NHS
Blood and Transplant

KIDNEY TRANSPLANTATION ANNUAL RENAL UNIT REPORT

REPORT FOR 2019/20
(1 APRIL 2011 – 31 MARCH 2020)

March 2022

PRODUCED IN COLLABORATION WITH THE UK RENAL REGISTRY

Contents

Contents

Introduction

This report presents data on activity and outcomes of kidney transplant candidates and recipients between 1 April 2011 and 31 March 2020, for all 70 renal centres in the UK. Data were obtained from the UK Transplant Registry, at NHS Blood and Transplant, which holds information relating to donors, recipients and outcomes for all kidney transplants performed in the UK. Renal unit information was supplied by the UK Renal Registry.

Graft and patient survival estimates are reported at 1- and 5- year post-transplant for the periods 1 April 2015 to 31 March 2019 and 1 April 2011 to 31 March 2015, respectively. Adjusted mean eGFR post-transplant is reported at 3- and 12- months post-transplant for the period 1 April 2015 to 31 March 2019. Results are described separately according to the type of donor (deceased and living).

The unit specific results for survival estimates are adjusted for differences in risk factors between the units. The risk models used are described in in Appendix A3.

Patients requiring multi-organ transplants are excluded from all analyses and all results are described for adult (aged ≥ 18 years) patients.

Use of the contents of this report should be acknowledged as follows:
Annual Report on Kidney Transplantation 2019/2020 by Renal Unit, NHS Blood and Transplant.

Adult kidney transplant list

1.1 Kidney only transplant list, 30 April 2019 – 31 March 2020

Figure 1.1 shows the mean number of adult patients on the active kidney only transplant list per million population (pmp) at the end of each month by renal unit for the period 30 April 2019 to 31 March 2020. West London Renal and Transplant Centre (WLRTC), 'L West' below, had the highest mean rate of adult patients on the waiting list per million population. **Figure 1.2** shows similar information for adult patients on the suspended kidney only transplant list. Guy's had the highest mean rate of suspended adult patients.

Figure 1.1 Adult patients on the active kidney only transplant list (pmp) end of month average, 30 April 2019 - 31 March 2020, by renal unit

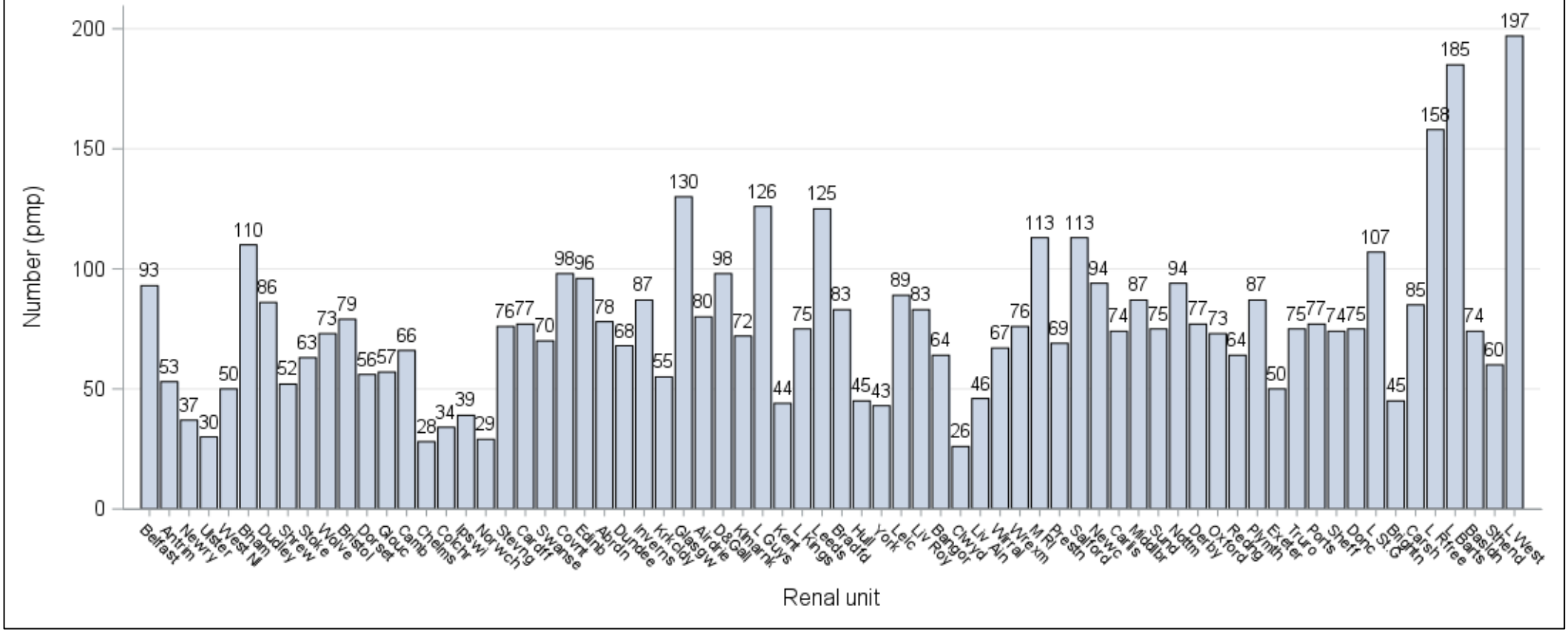
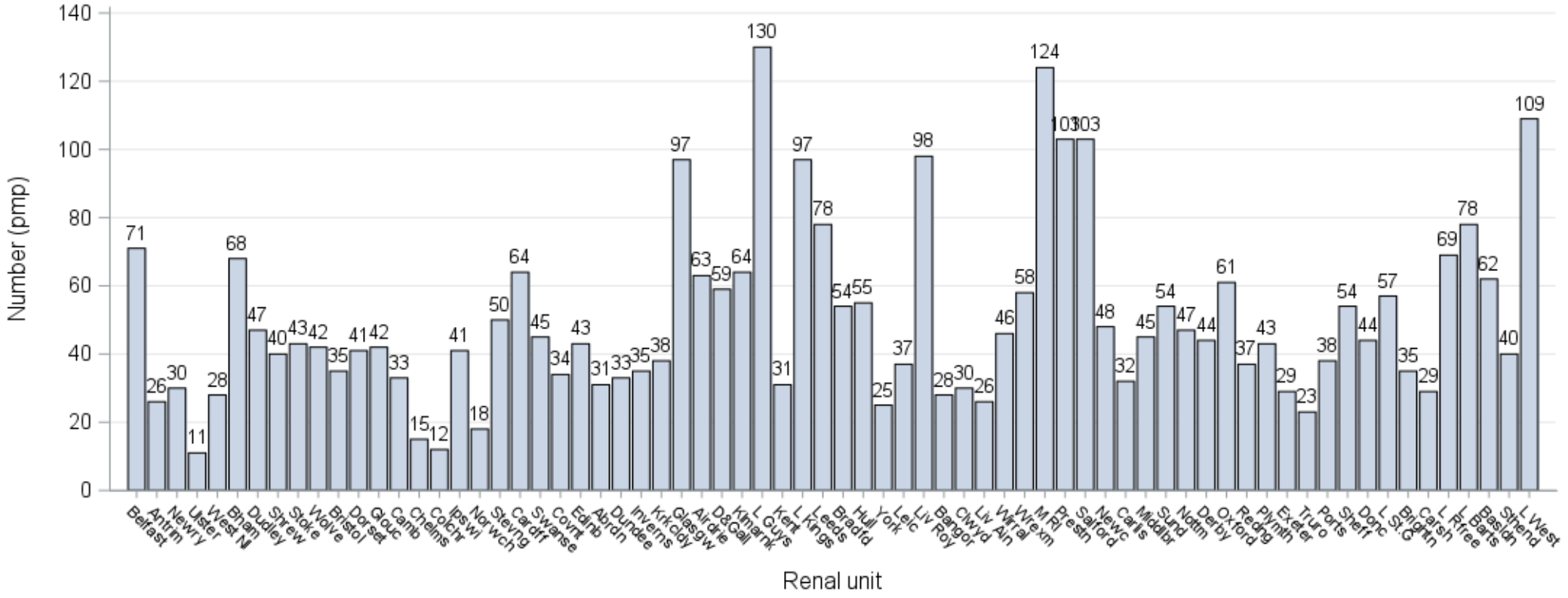


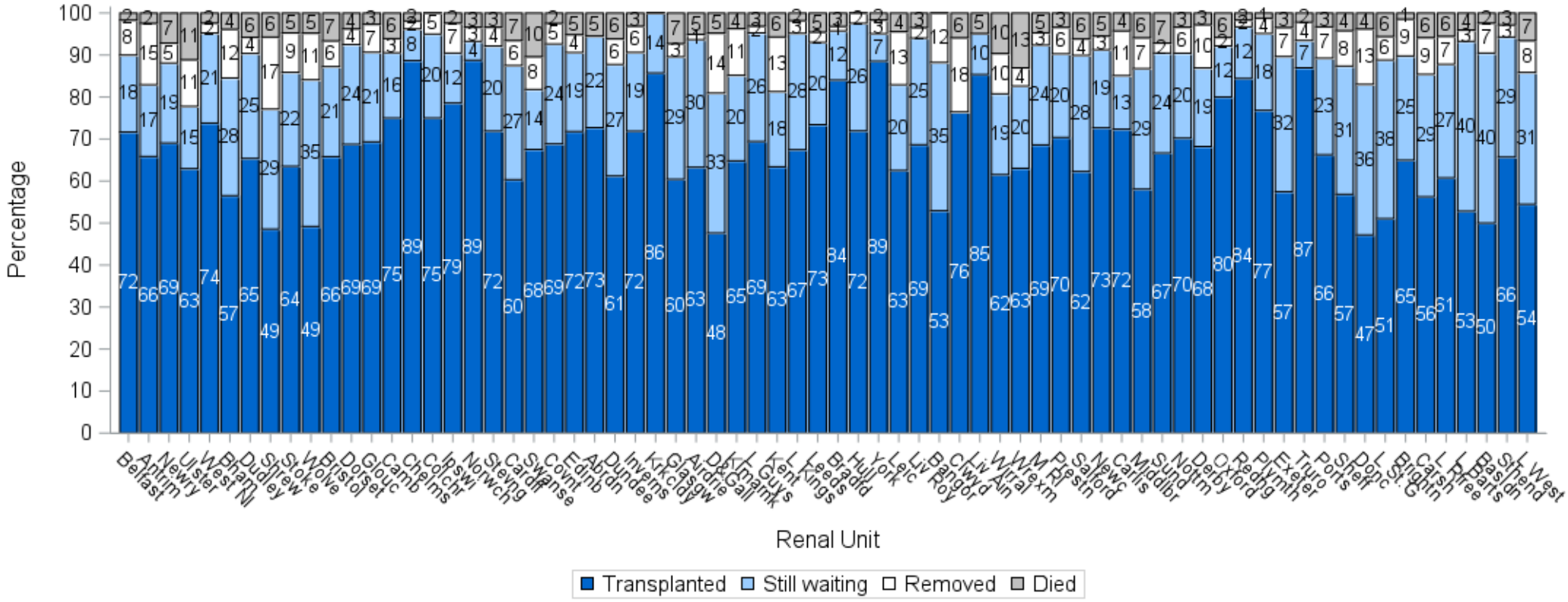
Figure 1.2 Adult patients on the suspended kidney only transplant list (pmp) end of month average, 30 April 2019 - 31 March 2020, by renal unit



1.2 Post-registration outcomes, 1 April 2014 – 31 March 2017

Figure 1.3 shows the registration outcomes of patients registered between 1 April 2014 and 31 March 2017 by renal unit at three years post-registration. The proportion of patients transplanted three years after listing at each unit ranges from 47% at Doncaster to 89% at Chelmsford, Norwich, and York. A small proportion of patients across centres were removed or died on the list.

Figure 1.3 Three-year post-registration outcome for 9463 new adult kidney only registrations made in the UK, 1 April 2014 - 31 March 2017, by renal unit



1.3 Demographic characteristics, 1 April 2017 – 31 March 2020

The ethnicity and age group of patients registered onto the transplant list between 1 April 2017 and 31 March 2020 are shown by renal unit in **Figures 1.4** and **1.5,** respectively. Note that all percentages quoted are based only on data where relevant information was available.

Figure 1.4 Ethnicity of patients registered onto the active kidney only transplant list between 1 April 2017 and 31 March 2020, by renal unit

