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Blood and Transplant

ANNUAL REPORT ON PANCREAS AND ISLET TRANSPLANTATION

REPORT FOR 2016/2017
(1 APRIL 2007 – 31 MARCH 2017)

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Contents

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 2007 and nine 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 2017, there were 224 patients on the UK active pancreas and islet transplant list, which represents a 1% decrease in number of patients a year earlier. The number of patients on the active pancreas list increased by 2% to 203 in 2017 while the active islet transplant list decreased by 25% to 21 patients in the same time period.

- There were 2,026 pancreas transplants performed in the UK in the ten year period and 217 islet transplants performed in the nine years since islet transplantation was first commissioned in the UK. The number of transplants from donations after brain death has increased slightly by 2% in the last year to 164. However, the number of transplants from donations after circulatory death has decreased by 11% in the last year to 49.

- 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 94% to 100% at one-year and 67% to 97% at five-years. All centre rates are risk-adjusted.

- The national rates of graft survival one- and five-years after first simultaneous pancreas and kidney transplant from deceased donors are 88% and 78%, respectively. These rates vary between centres, ranging from 79% to 96% at one-year and 59% to 88% at five-years. All centre rates are risk-adjusted.

- The national rates of patient survival one- and five-years after first pancreas only transplant from deceased donors are 95% and 82%, respectively. The national rates of graft survival one- and five-years are 80% and 53%. 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 82%. All centre rates are risk-adjusted.

- The national rate of one year graft survival for patients receiving a routine islet transplant followed by a priority islet transplant within the year is 97% compared with 79% for those patients receiving a routine islet transplant alone.

- Reductions in annual rate of severe hypoglycaemic events, HbA1c, and insulin dose have been reported at one-year post routine islet transplant.

Use of the contents of this report should be acknowledged as follows:
Annual Report on Pancreas and Islet Transplantation 2016/17, NHS Blood and Transplant

Introduction

This report presents information on pancreas transplant activity between 1 April 2007 and 31 March 2017, 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. Cambridge, Cardiff, Guy's and WLRTC only perform pancreas transplants while Bristol, King's College and the Royal Free only perform islet transplants. Throughout this report West London Renal and Transplant Centre is labeled as WLRTC.

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 2012 to 31 March 2016 and five-year post-transplant for the period 1 April 2008 to 31 March 2012.

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 2016 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 simultaneous pancreas and kidney (SPK) transplant between 1 January 2005 and 31 December 2016.

The centre specific results for survival estimates are adjusted for differences in risk factors between the centres. The risk models and methods used are described in the Appendix.

Patients requiring multi-organ transplants (except simultaneous pancreas and kidney or islets and kidney transplants (SPK, SIK)) are excluded from all analyses apart from in the introduction. 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.

Figure 2.1 shows the number of patients on the pancreas and islet transplant list at 31 March each year between 2008 and 2017. The number of patients actively waiting for a pancreas or islet transplant increased each year from 219 in 2008 to 333 in 2010 and has since fallen to 224 patients active on 31 March 2017.

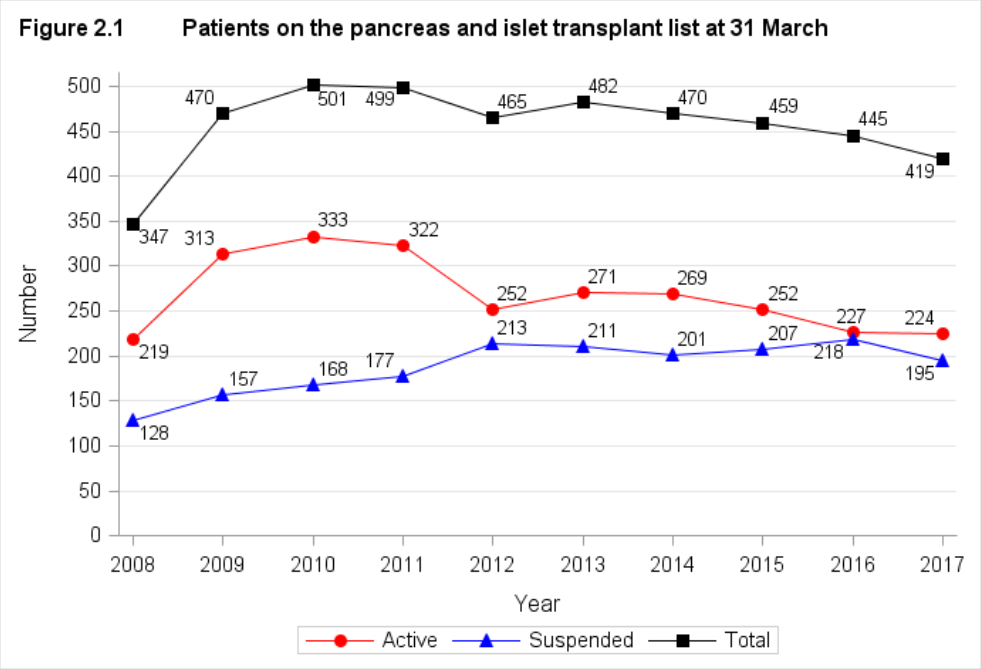


Figure 2.2 shows the number of patients on the pancreas and islet transplant list at 31 March 2017 for each transplant centre. Oxford has the largest transplant list with 74 patients registered for a pancreas or islet transplant. Of these patients, 62 are registered for a simultaneous pancreas and kidney (SPK) transplant, 5 are registered for a pancreas only transplant and 7 are registered for an islet transplant. Edinburgh has 2 patients waiting for a simultaneous islet and kidney (SIK) transplant.

Figure 2.2 **Patients on the active pancreas and islet transplant list at 31 March 2017, by centre**

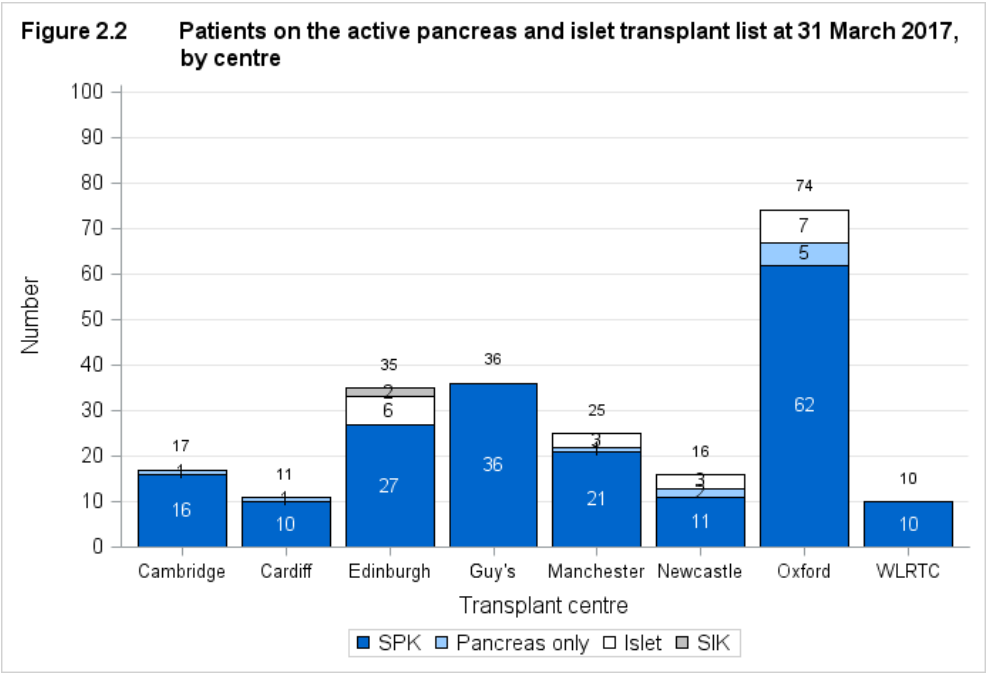


Figure 2.3 shows the total number of pancreas and islet transplants performed in the last ten years. Transplant numbers steadily increased from 214 in 2008/09 to 246 in 2013/14. However, the number of transplants performed in 2014/15 decreased to 226 and further to 213 in 2016/17. In particular the number of pancreas only transplants has decreased from 29 transplants in 2014/15 to 17 in 2016/17.

Figure 2.3 **Pancreas and islet transplants performed in the UK, 1 April 2007 - 31 March 2017, by financial year and transplant type**

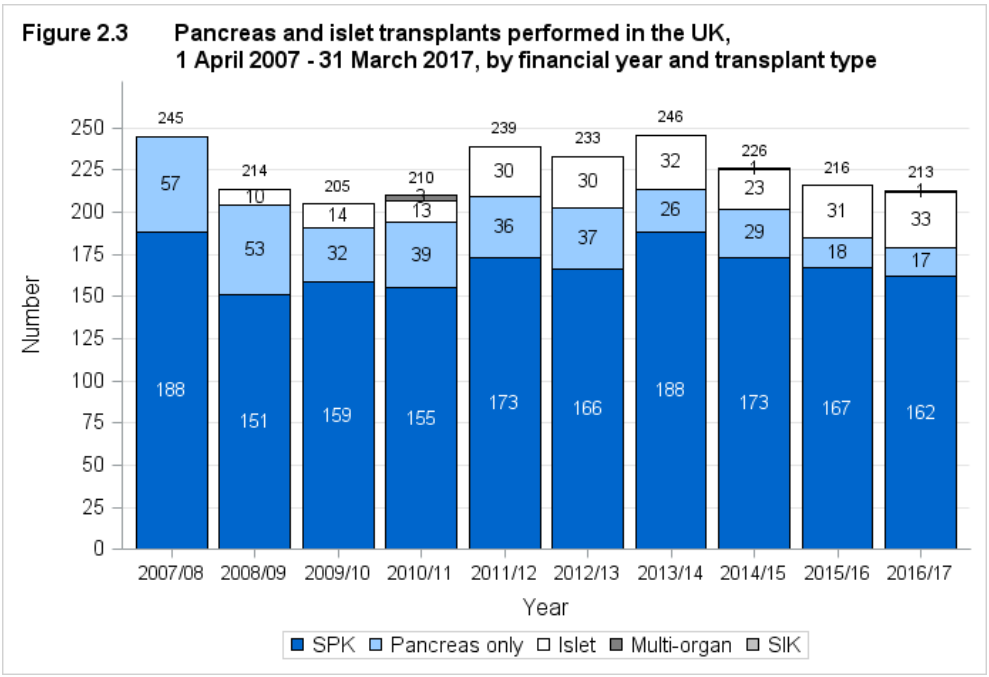


Figure 2.4 shows the total number of pancreas and islet transplants performed in 2016/17 at each transplant centre. Oxford performed the most pancreas and islet transplants last year, a total of 69 transplants, whilst Edinburgh performed the most islet

transplants (17). Manchester performed 1 simultaneous islet and kidney transplant and the Royal Free performed no transplants during this time period.

Figure 2.4 **Pancreas and islet transplants, 1 April 2016 - 31 March 2017, by centre and transplant type**

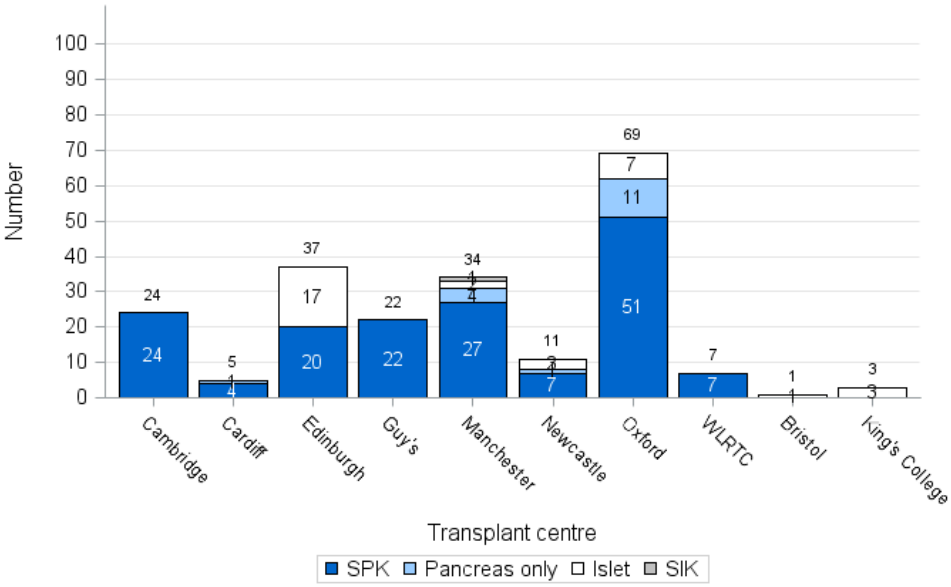
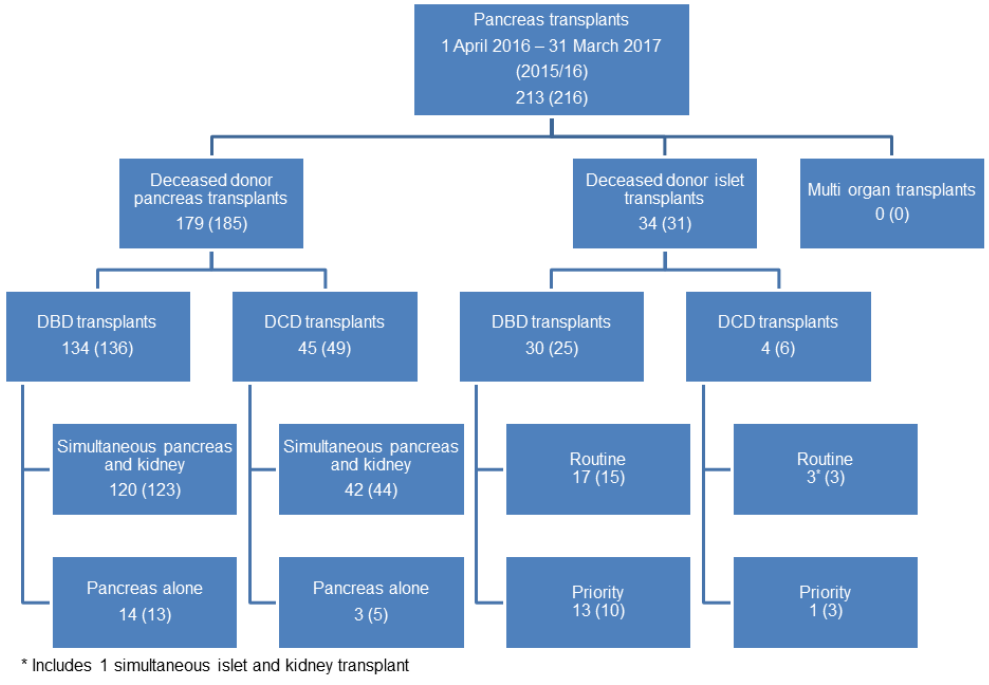


Figure 2.5 details the 213 pancreas and islet transplants performed in the UK between 1 April 2016 and 31 March 2017. Data for transplants performed in 2015/16 are also presented. The overall number of whole pancreas transplants performed in 2016/17 has fallen compared with 2015/16, 179 and 185 respectively. However the number of islet transplants has increased from 31 to 34.

Figure 2.5 Pancreas and islet transplants performed in the UK, 1 April 2016 – 31 March 2017 (1 April 2015 – 31 March 2016)



Geographical variation in pancreas registration and transplant rates

All NHS group 1 patients who were registered onto the pancreas or islet transplant lists with an active status between 1 April 2016 and 31 March 2017 were extracted from the UK Transplant Registry on 12 June 2017 (numerator). Only patients registered for pancreas only, kidney and pancreas, islet only and islet and kidney were considered. Patients were assigned to Strategic Health Authorities (SHA) in England using their postcode of residence, as reported at registration. The number of registrations per million population (pmp) by SHA was obtained using mid-2015 population estimates based on the Office for National Statistics (ONS) 2011 Census figures (denominator). No SHA age- or sex-specific standardisation of rates was performed.

The registration rates pmp were categorised into four groups – low, low-medium, medium-high and high – based on the quartiles of their distribution and visualised in a map using contrasting colours.

Transplant rates pmp were obtained as the number of pancreas only, pancreas and kidney, islet only and islet and kidney transplants on NHS group 1 recipients from deceased donors between 1 April 2016 and 31 March 2017 (numerator), divided by the mid-2015 population estimates from the ONS (denominator). Transplant rates pmp were categorised and visualised in a map as done for the registration rates.

For systematic component of variation only registrations or transplants in England between 1 April 2016 and 31 March 2017 were included. If a patient was re-registered during the time period, only the first registration was considered. If a patient underwent

more than one pancreas/islet transplant in the time period, only the first transplant was considered.

Figure 2.6 shows rates of registration to the pancreas transplant list per million population (pmp) between 1 April 2016 and 31 March 2017 compared with pancreas transplant rates pmp for the same time period, by recipient country/Strategic Health Authority (SHA) of residence. **Table 2.1** shows the breakdown of these numbers by recipient country/Strategic Health Authority of residence. No adjustments have been made for potential demographic differences in populations. If a patient has had more than one registration/transplant in the period, each registration/transplant is considered. Note that this analysis only considered NHS Group 1 patients.

Since there will inevitable be some random variation in rates between areas, the systematic component of variation (SCV) was used to identify if the variation is more (or less) than a random effect for the different SHAs in England only. Only first registrations and transplants in this period were considered. The larger the SCV the greater the evidence of a high level of systematic variation between areas. Both registration and transplant rates yielded a low SCV at 0.1 and 0, respectively, and therefore, no evidence of geographical variation beyond what would be expected at random.

Figure 2.6 Comparison of pancreas registration rates (pmp) with transplant rates (pmp) by recipient country/Strategic Health Authority of residence

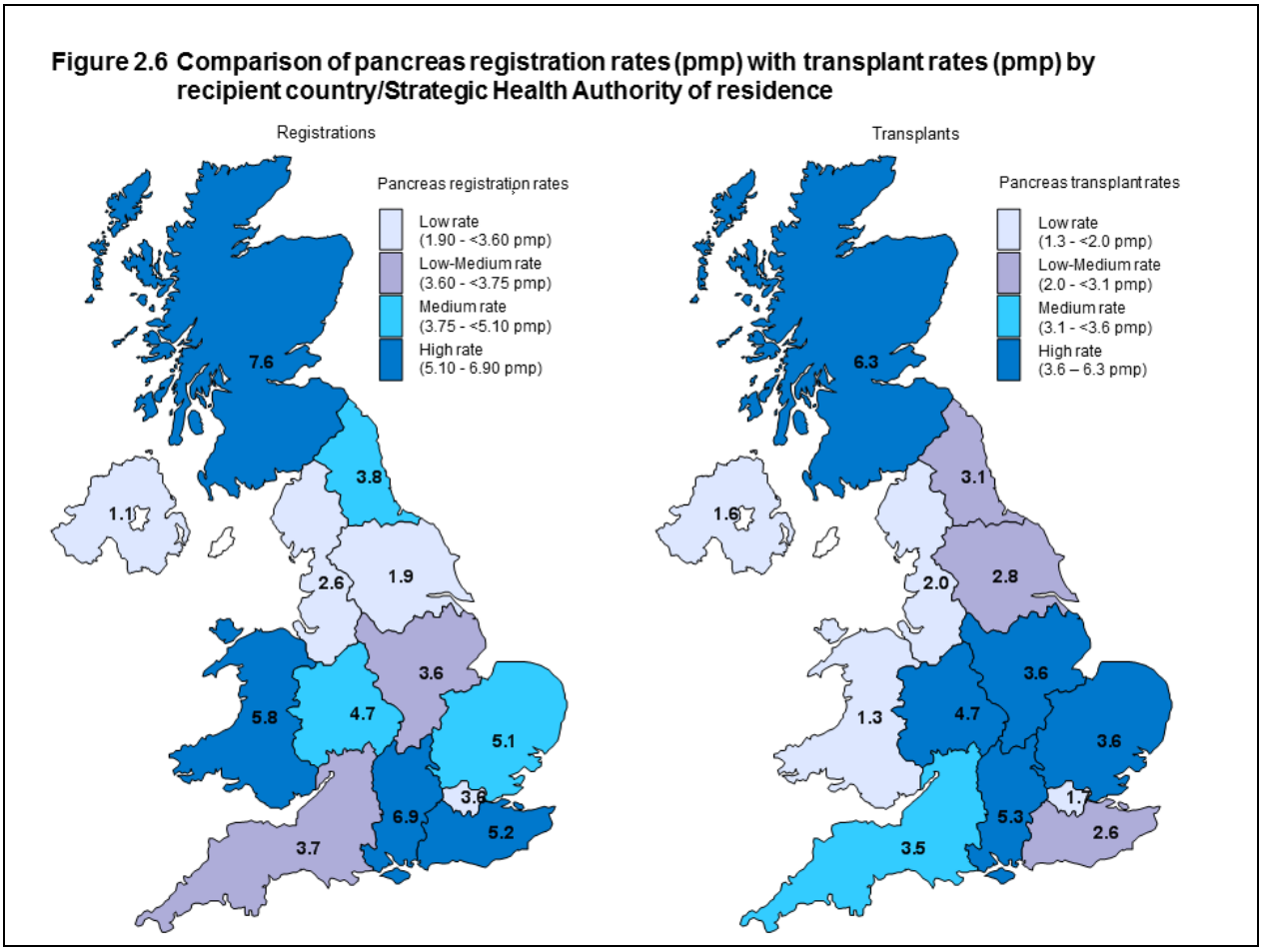


Table 2.1 Pancreas registration and transplant rates per million population (pmp) in the UK, 1 April 2016 – 31 March 2017, by Country/Strategic Health Authority

Country/ Strategic Health Authority	Registrations (pmp)		Transplants (pmp)	
North East	10	(3.8)	8	(3.1)
North West	19	(2.6)	14	(2)
Yorkshire and The Humber	10	(1.9)	15	(2.8)
North of England	**39**	**(2.6)**	**37**	**(2.4)**
East Midlands	17	(3.6)	17	(3.6)
West Midlands	27	(4.7)	27	(4.7)
East of England	31	(5.1)	22	(3.6)
Midlands and East	**75**	**(4.5)**	**66**	**(4)**
London	**31**	**(3.6)**	**15**	**(1.7)**
South East Coast	24	(5.2)	12	(2.6)
South Central	30	(6.9)	23	(5.3)
South West	20	(3.7)	19	(3.5)
South of England	**74**	**(5.1)**	**54**	**(3.7)**
England	**219**	**(4)**	**172**	**(3.1)**
Isle of Man	**0**		**0**	
Channel Islands	**0**		**0**	
Wales	**18**	**(5.8)**	**4**	**(1.3)**
Scotland	**41**	**(7.6)**	**34**	**(6.3)**
Northern Ireland	**2**	**(1.1)**	**3**	**(1.6)**
TOTAL	**280**	**(4.3)**	**213**	**(3.3)**

Pancreas transplant list

3.1 Patients on the pancreas transplant list as at 31 March, 2008 – 2017

Figure 3.1 shows the number of patients on the pancreas transplant list at 31 March each year between 2008 and 2017. The number of patients actively waiting for a pancreas transplant increased from 216 in 2008 to 316 in 2010 and then fell to 228 in 2012. Since then, numbers have slowly decreased and 203 patients were listed for a pancreas transplant at 31 March 2017.

