NHS
Blood and Transplant

ANNUAL REPORT ON PANCREAS AND ISLET TRANSPLANTATION

REPORT FOR 2022/2023
(1 APRIL 2013 – 31 MARCH 2023)

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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 2013. 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 31 March 2023, there were 290 patients on the UK active pancreas and islet transplant list, which represents a 4% increase in number of patients a year earlier. The number of patients on the active pancreas list increased by 5% to 265 in 2023 and the active islet transplant list decreased by 4% to 25 patients in the same time period.

- There were 1663 pancreas transplants performed in the UK in the ten year period and 257 islet transplants performed in the same time period. The number of transplants from donations after brain death has decreased by 10% in the last year to 101. The number of transplants from donations after circulatory death has increased by 12% in the last year to 46.

- The national rates of patient survival one- and five-years after first simultaneous pancreas and kidney transplant from deceased donors are 98% and 92%, respectively. These rates vary between centres, ranging from 93% to 100% at one-year and 83% 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 94% and 84%, respectively. These rates vary between centres, ranging from 82% to 100% at one-year and 76% to 91% 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 100% and 87%, respectively. The national rates of graft survival at one- and five-years are 76% and 73%.

- The national rate of ten-year patient survival from listing for deceased donor simultaneous pancreas and kidney transplant is 77%. The rates at centres, ranging from 73% to 82%. 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 83% and 60%. For patients with a functioning graft at one-year post-transplant, the national rate of five year graft survival was 76% for patients receiving an additional priority islet graft and 57% 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 2022/23, NHS Blood and Transplant.

Introduction

This report presents information on pancreas and islet transplant activity between 1 April 2013 and 31 March 2023, for all eight centres performing pancreas transplantation and six centres performing islet transplantation in the UK. Cambridge, Cardiff, Guy's and WLRTC only perform pancreas transplants while 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 2018 to 31 March 2022 and five-year post-transplant for the period 1 April 2014 to 31 March 2018.

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 2018 to 31 March 2022, and graft survival at five-year post-transplant for the period 1 April 2013 to 31 March 2022, 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 2010 and 31 December 2022.

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 transplant recipients 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 and 2021 do not accurately reflect the need for pancreas and islet transplantation due to the COVID-19 pandemic. In 2020, different practices were established across the UK with regards to waiting list management.

Figure 2.1 shows the number of patients on the pancreas and islet transplant list at 31 March each year between 2014 and 2023. The number of patients actively waiting for a pancreas or islet transplant has increased slightly by 8% from 269 in 2014 to 290 in 2023.

Figure 2.1 Patients on the pancreas and islet transplant list at 31 March

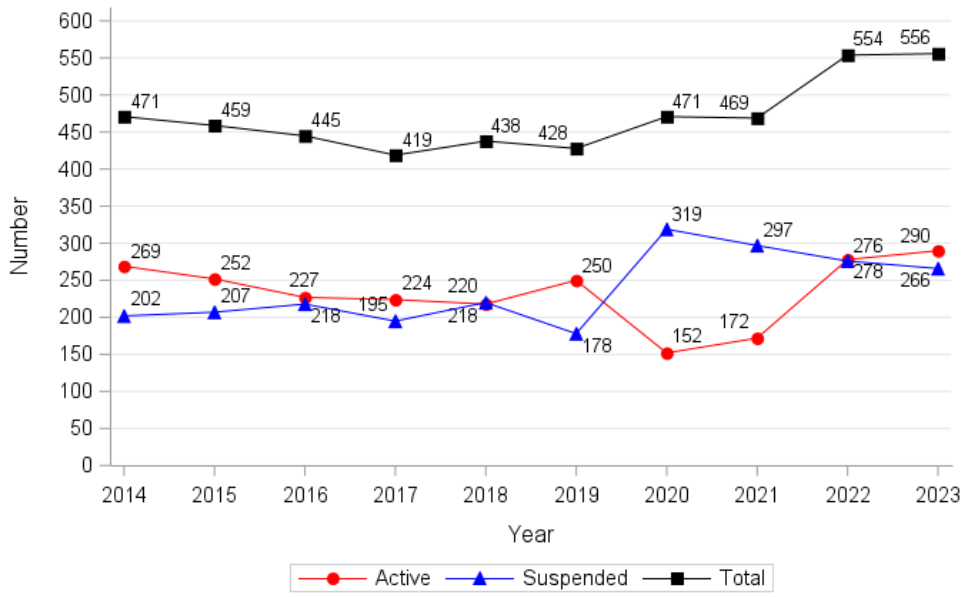


Figure 2.2 shows the number of patients on the pancreas and islet transplant list at 31 March 2023 for each transplant centre. Manchester has the largest transplant list with 100 patients registered for a pancreas or islet transplant. Of these patients, 88 are registered for a SPK, three for a pancreas only, three for a SIK and one for an islet only transplant. Edinburgh, Manchester and Oxford have patients waiting for an SIK transplant, 13 in total. There were no patients on the active islet list at King's College or The Royal Free at 31 March 2023.

Figure 2.2 Patients on the active pancreas and islet transplant list at 31 March 2023, by centre

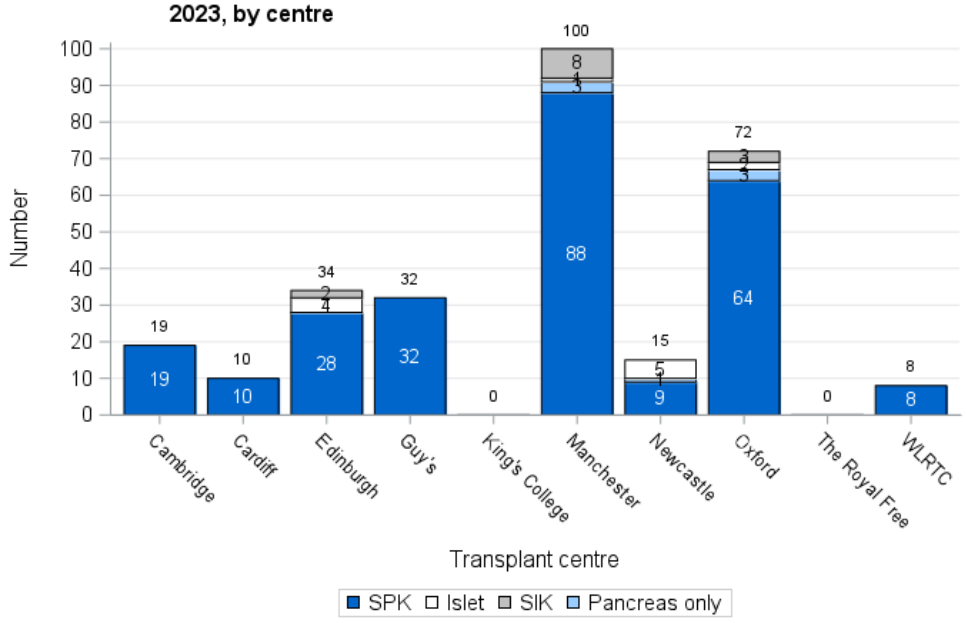


Figure 2.3 shows the total number of pancreas and islet transplants performed in the last ten financial years. Transplant numbers decreased gradually from 246 in 2013/14 to 203 in 2019/20 and then halved to 101 in 2021/22 due to the COVID-19 pandemic. In 2022/23 transplant numbers decreased to 147 transplants. In particular, the number of pancreas only transplants decreased from 26 transplants in 2013/14 to eight in 2022/23.

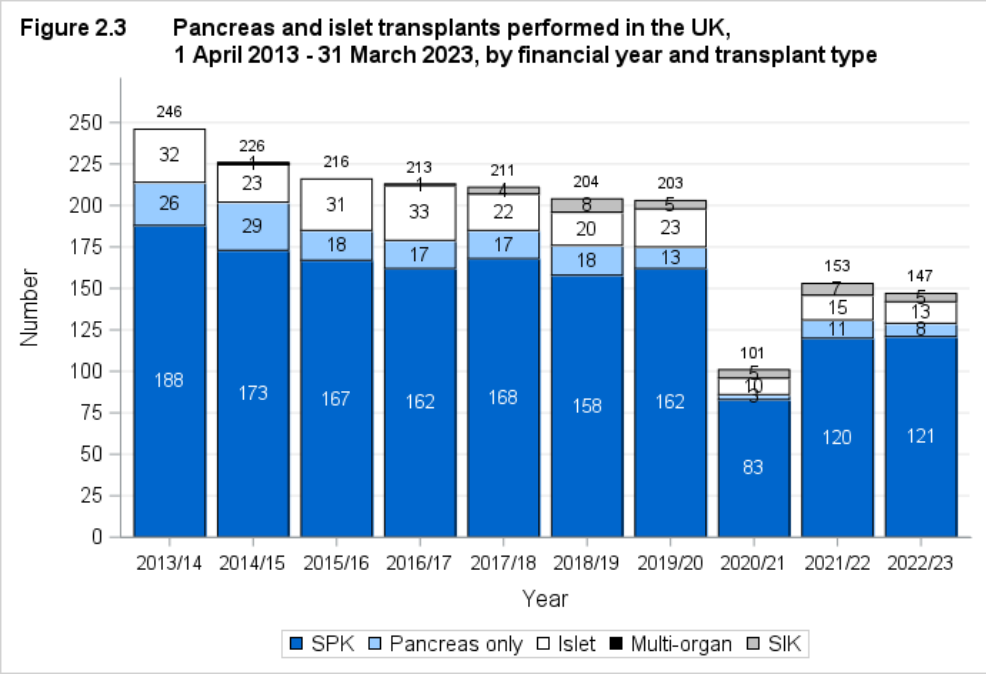


Figure 2.4 shows the total number of pancreas and islet transplants performed in 2022/23 at each transplant centre. Oxford performed the most pancreas and islet transplants last year, a total of 36 transplants, whilst Edinburgh performed the most islet and SIK transplants (nine). A total of five SIK transplants were performed at Manchester, Edinburgh and Oxford. King's College and The Royal Free performed no transplants during this time period.

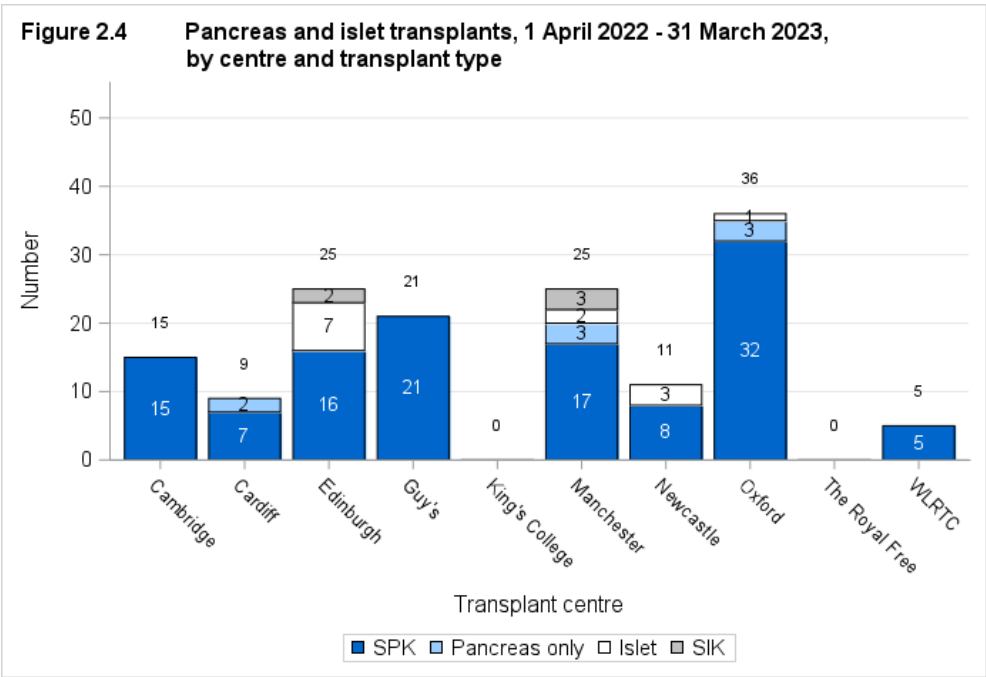
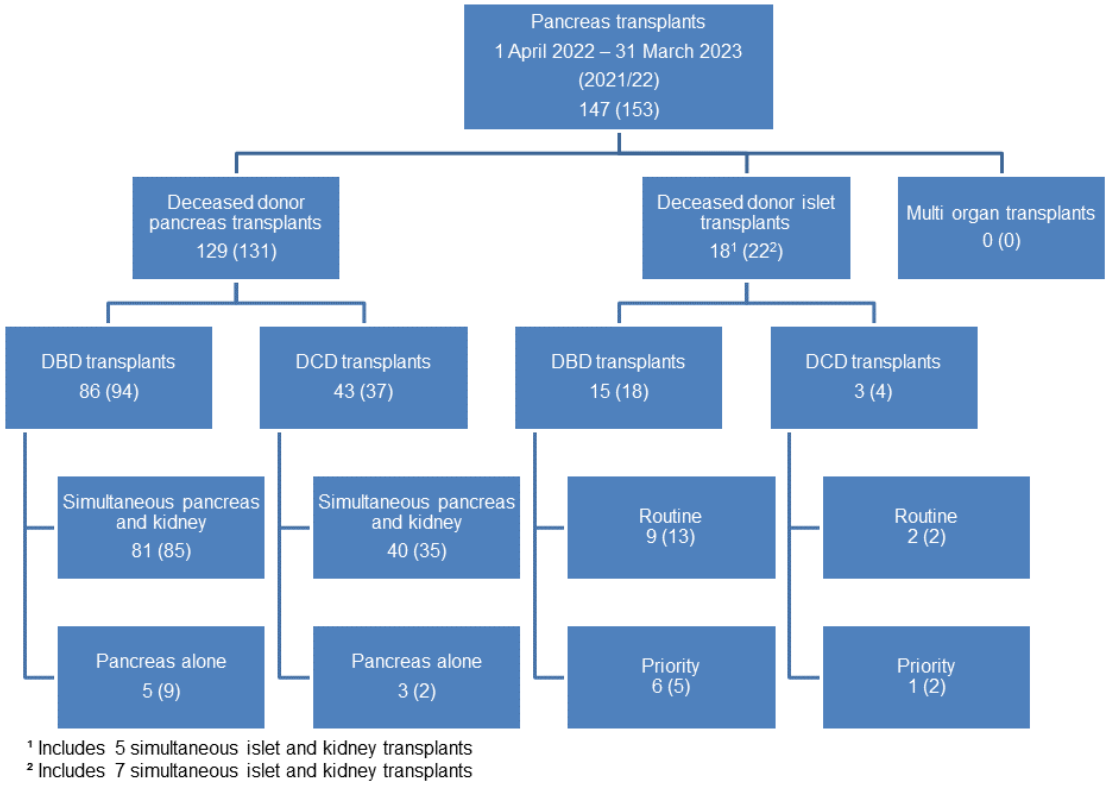


Figure 2.5 details the 147 pancreas and islet transplants performed in the UK between 1 April 2022 and 31 March 2023. Data for transplants performed in 2021/22 are also presented. The overall number of whole pancreas transplants performed in 2022/23 has decreased by two compared with 2021/22 to 129. The number of islet transplants has decreased by four compared with 2021/22 to 18.

Figure 2.5 Pancreas and islet transplants performed in the UK, 1 April 2022 – 31 March 2023 (1 April 2021 – 31 March 2022)



[1] Includes 5 simultaneous islet and kidney transplants
[2] Includes 7 simultaneous islet and kidney transplants

Geographical variation in registration and transplant rates

Figure 2.6 shows rates of registration to the pancreas and islet transplant list per million population (pmp) between 1 April 2022 and 31 March 2023 compared with pancreas and islet transplant rates pmp for the same time period, by recipient country/NHS region of residence. **Table 2.2** 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 inevitable be some random variation in rates between areas, the systematic component of variation (SCV) was used to identify if the variation is more (or less) than a random effect for the different 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 0.0092 (p-value = 0.189) and 0 (p-value = 0.999), 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, no evidence of geographical variation beyond what would be expected at random. 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 and islet registration rates (pmp) with transplant rates (pmp) by recipient country/NHS region of residence

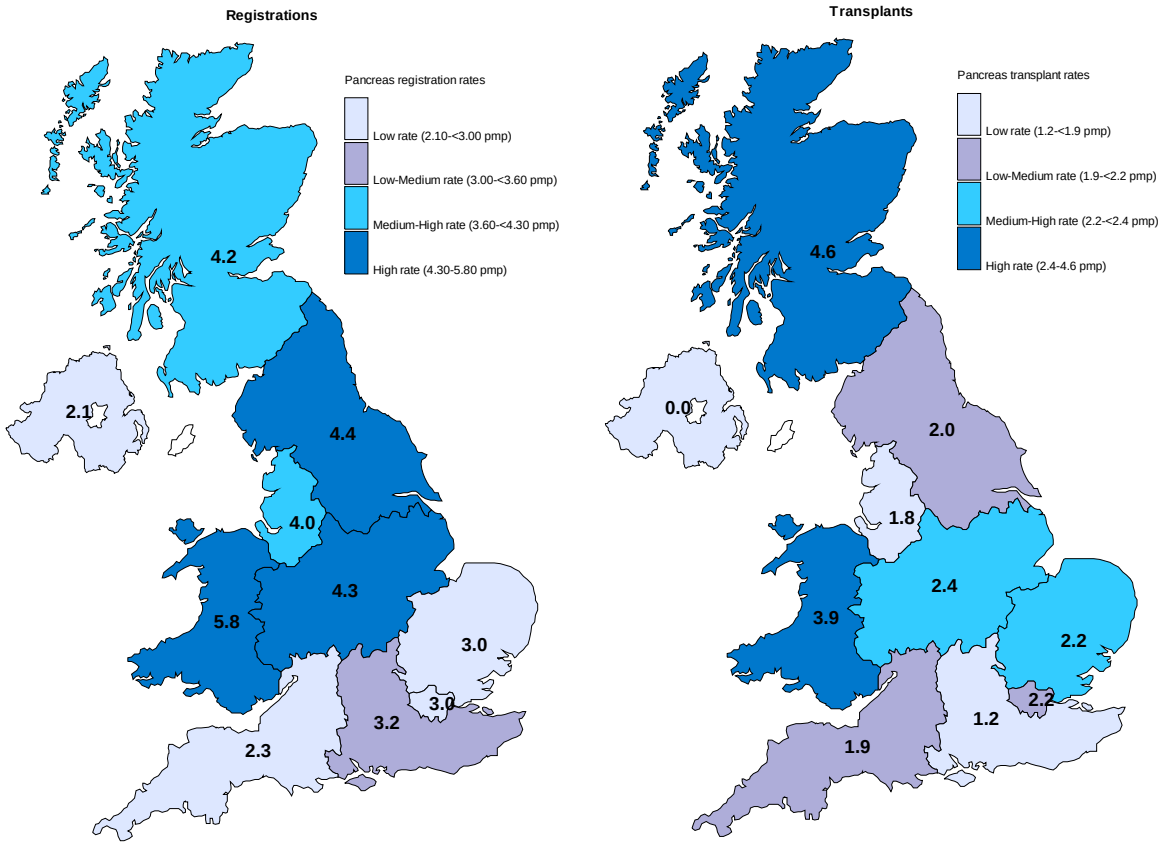


Table 2.1 Pancreas and islet registration and transplant rates per million population (pmp) in the UK, 1 April 2022 - 31 March 2023, by Country/NHS region

Country/NHS region	Registrations (pmp)		Transplants (pmp)	
North East and Yorkshire	36	(4.4)	16	(2.0)
North West	30	(4.0)	13	(1.8)
Midlands	47	(4.3)	26	(2.4)
East of England	19	(3.0)	14	(2.2)
London	26	(3.0)	19	(2.2)
South East	30	(3.2)	11	(1.2)
South West	13	(2.3)	11	(1.9)
England	**201**	**(3.6)**	**110**	**(1.9)**
Isle of Man	**0**	**(0.0)**	**0**	**(0.0)**
Channel Islands	**0**	**(0.0)**	**0**	**(0.0)**
Wales	**18**	**(5.8)**	**12**	**(3.9)**
Scotland	**23**	**(4.2)**	**25**	**(4.6)**
Northern Ireland	**4**	**(2.1)**	**0**	**(0.0)**
TOTAL	**246**	**(3.7)**	**147**	**(2.2)**

Pancreas transplant list

3.1 Patients on the pancreas transplant list as at 31 March, 2014 – 2023

Figure 3.1 shows the number of patients on the pancreas transplant list at 31 March each year from 2014. The number of patients actively waiting for a pancreas transplant was the highest at 265 in 2023 an increase of 27% from 208 in 2019 prior to the COVID-19 pandemic.

Figure 3.1 Patients on the pancreas transplant list at 31 March

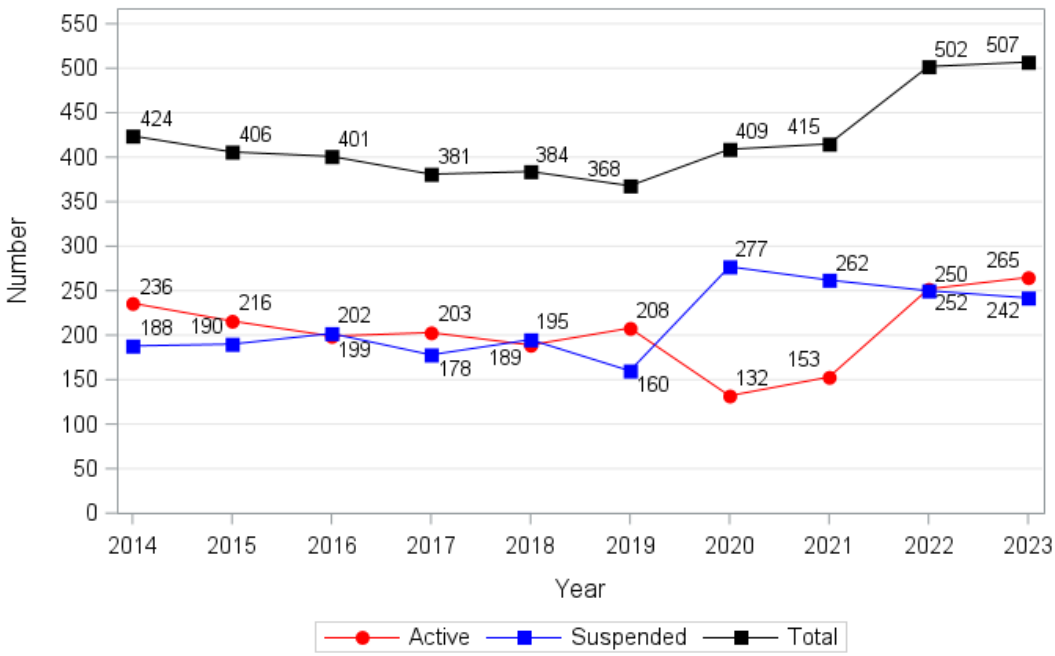


Figure 3.2 shows the number of patients on the active pancreas transplant list at 31 March 2023 by centre. Manchester had the largest proportion of the transplant list (34%), followed by Oxford with 25%.