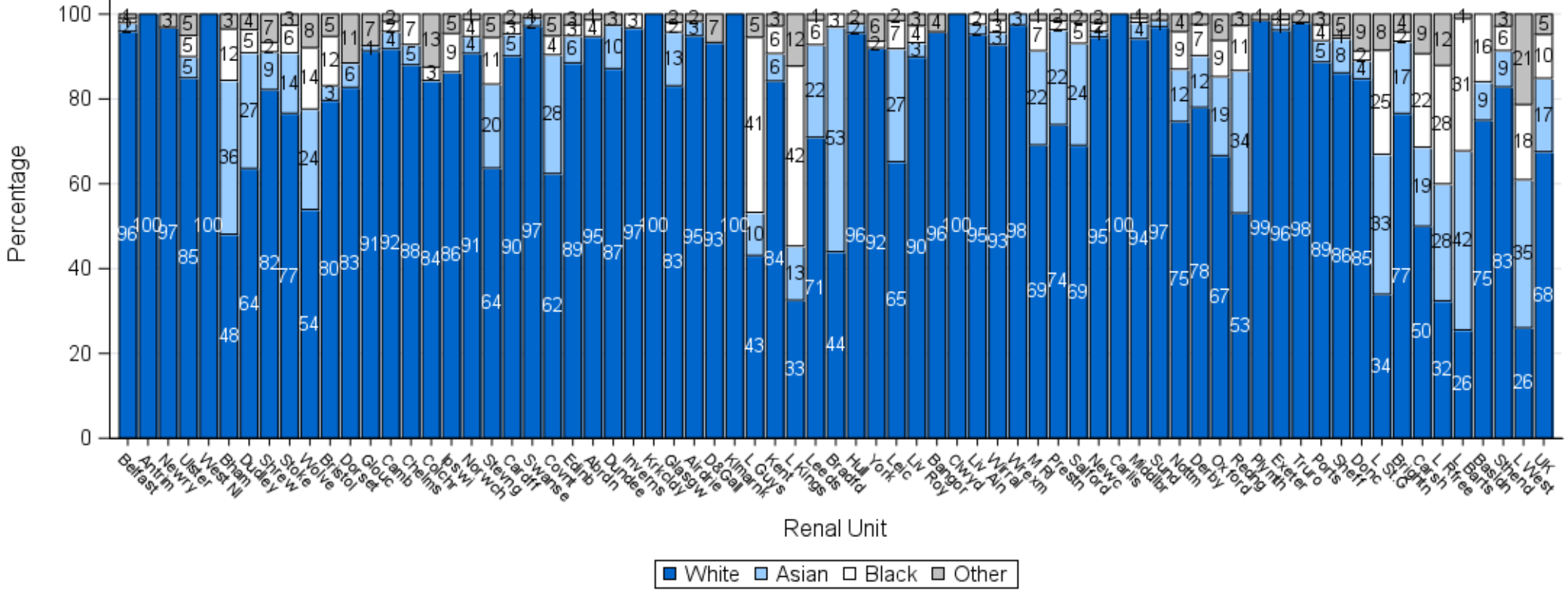
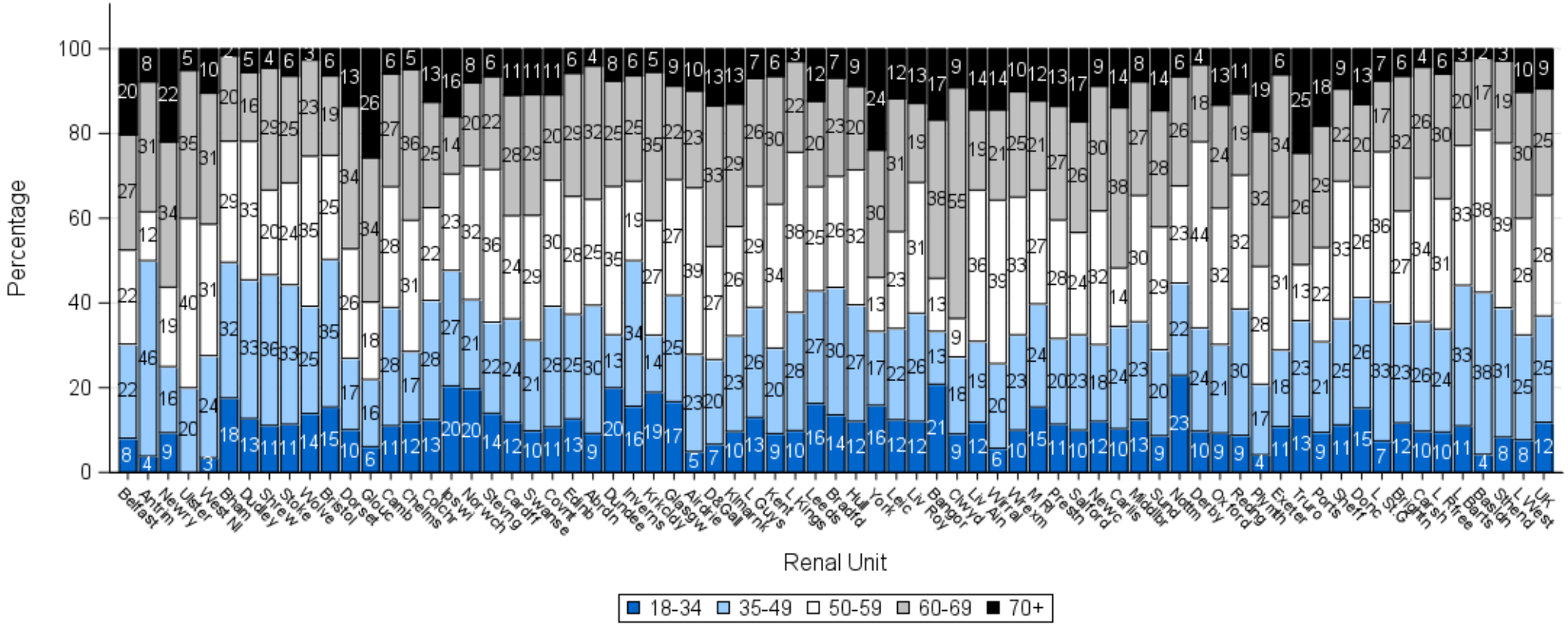


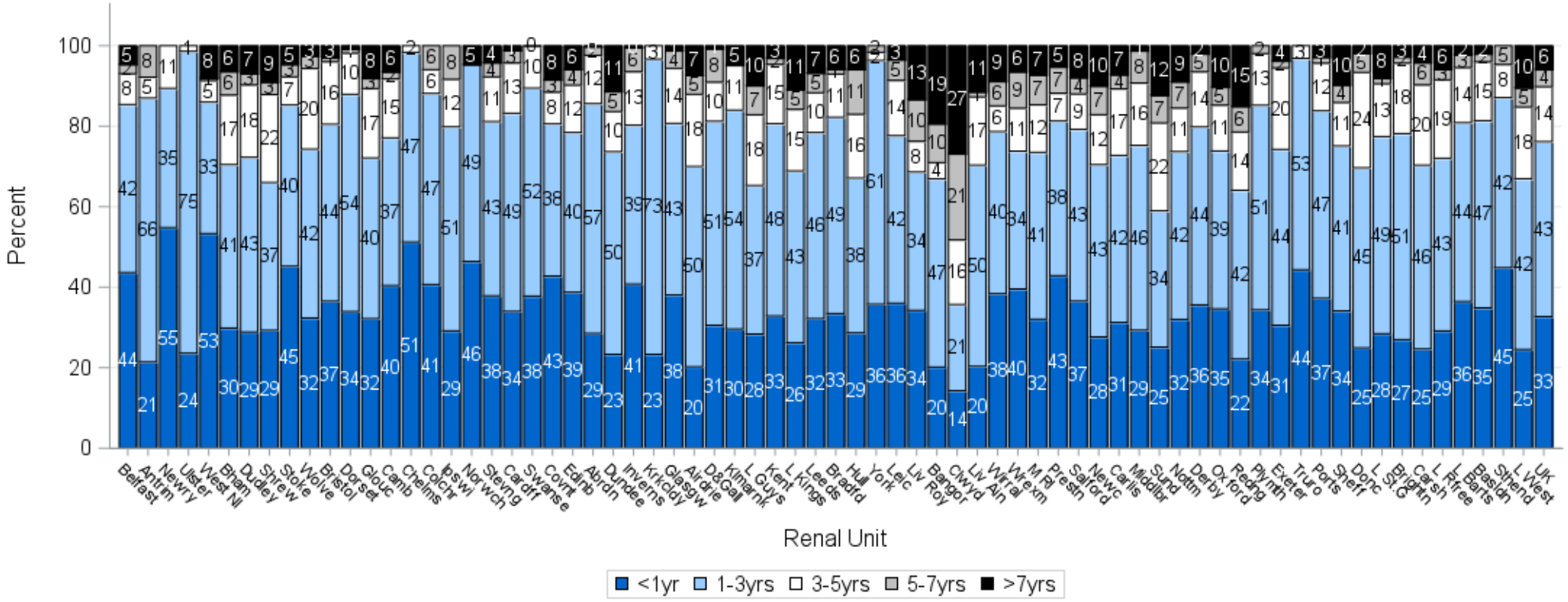
Figure 1.5 Age of patients registered onto the active kidney only transplant list between 1 April 2017 and 31 March 2020, by renal unit



1.4 Waiting times for patients on the list as at the end of each month, 30 April 2019 - 31 March 2020

Figure 1.6 shows the length of time patients have been waiting on the kidney only transplant list by renal unit for those active on the list as at the end of each month, 30 April 2019 - 31 March 2020. A small proportion of patients (6%) have been waiting for a transplant for more than seven years. 99% of these long waiters are highly sensitised with a calculated reaction frequency (cRF) of 85% or higher, with 87% having a cRF of 100% which makes these patients very difficult to match.

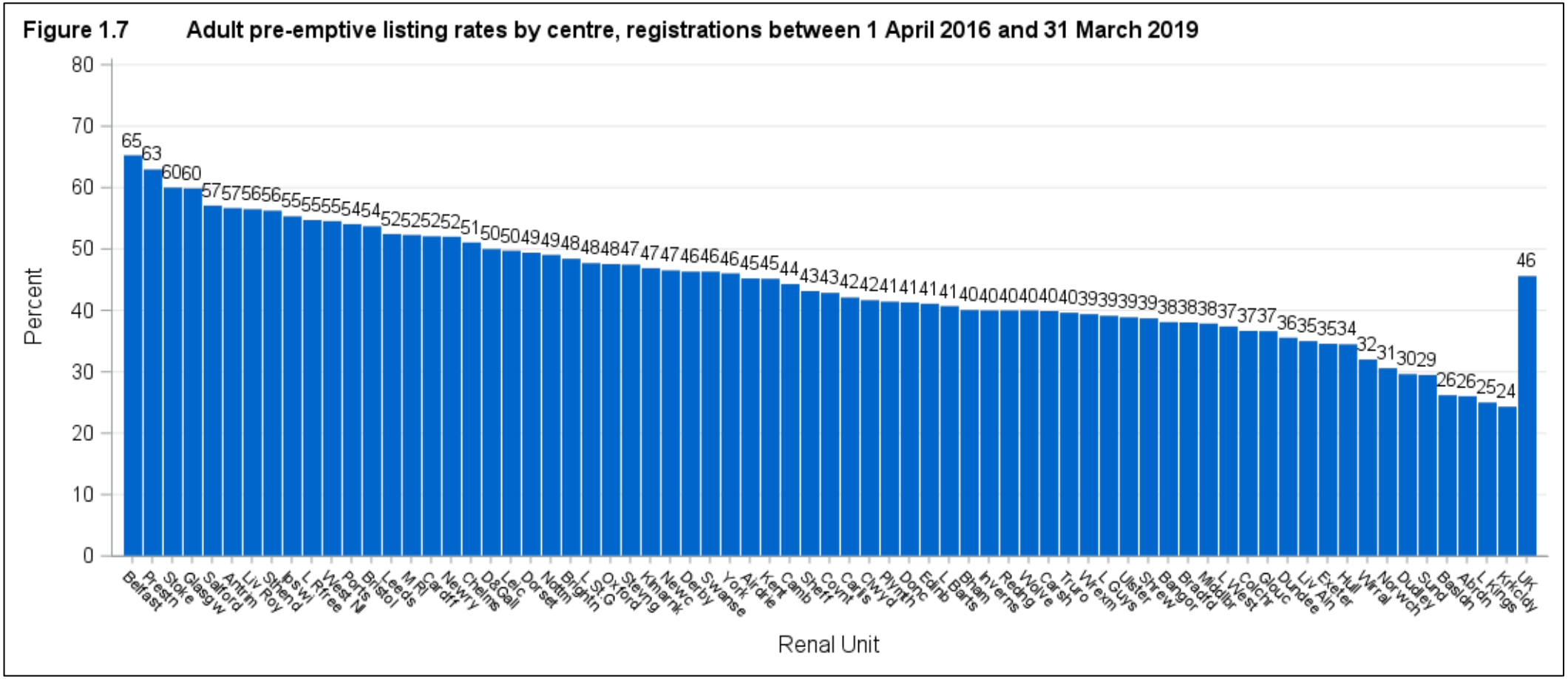
Figure 1.6 Waiting time of patients on the active kidney only transplant list as at the end of each month, 30 April 2019 - 31 March 2020, by renal unit



1.5 Pre-emptive listing rates, 1 April 2016 - 31 March 2019

Rates of pre-emptive kidney only listings are shown in **Figure 1.7** for adult patients joining the list between 1 April 2016 and 31 March 2019. Patients listed on the deceased donor transplant list prior to receiving a living donor transplant are excluded. Pre-emptive listing accounted for 46% of all adult registrations across the UK ranging from 65% at Belfast to 24% at Kirkcaldy.

Figure 1.7 Adult pre-emptive listing rates by centre, registrations between 1 April 2016 and 31 March 2019



Adult kidney transplants

2.1 Kidney only transplants, 1 April 2017 – 31 March 2020

Figure 2.1 shows the mean number of adult kidney only transplants performed per million population (pmp) between 1 April 2017 and 31 March 2020, by renal unit and type of donor. Belfast had the highest overall mean rate of adult kidney only transplants per million population at 121 pmp; Belfast also had the highest living donor rate (76 pmp) and Guy's had the highest deceased donor rate (73 pmp). **Figure 2.2** shows the proportion of DBD, DCD and living donor transplants performed for each unit.

Figure 2.1 Adult kidney only transplants (pmp) annual average, 1 April 2017 - 31 March 2020, by donor type and renal unit

