NHS
Blood and Transplant

INTERIM REPORT ON PANCREAS AND ISLET TRANSPLANTATION

5 YEAR REPORT
(1 OCTOBER 2016 – 30 SEPTEMBER 2021)

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PRODUCED IN COLLABORATION WITH NHS ENGLAND

Contents

Executive Summary

This report presents key figures about pancreas and islet transplantation in the UK. The period reported covers five years of pancreas and islets transplant data, from 1 October 2016. The report presents information on the number of pancreas and islet transplants as well as survival analysis after first simultaneous pancreas and kidney and pancreas only transplantation on a national and centre-specific basis.

Key findings

- On the 30 September 2021, there were 299 patients on the UK active pancreas and islet transplant list, which represents a 121% increase in the number of patients from one year earlier, due to centres reactivating patients following the COVID-19 pandemic. The number of patients on the active pancreas list increased by 116% to 270 and the active islet transplant list increased by 190% to 29 patients between 30 September 2020 and 2021.

- There were 59 pancreas transplants and 13 islet transplants performed in the UK in the six months from April to September 2021. Of these 72 transplants, 78% of transplants were from donations after brain death. In the year 1 October 2020 to 30 September 2021, 22% of pancreas and islet transplants were from donations after circulatory death.

- The median waiting time for patients registered, between 1 October 2015 to 30 September 2019, for a pancreas transplant in the UK was 352 days (95% confidence interval (CI) 326 - 378 days). The median ranged from 208 to 543 days depending on which centre the patient was registered at. The median waiting time for a routine islet (including simultaneous islet and kidney) transplant for patients registered in the same time frame was 631 days (95% CI 338 - 924 days).

- The national rates of graft survival one- and five-years after first simultaneous pancreas and kidney transplant from deceased donors are 93% and 82%, respectively. These rates vary between centres, ranging from 85% to 100% at one-year and 71% to 97% at five-years. All centre rates are risk-adjusted.

- The national rates of patient survival one- and five-years after first simultaneous pancreas and kidney transplant from deceased donors are 99% and 90%, respectively. These rates vary between centres, ranging from 97% to 100% at one-year and 81% to 96% at five-years. All centre rates are risk-adjusted.

- The national rates of graft survival one- and five-years after first pancreas only transplant from deceased donors are 91% and 60%, respectively. The national rates of patient survival one- and five-years are 100% and 89%. Centre specific estimates of these rates must be interpreted with caution due to the small number of transplants upon which they are based.

Introduction

This report presents information on pancreas and islet transplant activity between 1 October 2016 and 30 September 2021, for all eight centres performing pancreas transplantation and all seven centres performing islet transplantation in the UK.

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 October 2016 to 30 September 2020 and five-year post-transplant for the period 1 October 2012 to 30 September 2016.

The centre specific results for survival estimates after first simultaneous pancreas and kidney transplants are adjusted for differences in risk factors between the centres. The risk models used are described in the Appendix.

Methods used are also described in the Appendix.

Patients requiring multi-organ transplants (except SPK and SIK) are excluded from all analyses apart from in the introduction. All results are described separately for pancreas and islet patients other than those presented in the 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 and 30 September 2020 and 31 March 2021, do not accurately reflect the need for pancreas and islet transplantation due to the COVID-19 pandemic. Different practices were established across the UK centres with regards to waiting list management.

Figure 2.1 shows the number of patients on the pancreas and islet transplant list at 31 March and 30 September each year from 2017 to 2021. Overall the number of patients actively waiting for a pancreas or islet transplant has increased this year, from 135 at 30 September 2020 to 299 at 30 September 2021.

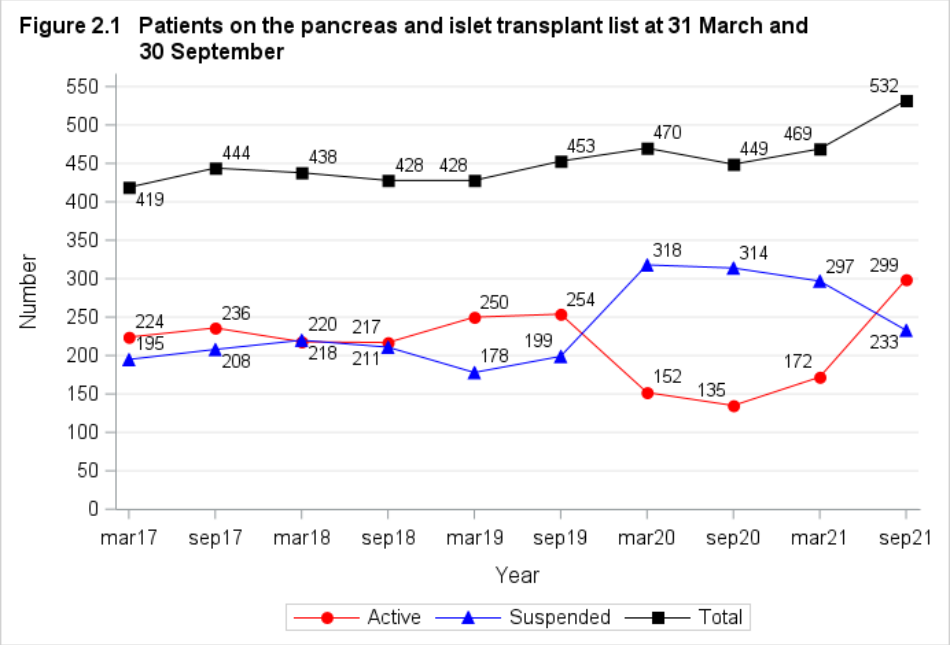


Figure 2.2 shows the number of patients on the pancreas and islet transplant list at 30 September 2021 for each transplant centre. Cambridge, Cardiff, Guy's and WLRTC only perform pancreas transplants while Bristol, King's College and The Royal Free only perform islet transplants. Oxford had the largest transplant list with 89 patients registered for a pancreas or islet transplant.

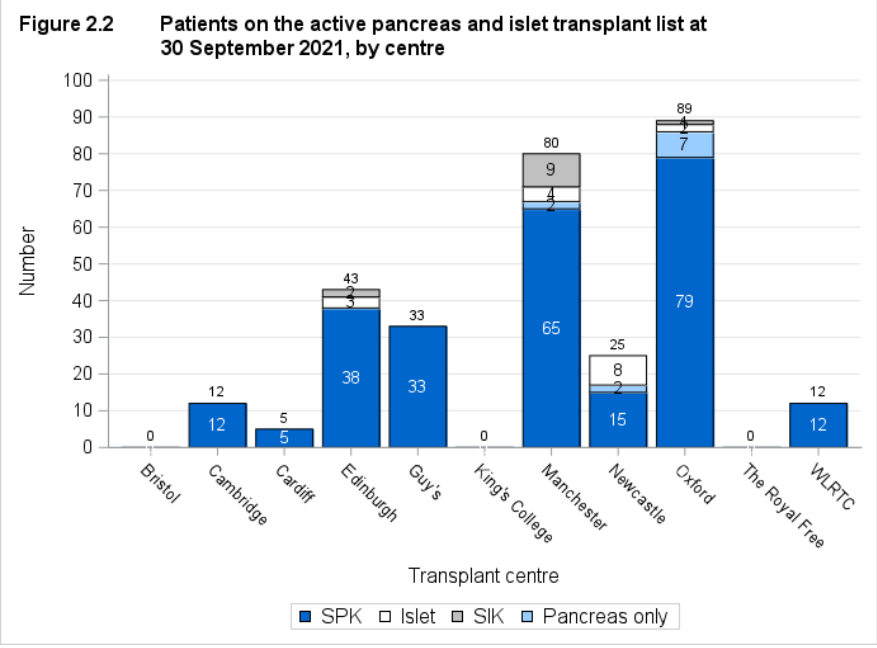


Figure 2.3 shows the total number of pancreas and islet transplants performed in the last five years. There was a decrease of 4% in transplant activity between October 2019 – September 2020 and October 2020 – September 2021, 140 and 134 respectively.

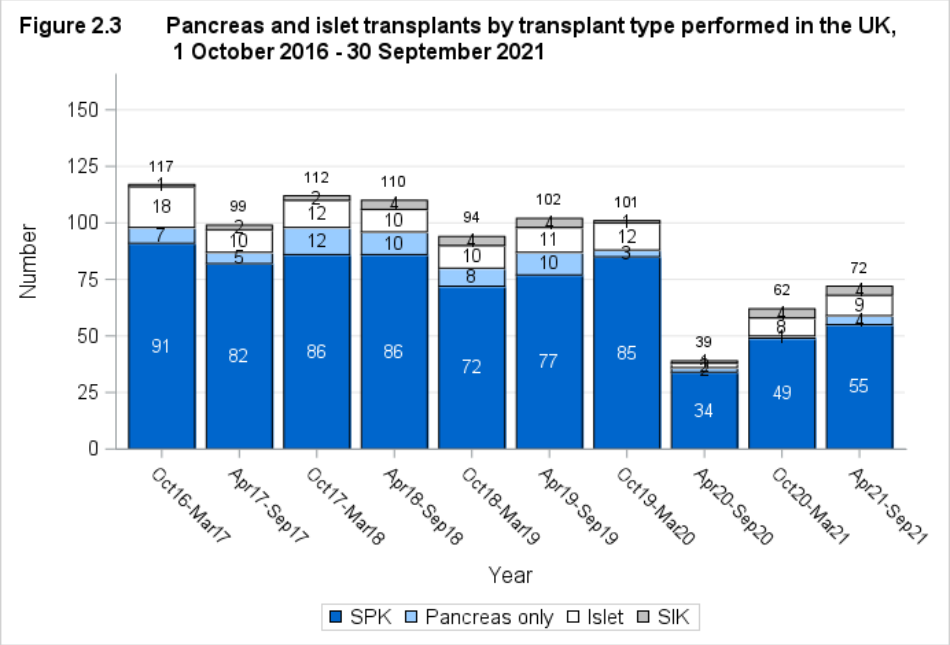


Figure 2.4 shows the total number of pancreas and islet transplants performed from April to September 2021 at each transplant centre. Oxford performed the most transplants, a total of 21 transplants.

