



Blood and Transplant

ANNUAL REPORT ON PANCREAS AND ISLET TRANSPLANTATION

**REPORT FOR 2014/2015
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Executive Summary

This report presents key figures about pancreas and islet transplantation in the UK. The period reported covers 10 years of pancreas transplant data, from 1 April 2005 and seven years of islet transplant data, from 1 April 2008. The report presents information on the number of transplants and survival analysis after first simultaneous pancreas and kidney and pancreas only transplantation on a national and centre-specific basis.

Key findings

- On the 31 March 2015, there were 252 patients on the UK active pancreas and islet [transplant list](#), which represents a 6% decrease in number of patients a year earlier. The number of patients on the active pancreas list decreased by 8% to 216 in 2015 while the active islet [transplant list](#) increased by 9% to 36 patients in the same time period.
- There were 1969 pancreas transplants performed in the UK in the ten year period and 152 islet transplants performed in the seven years since islet transplantation was first commissioned in the UK. The number of transplants from [donations after brain death](#) has decreased in the last year to 162 (20%). However, the number of transplants from [donations after circulatory death](#) has increased by 47% in the last year to 63.
- The national rates of [graft](#) survival one- and five-years after first simultaneous pancreas and kidney transplant from deceased donors are 86% and 74%, respectively. These rates vary between centres, ranging from 71% to 94% at one-year and 58% to 84% at five-years. All centre rates are [risk-adjusted](#).
- The national rates of [patient](#) survival one- and five-years after first simultaneous pancreas and kidney transplant from deceased donors are 97% and 89%, respectively. These rates vary between centres, ranging from 93% to 100% at one-year and 80% to 98% at five-years. All centre rates are [risk-adjusted](#).
- The national rates of [graft](#) survival one- and five-years after first pancreas only transplant from deceased donors are 65% and 46%, respectively. The national rates of patient survival one- and five-years are 96% and 82%. Centre specific estimates of these rates must be interpreted with caution due to the small number of transplants upon which they are based.
- The national rate of ten year [patient](#) survival from listing for deceased donor simultaneous pancreas and kidney transplant is 73%. These rates vary between centres, ranging from 66% to 84%. All centre rates are [risk-adjusted](#).
- The national survival estimate for [graft](#) survival one-year after first routine islet transplant is 81%. Reductions in annual rate of severe [hypoglycaemic](#) events, [HbA1c](#), and insulin dose have been reported at one-year post routine islet transplant.

Introduction

This report presents information on pancreas transplant activity between 1 April 2005 and 31 March 2015, for all eight centres performing pancreas transplantation in the UK. Information on islet transplant activity is presented for all seven centres performing islet transplantation, since 1 April 2008 when islet transplantation was first commissioned in the UK. Data were obtained from the UK Transplant Registry, at NHS Blood & Transplant, that holds information relating to donors, recipients and outcomes for all pancreas and islet transplants performed in the UK.

[Graft](#) and [patient](#) pancreas survival estimates are reported at one-year post-transplant for the period 1 April 2010 to 31 March 2014 and five-year post-transplant for the period 1 April 2006 to 31 March 2010.

Islet transplant survival is measured by four key variables: graft survival, and a reduction in [HbA1c](#), insulin requirements and the annual rate of severe [hypoglycaemic](#) events. Islet outcomes are reported at one-year post-transplant for the period 1 April 2008 to 31 March 2014 for the national cohort only. Islet outcomes are [unadjusted](#) for risk. Islet outcome data from the UK Transplant Registry is supplemented by data collected from the UK Islet Transplant Consortium.

Pancreas [patient](#) survival from listing is reported at one, five and ten year post registration for a deceased donor pancreas, simultaneous pancreas and kidney (SPK) or islet transplant between 1 January 2003 and 31 December 2014.

The centre specific results for survival estimates are adjusted for differences in [risk factors](#) between the centres. The risk models used are described in the Appendix.

Methods used are described in the Appendix.

Patients requiring [multi-organ transplants](#) (except simultaneous pancreas and kidney transplants (SPK)) are excluded from all analyses apart from in the introduction and all results are described separately for pancreas and islet patients other than those presented in this Introduction section. Intestinal transplants that involve a pancreas are excluded from all sections of the report.

Throughout this report West London Renal and Transplant Centre is labeled as WLRTC.

Figure 2.1 shows the number of patients on the pancreas and islet [transplant list](#) at 31 March each year between 2006 and 2015. The number of patients actively waiting for a pancreas or islet transplant increased each year from 131 in 2006 to 333 in 2010, falling to 252 in 2012 and has since remained fairly steady with 252 patients active on 31 March 2015.

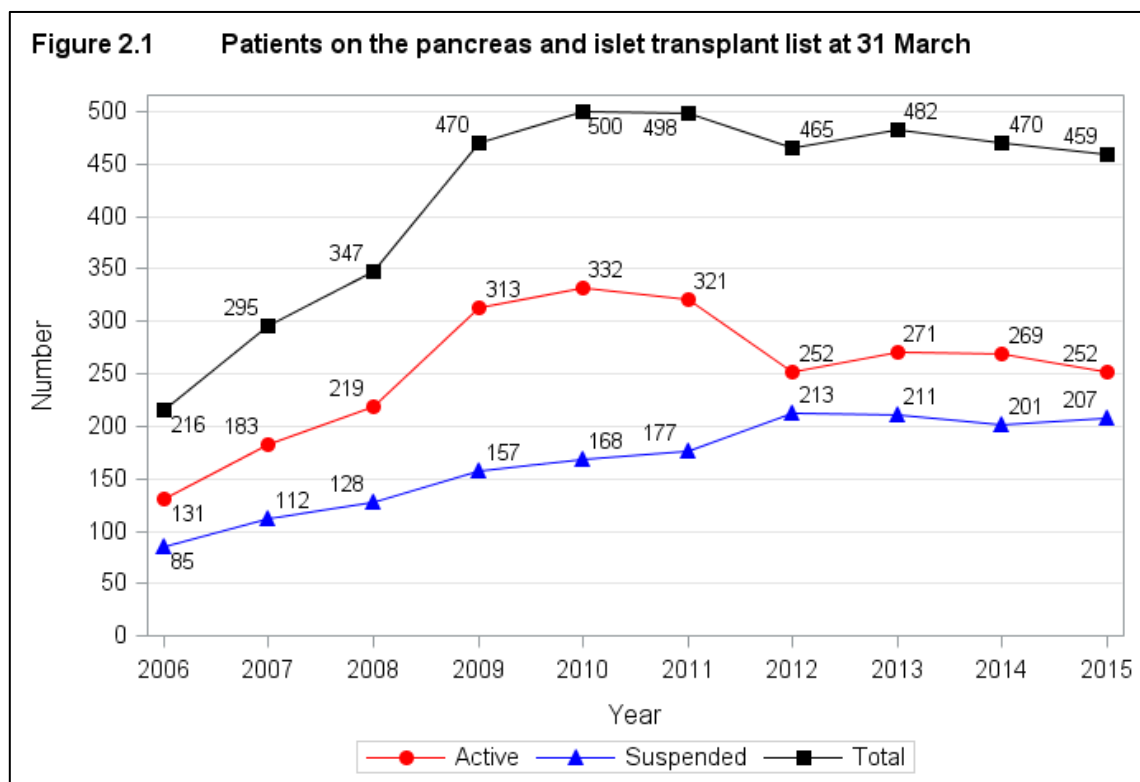


Figure 2.2 shows the number of patients on the pancreas and islet [transplant list](#) at 31 March 2015 for each transplant centre. Oxford has the largest [transplant list](#) with 78 patients registered for a pancreas or islet transplant. Of these patients, 64 are registered for a simultaneous pancreas and kidney (SPK) transplant, 10 are registered for a pancreas only transplant and four are registered for an islet transplant. Cambridge, Cardiff, Guy's and WLRTC only perform pancreas transplants while Bristol, King's College and the Royal Free only perform islet transplants.

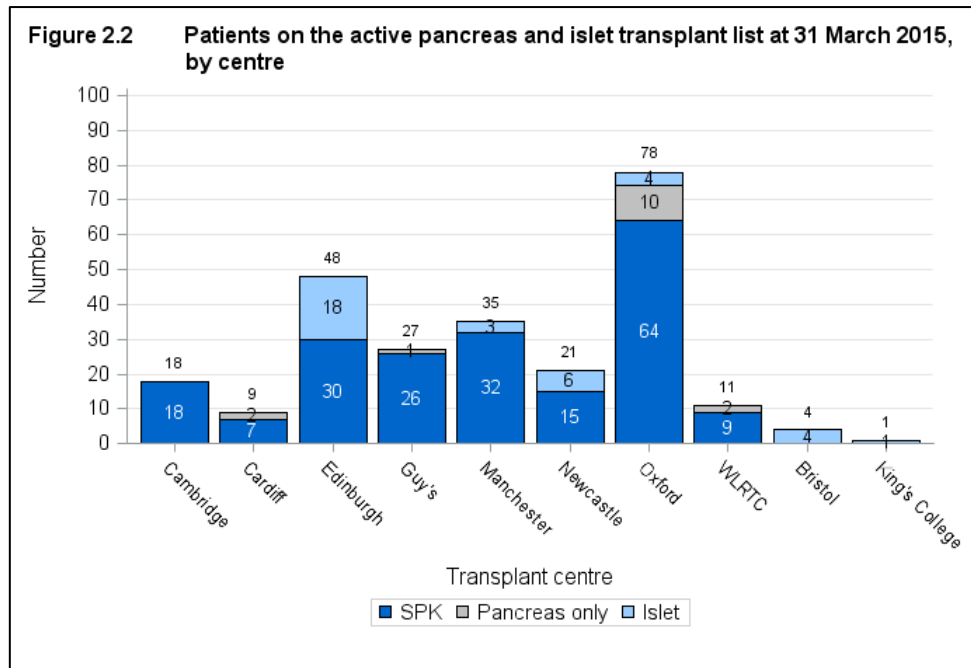


Figure 2.3 shows the total number of pancreas and islet transplants performed in the last ten years. The number of transplants doubled in the first three years from 122 in 2005/06 to 245 in 2007/08. Following consecutive falls in 2008/09 and 2009/10, transplant numbers steadily increased to 246 in 2013/14. However, the number of transplants performed in 2014/15 has decreased to 226, and in particular the number of islet transplants has decreased from 32 transplants in 2013/14 to 23 in 2014/15.

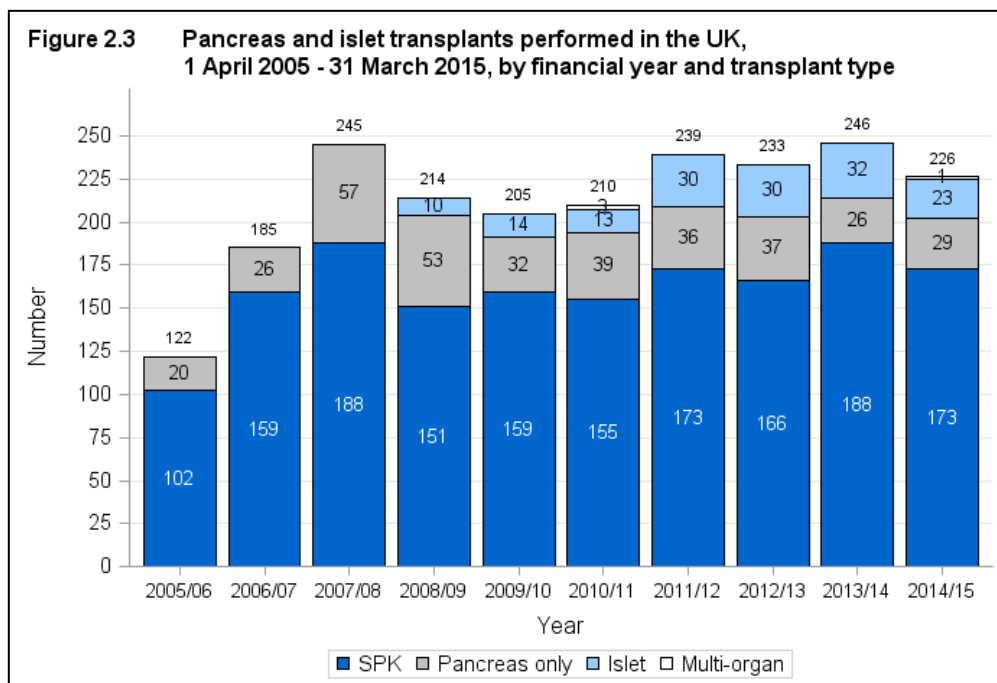


Figure 2.4 shows the total number of pancreas and islet transplants performed in 2014/15 at each transplant centre. Oxford performed the most pancreas and islet transplants last year, a total of 71 transplants. The Royal Free, an islet only transplant centre, performed four islet transplants last year, whilst Bristol performed only one islet transplant.

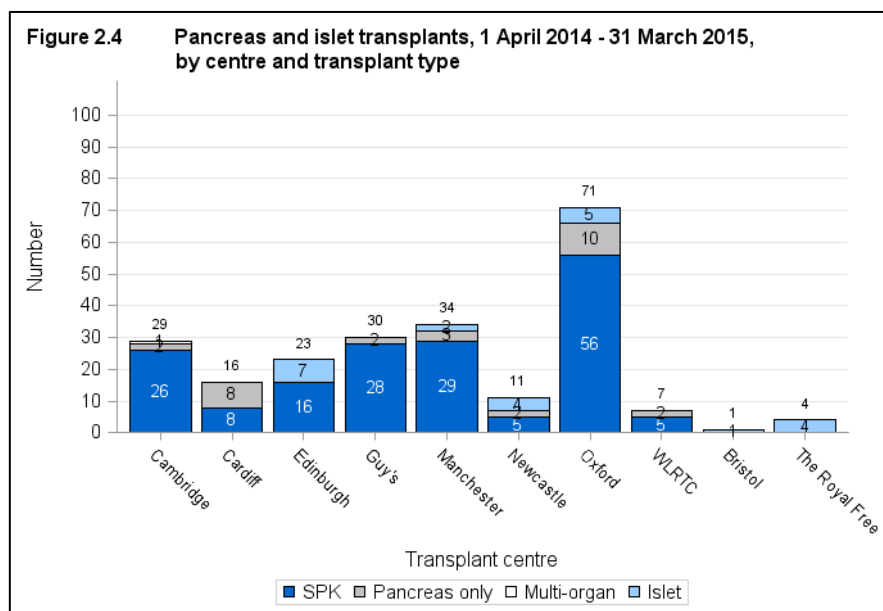
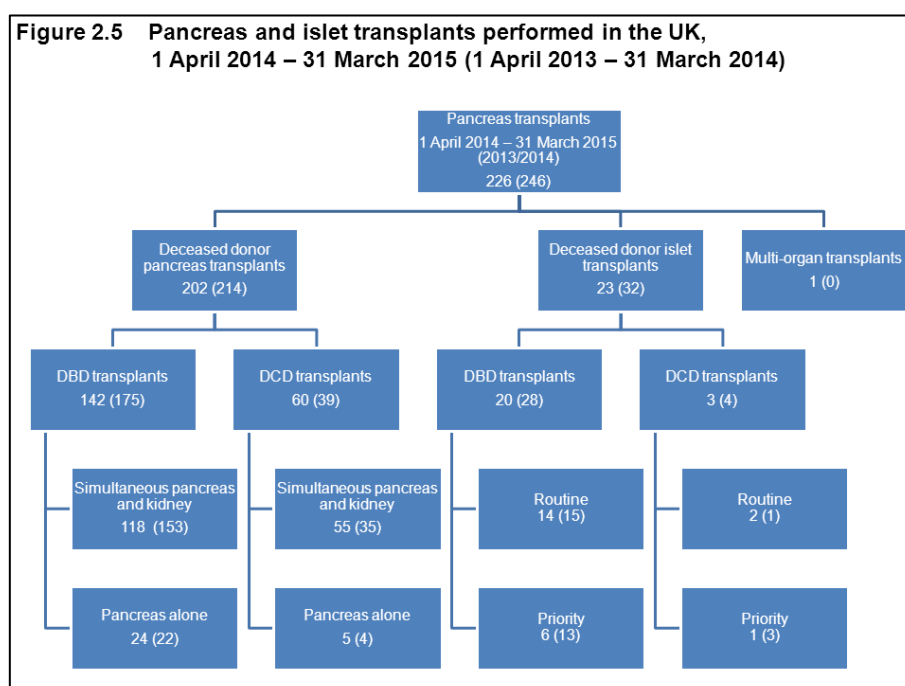


Figure 2.5 details the 226 pancreas and islet transplants performed in the UK between 1 April 2014 and 31 March 2015. Data for transplants performed in 2013/14 are also presented. Although the overall number of pancreas and islet transplants performed in 2014/15 has decreased compared with 2013/14, the number of deceased donor after circulatory death pancreas transplants has increased from 39 in 2013/14 to 60 in 2014/15. An additional liver and pancreas transplant was performed at Cambridge in 2014/15.



Pancreas transplant list

3.1 Patients on the pancreas transplant list as at 31 March, 2006 – 2015

Figure 3.1 shows the number of patients on the pancreas [transplant list](#) at 31 March each year between 2006 and 2015. The number of patients actively waiting for a pancreas transplant increased from 131 in 2006 to 316 in 2010 and then fell to 228 in 2012. Since then numbers have remained fairly consistent and 216 patients were listed for a pancreas transplant at 31 March 2015.

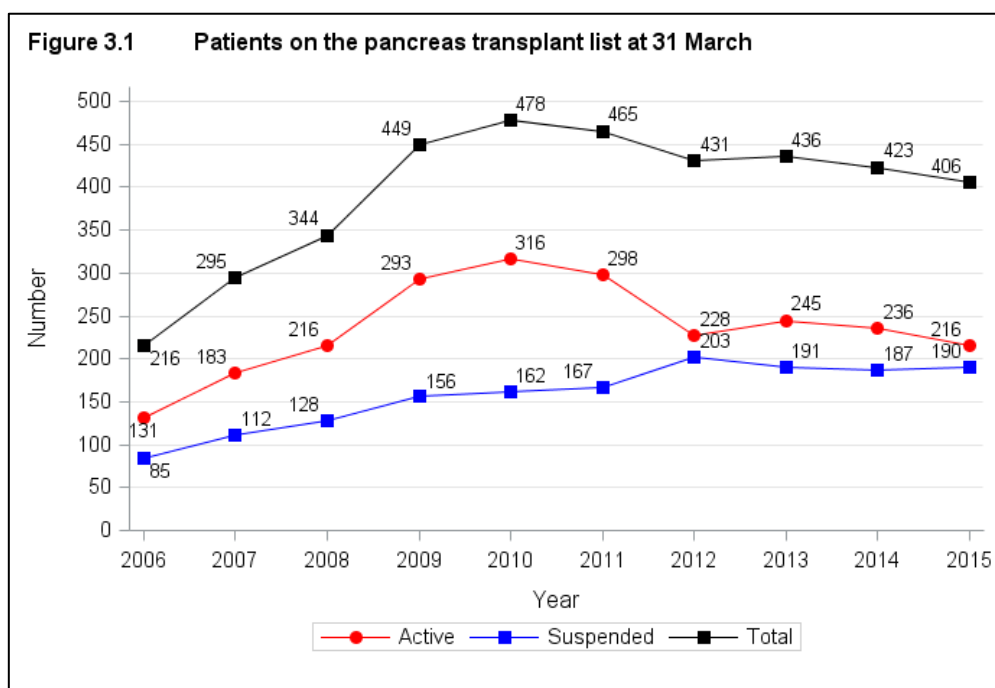


Figure 3.2 shows the number of patients on the active pancreas [transplant list](#) at 31 March 2015 by centre. Oxford had the largest proportion of the [transplant list](#) (34%) and Cardiff had the smallest proportion (4%).

