ANZ DATA

AUSTRALIA & NEW ZEALAND
DIALYSIS & TRANSPLANT
REGISTRY

DIALYSIS HOSPITAL REPORT

2013 - 2018

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 ≥18 years who commenced dialysis during 2013-2018 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. Some observations had missing values (n=1337) 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	23 (1)	4	3.8	1.06 (0.20-5.72)
2	Alfred Hospital	410 (19)	110	79.6	1.38 (1.02-1.87)
3	Alice Springs Hospital	280 (28)	43	56.5	0.76 (0.47-1.23)
4	Austin Hospital	324 (3)	66	71.4	0.92 (0.65-1.31)
5	Bathurst Base Hospital	18 (0)	3	6.8	0.44 (0.08-2.49)
6	Bendigo Hospital	87 (0)	21	25.7	0.82 (0.40-1.69)
7	Bundaberg Hospital	89 (2)	24	18.0	1.33 (0.71-2.50)
8	Cairns Hospital	307 (26)	53	49.9	1.06 (0.69-1.63)
9	Canberra Hospital	276 (22)	78	61.2	1.28 (0.90-1.81)
10	Central Northern Adelaide Renal Service	710 (46)	127	123.5	1.03 (0.78-1.36)
11	Chermside Dialysis Centre	57 (0)	14	13.4	1.04 (0.52-2.11)
12	Coffs Harbour Hospital	61 (11)	10	17.9	0.56 (0.19-1.62)
13	Diamond Valley Dialysis Centre	36 (0)	6	12.5	0.48 (0.11-2.09)
14	Dubbo Base Hospital	95 (0)	25	28.9	0.87 (0.45-1.68)
15	Eastern Health Integrated Renal Services	283 (9)	50	60.4	0.83 (0.54-1.26)
16	Epworth Eastern Hospital	44 (2)	12	10.6	1.13 (0.46-2.77)
17	Epworth Geelong Hospital	7 (0)	1	4.2	0.24 (0.04-1.37)
18	Epworth Richmond Hospital	23 (1)	9	4.8	1.86 (0.65-5.28)
19	Fiona Stanley Hospital	575 (119)	106	86.2	1.23 (0.93-1.63)
20	Flinders Medical Centre	264 (10)	60	70.0	0.86 (0.60-1.23)
21	Forest Hill Satellite	51 (1)	13	19.1	0.68 (0.27-1.71)
22	Geelong Hospital	181 (1)	39	44.7	0.87 (0.53-1.43)
23	Gold Coast Private Hospital	45 (2)	15	16.3	0.92 (0.43-1.98)

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[*] 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	235 (22)	44	47.2	0.93 (0.62-1.39)
25	Gosford Hospital	219 (5)	58	51.9	1.12 (0.76-1.65)
26	Henry Dalziel Dialysis Clinic - Greenslopes	116 (0)	33	25.2	1.31 (0.80-2.15)
27	Hervey Bay Hospital	87 (1)	23	20.9	1.10 (0.62-1.96)
28	John Flynn Hospital	49 (0)	23	12.8	1.80 (0.94-3.45)
29	John Hunter Hospital	324 (9)	85	76.4	1.11 (0.80-1.54)
30	Launceston Hospital	157 (5)	40	29.8	1.34 (0.80-2.24)
31	Lismore Hospital	105 (1)	30	32.7	0.92 (0.54-1.56)
32	Lismore St Vincent's Private Dialysis Centre	15 (1)	4	5.2	0.77 (0.18-3.34)
33	Liverpool Private Dialysis Centre	9 (0)	1	1.6	0.64 (0.08-5.34)
34	Mackay Hospital	92 (3)	19	22.1	0.86 (0.40-1.84)
35	Malvern Dialysis Centre	57 (0)	20	14.0	1.43 (0.72-2.85)
36	Manning Rural Referral Hospital	56 (1)	17	14.8	1.15 (0.51-2.59)
37	Mater Hospital	27 (0)	7	5.1	1.36 (0.41-4.48)
38	Mater Hospital - South Brisbane	48 (6)	6	10.1	0.59 (0.16-2.16)
39	Mater Hospital - Townsville	21 (3)	4	3.7	1.07 (0.17-6.87)
40	Mayo Private Hospital - Taree	21 (1)	6	7.2	0.83 (0.24-2.92)
41	Monash Medical Centre (Adults)	686 (40)	108	129.9	0.83 (0.62-1.12)
42	Nambour Selangor Private Hospital	19 (2)	6	9.1	0.66 (0.17-2.59)
43	Newcastle Nephrocare	35 (2)	7	12.2	0.57 (0.17-1.98)
44	North Melbourne Dialysis Centre	15 (0)	5	2.9	1.71 (0.47-6.28)
45	Northern Beaches Hospital	11 (3)	0	2.2	0.00 (.-.)
46	Northern Health Service - Melbourne	164 (16)	38	33.3	1.14 (0.68-1.90)
47	Northlakes Private Dialysis Centre	29 (1)	4	7.0	0.58 (0.09-3.65)
48	Orange Hospital	60 (5)	20	9.2	2.18 (1.12-4.27)
49	Pindara Renal Unit	16 (2)	4	4.9	0.82 (0.19-3.54)
50	Port Macquarie Hospital	53 (4)	13	12.1	1.08 (0.47-2.48)
51	Port Macquarie Private Hospital Hospital	10 (0)	3	3.8	0.78 (0.10-6.23)
52	Prince Of Wales Hospital	119 (9)	28	27.2	1.03 (0.59-1.79)