Figure 3.2 Patients on the active pancreas transplant list at 31 March 2023, by centre

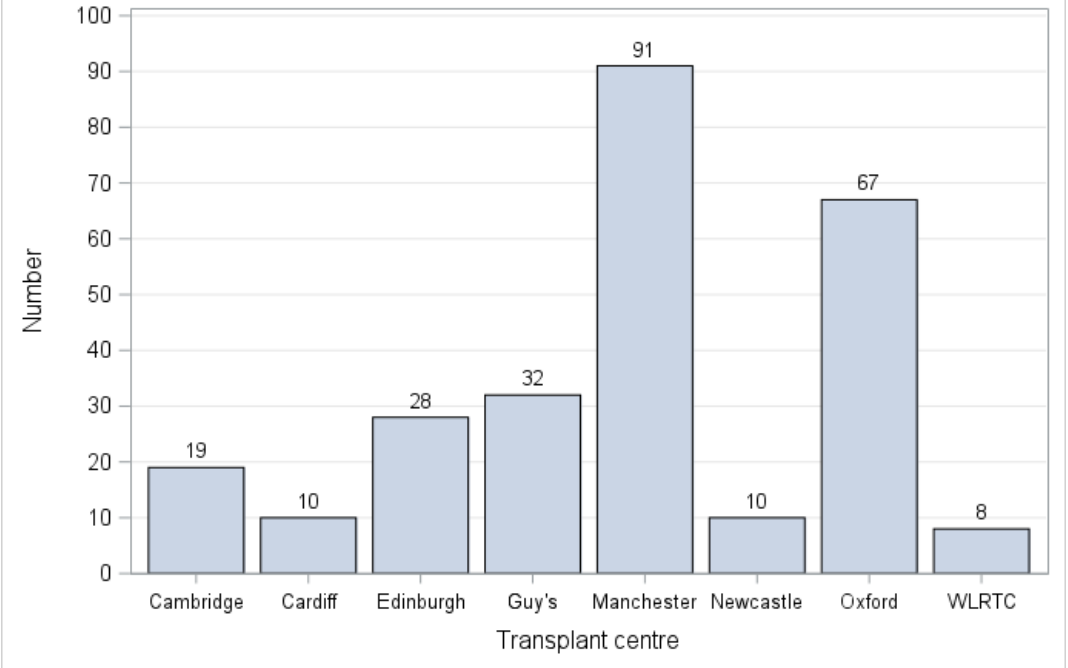
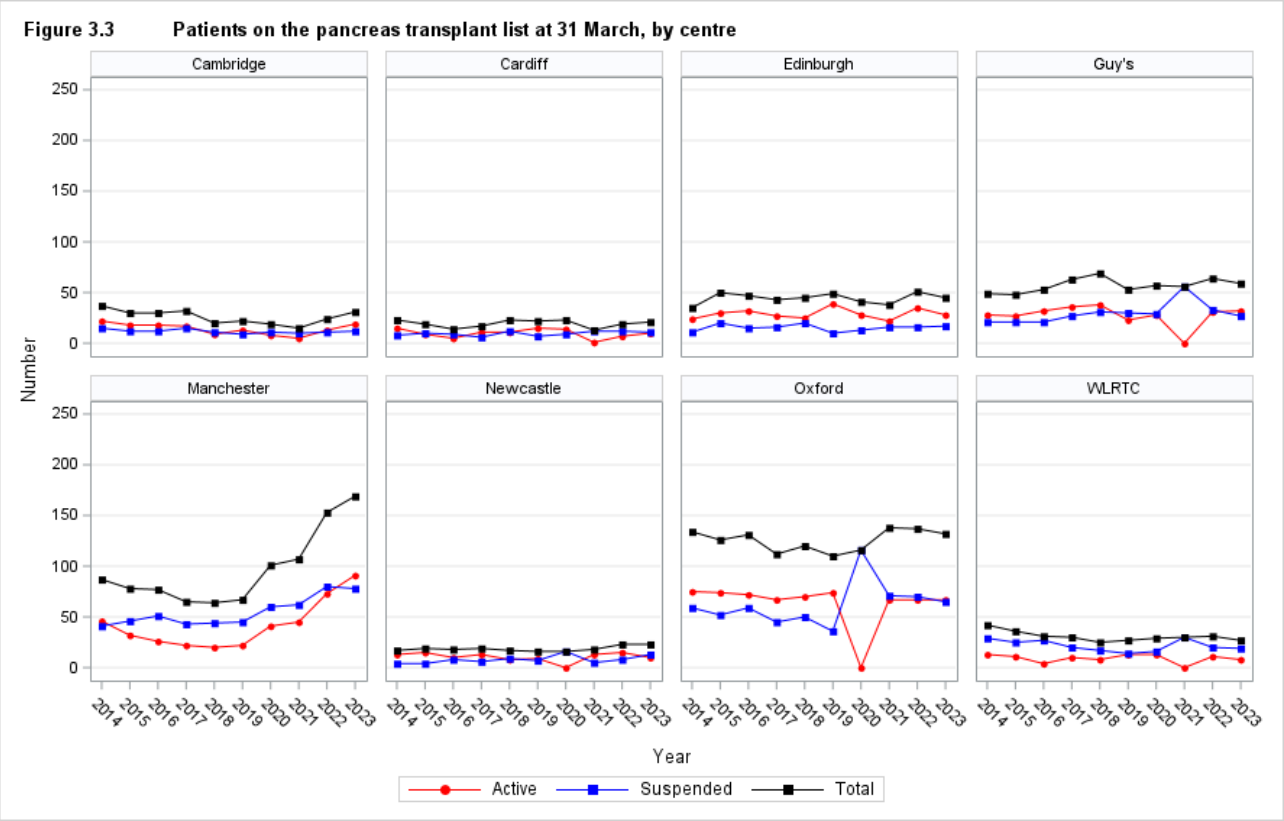


Figure 3.3 shows the number of patients on the pancreas transplant list at 31 March each year from 2014 by transplant centre. The number of patients actively waiting for a pancreas transplant at Manchester has increased in the last four years.



3.2 Post-registration outcomes, 1 April 2019 – 31 March 2020

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.

24% of patients registered between 1 April 2019 and 31 March 2020 were transplanted within one year, while three years after listing 65% 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. It is important to note that the three-year period after registration for these patients included two years impacted by the COVID-19 pandemic.

Figure 3.4 Post-registration outcome for 234 new pancreas registrations made in the UK, 1 April 2019 - 31 March 2020

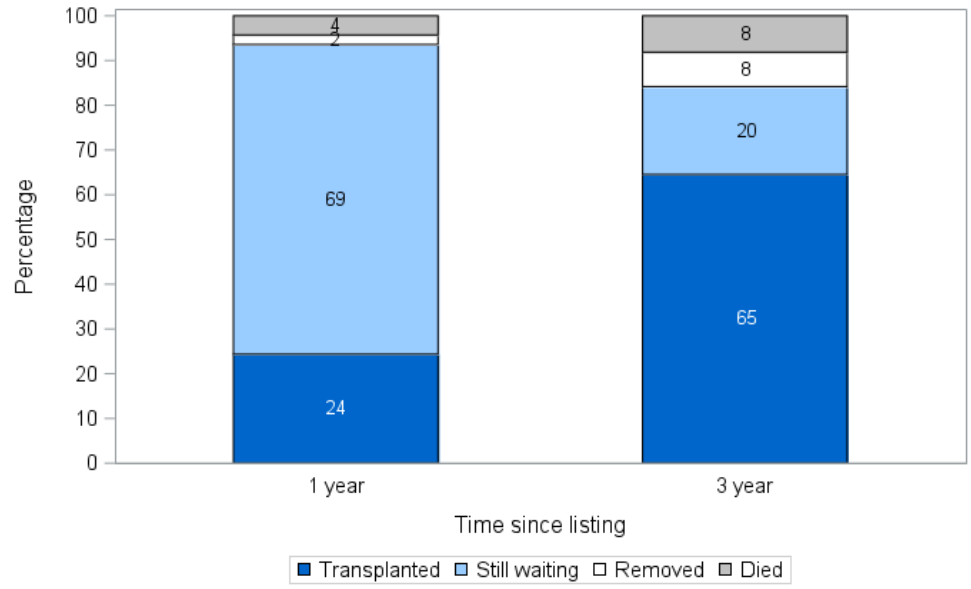
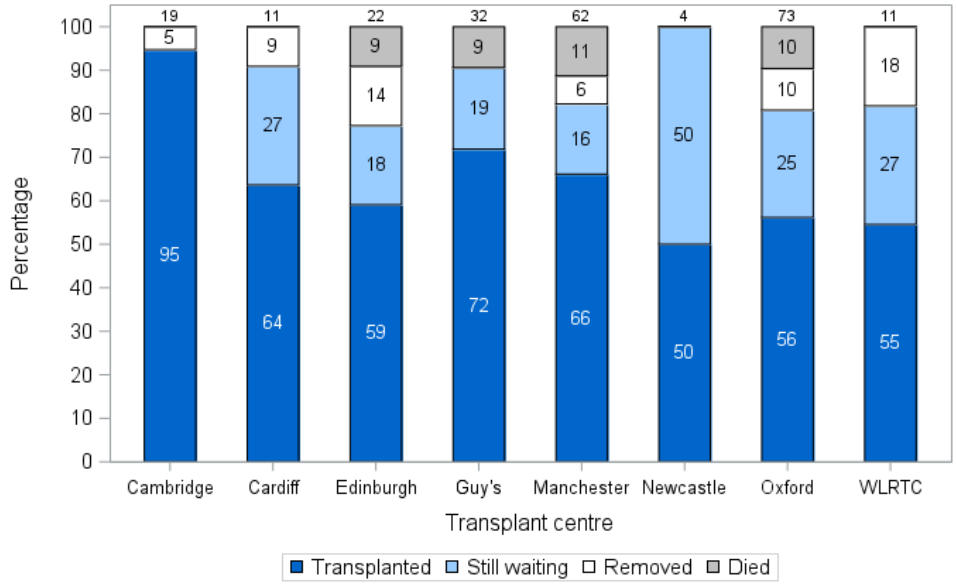


Figure 3.5 shows the proportion of patients transplanted or still waiting three years after joining the list by centre. Three years after listing, Cambridge had transplanted 95% of their patients while Newcastle had transplanted 50%.

Figure 3.5 Three-year post-registration outcome for 234 new pancreas registrations made in the UK, 1 April 2019 - 31 March 2020, by centre



3.3 Demographic characteristics, 1 April 2022 – 31 March 2023

The sex, ethnicity, age group, sensitisation group (cRF%) and matchability points score group of patients registered on the pancreas transplant list in 2022/23 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, 211 patients were registered on the pancreas transplant list, 205 (97%) were waiting for a SPK transplant. Of these 205, 54% were male, 83% were white, the median age was 40 years and the median cRF was 0%.

Of the six (3%) patients on the pancreas only transplant list, 33% were male, all were white, the median age was 36 years and the median cRF was 51%.

Figure 3.6 Registrations on the active pancreas transplant list, 1 April 2022 - 31 March 2023, by centre and sex

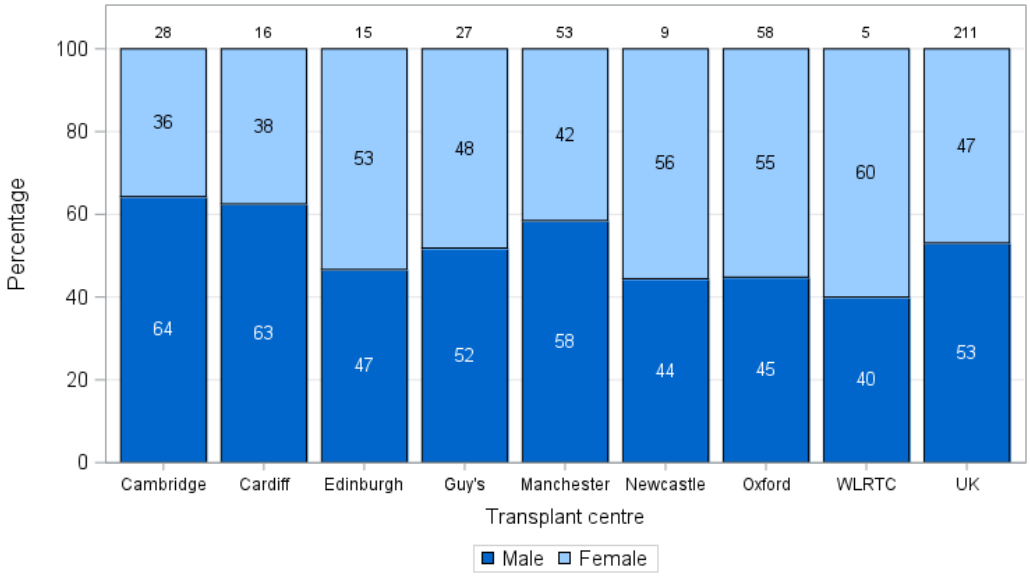


Figure 3.7 Registrations on the active pancreas transplant list, 1 April 2022 - 31 March 2023, by centre and ethnicity

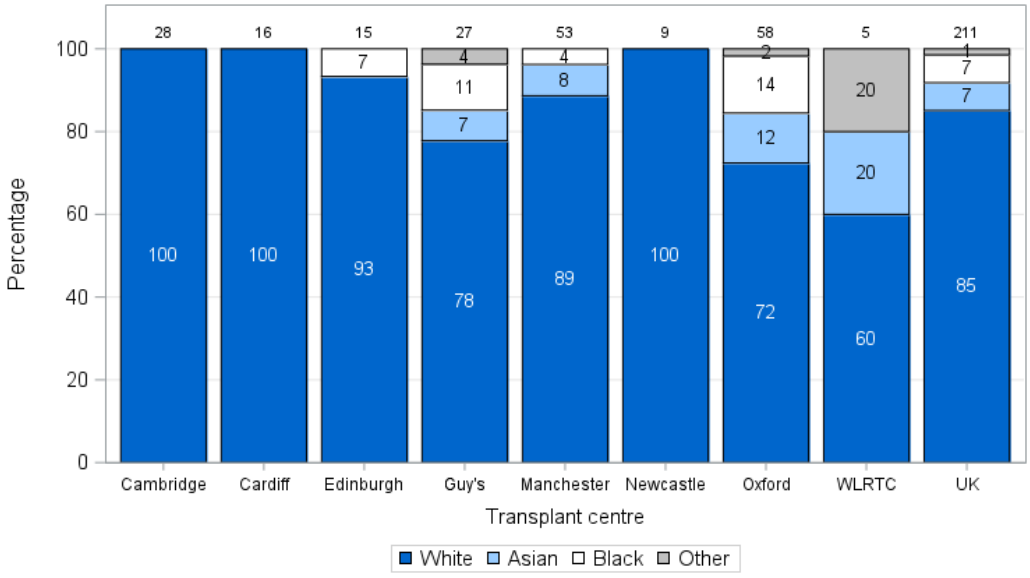


Figure 3.8 Registrations on the active pancreas transplant list, 1 April 2022 - 31 March 2023, by centre and age group

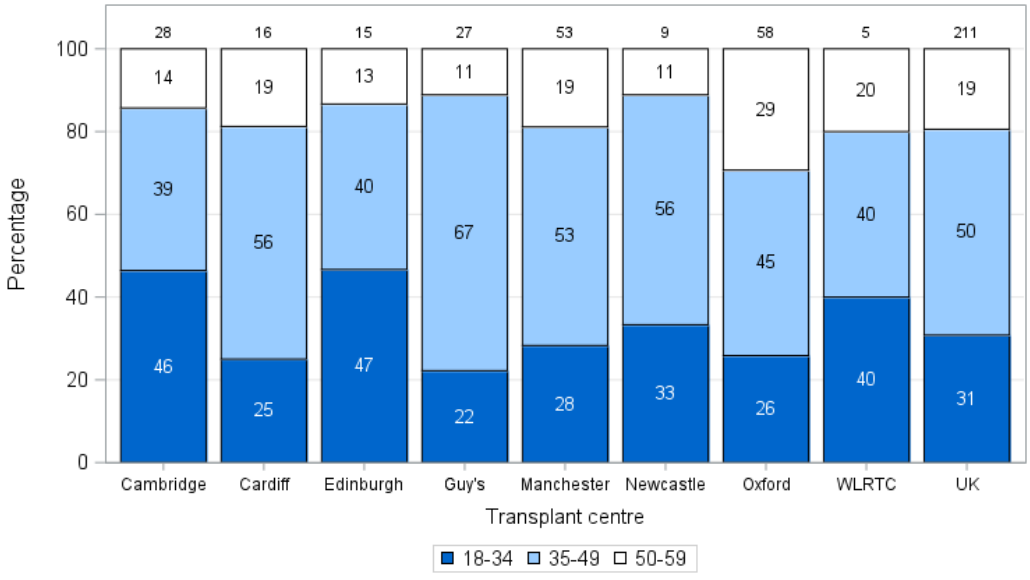


Figure 3.9 Registrations on the active pancreas transplant list, 1 April 2022 - 31 March 2023, by centre and sensitisation group (cRF%)

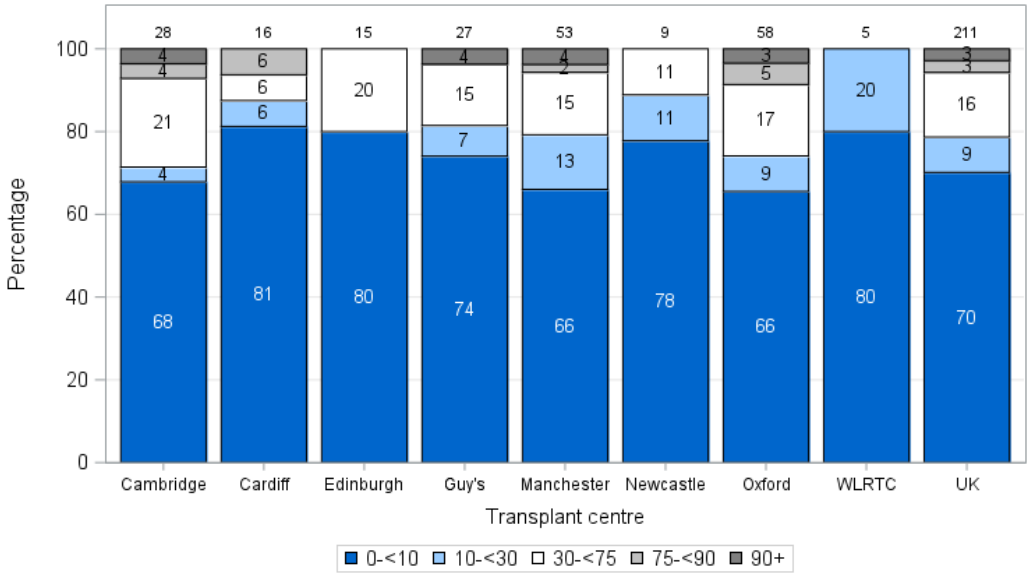
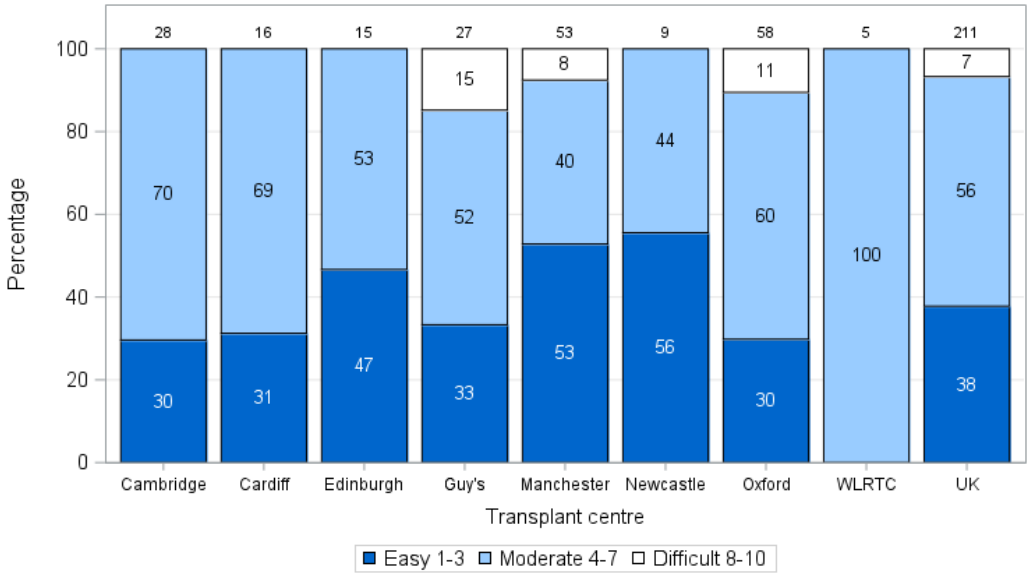


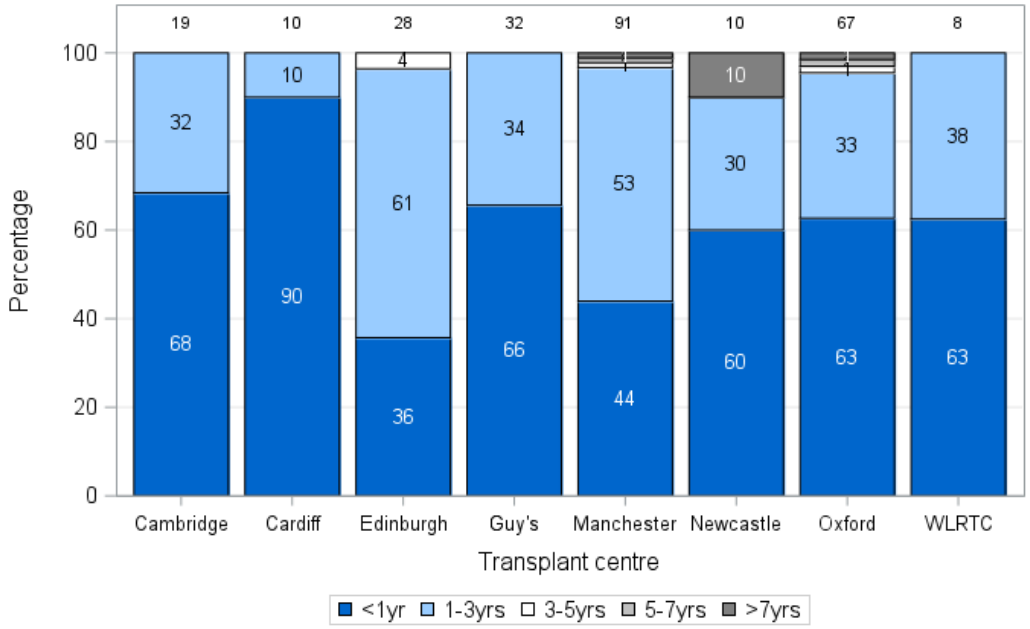
Figure 3.10 Registrations on the active pancreas transplant list, 1 April 2022 - 31 March 2023, by centre and matchability group



3.4 Patient waiting times for those currently on the list, 31 March 2023

Figure 3.11 shows the length of time active patients have been waiting on the pancreas transplant list at 31 March 2023 by centre. Most patients currently listed have been waiting less than one year. However, three highly sensitised (cRF ≥90%) patients have been waiting more than 7 years for a pancreas transplant: one SPK at Manchester, one pancreas alone at Newcastle and one pancreas alone at Oxford.

