KIDNEY TRANSPLANTATION ANNUAL RENAL UNIT REPORT

REPORT FOR 2017/2018
(1 APRIL 2009 – 31 MARCH 2018)

JANUARY 2020

Contents

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Introduction

This report presents data on activity and outcomes of kidney transplant candidates and recipients between 1 April 2009 and 31 March 2018, for all 71 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 2013 to 31 March 2017 and 1 April 2009 to 31 March 2013, respectively. Adjusted mean eGFR post-transplant is reported at 3- and 12- months post-transplant for the period 1 April 2013 to 31 March 2017. 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 2017/2018 by Renal Unit, NHS Blood and Transplant.

Adult kidney transplant list

1.1 Kidney only transplant list, 30 April 2017 – 31 March 2018

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 2017 to 31 March 2018. London West 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.

Figure 1.1   Adult patients on the active kidney only transplant list (pmp) end of month average, 30 April 2017 - 31 March 2018, by renal unit
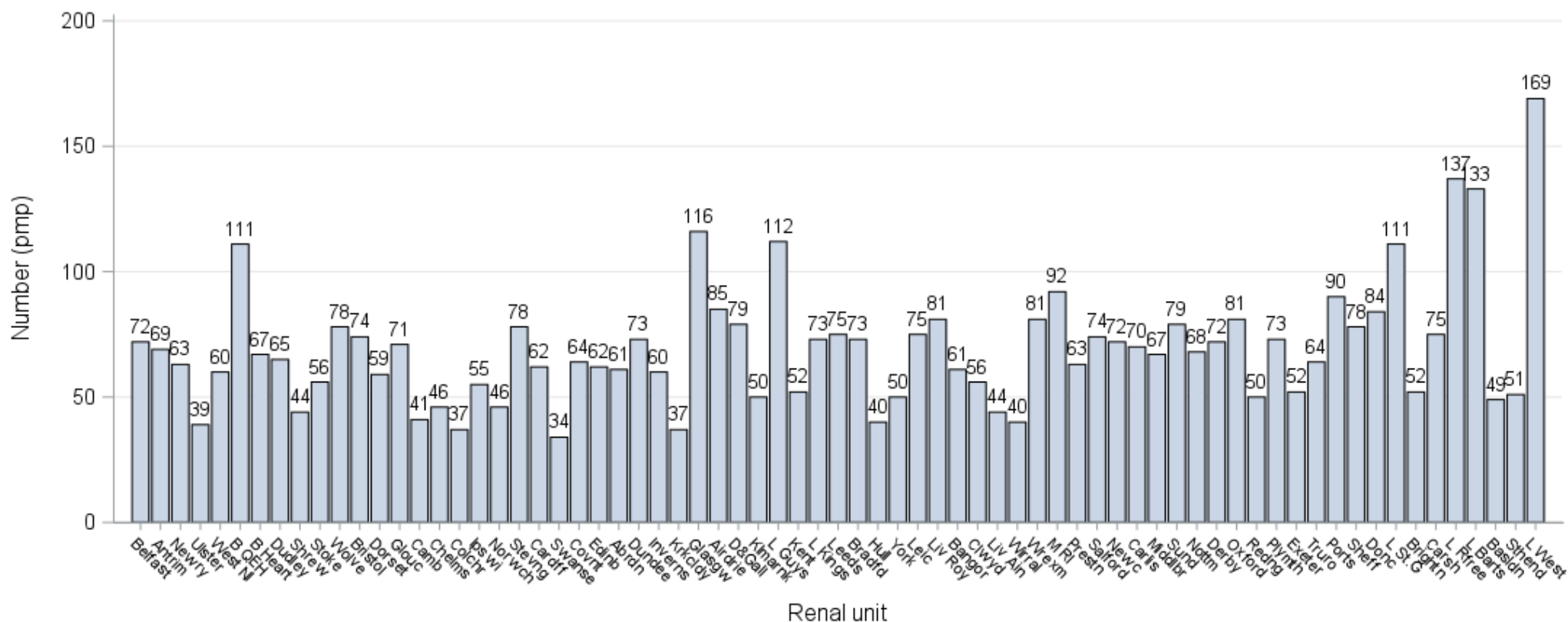
Figure 1.2   Adult patients on the suspended kidney only transplant list (pmp) end of month average, 30 April 2017 - 31 March 2018, by renal unit
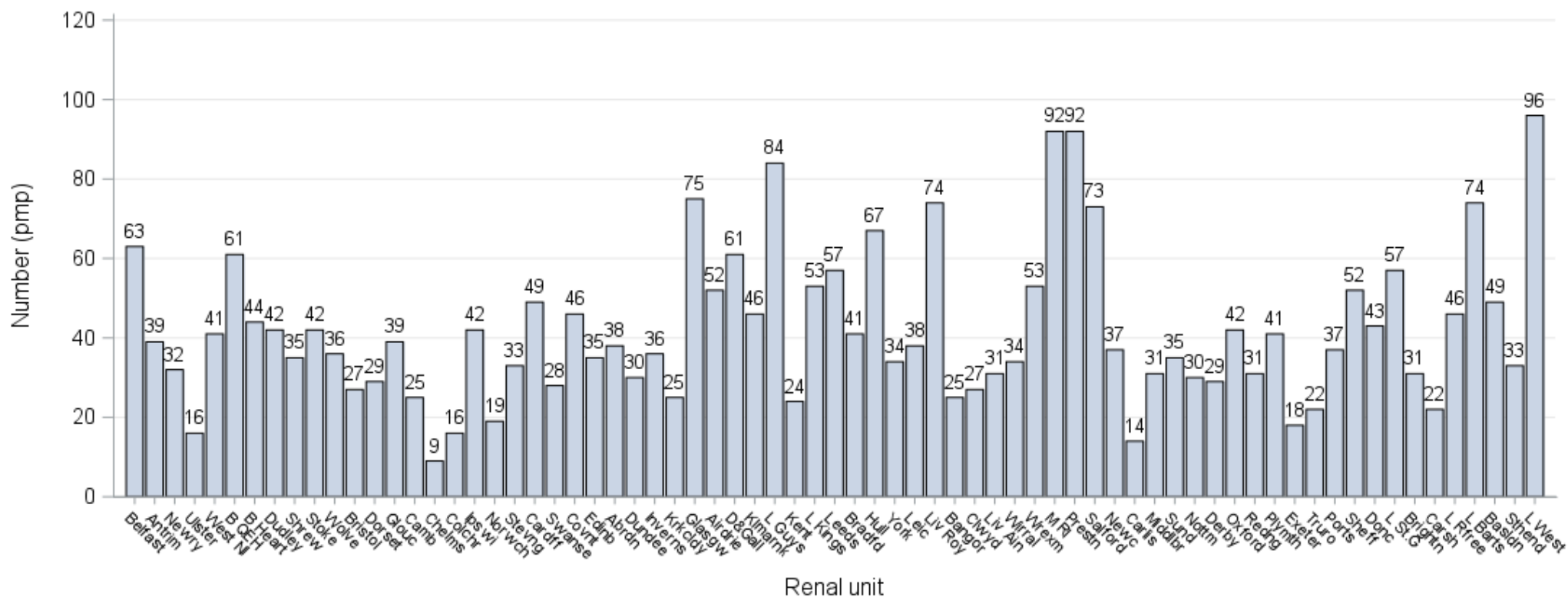
1.2   Post-registration outcomes, 1 April 2012 – 31 March 2015

Figure 1.3 shows the registration outcomes of patients registered between 1 April 2012 and 31 March 2015 by renal unit at three years post-registration. The proportion of patients transplanted three years after listing at each unit ranges from 34% at Birmingham Heartlands to 84% at Norwich and Ipswich. A small proportion of patients across centres were removed or died on the list.

Figure 1.3   Three-year post-registration outcome for 8981 new adult kidney only registrations made in the UK, 1 April 2012 - 31 March 2015, by renal unit
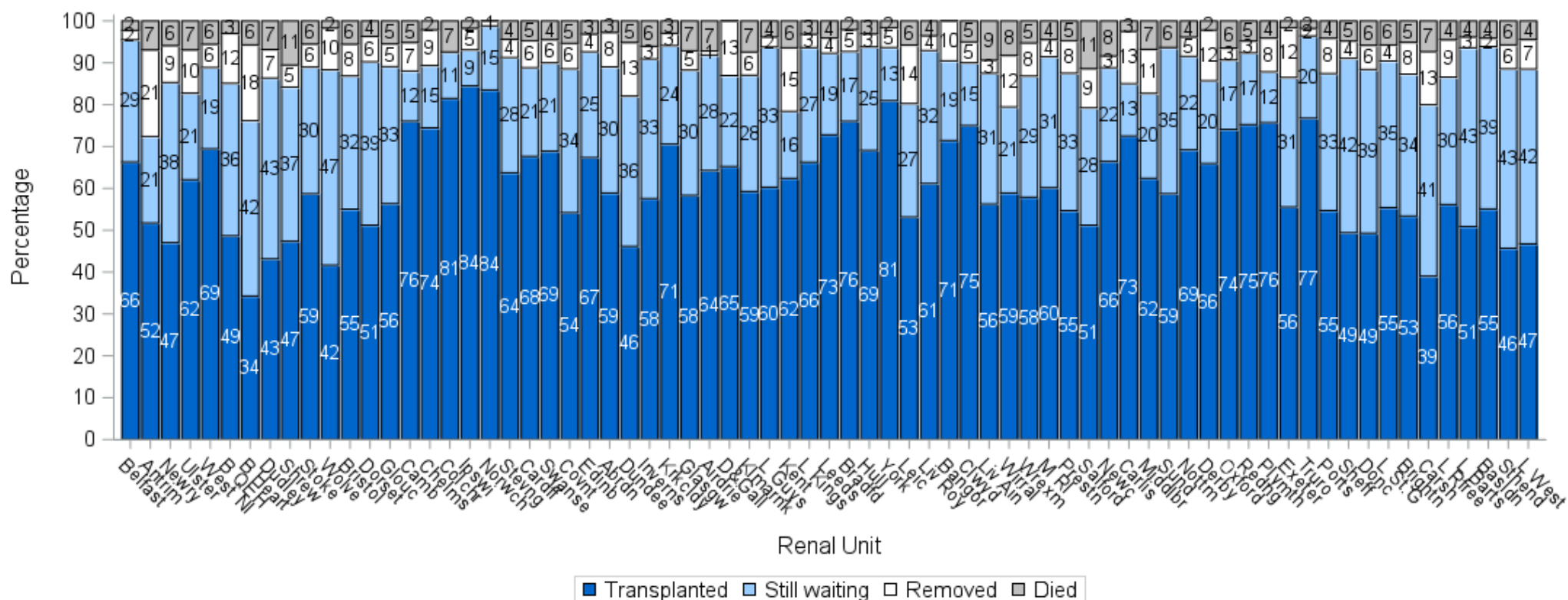
1.3   Demographic characteristics, 1 April 2015 – 31 March 2018

