



DIALYSIS HOSPITAL REPORT

2011 - 2016

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From the ANZDATA Database last surveyed on 31st December 2016



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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 a common means of presenting this variability. For example, 95% confidence intervals illustrate a range which is expected to contain the true value 19 times out of 20. By definition, therefore, it is expected that 1 result in 20 will lie outside of 95% confidence intervals due to chance alone, if the assumptions of the model used to obtain the estimate are valid.

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. Several changes to the methodology for the SMRs have been made in this report, see the accompanying document for an explanation of these changes. 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. With the change in the definition of the expected number of deaths, the standard error of the SMRs are now 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 2011-2016 and remained on dialysis for more than 90 days were included in the model, with the exception of patients currently receiving RRT under the care of Canberra Hospital, as a result of delayed return of their 2016 ANZDATA survey data due to a data embargo by ACT Health. Follow-up continued until first transplant, recovery of renal function lasting >30 days, death or most recent date of follow-up. A small number of observations had missing values ($n=993$) 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)	0	1.5	0.00 (-.-)
2	Alfred Hospital	376 (6)	100	70.2	1.42 (1.09-1.86)
3	Alice Springs Hospital	263 (8)	27	62.1	0.43 (0.25-0.76)
4	Austin Hospital	302 (7)	65	74.7	0.87 (0.63-1.21)
5	Bathurst Base Hospital	19 (0)	1	6.1	0.16 (0.03-0.87)
6	Bendigo Hospital	74 (0)	17	18.4	0.93 (0.49-1.75)
7	Bundaberg Hospital	77 (2)	22	15.8	1.40 (0.80-2.43)
8	Cairns Hospital	289 (28)	59	45.9	1.29 (0.91-1.82)
9	Central Northern Adelaide Renal Service	705 (45)	159	125.8	1.26 (1.03-1.56)
10	Chermside Dialysis Unit	61 (0)	15	14.8	1.01 (0.53-1.94)
11	Coffs Harbour Hospital	54 (7)	9	14.8	0.61 (0.26-1.41)
12	Diamond Valley Dialysis Centre	40 (0)	10	12.8	0.78 (0.35-1.73)
13	Dubbo Base Hospital	101 (0)	23	32.8	0.70 (0.40-1.22)
14	Eastern Health Integrated Renal Services	254 (2)	52	59.2	0.88 (0.60-1.28)
15	Epworth Eastern Hospital	18 (0)	1	6.2	0.16 (0.03-0.84)
16	Epworth Richmond Hospital	34 (2)	12	7.1	1.69 (0.70-4.07)
17	Fiona Stanley Hospital	464 (101)	50	82.0	0.61 (0.43-0.87)
18	Flinders Medical Centre	250 (6)	53	65.6	0.81 (0.56-1.16)
19	Forest Hill Satellite	56 (2)	12	19.0	0.63 (0.28-1.41)
20	Geelong Hospital	189 (6)	34	46.2	0.74 (0.48-1.12)
21	Gold Coast Hospital	214 (17)	49	45.9	1.07 (0.75-1.51)
22	Gold Coast Private Hospital	34 (0)	5	10.7	0.47 (0.13-1.66)
23	Gosford Hospital	180 (8)	51	42.2	1.21 (0.86-1.70)