[*] 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	Princess Alexandra Hospital	596 (42)	119	104.3	1.14 (0.88-1.48)
54	Ramsay Cairns Private Dialysis Centre	16 (1)	4	3.8	1.04 (0.21-5.27)
55	Rockhampton Hospital	123 (1)	29	34.7	0.84 (0.47-1.48)
56	Royal Brisbane And Women's Hospital	344 (19)	62	69.6	0.89 (0.63-1.27)
57	Royal Darwin Hospital	331 (23)	55	54.7	1.01 (0.64-1.58)
58	Royal Hobart Hospital	119 (5)	24	26.1	0.92 (0.50-1.71)
59	Royal Melbourne Hospital	642 (146)	113	103.3	1.09 (0.82-1.46)
60	Royal North Shore Hospital	292 (77)	35	45.4	0.77 (0.45-1.32)
61	Royal Perth Hospital	539 (81)	119	95.1	1.25 (0.94-1.67)
62	Sir Charles Gairdner Hospital	540 (65)	122	103.3	1.18 (0.89-1.57)
63	South West Sydney Renal Service	695 (126)	129	139.9	0.92 (0.71-1.19)
64	St Andrew's Ipswich - Dialysis Centre	10 (2)	0	2.4	0.00 (.-.)
65	St Andrews Hospital Toowoomba	11 (1)	1	1.8	0.56 (0.11-2.82)
66	St George Hospital	261 (2)	67	76.3	0.88 (0.61-1.26)
67	St Vincent's Hospital (NSW)	132 (3)	31	30.5	1.02 (0.53-1.94)
68	St Vincent's Hospital (VIC)	323 (17)	53	70.4	0.75 (0.51-1.11)
69	Statewide Renal Services	570 (31)	114	127.0	0.90 (0.67-1.19)
70	Sunshine Coast University Hospital	167 (10)	28	27.8	1.01 (0.56-1.81)
71	Sunshine Coast University Private Hospital (Ramsay)	11 (0)	1	3.5	0.29 (0.03-2.60)
72	Sunshine Private Hospital	15 (2)	0	2.3	0.00 (.-.)
73	Sydney Adventist Hospital	47 (0)	12	21.7	0.55 (0.24-1.30)
74	Tamworth Hospital	118 (4)	49	25.1	1.95 (1.25-3.05)
75	The Tweed Hospital	70 (6)	20	13.7	1.46 (0.83-2.58)
76	Toowoomba Hospital	150 (8)	33	29.3	1.13 (0.69-1.83)
77	Townsville Hospital	237 (32)	44	51.1	0.86 (0.55-1.35)
78	Wesley Hospital	71 (31)	12	9.8	1.22 (0.50-2.98)
79	Western Health Service	338 (12)	65	75.9	0.86 (0.58-1.26)
80	Western Renal Service	843 (17)	175	191.9	0.91 (0.72-1.15)

* 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)
81	Wollongong Hospital	195 (16)	47	45.6	1.03 (0.67-1.59)

[*] 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)
82	Auckland Hospital	335 (7)	71	96.6	0.73 (0.51-1.06)
83	Christchurch Hospital	205 (2)	56	44.3	1.26 (0.86-1.85)
84	Dunedin Hospital	102 (2)	31	22.3	1.39 (0.83-2.32)
85	Hawkes Bay Hospital	149 (42)	38	33.0	1.15 (0.73-1.81)
86	Middlemore Hospital	597 (10)	135	168.1	0.80 (0.60-1.07)
87	Palmerston North Hospital	133 (6)	28	36.6	0.76 (0.44-1.33)
88	Taranaki Hospital	71 (2)	26	18.3	1.42 (0.83-2.44)
89	Waikato Hospital	593 (19)	170	150.0	1.13 (0.88-1.46)
90	Waitemata Renal Service	311 (18)	84	89.7	0.94 (0.67-1.30)
91	Wellington Hospital	353 (0)	100	81.9	1.22 (0.90-1.65)
92	Whangarei Hospital	190 (2)	48	61.4	0.78 (0.50-1.22)

[*] 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.