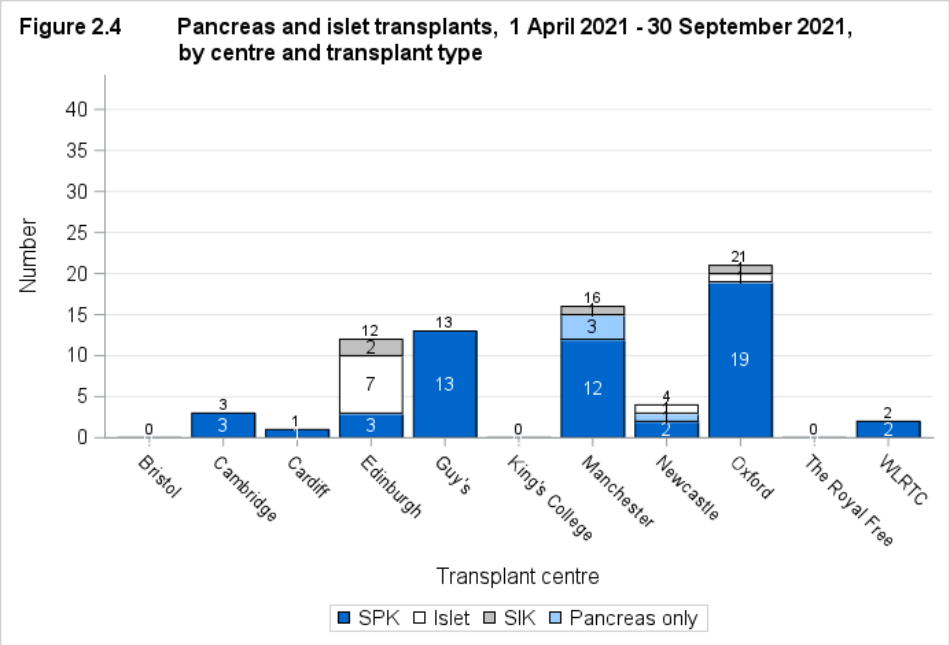
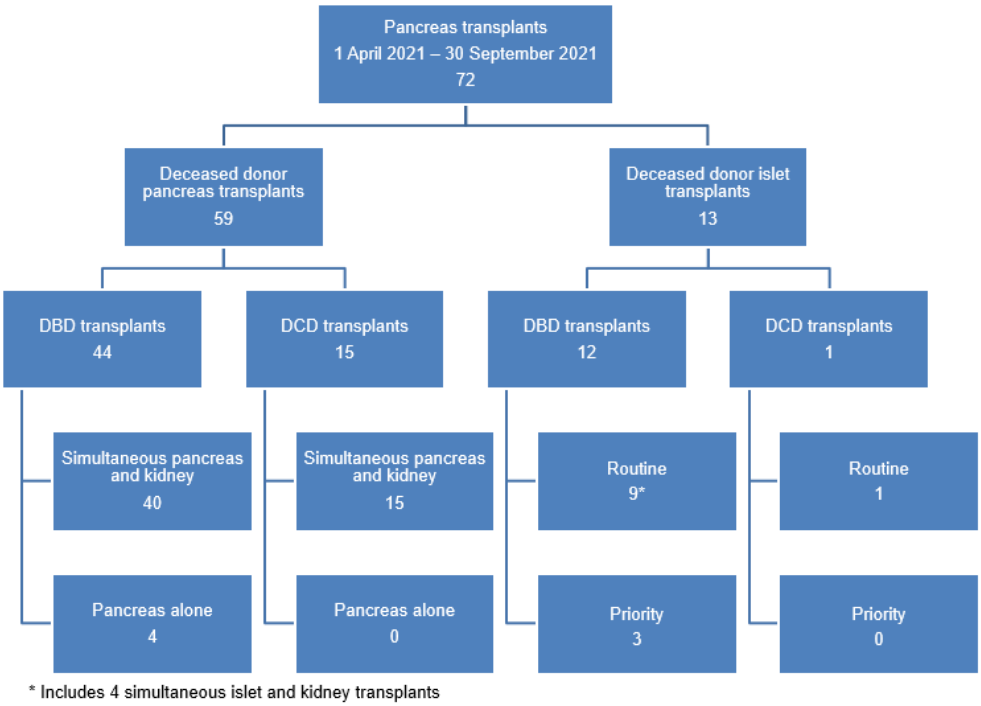


Figure 2.5 details the 72 pancreas and islet transplants performed in the UK between 1 April 2021 and 30 September 2021. 78% of these were from DBD deceased donors. 59 were pancreas transplants and 13 were islet transplants. 93% of pancreas transplants were SPK's in this time period. For islet transplantation, 10 were a routine SIK transplant and three were priority top-up grafts.

Figure 2.5 Pancreas and islet transplants performed in the UK, 1 April 2021 – 30 September 2021



* Includes 4 simultaneous islet and kidney transplants

Pancreas transplant list

3.1 Patients on the pancreas transplant list as at 31 March and 30 September, 2017 – 2021

Figure 3.1 shows the number of patients on the pancreas transplant list at 31 March and 30 September between 2017 and 2021. Overall the number of patients actively waiting for a pancreas transplant has increased from 203 in March 2017 to 270 in September 2021.

Figure 3.1 Patients on the pancreas transplant list at 31 March and 30 September

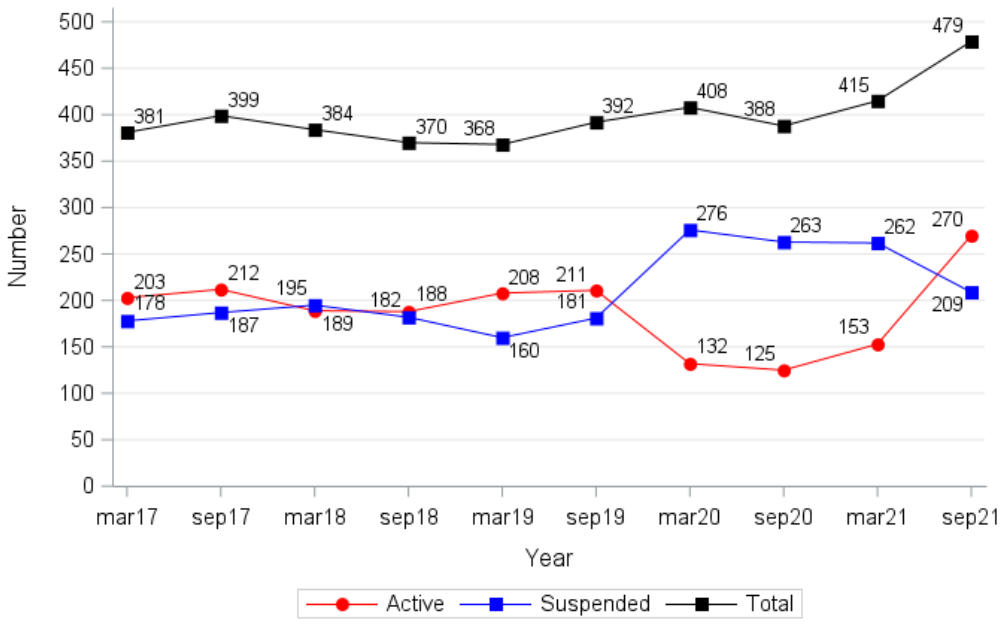
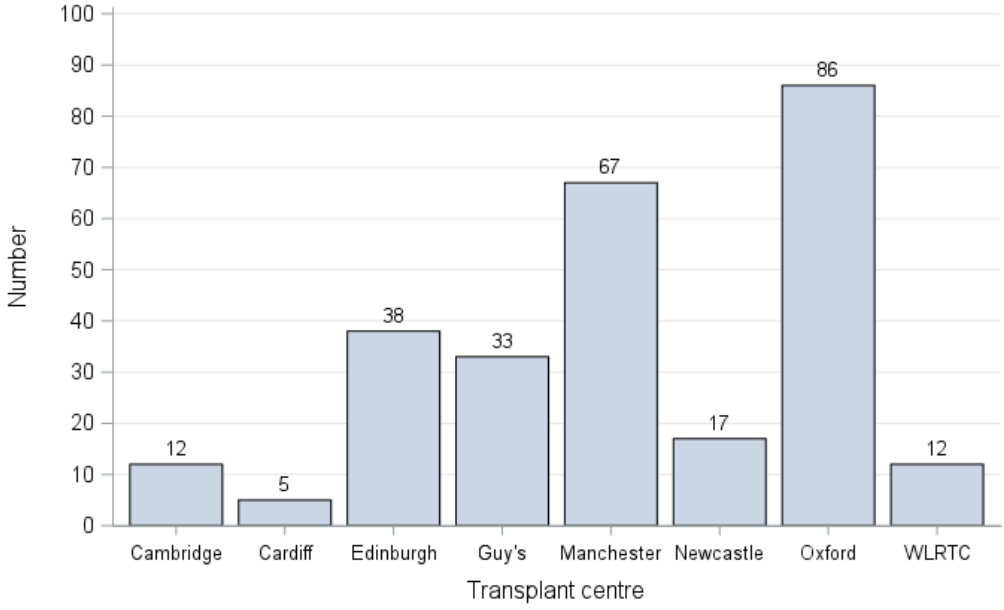


Figure 3.2 shows the number of patients on the active pancreas transplant list at 30 September 2021 by centre. Oxford had the largest proportion on the transplant list (32%) and Cardiff had the smallest proportion (2%).

