National Kidney Transplant Service

Annual Report 2022

Forward

Successful kidney transplantation is the best treatment for patients with end stage kidney disease, allowing them to regain quality of life, freedom from dialysis and improving their overall health. The National Kidney Transplant Service (NKTS) remains committed to the provision of a high-quality kidney transplant service with more than **5,800** kidney transplants performed to date. Currently, **2,544** recipients enjoy the benefits of a functioning transplant. Increasingly, potential kidney transplant recipients are identifying a living kidney donor and we have performed **489** living kidney donor transplants in the past 16 years.

Clearly, none of this would be possible without the extraordinary generosity of deceased donor families and friends who consent to organ donation in the midst of their grief. Equally, the courage of the living donor who undergoes major surgery to restore the health of their recipient must be acknowledged. The transplant team at the NKTS wishes to acknowledge in a very special way each and every kidney donor. We see first-hand the extraordinary transformation that each successful transplant brings.

Editorial team:

Ms. Dilly Little: Surgical Director, NKTS

Patrick O'Kelly: Statistician, NKTS

Anne Cooney: Transplant Data Manager, NKTS

1. Introduction

Kidney Transplantation offers the preferred treatment option for patients with end stage kidney disease (ESKD), offering improved survival benefits and restoring quality of life for those undergoing a successful transplant. The recent Covid-19 pandemic with the risk of severe infection and mortality in patients who are immunosuppressed post-transplant, has posed significant challenges for the safe delivery of kidney transplantation, worldwide. As we learn more about Covid-19 infection and how to adapt to live with the virus and its various manifestations, the National Kidney Transplant Service (NKTS) in Ireland has worked hard to minimise the risks to individual patients while endeavoring to maintain and expand the opportunities for successful kidney transplantation. Challenges such as reduced deceased donor activity due to the admission of Covid-19 positive patients to the Intensive Care Units have lessened, especially in the latter half of 2022 and so transplant activity in this period matched pre Covid-19 rates. The NKTS remains committed to providing a safe environment for admission of patients for transplant surgery and ensuring the safety of living kidney donors and their recipients.

In 2022, we performed **163** kidney transplants, marking a welcome return to pre Covid-19 rates. **130** kidney transplants were performed with kidneys retrieved from deceased donors. Unfortunately, some activity was curtailed by the inevitable presence of positive Covid-19 cases in the transplant ward which resulted in a small number of kidneys retrieved by the NKTS being exported to the UK Transplant Service.

The Living Kidney Transplant programme remained active during 2022 due to the availability of Covid-19 vaccines for potential living donors and their recipients. Despite this, due to Covid-19 infections and other unpredictable clinical situations we faced a number of short notice cancellations of living donor transplants. As potential donors and recipients were shielding from Covid-19 earlier in the year, this posed logistical difficulties in substituting pairs for surgery at short notice. Despite this, the living donor rate was sustained and we performed **33** transplants with approximately **15** donor recipient pairs having completed their evaluations and scheduled for surgery early in 2023.

As end stage renal failure is recognized as a risk factor for Covid-19, all potential kidney recipients on the transplant waiting list are advised to avail of the Covid-19 vaccines and boosters, offered under the National vaccination programme. The medical and scientific evidence indicates that any risks associated with the available vaccines are extremely low compared to the consequences and risks of a transplant patient contracting Covid-19 infection. Obviously, a post-transplant patient on immunosuppression who contracts Covid-19 is extremely vulnerable to severe infection with an associated risk of death or long-term illness. Patients with cardiovascular disease, respiratory disease, diabetes, obesity and age greater than 60 years are especially at risk. The vast majority of patients on the transplant waiting list have taken up this advice and have been vaccinated. Unfortunately, with the arrival of variants and the relaxation of community restrictions, the increased transmission risk of the virus has meant the risks to transplant recipients is magnified. Renal transplant recipients are strongly advised to keep up their immunity by adhering to public health advice regarding vaccination not only for Covid-19 , but for influenza and all other appropriate vaccines.

To reduce the risk of exposure to infection for transplant recipients post discharge from hospital, the NKTS has adopted the use of virtual clinics and remote monitoring, using a purpose designed system. This system continuously tracks symptoms, blood pressure, weight and laboratory results in the patient's home, reducing the need for hospital attendance by 70% post transplantation. Patients can monitor their own data by downloading an App onto their mobile phone. Thanks to the support of the HSE Community intervention team, laboratory tests can be performed on blood drawn in the patient's home, reducing the need for hospital visits. This project was supported by Slainte Care and has been extremely successful in allowing the delivery of patient focused care.

Because of the requirement of augmented immunosuppression required to transplant "highly sensitised" recipients, these patients are especially at risk if they contract Covid-19 or other infections. We prioritise these patients on the transplant waiting list and in 2022, **25** very highly sensitised patients (PGen $\geqslant$ 95%) were transplanted, including a recipient who had waited more than **20** years for their transplant. Analysis of donor specific antibody status pre-transplant, allowed these patients to be transplanted. Continuous monitoring of the immune response in these patients is especially important post transplant, to ensure that a late rejection episode is treated in a timely fashion.

There were **21** kidney transplants performed from non-heart beating deceased donors with one donor hospital referring their first such donor. In July 2022, we conducted our second laboratory based simulated training day in the Royal College of Surgeons in Ireland for non-consultant surgical trainees and newly appointed advanced nurse practitioner candidates, focusing on the surgical skills and techniques of kidney retrieval surgery. This training was supported by Organ Donor Transplant Ireland and was extremely well received by all attendees. We plan to run this course as an annual event. In addition, the NKTS at Beaumont Hospital was approved as an accredited renal transplant surgical training centre by the UEMS European Board of Transplant Surgery, following a successful inspection process in September 2022.

The number of patients alive with a functioning kidney transplant at year end 2022 is **2,544** (recipients who were transplanted at Beaumont Hospital), showing a slight increase compared to 2021. The number of patients listed on the transplant waiting list remained stable compared to 2021 with a total of **512** listed at the end of 2022. In 2022, **187** new patients were listed for kidney transplant representing an increase of 25% on the previous year. However, the global shortage of organs relative to the number of patients waiting for a kidney transplant remains an on-going challenge - the overall median time on the kidney transplant waiting list increased to **26** months.

Irish Kidney transplant outcomes continue to be excellent. The median allograft survival of a first deceased adult donor is **14.1** years for the last 30 years. Based on the most recent data (2017 - 2021), one year Irish kidney transplant outcomes are excellent, with one year adult deceased donor allograft survival of **97%** and patient survival of **98%**. Currently, **23** recipients have a functioning kidney 40 years or more after their transplant.

We performed **33** living donor transplants in 2022. This included **5** paediatric kidney transplants from living donors. While allograft outcomes for living donor transplants are comparable to that for deceased donor transplants in the first year (**95%** and **93%** respectively) and for patient outcomes (**100%** and **97%**), the benefits of living donor transplantation become apparent in subsequent years. At 5 years post transplant, living donor allograft and patient survival was **90%** and **97%** respectively compared to **81%** and **89%** deceased donor survival. In addition, patients who received a living kidney donor spent considerably less time waiting for a transplant and less time on dialysis, with a significant number avoiding the need for dialysis entirely. These outcomes highlight the

enormous advantages of living kidney donation and illustrate why living donation should be the first choice for the majority of Irish patients.

We continue to benchmark our data against the European Collaborative Transplant Study (CTS) and our outcome data exceeds the CTS for many groups. Patients undergoing repeated transplants of 2nd, 3rd or 4th kidney transplants in Dublin have outcome data that exceeds the CTS data in all time periods.

In summary, 2022 has again proven to be one of the more challenging years for everyone involved in healthcare provision but especially for patients awaiting a life-changing kidney transplant. We would like to acknowledge the on-going work and efforts of all the members of the transplant team, the staff of the Intensive Care Units throughout the country and all the staff in Beaumont Hospital who continue to support us. We would especially like to acknowledge the forbearance of the patients that depend on this transplant programme and the bravery of the living kidney donors. We will continue to strive to provide the best and safest standard of care to all our patients.

Finally, we are continuously humbled by the generosity shown by all kidney donors and their families. Every deceased donor kidney transplant comes at a time of utmost tragedy for families, who look beyond their own loss and grief to save the life of another person. Living donors place themselves in harm's way to help a loved one, often without a second thought. As such, we have witnessed the best of human nature through working in this programme and wish to thank all donors and their families for their generosity.

Highlights for 2022

- **163** kidney transplants were performed in the Republic of Ireland.
- The median waiting time to transplant for all recipients in 2022 was **26** months.
- **2,629** recipients (transplanted in Beaumont and abroad) are living with functioning kidney transplants at the end of 2022.
- **23** recipients enjoy allograft function of over 40 years.
- **25** very highly sensitised patients (PGen $\geqslant$ 95%) were transplanted in 2022 representing 15% of transplant activity.
- Kidney transplant survival is significantly better in the Republic of Ireland when compared with European outcomes, with 5-year adult patient survival of **91%** versus EU **87%** and 5-year allograft survival of **86%** versus EU rate of **78%**.
- Allograft and patient survival rates have steadily improved among recipients of both living and decreased donor kidney transplants. One-year allograft survival has increased from **87%** to **97%** over the last 25 years reflecting the NKTS continued commitment to delivering a quality service.

2. Kidney Transplant Activity 2022

Summary of transplant activity

- In 2022, **163** kidney transplants were performed in the Republic of Ireland an increase from 2021 of 24. Of these, **33** were from living donors, **130** were from deceased donors. The deceased donor rate returned to pre-pandemic levels due to increased activity in the latter part of 2022.
- The number of recipients living with a functioning allograft remains stable, reaching **2,629** (at year end 2022), **2,544** (97%)of whom were transplanted in Beaumont Hospital.
- There were **33** living donor kidneys transplanted in 2022 representing a slightly lower number than the average for the last 6 years (35) and considerably lower than the highest number recorded in 2017 (51). Living donor transplants represent **20%** of all kidney transplants performed in 2022, compared to the overall percent for the last 6 years of **22%**.
- There were **8** simultaneous pancreas/kidney (SPK) transplants performed in collaboration with our colleagues in St. Vincents University Hospital.
- There were **12** paediatric (age <19 years) transplants performed. Five of these were from living donors.
- There were **8** paired kidney exchange transplants performed in collaboration with our colleagues in the United Kingdom Living Kidney Shared Scheme (UKLKSS).

Table 2.1: Summary of transplant activity 2017 - 2022

Category	2017	2018	2019	2020	2021	2022	Average (6yrs)
Total number of transplanted kidneys*	192	167	153	123	139	163	156
Number of deceased-donor kidney only transplants	136	122	126	92	102	122	117
Number of Living donor kidney transplants	51	40	25	28	35	33	35
Number of Simultaneous Pancreas/Kidney (SPK)	5	5	2	3	2	8	4
Number of Paired Kidney Exchange (Living donor UK)	3	3	3	1	2	8	3

Note: *includes SPK, and excludes paired kidney exchange (UKLKSS)

Table 2.2: Recipient allograft survival at the end of 2022

Category	0-10 yrs	>10-20 yrs	>20-30 yrs	>30-40 yrs	>40 yrs	Total
Deceased donor kidney only transplants	1001	690	266	54	11	2022
Living donor kidney transplants	329	84	7	19	12	451
Simultaneous pancreas/kidney (SPK)	36	28	7	0	0	71
All kidney transplants	1366	802	280	73	23	2544

Note: includes patients transplanted in Beaumont Hospital and excludes those transplanted abroad

Figure 2.1: Number of deceased donor kidney transplants performed per annum 1964 - 2022

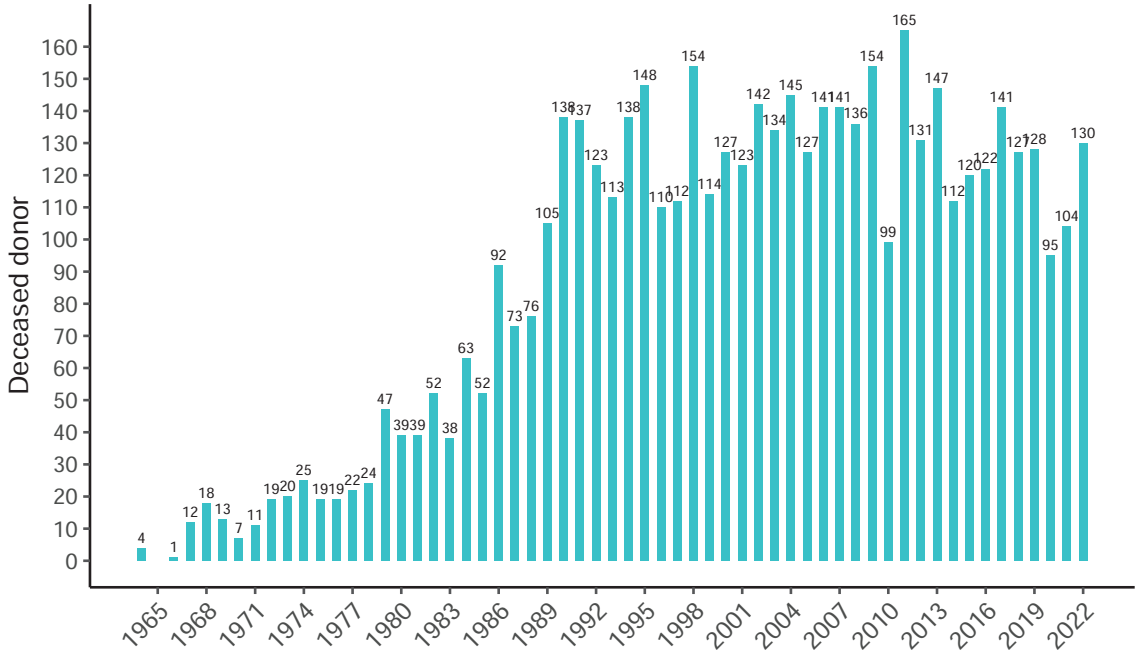


Figure 2.2: Number of living donor kidney transplants performed per annum 1972 - 2022

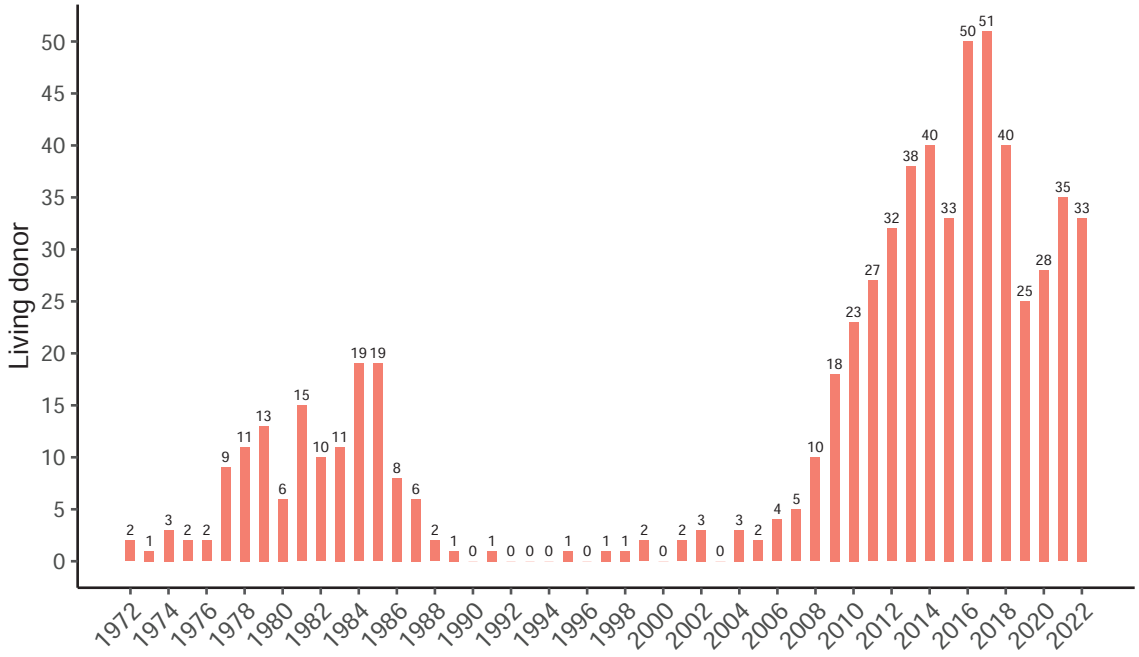
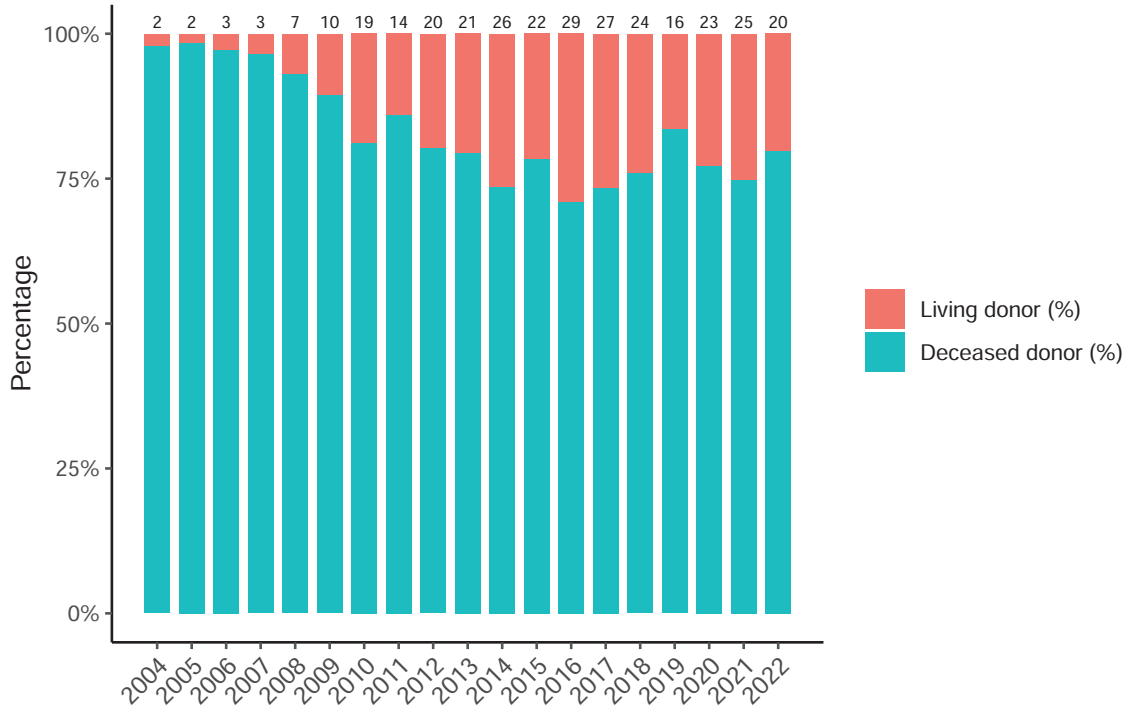


Figure 2.3: Proportion of total living and deceased donor kidney transplants performed 2004 - 2022



*Note: % of living donor kidney recipients quoted on top of bars

20% Living donation represented 20% of transplant activity in 2022.

