

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 financial years were analysed. Data on 185 routine, and subsequent priority, islet transplants performed in the UK between 1 April 2010 and 31 March 2021 were analysed from the UKTR. Outcome data are reported for routine transplants only.

RESULTS

- 3 In 2021/2022 there were 22 islet transplants performed, of which seven were SIK. There were 26 patients on the islet transplant list at 31 March 2022, 22 routine (eight SIK) and four priority patients.
- 4 One-year graft survival for first routine islet alone grafts is 80% for transplants performed 1 April 2016 to 31 March 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, 61% and 35%, respectively $p < 0.0001$.
- 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, 103 (86%) 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 54 (IQR 46 – 63) at three years post-transplant, for patients who received a routine and a priority graft. Overall, a reduction in HbA1c was reported for 101 (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 2021/2022, the number of islet transplants and patients on the waiting list at the end of the year have increased. One-year graft survival is 80% for transplants performed between 1 April 2016 and 31 March 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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- 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 April 2019 and 31 March 2022 from the UK Transplant Registry (UKTR) are reported, by centre and financial year.
- 11 Between 1 April 2010 and 31 March 2021, there were 185 routine islet transplants performed in the UK. Outcome data on these 185 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 financial years, 1 April 2019 to 31 March 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 financial years by islet status.
- 14 Between 1 April 2010 and 31 March 2021, there were a total of 290 islet transplants performed, 185 (64%) of which were routine (including 24 SIK transplants) and 105 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 March 2021, the number of known graft failures at one-year post-transplant is reported in **Table 4**. Of the 185 routine transplants performed, 104 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 30 (29%) patients; 3-6 months for 37 (36%) patients; 6-12 months for 34 (33%) patients and more than one year for two patients who were highly sensitised.

Table 1 UK islet transplant activity between 1 April 2019 and 31 March 2022, by transplant type and financial year

Transplant Centre	2019 - 2020							2020 - 2021							2021 - 2022						
	ITA	IAK	IAP	IAPK	SIK	Total		ITA	IAK	IAP	IAPK	SIK	Total		ITA	IAK	IAP	IAPK	SIK	Total	
						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	9 ⁴	3	0	0	1	13	46	3	1	0	0	1 ¹	5	33	8	2 ¹	0	0	3	13	59
King's	2 ¹	0	0	0	0	2	7	1	0	0	0	0	1	7	0	0	0	0	0	0	0
Manchester	0	1	0	0	4	5	18	0	0	0	0	3 ²	3	20	0	1 ¹	0	0	3 ¹	4	18
Newcastle	4	0	0	0	0	4	14	3	1	0	0	0	4	27	2	1	0	0	0	3	14
Oxford	4	0	0	0	0	4	14	1	0	0	0	1	2	13	1 ¹	0	0	0	1	2	9
Royal Free	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	19	4	0	0	5	28	100	8	2	0	0	5	15	100	11	4	0	0	7	22	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

³ Includes 3 DCD transplants

⁴ Includes 4 DCD transplants

Table 2 UK islet transplant activity between 1 April 2019 and 31 March 2022, by islet status, number of patients and financial year

Transplant Centre	2019 - 2020								2020 - 2021								2021 - 2022							
	Routine		Priority	Total		Number of patients		Routine		Priority	Total		Number of patients		Routine		Priority	Total		Number of patients				
	Islet alone	SIK		N	%	N	%	Islet alone	SIK		N	%	N	%	Islet alone	SIK		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	6	1	6	13	46	8	38	2	1	2	5	33	4	29	5	3	5	13	59	9	50			
King's	2	0	0	2	7	2	10	0	0	1	1	7	1	7	0	0	0	0	0	0	0			
Manchester	0	4	1	5	18	5	24	0	3	0	3	20	3	21	0	3	1	4	18	4	22			
Newcastle	3	0	1	4	14	3	14	3	0	1	4	27	4	29	2	0	1	3	14	3	17			
Oxford	2	0	2	4	14	3	14	1	1	0	2	13	2	14	1	1	0	2	9	2	11			
Royal Free	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
TOTAL	13	5	10	28	100	21	100	6	5	4	15	100	14	100	8	7	7	22	100	18	100			

Table 3 UK islet transplant list, 31 March 2020 to 31 March 2022, by islet status and financial year

Transplant Centre	31 March 2020					31 March 2021					31 March 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	2	1	1	4	20	1	2	0	3	16	4	1	0	5	19
King's	0	0	1	1	5	0	0	0	0	0	0	0	0	0	0
Manchester	3	12	0	15	75	0	8	1	9	47	3	6	1	10	38
Newcastle	0	0	0	0	0	3	1	1	5	26	5	0	3	8	31
Oxford	0	0	0	0	0	1	0	1	2	11	2	1	0	3	12
Royal Free	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	5	13	2	20	100	5	11	3	19	100	14	8	4	26	100

Table 4 One-year graft outcome following routine islet transplant, 1 April 2010 to 31 March 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	67	57	16
Routine and one priority graft	93	88	6
Routine and two priority grafts	1	1	0
SIK routine graft			
Routine only	15	10	2
Routine and one priority graft	9	8	0
Routine and two priority grafts	0	0	0
Total	185	164	24