Figure 3.1 Patients on the pancreas transplant list at 31 March

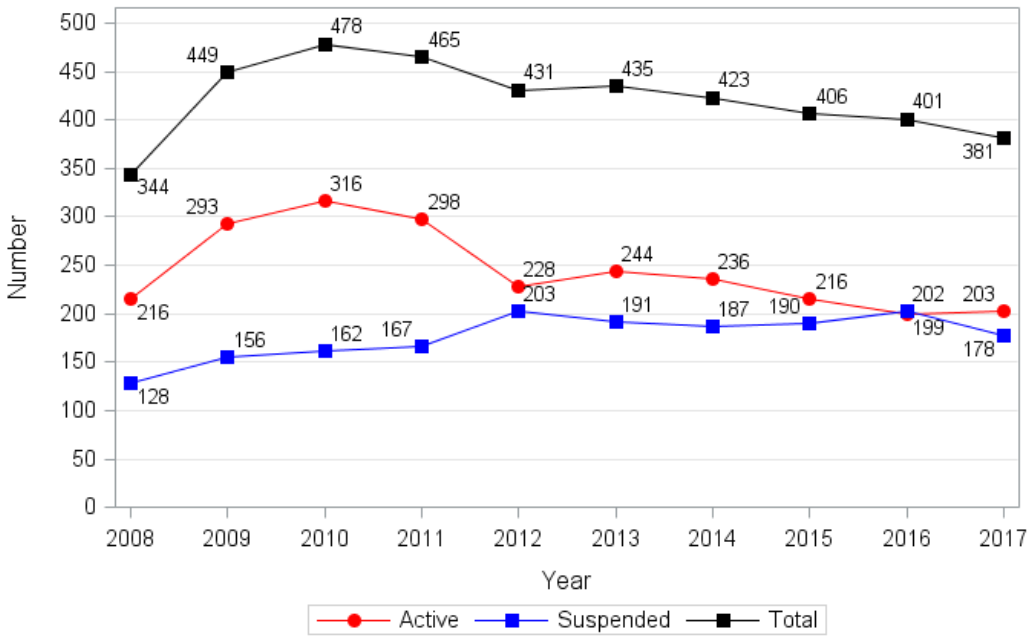


Figure 3.2 shows the number of patients on the active pancreas transplant list at 31 March 2017 by centre. Oxford had the largest proportion of the transplant list (33%) and WLRTC had the smallest proportion (5%).

Figure 3.2 Patients on the active pancreas transplant list at 31 March 2017, by centre

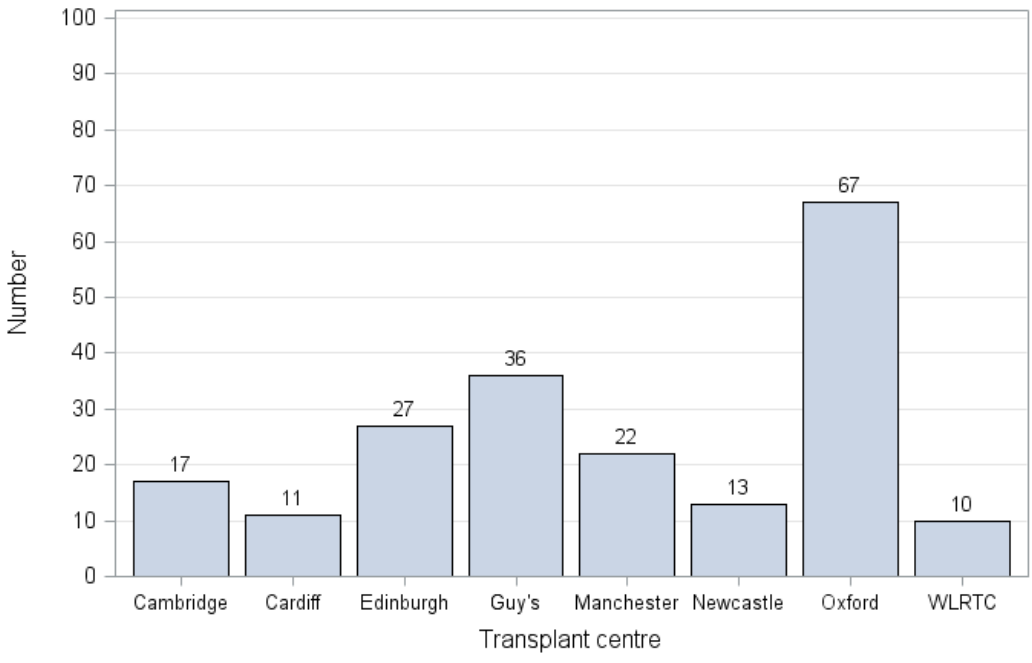
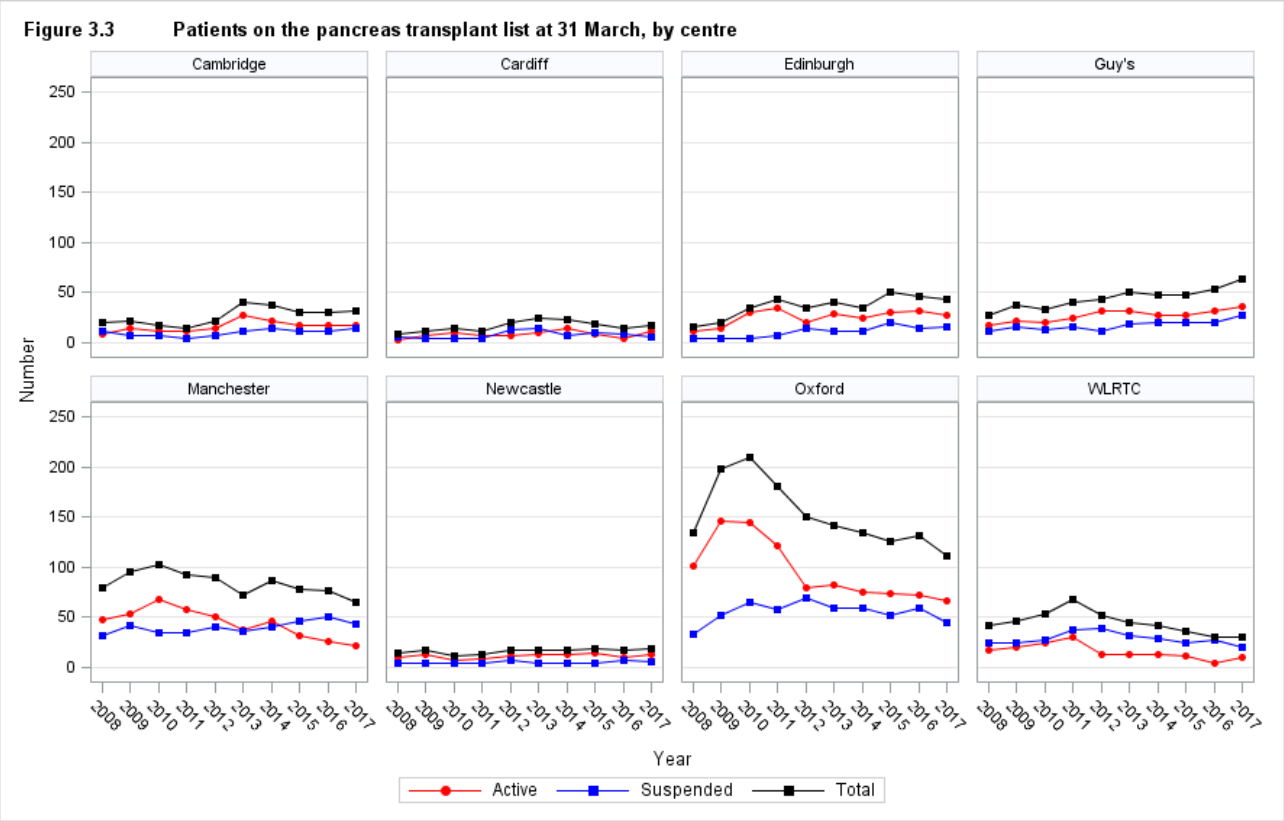


Figure 3.3 shows the number of patients on the pancreas transplant list at 31 March each year between 2008 and 2017 for each transplant centre.



3.2 Post-registration outcomes, 1 April 2013 – 31 March 2014

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 who died while on the transplant list. Only 40% of patients registered between 1 April 2013 and 31 March 2014 were transplanted within one year, while three years after listing 76% of patients had received a transplant. There were 7% of patients who had died waiting for a transplant within 3 years of listing.

Figure 3.4 Post-registration outcome for 257 new pancreas registrations made in the UK, 1 April 2013 - 31 March 2014

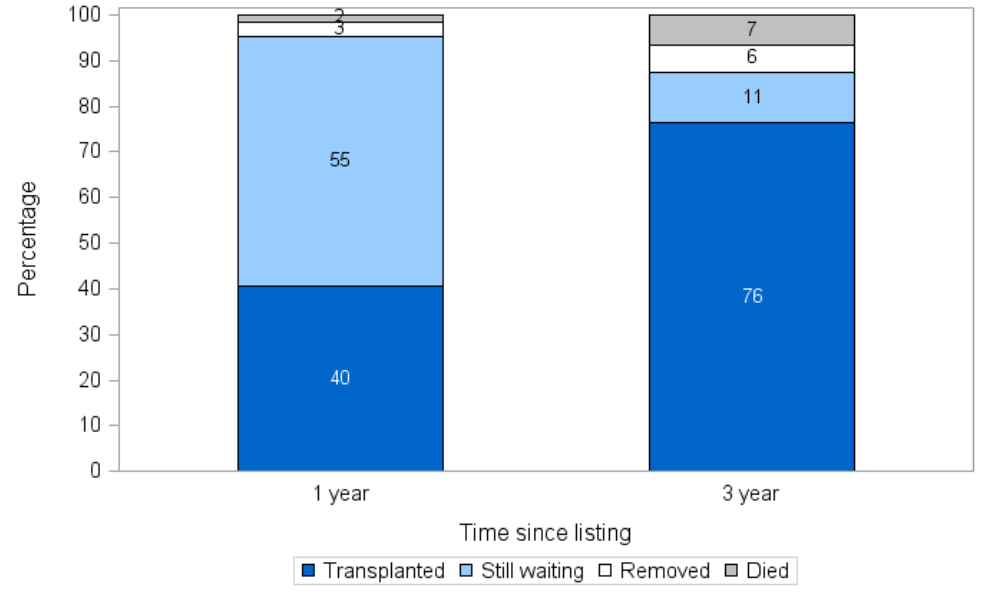
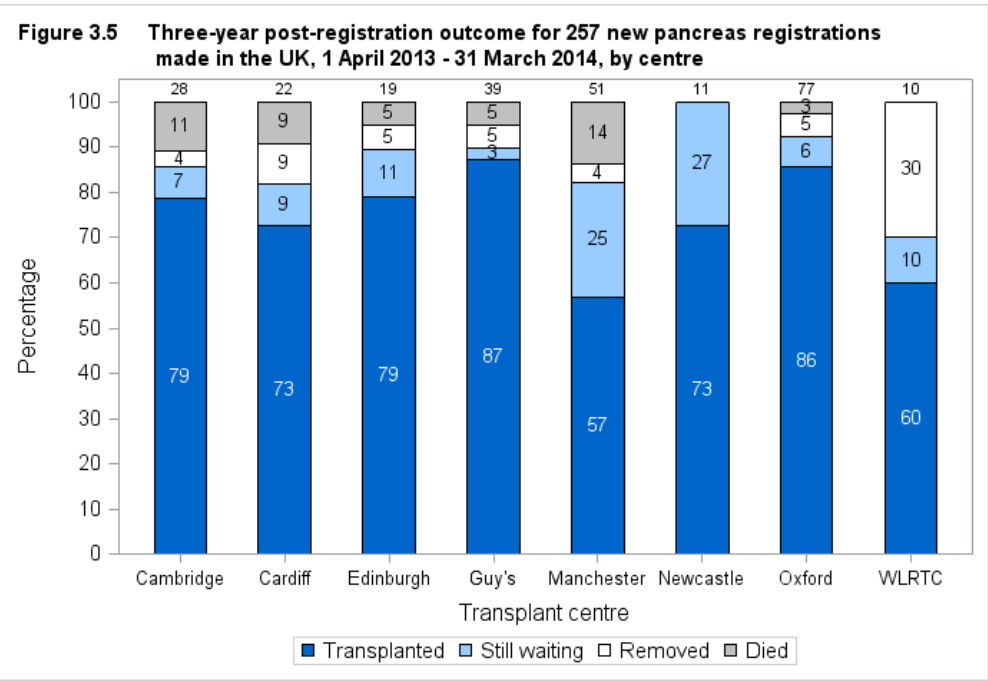


Figure 3.5 shows the proportion of patients transplanted or still waiting three years after joining the list by centre. Three years after listing, Guy's had transplanted 87% of their patients while Manchester only transplanted 57%.

Figure 3.5 Three-year post-registration outcome for 257 new pancreas registrations made in the UK, 1 April 2013 - 31 March 2014, by centre



3.3 Demographic characteristics, 1 April 2016 – 31 March 2017

The sex, ethnicity, age group and sensitisiation group (cRF%) of patients registered on the pancreas transplant list in 2016/17 are shown by centre in **Figures 3.6, 3.7, 3.8,** and **3.9** respectively. Note that all percentages quoted are based only on data where relevant information was available.

Overall, 241 patients were registered on the pancreas transplant list, 224 (93%) were waiting for a simultaneous kidney/pancreas transplant. Of which 58% were male, 84% were white, the median age was 41 years and the median cRF was 0%.

Of the 17 (7%) patients on the pancreas only transplant list, 35% were male, 100% were white, the median age was 48 years and the median cRF was 47%.

Figure 3.6 **Registrations on the active pancreas transplant list, 1 April 2016 and 31 March 2017, by centre and sex**

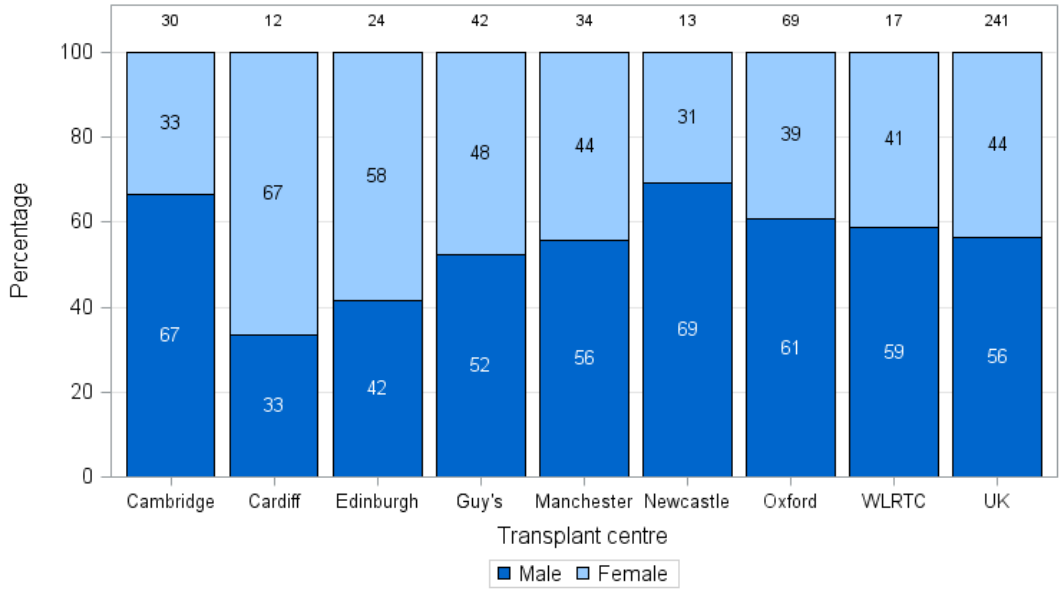


Figure 3.7 **Registrations on the active pancreas transplant list, 1 April 2016 and 31 March 2017, by centre and ethnic origin**

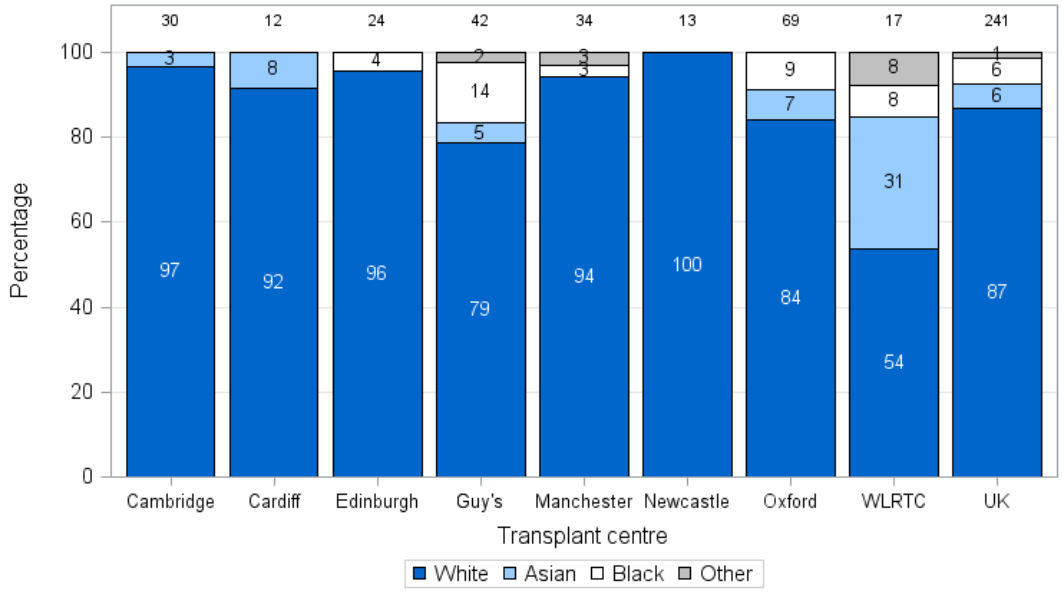


Figure 3.8 **Registrations on the active pancreas transplant list, 1 April 2016 and 31 March 2017, by centre and age group**

