DIALYSIS HOSPITAL REPORT

2014 - 2019

Contents

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 coefficents 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 $\geq$18 years who commenced dialysis during 2014-2019 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=1112) 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	35 (1)	6	6.2	0.97 (0.26-3.68)
2	Alfred Hospital	404 (18)	113	85.0	1.33 (1.03-1.72)
3	Alice Springs Hospital	286 (32)	39	56.1	0.70 (0.44-1.11)
4	Austin Hospital	328 (4)	67	69.6	0.96 (0.70-1.33)
5	Bathurst Base Hospital	22 (0)	5	7.7	0.65 (0.17-2.51)
6	Bendigo Hospital	94 (0)	25	26.1	0.96 (0.53-1.75)
7	Bundaberg Hospital	87 (0)	20	19.1	1.05 (0.54-2.03)
8	Cairns Hospital	350 (23)	56	56.1	1.00 (0.69-1.44)
9	Canberra Hospital	285 (7)	64	64.4	0.99 (0.70-1.40)
10	Central Northern Adelaide Renal Service	749 (35)	145	134.1	1.08 (0.86-1.36)
11	Chermside Dialysis Centre	61 (0)	18	14.5	1.25 (0.68-2.29)
12	Coffs Harbour Hospital	59 (13)	11	13.8	0.80 (0.38-1.70)
13	Diamond Valley Dialysis Centre	36 (0)	6	12.0	0.50 (0.15-1.72)
14	Dubbo Base Hospital	96 (1)	26	28.4	0.92 (0.54-1.57)
15	Eastern Health Integrated Renal Services	279 (5)	44	59.3	0.74 (0.47-1.17)
16	Epworth Eastern Hospital	48 (0)	18	12.5	1.44 (0.71-2.95)
17	Epworth Geelong Hospital	9 (0)	0	2.6	0.00 (.-.)
18	Epworth Richmond Hospital	32 (1)	6	7.6	0.79 (0.21-2.96)
19	Fiona Stanley Hospital	635 (131)	108	95.2	1.13 (0.88-1.46)
20	Flinders Medical Centre	266 (6)	55	60.9	0.90 (0.63-1.30)
21	Forest Hill Satellite	52 (0)	11	11.3	0.98 (0.43-2.21)
22	Geelong Hospital	179 (1)	41	39.5	1.04 (0.67-1.62)
23	Gold Coast Private Hospital	61 (0)	21	18.5	1.14 (0.62-2.07)

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

	Hospital Name	No. Patients*	No. Deaths	No. Expected	SMR (95% FDR CI)
24	Gold Coast University Hospital	249 (20)	50	56.1	0.89 (0.63-1.27)
25	Gosford Hospital	213 (2)	50	49.6	1.01 (0.67-1.51)
26	Henry Dalziel Dialysis Clinic - Greenslopes	129 (4)	34	25.5	1.33 (0.83-2.14)
27	Hervey Bay Hospital	87 (0)	25	19.7	1.27 (0.77-2.08)
28	Ipswich Hospital	30 (0)	0	8.7	0.00 (.-.)
29	John Flynn Hospital	46 (0)	23	9.7	2.37 (1.36-4.12)
30	John Hunter Hospital	352 (5)	89	80.2	1.11 (0.82-1.50)
31	Launceston Hospital	162 (3)	40	31.7	1.26 (0.79-2.01)
32	Lismore Hospital	106 (1)	28	33.0	0.85 (0.49-1.46)
33	Lismore St Vincent's Private Dialysis Centre	15 (2)	2	6.4	0.31 (0.04-2.20)
34	Liverpool Private Dialysis Centre	31 (3)	3	4.2	0.71 (0.11-4.64)
35	Mackay Hospital	97 (3)	21	22.7	0.93 (0.50-1.70)
36	Malvern Dialysis Centre	71 (0)	22	16.8	1.31 (0.70-2.44)
37	Manning Rural Referral Hospital	57 (2)	15	14.2	1.06 (0.49-2.28)
38	Mater Hospital	25 (0)	7	7.1	0.98 (0.34-2.85)
39	Mater Hospital Brisbane	59 (3)	11	11.8	0.94 (0.40-2.21)
40	Mater Hospital Townsville	30 (3)	5	5.4	0.92 (0.24-3.58)
41	Mayo Private Hospital - Taree	24 (1)	6	7.4	0.81 (0.23-2.87)
42	Monash Medical Centre (Adults)	724 (33)	98	137.4	0.71 (0.53-0.96)
43	Mount Isa Hospital	9 (3)	0	1.6	0.00 (.-.)
44	Nambour Selangor Private Hospital	18 (3)	6	5.7	1.05 (0.30-3.72)
45	Newcastle Nephrocare	39 (1)	6	13.1	0.46 (0.13-1.64)
46	North Melbourne Dialysis Centre	13 (0)	3	3.2	0.93 (0.20-4.25)
47	Northern Beaches Hospital	29 (2)	2	7.8	0.26 (0.04-1.72)
48	Northern Health Service Melbourne	166 (22)	34	35.3	0.96 (0.60-1.55)
49	Northlakes Private Dialysis Centre	37 (0)	9	9.7	0.93 (0.30-2.85)
50	Orange Hospital	62 (1)	18	9.5	1.90 (0.98-3.66)
51	Pindara Renal Unit	19 (1)	4	3.7	1.09 (0.33-3.57)
52	Port Macquarie Hospital	58 (4)	11	12.7	0.87 (0.35-2.15)