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 March 2021

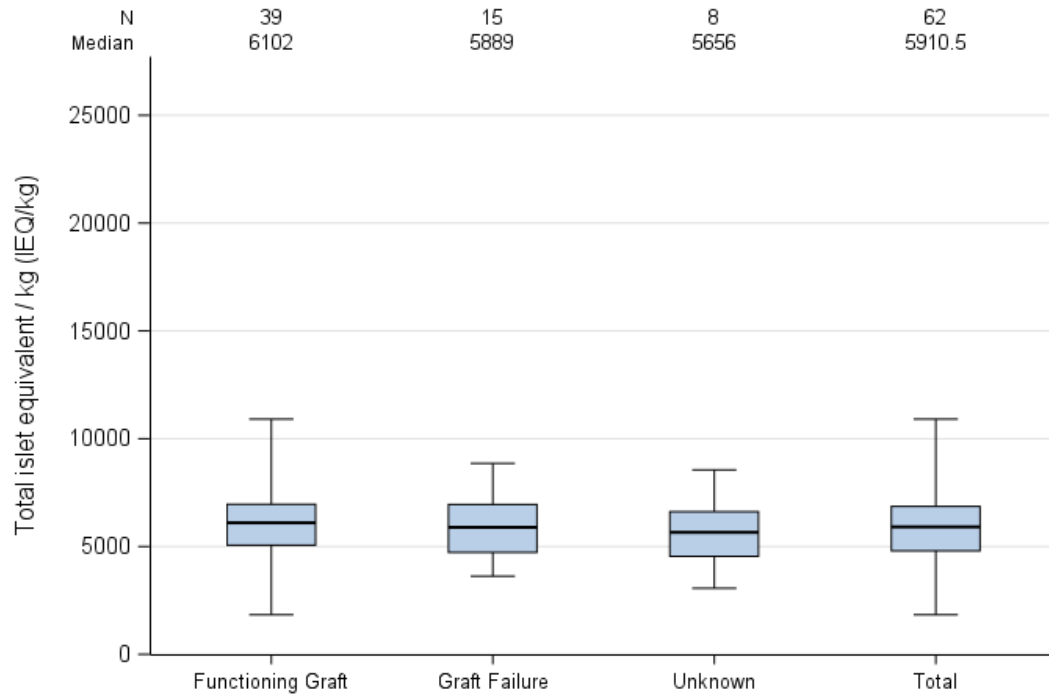


Figure 2a One-year graft function by total IEQ per kg recipient body weight for islet alone routine and priority grafts, 1 April 2010 to 31 March 2021

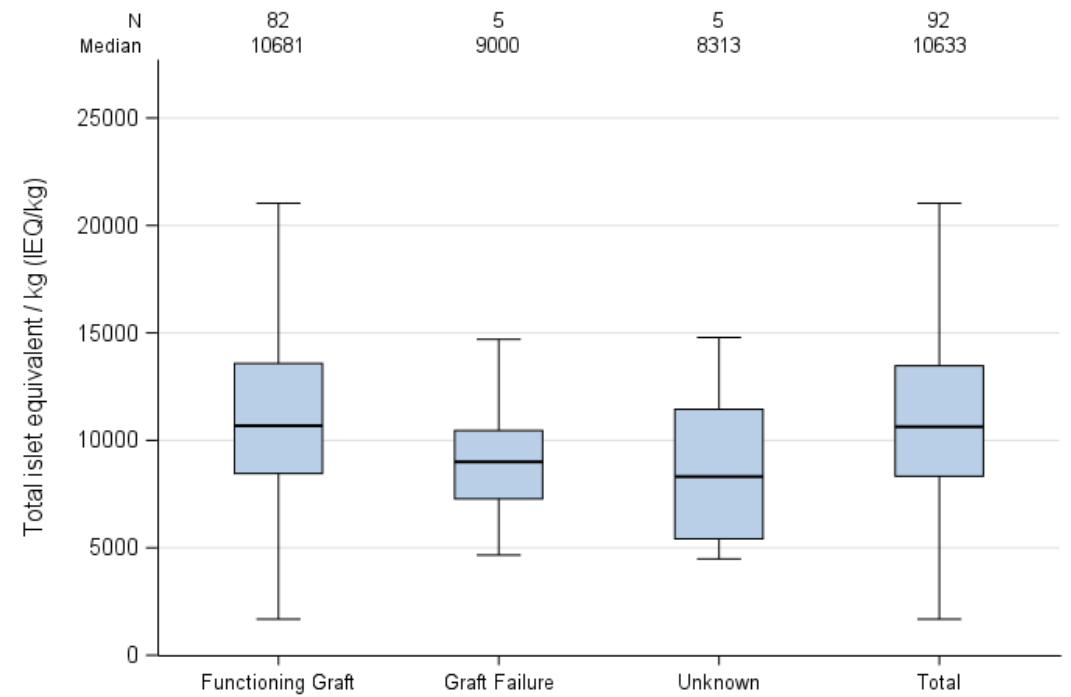


Figure 1b One-year graft function by total IEQ per kg recipient body weight for islet alone routine only grafts, 1 April 2016 to 31 March 2021