The ethnicity and age group of patients registered onto the transplant list between 1 April 2015 and 31 March 2018 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 2015 and 31 March 2018, by renal unit
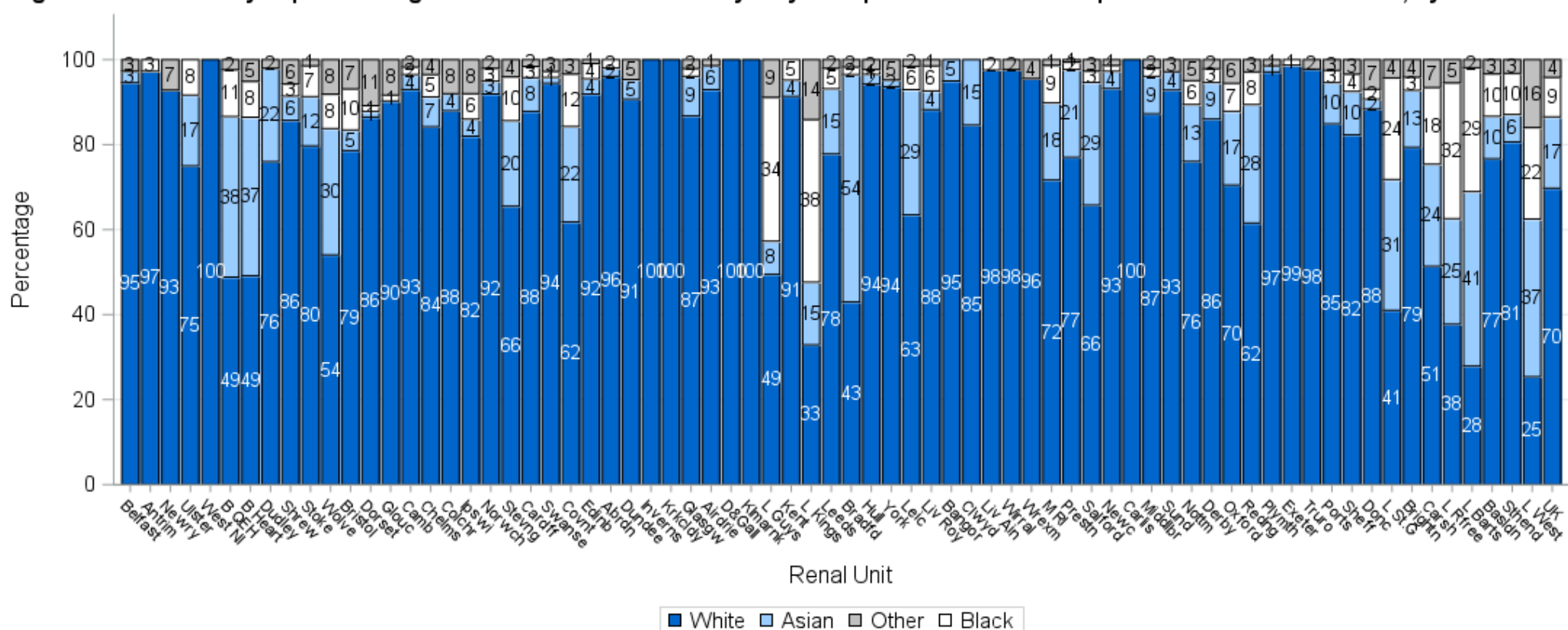
Figure 1.5   Age of patients registered onto the active kidney only transplant list between 1 April 2015 and 31 March 2018, by renal unit
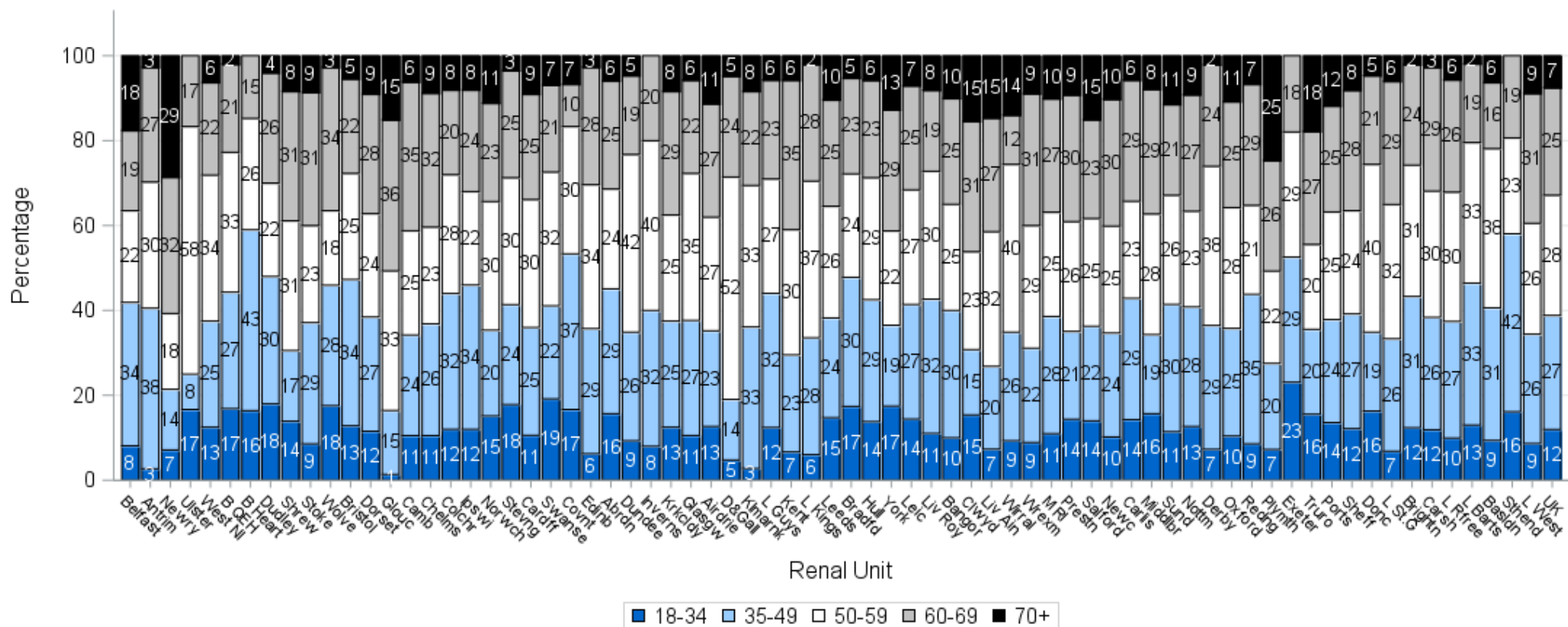
1.4 Waiting times for patients on the list, as at 31 March 2018

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 31 March 2018. A small proportion of patients (4%) 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% have 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 31 March 2018, by renal unit
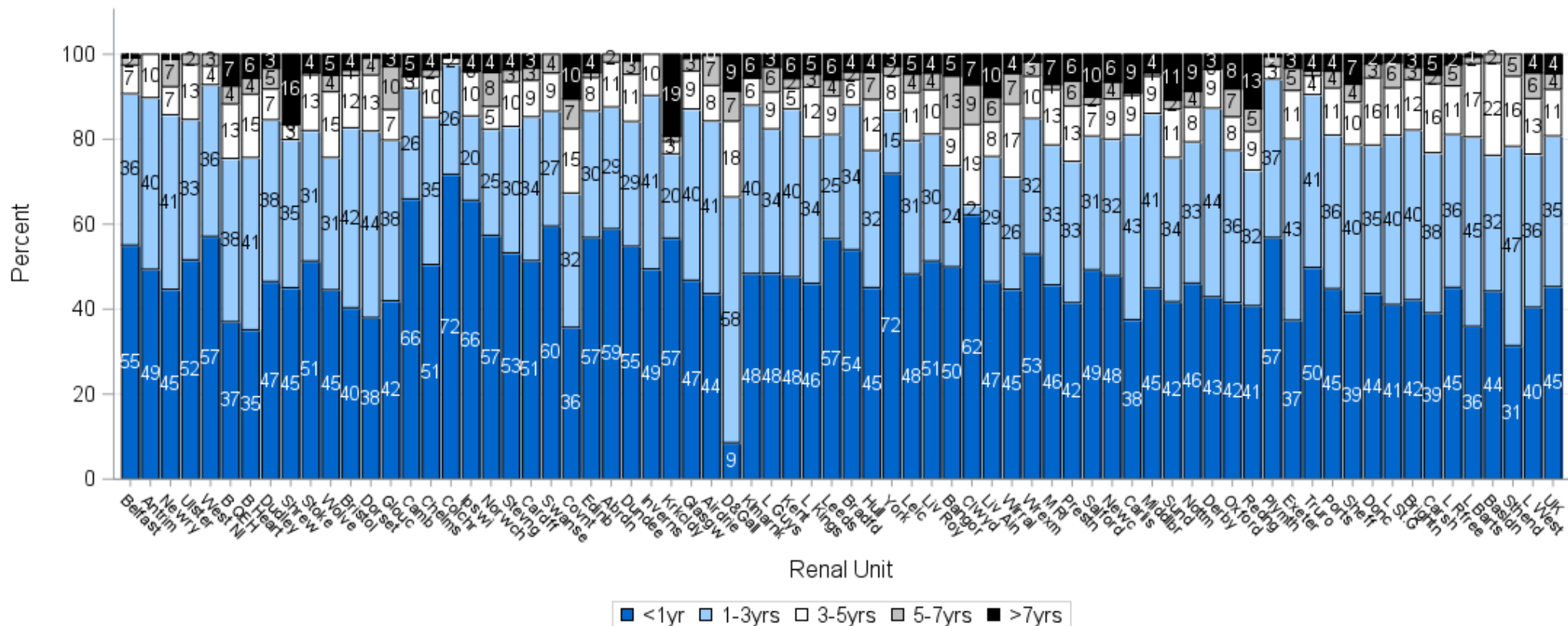
1.5   Pre-emptive listing rates, 1 April 2014 - 31 March 2017

Rates of pre-emptive kidney only listings are shown in **Figure 1.7** for adult patients joining the list between 1 April 2014 and 31 March 2017. 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 67% at Nottingham to 24% at Colchester and Kirkcaldy.