Figure 3.2 Patients on the active pancreas transplant list by centre at 30 September 2021



3.2 Median active waiting time to transplant, 1 October 2015 - 30 September 2019

The length of time a patient waits for a pancreas transplant varies across the UK. The median active waiting time to deceased donor pancreas transplantation is calculated using the Kaplan-Meier method and is shown in **Figure 3.3** and **Table 3.1** for patients registered at each individual unit.

The median active waiting time to transplant for patients registered on the pancreas transplant list between 1 October 2015 and 30 September 2019 is 352 days, less than a year. This ranged from 208 days at WLRTC to 543 days at Edinburgh.

Figure 3.3 Median waiting time to deceased donor transplant for patients registered on the pancreas transplant list, 1 October 2015 - 30 September 2019

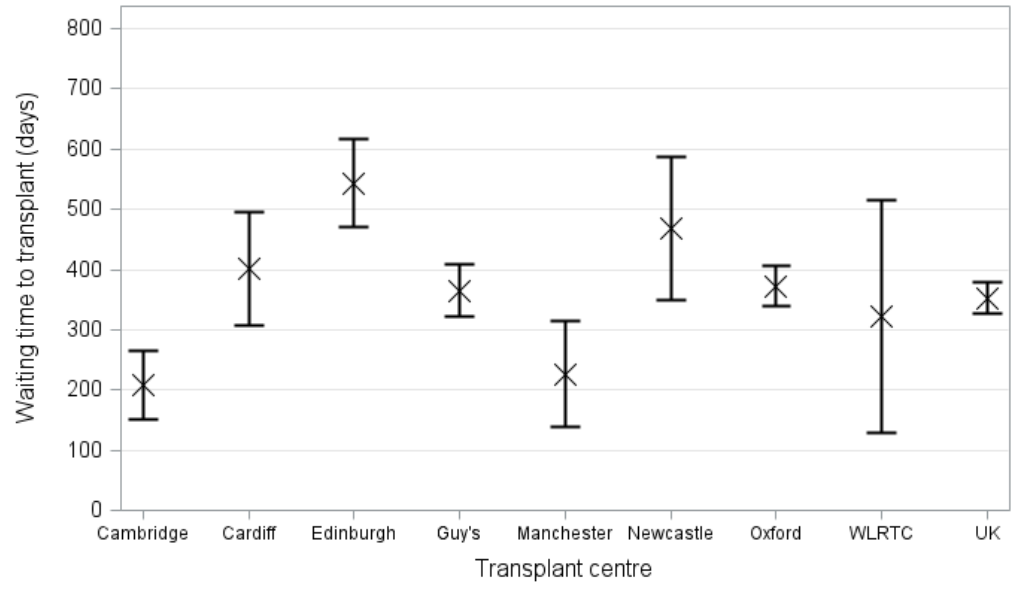


Table 3.1 Median active waiting time to pancreas transplant in the UK, for patients registered 1 October 2015 - 30 September 2019

Transplant centre	Number of patients registered	Waiting time (days)	
		Median	95% Confidence interval
Cambridge	94	208	151 - 265
Cardiff	43	401	307 - 495
Edinburgh	94	543	470 - 616
Guy's	138	365	321 - 409
Manchester	156	226	138 - 314
Newcastle	37	468	349 - 587
Oxford	282	372	339 - 405
WLRTC	51	322	128 - 516
UK	**895**	**352**	**326 - 378**

Response to pancreas offers

4.1 Offer decline rates, 1 April 2018 – 30 September 2021

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

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

Figure 4.1 compares individual centre offer DBD decline rates with the national rate over the time period, 1 April 2018 and 30 September 2021. Centres can be identified by the information shown in **Table 4.1**. Cambridge had an offer decline rate significantly lower than the national average, whilst Edinburgh had significantly higher offer decline rates than the national average.

Figure 4.1 **DBD donor pancreas offer decline rates for pancreases that resulted in a pancreas transplant, 1 April 2018 - 30 September 2021**

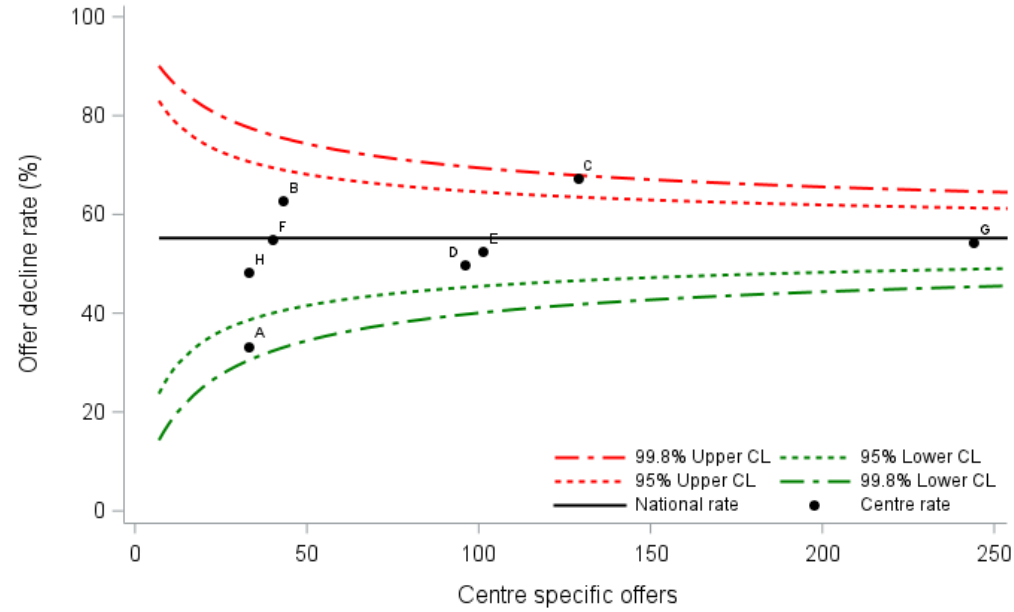


Table 4.1 compares individual centre offer decline rates over time by financial year. The decline rates from April to September 2021 highlight the low number of patient specific offers made during the pandemic.

Table 4.1 DBD donor pancreas offer decline rates by transplant centre, 1 April 2018 and 30 September 2021

Centre	Code	2018/19		2019/20		2020/21		Apr - Sep 21		Overall	
		No. offers	(% declined)	No. offers	(% declined)	No. offers	(% declined)	No. offers	(% declined)	No. offers	(% declined)
Cambridge	A	14	(43)	6	(67)	11	(0)	2	(50)	33	(33)
Cardiff	B	18	(61)	19	(68)	6	(50)	0		43	(63)
Edinburgh	C	40	(65)	54	(63)	16	(56)	19	(95)	129	(67)
Guy's	D	39	(56)	39	(49)	3	(33)	15	(40)	96	(50)
Manchester	E	19	(42)	41	(51)	19	(63)	22	(55)	101	(52)
Newcastle	F	21	(62)	10	(40)	4	(75)	5	(40)	40	(55)
Oxford	G	82	(51)	98	(62)	28	(25)	36	(64)	244	(55)
WLRTC	H	14	(50)	13	(38)	1	(0)	5	(80)	33	(48)
UK		**247**	**(55)**	**280**	**(58)**	**88**	**(40)**	**104**	**(63)**	**719**	**(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

Figure 4.2 compares individual centre offer DCD decline rates with the national rate over the time period, 1 April 2018 and 30 September 2021. Centres can be identified by the information shown in **Table 4.2**. Cambridge had offer decline rates significantly lower than the national rate, whilst Newcastle had significantly higher rates than the national average.