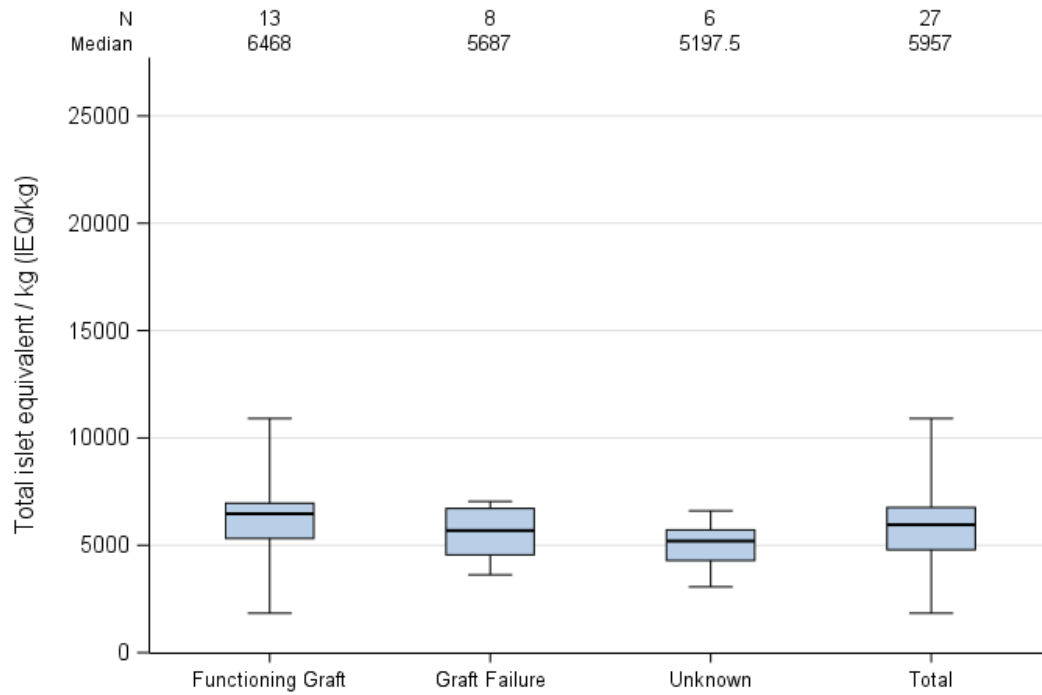
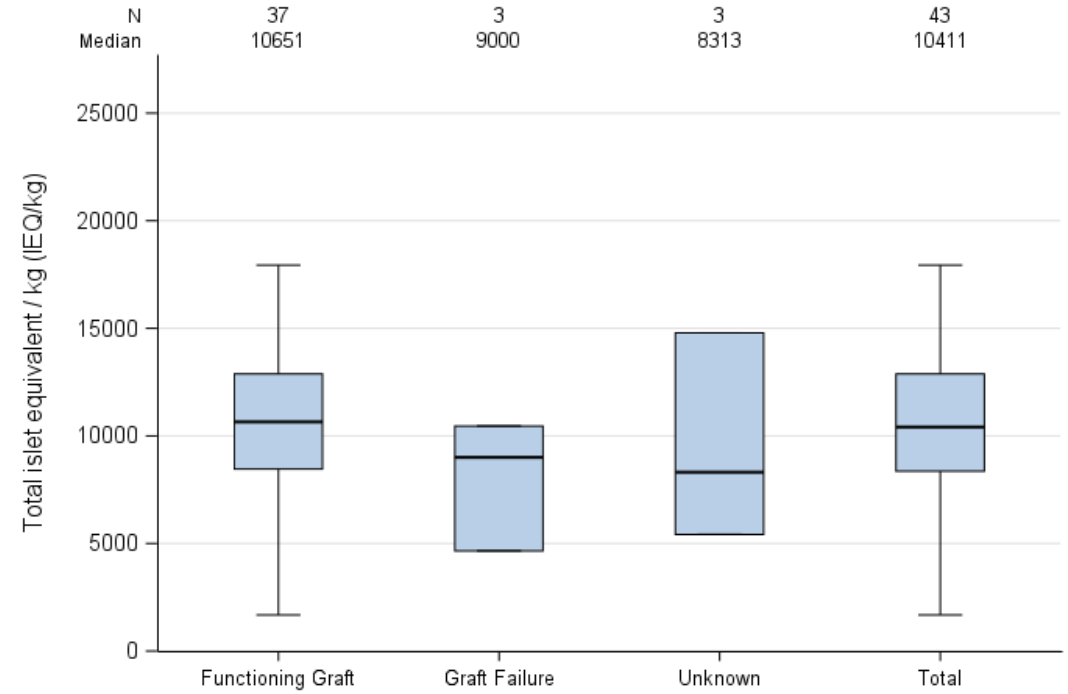


Figure 2b One-year graft function by total IEQ per kg recipient body weight for islet alone routine and priority grafts, 1 April 2016 to 31 March 2021



- 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, April 2016 to 31 March 2021. The median total IEQ per kg transplanted for 14 SIK routine only transplants was 3828.5 (IQR 2579 - 5424) and for nine SIK routine and priority grafts was 7924 (IQR 7015 – 10526). 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 January 2010 and 31 March 2016 and 80%, 95% CI (64-89%) for transplants performed between 1 April 2016 and 31 March 2021, although not statistically significantly different ($p=0.1345$). Five year graft survival is 52%, 95% CI (40-63%) for transplants performed between 1 January 2008 and 31 March 2014 and 54%, 95% CI (40-66%) for transplants performed between 1 April 2014 and 31 March 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 35%, 95% CI (22-49%) and for first routine grafts followed by a priority graft is 61%, 95% CI (50-71%). This difference was statistically significant, $p<0.0001$.
- 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 49%, 95% CI (31-65%) and for routine grafts followed by a priority graft is 65%, 95% CI (53-75%). This difference was not statistically significant, $p=0.0703$.
- 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 94%, 95% CI (86-97%).
- 21 Of the 24 SIK islet transplants in the 1 April 2010 to 31 March 2021 time period, 23 were the first islet transplant for the patient. Of these 23, follow-up information was available for 22 and the estimated one-year graft survival rate is 91%, 95% CI (68-98%).

