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Blood and Transplant

ANNUAL REPORT ON PANCREAS AND ISLET TRANSPLANTATION

REPORT FOR 2019/2020
(1 APRIL 2010 – 31 MARCH 2020)

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Contents

Executive Summary

This report presents key figures about pancreas and islet transplantation in the UK. The period reported covers ten years of pancreas and islet transplant data, from 1 April 2010. 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. Also reported on a national basis is survival analysis after islet transplantation and additional outcome measures.

Key findings

- On the 29 February 2020, there were 237 patients on the UK active pancreas and islet transplant list, which represents a 5% decrease in number of patients a year earlier. The number of patients on the active pancreas list increased by 0.5% to 209 in 2020 and the active islet transplant list decreased by 33% to 28 patients in the same time period.

- There were 1922 pancreas transplants performed in the UK in the ten year period and 275 islet transplants performed in the same time period. The number of transplants from donations after brain death has increased by 3% in the last year to 152. However, the number of transplants from donations after circulatory death has decreased by 9% in the last year to 51.

- The national rates of patient survival one- and five-years after first simultaneous pancreas and kidney transplant from deceased donors are 98% and 89%, respectively. These rates vary between centres, ranging from 95% to 100% at one-year and 86% to 98% 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 90% and 81%, respectively. These rates vary between centres, ranging from 86% to 97% at one-year and 71% to 92% 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 96% and 88%, respectively. The national rates of graft survival one- and five-years are 82% and 54%. 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 75%. These rates vary between centres, ranging from 74% to 76%. All centre rates are risk-adjusted.

- The national rates of one- and five-years graft survival for patients receiving a first routine islet transplant are 88% and 54%. For patients with a functioning graft at one-year post-transplant, the national rate of five year graft survival was 67% for patients receiving an additional priority islet graft and 51% for patients who did not.

- Reductions in annual rate of severe hypoglycaemic events, median HbA1c and median insulin requirements 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 2019/20, NHS Blood and Transplant.

Introduction

This report presents information on pancreas and islet transplant activity between 1 April 2010 and 31 March 2020, for all eight centres performing pancreas transplantation and seven centres performing islet transplantation 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, simultaneous pancreas and kidney transplants and simultaneous islet and kidney transplants are reported as SPK and SIK transplants respectively.

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 2015 to 31 March 2019 and five-year post-transplant for the period 1 April 2011 to 31 March 2015.

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 2015 to 31 March 2019, and graft survival at five-year post-transplant for the period 1 April 2010 to 31 March 2019, for the national cohort only. Islet outcomes are unadjusted for risk and 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 years post registration for a deceased donor simultaneous pancreas and kidney transplants between 1 January 2008 and 31 December 2019.

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 and SIK)) are excluded from all analyses apart from 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.

The COVID-19 pandemic has led to unprecedented challenges for UK transplantation. Concerns about the ability to care for transplant recipients, lack of access to resource because it is being used for patients in the pandemic, and the risk versus benefit for immunosuppressed transplant recipients, have resulted in a major reduction in the number of organ transplants undertaken.

Waiting list figures at the 31 March 2020 do not accurately reflect the need for pancreas and islet transplantation due to the COVID-19 pandemic. Different practices were established across the UK with regards to waiting list management. Due to this, a snapshot of the waiting list at 29 February 2020 has been used to better reflect activity near the end of the 2019-2020 financial year.

Figure 2.1 shows the number of patients on the pancreas and islet transplant list at 31 March each year between 2011 and 2020. The number of patients actively waiting for a pancreas or islet transplant has decreased by 26% from 322 in 2011 to 237 in 2020.

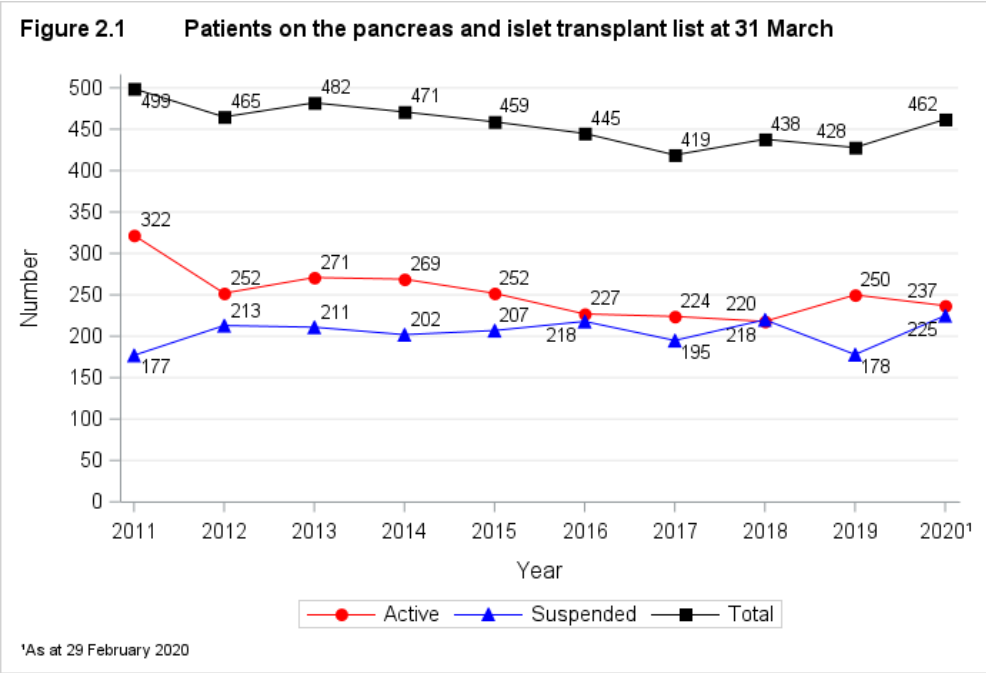


Figure 2.2 shows the number of patients on the pancreas and islet transplant list at 29 February 2020 for each transplant centre. Oxford has the largest transplant list with 71 patients registered for a pancreas or islet transplant. Of these patients, 62 are registered for a SPK, six for a pancreas only, two for an islet only and one for an SIK transplant. Edinburgh, Manchester and Oxford have patients waiting for an SIK transplant, 12 in total. There were no patients on the active islet list at Bristol at 29 February 2020.

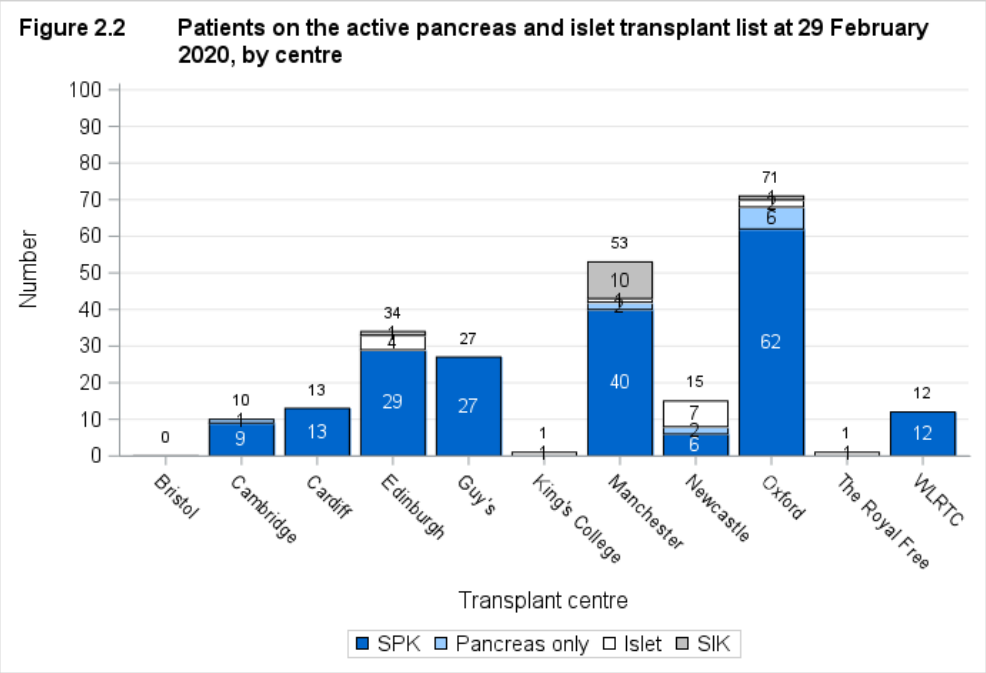


Figure 2.3 shows the total number of pancreas and islet transplants performed in the last ten financial years. Transplant numbers increased from 210 in 2010/11 to 246 in 2013/14, but decreased over the last few years to 203 in 2019/20. In particular, the number of pancreas only transplants decreased from 39 transplants in 2010/11 to 13 in 2019/20.

Figure 2.3 Pancreas and islet transplants performed in the UK, 1 April 2010 - 31 March 2020, by financial year and transplant type

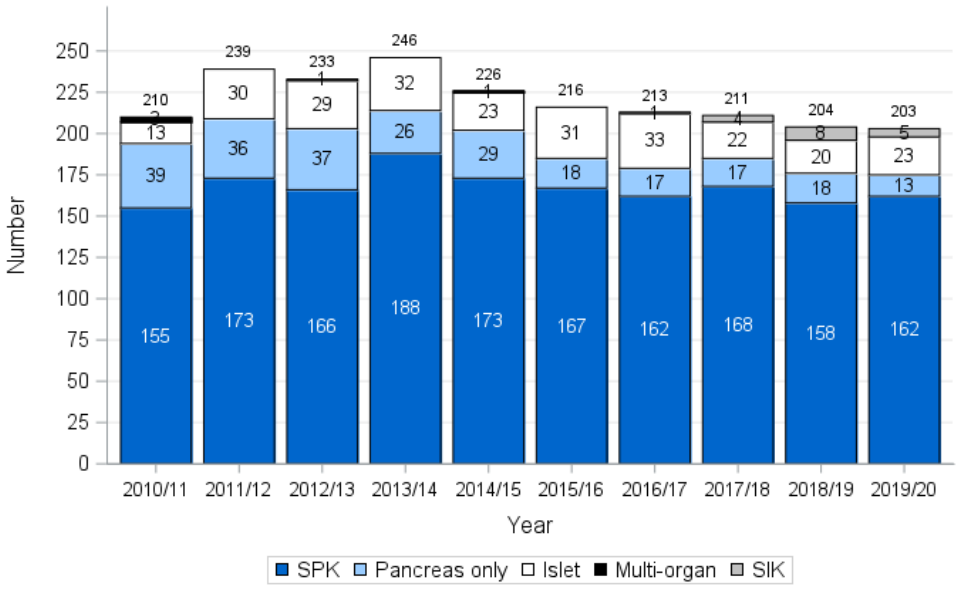


Figure 2.4 shows the total number of pancreas and islet transplants performed in 2019/20 at each transplant centre. Oxford performed the most pancreas and islet transplants last year, a total of 57 transplants, whilst Edinburgh performed the most islet and SIK transplants (13). A total of five SIK transplants were performed at Manchester and Edinburgh. The Royal Free and Bristol performed no transplants during this time period.

Figure 2.4 Pancreas and islet transplants, 1 April 2019 - 31 March 2020, by centre and transplant type

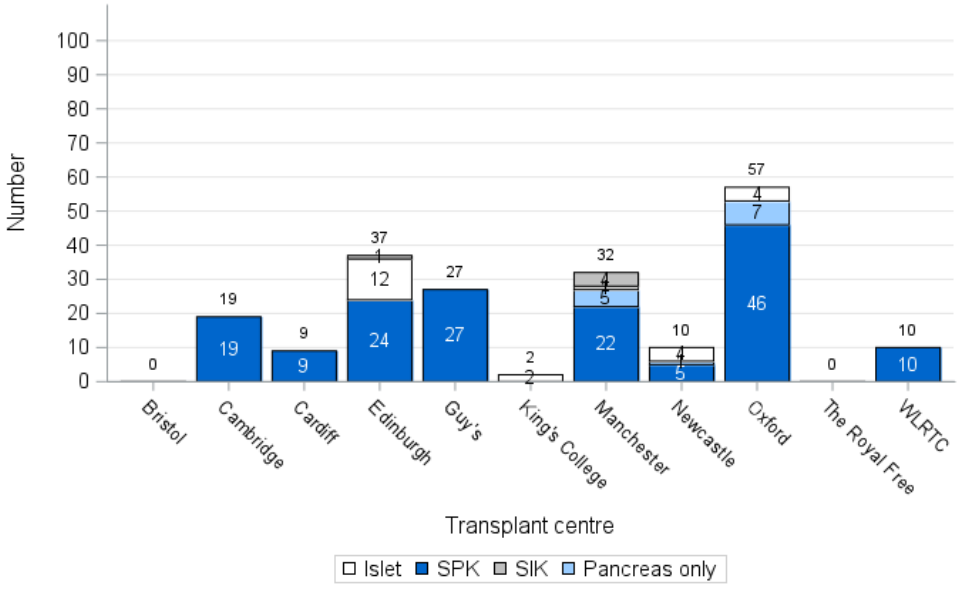
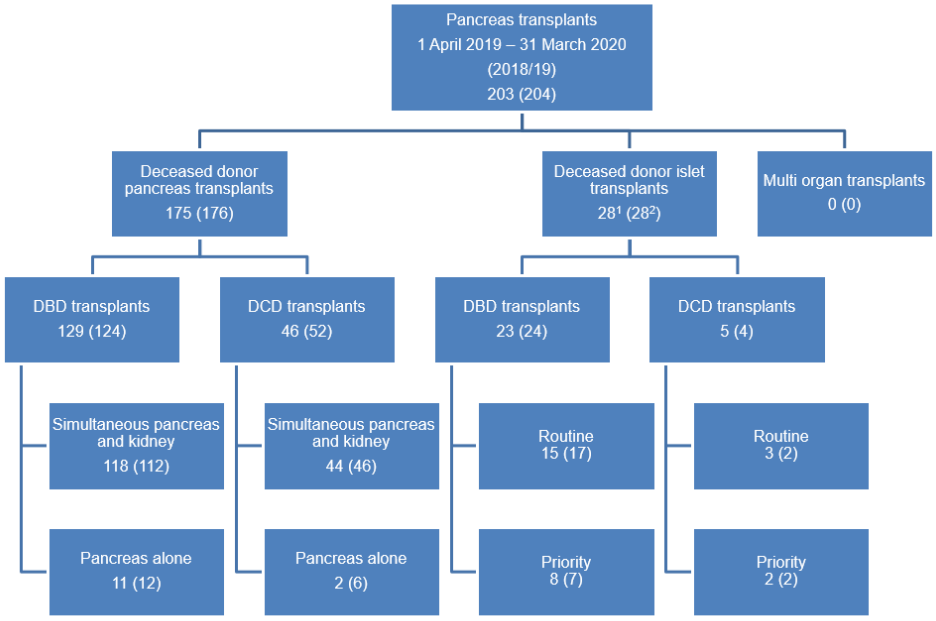


Figure 2.5 details the 203 pancreas and islet transplants performed in the UK between 1 April 2019 and 31 March 2020. Data for transplants performed in 2018/19 are also presented. The overall number of whole pancreas transplants performed in 2019/20 has decreased by one compared with 2018/19 to 175. The number of islet transplants was 28 in both years.

Figure 2.5 Pancreas and islet transplants performed in the UK, 1 April 2019 – 31 March 2020 (1 April 2018 – 31 March 2019)



[1] Includes 5 simultaneous islet and kidney transplants
[2] Includes 8 simultaneous islet and kidney transplants

Geographical variation in 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 2019 and 31 March 2020 were extracted from the UK Transplant Registry on 3 July 2020 (numerator). Only patients registered for pancreas only, kidney and pancreas, islet only and islet and kidney were considered. Patients were assigned to NHS regions in England using their postcode of residence, as reported at registration. The number of registrations per million population (pmp) by NHS region was obtained using mid-2018 population estimates based on the Office for National Statistics (ONS) 2011 Census figures (denominator). No NHS region 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 2019 and 31 March 2020 (numerator), divided by the mid-2018 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 2019 and 31 March 2020 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 2019 and 31 March 2020 compared with pancreas transplant rates pmp for the same time period, by recipient country/NHS region of residence. **Table 2.1** shows the breakdown of these numbers by recipient country/NHS region 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 inevitably 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 NHS regions 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. Registration and transplant rates yielded an SCV of 0.0283 (p-value = 0.037) and 0.0191 (p-value = 0.136), respectively. The p-value shows the probability that an SCV of this size (or higher) would be observed by chance if only random variation existed and therefore, there is moderate evidence of geographical variation for registrations beyond what would be expected at random and there is no evidence of geographical variation for transplants. No adjustment has been made for area-specific demographic characteristics that may impact the rates of registration to the transplant list and transplantation such as age and sex. Therefore, these results should be interpreted with caution.

Figure 2.6 Comparison of pancreas registration rates (pmp) with transplant rates (pmp) by recipient country/NHS region of residence

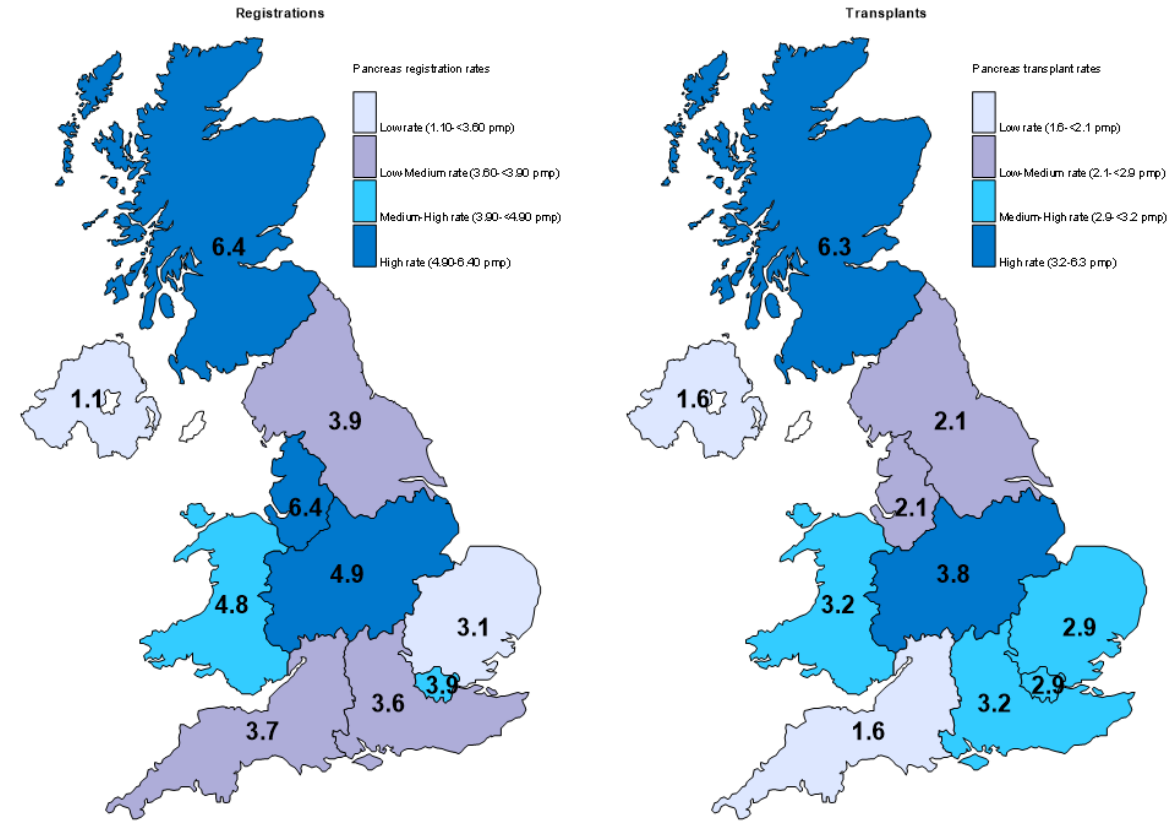


Table 2.1 Pancreas registration and transplant rates per million population (pmp) in the UK, 1 April 2019 - 31 March 2020, by Country/NHS region

Country/NHS region	Registrations (pmp)		Transplants (pmp)	
North East and Yorkshire	33	(3.9)	18	(2.1)
North West	45	(6.4)	15	(2.1)
Midlands	52	(4.9)	40	(3.8)
East of England	20	(3.1)	19	(2.9)
London	35	(3.9)	26	(2.9)
South East	32	(3.6)	28	(3.2)
South West	21	(3.7)	9	(1.6)
England	**238**	**(4.3)**	**155**	**(2.8)**
Isle of Man	**0**	**(0.0)**	**0**	**(0.0)**
Channel Islands	**0**	**(0.0)**	**1**	**(6.3)**
Wales	**15**	**(4.8)**	**10**	**(3.2)**
Scotland	**35**	**(6.4)**	**34**	**(6.3)**
Northern Ireland	**2**	**(1.1)**	**3**	**(1.6)**
TOTAL	**291[1]**	**(4.4)**	**203**	**(3.1)**

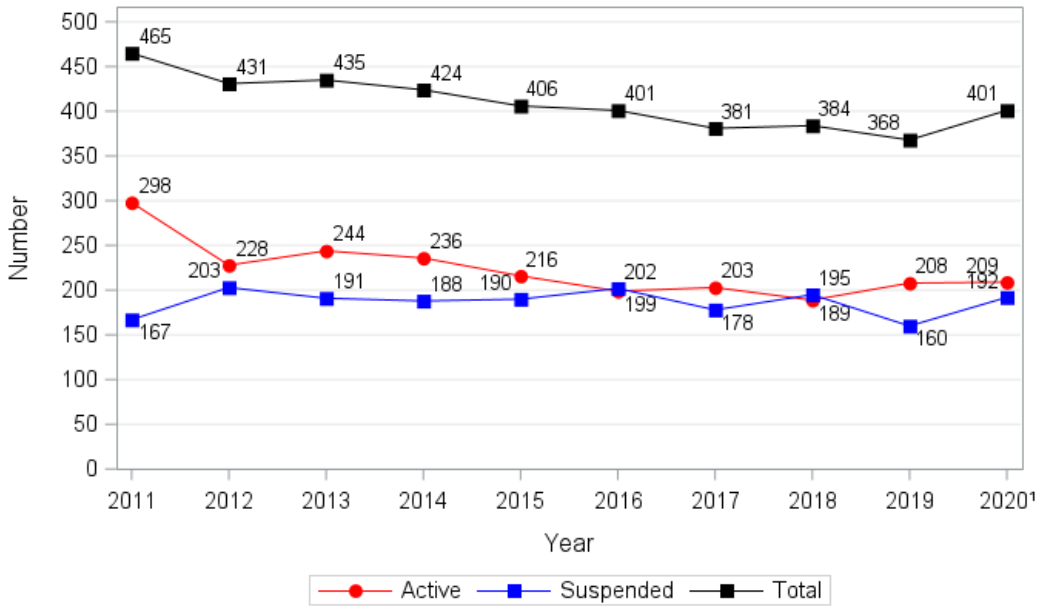
[1] Registrations include 1 recipient whose postcode was unknown

Pancreas transplant list

3.1 Patients on the pancreas transplant list as at 31 March, 2011 – 2020

Figure 3.1 shows the number of patients on the pancreas transplant list at 31 March each year from 2011. The number of patients actively waiting for a pancreas transplant was the highest at 298 in 2011 and then fell to 195 in 2018. In the last two years there has been a small increase to 209 on 29 February 2020.

Figure 3.1 Patients on the pancreas transplant list at 31 March



¹As at 29 February 2020

Figure 3.2 shows the number of patients on the active pancreas transplant list at 29 February 2020 by centre. Oxford had the largest proportion of the transplant list (33%) and Newcastle had the smallest proportion (4%).