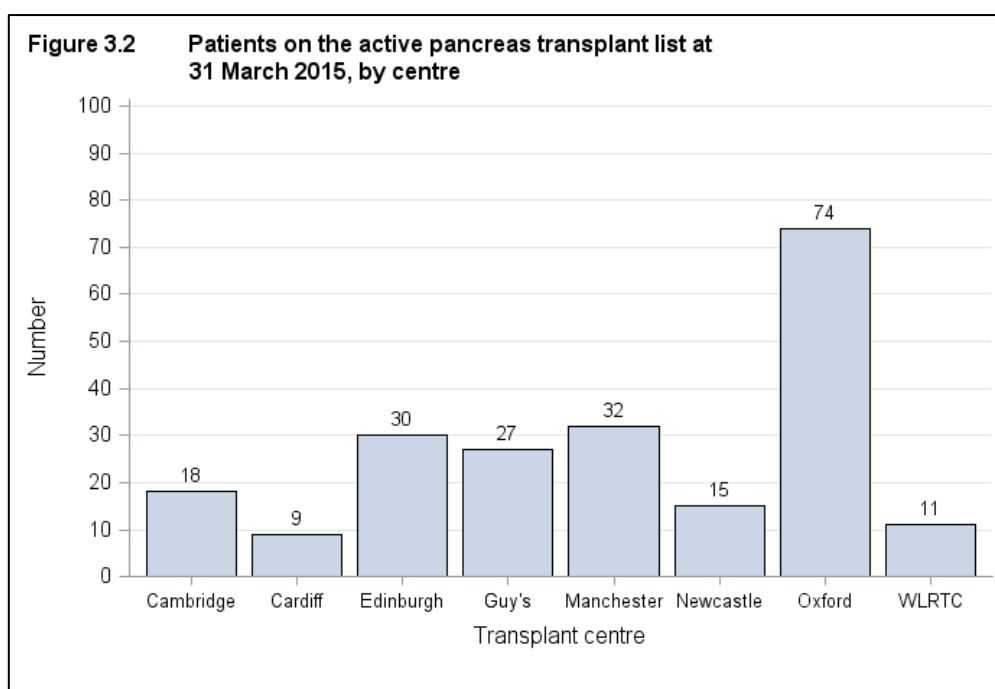
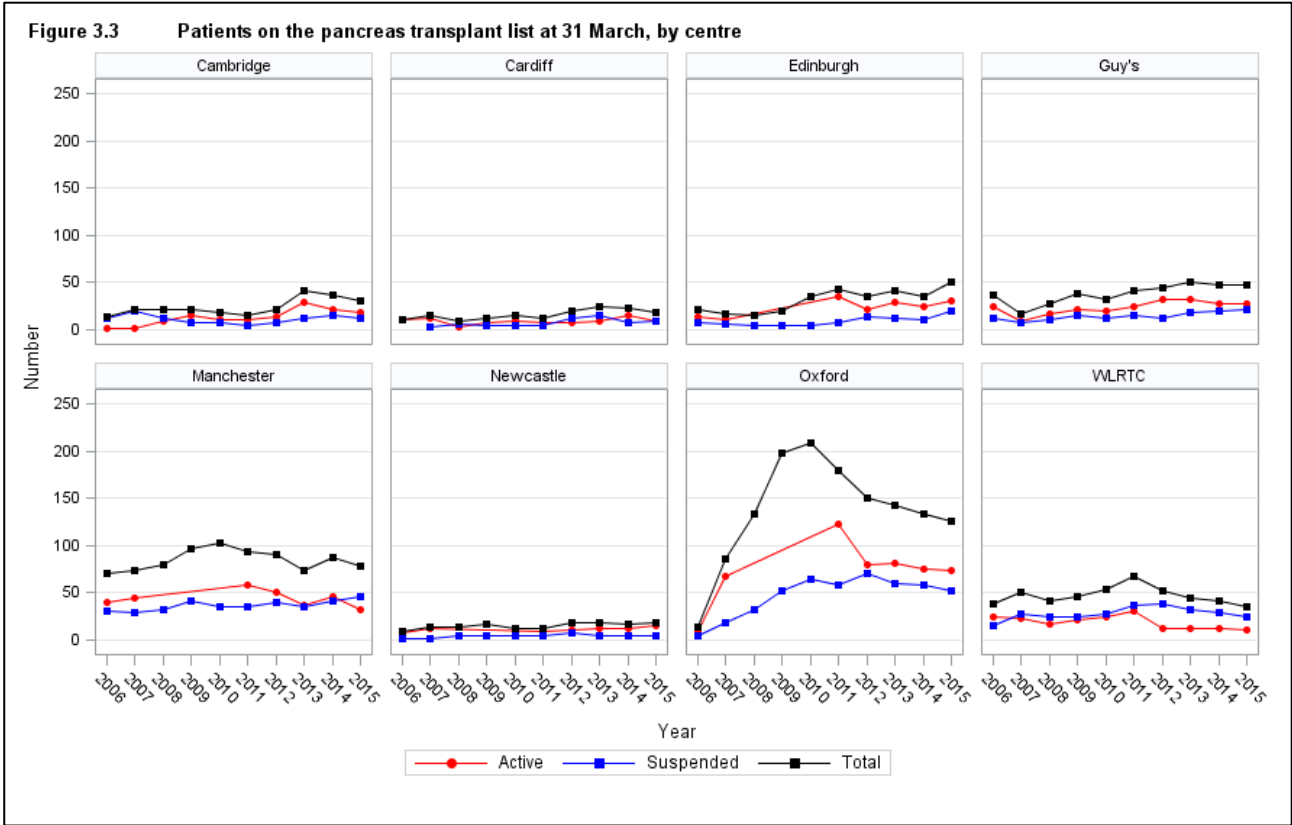


Figure 3.3 shows the number of patients on the pancreas [transplant list](#) at 31 March each year between 2006 and 2015 for each transplant centre.



3.2 Post-registration outcomes, 1 April 2011 – 31 March 2012

An indication of outcomes for patients listed for a pancreas transplant is summarised in **Figure 3.4**. This shows the proportion of patients transplanted or still waiting one and three years after joining the list. It also shows the proportion removed from the [transplant list](#) (typically because they become too unwell for transplant) and those dying while on the [transplant list](#). Only 37% of patients registered between 1 April 2011 and 31 March 2012 were transplanted within one year, while three years after listing 78% of patients have received a transplant.

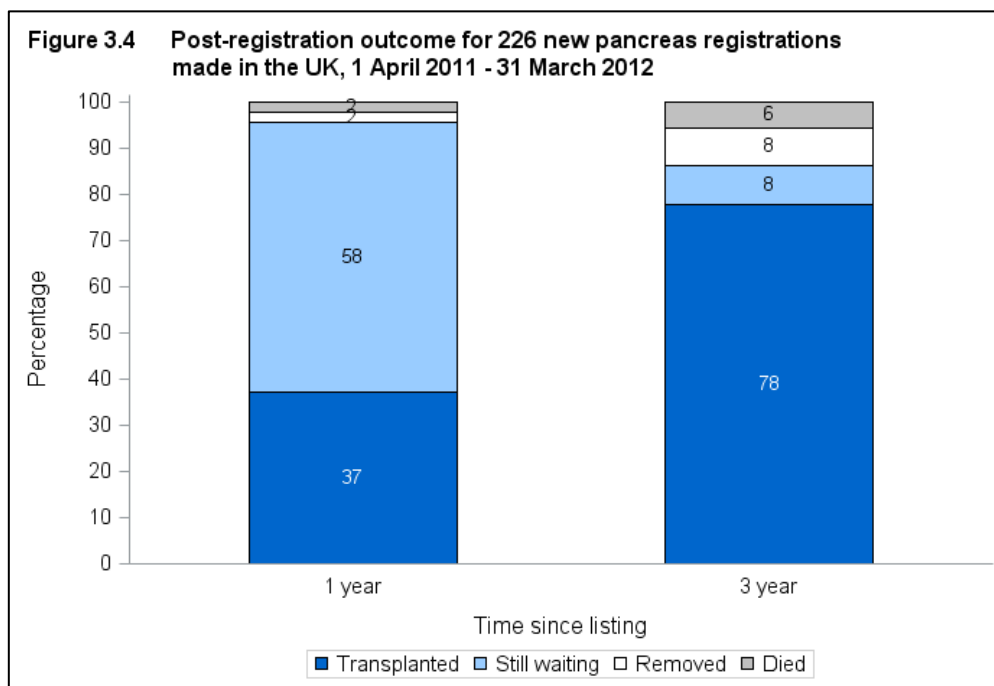
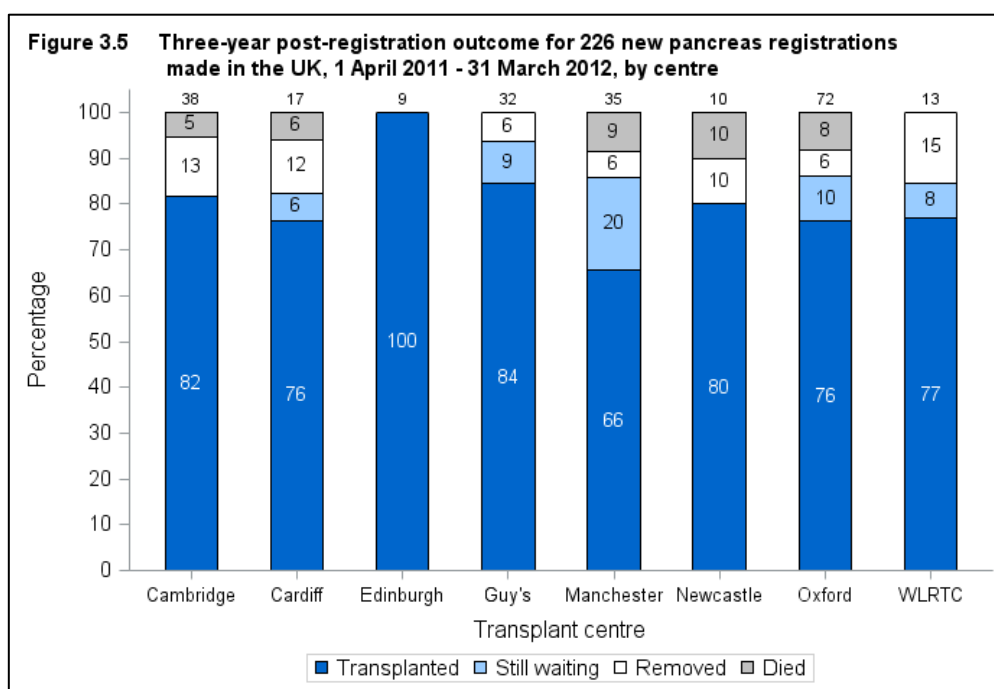


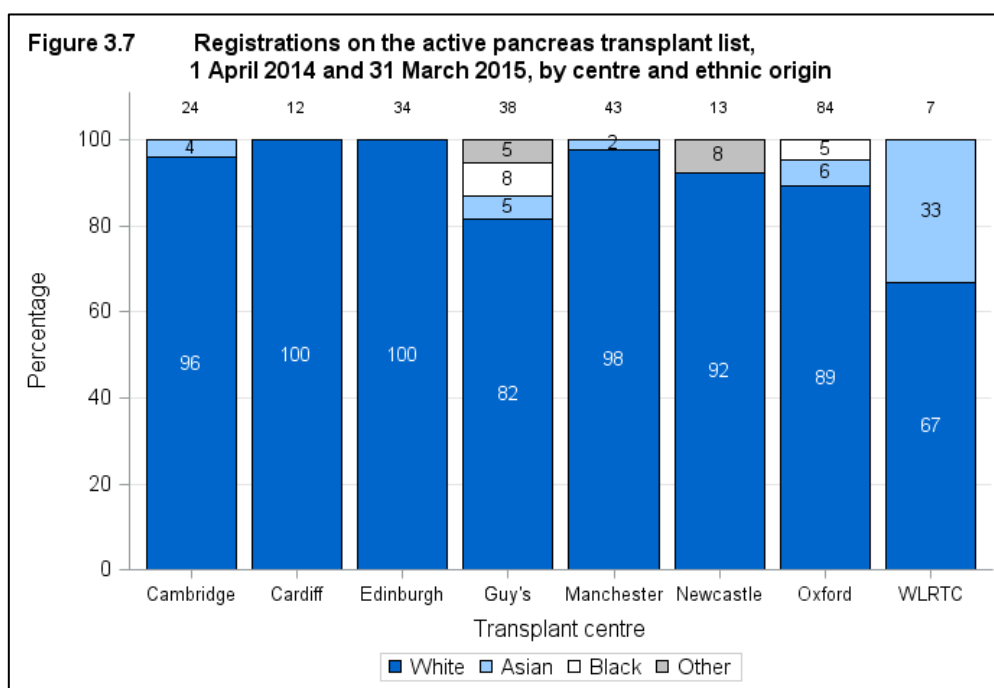
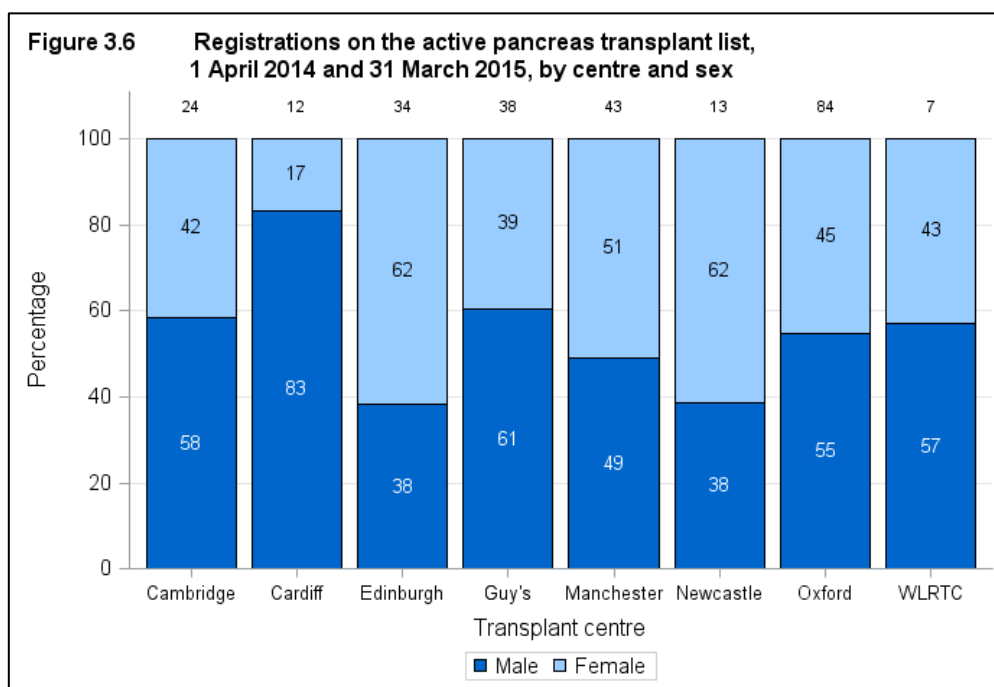
Figure 3.5 shows the proportion of patients transplanted or still waiting three years after joining the list by centre. Three years after listing, Edinburgh had transplanted 100% of their patients while Manchester transplanted 66%.

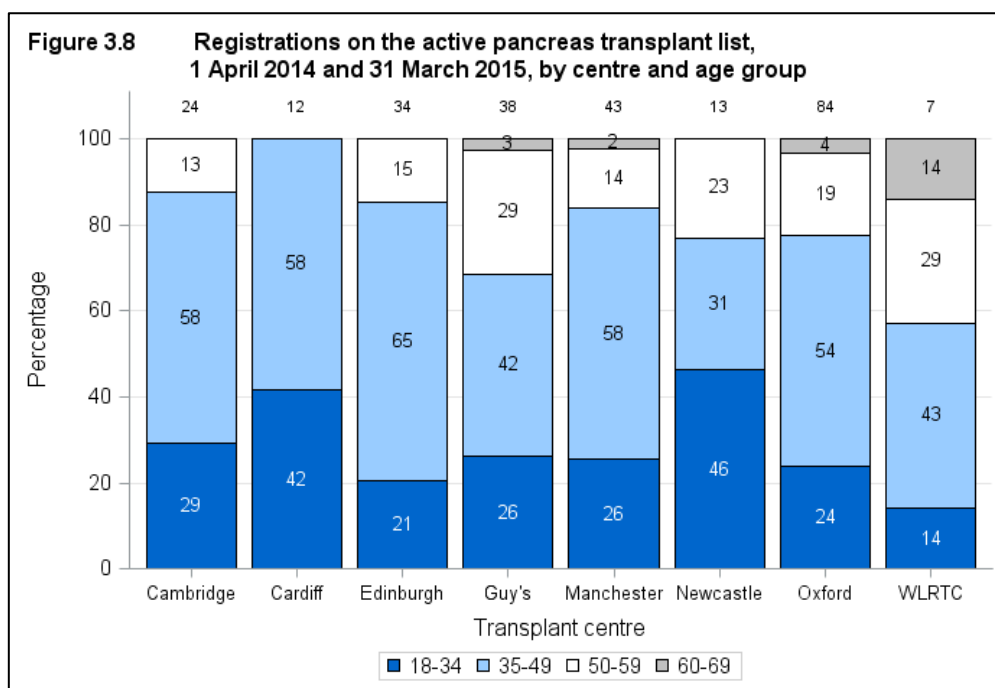


3.3 Demographic characteristics, 1 April 2014 – 31 March 2015

The sex, ethnicity and age group of patients registered on the pancreas [transplant list](#) in 2014/15 are shown by centre in **Figure 3.6**, **3.7** and **3.8**, respectively. Note that all percentages quoted are based only on data where relevant information was available. Overall, 93% of patients registered on the pancreas transplant list were on the simultaneous kidney/pancreas transplant list, 47% were female, 91% were white and the median age was 42 years.

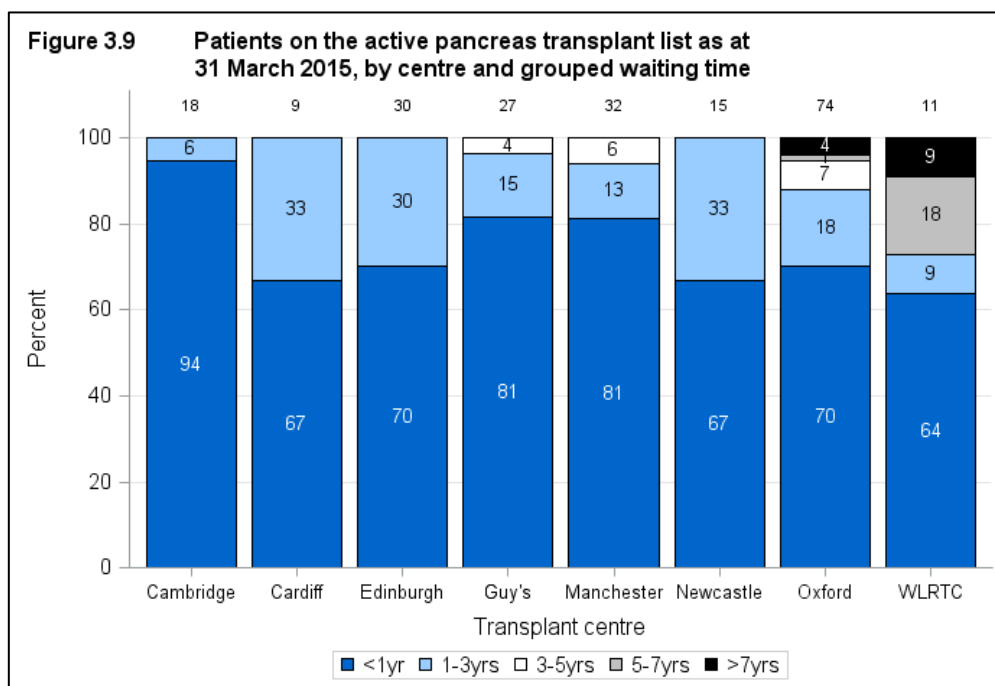
Of the patients on the pancreas only transplant list, 50% were female, all were white and the median age was 47 years.





