

NHS BLOOD AND TRANSPLANT**PANCREAS ADVISORY GROUP****ISLET TRANSPLANT ACTIVITY AND OUTCOME
SUMMARY****INTRODUCTION**

- 1 Islet transplant data has been collected by NHSBT since the introduction of four transplant and follow-up forms in July 2010. This paper provides summaries of transplant activity and outcomes.

DATA

- 2 Islet transplant activity, including simultaneous islet and kidney (SIK) grafts, and end of year transplant list for the last three calendar years were analysed. Data on 198 routine, and subsequent priority, islet transplants performed in the UK between 1 April 2010 and 31 December 2021 were analysed from the UKTR. Outcome data are reported for routine transplants only.

RESULTS

- 3 In 2022 there were 17 islet transplants performed, of which five were SIK. There were 22 patients on the islet transplant list at 31 December 2022, 21 routine (11 SIK) and one priority patients.
- 4 One-year graft survival for first routine islet alone grafts is 83% for transplants performed 1 January 2016 to 31 December 2021. There is a significant difference in five-year graft survival for those receiving a routine and priority top-up graft compared with those receiving a routine only graft, 62% and 38%, respectively $p=0.0002$.
- 5 For patients receiving an islet alone routine and a priority graft, the median annual rate of severe hypoglycaemic events fell from 9 events (IQR 0 – 47) at time of transplant, to none at one, two, three and five years' post-transplant. Of all routine islet transplants, 107 (88%) experienced no severe hypoglycaemic events in the first-year post-transplant.
- 6 Median HbA1c fell from 64 mmol/mol (IQR 55 – 75) at time of transplant, to 51 mmol/mol (IQR 42 – 58) at one year and 55 (IQR 47 – 63) at three years post-transplant, for patients who received a routine and a priority graft. Overall, a reduction in HbA1c was reported for 104 (83%) patients at one-year post-transplant.
- 7 The median insulin dose, for patients who received routine and priority grafts, fell from 0.52 units/kg (IQR 0.38 – 0.63) at time of transplant to 0.3 units/kg (IQR 0.18 – 0.49) three years post-transplant. Insulin independence at some point in the first-year post-transplant was achieved for 34% of patients overall where reported.

SUMMARY

- 8 In 2022, the number of islet transplants and patients on the waiting list at the end of the year have increased. One-year graft survival is 83% for transplants performed between 1 January 2016 and 31 December 2021. The median annual rate of severe hypoglycaemic events, HbA1c and insulin dose at one-year, two, three and five years post routine transplant are lower than pre-transplant.

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INTRODUCTION

- 9 Islet transplant data has been collected by NHSBT since the introduction of four transplant and follow-up forms in July 2010. This paper provides basic summaries of transplant activity and outcomes.

DATA

- 10 Recent data on islet transplant activity, including simultaneous islet and kidney (SIK) grafts, and end of year transplant list between 1 January 2020 and 31 December 2022 from the UK Transplant Registry (UKTR) are reported, by centre and calendar year.
- 11 Between 1 April 2010 and 31 December 2021, there were 198 routine islet transplants performed in the UK. Outcome data on these 198 routine, and any subsequent priority, islet transplants have been analysed from the UKTR. Outcome data are reported for routine transplants only. Where outcome data are unavailable from UKTR, data collected by the UKITC clinical research forms have been considered. These data have been provided by the Newcastle research group who collate and maintain the research data base.
- 12 All islet transplant outcome data reported are specific to the routine transplant and one-year centre specific outcomes are presented in the Appendix.

RESULTS

- 13 The number of islet transplants performed by centre for the last three calendar years, 1 January 2020 to 31 December 2022, is shown by transplant type and islet status in **Tables 1** and **2**, respectively. **Table 3** shows the transplant list at the end of the last three calendar years by islet status.
- 14 Between 1 April 2010 and 31 December 2021, there were a total of 308 islet transplants performed, 198 (64%) of which were routine (including 30 SIK transplants) and 110 were priority. One patient received only a priority transplant in this time period as their routine transplant was before 1 April 2010.
- 15 For those patients receiving a routine transplant between 1 April 2010 and 31 December 2021, the number of known graft failures at one-year post-transplant is reported in **Table 4**. Of the 198 routine transplants performed, 109 patients subsequently received a priority graft. The majority of these patients received their first priority graft within six months of their routine graft: 0-3 months for 32 (29%) patients; 3-6 months for 38 (35%) patients; 6-12 months for 37 (34%) patients and more than one year for two patients who were highly sensitised.

Table 1 UK islet transplant activity between 1 January 2020 and 31 December 2022, by transplant type and calendar year

Transplant Centre	2020					Total		2021					Total		2022					Total	
	ITA	IAK	IAP	IAPK	SIK	N	%	ITA	IAK	IAP	IAPK	SIK	N	%	ITA	IAK	IAP	IAPK	SIK	N	%
Bristol	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Edinburgh	4 ¹	0	0	0	1 ¹	5	36	7	2	0	0	3	12	52	6 ¹	3 ¹	0	0	2 ¹	11	65
King's	1	0	0	0	0	1	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manchester	0	0	0	0	2 ¹	2	14	0	1 ¹	0	0	3 ²	4	17	0	2	0	0	3	5	29
Newcastle	4	0	0	0	0	4	29	3	2	0	0	0	5	22	1	0	0	0	0	1	6
Oxford	1	0	0	0	1	2	14	1 ¹	0	0	0	1	2	9	0	0	0	0	0	0	0
Royal Free	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	10	0	0	0	4	14	100	11	5	0	0	7	23	100	7	5	0	0	5	17	100

ITA = Islet transplant alone IAK = Islet after kidney IAP = Islet after pancreas IAPK = Islet after simultaneous pancreas/ kidney
 SIK = Simultaneous islet/kidney

¹ Includes 1 DCD transplant

² Includes 2 DCD transplants

Table 2 UK islet transplant activity between 1 January 2020 and 31 December 2022, by islet status, number of patients and calendar year

Transplant Centre	2020								2021								2022							
	Routine Islet alone		Priority	Total		Number of patients		Routine Islet alone		Priority	Total		Number of patients		Routine Islet alone		Priority	Total		Number of patients				
	SIK	N	%	N	%	N	%	SIK	N	%	N	%	N	%	SIK	N	%	N	%	N	%			
Bristol	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Edinburgh	1	1	3	5	36	5	38	5	3	4	12	52	9	47	4	2	5	11	65	8	57			
King's	0	0	1	1	7	1	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Manchester	0	2	0	2	14	2	15	0	3	1	4	17	4	21	0	3	2	5	29	5	36			
Newcastle	3	0	1	4	29	3	23	4	0	1	5	22	4	21	1	0	0	1	6	1	7			
Oxford	1	1	0	2	14	2	15	1	1	0	2	9	2	11	0	0	0	0	0	0	0			
Royal Free	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
TOTAL	5	4	5	14	100	13	100	10	7	6	23	100	19	100	5	5	7	17	100	14	100			

