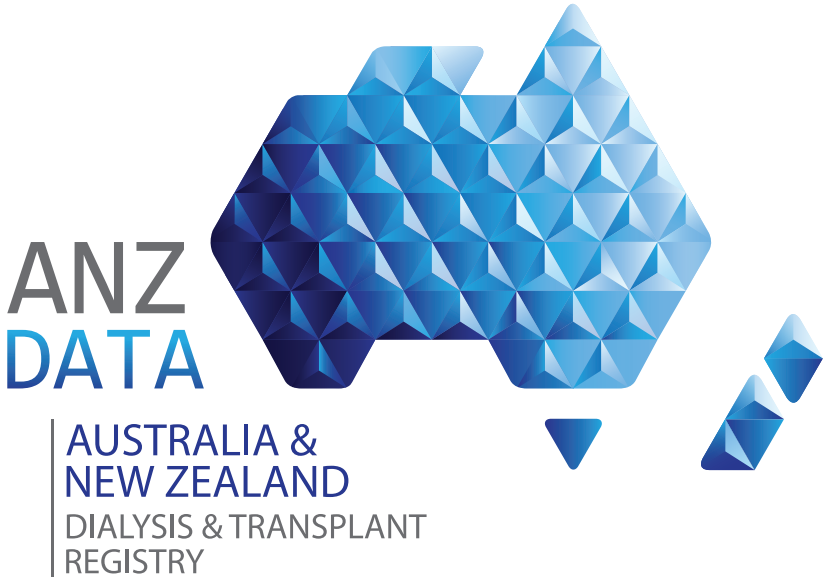


TRANSPLANTING HOSPITAL REPORT

2016 - 2021

PUBLISHED November 2022
From the ANZDATA Database last surveyed on 31st December 2021

Contents

1 Introduction

This report is an abridged version of the transplant 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.

All Australian and New Zealand patients transplanted between 1 January 2016 and 31 December 2021 and who were aged ≥16 years at the time of operation were included. Both deceased and living donor transplants were included, but patients who received multi-organ grafts were excluded. Patients transplanted at a paediatric hospital were excluded. Recipients aged ≥18 years at the time of transplant were included for hospitals that provide transplantation services for all ages.

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 transplant 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 Methods

Random effects logistic regression was used to calculate the expected number of events (deaths or graft failures) at 1 year post-transplant for transplanting hospitals based on the patient and donor case-mix. Graft failure included return to dialysis or death.

Factors included in logistic regression models were recipient age, donor age, recipient gender, presence of chronic lung disease and vascular disease (coronary artery disease, cerebrovascular disease and/or peripheral vascular disease) in the recipient, primary kidney disease, number of HLA mismatches, donor type by cause of death (cerebrovascular accident (CVA), or other cause) and total ischaemic time, time since commencing KRT, peak panel reactive antibody (PRA) and transplant year. For Australian patients the peak PRA is defined as the authorised calculated PRA at match, where available, and the authorised PRA otherwise. In addition, a random effect at the level of the transplanting hospital was included.

The logistic regression model was fitted to data from all transplant recipients to obtain the probability of an event occurring for each patient based upon their characteristics. The expected number of events was defined as the number of events 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 event 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 events. The standard error of the ratios of observed to expected events were estimated using 500 bootstrapped samples. Missing values for comorbidities were recoded to the comorbidity being absent. Following the comorbidities being recoded, some observations still had missing values for one or more predictor variables and these cases were excluded. We have indicated the number of missing patients for each hospital. Where this is large, then the potential exists to bias results if the pattern of missingness is not random.

For all models, the expected number of events predicted by the model within each category of covariates was consistent with the observed numbers. Additionally, the area under the receiver-operating characteristic (ROC) curves attributable to each model was also examined. For 1 year death and graft failure the area under the ROC curve were 78.0% (95% CI: 73.3-82.8) and 72.0% (95% CI: 68.8-75.2), respectively. These results indicate a model with moderate fit, and the degree of model fit is comparable with US and UK models.

This section contains the random effects logistic regression model results as odds ratios with 95% confidence intervals for the two outcomes. It also contains the number of transplants performed by each hospital and the number of graft failure events (which includes death) and patient deaths within 1 year post-transplant. The expected number of events (graft failures or deaths) based on patient case-mix is presented as well as the ratio of observed to expected. The ratio of observed to expected is presented with a 95% false discovery rate (FDR) confidence interval, that accounts for the multiple comparisons made between centres. The expected proportion of centres identified falsely by lying outside their confidence interval is 0.05. The rate of observed events per number of transplants is also presented with a 95% confidence interval.