Figure 1.7   Adult pre-emptive listing rates by centre, registrations between 1 April 2014 and 31 March 2017
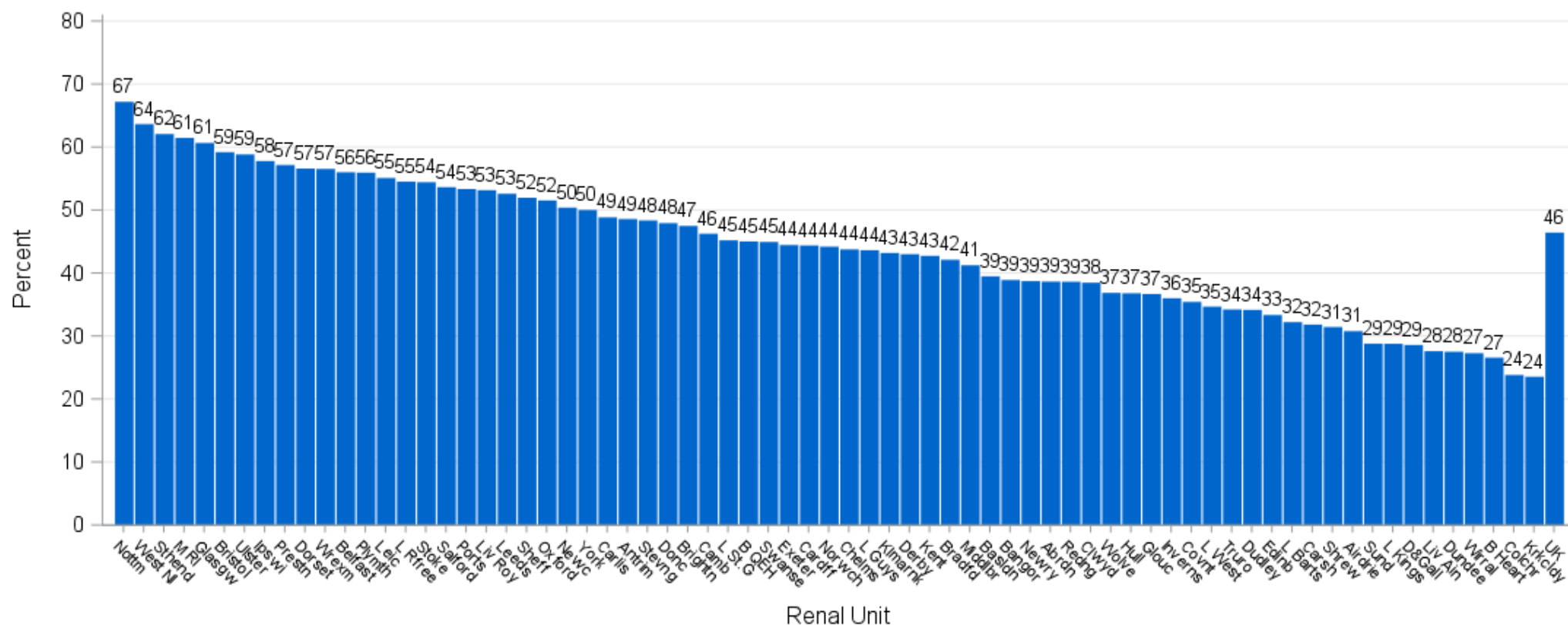
Adult kidney transplants

2.1   Kidney only transplants, 1 April 2015 – 31 March 2018

Figure 2.1 shows the mean number of adult kidney only transplants performed per million population (pmp) between 1 April 2015 and 31 March 2018, by renal unit and type of donor. Belfast had the highest overall mean rate of adult kidney only transplants per million population at 86 pmp, as well as the highest living donor rate (53 pmp). Guy's had the highest deceased donor rate (51 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 2015 - 31 March 2018, by donor type and renal unit
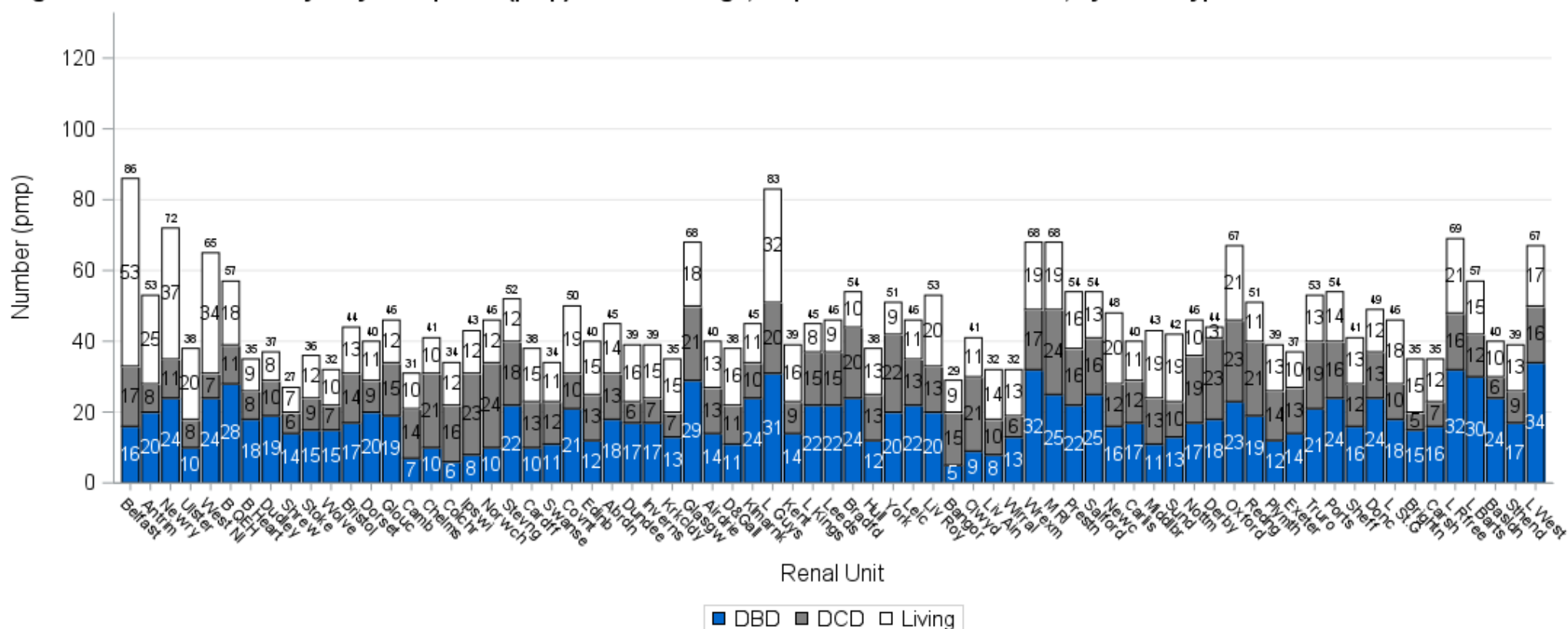
Figure 2.2 — Distribution of adult kidney only transplants, 1 April 2015 and 31 March 2018, by donor type and renal unit
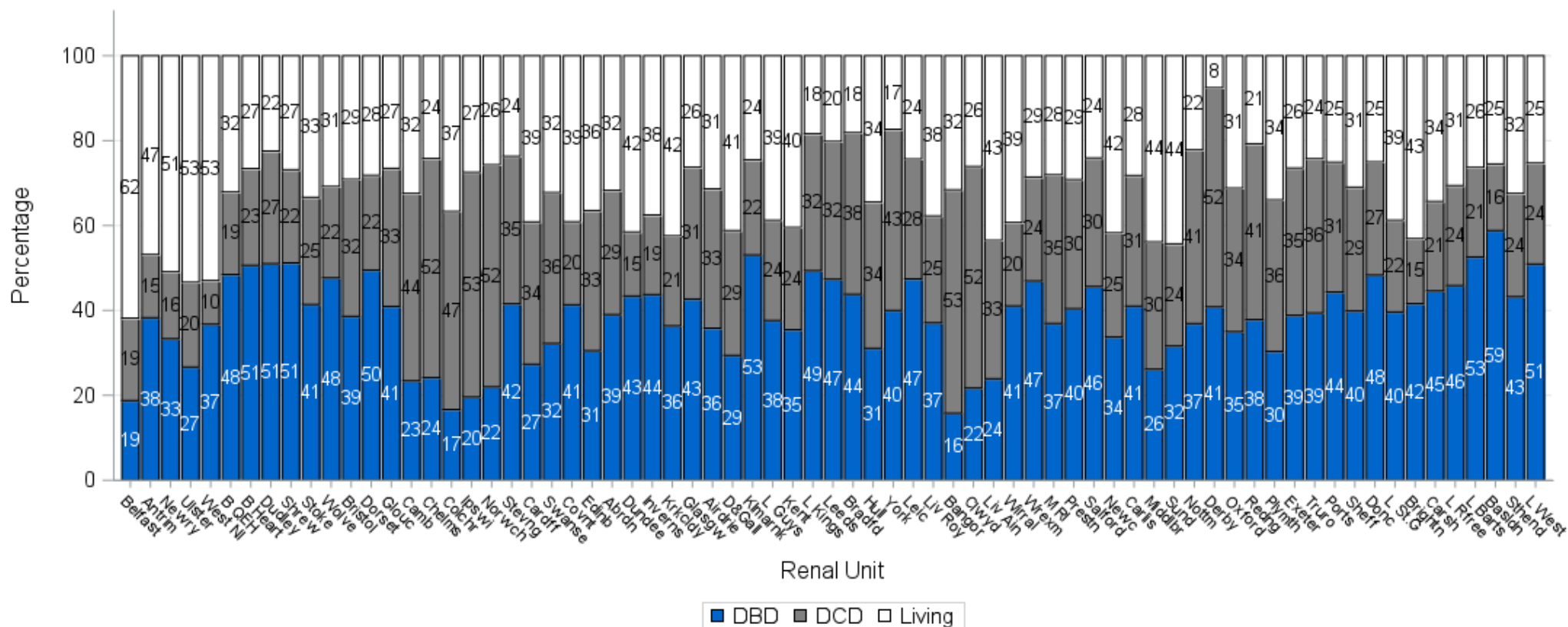
2.2 Demographic characteristics of recipients, 1 April 2015 - 31 March 2018