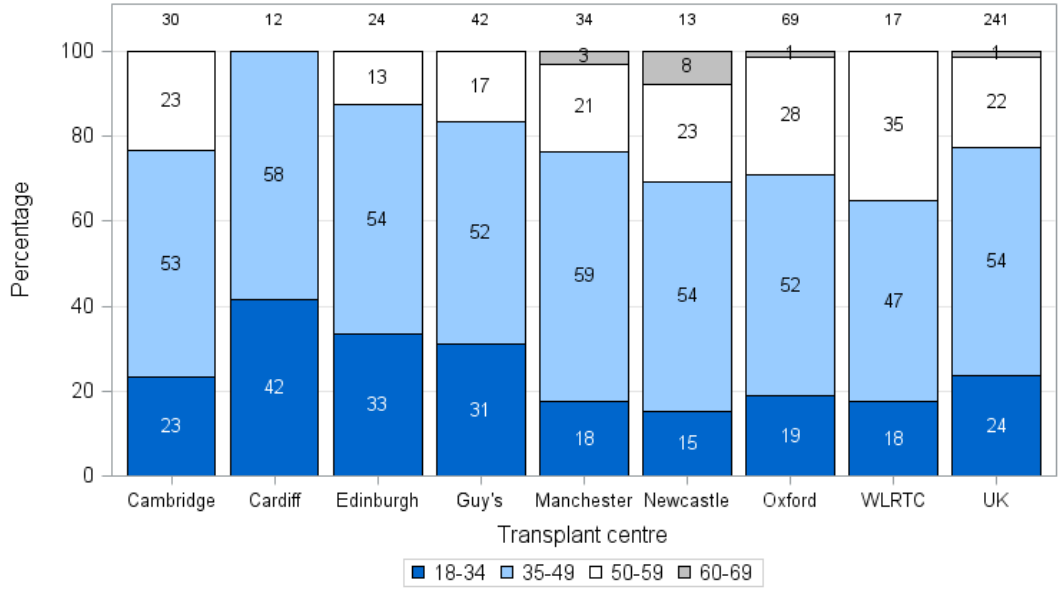
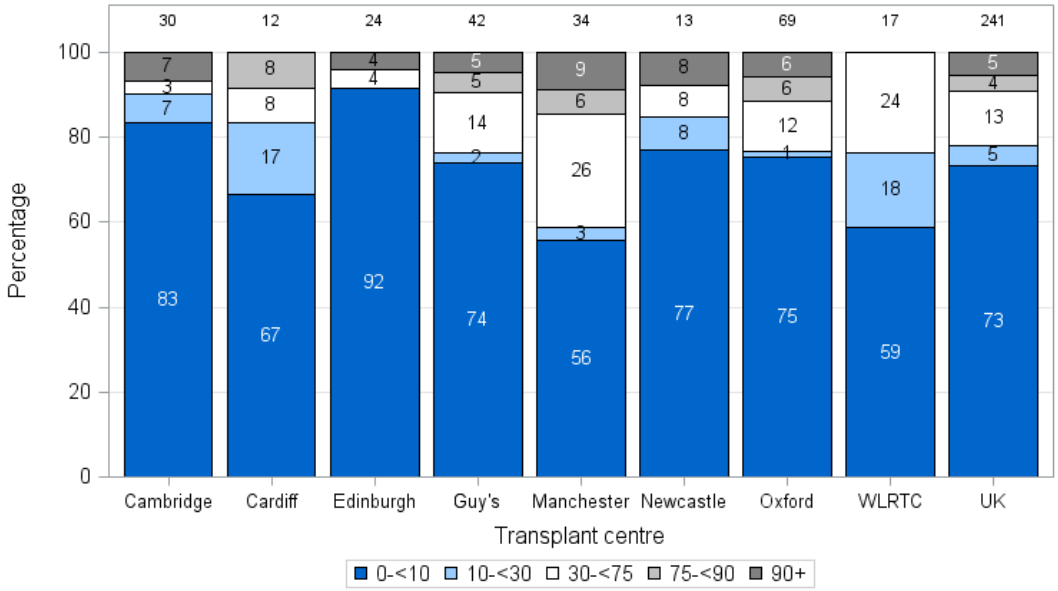


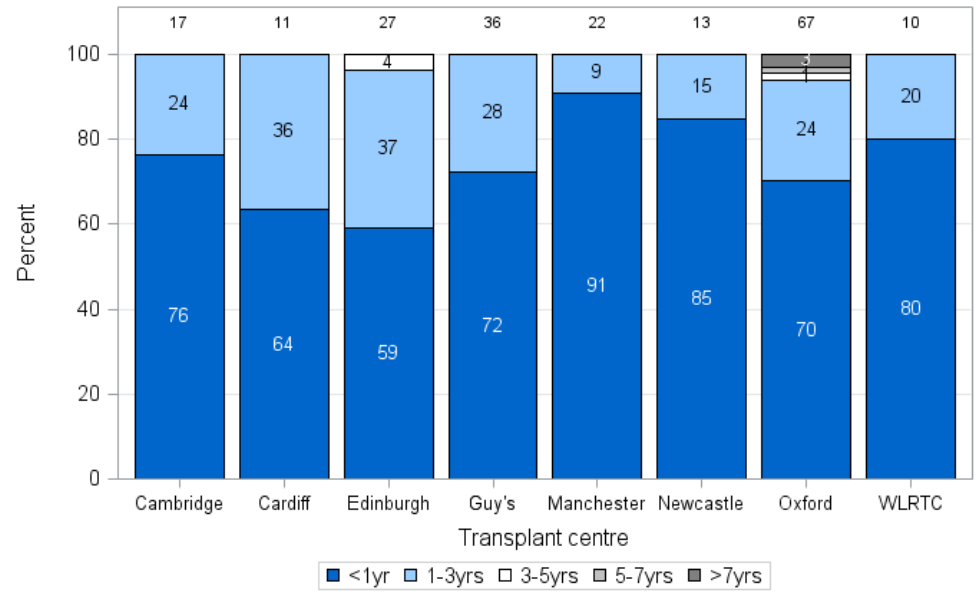
Figure 3.9 **Registrations on the active pancreas transplant list, 1 April 2016 and 31 March 2017, by centre and sensitisation group (cRF%)**



3.4 Patient waiting times for those currently on the list, 31 March 2017

Figure 3.10 shows the length of time patients have been waiting on the pancreas transplant list at 31 March 2017 by centre. The majority of patients currently listed have been waiting less than one year. Two patients at Oxford have been waiting more than 7 years for transplant; both are simultaneous kidney/pancreas patients and are highly sensitised with a cRF of 99% or more.

Figure 3.10 Patients on the active pancreas transplant list as at 31 March 2017, by centre and grouped waiting time



3.5 Median waiting time to transplant, 1 April 2011 - 31 March 2014

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 calculated using the Kaplan-Meier method and is shown in **Figure 3.11** 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 2011 and 31 March 2014 is 344 days, just over 11 months. This ranged from 179 days at Cardiff to 521 days at Newcastle.

Figure 3.11 Median waiting time to deceased donor transplant for patients registered on the pancreas transplant list, 1 April 2011 - 31 March 2014

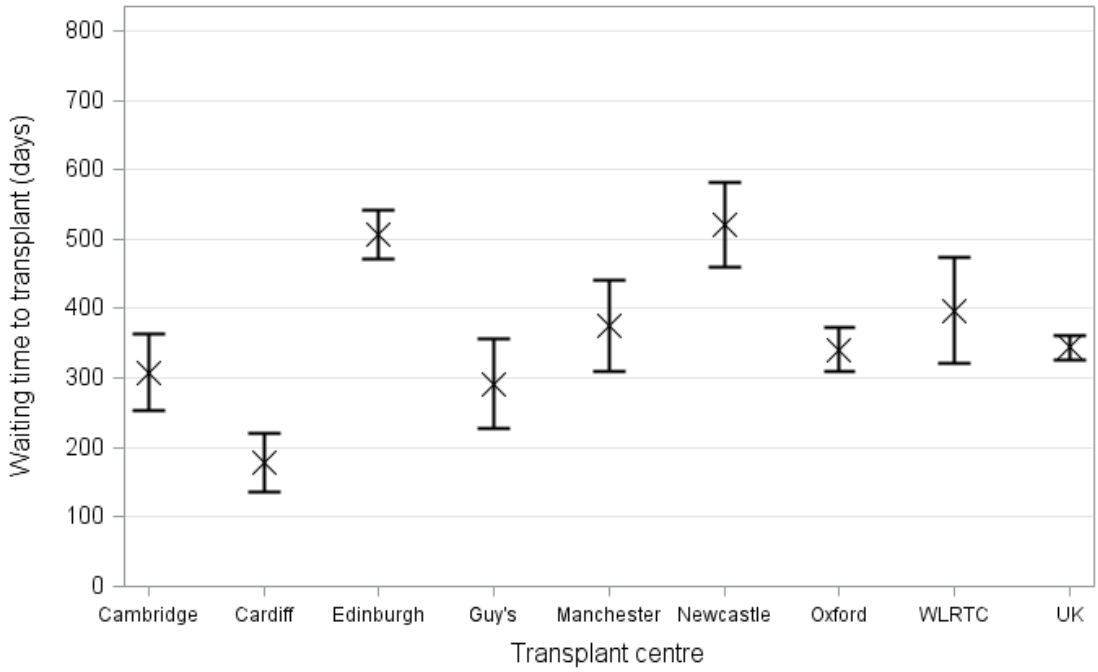


Table 3.1 Median waiting time to pancreas transplant in the UK, for patients registered 1 April 2011 - 31 March 2014

Transplant centre	Number of patients registered	Waiting time (days) Median	95% Confidence interval
Cambridge	81	308	253 - 363
Cardiff	60	179	137 - 221
Edinburgh	56	506	471 - 541
Guy's	112	292	227 - 357
Manchester	116	375	310 - 440
Newcastle	29	521	460 - 582
Oxford	231	341	310 - 372
WLRTC	38	397	321 - 473
UK	**723**	**344**	**326 - 362**

Response to pancreas offers

4.1 Offer decline rates, 1 April 2014 – 31 March 2017

Pancreas offers from DBD and DCD donors whose pancreas was retrieved, offered directly on behalf of a named individual patient and resulted in transplantation were analysed separately. Any offers of pancreases declined for transplantation, pancreases offered for multi-organ or small bowel transplant 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 DBD decline rates with the national rate over the time period, 1 April 2014 and 31 March 2017. Centres can be identified by the information shown in **Table 4.1**. Guy's and Cambridge had offer decline rates better than the national rate, whilst Edinburgh and Newcastle had higher rates than the national average.

Figure 4.1 DBD donor pancreas offer decline rates for pancreases that resulted in a pancreas transplant, 1 April 2014 and 31 March 2017

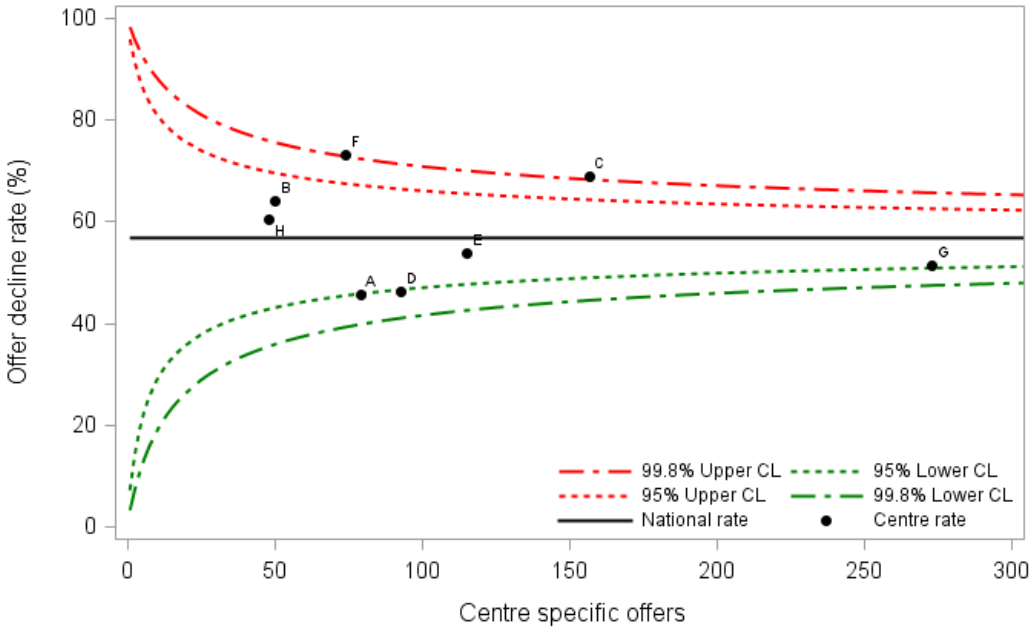


Table 4.1 compares individual centre DBD offer decline rates over time by financial year. The offer decline rate for Edinburgh and Newcastle have decreased to 64% and 72% respectively, for this financial year. However, the rates are still higher than the national rate, 54%.

Table 4.1 DBD donor pancreas offer decline rates by transplant centre, 1 April 2014 and 31 March 2017

Centre	Code	2014/15		2015/16		2016/17		Overall	
		N	(%)	N	(%)	N	(%)	N	(%)
Cambridge	A	38	(61)	21	(33)	20	(30)	79	(46)
Cardiff	B	24	(71)	22	(68)	4	(0)	50	(64)
Edinburgh	C	43	(70)	58	(72)	56	(64)	157	(69)
Guy's	D	29	(41)	33	(39)	31	(58)	93	(46)
Manchester	E	43	(51)	43	(63)	29	(45)	115	(54)
Newcastle	F	21	(67)	24	(79)	29	(72)	74	(73)
Oxford	G	81	(47)	99	(57)	93	(49)	273	(51)
WLRTC	H	23	(70)	15	(40)	10	(70)	48	(60)
UK		**302**	**(57)**	**315**	**(59)**	**272**	**(54)**	**889**	**(57)**

Centre has reached the upper 99.8% confidence limit
Centre has reached the upper 95% confidence limit
Centre has reached the lower 95% confidence limit
Centre has reached the lower 98.8% confidence limit

Figure 4.2 compares individual centre offer DCD decline rates with the national rate over the time period, 1 April 2014 and 31 March 2017. Centres can be identified by the information shown in **Table 4.2**.

Figure 4.2 DCD donor pancreas offer decline rates for pancreases that resulted in a pancreas transplant, 1 April 2014 and 31 March 2017

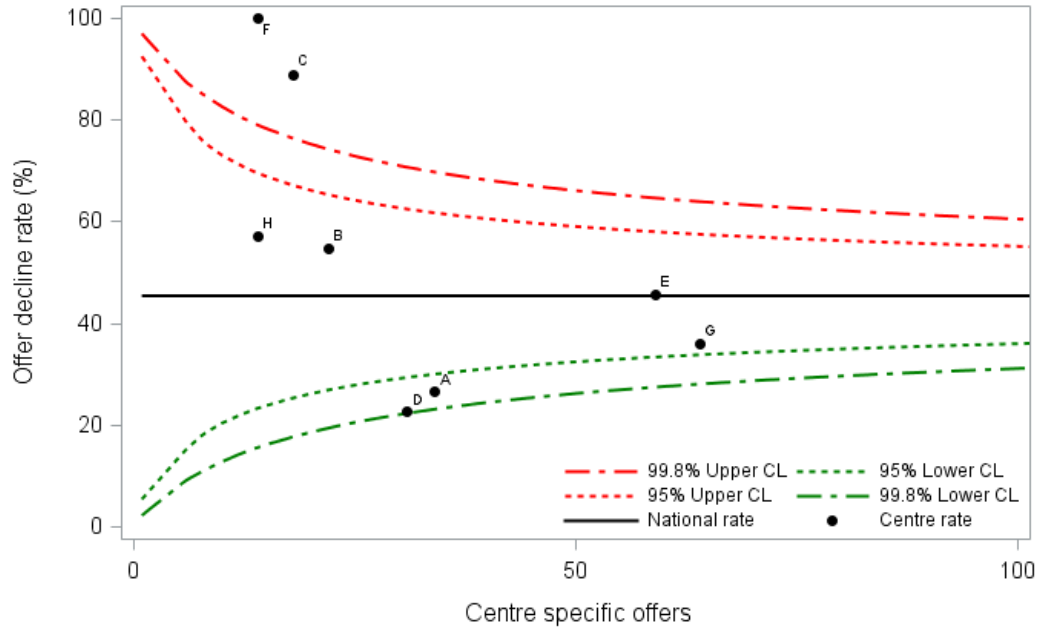


Table 4.2 compares individual DCD centre offer decline rates over time by financial year. Similarly to DBD decline rates, Guy's and Cambridge had offer decline rates better than the national rate, whilst Edinburgh and Newcastle had higher rates than the national average.

Table 4.2 DCD donor pancreas offer decline rates by transplant centre, 1 April 2014 and 31 March 2017

Centre	Code	2014/15		2015/16		2016/17		Overall	
		N	(%)	N	(%)	N	(%)	N	(%)
Cambridge	A	16	(31)	11	(27)	7	(14)	34	(26)
Cardiff	B	16	(56)	3	(33)	3	(67)	22	(55)
Edinburgh	C	7	(71)	7	(100)	4	(100)	18	(89)
Guy's	D	13	(23)	9	(22)	9	(22)	31	(23)
Manchester	E	21	(57)	21	(43)	17	(35)	59	(46)
Newcastle	F	4	(100)	7	(100)	3	(100)	14	(100)
Oxford	G	24	(33)	19	(32)	21	(43)	64	(36)
WLRTC	H	4	(100)	5	(40)	5	(40)	14	(57)
UK		**105**	**(48)**	**82**	**(45)**	**69**	**(42)**	**256**	**(45)**

Centre has reached the upper 99.8% confidence limit
Centre has reached the upper 95% confidence limit
Centre has reached the lower 95% confidence limit
Centre has reached the lower 98.8% confidence limit

Pancreas transplants

5.1 Pancreas transplants, 1 April 2007 – 31 March 2017

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%). The number of DCD transplants performed reached a peak of 60 in 2014/15 but within the last two financial years, DCD pancreas transplants have dropped to 49 in 2015/16 and 45 in 2016/17 and accounts for a quarter of pancreas transplants in both years.

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 the last three years to 134 transplants in 2016/17.

Figure 5.1 Pancreas transplants, 1 April 2007 - 31 March 2017, by financial year and donor type

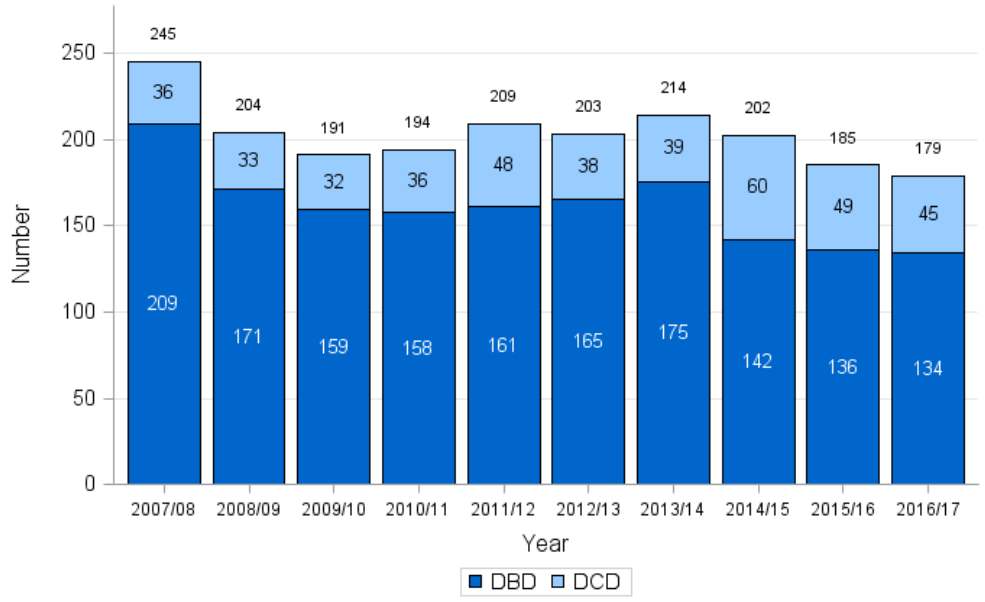


Figure 5.2 shows the total number of pancreas transplants performed in 2016/17, by centre and type of donor. The same information is presented in **Figure 5.3** but this shows the proportion of DBD and DCD transplants performed at each centre. Oxford performed the most DBD and DCD transplants (62). There were no DCD transplants performed at Newcastle and Edinburgh in the last financial year. WLRTC had the largest proportion of DCD transplants (43%), closely followed by Manchester (42%).