The ratios of observed to expected for both outcomes are also presented in funnel plots. These show the ratios on a logarithmic scale (y-axis) plotted against the effective sample size (x-axis). Hospitals with a ratio of 0 are not shown. The red line indicates a ratio 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.

3 Graft Failure at 1 Year Post-transplant

3.1 Risk-adjusted Graft Failure Ratios

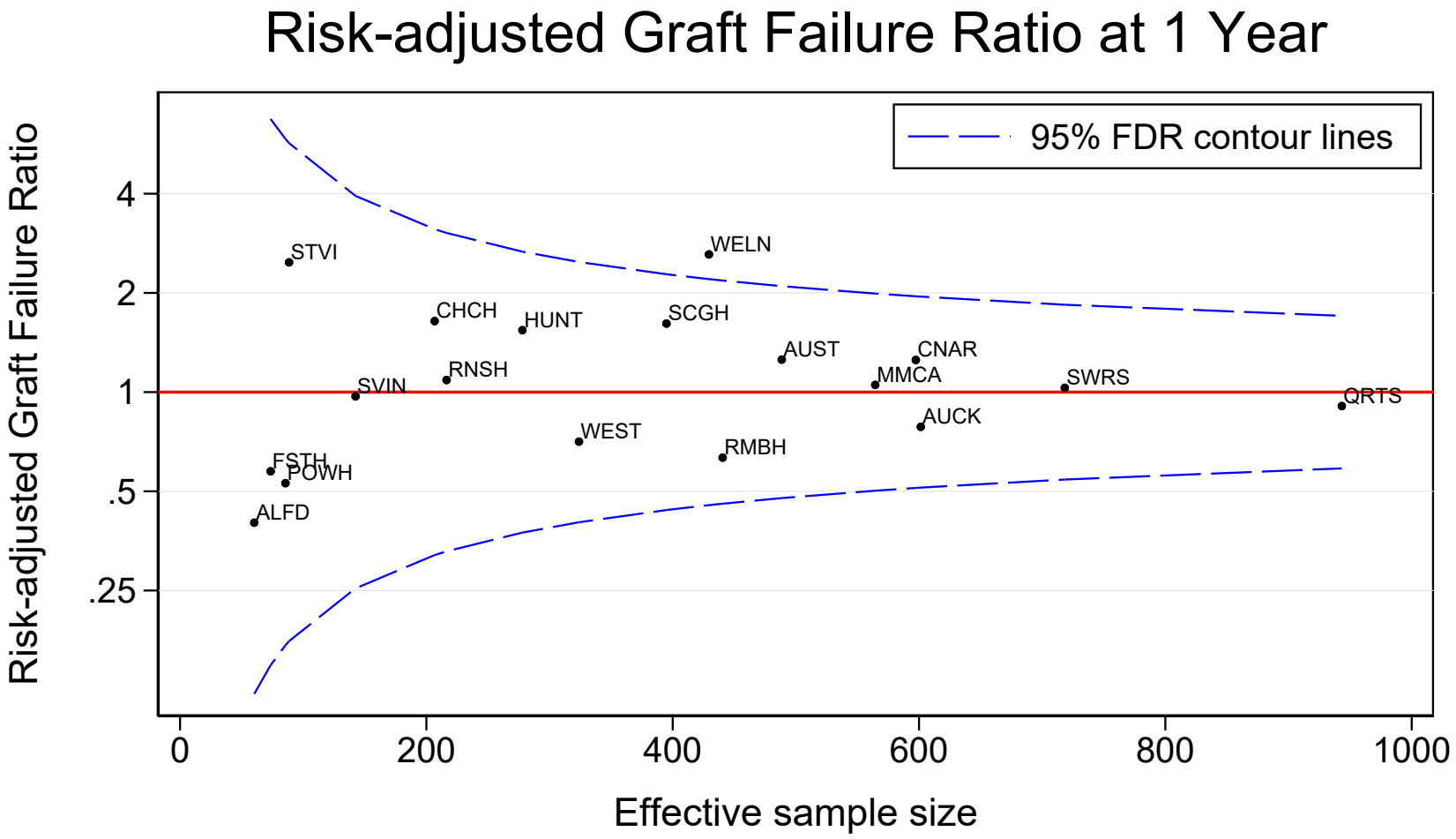
Table 1: Observed vs expected number of graft failures at 1 year post transplant