3.4 Patient waiting times for those currently on the list, 31 March 2015

Figure 3.9 shows the length of time patients have been waiting on the pancreas [transplant list](#) at 31 March 2015 by centre. The majority of patients currently listed have been waiting less than one year and all patients at Cambridge, Cardiff, Edinburgh and Newcastle have been waiting less than three years. Three patients at Oxford (two simultaneous kidney/pancreas patients and one pancreas only patient) and one pancreas only patient at WLRTC have been waiting more than 7 years for transplant; all four patients are highly sensitised with a [cRF](#) of 99% or more.



3.5 Median waiting time to transplant, 1 April 2009 - 31 March 2012

The length of time a patient waits for a pancreas transplant varies across the UK. The [median](#) waiting time for deceased donor pancreas transplantation is shown in **Figure 3.10** and **Table 3.1** for patients registered at each individual unit.

The [median](#) waiting time to transplant for patients registered on the pancreas [transplant list](#) between 1 April 2009 and 31 March 2012 is 404 days, just over 13 months. This ranged from 125 days at Cambridge to 607 days at Edinburgh.

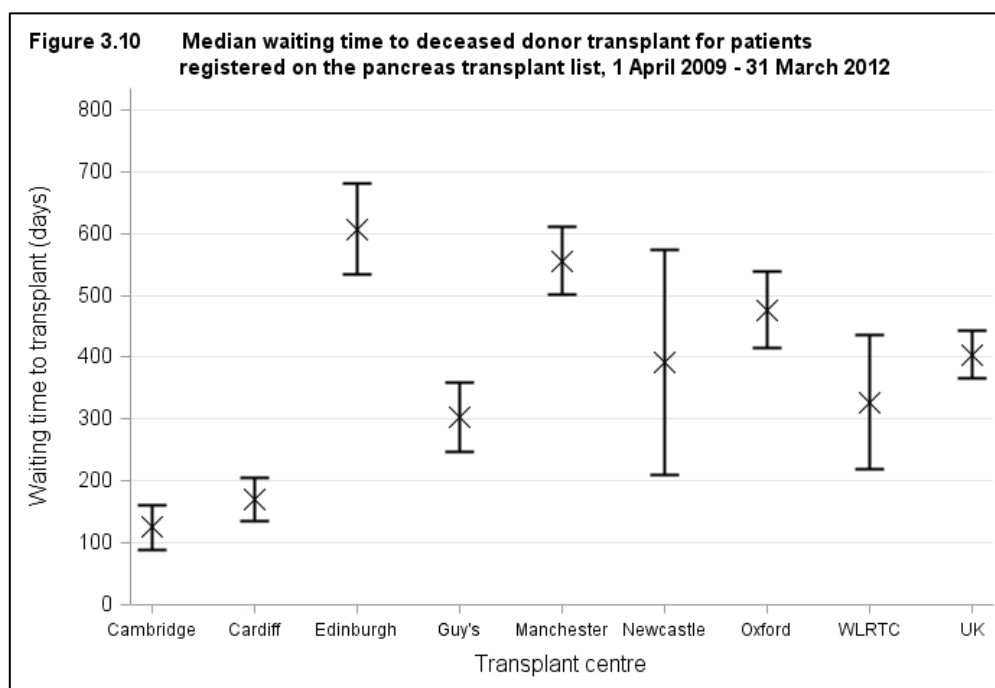


Table 3.1 Median waiting time to pancreas transplant in the UK, for patients registered 1 April 2009 - 31 March 2012

Transplant centre	Number of patients registered	Waiting time (days)	
		Median	95% Confidence interval
Cambridge	76	125	88 - 162
Cardiff	42	170	135 - 205
Edinburgh	53	607	533 - 681
Guy's	85	303	247 - 359
Manchester	107	556	501 - 611
Newcastle	30	392	211 - 573
Oxford	266	476	414 - 538
WLRTC	63	327	219 - 435
UK	722	404	366 - 442

Response to pancreas offers

4.1 Offer decline rates, 1 April 2012 – 31 March 2015

Pancreas offers from [DBD](#) donors whose pancreas was retrieved, offered directly on behalf of a named individual patient and resulted in transplantation are included in the analysis. Any offers of pancreases declined for transplantation, pancreases offered for [multi-organ](#) or small bowel transplant or [DCD](#) offers were excluded, as were offers made through the fast track scheme or the reallocation of the pancreas.

[Funnel plots](#) are used to compare centre specific offer decline rates and indicate how consistent the rates of the individual transplant centres are with the national rate. Patient [case mix](#) is known to influence the number of offers a centre may receive. In this analysis however only individual offers for named patients were considered which excluded any [ABO](#)- and [HLA](#)-incompatible patients. For this reason it was decided not to risk adjust for known centre differences in patient [case mix](#).

Figure 4.1 compares individual centre offer decline rates with the national rate over the time period, 1 April 2012 and 31 March 2015. Centres can be identified by the information shown in **Table 4.1**. Guy's had offer decline rates better than the national rate, whilst Edinburgh had higher rates than the national average.

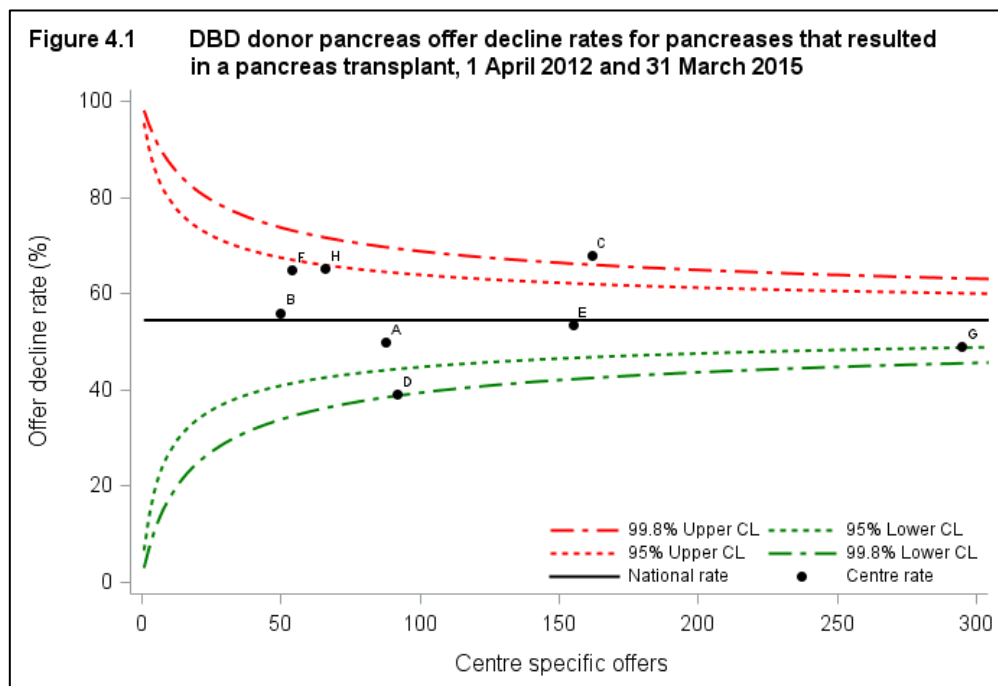


Table 4.1 compares individual centre offer decline rates over time by financial year. The offer decline rate for Edinburgh was 70% in both 2013/14 and 2014/15, significantly higher than the national rate.

Table 4.1 DBD donor pancreas offer decline rates by transplant centre, 1 April 2012 and 31 March 2015									
Centre	Code	2012/13		2013/14		2014/15		Overall	
		N	(%)	N	(%)	N	(%)	N	(%)
Cambridge	A	15	(40)	35	(43)	38	(61)	88	(50)
Cardiff	B	12	(33)	14	(50)	24	(71)	50	(56)
Edinburgh	C	53	(64)	66	(70)	43	(70)	162	(68)
Guy's	D	27	(41)	36	(36)	29	(41)	92	(39)
Manchester	E	60	(52)	52	(58)	43	(51)	155	(54)
Newcastle	F	10	(60)	23	(65)	21	(67)	54	(65)
Oxford	G	115	(56)	99	(42)	81	(47)	295	(49)
WLRTC	H	32	(63)	11	(64)	23	(70)	66	(65)
UK		324	(54)	336	(52)	302	(57)	962	(54)

4.2 Reallocation of DBD pancreas, 1 April 2012 – 31 March 2015

Since 1 December 2010 all pancreases from donation after brain death ([DBD](#)) donors have been allocated through the national Pancreas Allocation Scheme ([PAS](#)). On occasion however the pancreas is accepted and dispatched to a named patient but is subsequently declined. In this situation, the centre in receipt of the pancreas can reallocate the organ to a locally listed patient of their choice, based on an individual centre matching run, in order to minimise cold ischaemia time ([CIT](#)).

Centre specific reallocation rates are presented as a proportion of the transplants performed. [Funnel plots](#) are used to compare centre specific reallocation rates and indicate how consistent the rates of the individual transplant centres are with the national rate.

Figure 4.2 compares individual centre reallocation rates with the national rate over the time period, 1 April 2012 and 31 March 2015. Centres can be identified by the information shown in **Table 4.2**. All centres apart from Oxford had reallocation rates which are lower than the national rate.

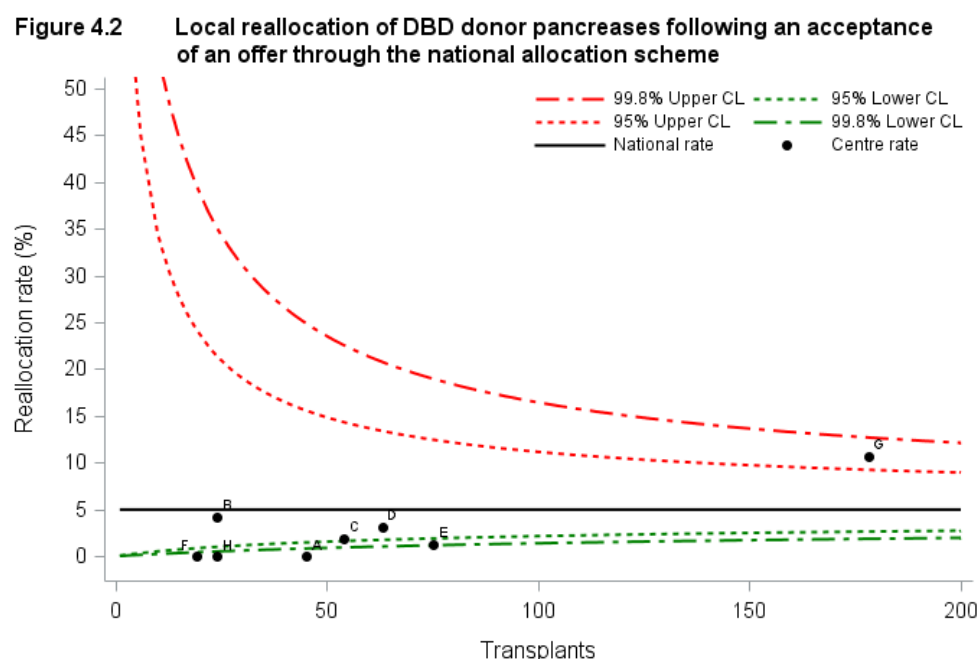


Table 4.2 compares individual centre reallocation rates over time by financial year. Overall pancreas reallocation rates have fallen from 8% in 2012/13 to 4% in 2014/15. Pancreases accepted and dispatched to Cambridge, Newcastle and WLRTC were not reallocated within the time period. In addition to these centres, Edinburgh and Manchester did not reallocate any pancreases in 2014/15. Oxford's rate has decreased from 18% in 2012/13 which was considerably higher than the national rate to 8% in 2014/15.

Centre	Code	2012/13		2013/14		2014/15		Overall	
		N	(%)	N	(%)	N	(%)	N	(%)
Cambridge	A	9	(0)	20	(0)	16	(0)	45	(0)
Cardiff	B	8	(0)	8	(0)	8	(13)	24	(4)
Edinburgh	C	19	(0)	21	(5)	14	(0)	54	(2)
Guy's	D	18	(6)	26	(0)	19	(5)	63	(3)
Manchester	E	30	(3)	24	(0)	21	(0)	75	(1)
Newcastle	F	4	(0)	8	(0)	7	(0)	19	(0)
Oxford	G	65	(18)	63	(5)	50	(8)	178	(11)
WLRTC	H	12	(0)	5	(0)	7	(0)	24	(0)
UK		165	(8)	175	(2)	142	(4)	482	(5)

4.3 Reallocation of DCD pancreas, 1 April 2012 – 31 March 2015

Similar to pancreases from [DBD](#) donors, all pancreases from donation after circulatory death ([DCD](#)) donors have been allocated through the national Pancreas Allocation Scheme ([PAS](#)) since 1 December 2010. **Table 4.3** compares individual centre reallocation rates over time by financial year. Pancreases accepted and dispatched to all centres apart from Guys and Manchester in 2014/15 were not reallocated within the time period. Manchester re-allocated two (18%) of the 11 pancreases accepted and dispatched to them in 2014/15, whilst Guys re-allocated one pancreas.

Table 4.3 Local reallocation of DCD donor pancreases following acceptance of an offer through the national allocation scheme								
Centre	2012/13		2013/14		2014/15		Overall	
	N	(%)	N	(%)	N	(%)	N	(%)
Cambridge	0	-	7	(0)	12	(0)	19	(0)
Cardiff	8	(0)	4	(0)	8	(0)	20	(0)
Edinburgh	1	(0)	0	-	2	(0)	3	(0)
Guy's	13	(0)	9	(0)	11	(9)	33	(3)
Manchester	3	(0)	7	(0)	11	(18)	21	(10)
Newcastle	0	-	1	(0)	0	-	1	(0)
Oxford	10	(0)	11	(0)	16	(0)	37	(0)
WLRTC	3	(0)	0	-	0	-	3	(0)
UK	38	(0)	39	(0)	60	(5)	137	(2)

Pancreas transplants

5.1 Pancreas transplants, 1 April 2005 – 31 March 2015

Figure 5.1 shows the total number of pancreas transplants performed in the last ten years, by type of donor. The first [DCD](#) pancreas transplant was performed in 2005/06 and by 2007/08 there were 36 [DCD](#) transplants (15%). This number remained between 30 and 40 transplants per year (16% - 19%) with the exception of 2011/12 when there were 48 [DCD](#) transplants performed (23%). The number of [DCD](#) transplants performed in 2014/15 has increased by 54% compared with 2013/14.

[DBD](#) pancreas transplant numbers increased by 73% in the first three years to 209 in 2007/08. After a fall in 2008/09 and 2009/10, [DBD](#) numbers steadily increased between 2010/11 and 2013/14. However, the number of [DBD](#) transplants has decreased in 2014/15 to 142 transplants.

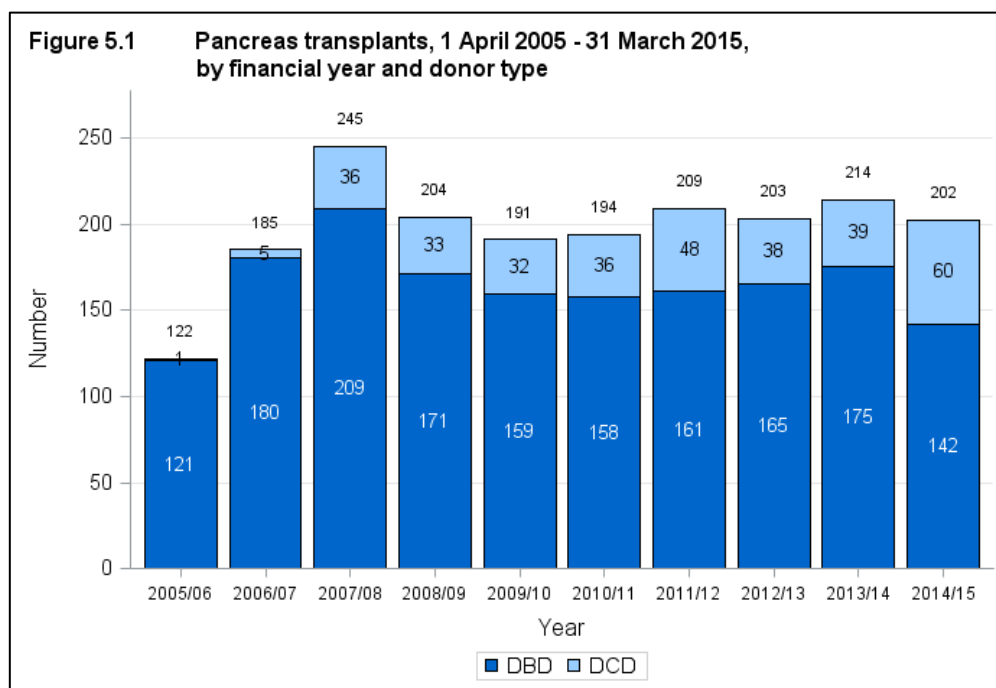


Figure 5.2 shows the total number of pancreas transplants performed in 2014/15, by centre and type of donor. The same information is presented in **Figure 5.3** but this shows the proportion of [DBD](#) and [DCD](#) transplants performed at each centre. Oxford performed the most [DBD](#) and [DCD](#) transplants. There were no [DCD](#) transplants performed at Newcastle and WLRTC in the last financial year. Cardiff had the largest proportion of [DCD](#) transplants (50%). Of the transplants performed last year at Cambridge and Guy's, 43% and 37%, respectively, were from [DCD](#) donors.