Figure 3.11 Patients on the active pancreas transplant list as at 31 March 2023, by centre and grouped waiting time



3.5 Median active waiting time to transplant, 1 April 2017 - 31 March 2021

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 2017 and 31 March 2021 is 364 days. This ranged from 156 days at Cambridge to 678 days at Newcastle.

Figure 3.12 **Median active waiting time to deceased donor transplant for patients registered on the pancreas transplant list, 1 April 2017 - 31 March 2021**

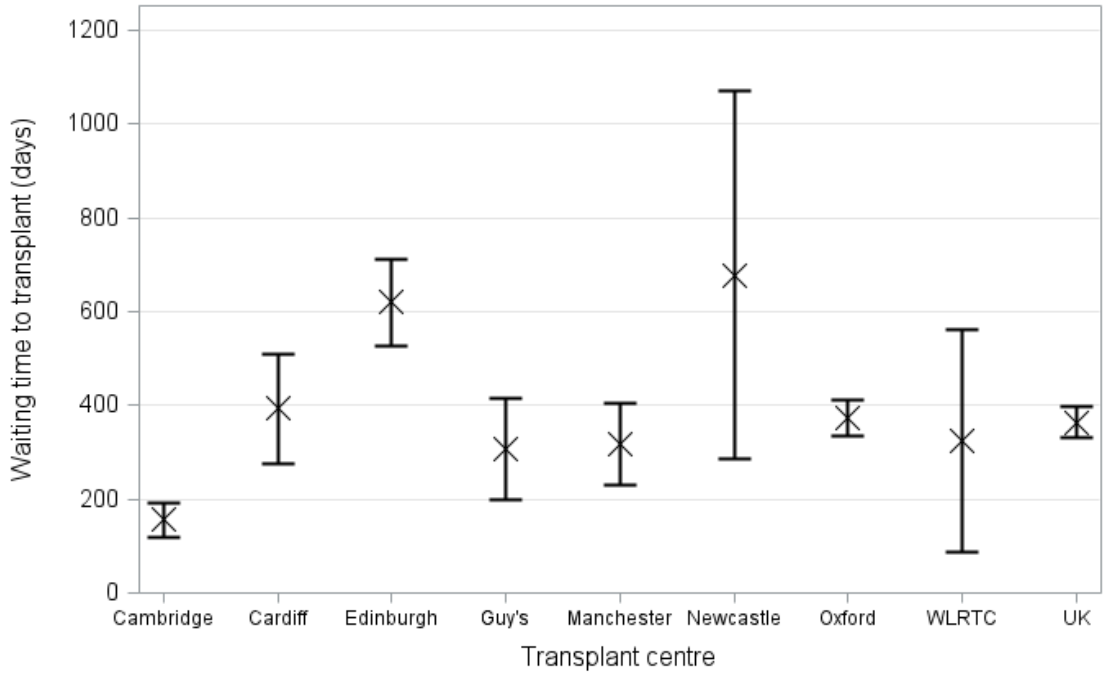


Table 3.1 **Median active waiting time to pancreas transplant in the UK, for patients registered 1 April 2017 - 31 March 2021**

Transplant centre	Number of patients registered	Waiting time (days) Median	95% Confidence interval
Cambridge	86	156	119 - 193
Cardiff	36	393	276 - 510
Edinburgh	79	620	527 - 713
Guy's	103	307	200 - 414
Manchester	168	318	232 - 404
Newcastle	31	678	285 - 1071
Oxford	269	374	336 - 412
WLRTC	39	326	89 - 563
UK	**811**	**364**	**331 - 397**

Response to pancreas offers

4.1 Offer decline rates, 1 April 2020 – 31 March 2023

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. Person 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 person case mix.

Figure 4.1 compares individual centre offer DBD decline rates with the national rate over the time period, 1 April 2020 and 31 March 2023. Centres can be identified by the information shown in **Table 4.1**. Cambridge had an offer decline rate significantly better than the national rate and Edinburgh had a decline rate significantly higher than the national average.

Figure 4.1 DBD donor pancreas offer decline rates for pancreases that resulted in a pancreas transplant, 1 April 2020 and 31 March 2023

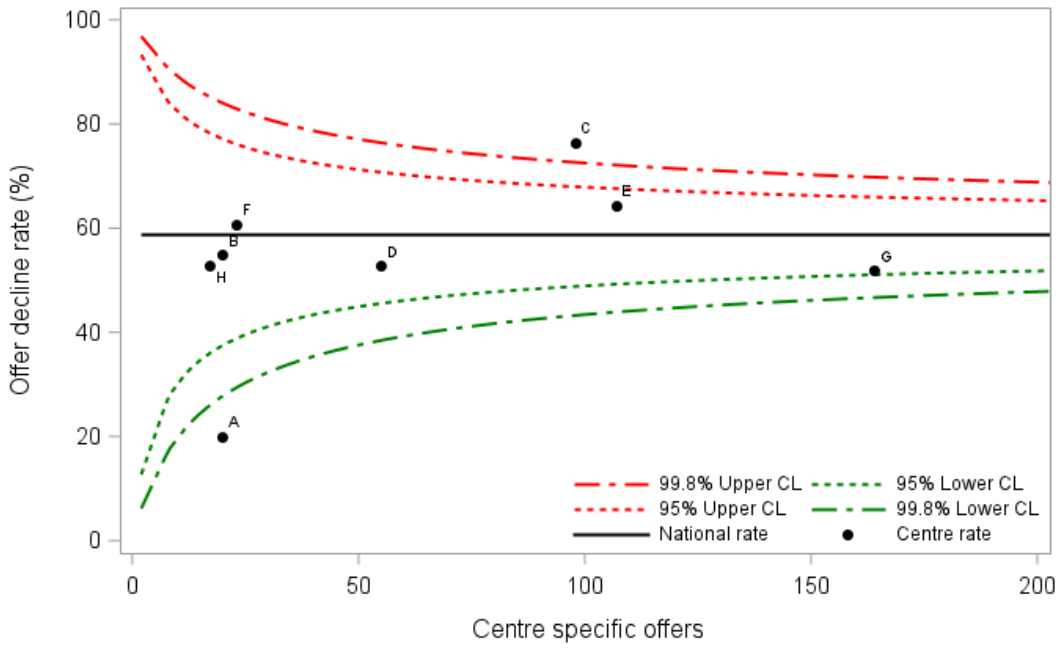


Table 4.1 compares individual centre DBD offer decline rates over time by financial year. The overall offer decline rate decreased from 66% in 2021/22 to 59% in 2022/23.

Table 4.1 DBD donor pancreas offer decline rates by transplant centre, 1 April 2020 and 31 March 2023

Centre	Code	2020/21		2021/22		2022/23		Overall	
		N	(%)	N	(%)	N	(%)	N	(%)
Cambridge	A	11	(0)	3	(33)	6	(50)	20	(20)
Cardiff	B	6	(50)	7	(71)	7	(43)	20	(55)
Edinburgh	C	16	(56)	41	(88)	41	(73)	98	(77)
Guy's	D	3	(33)	32	(59)	20	(45)	55	(53)
Manchester	E	19	(63)	46	(65)	42	(64)	107	(64)
Newcastle	F	4	(75)	10	(50)	9	(67)	23	(61)
Oxford	G	28	(25)	79	(59)	57	(54)	164	(52)
WLRTC	H	1	(0)	11	(64)	5	(40)	17	(53)
UK		**88**	**(40)**	**229**	**(66)**	**187**	**(59)**	**504**	**(59)**

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 2020 and 31 March 2023. Cambridge had an offer decline rate better than the national rate and all other centre decline rates were comparable with the national rate. 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 2020 and 31 March 2023

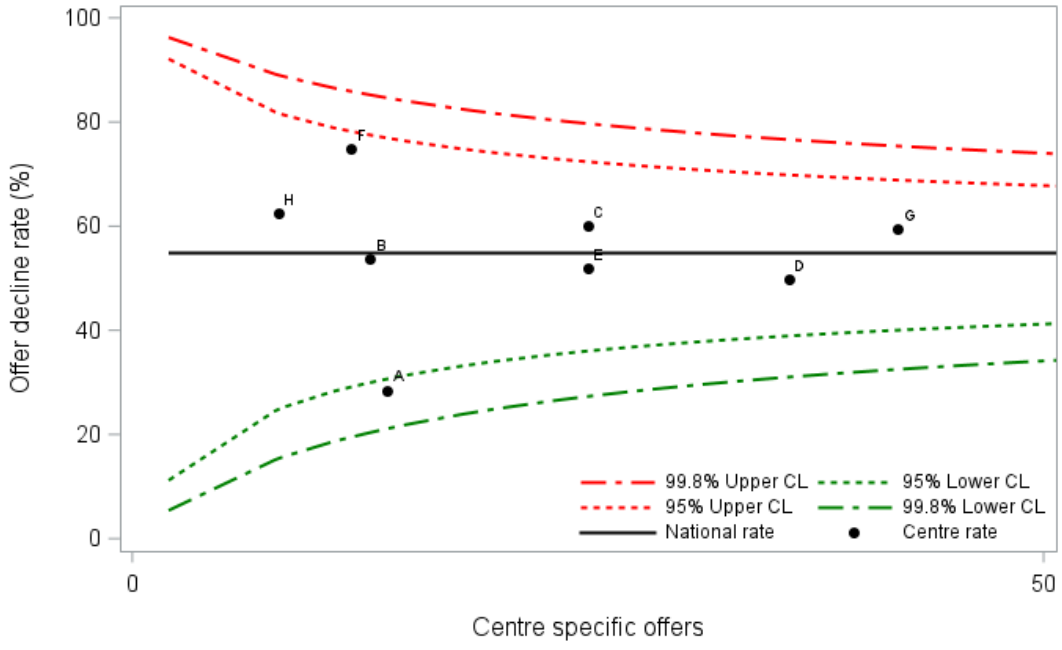


Table 4.2 compares individual DCD centre offer decline rates over time by financial year.

Table 4.2 DCD donor pancreas offer decline rates by transplant centre, 1 April 2020 and 31 March 2023

Centre	Code	2020/21		2021/22		2022/23		Overall	
		N	(%)	N	(%)	N	(%)	N	(%)
Cambridge	A	3	(0)	7	(29)	4	(50)	14	(29)
Cardiff	B	1	(100)	4	(50)	8	(50)	13	(54)
Edinburgh	C	4	(25)	7	(57)	14	(71)	25	(60)
Guy's	D	3	(0)	16	(63)	17	(47)	36	(50)
Manchester	E	6	(67)	10	(40)	9	(56)	25	(52)
Newcastle	F	1	(100)	3	(100)	8	(63)	12	(75)
Oxford	G	4	(50)	21	(62)	17	(59)	42	(60)
WLRTC	H			5	(80)	3	(33)	8	(63)
UK		**22**	**(41)**	**73**	**(58)**	**80**	**(56)**	**175**	**(55)**

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 2013 – 31 March 2023

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 2013/14 there were 39 DCD transplants (18%). The number of DCD transplants performed reached a peak of 60 in 2014/15 but this level was not maintained in subsequent years. In 2022/23 there were 43 transplants, although this still accounts for around a third of all pancreas transplants.

In 2013/14 the number of DBD transplants peaked at 175 (82%), however, this has decreased over the time period shown to 86 DBD transplants in 2022/23.

Figure 5.1 Pancreas transplants,1 April 2013 - 31 March 2023, by financial year and donor type

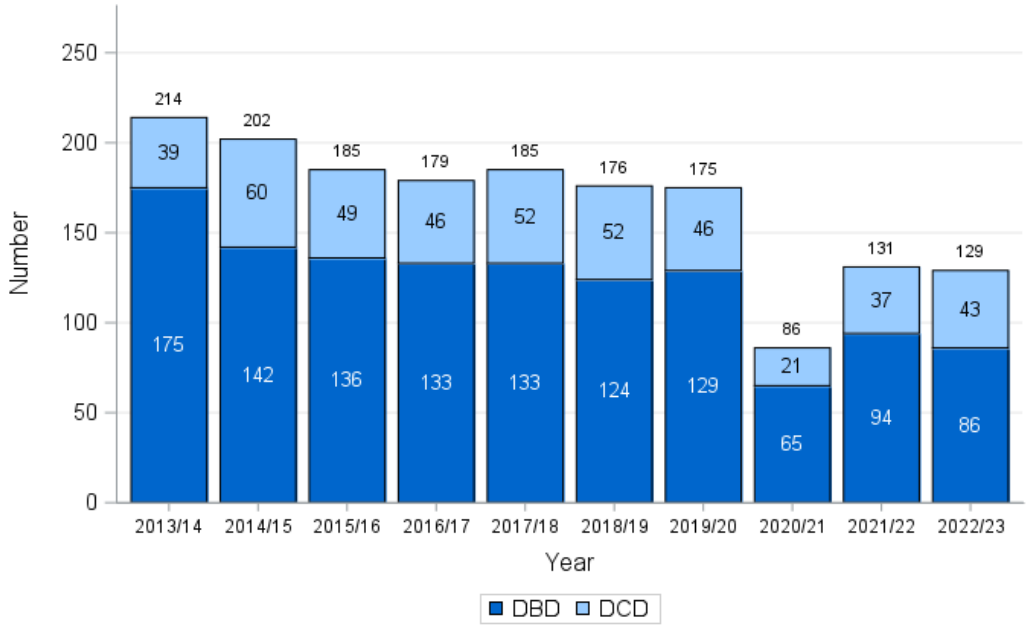


Figure 5.2 shows the total number of pancreas transplants performed in 2022/23, by centre and type of donor. The same information is presented in **Figure 5.3** but this shows the proportion of DBD and DCD transplants performed at each centre. Oxford performed the most DBD and DCD transplants (35), however Cardiff had the largest proportion of DCD transplants (56%). WLRTC performed the lowest number of transplants, five including two DCD transplants, in the last financial year.

Figure 5.2 Pancreas transplants, 1 April 2022 - 31 March 2023, by centre and donor type

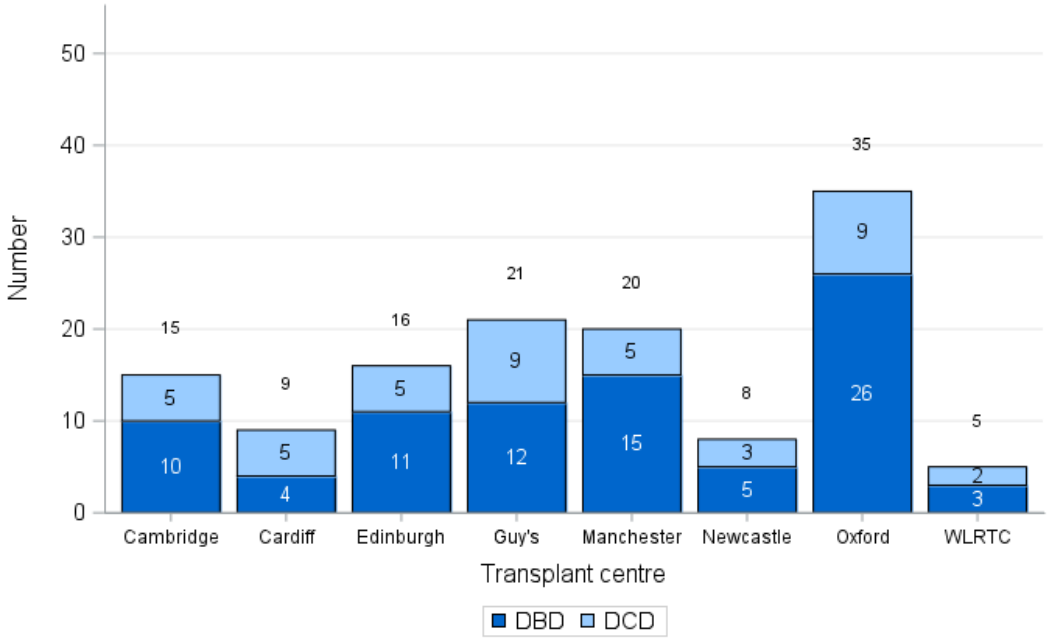


Figure 5.3 Pancreas transplants, 1 April 2022 - 31 March 2023, by centre and donor type

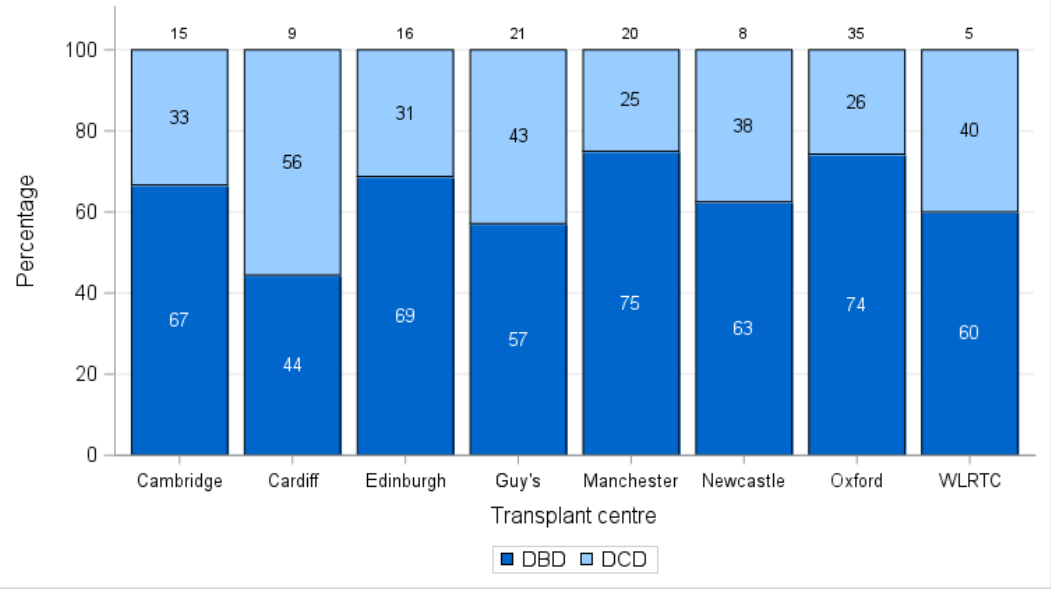
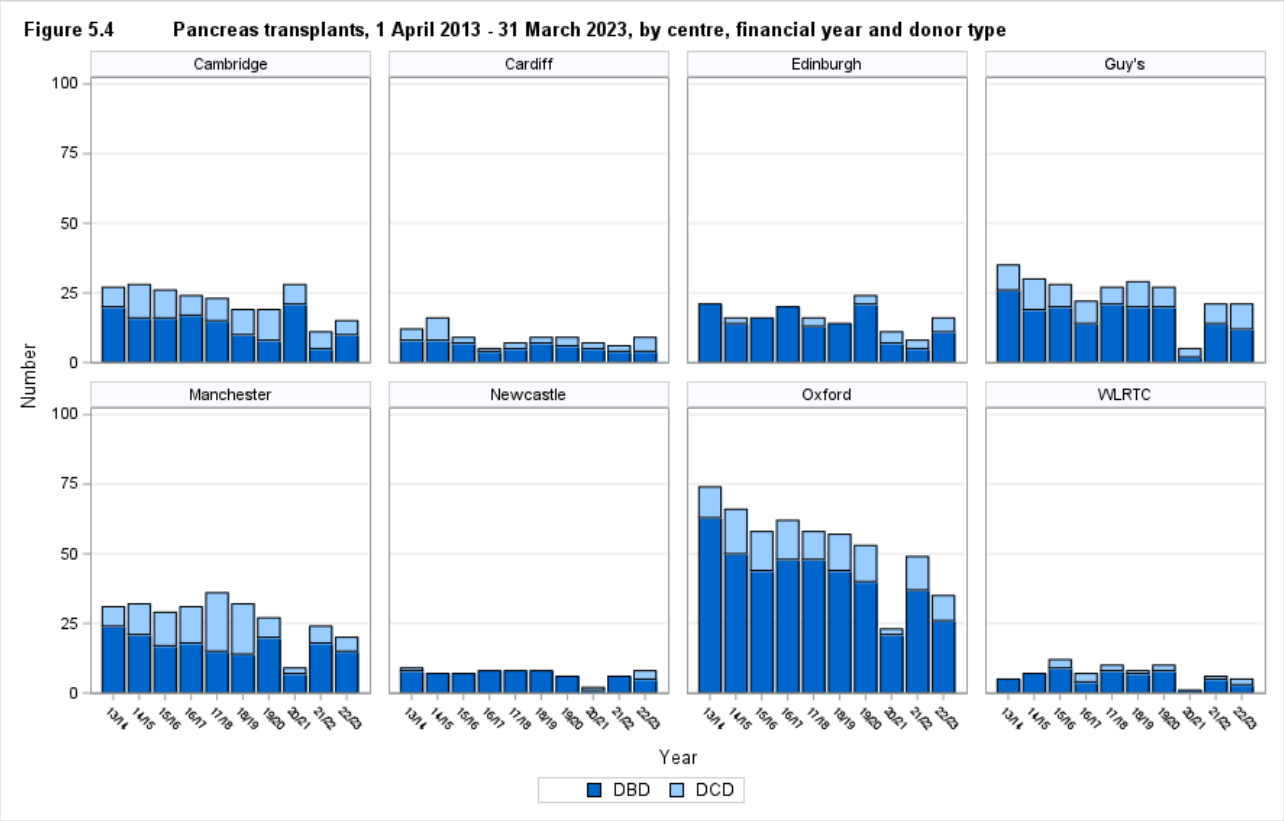


Figure 5.4 shows the total number of pancreas transplants performed in last ten financial years, by centre and type of donor. Oxford have consistently performed a large number of pancreas transplants including a number of DCD transplants over the last ten years. However, the number of transplants performed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



5.2 Demographic characteristics, 1 April 2022 - 31 March 2023

The sex, ethnicity, age group, sensitisation group (cRF%) and matchability points score group of transplant recipients that received a pancreas transplant in 2022/23 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, 129 patients were transplanted, 121 (94%) were SPK transplants. Of which 57% were male, 88% were white, the median age was 39 years, the median cRF was 0% and 6% were in the difficult match group.

Of the 8 (6%) patients transplanted as a pancreas only transplant, 25% were male, 100% were white, the median age was 39 years, the median cRF was 68% and 13% were in the difficult match group.