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

	Hospital Name	No. Patients[*]	No. Deaths	No. Expected	SMR (95% FDR CI)
53	Port Macquarie Private Hospital	12 (0)	4	3.9	1.02 (0.39-2.68)
54	Prince Of Wales Hospital	108 (13)	26	25.9	1.00 (0.58-1.75)
55	Princess Alexandra Hospital	579 (10)	119	103.1	1.15 (0.92-1.45)
56	Ramsay Cairns Private Dialysis Centre	17 (1)	4	3.5	1.15 (0.27-4.83)
57	Rockhampton Hospital	131 (4)	37	36.9	1.00 (0.64-1.57)
58	Royal Brisbane And Women's Hospital	364 (14)	69	71.1	0.97 (0.71-1.33)
59	Royal Darwin Hospital	372 (23)	65	70.2	0.93 (0.64-1.34)
60	Royal Hobart Hospital	131 (0)	28	22.7	1.23 (0.74-2.06)
61	Royal Melbourne Hospital	664 (91)	127	106.2	1.20 (0.93-1.54)
62	Royal North Shore Hospital	273 (25)	44	52.9	0.83 (0.53-1.31)
63	Royal Perth Hospital	550 (57)	118	95.8	1.23 (0.95-1.60)
64	Sir Charles Gairdner Hospital	546 (46)	135	109.5	1.23 (0.96-1.58)
65	South West Sydney Renal Service	699 (66)	134	146.1	0.92 (0.71-1.19)
66	St Andrew's Ipswich - Dialysis Centre	12 (2)	1	3.4	0.29 (0.17-0.50)
67	St Andrews Hospital Toowoomba	11 (0)	3	1.9	1.61 (0.32-8.08)
68	St George Hospital	257 (1)	58	68.8	0.84 (0.59-1.21)
69	St Vincent's Hospital (NSW)	136 (2)	31	32.7	0.95 (0.55-1.64)
70	St Vincent's Hospital (VIC)	336 (10)	59	75.9	0.78 (0.55-1.10)
71	Statewide Renal Services	579 (27)	132	137.5	0.96 (0.76-1.22)
72	Sunshine Coast University Hospital	174 (3)	32	28.6	1.12 (0.70-1.80)
73	Sunshine Coast University Private Hospital (Ramsay)	11 (1)	2	2.5	0.80 (0.11-5.82)
74	Sunshine Private Hospital	20 (2)	1	4.3	0.23 (0.05-1.07)
75	Sydney Adventist Hospital	46 (0)	16	20.2	0.79 (0.41-1.53)
76	Tamworth Hospital	108 (1)	41	21.7	1.89 (1.21-2.93)
77	The Tweed Hospital	80 (6)	19	14.9	1.28 (0.71-2.30)
78	Toowoomba Hospital	132 (6)	22	21.4	1.03 (0.58-1.81)
79	Townsville Hospital	231 (24)	57	46.2	1.23 (0.87-1.76)
80	Wesley Hospital	81 (40)	12	8.8	1.36 (0.55-3.33)
81	Western Health Service	341 (7)	57	73.1	0.78 (0.54-1.13)

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

	Hospital Name	No. Patients*	No. Deaths	No. Expected	SMR (95% FDR CI)
82	Western Renal Service	861 (6)	169	199.4	0.85 (0.68-1.06)
83	Wollongong Hospital	203 (14)	51	47.4	1.08 (0.74-1.57)