Figure 3.2 Patients on the active pancreas transplant list at 29 February 2020, by centre

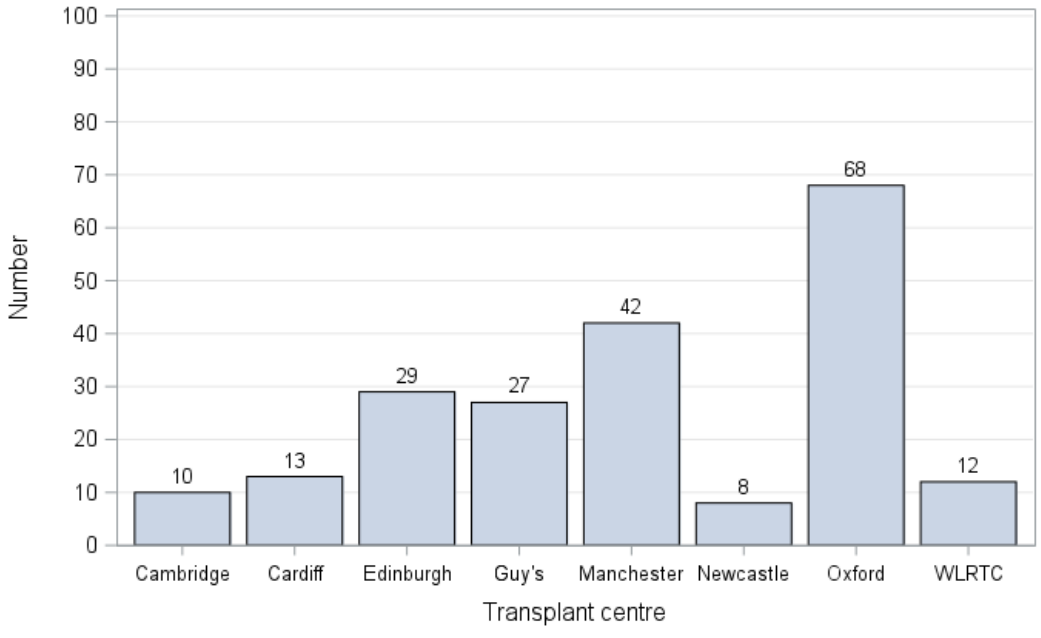
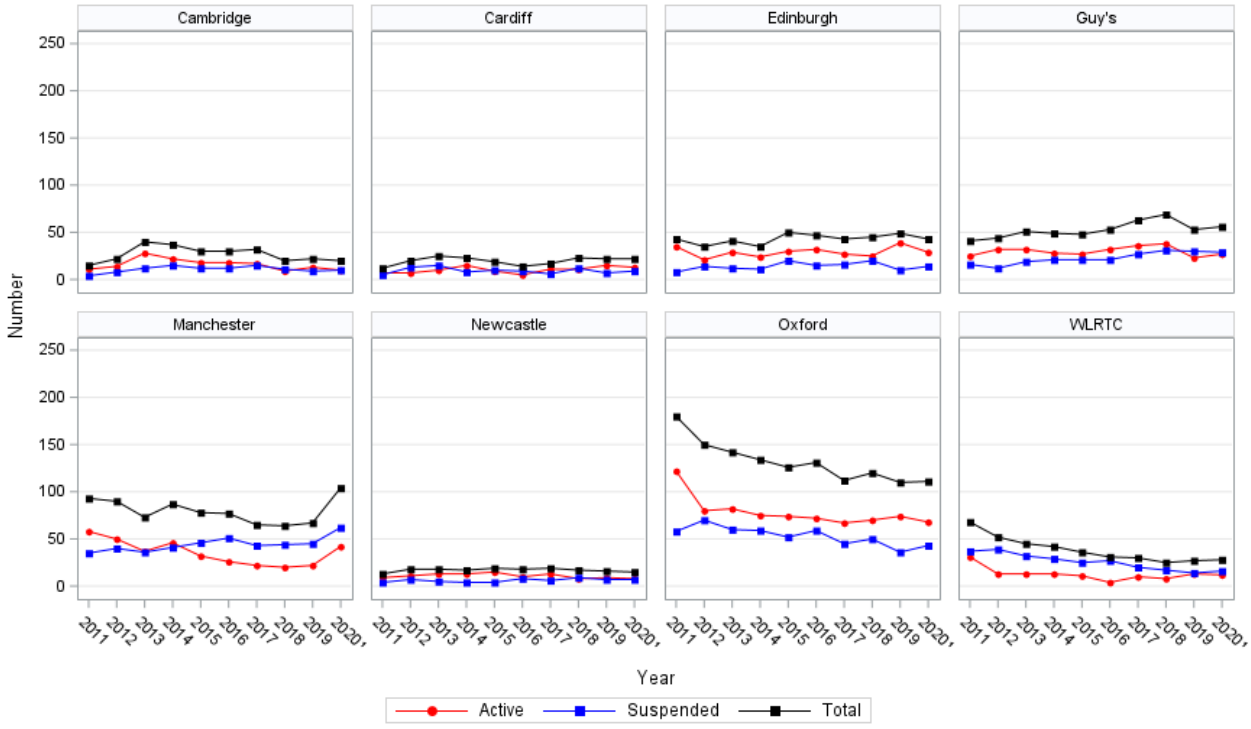


Figure 3.3 shows the number of patients on the pancreas transplant list at 31 March each year from 2011 for each transplant centre. The number of patients actively waiting for a pancreas transplant for most centres has been decreasing slightly over the ten year period, with the most noticeable decrease in Oxford.

Figure 3.3 Patients on the pancreas transplant list at 31 March, by centre



[1]As at 29 February 2020

3.2 Post-registration outcomes, 1 April 2016 – 31 March 2017

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 34% of patients registered between 1 April 2016 and 31 March 2017 were transplanted within one year, while three years after listing 75% of patients had received a transplant. There were 4% of patients who had died waiting for a transplant within one year of listing and 8% within three years of listing.

Figure 3.4 Post-registration outcome for 234 new pancreas registrations made in the UK, 1 April 2016 - 31 March 2017

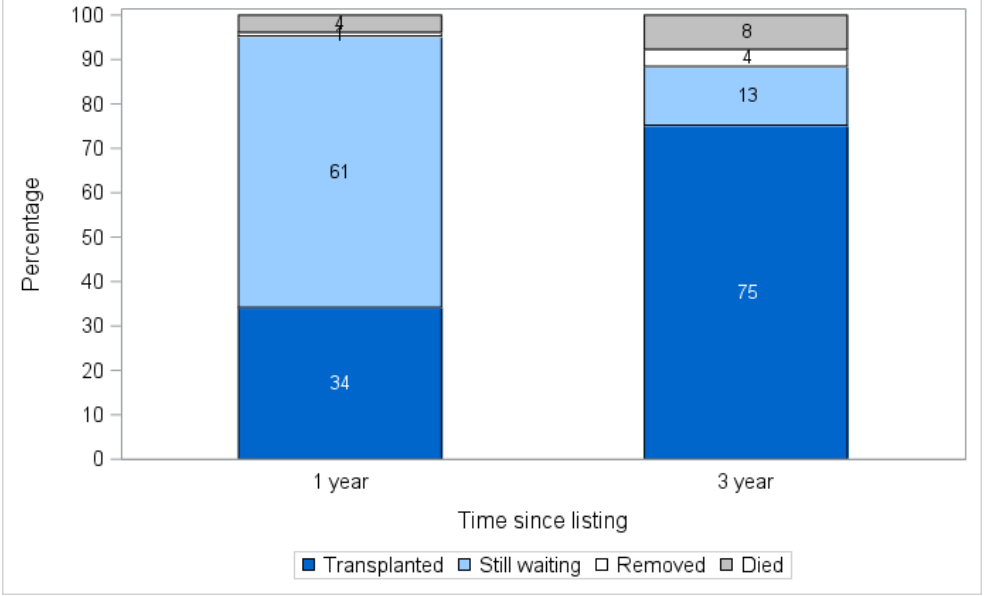
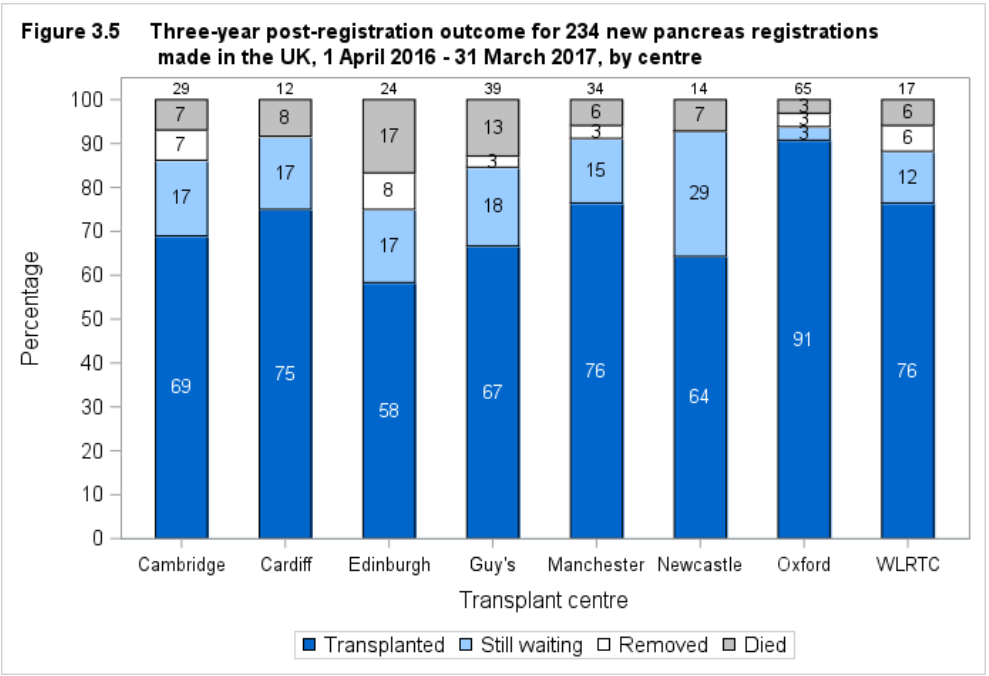


Figure 3.5 shows the proportion of patients transplanted or still waiting three years after joining the list by centre. Three years after listing, Oxford had transplanted 91% of their patients while Edinburgh had transplanted 58% and 17% had died waiting.

Figure 3.5 Three-year post-registration outcome for 234 new pancreas registrations made in the UK, 1 April 2016 - 31 March 2017, by centre



3.3 Demographic characteristics, 1 April 2019 – 31 March 2020

The sex, ethnicity, age group, sensitisation group (cRF%) and matchability points score group of patients registered on the pancreas transplant list in 2019/20 are shown by centre and overall for the UK in **Figures 3.6, 3.7, 3.8, 3.9** and **3.10** respectively. Note that all percentages quoted are based only on data where relevant information was available.

Overall, 245 patients were registered on the pancreas transplant list, 225 (92%) were waiting for a SPK transplant. Of these 225, 65% were male, 85% were white, the median age was 40 years and the median cRF was 0%.

Of the 20 (8%) patients on the pancreas only transplant list, 30% were male, 95% were white, the median age was 41 years and the median cRF was 32%.

Figure 3.6 Registrations on the active pancreas transplant list, 1 April 2019 - 31 March 2020, by centre and sex

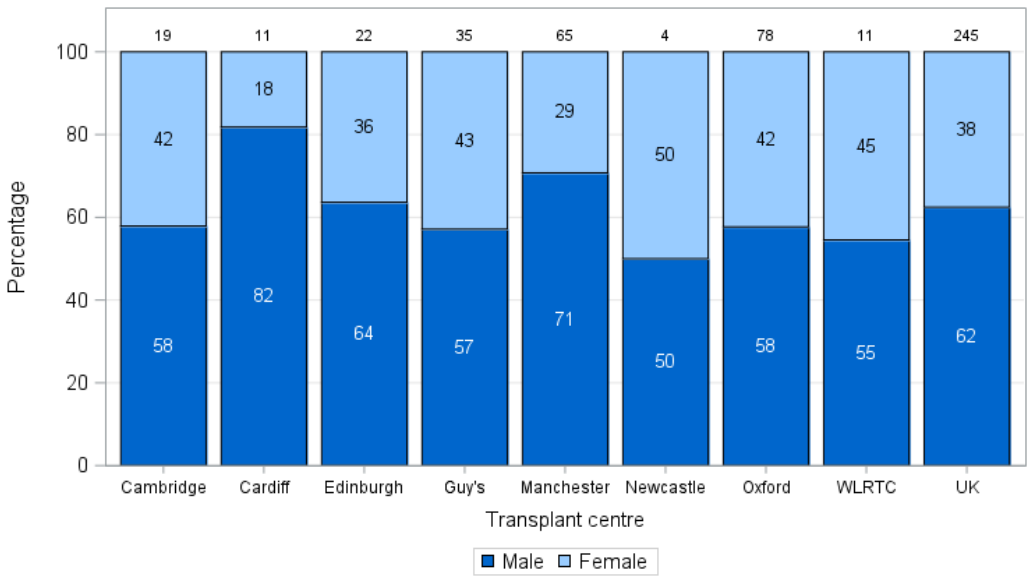


Figure 3.7 Registrations on the active pancreas transplant list, 1 April 2019 - 31 March 2020, by centre and ethnic origin

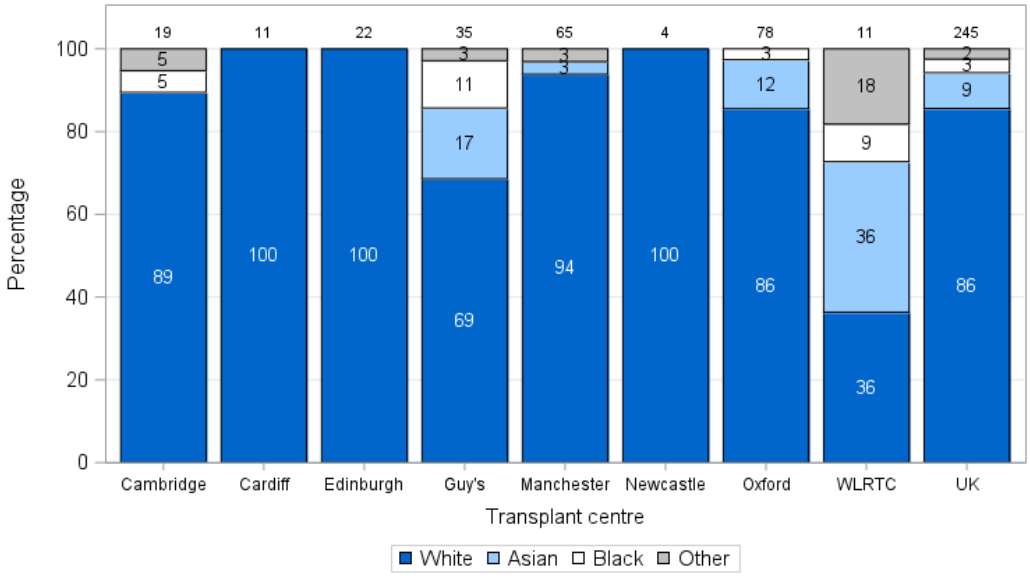


Figure 3.8 Registrations on the active pancreas transplant list, 1 April 2019 - 31 March 2020, by centre and age group

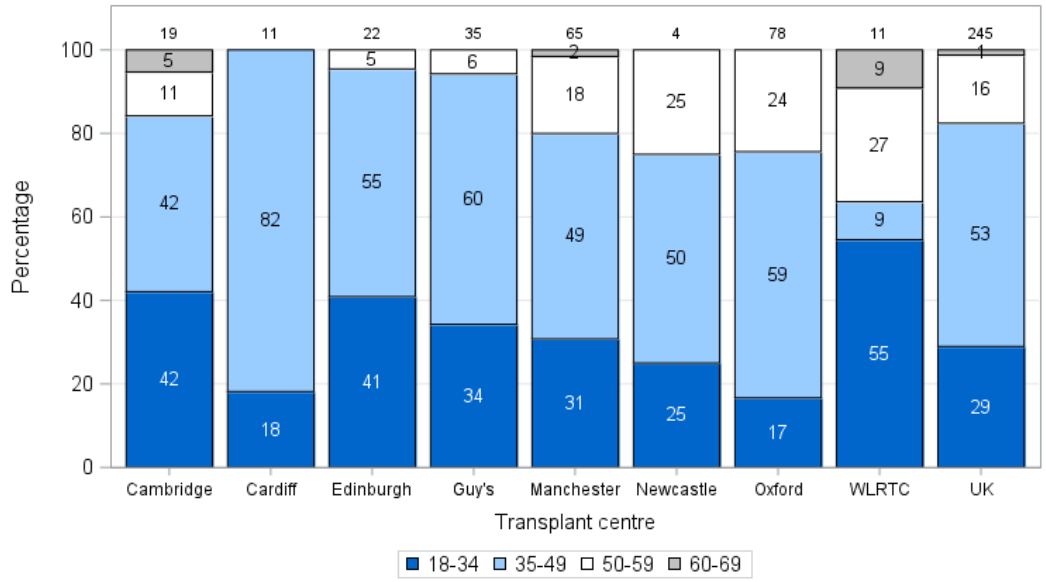


Figure 3.9 Registrations on the active pancreas transplant list, 1 April 2019 - 31 March 2020, by centre and sensitisation group (cRF%)

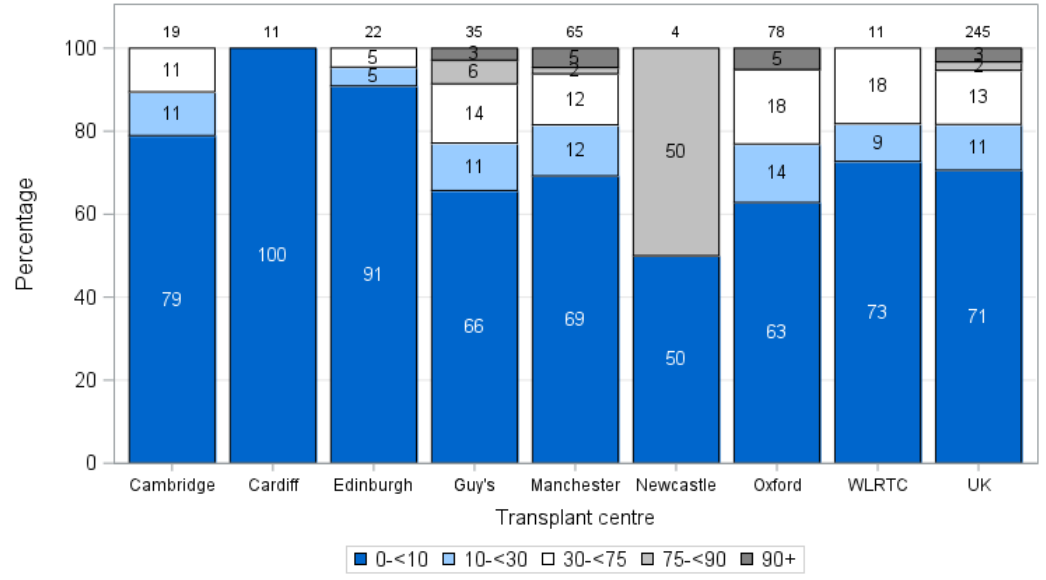
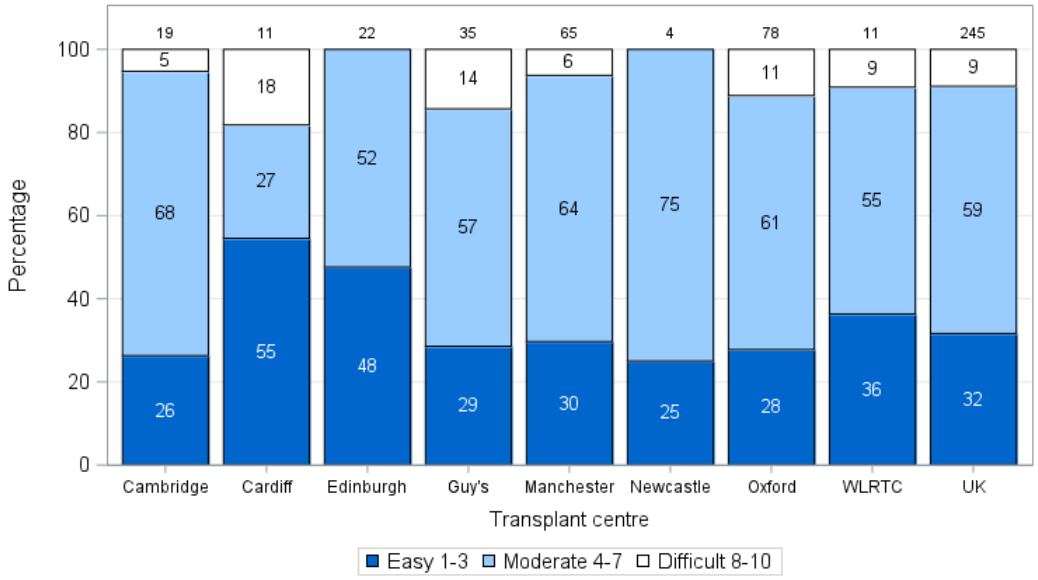


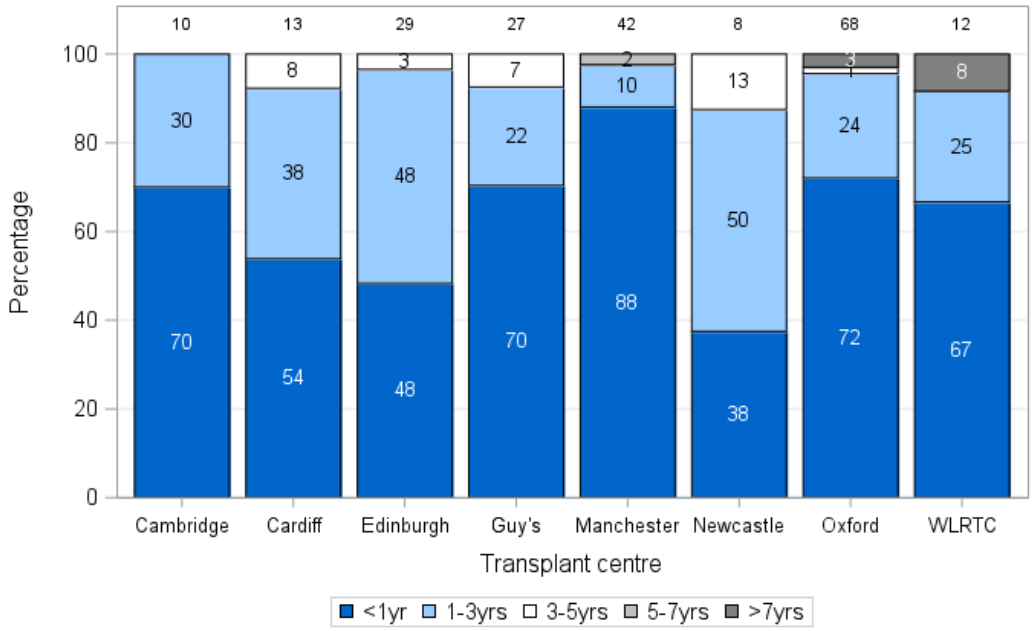
Figure 3.10 Registrations on the active pancreas transplant list, 1 April 2019 - 31 March 2020, by centre and matchability group



3.4 Patient waiting times for those currently on the list, 29 February 2020

Figure 3.11 shows the length of time patients have been waiting on the pancreas transplant list at 29 February 2020 by centre. The majority of patients currently listed have been waiting less than one year. However, two patients at Oxford and one patient at WLRTC have been waiting more than 7 years for transplant. The two patients at Oxford (one SPK patient and one pancreas alone patient) and one patient at WLRTC (SPK) are highly sensitised with a cRF of 100%.