Figure 4.2 DCD donor pancreas offer decline rates for pancreases that resulted in a pancreas transplant, 1 April 2018 and 30 September 2021

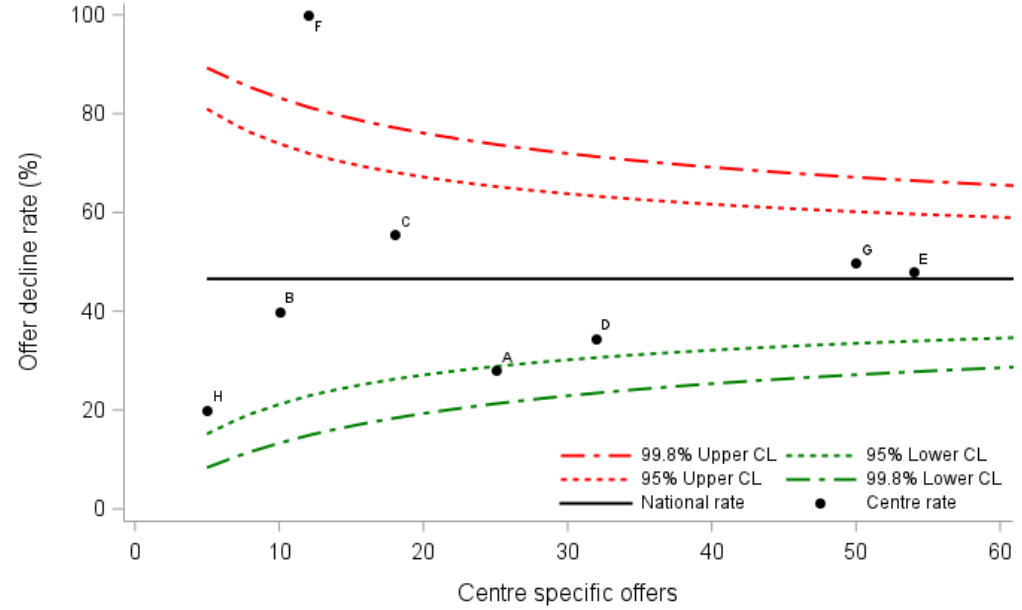


Table 4.2 DCD donor pancreas offer decline rates by transplant centre, 1 April 2018 and 30 September 2021

Centre	Code	2018/19		2019/20		2020/21		Apr - Sep 21		Overall	
		No. offers	(% declined)	No. offers	(% declined)	No. offers	(% declined)	No. offers	(% declined)	No. offers	(% declined)
Cambridge	A	10	(30)	9	(33)	3	(0)	3	(33)	25	(28)
Cardiff	B	3	(33)	5	(40)	1	(100)	1	(0)	10	(40)
Edinburgh	C	5	(100)	4	(25)	4	(25)	5	(60)	18	(56)
Guy's	D	12	(33)	11	(36)	3	(0)	6	(50)	32	(34)
Manchester	E	28	(43)	15	(53)	6	(67)	5	(40)	54	(48)
Newcastle	F	5	(100)	4	(100)	1	(100)	2	(100)	12	(100)
Oxford	G	19	(42)	18	(50)	4	(50)	9	(67)	50	(50)
WLRTC	H	2	(50)	2	(0)	0		1	(0)	5	(20)
UK		**84**	**(46)**	**68**	**(46)**	**22**	**(41)**	**32**	**(53)**	**206**	**(47)**

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 October 2016 – 30 September 2021

Figure 5.1 shows the total number of pancreas transplants performed in the last five years, by type of donor. The figure shows that 27 pancreas transplants were from DCD donors from October 2020 to September 2021; this amounts to 25% of pancreas transplants in that time period. There were 44 DBD pancreas transplants from April to September 2021, a 63% increase compared to April to September 2020.

Figure 5.1 Pancreas transplants, 1 October 2016 - 30 September 2021 by financial year and donor type

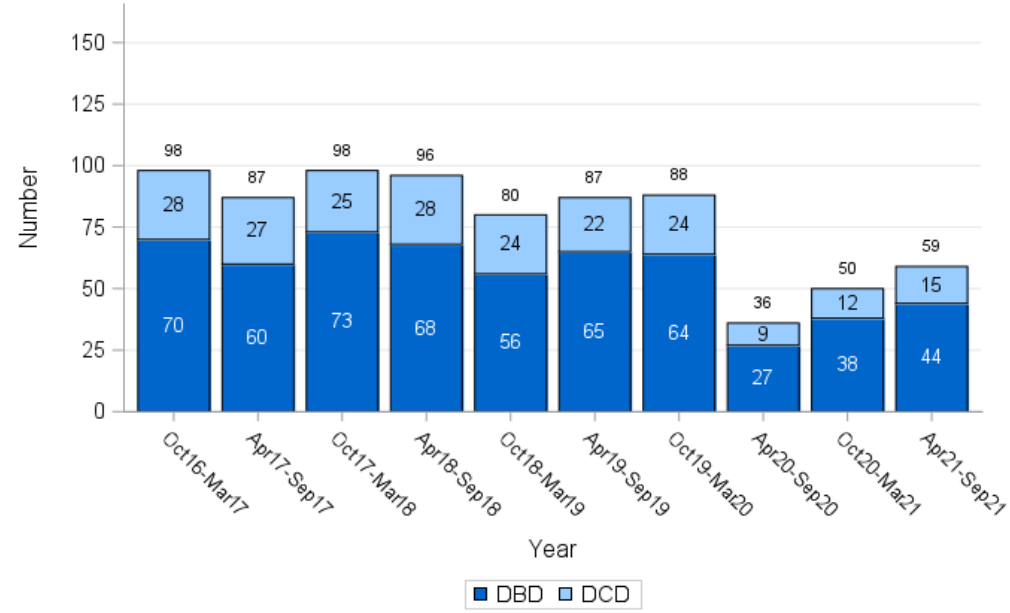


Figure 5.2 shows the total number of pancreas transplants performed from April to September 2021, by centre and type of donor. The same information is presented in **Figure 5.3** but this shows the proportion of DBD and DCD transplants performed at each centre.

Oxford performed the most DBD and DCD transplants, 19, with 84% being DBD transplants. There were no DCD transplants performed at Newcastle, all other centres had a proportion of 16% or more. Based on small numbers, Cardiff had the largest proportion of DCD transplants at 100%, followed by Edinburgh and Cambridge at 67%.

Figure 5.2 Pancreas transplants, 1 April 2021 - 30 September 2021 by centre and donor type

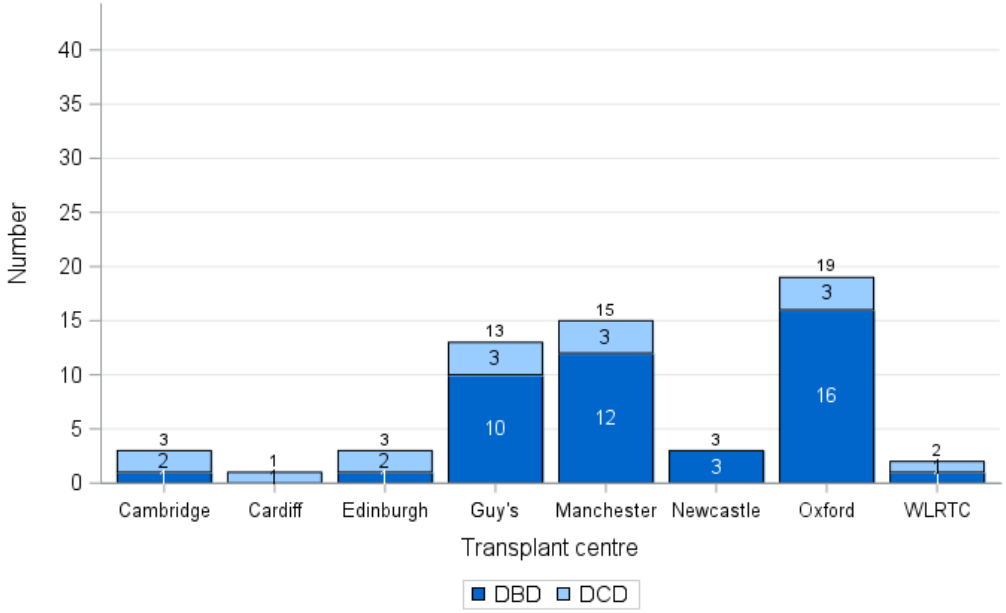
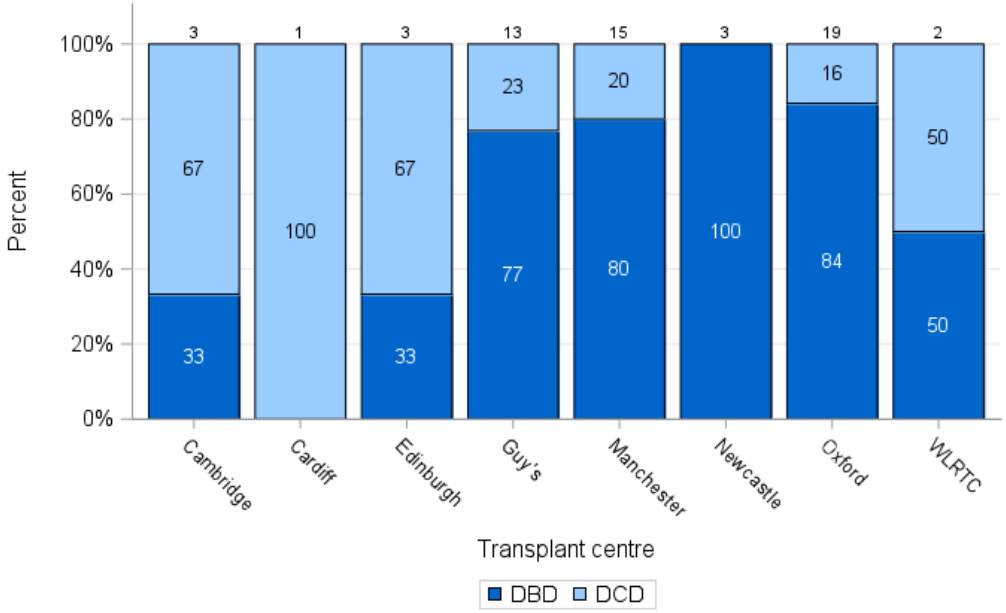


Figure 5.3 Pancreas transplants, 1 April 2021 - 30 September 2021 by centre and donor type



Pancreas outcomes

6.1 Deceased donor graft and patient survival for first SPK transplant

Funnel plots are used to compare centre specific risk-adjusted patient and graft survival rates and indicate how consistent these rates are with the national survival rates. Note that some patients return to local renal units for follow-up care after their transplant and although we report survival according to transplant unit, patients may in fact be followed up quite distantly from their transplant centre. It is important to note that adjusting for patient mix through the use of risk-adjustment models may not account for all possible causes of centre differences. There may be other factors that are not taken into account in the risk-adjustment process that may affect the survival rate of a particular centre.