3. Kidney Transplant Waiting List 2022

• At the end of 2022, the number of patients on the kidney transplant waiting list was identical to the previous year at **512**. This represents the gradual reversal of the trend from recent years where a high of **606** was recorded at the end of 2013 and subsequently decreased to **462** by the end of 2018 (Figure 3.1) before increasing again slightly during the years affected by Covid-19.

• Median time on dialysis prior to first transplant was **35** months overall, **39** months for deceased donor and **21** months for living donor recipients (Figure 3.2)

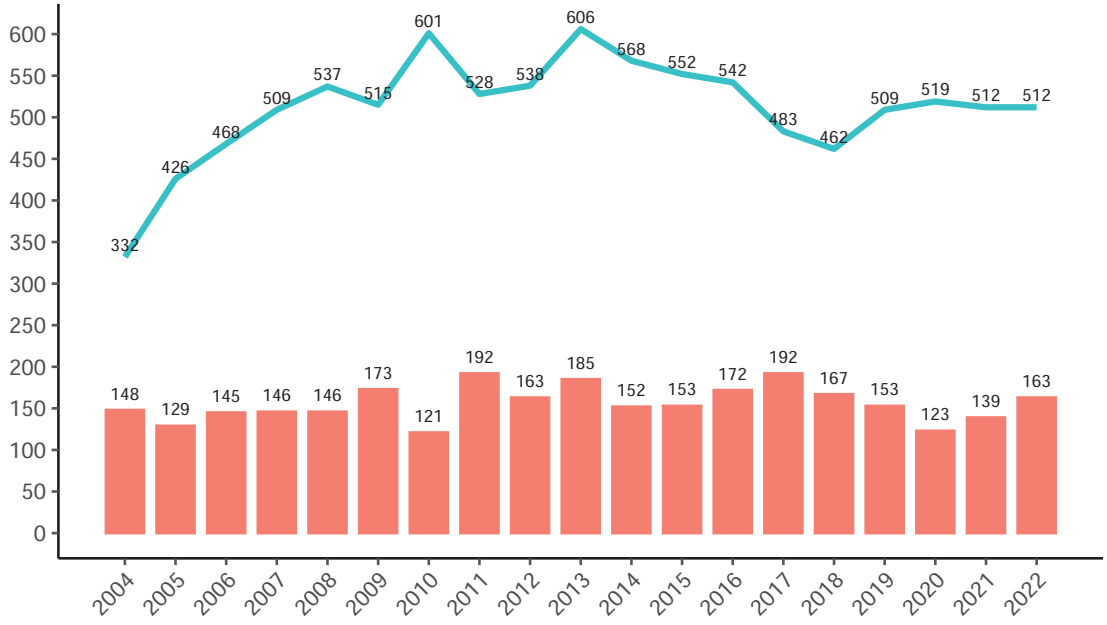
• In 2022, **18 (11%)** of transplants were performed in patients not yet established on dialysis (i.e. pre-emptively), 9 of whom received a deceased donor kidney and 9 received a living donor kidney (Figure 3.3).

• The overall median waiting time to first kidney transplant in 2022 was **26** months, i.e. of the 163 transplants performed in 2022, 50% of recipients received a kidney within 26 months of being placed on the transplant waiting list (Figure 3.4). Of note highly sensitized patients (PGen $\geqslant$ 95%) had median waiting time of **32 months**.

• Waiting times for living donor transplants was considerably shorter at **15** months compared to **31** months for deceased donors (Figure 3.4).

Number of patients on the kidney transplant waiting list and total number of kidney transplants performed per year

Figure 3.1: Number of patients on the kidney transplant waiting list(active and suspended) and number of transplants per annum 2004 - 2022*



*Note: number of transplants per annum = bar graph, waiting list = line graph

Median time on renal replacement therapy and kidney transplant waiting list prior to transplant

Figure 3.2: Median time on dialysis prior to first transplant 2004 - 2022

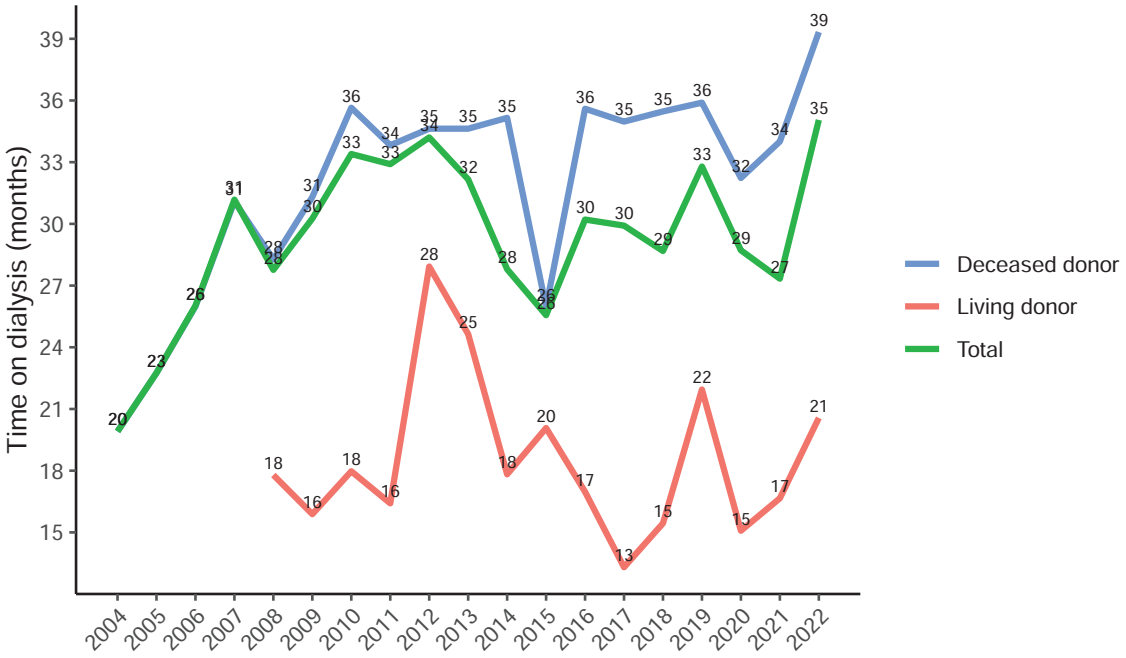


Figure 3.3: Percentage of transplants per year performed pre-emptively for deceased and living donor recipients 2008 - 2022

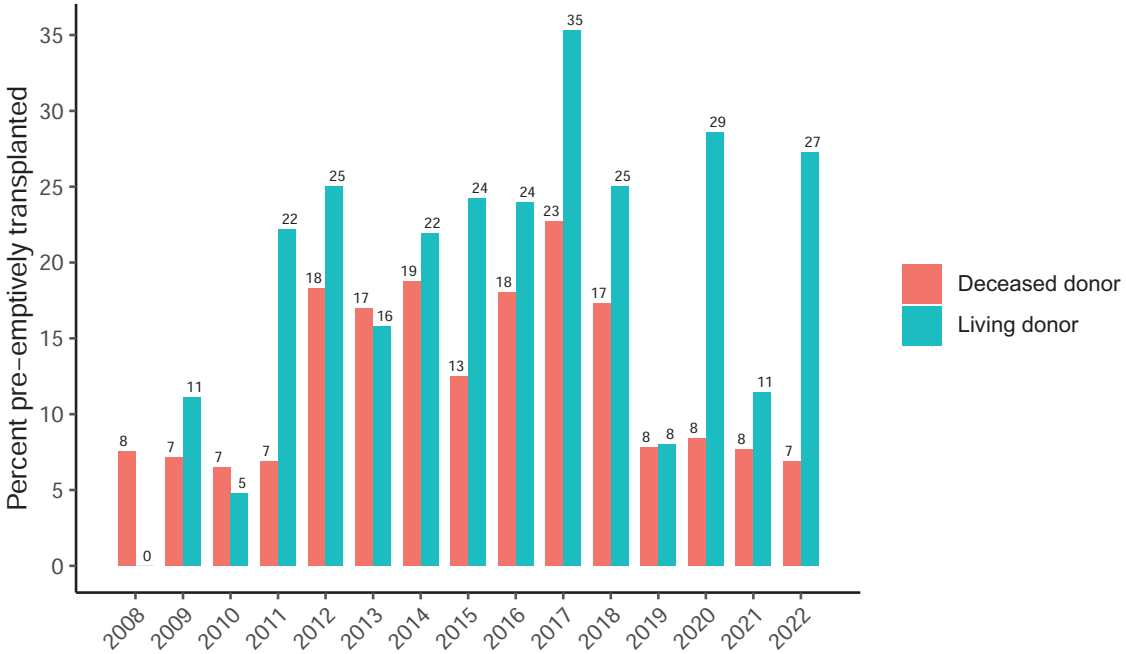
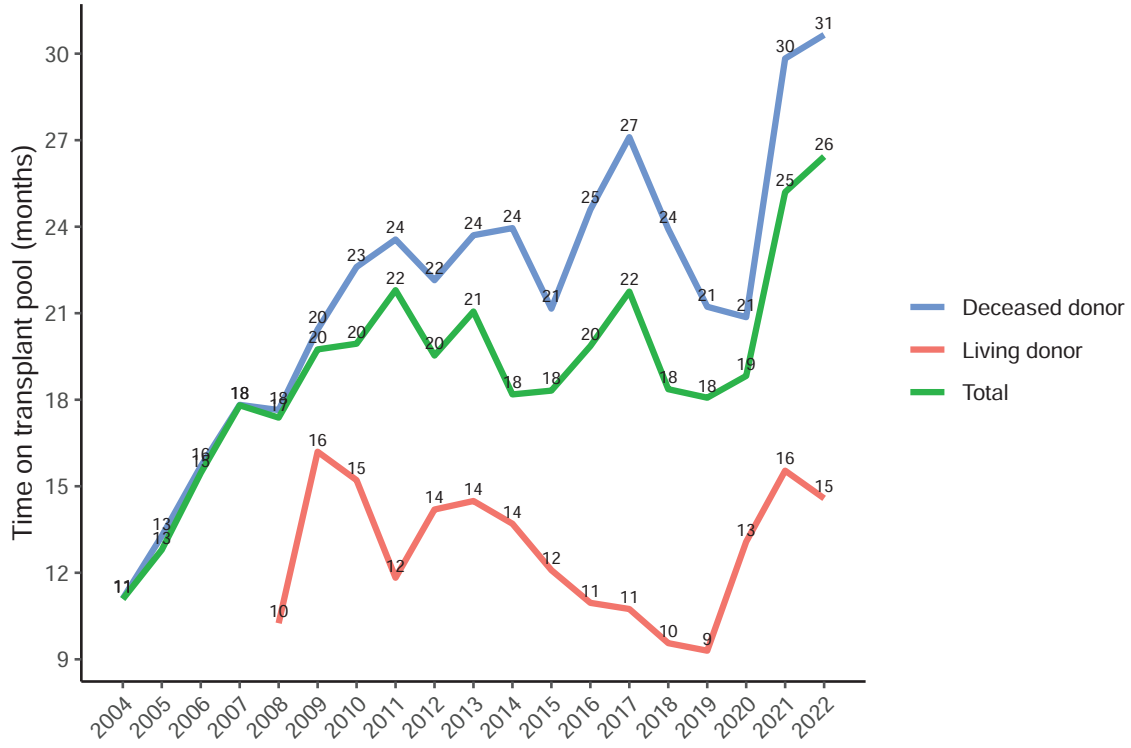


Figure 3.4: Median time on kidney transplant waiting list prior to first transplant 2004 - 2022



50% Recipients with an identified living donor spend approximately **50% less time on dialysis** and the waiting list prior to transplant.

Referring center for kidney transplant recipients

The number of patients transplanted per referring center broadly reflects the number on the waiting list per center. Figure 3.5 details the number on the waiting list per center for 2022 which correlates with the percentage of transplants for each center for the period 2017 - 2022 (Figure 3.5).

Figure 3.5: Number of patients per referring center on the kidney transplant waiting list at the end of 2022

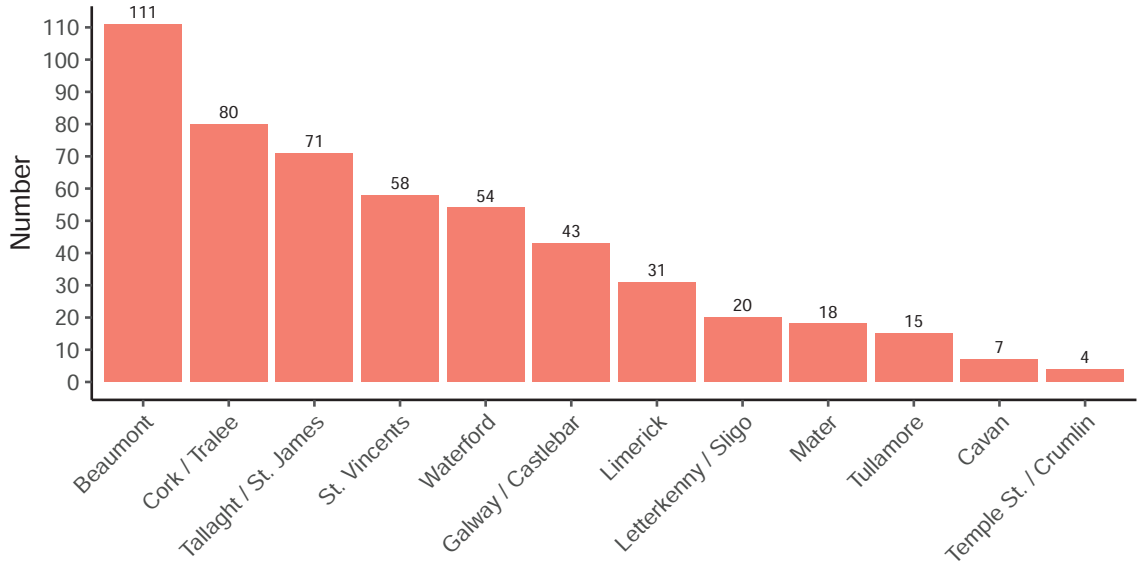
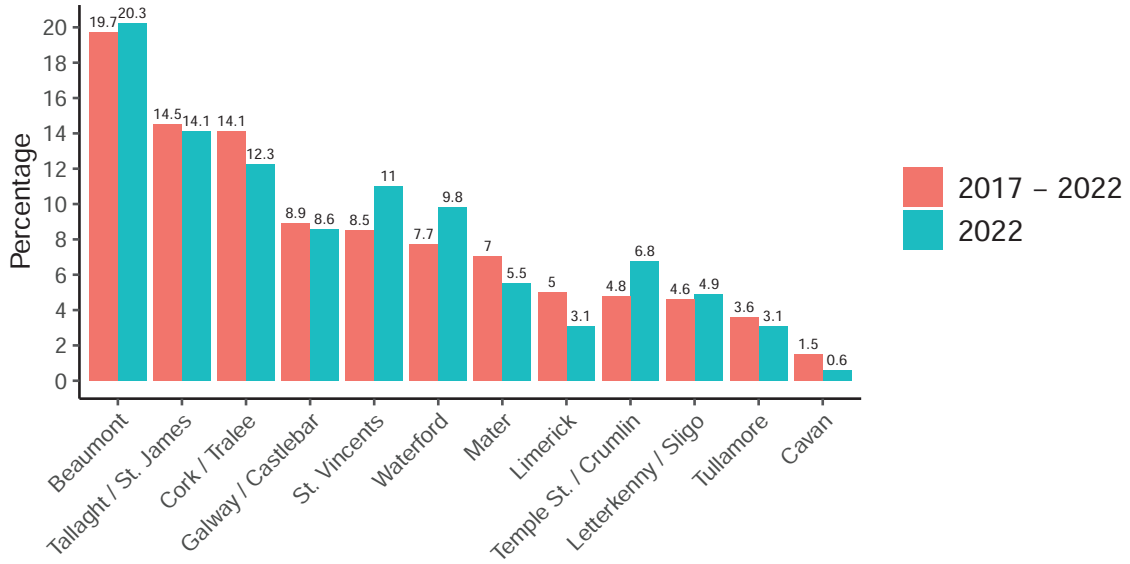


Figure 3.6: Percentage of total kidneys transplanted by referring center for 2022 and 2017-2022



4. Donor and Recipient Characteristics at Transplant

• There has been a noticeable trend of increasing recipient age at time of transplant for deceased donors. The median age increased from a low of **40** years in 2004 to **54** years in 2021. In 2022, the median age at the time of transplant was **51** years (Figure 4.1). The age range for this cohort is 4 to 78 years.

• In 2022, **32** (20%) of recipients were $\geqslant$ 65 years of age representing an emerging trend of transplanting older recipients.

• During 2022, the median recipient age for living donor transplants was **48** years, the oldest median age recorded for the period 2007 – 2021 with an age range of 4 – 72 years (Figure 4.2). For comparison, during a previous period of high living donor transplant activity 1977 – 1985, the median age of recipient at transplant was **28** years.

• Recipient sex ratios of deceased and living donor kidneys has remained constant over time with approximately two thirds of transplants being male recipients, which reflects the sex distribution of patients on the transplant waiting list. In 2022 the percentage of male recipients was **(57%)**, less than the overall **(63%)** for 2004 - 2022 (Figure 4.3).

• Renal replacement modalities prior to transplant in 2022 varied somewhat from previous years with regular haemodialysis (RHD) increased compared to the overall for the period 2004-2022 and the percentage for peritoneal dialysis (PD) reduced slightly (Figure 4.4).