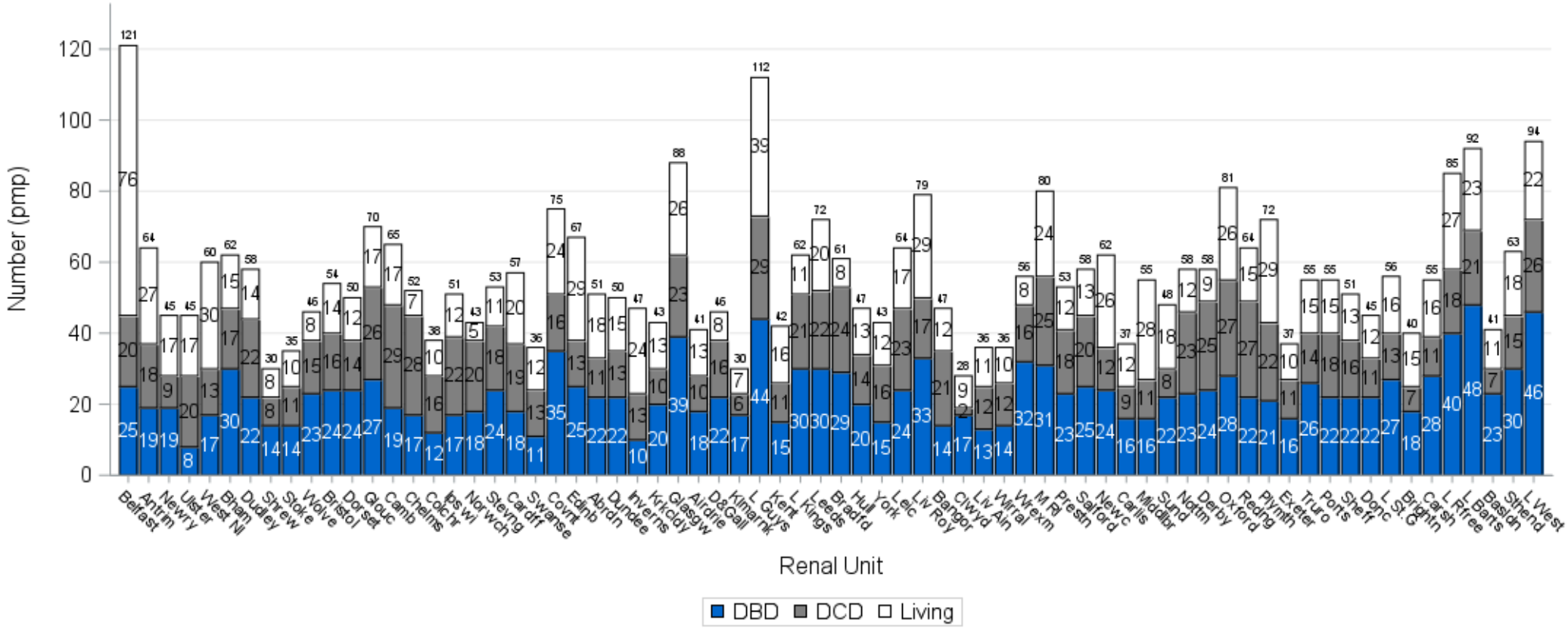
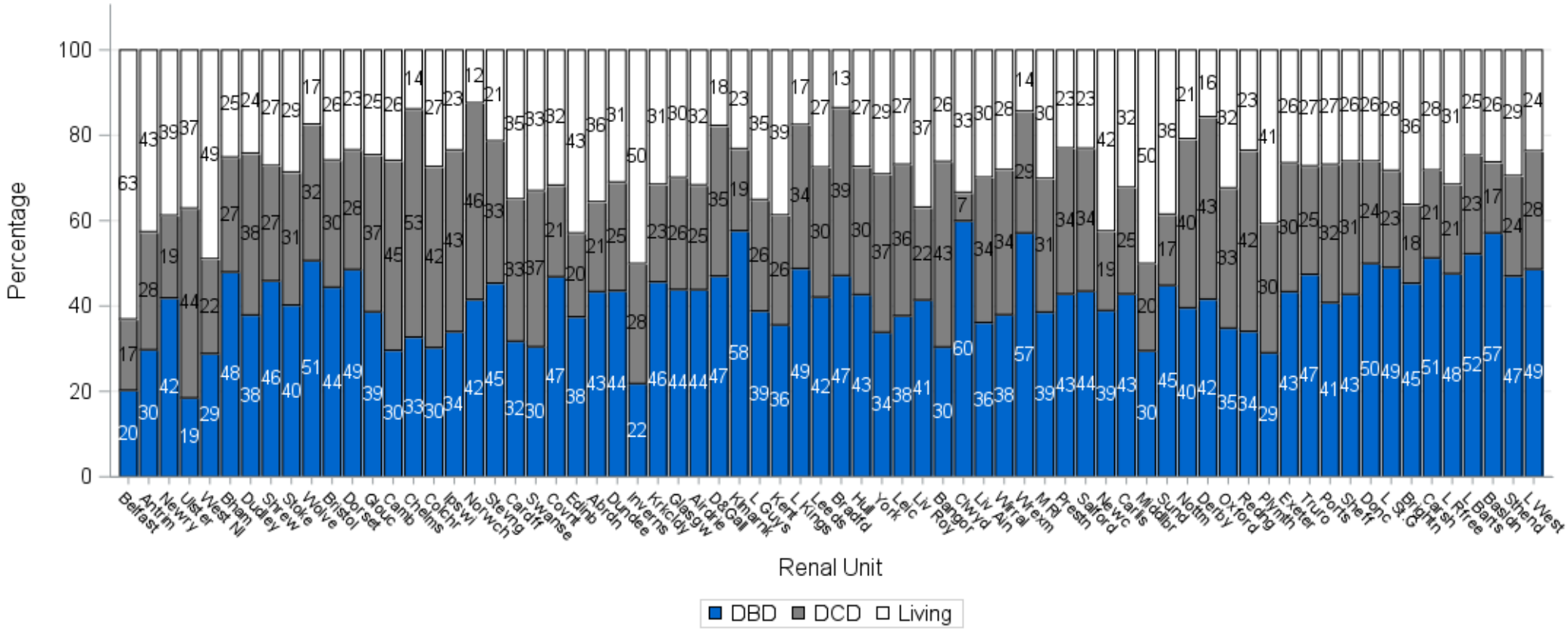


Figure 2.2 Distribution of adult kidney only transplants, 1 April 2017 and 31 March 2020, by donor type and renal unit



2.2 Demographic characteristics of recipients, 1 April 2017 - 31 March 2020

The ethnicity and age group of patients who received a kidney only transplant between 1 April 2017 and 31 March 2020 are shown by renal unit in **Figures 2.3** and **2.4,** respectively. Note that all percentages quoted are based only on data where relevant information was available.

Figure 2.3 Ethnicity of kidney only transplant recipients, 1 April 2017 and 31 March 2020, by renal unit

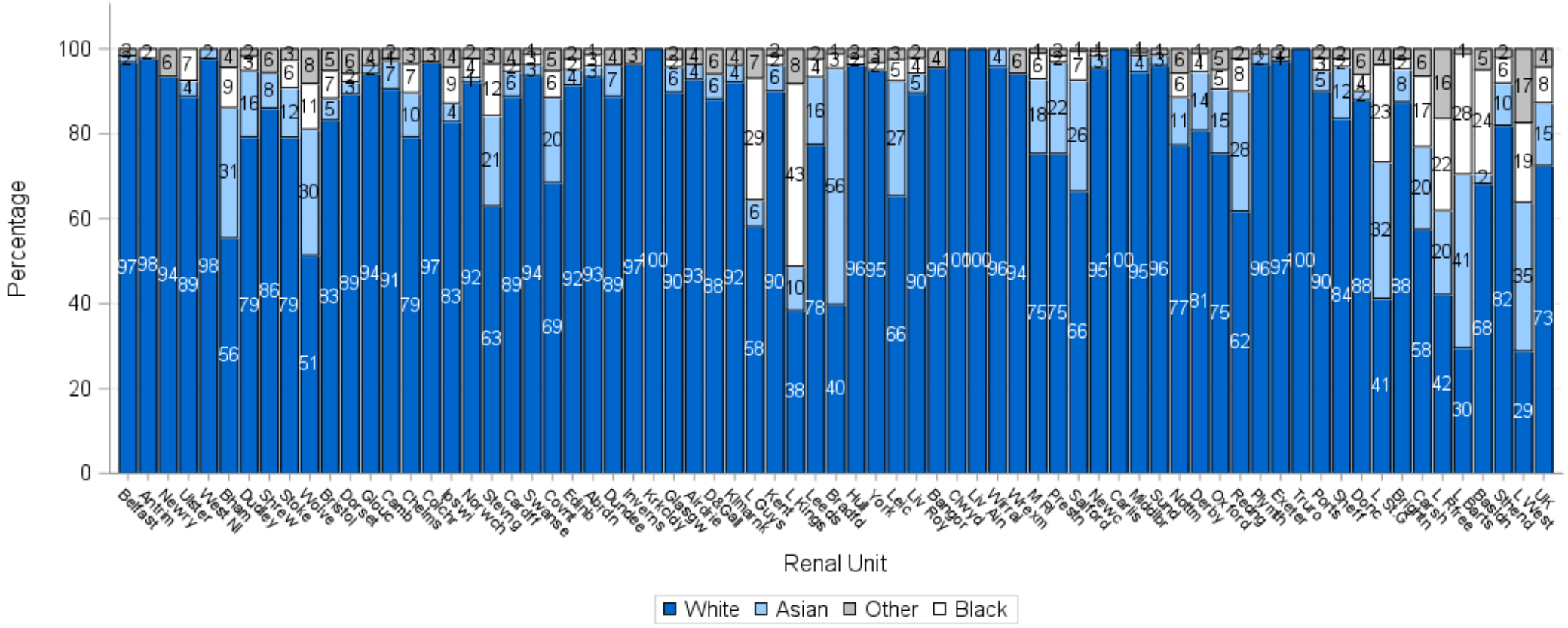
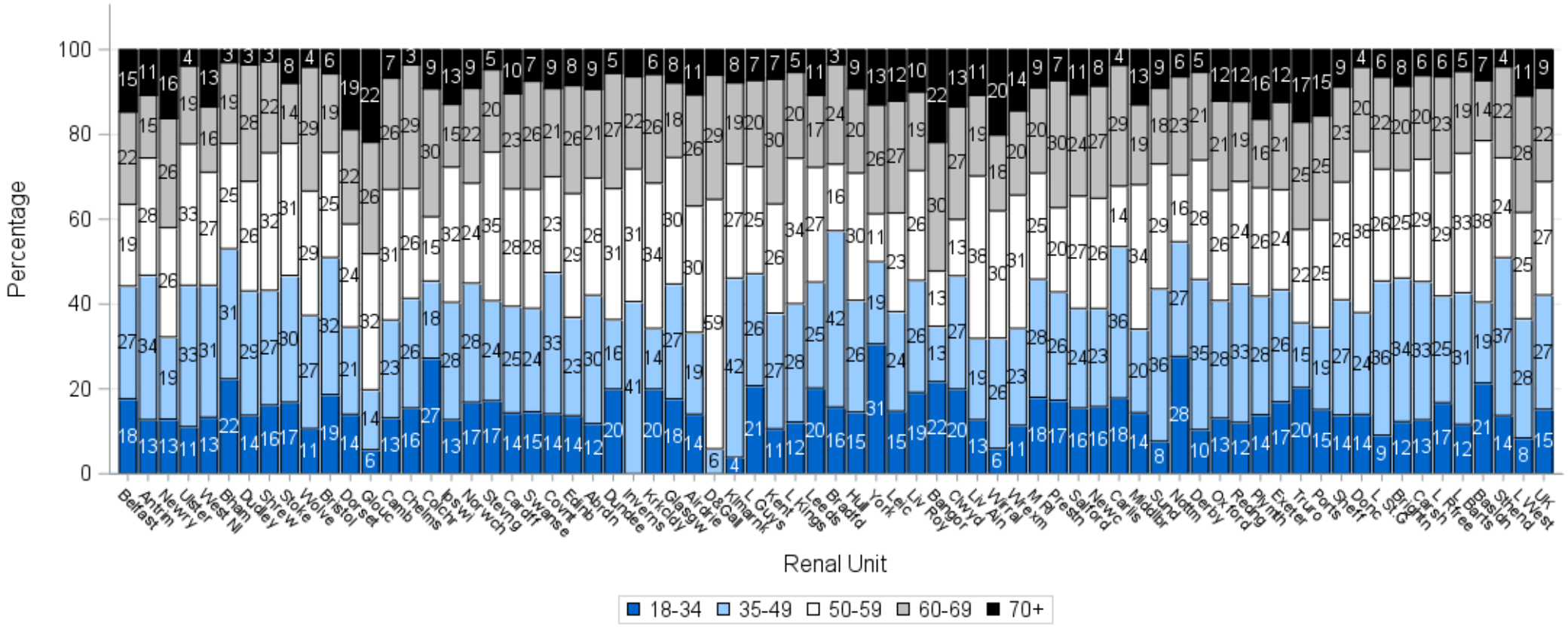


Figure 2.4 Age of kidney only transplant recipients, 1 April 2017 and 31 March 2020, by renal unit



2.3 Pre-emptive transplant rates, 1 April 2017 - 31 March 2020

Rates of pre-emptive kidney only transplantation for transplants performed between 1 April 2017 and 31 March 2020 are shown in **Figure 2.5** for deceased donor transplants and **Figure 2.6** for living donor transplants. Living donor transplants are more likely to be carried out before the need for dialysis than deceased donor transplants: 39% and 15% respectively. This is because a living donor transplant can often be carried out more quickly than a deceased donor kidney transplant. Adult deceased donor pre-emptive transplant rates ranged from 38% at Belfast to 0% at several units. Adult living donor pre-emptive transplant rates ranged from 65% at St George's to 0% at several units.

Figure 2.5 Adult deceased donor pre-emptive transplant rates by renal unit, 1 April 2017 - 31 March 2020

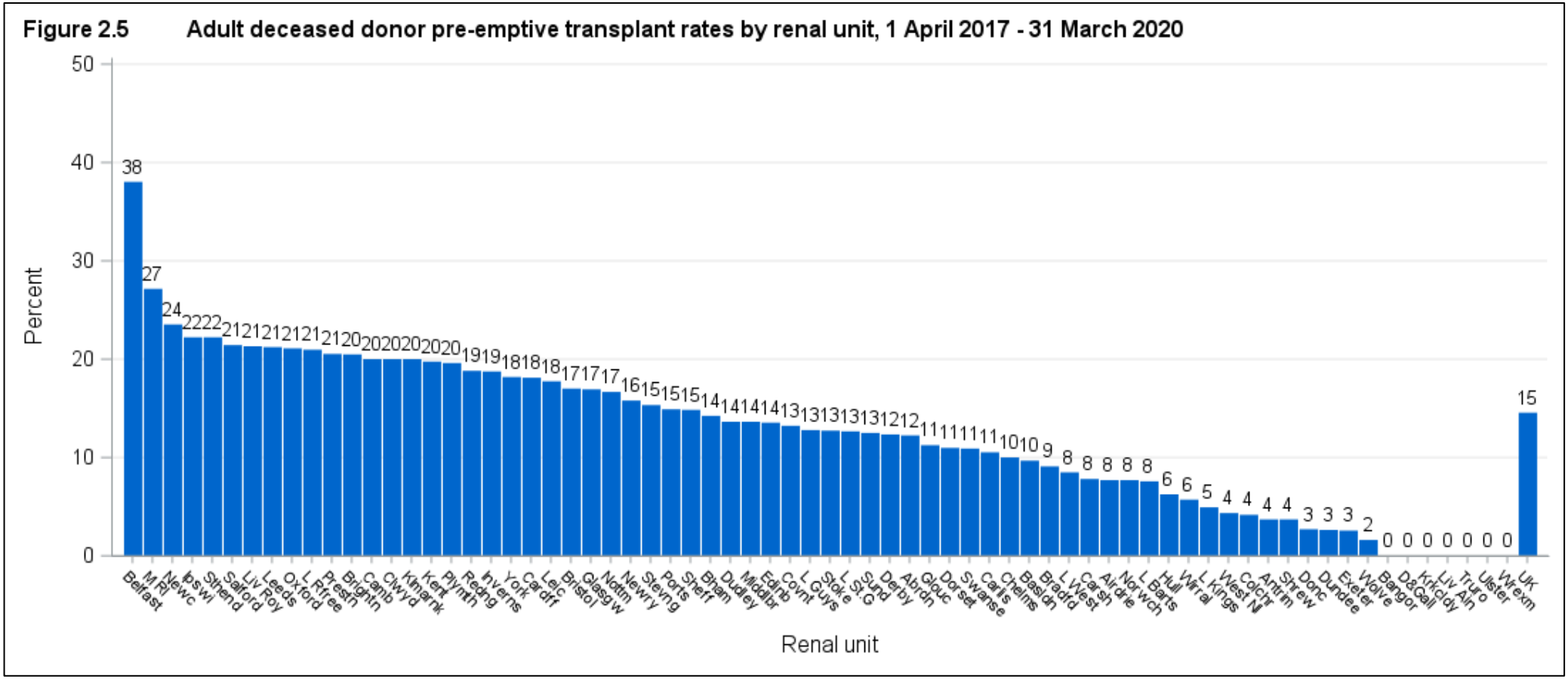
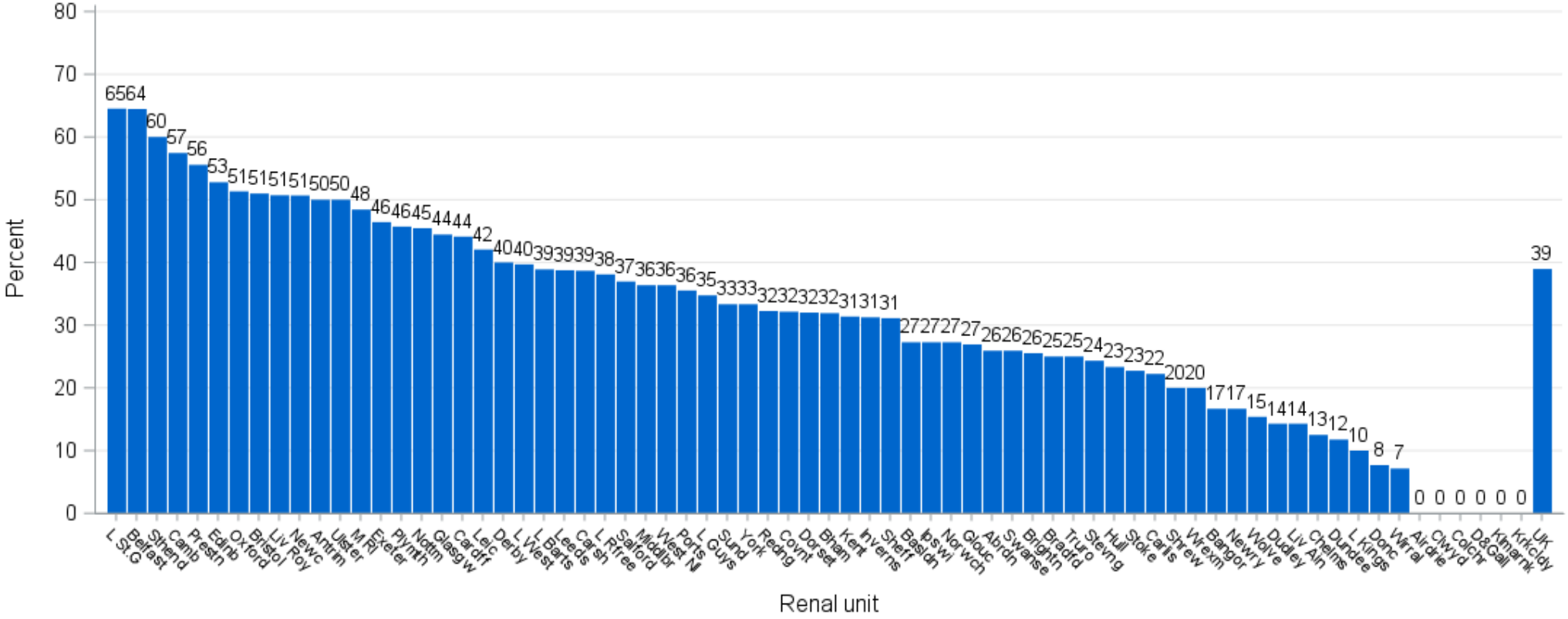