Figures 6.1 and **6.2** compare individual centre survival estimates with the national rates for one-year patient and graft survival for deceased donor first SPK transplants and, for patient survival, first ever transplant. **Figures 6.3** and **6.4** compare five-year survival estimates. The funnel plots show that, for the most part, the centres lie within the confidence limits. Some of the funnel plots show some centres to be above the upper 99.8% confidence limit. This suggests that these centres may have survival rates that are considerably higher than the national rate. None of the funnel plots show centres to be below the lower 95% confidence limit. Centres can be identified by the information shown in **Tables 6.1** and **6.2**.

Figure 6.1 Risk-adjusted one year patient survival rates for deceased donor first SPK transplants, 1 October 2016 - 30 September 2020

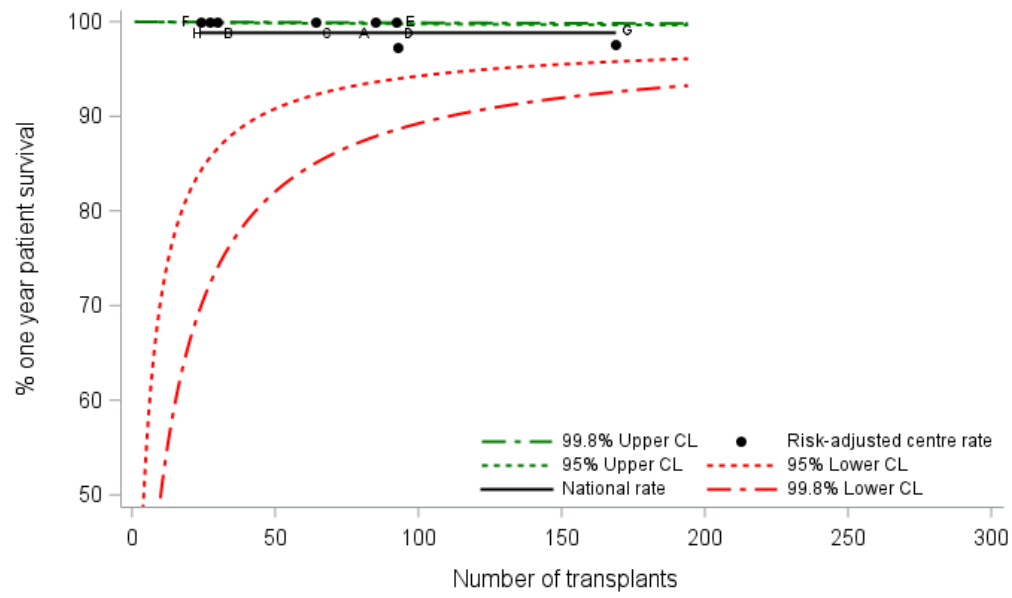


Figure 6.2 **Risk-adjusted one year pancreas graft (death censored) survival rates for all deceased donor first SPK transplants, 1 October 2016 - 30 September 2020**

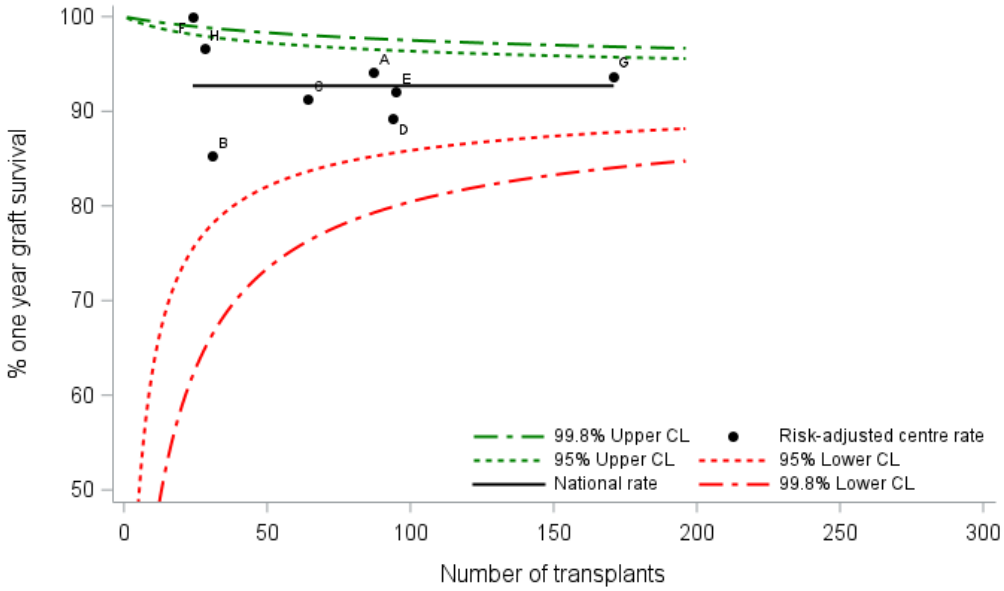


Figure 6.3 **Risk-adjusted five year patient survival rates for deceased donor first SPK transplants, 1 October 2012 - 30 September 2016**

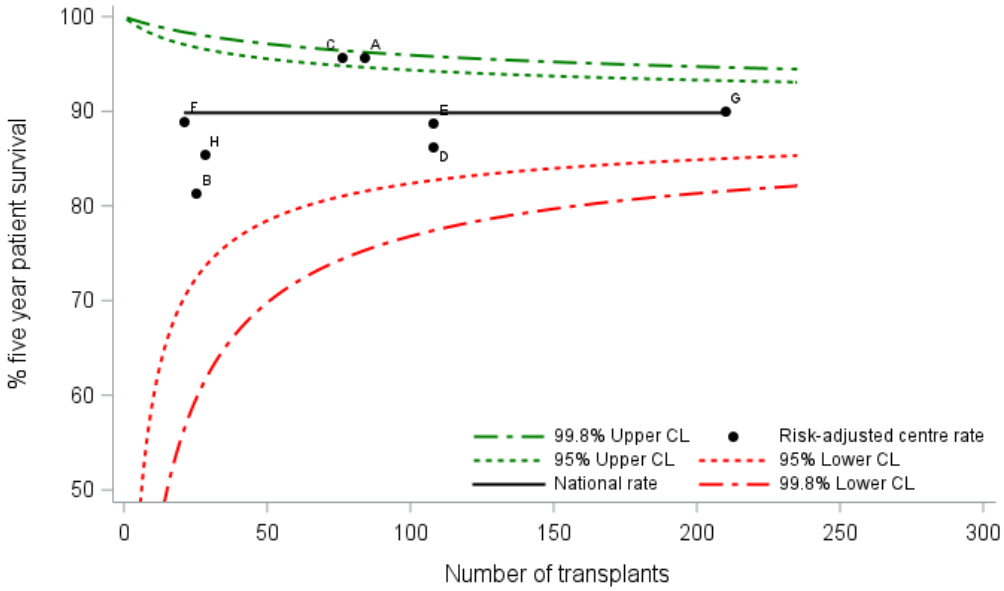


Figure 6.4 **Risk-adjusted five year pancreas graft (death censored) survival rates for all deceased donor first SPK transplants, 1 October 2012 - 30 September 2016**