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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	Henry Dalziel Dialysis Clinic - Greenslopes	98 (0)	21	18.0	1.16 (0.63-2.17)
25	Hervey Bay Hospital	83 (0)	20	17.1	1.17 (0.60-2.29)
26	John Flynn Hospital	59 (0)	27	17.5	1.54 (0.87-2.73)
27	John Hunter Hospital	324 (17)	72	62.2	1.16 (0.84-1.59)
28	Launceston Hospital	150 (3)	45	26.4	1.71 (1.18-2.47)
29	Lismore Hospital	111 (1)	34	37.2	0.92 (0.56-1.50)
30	Lismore St Vincent's Private Dialysis Centre	23 (0)	6	14.1	0.42 (0.11-1.68)
31	Liverpool Private Dialysis Centre	9 (0)	0	3.6	0.00 (-.)
32	Mackay Hospital	90 (0)	16	23.8	0.67 (0.35-1.28)
33	Macleay Dialysis Centre Kempsey	15 (1)	3	4.5	0.67 (0.12-3.78)
34	Malvern Dialysis Centre	49 (0)	17	13.7	1.24 (0.63-2.42)
35	Manning Rural Referral Hospital	61 (4)	17	14.0	1.21 (0.62-2.38)
36	Mater Brisbane	9 (1)	0	2.1	0.00 (-.)
37	Mater Hospital	24 (1)	6	4.8	1.26 (0.46-3.46)
38	Mater Townsville	10 (4)	0	2.2	0.00 (-.)
39	Mayo Private Hospital - Taree	20 (0)	8	6.4	1.26 (0.46-3.46)
40	Monash Medical (Adults)	640 (32)	109	135.7	0.80 (0.62-1.04)
41	Nambour Hospital	145 (6)	18	25.7	0.70 (0.37-1.34)
42	Nambour Selangor and Caloundra Private	23 (2)	3	9.1	0.33 (0.06-1.66)
43	Newcastle Nephrocare	40 (1)	8	12.9	0.62 (0.24-1.60)
44	North Melbourne Dialysis Centre	18 (1)	8	4.7	1.71 (0.57-5.13)
45	Northern Health Service Melbourne	114 (11)	24	23.5	1.02 (0.60-1.73)
46	Orange Hospital	68 (1)	28	15.1	1.86 (1.06-3.25)
47	Pindara Renal Unit	8 (1)	2	4.1	0.48 (0.05-4.78)
48	Port Macquarie Hospital	57 (5)	13	10.8	1.20 (0.56-2.59)
49	Port Macquarie Private Hospital	19 (0)	9	7.2	1.25 (0.45-3.52)
50	Prince Of Wales Hospital	114 (0)	28	27.9	1.00 (0.63-1.61)
51	Princess Alexandra Hospital	541 (18)	101	89.8	1.12 (0.86-1.46)
52	Rockhampton Hospital	123 (0)	29	25.3	1.15 (0.70-1.88)

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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	Royal Brisbane Hospital	306 (27)	52	61.2	0.85 (0.60-1.20)
54	Royal Darwin Hospital	281 (16)	53	48.9	1.08 (0.74-1.58)
55	Royal Hobart Hospital	120 (0)	37	26.9	1.38 (0.89-2.13)
56	Royal Melbourne Hospital	615 (82)	120	104.8	1.14 (0.88-1.48)
57	Royal North Shore Hospital	248 (71)	40	43.8	0.91 (0.59-1.42)
58	Royal Perth Hospital	482 (48)	114	107.3	1.06 (0.83-1.36)
59	Sir Charles Gairdner Hospital	520 (77)	121	95.1	1.27 (0.99-1.63)
60	South West Sydney Renal Service	640 (120)	145	160.2	0.91 (0.74-1.11)
61	St Andrews Hospital Toowoomba	11 (0)	1	4.5	0.22 (0.05-1.07)
62	St George Hospital	259 (0)	52	63.6	0.82 (0.57-1.18)
63	St Vincent's Hospital (NSW)	126 (1)	30	27.2	1.10 (0.61-1.98)
64	St Vincent's Hospital (VIC)	313 (9)	69	69.3	1.00 (0.74-1.34)
65	Statewide Renal Services	550 (26)	130	124.5	1.04 (0.84-1.30)
66	Sunshine Coast University Private Hospital (Ramsay)	3 (0)	0	0.9	0.00 (-.)
67	Sydney Adventist Hospital	45 (0)	12	15.4	0.78 (0.37-1.65)
68	Tamworth Hospital	111 (3)	40	21.1	1.90 (1.26-2.84)
69	The Tweed Hospital	62 (8)	19	13.7	1.38 (0.76-2.52)
70	Toowoomba Hospital	140 (5)	36	33.0	1.09 (0.68-1.75)
71	Townsville Hospital	178 (5)	41	43.6	0.94 (0.63-1.41)
72	Varsity Lakes Dialysis Clinic - Fresenius	9 (0)	0	2.3	0.00 (-.)
73	Wesley Hospital	61 (16)	7	9.0	0.78 (0.27-2.28)
74	Western Health	299 (14)	58	69.8	0.83 (0.58-1.18)
75	Western Renal Service	792 (15)	175	172.5	1.01 (0.83-1.25)
76	Wollongong Hospital	219 (9)	47	55.0	0.85 (0.59-1.24)

* 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)
77	Auckland Hospital	288 (5)	67	88.5	0.76 (0.54-1.06)
78	Christchurch Hospital	207 (7)	56	40.1	1.40 (1.02-1.92)
79	Dunedin Hospital	107 (1)	35	24.8	1.41 (0.87-2.29)
80	Hawkes Bay Hospital	141 (35)	29	31.6	0.92 (0.57-1.47)
81	Middlemore Hospital	576 (7)	127	151.1	0.84 (0.67-1.05)
82	Palmerston Hospital	148 (0)	33	37.4	0.88 (0.56-1.39)
83	Taranaki Hospital	73 (3)	21	17.0	1.23 (0.72-2.12)
84	Waikato Hospital	525 (19)	152	133.8	1.14 (0.91-1.42)
85	Waitemata Renal Service	263 (5)	49	78.9	0.62 (0.44-0.88)
86	Wellington Hospital	321 (0)	101	82.1	1.23 (0.96-1.58)
87	Whangarei Hospital	165 (1)	46	50.2	0.92 (0.62-1.35)