Figure 2.6 Adult living donor pre-emptive transplant rates by renal unit, 1 April 2017 - 31 March 2020



Adult kidney outcomes – post transplant survival

We present a visual comparison of survival rates among renal units that is based on a graphical display known as a funnel plot (1,2). This display is used to show how consistent the rates of the different renal units are with the national rate. Funnel plots show the risk-adjusted survival rate plotted against the number of transplants for each unit, with the overall national unadjusted survival rate (solid line), and its 95% (thin dotted lines) and 99.8% (thick dotted lines) confidence limits superimposed. Each dot in the plot represents one of the units.

If a unit lies within all the limits, then that unit has a survival rate that is statistically consistent with the national rate. If a unit lies outside the 95% confidence limits, this serves as an alert that the unit may have a rate that is significantly different from the national rate. If a unit lies outside the 99.8% limits, then further investigations may be carried out to determine the reasons for the possible difference. When a unit lies above the upper limits, this indicates a survival rate that is higher than the national rate, while a unit that lies below the lower limits has a survival rate that is lower than the national rate. It is important to note that adjusting for patient mix through the use of risk-adjustment models may not account for all possible causes of unit differences. There may be other factors that are not taken into account in the risk-adjustment process that may affect the survival rate of a particular unit.

This section excludes multi-organ transplants and includes first time transplants only, with results presented separately for deceased and living donor transplants. One-year patient and graft survival rates are based on transplants performed in the period 1 April 2015 to 31 March 2019 while five-year patient and graft survival rates are based on transplants in the period 1 April 2011 to 31 March 2015. The risk factors used to produce the risk-adjusted survival rates are detailed in **Table A3.1** in Appendix A3.

Note that although we report survival according to renal unit, many patients receive after care from their transplant centre before returning to their local renal units. **We do not know at what point a patient is transferred back from the transplant centre to their renal unit, but we do know that this practice can differ widely across the country.**

References:

1. Tekkis PP, McCulloch P, Steger AC, Benjamin IS, Poloniecki JD. Mortality control charts for comparing performance of surgical units: validation study using hospital mortality data. British Medical Journal 2003; 326: 786 – 788.

2. Stark J, Gallivan S, Lovegrove J, Hamilton JRL, Monro JL, Pollock JCS, Watterson KG. Mortality rates after surgery for congenital heart defects in children and surgeons' performance. Lancet 2000; 355: 1004 – 1007.

3.1 Deceased donor graft and patient survival

Figures 3.1-3.4 and **Table 3.1** show the risk-adjusted patient and graft survival rates for each unit and nationally following deceased donor transplantation. At five years post-transplant, the national patient survival rate was 87% and the graft survival was also 86%.

The funnel plots show that, for the most part, the renal units lie within the confidence limits. The funnel plots show two units lie outside the lower 95% confidence limits in the five-year estimates and two units in the one-year estimates, indicating that these units have survival rates that are significantly lower than the national rate. All of the funnel plots show some units to be above the upper 99.8% confidence limit. This suggests that these units may have survival rates that are considerably higher than the national rate. Units can be identified by the information shown in **Table 3.1**.

Figure 3.1 **Risk-adjusted one year graft (death censored) survival rates for first deceased donor kidney transplants in adult patients, between 1 April 2015 and 31 March 2019**

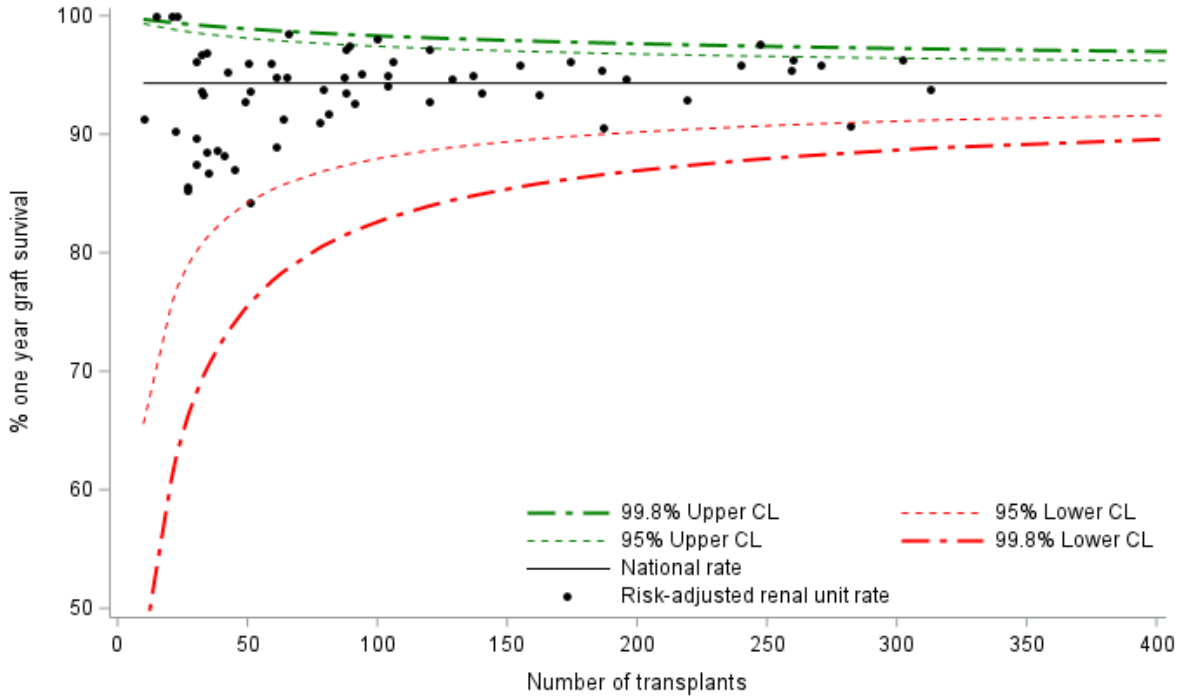


Figure 3.2 **Risk-adjusted one year patient survival rates for first deceased donor kidney transplants in adult patients, between 1 April 2015 and 31 March 2019**

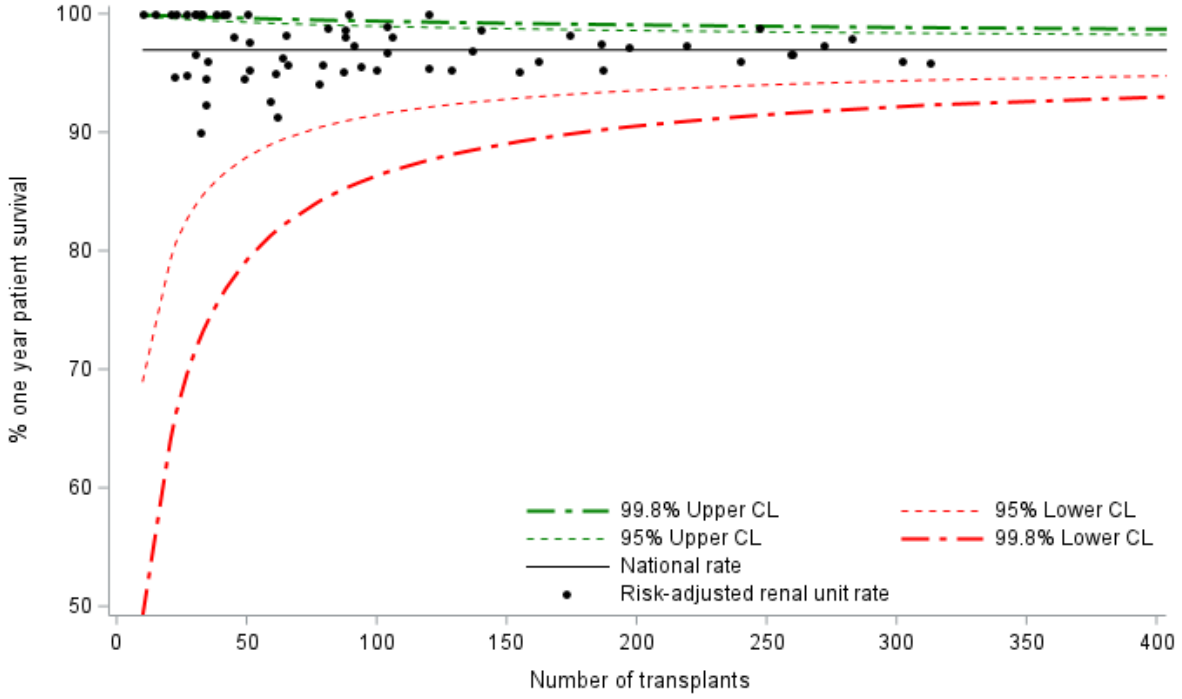


Figure 3.3 **Risk-adjusted five year graft (death censored) survival rates for first deceased donor kidney transplants in adult patients, between 1 April 2011 and 31 March 2015**

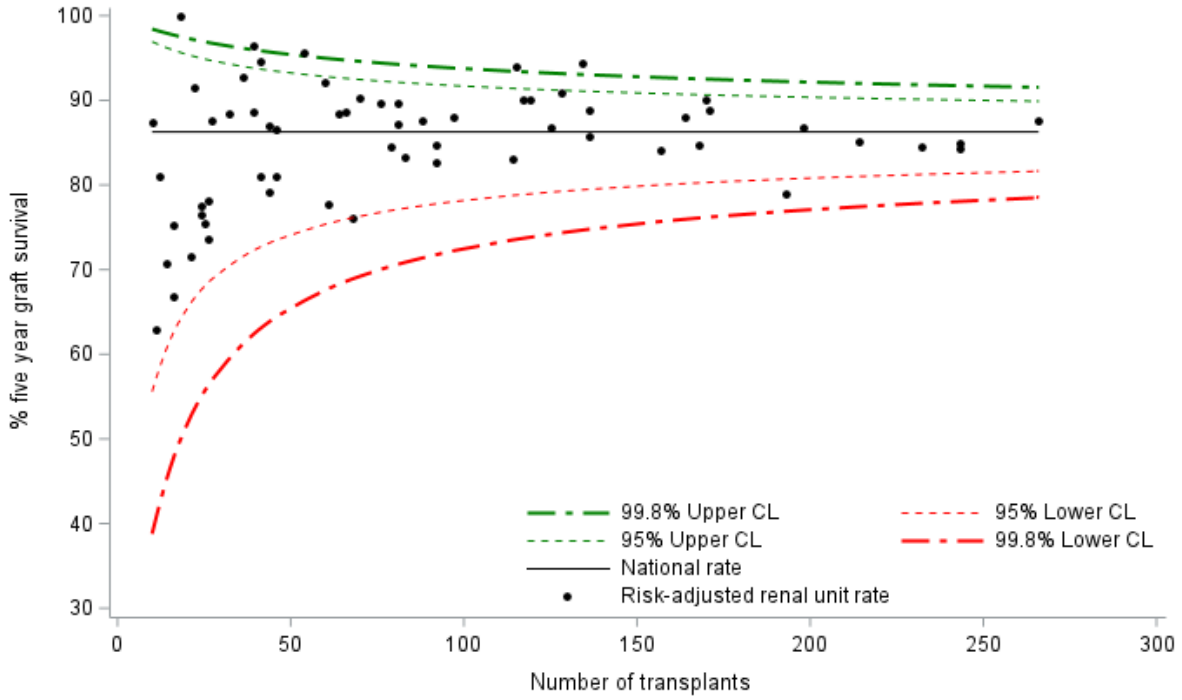


Figure 3.4 **Risk-adjusted five year patient survival rates for first deceased donor kidney transplants in adult patients, between 1 April 2011 and 31 March 2015**