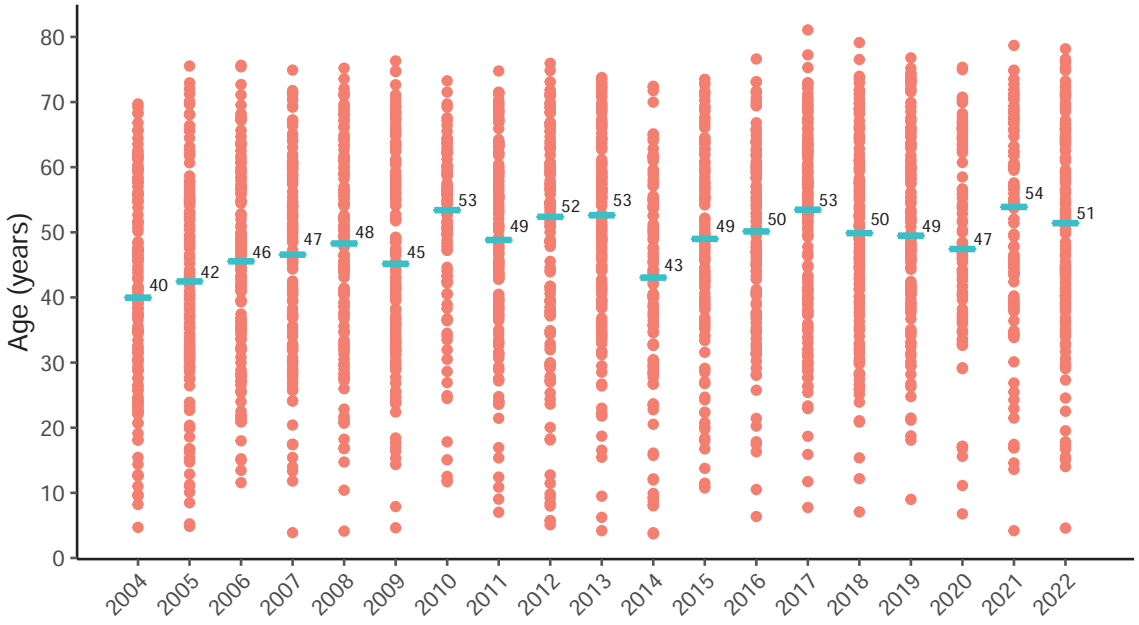
• The number of people on the transplant waiting list for whom there is difficulty in finding a compatible donor due to the presence of antibodies poses a major challenge. The majority of these highly sesitised (PGen $\geqslant$ 95%) patients have had a previous kidney transplant or other sensitising events including previous blood transfusion, pregnancy or infection. There has been a steady increase in the number of such 'highly sensitised' patients transplanted in recent years with **15%** of all recipients in 2022 having a PGen $\geqslant$ 95% at time of transplant (Figure 4.6). There were **86** highly sensitised patients on the waiting list at the end of 2022. This cohort of patients remains challenging to transplant especially with the risk of exposing them to augmented immunosuppression during the Covid-19 pandemic.

• Median donor age for deceased donor recipients was **45** years, (range 2 – 74 years) in 2022 (Figure 4.7), where the highest median donor age was 52 years in 2019. Median donor age for living donors has remained relatively constant in recent years and was **49** years (range 30 – 67 years) in 2022 (Figure 4.8).

• Donor sex ratios during 2022 changed slightly with percentage of male deceased donors increasing to 64%. The living donor 2007-2022 trend was reversed with males donating 58% and females 42% (Figures 4.9 and 4.10).

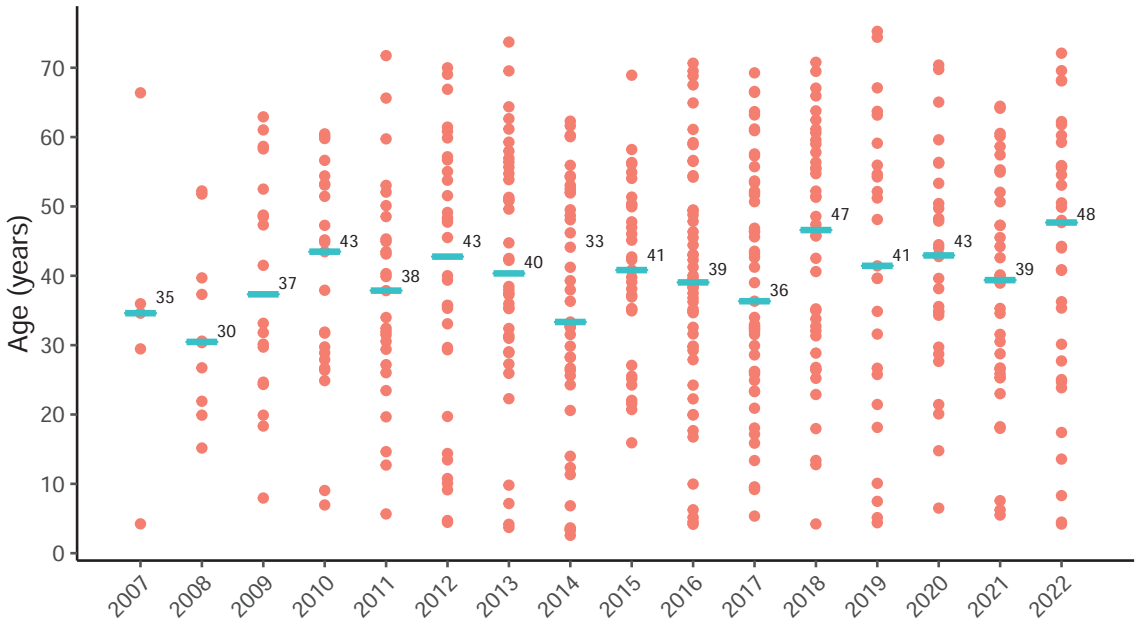
Recipient age

Figure 4.1: Recipient age at transplant for deceased donor kidneys 2004 – 2022*



*Note: median age quoted in graph

Figure 4.2: Recipient age at transplant for living donor kidneys 2004 – 2022*

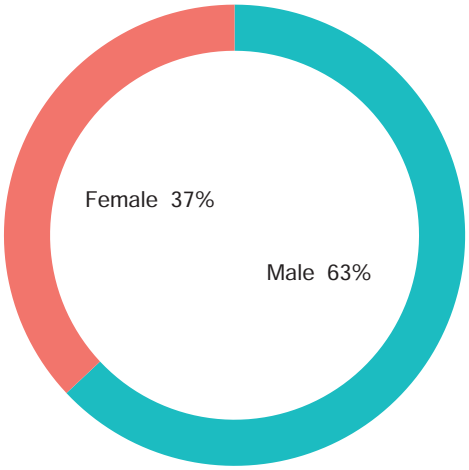


*Note: median age quoted in graph

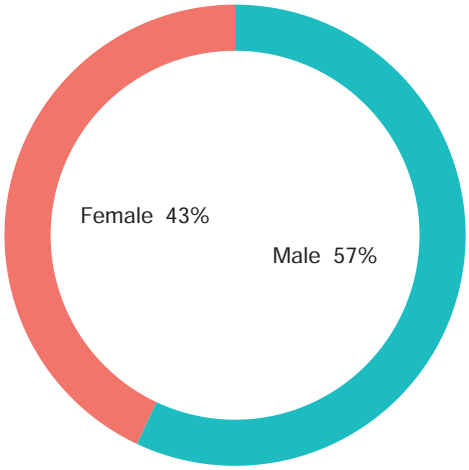
Recipient sex

Figure 4.3: Sex of recipient for combined deceased and living donor kidneys 2004-2022

2004 – 2022



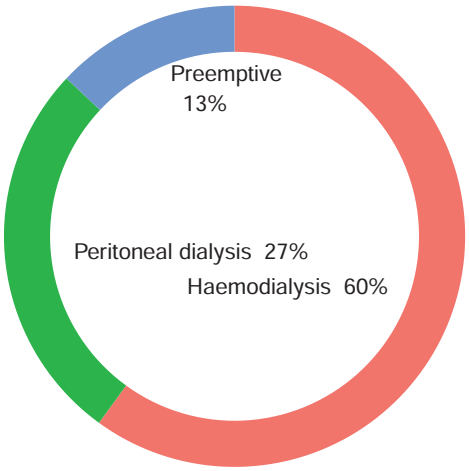
2022



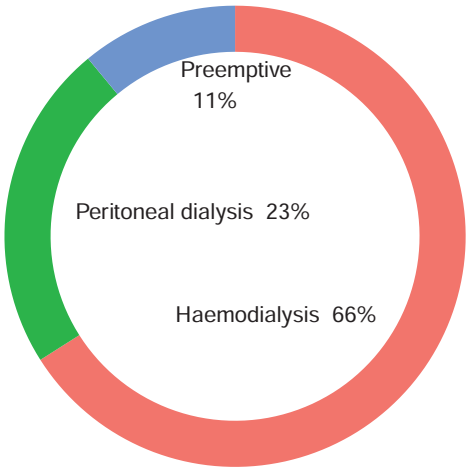
Mode of renal replacement therapy prior to transplantation

Figure 4.4: Mode of renal replacement prior to first kidney transplant 2004 - 2022

2004 – 2022

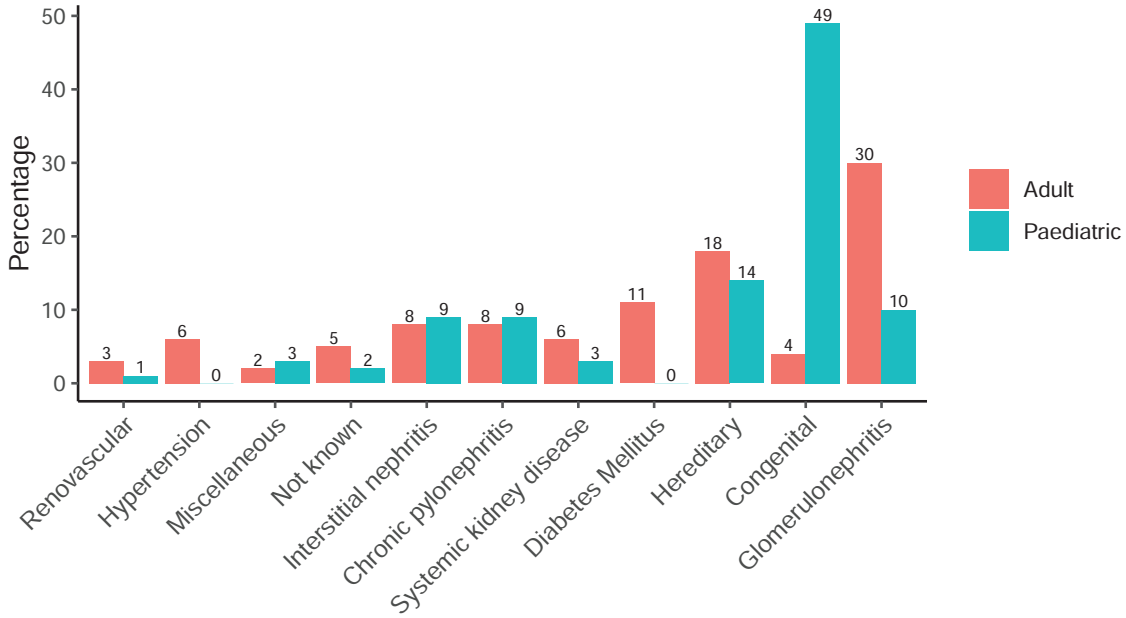


2022



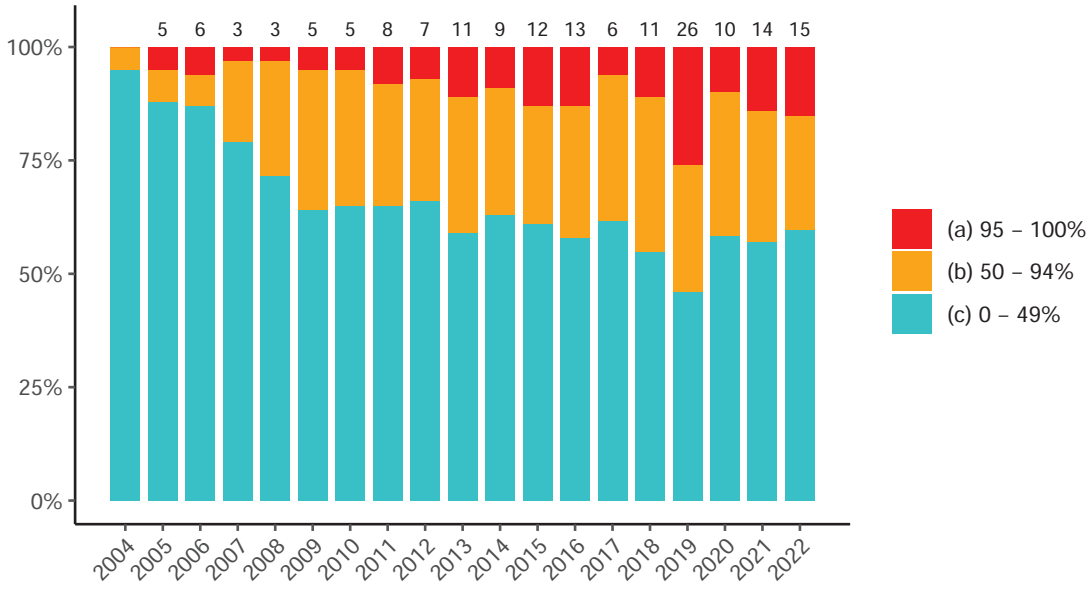
Cause of end stage renal disease for adult and paediatric recipients

Figure 4.5: Cause of ESRD for adult and paediatric transplant recipients 2004-2022



Panel reactive antibodies (PGen) of renal transplant recipients

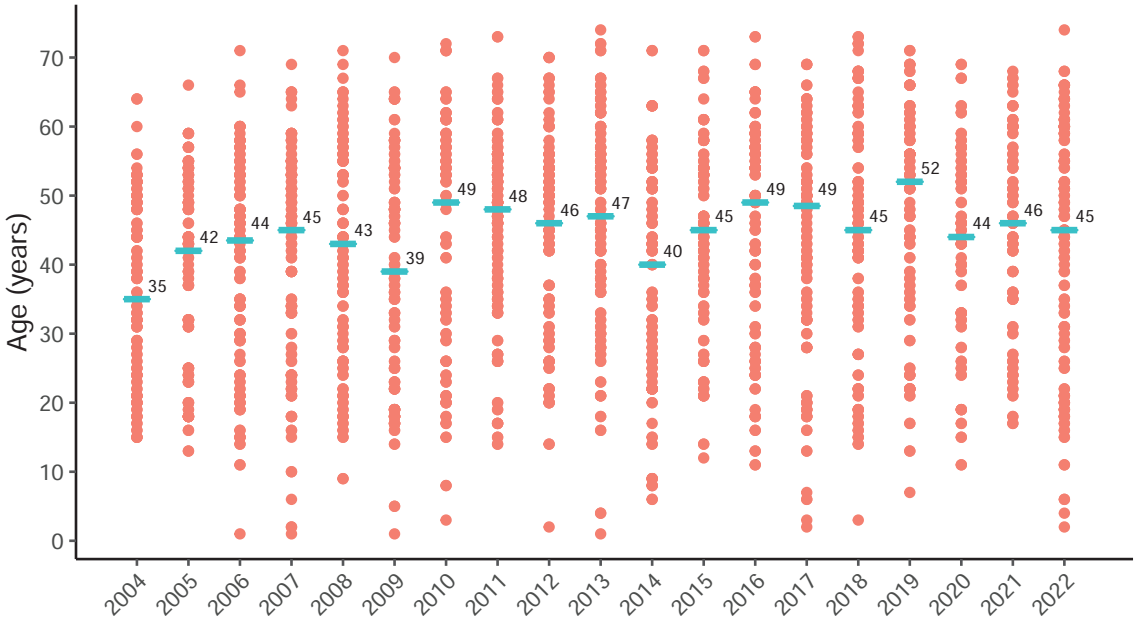
Figure 4.6: Recipient PGen in categories for all kidney transplants 2004 - 2022*