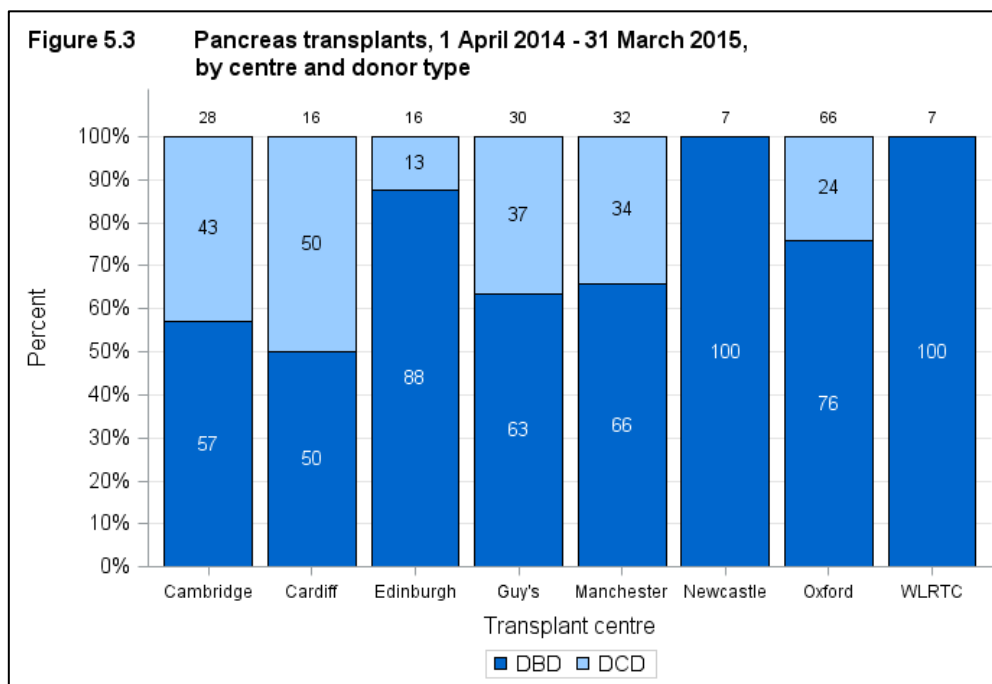
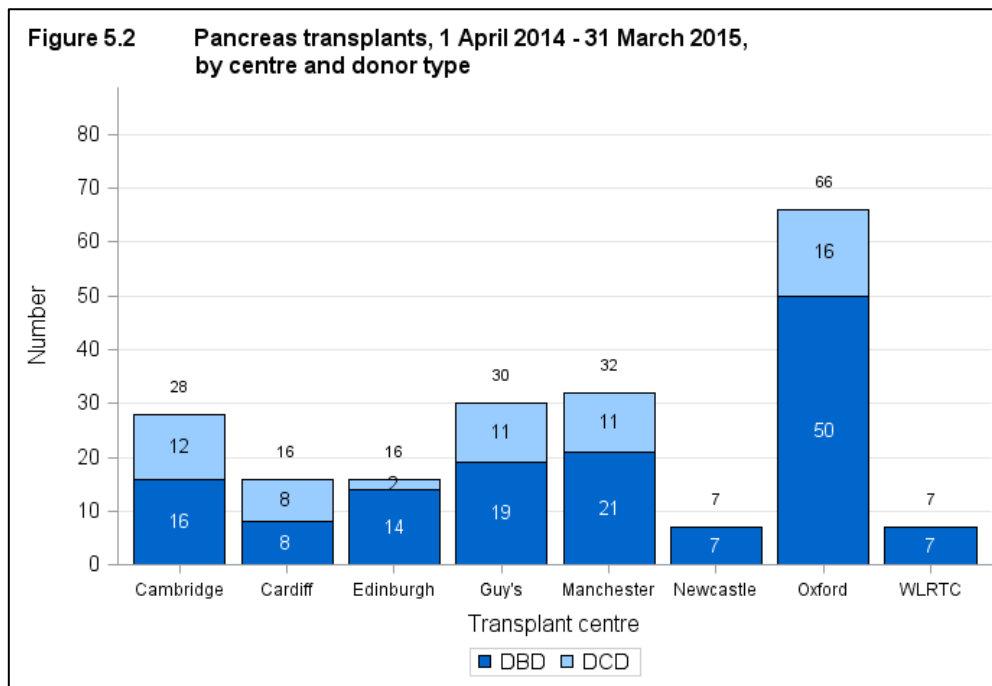
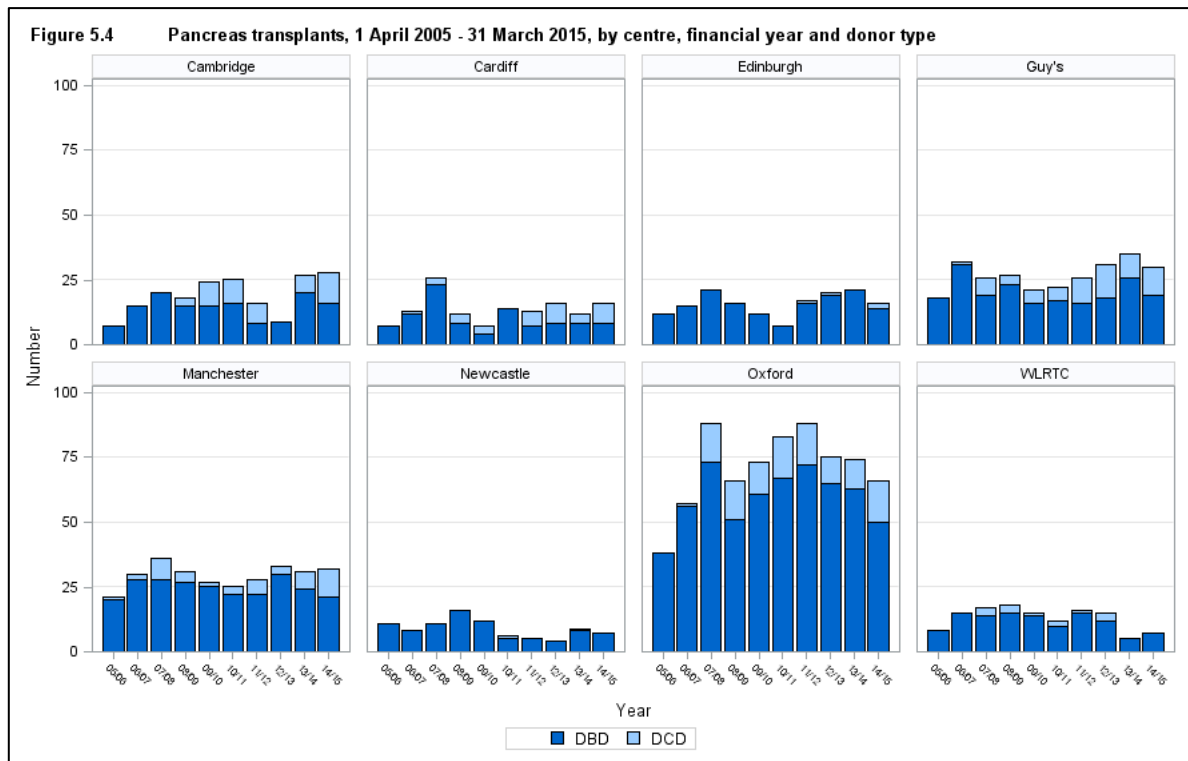


Figure 5.4 shows the total number of pancreas transplants performed in last ten years, by centre and type of donor. Oxford have consistently performed a large number of pancreas transplants since 2006/07 including a number of [DCD](#) transplants over the last seven years. However, the number of transplants performed at Oxford has decreased by 25% since 2011/12.



5.2 Cold ischaemia time, 1 April 2005 – 31 March 2015

[Median](#) cold ischaemia times ([CIT](#)) are shown in addition to [inter-quartile](#) ranges in **Figures 5.5 to 5.10**. Fifty percent of the transplants have a [CIT](#) within the [inter-quartile](#) range (indicated by a box). Where there is only one observation to report, the single data point is represented by a dash as per the [median](#) for multiple observations. There is some variation in average ([median](#)) [CIT](#) between different transplant centres although all centres continually try to reduce this time.

Figure 5.5 shows the median total ischaemia time in DBD donor pancreas transplants over the last 10 years. The overall median cold ischaemia time has been slowly falling over the last 10 years from 13 hours in 2005/06 to 10 hours in 2014/15.

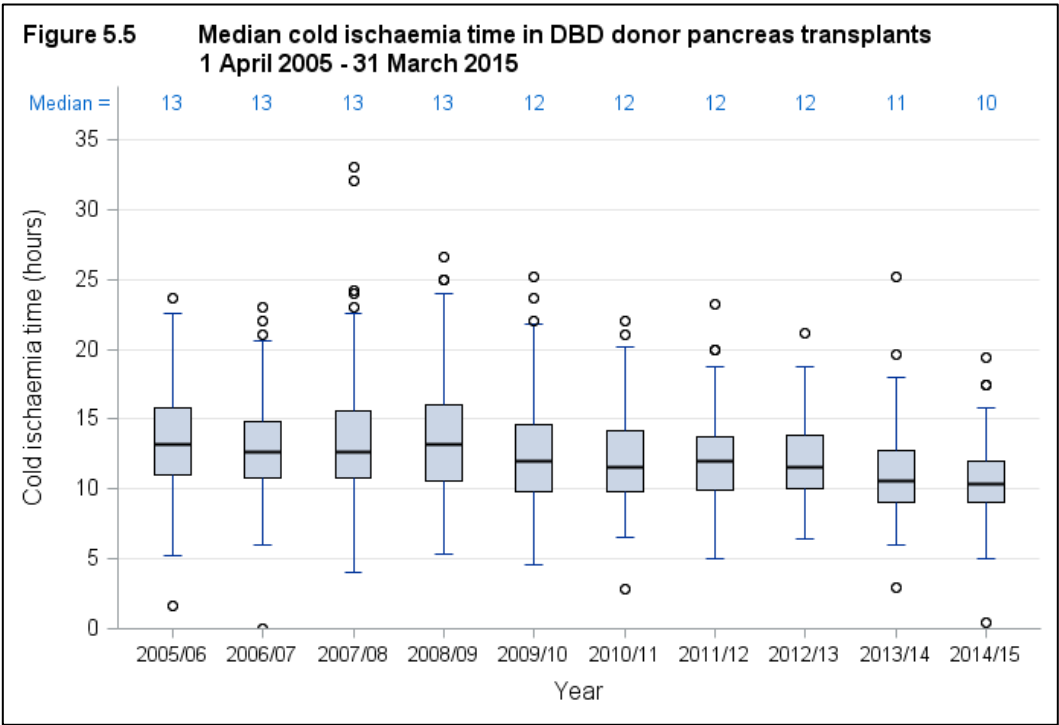


Figure 5.6 shows the median total ischaemia time in DBD donor pancreas transplants in 2014/15 for each transplant centre. WLRTC had the longest median cold ischaemia time in 2014/15 of 14 hours compared with Manchester and Newcastle who had the shortest, 9 hours.

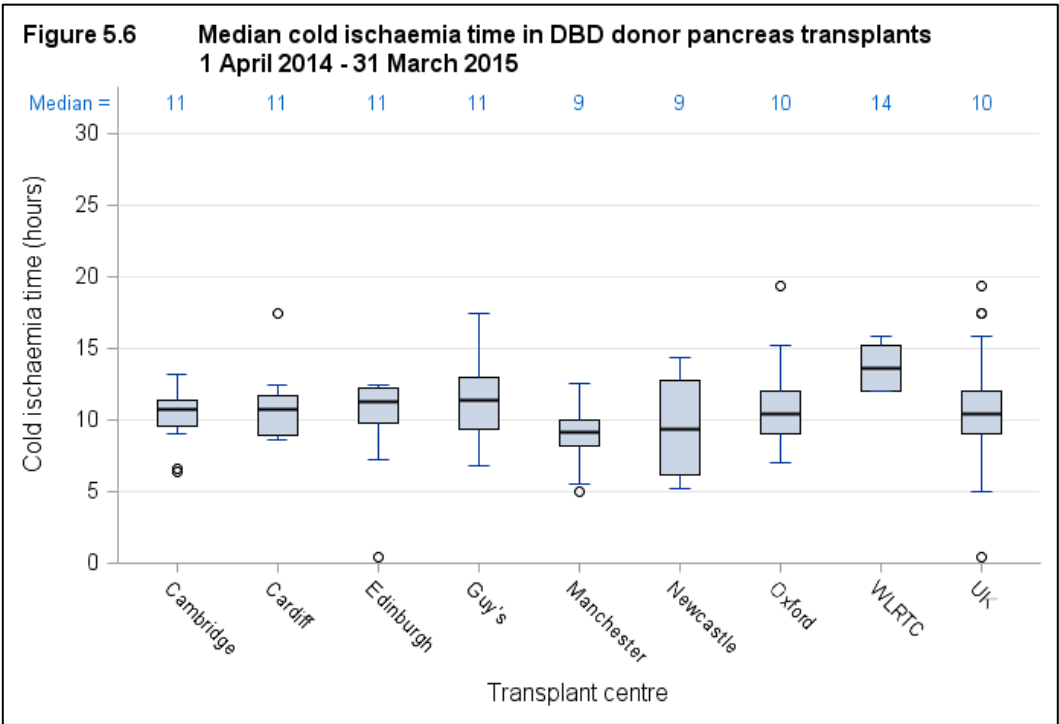


Figure 5.7 shows the [median](#) total ischaemia time in [DBD](#) donor pancreas transplants over the last ten years for each transplant centre.

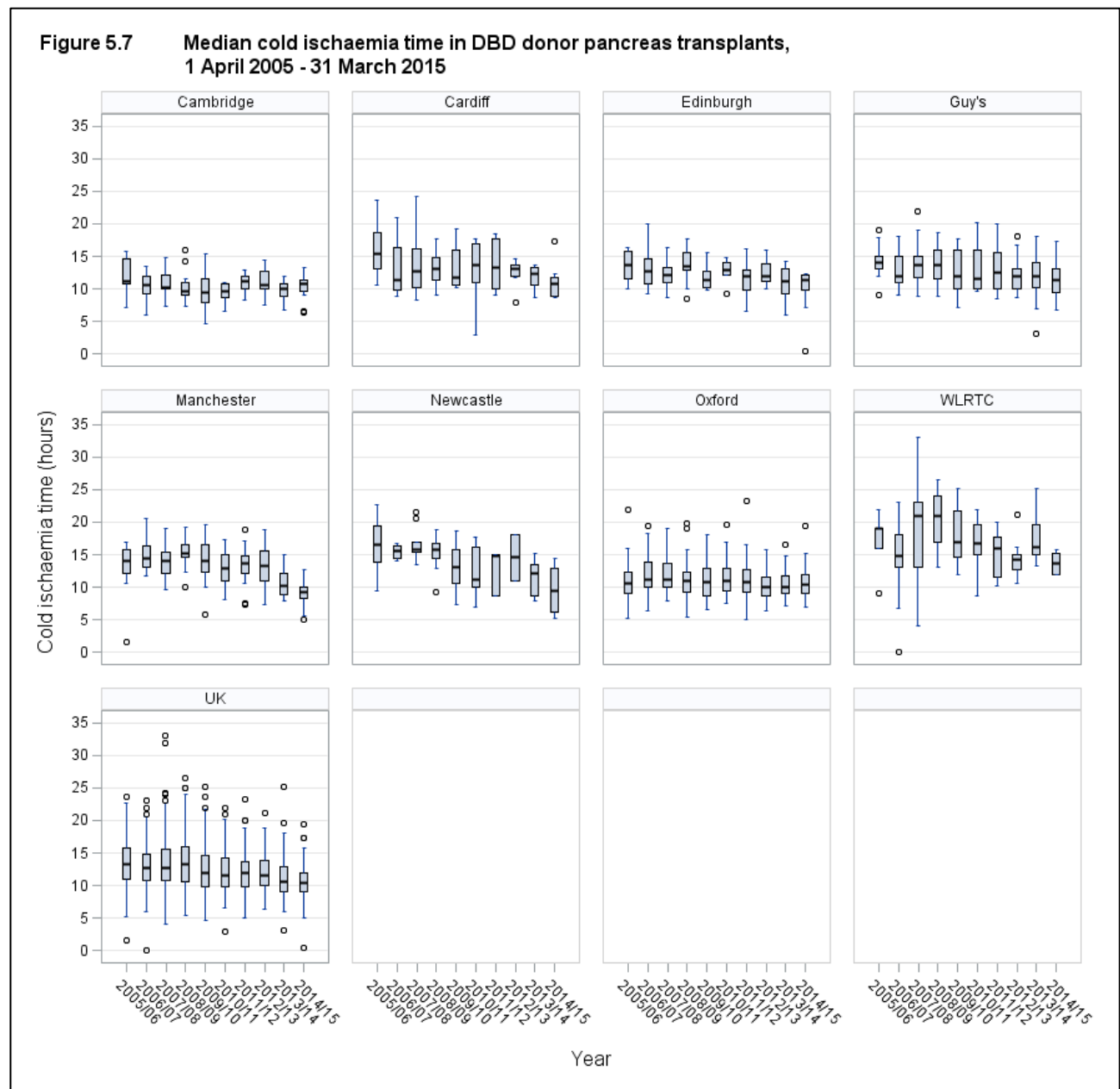


Figure 5.8 shows the [median](#) total ischaemia time in [DCD](#) donor pancreas transplants over the last ten years since the first [DCD](#) pancreas transplant. Overall [median](#) cold ischaemia time has fallen from 15 hours in 2007/08 to 10 hours in 2014/15.

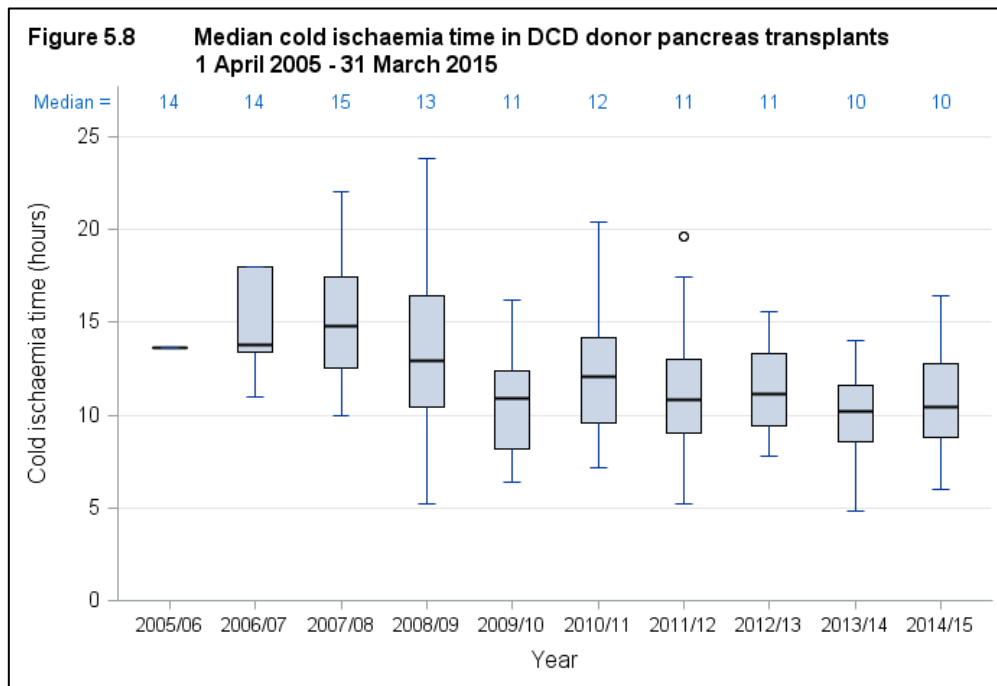


Figure 5.9 shows the [median](#) total ischaemia time in [DCD](#) donor pancreas transplants in 2014/15 for each transplant centre. Manchester had the shortest [median](#) cold ischaemia time of 9 hours, whilst Oxford had the longest [median](#) ischaemia time of 12 hours.