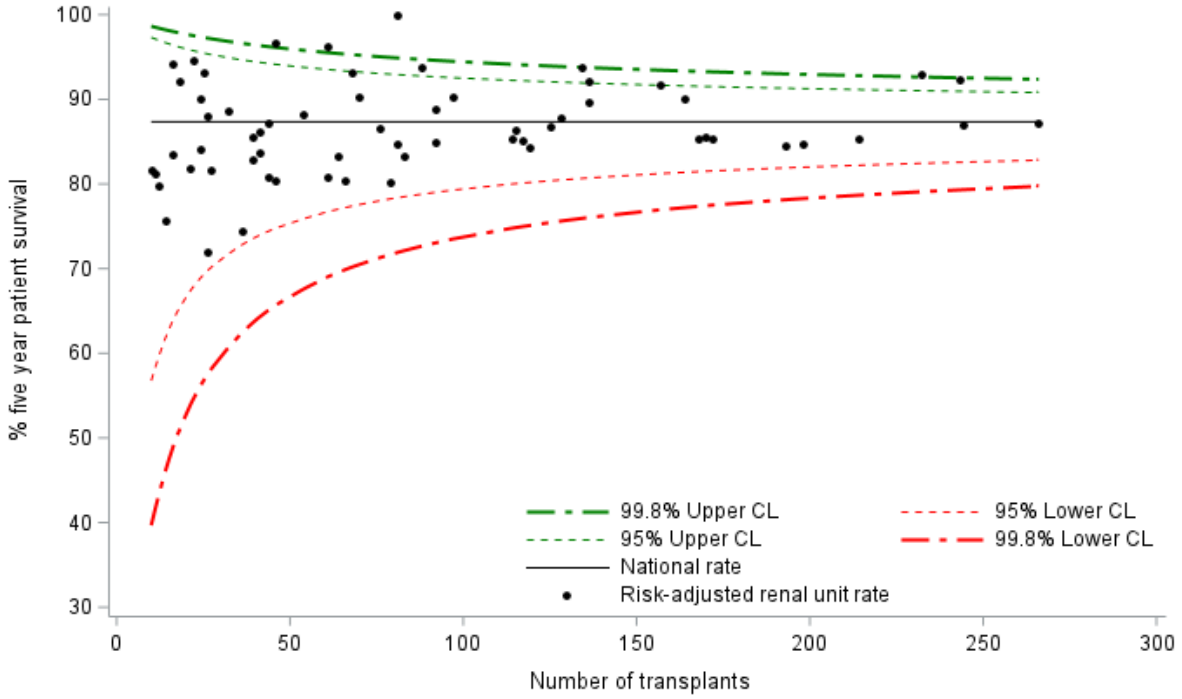


Table 3.1 One and five year first adult kidney-only graft and patient survival using kidneys from deceased donors

	Kidney graft survival				Patient survival			
	One-year*		Five-year**		One-year*		Five-year**	
Unit	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Belfast	92	(82 - 97)	96	(80 - 100)	99	(93 - 100)	86	(66 - 95)
Antrim	85	(62 - 96)	63	(0 - 92)	95	(81 - 99)	81	(45 - 96)
Newry	87	(63 - 97)	75	(37 - 93)	97	(81 - 100)	94	(68 - 100)
Ulster	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
West NI	96	(78 - 100)	N/A	N/A	100	N/A	N/A	N/A
Bham	91	(86 - 94)	85	(79 - 90)	98	(95 - 99)	85	(79 - 90)
Dudley	88	(72 - 96)	72	(38 - 90)	100	N/A	82	(47 - 96)
Shrew	86	(63 - 96)	76	(47 - 91)	100	N/A	93	(63 - 100)
Stoke	98	(91 - 100)	87	(71 - 95)	96	(88 - 99)	80	(62 - 92)
Wolve	84	(69 - 93)	87	(72 - 95)	98	(87 - 100)	87	(70 - 96)
Bristol	93	(88 - 97)	90	(82 - 95)	96	(91 - 99)	85	(75 - 92)
Dorset	95	(87 - 99)	96	(84 - 99)	95	(87 - 99)	88	(76 - 95)
Glouc	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Camb	94	(87 - 98)	94	(88 - 98)	99	(94 - 100)	94	(88 - 97)
Chelms	91	(81 - 97)	81	(63 - 92)	96	(86 - 100)	84	(64 - 94)
Colchr	100	N/A	88	(64 - 97)	100	N/A	82	(60 - 93)
Ipswi	95	(83 - 99)	95	(80 - 99)	100	N/A	86	(68 - 96)
Norwch	98	(91 - 100)	90	(79 - 96)	100	N/A	87	(75 - 94)
Stevng	96	(91 - 98)	90	(82 - 95)	95	(90 - 98)	84	(75 - 91)
Cardff	95	(89 - 98)	89	(83 - 93)	95	(90 - 98)	85	(79 - 90)
Swanse	95	(85 - 99)	85	(74 - 92)	95	(85 - 99)	85	(76 - 91)
Covnt	95	(88 - 98)	88	(75 - 96)	97	(90 - 99)	83	(69 - 92)
Edinb	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Abrdn	96	(85 - 100)	81	(61 - 92)	100	N/A	97	(81 - 100)
Dundee	94	(77 - 99)	76	(45 - 92)	100	N/A	90	(64 - 99)
Inverns	90	(65 - 99)	67	(15 - 91)	95	(70 - 100)	84	(52 - 97)
Krkcldy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Glasgw	96	(93 - 98)	87	(80 - 92)	97	(93 - 99)	85	(77 - 90)
Airdrie	93	(79 - 99)	78	(61 - 88)	95	(84 - 99)	81	(65 - 91)
D&Gall	91	(51 - 100)	81	(31 - 98)	100	N/A	80	(27 - 98)
Klmarnk	90	(70 - 98)	78	(49 - 93)	100	N/A	88	(65 - 98)
L Guys	96	(92 - 98)	84	(77 - 89)	98	(95 - 100)	92	(86 - 96)
Kent	94	(86 - 98)	83	(72 - 90)	98	(93 - 100)	89	(79 - 95)
L Kings	89	(76 - 96)	N/A	N/A	91	(69 - 99)	N/A	N/A
Leeds	93	(88 - 96)	84	(78 - 89)	97	(94 - 99)	87	(82 - 91)
Bradfd	93	(85 - 97)	87	(76 - 94)	97	(90 - 100)	85	(72 - 93)
Hull	94	(85 - 98)	90	(80 - 96)	96	(87 - 99)	100	N/A
York	95	(85 - 99)	92	(80 - 98)	98	(90 - 100)	96	(87 - 100)
Leic	96	(93 - 98)	84	(78 - 89)	96	(93 - 98)	93	(89 - 96)
Liv Roy	93	(86 - 97)	83	(73 - 90)	95	(89 - 98)	85	(76 - 92)
Bangor	100	N/A	100	N/A	100	N/A	92	(72 - 99)
Clwyd	100	N/A	87	(30 - 100)	100	N/A	82	(34 - 98)
Liv Ain	97	(82 - 100)	74	(38 - 91)	92	(78 - 98)	72	(42 - 89)
Wirral	89	(71 - 97)	89	(71 - 97)	95	(81 - 99)	83	(65 - 93)
Wrexm	93	(76 - 99)	71	(15 - 94)	100	N/A	76	(38 - 93)

Table 3.1 **One and five year first adult kidney-only graft and patient survival using kidneys from deceased donors**

	Kidney graft survival				Patient survival			
	One-year*		Five-year**		One-year*		Five-year**	
Unit	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
M RI	96	(92 - 98)	90	(84 - 94)	96	(93 - 98)	86	(78 - 91)
Prestn	95	(91 - 98)	91	(83 - 96)	97	(94 - 99)	88	(80 - 93)
Salford	95	(91 - 97)	87	(78 - 93)	97	(94 - 99)	87	(79 - 92)
Newc	96	(90 - 99)	85	(72 - 93)	98	(93 - 100)	80	(68 - 89)
Carlis	97	(82 - 100)	93	(74 - 99)	90	(71 - 98)	74	(52 - 88)
Middlbr	91	(82 - 96)	83	(71 - 91)	94	(86 - 98)	83	(72 - 91)
Sund	94	(81 - 99)	79	(59 - 91)	95	(83 - 99)	81	(63 - 91)
Nottm	95	(90 - 98)	86	(78 - 91)	97	(92 - 99)	90	(82 - 95)
Derby	98	(93 - 100)	90	(80 - 96)	95	(88 - 99)	90	(80 - 96)
Oxford	96	(93 - 98)	88	(81 - 93)	97	(95 - 99)	90	(84 - 94)
Redng	97	(93 - 99)	88	(79 - 94)	100	N/A	90	(82 - 95)
Plymth	96	(86 - 100)	76	(60 - 87)	93	(81 - 98)	93	(84 - 98)
Exeter	95	(88 - 99)	89	(75 - 96)	96	(89 - 99)	80	(65 - 90)
Truro	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ports	98	(94 - 99)	85	(77 - 90)	99	(96 - 100)	85	(79 - 90)
Sheff	93	(88 - 97)	94	(88 - 98)	99	(95 - 100)	86	(77 - 92)
Donc	87	(72 - 95)	88	(70 - 97)	98	(89 - 100)	89	(71 - 97)
L St. G	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Brightn	97	(90 - 100)	88	(77 - 94)	99	(92 - 100)	94	(85 - 98)
Carsh	91	(85 - 95)	89	(81 - 94)	95	(90 - 98)	92	(85 - 96)
L Rfree	95	(92 - 98)	85	(80 - 89)	97	(94 - 98)	92	(88 - 96)
L Barts	94	(91 - 96)	79	(72 - 85)	96	(93 - 98)	85	(76 - 91)
Basldn	89	(71 - 97)	78	(51 - 92)	100	N/A	84	(59 - 96)
Sthend	87	(66 - 96)	92	(70 - 99)	96	(78 - 100)	95	(70 - 100)
L West	94	(92 - 96)	88	(83 - 91)	98	(96 - 99)	87	(82 - 91)
UK	**94**	**(94 - 95)**	**86**	**(85 - 87)**	**97**	**(97 - 97)**	**87**	**(86 - 88)**

* Includes transplants performed between 1 April 2015 - 31 March 2019
** Includes transplants performed between 1 April 2011 - 31 March 2015
Centre survival rates have been omitted where less than 75% of data reported

3.2 Living donor graft and patient survival

Figures 3.5-3.8 and **Table 3.2** show the risk-adjusted patient and graft survival rates for each unit and nationally following living donor transplantation. At five years post-transplant, the national patient survival rate was 95% and the graft survival was 92%.

Many units appear above the upper 99.8% confidence limit in the funnel plots. This suggests that these units may have survival rates that are considerably higher than the national rate. One unit appears outside the lower 95% confidence limit indicating that a survival rate significantly lower than the national rate. Units can be identified by the information shown in **Table 3.2**.

Figure 3.5 **Risk-adjusted one year graft (death censored) survival rates for first live donor kidney transplants in adult patients, between 1 April 2015 and 31 March 2019**

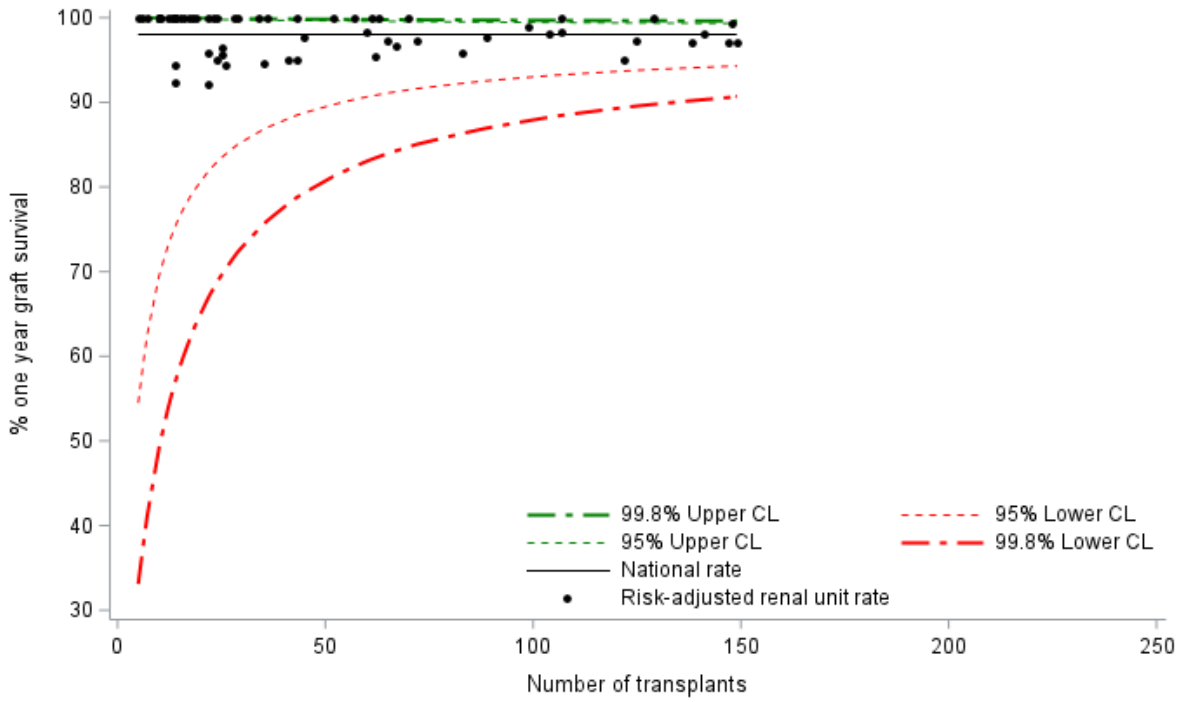


Figure 3.6 **Risk-adjusted one year patient survival rates for first live donor kidney transplants in adult patients, between 1 April 2015 and 31 March 2019**

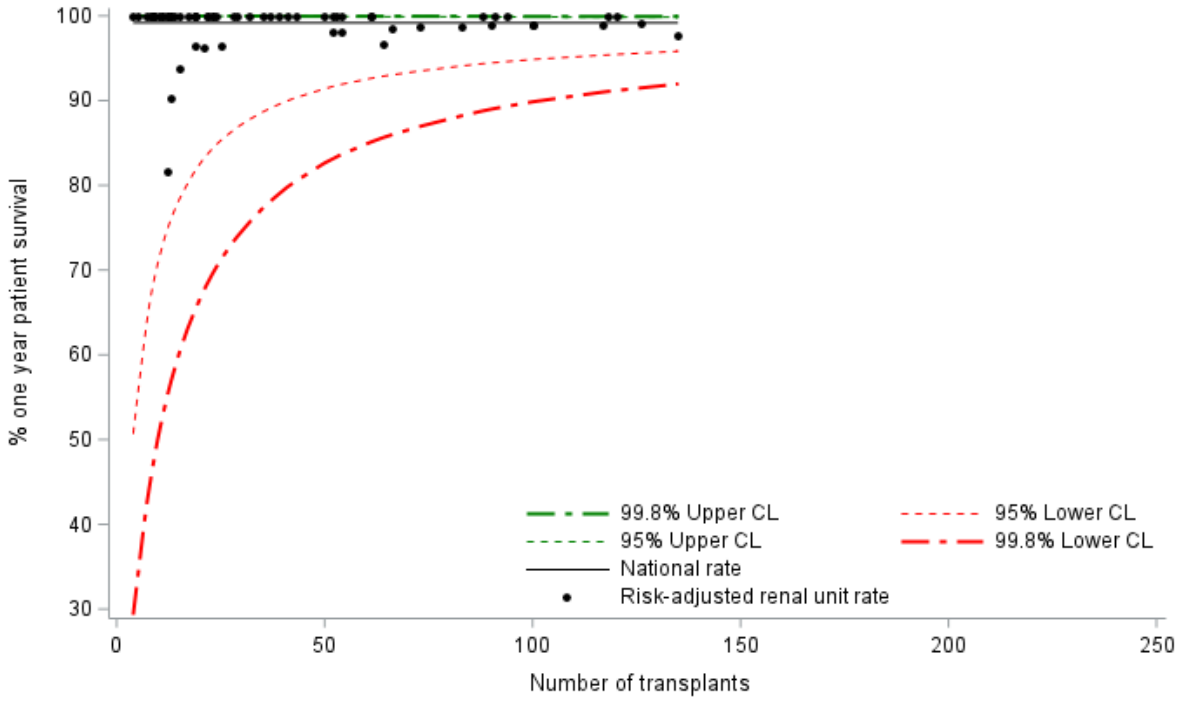


Figure 3.7 **Risk-adjusted five year graft (death censored) survival rates for first live donor kidney transplants in adult patients, between 1 April 2011 and 31 March 2015**