*Note: % of highly sensitised patients quoted on top of bars

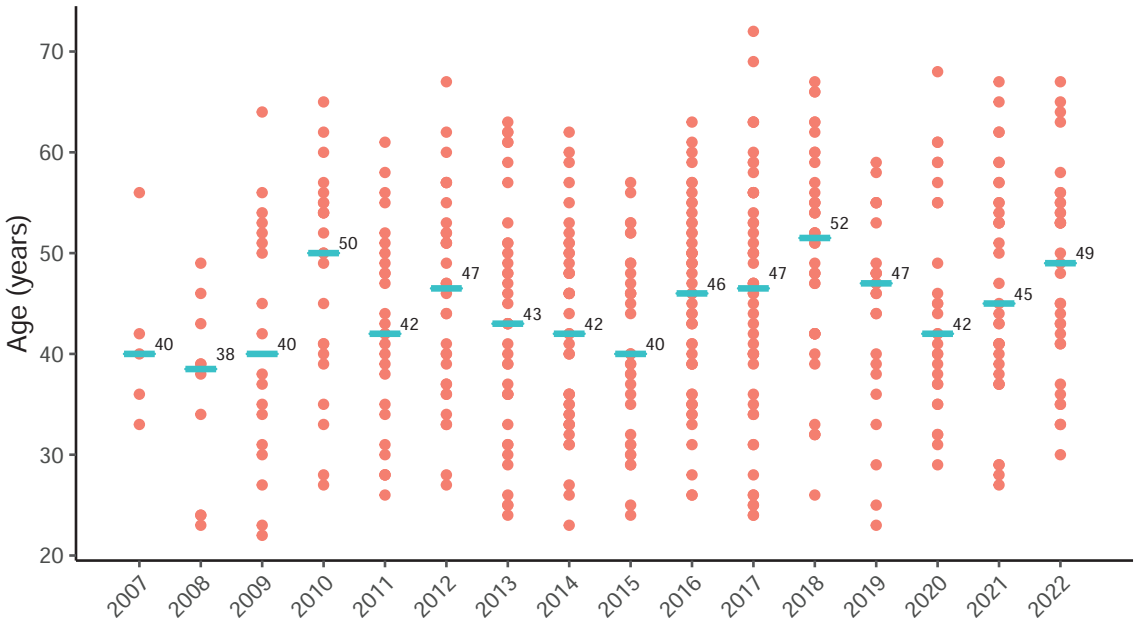
Donor age

Figure 4.7: Donor age at transplant for deceased donor kidneys 2004 – 2022*



*Note: median age quoted in graph

Figure 4.8: Donor age at transplant for living donor kidneys 2004 – 2022*



*Note: median age quoted in graph

Donor sex

Figure 4.9: Donor sex for deceased donor kidney transplants 2004 - 2022

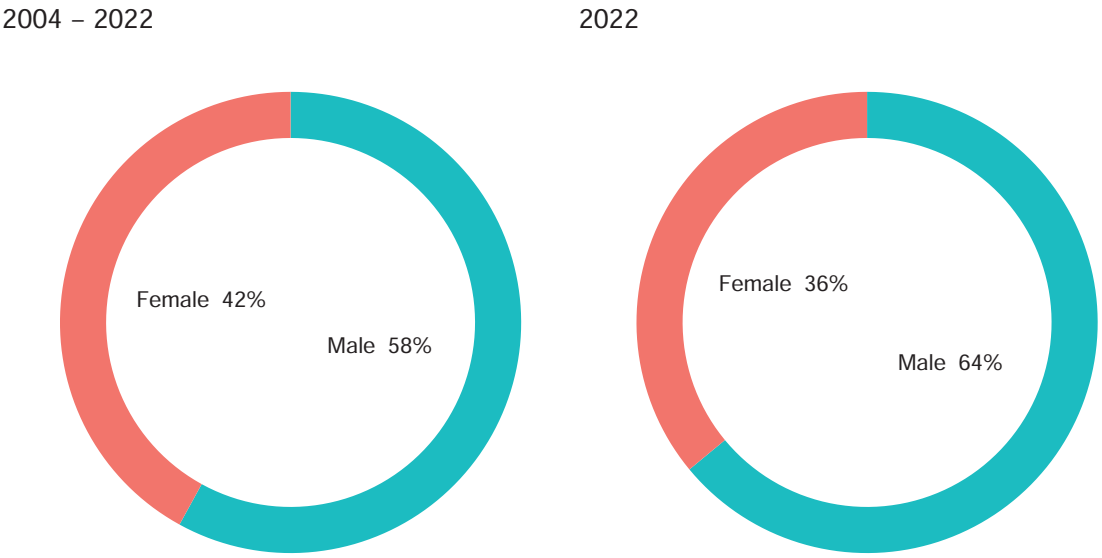
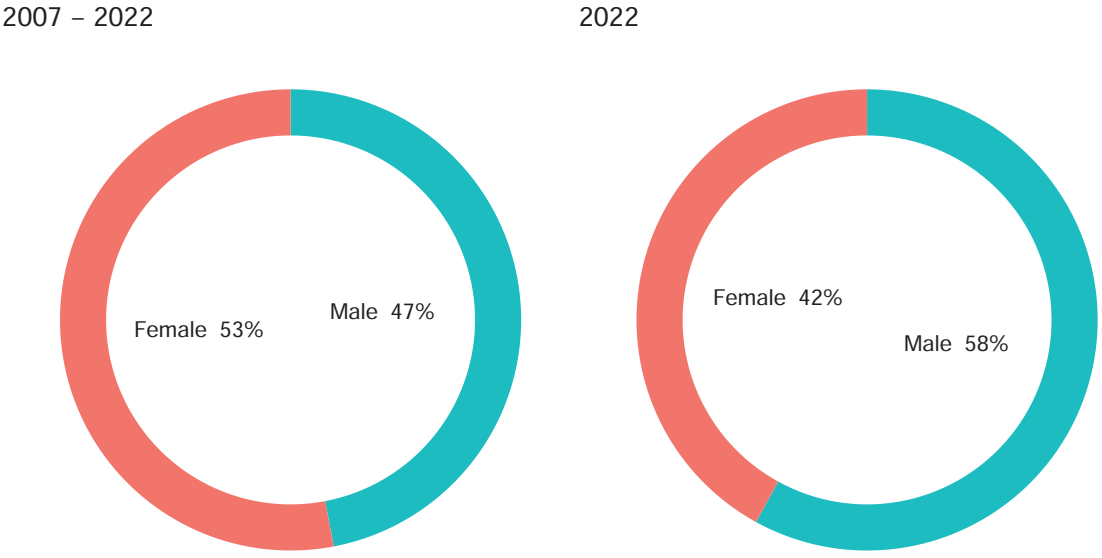


Figure 4.10: Donor sex for living donor kidney transplants 2007 - 2022



5. Deceased Donor Recipient Outcomes

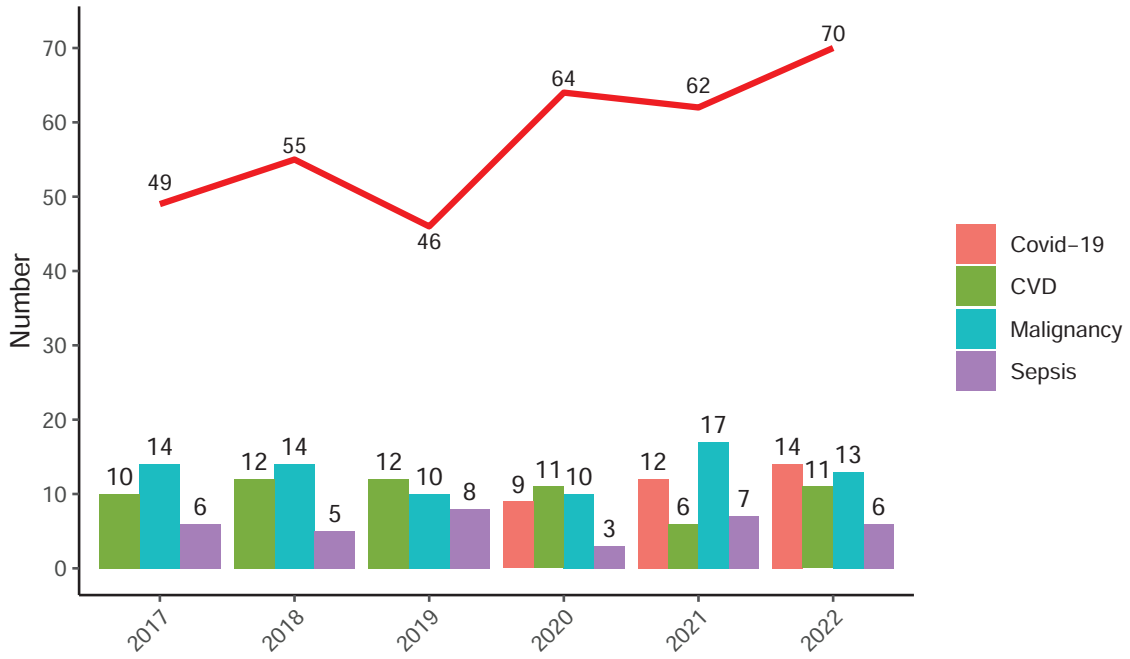
Cause of death for adult kidney recipients

The number of deaths for kidney transplant recipients has increased in the last 6 years. Some of this increase can be attributed directly to Covid-19. Table 5.1 details the total number of deaths for recipients whose graft had failed prior to death and for those with a functioning graft. Causes of death for patients with a functioning graft (DWFG) are summarised below where the cause was known or recorded. Malignancy and Cardiovascular disease (CVD) were the leading causes of DWFG. Miscellaneous causes include pulmonary embolism,haemmorage from ruptured vascular aneurysm and other sites and diabetic coma amongst others. The cause of DWFG was not known or not reported for 15% of recipients.

Table 5.1: Cause of death for kidney transplant recipients 2017 - 2022

Year	Total Deaths	Death WFG	Sepsis	CVD	Malig -nancy	CNS	Trauma	Misc.	NK	Resp.	MOF	Covid-19
2017	76	49	6	10	14	6	1	2	8	2	0	0
2018	78	55	5	12	14	4	0	5	13	0	2	0
2019	70	46	8	12	10	3	1	6	6	0	0	0
2020	94	64	3	11	10	6	2	4	10	6	3	9
2021	98	62	7	6	17	1	1	6	10	2	0	12
2022	100	70	6	11	13	5	1	11	7	2	0	14
Total	516	346	35	62	78	25	6	34	54	12	5	35

Figure 5.1: Cause of death for recipients with a functioning graft for kidney recipients 2017 - 2022



Adult deceased donor kidney allograft outcomes

This section focuses on adult deceased donor allograft and patient survival for the 30 year period 1992 - 2021. A total of **2,930** adult kidney only first transplants were performed in this period. Previous reports have focused on 25 years of data. The definition of an adult recipient is age 19 years or older at date of transplant.

- The overall median allograft survival for adult first deceased donor transplants in the past 30 years is **14.1** years (Table 5.2).
- Overall 5-year uncensored allograft survival for adult first deceased donor transplants in the past 30 years is **81%** and **89%** when censored for death with a functioning graft (Table 5.3).
- Outcomes for first and second allografts for this period are quite similar with median times of survival for first and second adult deceased allografts of **14.1** and **14.9** years respectively. Median survival for third and fourth allografts was **9.8** and **6.1** years respectively (Table 5.4).
- One year allograft survival for deceased donor adult kidney recipients for 2017 – 2021 was **97%** in comparison to one year survival of **87%** for period 1992 - 1996 (Table 5.5).
- Five-year allograft survival remains stable at **87%** for 2012 – 2016 comparable to the previous time period (2007 - 2011) of **88%**. These results compare very favorably with the earliest period 1992 – 1996 where 5 year allograft survival was **68%** (Table 5.5).

10% increase in one year adult allograft survival in 30 years, reflecting the continuous improvements in donor and recipient management and commitment to quality through continuous improvement of standards and processes

Adult first deceased donor allograft survival

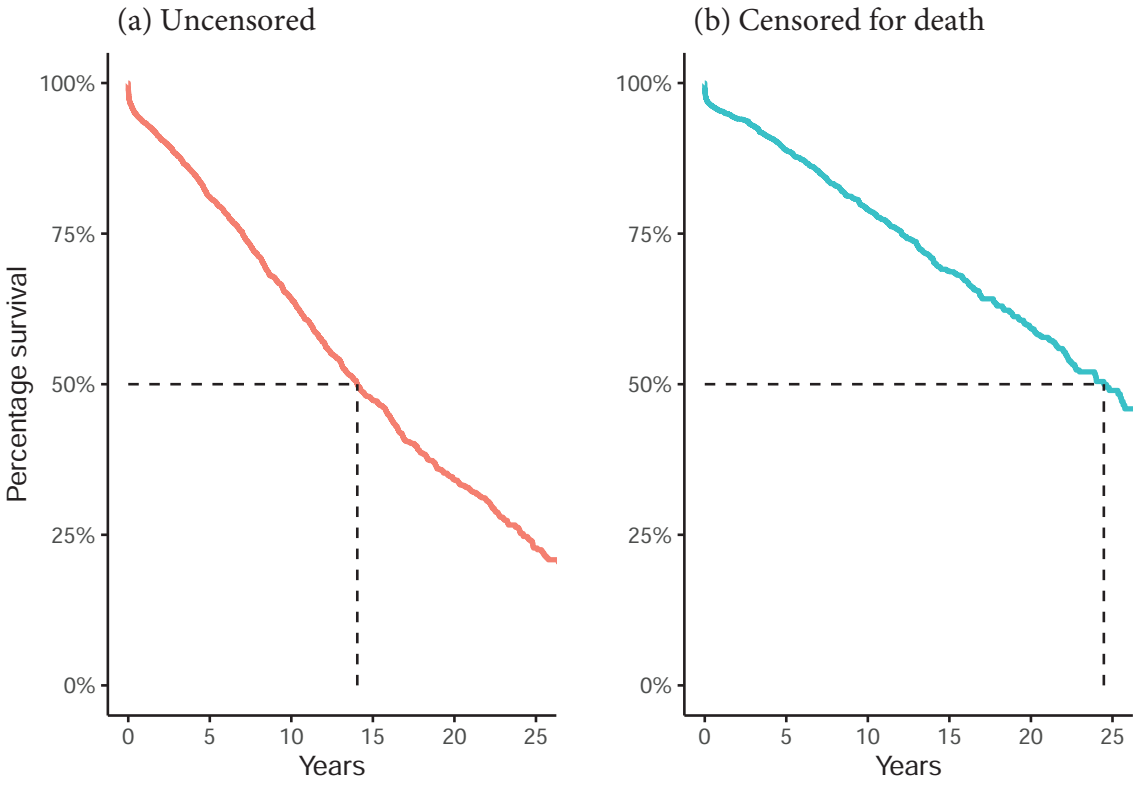
Table 5.2: Adult first deceased donor median allograft survival 1992 - 2021

Transplant number	Median allograft survival in years [95% C.I.] Uncensored for death
2,930	14.1 [13.3 - 14.8]

Table 5.3: Adult first deceased donor allograft survival 1992 - 2021

Follow up time (Years)	Estimated allograft survival [95% C.I.] (Uncensored)	Estimated allograft survival [95% C.I.] (Censored for death)
1	93.4 [92.4 - 94.2]	95.3 [94.5 - 96.0]
5	81.1 [79.5 - 82.5]	88.8 [87.6 - 90.0]
10	64.2 [62.3 - 66.1]	78.9 [77.2 - 80.6]
15	47.4 [45.1 - 49.6]	68.8 [66.4 - 71.0]
20	34.2 [31.7 - 36.6]	59.4 [56.4 - 62.2]

Figure 5.2: Adult first deceased donor kidney allograft survival 1992-2021

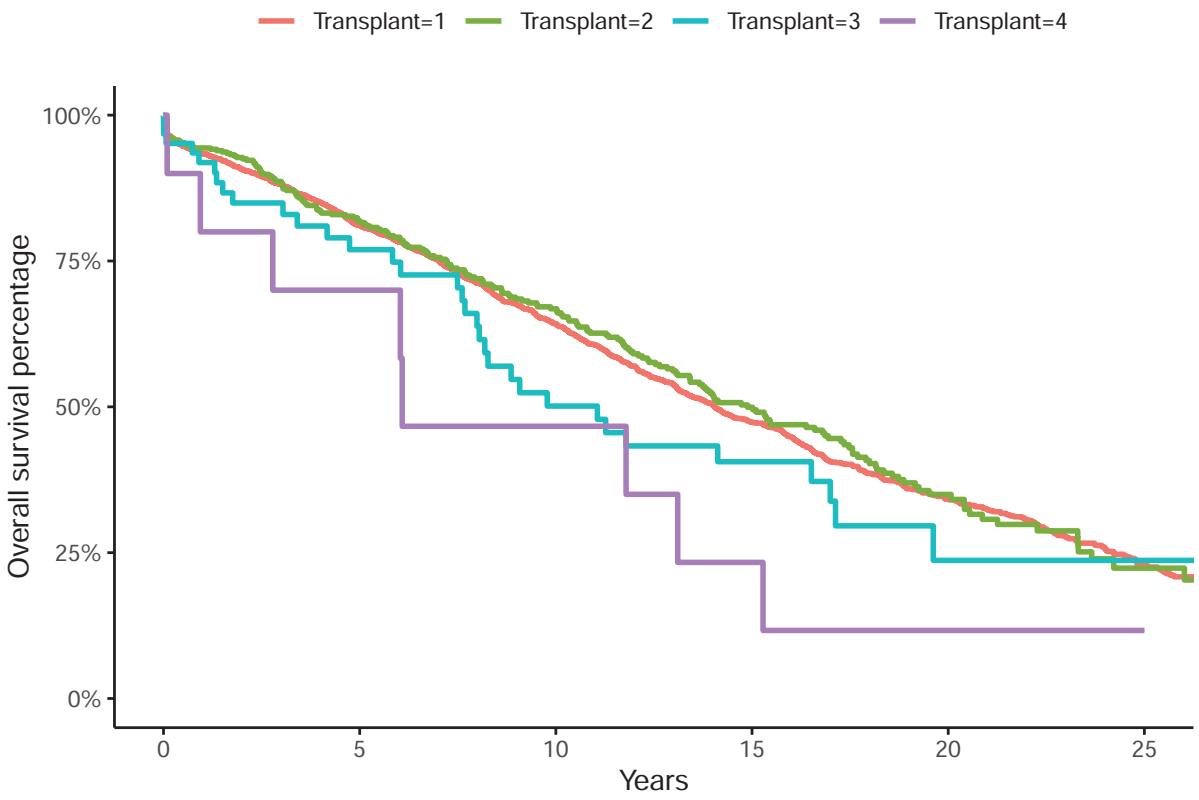


Adult first and repeat deceased donor allograft survival

Table 5.4: Adult first and repeat median allograft survival for deceased donor transplants 1992 - 2021 by transplant number

Transplant number	No of allografts	Median allograft survival (years) [95% C.I.]
1	2930	14.1 [13.3 - 14.8]
2	445	14.9 [13.1 - 17.3]
3	60	9.8 [8.0 - 17.0]
4	10	6.1 [0.1 - 15.3]

Figure 5.3: Adult deceased donor first & repeat allograft survival estimates 1992 – 2021

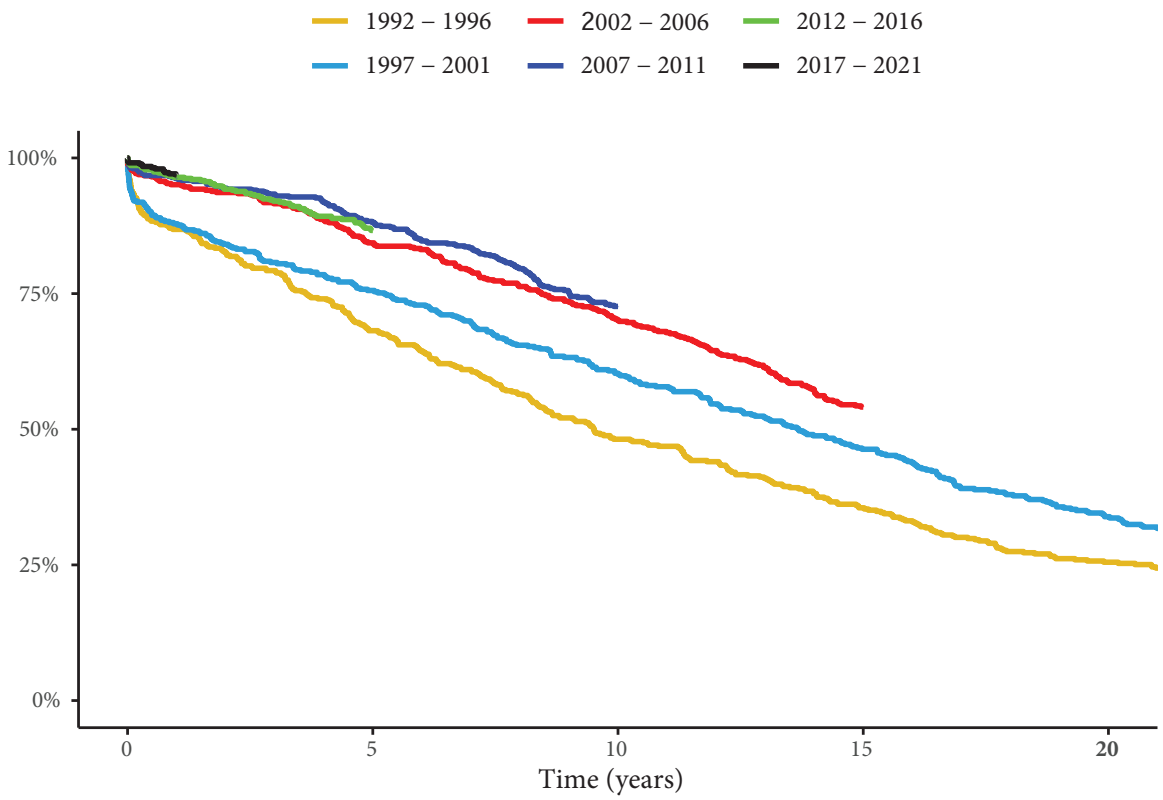


Adult first deceased donor allograft survival by era

Table 5.5: Adult first deceased donor allograft survival by era 1992 - 2021

Period transplanted	Follow up time (years)	Estimated allograft survival [95% C.I.]
1992 - 1996	1	86.8 [83.4 - 89.6]
1992 - 1996	5	68.2 [63.7 - 72.2]
1992 - 1996	10	48.2 [43.5 - 52.6]
1992 - 1996	15	35.5 [31.2 - 39.9]
1992 - 1996	20	25.5 [21.6 - 29.6]
1997 - 2001	1	87.8 [84.5 - 90.6]
1997 - 2001	5	75.6 [71.3 - 79.3]
1997 - 2001	10	60.3 [55.6 - 64.7]
1997 - 2001	15	46.3 [41.6 - 50.9]
1997 - 2001	20	33.9 [29.5 - 38.3]
2002 - 2006	1	95.1 [92.7 - 96.7]
2002 - 2006	5	84.4 [80.8 - 87.3]
2002 - 2006	10	70.1 [65.8 - 74.0]
2002 - 2006	15	54.1 [49.5 - 58.4]
2007 - 2011	1	96.2 [94.3 - 97.5]
2007 - 2011	5	88.1 [85.1 - 90.5]
2007 - 2011	10	72.6 [68.7 - 76.2]
2012 - 2016	1	96.4 [94.4 - 97.7]
2012 - 2016	5	86.7 [83.4 - 89.3]
2017 - 2021	1	96.8 [94.7 - 98.1]

Figure 5.4: Kaplan-Meier adult first deceased donor allograft survival estimates by era 1992–2021



14.1 & 19.9 years

" Median adult deceased allograft and patient survival for the last 30 years is **14.1** and **19.9 years** respectively."

