

DIALYSIS HOSPITAL REPORT

2012 - 2017

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From the ANZDATA Database last surveyed on 31st December 2017



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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 probability of a single centre lying

outside their confidence interval due to chance 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 2012-2017 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 ($n=1334$) 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	14 (0)	1	1.8	0.54 (0.07-4.21)
2	Alfred Hospital	396 (13)	104	76.1	1.37 (1.01-1.84)
3	Alice Springs Hospital	272 (15)	33	61.7	0.53 (0.32-0.89)
4	Austin Hospital	315 (8)	67	73.0	0.92 (0.65-1.29)
5	Bathurst Base Hospital	19 (0)	2	9.1	0.22 (0.03-1.71)
6	Bendigo Hospital	86 (1)	18	22.9	0.79 (0.39-1.59)
7	Bundaberg Hospital	86 (2)	22	18.5	1.19 (0.62-2.29)
8	Cairns Hospital	297 (27)	59	52.9	1.12 (0.76-1.63)
9	Canberra Hospital	286 (24)	82	66.0	1.24 (0.89-1.74)
10	Central Northern Adelaide Renal Service	726 (51)	145	125.1	1.16 (0.90-1.49)
11	Chermside Dialysis Centre	46 (0)	17	15.3	1.11 (0.59-2.11)
12	Coffs Harbour Hospital	61 (10)	11	15.7	0.70 (0.30-1.62)
13	Diamond Valley Dialysis Centre	35 (0)	8	11.2	0.72 (0.26-1.98)
14	Dubbo Base Hospital	96 (0)	30	31.8	0.94 (0.57-1.57)
15	Eastern Health Integrated Renal Services	263 (9)	51	64.4	0.79 (0.53-1.18)
16	Epworth Eastern Hospital	34 (1)	5	10.4	0.48 (0.09-2.44)
17	Epworth Geelong Hospital	4 (0)	1	1.9	0.52 (0.07-3.70)
18	Epworth Richmond Hospital	26 (2)	12	3.4	3.51 (1.71-7.19)
19	Fiona Stanley Hospital	527 (117)	81	84.9	0.95 (0.70-1.31)
20	Flinders Medical Centre	245 (7)	60	67.3	0.89 (0.62-1.29)
21	Forest Hill Satellite	54 (3)	16	20.9	0.76 (0.38-1.55)
22	Geelong Hospital	190 (5)	40	48.4	0.83 (0.53-1.29)
23	Gold Coast Private Hospital	39 (0)	9	15.1	0.60 (0.22-1.65)

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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 University Hospital	225 (21)	51	47.4	1.08 (0.74-1.56)
25	Gosford Hospital	189 (12)	50	42.5	1.18 (0.79-1.76)
26	Henry Dalziel Dialysis Clinic - Greenslopes	109 (1)	24	23.1	1.04 (0.55-1.97)
27	Hervey Bay Hospital	85 (0)	19	19.4	0.98 (0.50-1.93)
28	John Flynn Hospital	54 (0)	26	13.3	1.96 (0.96-3.98)
29	John Hunter Hospital	330 (21)	79	70.2	1.13 (0.84-1.51)
30	Launceston Hospital	158 (4)	49	29.0	1.69 (1.17-2.44)
31	Lismore Hospital	101 (1)	28	30.7	0.91 (0.51-1.62)
32	Lismore St Vincent's Private Dialysis Centre	19 (1)	9	7.5	1.20 (0.48-3.03)
33	Liverpool Private Dialysis Centre	10 (0)	0	2.0	0.00 (-.)
34	Mackay Hospital	91 (1)	15	24.1	0.62 (0.28-1.38)
35	Malvern Dialysis Centre	57 (0)	20	16.8	1.19 (0.59-2.40)
36	Manning Rural Referral Hospital	59 (3)	16	15.2	1.05 (0.47-2.36)
37	Mater Hospital	27 (1)	8	6.2	1.29 (0.45-3.68)
38	Mater Hospital - South Brisbane	37 (11)	2	6.7	0.30 (0.04-2.15)
39	Mater Hospital - Townsville	14 (3)	1	2.9	0.34 (0.07-1.66)
40	Mayo Private Hospital - Taree	23 (1)	8	7.9	1.01 (0.35-2.90)
41	Monash Medical Centre (Adults)	662 (37)	108	134.1	0.81 (0.61-1.06)
42	Nambour Selangor Private Hospital	23 (2)	3	10.7	0.28 (0.05-1.69)
43	Newcastle Nephrocare	43 (3)	8	12.5	0.64 (0.22-1.83)
44	North Melbourne Dialysis Centre	16 (0)	7	4.0	1.74 (0.60-4.99)
45	Northern Health Service - Melbourne	139 (15)	30	31.6	0.95 (0.54-1.66)
46	Northlakes Private Dialysis Centre	18 (1)	1	4.3	0.23 (0.04-1.51)
47	Orange Hospital	69 (3)	26	13.9	1.88 (1.05-3.35)
48	Pindara Renal Unit	12 (2)	4	5.5	0.73 (0.18-2.94)
49	Port Macquarie Hospital	70 (7)	16	18.5	0.86 (0.40-1.87)
50	Port Macquarie Private Hospital Hospital	17 (0)	8	6.2	1.30 (0.38-4.39)
51	Prince Of Wales Hospital	121 (3)	27	31.6	0.86 (0.51-1.45)
52	Princess Alexandra Hospital	561 (49)	100	95.4	1.05 (0.77-1.42)