Figure 5.2 Pancreas transplants, 1 April 2016 - 31 March 2017, by centre and donor type

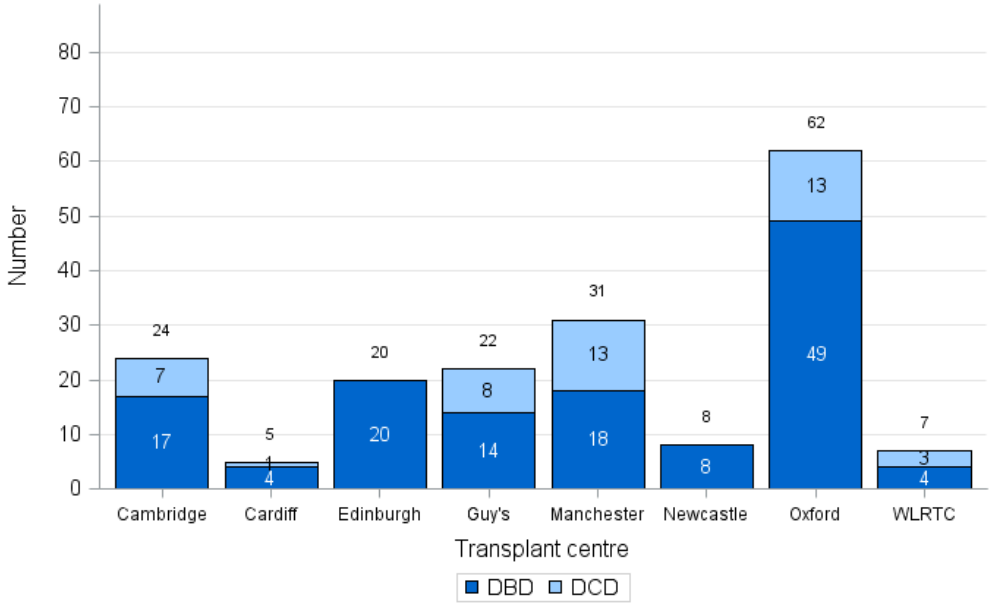


Figure 5.3 Pancreas transplants, 1 April 2016 - 31 March 2017, by centre and donor type

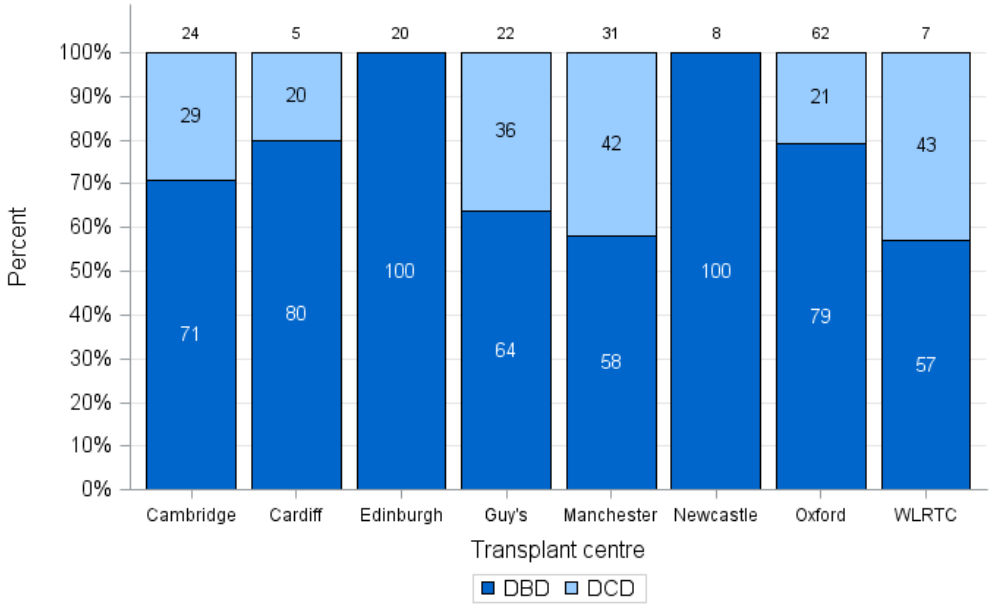
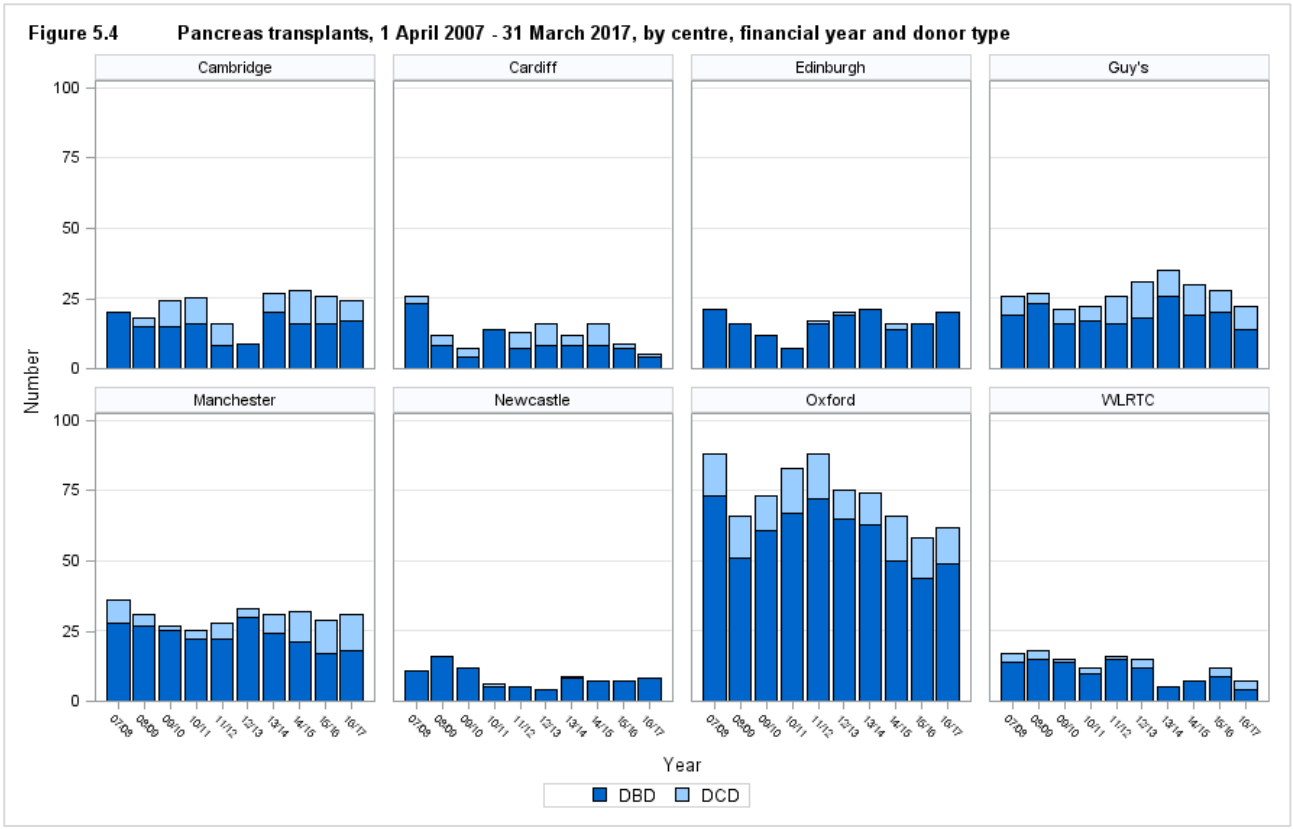


Figure 5.4 shows the total number of pancreas transplants performed in last ten years, by centre and type of donor. Oxford have consistently performed a large number of pancreas transplants since 2007/08 including a number of DCD transplants over the last ten years. However, the number of transplants performed at Oxford has decreased since 2011/12.



5.2 Demographic characteristics, 1 April 2016 - 31 March 2017

The sex, ethnicity, age group and sensitisation group (cRF%) of patients that received a pancreas transplant in 2016/17 are shown by centre in **Figures 5.5, 5.6, 5.7** and **5.8** respectively. Note that all percentages quoted are based only on data where relevant information was available.

Overall, 179 patients were transplanted on the pancreas transplant list, 162 (91%) were a simultaneous kidney/pancreas transplant. Of which 55% were male, 91% were white, the median age was 43 years and the median cRF was 0%.

Of the 17 (9%) patients on the pancreas only transplant list, 35% were male, 100% were white, the median age was 46 years and the median cRF was 51%.

Figure 5.5 **Pancreas transplants, 1 April 2016 and 31 March 2017, by centre and sex**

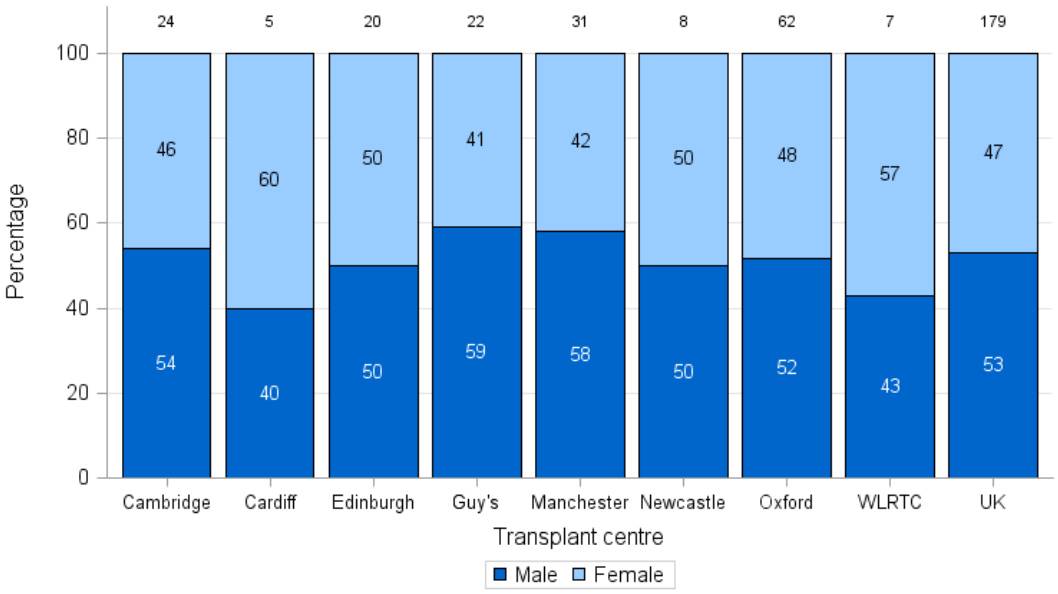


Figure 5.6 Pancreas transplants, 1 April 2016 and 31 March 2017, by centre and ethnic origin

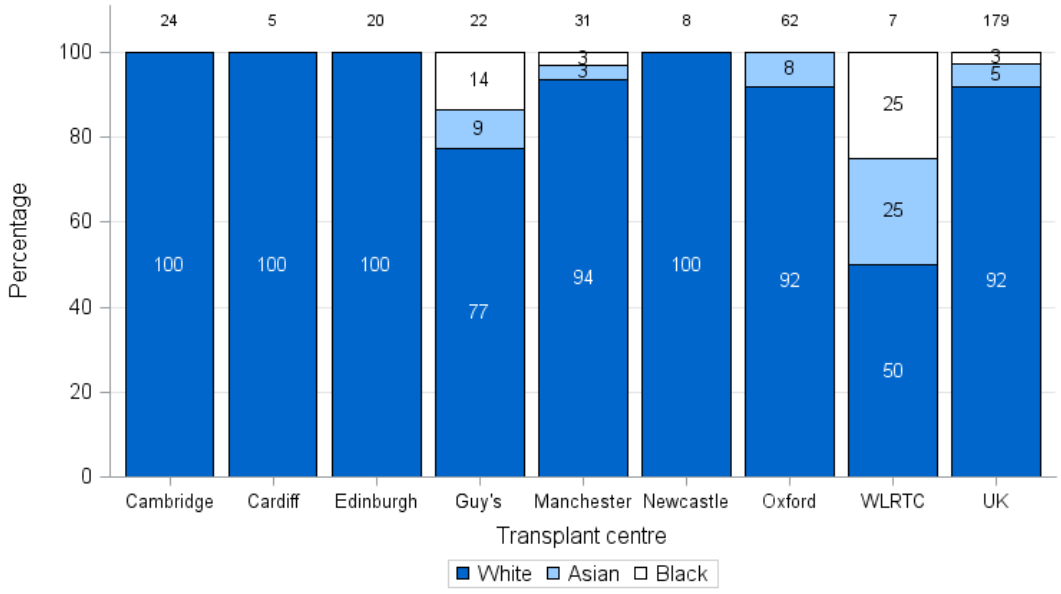


Figure 5.7 Pancreas transplants, 1 April 2016 and 31 March 2017, by centre and age group

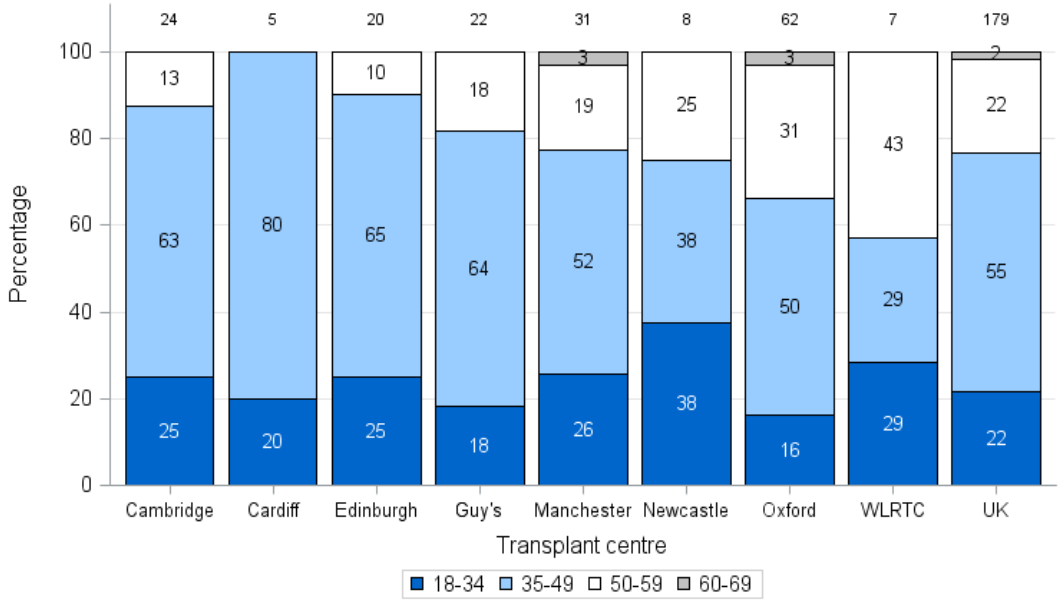
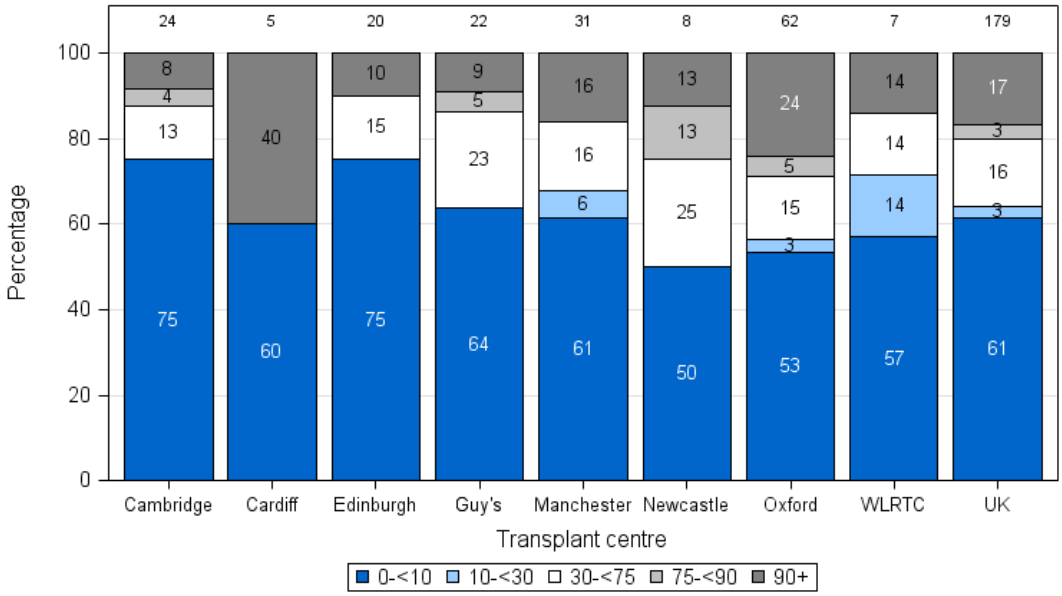


Figure 5.8 Pancreas transplants, 1 April 2016 and 31 March 2017, by centre and sensitisation (cRF%) group



5.3 Cold ischaemia time, 1 April 2007 – 31 March 2017

Median cold ischaemia times (CIT) are shown in addition to inter-quartile ranges in **Figures 5.9** to **5.14**. 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 5.9 shows the median cold ischaemia time in DBD donor pancreas transplants over the last 10 years. During this time period the overall median cold ischaemia time has been fluctuating between 13 hours in 2007/08 and 11 hours in 2016/17.

Figure 5.9 **Median cold ischaemia time in DBD donor pancreas transplants 1 April 2007 - 31 March 2017**

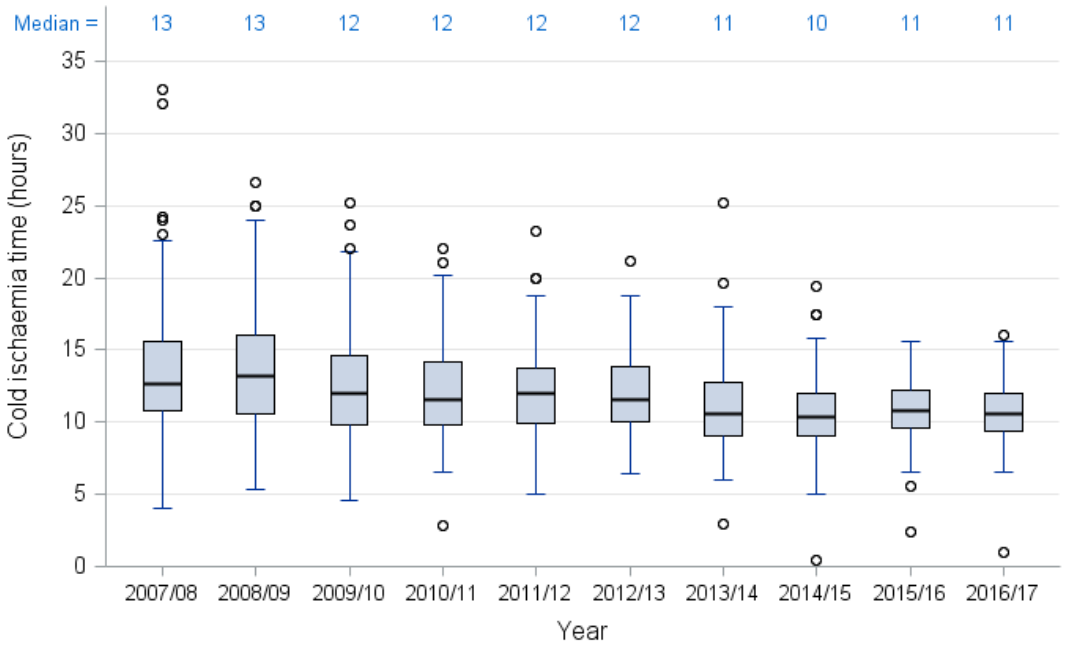


Figure 5.10 shows the median cold ischaemia time in DBD donor pancreas transplants in 2016/17 for each transplant centre. Three centres had the longest median cold ischaemia time in 2016/17 of 12 hours compared with Cambridge who had the shortest of 9 hours.

Figure 5.10 **Median cold ischaemia time in DBD donor pancreas transplants 1 April 2016 - 31 March 2017**

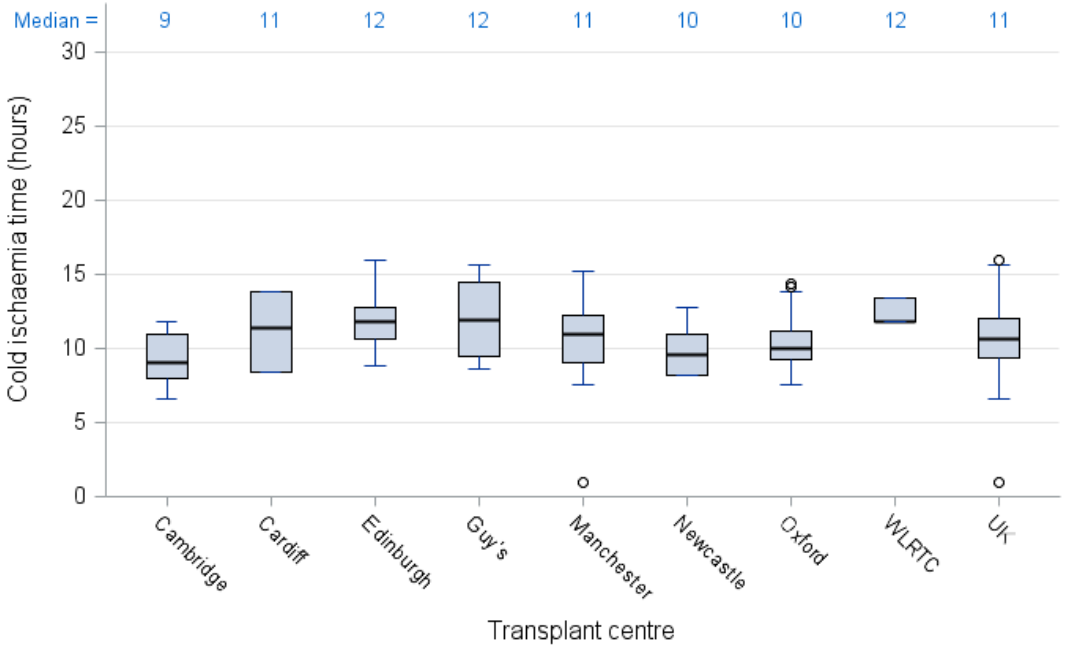


Figure 5.11 shows the median cold ischaemia time in DBD donor pancreas transplants over the last ten years for each transplant centre.