Adult deceased donor patient survival

- The overall median patient survival for adult deceased donor recipients between 1992 – 2021 was **19.9** years (Table 5.6).
- Patient survival at 1 year has remained stable for the eras studied, reaching a high of **98%** for the period 2017 – 2021. 5 year survival rates have improved markedly from **82%** in the initial period to **92%** for 2012 - 2017 (Table 5.8).

Adult first deceased donor patient survival

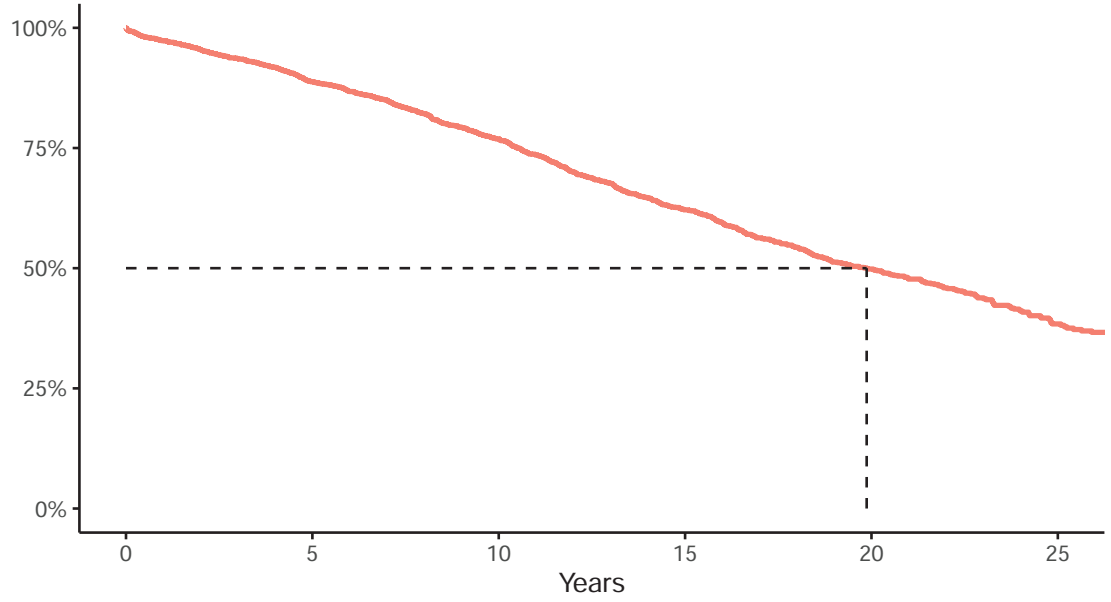
Table 5.6: Adult first deceased donor median patient survival 1992 - 2021

No. of transplants	Median patient survival (years) [95% C.I.]
2930	19.9 [18.6 - 21.4]

Table 5.7: Estimated adult first deceased donor patient survival 1992 - 2021

Follow up time (years)	Estimated patient survival [95% C.I.]
1	97.3 [96.7 - 97.8]
5	88.8 [87.5 - 89.9]
10	76.9 [75.1 - 78.5]
15	62.1 [59.9 - 64.3]
20	49.8 [47.3 - 52.3]

Figure 5.5: Kaplan-Meier adult deceased donor patient survival estimates 1992-2021

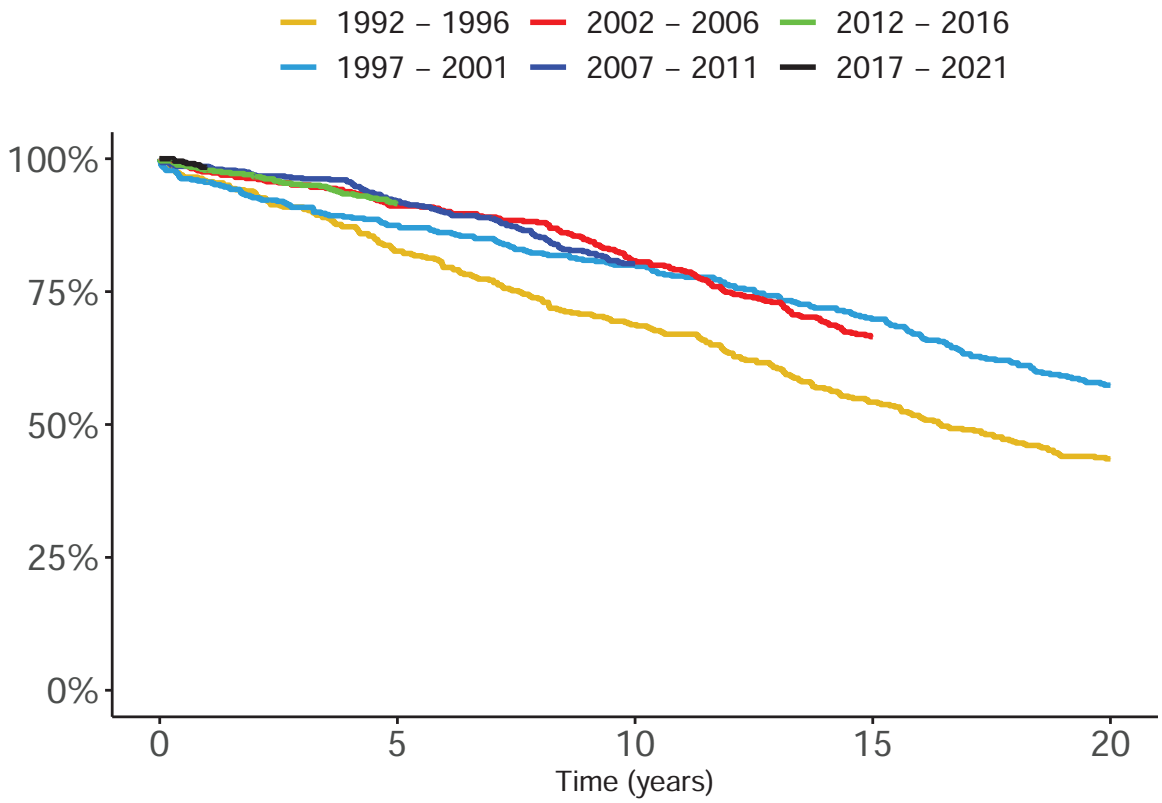


Adult first deceased donor patient survival by era

Table 5.8: Adult first deceased donor patient survival by era transplanted 1992 - 2021

Period transplanted	Follow up time (years)	Estimated patient survival [95% C.I.]
1992 - 1996	1	96.5 [89.6 - 98.9]
1992 - 1996	5	82.4 [72.5 - 89.0]
1992 - 1996	10	69.2 [58.1 - 77.9]
1992 - 1996	15	54.3 [43.0 - 64.3]
1992 - 1996	20	40.7 [30.0 - 51.0]
1997 - 2001	1	95.6 [93.2 - 97.1]
1997 - 2001	5	87.5 [84.0 - 90.2]
1997 - 2001	10	80.0 [76.0 - 83.4]
1997 - 2001	15	69.8 [65.3 - 73.9]
1997 - 2001	20	57.4 [52.6 - 61.9]
2002 - 2006	1	97.5 [95.7 - 98.6]
2002 - 2006	5	91.1 [88.2 - 93.3]
2002 - 2006	10	80.8 [77.0 - 84.1]
2002 - 2006	15	66.5 [62.1 - 70.6]
2007 - 2011	1	98.6 [97.2 - 99.3]
2007 - 2011	5	92.0 [89.5 - 94.0]
2007 - 2011	10	80.3 [76.7 - 83.4]
2012 - 2016	1	97.8 [96.1 - 98.8]
2012 - 2016	5	91.6 [88.8 - 93.7]
2017 - 2021	1	98.4 [96.5 - 99.3]

Figure 5.6: Kaplan-Meier adult first deceased donor patient survival estimates by era 1992–2021



23 recipients have a functioning kidney transplant for over 40 years.

Paediatric deceased donor allograft and patient outcomes 1997 - 2021

This section focuses on paediatric deceased donor allograft and patient survival for the 25 year period 1997 - 2021. During this period there were 193 deceased donor paediatric transplants, of which 176 were first transplants.

- There were **12** paediatric transplants during 2022 of which 7 were from deceased donors. The median recipient paediatric age was **15.5** years, range 4 - 17 years. Five recipients received a first and 2 a repeat transplant.
- The overall median allograft survival for recipients of first deceased donors was **16.4** years (Table 5.9).
- One year paediatric deceased donor allograft survival was **93%** with one year patient survival of **99%**, reducing only to **98%** at 5 and 10 years (Table 5.10).

Paediatric first deceased donor median allograft survival

Table 5.9: Paediatric first deceased donor median allograft survival 1997 - 2021

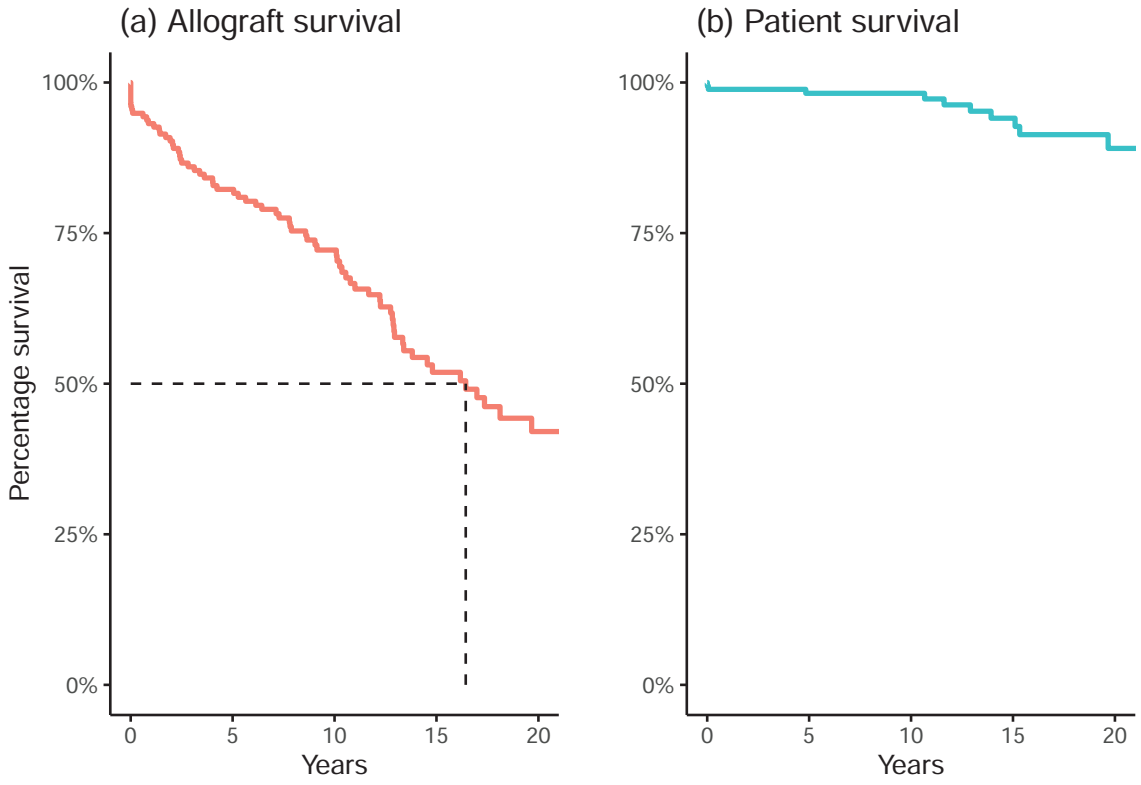
Transplant number	Median allograft survival in years [95% C.I.]
176	16.4 [12.9 - 21.8]

Paediatric first deceased donor allograft and patient survival

Table 5.10: Paediatric first deceased donor allograft and patient survival 1997 - 2021

Follow up time (Years)	Estimated allograft survival [95% C.I.]	Estimated patient survival [95% C.I.]
1	93.2 [88.3 - 96.1]	98.9 [95.5 - 99.7]
5	82.3 [75.6 - 87.3]	98.2 [94.5 - 99.4]
10	72.2 [64.4 - 78.6]	98.2 [94.5 - 99.4]
15	51.9 [42.3 - 60.6]	94.1 [87.6 - 97.2]
20	42.1 [31.6 - 52.2]	89.1 [79.4 - 94.3]

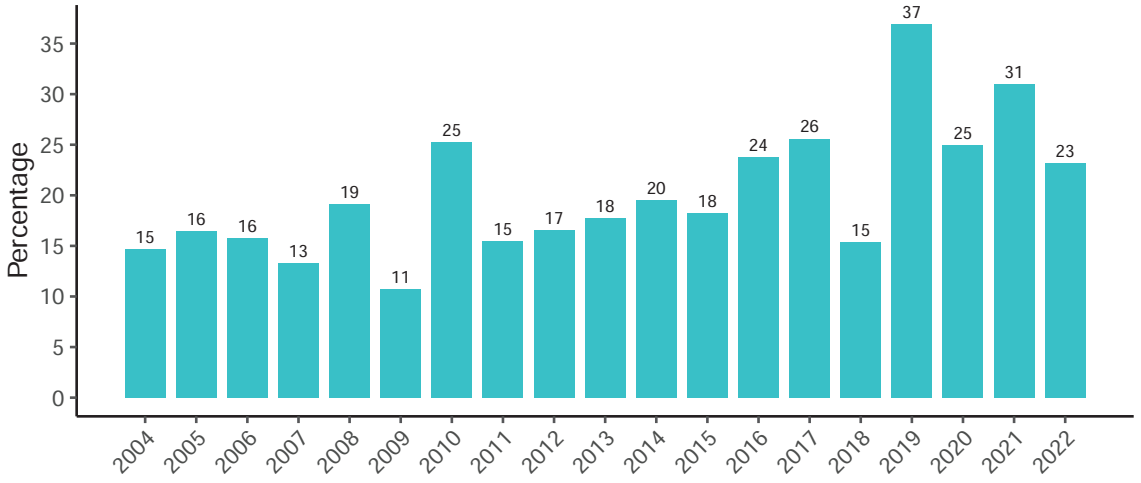
Figure 5.7: Paediatric first deceased donor kidney allograft and patient survival 1997-2021



Delayed graft function

The rate of delayed allograft function (defined as the temporary requirement of dialysis within one week of transplant) for recipients of deceased donor kidneys has been high for the last 4 years, reaching over 37% in 2019 and was 23% in 2022 (Figure 5.8) reflecting the use of kidneys from non-heart beating (DCD) and extended criteria donors. There are significantly lower rates of delayed graft function for recipients of living donor kidneys and in 2022 the rate was 4%.

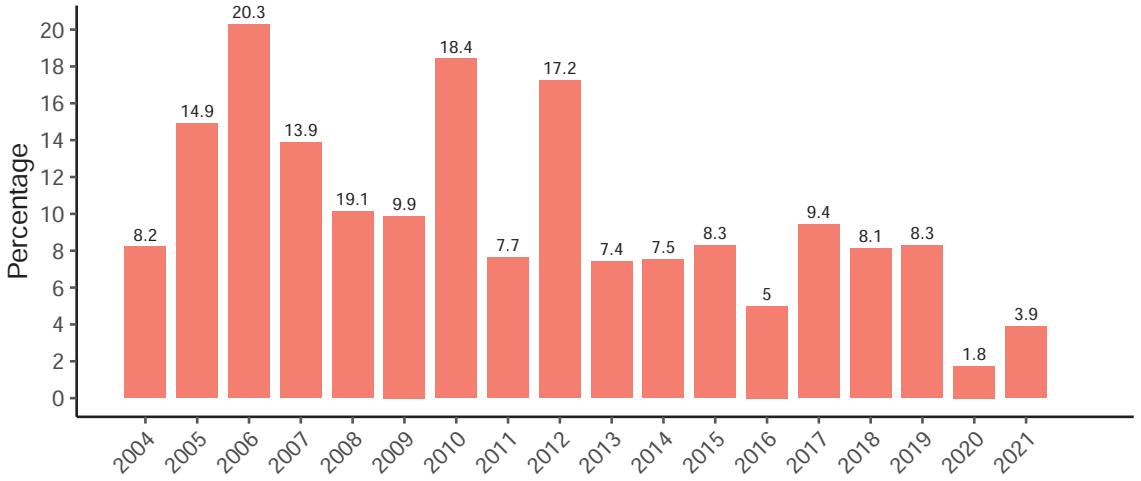
Figure 5.8: Delayed allograft function for adult deceased donor recipients post-transplant 2004-2022



Biopsy proven acute rejection

Instances of acute rejection, defined as either biopsy proven TCMR (T-cell mediated rejection) or ABMR (antibody mediated rejection) within the first year of transplantation have been relatively stable over the last decade with an average of 10% per year. The rate for 2021 was significantly below this average at 3.9% (Figure 5.9).

Figure 5.9: Acute rejection rate for adult (living and deceased) recipients post-transplant 2004-2021



6. International Comparisons

Comparison of Irish Kidney Transplant Outcomes with European Union (Collaborative Transplant Study)

The Collaborative Transplant Study (CTS) is based on the voluntary cooperation of transplant centers from around the world. The CTS has active support of more than 400 transplant centers in 42 countries, with more than 800,000 data sets for kidney, heart, lung, liver, and pancreas transplants collected. The study is coordinated from the Institute of Immunology of the University of Heidelberg, Germany. The Heidelberg CTS team includes physicians, immunologists, computer scientists, statisticians and laboratory staff.

The study's aims are strictly scientific. Aside from maintaining a transplant registry, the CTS conducts various prospective and retrospective studies on particular research topics.