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

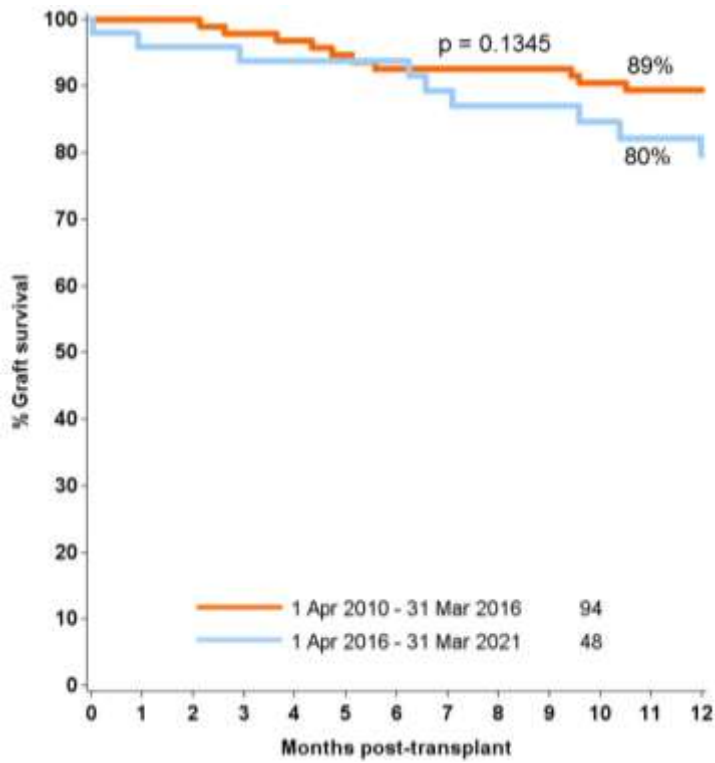


Figure 4 Five-year graft survival following first routine islet alone transplantation performed in the UK between 1 April 2008 and 31 March 2021, by when transplant was performed

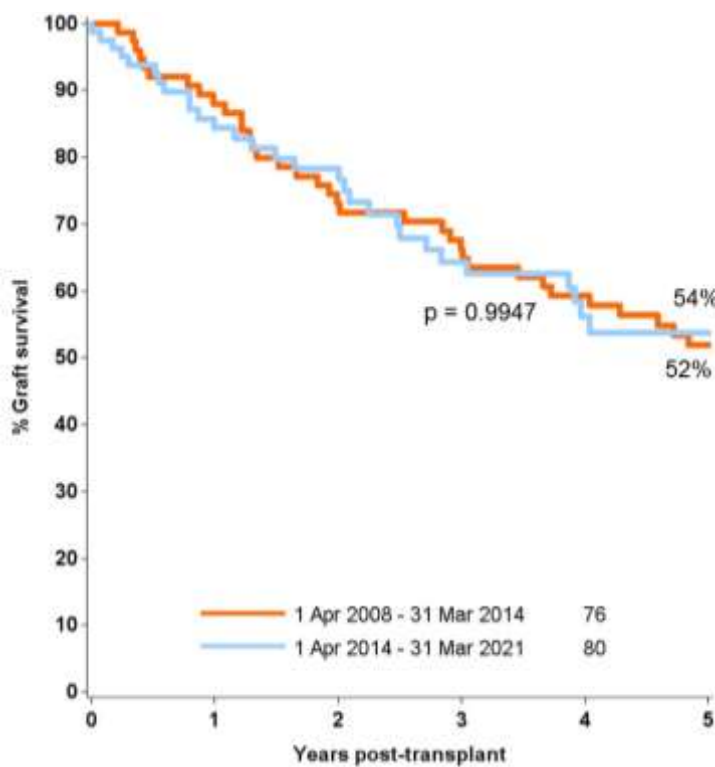


Figure 5 Five-year graft survival following first routine islet alone transplantation performed in the UK between 1 April 2008 and 31 March 2021, by type of graft

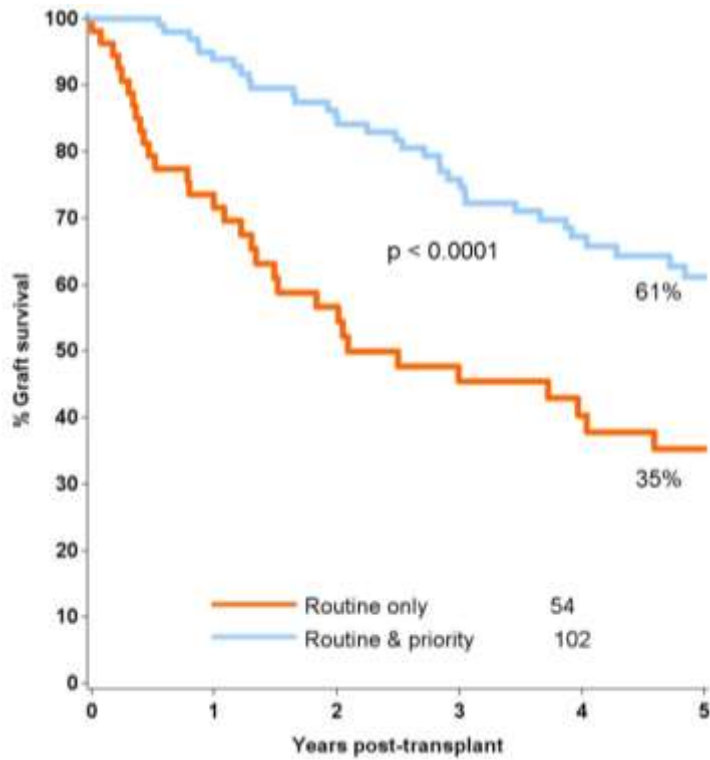


Figure 6 Five-year graft survival following first routine islet alone transplantation where the routine graft was functioning at one year in the UK between 1 April 2008 and 31 March 2021, by type of graft