Figure 5.11 Median cold ischaemia time in DBD donor pancreas transplants, 1 April 2007 - 31 March 2017

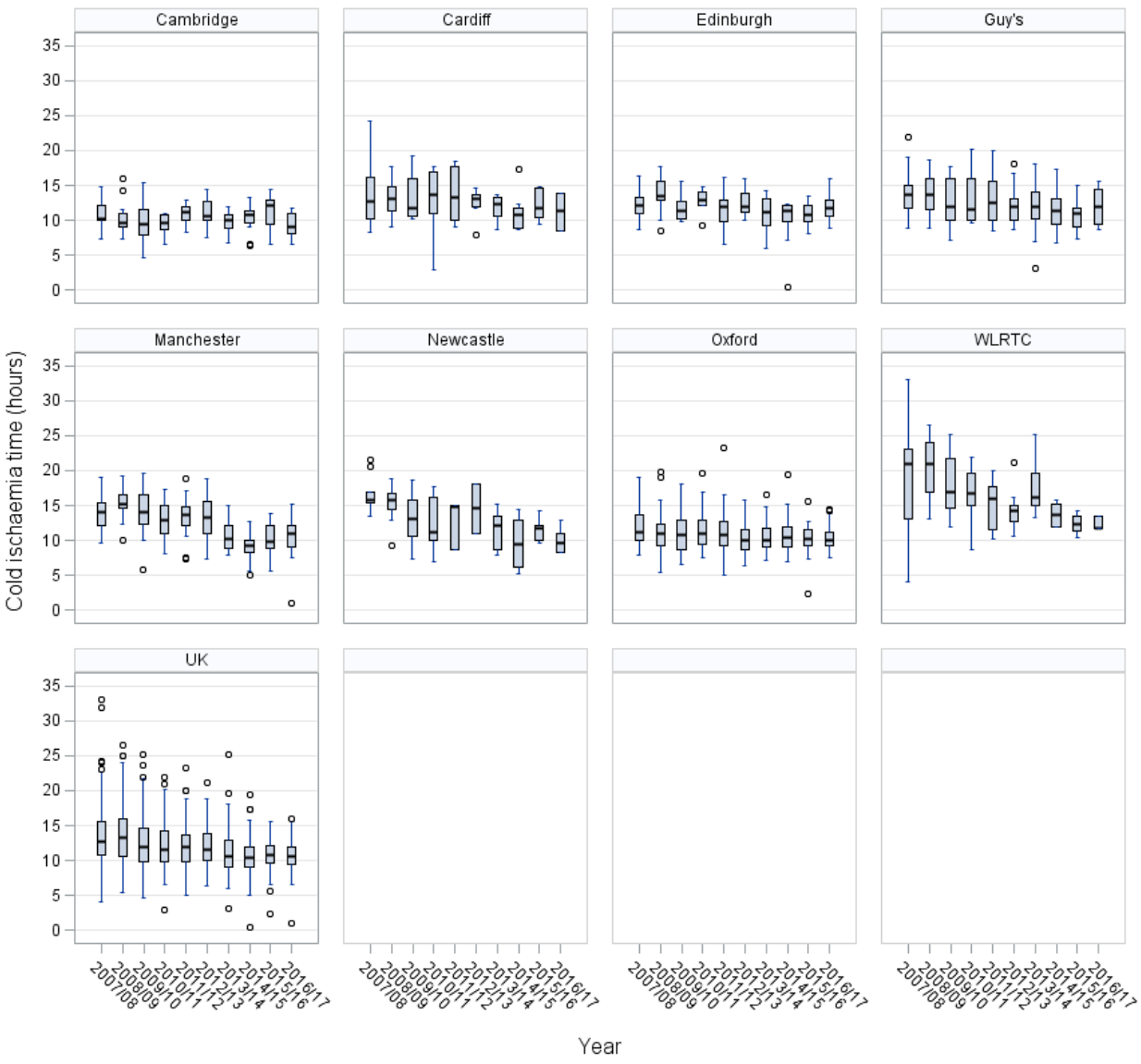


Figure 5.12 shows the median cold ischaemia time in DCD donor pancreas transplants over the last ten years. Overall median cold ischaemia time has fallen from 15 hours in 2007/08 to 10 hours in 2016/17.

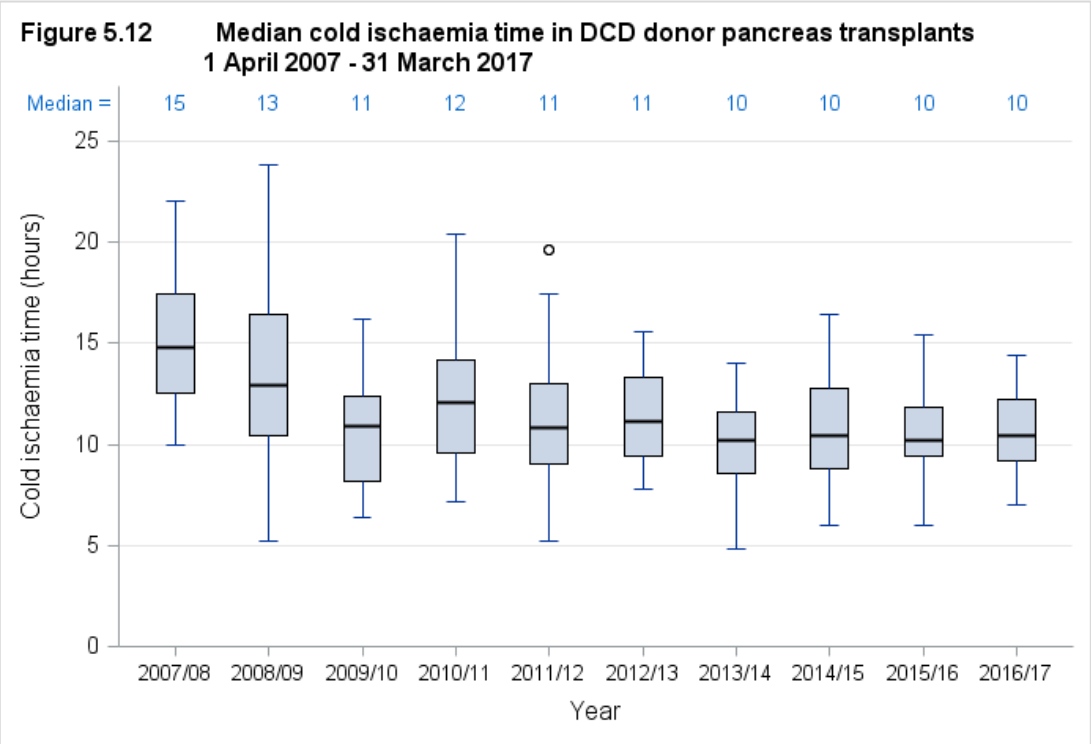


Figure 5.9 shows the median cold ischaemia time in DCD donor pancreas transplants in 2016/17 for each transplant centre. Cambridge and Oxford had the shortest median cold ischaemia time of 10 hours, whilst Guy's had the longest median ischaemia time of 12 hours. Cardiff is not shown as the cold ischaemia time was not reported for their single DCD donor pancreas transplant.

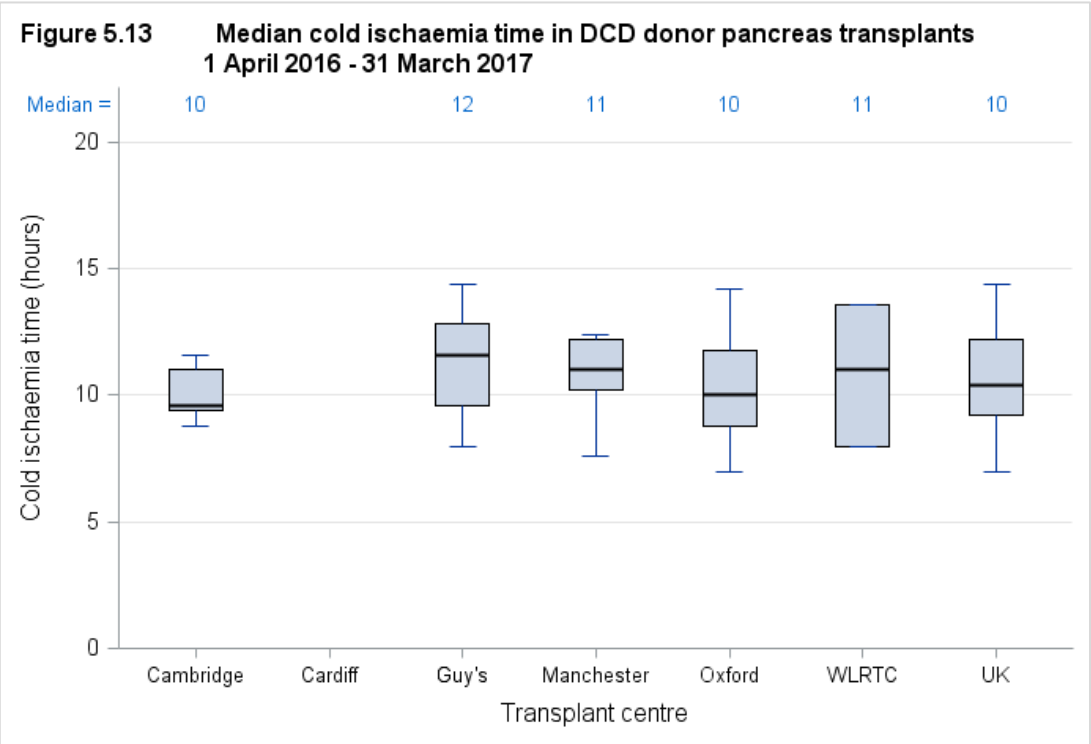
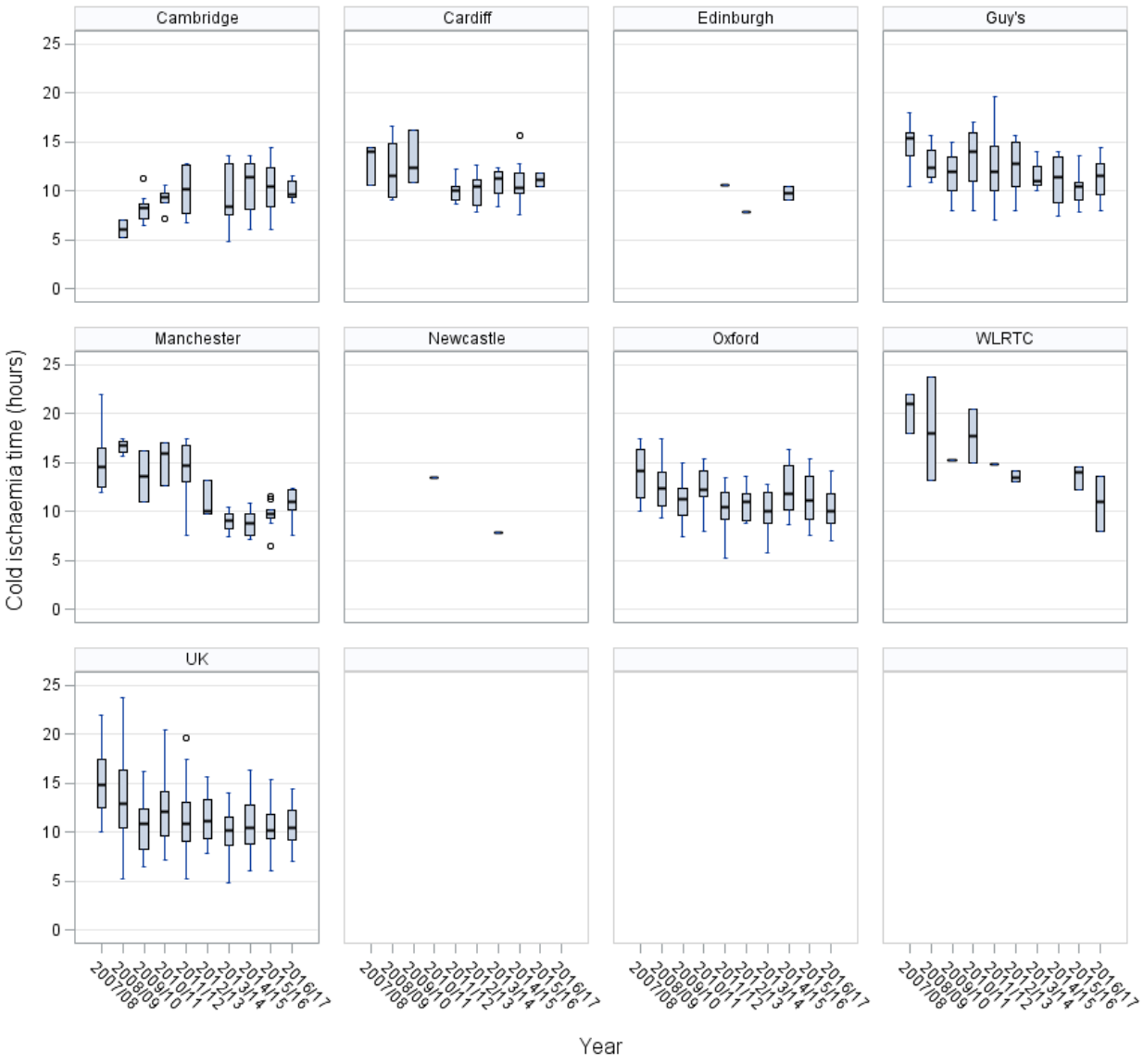


Figure 5.14 shows the median cold ischaemia time in DCD donor pancreas transplants for each transplant centre over the last ten years.

Figure 5.14 Median cold ischaemia time in DCD donor pancreas transplants, 1 April 2007 - 31 March 2017



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 95% confidence limit. This suggests that these centres may have survival rates that are considerably higher than the national rate. **Figure 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 2012 and 31 March 2016**

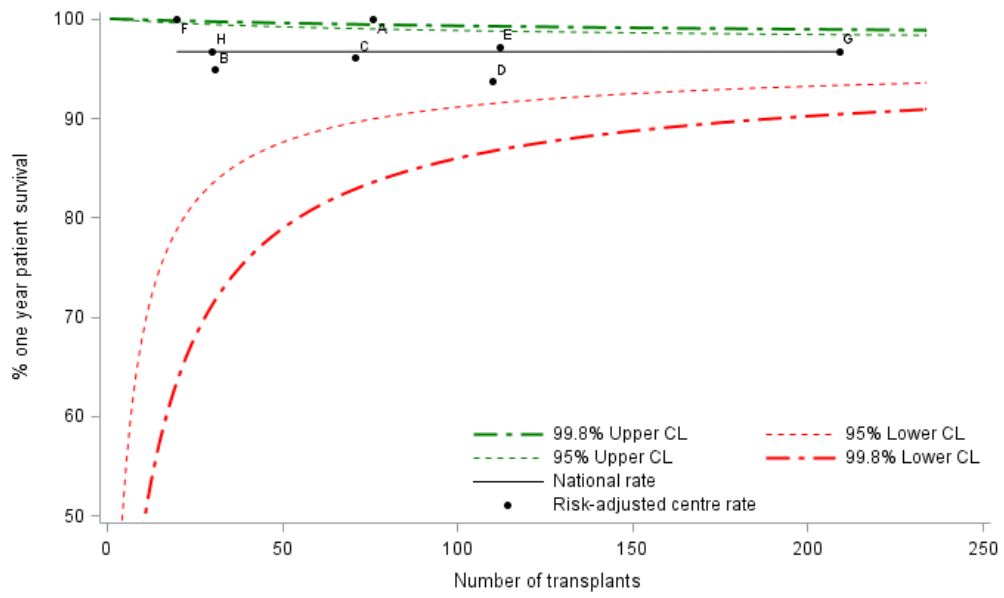


Figure 6.2 **Risk-adjusted one year pancreas graft (death censored) survival rates for all deceased donor first SPK transplants, between 1 April 2012 and 31 March 2016**

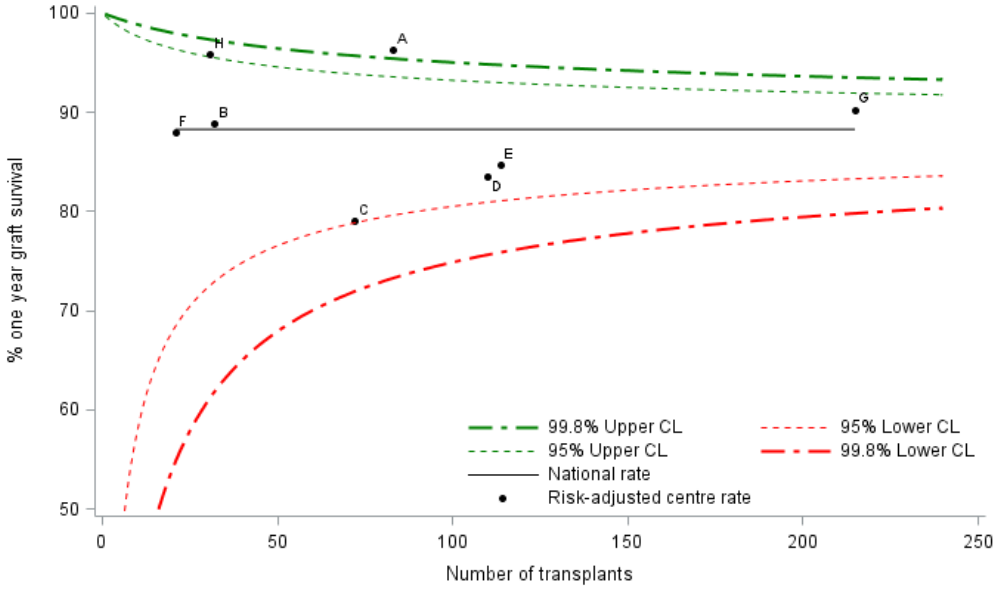


Figure 6.3 **Risk-adjusted five year patient survival rates for deceased donor first SPK transplants, between 1 April 2008 and 31 March 2012**

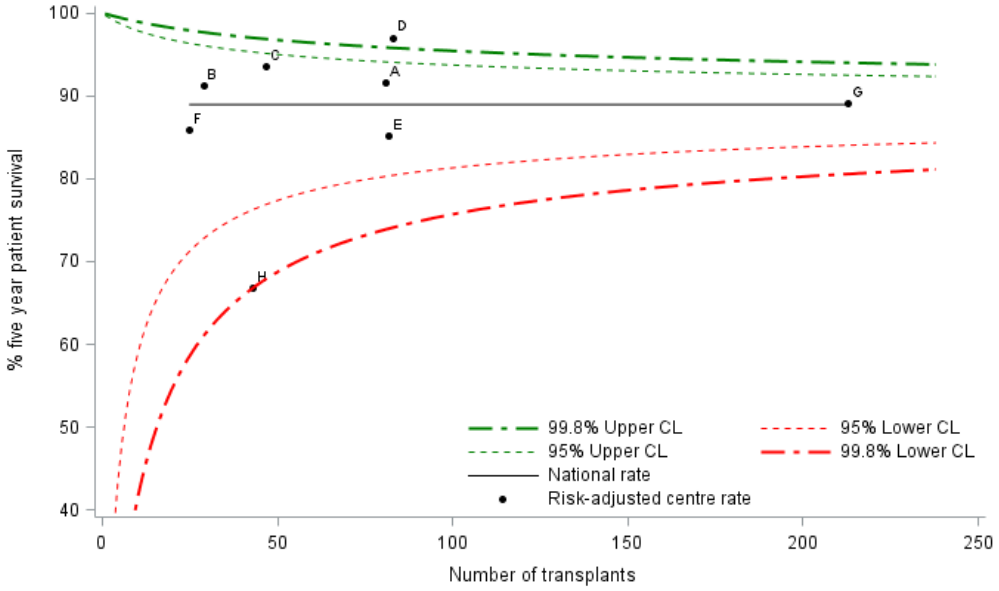


Figure 6.4 **Risk-adjusted five year pancreas graft (death censored) survival rates for all deceased donor first SPK transplants, between 1 April 2008 and 31 March 2012**

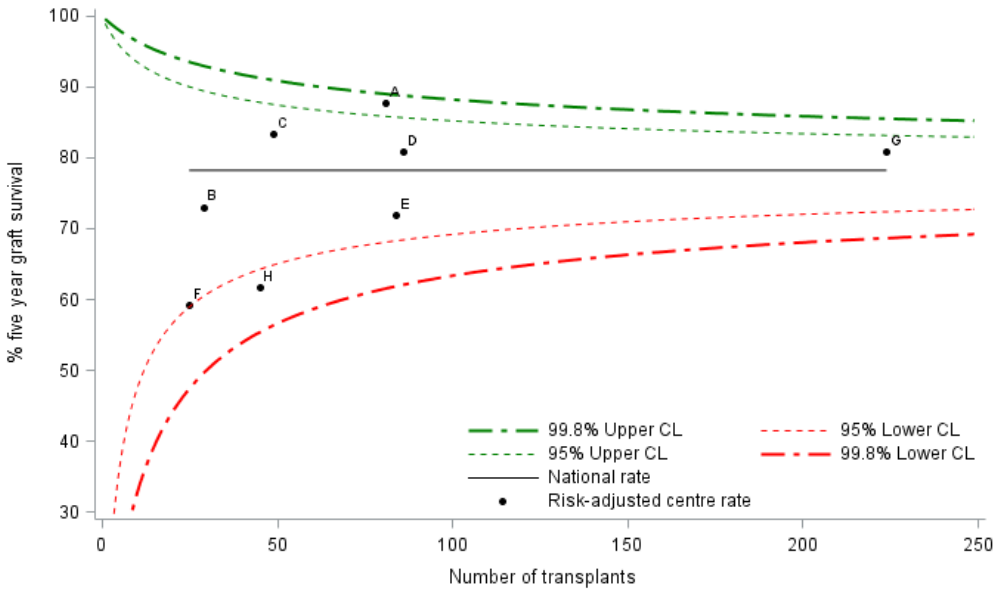


Table 6.1 **Risk-adjusted one and five year patient survival for first SPK transplants using pancreases from deceased donors**

		patient survival					
		One-year*			Five-year**		
Centre	Code	N	%	(95% CI)	N	%	(95% CI)
Cambridge	A	76	100	N/A	81	92	(80 - 97)
Cardiff	B	31	95	(71 - 100)	29	91	(68 - 99)
Edinburgh	C	71	96	(88 - 99)	47	93	(81 - 99)
Guy's	D	110	94	(85 - 98)	83	97	(89 - 100)
Manchester	E	112	97	(92 - 99)	82	85	(73 - 93)
Newcastle	F	20	100	N/A	25	86	(59 - 97)
Oxford	G	209	97	(93 - 99)	213	89	(84 - 93)
WLRTC	H	30	97	(82 - 100)	43	67	(37 - 85)
UK		**659**	**97**	**(95 - 98)**	**603**	**89**	**(86 - 91)**