Figure 3.11 Patients on the active pancreas transplant list as at 29 February 2020, by centre and grouped waiting time



3.5 Median waiting time to transplant, 1 April 2014 - 31 March 2018

The length of time a patient waits for a pancreas transplant varies across the UK. The median active waiting time for deceased donor pancreas transplantation is calculated using the Kaplan-Meier method and is shown in **Figure 3.12** and **Table 3.1** for patients registered at each individual centre.

The median active waiting time to transplant for patients registered on the pancreas transplant list between 1 April 2014 and 31 March 2018 is 350 days, over 11 months. This ranged from 193 days at WLRTC to 520 days at Edinburgh.

Figure 3.12 Median waiting time to deceased donor transplant for patients registered on the pancreas transplant list, 1 April 2014 - 31 March 2018

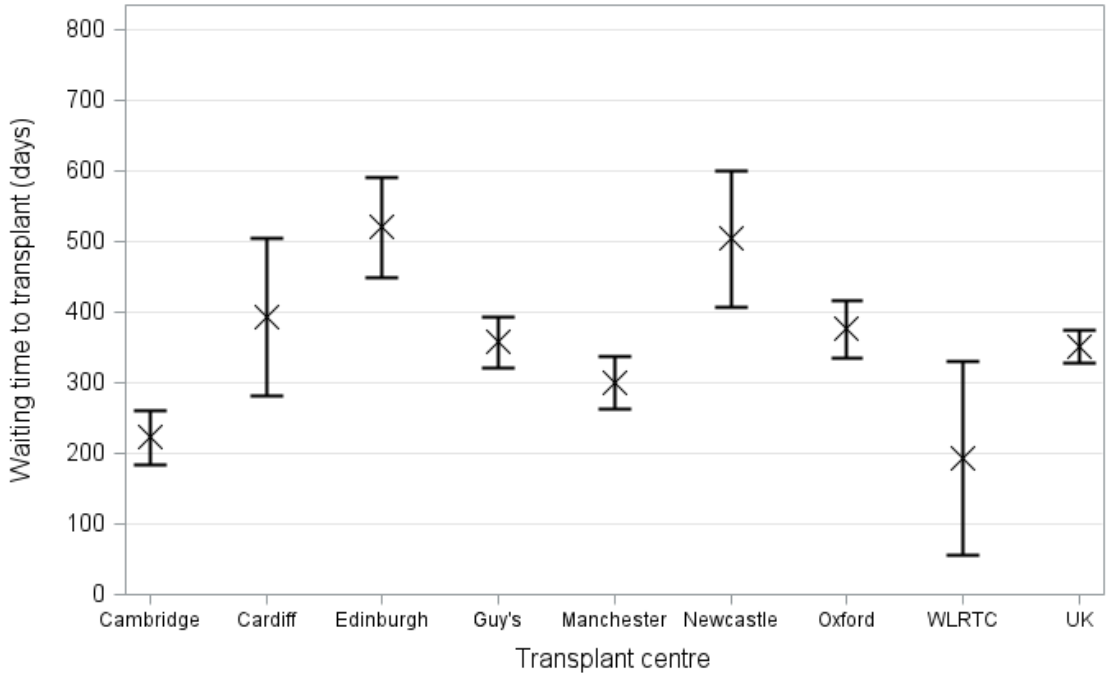


Table 3.1 Median waiting time to pancreas transplant in the UK, for patients registered 1 April 2014 - 31 March 2018

Transplant centre	Number of patients registered	Waiting time (days) Median	95% Confidence interval
Cambridge	103	223	185 - 261
Cardiff	45	393	282 - 504
Edinburgh	97	520	449 - 591
Guy's	149	357	320 - 394
Manchester	147	300	263 - 337
Newcastle	42	504	408 - 600
Oxford	289	376	336 - 416
WLRTC	48	193	56 - 330
UK	**920**	**351**	**328 - 374**

Response to pancreas offers

4.1 Offer decline rates, 1 April 2017 – 31 March 2020

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 2017 and 31 March 2020. Centres can be identified by the information shown in **Table 4.1**. Manchester had offer decline rates significantly better than the national rate, whilst Edinburgh had significantly higher decline rates than the national average.

Figure 4.1 DBD donor pancreas offer decline rates for pancreases that resulted in a pancreas transplant, 1 April 2017 and 31 March 2020

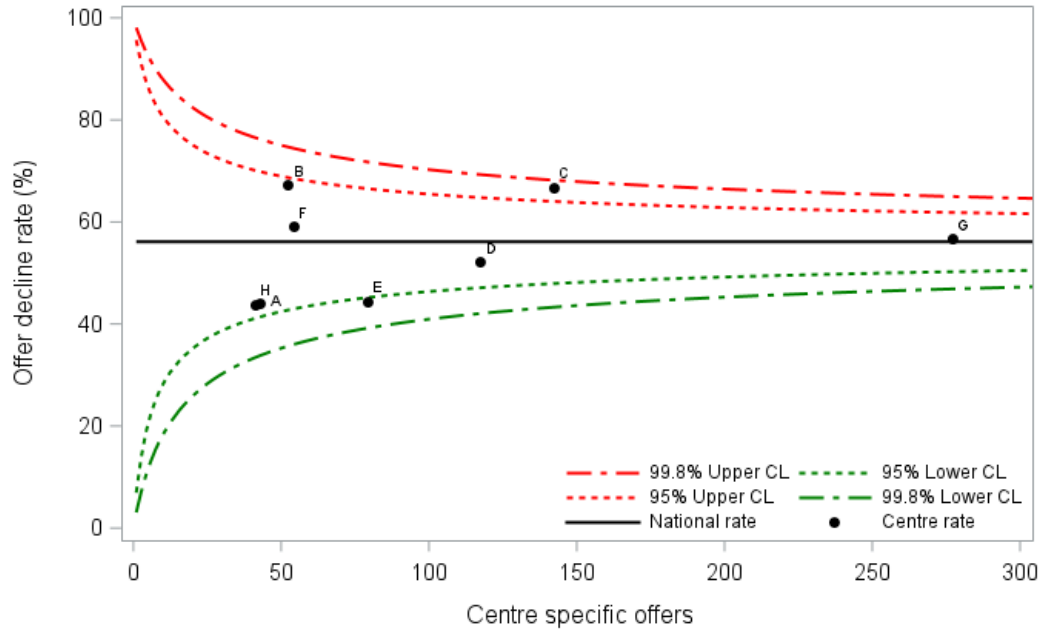


Table 4.1 compares individual centre DBD offer decline rates over time by financial year. The overall offer decline rate increased from 55% in 2018/19 to 58% in 2019/20. Newcastle decline rate decreased to 40% in 2019/20 from 62% in 2018/19 and Cambridge declined rate increased to 67% in 2019/20 from 43% in 2018/19.

Table 4.1 DBD donor pancreas offer decline rates by transplant centre, 1 April 2017 and 31 March 2020

Centre	Code	2017/18		2018/19		2019/20		Overall	
		N	(%)	N	(%)	N	(%)	N	(%)
Cambridge	A	23	(39)	14	(43)	6	(67)	43	(44)
Cardiff	B	15	(73)	18	(61)	19	(68)	52	(67)
Edinburgh	C	48	(73)	40	(65)	54	(63)	142	(67)
Guy's	D	39	(51)	39	(56)	39	(49)	117	(52)
Manchester	E	19	(32)	19	(42)	41	(51)	79	(44)
Newcastle	F	23	(65)	21	(62)	10	(40)	54	(59)
Oxford	G	97	(56)	82	(51)	98	(62)	277	(57)
WLRTC	H	14	(43)	14	(50)	13	(38)	41	(44)
UK		**278**	**(56)**	**247**	**(55)**	**280**	**(58)**	**805**	**(56)**

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 99.8% confidence limit

Figure 4.2 compares individual centre offer DCD decline rates with the national rate over the time period, 1 April 2017 and 31 March 2020. 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 2017 and 31 March 2020

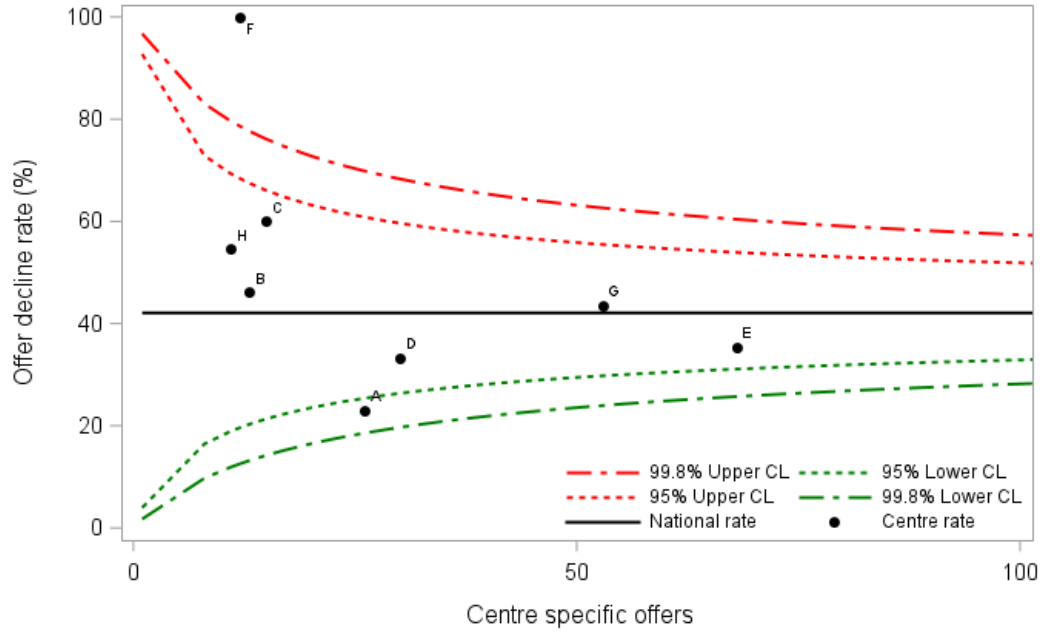


Table 4.2 compares individual DCD centre offer decline rates over time by financial year. In 2019/20, WLRTC had an offer decline rate better than the national rate, whilst Newcastle had a much higher decline rate than the national average.

Table 4.2 DCD donor pancreas offer decline rates by transplant centre, 1 April 2017 and 31 March 2020

Centre	Code	2017/18		2018/19		2019/20		Overall	
		N	(%)	N	(%)	N	(%)	N	(%)
Cambridge	A	7	(0)	10	(30)	9	(33)	26	(23)
Cardiff	B	5	(60)	3	(33)	5	(40)	13	(46)
Edinburgh	C	6	(50)	5	(100)	4	(25)	15	(60)
Guy's	D	7	(29)	12	(33)	11	(36)	30	(33)
Manchester	E	25	(16)	28	(43)	15	(53)	68	(35)
Newcastle	F	3	(100)	5	(100)	4	(100)	12	(100)
Oxford	G	16	(38)	19	(42)	18	(50)	53	(43)
WLRTC	H	7	(71)	2	(50)	2	(0)	11	(55)
UK		**76**	**(34)**	**84**	**(46)**	**68**	**(46)**	**228**	**(42)**

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 99.8% confidence limit

Pancreas transplants

5.1 Pancreas transplants, 1 April 2010 – 31 March 2020

Figure 5.1 shows the total number of pancreas transplants performed in the last ten financial years, by type of donor. The first DCD pancreas transplant was performed in 2005/06 and by 2010/11 there were 36 DCD transplants (19%). 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 52 in 2018/19 and 46 in 2019/20 which accounts for around 30% and 26% of pancreas transplants respectively.

In 2013/14 the number of DBD transplants peaked at 175 (82%), however, this has decreased in the last six years to 129 DBD transplants in 2019/20.

Figure 5.1 Pancreas transplants,1 April 2010 - 31 March 2020, by financial year and donor type

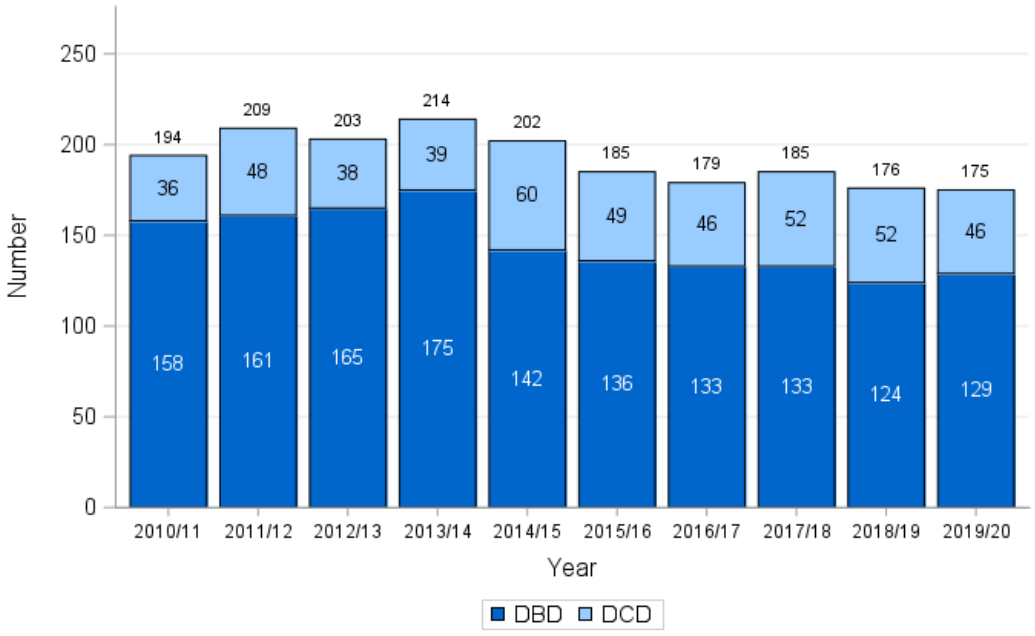


Figure 5.2 shows the total number of pancreas transplants performed in 2019/20, by centre and type of donor. The same information is presented in **Figure 5.3** but this shows the proportion of DBD and DCD transplants performed at each centre. Oxford performed the most DBD and DCD transplants (53), however Cambridge had the largest proportion of DCD transplants (58%). Newcastle performed the lowest number of transplants (six), and there were no DCD transplants, in the last financial year.

Figure 5.2 Pancreas transplants, 1 April 2019 - 31 March 2020, by centre and donor type

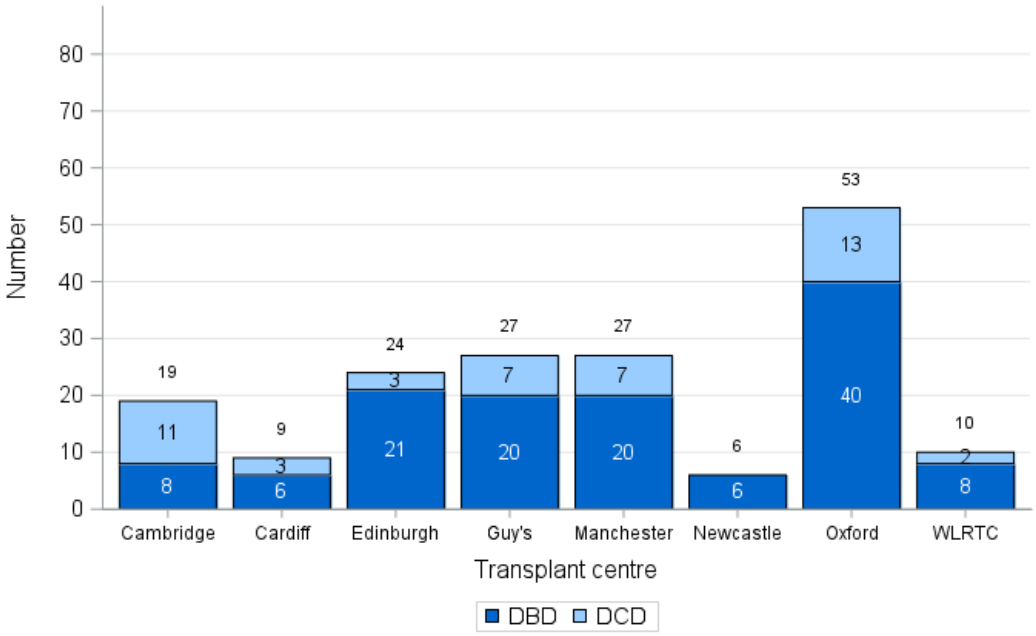


Figure 5.3 Pancreas transplants, 1 April 2019 - 31 March 2020, by centre and donor type

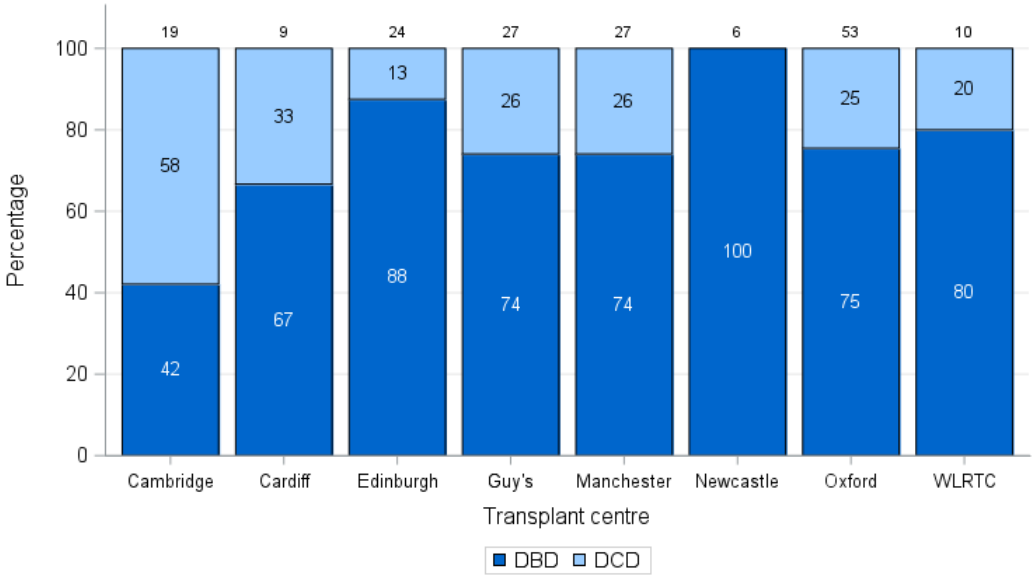
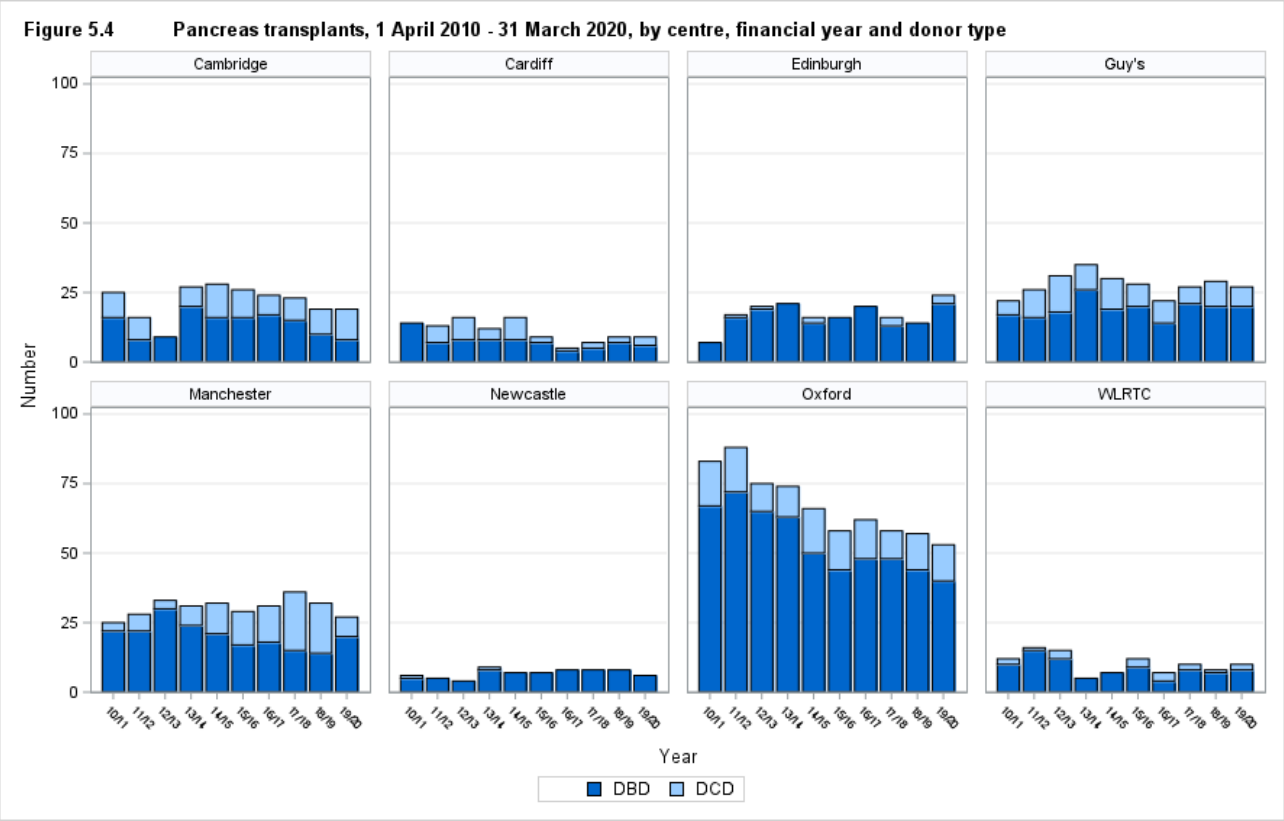


Figure 5.4 shows the total number of pancreas transplants performed in last ten financial years, by centre and type of donor. Oxford have consistently performed a large number of pancreas transplants since 2010/11 including a number of DCD transplants over the last ten years. However, the number of transplants performed at Oxford has been steadily decreasing since 2011/12. Edinburgh and Newcastle have not performed many DCD transplants over the ten year period.



5.2 Demographic characteristics, 1 April 2019 - 31 March 2020

The sex, ethnicity, age group, sensitisation group (cRF%) and matchability points score group of patients that received a pancreas transplant in 2019/20 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, 175 patients were transplanted on the pancreas transplant list, 162 (93%) were SPK transplants. Of which 57% were male, 81% were white, the median age was 41 years and the median cRF was 0%. Of the 13 (7%) patients transplanted as a pancreas only transplant, 31% were male, 100% were white, the median age was 43 years and the median cRF was 23%.