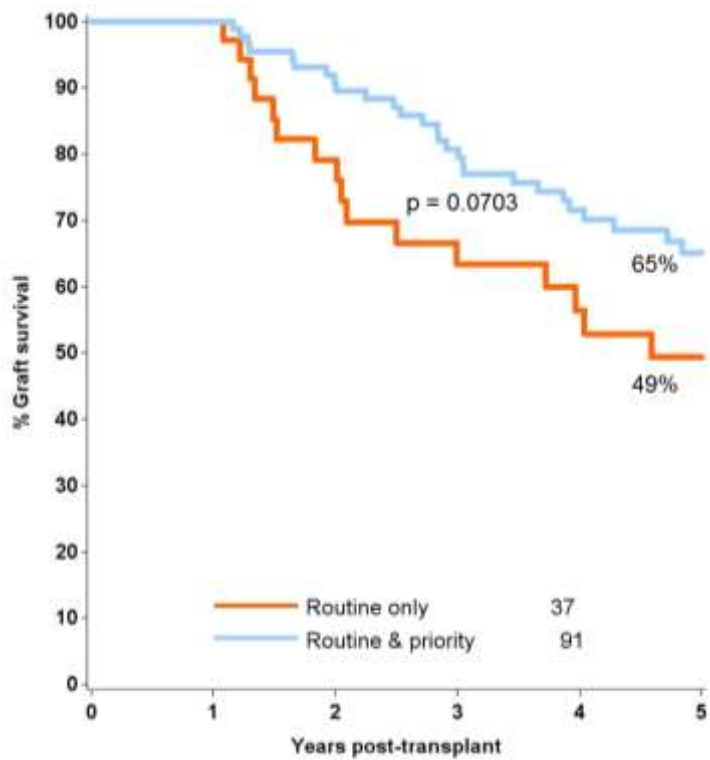
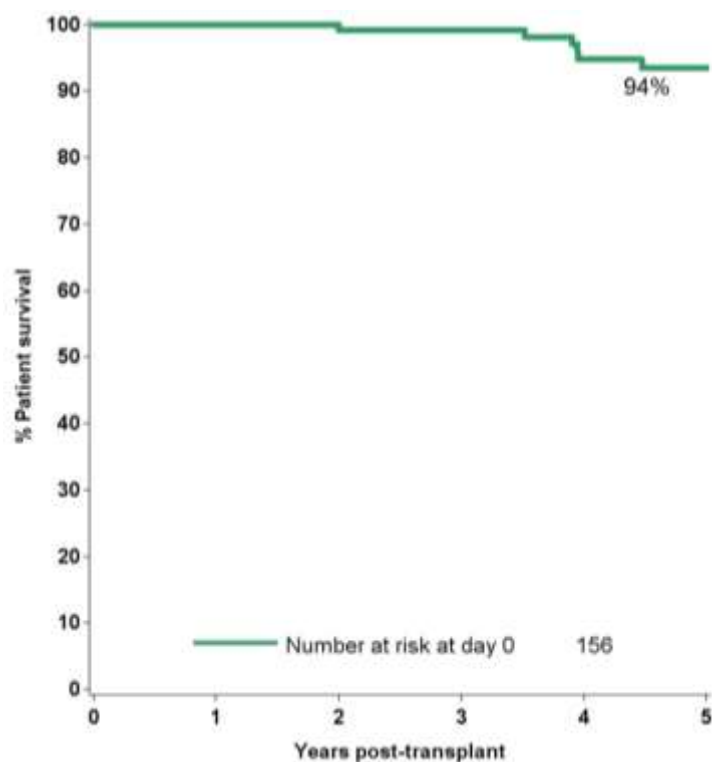


Figure 7 Five-year patient survival following first routine islet alone transplantation performed in the UK between 1 April 2008 and 31 March 2021



- 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 120 cases, 103 (86%) patients experienced no severe hypoglycaemic events during the first year following their routine transplant, whilst 17 (14%) patients experienced between one and five events. Of 119 cases where it could be calculated, 80 (67%) patients had a reduced number of events at one year post-transplant.
- 24 For the 21 SIK transplants where severe hypoglycaemic events were reported at transplant, the median rate was 2 (IQR 0-46) and for the 13 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 122 cases at one-year post-transplant and in 101 (83%) patients a reduction in HbA1c was reported. The proportion of patients with HbA1c of less than 53 mmol/mol was 17% of 154 at time of transplant, 56% of 127 patients at one-year post-transplant, 40% of 82 patients at three years and 37% of 46 patients at five years post-transplant.
- 26 For the 22 SIK transplants where HbA1c was reported at transplant, the median was 64 mmol/mol (IQR 59-76) and for the 12 reported at one-year post-transplant, the median was 55 mmol/mol (IQR 49-66).

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

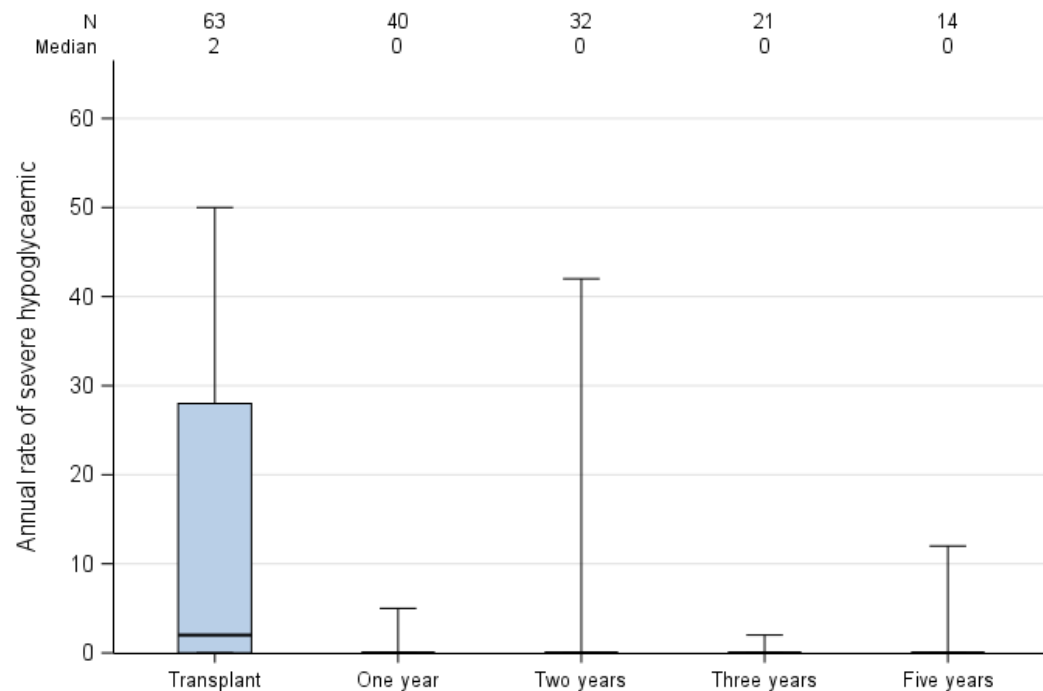


Figure 9 Median annual rate of severe hypoglycaemic events post-transplant for routine and priority grafts, 1 April 2010 – 31 March 2021 (excluding SIK transplants)