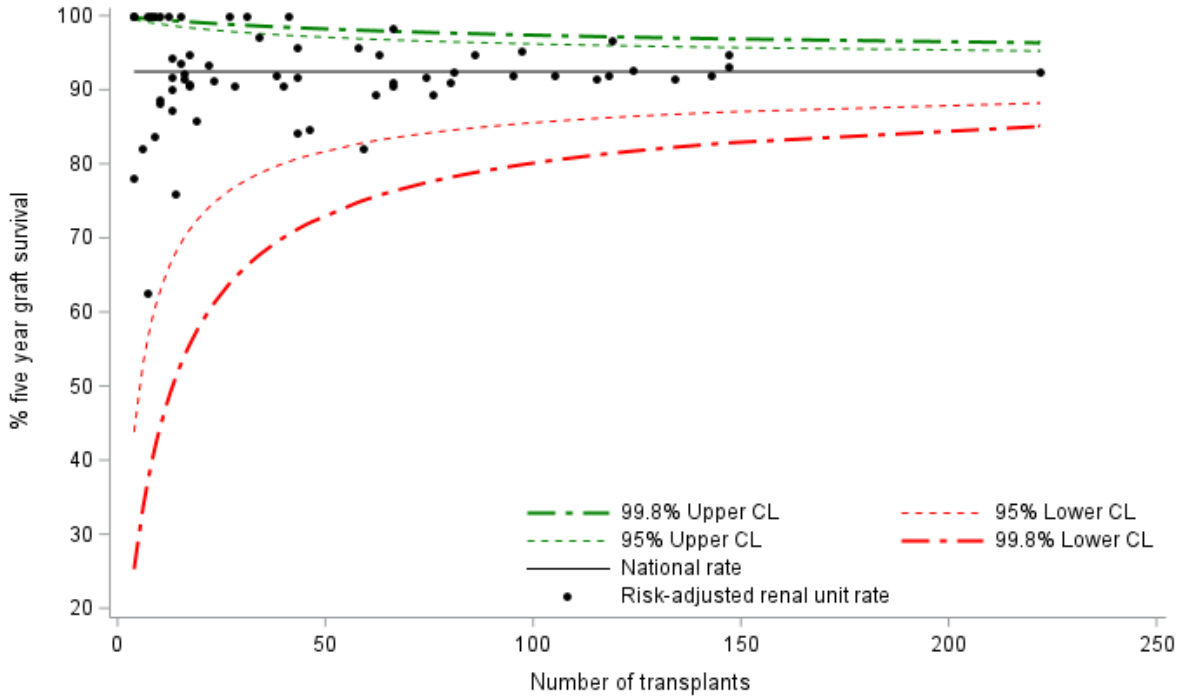


Figure 3.8 **Risk-adjusted five year patient survival rates for first live donor kidney transplants in adult patients, between 1 April 2011 and 31 March 2015**

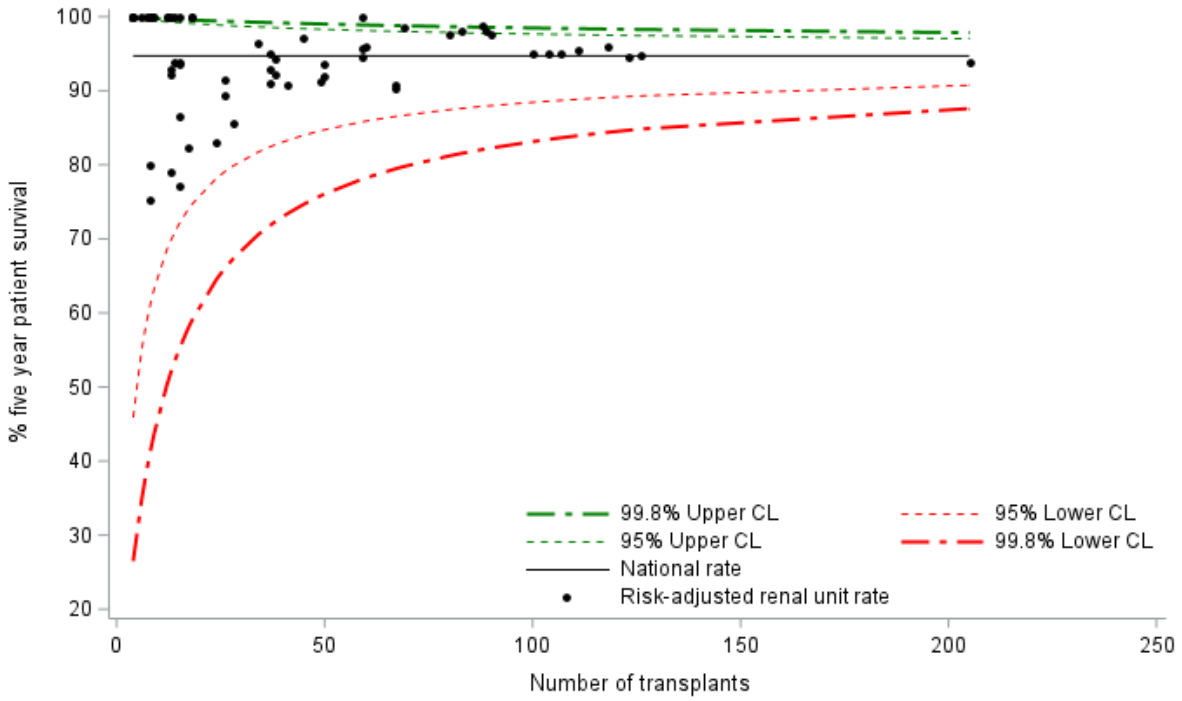


Table 3.2 One and five year first adult kidney-only graft and patient survival using kidneys from living donors

	Kidney graft survival				Patient survival			
	One-year*		Five-year**		One-year*		Five-year**	
Unit	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Belfast	98	(93 - 100)	97	(91 - 99)	100	N/A	99	(93 - 100)
Antrim	100	N/A	92	(56 - 100)	100	N/A	94	(64 - 100)
Newry	100	N/A	88	(34 - 100)	96	(79 - 100)	100	N/A
Ulster	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
West NI	94	(69 - 100)	100	N/A	100	N/A	89	(69 - 98)
Bham	97	(93 - 99)	92	(86 - 96)	99	(94 - 100)	95	(88 - 98)
Dudley	92	(58 - 100)	87	(54 - 98)	100	N/A	100	N/A
Shrew	100	N/A	94	(65 - 100)	100	N/A	100	N/A
Stoke	100	N/A	96	(84 - 99)	96	(80 - 100)	94	(80 - 99)
Wolve	100	N/A	91	(67 - 99)	100	N/A	77	(33 - 95)
Bristol	97	(90 - 100)	91	(80 - 97)	100	N/A	91	(78 - 97)
Dorset	95	(73 - 100)	93	(63 - 100)	100	N/A	82	(49 - 96)
Glouc	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Camb	100	N/A	98	(91 - 100)	100	N/A	100	N/A
Chelms	94	(69 - 100)	84	(10 - 100)	100	N/A	75	(11 - 97)
Colchr	100	N/A	100	N/A	100	N/A	100	N/A
Ipswi	100	N/A	82	(0 - 100)	100	N/A	100	N/A
Norwch	96	(77 - 100)	76	(30 - 95)	94	(66 - 100)	93	(60 - 100)
Stevng	98	(87 - 100)	92	(77 - 98)	100	N/A	96	(80 - 100)
Cardff	96	(87 - 99)	89	(79 - 95)	100	N/A	90	(79 - 96)
Swanse	92	(72 - 99)	91	(72 - 98)	96	(80 - 100)	83	(51 - 97)
Covnt	100	N/A	91	(80 - 97)	100	N/A	96	(86 - 100)
Edinb	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Abrdn	100	N/A	91	(69 - 99)	100	N/A	100	N/A
Dundee	96	(80 - 100)	95	(71 - 100)	100	N/A	100	N/A
Inverns	100	N/A	100	N/A	100	N/A	100	N/A
Krkcldy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Glasgw	95	(89 - 98)	92	(85 - 96)	99	(94 - 100)	95	(87 - 99)
Airdrie	100	N/A	100	N/A	100	N/A	100	N/A
D&Gall	100	N/A	78	(0 - 99)	100	N/A	100	N/A
Klmarnk	100	N/A	100	N/A	100	N/A	80	(28 - 98)
L Guys	97	(93 - 99)	93	(87 - 97)	100	N/A	95	(89 - 98)
Kent	100	N/A	95	(85 - 99)	100	N/A	91	(79 - 97)
L Kings	100	N/A	N/A	N/A	82	(0 - 100)	N/A	N/A
Leeds	99	(94 - 100)	92	(81 - 97)	99	(93 - 100)	96	(85 - 99)
Bradfd	100	N/A	91	(52 - 100)	100	N/A	94	(66 - 100)
Hull	95	(82 - 99)	85	(67 - 94)	100	N/A	91	(74 - 98)
York	100	N/A	91	(66 - 99)	100	N/A	94	(66 - 100)
Leic	98	(93 - 100)	91	(85 - 95)	99	(94 - 100)	95	(89 - 98)
Liv Roy	96	(88 - 99)	93	(83 - 98)	98	(91 - 100)	99	(93 - 100)
Bangor	100	N/A	100	N/A	100	N/A	100	N/A
Clwyd	100	N/A	100	N/A	100	N/A	100	N/A
Liv Ain	96	(76 - 100)	63	(0 - 92)	100	N/A	100	N/A

Table 3.2 One and five year first adult kidney-only graft and patient survival using kidneys from living donors

	Kidney graft survival				Patient survival			
	One-year*		Five-year**		One-year*		Five-year**	
Unit	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Wirral	100	N/A	100	N/A	100	N/A	87	(52 - 98)
Wrexm	100	N/A	100	N/A	100	N/A	100	N/A
M RI	97	(92 - 99)	95	(89 - 98)	99	(94 - 100)	96	(91 - 99)
Prestn	100	N/A	95	(87 - 99)	97	(88 - 100)	98	(91 - 100)
Salford	97	(88 - 100)	91	(80 - 97)	100	N/A	95	(84 - 99)
Newc	98	(91 - 100)	89	(77 - 96)	99	(93 - 100)	94	(84 - 98)
Carlis	100	N/A	89	(37 - 100)	100	N/A	100	N/A
Middlbr	100	N/A	82	(67 - 91)	100	N/A	92	(80 - 98)
Sund	100	N/A	100	N/A	100	N/A	91	(69 - 99)
Nottm	95	(80 - 99)	97	(84 - 100)	100	N/A	86	(63 - 96)
Derby	100	N/A	92	(54 - 100)	100	N/A	92	(57 - 100)
Oxford	99	(97 - 100)	93	(86 - 97)	99	(96 - 100)	95	(89 - 99)
Redng	100	N/A	91	(76 - 97)	100	N/A	95	(82 - 99)
Plymth	95	(82 - 99)	84	(63 - 95)	100	N/A	91	(73 - 98)
Exeter	100	N/A	92	(76 - 98)	100	N/A	93	(79 - 99)
Truro	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ports	N/A	N/A	95	(88 - 99)	N/A	N/A	98	(93 - 100)
Sheff	97	(90 - 100)	96	(88 - 99)	98	(89 - 100)	97	(84 - 100)
Donc	100	N/A	94	(69 - 100)	100	N/A	79	(25 - 97)
Brightn	98	(90 - 100)	100	N/A	98	(90 - 100)	92	(77 - 98)
Carsh	100	N/A	92	(83 - 97)	100	N/A	98	(93 - 100)
L Rfree	100	N/A	92	(84 - 97)	100	N/A	98	(92 - 100)
L Barts	98	(94 - 100)	92	(85 - 96)	100	N/A	95	(87 - 99)
Basldn	100	N/A	90	(64 - 99)	90	(45 - 100)	100	N/A
Sthend	100	N/A	86	(59 - 97)	100	N/A	100	N/A
L West	97	(93 - 99)	92	(88 - 96)	98	(93 - 100)	94	(90 - 97)
UK	**98**	**(97 - 98)**	**92**	**(91 - 93)**	**99**	**(99 - 99)**	**95**	**(94 - 96)**

* Includes transplants performed between 1 April 2015 - 31 March 2019
** Includes transplants performed between 1 April 2011 - 31 March 2015
Centre survival rates have been omitted where less than 75% of data reported

Adult kidney outcomes – risk adjusted eGFR

4.1 Risk adjusted eGFR

Funnel plots were used to compare the adjusted mean 3 and 12 month eGFR at each renal unit to the national average. The plots show each unit's adjusted mean eGFR at 3- and 12-months post-transplant against the number of patients at each unit. The national adjusted mean eGFRs at 3- and 12-months post-transplant are shown by the black line and the 95% and 99.8% confidence limits around this national average are shown by the dotted lines. Units that fall within the upper and lower 95% confidence limits have an adjusted mean eGFR statistically consistent with the national average eGFR. Those units that are above the 95% upper confidence limit have significantly higher adjusted mean eGFR than the national average and units that are below the 95% lower confidence limit have significantly lower adjusted mean eGFR than the national average.

This section excludes multi-organ transplants and includes first time transplants only, with results presented separately for deceased and living donor transplants. Estimates are based on transplants performed in the period 1 April 2015 to 31 March 2019. The risk factors used to produce the risk-adjusted eGFR values are detailed in **Table A3.2** in Appendix A3.

Figures 4.1-4.4 and **Table 4.1** show the risk-adjusted mean eGFR for each unit and nationally. The funnel plots show a number of units outside the lower 95% and 99.8% confidence limits from both deceased and living donors, this may indicate adjusted mean eGFR values considerably lower than the national rate. Units can be identified by the information shown in **Table 4.1**. At 12 months post-transplant, the national mean eGFR rate was 48.9 mL/min/1.73m^2 and 56.3 mL/min/1.73m^2 for deceased and living donor transplants respectively.