The ethnicity and age group of patients who received a kidney only transplant between 1 April 2015 and 31 March 2018 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 2015 and 31 March 2018, by renal unit
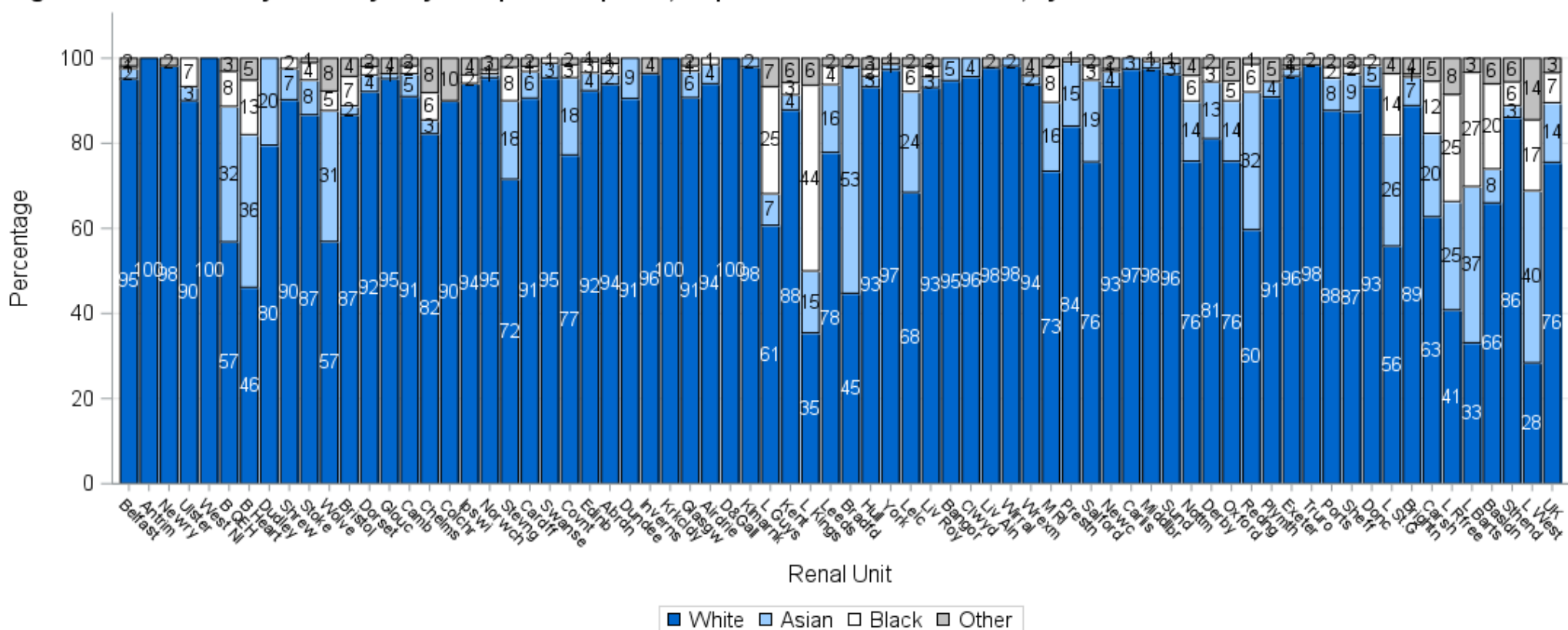
Figure 2.4   Age of kidney only transplant recipients, 1 April 2015 and 31 March 2018, by renal unit
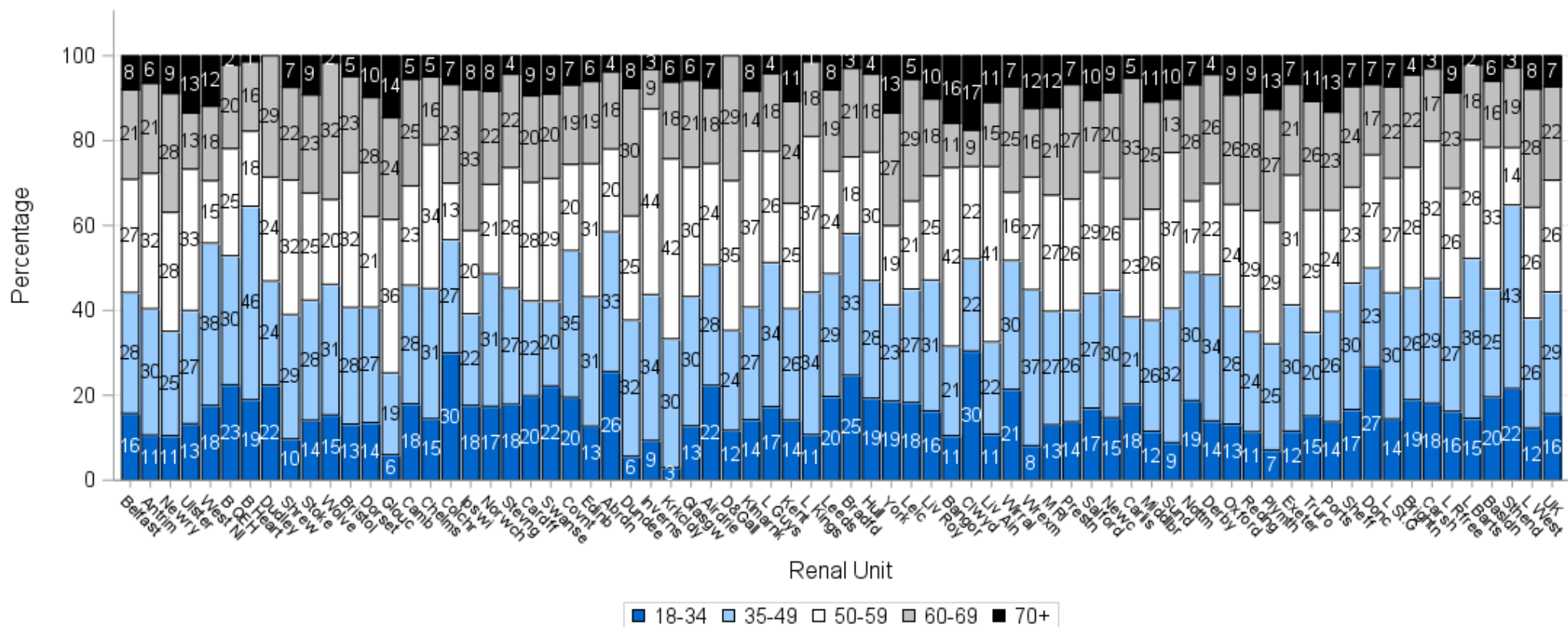
2.3   Pre-emptive transplant rates, 1 April 2015 - 31 March 2018

Rates of pre-emptive kidney only transplantation for transplants performed between 1 April 2015 and 31 March 2018 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: 38% and 16% 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 34% at Manchester to 0% at Basildon, Aintree, and Ulster. Adult living donor pre-emptive transplant rates ranged from 67% at St George's to 0% at Dudley and Wolverhampton.

Figure 2.5   Adult deceased donor pre-emptive transplant rates by renal unit, 1 April 2015 - 31 March 2018
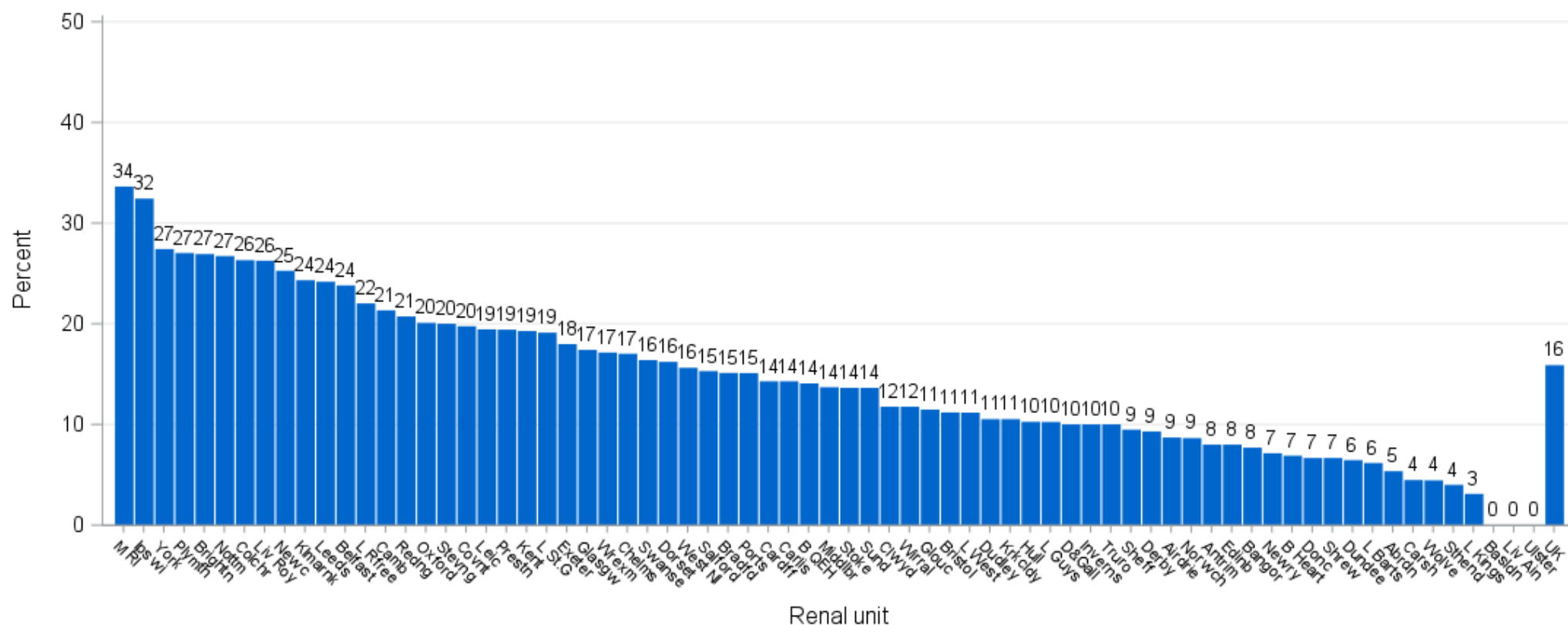
Figure 2.6   Adult living donor pre-emptive transplant rates by renal unit, 1 April 2015 - 31 March 2018
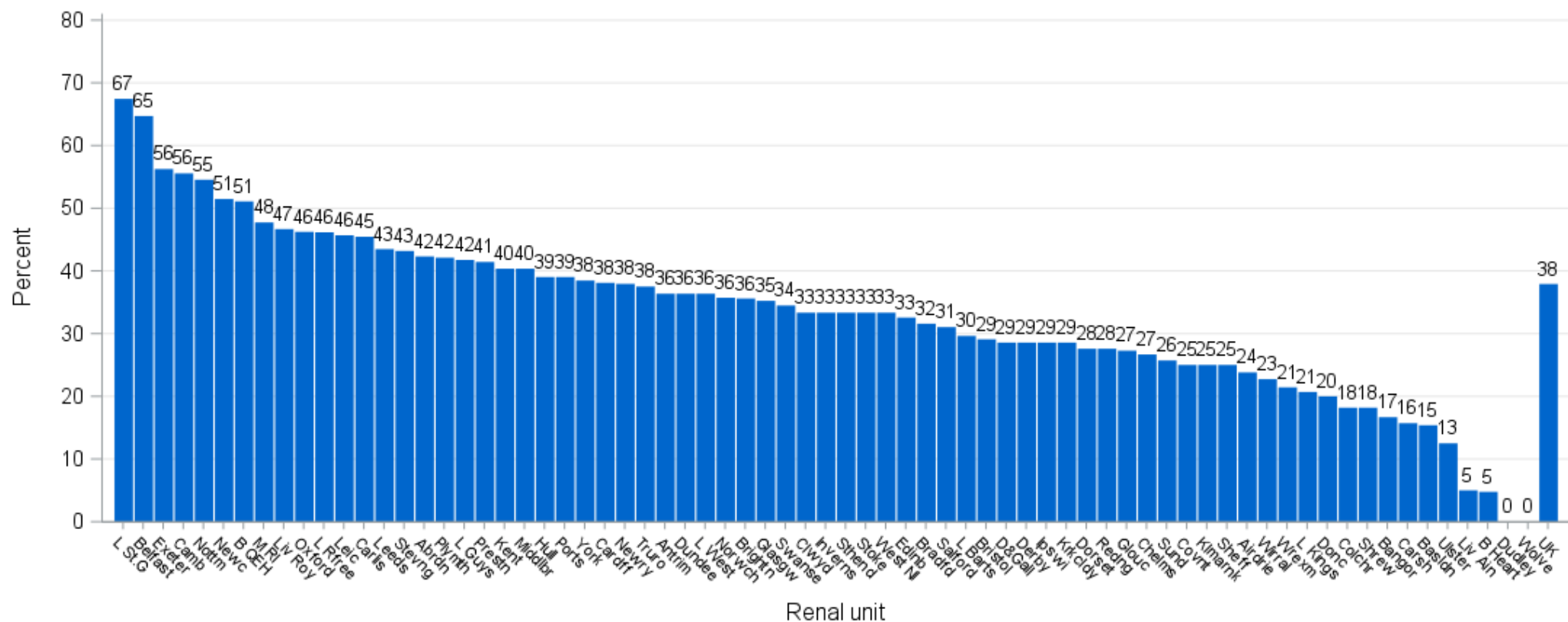
Adult kidney outcomes – post transplant survival

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 2013 to 31 March 2017 while five-year patient and graft survival rates are based on transplants in the period 1 April 2009 to 31 March 2013. 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 86%.