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 98.8% confidence limit

* Includes transplants performed between 1 April 2012 - 31 March 2016
** Includes transplants performed between 1 April 2008 - 31 March 2012

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

		pancreas graft survival					
		One-year*			Five-year**		
Centre	Code	N	%	(95% CI)	N	%	(95% CI)
Cambridge	A	83	96	(89 - 99)	81	88	(77 - 94)
Cardiff	B	32	89	(71 - 97)	29	73	(47 - 88)
Edinburgh	C	72	79	(63 - 89)	49	83	(67 - 93)
Guy's	D	110	83	(74 - 90)	86	81	(69 - 89)
Manchester	E	114	85	(75 - 91)	84	72	(57 - 82)
Newcastle	F	21	88	(56 - 99)	25	59	(27 - 80)
Oxford	G	215	90	(85 - 94)	224	81	(74 - 86)
WLRTC	H	31	96	(76 - 100)	45	62	(38 - 78)
UK		**678**	**88**	**(86 - 90)**	**623**	**78**	**(75 - 81)**

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 98.8% confidence limit

* Includes transplants performed between 1 April 2012 - 31 March 2016
** Includes transplants performed between 1 April 2008 - 31 March 2012

6.2 Deceased donor graft and patient survival for first PO transplants

Individual centre unadjusted 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 Unadjusted one and five year patient survival for first PO transplants using pancreases from deceased donors

		patient survival					
		One-year*			Five-year**		
Centre	Code	N	%	(95% CI)	N	%	(95% CI)
Cardiff	B	7	-	-	7	-	-
Guy's	D	4	-	-	2	-	-
Manchester	E	3	-	-	7	-	-
Newcastle	F	2	-	-	4	-	-
Oxford	G	33	94	(77 - 98)	57	79	(64 - 88)
Edinburgh	C	0	-	-	1	-	-
WLRTC	H	0	-	-	-	-	-
UK		**49**	**95**	**(83 - 99)**	**78**	**82**	**(69 - 90)**

* Includes transplants performed between 1 April 2012 - 31 March 2016
** Includes transplants performed between 1 April 2008 - 31 March 2012
- Data not presented where less than 10 transplants included

Table 6.4 Unadjusted one and five year pancreas graft survival for first PO transplants using pancreases from deceased donors

		pancreas graft survival					
		One-year*			Five-year**		
Centre	Code	N	%	(95% CI)	N	%	(95% CI)
Cambridge	A	3	-	-	0	-	-
Cardiff	B	13	69	(37 - 87)	12	67	(34 - 86)
Edinburgh	C	1	-	-	1	-	-
Guy's	D	6	-	-	5	-	-
Manchester	E	7	-	-	16	42	(18 - 65)
Newcastle	F	5	-	-	9	-	-
Oxford	G	41	85	(70 - 93)	72	57	(45 - 68)
WLRTC	H	6	-	-	10	38	(10 - 66)
UK		**82**	**80**	**(70 - 87)**	**125**	**53**	**(43 - 61)**

* Includes transplants performed between 1 April 2012 - 31 March 2016
** Includes transplants performed between 1 April 2008 - 31 March 2012
- Data not presented where less than 10 transplants included

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 2005 and 31 December 2016. 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 e.g. 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 SPK 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 and Oxford were near the lower 95.5% confidence limit. This suggests that 10 year survival from listing at Manchester and Oxford are 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.

Figure 7.1 **Risk-adjusted 10 year patient survival from listing for first deceased donor SPK transplant in patients registered between 1 January 2005 and 31 December 2016**

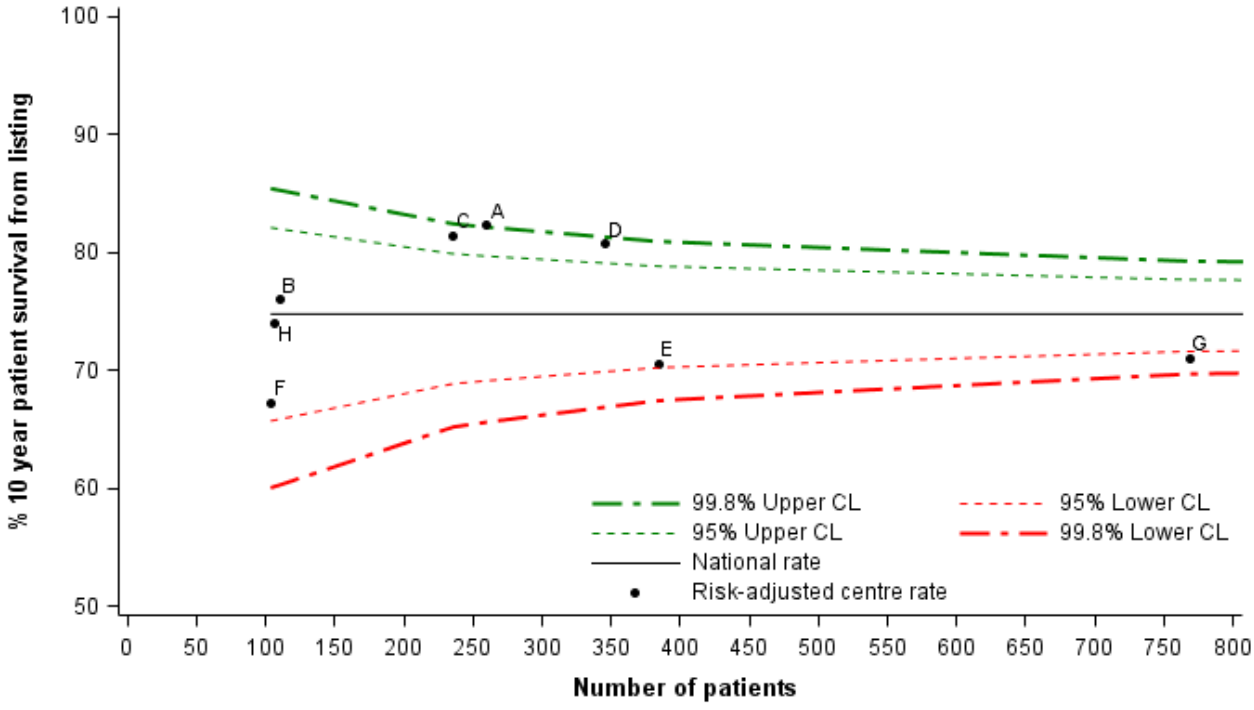


Table 7.1 **Risk-adjusted 1, 5 and 10 year patient survival from listing for first deceased donor SPK transplant in patients registered between 1 January 2005 and 31 December 2016**

Centre	Code	One year		Five year		Ten year	
		N	(%)	N	(%)	N	(%)
Cambridge	A	260	(97)	260	(89)	260	(82)
Cardiff	B	110	(96)	110	(86)	110	(76)
Edinburgh	C	236	(97)	236	(88)	236	(81)
Guy's	D	346	(97)	346	(88)	346	(81)
Manchester	E	385	(97)	385	(82)	385	(71)
Newcastle	F	104	(96)	104	(83)	104	(67)
Oxford	G	769	(96)	769	(83)	769	(71)
WLRTC	H	107	(97)	107	(87)	107	(74)
UK		**2317**	**(96)**	**2317**	**(85)**	**2317**	**(75)**

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 98.8% confidence limit

Form return rates

8.1 Pancreas form return rates, 1 January – 31 December 2016

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 2016 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 89% of lifetime follow-up forms issued have been returned.

Table 8.1 Form return rates following pancreas transplantation, by centre, 1 January 2016 - 31 December 2016

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	0	2	100	17	100
Bangor, Ysbyty Gwynedd District General Hospital							3	67
Basildon, Basildon Hospital							3	100
Belfast, Antrim Hospital							2	50
Belfast, Belfast City Hospital							4	100
Belfast, The Ulster Hospital							1	100
Birmingham, Birmingham Heartlands Hospital							14	86
Birmingham, Queen Elizabeth Hospital Birmingham					1	100	34	100
Bradford, St Lukes Hospital							5	100
Brighton, Royal Sussex County Hospital					3	100	19	100
Bristol, Southmead Hospital					3	100	48	98
Camberley, Frimley Park Hospital							1	0
Cambridge, Addenbrookes Hospital	24	100	21	100	20	100	95	100
Canterbury, Kent And Canterbury Hospital			1	100	3	100	29	100
Cardiff, University Of Wales Hospital	3	100	5	100	11	100	71	100
Carlisle, Cumberland Infirmary			1	100	2	100	1	100
Carshalton, St Helier Hospital					1	0	14	50
Chelmsford, Broomfield Hospital							1	100
Chester, Countess Of Chester Hospital							1	100
County Down, Daisy Hill Hospital					2	100	2	100
Coventry, University Hospital (walsgrave)					2	100	24	100
Crewe, Leighton Hospital							1	100
Derby, Royal Derby Hospital							5	100
Doncaster, Doncaster Royal Infirmary					2	100	2	100
Dorchester, Dorset County Hospital			1	100			34	97
Douglas, Nobles I-o-m Hospital					1	100	3	100
Dudley, Russells Hall Hospital			1	100			1	100
Dulwich, Kings College							3	100
Dumfries, Dumfries And Galloway Royal Infirmary							2	100
Dundee, Ninewells Hospital			5	100	3	100	14	93
Edinburgh, Royal Infirmary Of Edinburgh	20	100	13	100	7	86	61	61
Exeter, Royal Devon And Exeter Hospital (wonford)			2	100	3	67	21	95
Glasgow, Queen Elizabeth University Hospital							23	100
Gloucester, Gloucestershire Royal Hospital							13	31
Hereford, The County Hospital							3	67
Hull, The Hull Royal Infirmary			1	100	4	75	10	60
Inverness, Raigmore Hospital			1	100	1	100	8	25

Table 8.1 Form return rates following pancreas transplantation, by centre, 1 January 2016 - 31 December 2016

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							7	100
Kilmarnock, Crosshouse Hospital							4	0
Leeds, St Jamess University Hospital					4	100	10	100
Leicester, Leicester General Hospital			1	100			19	100
Lincoln, Lincoln County Hospital							3	100
Liverpool, Royal Liverpool University Hospital							10	100
Liverpool, University Hospital Aintree							1	0
London, Guys Hospital	20	100	21	100	15	93	114	90
London, St Georges Hospital							4	25
London, The Royal Free Hospital			2	100	5	100	40	95
London, The Royal London Hospital (whitechapel)							9	100
Londonderry, Altnagelvin Area Hospital							1	0
Manchester, Manchester Royal Infirmary	28	100	26	100	12	100	76	100
Middlesbrough, The James Cook University Hospital					2	50	15	87
Newcastle, Freeman Hospital	7	100	4	100	4	100	36	100
Northampton, Northampton General Hospital							6	33
Norwich, Norfolk And Norwich University Hospital					2	100	20	100
Nottingham, Nottingham University Hospitals City Campus							31	97
Omagh, Tyrone County Hospital							1	0
Oxford, Churchill Hospital	53	100	44	100	28	96	119	100
Peterborough, Peterborough City Hospital							1	0
Plymouth, Derriford Hospital			5	60	4	100	15	100
Portsmouth, Queen Alexandra Hospital			7	100	3	100	40	100
Preston, Royal Preston Hospital					1	100	17	100
Reading, Royal Berkshire Hospital							25	84
Rhyl, Royal Alexandra Hospital					1	100	1	100
Salford, Salford Royal					2	100	17	100
Sheffield, Northern General Hospital			1	100			9	56
Shrewsbury, Royal Shrewsbury Hospital							2	0
St Helier, Jersey General Hospital							1	100
Stevenage, Lister Hospital					1	100	3	100
Stoke-on-trent, Royal Stoke University Hospital					1	100	7	100
Sunderland, Sunderland Royal Hospital							4	50
Swansea, Morriston Hospital							10	50
Truro, Royal Cornwall Hospital (treliske)			2	100	4	25	18	17
West London Renal Transplant Centre	8	100	8	63	12	50	76	59
Westcliff On Sea, Southend Hospital							3	100
Wirral, Arrowe Park Hospital					1	100		
Wolverhampton, New Cross Hospital			1	100	1	100	21	100
Wrexham, Maelor General Hospital							8	0
York, York District Hospital							12	100
Overall	**163**	**100**	**175**	**97**	**175**	**90**	**1410**	**89**

Islet transplant list

9.1 Patients on the islet transplant list as at 31 March, 2008 – 2017

Figure 9.1 shows the number of patients on the islet transplant list at 31 March each year between 2008 and 2017. 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, however the number has decreased to 21 in 2017.

Figure 9.1 Patients on the islet transplant list at 31 March

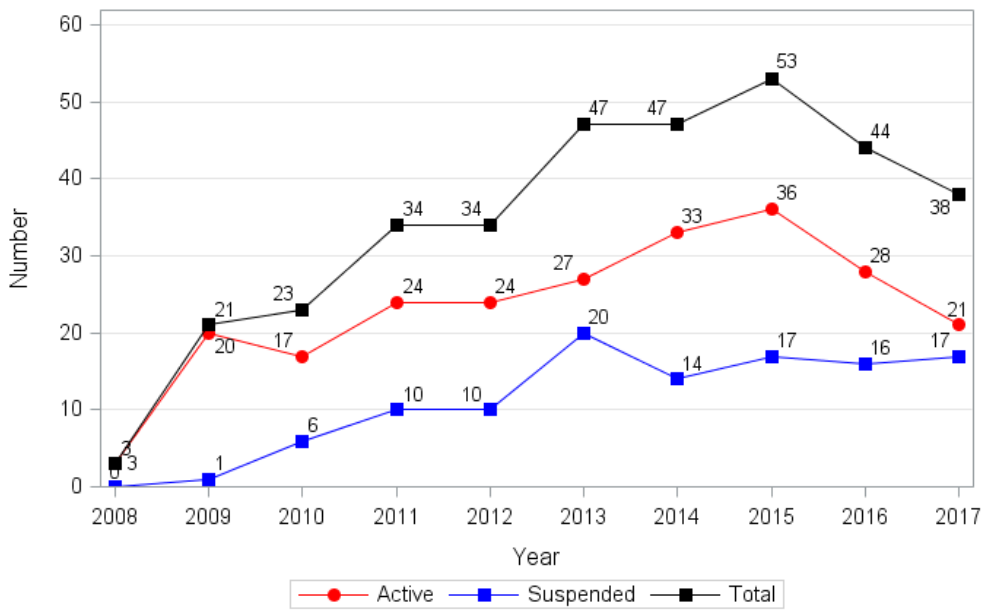


Figure 9.2 shows the number of patients on the active islet transplant list at 31 March 2017 by centre. Eight (38%) of the patients on the active transplant list were registered at Edinburgh, whilst there were no patients registered at Bristol, King's College and the Royal Free.

Figure 9.2 Patients on the active islet transplant list at 31 March 2017, by centre

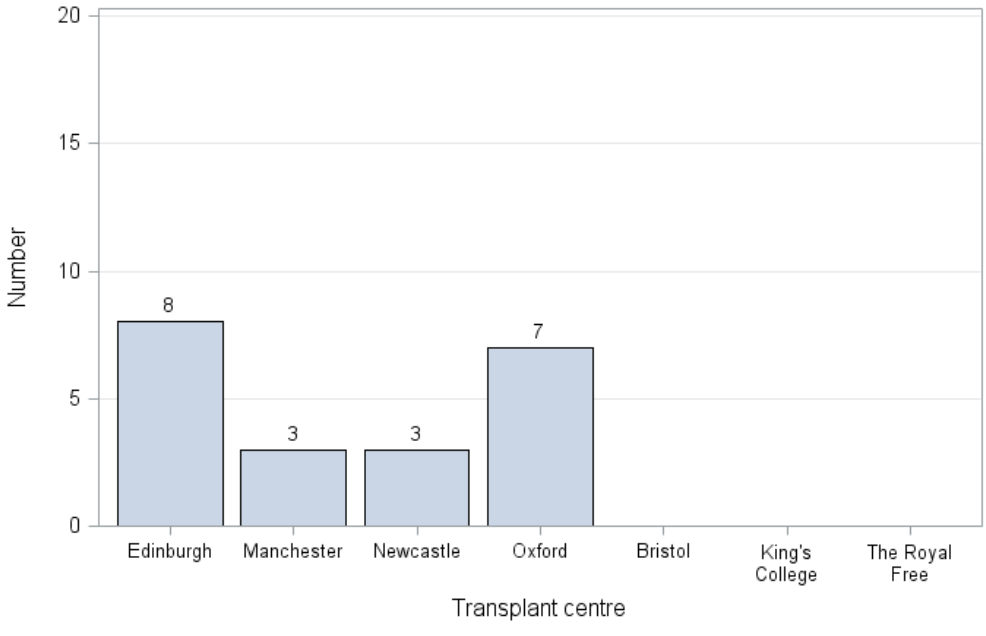
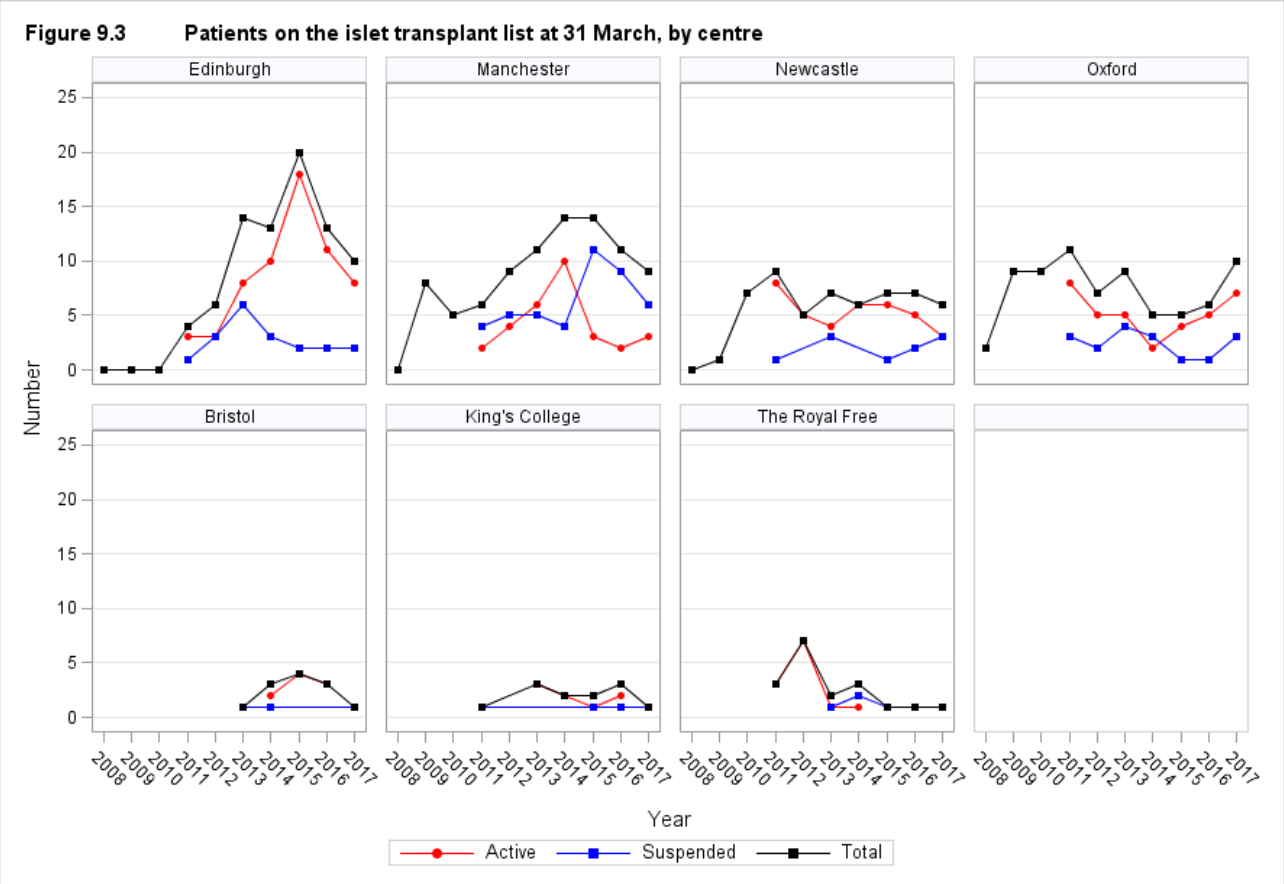


Figure 9.3 shows the number of patients on the islet transplant list at 31 March each year between 2008 and 2017 for each transplant centre. The number of active and suspended patients by centre is not recorded prior to 2011, hence only the total number are reported between 2008 and 2010. The number of patients actively registered at Edinburgh has decreased from 18 on 31 March 2015 to 8 on 31 March 2017.