Table 3 UK islet transplant list, 31 December 2020 to 31 December 2022, by islet status and calendar year

Transplant Centre	31 December 2020					31 December 2021					31 December 2022				
	Routine		Priority	Total		Routine		Priority	Total		Routine		Priority	Total	
	Islet alone	SIK		N	%	Islet alone	SIK		N	%	Islet alone	SIK		N	%
Bristol	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Edinburgh	4	0	1	5	25	6	3	4	13	39	2	0	1	3	14
King's	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manchester	0	7	0	7	35	1	6	2	9	27	0	8	0	8	36
Newcastle	5	1	0	6	30	5	1	3	9	27	7	1	0	8	36
Oxford	2	0	0	2	10	1	0	1	2	6	1	2	0	3	14
Royal Free	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	11	8	1	20	100	13	10	10	33	100	10	11	1	22	100

Table 4 One-year graft outcome following routine islet transplant, 1 April 2010 to 31 December 2021			
Number of grafts	No. of transplants	No. with known outcome at one year	No. with known graft failure at one year
Islet routine graft			
Routine only	71	60	16
Routine and one priority graft	96	91	6
Routine and two priority grafts	1	1	0
SIK routine graft			
Routine only	18	11	3
Routine and one priority graft	12	9	0
Routine and two priority grafts	0	0	0
Total	198	172	25

Figure 1a One-year graft function by total IEQ per kg recipient body weight for islet alone routine only grafts, 1 April 2010 to 31 December 2021

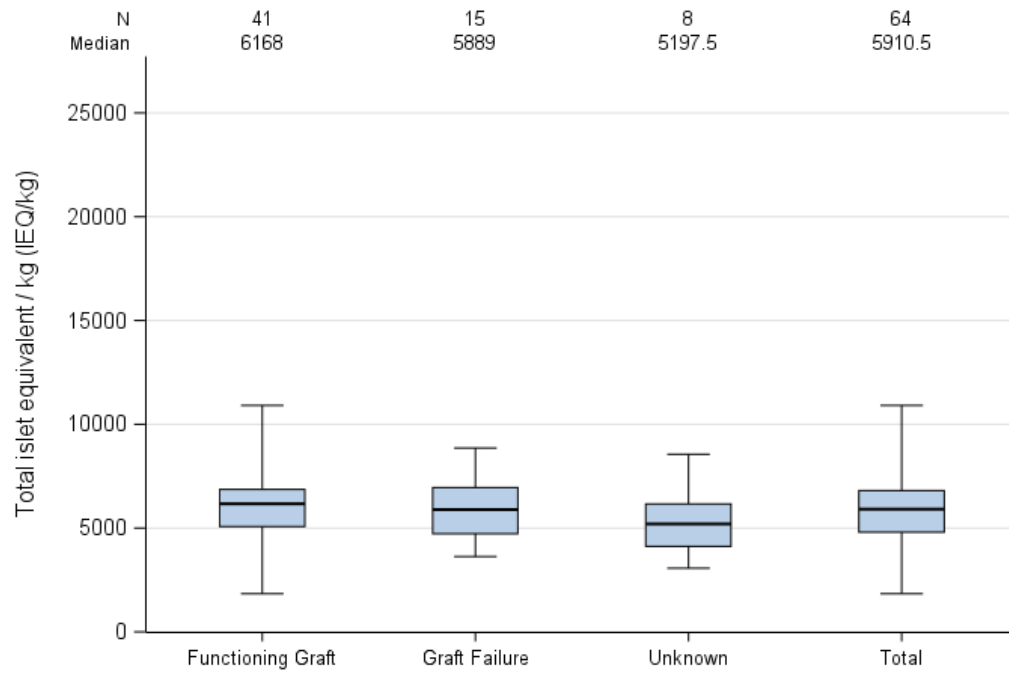


Figure 2a One-year graft function by total IEQ per kg recipient body weight for islet alone routine and priority grafts, 1 April 2010 to 31 December 2021

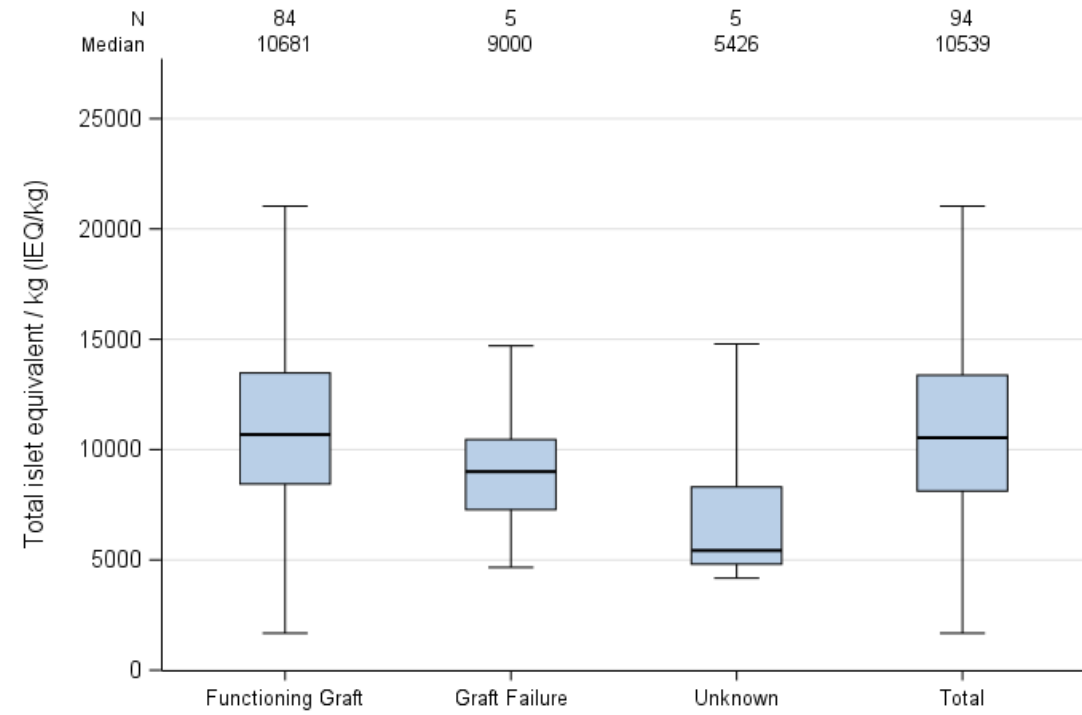


Figure 1b One-year graft function by total IEQ per kg recipient body weight for islet alone routine only grafts, 1 January 2016 to 31 December 2021