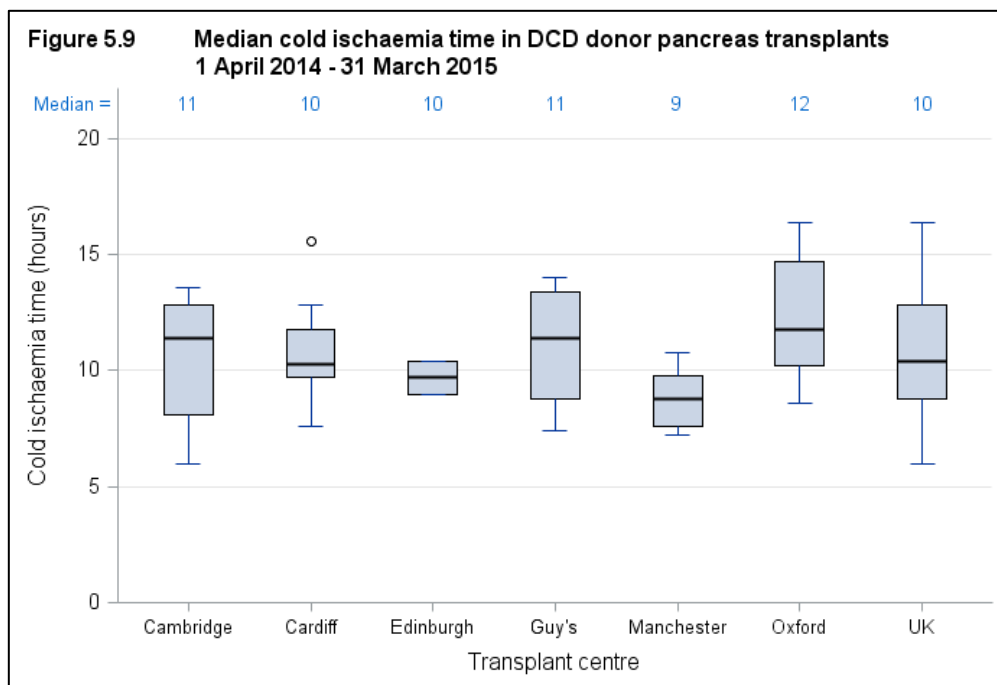
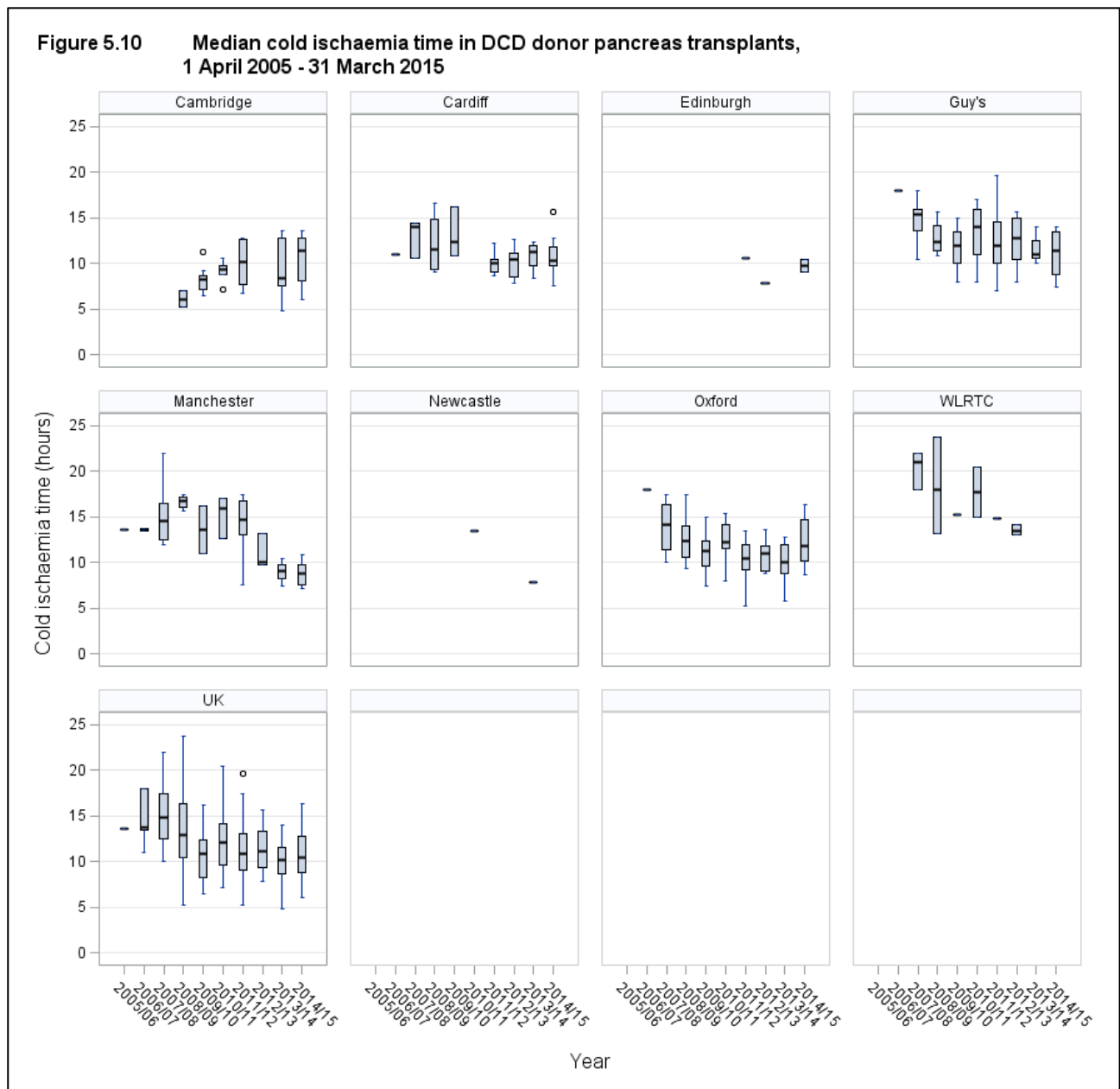


Figure 5.10 shows the [median](#) total ischaemia time in [DCD](#) donor pancreas transplants for each transplant centre over the last ten years since the first [DCD](#) pancreas transplant. Cold ischaemia time was reported for all four of the [DCD](#) transplants performed in Edinburgh and both [DCD](#) transplants performed in Newcastle.



Pancreas outcomes

6.1 Deceased donor graft and patient survival for first SPK transplant

[Funnel plots](#) are used to compare centre specific [risk-adjusted patient](#) and [graft](#) survival rates and indicate how consistent these rates are with the national survival rates. Note that some patients return to local renal units for follow-up care after their transplant and although we report survival according to transplant unit, patients may in fact be followed up quite distantly from their transplant centre. 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 centre 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 centre.

Figures 6.1 and **6.2** compare individual centre survival estimates with the national rates for one-year [patient](#) and [graft](#) survival for deceased donor first simultaneous pancreas and kidney (SPK) transplants. **Figures 6.3** and **6.4** compare five-year survival estimates. The [funnel plots](#) show that, for the most part, the centres lie within the [confidence limits](#). Some of the [funnel plots](#) show some centres to be above the upper 99.8% [confidence limit](#). This suggests that these centres may have survival rates that are considerably higher than the national rate. **Figures 6.3** shows one centre outside the lower 95% [confidence limit](#), indicating that this centre may have a significantly lower five-year [patient](#) survival rate than the national rate. Similarly, **Figure 6.4** shows that one centre may have a significantly lower five year [graft](#) survival rate compared with the national rate. Centres can be identified by the information shown in **Tables 6.1** and **6.2**.

Figure 6.1 Risk-adjusted one year patient survival rates for deceased donor first SPK transplants, between 1 April 2010 and 31 March 2014

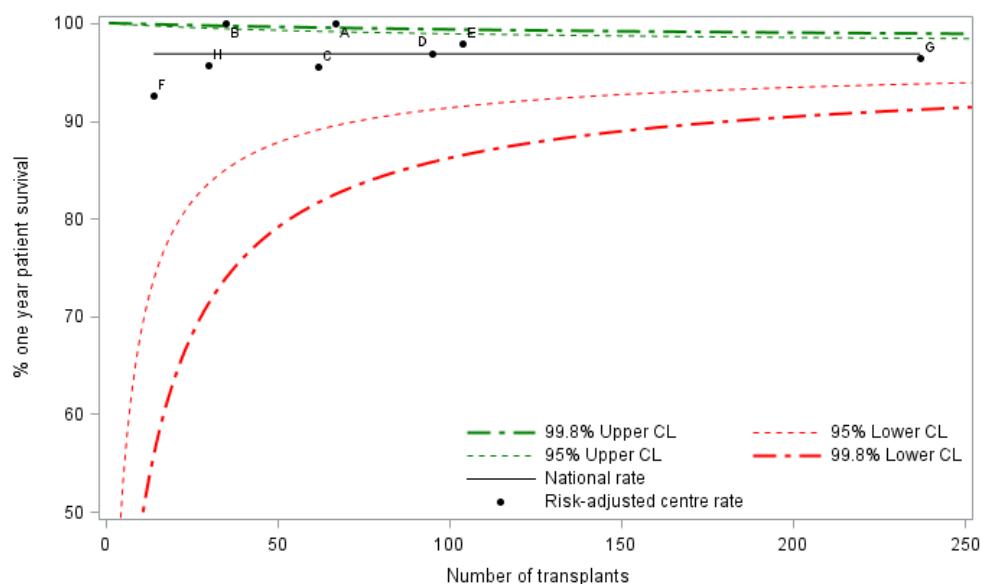


Figure 6.2 Risk-adjusted one year pancreas graft (death censored) survival rates for all deceased donor first SPK transplants, between 1 April 2010 and 31 March 2014

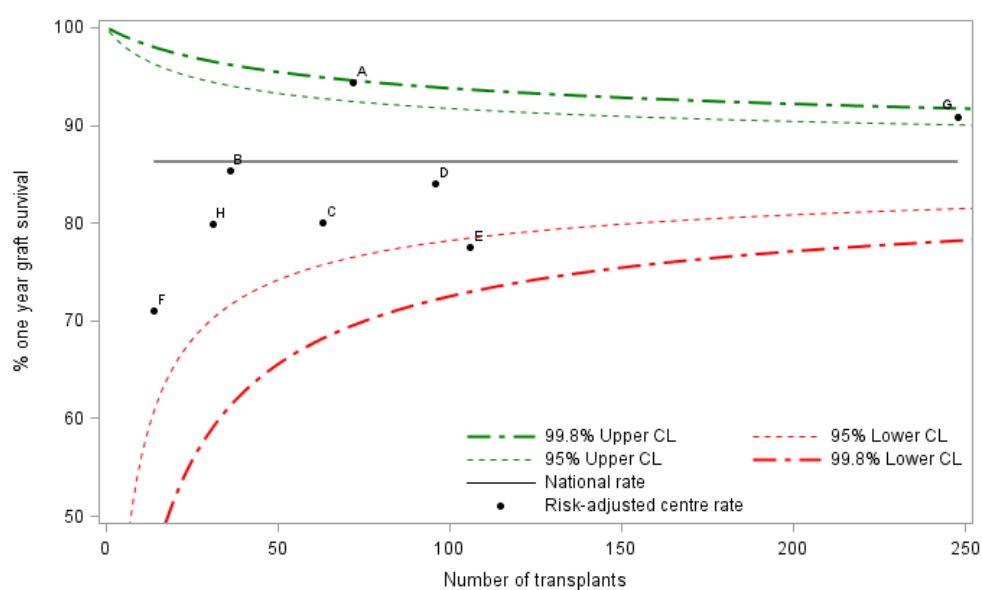


Figure 6.3 Risk-adjusted five year patient survival rates for deceased donor first SPK transplants, between 1 April 2006 and 31 March 2010

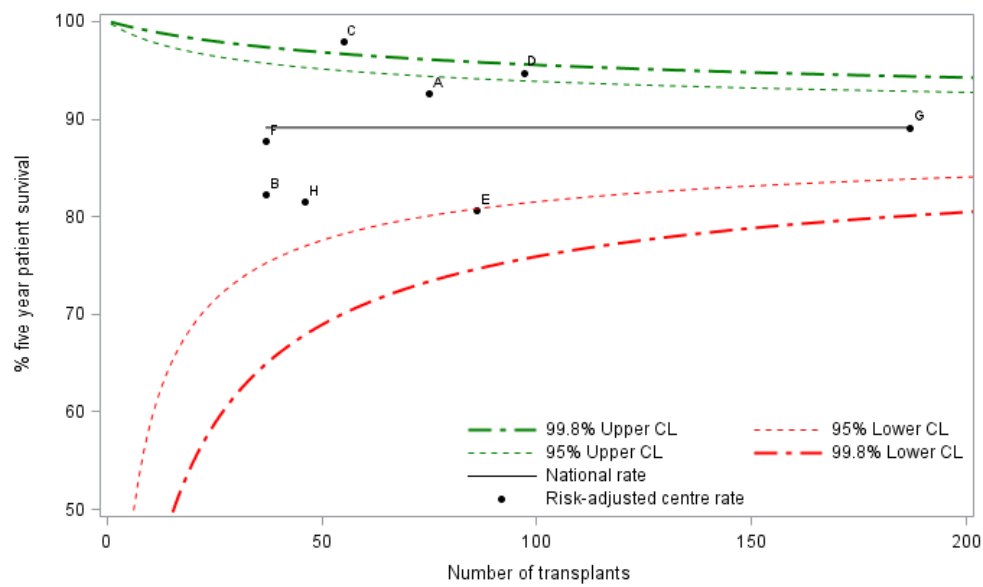


Figure 6.4 Risk-adjusted five year pancreas graft (death censored) survival rates for all deceased donor first SPK transplants, between 1 April 2006 and 31 March 2010

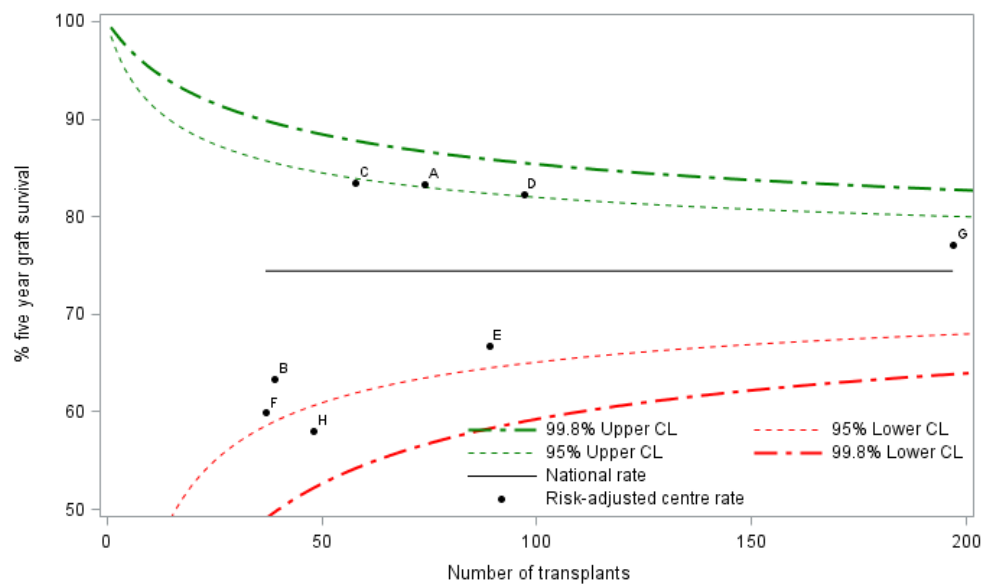


Table 6.1 Risk-adjusted one and five year [patient](#) survival for first SPK transplants using pancreases from deceased donors

Centre	Code	N	Patient survival				
			One-year*		Five-year**		
			%	(95% CI)	N	%	(95% CI)
Cambridge	A	67	100	N/A	75	93	(83 – 98)
Cardiff	B	35	100	N/A	37	82	(61 – 93)
Edinburgh	C	62	96	(87 – 99)	55	98	(88 – 100)
Guy's	D	95	97	(89 – 100)	97	95	(88 – 98)
Manchester	E	104	98	(92 – 100)	86	81	(68 – 89)
Newcastle	F	14	93	(59 – 100)	37	88	(69 – 97)
Oxford	G	237	96	(93 – 98)	187	89	(83 – 93)
WLRTC	H	30	96	(76 – 100)	46	82	(60 – 93)
UK		644	97	(95 – 98)	620	89	(86 – 91)

* Includes transplants performed between 1 April 2010 - 31 March 2014
 ** Includes transplants performed between 1 April 2006 - 31 March 2010

Table 6.2 Risk-adjusted one and five year pancreas [graft](#) survival for first SPK transplants using pancreases from deceased donors

Centre	Code	N	Pancreas Graft survival				
			One-year*		Five-year**		
			%	(95% CI)	N	%	(95% CI)
Cambridge	A	72	94	(85 – 98)	74	83	(71 – 91)
Cardiff	B	36	85	(68 – 95)	39	63	(40 – 79)
Edinburgh	C	63	80	(65 – 90)	58	83	(69 – 92)
Guy's	D	96	84	(73 – 91)	97	82	(72 – 90)
Manchester	E	106	78	(66 – 86)	89	67	(52 – 78)
Newcastle	F	14	71	(26 – 92)	37	60	(34 – 78)
Oxford	G	248	91	(86 – 94)	197	77	(69 – 83)
WLRTC	H	31	80	(56 – 93)	48	58	(35 – 74)
UK		666	86	(83 – 89)	639	74	(71 – 78)

* Includes transplants performed between 1 April 2010 - 31 March 2014
 ** Includes transplants performed between 1 April 2006 - 31 March 2010

6.2 Deceased donor graft and patient survival for first PO transplants

Individual centre survival estimates and national rates for one-year and five-year [patient](#) and pancreas [graft](#) survival for deceased donor first pancreas only (PO) transplants are shown in **Tables 6.3** and **6.4**, respectively. Centre specific estimates of these rates must be interpreted with caution due to the small number of transplants upon which they are based.

Table 6.3 Risk-adjusted one and five year patient survival for first PO transplants using pancreases from deceased donors						
Centre	N	Patient survival				
		One-year*		Five-year**		
		%	(95% CI)	N	%	(95% CI)
Cambridge	0	-	-	0	-	-
Cardiff	9	100	N/A	2	-	-
Edinburgh	1	-	-	0	-	-
Guy's	5	100	N/A	1	-	-
Manchester	3	-	-	11	93	(62 – 100)
Newcastle	3	-	-	2	-	-
Oxford	44	95	(82 – 99)	39	78	(55 – 91)
WLRTC	0	-	-	1	-	-
UK	65	96	(86 – 99)	56	82	(66 – 91)
* Includes transplants performed between 1 April 2010 - 31 March 2014 ** Includes transplants performed between 1 April 2006 - 31 March 2010 - No transplants performed in time period or insufficient survival data						

Table 6.4 Risk-adjusted one and five year pancreas graft survival for first PO transplants using pancreases from deceased donors						
Centre	N	Pancreas graft survival				
		One-year*		Five-year**		
		%	(95% CI)	N	%	(95% CI)
Cambridge	1	-	-	0	-	-
Cardiff	15	50	(0 - 80)	15	65	(18 - 89)
Edinburgh	2	-	-	1	-	-
Guy's	8	48	(0 - 86)	5	0	(0 - 67)
Manchester	7	40	(0 - 84)	25	32	(0 - 60)
Newcastle	7	64	(0 - 93)	6	65	(0 - 96)
Oxford	52	73	(54 - 85)	69	52	(32 - 67)
WLRTC	9	85	(16 – 100)	14	10	(0 - 55)
UK	101	65	(54 - 73)	135	45	(36 - 53)
* Includes transplants performed between 1 April 2010 - 31 March 2014 ** Includes transplants performed between 1 April 2006 - 31 March 2010						

Survival from listing

7.1 Patient survival from listing for SPK transplant

Survival from listing was analysed for all adult (≥ 18 years) patients registered for the first time for simultaneous pancreas and kidney (SPK) between 1 January 2003 and 31 December 2014. Patients registered for a pancreas only or islet transplant have been excluded from this analysis. Survival time was defined as the time from joining the [transplant list](#) to death, regardless of the length of time on the [transplant list](#), whether or not the patient was transplanted and any factors associated with such a transplant eg donor type. Survival time was censored at either the date of removal from the list, or at the last known follow up date post-transplant when no death date was recorded, or at the time of analysis if the patient was still active on the [transplant list](#).