The NKTS at Beaumont Hospital provides anonymised data through a secure encrypted portal to the CTS, and they, in return, have produced graphs showing the performance of the NKTS compared to other European centers. 2020 is the most recent year that data is available for survival analysis published by the CTS. The time frames presented below were requested to best reflect NKTS activity and enhance comparisons with other centers.

Figure 6.1: EU (CTS) comparison of adult first deceased-donor kidney patient survival 1991-2020

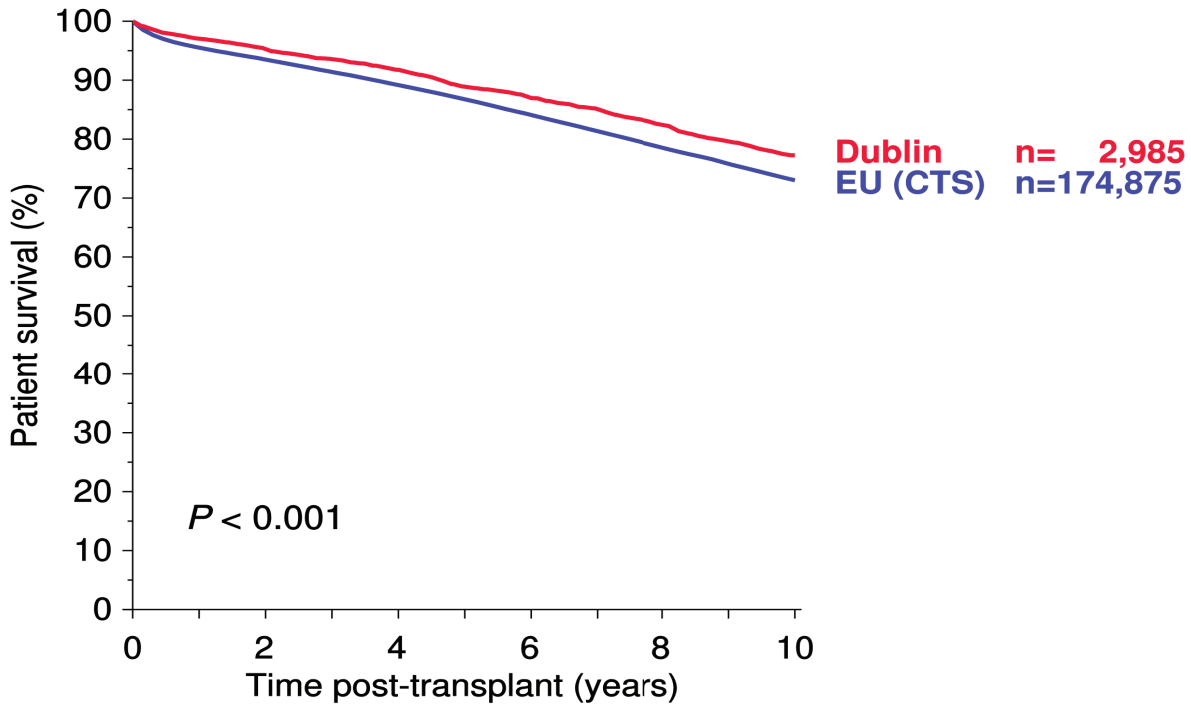


Figure 6.2: EU (CTS) comparison of adult first deceased-donor kidney patient survival by era transplanted

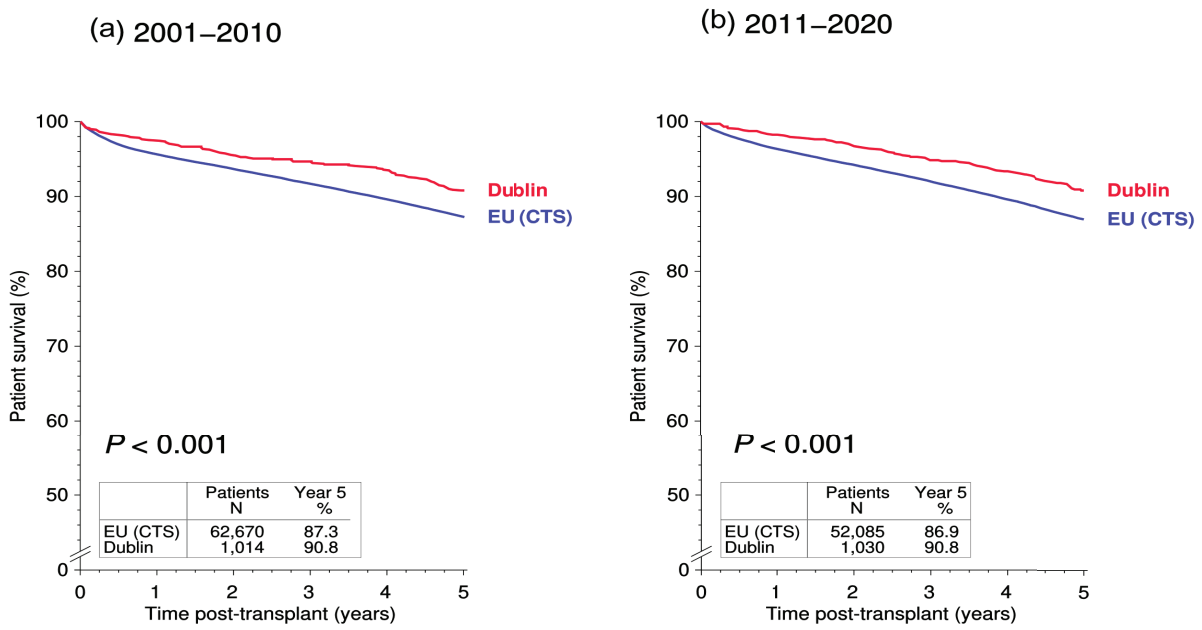


Figure 6.3: EU (CTS) comparison of adult first deceased-donor kidney allograft survival 1991-2020

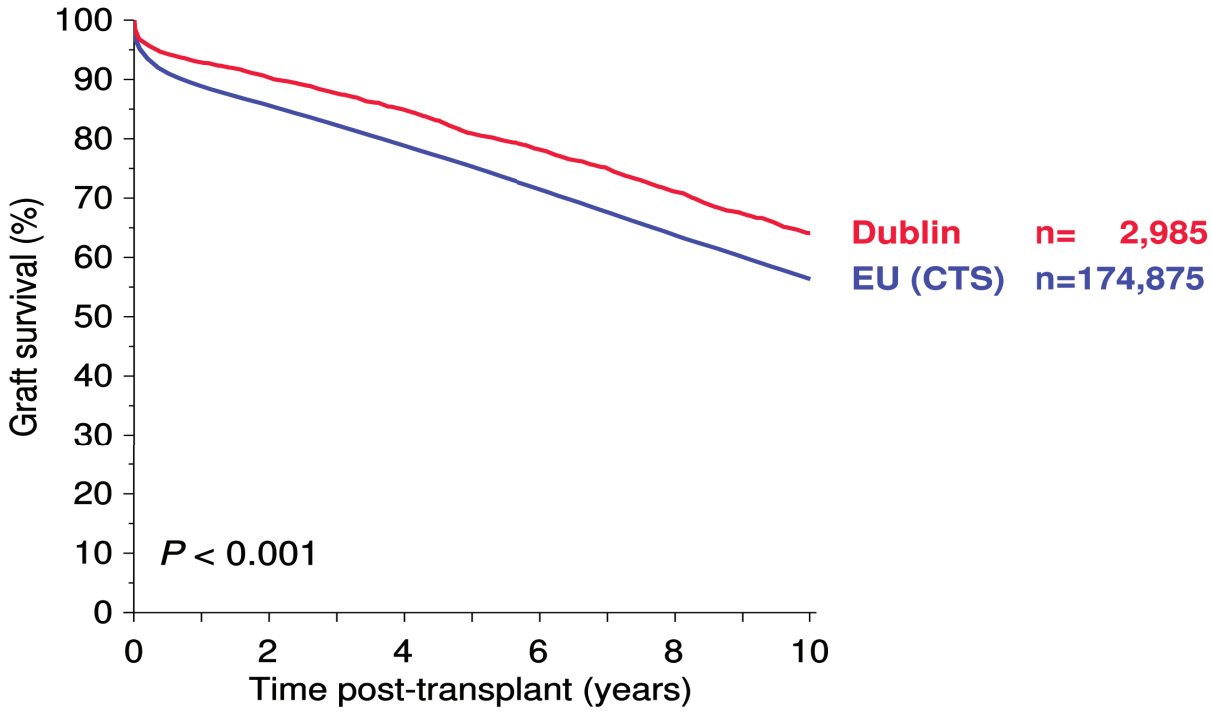


Figure 6.4: EU (CTS) comparison of adult first deceased-donor kidney allograft survival by era transplanted

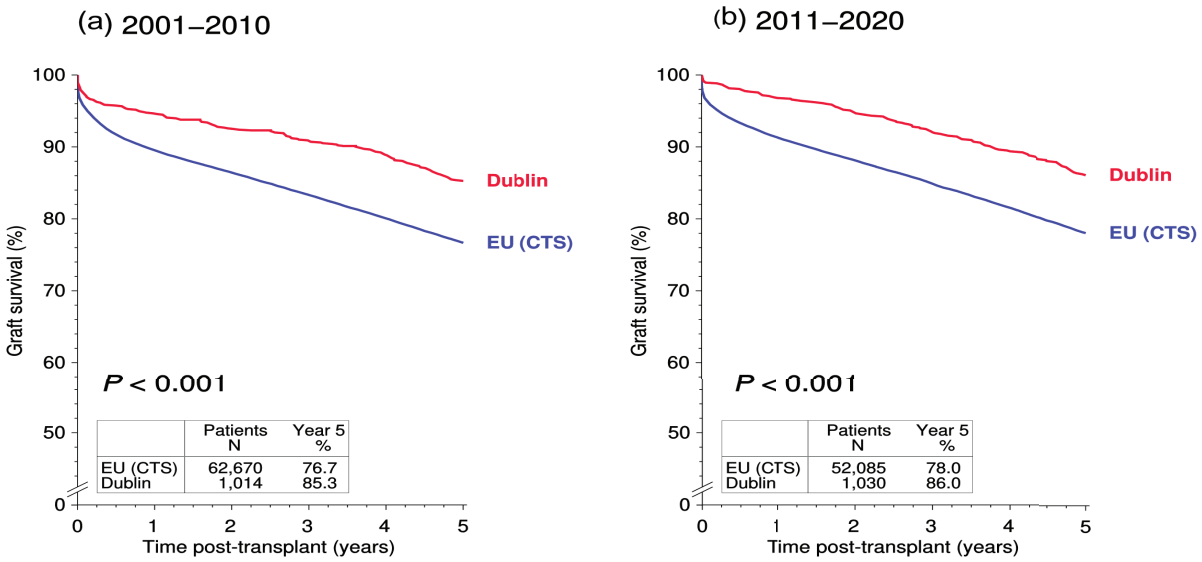


Figure 6.5: EU (CTS) comparison of adult re-transplanted deceased-donor kidney allograft survival by era transplanted

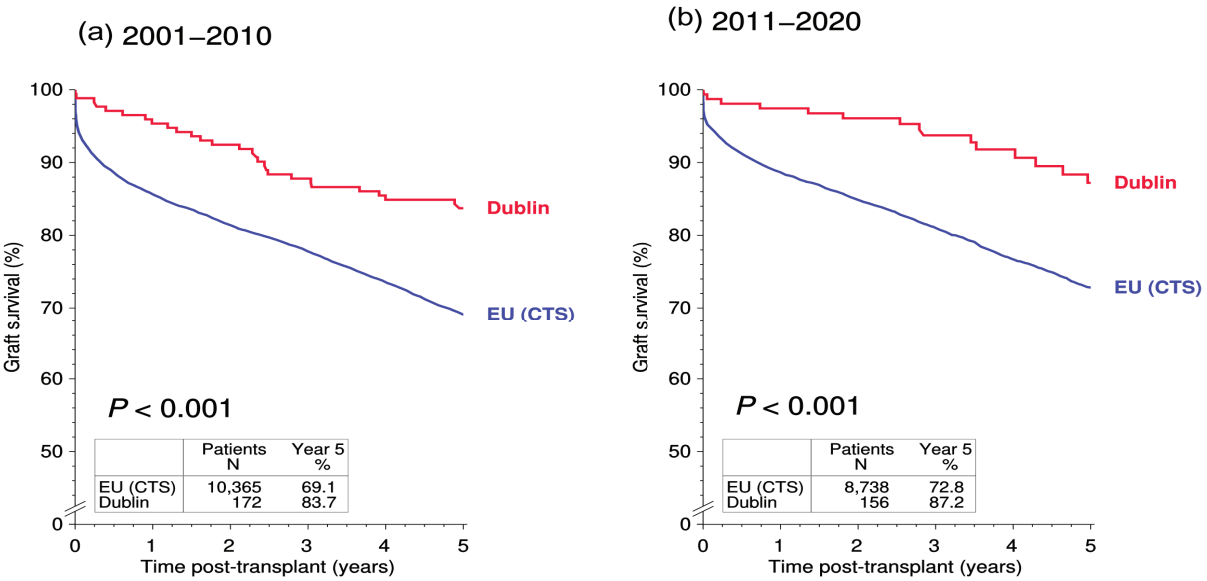


Figure 6.6: EU (CTS) comparison of adult first living-donor kidney patient survival 2006 - 2020

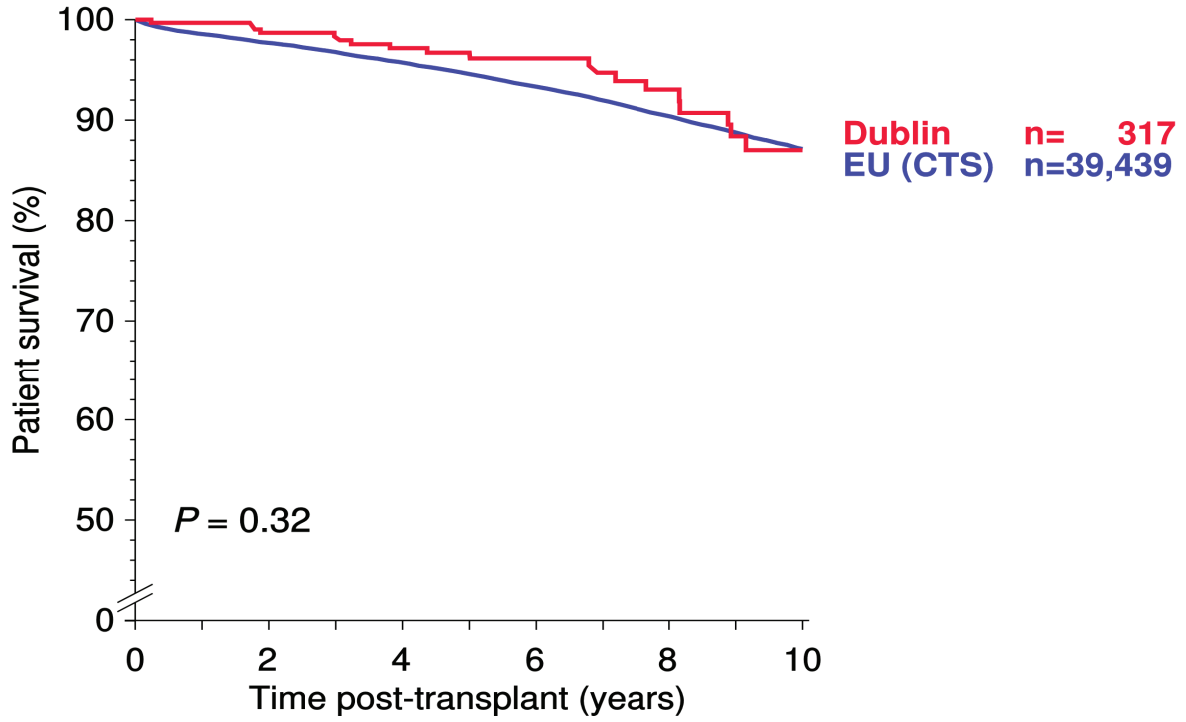


Figure 6.7: EU (CTS) comparison of adult first living-donor kidney allograft survival 2006 - 2020

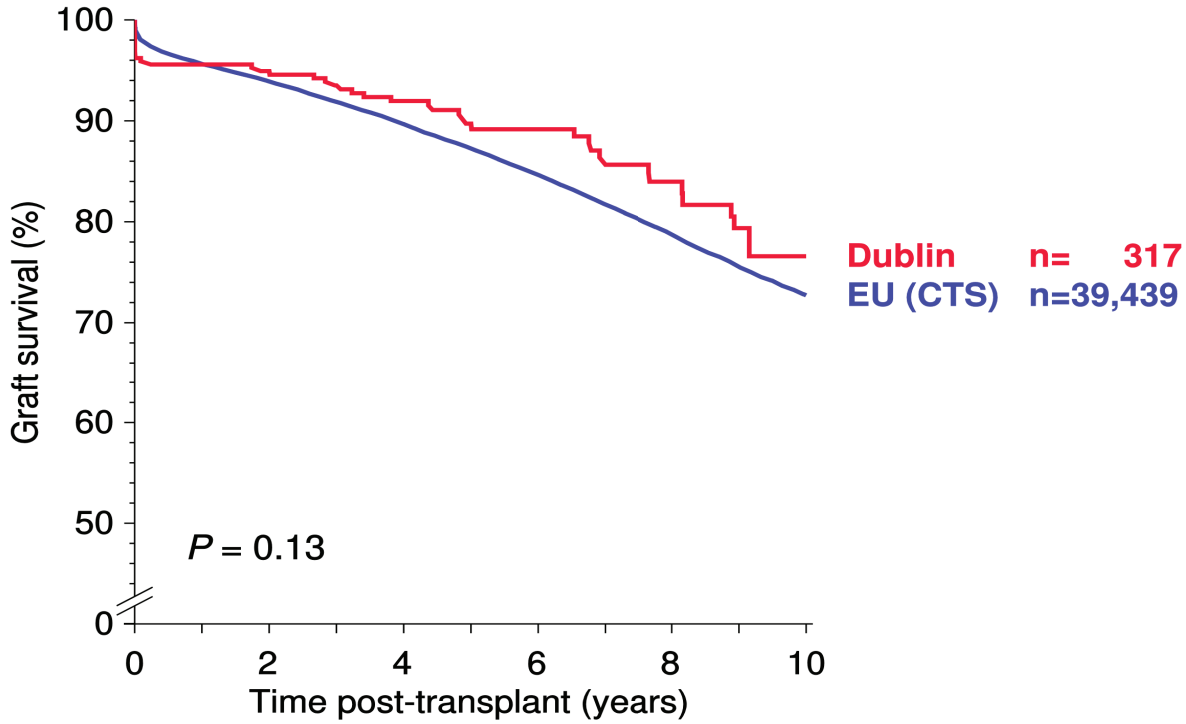


Figure 6.8: EU (CTS) comparison of paediatric first deceased-donor kidney allograft survival 2006-2020