Code	Hospital	Grafts*	Observed	Expected	Observed Rate (95% CI)	Ratio (95% FDR CI)
ALFD	Alfred Hospital	135 (13)	2	5.0	0.015 (0.002-0.052)	0.40 (0.05-3.31)
AUCK	Auckland City Hospital	546 (0)	18	22.9	0.033 (0.020-0.052)	0.78 (0.40-1.53)
AUST	Austin Hospital	318 (18)	15	12.0	0.047 (0.027-0.077)	1.26 (0.60-2.63)
CHCH	Christchurch Hospital	160 (1)	8	4.9	0.050 (0.022-0.096)	1.64 (0.53-5.13)
CNAR	Central Northern Adelaide Renal Service	403 (11)	20	16.0	0.057 (0.037-0.084)	1.25 (0.64-2.45)
FSTH	Fiona Stanley Hospital	199 (15)	3	5.2	0.020 (0.006-0.051)	0.57 (0.09-3.88)
HUNT	John Hunter Hospital	166 (17)	10	6.5	0.096 (0.056-0.152)	1.54 (0.58-4.11)
MMCA	Monash Medical Centre	388 (11)	18	17.1	0.054 (0.034-0.082)	1.05 (0.53-2.09)
POWH	The Prince Of Wales Hospital	191 (16)	4	7.6	0.021 (0.006-0.053)	0.53 (0.09-3.10)
QRTS	Queensland Kidney Transplant Service	868 (15)	27	29.8	0.031 (0.021-0.045)	0.91 (0.53-1.55)
RMBH	The Royal Melbourne Hospital	631 (38)	15	23.7	0.025 (0.015-0.041)	0.63 (0.29-1.38)
RNSH	Royal North Shore Hospital	193 (0)	8	7.4	0.041 (0.018-0.080)	1.09 (0.36-3.31)
SCGH	Sir Charles Gairdner Hospital	284 (28)	14	8.7	0.063 (0.038-0.098)	1.61 (0.71-3.68)
STVI	St Vincent's Hospital (NSW)	47 (4)	4	1.6	0.106 (0.035-0.231)	2.48 (0.43-14.10)
SVIN	St Vincent's Hospital (VIC)	118 (1)	5	5.2	0.051 (0.019-0.107)	0.97 (0.25-3.82)
SWRS	Statewide Renal Services	543 (60)	21	20.4	0.042 (0.027-0.063)	1.03 (0.56-1.90)
WELN	Wellington Regional Hospital	181 (4)	14	5.3	0.077 (0.043-0.126)	2.62 (1.19-5.77)
WEST	Western Renal Service	386 (12)	12	17.0	0.036 (0.020-0.060)	0.71 (0.28-1.76)

Transplant procedures performed 2016-2020

* The number in brackets is the number of grafts excluded from logistic regression due to missing data

3.2 Funnel Plot



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

3.3 Logistic Model Coefficients

Table 2: Logistic regression model odds ratios for graft failure at 1 year post transplant

	Odds Ratio	95% CI
Subsequent Graft	1.02	[0.62,1.68]
Age (years)	1.02	[1.00,1.03]
Male	1.34	[0.98,1.84]
Duration of Kidney Failure		
Preemptive	0.27	[0.11,0.64]
<6 months	0.36	[0.15,0.84]
6-12 months	0.38	[0.19,0.78]
12-23 months	0.47	[0.30,0.74]
24+ months	ref.	
Peak PRA	1.01	[1.00,1.01]
Donor Age (years)		
<15 years	2.19	[0.96,4.98]
15-49 years	ref.	
50-59 years	1.97	[1.38,2.81]
≥60 years	1.88	[1.29,2.74]
Lung Disease	1.33	[0.89,1.99]
Cardiac Disease	1.30	[0.96,1.77]
Primary Kidney Disease		
Glomerular Disease	ref.	
Polycystic Disease	1.15	[0.70,1.88]
Diabetic Kidney Disease	1.50	[1.01,2.22]
Miscellaneous	1.25	[0.88,1.77]
Number of Mismatches	1.06	[0.97,1.16]
Year of Transplant		
2016	ref.	
2017	0.78	[0.50,1.22]
2018	0.88	[0.57,1.37]
2019	1.03	[0.67,1.57]
2020	1.04	[0.66,1.62]
Donor Type / Cause of Death / Ischaemic Time		
LD	ref.	
DD CVA 0-11 hours	1.29	[0.77,2.17]
DD non-CVA 0-11 hours	0.99	[0.58,1.67]
DD CVA ≥12 hours	1.32	[0.76,2.29]
DD non-CVA ≥12 hours	1.29	[0.75,2.21]