Figure 5.5 Pancreas transplants, 1 April 2019 - 31 March 2020, by centre and sex

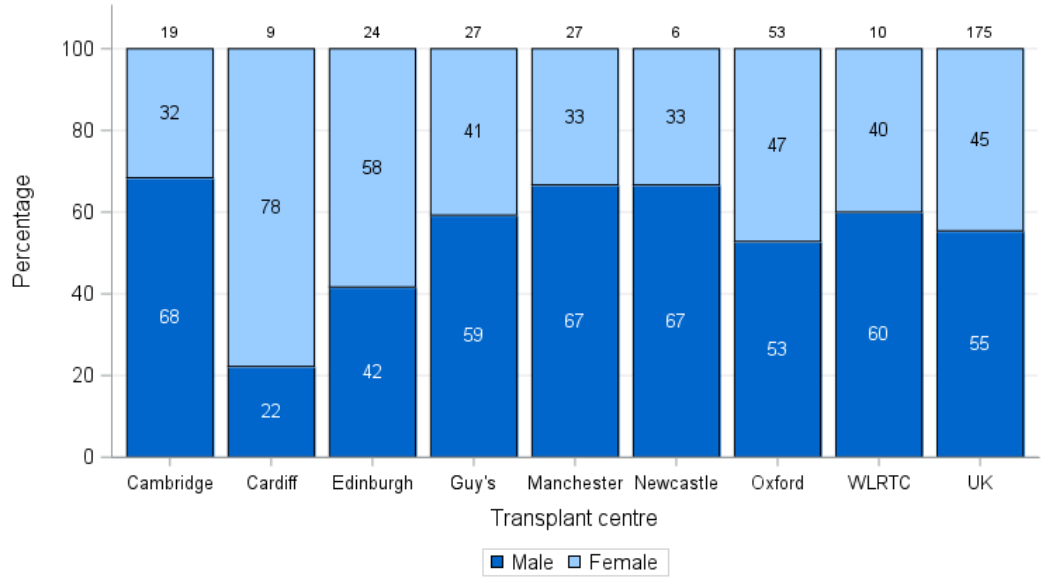


Figure 5.6 Pancreas transplants, 1 April 2019 - 31 March 2020, by centre and ethnic origin

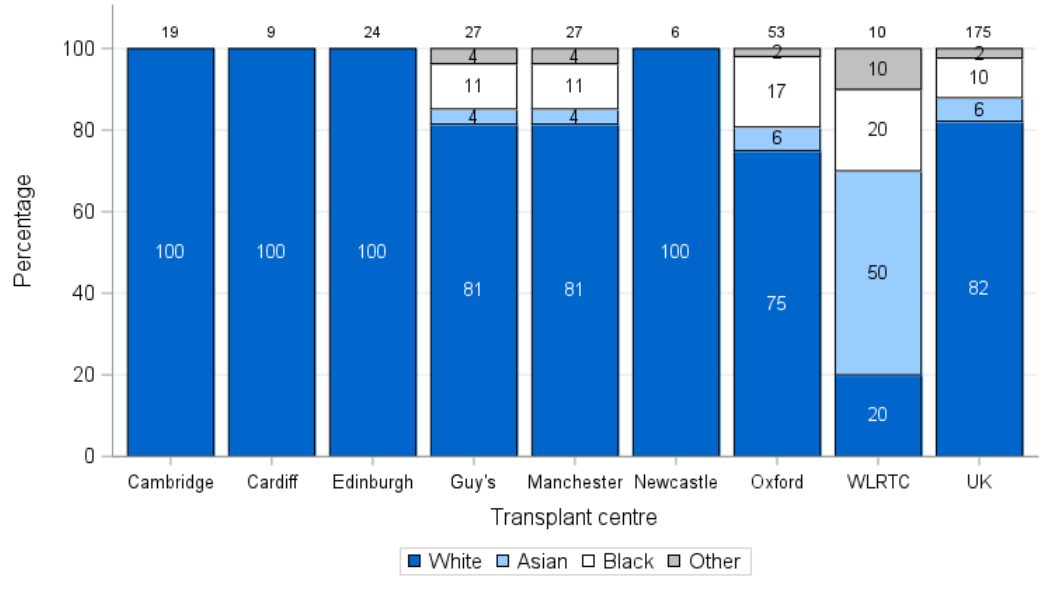


Figure 5.7 Pancreas transplants, 1 April 2019 - 31 March 2020, by centre and age group

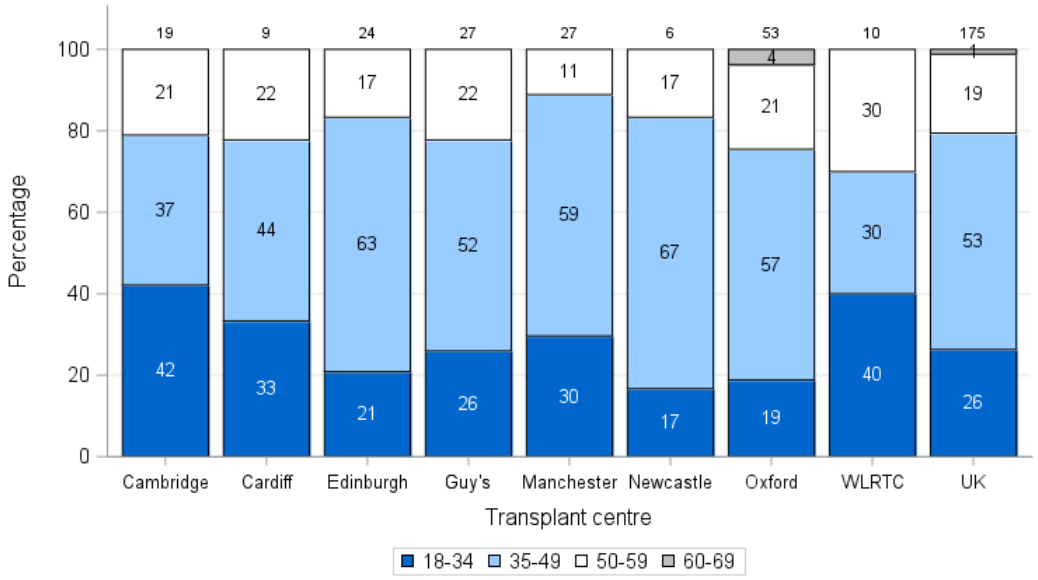


Figure 5.8 Pancreas transplants, 1 April 2019 - 31 March 2020, by centre and sensitisation (cRF%) group

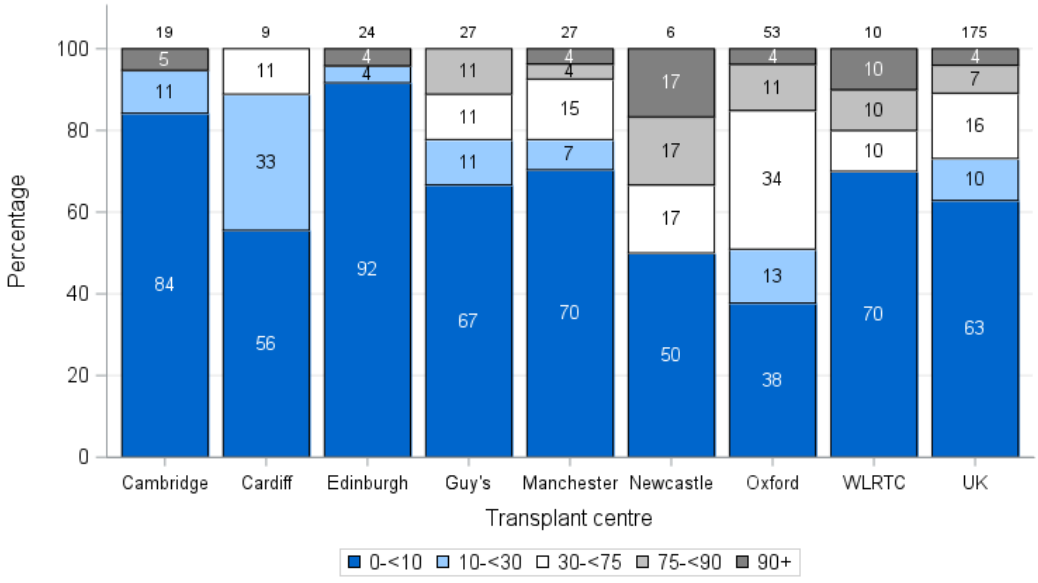
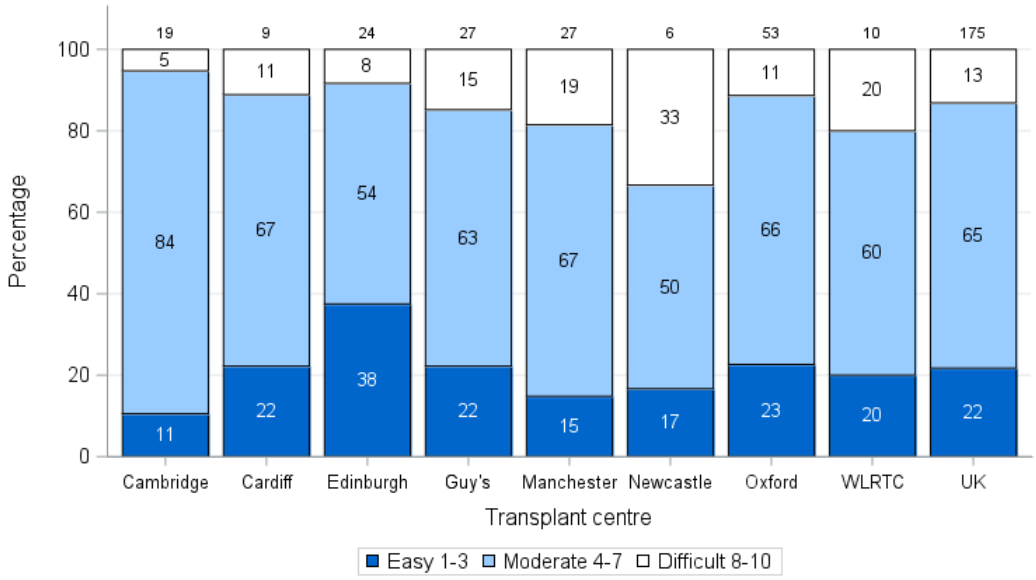


Figure 5.9 Pancreas transplants, 1 April 2019 - 31 March 2020, by centre and matchability group



5.3 Cold ischaemia time, 1 April 2010 – 31 March 2020

Median cold ischaemia times (CIT) are shown in addition to inter-quartile ranges in **Figures 5.10** to **5.15**. 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 circle and the median for multiple observations is represented by a line. There is some variation in average (median) CIT between different transplant centres although all centres continually try to reduce this time.

The cold ischaemia times used for all donors, is as reported on the pancreas transplant record form and may include periods of machine perfusion; no adjustment has been made for this.

Figure 5.10 shows the median cold ischaemia time in DBD donor pancreas transplants over the last ten years. During this time period the overall median cold ischaemia time has steadily decreased from 12 hours in 2010/11 to 11 hours in 2019/20.

Figure 5.10 Median cold ischaemia time in DBD donor pancreas transplants 1 April 2010 - 31 March 2020

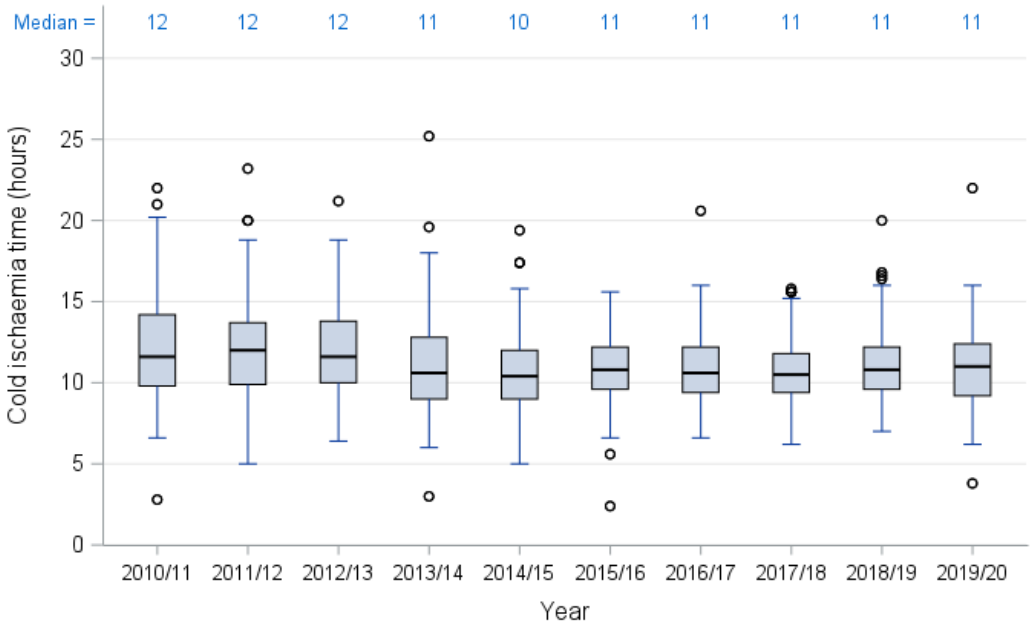


Figure 5.11 shows the median cold ischaemia time in DBD donor pancreas transplants in 2019/20 for each transplant centre. WLRTC had the longest median cold ischaemia time of 13 hours, whilst Guy's, Oxford, Cambridge and Cardiff had the shortest time of 10 hours.

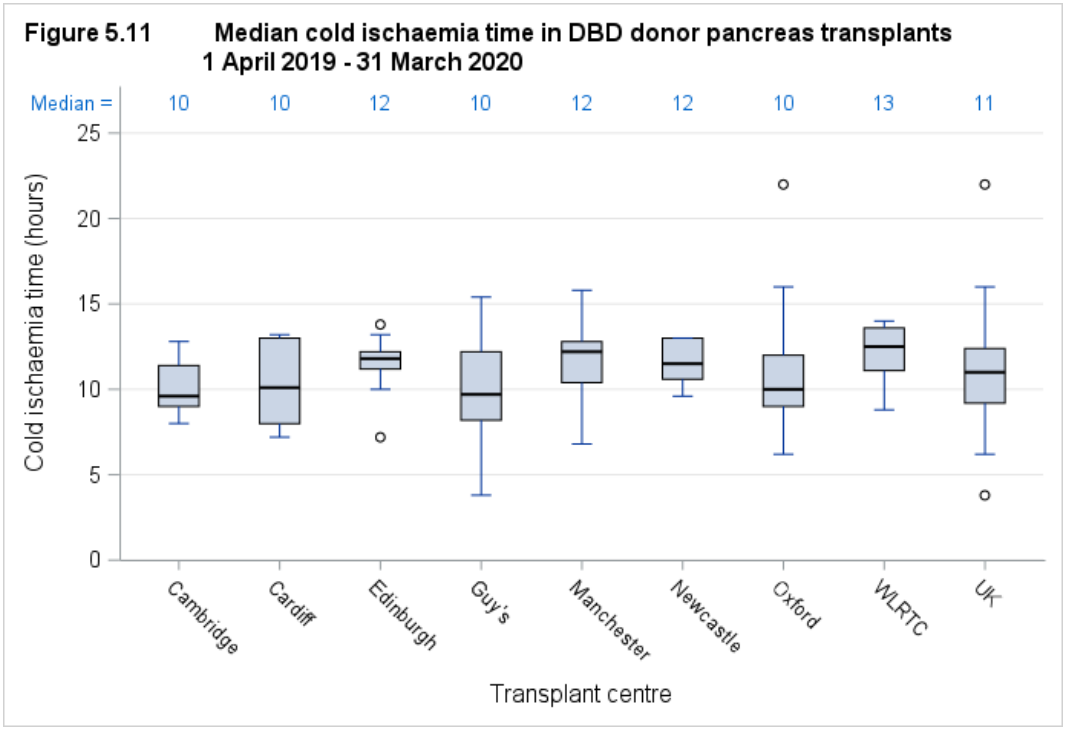


Figure 5.12 shows the median cold ischaemia time in DBD donor pancreas transplants over the last ten years for each transplant centre. WLRTC median cold ischaemia times had steadily decreased but in the last couple of years has started to rise. Overall, the median cold ischaemia times have remained constant, however the inter-quartile ranges have reduced as time has continued.

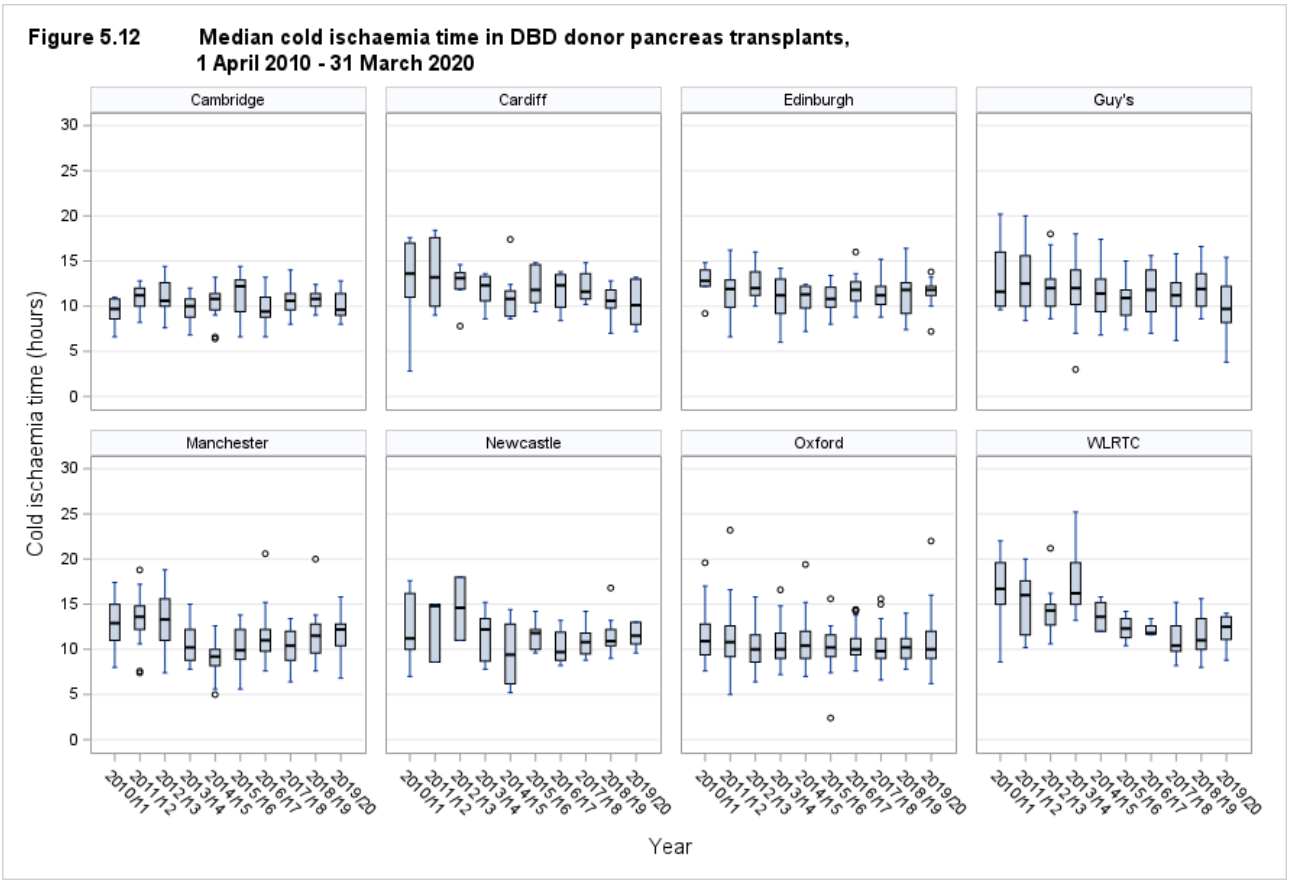


Figure 5.13 shows the median cold ischaemia time in DCD donor pancreas transplants over the last ten years and overall has predominately been 10 hours.

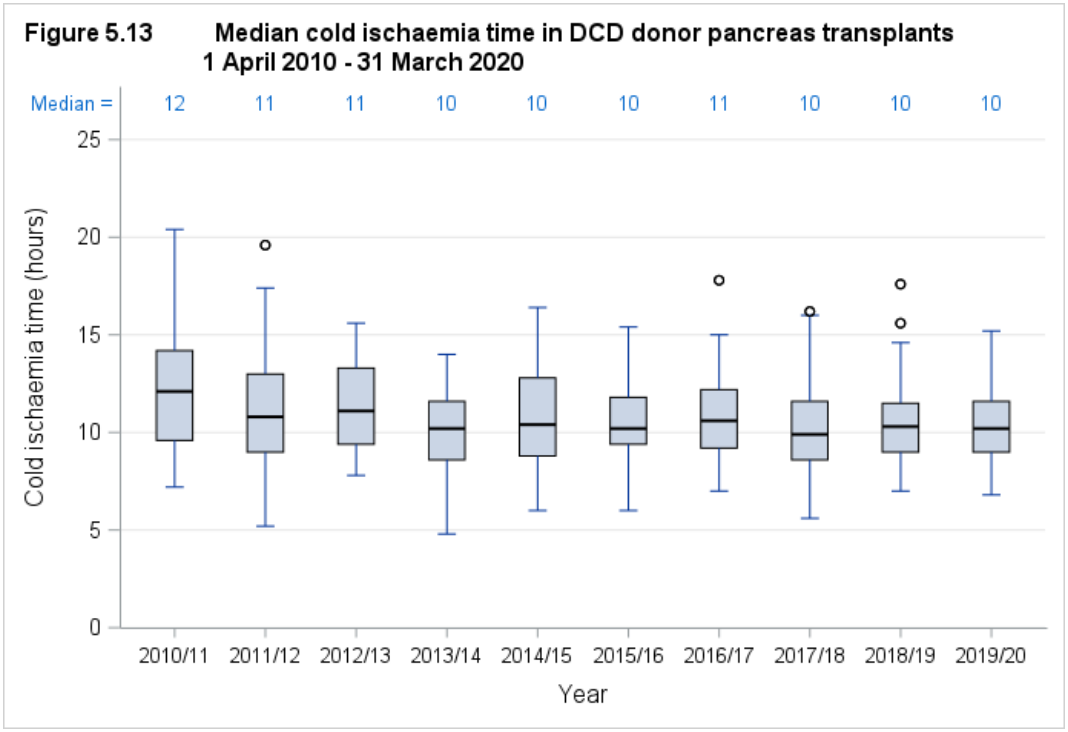


Figure 5.14 shows the median cold ischaemia time in DCD donor pancreas transplants in 2019/20 for each transplant centre. Cardiff had the shortest median cold ischaemia time of 8 hours. Newcastle is not presented as no DCD transplants were performed in 2019/20.