The [funnel plot](#) shown in **Figure 7.1**, compares centre specific ten-year [risk-adjusted patient](#) survival rates from the point of pancreas, simultaneous pancreas and kidney (SPK) or islet transplant listing and indicates how consistent the rates of the individual transplant centres are with the national rate. Cambridge, Edinburgh and Guy's all have 10 year survival rates above the upper 99.8% [confidence limit](#) indicating that these centres have 10 year survival rates from listing that are considerably higher than the national rate. The 10 year survival rate for Manchester was on the lower 99.8% [confidence limit](#). This suggests that 10 year survival from listing at Manchester may be significantly lower than the national rate. Centres can be identified by the information shown in **Table 7.1**, which also shows one- and five-year [risk-adjusted](#) survival rates from the point of transplant listing.

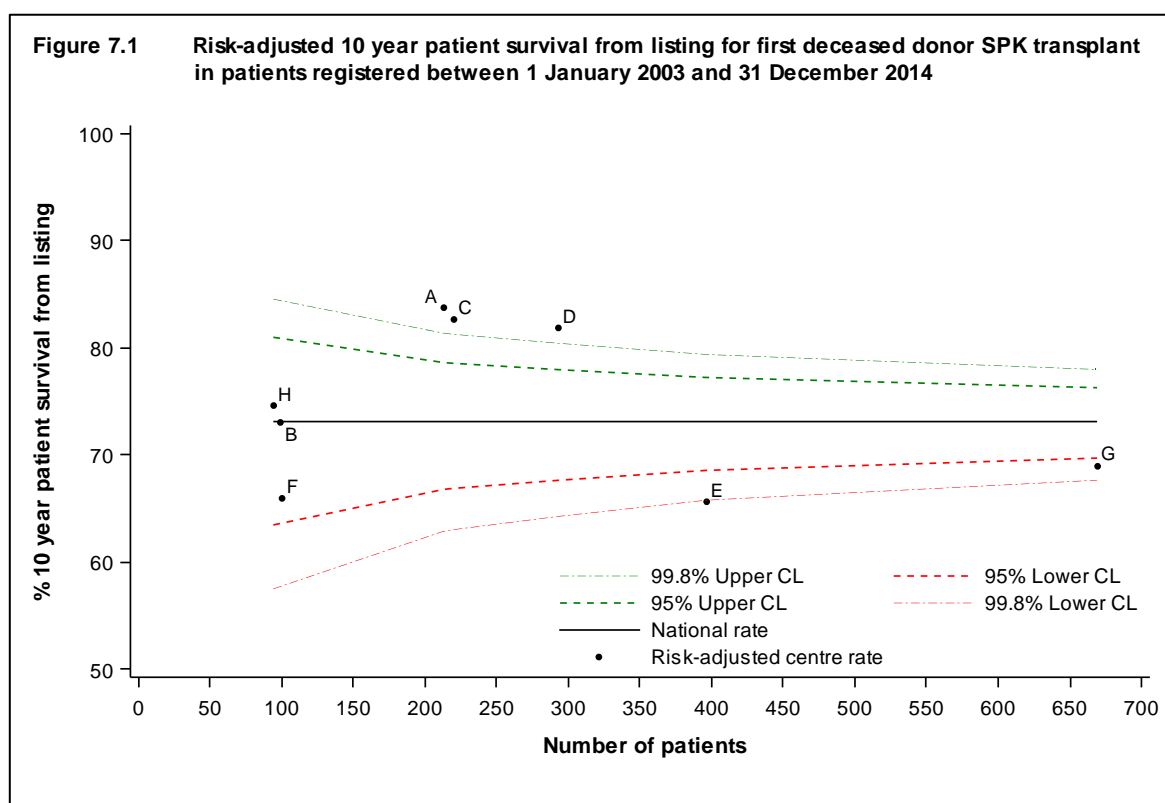


Table 7.1 Risk-adjusted 1, 5 and 10 year patient survival from listing for first deceased donor SPK transplant in patients registered between 1 January 2003 and 31 December 2014

Centre	Code	One year		Five year		Ten year	
		N	(%)	N	(%)	N	(%)
Cambridge	A	213	(98)	213	(90)	213	(84)
Cardiff	B	99	(95)	99	(85)	99	(73)
Edinburgh	C	220	(98)	220	(90)	220	(83)
Guy's	D	293	(98)	293	(89)	293	(82)
Manchester	E	396	(96)	396	(80)	396	(66)
Newcastle	F	100	(94)	100	(81)	100	(66)
Oxford	G	669	(96)	669	(82)	669	(69)
WLRTC	H	94	(98)	94	(88)	94	(75)
UK		2084	(96)	2084	(85)	2084	(73)

Form return rates

8.1 Pancreas form return rates, 1 January – 31 December 2014

Form return rates are reported in **Table 8.1** for the pancreas transplant record, three month and 1 year follow up form, along with lifetime follow up (more than 2 years). These include all pancreas transplants performed between 1 January and 31 December 2014 for the transplant record, and all requests for follow up forms issued in this time period. Centres highlighted are transplant centres. Overall, 100% of transplant record forms issued and 93% of follow-up forms issued have been returned.

Table 8.1 Form return rates following pancreas transplantation, by centre, 1 January 2014 - 31 December 2014

Centre	Transplant record		3 month follow-up		12 month follow-up		Lifetime follow-up	
	N	% returned	N	% returned	N	% returned	N	% returned
Aberdeen, Aberdeen Royal Infirmary					1	100	15	80
Airdrie, Monklands District General Hospital							4	25
Bangor, Ysbyty Gwynedd District General Hospital							3	67
Basildon, Basildon Hospital							3	100
Belfast, Antrim Hospital					2	100	.	.
Belfast, Belfast City Hospital			1	100	2	100	3	100
Belfast, The Ulster Hospital							1	0
Birmingham, Birmingham Heartlands Hospital					1	100	7	100
Birmingham, Queen Elizabeth Hospital							20	100
Bradford, St Lukes Hospital							1	100
Brighton, Royal Sussex County Hospital					4	100	15	100
Bristol, Southmead Hospital					5	100	47	100
Camberley, Frimley Park Hospital					1	100	.	.
Cambridge, Addenbrookes Hospital	29	100	27	100	20	100	67	99
Canterbury, Kent And Canterbury Hospital					2	100	24	100
Cardiff, University Of Wales Hospital	9	100	9	100	13	100	60	95
Carlisle, Cumberland Infirmary							2	100
Carshalton, St Helier Hospital					2	100	25	92
Chelmsford, Broomfield Hospital							1	100
Chester, Countess Of Chester Hospital			1	100			1	100
Closed - Glasgow, Glasgow Western Infirmary							7	100
County Down, Daisy Hill Hospital							1	100
Coventry, University Hospital (walsgrave)							18	100
Derby, Royal Derby Hospital							4	100
Doncaster, Doncaster Royal Infirmary							1	100
Dorchester, Dorset County Hospital					1	100	29	100
Douglas, Nobles I-o-m Hospital							1	100
Dudley, Russells Hall Hospital							2	100
Dulwich, Kings College							3	100
Dumfries And Galloway Royal Infirmary							2	100
Dundee, Ninewells Hospital					2	100	8	100
Edinburgh, Royal Infirmary Of Edinburgh	16	100	16	100	11	100	51	69
Exeter, Royal Devon And Exeter Hospital					1	100	17	82
Glasgow, Queen Elizabeth University Hospital							5	0
Glasgow, Stobhill General Hospital							1	0
Gloucester, Gloucestershire Royal Hospital							12	100
Hereford, The County Hospital							1	100
Hull, The Hull Royal Infirmary					1	100	5	60
Inverness, Raigmore Hospital							6	100

**Table 8.1 Form return rates following pancreas transplantation, by centre,
1 January 2014 - 31 December 2014**

Centre	Transplant record		3 month follow-up		12 month follow-up		Lifetime follow-up	
	N	% returned	N	% returned	N	% returned	N	% returned
Ipswich, Ipswich Hospital					1	100	7	100
Kilmarnock, Crosshouse Hospital							4	25
Leeds, St James's University Hospital					4	100	6	100
Leicester, Leicester General Hospital							14	100
Lincoln, Lincoln County Hospital							2	100
Liverpool, Royal Liverpool University Hospital					1	100	8	63
London, Guys Hospital	36	100	36	100	18	100	92	100
London, St Georges Hospital					1	100	4	75
London, The Royal Free Hospital			1	100	6	100	34	59
London, The Royal London Hospital (whitechapel)					1	100	8	100
Londonderry, Altnagelvin Area Hospital					1	100		
Manchester, Manchester Royal Infirmary	28	100	26	100	19	100	86	98
Middlesbrough, The James Cook University Hospital					1	100	16	100
Newcastle, Freeman Hospital	7	100	6	100	7	100	27	100
Northampton, Northampton General Hospital					.	.	7	71
Norwich, Norfolk And Norwich University Hospital					1	100	13	100
Nottingham, Nottingham University Hospitals City Campus							21	100
Omagh, Tyrone County Hospital							1	100
Oxford, Churchill Hospital	68	100	67	100	49	100	107	83
Paisley, Royal Alexandra Hospital							1	100
Peterborough, Peterborough City Hospital							1	100
Plymouth, Derriford Hospital			1	100	1	100	11	45
Portsmouth, Queen Alexandra Hospital					2	100	29	100
Preston, Royal Preston Hospital							11	91
Reading, Royal Berkshire Hospital							29	100
Salford, Salford Royal							11	100
Sheffield, Northern General Hospital							3	100
Shrewsbury, Royal Shrewsbury Hospital							2	0
St Helier, Jersey General Hospital							1	100
Stevenage, Lister Hospital							2	100
Stoke-on-trent, Royal Stoke University Hospital					1	100	6	83
Sunderland, Sunderland Royal Hospital							3	100
Swansea, Morriston Hospital							7	71
Truro, Royal Cornwall Hospital (triliske)			.	.	1	0	13	100
West London Renal Transplant Centre	5	100	6	100	9	100	75	92
Westcliff On Sea, Southend Hospital							3	100
Wolverhampton, New Cross Hospital					1	100	13	100
Wrexham, Maelor General Hospital					2	50	5	40
York, York District Hospital					1	100	13	77
Overall	198	100	197	100	197	99	1169	91

Islet transplant list

9.1 Patients on the islet transplant list as at 31 March, 2008 – 2015

Figure 9.1 shows the number of patients on the islet [transplant list](#) at 31 March each year between 2008 and 2015. The number of patients active on the islet [transplant list](#) has increased from 3 in 2008 (when islet transplantation was first commissioned in the UK) to 36 in 2015.

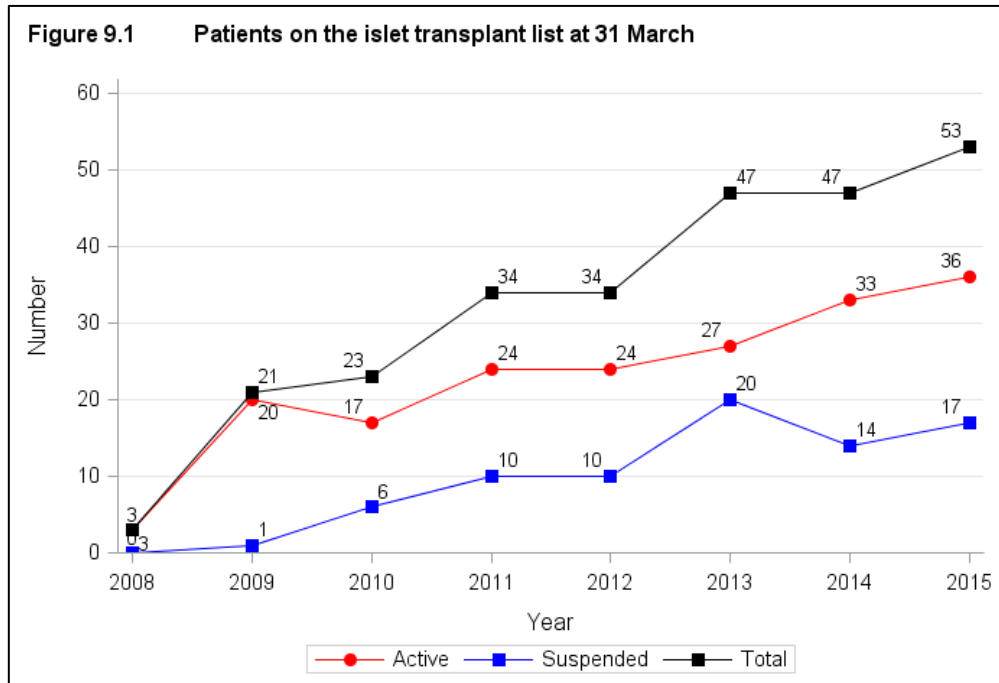


Figure 9.2 shows the number of patients on the active islet [transplant list](#) at 31 March 2015 by centre. Eighteen (50%) of the patients on the active [transplant list](#) were registered at Edinburgh, whilst there were no patients registered at the Royal Free.

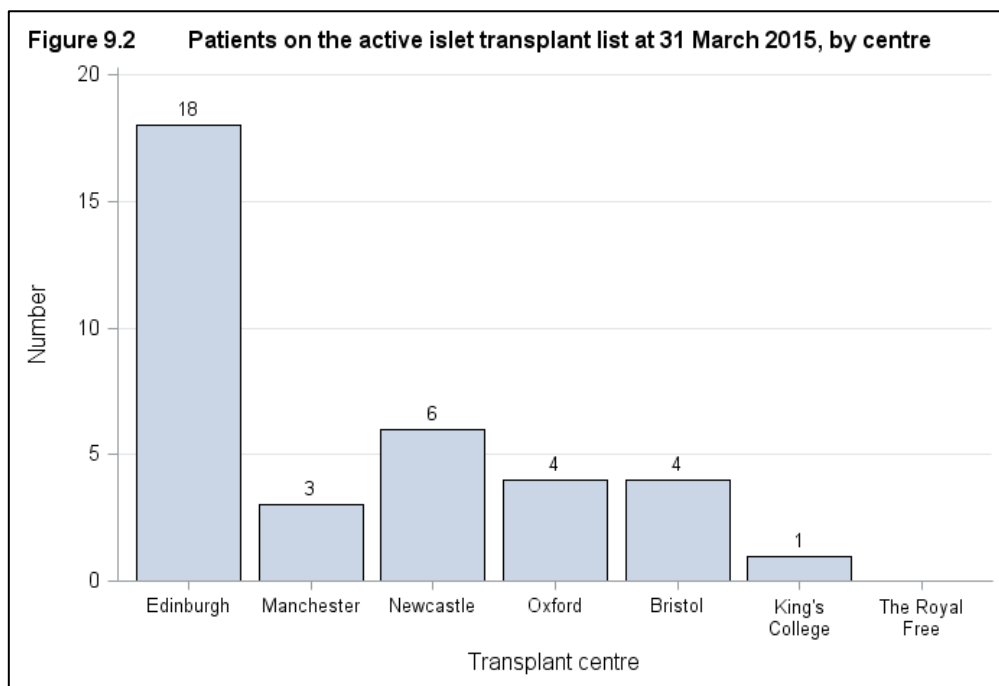
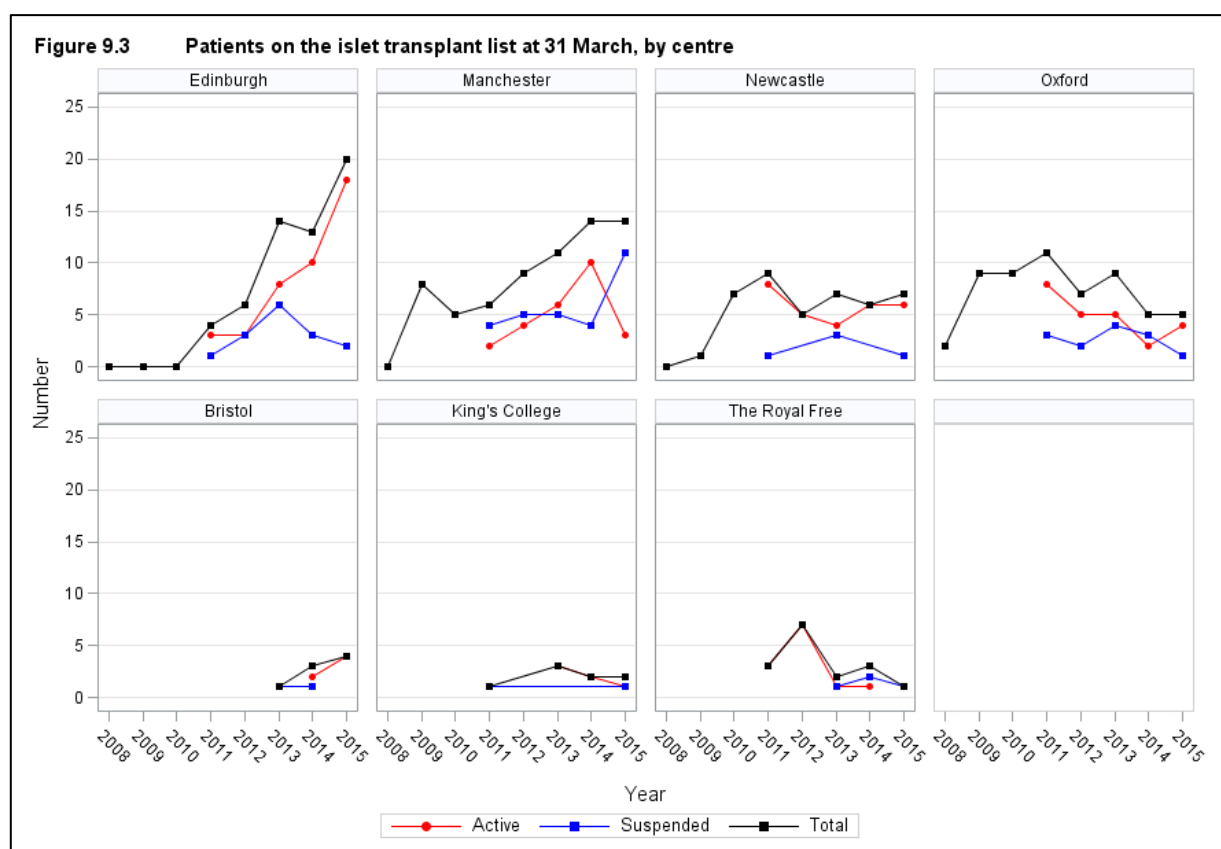


Figure 9.3 shows the number of patients on the islet [transplant list](#) at 31 March each year between 2008 and 2015 for each transplant centre. The number of active and suspended patients by centre is not recorded prior to 2011, hence only the total number are reported between 2008 and 2010. The number of patients actively registered at Edinburgh has increased from 10 on 31 March 2014 to 18 on 31 March 2015.