9.2 Post-registration outcomes, 1 April 2013 – 31 March 2014

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 who died while on the transplant list. 45% of patients are transplanted within one year, while three years after listing 77% of patients have received a transplant.

Figure 9.4 Post-registration outcome for 44 new islet registrations made in the UK, 1 April 2013 - 31 March 2014

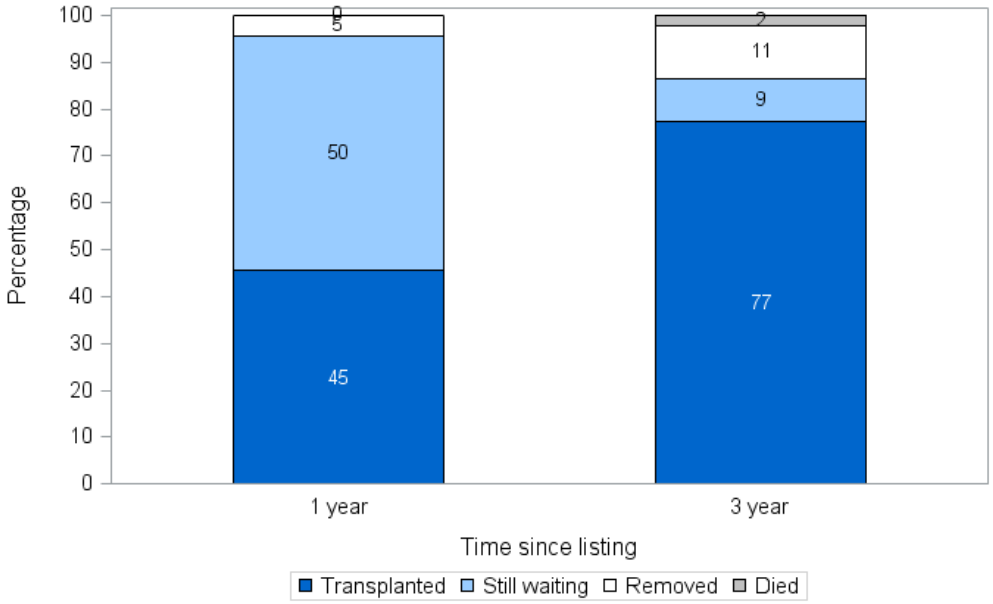
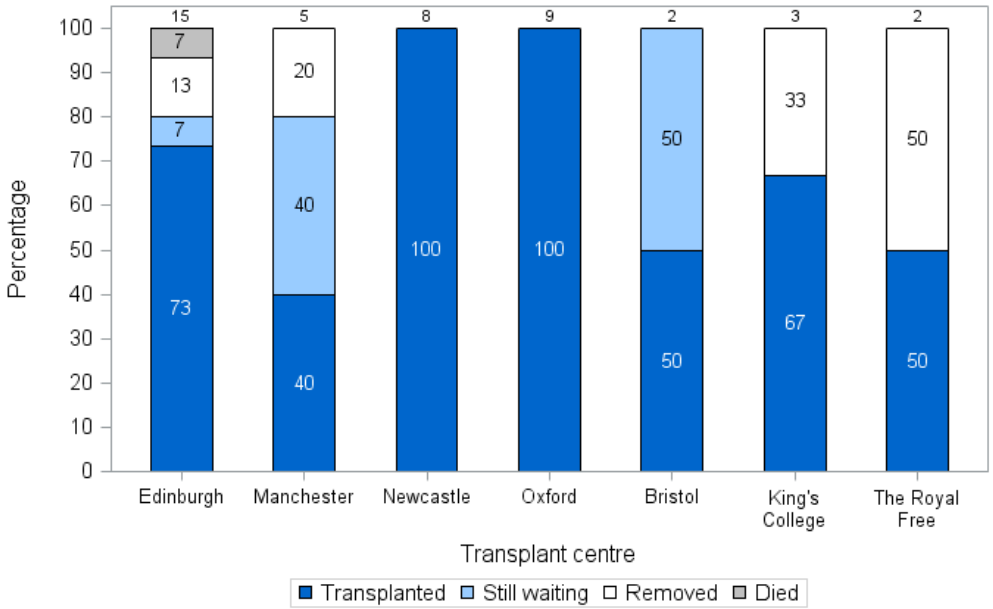


Figure 9.5 shows the proportion of patients transplanted or still waiting three years after joining the list by centre. Three years after registration, 33% of patients were removed from the list at King's College, although the number of registrations were small. Overall the majority of centres transplanted 50% of patients registered within 3 years. One patient died whilst waiting for a transplant at Edinburgh.

Figure 9.5 Three-year post-registration outcome for 44 new islet registrations made in the UK, 1 April 2013 - 31 March 2014, by centre



9.3 Demographic characteristics, 1 April 2016 – 31 March 2017

The sex and age group of patients registered on the islet transplant list during 2016/17 are shown by centre in **Figures 9.6** and **9.7**. Note that all percentages quoted are based only on data where relevant information was available.

Overall, the majority of patients registered on the islet transplant list were female and the median age was 48 years.

Figure 9.6 **Registrations on the active islet transplant list, 1 April 2016 and 31 March 2017, by centre and sex**

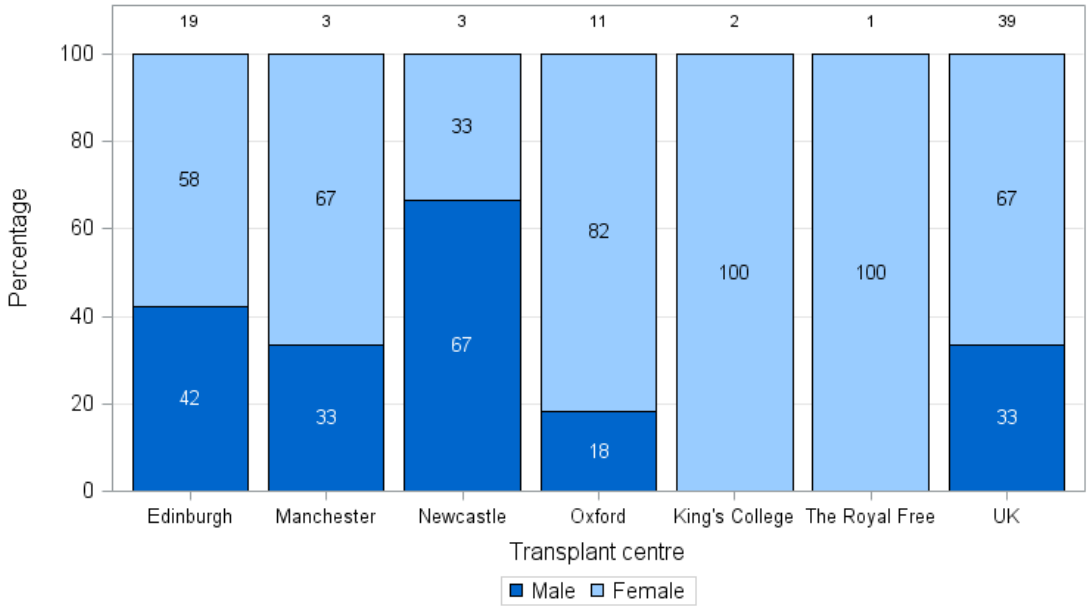
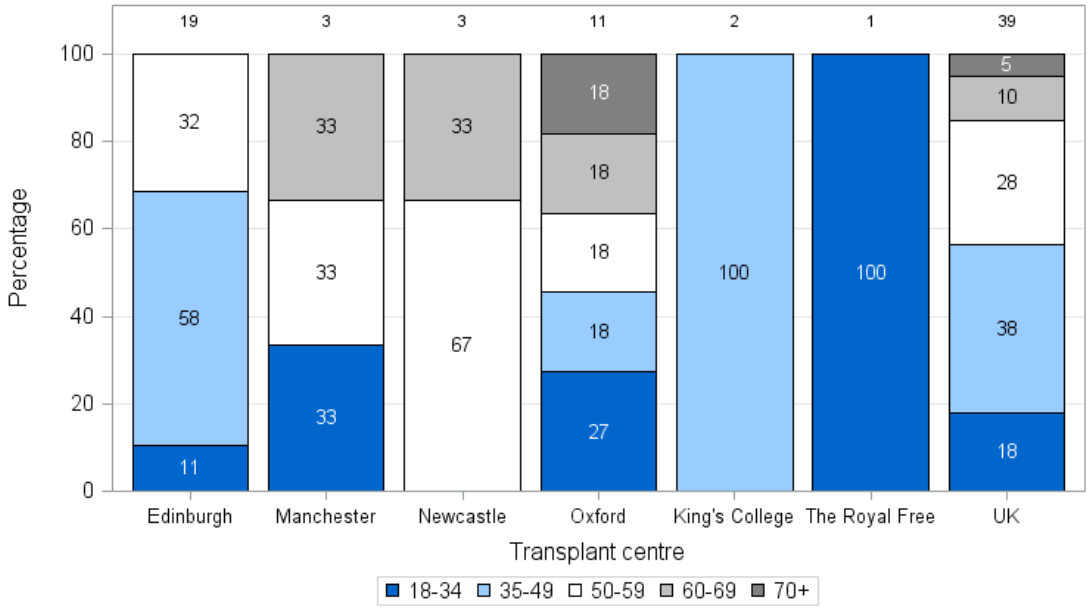


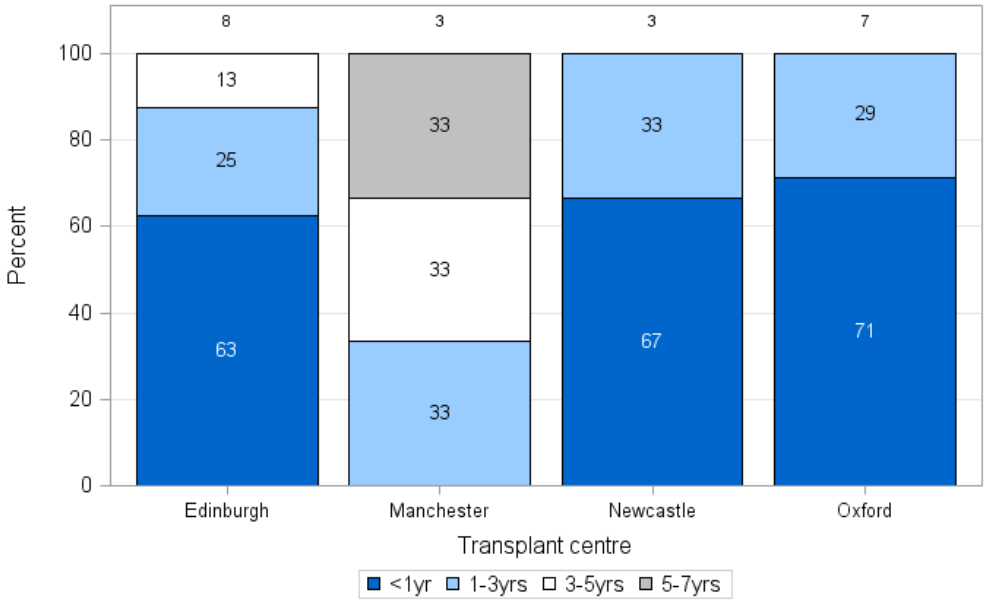
Figure 9.7 **Registrations on the active islet transplant list, 1 April 2016 and 31 March 2017, by centre and age group**



9.4 Patient waiting times for those currently on the list, 31 March 2017

Figure 9.8 shows the length of time patients have been waiting on the islet transplant list at 31 March 2017 by centre. One highly sensitised patient (94% cRF) registered at Manchester has been waiting more than 5 years for transplant.

Figure 9.8 Patients on the active islet transplant list as at 31 March 2017, by centre and grouped waiting time



9.5 Median waiting time to transplant, 1 April 2011 - 31 March 2014

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 calculated using the Kaplan-Meier method and 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 2011 and 31 March 2014 is 355 days (almost 12 months), ranging from 146 days at Edinburgh to 1010 days (over 2 and a half years) at Manchester.

There was insufficient data to calculate the 95% confidence interval to islet transplant for patients registered at Manchester in this time period.

Figure 9.9 Median waiting time to deceased donor transplant for patients registered on the islet transplant list, 1 April 2011 - 31 March 2014

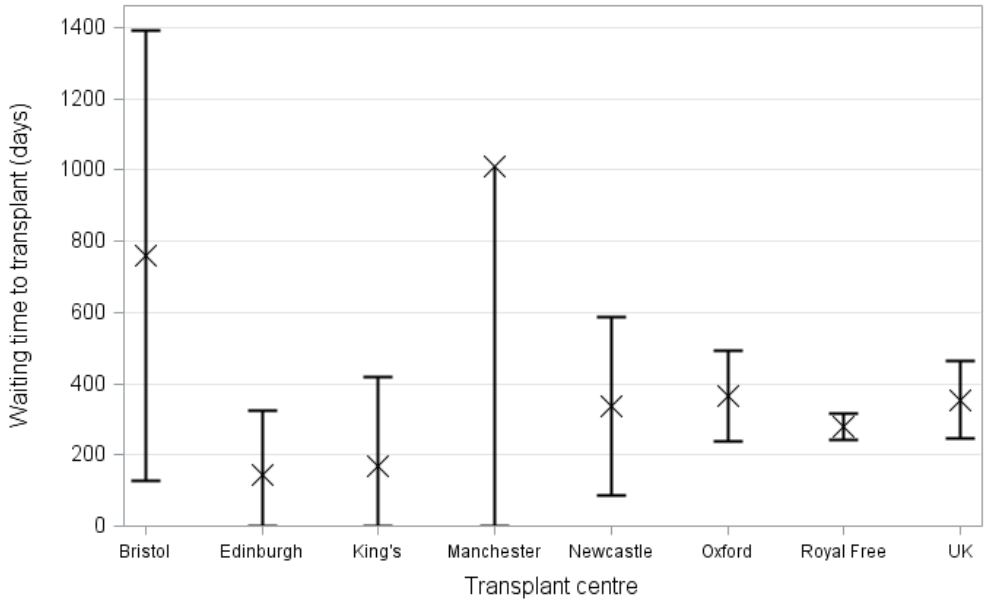


Table 9.1 Median waiting time to islet transplant in the UK, for patients registered 1 April 2011 - 31 March 2014

Transplant centre	Number of patients registered	Waiting time (days) Median	95% Confidence interval
Bristol	4	-	-
Edinburgh	40	146	0 - 323
King's	7	-	-
Manchester[1]	14	1010	-
Newcastle	23	338	87 - 589
Oxford	21	365	237 - 493
Royal Free	9	-	-
UK	**118**	**355**	**246 - 464**

- Data not presented when less than 10 patients
[1] Insufficient data to calculate the 95% Confidence interval

Response to islet offers

10.1 Offer decline rates, 1 April 2014 – 31 March 2017

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 islets declined for transplantation or DCD offers were excluded, as were offers made through the fast track scheme or the reallocation of the pancreas.

Individual centre offer decline rates by financial year and over the time period, 1 April 2014 and 31 March 2017 are shown in **Table 10.1**. Royal Free had the lowest overall rates (0%) whilst Newcastle had the highest rate (66%). Note that all rates are based on a small number of offers.

Figure 10.1 DBD donor islet offer decline rates for pancreases that resulted in an islet transplant, 1 April 2014 and 31 March 2017

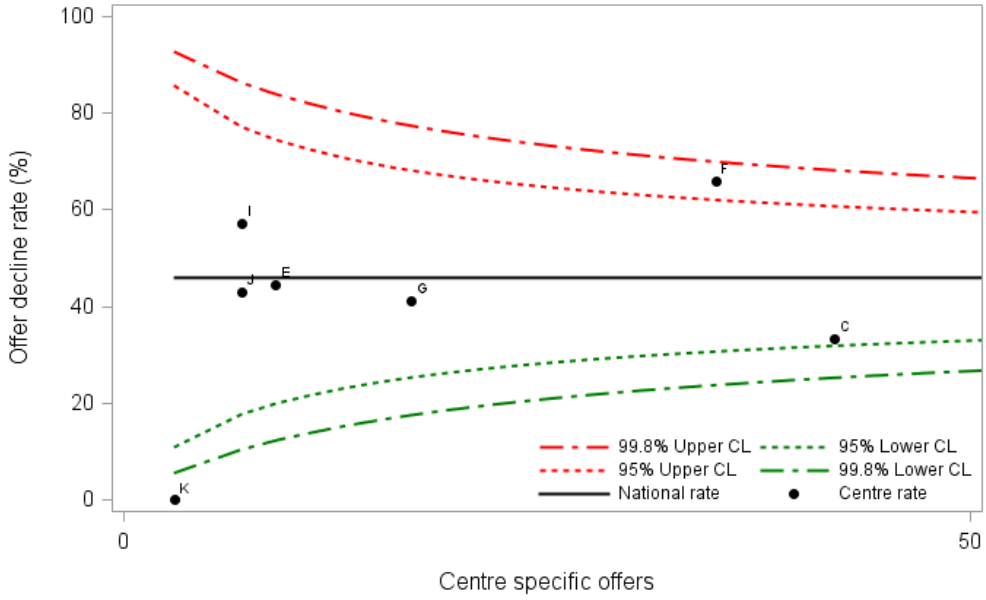


Table 10.1 DBD donor islet offer decline rates by transplant centre, 1 April 2014 and 31 March 2017

Centre	Code	2014/15		2015/16		2016/17		Overall	
		N	(%)	N	(%)	N	(%)	N	(%)
Bristol	I	4	(75)	2	(50)	1	(0)	7	(57)
Edinburgh	C	10	(50)	17	(35)	15	(20)	42	(33)
King's	J	2	(100)	2	(50)	3	(0)	7	(43)
Manchester	E	3	(33)	1	(0)	5	(60)	9	(44)
Newcastle	F	8	(63)	15	(60)	12	(75)	35	(66)
Oxford	G	9	(44)	2	(0)	6	(50)	17	(41)
Royal Free	K	3	(0)					3	(0)
UK		**39**	**(51)**	**39**	**(44)**	**42**	**(43)**	**120**	**(46)**

Centre has reached the upper 99.8% confidence limit
Centre has reached the upper 95% confidence limit
Centre has reached the lower 95% confidence limit
Centre has reached the lower 98.8% confidence limit

Islet transplants

11.1 Islet transplants, 1 April 2008 – 31 March 2017

Figure 11.1 shows the total number of islet transplants performed in the last nine 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. This 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 34 transplants in 2016/17, although in 2014/15 only 23 transplants were performed.

Figure 11.1 Islet transplants, 1 April 2008 - 31 March 2017, by financial year and donor type

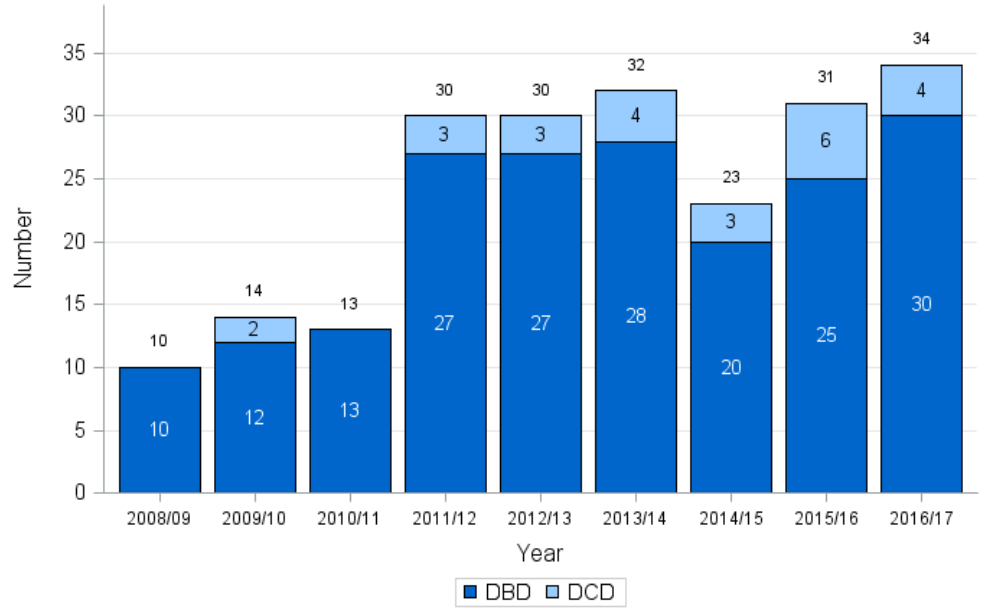


Figure 11.2 shows the total number of islet transplants performed in 2016/17, by centre and type of donor. The same information is presented in **Figure 11.3** but this shows the proportion of DBD and DCD transplants performed at each centre. Edinburgh performed the most islet transplants in 2016/17 (17), followed by Oxford (7). Edinburgh, Manchester and Oxford performed DCD transplants as well as DBD transplants. Royal Free did not perform any islet transplants in 2016/17.