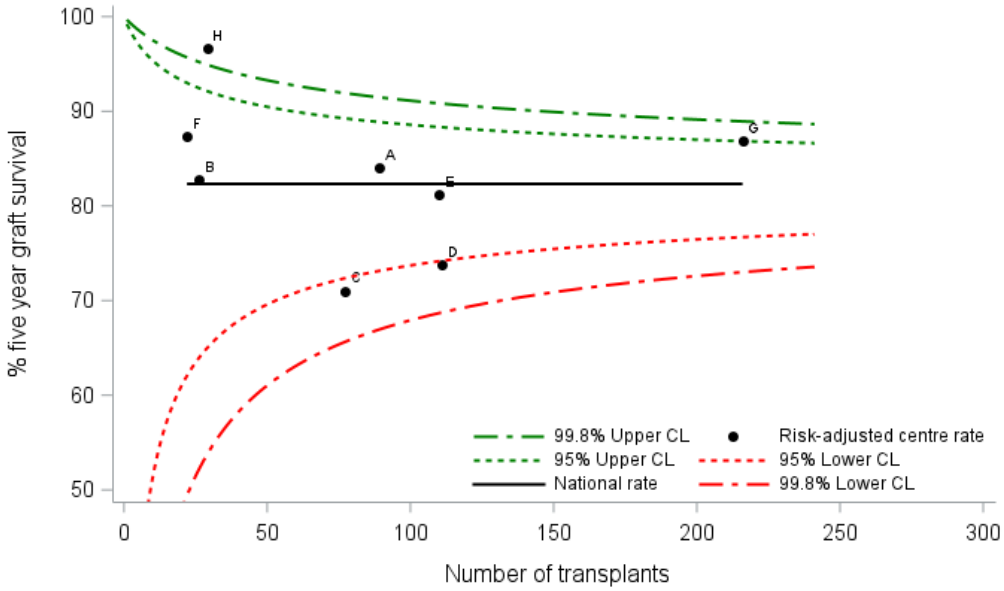


Table 6.1 **Risk-adjusted one and five year patient survival for first SPK transplants using pancreases from deceased donors**

		patient survival					
		One-year*			Five-year**		
Centre	Code	N	%	(95% CI)	N	%	(95% CI)
Cambridge	A	85	100	N/A	84	96	(87 - 99)
Cardiff	B	30	100	N/A	25	81	(52 - 95)
Edinburgh	C	64	100	N/A	76	96	(87 - 99)
Guy's	D	93	97	(90 - 100	108	86	(76 - 93)
Manchester	E	92	100	N/A	108	89	(80 - 94)
Newcastle	F	24	100	N/A	21	89	(60 - 99)
Oxford	G	169	98	(94 - 99)	210	90	(85 - 94)
WLRTC	H	27	100	N/A	28	85	(63 - 96)
UK		**584**	**99**	**(97 - 99)**	**660**	**90**	**(87 - 92)**

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 October 2016 - 30 September 2020
** Includes transplants performed between 1 October 2012 - 30 September 2016

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	87	94	(86 - 98)	89	84	(73 - 91)
Cardiff	B	31	85	(63 - 96)	26	83	(60 - 94)
Edinburgh	C	64	91	(80 - 97)	77	71	(53 - 83)
Guy's	D	94	89	(80 - 95)	111	74	(62 - 82)
Manchester	E	95	92	(83 - 97)	110	81	(70 - 89)
Newcastle	F	24	100	N/A	22	87	(54 - 98)
Oxford	G	171	94	(89 - 97)	216	87	(81 - 91)
WLRTC	H	28	97	(81 - 100	29	97	(82 - 100
UK		**594**	**93**	**(90 - 95)**	**680**	**82**	**(79 - 85)**

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 October 2016 - 30 September 2020
** Includes transplants performed between 1 October 2012 - 30 September 2016

6.2 Deceased donor graft and patient survival for first PO transplants

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

Table 6.3 Unadjusted one and five year patient survival for first PO transplants using pancreases from deceased donors

		patient survival					
		One-year*			Five-year**		
Centre	Code	N	%	(95% CI)	N	%	(95% CI)
Cambridge	A	0	-	-	0	-	-
Cardiff	B	2	-	-	7	-	-
Edinburgh	C	0	-	-	0	-	-
Guy's	D	0	-	-	3	-	-
Manchester	E	2	-	-	3	-	-
Newcastle	F	0	-	-	2	-	-
Oxford	G	10	100	-	29	88	(68 - 96)
WLRTC	H	3	-	-	0	-	-
UK		**17**	**100**	**-**	**44**	**89**	**(73 - 96)**

* Includes transplants performed between 1 October 2016 - 30 September 2020
** Includes transplants performed between 1 October 2012 - 30 September 2016
- Data not presented where less than 10 transplants included

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

		pancreas graft survival					
		One-year*			Five-year**		
Centre	Code	N	%	(95% CI)	N	%	(95% CI)
Cambridge	A	0	-	-	3	-	-
Cardiff	B	3	-	-	11	44	(15 - 70)
Edinburgh	C	0	-	-	1	-	-
Guy's	D	0	-	-	3	-	-
Manchester	E	9	-	-	6	-	-
Newcastle	F	3	-	-	5	-	-
Oxford	G	13	100	-	39	61	(43 - 75)
WLRTC	H	4	-	-	4	-	-
UK		**32**	**91**	**(74 - 97)**	**72**	**60**	**(47 - 71)**

* Includes transplants performed between 1 October 2016 - 30 September 2020
** Includes transplants performed between 1 October 2012 - 30 September 2016
- Data not presented where less than 10 transplants included

Islet transplant list

7.1 Patients on the islet transplant list as at 31 March and 30 September, 2017 – 2021

Figure 7.1 shows the number of patients on the islet transplant list at 31 March and 30 September each year between 2017 and 2021. The number of patients active on the islet transplant list has increased by 190%, from 10 in September 2020 when some centres had smaller lists due to the COVID-19 pandemic, to 29 in September 2021,

Figure 7.1 Patients on the islet transplant list at 31 March and 30 September

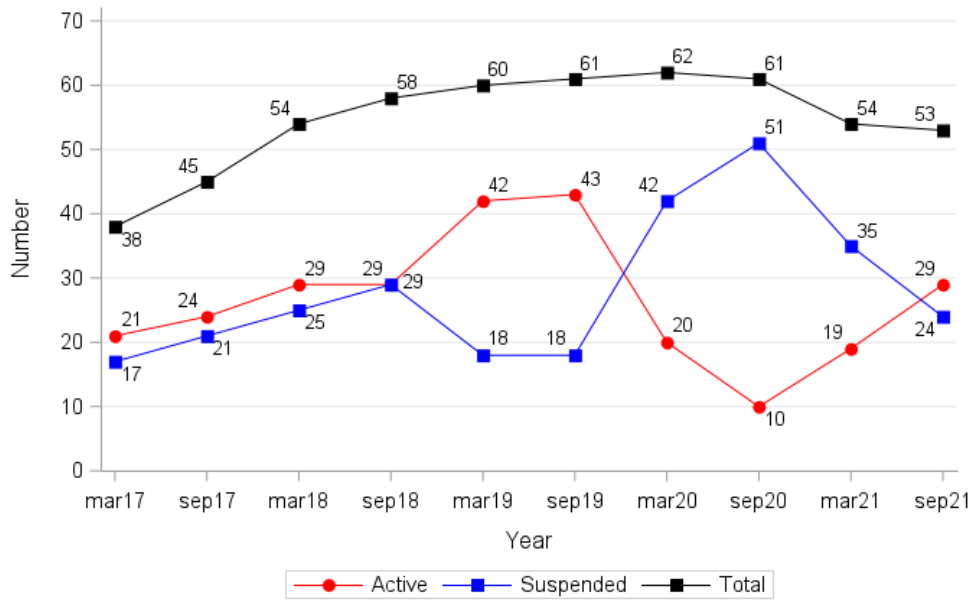
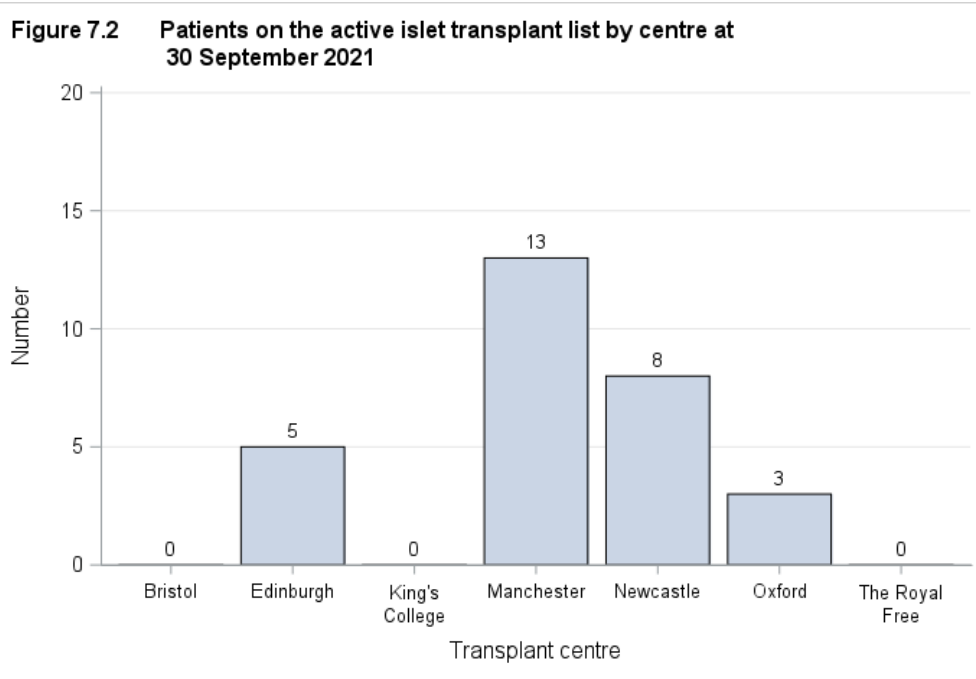


Figure 7.2 shows the number of patients on the active islet transplant list at 30 September 2021 by centre. 13 (45%) of the patients on the active transplant list were registered at Manchester, whilst there were no patients on the active list registered at Bristol, King's College or the Royal Free.