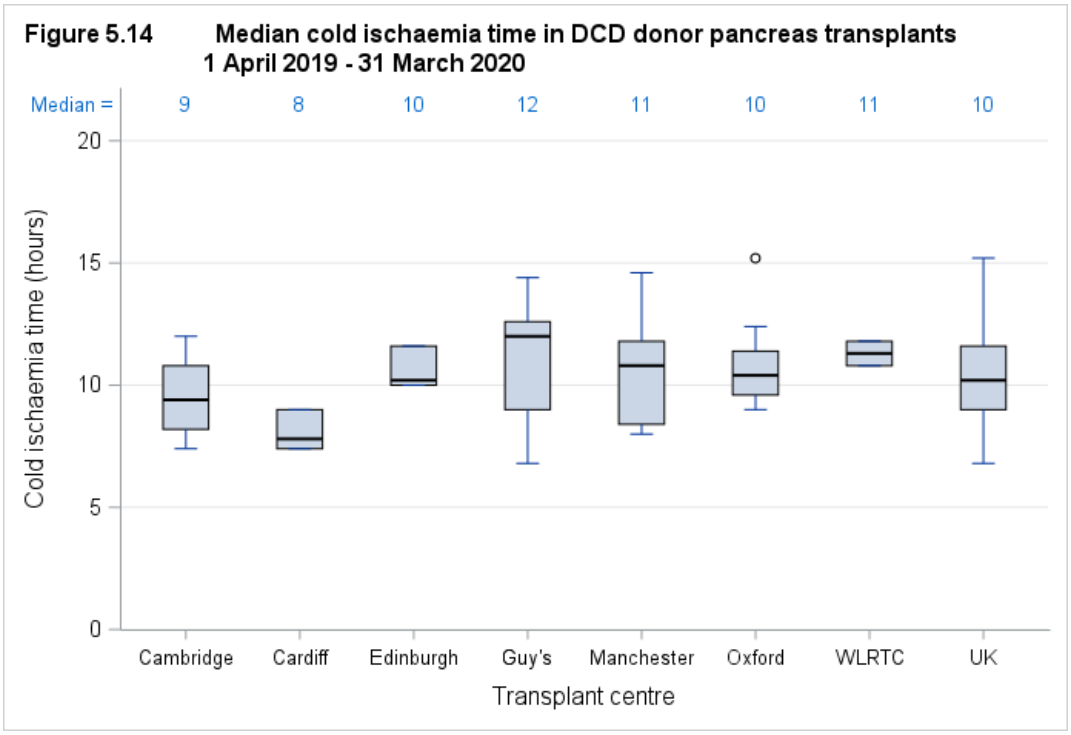
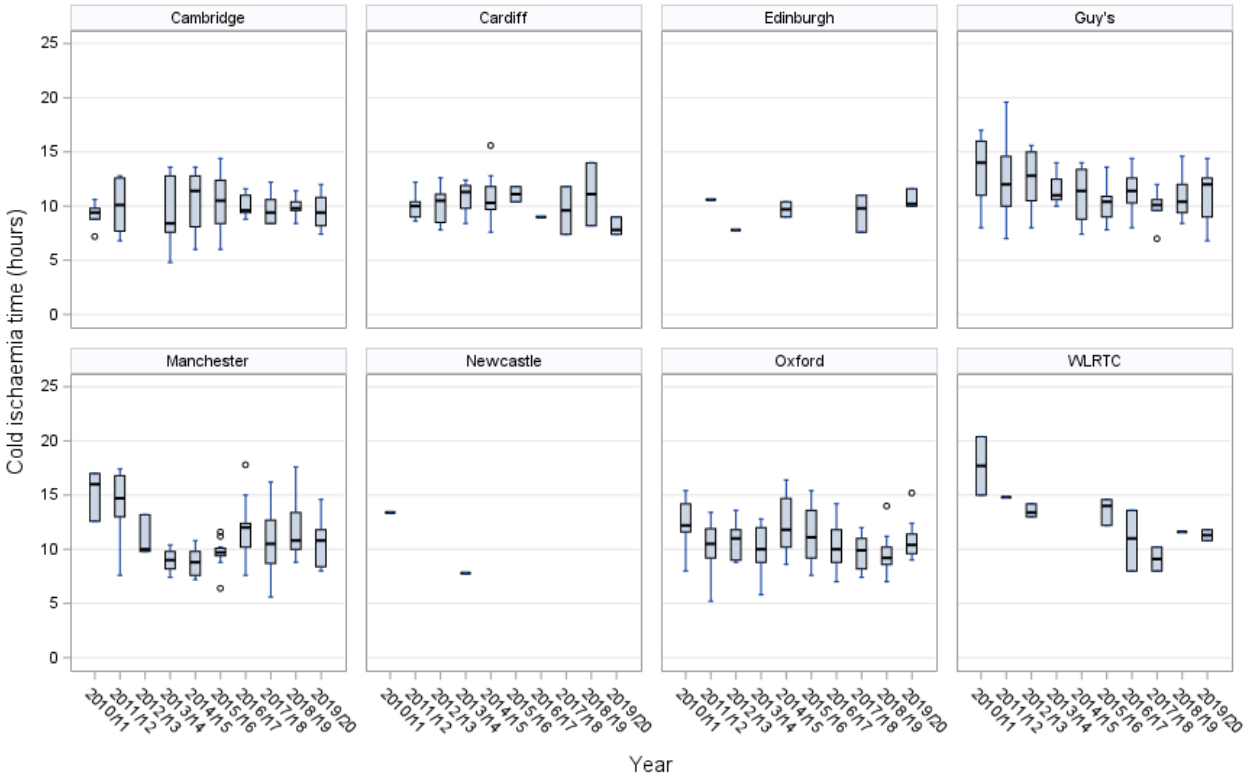


Figure 5.15 shows the median cold ischaemia time in DCD donor pancreas transplants for each transplant centre over the last ten years. It can be more clearly seen that overall the median cold ischaemia time has decreased from 2010/11 to 2019/20 with some minor fluctuations over the time period.

Figure 5.15 Median cold ischaemia time in DCD donor pancreas transplants, 1 April 2010 - 31 March 2020



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 survival is reported 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.

The survival data used for these analyses is reported to NHSBT via follow-up forms. It should be noted that one centre has a large number of follow-up forms outstanding which will affect the validity of some of the survival rates, especially the 5-year survival rate. Follow-up form return rates by centre, for forms issued during the 2019 calendar year, are presented in Section 8.

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 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. Centres can be identified by the information shown in **Tables 6.1** and **6.2** for patient and graft survival, respectively.

Figure 6.1 **Risk-adjusted one year patient survival rates for deceased donor first SPK transplants, between 1 April 2015 and 31 March 2019**

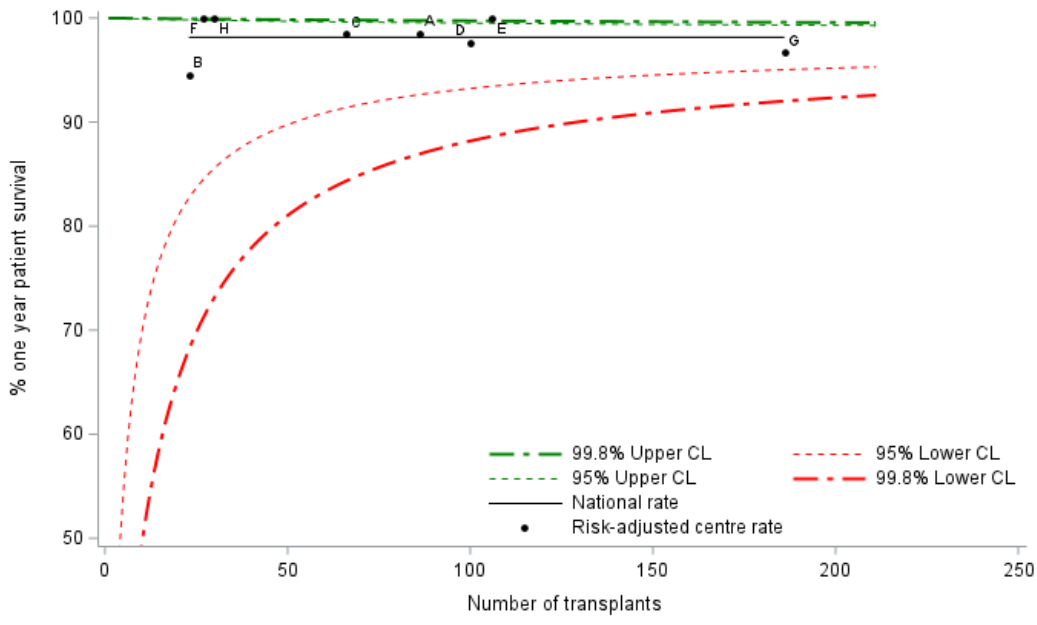


Figure 6.2 **Risk-adjusted one year pancreas graft (death censored) survival rates for all deceased donor first SPK transplants, between 1 April 2015 and 31 March 2019**

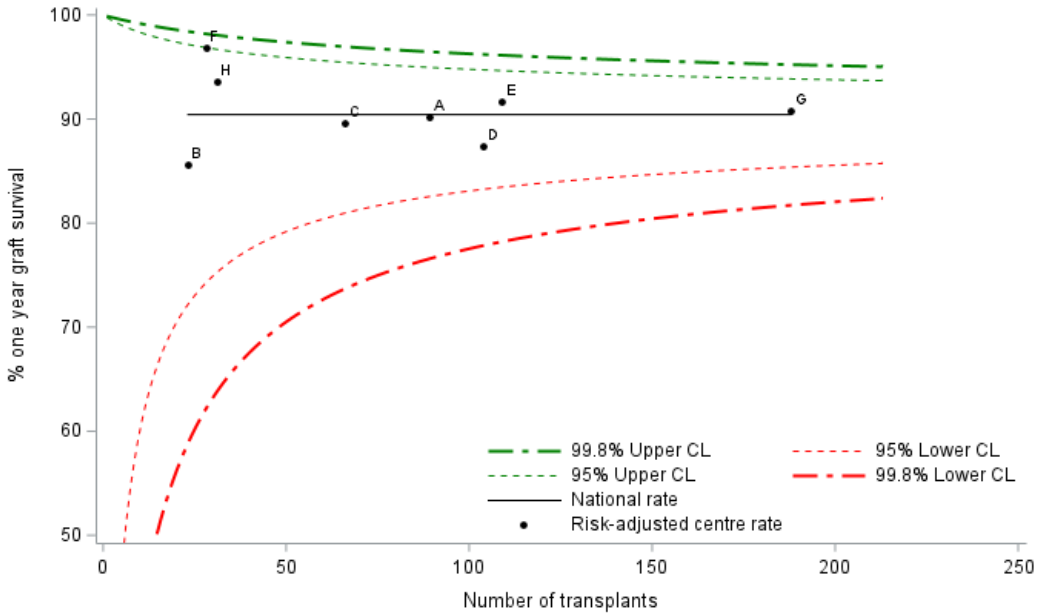


Figure 6.3 **Risk-adjusted five year patient survival rates for deceased donor first SPK transplants, between 1 April 2011 and 31 March 2015**

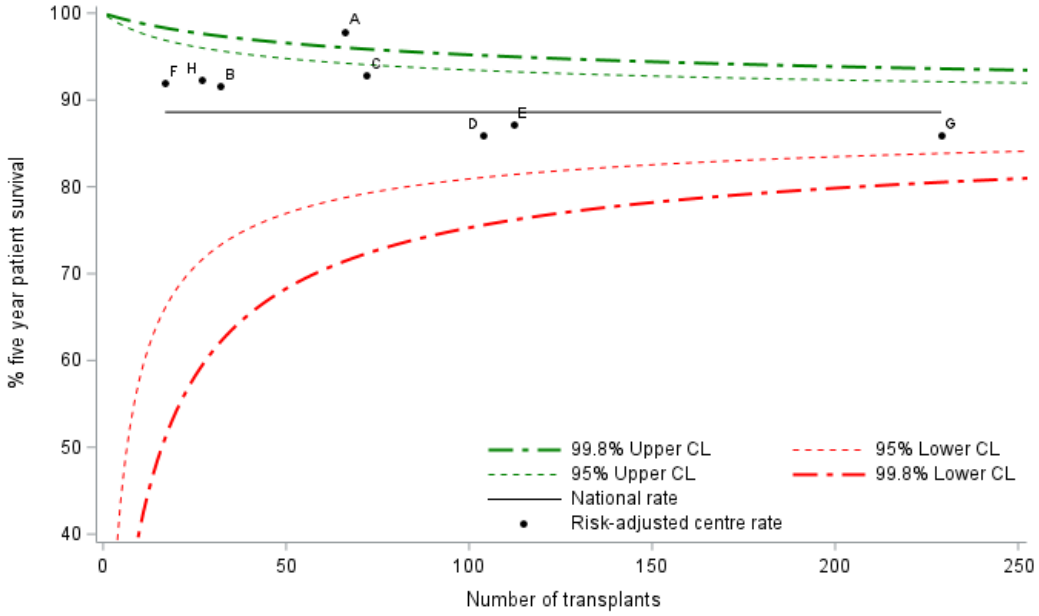


Figure 6.4 **Risk-adjusted five year pancreas graft (death censored) survival rates for all deceased donor first SPK transplants, between 1 April 2011 and 31 March 2015**

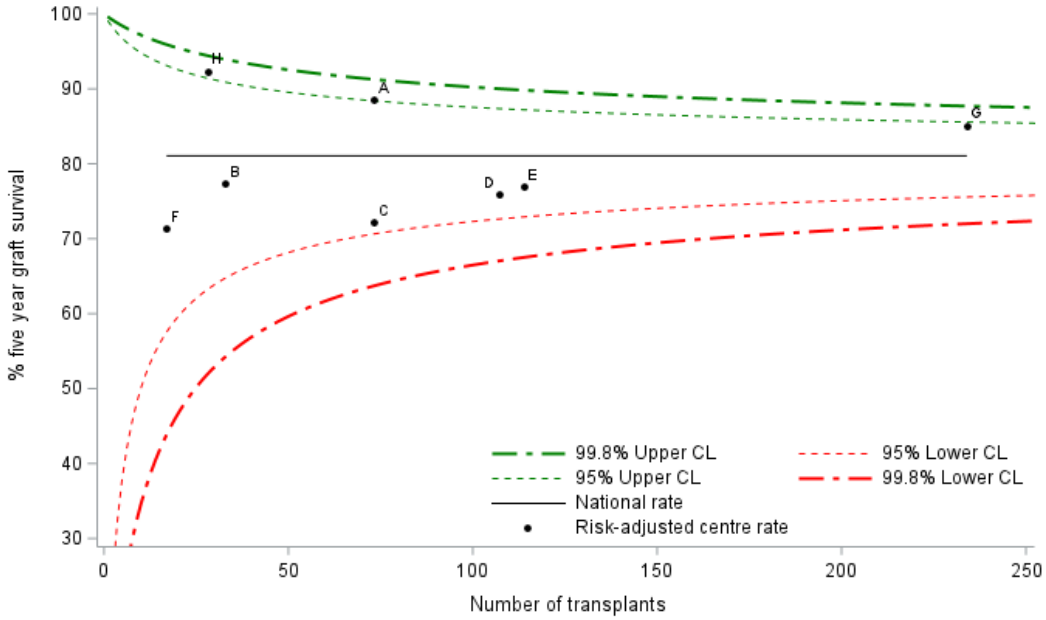


Table 6.1 **Risk-adjusted one and five year patient survival for first SPK transplants using pancreases from deceased donors**

		patient survival					
		One-year*			Five-year**		
Centre	Code	N	%	(95% CI)	N	%	(95% CI)
Cambridge	A	86	99	(92 - 100)	66	98	(88 - 100)
Cardiff	B	23	95	(70 - 100)	32	92	(70 - 99)
Edinburgh	C	66	98	(91 - 100)	72	93	(83 - 98)
Guy's	D	100	98	(92 - 100)	104	86	(74 - 93)
Manchester	E	106	100	N/A	112	87	(78 - 93)
Newcastle	F	27	100	N/A	17	92	(55 - 100)
Oxford	G	186	97	(92 - 99)	229	86	(80 - 90)
WLRTC	H	30	100	N/A	27	92	(72 - 99)
UK		**624**	**98**	**(97 - 99)**	**659**	**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 99.8% confidence limit

* Includes transplants performed between 1 April 2015 - 31 March 2019
** Includes transplants performed between 1 April 2011 - 31 March 2015

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	89	90	(81 - 96)	73	89	(78 - 95)
Cardiff	B	23	86	(58 - 97)	33	77	(57 - 90)
Edinburgh	C	66	90	(77 - 96)	73	72	(56 - 84)
Guy's	D	104	87	(78 - 93)	107	76	(65 - 84)
Manchester	E	109	92	(84 - 96)	114	77	(65 - 85)
Newcastle	F	28	97	(82 - 100	17	71	(27 - 92)
Oxford	G	188	91	(86 - 94)	234	85	(79 - 90)
WLRTC	H	31	94	(77 - 99)	28	92	(72 - 99)
UK		**638**	**90**	**(88 - 92)**	**679**	**81**	**(78 - 84)**

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

* Includes transplants performed between 1 April 2015 - 31 March 2019
** Includes transplants performed between 1 April 2011 - 31 March 2015

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)
Cambridge	A	0	-	-	0	-	-
Cardiff	B	4	-	-	10	100	-
Edinburgh	C	0	-	-	0	-	-
Guy's	D	0	-	-	6	-	-
Manchester	E	1	-	-	3	-	-
Newcastle	F	0	-	-	2	-	-
Oxford	G	18	94	(63 - 99)	39	85	(68 - 94)
WLRTC	H	3	-	-	0	-	-
UK		**26**	**96**	**(73 - 99)**	**60**	**88**	**(74 - 95)**

* Includes transplants performed between 1 April 2015 - 31 March 2019
** Includes transplants performed between 1 April 2011 - 31 March 2015
- 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	0	-	-	3	-	-
Cardiff	B	5	-	-	17	45	(21 - 67)
Edinburgh	C	0	-	-	1	-	-
Guy's	D	0	-	-	9	-	-
Manchester	E	8	-	-	5	-	-
Newcastle	F	2	-	-	7	-	-
Oxford	G	23	91	(68 - 98)	45	64	(47 - 76)
WLRTC	H	4	-	-	8	-	-
UK		**42**	**82**	**(66 - 91)**	**95**	**54**	**(43 - 64)**

* Includes transplants performed between 1 April 2015 - 31 March 2019
** Includes transplants performed between 1 April 2011 - 31 March 2015
- 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 SPK between 1 January 2008 and 31 December 2019. 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. All centres survival rates were very similar to the national rate of 75%. 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. Note that all rates (at one, five and ten years) were calculated from the same cohort of patients, and the number of patients remaining at risk of death after each time horizon (i.e. not already censored or deceased) is included in **Table 7.1** for reference.

Figure 7.1 **Risk-adjusted 10 year patient survival from listing for first deceased donor SPK transplant in patients registered between 1 January 2008 and 31 December 2019**

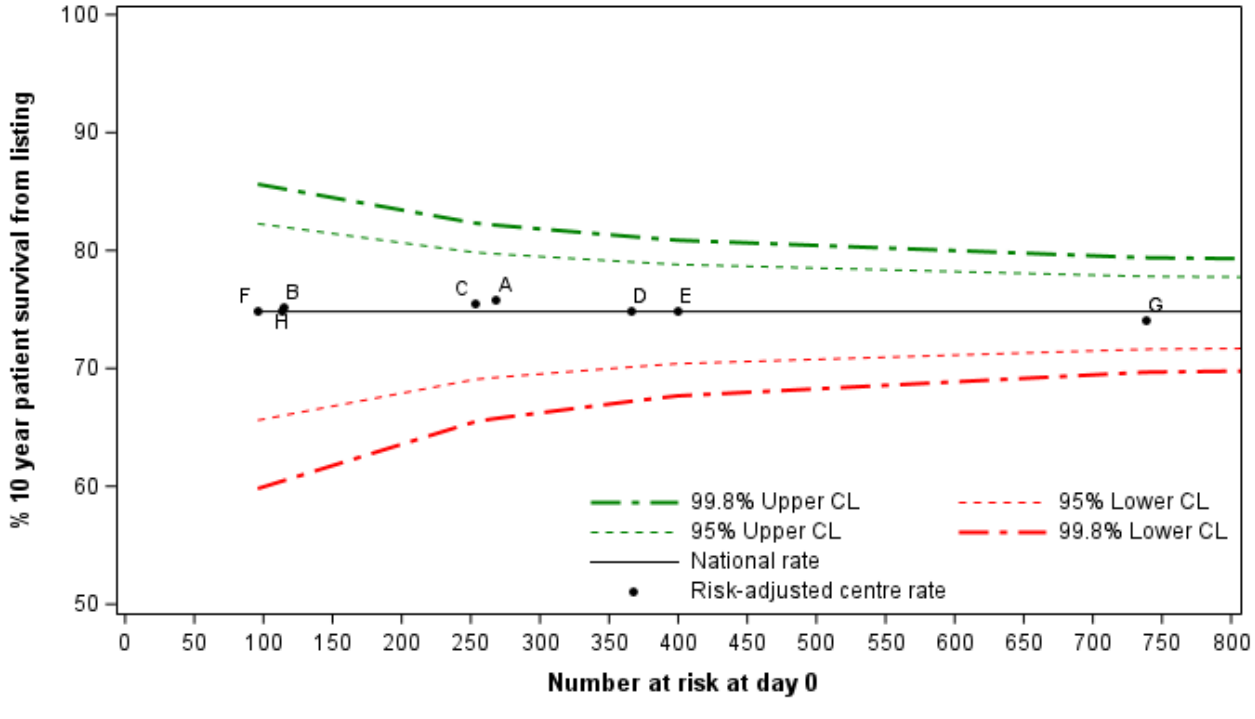


Table 7.1 Risk-adjusted 1, 5 and 10 year patient survival from listing for first deceased donor SPK transplant in patients registered between 1 January 2008 and 31 December 2019

Centre	Code	Number at risk at day 0	One year Survival rate (%) (95% CI)	One year Number at risk[1]	Five year Survival rate (%) (95% CI)	Five year Number at risk[1]	Ten year Survival rate (%) (95% CI)	Ten year Number at risk[1]
Cambridge	A	267	97 (95-98)	244	86 (82-90)	123	76 (68-82)	28
Cardiff	B	114	97 (96-98)	102	86 (84-88)	55	75 (70-79)	12
Edinburgh	C	253	97 (96-98)	235	86 (83-89)	108	76 (69-80)	23
Guy's	D	366	97 (96-98)	332	86 (84-88)	162	75 (71-78)	40
Manchester	E	399	97 (95-98)	351	86 (84-88)	172	75 (71-78)	43
Newcastle	F	96	97 (96-98)	89	86 (84-88)	42	75 (71-78)	11
Oxford	G	738	97 (95-98)	663	86 (82-89)	310	74 (68-79)	73
WLRTC	H	113	97 (95-98)	114	86 (84-88)	58	75 (71-78)	14
UK		**2346**	**97 (96-97)**	**2130**	**86 (84-88)**	**1030**	**75 (72-78)**	**244**

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

[1] Number of patients with reported follow-up beyond this time point

Form return rates

8.1 Pancreas form return rates, 1 January – 31 December 2019

Form return rates are reported in **Table 8.1** for the pancreas transplant record, three month and one year follow up form, along with lifetime follow up (more than two years). These include all pancreas transplants performed between 1 January and 31 December 2019 for the transplant record, and all requests for follow up forms issued in this time period. Centres highlighted are transplant centres. Overall, 94% of transplant record forms issued and 77% of lifetime follow-up forms issued have been returned. Of the transplant centres, Oxford and WLRTC have the lowest lifetime follow-up form return rates, 31% and 22%, respectively. Data as at 1st July 2020.