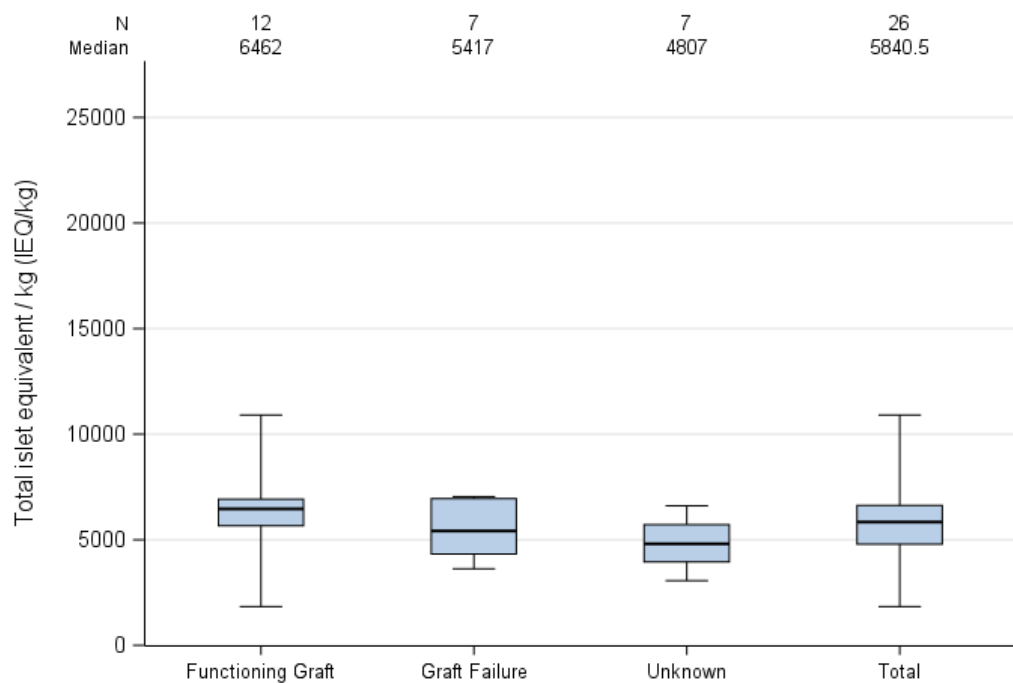
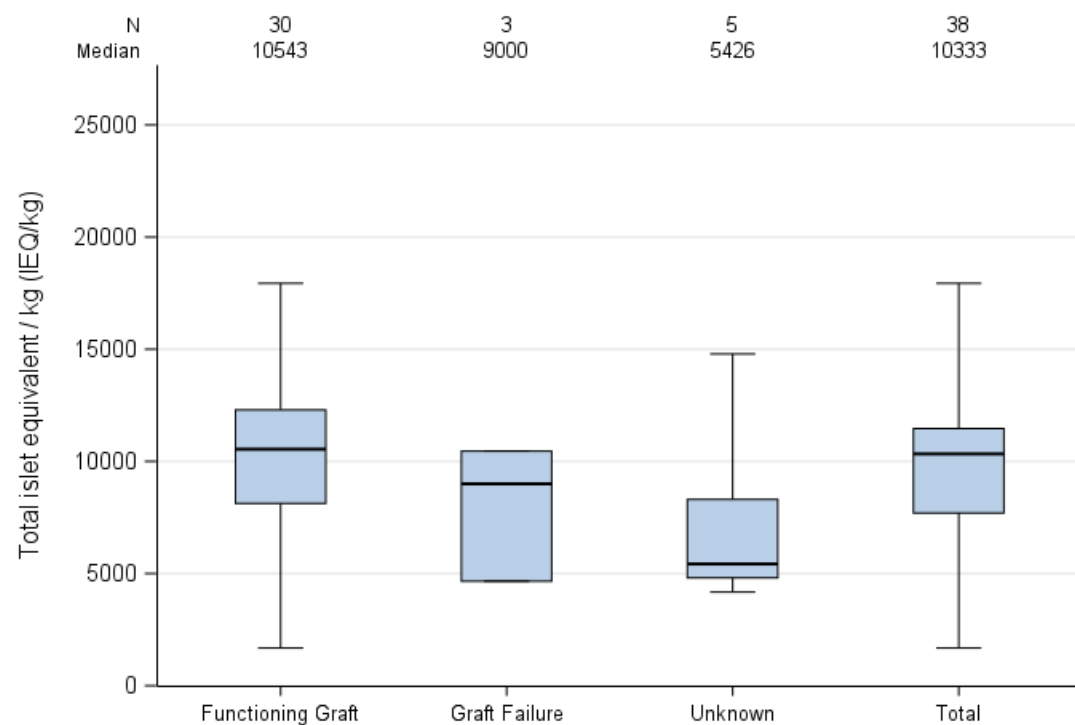


Figure 2b One-year graft function by total IEQ per kg recipient body weight for islet alone routine and priority grafts, 1 January 2016 to 31 December 2021



- 16 One-year graft outcome by total IEQ per kg (IEQx1000/kg) transplanted is presented in **Figures 1a** and **2a**, for the whole time period for islet alone routine only and routine and priority grafts, respectively. **Figures 1b** and **2b** show the data for transplants in the recent time period, 1 January 2016 to 31 December 2021. The median total IEQ per kg transplanted for 15 SIK routine only transplants was 3594 (IQR 2579 - 5424) and for 12 SIK routine and priority grafts was 8096.5 (IQR 7312 – 10805.5). This was lower than the median for islet alone transplants in both groups.
- 17 Kaplan-Meier survival plots showing one-year and five-year graft survival after first routine islet alone transplants are presented in **Figure 3** and **Figure 4**, respectively. One year graft survival is 89%, 95% CI (81-94%) for transplants performed between 1 April 2010 and 31 December 2015 and 83%, 95% CI (69-91%) for transplants performed between 1 January 2016 and 31 December 2021, and not statistically significantly different ($p=0.3012$). Five year graft survival is 50%, 95% CI (39-61%) for transplants performed between 1 April 2008 and 31 December 2014 and 61%, 95% CI (46-73%) for transplants performed between 1 January 2015 and 31 December 2021.
- 18 **Figure 5** shows a Kaplan-Meier survival plot of five-year graft survival by type of graft. Estimated five-year graft survival for first routine only grafts is 38%, 95% CI (24-51%) and for first routine grafts followed by a priority graft is 62%, 95% CI (51-72%). This difference was statistically significant, $p=0.0002$.
- 19 **Figure 6** shows a Kaplan-Meier survival plot of five-year graft survival by type of graft, where the first routine graft was still functioning at one-year post-transplant. Estimated five-year graft survival for routine only grafts is 52%, 95% CI (34-67%) and for routine grafts followed by a priority graft is 66%, 95% CI (54-76%). This difference was not statistically significant, $p=0.0840$.
- 20 **Figure 7** shows a Kaplan-Meier survival plot of five-year patient survival after first routine islet alone transplant. Five year patient survival is 92%, 95% CI (84-96%).
- 21 Of the 30 SIK islet transplants in the 1 April 2010 to 31 December 2021 time period, 28 were the first islet transplant for the patient. Of these 28, follow-up information was available for 27 and the estimated one-year graft survival rate is 88%, 95% CI (68-96%).