Figure 5.5 Pancreas transplants, 1 April 2022 - 31 March 2023, by centre and sex

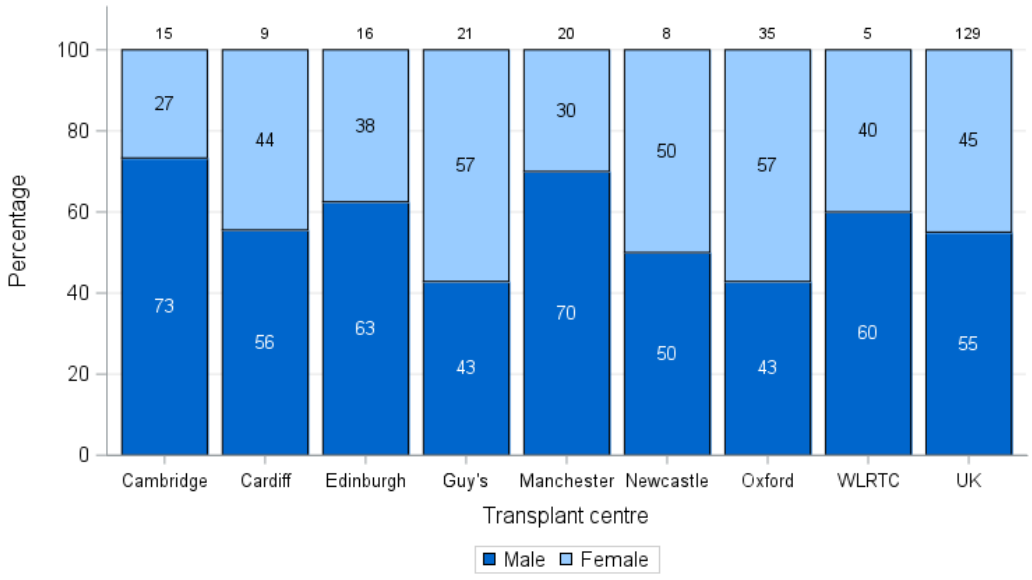


Figure 5.6 Pancreas transplants, 1 April 2022 - 31 March 2023, by centre and ethnicity

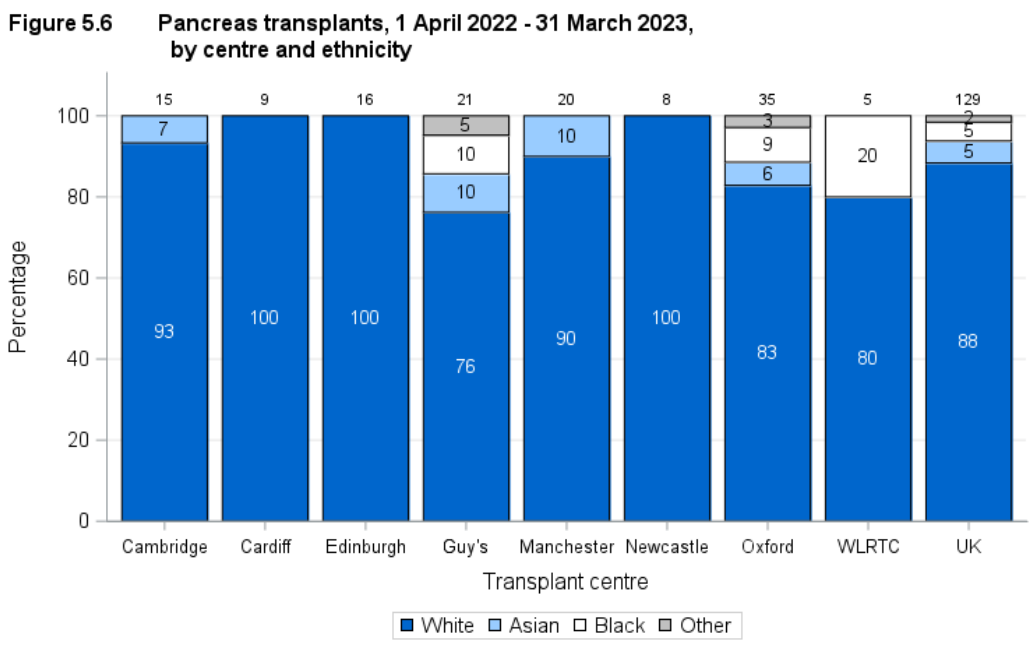


Figure 5.7 Pancreas transplants, 1 April 2022 - 31 March 2023, by centre and age group

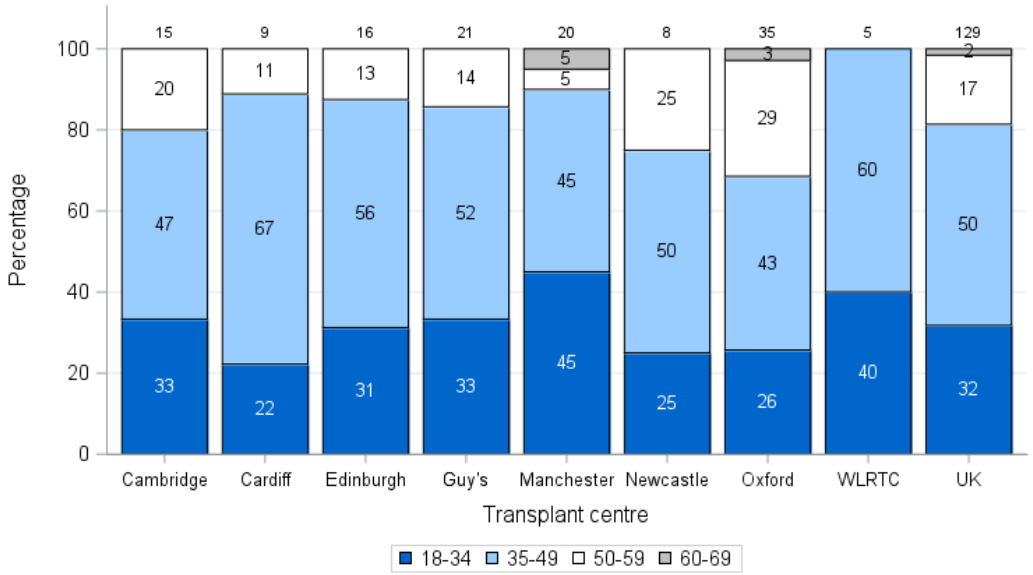


Figure 5.8 Pancreas transplants, 1 April 2022 - 31 March 2023, by centre and sensitisation (cRF%) group

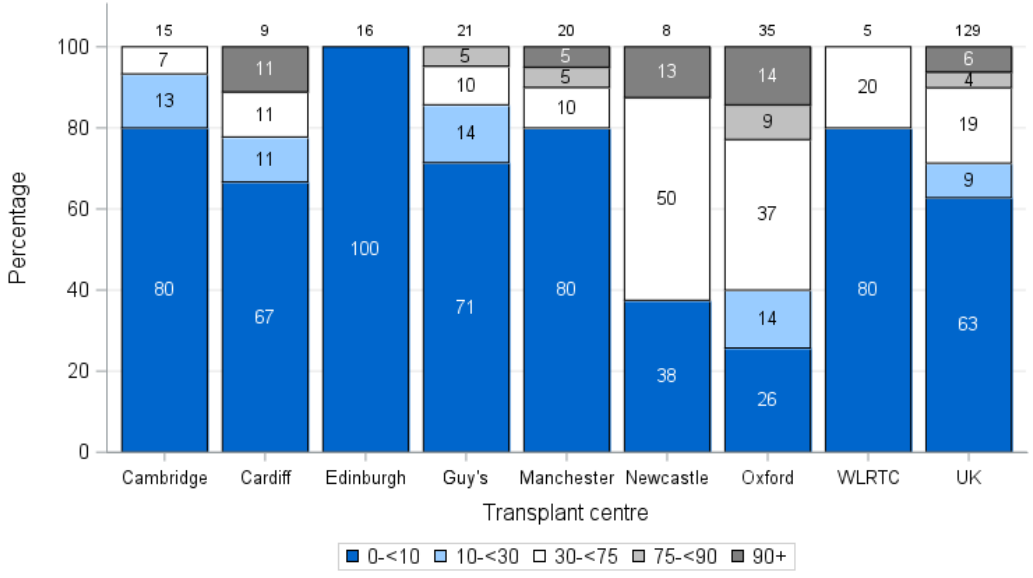
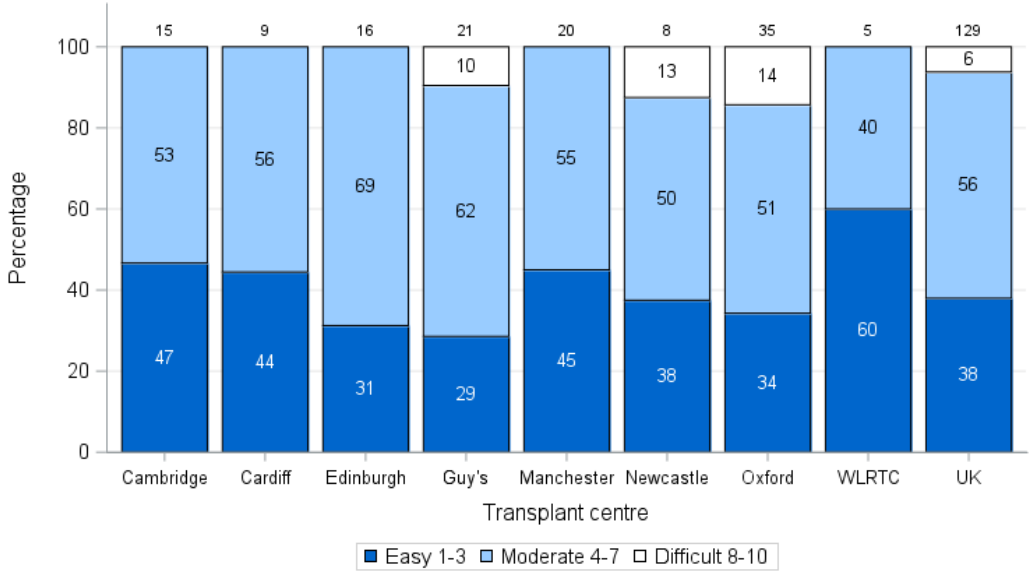


Figure 5.9 Pancreas transplants, 1 April 2022 - 31 March 2023, by centre and matchability group



5.3 Cold ischaemia time, 1 April 2013 – 31 March 2023

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 was 11 hours in most years.

Figure 5.10 Median cold ischaemia time in DBD donor pancreas transplants 1 April 2013 - 31 March 2023

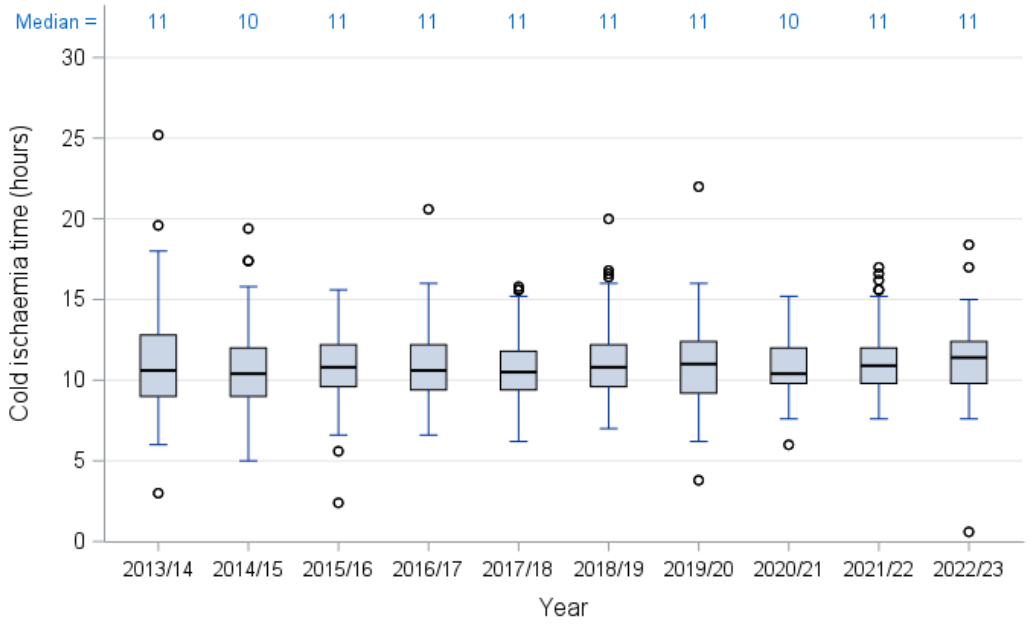


Figure 5.11 shows the median cold ischaemia time in DBD donor pancreas transplants in 2022/23 for each transplant centre. Please note the small numbers used in the calculations for each centre and interpret with caution. **Figure 5.12** shows the median cold ischaemia time in DBD donor pancreas transplants over the last ten years for each transplant centre.

Figure 5.11 Median cold ischaemia time in DBD donor pancreas transplants 1 April 2022 - 31 March 2023

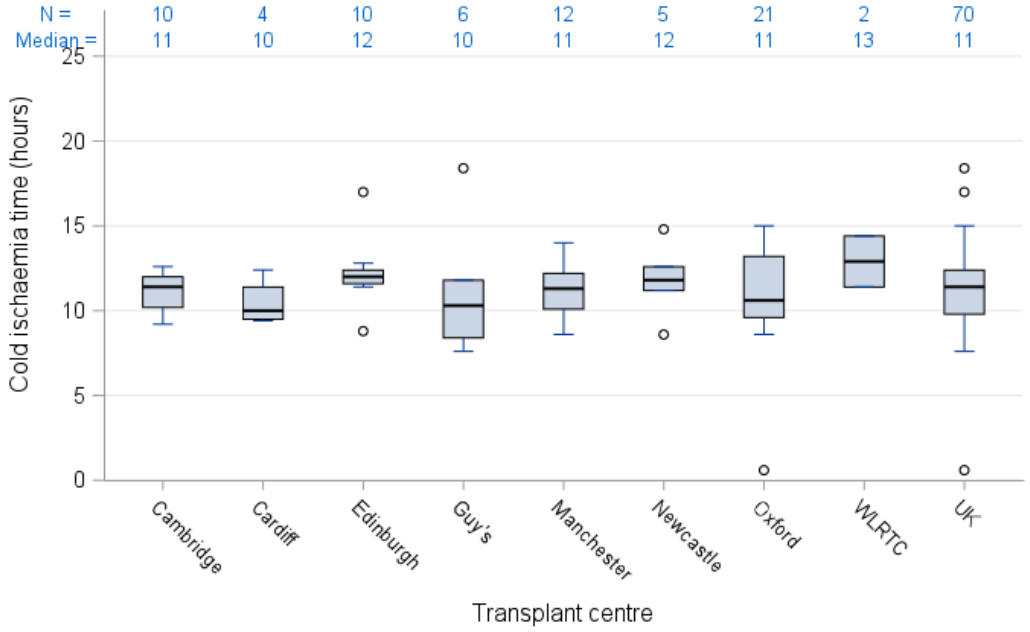


Figure 5.12 Median cold ischaemia time in DBD donor pancreas transplants, 1 April 2013 - 31 March 2023

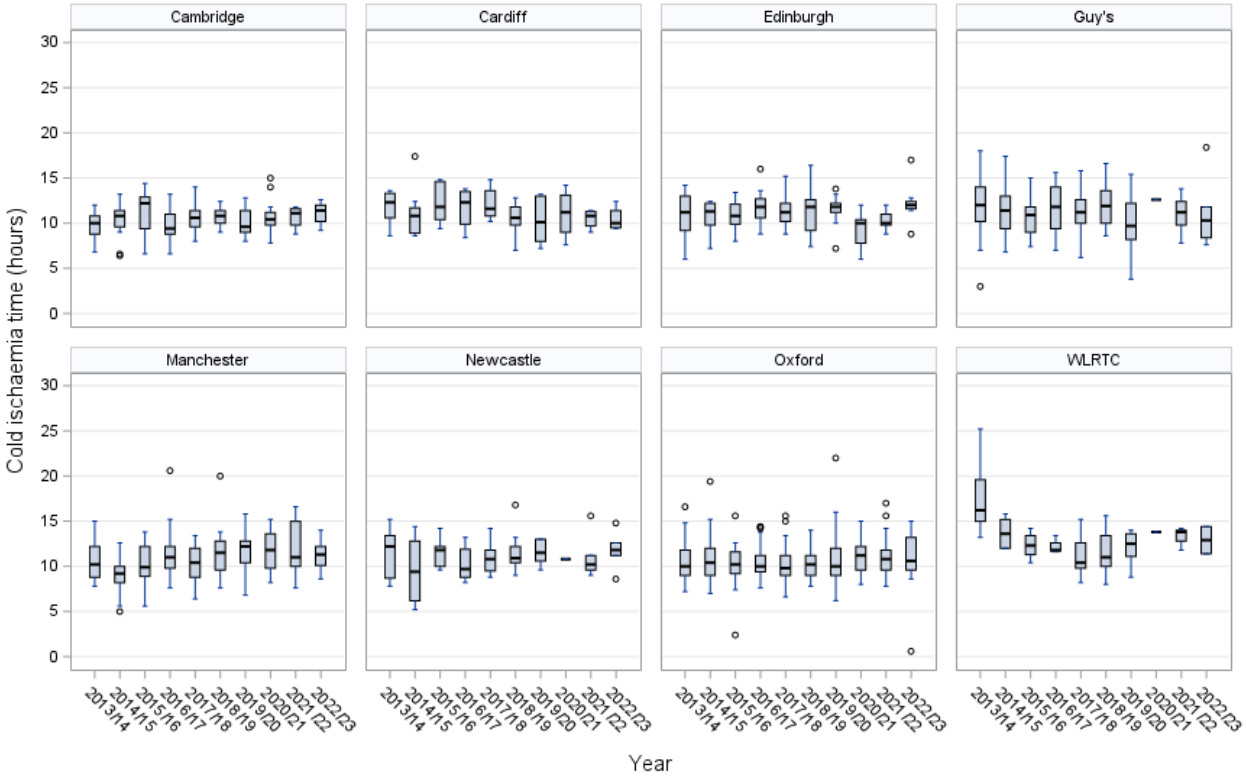


Figure 5.13 shows the median cold ischaemia time in DCD donor pancreas transplants over the last ten years and overall has predominately been 10 hours.

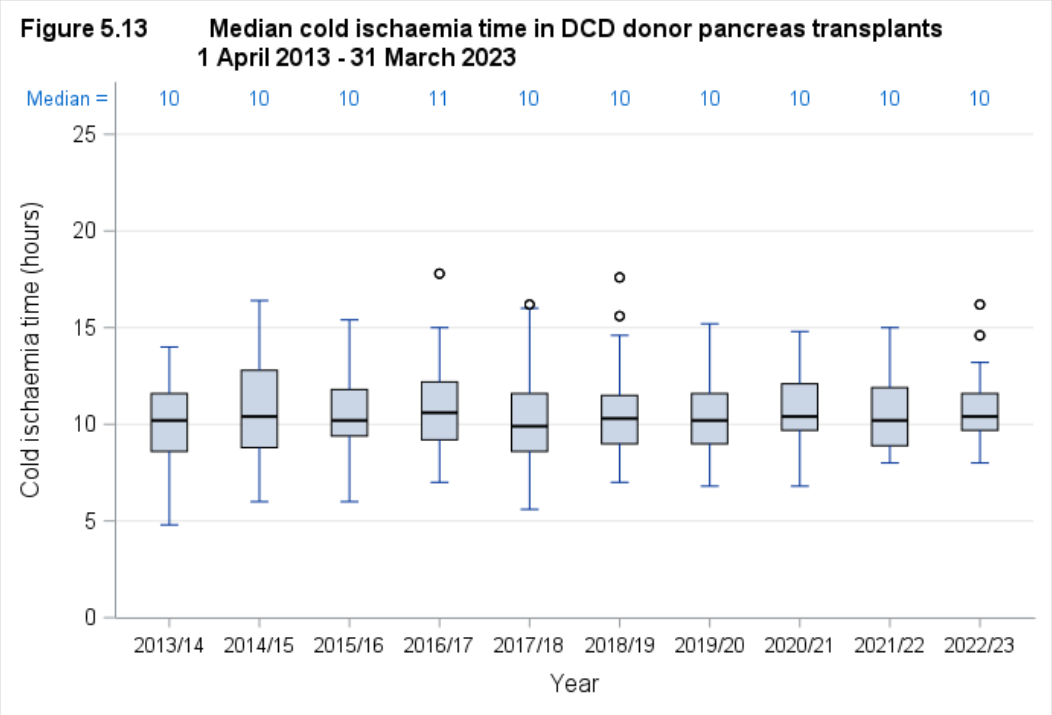


Figure 5.14 shows the median cold ischaemia time in DCD donor pancreas transplants in 2022/23 for each transplant centre. WLRTC did not perform any DCD donor transplants in the time period and are not presented in the graph. Please note the small numbers used in the calculations for each centre and interpret with caution.

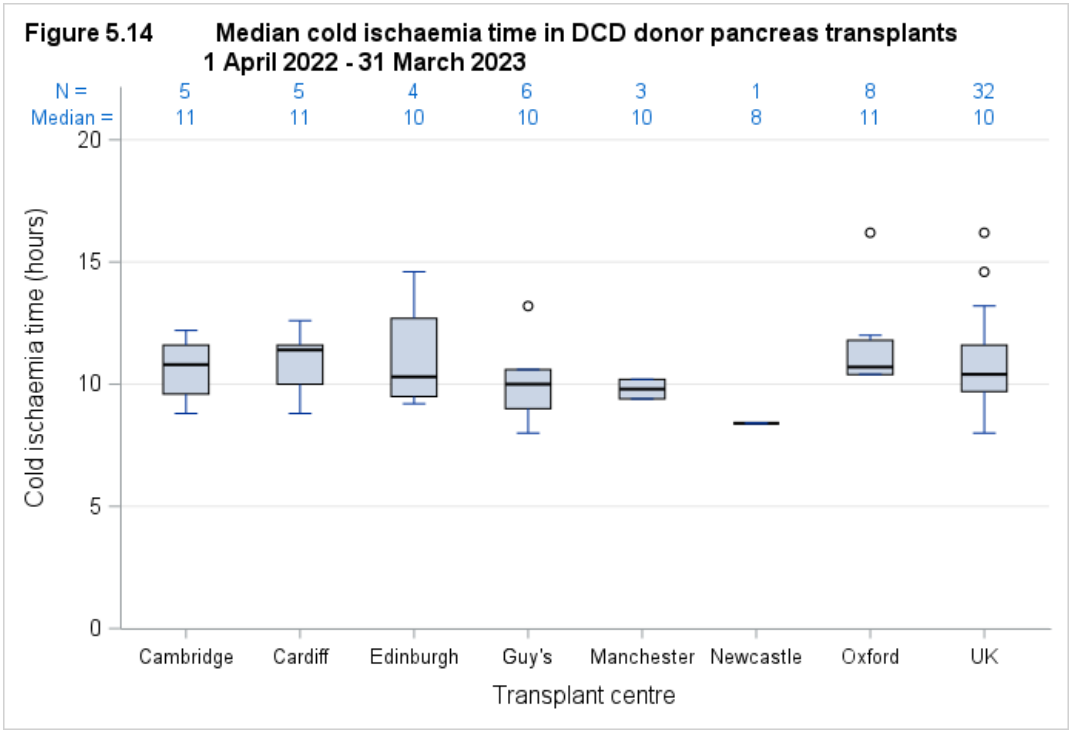
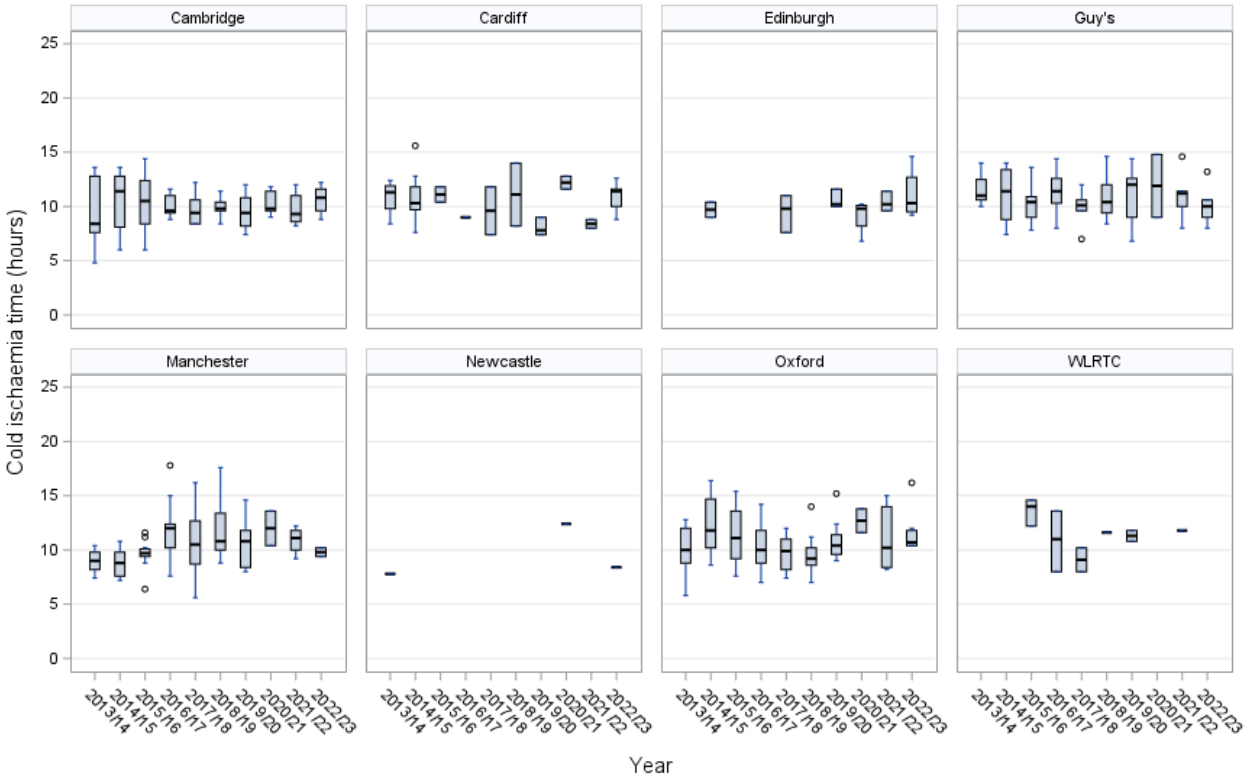


Figure 5.15 shows the median cold ischaemia time in DCD donor pancreas transplants for each transplant centre over the last ten years. The median cold ischaemia time has fluctuated in centres over the time period, due to the small number of transplants performed each year.