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

Australia and New Zealand Dialysis and Transplant Registry

Table 2: SMRs for New Zealand hospitals

|	Hospital Name	No. Patients*	No. Deaths	No. Expected	SMR (95% FDR CI)
84	Auckland Hospital	334 (0)	69	98.0	0.70 (0.52-0.96)
85	Christchurch Hospital	196 (0)	57	43.7	1.30 (0.96-1.77)
86	Dunedin Hospital	114 (1)	37	25.6	1.44 (0.91-2.29)
87	Hawkes Bay Hospital	135 (39)	31	30.3	1.02 (0.61-1.71)
88	Middlemore Hospital	618 (99)	114	165.2	0.69 (0.53-0.90)
89	Palmerston North Hospital	139 (15)	26	38.0	0.68 (0.40-1.16)
90	Taranaki Hospital	76 (2)	30	19.0	1.58 (1.01-2.48)
91	Waikato Hospital	650 (32)	194	155.9	1.24 (1.02-1.52)
92	Waitemata Renal Service	296 (17)	79	80.9	0.98 (0.72-1.32)
93	Wellington Hospital	350 (1)	101	79.0	1.28 (0.98-1.67)
94	Whangarei Hospital	195 (2)	54	67.2	0.80 (0.55-1.17)

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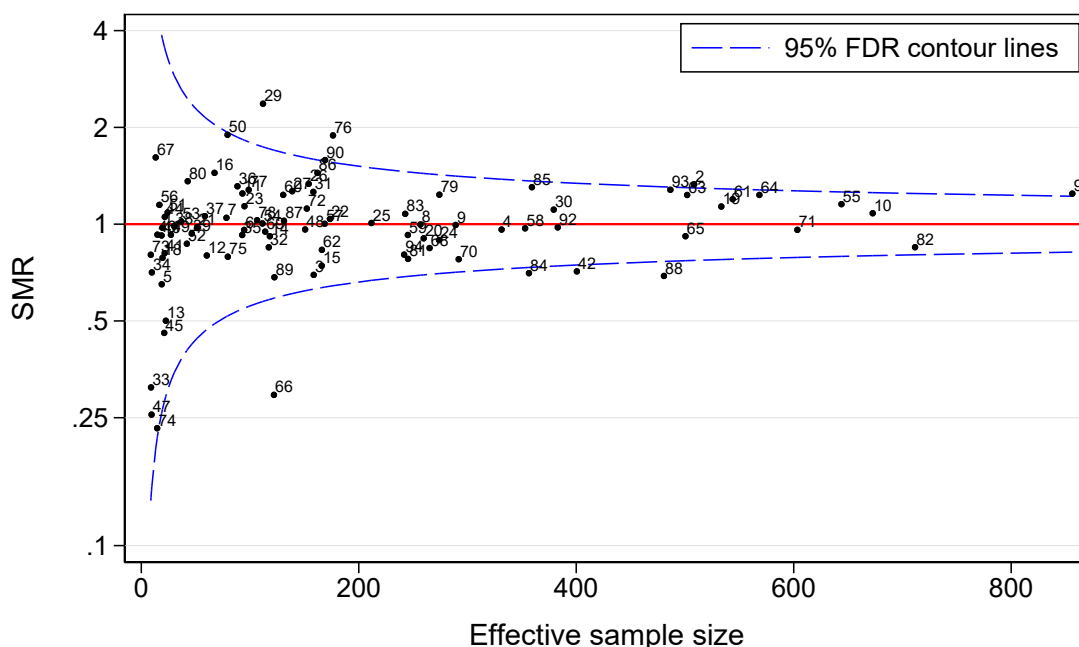
Missing comorbidities are recoded to being absent
Observations with other missing values are dropped from the model

2.3 Poisson Model Coefficients

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

	IRR	95% CI
Era of Treatment Start		
2014-2015	ref.	
2016-2017	1.036	(0.965-1.113)
2018-2019	0.974	(0.877-1.083)
Time Since Beginning Dialysis		
0-0.99 years	ref.	
1-1.99 years	1.195	(1.101-1.297)
2-2.99 years	1.494	(1.362-1.638)
3+ years	1.776	(1.611-1.959)
Age	1.027	(1.024-1.030)
Male	1.060	(0.990-1.134)
New Zealand	1.332	(1.156-1.536)
Diabetes (as comorbidity)	1.210	(1.093-1.339)
Chronic Lung Disease	1.305	(1.206-1.413)
Peripheral Vascular Disease	1.280	(1.187-1.381)
Cerebrovascular Disease	1.174	(1.077-1.280)
Coronary Artery Disease	1.323	(1.234-1.417)
Current or Former Smoker	1.118	(1.046-1.195)
Late Referral	1.293	(1.191-1.403)
BMI		
Underweight	1.566	(1.295-1.893)
Normal	ref.	
Overweight	0.846	(0.780-0.917)
Obese	0.722	(0.665-0.783)
Primary Renal Disease		
Glomerulonephritis	ref.	
Diabetic Nephropathy	1.667	(1.490-1.865)
Hypertension	1.297	(1.143-1.472)
Polycystic Disease	0.771	(0.612-0.971)
Reflux Nephropathy	0.760	(0.507-1.139)
Other	1.665	(1.469-1.889)
Uncertain diagnosis	1.411	(1.190-1.672)