9.2 Post-registration outcomes, 1 April 2011 – 31 March 2012

An indication of outcomes for patients listed for an islet transplant is summarised in **Figure 9.4**. This shows the proportion of patients transplanted or still waiting one and three years after joining the list. It also shows the proportion removed from the [transplant list](#) (typically because they become too unwell for transplant) and those dying while on the [transplant list](#). Only 61% of patients are transplanted within one year, while three years after listing 76% of patients have received a transplant.

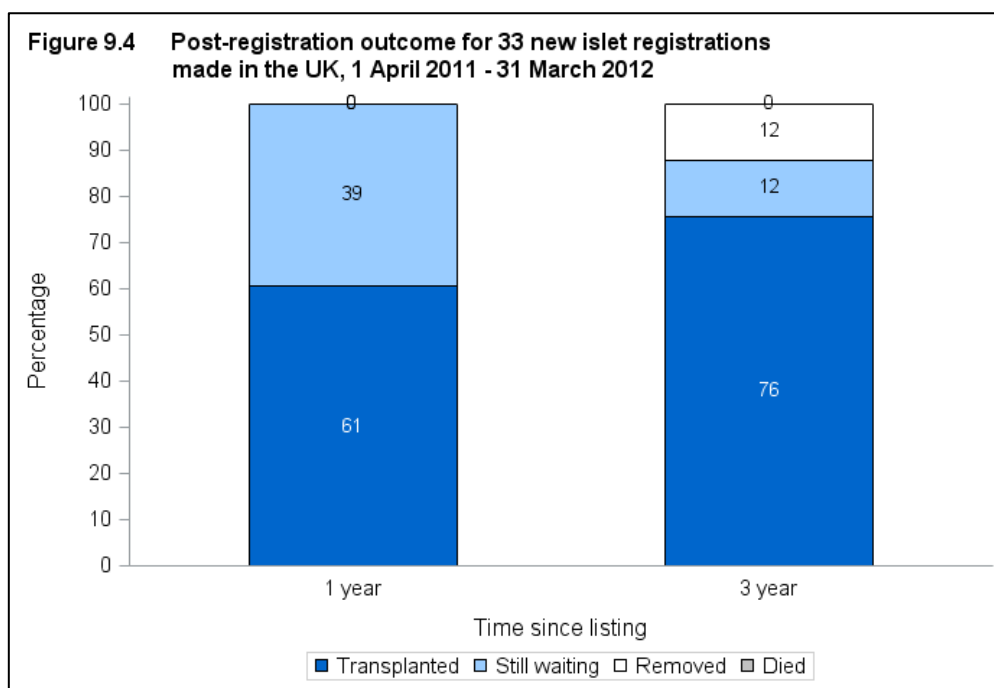
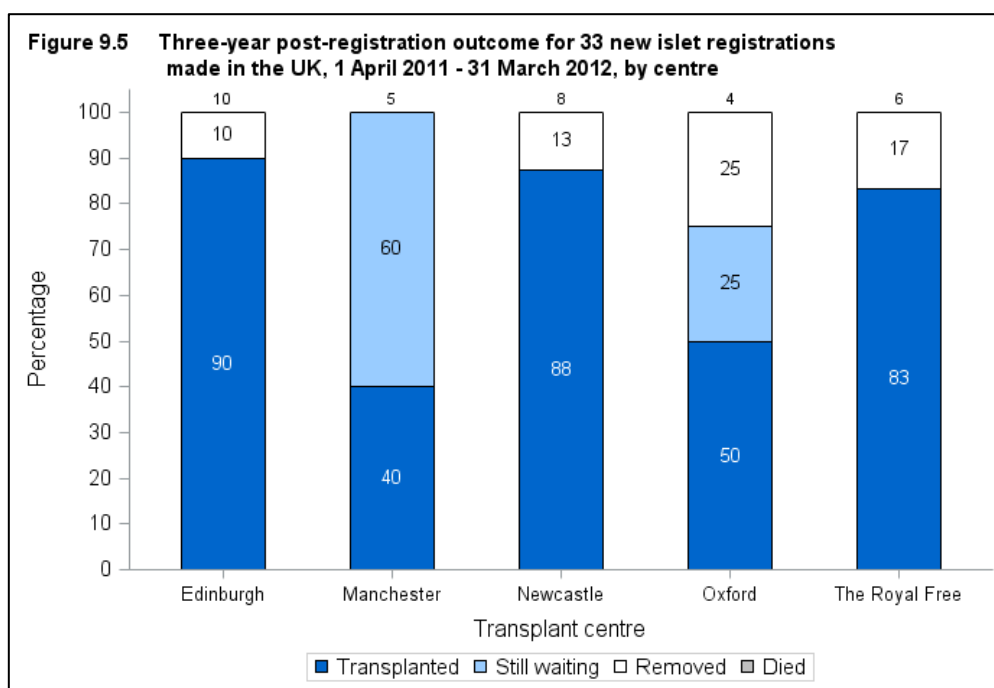
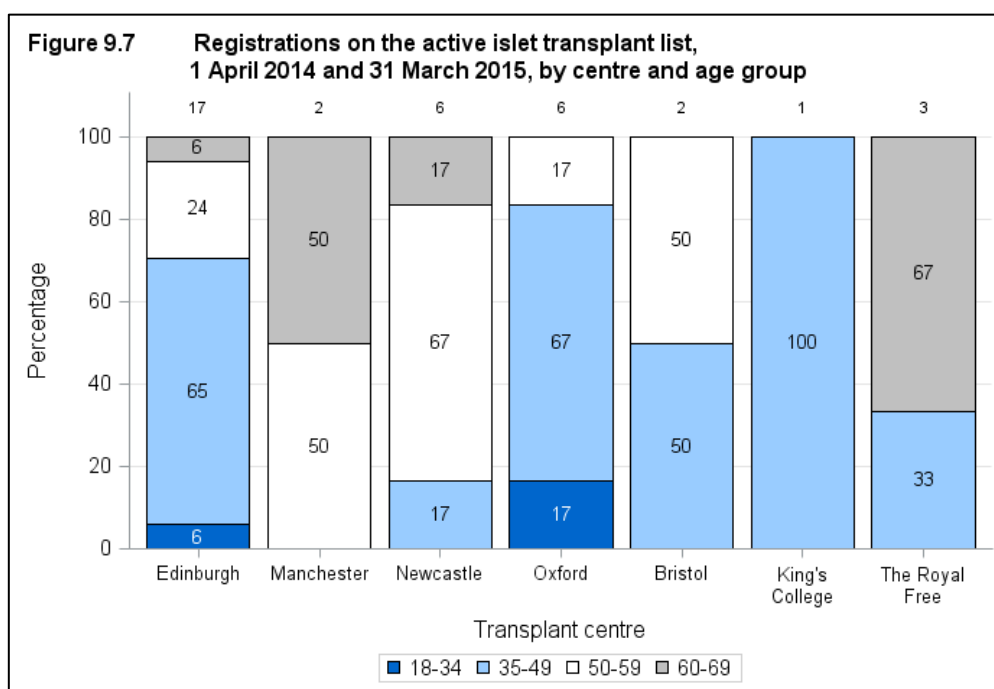
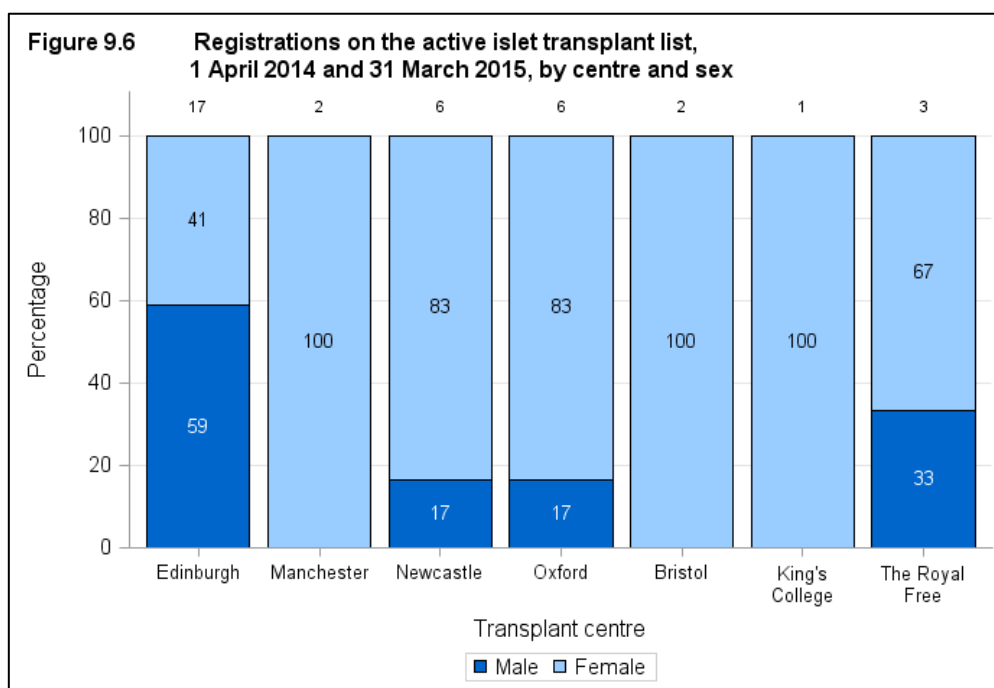


Figure 9.5 shows the proportion of patients transplanted or still waiting three years after joining the list by centre. Three years after registration, Edinburgh, Newcastle and the Royal Free had transplanted over 80% of their patients, while three of the five patients registered at Manchester were still waiting. None of the patients died whilst waiting for a transplant.



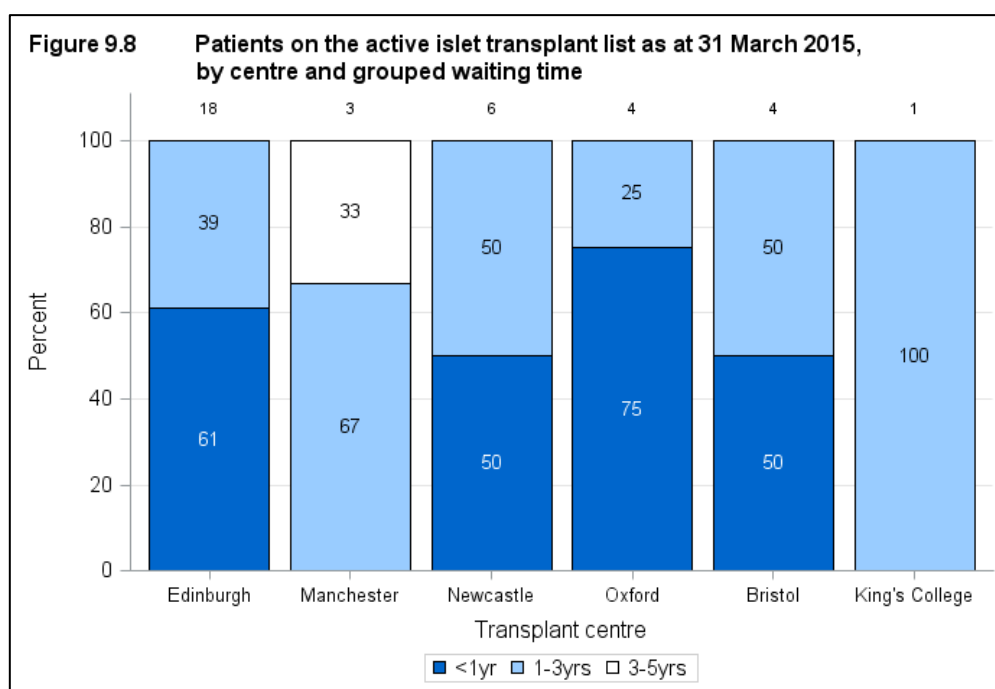
9.3 Demographic characteristics, 1 April 2014 – 31 March 2015

The sex and age group of patients registered on the [transplant list](#) during 2014/15 are shown by centre in **Figures 9.6** and **9.7**, respectively. Note that all percentages quoted are based only on data where relevant information was available. Overall, 64% of patients registered on the islet transplant list were female, all were white and the median age was 49 years



9.4 Patient waiting times for those currently on the list, 31 March 2015

Figure 9.8 shows the length of time patients have been waiting on the islet [transplant list](#) at 31 March 2015 by centre. One highly sensitised patient (98% [cRF](#)) registered at Manchester has been waiting more than three years for transplant.



9.5 Median waiting time to transplant, 1 April 2009 - 31 March 2012

The length of time a patient waits for an islet transplant varies across the UK. The [median](#) waiting time for deceased donor islet transplantation is shown in **Figure 9.9** and **Table 9.1** for patients registered at each individual unit.

The [median](#) waiting time to transplant for patients registered on the islet [transplant list](#) between 1 April 2009 and 31 March 2012 is 319 days (10 months), ranging from 46 days at King's College to 657 days at Oxford.



Table 9.1 Median waiting time to islet transplant in the UK, for patients registered 1 April 2009 - 31 March 2012

Transplant centre	Number of patients registered	Waiting time (days)	
		Median	95% Confidence interval
Edinburgh	15	135	58 - 212
King's	3	46	28 - 64
Manchester	8	-	-
Newcastle	19	319	0 - 760
Oxford	16	657	241 - 1073
Royal Free	14	266	121 - 411
UK	75	319	228 - 410

Response to islet offers

Offer decline rates

Islet offers from [DBD](#) donors whose pancreas was retrieved, offered directly on behalf of a named individual patient and resulted in islet transplantation are included in the analysis. Any offers of pancreases declined for transplantation, pancreases offered for [multi-organ](#) or small bowel transplant or [DCD](#) offers were excluded, as were offers made through the fast track scheme or the reallocation of the pancreas.

10.1 Offer decline rates, 1 April 2012 – 31 March 2015

Individual centre offer decline rates by financial year and over the time period, 1 April 2012 and 31 March 2015 are shown in **Table 10.1**. Royal Free and King's College had the lowest overall rates whilst Bristol had the highest rate (60%).

Table 10.1 DBD donor islet offer decline rates by transplant centre, 1 April 2012 and 31 March 2015								
Centre	2012/13		2013/14		2014/15		Overall	
	N	(%)	N	(%)	N	(%)	N	(%)
Edinburgh	8	(50)	11	(27)	10	(50)	29	(41)
Manchester	3	(67)	7	(57)	3	(33)	13	(54)
Newcastle	9	(44)	10	(50)	8	(63)	27	(52)
Oxford	9	(56)	8	(25)	9	(44)	26	(42)
Bristol	1	(0)	0	-	4	(75)	5	(60)
King's	1	(0)	5	(20)	2	(100)	8	(38)
Royal Free	9	(44)	0	-	3	(0)	12	(33)
UK	40	(48)	41	(37)	39	(51)	120	(45)

Islet transplants

11.1 Islet transplants, 1 April 2008 – 31 March 2015

Figure 11.1 shows the total number of islet transplants performed in the last six years since islet transplantation was first commissioned in the UK, by type of donor. There was a significant increase in 2011/12 from 13 to 30 transplants a year, following the introduction of the national [Pancreas Allocation Scheme](#) in 2010 which provided islet patients with equal access to donated pancreases for the first time. Since 2011/12, the number of islet transplants remained fairly constant with 32 transplants in 2013/14. However, the number of islet transplants performed has fallen to 23 in 2014/15, three of which involved islets from a [DCD](#).

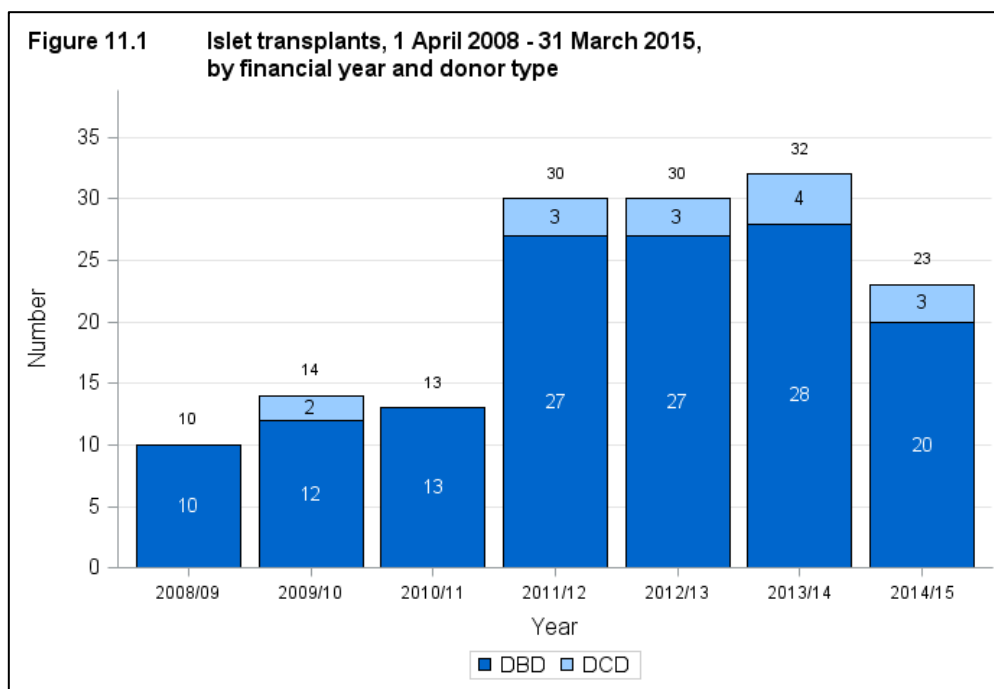


Figure 11.2 shows the total number of islet transplants performed in 2014/15, by centre and type of donor. The same information is presented in **Figure 11.3** but this shows the proportion of **DBD** and **DCD** transplants performed at each centre. Edinburgh performed the most islet transplants in 2014/15 (7). Newcastle, Edinburgh and the Royal Free all performed one **DCD** transplant. Bristol recommenced transplanting islets in 2014/15 and performed one transplant.