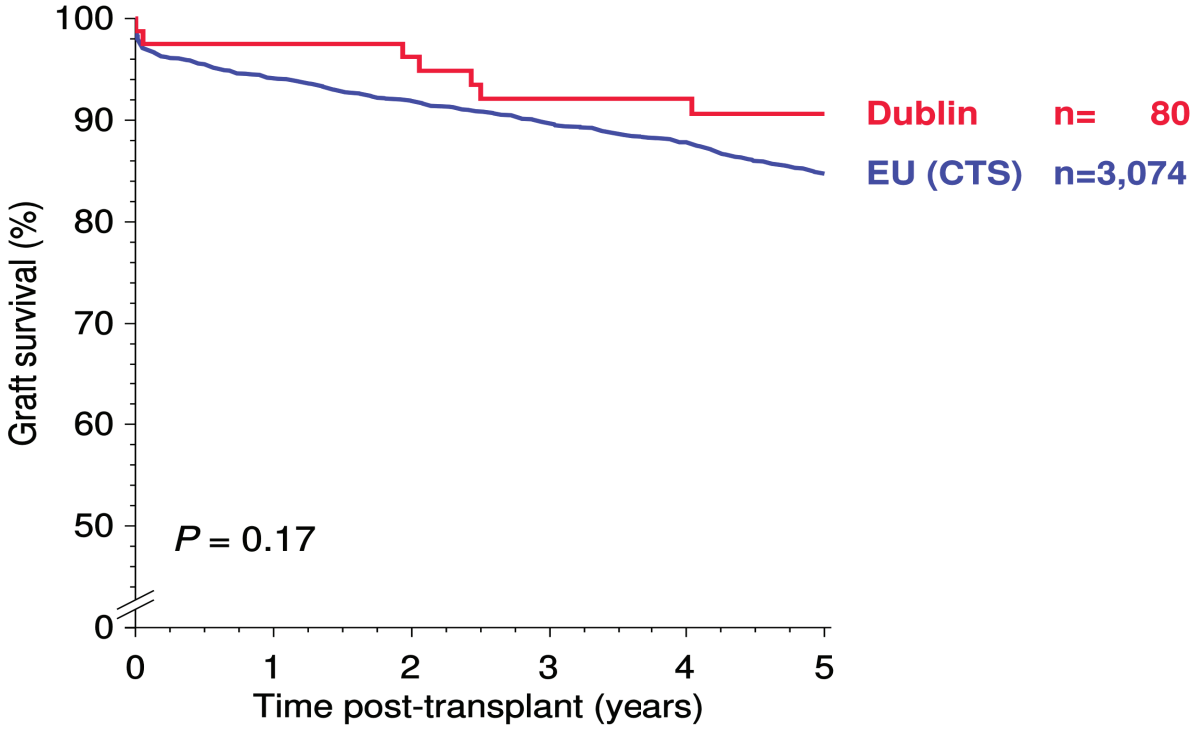
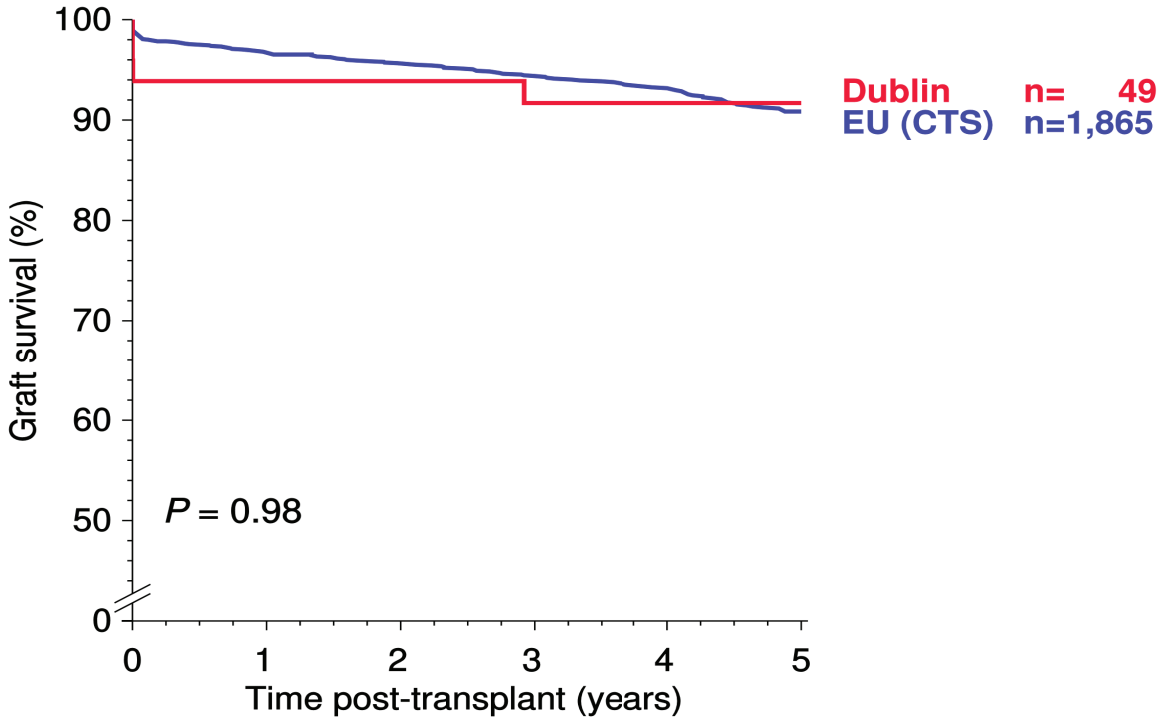


Figure 6.9: EU (CTS) comparison of paediatric first living-donor kidney allograft survival 2006-2020



Comparison of transplantation rates between European Renal Association (ERA)/ European Dialysis and Transplantation Association (EDTA) countries and Ireland

The ERA/EDTA Registry collects data on renal replacement therapy (RRT), rates and outcomes of kidney transplantation and donation via the national and regional renal registries in Europe. For this section comparisons are made between 20 ERA/EDTA countries for transplant rates.

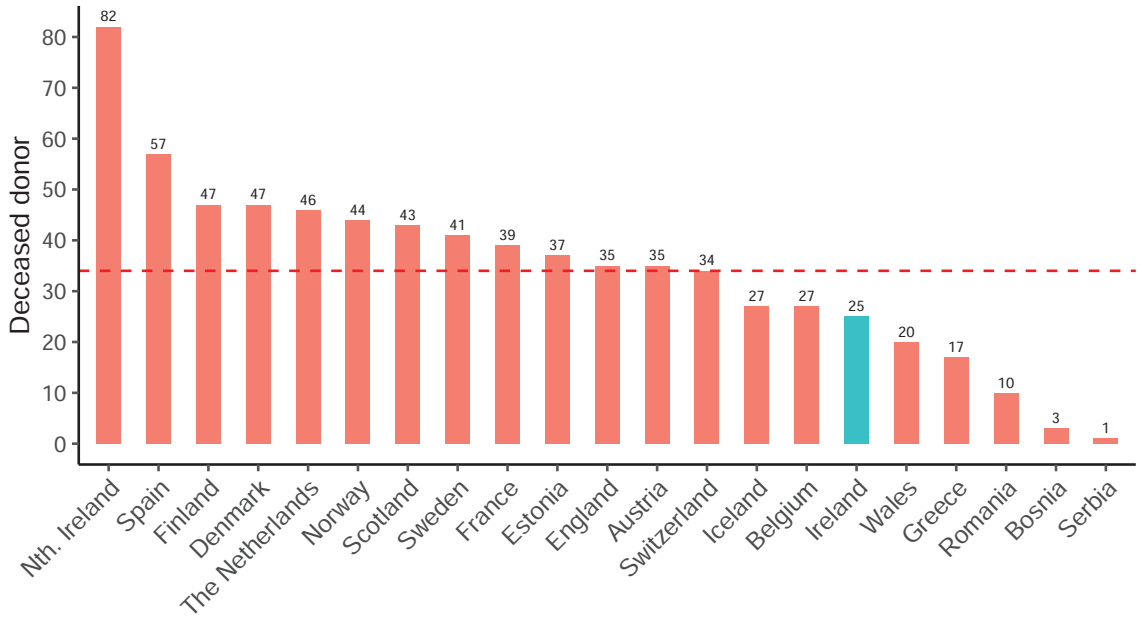
Data was retrieved from the 2020 (most recent) ERA/EDTA report released in November 2022. As this was the year Covid-19 had the biggest impact on transplant numbers, rates were down for all countries and categories of kidney transplant, in particular living donor transplants.

- The overall kidney transplant rate PMP (per million population) was **25** for Ireland during 2020 compared to the EDTA overall registry rate of **34** PMP. The countries with the highest rates of kidney transplantation are Northern Ireland, Spain, Finland and Denmark with **82, 57, and 47** PMP respectively.(Figure 6.10)

- Deceased donor kidney transplant rate PMP was **19** for Ireland in 2020, compared to the overall registry rate of **26** PMP. The countries with the highest rates of deceased donor kidney transplantation are Northern Ireland, Spain and Finland with **65, 52 and 42** PMP respectively(Figure 6.11)

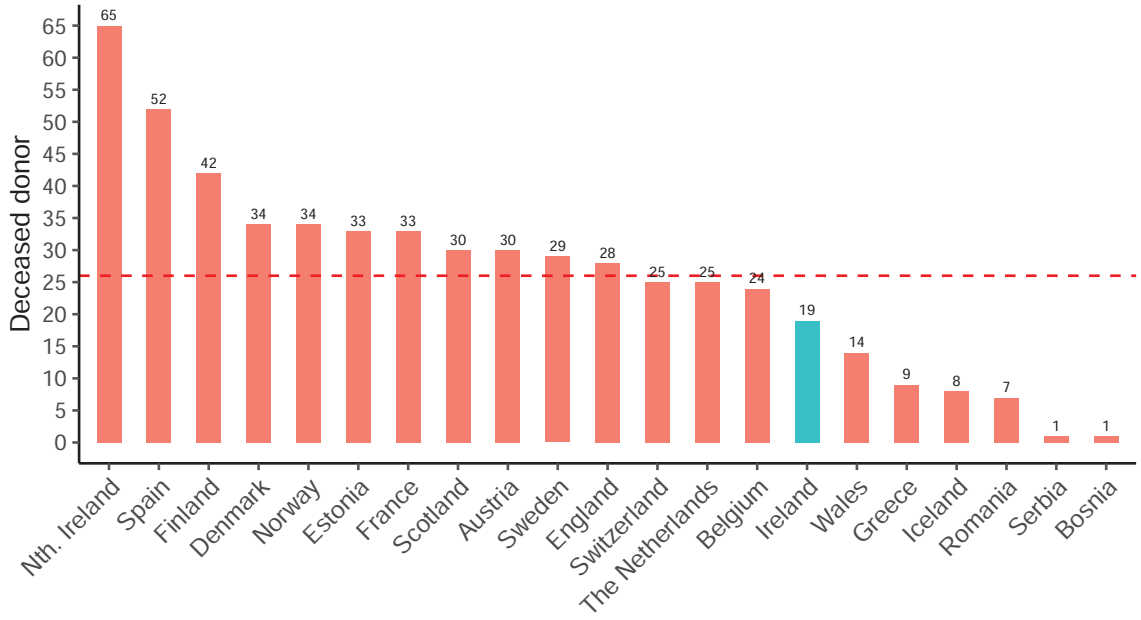
- Living donor kidney transplant rate PMP is **6** for Ireland in 2020 compared to a registry overall rate of 8 PMP. Countries with the highest rates of living donor kidney transplantation were The Netherlands, Northeren Ireland and Iceland with **21, 19 and 16** PMP respectively.(Figure6.12)

Figure 6.10: Total rates of transplantation PMP for EDTA countries and Ireland for 2020



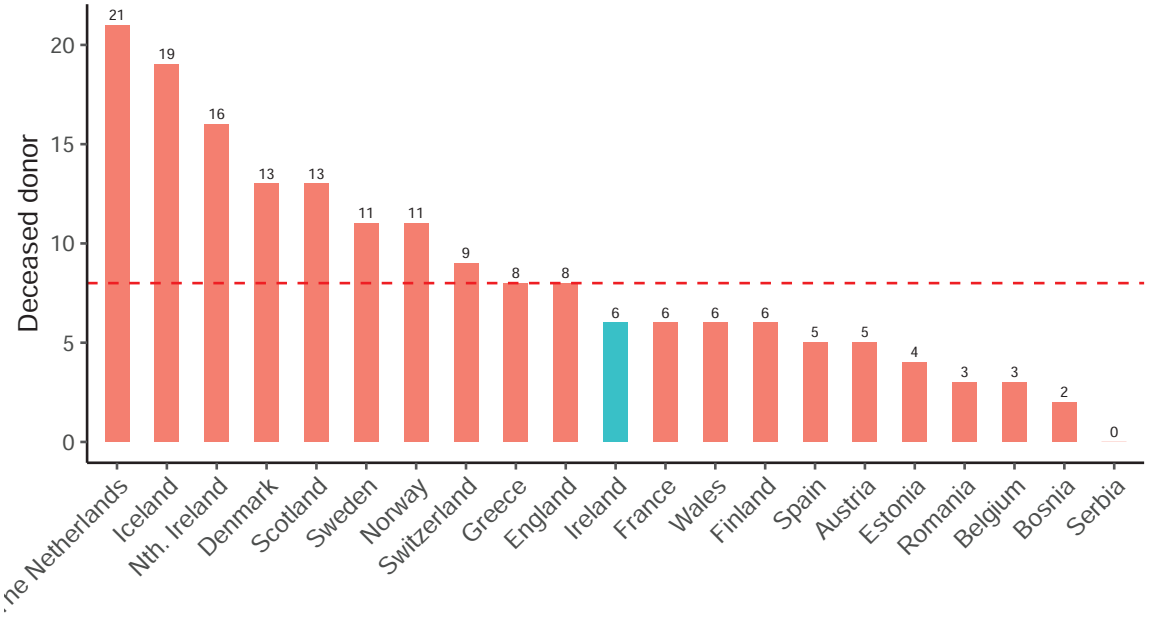
Note: dashed line = Average PMP for EDTA countries

Figure 6.11: Deceased donor rates of transplantation PMP for EDTA countries and Ireland for 2020



Note: dashed line = Average PMP for EDTA countries

Figure 6.12: Living donor rates of transplantation PMP for EDTA countries and Ireland 2020



Note: dashed line = Average PMP for EDTA countries

7. Living Donor Programme

Introduction

Donor organ shortage is a major problem for patients globally resulting in long waiting times for organ transplantation. Receiving a kidney transplant from a living recipient has many advantages over deceased donation including increased allograft and patient survival. This is evidenced in Table 5.3 and 5.7 (deceased donor adult transplant outcomes) and Table 7.1 (living donor adult transplant outcomes). There are also significant reductions in rejection rates and waiting times, plus the added benefit that surgery can be scheduled.

The NKTS invites and encourages all living donors to have regular checkups with their nephrologist to ensure they suffer no ill events post nephrectomy. Long term follow up data on kidney donors provides insight and information on the long term safety and possible health risks of donation for the donor. As stated in Article 15 of the "Directive 2010/53/EU of the European Parliament" countries within the European Union are obliged by law to have a follow up system for living kidney donors to which the NKTS complies with this legislation.

Covid-19 posed particular difficulties for the Living Donor Programme in 2022 but was managed very effectively resulting in **130** potential donors being immunologically evaluated for **85** recipients. This reflected an increase of **6.5%** presenting for evaluation compared to 2021 activity. Of this number **86** were medically assessed and underwent investigations to determine suitability to proceed with live donation. **69** were assessed for direct donation and **15** for the UK Living Donor Kidney Sharing Scheme (UKLKSS). Of note, these donor recipient pairs are now assessed in Belfast as part of cross border collaboration which has practical advantages for all involved (e.g. travel and access). Of the **15** donors in the UKLKSS, **8** proceeded to donation in 2022.

- There were **33** living donor kidneys transplanted in 2022

- In the period 2001 - 2022 donation to adults occurred mainly between siblings **(49%)**, spouses **(17%)**, parents **(15%)** and children **(10%)**. However for paediatric recipients, as expected, **83%** are parental donors (Figure 7.3)

- Median age at donation was **45** overall. Spousal and unrelated donors are generally of the older age groups while the youngest age groups are identified in adult children donating to parents **(33 years)**. Donor ages ranged from **20 to 72** (Figure 7.4).

- During 2022 the median length of in-hospital stay post-operatively was **3 days**. For the time period 2001-2010 this was **7 days** reducing to 5 and 4 days for the latter time periods 2011-2016 and 2017-2022 respectively (Figure 7.5). This is due to the fact that virtually all donor nephrectomies are performed using minimally invasive laparoscopic techniques allowing for accelerated post-operative recovery.

- Post-operatively all living donors are reviewed by the surgical team and are then offered an annual follow-up with their local nephrologist. **78%** of living donors are availing of this service with a median follow up time of **6.2** years.

- At follow-up, **13%** of living donors developed hypertension post donation ranging from **6%** in the 20 – 34 age group to **20%** in the age group > 55 years (Figure 7.6).

- As expected the renal function (eGFR) falls post donation, but rises in the following years ranging from a median of **95 ml/min/1.73m2** (pre donation) to **66 ml/min/1.73m2** at 5 years post donation (Figure 7.7).