Figure 5.15 Median cold ischaemia time in DCD donor pancreas transplants, 1 April 2013 - 31 March 2023



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 and to ensure validity of the survival rates, it is essential these follow-up forms are returned. Follow-up form return rates by centre, for forms issued during the 2022 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 2018 and 31 March 2022**

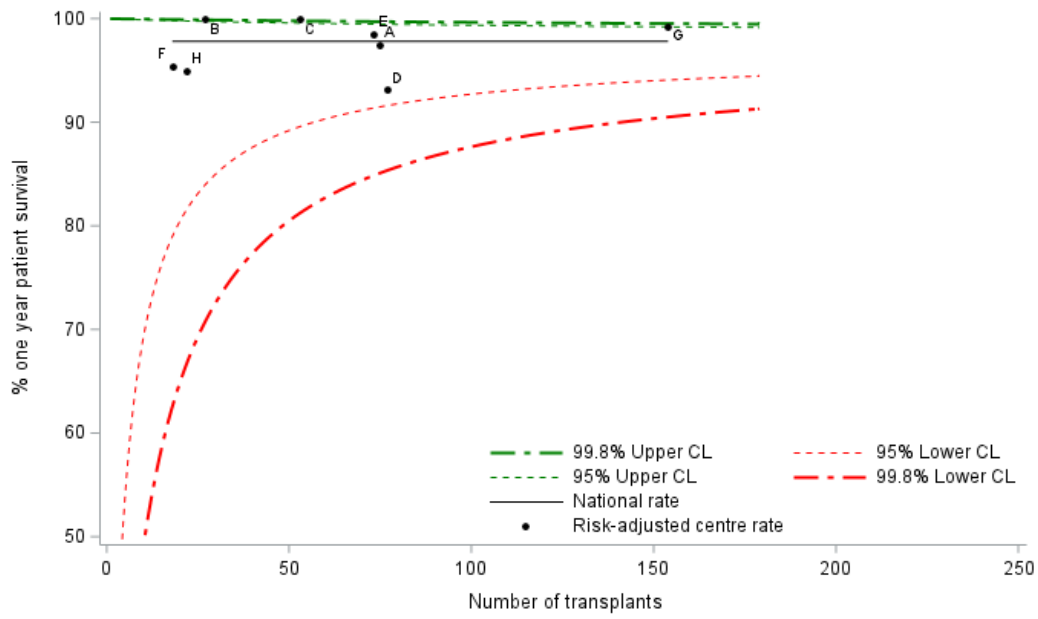


Figure 6.2 **Risk-adjusted one year pancreas graft (death censored) survival rates for all deceased donor first SPK transplants, between 1 April 2018 and 31 March 2022**

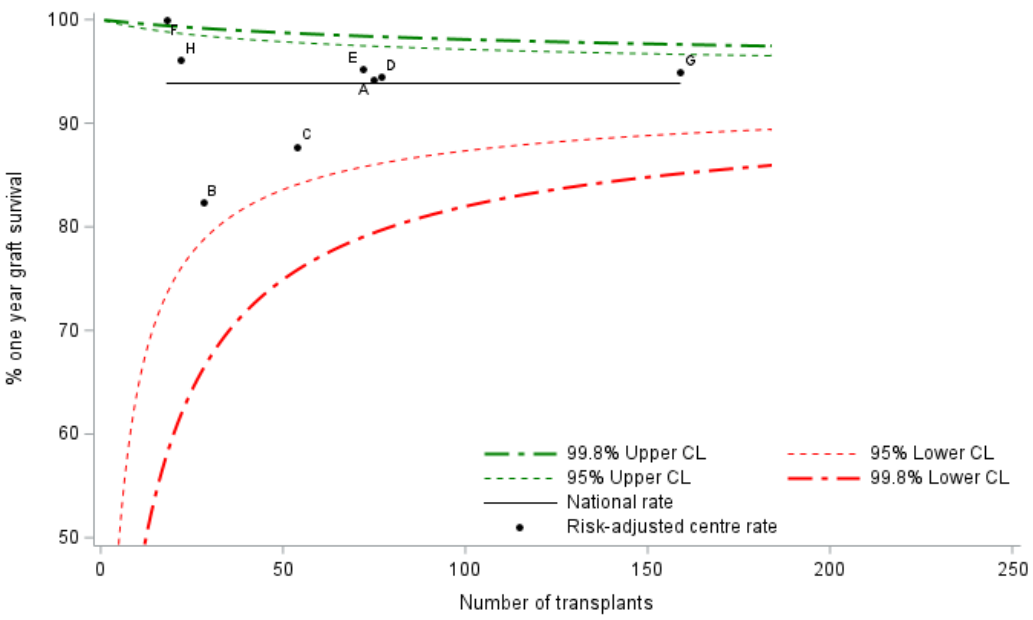


Figure 6.3 **Risk-adjusted five year patient survival rates for deceased donor first SPK transplants, between 1 April 2014 and 31 March 2018**

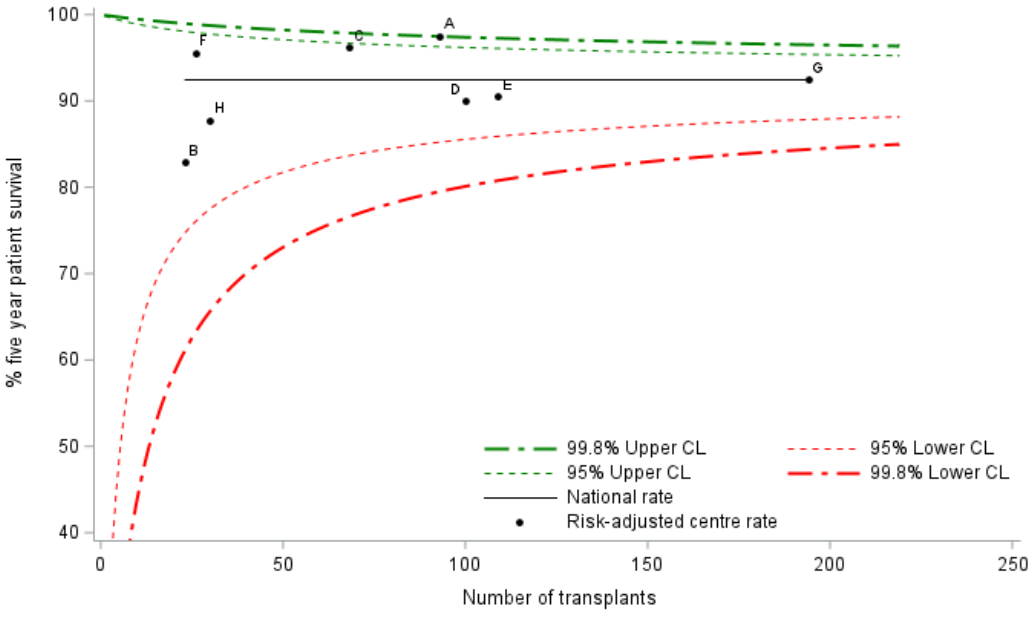


Figure 6.4 **Risk-adjusted five year pancreas graft (death censored) survival rates for all deceased donor first SPK transplants, between 1 April 2014 and 31 March 2018**

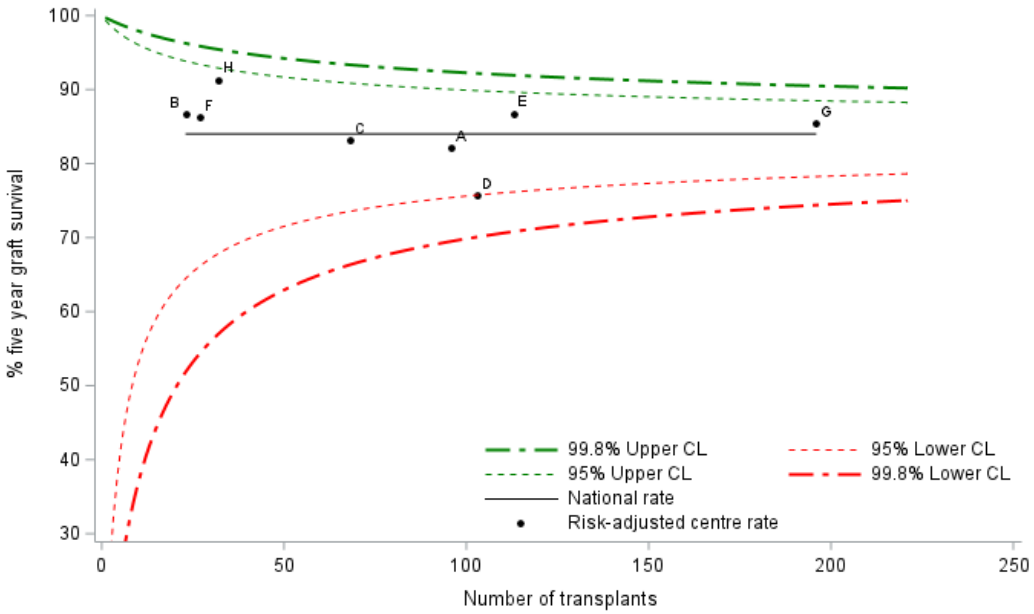


Table 6.1 **Risk-adjusted one and five year patient survival for first SPK transplants using pancreases from deceased donors**

		Patient survival					
		One-year*			Five-year**		
Centre	Code	N	%	(95% CI)	N	%	(95% CI)
Cambridge	A	75	98	(91 - 100)	93	98	(91 - 100)
Cardiff	B	27	100	N/A	23	83	(50 - 96)
Edinburgh	C	53	100	N/A	68	96	(86 - 100)
Guy's	D	77	93	(82 - 98)	100	90	(80 - 96)
Manchester	E	73	99	(92 - 100)	109	91	(82 - 96)
Newcastle	F	18	95	(75 - 100)	26	96	(76 - 100)
Oxford	G	154	99	(96 - 100)	194	92	(87 - 96)
WLRTC	H	22	95	(72 - 100)	30	88	(64 - 97)
UK		**499**	**98**	**(96 - 99)**	**643**	**92**	**(90 - 94)**

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 2018 - 31 March 2022
** Includes transplants performed between 1 April 2014 - 31 March 2018

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	75	94	(85 - 98)	96	82	(71 - 90)
Cardiff	B	28	82	(55 - 95)	23	87	(61 - 97)
Edinburgh	C	54	88	(71 - 96)	68	83	(69 - 92)
Guy's	D	77	95	(86 - 99)	103	76	(64 - 85)
Manchester	E	72	95	(86 - 99)	113	87	(77 - 93)
Newcastle	F	18	100	N/A	27	86	(65 - 96)
Oxford	G	159	95	(90 - 98)	196	86	(79 - 90)
WLRTC	H	22	96	(78 - 100)	32	91	(75 - 98)
UK		**505**	**94**	**(91 - 96)**	**658**	**84**	**(81 - 87)**

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 2018 - 31 March 2022
** Includes transplants performed between 1 April 2014 - 31 March 2018

6.2 Deceased donor graft and patient survival for first PO transplants

National rates for one-year and five-year patient survival following first pancreas only (PO) transplant are 100% and 87% (95% CI 68-95%), respectively. One-year and five-year graft survival rates are 76% (95% CI 55-88%) and 73% (95% CI 58-84%), respectively. One-year rates are calculated from transplants performed between 1 April 2018 and 31 March 2022 and five-year rates from transplants performed between 1 April 2014 and 31 March 2018. Individual centre rates are not presented due to small numbers at each centre within the cohorts.

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 2011 and 31 December 2022. 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**, uses a fixed effects Poisson regression model to compare centre specific ten-year risk-adjusted patient survival rates from the point of SPK transplant listing and indicates how consistent the rates of the individual transplant centres are with the national rate. One centre's survival rate was significantly higher than the national rate and all other centres survival rates were similar to the national rate of 77%. 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 2011 and 31 December 2022**

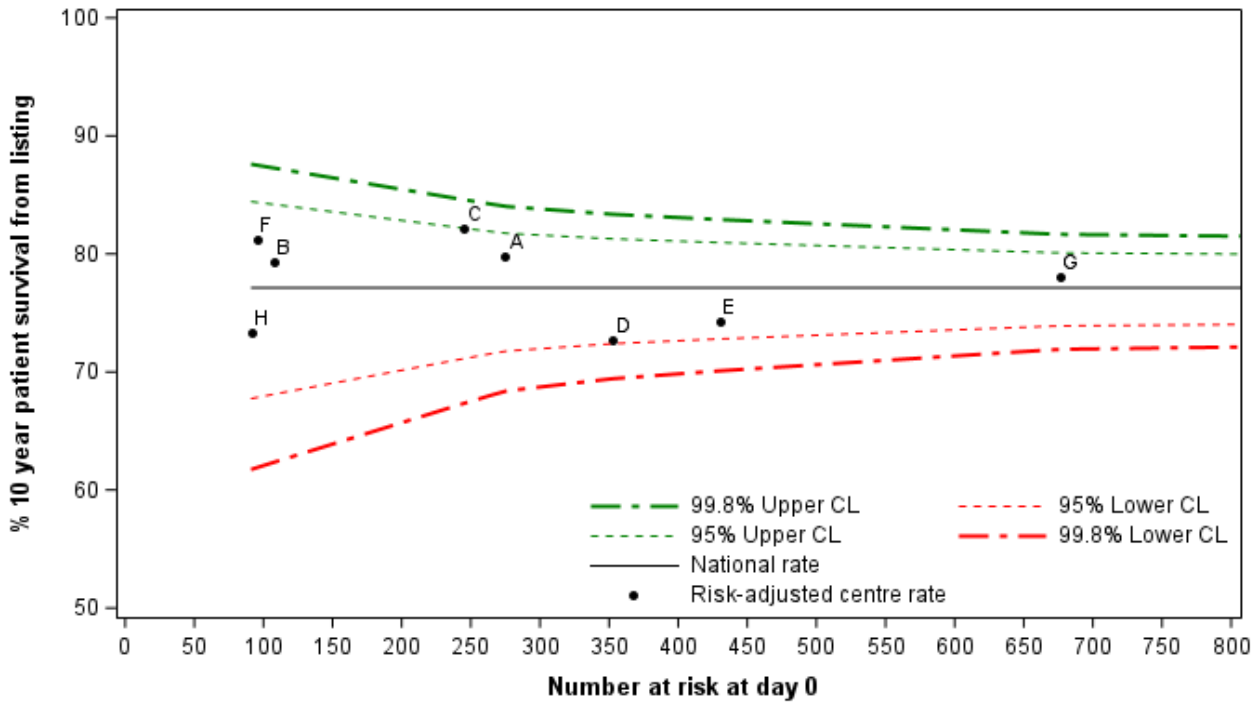


Table 7.1 Risk-adjusted 1, 5 and 10 year patient survival from listing for first deceased donor SPK transplant in patients registered between 1 January 2011 and 31 December 2022

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	275	97 (94-98)	245	86 (80-90)	121	80 (71-86)	19
Cardiff	B	107	99 (93-100)	97	90 (80-95)	49	79 (64-88)	11
Edinburgh	C	245	97 (94-99)	235	91 (85-94)	115	82 (74-88)	20
Guy's	D	352	96 (93-98)	328	85 (79-88)	177	73 (65-79)	31
Manchester	E	430	97 (95-98)	385	86 (81-89)	164	74 (67-80)	23
Newcastle	F	95	97 (90-99)	86	87 (75-93)	45	81 (65-90)	6
Oxford	G	676	96 (94-97)	620	88 (84-90)	308	78 (73-82)	54
WLRTC	H	91	97 (90-99)	95	85 (72-92)	44	73 (55-84)	8
UK		**2271**	**97 (96-97)**	**2091**	**87 (85-88)**	**1023**	**77 (74-80)**	**172**

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 2022

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 2022 for the transplant record, and all requests for follow up forms issued in this time period. Centres highlighted are transplant centres. Overall, 75% of transplant record forms issued and 70% of lifetime follow-up forms issued have been returned. Of the transplant centres, WLRTC has the lowest lifetime follow-up form return rate of 8%, although the majority of the missing forms are for follow-up six years or longer post-transplant. Data as on the database at 19th June 2023.

Table 8.1 Form return rates following pancreas transplantation, by centre, 1 January - 31 December 2022

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	90
Airdrie, Monklands District General Hospital							6	17
Bangor, Ysbyty Gwynedd District General Hospital							9	11
Basildon, Basildon Hospital							6	83
Belfast, Antrim Hospital							3	100
Belfast, Belfast City Hospital							6	100
Belfast, The Ulster Hospital							2	0
Birmingham, Birmingham Heartlands Hospital							14	14
Birmingham, Queen Elizabeth Hospital Birmingham					2	0	54	0
Bodelwyddan, Glan Clwyd District General Hospital							1	0
Bradford, St Lukes Hospital					1	100	12	92
Brighton, Royal Sussex County Hospital					1	100	24	100
Bristol, Southmead Hospital							34	85
Cambridge, Addenbrookes Hospital	13	100	15	100	14	100	140	91
Canterbury, Kent And Canterbury Hospital			3	100	3	100	39	97
Cardiff, University Of Wales Hospital	10	90	10	100	3	33	68	85
Carlisle, Cumberland Infirmary							4	75
Carshalton, St Helier Hospital					1	100	19	100
Chester, Countess Of Chester Hospital							3	0
County Down, Daisy Hill Hospital							6	100
Coventry, University Hospital (walsgrave)							29	100
Derby, Royal Derby Hospital					1	100	16	88
Doncaster, Doncaster Royal Infirmary					1	100	7	100
Dorchester, Dorset County Hospital			1	100	2	50	36	47
Douglas, Nobles I-o-m Hospital							5	0
Dudley, Russells Hall Hospital							4	0
Dulwich, Kings College							2	0
Dumfries, Dumfries And Galloway Royal Infirmary							3	67
Dundee, Ninewells Hospital							21	5
Edinburgh, Royal Infirmary Of Edinburgh	14	79	13	92	11	100	63	73
Exeter, Royal Devon And Exeter Hospital (Wonford)			1	100			24	63
Glasgow, Queen Elizabeth University Hospital							32	0
Gloucester, Gloucestershire Royal Hospital							19	37
Hereford, The County Hospital					1	100	5	80
Hull, The Hull Royal Infirmary					1	100	18	100
Inverness, Raigmore Hospital							15	93
Ipswich, Ipswich Hospital							4	0
Kilmarnock, Crosshouse Hospital							8	88
Kirkcaldy, Victoria Hospital							3	33
Larbert, Forth Valley Royal Hospital							5	0

Table 8.1 Form return rates following pancreas transplantation, by centre, 1 January - 31 December 2022

Centre	Transplant record		3 month follow-up		12 month follow-up		Lifetime follow-up	
	N	% returned	N	% returned	N	% returned	N	% returned
Leeds, St James's University Hospital							23	100
Leicester, Leicester General Hospital			1	100			26	92
Lincoln, Lincoln County Hospital					1	100	5	100
Liverpool, Royal Liverpool University Hospital							8	75
Liverpool, University Hospital Aintree							1	0
London, Guys Hospital	23	39	13	92	3	33	144	89
London, Kings College Hospital					2	0	2	0
London, St Georges Hospital							6	17
London, The Royal Free Hospital			1	0	1	100	44	73
London, The Royal London Hospital (Whitechapel)			3	0	3	0	18	39
Manchester, Manchester Royal Infirmary	20	75	22	100	20	95	90	96
Middlesbrough, The James Cook University Hospital							13	85
Newcastle, Freeman Hospital	8	88	7	86	5	100	61	95
Northampton, Northampton General Hospital							24	25
Norwich, Norfolk And Norwich University Hospital					1	100	32	97
Nottingham, University Hospitals City Campus							39	0
Omagh, Tyrone County Hospital					1	0	2	0
Oxford, Churchill Hospital	35	83	38	95	24	83	144	88
Peterborough, Peterborough City Hospital							5	0
Plymouth, Derriford Hospital							24	83
Portsmouth, Queen Alexandra Hospital					1	100	57	98
Portsmouth, St Marys Hospital			1	100	2	100	8	88
Preston, Royal Preston Hospital					1	0	29	79
Reading, Royal Berkshire Hospital							31	100
Rhyl, Royal Alexandra Hospital							2	100
Salford, Salford Royal							17	53
Sheffield, Northern General Hospital							13	62
Shrewsbury, Royal Shrewsbury Hospital							6	50
St Helier, Jersey General Hospital							3	0
Stevenage, Lister Hospital			1	100			9	33
Stoke-on-trent, Royal Stoke University Hospital					1	0	16	50
Swansea, Morriston Hospital							21	86
Truro, Royal Cornwall Hospital (Treliske)							24	0
West London Renal Transplant Centre	5	60	7	100	4	0	86	8
Westcliff On Sea, Southend Hospital							4	25
Wirral, Arrowe Park Hospital							6	33
Wolverhampton, New Cross Hospital			1	100	1	100	32	100
Wrexham, Maelor General Hospital							13	62
York, York District Hospital					1	0	13	85
Overall	**128**	**75**	**138**	**93**	**115**	**78**	**1897**	**70**

Islet transplant list

9.1 Patients on the islet transplant list as at 31 March, 2014 – 2023

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 4% from 26 on 31 March 2022 to 25 on 31 March 2023. Of the 25, 52% (13) patients were registered for an SIK transplant.