Figure 3 One-year graft survival following first routine islet alone transplantation performed in the UK between 1 April 2010 and 31 December 2021, by when transplant was performed

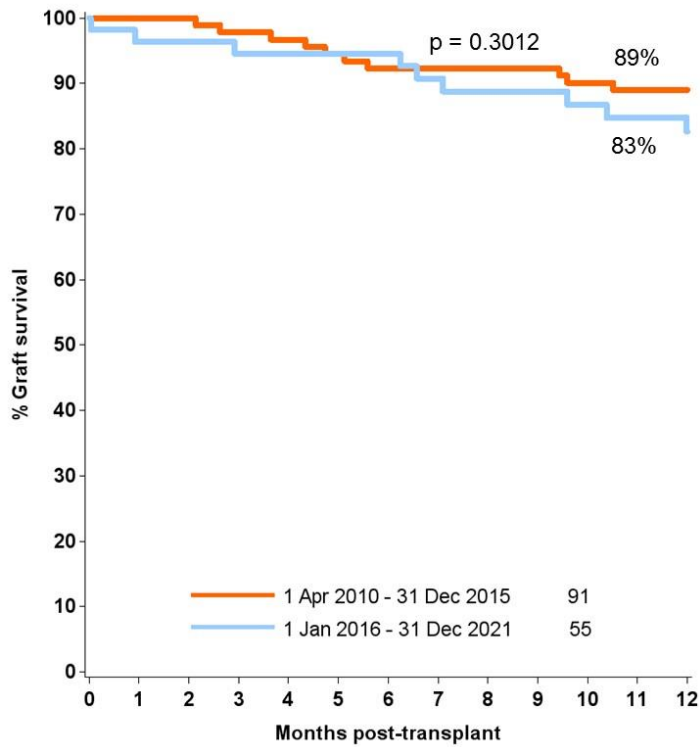


Figure 4 Five-year graft survival following first routine islet alone transplantation performed in the UK between 1 April 2008 and 31 December 2021, by when transplant was performed

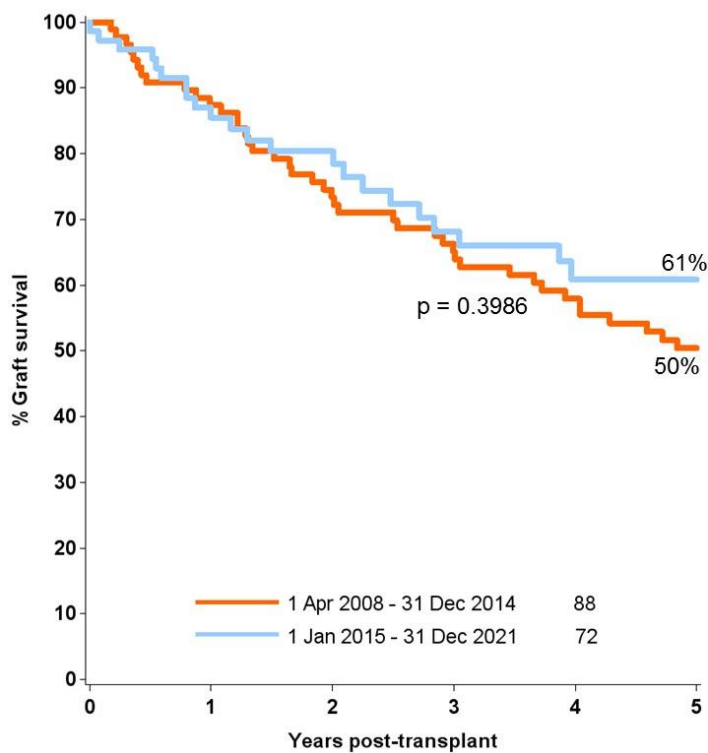


Figure 5 Five-year graft survival following first routine islet alone transplantation performed in the UK between 1 April 2008 and 31 December 2021, by type of graph

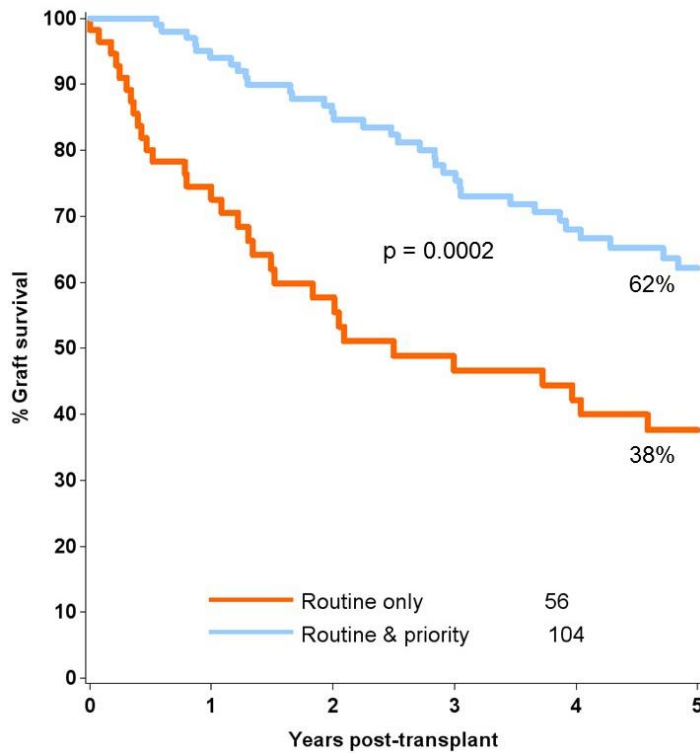


Figure 6 Five-year graft survival following first routine islet alone transplantation where the routine graft was functioning at one year in the UK between 1 April 2008 and 31 December 2021, by type of graph