4 Mortality at 1 Year Post-transplant

4.1 Risk-adjusted Mortality Ratios

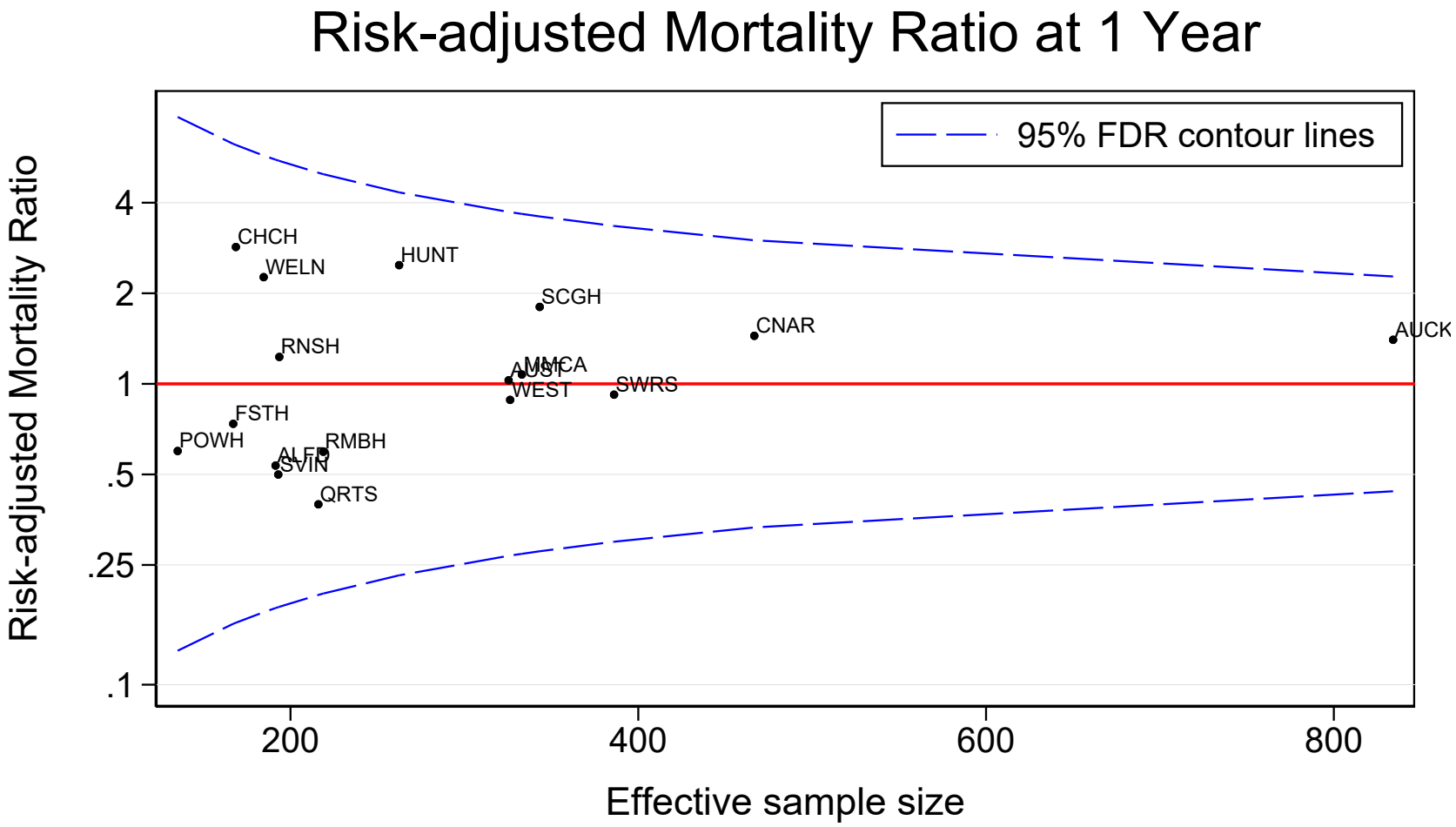
Table 3: Observed vs expected number of deaths at 1 year post transplant