Figure 9.1 Patients on the routine islet transplant list at 31 March

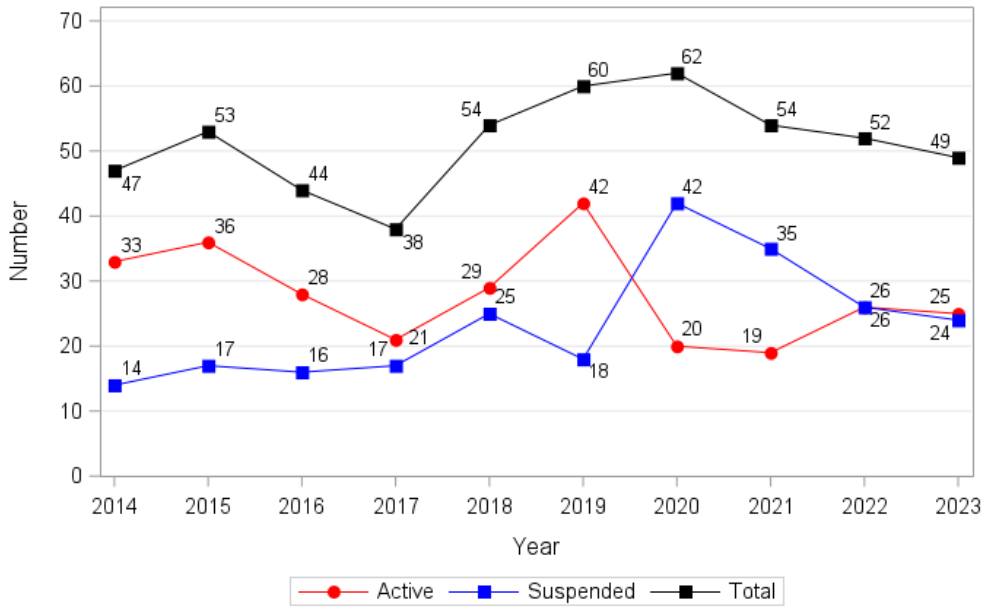


Figure 9.2 shows the number of patients on the active islet transplant list at 31 March 2023 by centre. Of the 25 patients on the active transplant list 36% were registered at Manchester, of which eight were SIK, 24% at Edinburgh (two SIK) and 20% at Oxford (three SIK).

Figure 9.2 Patients on the active islet transplant list at 31 March 2023, by centre

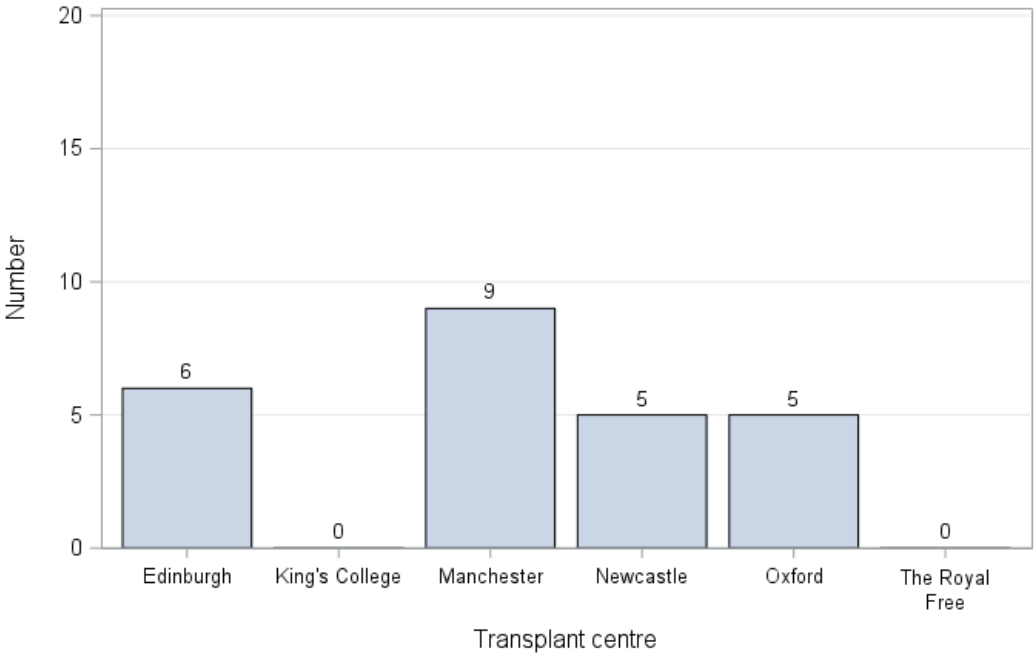
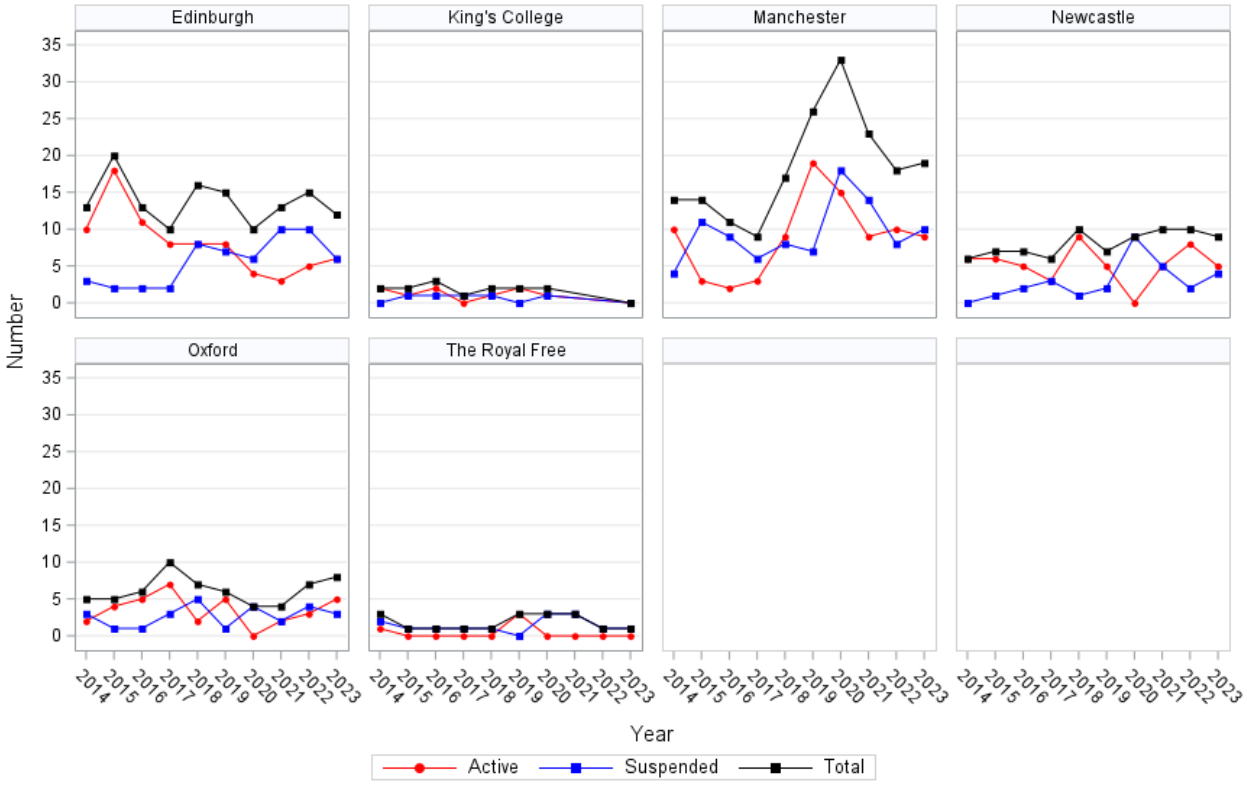


Figure 9.3 shows the number of patients on the islet transplant list at 31 March each year between 2014 and 2023 for each transplant centre. There have been very few patients registered at King's College or the Royal Free, in the time period.

Figure 9.3 Patients on the islet transplant list at 31 March, by centre



Bristol closed 31 March 2022 – patients referred to Oxford.

9.2 Post-registration outcomes, 1 April 2019 – 31 March 2020

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.

46% of patients were transplanted within one year, while three years after listing 59% of patients had received a transplant and 20% were removed from the list. It is important to note that the three-year period after registration for these patients included two-years impacted by the COVID-19 pandemic.

Figure 9.4 Post-registration outcome for 46 new islet registrations made in the UK, 1 April 2019 - 31 March 2020

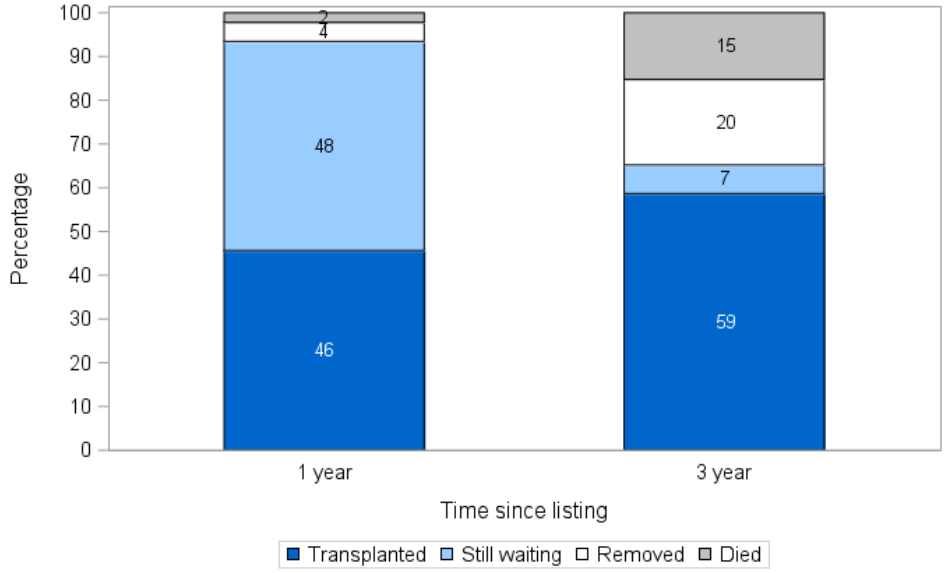
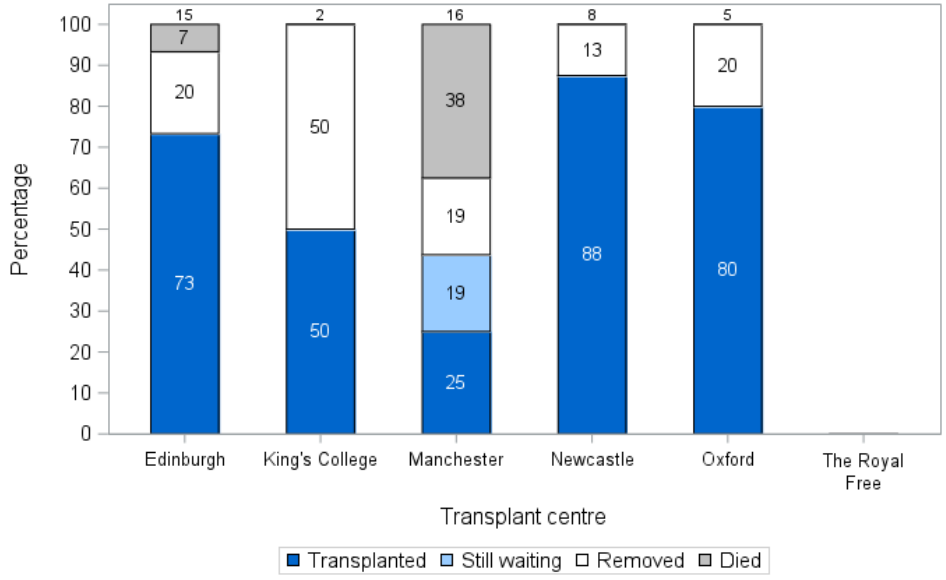


Figure 9.5 shows the proportion of patients transplanted or still waiting three years after joining the list by centre. Over half the centres have very small numbers of patient registrations in this time period so the figures should be interpreted with caution. Of those centres with patients registered in this time period, the majority transplanted 50% or more of their patients within three years. 7% and 38% of patients died whilst waiting for an islet transplant at Edinburgh and Manchester, respectively. The Royal Free had no patients registered in the time period.

Figure 9.5 Three-year post-registration outcome for 46 new islet registrations made in the UK, 1 April 2019 - 31 March 2020, by centre



9.3 Demographic characteristics, 1 April 2022 – 31 March 2023

The sex and age group of patients registered on the islet transplant list during 2022/23 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 (54%) and the median age was 51 years.

Figure 9.6 Registrations on the active routine islet transplant list, 1 April 2022 - 31 March 2023, by centre and sex

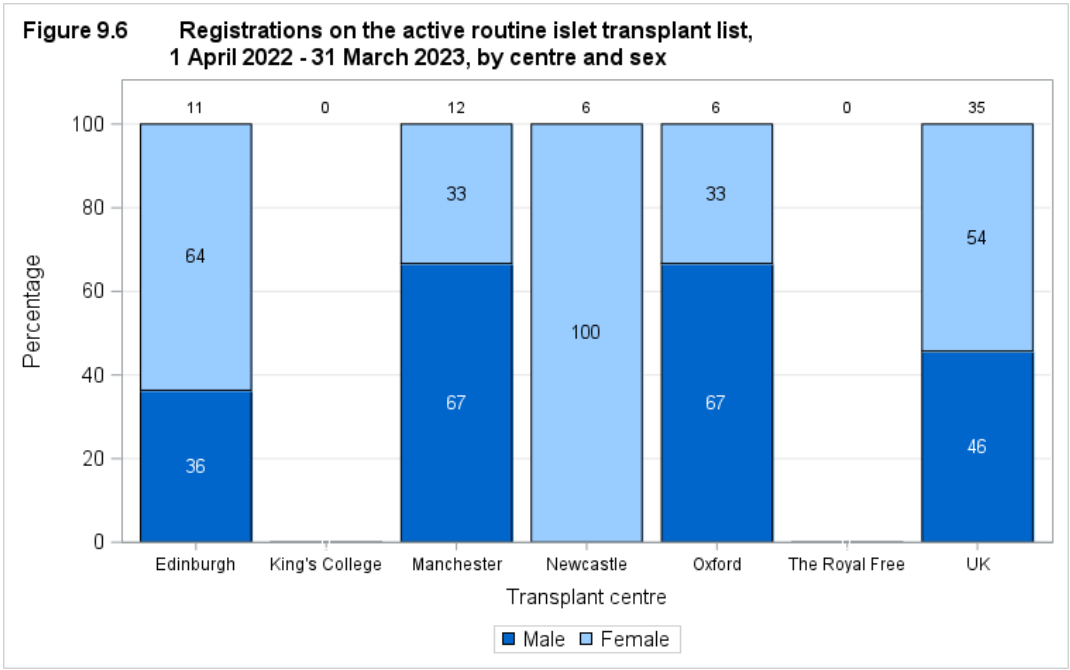
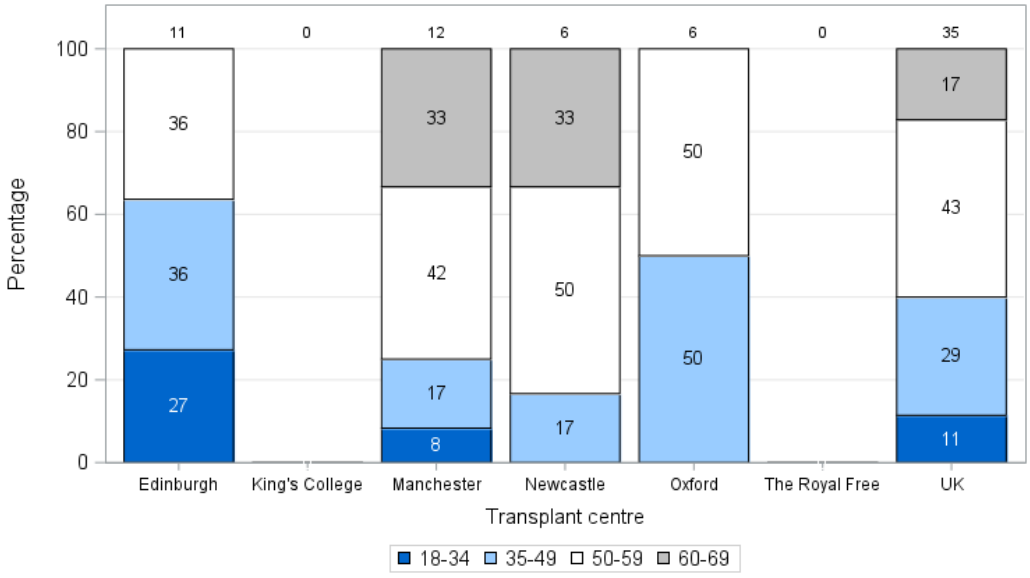


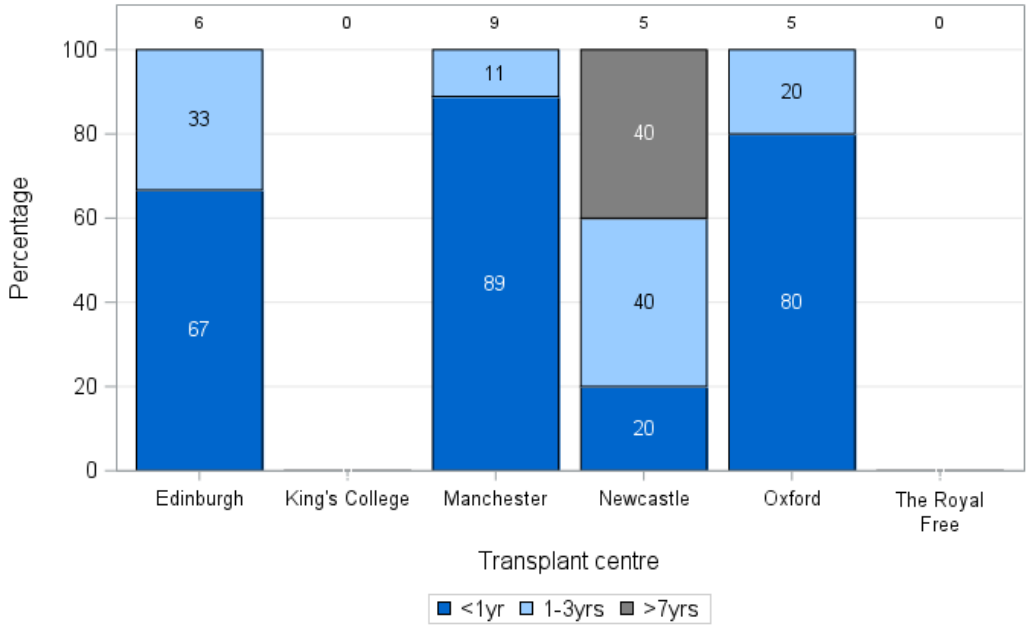
Figure 9.7 Registrations on the active routine islet transplant list, 1 April 2022 - 31 March 2023, by centre and age group



9.4 Patient waiting times for those currently on the list, 31 March 2023

Figure 9.8 shows the length of time patients have been waiting on the islet transplant list at 31 March 2023 by centre.

Figure 9.8 Patients on the active routine islet transplant list as at 31 March 2023, by centre and grouped waiting time



9.5 Median active waiting time to transplant, 1 April 2017 - 31 March 2021

The length of time a person waits for routine islet transplant varies across the UK. The median active 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 active waiting time to transplant for patients registered on the islet transplant list between 1 April 2017 and 31 March 2021 is 318 days (around 10 months). The median active waiting time is not shown where less than 10 patients are registered.

Figure 9.9 Median active waiting time to deceased donor transplant for routine registered patients on the islet transplant list, 1 April 2017 - 31 March 2021

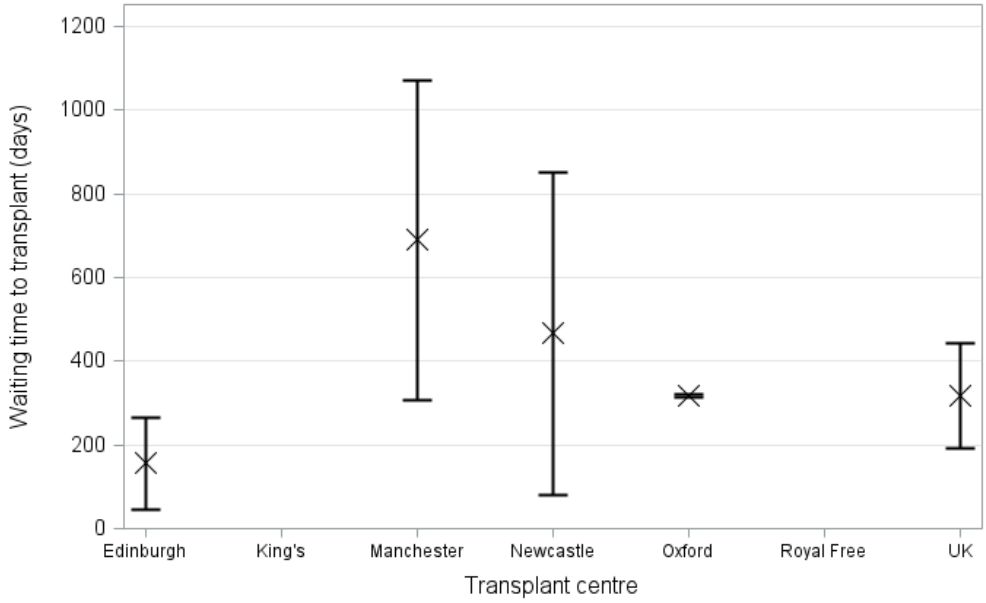


Table 9.1 Median active waiting time to islet transplant in the UK, for patients registered 1 April 2017 - 31 March 2021

Transplant centre	Number of patients registered	Waiting time (days) Median	95% Confidence interval
Edinburgh	38	156	45 - 267
King's	5	-	.
Manchester	52	689	308 - 1070
Newcastle	18	467	82 - 852
Oxford	11	317	314 - 320
Royal Free	2	-	.
UK	**126**	**318**	**192 - 444**

- Data not presented when less than 10 patients registered

Response to islet offers

10.1 Offer decline rates, 1 April 2020 – 31 March 2023

Islet offers from DBD donors whose pancreas was retrieved, offered directly on behalf of a named individual person 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, 1 April 2020 and 31 March 2023 are shown in **Table 10.1**. Edinburgh had the lowest overall decline rate (13%) whilst Oxford had the highest decline rate (60%). Edinburgh had an offer decline rate better than the national average. King's College and Royal Free had no patients registered and received no offers in this time period.