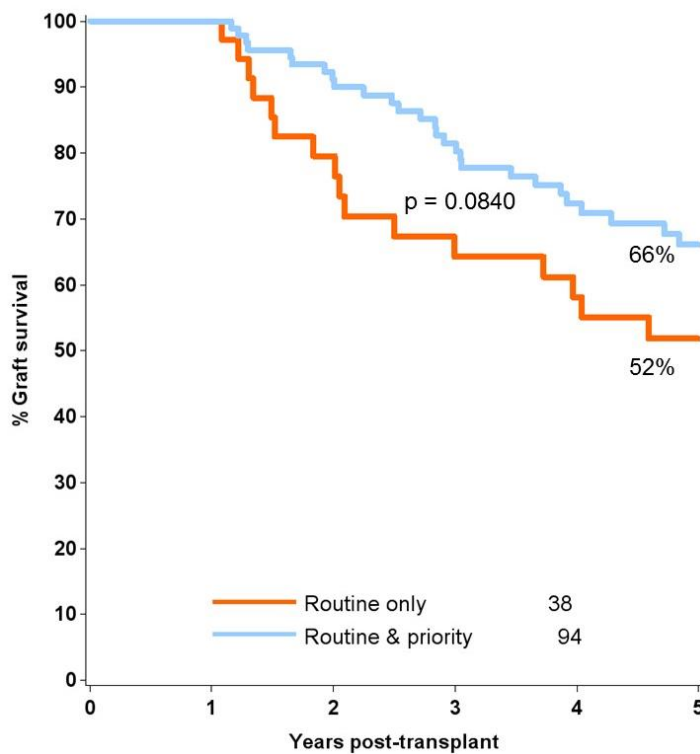
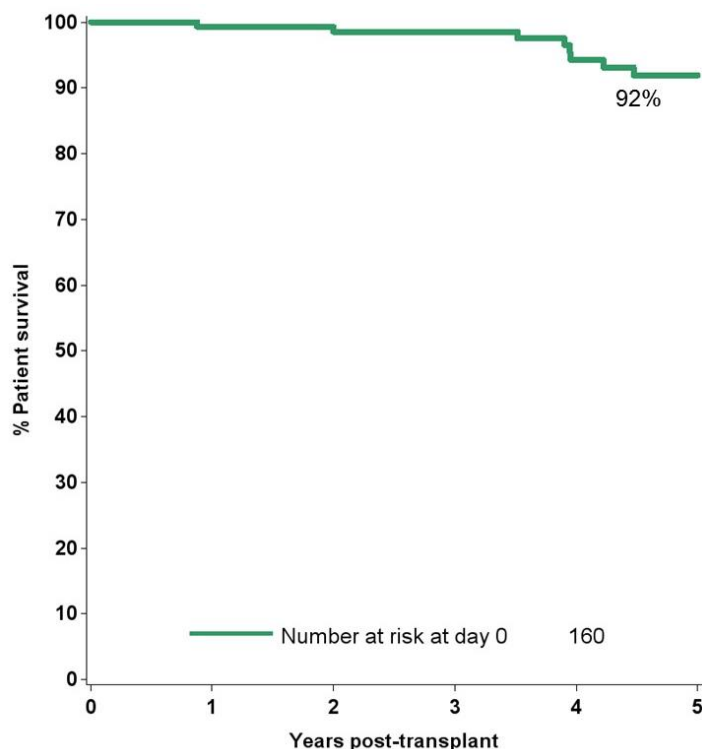


Figure 7 Five-year patient survival following first routine islet alone transplantation performed in the UK between 1 April 2008 and 31 December 2021



- 23 **Figures 8 and 9** show the median rate of severe hypoglycaemic events, excluding SIK transplants, for routine only grafts and for routine and priority grafts, respectively. Overall, at one-year post-transplant data were available in 125 cases, 107 (86%) patients experienced no severe hypoglycaemic events during the first year following their routine transplant, whilst 18 (14%) patients experienced between one and five events. Of 122 cases where it could be calculated, 83 (68%) patients had a reduced number of events at one year post-transplant.
- 24 For the 25 SIK transplants where severe hypoglycaemic events were reported at transplant, the median rate was 2 (IQR 0-41) and for the 14 reported at one-year post-transplant, the median rate was 0 (IQR 0-0).
- 25 Median HbA1c is reported in **Figure 10** for routine only grafts and **Figure 11** for routine and priority grafts, excluding SIK transplants. Overall, data were available to calculate the reduction in HbA1c in 126 cases at one-year post-transplant and in 104 (83%) patients a reduction in HbA1c was reported. The proportion of patients with HbA1c of less than 53 mmol/mol was 17% of 156 at time of transplant, 56% of 133 patients at one-year post-transplant, 40% of 85 patients at three years and 37% of 49 patients at five years post-transplant.
- 26 For the 26 SIK transplants where HbA1c was reported at transplant, the median was 64 mmol/mol (IQR 59-73) and for the 13 reported at one-year post-transplant, the median was 55 mmol/mol (IQR 43-61).

Figure 8 Median annual rate of severe hypoglycaemic events post-transplant for routine only grafts, 1 April 2010 – 31 December 2021 (excluding SIK transplants)

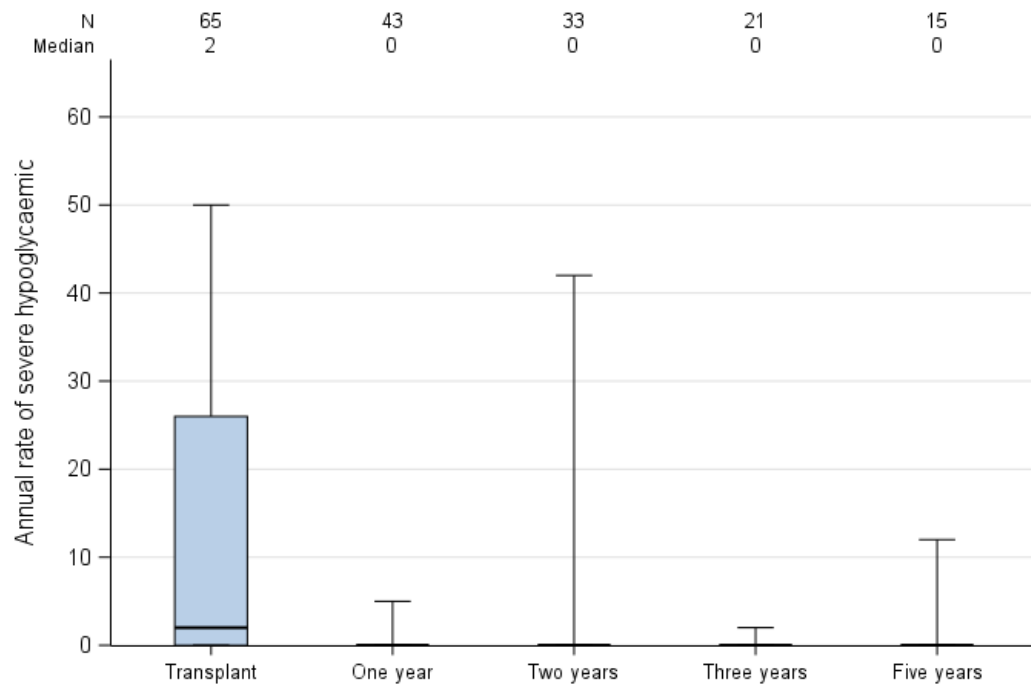


Figure 9 Median annual rate of severe hypoglycaemic events post-transplant for routine and priority grafts, 1 April 2010 – 31 December 2021 (excluding SIK transplants)

