.41)
97	Taranaki Hospital	72 (0)	27	17.6	1.53 (0.94-2.50)
98	Waikato Hospital	607 (19)	194	127.5	1.52 (1.27-1.82)
99	Waitemata Renal Service	375 (13)	80	80.4	1.00 (0.74-1.34)
100	Wellington Regional Hospital	399 (2)	112	65.9	1.70 (1.31-2.20)
101	Whangarei Hospital	174 (1)	52	46.7	1.11 (0.78-1.58)

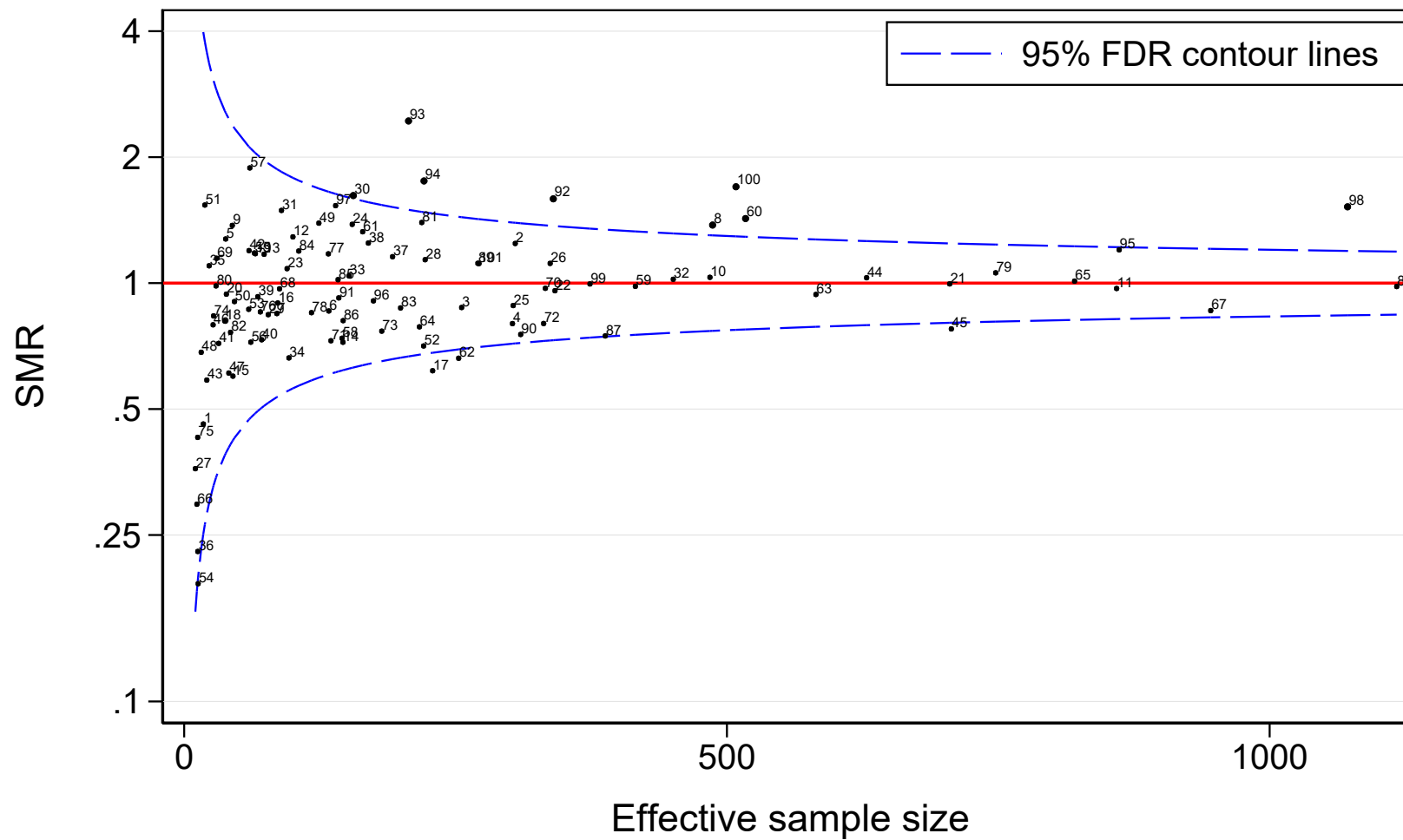
^{*} The number in brackets is the number of patients excluded from Poisson regression due to missing data

2.2 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

2.3 Poisson Model Coefficients

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

	IRR	95% CI
Era of Treatment Start		
2019-2020	ref.	
2021-2022	1.004	(0.944-1.068)
2023-2024	0.918	(0.834-1.011)
Time Since Beginning Dialysis		
0-0.99 years	ref.	
1-1.99 years	1.247	(1.161-1.341)
2-2.99 years	1.540	(1.421-1.669)
3+ years	1.939	(1.782-2.110)
Age	1.031	(1.029-1.034)
Male	1.012	(0.953-1.073)
Diabetes (as comorbidity)	1.176	(1.078-1.284)
Chronic Lung Disease	1.228	(1.143-1.319)
Peripheral Vascular Disease	1.333	(1.246-1.426)
Cerebrovascular Disease	1.243	(1.149-1.345)
Coronary Artery Disease	1.354	(1.275-1.438)
Current or Former Smoker	1.143	(1.080-1.211)
Late Referral	1.359	(1.262-1.464)
BMI		
Underweight	1.348	(1.137-1.599)
Normal	ref.	
Overweight	0.832	(0.774-0.895)
Obese	0.813	(0.757-0.873)
Primary Kidney Disease		
Glomerular Disease	ref.	
Diabetic kidney disease	1.796	(1.627-1.982)
Hypertension / Renal vascular disease	1.314	(1.173-1.472)
Familial / hereditary kidney diseases	0.736	(0.604-0.896)
Tubulointerstitial disease	1.453	(1.267-1.665)
Other systemic diseases affecting the kidney	2.335	(1.963-2.777)
Miscellaneous kidney disorders	1.512	(1.343-1.704)