Figure 10.1 DBD donor islet offer decline rates for pancreases that resulted in an islet transplant, 1 April 2020 and 31 March 2023

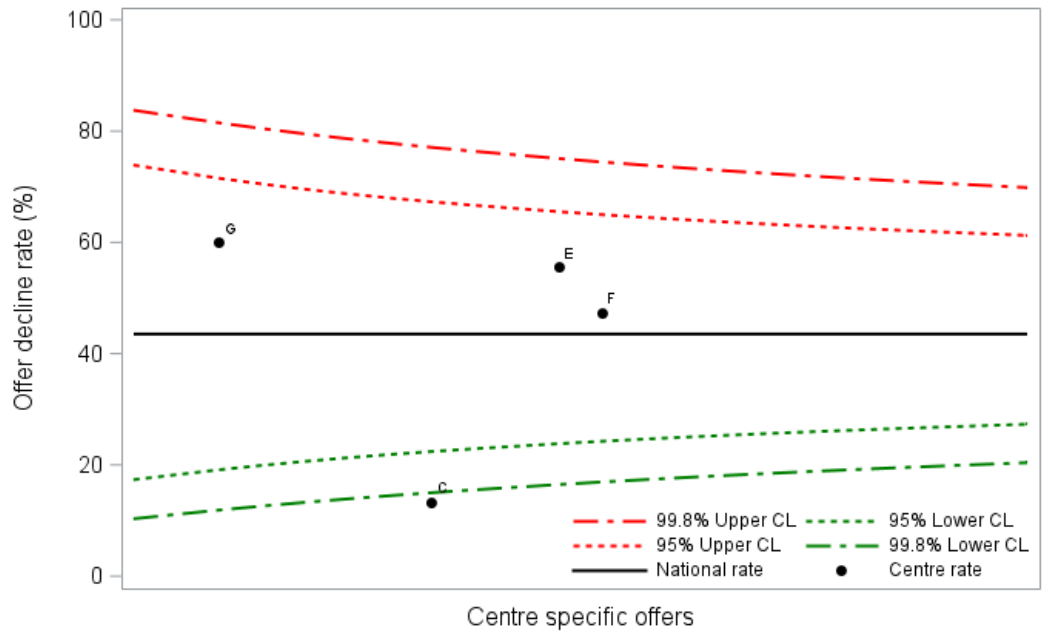


Table 10.1 DBD donor islet offer decline rates by transplant centre, 1 April 2020 and 31 March 2023

Centre	Code	2020/21		2021/22		2022/23		Overall	
		N	(%)	N	(%)	N	(%)	N	(%)
Edinburgh	C	5	(40)	7	(0)	3	(0)	15	(13)
King's	J	0	-	0	-	0	-	0	-
Manchester	E	4	(75)	7	(71)	7	(29)	18	(56)
Newcastle	F	6	(33)	7	(57)	6	(50)	19	(47)
Oxford	G	2	(0)	7	(86)	1	(0)	10	(60)
Royal Free	K	0	-	0	-	0	-	0	-
UK		**17**	**(41)**	**28**	**(54)**	**17**	**(29)**	**62**	**(44)**

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 2013 – 31 March 2023

Figure 11.1 shows the total number of islet transplants performed in the last ten financial years, by type of donor. Since 2013/14, the number of islet transplants has fluctuated around 30 each year apart from the last three years, following the COVID-19 pandemic.

Figure 11.1 Islet transplants,1 April 2013 - 31 March 2023, by financial year and donor type

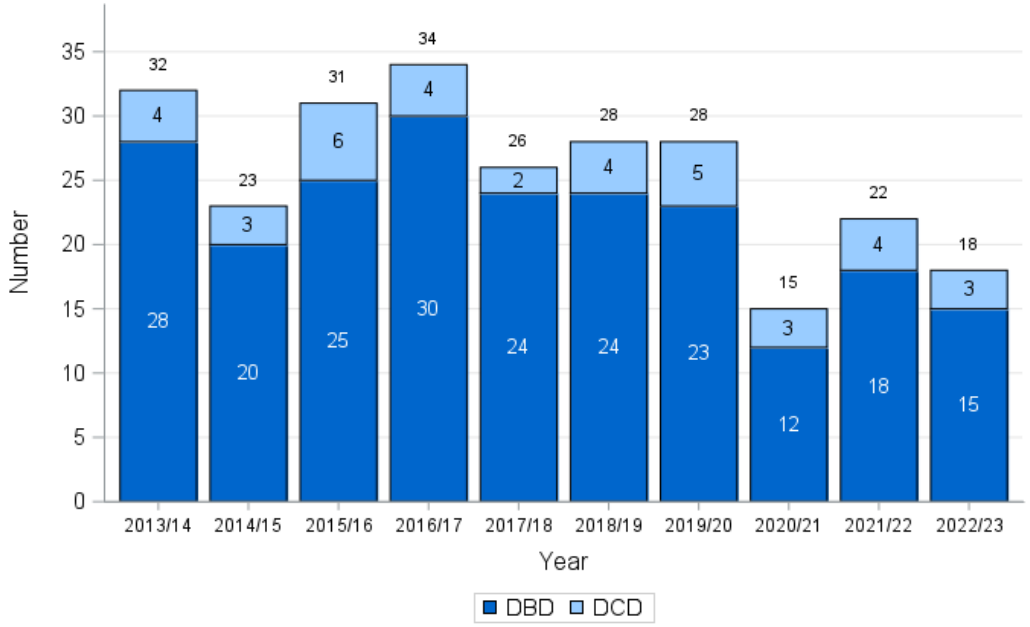


Figure 11.2 shows the total number of islet transplants performed in 2022/23, by centre and type of donor. The same information is presented in **Figure 11.3** but this shows the proportion of DBD and DCD transplants performed at each centre. Edinburgh performed the most islet transplants in 2022/23 (nine), followed by Manchester (five). Edinburgh was the only centre to perform DCD as well as DBD transplants. Royal Free and King's did not perform any islet transplants in 2022/23.

Figure 11.2 Islet transplants, 1 April 2022 - 31 March 2023, by centre and donor type

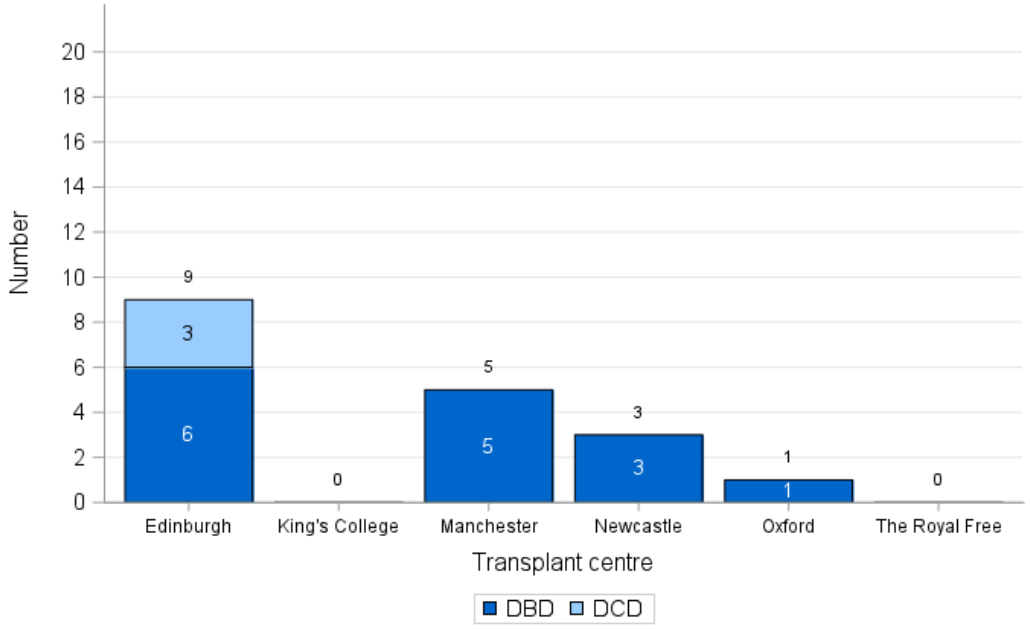


Figure 11.3 Islet transplants, 1 April 2022 - 31 March 2023, by centre and donor type

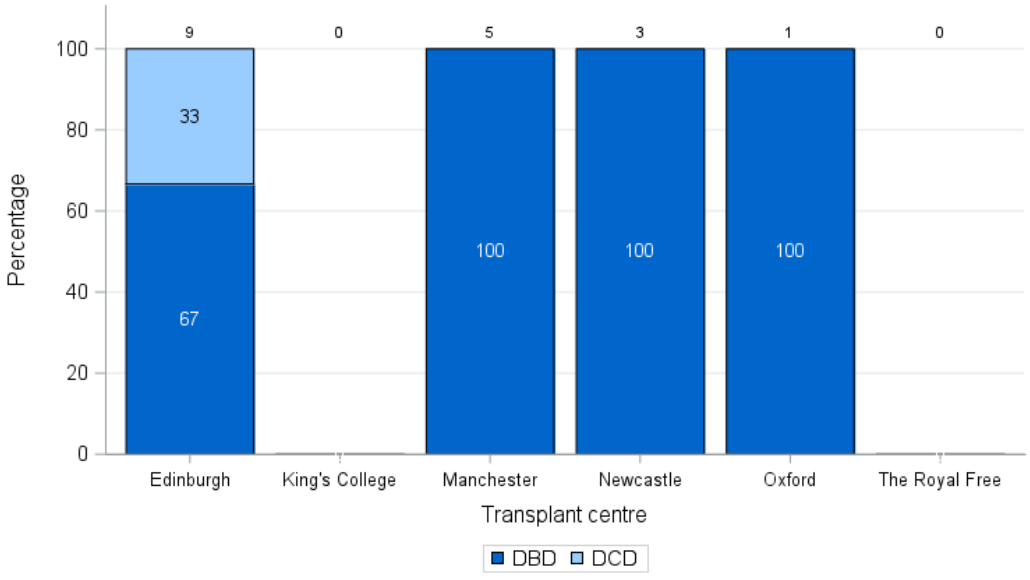
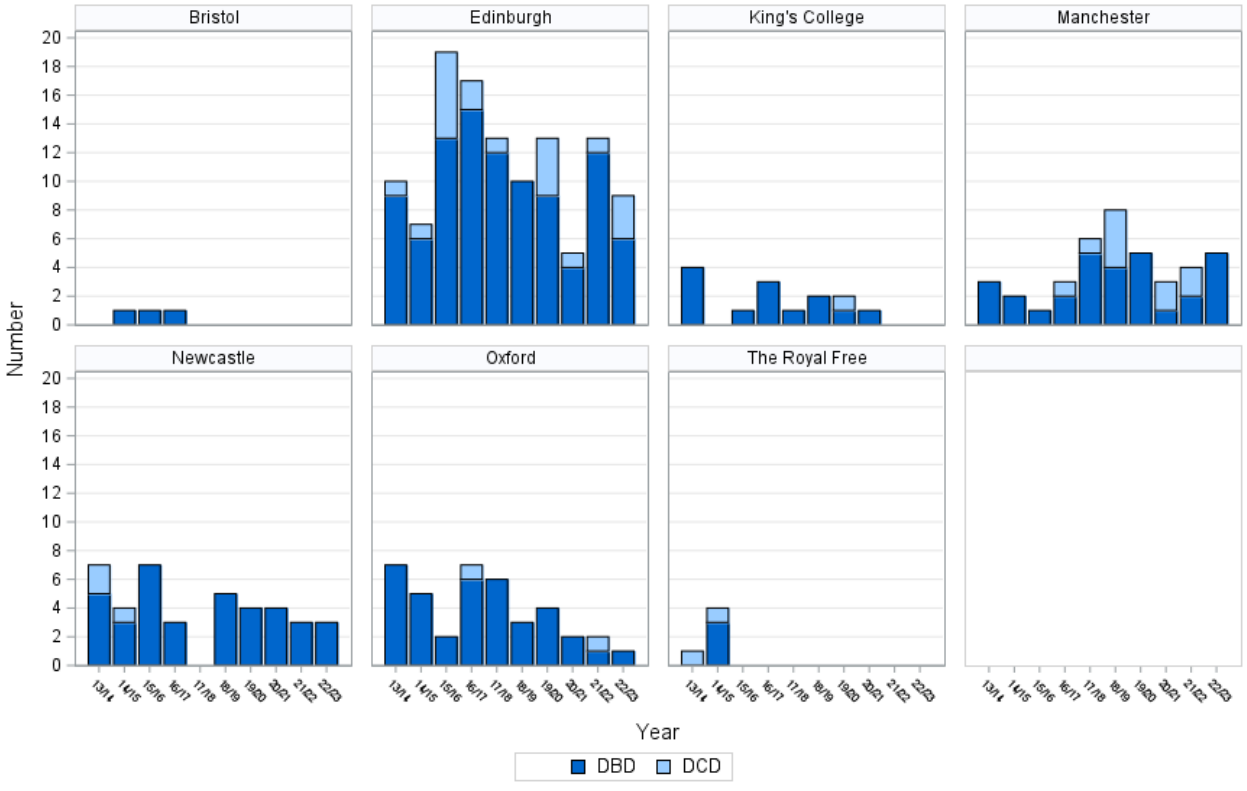


Figure 11.4 shows the total number of islet transplants performed in last ten years, by centre and type of donor. Oxford and Manchester have consistently performed a number of islet transplants each year. Edinburgh have consistency performed the most transplants each year. Bristol are no longer performing islet transplants and have been referring patients to Oxford. Royal Free have performed no islet transplant in the last eight years.

Figure 11.4 Islet transplants, 1 April 2008 - 31 March 2023, by centre, financial year and donor type



Bristol closed 31 March 2022 – patients referred to Oxford.

11.2 Demographic characteristics, 1 April 2022 - 31 March 2023

The sex, age group, sensitisation group (cRF%) and matchability points score group of patients that received an islet transplant in 2022/23 are shown by centre in **Figures 11.5**, **11.6**, **11.7** and **11.8** respectively. Note that all percentages quoted are based only on data where relevant information was available. Overall, 18 patients were transplanted on the islet transplant list, the median age was 51 years, the majority were female 10 (56%), 61% had a sensitisation of less than 10 and 11% were in the difficult to match group

Figure 11.5 Islet transplants, 1 April 2022 - 31 March 2023, by centre and sex

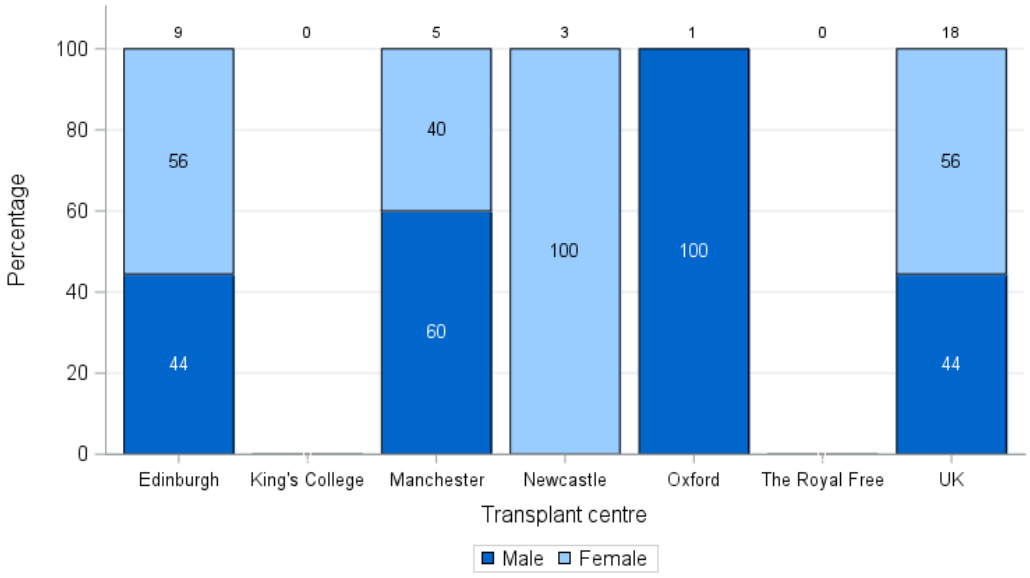


Figure 11.6 Islet transplants, 1 April 2022 - 31 March 2023, by centre and age group

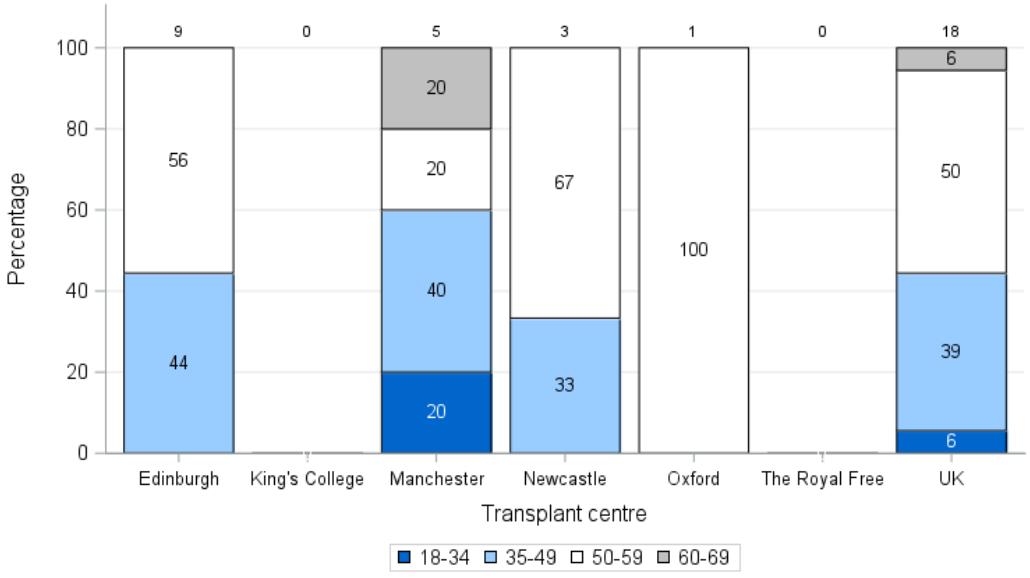


Figure 11.7 Islet transplants, 1 April 2022 - 31 March 2023, by centre and sensitisation (cRF%) group

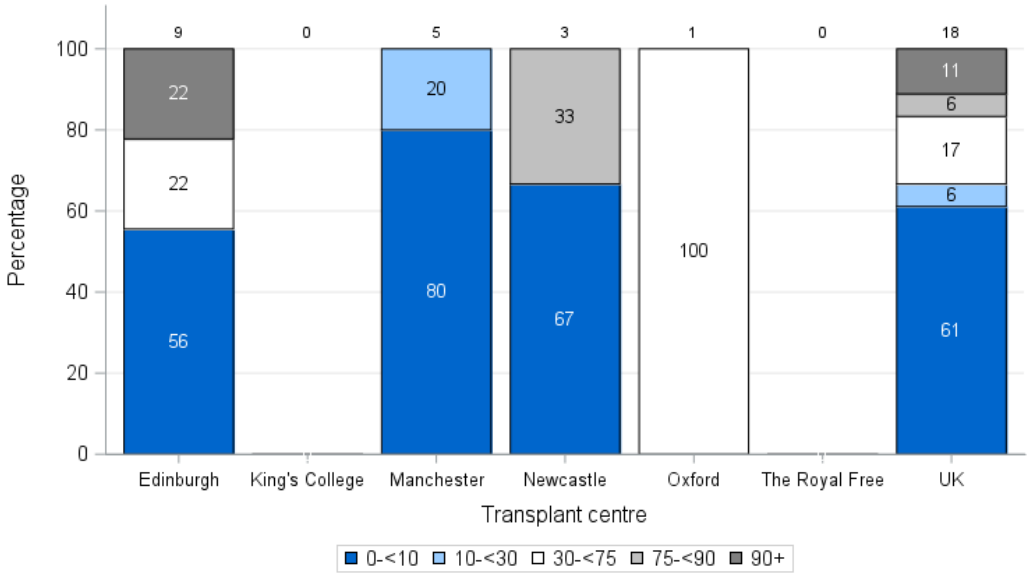
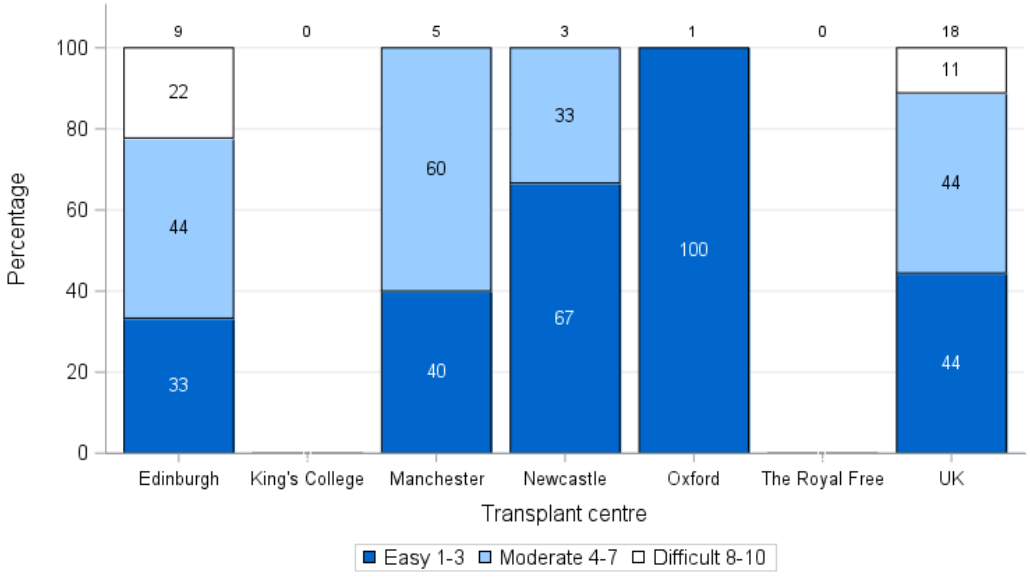


Figure 11.8 Islet transplants, 1 April 2022 - 31 March 2023, by centre and matchability group



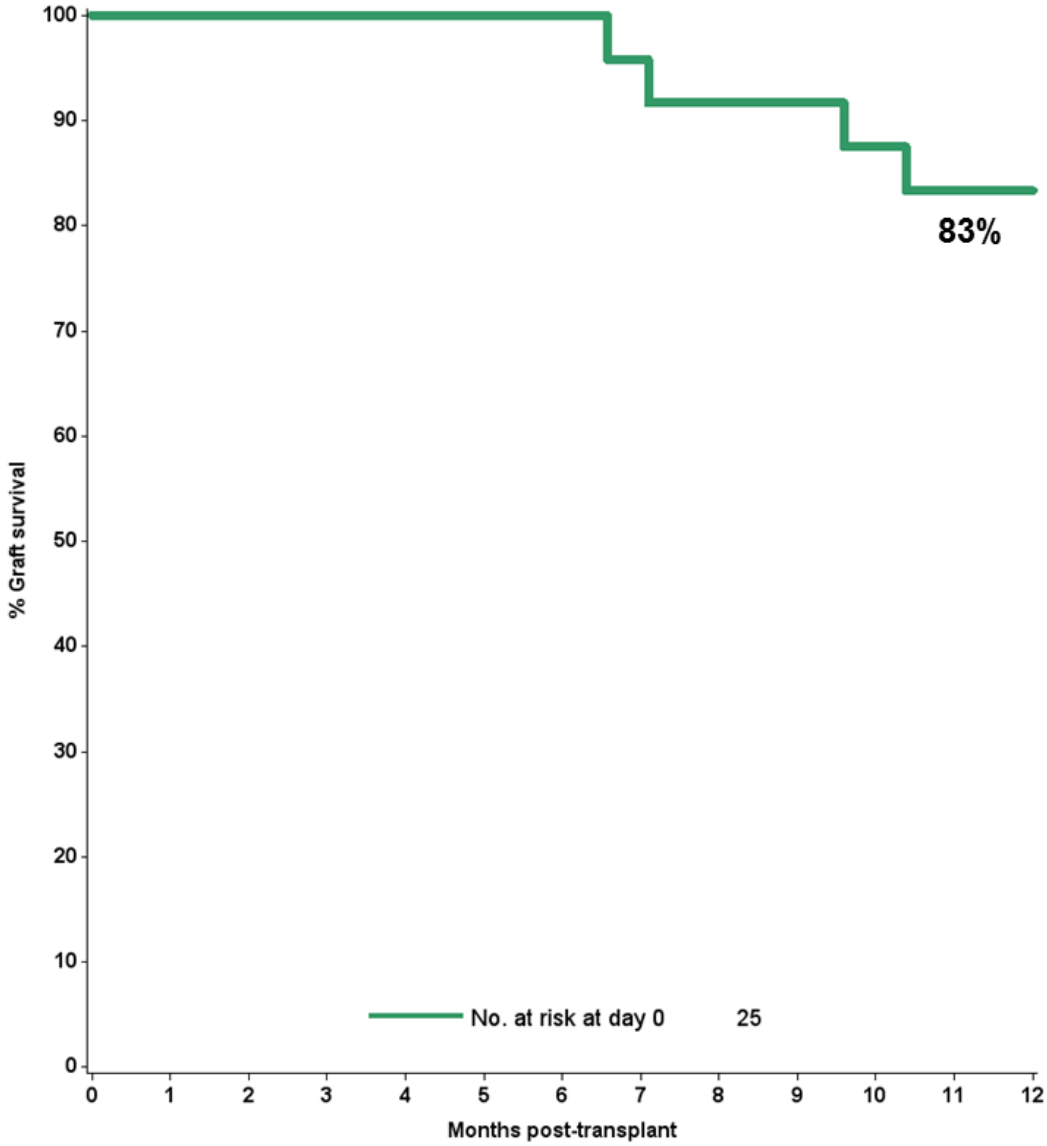
Islet outcomes

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 2013 and 31 March 2022.