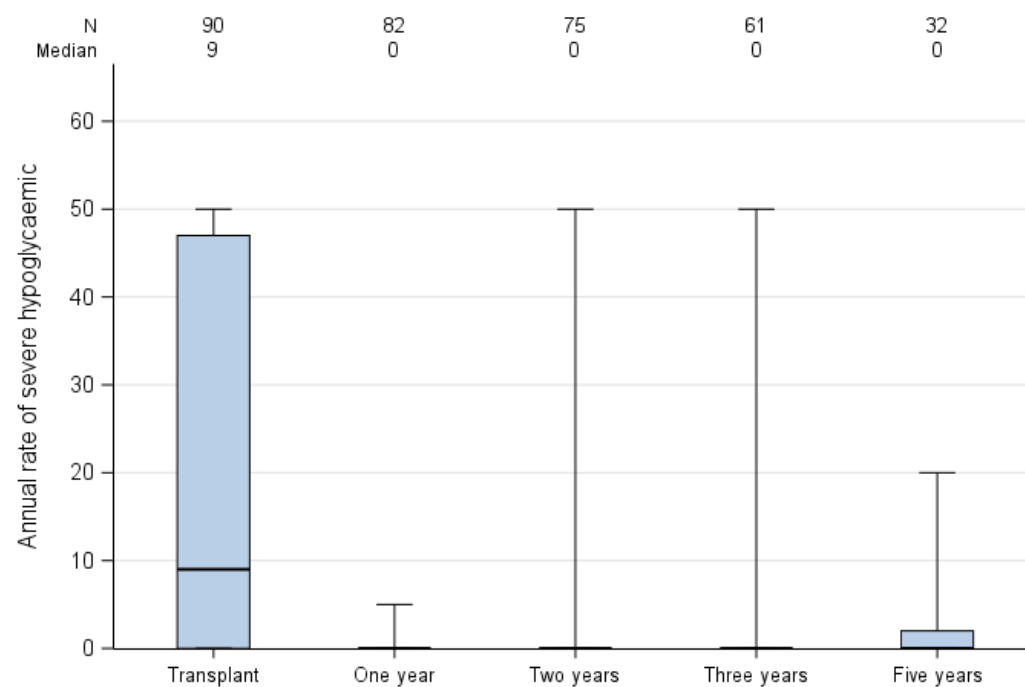


Figure 10 Median HbA1C post-transplant for routine only grafts, 1 April 2010 – 31 December 2021 (excluding SIK transplants)

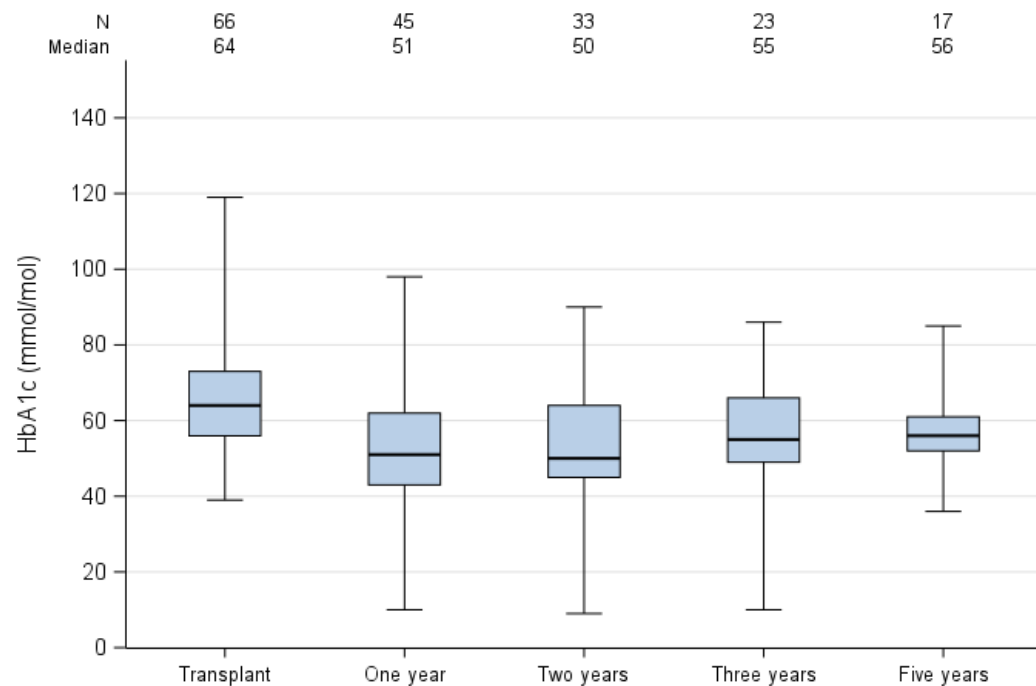


Figure 11 Median HbA1C post-transplant for routine and priority grafts, 1 April 2010 – 31 December 2021 (excluding SIK transplants)