Observations with missing values are dropped from the model
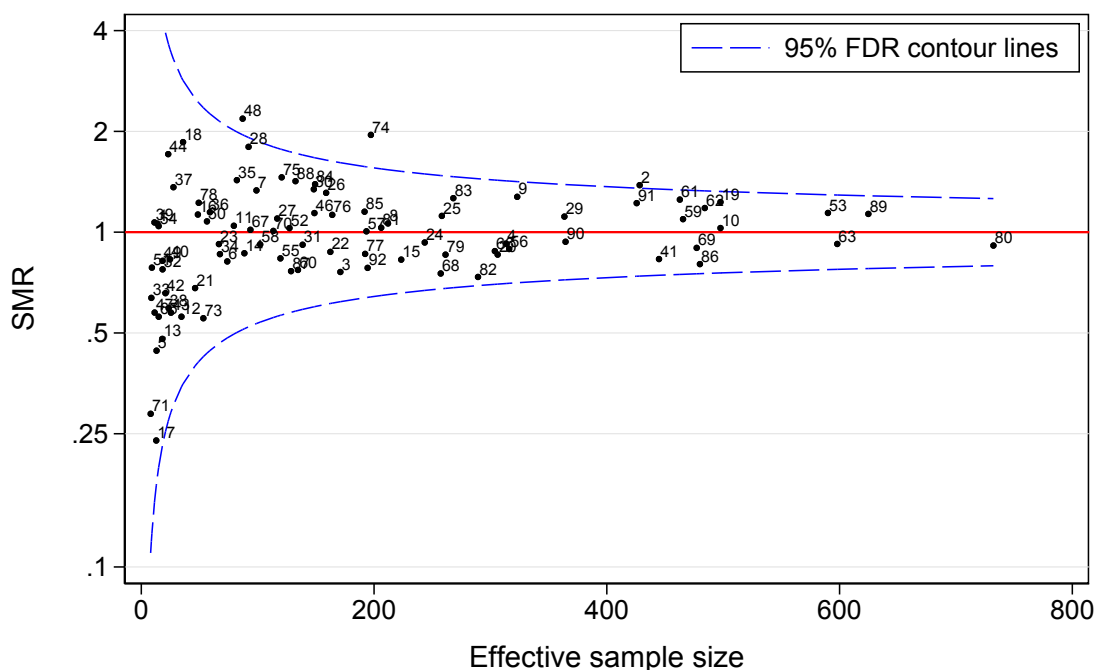
2.3 Poisson Model Coefficients

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

	IRR	95% CI
Era of Treatment Start		
2013-2014	ref.	
2015-2016	1.036	(0.964-1.113)
2017-2018	1.011	(0.907-1.126)
Time Since Beginning Dialysis		
0-0.99 years	ref.	
1-1.99 years	1.203	(1.106-1.309)
2-2.99 years	1.511	(1.376-1.660)
3+ years	1.880	(1.705-2.072)
Age	1.028	(1.025-1.031)
Male	1.050	(0.980-1.125)
Country and Race		
Australian non-indigenous	ref.	
Australian Aboriginal/Torres Strait Islander	0.917	(0.799-1.052)
New Zealand non-indigenous	1.333	(1.143-1.554)
New Zealand Māori/Pacific	1.293	(1.104-1.514)
Diabetes (as comorbidity)	1.137	(1.024-1.262)
Chronic Lung Disease	1.308	(1.208-1.417)
Peripheral Vascular Disease	1.274	(1.182-1.374)
Cerebrovascular Disease	1.206	(1.107-1.314)
Coronary Artery Disease	1.279	(1.193-1.372)
Current or Former Smoker	1.131	(1.057-1.210)
Late Referral	1.281	(1.179-1.391)
BMI		
Underweight	1.624	(1.344-1.963)
Normal	ref.	
Overweight	0.849	(0.782-0.921)
Obese	0.737	(0.678-0.801)
Primary Renal Disease		
Glomerulonephritis	ref.	
Diabetic Nephropathy	1.640	(1.466-1.835)
Hypertension	1.255	(1.107-1.424)
Polycystic Disease	0.724	(0.573-0.914)
Reflux Nephropathy	0.844	(0.586-1.217)
Other	1.677	(1.480-1.900)
Uncertain diagnosis	1.331	(1.119-1.583)