The funnel plots show that, for the most part, the renal units lie within the confidence limits. The funnel plots show some units lie outside the lower 95% confidence limits in the five-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 2013 and 31 March 2017
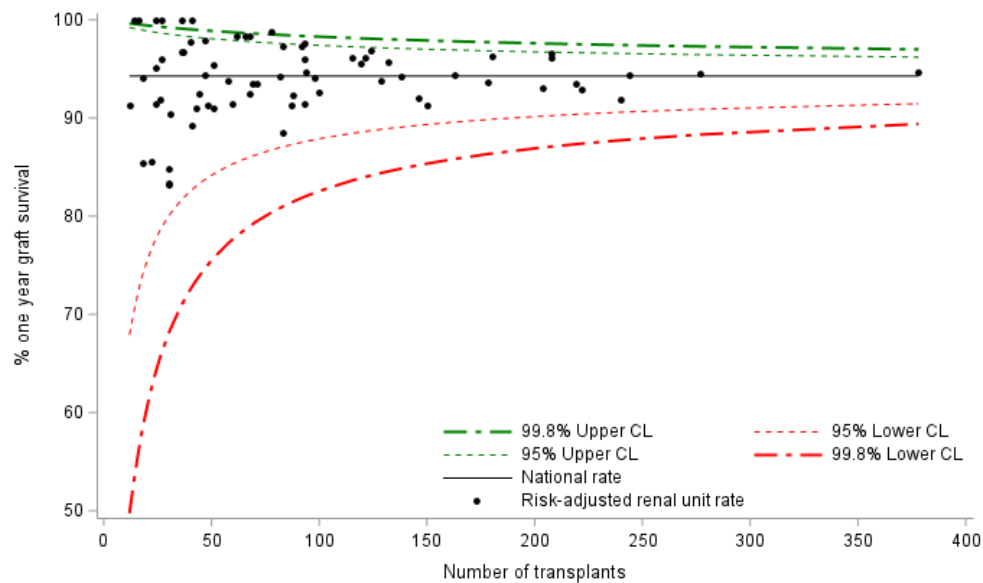
Figure 3.2 Risk-adjusted one year patient survival rates for first deceased donor kidney transplants in adult patients, between 1 April 2013 and 31 March 2017
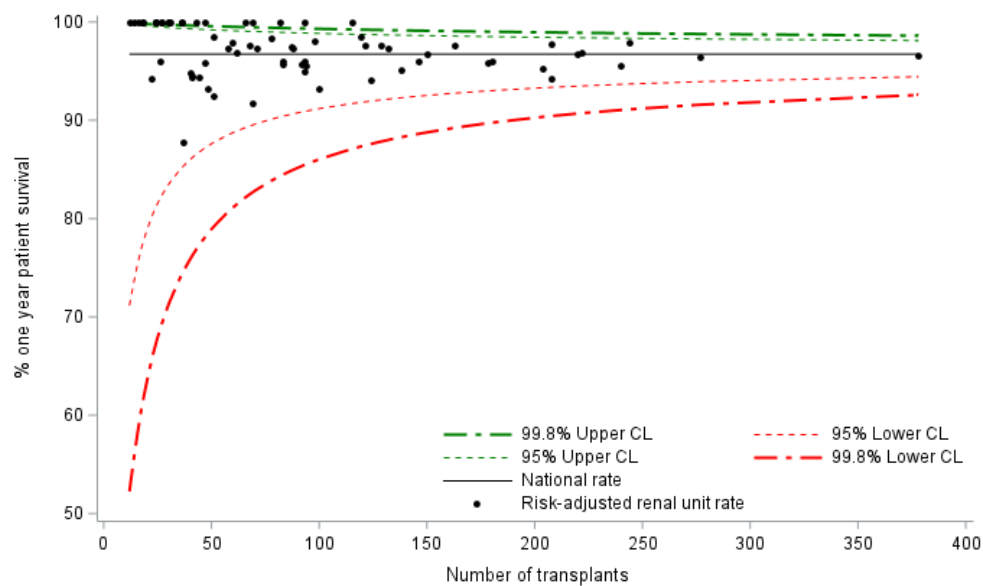
Figure 3.3   Risk-adjusted five year graft (death censored) survival rates for first deceased donor kidney transplants in adult patients, between 1 April 2009 and 31 March 2013

Figure 3.4   Risk-adjusted five year patient survival rates for first deceased donor kidney transplants in adult patients, between 1 April 2009 and 31 March 2013

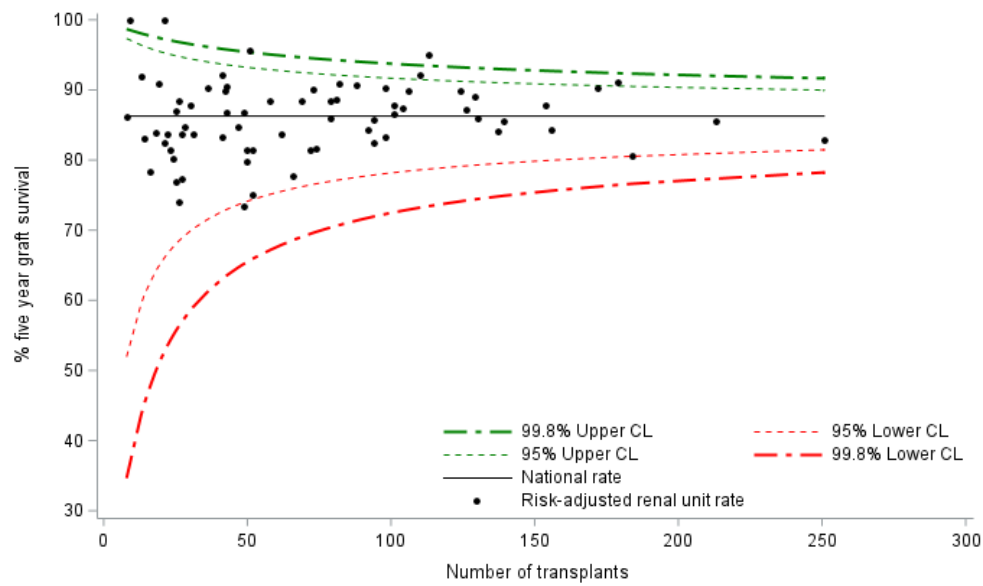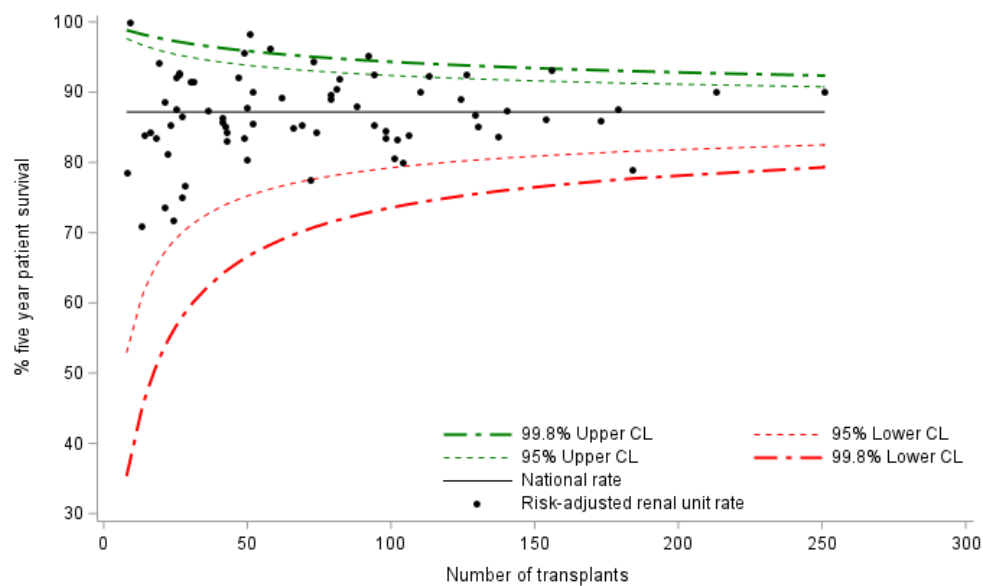| Unit	Kidney graft survival				Patient survival			
	One-year*		Five-year**		One-year*		Five-year**	
	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Belfast	91	(75 - 98)	90	(71 - 98)	93	(80 - 99)	87	(63 - 97)
Antrim	85	(48 - 98)	83	(39 - 98)	100	N/A	84	(42 - 98)
Newry	85	(61 - 96)	78	(37 - 96)	100	N/A	84	(44 - 98)
Ulster	100	N/A	100	N/A	100	N/A	100	N/A
West NI	100	N/A	83	(49 - 96)	100	N/A	74	(38 - 91)
B QEH	94	(89 - 97)	82	(72 - 90)	96	(92 - 98)	93	(83 - 98)
B Heart	91	(80 - 97)	78	(63 - 88)	98	(89 - 100)	85	(70 - 94)
Dudley	83	(61 - 95)	81	(53 - 95)	100	N/A	85	(57 - 97)
Shrew	83	(61 - 95)	87	(62 - 97)	100	N/A	92	(57 - 100)
Stoke	98	(91 - 100)	82	(65 - 92)	97	(89 - 100)	88	(72 - 96)
Wolve	94	(84 - 99)	84	(62 - 95)	96	(85 - 100)	92	(69 - 99)
Bristol	96	(90 - 99)	87	(77 - 94)	97	(92 - 99)	80	(68 - 89)
Dorset	94	(81 - 99)	85	(67 - 94)	92	(81 - 97)	92	(80 - 98)
Glouc	91	(74 - 98)	83	(61 - 95)	100	N/A	86	(67 - 95)
Camb	98	(91 - 100)	95	(89 - 98)	100	N/A	92	(86 - 97)
Chelms	98	(88 - 100)	81	(66 - 91)	95	(81 - 99)	86	(70 - 94)
Colchr	100	N/A	84	(53 - 97)	100	N/A	84	(58 - 96)
Ipswi	98	(89 - 100)	90	(76 - 97)	100	N/A	84	(66 - 94)
Norwch	94	(85 - 98)	91	(82 - 96)	100	N/A	88	(78 - 94)
Stevng	94	(89 - 98)	87	(77 - 93)	95	(89 - 98)	81	(69 - 89)
Cardff	97	(92 - 99)	90	(84 - 94)	94	(89 - 97)	86	(80 - 91)
Swanse	93	(84 - 97)	90	(82 - 96)	98	(91 - 100)	84	(75 - 90)
Covnt	97	(90 - 100)	80	(62 - 91)	96	(88 - 99)	80	(63 - 91)
Edinb	98	(91 - 100)	90	(78 - 96)	100	N/A	94	(84 - 99)
Abrdn	94	(82 - 99)	87	(69 - 96)	97	(85 - 100)	83	(63 - 94)
Dundee	96	(78 - 100)	74	(43 - 90)	100	N/A	93	(74 - 99)
Inverns	86	(58 - 97)	80	(49 - 95)	94	(68 - 100)	72	(42 - 89)
Krkcldy	100	N/A	88	(64 - 97)	100	N/A	92	(69 - 99)
Glasgw	93	(88 - 96)	91	(85 - 95)	95	(91 - 98)	88	(81 - 93)
Airdrie	93	(83 - 98)	92	(77 - 98)	97	(90 - 100)	86	(68 - 96)
D&Gall	91	(52 - 100)	86	(24 - 100)	100	N/A	79	(23 - 97)
Klmarnk	97	(82 - 100)	84	(58 - 96)	100	N/A	87	(61 - 97)
L Guys	91	(86 - 95)	87	(80 - 93)	97	(92 - 99)	93	(85 - 97)
Kent	94	(87 - 98)	89	(78 - 95)	98	(93 - 100)	91	(81 - 96)
L Kings	96	(91 - 99)	91	(82 - 96)	98	(92 - 100)	92	(81 - 97)
Leeds	94	(89 - 96)	88	(80 - 93)	97	(93 - 99)	86	(79 - 91)
Bradfd	93	(86 - 97)	86	(74 - 93)	93	(84 - 98)	90	(80 - 96)
Hull	91	(83 - 96)	82	(68 - 91)	97	(91 - 100)	84	(71 - 93)
York	98	(91 - 100)	87	(71 - 95)	100	N/A	96	(85 - 99)
Leic	95	(91 - 97)	84	(77 - 90)	96	(94 - 98)	93	(87 - 97)
Liv Roy	97	(91 - 100)	88	(79 - 94)	96	(87 - 99)	83	(72 - 91)
Bangor	100	N/A	100	N/A	100	N/A	89	(67 - 98)
Clwyd	94	(67 - 100)	92	(55 - 100)	100	N/A	71	(25 - 92)
Liv Ain	92	(71 - 99)	85	(61 - 96)	96	(78 - 100)	77	(49 - 91)
Wirral	89	(73 - 97)	90	(74 - 97)	95	(81 - 99)	85	(69 - 94)
Wrexm	95	(73 - 100)	84	(52 - 97)	100	N/A	81	(56 - 94)
M RI	97	(93 - 99)	89	(81 - 94)	94	(90 - 97)	87	(78 - 92)
Prestn	94	(89 - 97)	86	(75 - 93)	98	(94 - 99)	85	(73 - 93)
Salford	96	(92 - 99)	90	(82 - 95)	96	(92 - 98)	89	(82 - 94)
Newc	95	(88 - 98)	83	(72 - 91)	96	(89 - 99)	85	(74 - 91)
Carlis	97	(82 - 100)	77	(47 - 93)	88	(69 - 97)	75	(46 - 91)