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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	Ramsay Cairns Private Dialysis Centre	9 (0)	0	1.7	0.00 (-.-)
54	Rockhampton Hospital	120 (0)	33	29.2	1.13 (0.68-1.86)
55	Royal Brisbane And Women's Hospital	325 (19)	57	66.0	0.86 (0.59-1.27)
56	Royal Darwin Hospital	310 (30)	57	51.7	1.10 (0.72-1.69)
57	Royal Hobart Hospital	117 (4)	27	25.4	1.06 (0.63-1.78)
58	Royal Melbourne Hospital	615 (118)	125	100.0	1.25 (0.97-1.61)
59	Royal North Shore Hospital	269 (88)	38	39.9	0.95 (0.60-1.51)
60	Royal Perth Hospital	493 (60)	108	94.9	1.14 (0.85-1.51)
61	Sir Charles Gairdner Hospital	527 (75)	112	100.2	1.12 (0.84-1.48)
62	South West Sydney Renal Service	669 (124)	138	157.8	0.87 (0.68-1.12)
63	St Andrews Hospital Toowoomba	5 (0)	2	2.0	0.99 (0.31-3.18)
64	St George Hospital	253 (1)	58	68.9	0.84 (0.57-1.24)
65	St Vincent's Hospital (NSW)	126 (2)	36	30.7	1.17 (0.66-2.09)
66	St Vincent's Hospital (VIC)	330 (25)	67	70.5	0.95 (0.67-1.34)
67	Statewide Renal Services	549 (33)	133	124.6	1.07 (0.84-1.36)
68	Sunshine Coast University Hospital	148 (10)	21	23.3	0.90 (0.49-1.67)
69	Sunshine Coast University Private Hospital (Ramsay)	8 (0)	1	1.8	0.57 (0.05-6.78)
70	Sunshine Private Dialysis Centre	6 (1)	1	1.1	0.93 (0.32-2.70)
71	Sydney Adventist Hospital	50 (1)	11	19.1	0.57 (0.22-1.51)
72	Tamworth Hospital	121 (8)	47	25.6	1.84 (1.16-2.91)
73	The Tweed Hospital	67 (8)	21	15.2	1.38 (0.76-2.51)
74	Toowoomba Hospital	154 (8)	34	33.1	1.03 (0.62-1.70)
75	Townsville Hospital	227 (30)	39	47.8	0.82 (0.52-1.29)
76	Varsity Lakes Dialysis Centre	11 (0)	3	3.1	0.96 (0.15-6.19)
77	Wesley Hospital	63 (23)	7	7.9	0.88 (0.27-2.90)
78	Western Health	324 (28)	67	74.2	0.90 (0.64-1.28)
79	Western Renal Service	798 (16)	161	183.8	0.88 (0.69-1.11)
80	Wollongong Hospital	207 (12)	49	48.0	1.02 (0.68-1.53)

* 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)
81	Auckland Hospital	307 (1)	74	90.0	0.82 (0.59-1.15)
82	Christchurch Hospital	210 (8)	51	38.7	1.32 (0.90-1.92)
83	Dunedin Hospital	98 (1)	30	24.1	1.25 (0.68-2.28)
84	Hawkes Bay Hospital	150 (48)	31	27.5	1.13 (0.68-1.87)
85	Middlemore Hospital	610 (9)	142	162.1	0.88 (0.67-1.14)
86	Palmerston North Hospital	151 (5)	38	40.3	0.94 (0.62-1.44)
87	Taranaki Hospital	65 (3)	19	15.2	1.25 (0.69-2.27)
88	Waikato Hospital	554 (21)	151	134.6	1.12 (0.87-1.44)
89	Waitemata Renal Service	277 (10)	63	84.6	0.74 (0.53-1.05)
90	Wellington Hospital	332 (0)	96	79.6	1.21 (0.92-1.58)
91	Whangarei Hospital	185 (2)	49	56.9	0.86 (0.59-1.26)