Figure 7.2 Patients on the active islet transplant list by centre at 30 September 2021

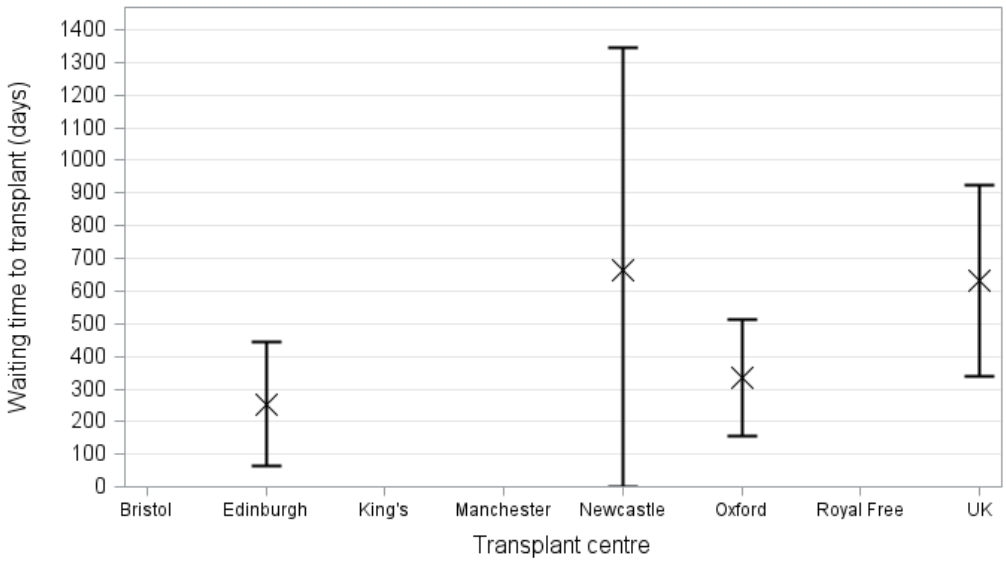


7.2 Median waiting time to transplant, 1 October 2015 – 30 September 2019

The length of time a patient waits for a routine islet transplant, including simultaneous islet and kidney transplants, varies across the UK. The median waiting time (including time spent suspended on the list) for deceased donor islet transplantation is calculated using the Kaplan-Meier method and is shown in **Figure 7.3** and **Table 7.1** for patients registered on the routine list at each individual unit.

The median waiting time to transplant for patients registered on the routine islet transplant list between 1 October 2015 and 30 September 2019 is 631 days, over 18 months, 95% confidence interval 338 to 924 days. Only three centres had sufficient time to transplant data to calculate a median waiting time.

Figure 7.3 Median waiting time to deceased donor transplant for patients registered on the routine islet transplant list, 1 October 2015 - 30 September 2019



Data not presented where less than 10 patients included or where there is insufficient data to calculate the median waiting time

Table 7.1 Median waiting time to routine islet transplant in the UK, for patients registered 1 October 2015 - 30 September 2019

Transplant centre	Number of patients registered	Waiting time (days) Median	95% Confidence interval
Bristol	0	-	-
Edinburgh	43	253	64 - 442
King's	5	-	-
Manchester[1]	43	-	-
Newcastle	15	665	0 - 1343
Oxford	16	336	157 - 515
Royal Free	3	-	-
UK	**125**	**631**	**338 - 924**

- Data not presented where less than 10 patients included
[1] Insufficient data to calculate median waiting time

Response to islet offers

8.1 Offer decline rates, 1 April 2018 – 30 September 2021

Islet offers from DBD donors whose pancreas was retrieved, offered directly on behalf of a named individual patient and resulted in islet transplantation are included in the analysis. Any offers of islets declined for transplantation or DCD offers were excluded, as were offers made through the fast track scheme or the reallocation of the pancreas.

Individual centre offer decline rates over the time period, 1 April 2018 and 30 September 2021 are shown in **Table 8.1**. Note that all rates are based on a small number of offers. King's (0%) and Royal Free (100%) had the lowest and highest overall decline rates, respectively. Of the three centres with over 20 offers in the time period, Edinburgh had the lowest decline rate of 32%.

Figure 8.1 **DBD donor islet offer decline rates for pancreases that resulted in an islet transplant, 1 April 2018 - 30 September 2021**

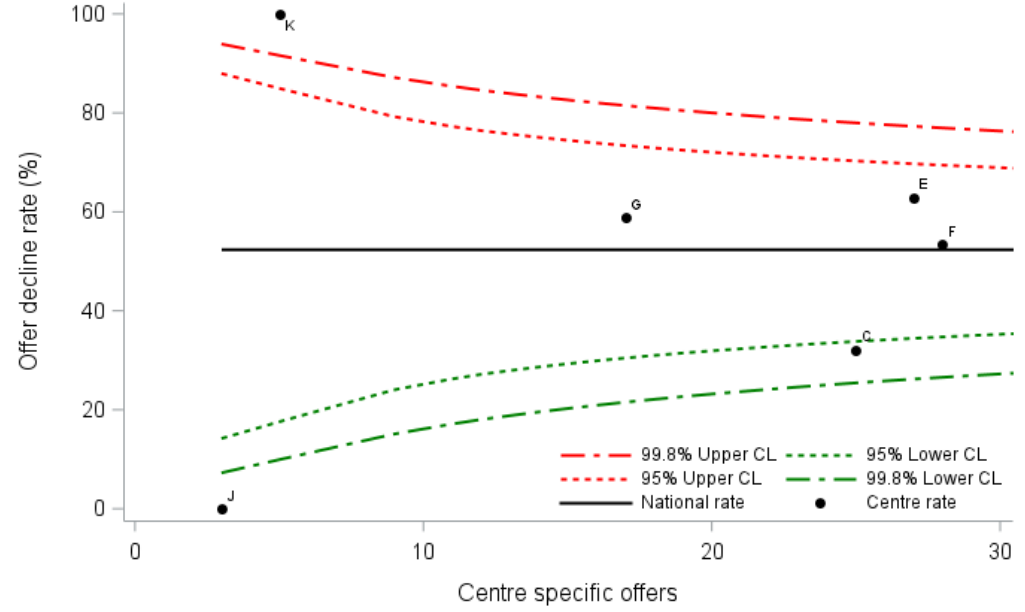


Table 8.1 **DBD donor islet offer decline rates by transplant centre, 1 April 2018 and 30 September 2021**

Centre	Code	2018/19		2019/20		2020/21		Apr - Sep 21		Overall	
		No. offers	(% declined)	No. offers	(% declined)	No. offers	(% declined)	No. offers	(% declined)	No. offers	(% declined)
Bristol	I	0	-	0	-	0	-	0	-	0	-
Edinburgh	C	8	(50)	7	(29)	5	(40)	5	(0)	25	(32)
King's	J	2	(0)	1	(0)	0		0		3	(0)
Manchester	E	10	(70)	8	(38)	4	(75)	5	(80)	27	(63)
Newcastle	F	10	(50)	8	(63)	6	(33)	4	(75)	28	(54)
Oxford	G	4	(50)	4	(50)	2	(0)	7	(86)	17	(59)
Royal Free	K	1	(100)	4	(100)	0		0		5	(100)
UK		**35**	**(54)**	**32**	**(50)**	**17**	**(41)**	**21**	**(62)**	**105**	**(52)**

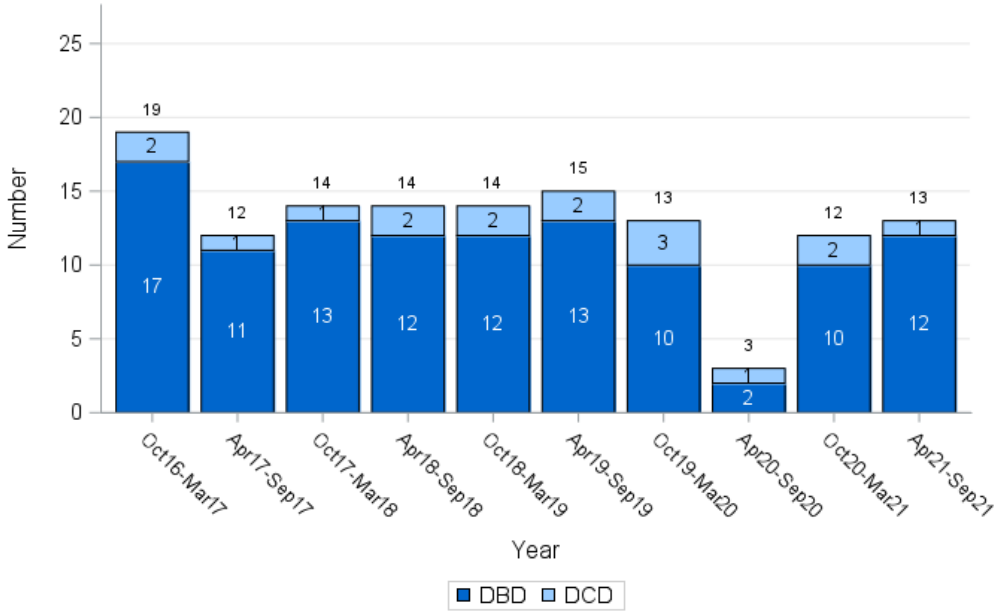
Centre has reached the upper 99.8% confidence limit
Centre has reached the upper 95% confidence limit
Centre has reached the lower 95% confidence limit
Centre has reached the lower 99.8% confidence limit

Islet transplants

9.1 Islet transplants, 1 October 2016 – 30 September 2021

Figure 9.1 shows the total number of islet transplants performed in the last five years by type of donor. The number of islet transplants has ranged from three to 19 in the six-month periods from October 2016 to September 2021. DCD islet transplants have ranged from one to three in the same time periods. In the latest six-month period, 13 islet transplants were performed, nine DBD at Edinburgh, two at Oxford (one DBD and one DCD), one DBD at Manchester and one DBD at Newcastle.