Table 8.1 Form return rates following pancreas transplantation, by centre, 1 January - 31 December 2019

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	21	100
Airdrie, Monklands District General Hospital							6	0
Bangor, Ysbyty Gwynedd District General Hospital							6	50
Basildon, Basildon Hospital							5	80
Belfast, Antrim Hospital							3	33
Belfast, Belfast City Hospital							6	100
Belfast, The Ulster Hospital							2	0
Birmingham, Birmingham Heartlands Hospital							14	100
Birmingham, Queen Elizabeth Hospital Birmingham					6	100	36	92
Bradford, St Lukes Hospital					2	100	7	86
Brighton, Royal Sussex County Hospital					4	100	24	100
Bristol, Southmead Hospital					2	100	40	100
Cambridge, Addenbrookes Hospital	22	100	21	100	16	100	113	99
Canterbury, Kent And Canterbury Hospital			1	100	3	100	37	100
Cardiff, University Of Wales Hospital	12	100	9	100	7	100	69	100
Carlisle, Cumberland Infirmary							4	100
Carshalton, St Helier Hospital					1	100	16	56
Chelmsford, Broomfield Hospital							1	100
Chester, Countess Of Chester Hospital							2	0
Closed - Glasgow, Glasgow Western Infirmary					1	100	5	40
County Down, Daisy Hill Hospital					1	100	5	100
Coventry, University Hospital (Walsgrave)					1	100	28	100
Derby, Royal Derby Hospital							10	90
Doncaster, Doncaster Royal Infirmary					1	100	5	100
Dorchester, Dorset County Hospital			2	100	2	100	32	100
Douglas, Nobles I-o-M Hospital							4	75
Dudley, Russell's Hall Hospital							4	100
Dulwich, Kings College							2	100
Dumfries, Dumfries And Galloway Royal Infirmary							3	100
Dundee, Ninewells Hospital					1	100	21	100
Edinburgh, Royal Infirmary Of Edinburgh	19	84	16	88	9	89	38	87
Exeter, Royal Devon And Exeter Hospital (Wonford)			1	100			24	96
Glasgow, Queen Elizabeth University Hospital							24	50
Gloucester, Gloucestershire Royal Hospital							13	85
Hereford, The County Hospital							3	100

Table 8.1 Form return rates following pancreas transplantation, by centre, 1 January - 31 December 2019

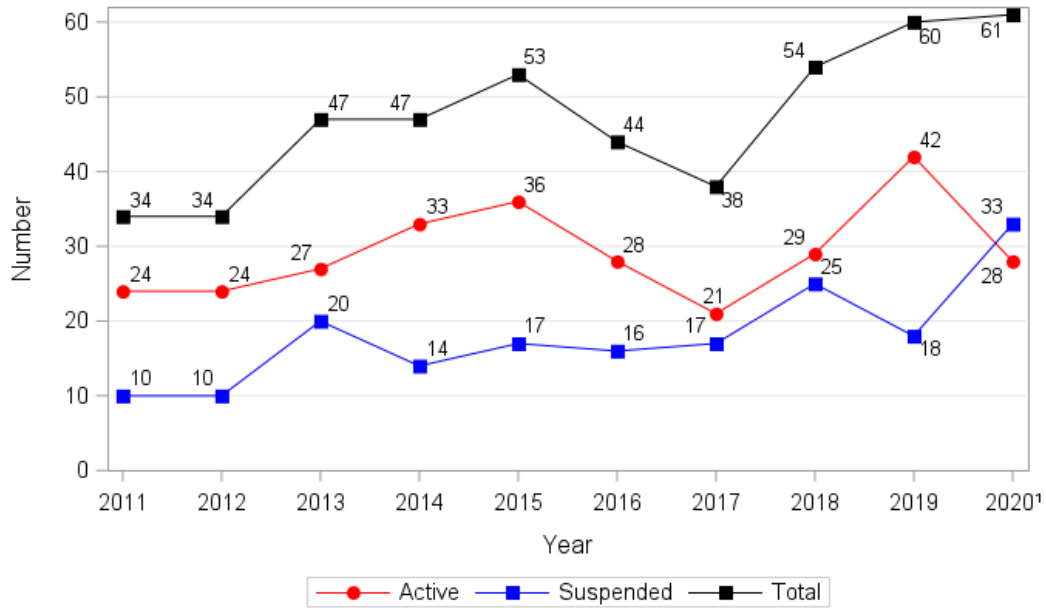
Centre	Transplant record		3 month follow-up		12 month follow-up		Lifetime follow-up	
	N	% returned	N	% returned	N	% returned	N	% returned
Hull, The Hull Royal Infirmary			2	100	2	100	15	100
Inverness, Raigmore Hospital					2	100	14	100
Ipswich, Ipswich Hospital							6	67
Kilmarnock, Crosshouse Hospital							9	44
Kirkcaldy, Victoria Hospital							2	50
Larbert, Forth Valley Royal Hospital							5	80
Leeds, St Jamess University Hospital					2	100	18	100
Leicester, Leicester General Hospital					3	0	22	36
Lincoln, Lincoln County Hospital							3	33
Liverpool, Royal Liverpool University Hospital							7	100
Liverpool, University Hospital Aintree							1	100
London, Guys Hospital	28	93	26	100	17	100	136	98
London, St Georges Hospital					1	0	4	0
London, The Royal Free Hospital			1	100	3	100	42	100
London, The Royal London Hospital (Whitechapel)					1	0	12	17
Manchester, Manchester Royal Infirmary	27	85	29	97	15	93	96	99
Middlesbrough, The James Cook University Hospital							13	100
Newcastle, Freeman Hospital	7	100	9	100	7	100	50	100
Northampton, Northampton General Hospital							12	67
Norwich, Norfolk And Norwich University Hospital					1	100	26	100
Nottingham, Nottingham University Hospitals City Campus					1	0	36	3
Omagh, Tyrone County Hospital							1	0
Oxford, Churchill Hospital	48	98	37	24	30	57	176	31
Peterborough, Peterborough City Hospital							5	0
Plymouth, Derriford Hospital			1	100	4	75	20	70
Portsmouth, Queen Alexandra Hospital					7	100	51	100
Preston, Royal Preston Hospital							24	96
Reading, Royal Berkshire Hospital							26	85
Rhyl, Royal Alexandra Hospital							2	100
Salford, Salford Royal							18	100
Sheffield, Northern General Hospital					1	0	12	33
Shrewsbury, Royal Shrewsbury Hospital							4	50
St Helier, Jersey General Hospital							1	0
Stevenage, Lister Hospital							6	50
Stoke-on-Trent, Royal Stoke University Hospital					3	100	11	91
Sunderland, Sunderland Royal Hospital							2	0
Swansea, Morriston Hospital							13	100
Truro, Royal Cornwall Hospital (Treliske)							22	0
West London Renal Transplant Centre	9	100	8	13	7	0	91	22
Westcliff On Sea, Southend Hospital							2	50
Wirral, Arrowe Park Hospital							3	100
Wolverhampton, New Cross Hospital			1	100	7	100	24	92
Wolverhampton, West Park Hospital							1	100
Wrexham, Maelor General Hospital					1	100	12	100
York, York District Hospital					2	100	10	100
Overall	**172**	**94**	**164**	**77**	**177**	**82**	**1702**	**77**

Islet transplant list

9.1 Patients on the islet transplant list as at 31 March, 2011 – 2020

Figure 9.1 shows the number of patients on the islet transplant list at 31 March each year. The number of patients active on the islet transplant list has decreased by 33% from 42 in 2018/19 to 28 on 29 February 2020. Of the 28, 43% (12) patients are registered for an SIK transplant.

Figure 9.1 Patients on the islet transplant list at 31 March



¹As at 29 February 2020

Figure 9.2 shows the number of patients on the active islet transplant list at 29 February 2020 by centre. Of the 28 patients on the active transplant list 39% were registered at Manchester, of which 10 were SIK, 25% at Newcastle and 18% at Edinburgh, one patient was registered for an SIK at both Oxford and Edinburgh. There were no patients registered at Bristol.

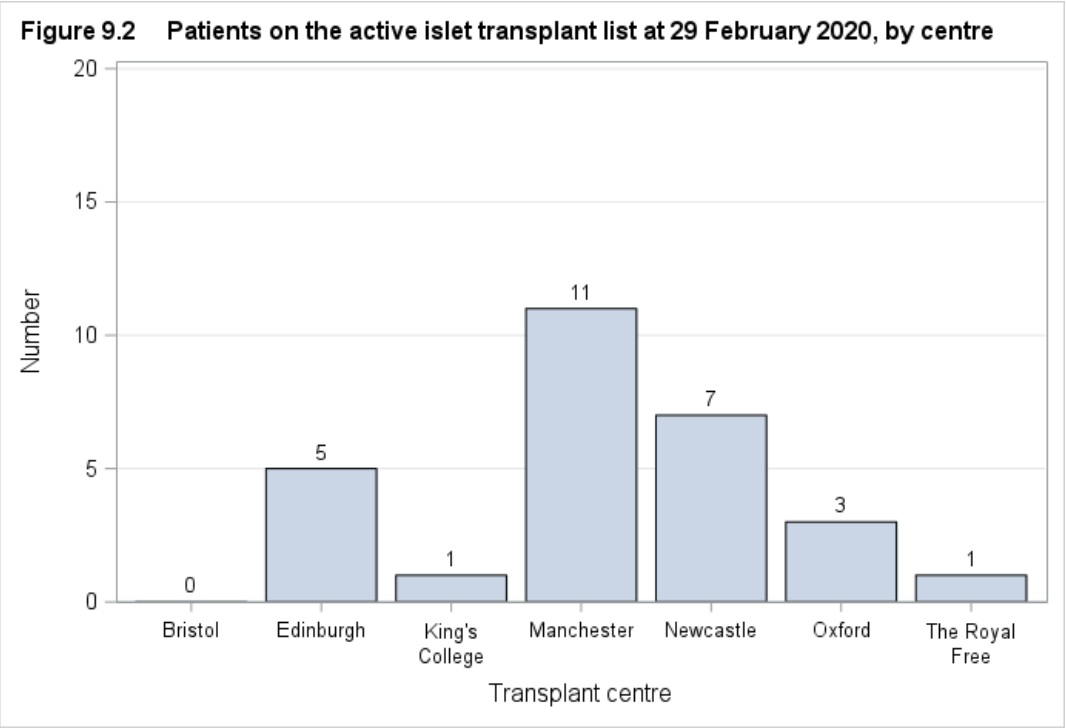
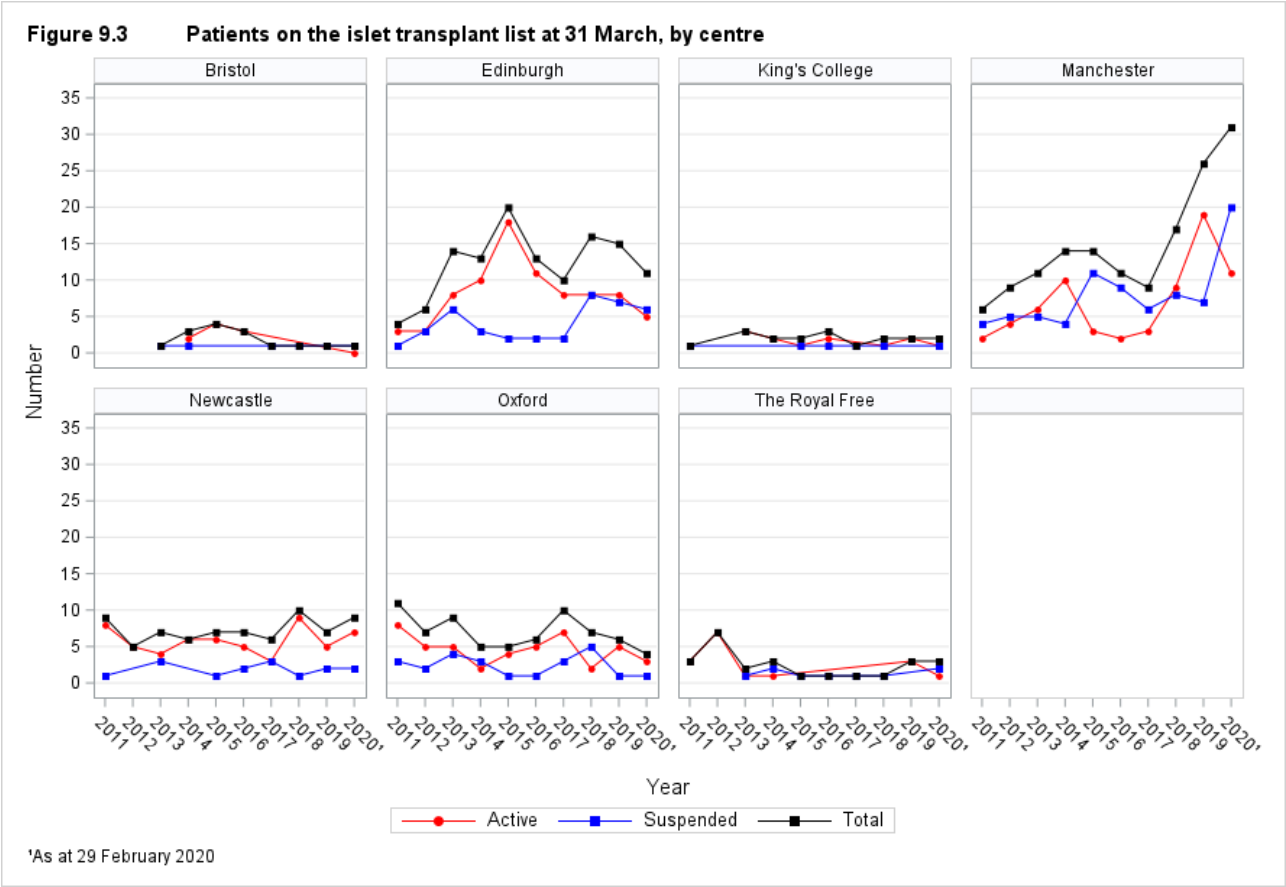


Figure 9.3 shows the number of patients on the islet [transplant list](#) at 31 March each year between 2011 and 2020 for each transplant centre. There have been very few patients registered at Bristol, King's College or the Royal Free, in the time period.



9.2 Post-registration outcomes, 1 April 2016 – 31 March 2017

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. 56% of patients were transplanted within one year, while three years after listing 62% of patients had received a transplant and 28% were removed from the list.

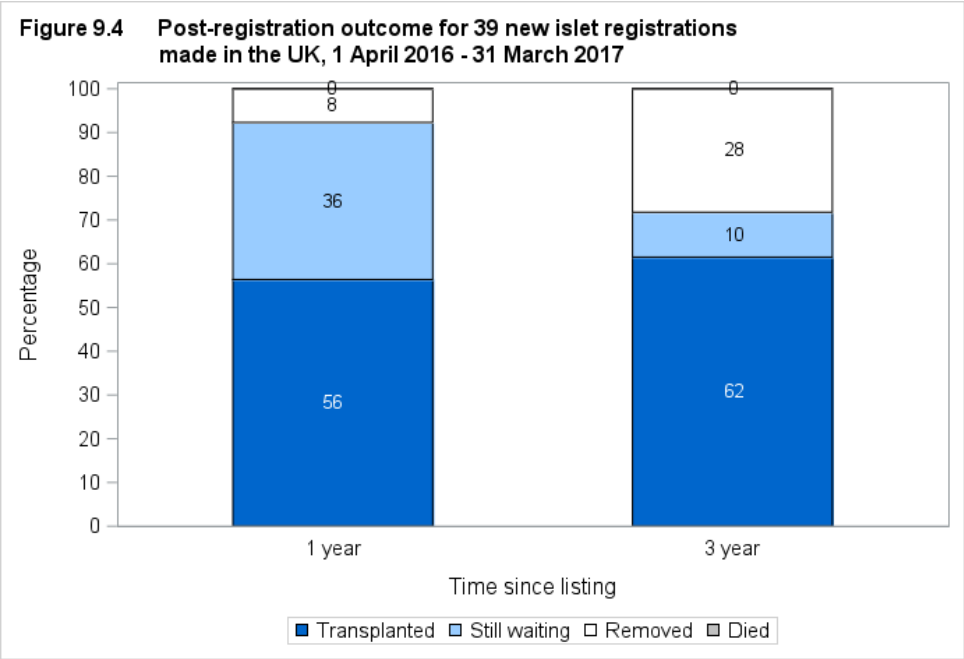
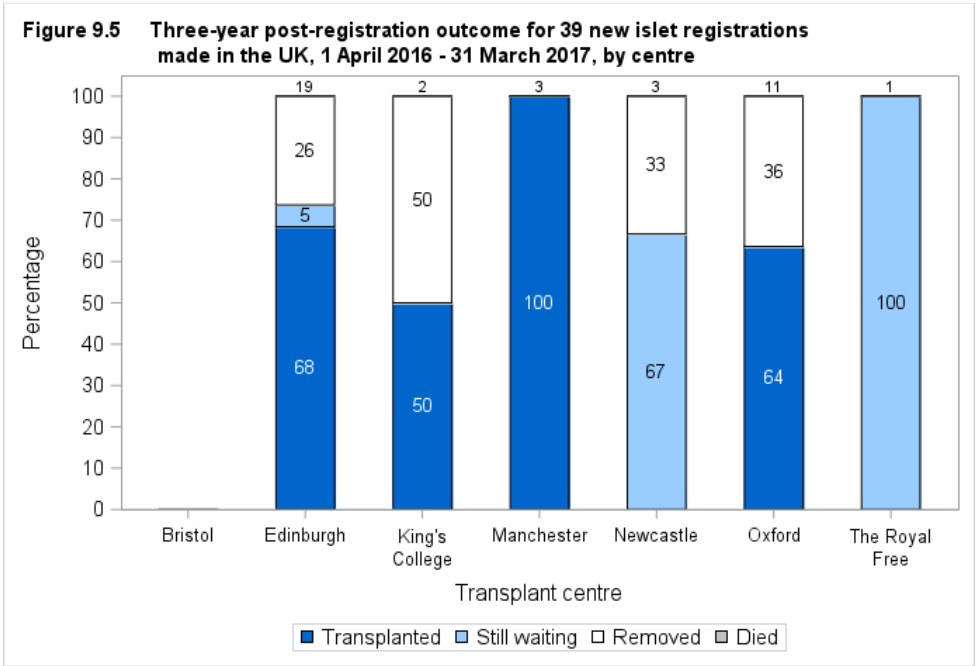


Figure 9.5 shows the proportion of patients transplanted or still waiting three years after joining the list by centre. Three years after registration, 26% and 33% of patients were removed from the list at Edinburgh and Newcastle, respectively. Of those centres with patients registered in this time period, all transplanted 50% or more of their patients within three years. There were no patients who died whilst waiting for an islet transplant.



9.3 Demographic characteristics, 1 April 2019 – 31 March 2020

The sex and age group of patients registered on the islet transplant list during 2019/20 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 (61%) and the median age was 55 years.

Figure 9.6 Registrations on the active islet transplant list, 1 April 2019 - 31 March 2020, by centre and sex

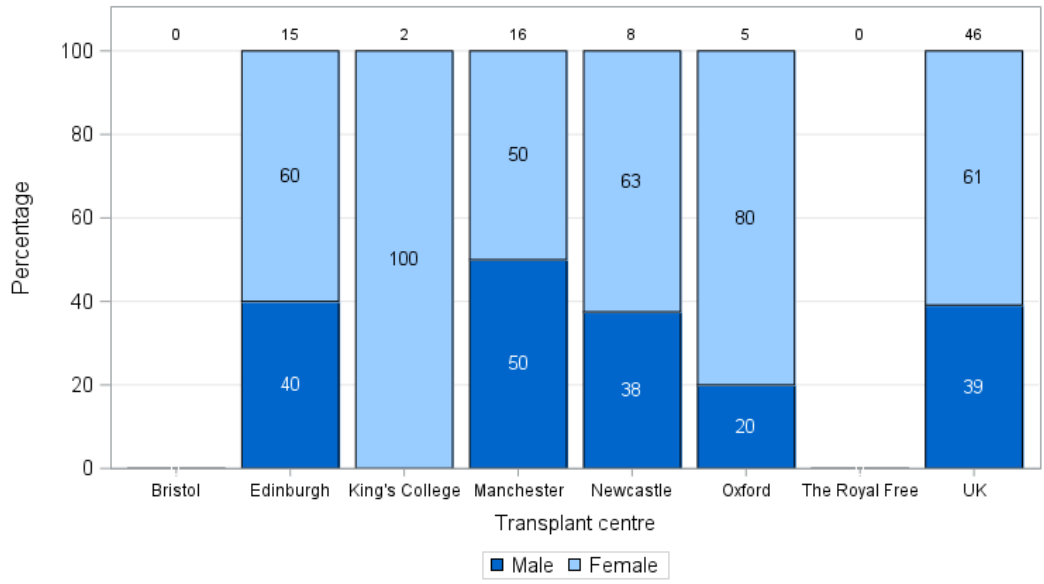
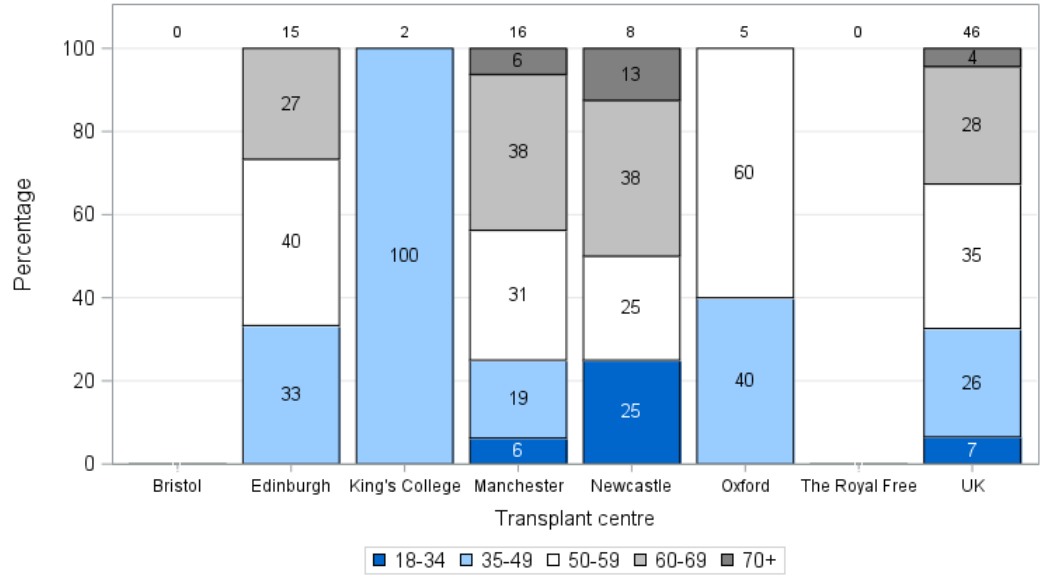


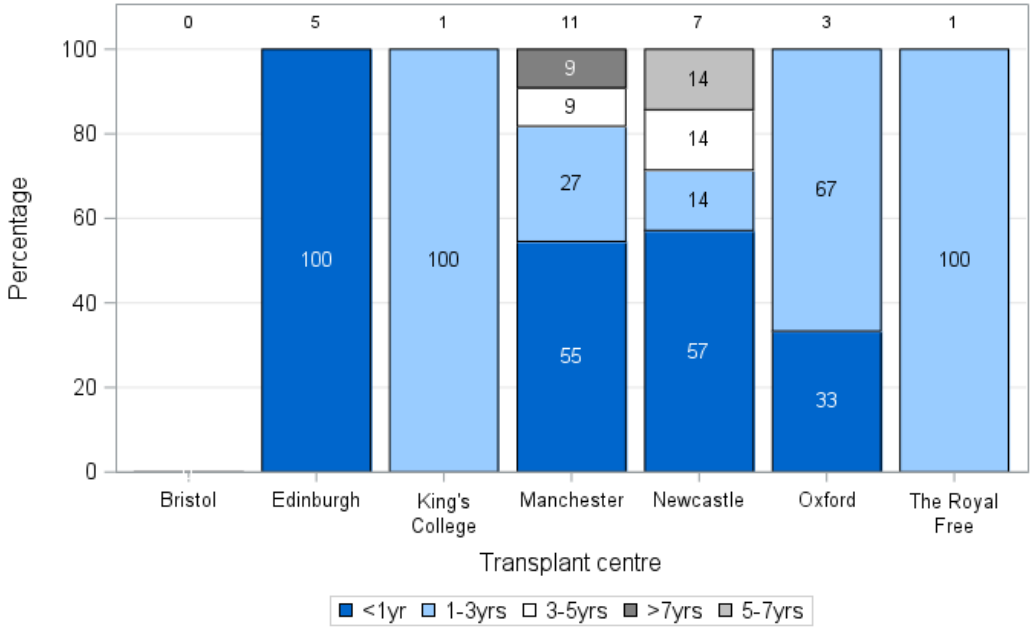
Figure 9.7 Registrations on the active islet transplant list, 1 April 2019 - 31 March 2020, by centre and age group



9.4 Patient waiting times for those currently on the list, 29 February 2020

Figure 9.8 shows the length of time patients have been waiting on the islet transplant list at 29 February 2020 by centre. One highly sensitised patient (99% cRF) registered at Manchester has been waiting more than seven years for transplant.

Figure 9.8 Patients on the active islet transplant list as at 29 February 2020, by centre and grouped waiting time



9.5 Median waiting time to transplant, 1 April 2014 - 31 March 2018

The length of time a patient waits for any 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 2014 and 31 March 2018 is 464 days (over one year). The median waiting time is not shown where less than 10 patients are registered.