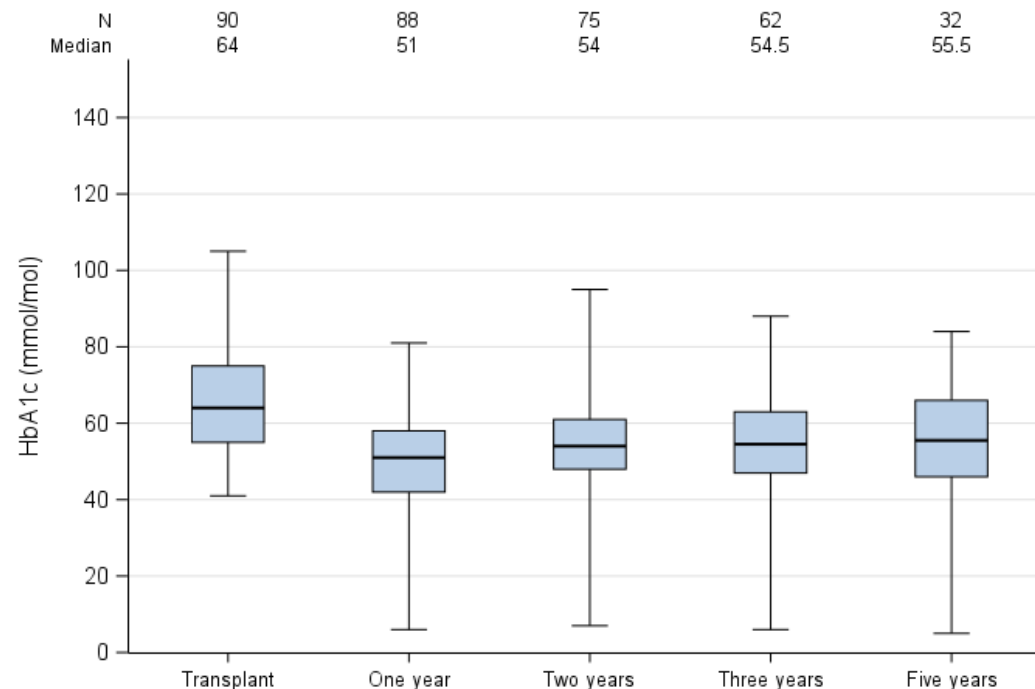


Figure 12 Median insulin dose post-transplant for routine only grafts, 1 April 2010 – 31 December 2021 (excluding SIK transplants)

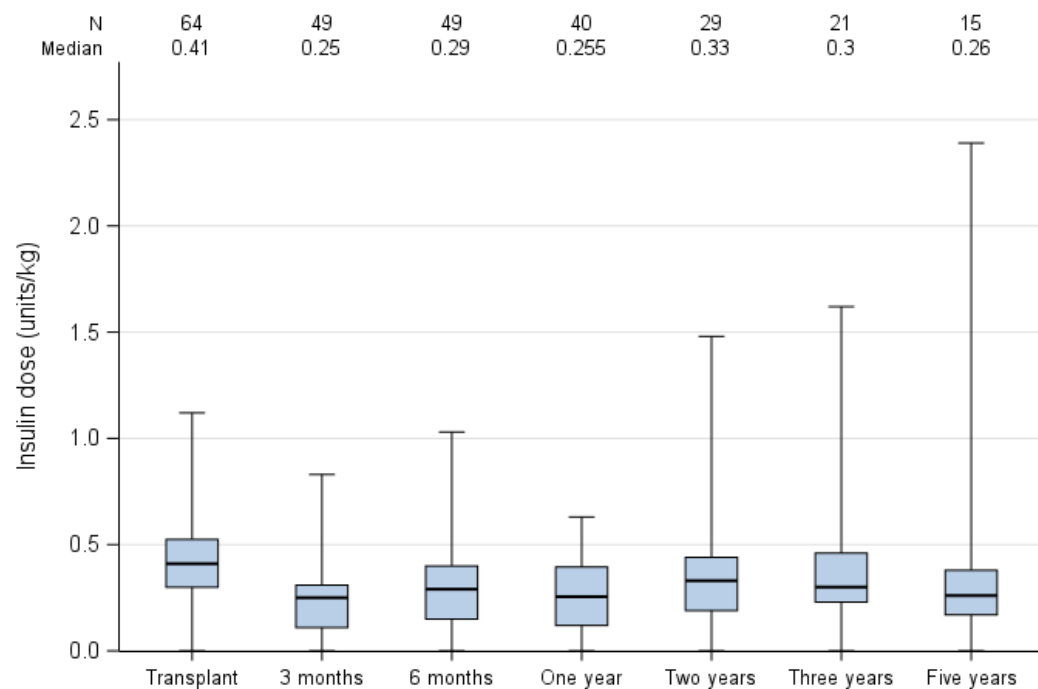
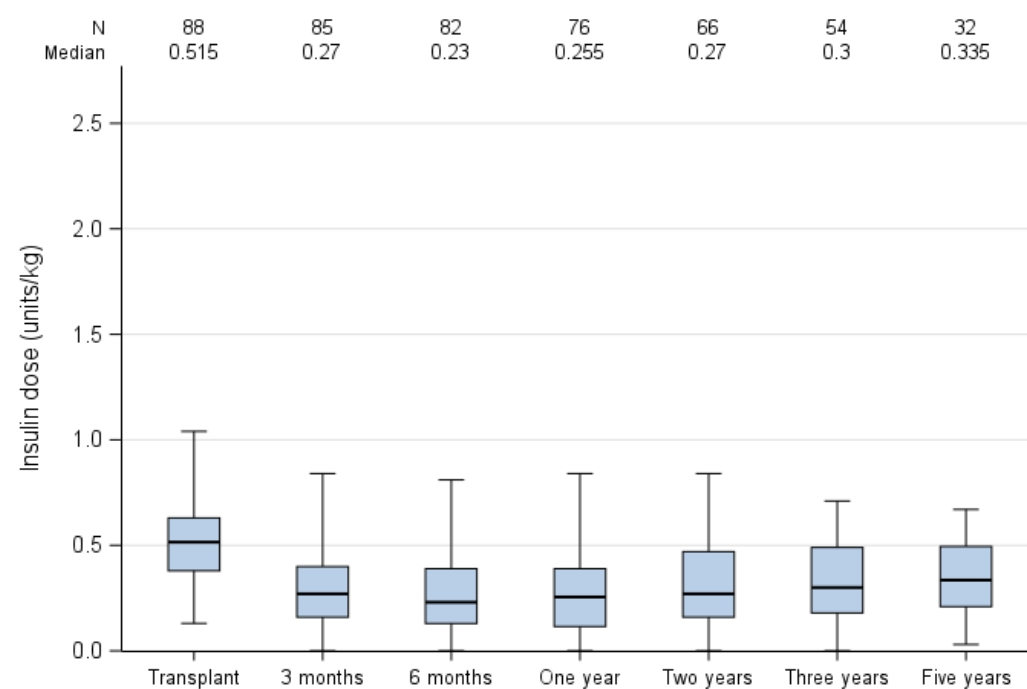


Figure 13 Median insulin dose post-transplant for routine and priority grafts, 1 April 2010 – 31 December 2021 (excluding SIK transplants)



- 27 **Figure 12** and **Figure 13** show the median insulin dose for routine only grafts and routine and priority grafts, respectively, excluding SIK transplants. Overall, in 112 patients where the difference in insulin dose between transplant and one-year post-transplant could be calculated, 100 (89%) reported a reduction. Of the 126 patients with insulin independence status reported for the first-year post-transplant, 43 (34%) achieved insulin independence at some point in the year.
- 28 For the 27 SIK transplants where insulin dose was reported at transplant, the median was 0.48 units/kg (IQR 0.35-0.7) and for the 13 reported at one-year post-transplant, the median was 0.35 units/kg (IQR 0.26-0.47).