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)
Middlbr	89	(78 - 95)	81	(68 - 90)	96	(89 - 99)	78	(63 - 87)
Sund	100	N/A	73	(54 - 86)	94	(80 - 99)	84	(66 - 93)
Nottm	94	(88 - 97)	86	(77 - 92)	98	(93 - 100)	85	(76 - 91)
Derby	99	(93 - 100)	88	(78 - 95)	98	(91 - 100)	89	(79 - 95)
Oxford	96	(93 - 98)	86	(77 - 91)	98	(95 - 99)	87	(80 - 93)
Redng	96	(91 - 99)	92	(85 - 97)	100	N/A	90	(83 - 95)
Plymth	95	(83 - 99)	75	(56 - 87)	93	(81 - 98)	90	(77 - 97)
Exeter	96	(88 - 99)	88	(76 - 95)	95	(87 - 99)	85	(73 - 93)
Truro	93	(78 - 98)	89	(75 - 96)	94	(80 - 99)	96	(89 - 99)
Ports	93	(88 - 96)	84	(75 - 90)	97	(94 - 99)	84	(76 - 90)
Sheff	96	(90 - 98)	90	(81 - 95)	99	(95 - 100)	84	(74 - 91)
Donc	91	(79 - 97)	88	(66 - 98)	98	(91 - 100)	92	(73 - 99)
L St.G	92	(83 - 97)	96	(85 - 99)	97	(90 - 100)	98	(91 - 100)
Brightn	91	(81 - 97)	84	(69 - 93)	96	(88 - 99)	89	(77 - 96)
Carsh	92	(86 - 96)	84	(74 - 91)	96	(91 - 99)	95	(88 - 99)
L Rfree	94	(91 - 97)	86	(80 - 90)	98	(95 - 99)	90	(85 - 94)
L Barts	92	(88 - 95)	81	(73 - 86)	96	(92 - 98)	79	(70 - 86)
Basldn	90	(72 - 98)	77	(50 - 92)	100	N/A	88	(64 - 97)
Sthend	91	(69 - 99)	91	(67 - 99)	100	N/A	94	(68 - 100)
L West	95	(92 - 97)	83	(77 - 88)	97	(94 - 98)	90	(85 - 93)
UK	**94**	**(94 - 95)**	**86**	**(85 - 87)**	**97**	**(96 - 97)**	**87**	**(86 - 88)**

    Centre has reached the lower 99.8% confidence limit
    Centre has reached the lower 95% confidence limit
    Centre has reached the upper 95% confidence limit
    Centre has reached the upper 99.8% confidence limit

* Includes transplants performed between 1 April 2013 - 31 March 2017
** Includes transplants performed between 1 April 2009 - 31 March 2013

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 94% and the graft survival was 93%.

The funnel plots show that, for the most part, the renal units lie within the confidence limits. Some 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 3.2**.

Figure 3.5 Risk-adjusted one year graft (death censored) survival rates for first live donor kidney transplants in adult patients, between 1 April 2013 and 31 March 2017
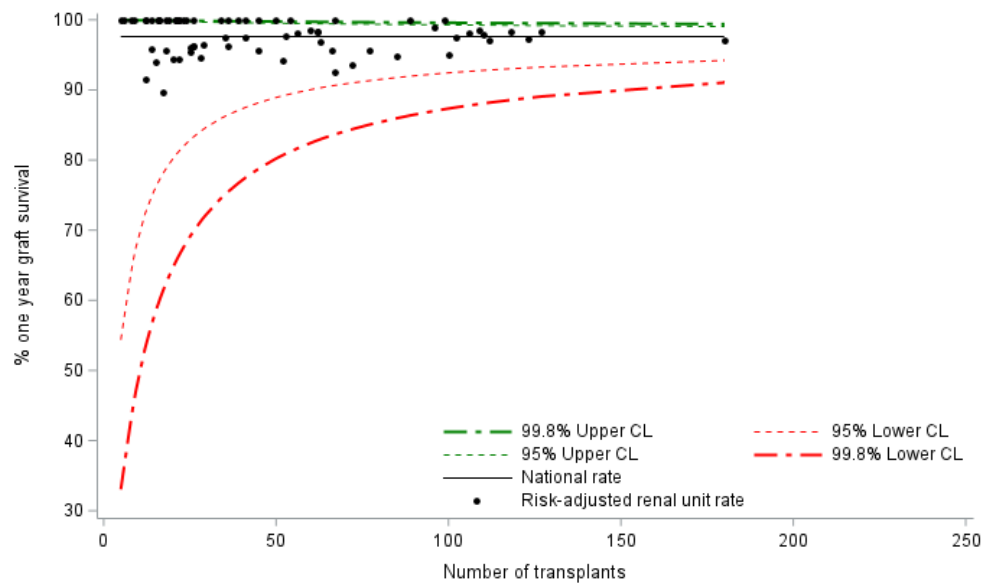
Figure 3.6 Risk-adjusted one year patient survival rates for first live donor kidney transplants in adult patients, between 1 April 2013 and 31 March 2017
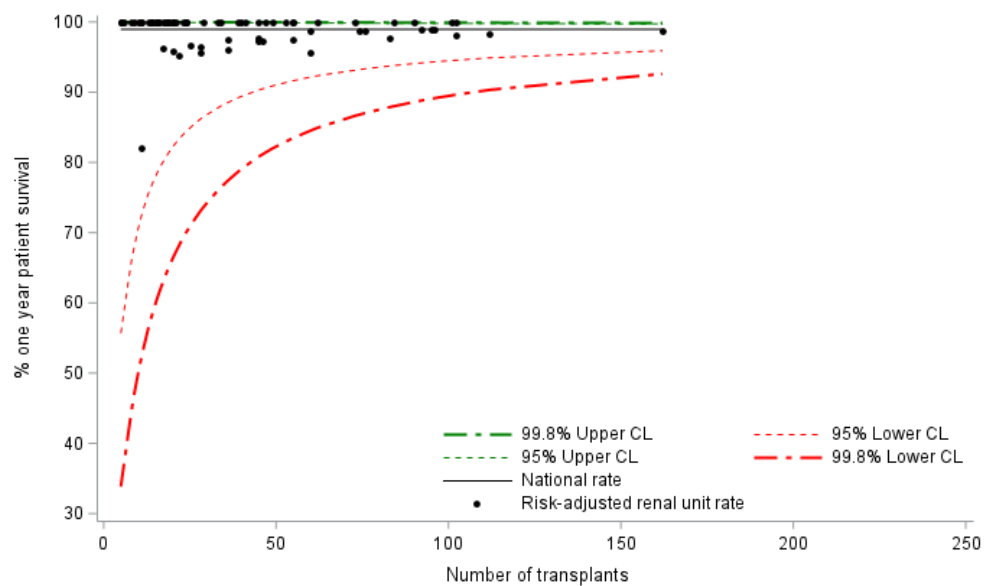
Figure 3.7   Risk-adjusted five year graft (death censored) survival rates for first live donor kidney transplants in adult patients, between 1 April 2009 and 31 March 2013

Figure 3.8   Risk-adjusted five year patient survival rates for first live donor kidney transplants in adult patients, between 1 April 2009 and 31 March 2013