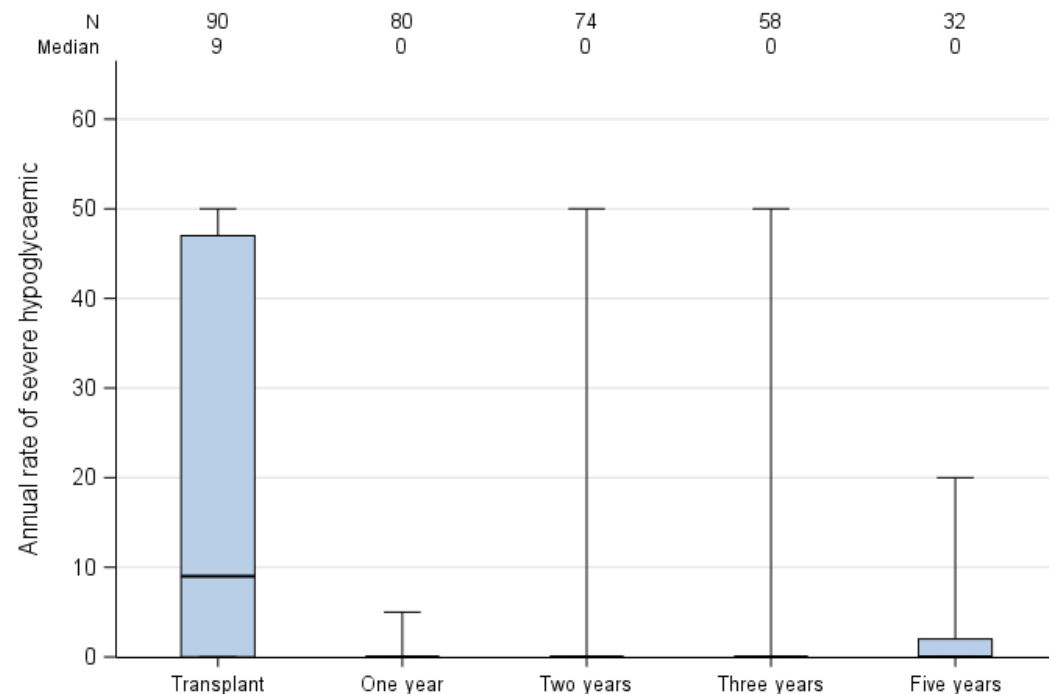


Figure 10 Median HbA1C post-transplant for routine only grafts, 1 April 2010 – 31 March 2021 (excluding SIK transplants)

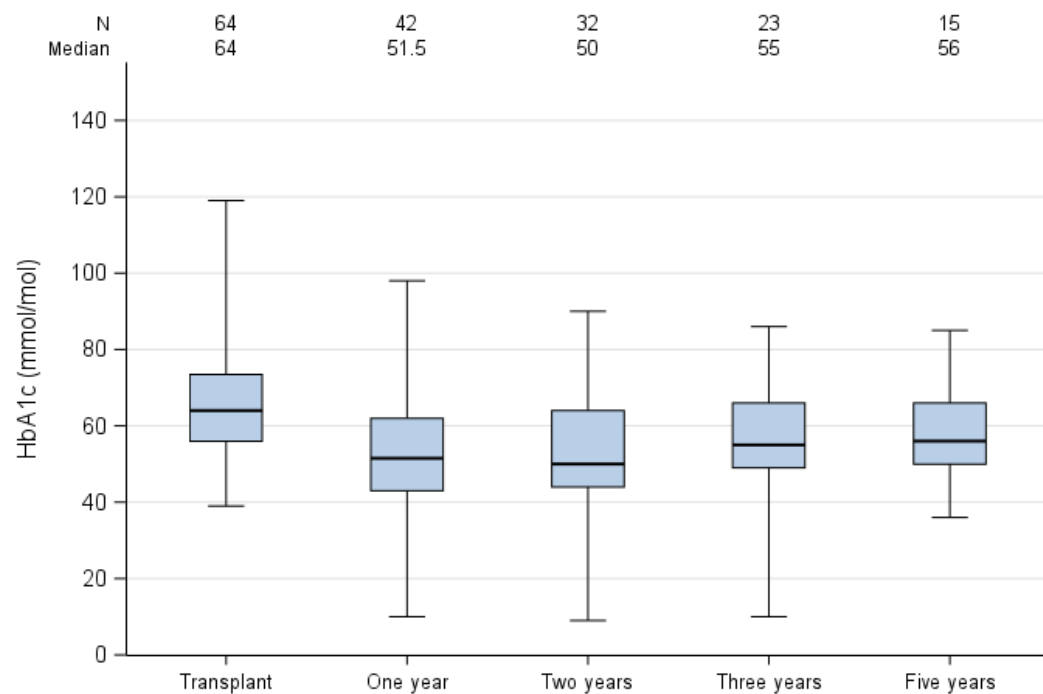


Figure 11 Median HbA1C post-transplant for routine and priority grafts, 1 April 2010 – 31 March 2021 (excluding SIK transplants)