Figure 11.2 **Islet transplants, 1 April 2016 - 31 March 2017, by centre and donor type**

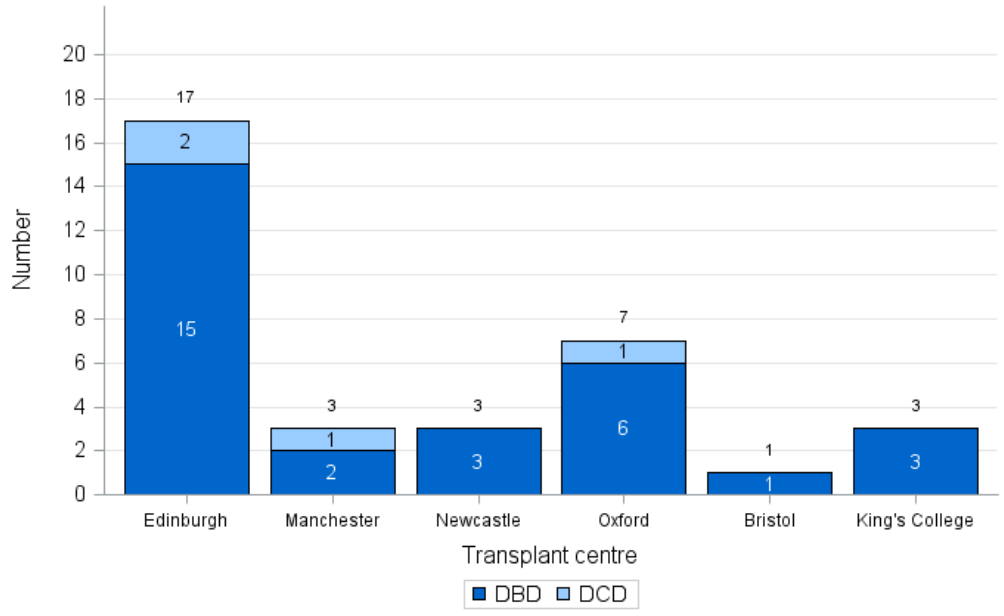


Figure 11.3 **Islet transplants, 1 April 2016 - 31 March 2017, by centre and donor type**

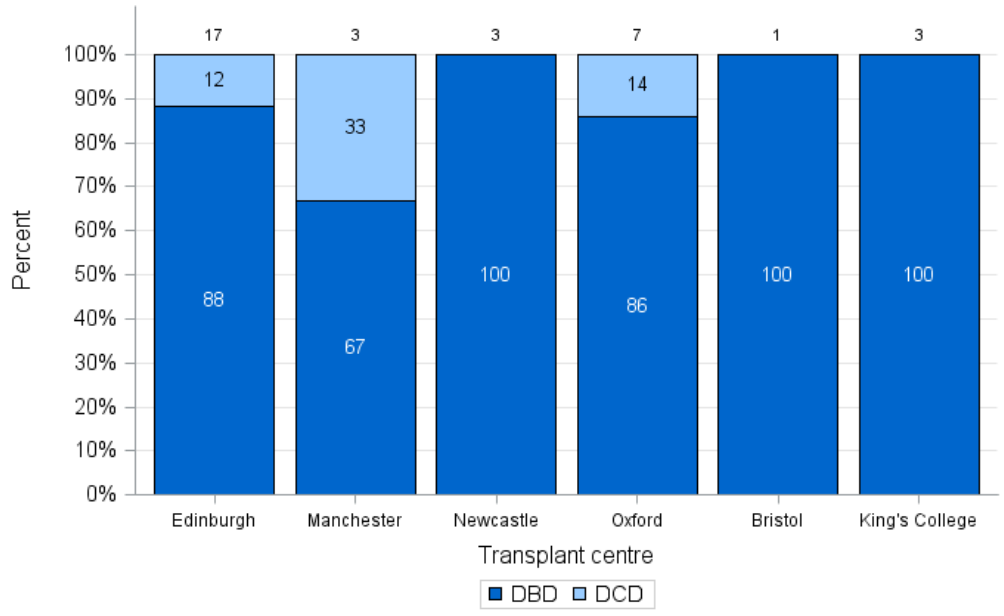
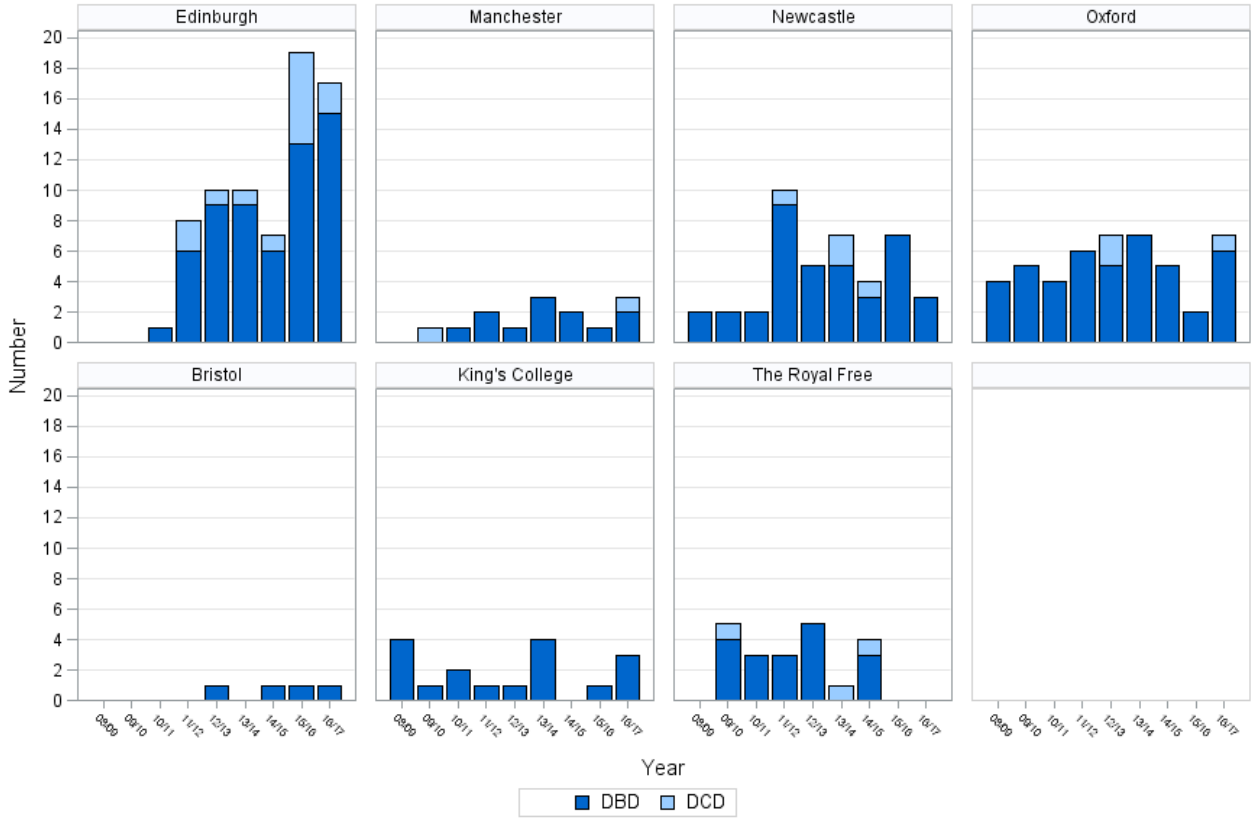


Figure 11.4 shows the total number of islet transplants performed in last nine years, by centre and type of donor. Oxford and Newcastle have consistently performed a number of islet transplants each year, while Edinburgh has increased their transplant activity in the last six years. Bristol has performed very few transplants over the nine year period.

Figure 11.4 Islet transplants, 1 April 2008 - 31 March 2017, by centre, financial year and donor type



11.2 Demographic characteristics, 1 April 2016 - 31 March 2017

The sex and age group of patients that received an islet transplant in 2016/17 are shown by centre in **Figures 11.5** and **11.6** respectively. Note that all percentages quoted are based only on data where relevant information was available. Overall, 34 patients were transplanted on the islet transplant list, the median age was 48 years and the majority were female 23 (68%).

Figure 11.5 Islet transplants, 1 April 2016 and 31 March 2017, by centre and sex

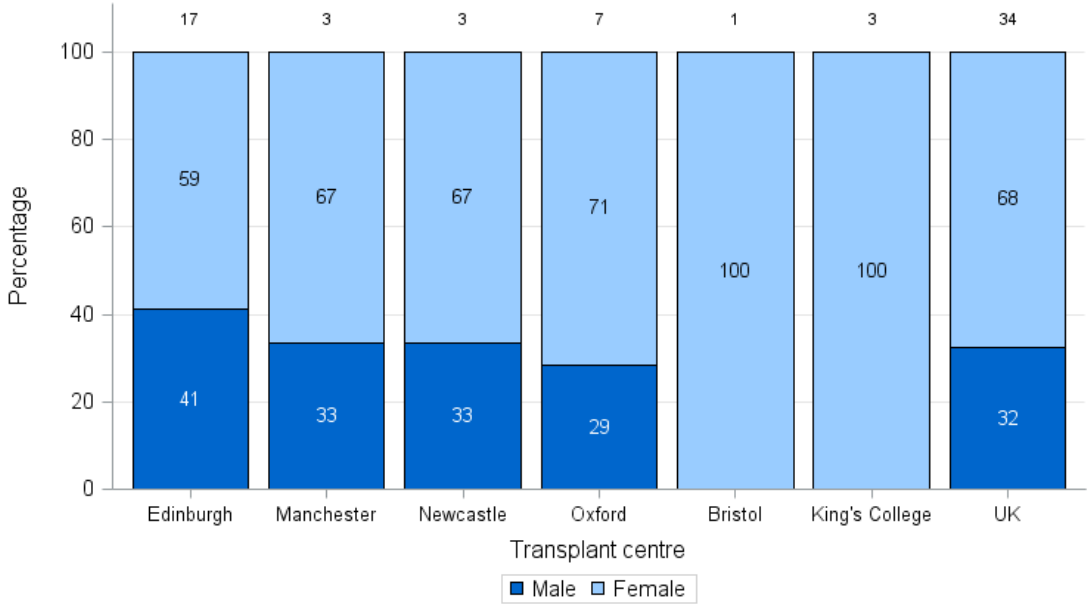
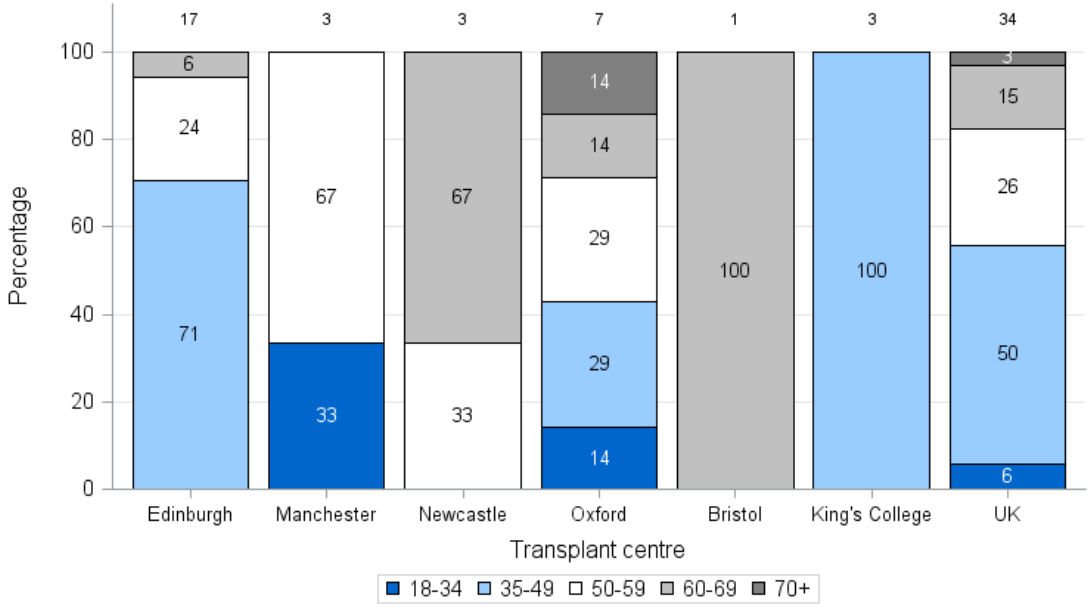


Figure 11.6 Islet transplants, 1 April 2016 and 31 March 2017, by centre and age group

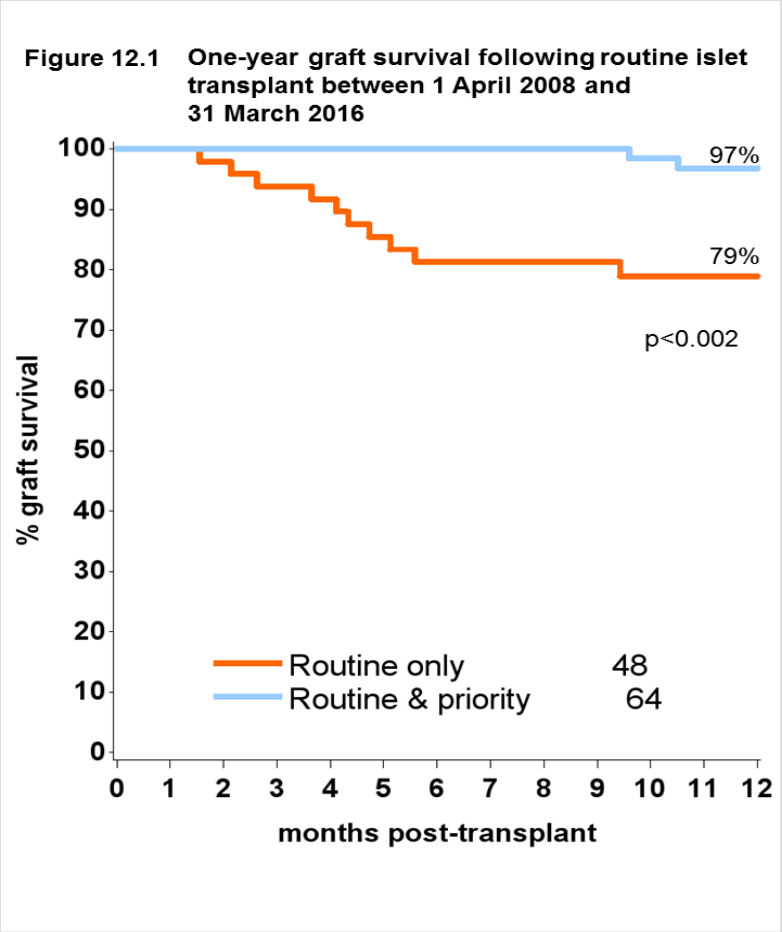


Islet outcomes

12.1 Outcome measures for routine islet transplants

Key measures of islet outcome include graft survival, annual rate of severe hypoglycaemic events, HbA1c and insulin requirements. This section includes outcomes reported to NHS Blood and Transplant for routine islet transplants between 1 April 2008 and 31 March 2016.

A Kaplan-Meier survival plot showing one-year graft survival by type of graft is shown in **Figure 12.1**. Estimated one-year graft survival for routine only grafts is 79%, 95% confidence interval (CI) (64-88%) and for routine followed by priority grafts is 97%, 95% CI (88-99%). There were statistically significant differences between the two groups, p<0.002.



The median annual rate of severe hypoglycaemic events prior to transplant (reported as number of events between registration and transplant) was 7 events per year (Interquartile range 0-34), and at one-year post-transplant this had been reduced to no events per year. Of the 91 patients where the number of severe hypoglycaemic events at one-year post-transplant was available, 71 (78%) experienced no severe hypoglycaemic events, 13 (14%) experienced one or two events and 7 (8%) experienced three or more events.

Figure 12.2 shows the reduction in median HbA1c (mmol/mol) for routine islet transplants. Median HbA1c dropped from 64mmol/mol prior to transplant to 51mmol/mol at one-year post-transplant. Of those 93 patients with HbA1c reported at one-year, 54 (58%) had an HbA1c less than 53mmol/mol.

Figure 12.2 **Median HbA1c (mmol/mol) for routine islet transplants, 1 April 2008 to 31 March 2016**

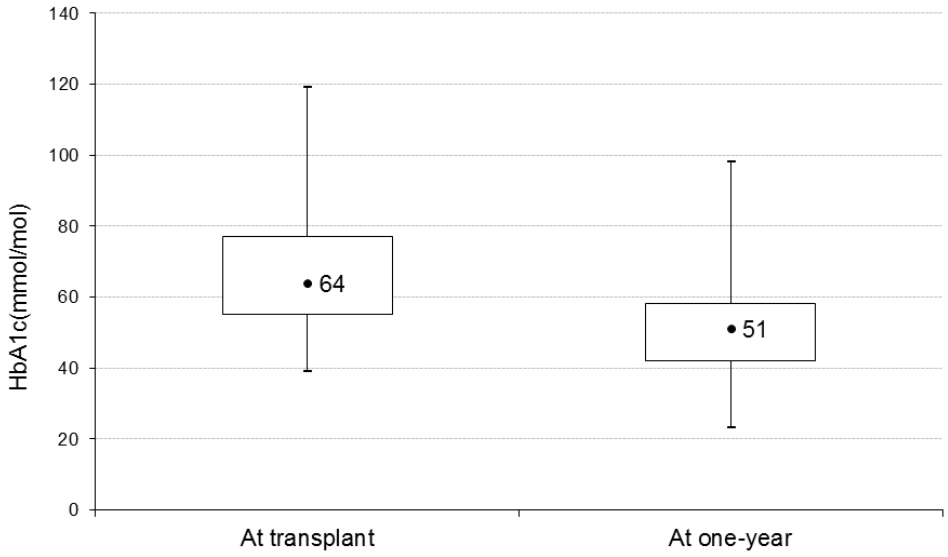
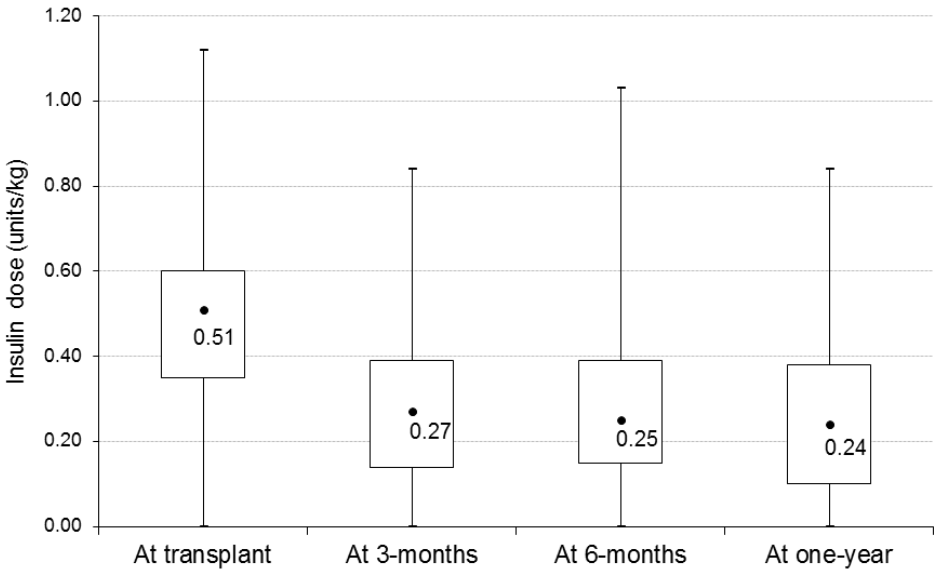


Figure 12.3 shows the median reduction in insulin dose per kilo recipient body weight at three-months, six-months and one-year post-transplant. Prior to transplant the median insulin dose is 0.51 units/kg, by three-months the median dose has dropped to 0.27 units/kg and this reduction has been maintained at one-year post-transplant with a median dose of 0.24 units/kg. Following islet transplantation of the 94 patients where information was reported, 29 (31%) achieved insulin independence at some point during their first year post-transplant.

Figure 12.3 **Median insulin dose per kilo of recipient weight for routine islet transplants, 1 April 2008 to 31 March 2016**



Form return rates

13.1 Islet form return rates, 1 January – 31 December 2016

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 2016 for the transplant record, and all requests for follow up forms issued in this time period. All transplant forms were returned, whereas only 87% of 3-month follow up forms were returned.

Table 13.1 Form return rates following islet transplantation, by centre, 1 January 2016 - 31 December 2016

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	2	100	1	100			2	100
Edinburgh, Royal Infirmary Of Edinburgh	18	100	8	100	9	100	15	100
London, Kings College Hospital	3	100	2	100	1	0	3	33
London, The Royal Free Hospital							5	100
Manchester, Manchester Royal Infirmary	1	100			1	100	4	100
Newcastle, Freeman Hospital	2	100	2	100	5	100	16	100
Oxford, Churchill Hospital	3	100	2	0	1	100	14	57
Overall	**29**	**100**	**15**	**87**	**17**	**94**	**59**	**86**

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
Hypoclycaemia 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 Methods

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 survival from listing	Age, gender, grouped registration year, ethnicity, blood group, cRF>85%

Systematic component of variation

For a given individual who is a resident in a given English Strategic Health Authority (SHA), registration to the transplant list is modelled as a Bernoulli trial. At the whole area level, this becomes a Binomial process which can be approximated by a Poisson distribution when rare events are modelled. Transplant counts follow similar assumptions.

To allow for the possibility that, even after allowing for area-specific Poisson rates, area differences remain, introduce an additional multiplicative rate factor which varies from area to area. Postulate a non-parametric distribution for the multiplicative factor, with variance σ^2. If the factor is one for all areas, then area differences are fully explained by the area-specific Poisson rate. If the factor varies with a nonzero variance, σ^2, then we conclude that there are unexplained area differences.

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