Figure 4.1 Adjusted mean eGFR at 3 months by renal unit for first adult deceased donor kidney transplants in the UK, 1 April 2015 and 31 March 2019

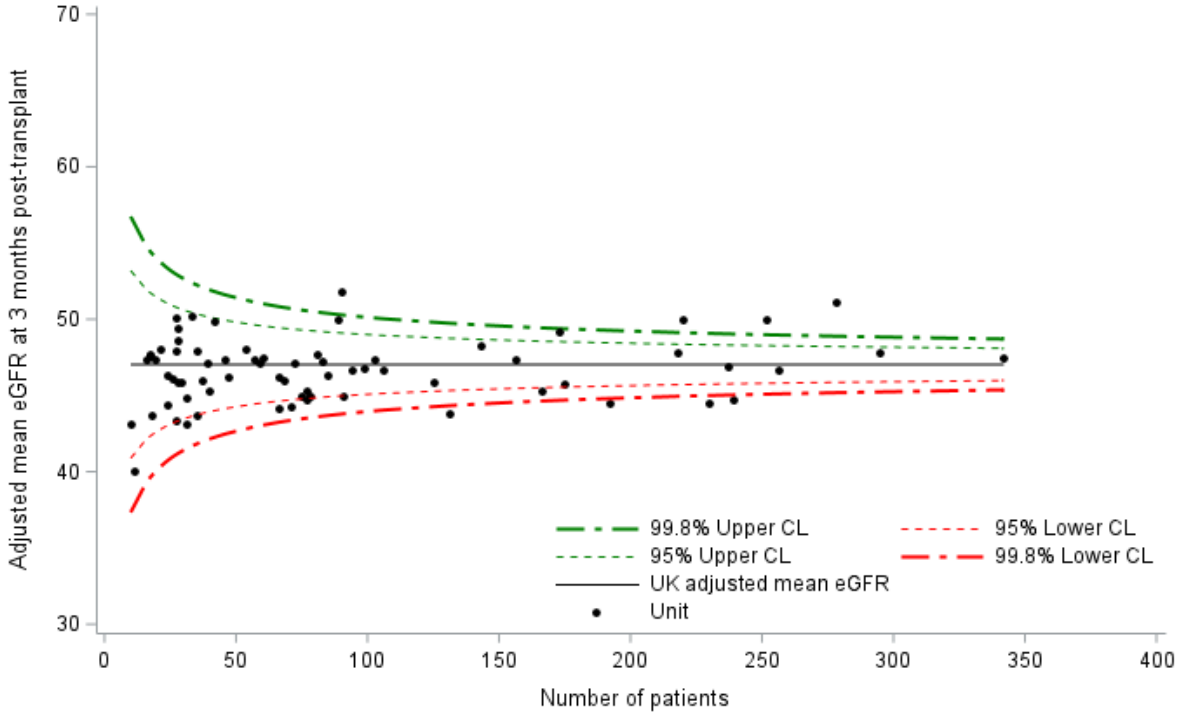


Figure 4.2 Adjusted mean eGFR at 12 months by renal unit for first adult deceased donor kidney transplants in the UK, 1 April 2015 and 31 March 2019

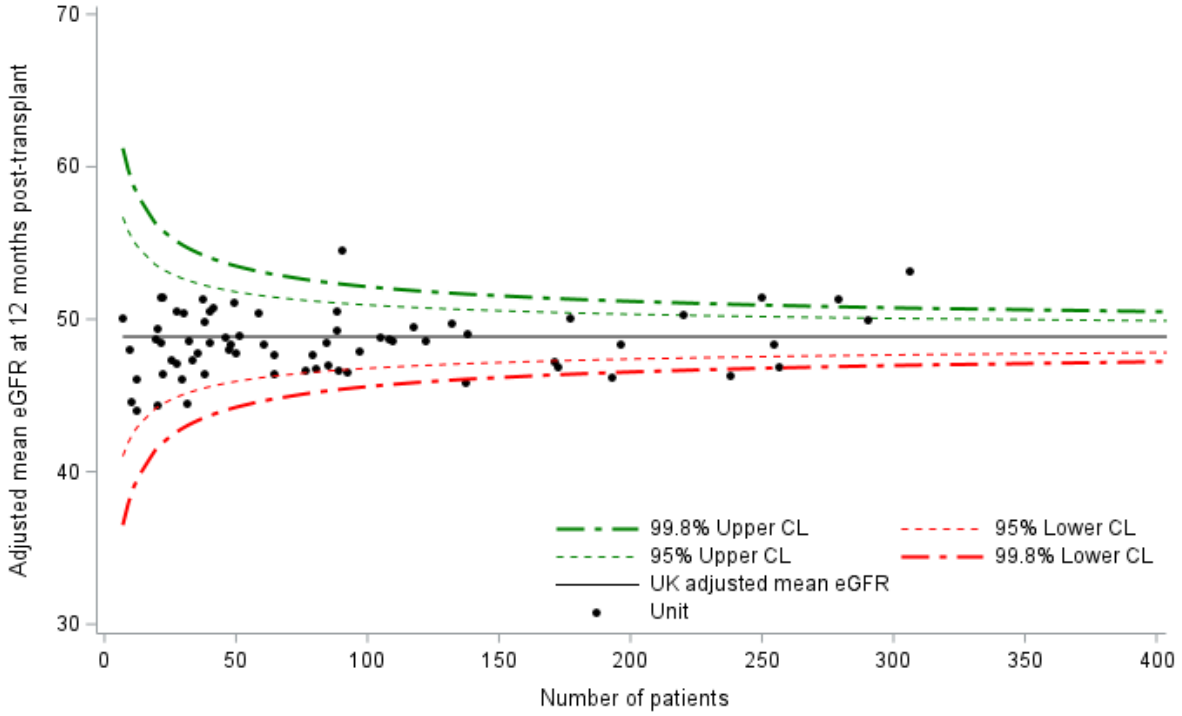


Figure 4.3 Adjusted mean eGFR at 3 months by renal unit for first adult living donor kidney transplants in the UK, 1 April 2015 and 31 March 2019

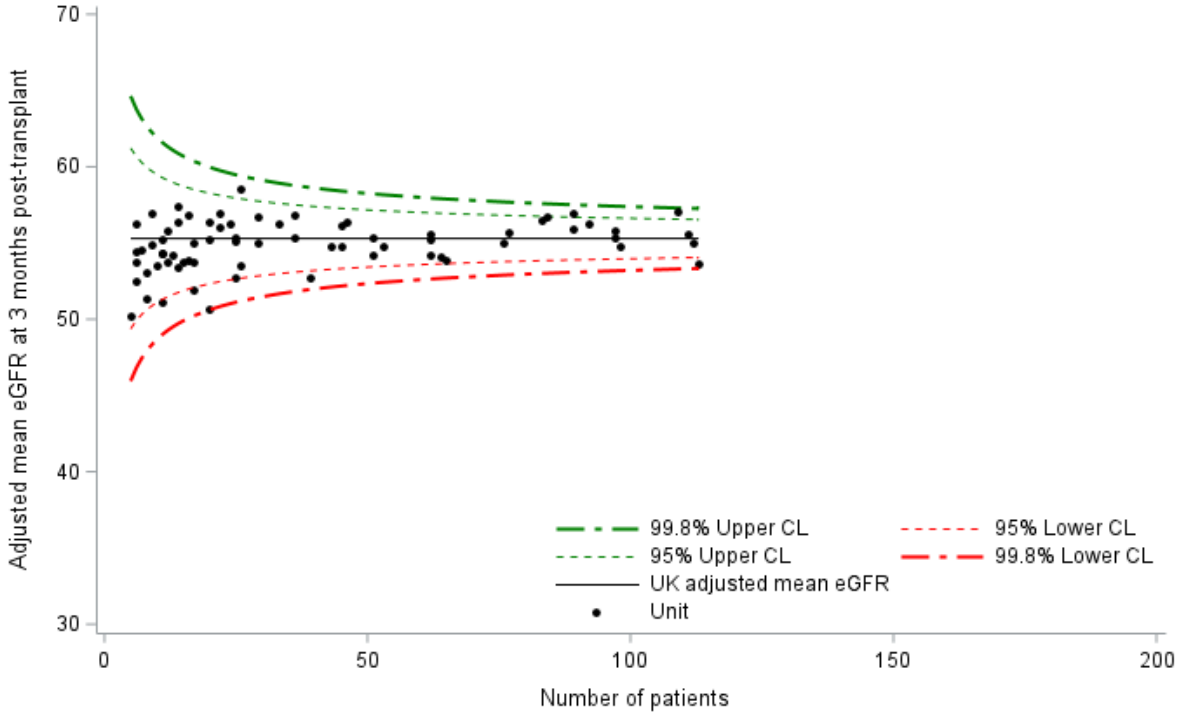


Figure 4.4 Adjusted mean eGFR at 12 months by renal unit for first adult living donor kidney transplants in the UK, 1 April 2015 and 31 March 2019

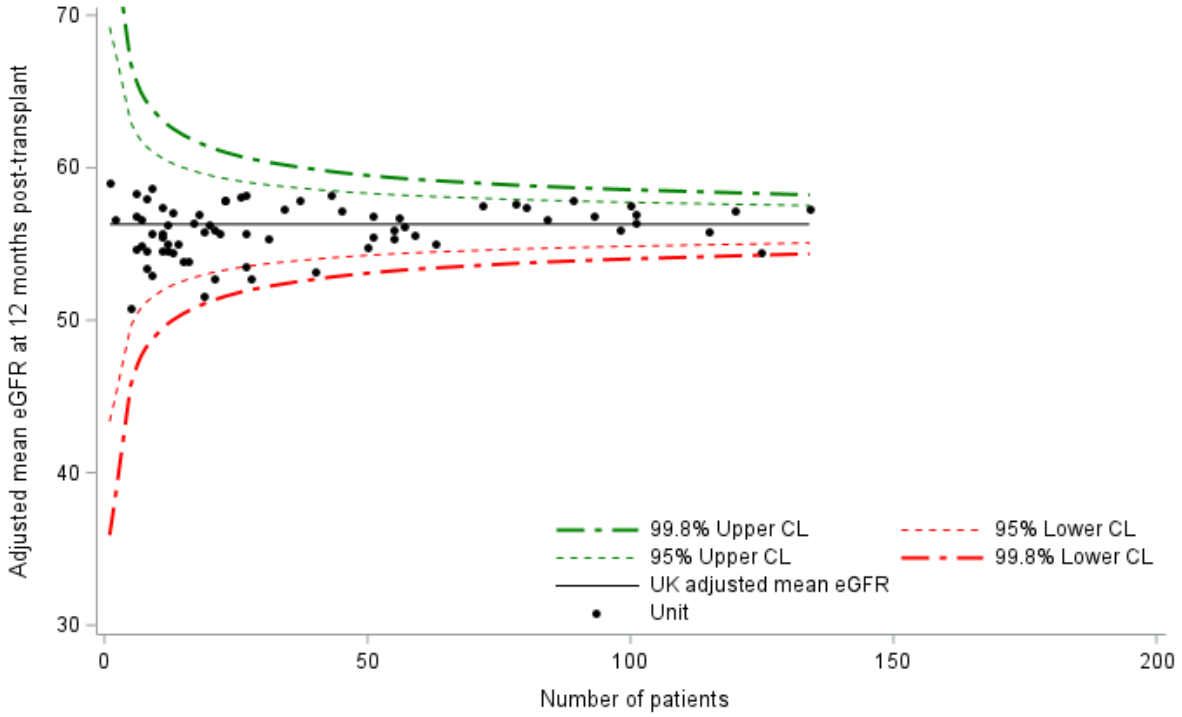


Table 4.1 Adjusted mean eGFR at 3 and 12 months, by donor type and renal unit

	Deceased donor transplants				Living donor transplants			
	3 months post-transplant*		12 months post-transplant**		3 months post-transplant***		12 months post-transplant****	
Unit	N	Mean	N	Mean	N	Mean	N	Mean
Belfast	77	44.8	80	46.8	112	55.1	115	55.8
Antrim	26	46.2	19	48.7	20	55.3	19	55.9
Newry	28	48.7	27	50.6	22	57.0	23	57.9
Ulster	17	47.7	12	46.2	14	56.4	6	56.9
West NI	27	50.1	21	51.5	25	55.4	20	56.3
Bham	220	50.0	279	51.4	97	55.8	120	57.2
Dudley	27	48.0	38	49.9	14	57.4	13	57.0
Shrew	19	47.4	25	47.4	6	53.8	8	53.5
Stoke	66	46.2	64	47.7	25	52.8	28	52.7
Wolve	42	49.8	49	51.2	17	55.0	22	55.7
Bristol	156	47.4	138	49.0	64	54.1	51	55.4
Dorset	35	43.7	47	48.0	15	53.8	15	53.9
Glouc	75	45.0	38	46.5	22	56.1	9	58.7
Camb	85	46.4	97	48.0	51	54.2	50	54.8
Chelms	59	47.1	60	48.4	13	54.2	12	55.0
Colchr	21	48.0	22	51.5	8	53.1	8	54.5
Ipswi	37	46.0	40	48.6	10	53.5	11	54.6
Norwch	78	45.0	85	47.1	17	52.0	21	52.7
Stevng	143	48.2	117	49.5	45	56.1	34	57.4
Cardff	125	45.8	122	48.6	62	54.2	59	55.6
Swanse	60	47.5	58	50.4	20	50.7	19	51.6
Covnt	89	50.0	88	50.6	46	56.4	43	58.2
Edinb	72	47.2	35	47.9	43	54.8	11	55.7
Abrdn	40	45.4	48	48.4	26	58.5	27	58.2
Dundee	24	46.4	32	48.6	14	53.4	21	55.9
Inverns	18	43.7	20	44.4	11	54.3	12	54.5
Krkcldy	17	47.6	7	50.1	11	51.2	1	59.0
Glasgw	256	46.7	254	48.4	98	54.7	98	56.0
Airdrie	46	47.3	46	48.8	24	56.3	23	57.9
D&Gall	10	43.2	10	44.6	5	50.3	5	50.8
Klmarnk	31	43.2	31	44.5	8	51.4	9	53.0
L Guys	166	45.3	172	46.9	89	56.0	93	56.9
Kent	77	45.3	89	46.7	45	54.8	57	56.2
L Kings	54	48.1	41	50.7	11	54.4	7	54.9
Leeds	218	47.9	220	50.4	83	56.5	80	57.4
Bradfd	90	51.8	90	54.5	12	55.8	12	56.3
Hull	68	46.0	79	47.7	33	56.3	37	57.9
York	66	44.2	64	46.5	17	53.8	16	53.9
Leic	295	47.9	290	50.0	92	56.3	89	57.8
Liv Roy	94	46.7	108	48.7	62	55.6	72	57.6
Bangor	11	40.1	12	44.1	7	54.5	6	54.7
Clwyd	16	47.4	20	49.4	6	56.3	6	58.4
Liv Ain	28	49.4	30	50.5	20	56.4	18	57.0
Wirral	29	45.9	27	47.2	16	56.8	17	56.3
Wrexm	31	44.9	33	47.4	12	53.8	11	55.5
M RI	239	44.7	238	46.3	97	55.4	101	56.4
Prestn	175	45.8	171	47.3	65	53.9	63	55.1
Salford	192	44.6	193	46.2	62	55.3	56	56.8