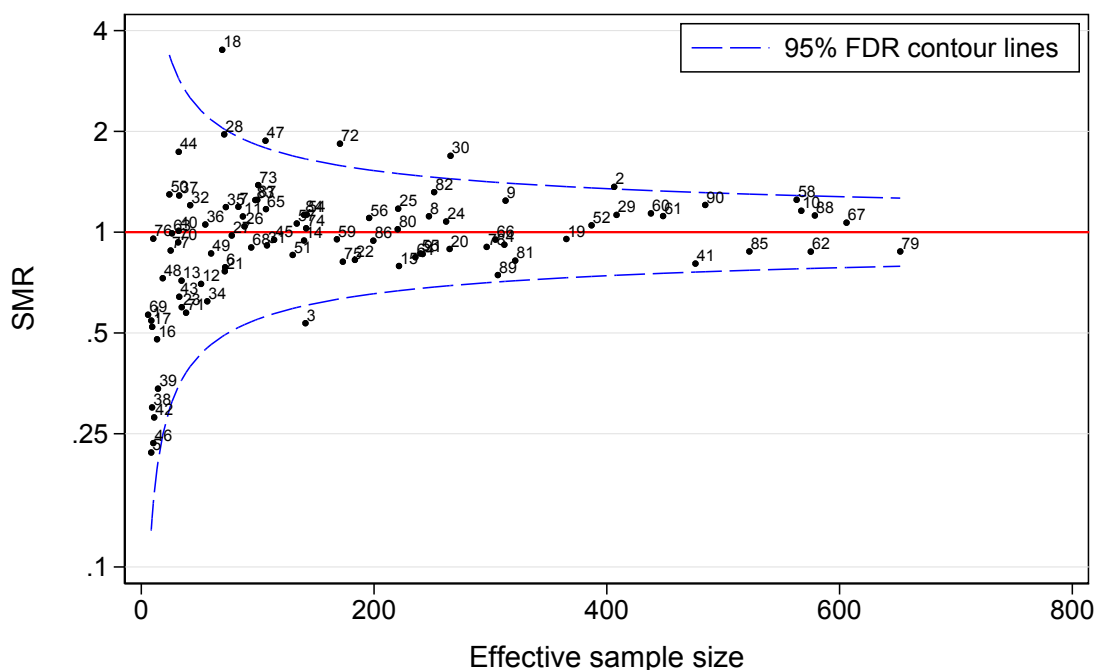
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2.2 Funnel Plot

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.



2.3 Poisson Model Coefficients

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

	IRR	95% CI
Era of Treatment Start		
2012-2013	ref.	
2014-2015	0.976	(0.908-1.050)
2016-2017	1.016	(0.910-1.135)
Time Since Beginning Dialysis		
0-0.99 years	ref.	
1-1.99 years	1.206	(1.107-1.313)
2-2.99 years	1.544	(1.405-1.697)
3+ years	1.922	(1.743-2.121)
Age	1.030	(1.027-1.033)
Male	1.029	(0.960-1.103)
Country and Race		
Australian non-indigenous	ref.	
Australian Aboriginal/Torres Strait Islander	0.955	(0.829-1.099)
New Zealand non-indigenous	1.395	(1.187-1.639)
New Zealand Māori/Pacific	1.273	(1.075-1.507)
Diabetes (as comorbidity)	1.235	(1.110-1.373)
Chronic Lung Disease	1.324	(1.222-1.434)
Peripheral Vascular Disease	1.259	(1.167-1.358)
Cerebrovascular Disease	1.232	(1.132-1.340)
Coronary Artery Disease	1.309	(1.219-1.405)
Current or Former Smoker	1.148	(1.072-1.229)
Late Referral	1.294	(1.192-1.404)
BMI		
Underweight	1.695	(1.401-2.052)
Normal	ref.	
Overweight	0.847	(0.780-0.920)
Obese	0.730	(0.671-0.795)
Primary Renal Disease		
Glomerulonephritis	ref.	
Diabetic Nephropathy	1.751	(1.564-1.960)
Hypertension	1.251	(1.102-1.421)
Polycystic Disease	0.685	(0.534-0.878)
Reflux Nephropathy	1.038	(0.741-1.454)
Other	1.612	(1.421-1.830)
Uncertain diagnosis	1.446	(1.215-1.721)