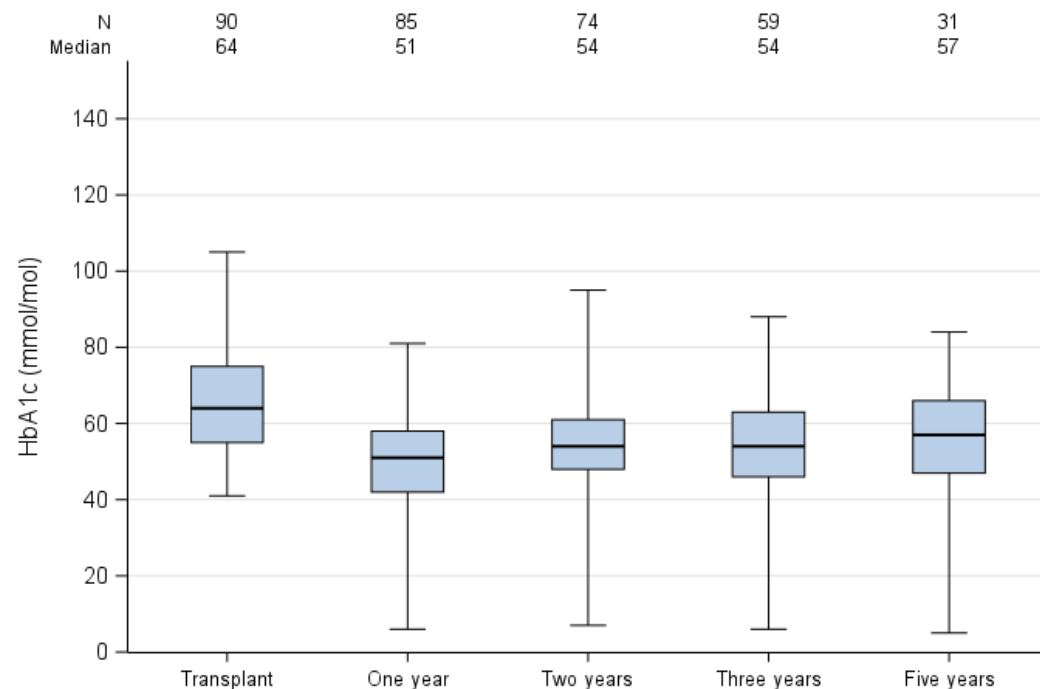


Figure 12 Median insulin dose post-transplant for routine only grafts, 1 April 2010 – 31 March 2021 (excluding SIK transplants)

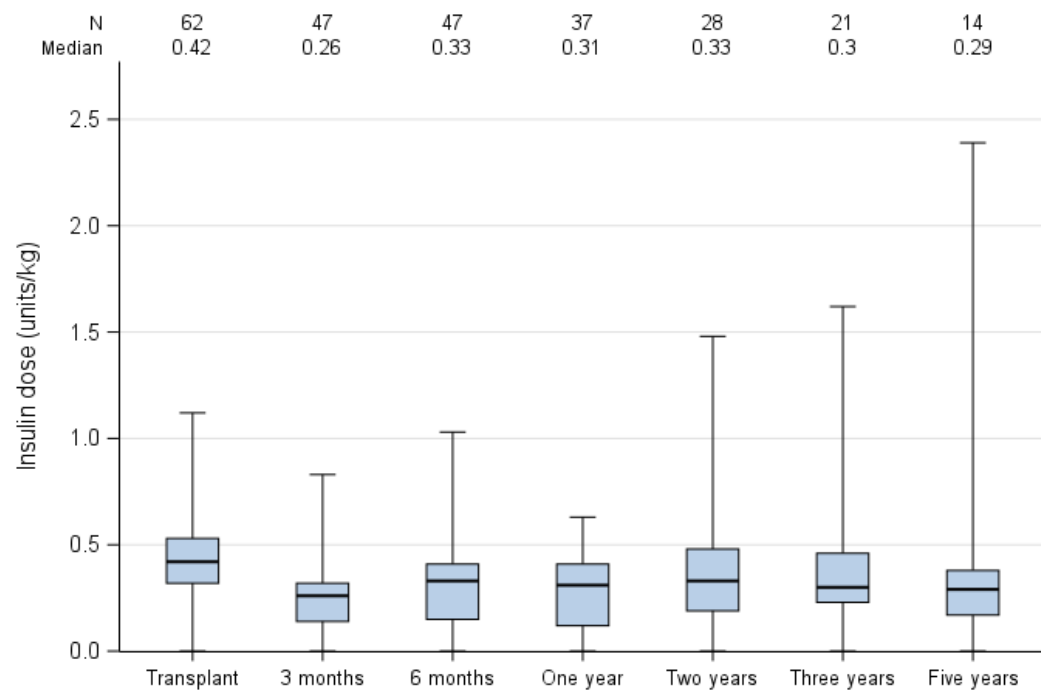
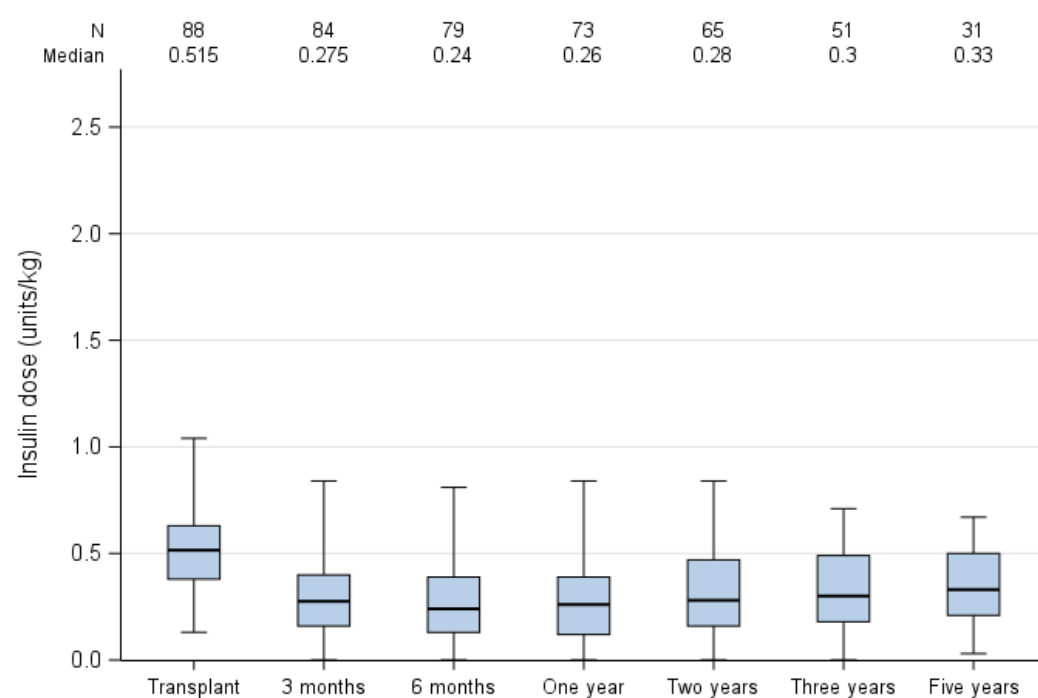