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

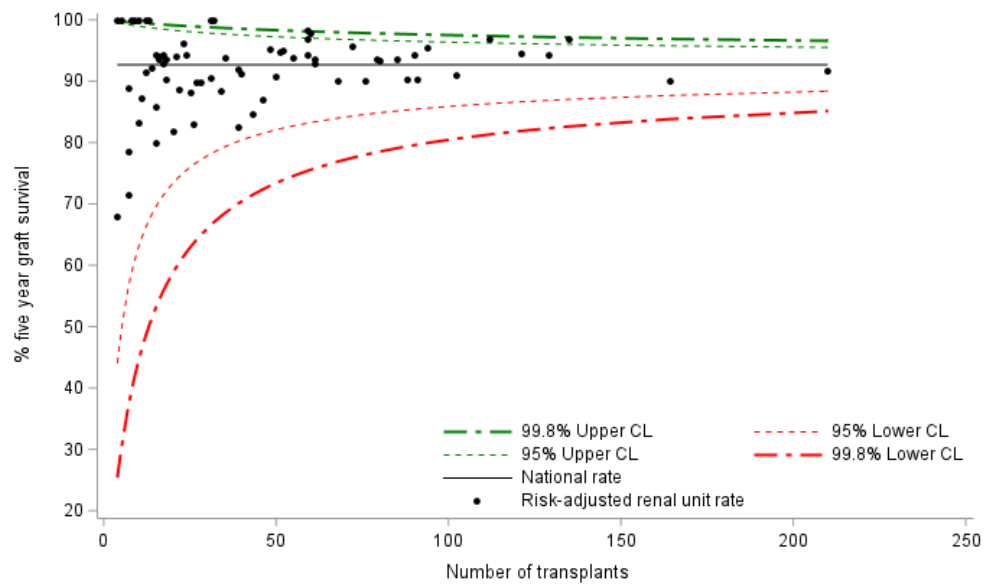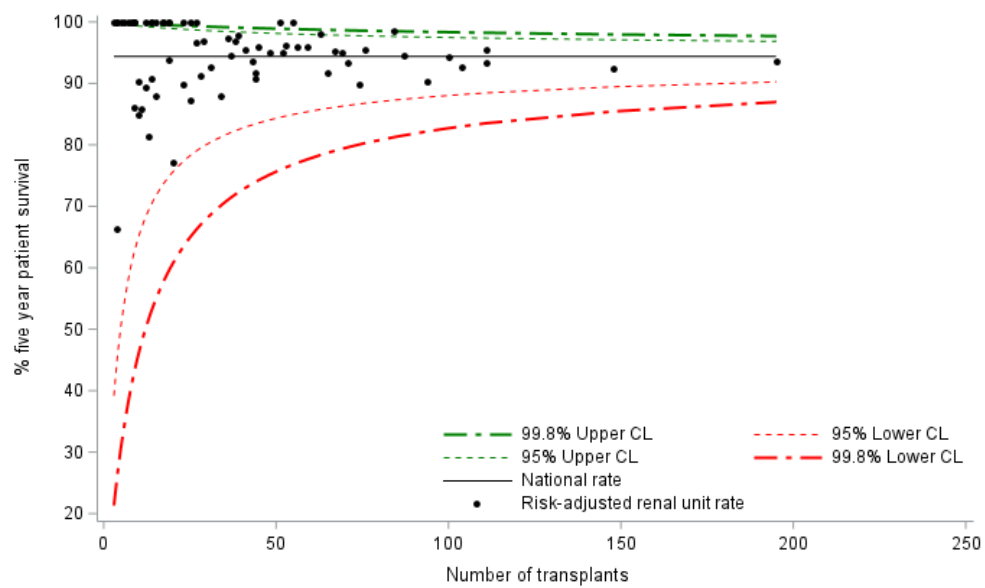| Unit	Kidney graft survival				Patient survival			
	One-year*		Five-year**		One-year*		Five-year**	
	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Belfast	98	(91 - 100)	93	(85 - 98)	100	N/A	96	(86 - 100)
Antrim	100	N/A	94	(68 - 100)	100	N/A	100	N/A
Newry	95	(70 - 100)	100	N/A	97	(82 - 100)	100	N/A
Ulster	94	(69 - 100)	87	(29 - 100)	100	N/A	90	(46 - 100)
West NI	96	(79 - 100)	100	N/A	100	N/A	91	(75 - 98)
B QEH	98	(94 - 100)	94	(87 - 98)	98	(93 - 100)	98	(91 - 100)
B Heart	97	(81 - 100)	83	(56 - 95)	96	(75 - 100)	100	N/A
Dudley	94	(68 - 100)	89	(39 - 100)	100	N/A	100	N/A
Shrew	100	N/A	94	(67 - 100)	100	N/A	100	N/A
Stoke	97	(86 - 100)	95	(85 - 99)	98	(86 - 100)	94	(77 - 99)
Wolve	96	(75 - 100)	96	(79 - 100)	100	N/A	77	(41 - 94)
Bristol	96	(87 - 99)	90	(78 - 96)	100	N/A	98	(90 - 100)
Dorset	100	N/A	94	(68 - 100)	100	N/A	90	(70 - 98)
Glouc	96	(79 - 100)	89	(59 - 99)	100	N/A	94	(66 - 100)
Camb	100	N/A	95	(82 - 99)	100	N/A	96	(85 - 100)
Chelms	100	N/A	86	(49 - 98)	100	N/A	81	(33 - 98)
Colchr	100	N/A	100	N/A	100	N/A	100	N/A
Ipswi	100	N/A	100	N/A	100	N/A	100	N/A
Norwch	96	(78 - 100)	90	(71 - 98)	96	(76 - 100)	100	N/A
Stevng	98	(88 - 100)	92	(77 - 98)	97	(85 - 100)	97	(85 - 100)
Cardff	94	(85 - 98)	90	(80 - 96)	96	(84 - 99)	95	(85 - 99)
Swanse	100	N/A	91	(78 - 98)	96	(79 - 100)	95	(81 - 99)
Covnt	100	N/A	94	(83 - 98)	100	N/A	96	(86 - 100)
Edinb	100	N/A	94	(77 - 99)	100	N/A	97	(83 - 100)
Abrdn	100	N/A	90	(72 - 98)	100	N/A	97	(81 - 100)
Dundee	100	N/A	94	(68 - 100)	100	N/A	100	N/A
Inverns	100	N/A	79	(0 - 99)	100	N/A	100	N/A
Krkcldy	100	N/A	92	(53 - 100)	100	N/A	100	N/A
Glasgw	95	(88 - 98)	94	(85 - 98)	100	N/A	90	(78 - 96)
Airdrie	96	(79 - 100)	94	(68 - 100)	100	N/A	91	(48 - 100)
D&Gall	100	N/A	68	(0 - 99)	100	N/A	100	N/A
Klmarnk	100	N/A	100	N/A	100	N/A	66	(0 - 96)
L Guys	97	(92 - 99)	97	(92 - 99)	99	(94 - 100)	93	(86 - 97)
Kent	97	(89 - 100)	90	(81 - 96)	100	N/A	96	(89 - 99)
L Kings	100	N/A	91	(76 - 97)	96	(78 - 100)	91	(73 - 98)
Leeds	100	N/A	93	(82 - 98)	100	N/A	96	(86 - 100)
Bradfd	100	N/A	93	(61 - 100)	100	N/A	86	(59 - 97)
Hull	94	(83 - 99)	85	(66 - 94)	97	(85 - 100)	97	(82 - 100)
York	94	(66 - 100)	90	(65 - 99)	100	N/A	100	N/A
Leic	98	(94 - 100)	90	(84 - 94)	99	(94 - 100)	93	(86 - 96)
Liv Roy	93	(81 - 98)	94	(83 - 99)	99	(93 - 100)	95	(82 - 99)
Bangor	100	N/A	100	N/A	100	N/A	100	N/A
Clwyd	100	N/A	72	(0 - 97)	100	N/A	100	N/A
Liv Ain	100	N/A	83	(40 - 98)	100	N/A	85	(16 - 100)
Wirral	100	N/A	88	(66 - 98)	95	(74 - 100)	100	N/A
Wrexm	100	N/A	100	N/A	100	N/A	100	N/A
M RI	97	(92 - 99)	97	(91 - 99)	99	(94 - 100)	94	(88 - 98)
Prestn	100	N/A	96	(88 - 99)	98	(92 - 100)	95	(86 - 99)
Salford	95	(87 - 99)	94	(85 - 98)	100	N/A	92	(81 - 97)
Newc	98	(91 - 100)	98	(90 - 100)	100	N/A	95	(85 - 99)
Carlis	100	N/A	92	(57 - 100)	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**

Unit	Kidney graft survival				Patient survival			
	One-year*		Five-year**		One-year*		Five-year**	
	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Middlbr	98	(90 - 100)	83	(64 - 93)	100	N/A	88	(69 - 97)
Sund	100	N/A	100	N/A	100	N/A	100	N/A
Nottm	97	(86 - 100)	88	(70 - 97)	97	(81 - 100)	93	(73 - 99)
Derby	92	(53 - 100)	94	(64 - 100)	100	N/A	88	(56 - 99)
Oxford	98	(94 - 100)	94	(88 - 98)	98	(94 - 100)	93	(85 - 97)
Redng	96	(85 - 99)	87	(72 - 95)	100	N/A	96	(84 - 99)
Plymth	95	(74 - 100)	90	(64 - 99)	100	N/A	87	(62 - 97)
Exeter	100	N/A	95	(83 - 99)	100	N/A	98	(87 - 100)
Truro	100	N/A	94	(64 - 100)	100	N/A	100	N/A
Ports	99	(94 - 100)	95	(88 - 99)	99	(93 - 100)	93	(85 - 98)
Sheff	99	(92 - 100)	97	(89 - 100)	98	(88 - 100)	100	N/A
Donc	100	N/A	80	(42 - 96)	100	N/A	89	(41 - 100)
L St.G	98	(89 - 100)	98	(88 - 100)	100	N/A	100	N/A
Brightn	96	(87 - 99)	94	(82 - 99)	98	(86 - 100)	92	(79 - 98)
Carsh	100	N/A	90	(81 - 96)	99	(93 - 100)	94	(87 - 98)
L Rfree	98	(93 - 100)	94	(88 - 98)	100	N/A	95	(89 - 99)
L Barts	98	(94 - 100)	91	(84 - 96)	100	N/A	90	(79 - 96)
Basldn	96	(77 - 100)	100	N/A	82	(1 - 100)	86	(22 - 100)
Sthend	90	(62 - 99)	82	(54 - 95)	100	N/A	100	N/A
L West	97	(93 - 99)	92	(87 - 95)	99	(95 - 100)	94	(89 - 97)
UK	**98**	**(97 - 98)**	**93**	**(92 - 94)**	**99**	**(99 - 99)**	**94**	**(93 - 95)**

Centre has reached the lower 99.8% confidence limit
Centre has reached the lower 95% confidence limit
Centre has reached the upper 95% confidence limit
Centre has reached the upper 99.8% confidence limit

* Includes transplants performed between 1 April 2013 - 31 March 2017
** Includes transplants performed between 1 April 2009 - 31 March 2013

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 2013 to 31 March 2017. 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 that, for the most part, the renal units lie within the confidence limits. Some of the funnel plots show some units lie outside the lower 95% confidence limits in the five-year estimates, indicating that these units have an adjusted mean eGFR values 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 adjusted mean eGFR values that are considerably higher 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 49.4 mL/min/1.73m^2 and 56.5 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 2013 and 31 March 2017
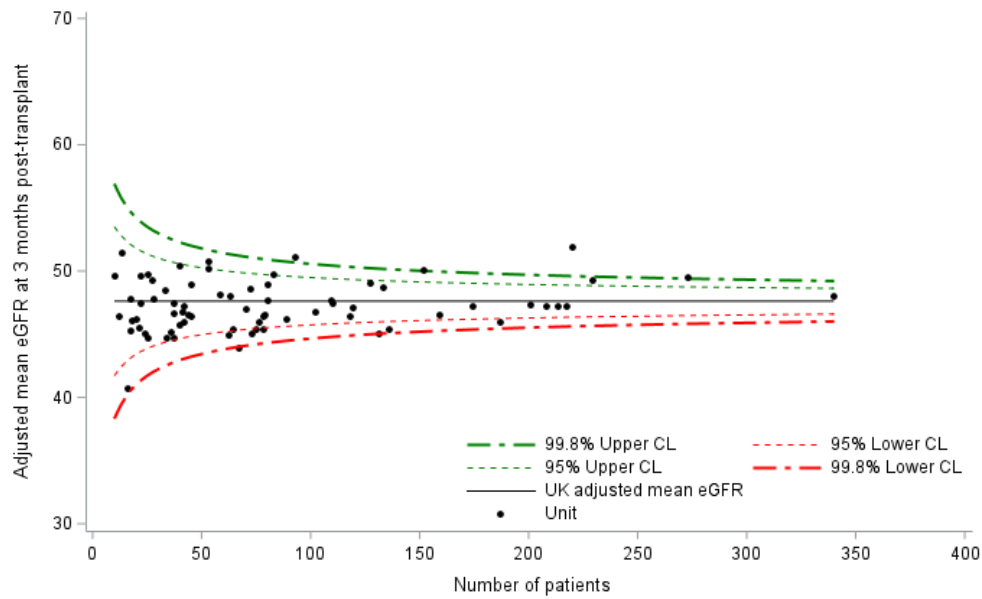
Figure 4.2   Adjusted mean eGFR at 12 months by renal unit for first adult deceased donor kidney transplants in the UK, 1 April 2013 and 31 March 2017
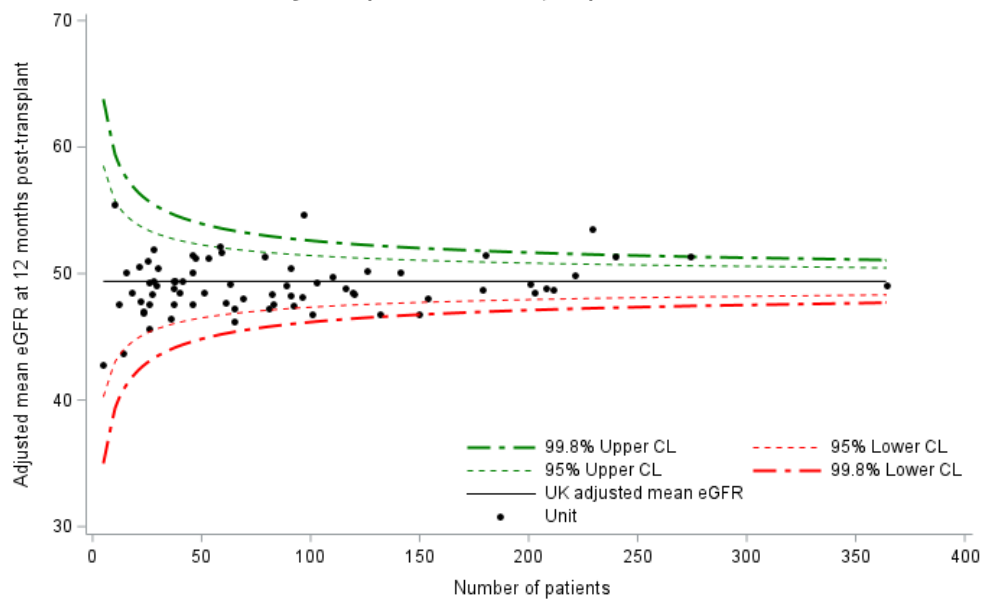
Figure 4.3   Adjusted mean eGFR at 3 months by renal unit for first adult living donor kidney transplants in the UK, 1 April 2013 and 31 March 2017