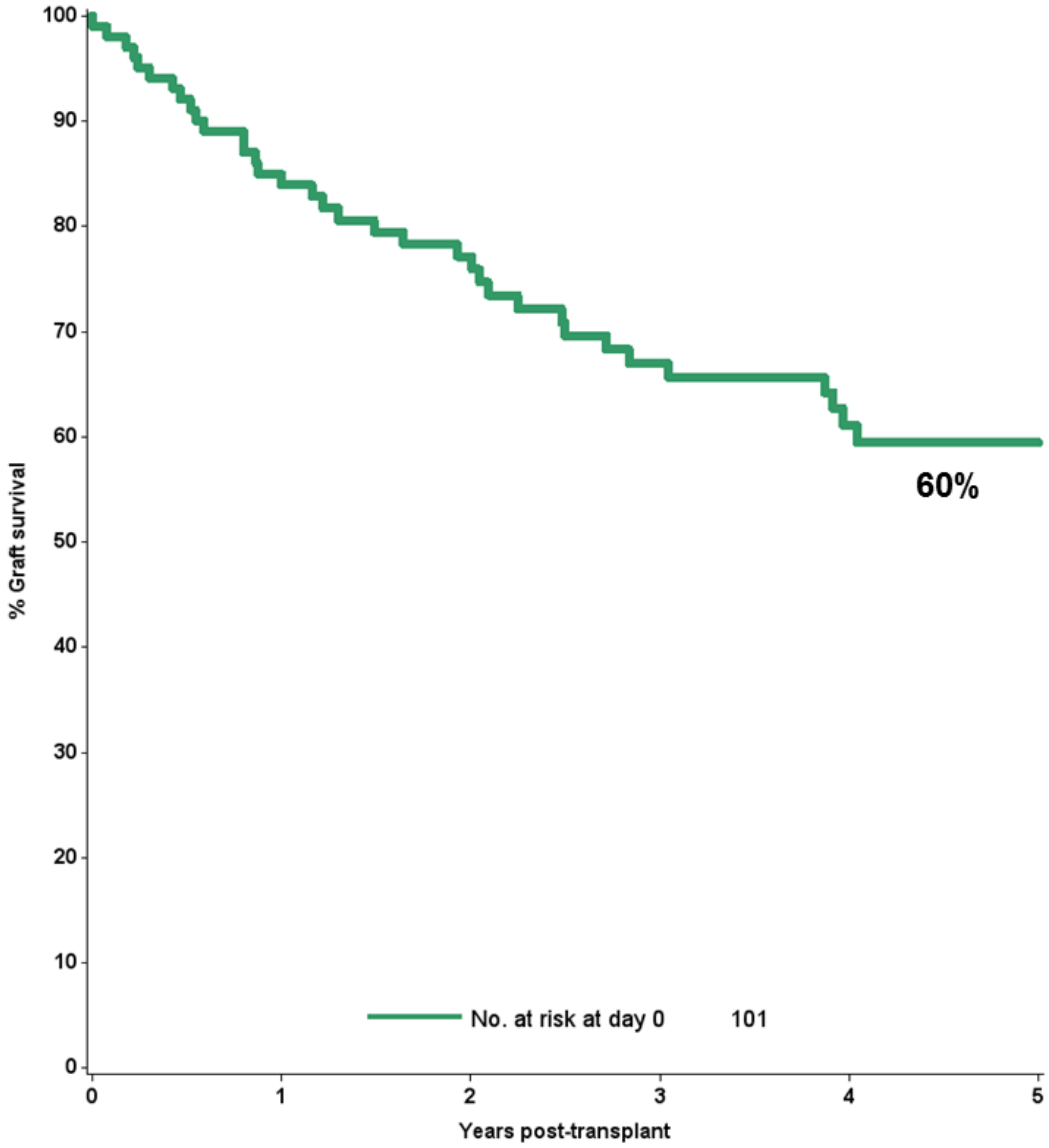
A one-year Kaplan-Meier graft survival plot for islet transplants between 1 April 2018 – 31 March 2022 is shown in **Figure 12.1**. Estimated one-year graft survival following a routine islet transplant is 83% with 95% confidence interval (CI) (62-93%). This includes patients who received only a routine 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 2018 and 31 March 2022



A five-year Kaplan-Meier graft survival plot for islet transplants between 1 April 2013 – 31 March 2022 is shown in **Figure 12.2**. Estimated five-year graft survival following a routine islet transplant is 60% with 95% CI (48-69%). This includes patients who received only a routine graft and those who additionally received a priority graft.

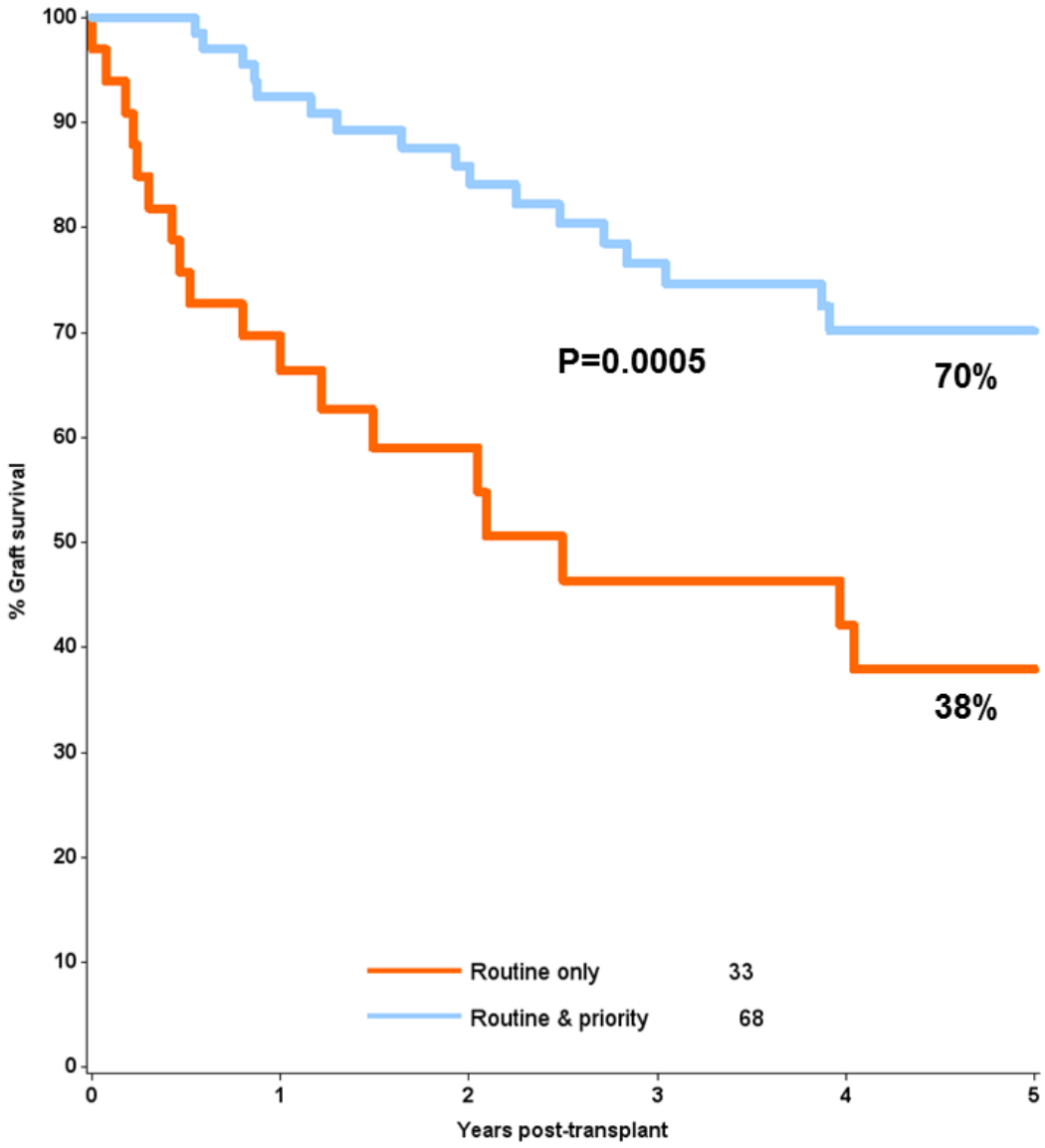
Figure 12.2 Five-year graft survival following first routine islet transplant between 1 April 2013 and 31 March 2022



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 2013 – 31 March 2022. **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 38% for routine only grafts, 95% CI (20-56%) and for routine followed by priority grafts is 70%, 95% CI (56-80%). This difference was statistically significant, p=0.0005.

Figure 12.3 Five-year graft survival following routine islet transplantation, by type of graft, between 1 April 2013 and 31 March 2022



Estimated five-year graft survival (for islet transplant, where the routine graft was functioning at one year) is 57% for routine only grafts, 95% CI (30-77%) and for routine followed by priority grafts is 76%, 95% CI (61-86%). This difference was not statistically significant, p=0.1601.

Figure 12.4 **Five-year graft survival following routine islet transplantation, where the routine graft was functioning at one year, between 1 April 2013 and 31 March 2022**

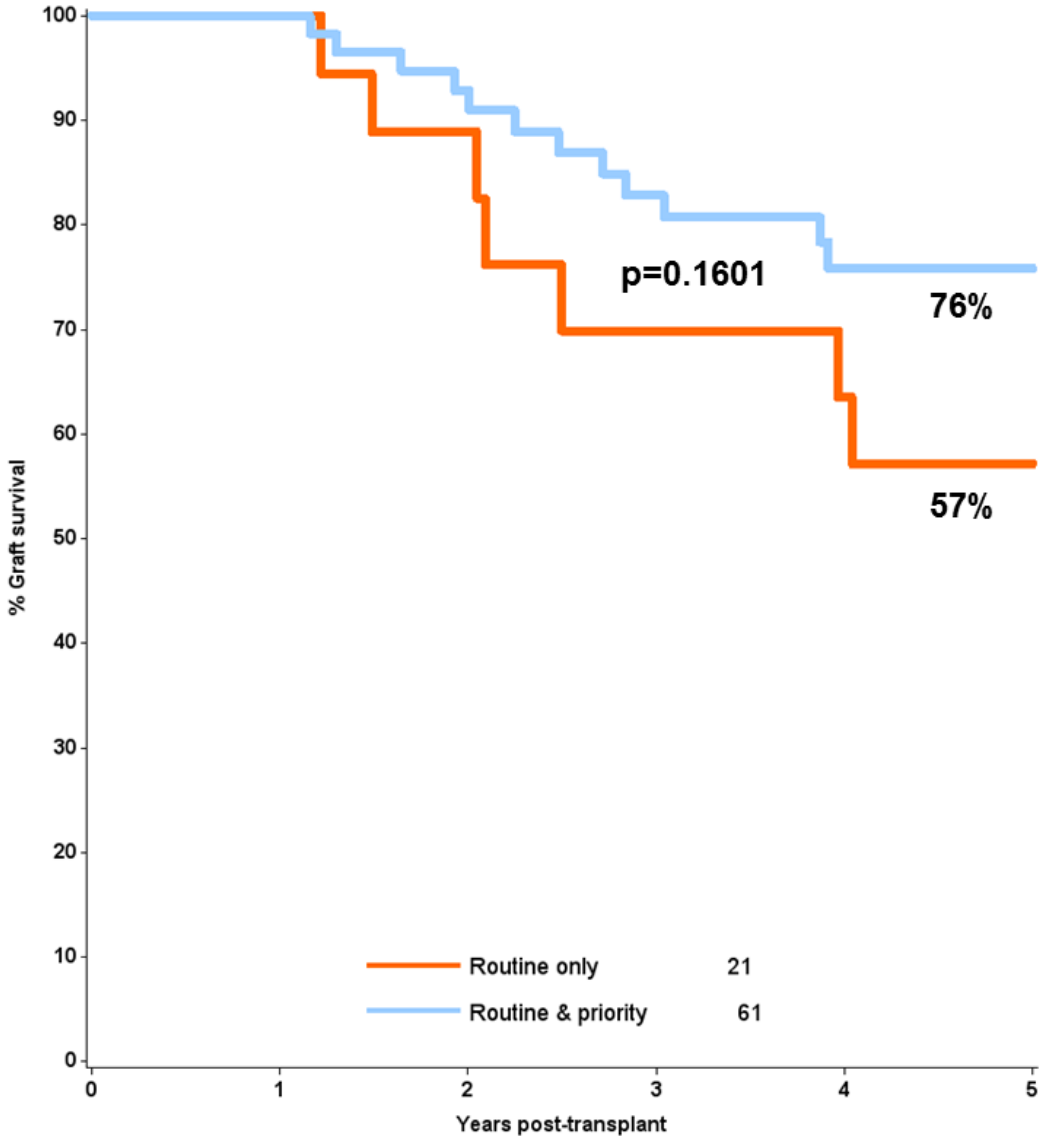


Figure 12.5 shows, for routine islet only transplants between 1 April 2018 – 31 March 2022, the median annual rate of severe hypoglycaemic events, at registration, prior to transplant (reported as number of events between registration and transplant) and at one-year post-transplant. Of the 19 patients where the number of severe hypoglycaemic events at one-year post-transplant was available, 16 (84%) experienced no severe hypoglycaemic events, two (11%) experienced one event and one (5%) experienced four events.

Figure 12.5 Median annual rate of severe hypoglycaemic events for routine islet only transplants, 1 April 2018 to 31 March 2022

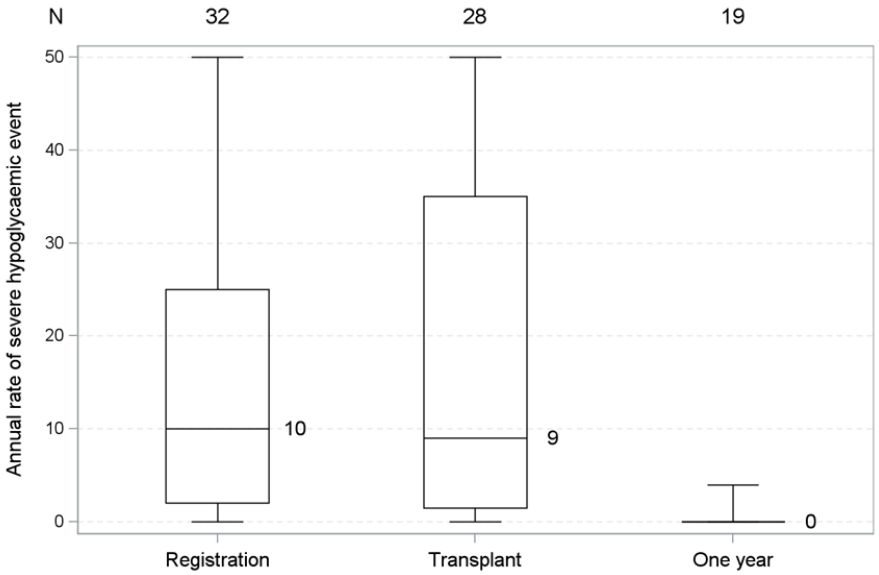


Figure 12.6 shows the reduction in median HbA1c (mmol/mol) for routine islet only transplants between 1 April 2018 – 31 March 2022. Median HbA1c dropped from 65mmol/mol prior to transplant to 58mmol/mol at one-year post-transplant. Of those 24 patients with HbA1c reported at one-year, 8 (33%) had an HbA1c less than 53mmol/mol.

Figure 12.6 Median HbA1c (mmol/mol) for routine islet only transplants, 1 April 2018 to 31 March 2022

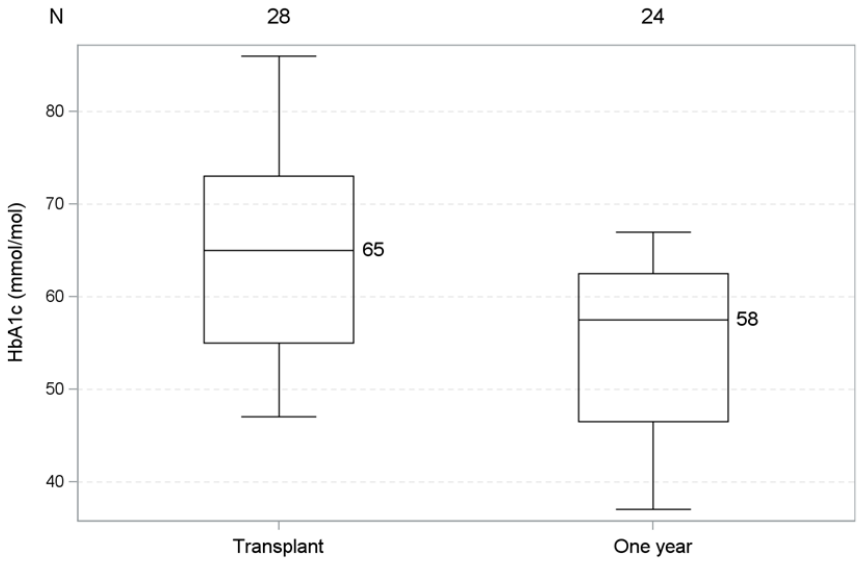
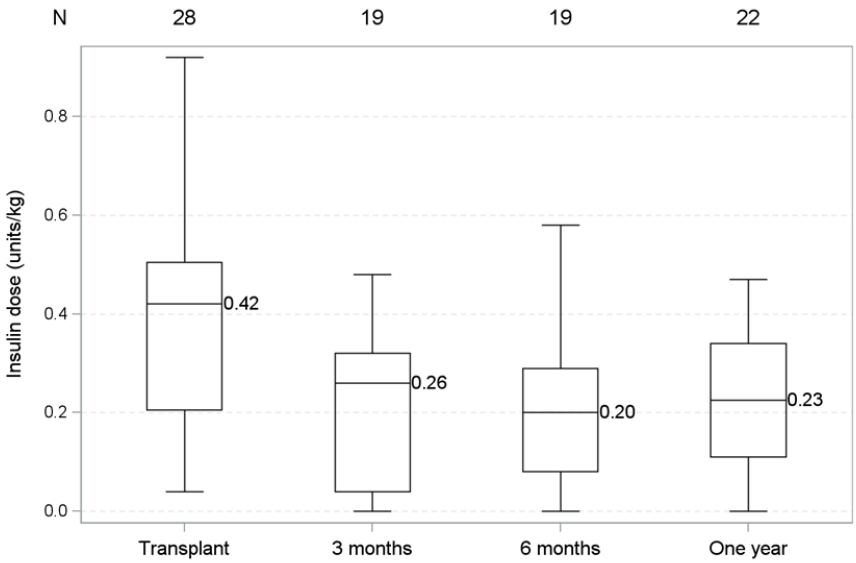


Figure 12.7 shows the median insulin dose per kilo recipient body weight at three-months, six-months and one-year post-transplant, for routine islet only transplants between 1 April 2018 – 31 March 2022. Prior to transplant the median insulin dose is 0.42 units/kg, by six-months the median dose has dropped to 0.20 units/kg and then increased slightly at one-year post-transplant with a median dose of 0.23 units/kg. Following islet transplantation, of the 16 patients where information was reported, 6 (38%) 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 2018 to 31 March 2022



Form return rates

13.1 Islet form return rates, 1 January – 31 December 2022

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 2022 for the transplant record, and all requests for follow-up forms issued in this time period. Centres highlighted are transplant centres. There were 94% of transplant record and 67% of lifetime follow-up forms returned. 86% of 3-month and 92% of 12-month follow-up forms were returned. Of the transplant centres, London, Kings College Hospital and London, The Royal Free Hospital had the lowest lifetime follow-up return rate of 0%.

Table 13.1 Form return rates following islet transplantation, by centre, 1 January - 31 December 2022

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	11	100	4	75	4	100	17	100
London, Kings College Hospital	-	-	-	-	-	-	4	0
London, The Royal Free Hospital	-	-	-	-	-	-	4	0
Manchester, Manchester Royal Infirmary	5	80	2	100	3	100	10	70
Newcastle, Freeman Hospital	1	100	1	100	4	100	9	78
Oxford, Churchill Hospital					2	50	9	44
Overall	**17**	**94**	**7**	**86**	**13**	**92**	**55**	**67**

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.

Fixed effects
A fixed effects model is a type of statistical model that is used to estimate the effect of one or more categorical variables on a continuous outcome variable, while controlling for other variables. In a fixed effects model, the categorical variables are assumed to be fixed and not a random sample from a larger population. Therefore, the model is able to estimate the effect of these variables on the outcome variable, while controlling for any other variables that may be influencing the outcome.

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) survival

1 and 5 year patient survival	Recipient age, donor type and waiting time
1 and 5 year graft survival	Recipient age, 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, sex, 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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