Figure 13 Median insulin dose post-transplant for routine and priority grafts, 1 April 2010 – 31 March 2021 (excluding SIK transplants)



- 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 108 patients where the difference in insulin dose between transplant and one-year post-transplant could be calculated, 96 (89%) reported a reduction. Of the 121 patients with insulin independence status reported for the first-year post-transplant, 41 (34%) achieved insulin independence at some point in the year.
- 28 For the 23 SIK transplants where insulin dose was reported at transplant, the median was 0.51 units/kg (IQR 0.34-0.72) and for the 12 reported at one-year post-transplant, the median was 0.34 units/kg (IQR 0.25-0.48).

SUMMARY

- 29 In 2021/2022, 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 80% for transplants performed between 1 April 2016 and 31 March 2021 and 89% for the earlier cohort between 1 April 2010 and 31 March 2016. Five-year graft survival was 52% overall between 1 April 2014 and 31 March 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, 61% and 35%, respectively, $p < 0.0001$.
- 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 March 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	66	47	(71)	60	6	(10)	4
King's College	11	7	(64)	8	2	(25)	0
Manchester	23	12	(52)	20	3	(15)	0
Newcastle	35	16	(46)	31	3	(10)	0
Oxford	36	17	(47)	31	9	(29)	2
Royal Free	11	5	(45)	11	1	(9)	0
Total	185¹	105	(57)	164²	24³	(15)	6

¹ Includes 24 SIK transplants: Edinburgh (8), Manchester (14), Newcastle (1), Oxford (1)
² Includes 18 SIK transplants: Edinburgh (6), Manchester (11), Newcastle (1)
³ Includes 2 SIK transplants: Manchester (2)

Table II Reduction in annual rate of severe hypoglycaemic events at one-year post transplant, 1 April 2010 to 31 March 2021¹

Transplant centre	Routine transplants (one-year data expected ²)		Annual rate of severe hypoglycaemic events								No. with reduced events	Reduction not calculated ⁴
	N	(N)	At registration		At transplant		At one-year		Reduction ³			
			N	Median (IQ range)	N	Median (IQ range)	N	Median (IQ range)	N	Median (IQ range)		
Bristol	3	3	3	2 (2 - 3)	3	3 (2 - 50)	3	0 (0 - 0)	3	3 (2 - 50)	3	0 (0)
Edinburgh	58	55	48	48 (20 - 50)	58	31 (8 - 50)	48	0 (0 - 0)	48	34 (8 - 50)	42	7 (13)
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	34	32	19	10 (5 - 25)	34	19 (2 - 31)	24	0 (0 - 1)	24	14 (1 - 29)	20	8 (26)
Oxford	35	32	7	3 (1 - 4)	28	0 (0 - 1)	22	0 (0 - 0)	21	0 (0 - 0)	5	11 (34)
Royal Free	11	10	3	4 (0 - 8)	10	0 (0 - 0)	9	0 (0 - 0)	9	0 (0 - 0)	1	1 (10)
Total	161	149	95	18 (3 - 50)	153	7 (0 - 34)	120	0 (0 - 0)	119	7 (0 - 42)	80	30 (20)

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	Reduction not calculated ⁴
	N	(N)	N	Median (IQ range)	N	Median (IQ range)	N	Median (IQ range)	N	N (%)
	Bristol	3	3	3	68 (53 - 70)	3	56 (33 - 81)	3	0 (0 - 37)	1
Edinburgh	58	55	57	62 (53 - 71)	49	53 (47 - 62)	48	6 (1 - 13)	36	7 (13)
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	34	32	34	73 (63 - 83)	26	52 (41 - 60)	26	17 (13 - 31)	23	6 (19)
Oxford	35	32	29	62 (55 - 69)	26	49 (41 - 58)	22	17 (10 - 25)	21	10 (31)
Royal Free	11	10	11	61 (56 - 86)	9	51 (43 - 57)	9	4 (0 - 20)	6	1 (10)
Total	161	149	154	64 (55 - 75)	127	51 (42 - 59)	122	13 (3 - 21)	101	27 (18)

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 N	Reduction not calculated ⁴ N (%)
	N	(N)	N	Median (IQ range)	N	Median (IQ range)	N	Median (IQ range)		
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	58	55	57	0.51 (0.38 - 0.61)	45	0.26 (0.11 - 0.39)	44	0.23 (0.13 - 0.35)	21	11 (20)
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	34	32	34	0.47 (0.35 - 0.56)	22	0.33 (0.12 - 0.41)	22	0.19 (0.04 - 0.28)	5	10 (31)
Oxford	35	32	27	0.45 (0.32 - 0.62)	20	0.26 (0.12 - 0.38)	20	0.26 (0.07 - 0.43)	6	12 (38)
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	161	149	150	0.48 (0.35 - 0.60)	110	0.28 (0.12 - 0.40)	108	0.23 (0.10 - 0.33)	41	41 (27)

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