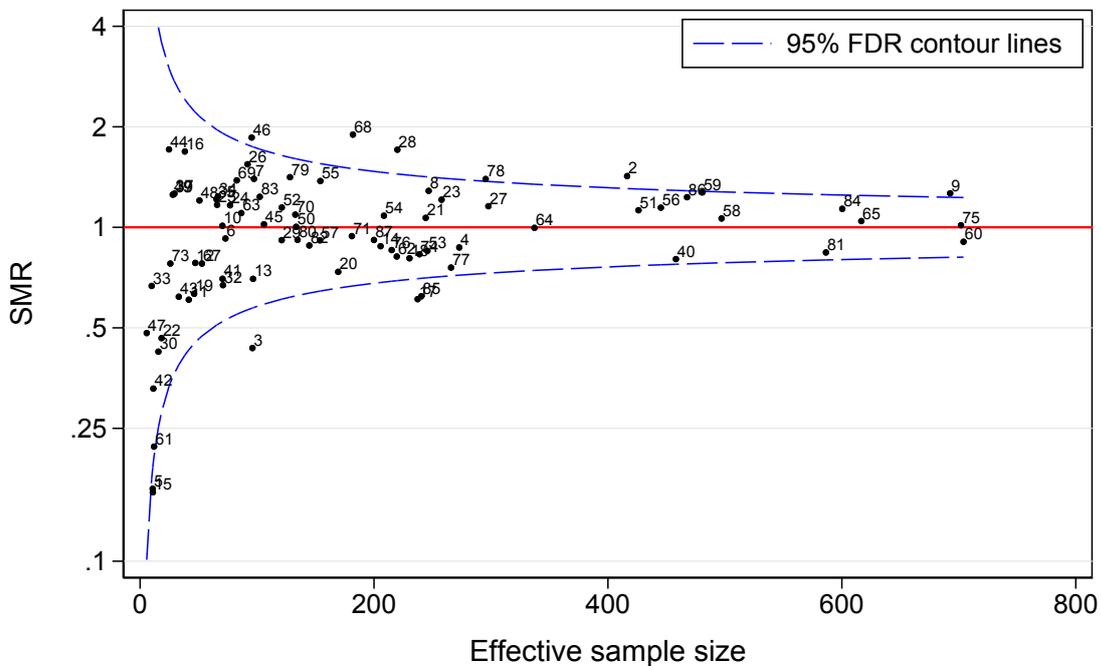
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2.2 Funnel Plot

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.



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		
2011-2012	ref.	
2013-2014	0.986	(0.915-1.063)
2015-2016	0.949	(0.846-1.064)
Time Since Beginning Dialysis		
0-0.99 years	ref.	
1-1.99 years	1.187	(1.089-1.294)
2-2.99 years	1.449	(1.316-1.596)
3+ years	1.710	(1.545-1.892)
Age	1.030	(1.027-1.033)
Male	1.038	(0.967-1.115)
Country and Race		
Australian non-indigenous	ref.	
Australian Aboriginal/Torres Strait Islander	1.088	(0.940-1.258)
New Zealand non-indigenous	1.479	(1.226-1.784)
New Zealand Māori/Pacific	1.421	(1.170-1.725)
Diabetes (as comorbidity)	1.219	(1.094-1.359)
Chronic Lung Disease	1.312	(1.211-1.422)
Peripheral Vascular Disease	1.221	(1.129-1.321)
Cerebrovascular Disease	1.231	(1.129-1.341)
Coronary Artery Disease	1.302	(1.209-1.401)
Current or Former Smoker	1.145	(1.067-1.230)
Late Referral	1.328	(1.224-1.440)
BMI		
Underweight	1.782	(1.471-2.158)
Normal	ref.	
Overweight	0.850	(0.781-0.925)
Obese	0.730	(0.670-0.796)
Primary Renal Disease		
GN	ref.	
Analgesic	1.231	(0.911-1.662)
Polycystic	0.745	(0.582-0.955)
Reflux	0.930	(0.642-1.349)
Hypertension	1.314	(1.157-1.493)
Diabetes	1.777	(1.586-1.991)
Other	1.799	(1.581-2.046)
Uncertain diagnosis	1.464	(1.226-1.749)