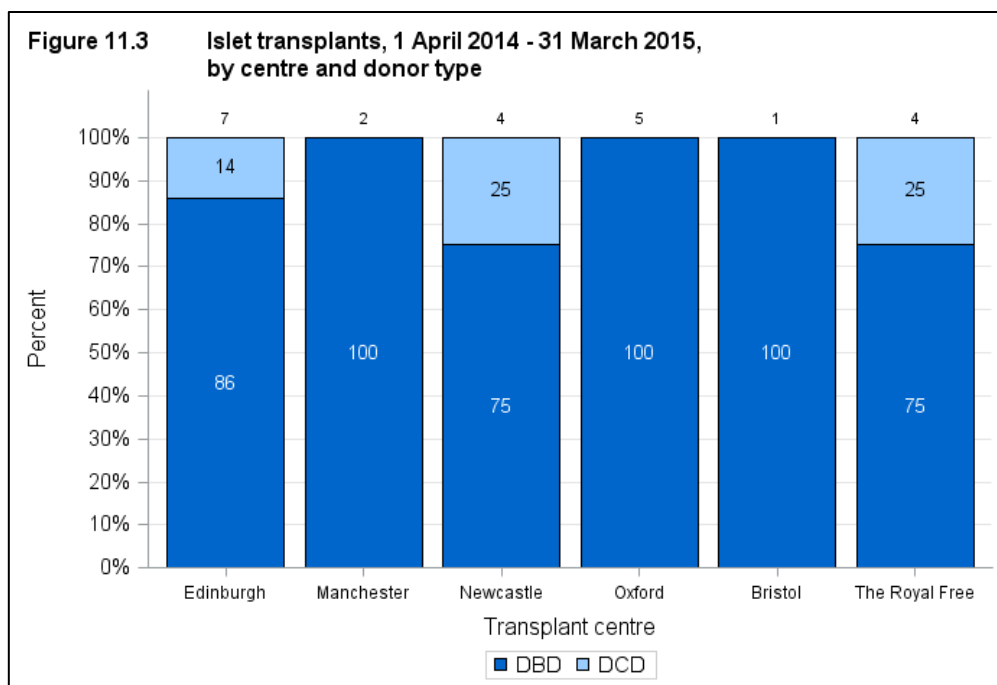
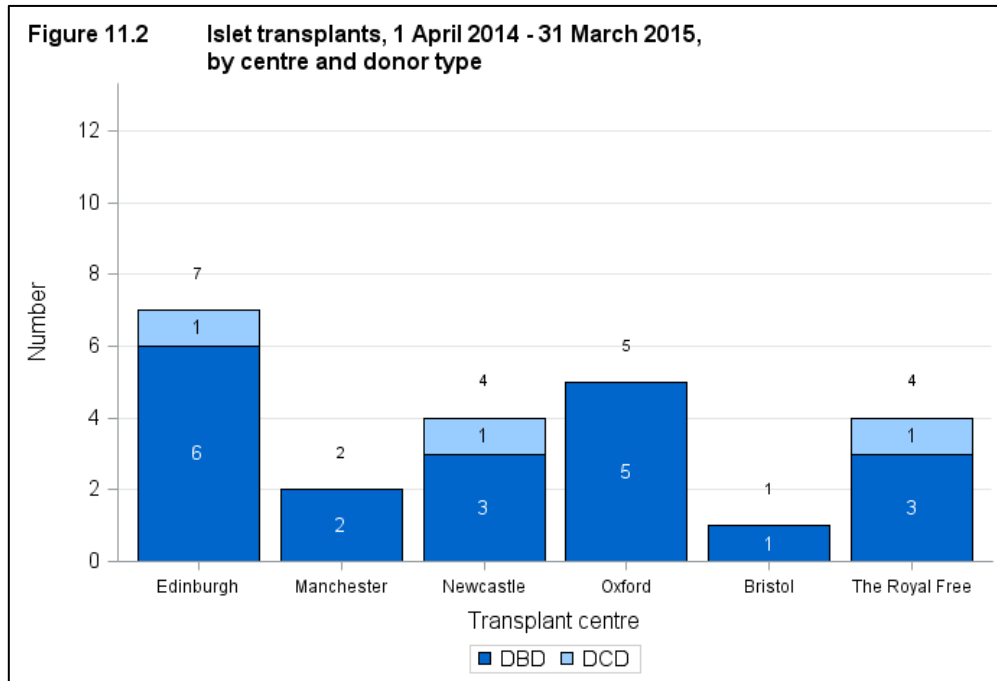
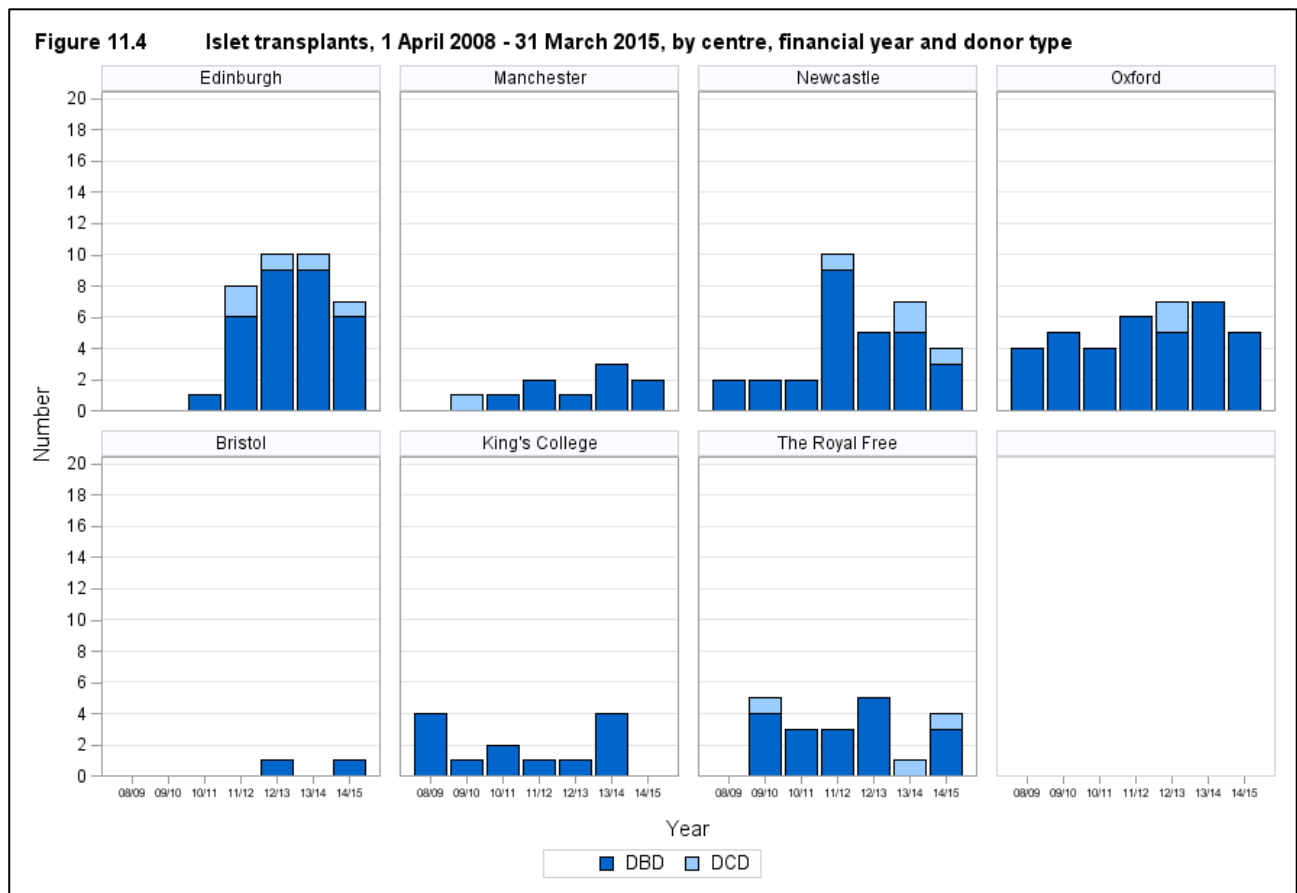


Figure 11.4 shows the total number of islet transplants performed in last seven years, by centre and type of donor. Oxford and Newcastle have consistently performed a number of islet transplants each year, while Edinburgh have increased their transplant activity in the last four years.



Islet outcomes

12.1 Outcome measures for routine islet transplants

The [Kaplan-Meier graft](#) survival estimate for one-year post-transplant for routine islet transplant in the UK is 81% with a 95% [confidence interval](#) between 70% and 89%. Other key measures of islet outcome include annual rate of severe [hypoglycaemic](#) events, [HbA1c](#) and insulin requirements.

The [median](#) annual rate of severe [hypoglycaemic](#) events prior to transplant was 9.5 events per year, and at one-year post-transplant this had been reduced to no events per year. In the year post-transplant, 75% of patients experienced no severe [hypoglycaemic](#) events and sixteen patients experienced between one and eleven events.

Figure 12.1 shows the reduction in [median HbA1c](#) (%) for routine islet transplants. [Median HbA1c](#) dropped from 8.2% prior to transplant to 6.8% at one-year post-transplant. At one-year, 38 patients (57%) had an [HbA1c](#) less than 7%.

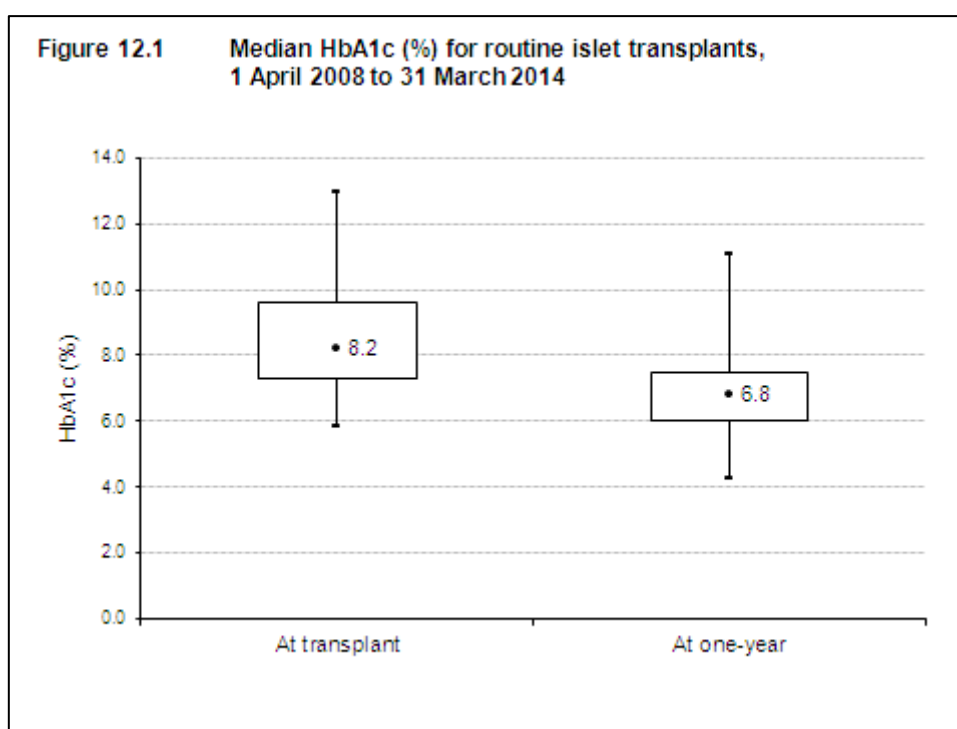
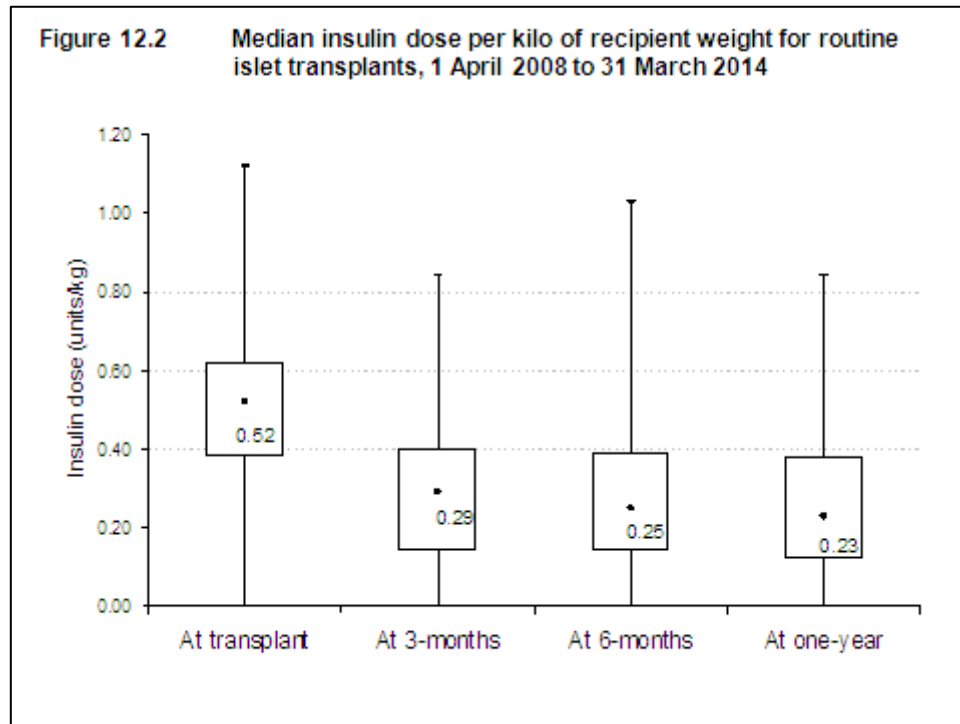


Figure 12.2 shows the [median](#) reduction in insulin dose per kilo recipient body weight at three-months, six-months and one-year post-transplant. Prior to transplant the [median](#) insulin dose is 0.52 units/kg, by three-months the [median](#) dose has dropped to 0.29 units/kg and this reduction has been maintained at one-year post-transplant with a [median](#) dose of 0.23 units/kg. Following islet transplantation, 25 (36%) of the 70 patients with known insulin dose at one year achieved insulin independence at some point during the first year.



Form return rates

13.1 Islet form return rates, 1 January – 31 December 2014

Form return rates are reported in **Table 13.1** for the islet transplant record, three month and 1 year follow up form, along with lifetime follow up (more than 2 years). These include all islet transplants performed between 1 January and 31 December 2014 for the transplant record, and all requests for follow up forms issued in this time period. All but one follow-up forms were issued to transplant centres.

Table 13.1 Form return rates following islet transplantation, by centre, 1 January 2014 - 31 December 2014								
Centre	Transplant record		3 month follow-up		12 month follow-up		Lifetime follow-up	
	N	% returned	N	% returned	N	% returned	N	% returned
Bristol, Southmead Hospital	1	100	1	100	.	.	1	100
Edinburgh, Royal Infirmary Of Edinburgh	7	100	6	100	7	100	7	100
Glasgow, Queen Elizabeth University Hospital	1	0
London, Kings College Hospital	1	100	1	100	1	100	2	100
London, The Royal Free Hospital	2	100	2	100	.	.	7	100
Manchester, Manchester Royal Infirmary	2	100	1	100	2	100	2	100
Newcastle, Freeman Hospital	5	100	3	100	2	100	5	100
Oxford, Churchill Hospital	5	60	2	100	1	100	15	73
Overall	23	91	16	100	13	100	40	88

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, AB, or one of the minor variants of these four groups. ABO blood groups are present on other tissues and, unless special precautions are taken, a blood group A pancreas transplanted to a blood 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 pancreas becomes available, the patient is included among those who are matched against the donor to determine whether or not the pancreas 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 pancreases that become available.

Calculated Reaction Frequency (cRF)

For a given patient with detectable [HLA](#) antibodies, the proportion of blood group identical donors from a pool of 10,000 and for which they would be [HLA](#) compatible is calculated. This percentage of donors is termed the 'calculated Reaction Frequency' (cRF), more commonly referred to as the [sensitisation](#) level. Patients with no detectable [HLA](#) antibodies will have 0 [sensitisation](#) (0% cRF).

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 pancreas 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.

Cold ischaemia time (CIT)

The length of time that elapses between a pancreas being removed from the donor to its transplantation into the recipient is called the Cold Ischaemia Time (CIT). Generally, the shorter this time, the more likely the pancreas is to work immediately and the better the long-term outcome. The factors which determine CIT include a) transportation of the pancreas from the retrieval hospital to the hospital where the transplant is performed, b) the need to tissue type the donor and [cross-match](#) the donor and potential recipients, c) the occasional necessity of moving the pancreas to another hospital if a transplant cannot go ahead, d) contacting and preparing the recipient for the transplant, and e) access to the operating theatre.

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

A donor whose heart is still beating when their entire brain has stopped working so that they cannot survive without the use of a ventilator. Organs for transplant are removed from the donor while their heart is still beating, but only after extensive tests determine that the brain cannot recover and they have been certified dead.

Donor after circulatory death

A donor whose heart stops beating before their brain stops working and who is then certified dead. The organs are then removed.

Funnel plot

A graphical method that shows how consistent the survival rates of the different transplant 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. For the purposes of pancreas transplantation, graft failure is defined as a return to permanent insulin dependence while for islet transplantation graft failure is defined as a C-peptide less than 50 pmol/l.

HbA1c

HbA1c refers to glycated haemoglobin which is measured by clinicians to obtain an overall picture of an individual's average blood sugar levels over a particular period. HbA1c is a valuable indicator of diabetes control.

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.

Hypoglycaemia

Hypoglycaemia occurs when the level of glucose present in the blood falls below a set point and is the most common complication of insulin therapy. Severe hypoglycaemia is defined as having low blood glucose levels that requires third party assistance to treat and is classed as a diabetic emergency.

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.

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 pancreas and liver. Intestinal transplants involving a pancreas are excluded from the whole report.

National Pancreas Allocation Scheme

A nationally agreed set of rules for sharing and allocating deceased donor pancreases for pancreas or islet transplant between transplant centres in the UK. The scheme was introduced on 1 December 2010 and is administered by NHS Blood and Transplant. Prior to December 2010 deceased donors were allocated on a centre basis.

The Pancreas Allocation Scheme prioritises all blood group eligible patients and assigns an individual point score to all patients based on a number of clinically relevant donor, recipient and transplant related factors. The individual points score assigns more points to patients with lower levels of [HLA mismatch](#), longer waiting times, higher levels of patient [sensitisation](#), short travel times between retrieval to transplant centre, longer duration of dialysis and better donor to recipient age matching. In addition, donors with a lower BMI are clinically desirable for pancreas transplantation whereas donors with a higher BMI are preferable for islet transplantation. As a result, where the donor has a low BMI more points are awarded for patients waiting for a pancreas transplant and where the donor has a high BMI more points are awarded to islet patients. Patients listed nationally for either a pancreas or islet transplant are then ranked by their total points score and the pancreas is offered preferentially to the patient with the highest total number of points, no matter where in the UK they receive their treatment or whether they are waiting for a pancreas or islet 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 centres, 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.

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 centre is the expected survival rate for that centre given the case mix of their patients. Adjusting for case mix in estimating centre-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.

Sensitisation

Potential recipients can develop a number of different [HLA](#) antibodies as a result of exposure to the different [HLA](#) antigens through blood transfusion, previous transplants and pregnancy. Many patients however, have no detectable [HLA](#) antibodies. If a potential recipient has an antibody to an [HLA](#) antigen then they cannot receive a transplant from a donor with that [HLA](#) antigen, thus restricting the pool of potential donors. Patients who are clinically incompatible with the donor are excluded from the offering sequence by the [Pancreas Allocation Scheme](#).

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 Statistical methodology and risk-adjustment for survival rate estimation

[Unadjusted](#) and [risk-adjusted](#) estimates of [patient](#) and [graft](#) survival for pancreas and simultaneous pancreas and kidney (SPK) transplant 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 the table below.

First transplants from deceased donors

Simultaneous pancreas and kidney (SPK) and pancreas only survival

1 and 5 year [patient](#) and [graft](#) survival Donor age, donor type, donor BMI and waiting time

Funnel plots for comparing risk-adjusted survival rates

The [funnel plot](#) is a graphical method to show how consistent the survival rates of the different transplant centres are compared to the national rate. The graph shows for each centre, 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.

A fundamentally similar method was used to conduct the survival from listing analysis. The [risk factors](#) used are detailed in the table below.

First registrations for simultaneous pancreas and kidney (SPK) transplant

1, 5 and 10 year [patient](#) Age, gender, grouped registration year, ethnicity, blood group, [cRF](#)>85% survival from listing

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