Figure 9.1 Islet transplants, 1 October 2016 - 30 September 2021 by financial year and donor type



Appendix

A1 Glossary of terms

ABO
The most important human blood group system for transplantation is the ABO system. Every human being is of blood group O, A, B, AB, or one of the minor variants of these four groups. ABO blood groups are present on other tissues and, unless special precautions are taken, a blood group A pancreas transplanted to a blood group O patient will be rapidly rejected.

Active transplant list
When a patient is registered for a transplant, they are registered on what is called the 'active' transplant list. This means that when a donor pancreas becomes available, the patient is included among those who are matched against the donor to determine whether or not the pancreas is suitable for them. It may sometimes be necessary to take a patient off the transplant list, either temporarily or permanently. This may be done, for example, if someone becomes too ill to receive a transplant. The patient is told about the decision to suspend them from the list and is informed whether the suspension is temporary or permanent. If a patient is suspended from the list, they are not included in the matching of any donor pancreases that become available.

Calculated Reaction Frequency (cRF)
For a given patient with detectable HLA antibodies, the proportion blood group identical donors from a pool of 10,000 against which the recipient has HLA specific antibodies is calculated. This percentage of donors is termed the 'calculated Reaction Frequency' (cRF), more commonly referred to as the sensitisation level. Patients with no detectable HLA antibodies will have 0 sensitisation (0% cRF).

Case mix
The types of patients treated at a unit for a common condition. This can vary across units depending on the facilities available at the unit as well as the types of people in the catchment area of the unit. The definition of what type of patient a person is depends on the patient characteristics that influence the outcome of the treatment. For example the case mix for patients registered for a pancreas transplant is defined in terms of various factors such as the blood group, tissue type and age of the patient. These factors have an influence on the chance of a patient receiving a transplant.

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

Confidence interval (CI)
When an estimate of a quantity such as a survival rate is obtained from data, the value of the estimate depends on the set of patients whose data were used. If, by chance, data from a different set of patients had been used, the value of the estimate may have been different. There is therefore some uncertainty linked with any estimate. A confidence

interval is a range of values whose width gives an indication of the uncertainty or precision of an estimate. The number of transplants or patients analysed influences the width of a confidence interval. Smaller data sets tend to lead to wider confidence intervals compared to larger data sets. Estimates from larger data sets are therefore more precise than those from smaller data sets. Confidence intervals are calculated with a stated probability, usually 95%. We then say that there is a 95% chance that the confidence interval includes the true value of the quantity we wish to estimate.

Confidence limit
The upper and lower bounds of a confidence interval.

Cox Proportional Hazards model
A statistical model that relates the instantaneous risk (hazard) of an event occurring at a given time point to the risk factors that influence the length of time it takes for the event to occur. This model can be used to compare the hazard of an event of interest, such as graft failure or patient death, across different groups of patients.

Cross-match
A cross-match is a test for patient antibodies against donor antigens. A positive cross-match shows that the donor and patient are incompatible. A negative cross-match means there is no reaction between donor and patient and that the transplant may proceed.

Donor after brain death
Donation after Brainstem Death (DBD) means donation which takes place following the diagnosis of death using neurological criteria.

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

Funnel plot
A graphical method that shows how consistent the survival rates of the different transplant units are compared to the national rate. The graph shows for each unit, a survival rate plotted against the number of transplants undertaken, with the national rate and confidence limits around this national rate superimposed. In this report, 95% and 99.8% confidence limits were used. Units that lie within the confidence limits have survival rates that are statistically consistent with the national rate. When a unit is close to or outside the limits, this is an indication that the centre may have a rate that is considerably different from the national rate.

Graft survival rate
The percentage of patients whose grafts are still functioning. This is usually specified for a given time period after transplant. For example, a five-year transplant survival rate is the percentage of transplants still functioning five years after transplant. For the purposes of pancreas transplantation, graft failure is defined as a return to permanent insulin dependence while for islet transplantation graft failure is defined as a C-peptide less than 50 pmol/l.

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

HLA mismatch
Human Leucocyte Antigens (HLA) are carried on many cells in the body and the immune system can distinguish between those that can be recognised as 'self' (belonging to you or identical to your own) and those that can be recognised as 'nonself'. The normal response of the immune system is to attack foreign/non-self material by producing antibodies against the foreign material. This is one of the mechanisms that provide protection against infection. This is unfortunate from the point of view of transplantation as the immune system will see the graft as just another 'infection' to be destroyed, produce antibodies against the graft and rejection of the grafted organ will take place. To help overcome this response, it is recognised that 'matching' the recipient and donor on the basis of HLA (and blood group) reduces the chances of acute rejection and, with the added use of immunosuppressive drugs, very much improves the chances of graft survival. 'Matching' refers to the similarity of the recipient HLA type and donor HLA type. HLA mismatch refers to the number of mismatches between the donor and the recipient at the A, B and DR (HLA) loci. There can only be a total of two mismatches at each locus. For example, an HLA mismatch value of 000, means that the donor and recipient are identical at all three loci, while an HLA mismatch value of 210 means that the donor and recipient differ completely at the A locus, are partly the same at the B locus and are identical at the DR locus.

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

Inter-quartile range
The values between which the middle 50% of the data fall. The lower boundary is the lower quartile, the upper boundary the upper quartile.

Kaplan-Meier method
A method that allows patients with incomplete follow-up information to be included in estimating survival rates. For example, in a cohort for estimating one year patient survival rates, a patient was followed up for only nine months before they relocated. If we calculated a crude survival estimate using the number of patients who survived for at least a year, this patient would have to be excluded as it is not known whether or not the patient was still alive at one year after transplant. The Kaplan-Meier method allows information about such patients to be used for the length of time that they are followed-up, when this information would otherwise be discarded. Such instances of incomplete follow-up are not uncommon and the Kaplan-Meier method allows the computation of estimates that are more meaningful in these cases.

Median
The midpoint in a series of numbers, so that half the data values are larger than the median, and half are smaller.

Multi-organ transplant
A transplant in which the patient receives more than one organ. For example, a patient may undergo a transplant of a pancreas and liver. Intestinal transplants involving a pancreas are excluded from the whole report.

National Pancreas 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 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 these 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 Statistical methodology and risk-adjustment for survival rate estimation

Unadjusted and risk-adjusted estimates of patient and graft survival for pancreas and simultaneous pancreas and kidney (SPK) transplant are given for each centre. Unadjusted rates give an estimate of what the survival rate at a centre is, assuming that all patients at the centre have the same chance of surviving a given length of time after transplant. In reality, patients differ and a risk-adjusted rate that allows for these differences would give a more meaningful estimate of survival.

Computing unadjusted survival rates

Unadjusted survival rates were calculated using the Kaplan-Meier method, which allows patients with incomplete follow-up information to be included in the computation. For example, in a cohort for estimating one-year patient survival rates, a patient was followed up for only nine months before they relocated. If we calculated a crude survival estimate using the number of patients who survived for at least a year, this patient would have to be excluded, as it is not known whether or not the patient was still alive one year after transplant. The Kaplan-Meier method allows information about such patients to be used for the length of time that they are followed-up, when this information would otherwise be discarded. Such instances of incomplete follow-up are not uncommon in the analysis of survival data and the Kaplan-Meier method therefore allows the computation of survival estimates that are more meaningful.

Computing risk-adjusted survival rates

A risk-adjusted survival rate is an estimate of what the survival rate at a centre would have been if they had had the same mix of patients as that seen nationally. The risk-adjusted rate therefore presents estimates in which differences in patient mix across centres have been removed as much as possible. For that reason, it is valid to only compare centres using risk-adjusted rather than unadjusted rates, as differences among the latter can be attributed to differences in patient mix.

Risk-adjusted survival estimates were obtained through indirect standardisation. A Cox Proportional Hazards model was used to determine the probability of survival for each patient based on their individual risk factor values. The sum of these probabilities for all patients at a centre gives the number, E, of patients or grafts expected to survive at least one year or five years after transplant at that centre. The number of patients who actually survive the given time period is given by O. The risk-adjusted estimate is then calculated by multiplying the ratio O/E by the overall unadjusted survival rate across all centres. The risk-adjustment models used were based on results from previous studies that looked at factors affecting the survival rates of interest. The factors included in the models are shown in the table below.

First transplants from deceased donors	
Simultaneous pancreas and kidney (SPK) and pancreas only survival	
1 and 5 year patient and graft survival	Donor age, donor type, donor BMI and waiting time

Funnel plots for comparing risk-adjusted survival rates

The funnel plot is a graphical method to show how consistent the survival rates of the different transplant centres are compared to the national rate. The graph shows for each centre, a survival rate plotted against the number of transplants undertaken, with the national rate and confidence limits around this national rate superimposed. In this report,

95% and 99.8% confidence limits were used. Units that lie within the confidence limits have survival rates that are statistically consistent with the national rate. When a unit is close to or outside the limits, this is an indication that the centre may have a rate that is considerably different from the national rate.

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