Code	Hospital	Patients*	Observed	Expected	Observed Rate (95% CI)	Ratio (95% FDR CI)
ALFD	Alfred Hospital	119 (11)	1	1.9	0.008 (0.000-0.046)	0.53 (0.10-2.98)
AUCK	Auckland City Hospital	495 (0)	12	8.6	0.024 (0.013-0.042)	1.40 (0.62-3.19)
AUST	Austin Hospital	294 (16)	6	5.8	0.020 (0.008-0.044)	1.03 (0.28-3.83)
CHCH	Christchurch Hospital	143 (1)	4	1.4	0.028 (0.008-0.070)	2.85 (0.46-17.74)
CNAR	Central Northern Adelaide Renal Service	351 (10)	8	5.5	0.026 (0.012-0.048)	1.44 (0.48-4.33)
FSTH	Fiona Stanley Hospital	167 (13)	1	1.4	0.006 (0.000-0.033)	0.74 (0.12-4.62)
HUNT	John Hunter Hospital	141 (16)	6	2.4	0.057 (0.025-0.109)	2.48 (0.57-10.74)
MMCA	Monash Medical Centre	337 (9)	7	6.5	0.021 (0.008-0.042)	1.07 (0.29-3.94)
POWH	The Prince Of Wales Hospital	172 (13)	2	3.3	0.012 (0.001-0.041)	0.60 (0.08-4.61)
QRTS	Queensland Kidney Transplant Service	763 (13)	5	12.6	0.007 (0.002-0.015)	0.40 (0.08-2.00)
RMBH	The Royal Melbourne Hospital	521 (28)	5	8.4	0.012 (0.004-0.025)	0.59 (0.12-2.96)
RNSH	Royal North Shore Hospital	168 (0)	4	3.3	0.024 (0.007-0.060)	1.23 (0.22-6.77)
SCGH	Sir Charles Gairdner Hospital	247 (26)	6	3.3	0.024 (0.009-0.052)	1.80 (0.50-6.49)
STVI	St Vincent's Hospital (NSW)	43 (2)	0	0.7	0.000 (0.000-0.082)	0.00 (.-.)
SVIN	St Vincent's Hospital (VIC)	100 (1)	1	2.0	0.010 (0.000-0.054)	0.50 (0.09-2.76)
SWRS	Statewide Renal Services	491 (54)	8	8.7	0.020 (0.010-0.037)	0.92 (0.27-3.08)
WELN	Wellington Regional Hospital	167 (3)	4	1.8	0.024 (0.007-0.060)	2.26 (0.39-12.99)
WEST	Western Renal Service	339 (12)	6	6.8	0.018 (0.007-0.038)	0.88 (0.24-3.29)

Patients transplanted 2016-2020 (primary grafts only)

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

4.2 Funnel Plot



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

4.3 Logistic Model Coefficients

Table 4: Logistic regression model odds ratios for mortality at 1 year post transplant

	Odds Ratio	95% CI
Age (years)	1.05	[1.02,1.07]
Male	1.10	[0.67,1.82]
Duration of Kidney Failure		
Preemptive	0.32	[0.08,1.26]
<6 months	0.30	[0.07,1.30]
6-12 months	0.55	[0.21,1.42]
12-23 months	0.37	[0.18,0.75]
24+ months	ref.	
Peak PRA	1.00	[0.99,1.01]
Donor Age (years)		
<15 years	1.35	[0.30,5.97]
15-49 years	ref.	
50-59 years	1.14	[0.65,2.00]
≥60 years	1.17	[0.67,2.05]
Lung Disease	2.40	[1.42,4.04]
Cardiac Disease	1.51	[0.94,2.44]
Primary Kidney Disease		
Glomerular Disease	ref.	
Polycystic Disease	1.75	[0.82,3.71]
Diabetic Kidney Disease	2.01	[1.09,3.72]
Miscellaneous	1.32	[0.70,2.49]
Number of Mismatches	1.08	[0.93,1.26]
Year of Transplant		
2016	ref.	
2017	0.87	[0.44,1.73]
2018	0.73	[0.36,1.48]
2019	1.05	[0.54,2.03]
2020	0.72	[0.34,1.52]
Donor Type / Cause of Death / Ischaemic Time		
LD	ref.	
DD CVA 0-11 hours	1.34	[0.53,3.38]
DD non-CVA 0-11 hours	1.20	[0.48,3.01]
DD CVA ≥12 hours	1.22	[0.45,3.29]
DD non-CVA ≥12 hours	1.93	[0.78,4.79]