SUMMARY

- 29 In 2022, the number of islet transplants and patients on the waiting list at the end of the year have increased.
- 30 One-year graft survival is 83% for transplants performed between 1 January 2016 and 31 December 2021 and 89% for the earlier cohort between 1 April 2010 and 31 December 2015. Five-year graft survival was 50% overall between 1 January 2015 and 31 December 2021. Those patients receiving a routine and a priority top-up graft had significantly better five-year graft survival than those receiving a routine only, 62% and 38%, respectively, $p=0.0002$.
- 31 The median annual rate of severe hypoglycaemic events, HbA1c and insulin dose at one-year, two, three and five years post routine transplant were lower than at pre-transplant.

APPENDIX

Table I		Islet graft function at one year post transplant by transplant centre, 1 April 2010 to 31 December 2021				
Transplant centre	Routine transplants performed	Priority transplants performed (% of routine)	Graft function at one year following routine transplant in the time period			
			No. with known outcome	Graft failure (% of known outcome)	Priority grafts with graft failure	
Bristol	3	1 (33)	3	0 (0)	0	
Edinburgh	73	50 (68)	64	7 (11)	4	
King's College	11	7 (64)	8	2 (25)	0	
Manchester	25	13 (52)	21	3 (14)	0	
Newcastle	37	17 (46)	34	3 (9)	0	
Oxford	38	17 (45)	31	9 (29)	2	
Royal Free	11	5 (45)	11	1 (9)	0	
Total	198¹	110 (56)	172²	25³ (15)	6	

¹ Includes 30 SIK transplants: Edinburgh (11), Manchester (16), Newcastle (1), Oxford (2)
² Includes 20 SIK transplants: Edinburgh (7), Manchester (12), Newcastle (1)
³ Includes 3 SIK transplants: Edinburgh (1), Manchester (2)

Transplant centre	Routine transplant s (one-year data expected ²)		At registration			Annual rate of severe hypoglycaemic events						Reduction ³	No. with reduced events	Reduction not calculated ⁴		
	N	(N)	N	Median	(IQ range)	N	Median	(IQ range)	N	Median	(IQ range)				N	Median
Bristol	3	3	3	2	(2 - 3)	3	3	(2 - 50)	3	0	(0 - 0)	3	3	(2 - 50)	3	0 (0)
Edinburgh	62	59	52	45	(10 - 50)	58	31	(8 - 50)	50	0	(0 - 0)	48	34	(8 - 50)	42	11 (19)
King's College	11	9	9	4	(2 - 16)	11	3	(0 - 16)	6	0	(0 - 0)	6	2	(0 - 50)	3	3 (33)
Manchester	9	8	6	5	(1 - 8)	9	3	(1 - 8)	8	0	(0 - 0)	8	4	(1 - 9)	6	0 (0)
Newcastle	36	34	21	10	(2 - 25)	36	18	(2 - 30)	27	0	(0 - 1)	27	8	(1 - 28)	23	7 (21)
Oxford	36	33	7	3	(1 - 4)	28	0	(0 - 1)	22	0	(0 - 0)	21	0	(0 - 0)	5	12 (36)
Royal Free	11	10	3	4	(0 - 8)	10	0	(0 - 0)	9	0	(0 - 0)	9	0	(0 - 0)	1	1 (10)
Total	168	156	101	13	(3 - 50)	155	7	(0 - 34)	125	0	(0 - 0)	122	7	(0 - 37)	83	34 (22)

¹ Excluding SIK transplants
² Follow-up reported or graft not known to have failed
³ Between transplant and one-year
⁴ Information missing at either transplant or one-year out of those where expected

Transplant centre	Routine transplants (one-year data expected ²)		At transplant			HbA1c mmol/mol At one-year			Reduction ³			No. with lower HbA1c N	Reduction not calculated ⁴ N (%)
	N	(N)	N	Median	(IQ range)	N	Median	(IQ range)	N	Median	(IQ range)		
Bristol	3	3	3	68	(53 - 70)	3	56	(33 - 81)	3	0	(0 - 37)	1	0 (0)
Edinburgh	62	59	57	62	(53 - 71)	52	54	(48 - 63)	49	6	(1 - 13)	37	10 (17)
King's College	11	9	11	70	(55 - 86)	6	42	(10 - 45)	6	26	(9 - 87)	6	3 (33)
Manchester	9	8	9	64	(57 - 75)	8	45	(43 - 47)	8	18	(8 - 36)	8	0 (0)
Newcastle	36	34	36	72	(61 - 83)	29	51	(42 - 58)	29	17	(13 - 28)	25	5 (15)
Oxford	36	33	29	62	(55 - 69)	26	49	(41 - 58)	22	17	(10 - 25)	21	11 (33)
Royal Free	11	10	11	61	(56 - 86)	9	51	(43 - 57)	9	4	(0 - 20)	6	1 (10)
Total	168	156	156	64	(55 - 75)	133	51	(42 - 59)	126	13	(3 - 21)	104	30 (19)

¹ Excluding SIK transplants
² Follow-up reported or graft not known to have failed
³ Between transplant and one-year
⁴ Information missing at either transplant or one-year out of those where expected

Transplant centre	Routine transplants (one-year data expected ²)		At transplant			Insulin dose/kg At one-year			Reduction ³			No. insulin independent	Reduction not calculated ⁴
	N	(N)	N	Median	(IQ range)	N	Median	(IQ range)	N	Median	(IQ range)	N	N (%)
Bristol	3	3	3	0.42	(0.37 - 0.48)	3	0.20	(0.12 - 0.47)	3	0.22	(0.01 - 0.25)	1	0 (0)
Edinburgh	62	59	57	0.51	(0.38 - 0.61)	48	0.25	(0.11 - 0.39)	45	0.23	(0.14 - 0.36)	23	14 (24)
King's College	11	9	10	0.35	(0.22 - 0.42)	4	0.13	(0.07 - 0.21)	4	0.20	(0.15 - 0.27)	3	5 (56)
Manchester	9	8	9	0.52	(0.45 - 0.55)	7	0.30	(0.23 - 0.38)	7	0.27	(0.25 - 0.35)	3	1 (13)
Newcastle	36	34	36	0.44	(0.33 - 0.56)	25	0.29	(0.12 - 0.40)	25	0.19	(0.04 - 0.28)	5	9 (26)
Oxford	36	33	27	0.45	(0.32 - 0.62)	20	0.26	(0.12 - 0.38)	20	0.26	(0.07 - 0.43)	6	13 (39)
Royal Free	11	10	10	0.56	(0.40 - 0.80)	9	0.42	(0.24 - 0.50)	8	0.14	(0.01 - 0.35)	2	2 (20)
Total	168	156	152	0.48	(0.33 - 0.60)	116	0.26	(0.12 - 0.39)	112	0.23	(0.10 - 0.33)	43	44 (28)

¹ Excluding SIK transplants
² Follow-up reported or graft not known to have failed
³ Between transplant and one-year
⁴ Information missing at either transplant or one-year out of those where expected