Figure 9.9 Median waiting time to deceased donor transplant for patients registered on the islet transplant list, 1 April 2014 - 31 March 2018

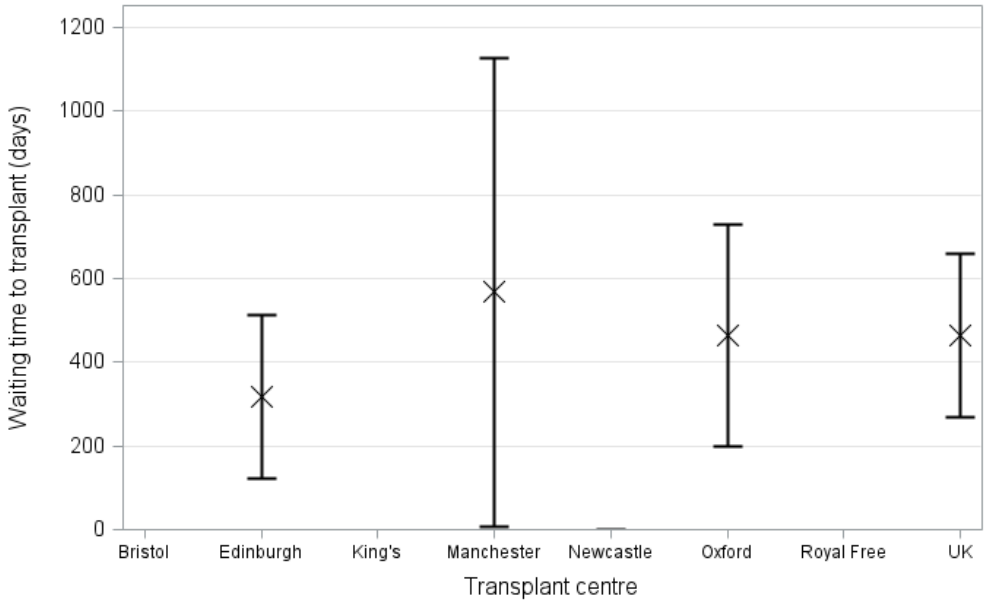


Table 9.1 Median waiting time to islet transplant in the UK, for patients registered 1 April 2014 - 31 March 2018

Transplant centre	Number of patients registered	Waiting time (days) Median	95% Confidence interval
Bristol	2	-	-
Edinburgh	70	318	124 - 512
King's	7	-	-
Manchester	21	567	7 - 1127
Newcastle	22[1]	-	-
Oxford	26	464	200 - 728
Royal Free	4	-	-
UK	**152**	**464**	**269 - 659**

[1] Insufficient data to calculate median waiting time.
- Data not presented when less than 10 patients registered

Response to islet offers

10.1 Offer decline rates, 1 April 2017 – 31 March 2020

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 2017 and 31 March 2020 are shown in **Table 10.1**. King's College had the lowest overall decline rate (0%) whilst Royal Free had the highest decline rate (100%). Bristol received no offers in this time period. 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 2017 and 31 March 2020

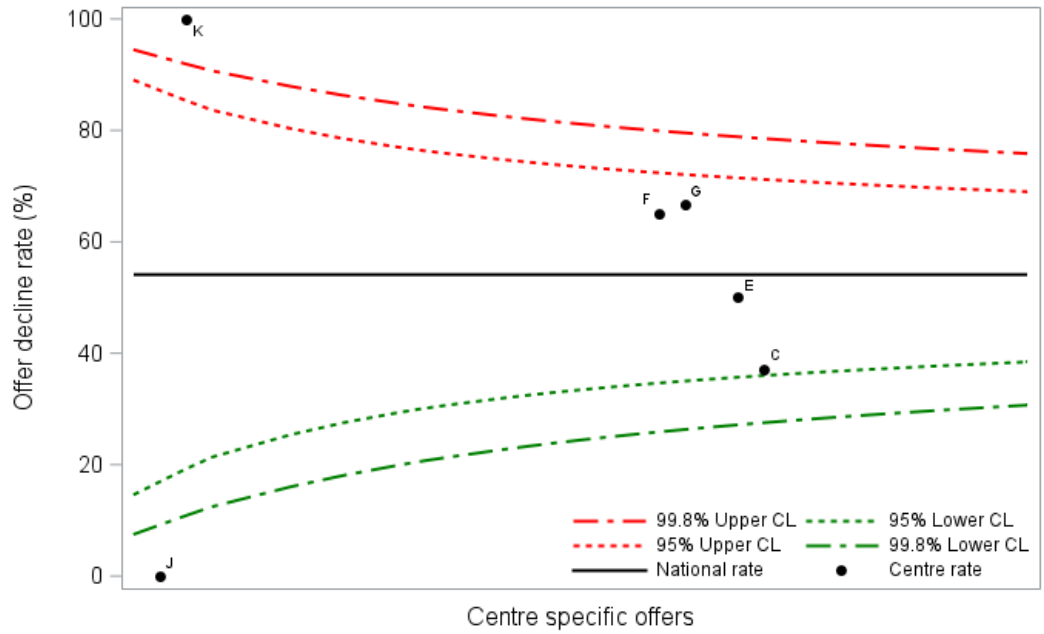


Table 10.1 DBD donor islet offer decline rates by transplant centre, 1 April 2017 and 31 March 2020

Centre	Code	2017/18		2018/19		2019/20		Overall	
		N	(%)	N	(%)	N	(%)	N	(%)
Edinburgh	C	12	(33)	8	(50)	7	(29)	27	(37)
King's	J	1	(0)	2	(0)	1	(0)	4	(0)
Manchester	E	8	(38)	10	(70)	8	(38)	26	(50)
Newcastle	F	5	(100)	10	(50)	8	(63)	23	(65)
Oxford	G	16	(75)	4	(50)	4	(50)	24	(67)
Royal Free	K			1	(100)	4	(100)	5	(100)
UK		**42**	**(57)**	**35**	**(54)**	**32**	**(50)**	**109**	**(54)**

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 99.8% confidence limit

Islet transplants

11.1 Islet transplants, 1 April 2010 – 31 March 2020

Figure 11.1 shows the total number of islet transplants performed in the last ten financial years, 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 December 2010. This provided islet patients with equal access to donated pancreases for the first time. Since 2011/12, the number of islet transplants increased to 34 transplants in 2016/17, although this has fallen in the last couple of years and 28 were performed in the last financial year.

Figure 11.1 Islet transplants,1 April 2010 - 31 March 2020, by financial year and donor type

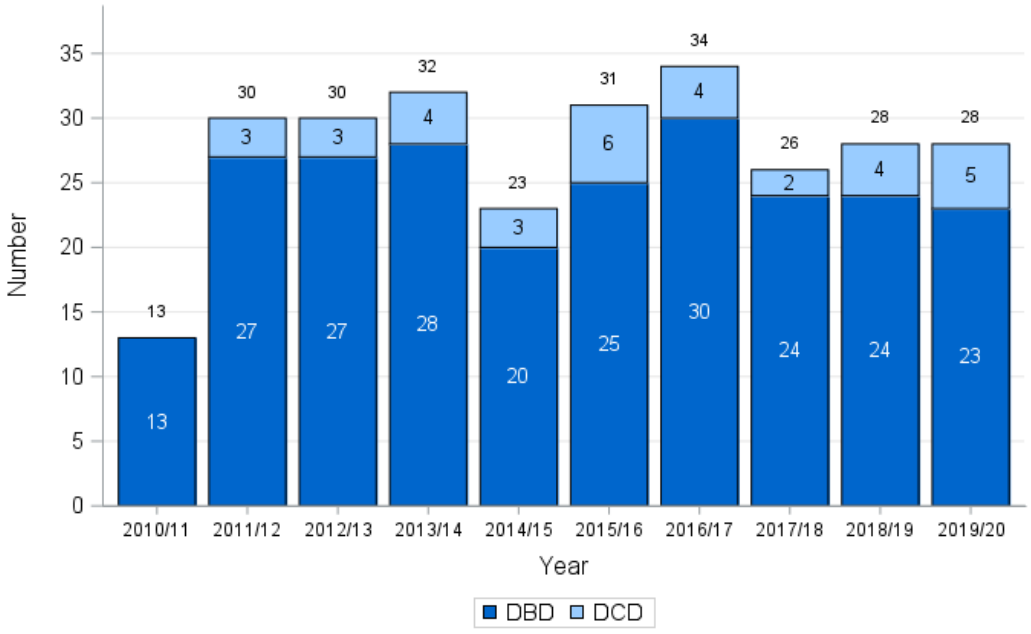


Figure 11.2 shows the total number of islet transplants performed in 2019/20, by centre and type of donor. The same information is presented in **Figure 11.3** but this shows the proportion of DBD and DCD transplants performed at each centre. Edinburgh performed the most islet transplants in 2019/20 (13), followed by Manchester (five). Edinburgh and King's College were the only centres to perform DCD as well as DBD transplants. Royal Free and Bristol did not perform any islet transplants in 2019/20.

Figure 11.2 Islet transplants, 1 April 2019 - 31 March 2020, by centre and donor type

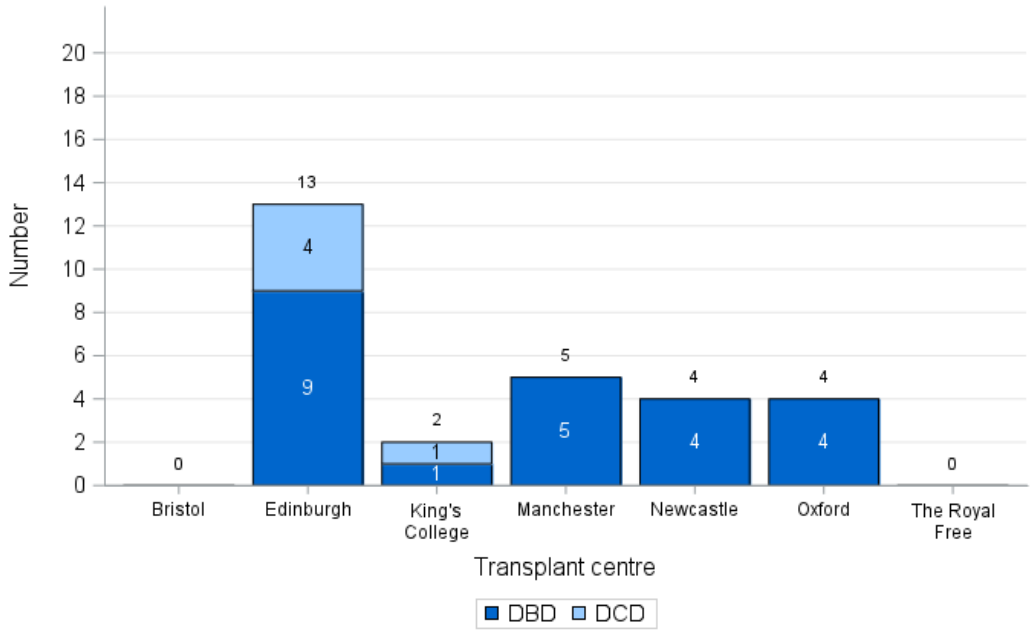


Figure 11.3 Islet transplants, 1 April 2019 - 31 March 2020, by centre and donor type

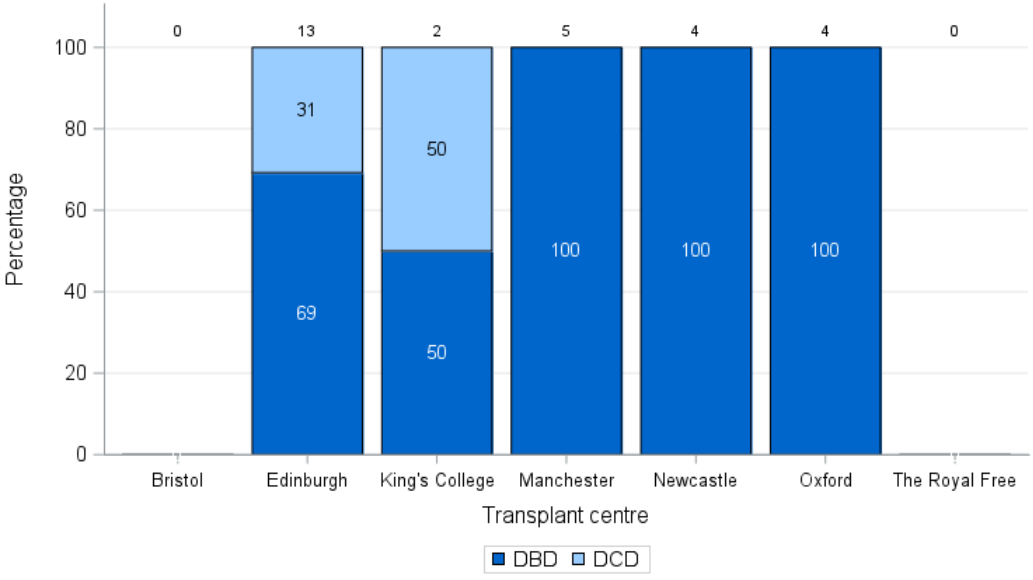
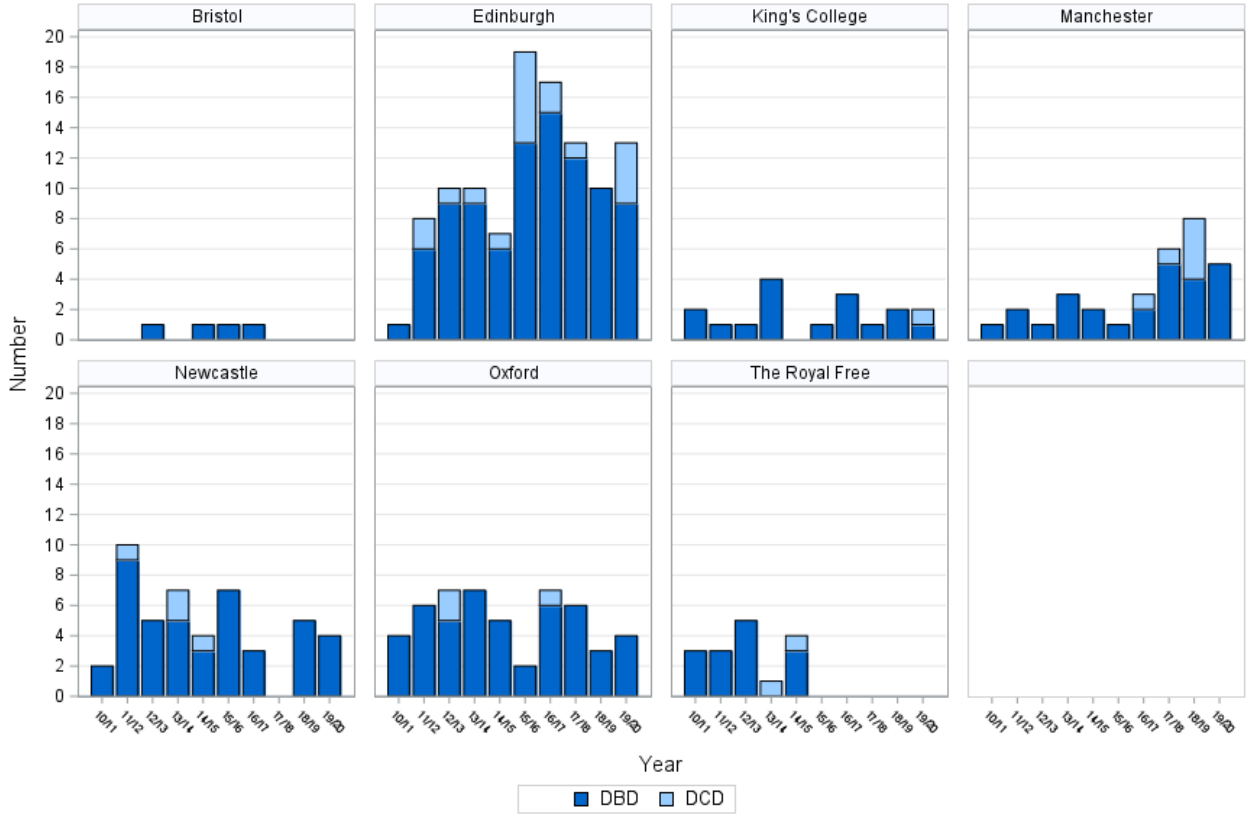


Figure 11.4 shows the total number of islet transplants performed in last ten years, by centre and type of donor. Oxford and Manchester have consistently performed a number of islet transplants each year, with Manchester increasing their transplant activity in the last two years. Edinburgh have consistency performed the most transplants each year in the last eight years. Bristol has performed very few transplants over the ten year period, and Royal Free have performed no islet transplant in the last five years.

Figure 11.4 Islet transplants, 1 April 2008 - 31 March 2020, by centre, financial year and donor type



11.2 Demographic characteristics, 1 April 2019 - 31 March 2020

The sex and age group of patients that received an islet transplant in 2019/20 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, 28 patients were transplanted on the islet transplant list, the median age was 57 years and the majority were female 18 (64%).

Figure 11.5 Islet transplants, 1 April 2019 - 31 March 2020, by centre and sex

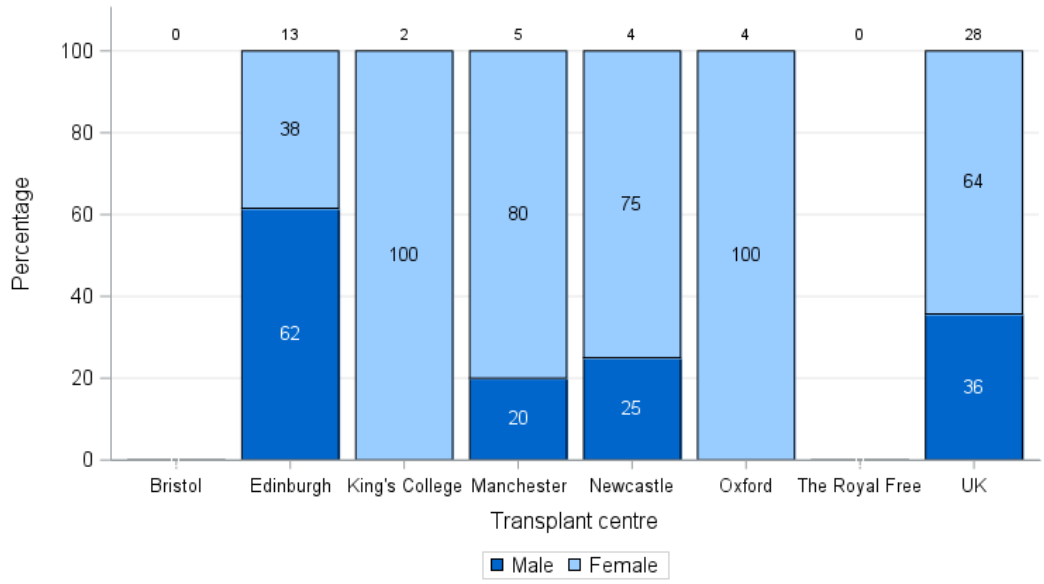
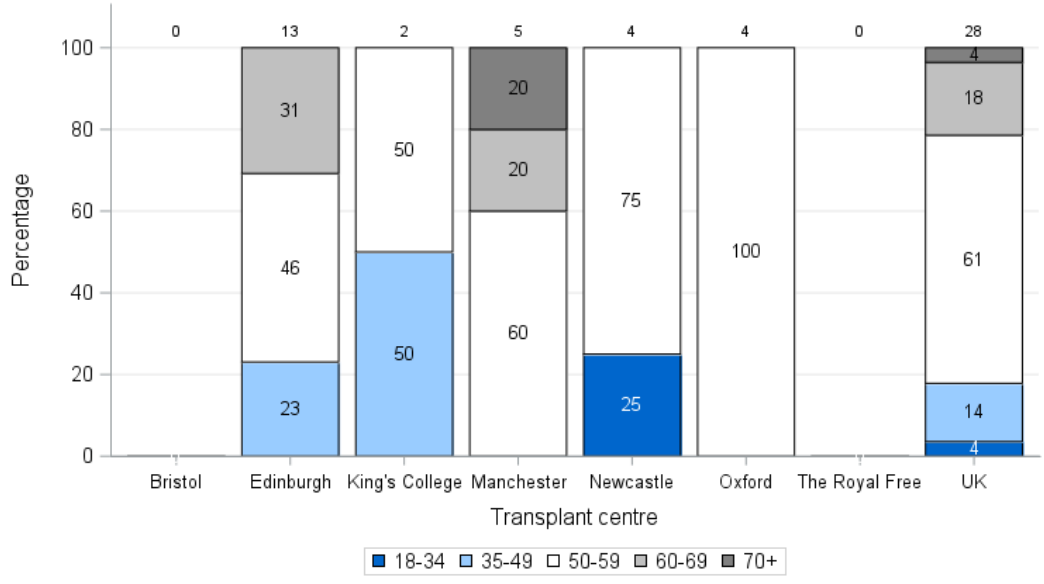


Figure 11.6 Islet transplants, 1 April 2019 - 31 March 2020, by centre and age group



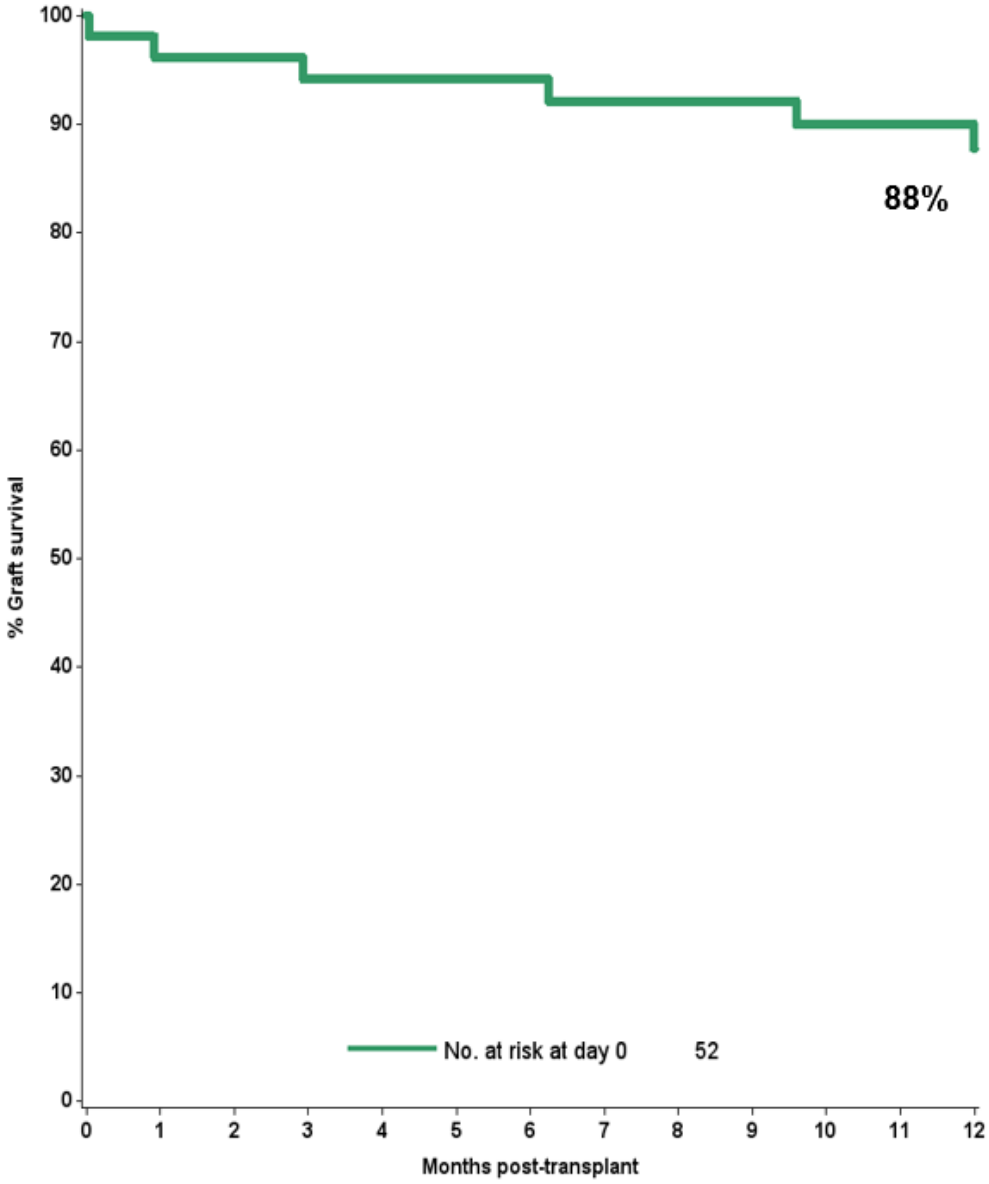
Islet outcomes

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 islet transplants between 1 April 2010 and 31 March 2019.