Figure 4.4   Adjusted mean eGFR at 12 months by renal unit for first adult living donor kidney transplants in the UK, 1 April 2013 and 31 March 2017

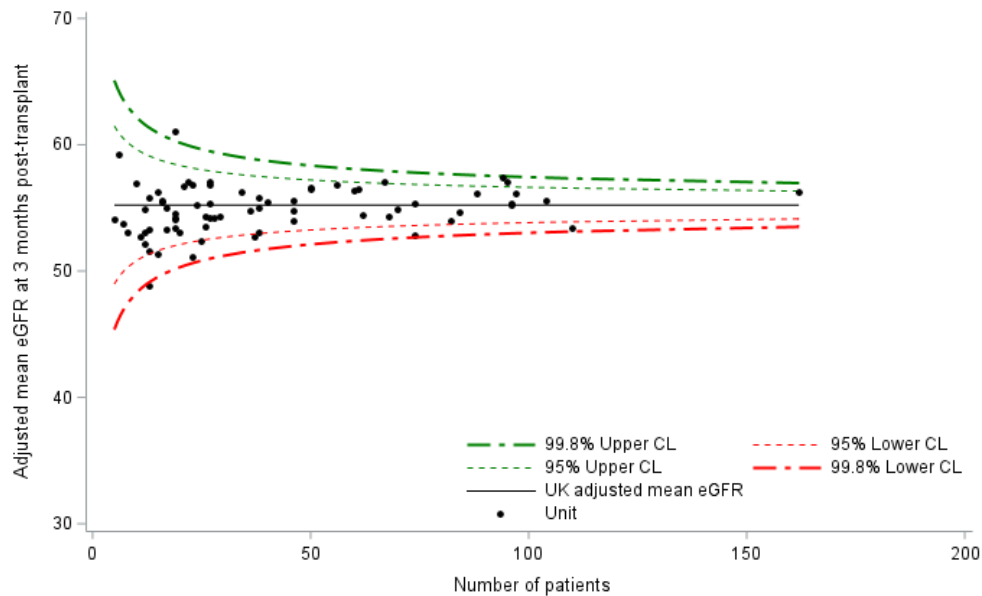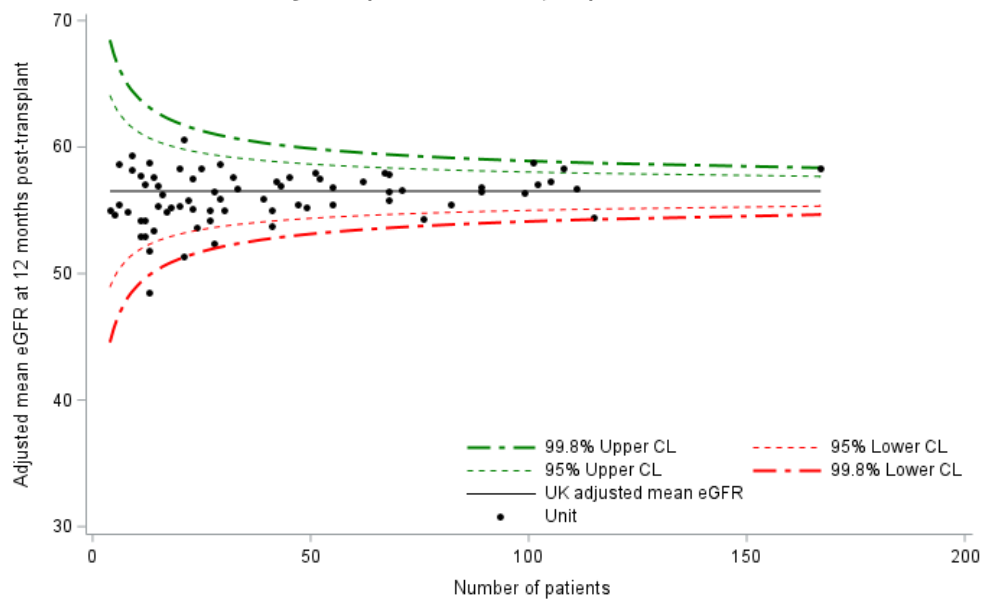**Table 4.1   Adjusted mean eGFR at 3 and 12 months, by donor type and renal unit**

| | 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	45	49.0	47	51.3	88	56.1	89	56.8
Antrim	17	47.8	15	50.2	19	54.2	20	55.3
Newry	28	47.8	29	49.1	27	57.1	29	58.7
Ulster	10	49.6	5	42.8	21	56.7	11	57.7
West NI	33	48.5	25	51.1	26	54.3	27	55.0
B QEH	152	50.1	180	51.5	96	55.3	111	56.7
B Heart	53	50.8	59	51.7	28	54.3	28	56.5
Dudley	25	49.8	28	51.9	22	57.1	20	58.3
Shrew	22	49.6	28	49.4	11	52.8	12	53.0
Stoke	63	48.1	63	49.2	37	52.7	41	53.8
Wolve	40	50.4	46	51.5	19	54.1	23	55.1
Bristol	133	48.8	126	50.3	68	54.3	55	55.5
Dorset	45	46.5	41	49.4	20	53.1	16	56.3
Glouc	42	45.9	23	46.9	24	55.3	9	58.2
Camb	75	45.4	92	47.5	46	54.8	47	55.5
Chelms	37	46.7	37	48.9	15	51.3	13	51.8
Colchr	18	46.1	26	47.6	5	54.1	5	54.7
Ipswi	37	44.7	46	47.6	12	52.2	11	53.0
Norwch	62	45.0	81	47.3	25	52.4	28	52.4
Stevng	119	47.1	119	48.6	56	56.8	51	58.0
Cardff	118	46.5	120	48.4	70	54.9	68	56.5
Swanse	64	45.5	61	47.7	23	51.2	21	51.4
Covnt	83	49.8	79	51.4	50	56.6	45	57.6
Edinb	58	48.2	38	49.4	27	54.2	17	54.9
Abrdn	53	50.2	58	52.2	19	61.1	21	60.6
Dundee	20	46.2	27	48.4	19	54.6	22	55.8
Inverns	21	45.6	22	47.8	16	55.6	15	55.4
Krkcldy	13	51.5	10	55.5	12	53.1	6	55.5
Glasgw	201	47.4	201	49.2	84	54.7	89	56.5
Airdrie	70	47.0	69	48.0	27	56.8	25	58.3
D&Gall	12	46.4	12	47.6	12	54.9	12	57.1
Klmarnk	37	47.4	37	49.4	13	51.6	14	53.4
L Guys	136	45.5	150	46.8	97	56.2	105	57.3
Kent	78	45.5	101	46.8	38	55.8	55	56.9
L Kings	110	47.5	103	49.3	34	56.3	32	57.7
Leeds	217	47.2	221	49.8	61	56.5	62	57.4
Bradfd	93	51.2	97	54.6	23	56.8	23	57.5
Hull	78	46.5	82	48.4	40	55.5	42	57.3
York	67	44.0	65	46.3	13	48.8	13	48.5
Leic	273	49.5	274	51.3	104	55.6	102	57.1
Liv Roy	80	47.7	89	49.1	60	56.4	68	57.9
Bangor	16	40.8	14	43.7	6	59.3	6	58.7
Clwyd	17	45.3	18	48.5	8	53.1	8	54.9
Liv Ain	25	44.8	26	45.6	16	55.5	15	57.0
Wirral	36	45.2	37	47.6	26	53.5	27	54.3
Wrexm	24	45.1	23	47.0	19	53.5	18	55.2
M RI	208	47.3	208	48.9	96	55.3	99	56.4
Prestn	159	46.6	154	48.1	82	54.0	82	55.5
Salford	174	47.3	179	48.8	74	55.3	71	56.6
Newc	89	46.3	96	48.2	62	54.5	68	55.9
Carlis	34	44.7	36	46.5	7	53.8	4	55.1

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
Middlbr	73	45.1	83	47.6	46	54.0	49	55.2
Sund	40	45.8	40	48.6	27	55.4	29	56.0
Nottm	131	45.1	132	46.8	29	54.3	30	55.0
Derby	76	46.0	65	47.2	13	53.3	12	54.2
Oxford	187	46.0	203	48.6	110	53.5	115	54.5
Redng	109	47.7	110	49.8	38	55.1	39	55.9
Plymth	44	46.5	51	48.5	17	53.3	24	53.7
Exeter	80	48.9	91	50.5	38	53.1	41	55.0
Truro	41	46.9	26	49.3	17	55.0	14	57.7
Ports	213	47.3	211	48.7	74	52.8	76	54.4
Sheff	102	46.8	116	48.8	36	54.7	43	57.0
Donc	42	47.2	46	50.1	15	56.2	13	58.8
L St.G	72	48.7	53	51.2	46	55.6	33	56.8
Brightn	79	46.6	91	48.3	50	56.6	52	57.6
Carsh	127	49.1	141	50.1	67	57.1	67	58.0
L Rfree	229	49.4	240	51.3	94	57.5	101	58.8
L Barts	220	51.9	229	53.6	95	57.1	108	58.3
Basldn	27	49.3	30	50.5	13	55.8	11	54.3
Sthend	22	47.5	21	50.6	10	56.9	9	59.3
L West	340	48.0	364	49.1	162	56.3	167	58.4
UK	**5974**	**47.6**	**6166**	**49.4**	**2900**	**55.2**	**2934**	**56.5**

Centre has reached the lower 99.8% confidence limit
Centre has reached the lower 95% confidence limit
Centre has reached the upper 95% confidence limit
Centre has reached the upper 99.8% confidence limit

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.

Prepared by:

Statistics and Clinical Studies, NHS Blood and Transplant

Rachel Hogg
Dr Matthew Robb