Table 4.1 Adjusted mean eGFR at 3 and 12 months, by donor type and renal unit

	Deceased donor transplants				Living donor transplants			
	3 months post-transplant*		12 months post-transplant**		3 months post-transplant***		12 months post-transplant****	
Unit	N	Mean	N	Mean	N	Mean	N	Mean
Newc	99	46.8	105	48.9	77	55.7	84	56.6
Carlis	27	43.4	29	46.1	9	54.9	7	56.6
Middlbr	71	44.3	76	46.7	53	54.8	55	56.0
Sund	47	46.2	50	47.8	39	52.8	40	53.2
Nottm	131	43.9	137	45.9	29	55.0	31	55.4
Derby	91	45.0	92	46.5	6	52.5	8	58.0
Oxford	230	44.5	256	47.0	113	53.6	125	54.5
Redng	106	46.7	109	48.6	29	56.7	26	58.1
Plymth	39	47.1	51	48.9	26	53.5	27	53.5
Exeter	81	47.7	88	49.3	25	55.2	27	55.7
Truro	24	44.4	9	48.1	6	54.5	2	56.6
Ports	237	46.9	196	48.4	76	55.0	55	55.3
Sheff	103	47.4	132	49.7	36	55.4	45	57.2
Donc	35	48.0	40	50.5	9	56.9	11	57.4
L St.G	57	47.4	22	46.5	36	56.9	14	55.0
Brightn	83	47.2	84	48.5	51	55.4	51	56.8
Carsh	173	49.3	177	50.2	84	56.8	78	57.6
L Rfree	252	49.9	250	51.5	109	57.0	101	57.0
L Barts	278	51.1	306	53.2	89	57.0	100	57.5
Basldn	33	50.2	37	51.4	16	53.9	13	54.5
Sthend	28	45.9	21	48.6	11	55.2	9	55.7
L West	342	47.5	416	48.8	111	55.6	134	57.3
UK	**6442**	**47.0**	**6569**	**48.9**	**2734**	**55.3**	**2697**	**56.3**

* Adjusted for recipient ethnicity, donor type, donor hypertension, recipient sex, donor diabetes history, donor alcohol abuse history, donor ethnicity, recipient diabetic status, donor age, donor height and cold ischaemia time.
** Adjusted for recipient sex, recipient ethnicity, donor hypertension history, donor type, donor diabetes history, donor alcohol abuse history, donor age, donor height, cold ischaemia time, waiting time and recipient age
*** Adjusted for recipient ethnicity, relationship between donor and recipient, donor age, donor GFR, donor weight, cold ischaemia time and donor BMI.
**** Adjusted for recipient ethnicity, recipient sex, financial year of transplant, donor age, donor GFR, donor weight, donor height and cold ischaemia time.

Appendix

A1 Glossary of terms

ABO
The most important human blood group system for transplantation is the ABO system. Every human being is of blood group O, A, B or AB, or of one of the minor variants of these four groups. ABO blood groups are present on other tissues and, unless special precautions are taken, a group A kidney transplanted to a group O patient will be rapidly rejected.

Active transplant list
When a patient is registered for a transplant, they are registered on what is called the 'active' transplant list. This means that when a donor kidney becomes available, the patient is included among those who are matched against the donor to determine whether or not the kidney is suitable for them. It may sometimes be necessary to take a patient off the transplant list, either temporarily or permanently. This may be done, for example, if someone becomes too ill to receive a transplant. The patient is told about the decision to suspend them from the list and is informed whether the suspension is temporary or permanent. If a patient is suspended from the list, they are not included in the matching of any donor kidneys that become available.

Case mix
The types of patients treated at a unit for a common condition. This can vary across units depending on the facilities available at the unit as well as the types of people in the catchment area of the unit. The definition of what type of patient a person is depends on the patient characteristics that influence the outcome of the treatment. For example the case mix for patients registered for a kidney transplant is defined in terms of various factors such as the blood group, tissue type and age of the patient. These factors have an influence on the chance of a patient receiving a transplant.

Confidence interval (CI)
When an estimate of a quantity such as a survival rate is obtained from data, the value of the estimate depends on the set of patients whose data were used. If, by chance, data from a different set of patients had been used, the value of the estimate may have been different. There is therefore some uncertainty linked with any estimate. A confidence interval is a range of values whose width gives an indication of the uncertainty or precision of an estimate. The number of transplants or patients analysed influences the width of a confidence interval. Smaller data sets tend to lead to wider confidence intervals compared to larger data sets. Estimates from larger data sets are therefore more precise than those from smaller data sets. Confidence intervals are calculated with a stated probability, usually 95%. We then say that there is a 95% chance that the confidence interval includes the true value of the quantity we wish to estimate.

Confidence limit
The upper and lower bounds of a confidence interval.

Cox Proportional Hazards model
A statistical model that relates the instantaneous risk (hazard) of an event occurring at a given time point to the risk factors that influence the length of time it takes for the event to occur. This model can be used to compare the hazard of an event of interest, such as graft failure or patient death, across different groups of patients.

Cross-match
A cross-match is a test for patient antibodies against donor antigens. A positive cross-match shows that the donor and patient are incompatible. A negative cross-match means there is no reaction between donor and patient and that the transplant may proceed.

Donor after brain death (DBD)
Donation after brainstem death means donation which takes place following the diagnosis of death using neurological criteria.

Donor after circulatory death (DCD)
Donation after circulatory death means donation which takes place following the diagnosis of death using circulatory criteria.

eGFR
Estimate of the glomerular filtration rate (GFR) – a recognised indication of renal function. Derived from serum creatinine, age and ethnicity, using the 4-variable Modification of Diet in Renal Disease (MDRD) formula.

Funnel plot
A graphical method that shows how consistent the survival rates of the different renal units are compared to the national rate. The graph shows for each unit, a survival rate plotted against the number of transplants undertaken, with the national rate and confidence limits around this national rate superimposed. In this report, 95% and 99.8% confidence limits were used. Units that lie within the confidence limits have survival rates that are statistically consistent with the national rate. When a unit is close to or outside the limits, this is an indication that the centre may have a rate that is considerably different from the national rate.

Graft survival rate
The percentage of patients whose grafts are still functioning. This is usually specified for a given time period after transplant. For example, a five-year transplant survival rate is the percentage of transplants still functioning five years after transplant.

HLA mismatch
Human Leucocyte Antigen (HLA) antigens are carried on many cells in the body and the immune system can distinguish between those that can be recognised as 'self' (belonging to you or identical to your own) and those that can be recognised as 'nonself'. The normal response of the immune system is to attack foreign/non-self material by producing antibodies against the foreign material. This is one of the mechanisms that provide protection against infection. This is unfortunate from the point of view of transplantation as the immune system will see the graft as just another 'infection' to be destroyed, produce antibodies against the graft and rejection of the grafted organ will take place. To help overcome this response, it is recognised that 'matching' the recipient and donor on the basis of HLA (and blood group)

reduces the chances of acute rejection and, with the added use of immunosuppressive drugs, very much improves the chances of graft survival. 'Matching' refers to the similarity of the recipient HLA type and donor HLA type. HLA mismatch refers to the number of mismatches between the donor and the recipient at the A, B and DR (HLA) loci. There can only be a total of two mismatches at each locus. For example, an HLA mismatch value of 000, means that the donor and recipient are identical at all three loci, while an HLA mismatch value of 210 means that the donor and recipient differ completely at the A locus, are partly the same at the B locus and are identical at the DR locus.

Inter-quartile range
The values between which the middle 50% of the data fall. The lower boundary is the lower quartile, the upper boundary the upper quartile.

Kaplan-Meier method
A method that allows patients with incomplete follow-up information to be included in estimating survival rates. For example, in a cohort for estimating one year patient survival rates, a patient was followed up for only nine months before they relocated. If we calculated a crude survival estimate using the number of patients who survived for at least a year, this patient would have to be excluded as it is not known whether or not the patient was still alive at one year after transplant. The Kaplan-Meier method allows information about such patients to be used for the length of time that they are followed-up, when this information would otherwise be discarded. Such instances of incomplete follow-up are not uncommon and the Kaplan-Meier method allows the computation of estimates that are more meaningful in these cases.

Live donor
A donor who is a living person and who is usually, but not always, a relative of the transplant patient. For example, a parent may donate one of their kidneys to their child.

Median
The midpoint in a series of numbers, so that half the data values are larger than the median, and half are smaller.

Multi-organ transplant
A transplant in which the patient receives more than one organ. For example, a patient may undergo a transplant of a kidney and liver.

National Kidney Allocation Scheme
A nationally agreed set of rules for sharing and allocating kidneys for transplant between transplant centres in the UK. The scheme is administered by NHS Blood and Transplant.

Patient survival rate
The percentage of patients who are still alive (whether the graft is still functioning or not). This is usually specified for a given time period after transplant. For example, a five-year patient survival rate is the percentage of patients who are still alive five years after their first transplant.

p value
In the context of comparing survival rates across units, the p value is the probability that the differences observed in the rates across centres occurred by chance. As this is a probability, it takes values between 0 and 1. If the p value is small, say less than 0.05, this implies that the differences are unlikely to be due to chance and there may be some identifiable cause for these differences. If the p value is large, say greater than 0.1, then it is quite likely that any differences seen are due to chance.

Pre-emptive
Patients that are placed on the kidney transplant list or receive a transplant prior to the need for dialysis are termed as pre-emptive. Patients listed pre-emptively will usually require dialysis within six months of being placed on the transplant list.

Risk-adjusted survival rate
Some transplants have a higher chance than others of failing at any given time. The differences in expected survival times arise due to differences in certain factors, the risk factors, among patients. A risk-adjusted survival rate for a unit is the expected survival rate for that unit given the case mix of their patients. Adjusting for case mix in estimating unit-specific survival rates allows valid comparison of these rates across centres and to the national rate.

Risk factors
These are the characteristics of a patient, transplant or donor that influence the length of time that a graft is likely to function or a patient is likely to survive following a transplant. For example, when all else is equal, a transplant from a younger donor is expected to survive longer than that from an older donor and so donor age is a risk factor.

Unadjusted survival rate
Unadjusted survival rates do not take account of risk factors and are based only on the number of transplants at a given centre and the number and timing of those that fail within the post-transplant period of interest. In this case, unlike for risk-adjusted rates, all transplants are assumed to be equally likely to fail at any given time. However, some centres may have lower unadjusted survival rates than others simply because they tend to undertake transplants that have increased risks of failure. Comparison of unadjusted survival rates across centres and to the national rate is therefore inappropriate.

A2 Methods

Unadjusted and risk-adjusted estimates of patient and graft survival are given for each centre. Unadjusted rates give an estimate of what the survival rate at a centre is, assuming that all patients at the centre have the same chance of surviving a given length of time after transplant. In reality, patients differ and a risk-adjusted rate that allows for these differences would give a more meaningful estimate of survival.

Computing unadjusted survival rates

Unadjusted survival rates were calculated using the Kaplan-Meier method, which allows patients with incomplete follow-up information to be included in the computation. For example, in a cohort for estimating one-year patient survival rates, a patient was followed up for only nine months before they relocated. If we calculated a crude survival estimate using the number of patients who survived for at least a year, this patient would have to be excluded, as it is not known whether or not the patient was still alive one year after transplant. The Kaplan-Meier method allows information about such patients to be used for the length of time that they are followed-up, when this information would otherwise be discarded. Such instances of incomplete follow-up are not uncommon in the analysis of survival data and the Kaplan-Meier method therefore allows the computation of survival estimates that are more meaningful.

Computing risk-adjusted survival rates

A risk-adjusted survival rate is an estimate of what the survival rate at a centre would have been if they had had the same mix of patients as that seen nationally. The risk-adjusted rate therefore presents estimates in which differences in patient mix across centres have been removed as much as possible. For that reason, it is valid to only compare centres using risk-adjusted rather than unadjusted rates, as differences among the latter can be attributed to differences in patient mix.

Risk-adjusted survival estimates were obtained through indirect standardisation. A Cox Proportional Hazards model was used to determine the probability of survival for each patient based on their individual risk factor values. The sum of these probabilities for all patients at a centre gives the number, E, of patients or grafts expected to survive at least one year or five years after transplant at that centre. The number of patients who actually survive the given time period is given by O. The risk-adjusted estimate is then calculated by multiplying the ratio O/E by the overall unadjusted survival rate across all centres.

The risk-adjustment models used were based on results from previous studies that looked at factors affecting the survival rates of interest. The factors included in the models are shown in **Table A3.1**.

A3 Risk adjustment factors

Table A3.1 Risk factors used in the adult kidney risk adjusted survival, by donor type and model

Donor Type	Model	Factors
Deceased	1 year graft survival	Donor age, donor type, donor cause of death, recipient age, waiting time to transplant, primary renal disease, HLA mismatch group, cold ischaemic time*, recipient ethnicity
	1 year patient survival	Donor age, recipient age, waiting time to transplant, primary renal disease, HLA mismatch group, cold ischaemic time*
	5 year graft survival	Graft year, donor age, donor type, donor cause of death, recipient age, waiting time to transplant, primary renal disease, HLA mismatch group, recipient ethnicity
	5 year patient survival	Graft year, donor age, recipient age, waiting time to transplant, primary renal disease
Living	1 year graft survival	Donor age, recipient age, primary renal disease, number of HLA mismatches
	1 year patient survival	Recipient age
	5 year graft survival	Graft year, donor age, recipient age, primary renal disease, number of HLA mismatches
	5 year patient survival	Recipient age, primary renal disease

*Time between retrieval of kidney from the donor and time of transplant in the patient.

Table A3.2 Risk factors used in the adult kidney risk adjusted eGFR, by donor type and model

Donor Type	Model	Factors
Deceased	3 month	recipient ethnicity, donor type, donor hypertension, recipient sex, donor diabetes history, donor alcohol abuse history, donor ethnicity, recipient diabetic status, donor age, donor height, cold ischaemic time*
	12 month	recipient sex, recipient ethnicity, donor hypertension history, donor type, donor diabetes history, donor alcohol abuse history, donor age, donor height, cold ischaemic time*, waiting time, recipient age
Living	3 month	recipient ethnicity, relationship between donor and recipient, donor age, donor GFR, donor weight, cold ischaemic time*, donor BMI
	12 month	recipient ethnicity, recipient sex, financial year of transplant, donor age, donor GFR, donor weight, donor height and cold ischaemic time*

*Time between retrieval of kidney from the donor and time of transplant in the patient.

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