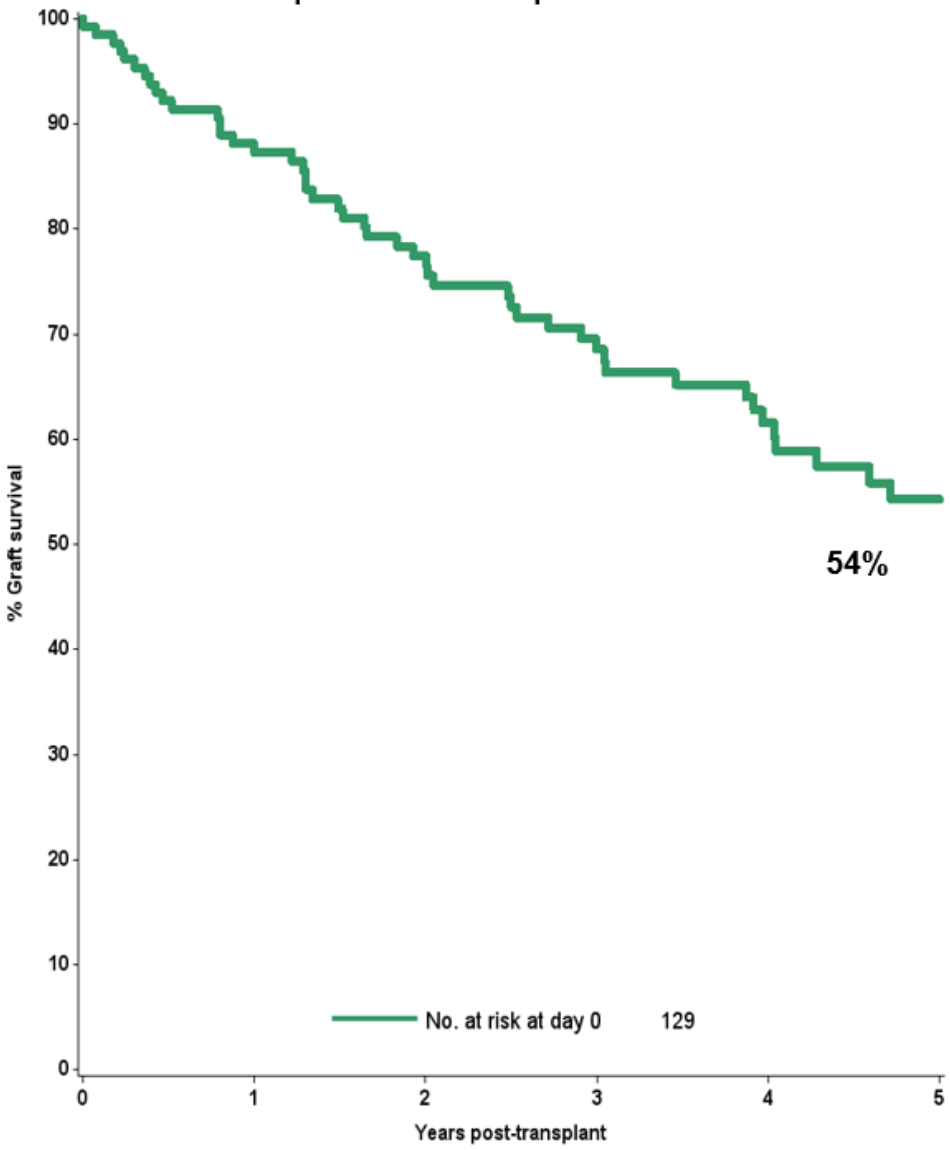
A one-year Kaplan-Meier graft survival plot for islet transplants between 1 April 2015 – 31 March 2019 is shown in **Figure 12.1**. Estimated one-year graft survival following a routine islet transplant is 88% with 95% confidence interval (CI) (75-94%). This includes patients who received only a routine graft and those patients who additionally received a priority graft.

Figure 12.1 One-year graft survival following first routine islet transplant between 1 April 2015 and 31 March 2019



A five-year Kaplan-Meier graft survival plot for islet transplants between 1 April 2010 – 31 March 2019 is shown in **Figure 12.2**. Estimated five-year graft survival following a routine islet transplant is 54% with 95% CI (44-64%). This includes patients who received only a routine graft and those who additionally received a priority graft.

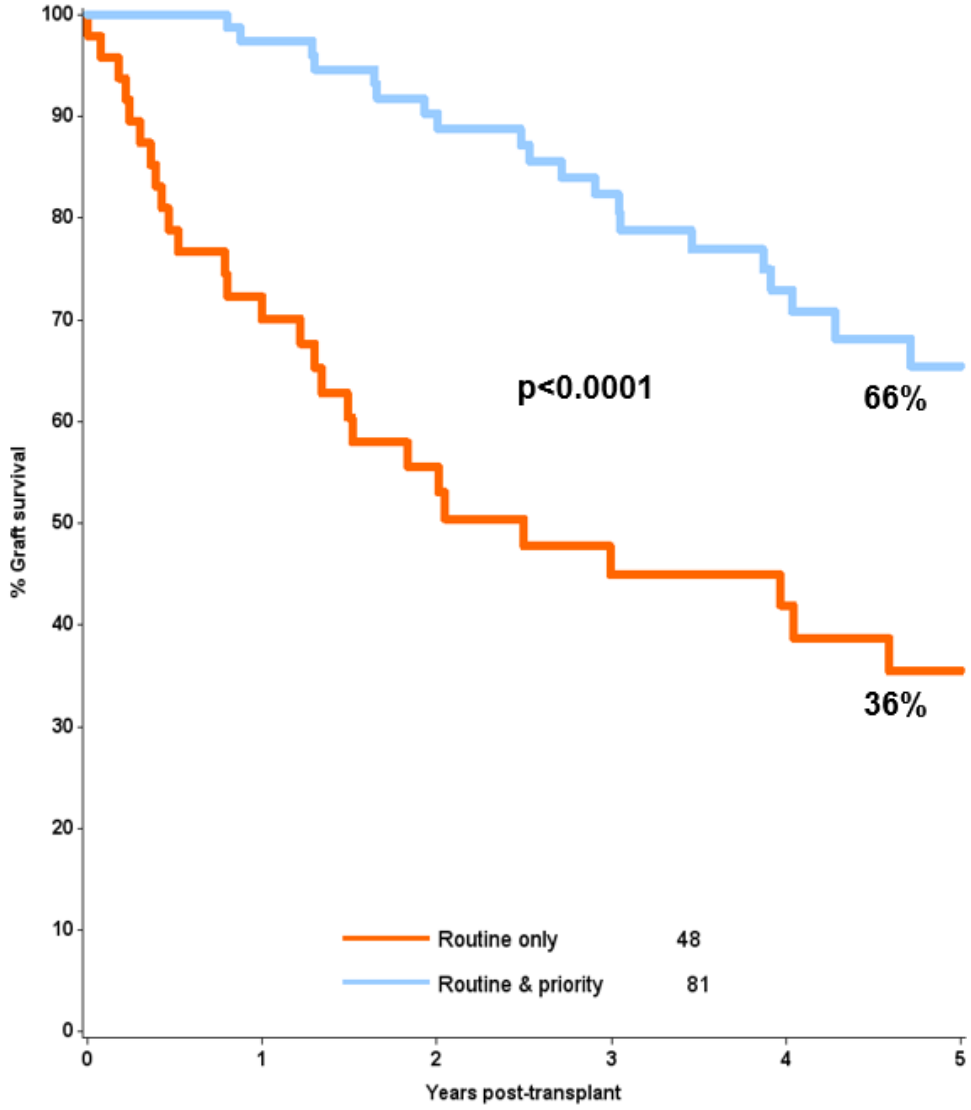
Figure 12.2 Five-year graft survival following first routine islet transplant between 1 April 2010 and 31 March 2019



Further, five-year Kaplan-Meier graft survival plots by type of graft are shown in **Figure 12.3** and **12.4**, for islet transplants between 1 April 2010 – 31 March 2020. **Figure 12.4** only includes routine grafts (routine only or routine followed by a priority) that still were functioning at one year post-transplant. In order to receive a priority (top-up) graft the patient's routine graft must still be functioning and the priority graft should be given within the first 12 months post routine transplant. Therefore, to accurately compare the two groups, i.e. those receiving a routine graft alone and those receiving a routine and subsequent priority graft, the survival estimate is conditional on one-year graft survival in both groups.

Estimated five-year graft survival (for all islet transplants) is 36% for routine only grafts, 95% CI (21-51%) and for routine followed by priority grafts is 66%, 95% CI (51-77%). This difference was statistically significant, p<0.0001.

Figure 12.3 **Five-year graft survival following routine islet transplantation, by type of graft, between 1 April 2010 and 31 March 2019**



Estimated five-year graft survival (for islet transplant, where the routine graft was functioning at one year) is 51% for routine only grafts, 95% CI (30-68%) and for routine followed by priority grafts is 67%, 95% CI (52-78%). This difference was not statistically significant, p=0.0733.

Figure 12.4 **Five-year graft survival following routine islet transplantation, where the routine graft was functioning at one year, between 1 April 2010 and 31 March 2019**

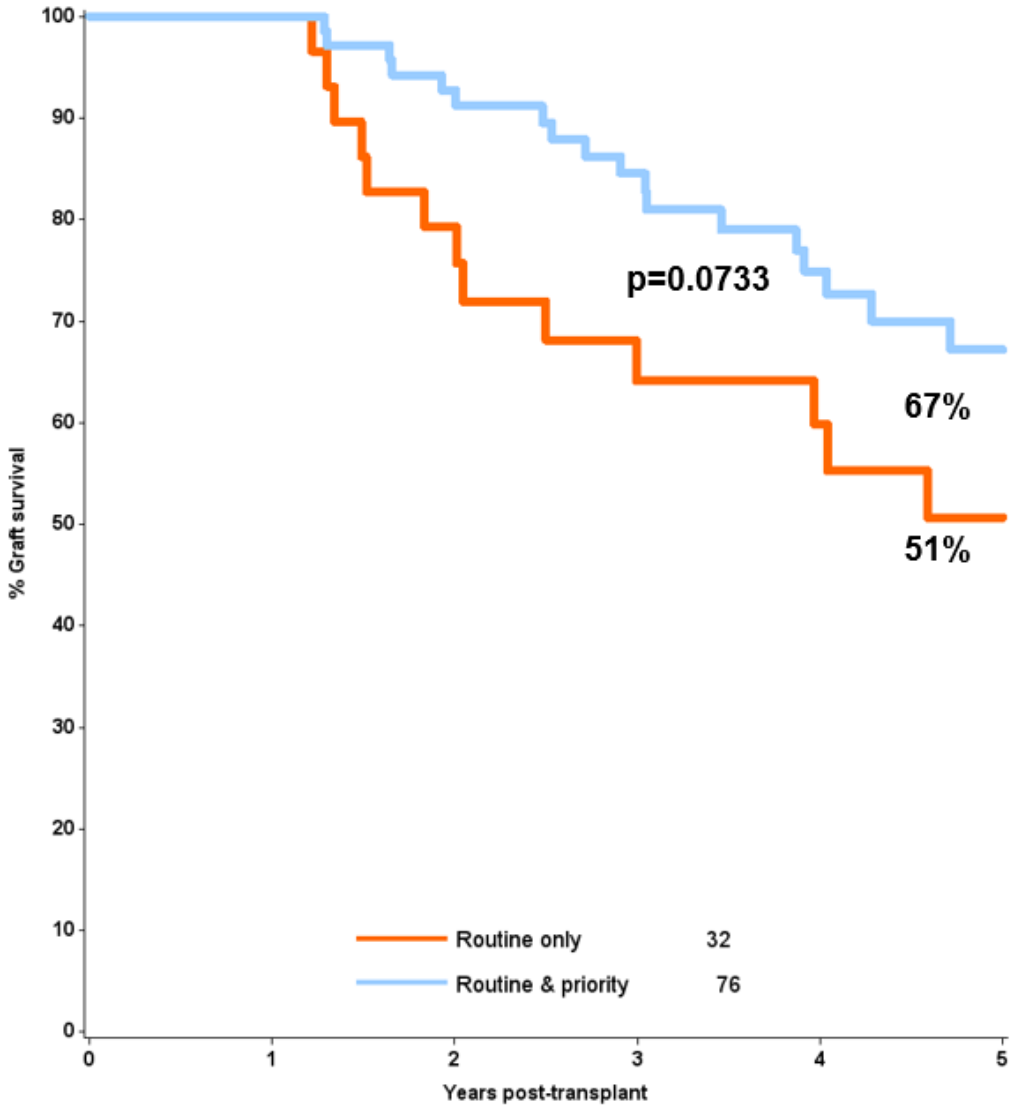


Figure 12.5 shows, for routine islet only transplants between 1 April 2015 – 31 March 2019, the median annual rate of severe hypoglycaemic events, prior to transplant (reported as number of events between registration and transplant) and at one-year post-transplant. Of the 37 patients where the number of severe hypoglycaemic events at one-year post-transplant was available, 32 (84%) experienced no severe hypoglycaemic events, four (11%) experienced one or two events and one (3%) experienced three or more events.

Figure 12.5 **Median annual rate of severe hypoglycaemic events for routine islet only transplants, 1 April 2015 to 31 March 2019**

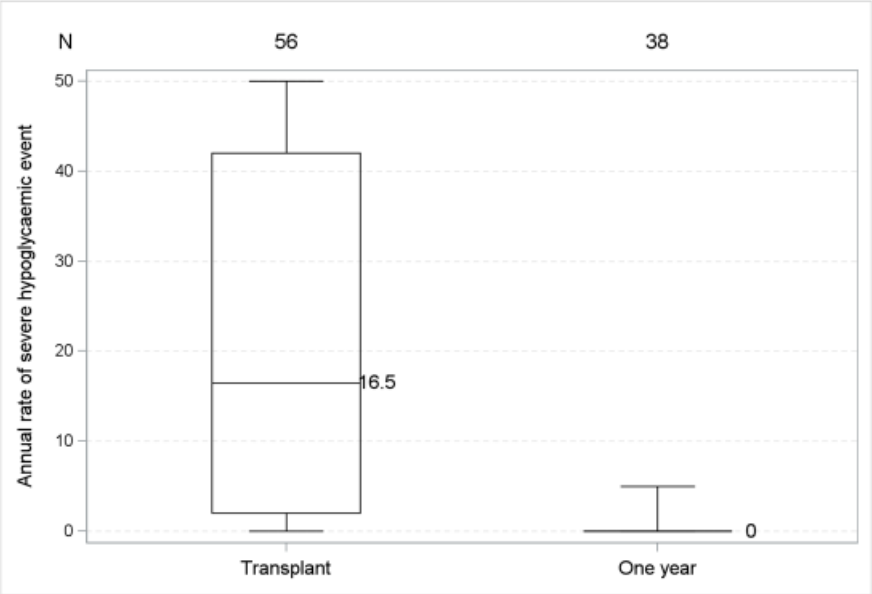


Figure 12.6 shows the reduction in median HbA1c (mmol/mol) for routine islet only transplants between 1 April 2015 – 31 March 2019. Median HbA1c dropped from 62mmol/mol prior to transplant to 48mmol/mol at one-year post-transplant. Of those 47 patients with HbA1c reported at one-year, 30 (64%) had an HbA1c less than 53mmol/mol.

Figure 12.6 **Median HbA1c (mmol/mol) for routine islet only transplants, 1 April 2015 to 31 March 2019**

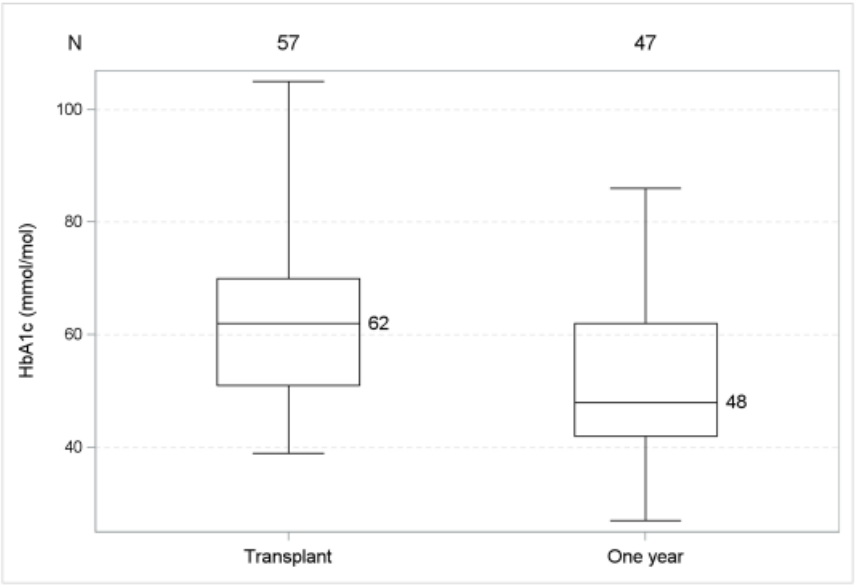
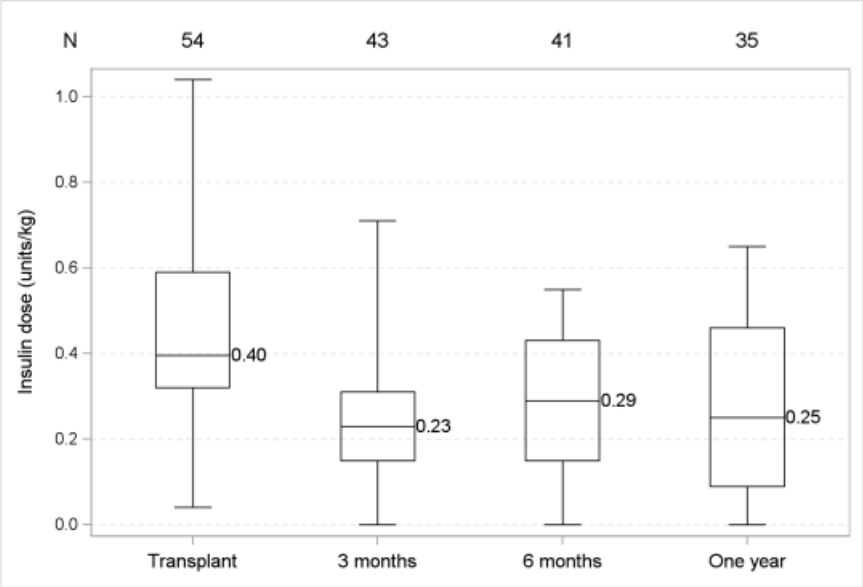


Figure 12.7 shows the median reduction in insulin dose per kilo recipient body weight at three-months, six-months and one-year post-transplant, for routine islet only transplants between 1 April 2015 – 31 March 2019. Prior to transplant the median insulin dose is 0.4 units/kg, by three-months the median dose has dropped to 0.23 units/kg and then increased slightly at one-year post-transplant with a median dose of 0.25 units/kg. Following islet transplantation of the 45 patients where information was reported, 20 (44%) achieved insulin independence at some point during their first year post-transplant.

Figure 12.7 **Median insulin dose per kilo of recipient weight for routine islet only transplants, 1 April 2015 to 31 March 2019**



Form return rates

13.1 Islet form return rates, 1 January – 31 December 2019

Form return rates are reported in **Table 13.1** for the islet transplant record, three month and one year follow-up form, along with lifetime follow-up (more than two years). These include all islet transplants performed between 1 January and 31 December 2019 for the transplant record, and all requests for follow-up forms issued in this time period. Centres highlighted are transplant centres. There were 81% of transplant record and 86% of 12 month follow-up forms returned, whereas only 72% of 3-month follow-up forms and 71% of lifetime forms were returned. Of the transplant centres, Oxford have the lowest lifetime follow-up return rate of 6%.

Table 13.1 Form return rates following islet transplantation, by centre, 1 January - 31 December 2019

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
Edinburgh, Royal Infirmary of Edinburgh	14	100	7	71	4	100	31	87
Glasgow, Queen Elizabeth University Hospital							1	0
London, Kings College Hospital	3	100	1	100	1	100	5	100
London, The Royal Free Hospital			1	100	1	100	7	71
Manchester, Manchester Royal Infirmary	8	88	4	75	3	100	8	88
Newcastle, Freeman Hospital	2	100	3	100	2	100	12	100
Oxford, Churchill Hospital	5	0	2	0	3	33	17	6
Overall	**32**	**81**	**18**	**72**	**14**	**86**	**83**	**71**

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 blood group identical donors from a pool of 10,000 against which the recipient has HLA specific antibodies 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
Donation after brainstem death (DBD) means donation which takes place following the diagnosis of death using neurological criteria

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

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 Antigens (HLA) 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.

Matchability points score
Matchability points score is a score between 1 and 10 reflecting the difficulty with which a well-matched HLA compatible organ can be found and takes into account sensitisation and rareness of HLA type. Scores are updated annually such that 10% of waiting list patients who are easiest to match have score=1 and 10% who are most difficult to match have a score=10.

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 Offering 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, revised on 11 September 2019 and is administered by NHS Blood and Transplant. Prior to December 2010 deceased donors were allocated on a centre basis.

The Pancreas Offering Scheme, from September 2019, prioritises difficult to match (100% sensitisation or matchability points score=10) and long-waiting patients in a top tier. The second tier includes all other 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 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 then they cannot receive a transplant from a donor with that HLA, thus restricting the pool of potential donors. Patients who are clinically incompatible with the donor are excluded from the offering sequence by the Pancreas Offering 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 NHS region 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.

The systematic component of variation (SCV; McPherson et al., N Engl J Med 1982, 307: 1310-4) is the moment estimator of σ^2. Under the null hypothesis of homogeneity across areas, the SCV would be zero. The SCV, therefore, allows us to detect variability across areas beyond that expected by chance; the larger the SCV, the greater the evidence of systematic variation across areas.

A one-sided p-value for the hypothesis that the SCV is greater than zero versus the null hypothesis that the SCV is equal to zero was derived using a parametric bootstrap where data were simulated from the Poisson distribution that would be consistent with the null hypothesis (multiplicative rate factor is equal to one in all areas and σ^2 equal to zero). The observed SCV was then compared against this simulated data to calculate the probability that an SCV of at least this size would be observed due to chance if the null hypothesis were true.

10,000 bootstrap samples of size 7 (number of areas) were simulated, where the registration/transplant count in each area was drawn from a Poisson distribution with its expected value being the area-specific expected count (the rate of transplants/registrations in the total population multiplied by the population of the area) . The SCV was then calculated in each of the 10,000 samples and a bootstrap p-value for the SCV in the observed data was estimated as:

$$P_{boot} = \frac{1 + \#\{SCV_{sim} \geq SCV_{obs}\}}{10000 + 1}$$

where $\#\{SCV_{sim} \geq SCV_{obs}\}$ is the number of SCV values in the simulated datasets which are greater than or equal to the SCV in the observed data. This follows the simulation method given in Ibanez et al., BMC Health Services Research, 2009, 9:60. No adjustment was made for area-specific demographic characteristics that may impact the rates of registration to the transplant list and transplantation such as age and sex.

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