Living donor recipient outcomes

Adult recipient living donor allograft and patient outcomes 2007 - 2021

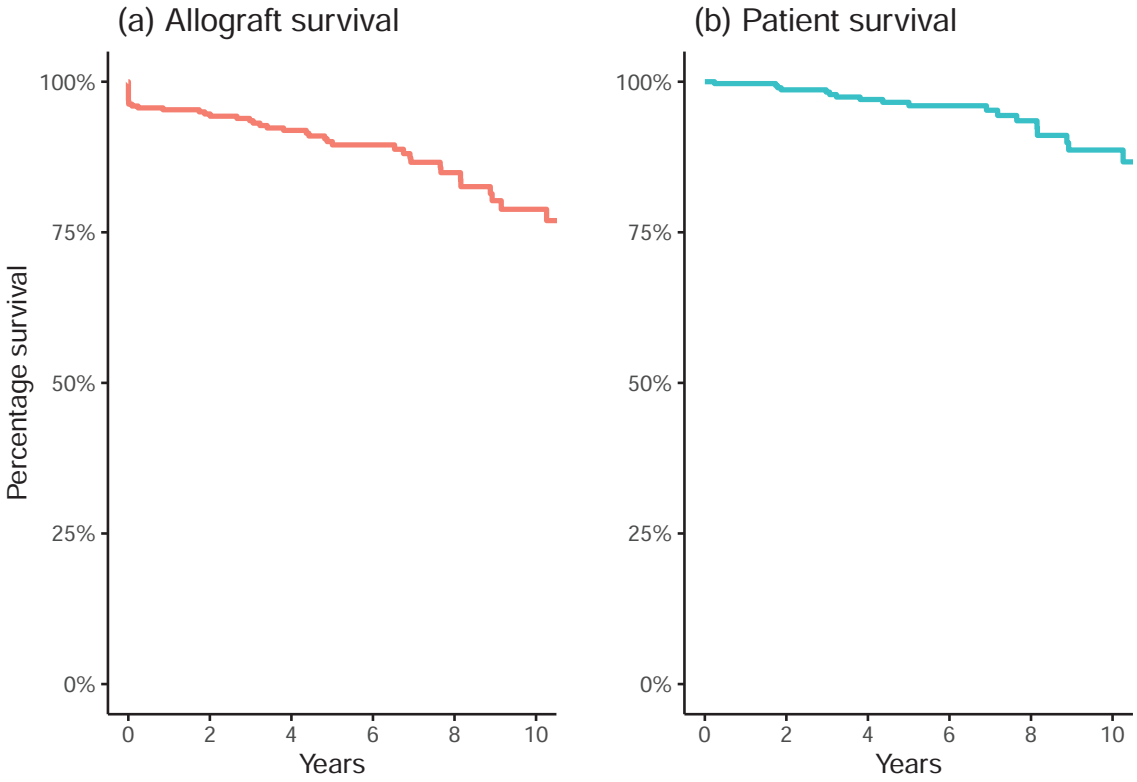
This section focuses on outcomes for adult recipients of living donor kidney from 2007-2021. During this period **396** living donor transplants were performed, **321** were for first transplant recipients **62** for second and **13** were for subsequent transplants.

• One-year allograft survival for adult living donor transplant recipients for the period 2007 - 2021 was **95%**, and patient survival was **100%**. Five-year allograft survival for adult living donor transplant recipients between 2007 and 2021 was **90%** and patient survival was **97%** (Table 7.1).

Table 7.1: Adult first living donor allograft and patient survival 2007 - 2021

Follow up time (years)	Adult living donor allograft survival[95% C.I]	Adult living donor patient survival[95% C.I]
1	95.3 [92.4 - 97.2]	99.7 [97.8 - 99.9]
3	93.5 [90.1 - 95.8]	98.3 [95.9 - 99.3]
5	90.0 [80.4 - 97.0]	96.6 [93.5 - 98.2]
10	78.7 [70.6 - 84.8]	88.6 [81.1 - 93.1]

Figure 7.1: Adult first living donor first kidney allograft and patient survival 2007 - 2021



Paediatric recipient living donor allograft and patient survival 2007 - 2021

This section details survival outcomes for the period 2007 - 2021. There were **60** paediatric living donor transplants during this period, 53 were first and **7** were repeat transplants.

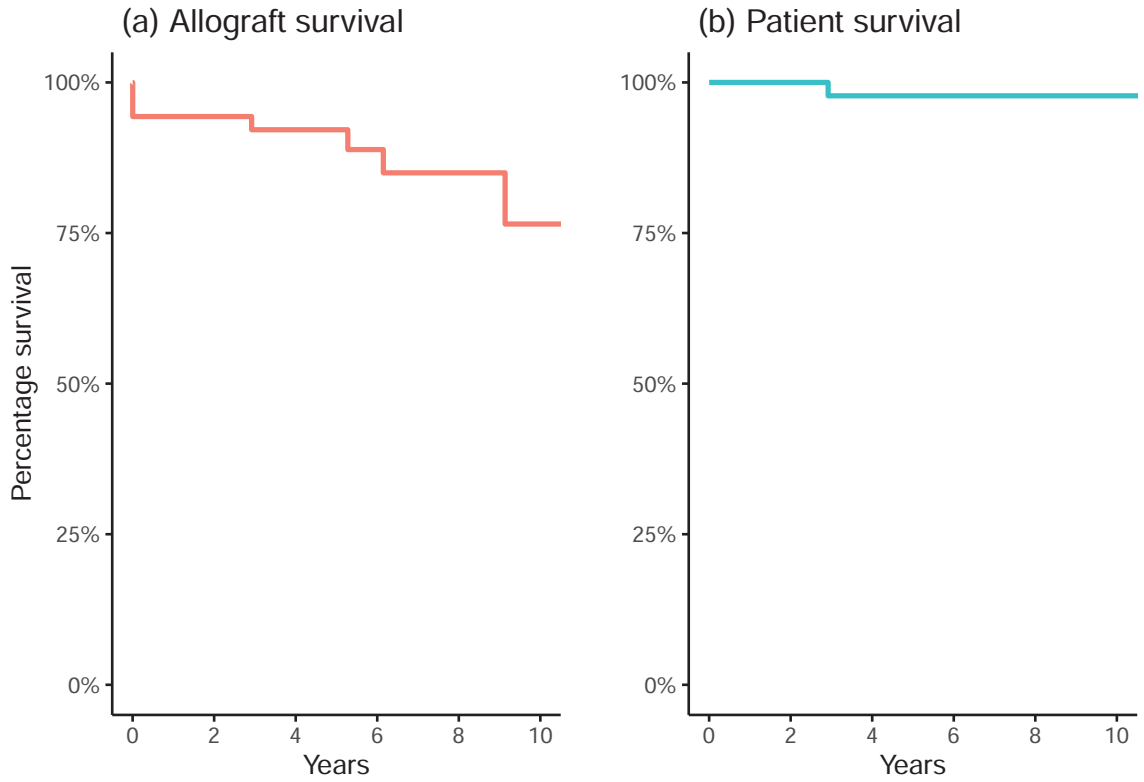
- There were **12** paediatric transplants in 2022, **5** were from living donors with age at transplant ranging from 4 to 17 years.
- One-year allograft survival for paediatric living donor transplant recipients for the period 2007 - 2021 was **94%**, and patient survival was **100%**. Ten year allograft and patient survival was **76%** and **98%** respectively (Table 7.2).

Paediatric first living donor recipient allograft and patient survival

Table 7.2: Paediatric first living donor allograft and patient survival 2007 - 2021

Follow up time (Years)	Estimated allograft survival [95% C.I.]	Estimated patient survival [95% C.I.]
1	94.3 [83.5 - 98.1]	100 [—-]
3	92.2 [80.4 - 97.0]	97.8 [85.3 - 99.7]
5	92.2 [80.4 - 97.0]	97.8 [85.3 - 99.7]
10	76.5 [50.8 - 90.0]	97.8 [85.3 - 99.7]

Figure 7.2: Paediatric first living donor kidney allograft and patient survival 2007 - 2021



Donor characteristics at donation date

Figure 7.3: Adult/ Paediatric Recipient by donor type of relation 2001 - 2022

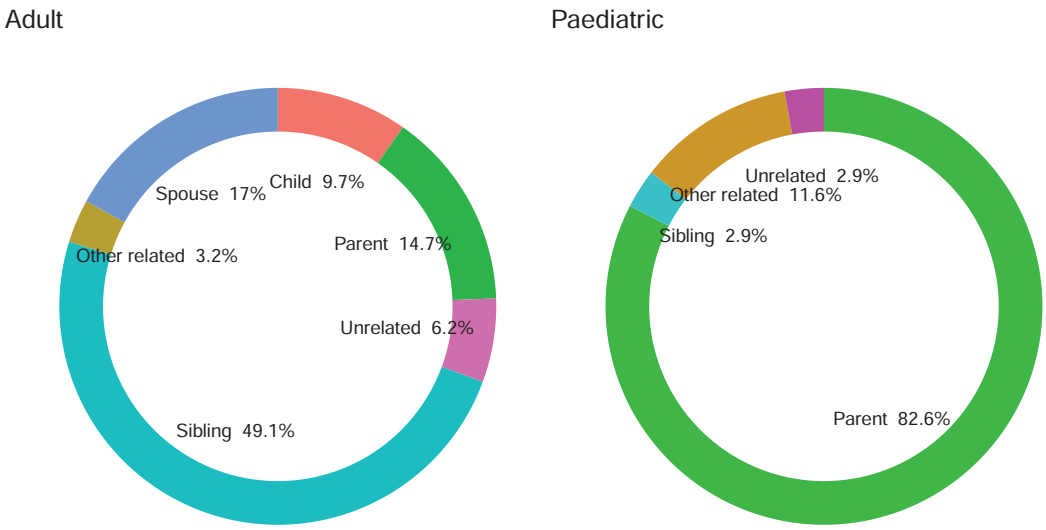


Figure 7.4: Percentage donor relation by age at donation

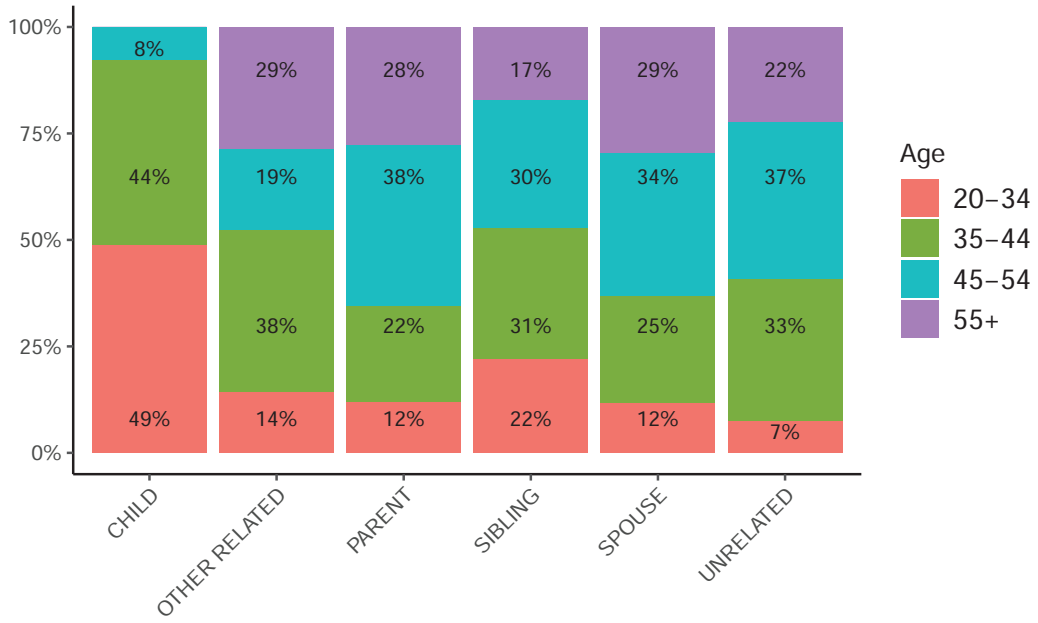


Figure 7.5: Length of stay of living donors by time period of donation

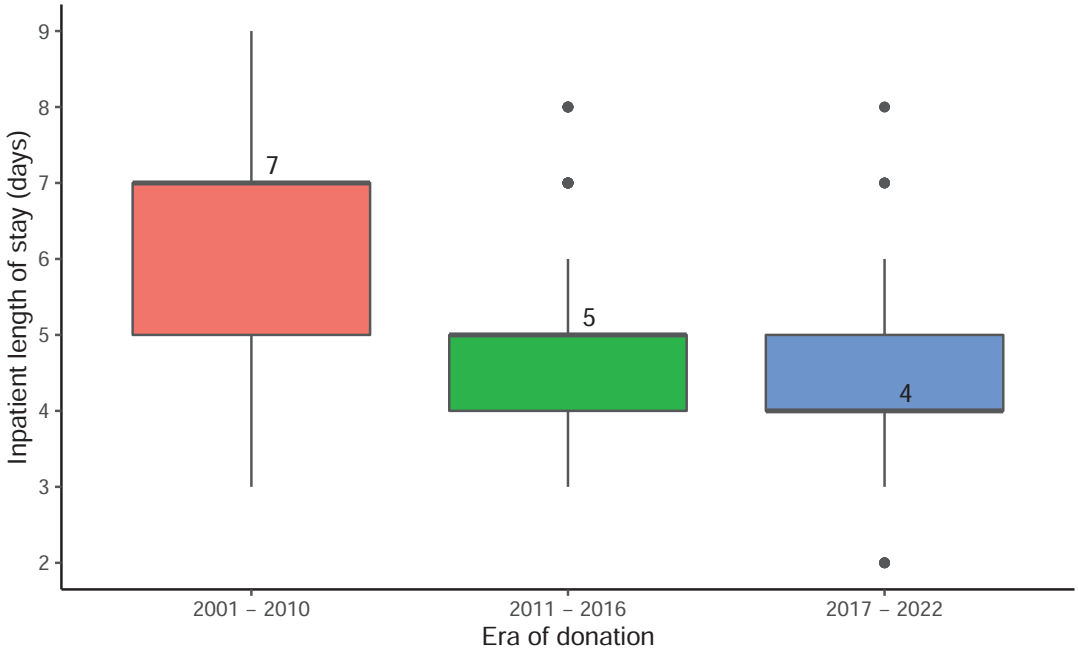


Figure 7.6: Percentage of post donation hypertension by donor age group

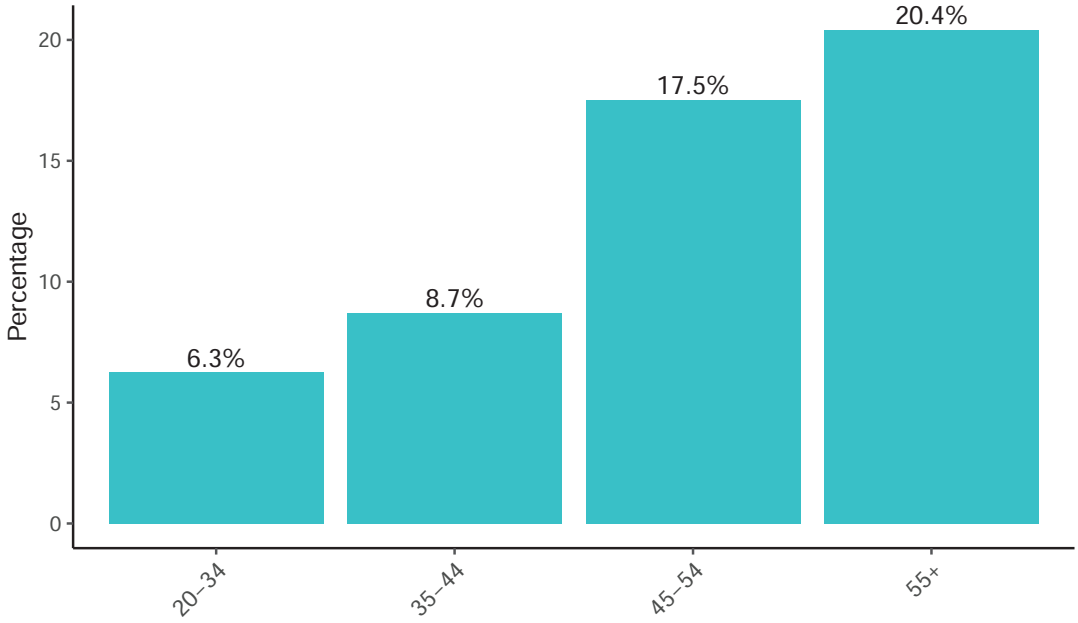
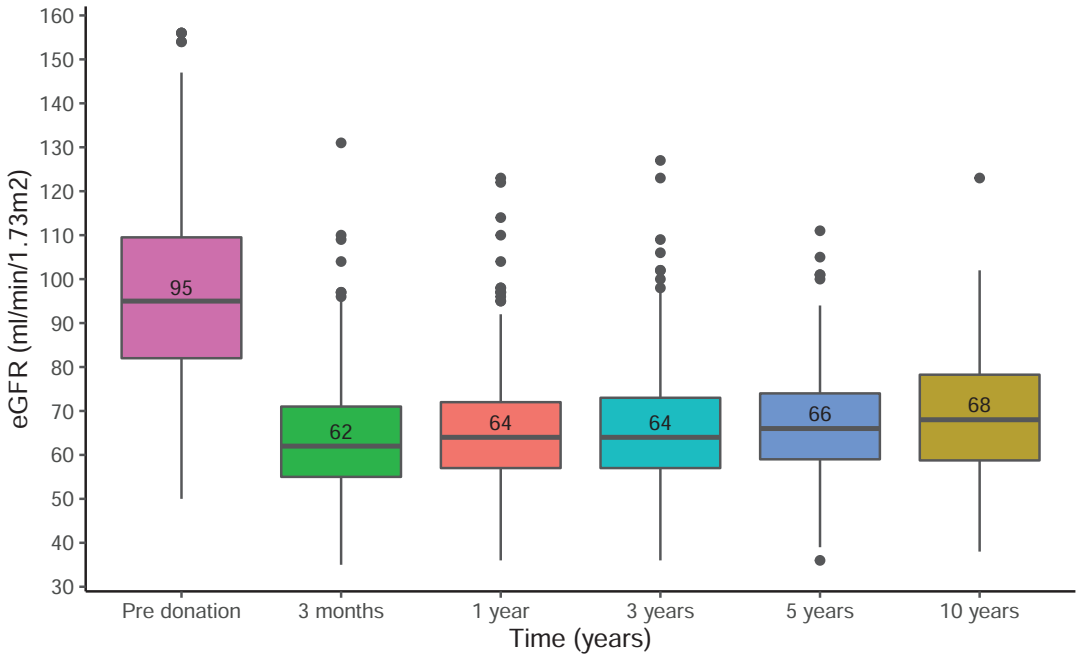


Figure 7.7: Median and interquartile eGFR for living donors pre and post donation



"Long term allograft survival rates for living donor kidney recipients **exceed** those for deceased donor recipients for both adults and paediatrics. 10 year adult living allograft **survival rate is 79%** compared to deceased rate of 64%. For paediatrics this is 76% and 72% respectively."

Design of Report

This statistical report describes activity in the National Kidney Transplant Unit for 2022 and for previous years to allow for comparisons and to assess outcomes with sufficient follow up times. The design is specifically user friendly, with graphs being used for the majority of data presentation, with some tables and a brief summary analysis. The use of bar and line graphs allows the amalgamation of data to totals and median values etc. whereas the use of dot and box plots allows the reader to view the totality of the data aswell as median and ranges. The use of modern graphics packages with annotated text enables the user to maximize information intake with ease. Specific major sections with small subsections allow the reader to quickly navigate various parts of the report that may be of specific interest.

Sections 5-7 focuses on graft and patient outcomes with individual sections concentrating on adult, paediatric and comparisons with European centres (CTS). Kaplan Meier methods are used to estimated survival outcomes and Log Rank tests used for comparison with CTS centres. A separate section on living donor outcomes facilitates the assessment of demographic features and outcomes from kidney donors from the year 2001. Tables, graphs and statistical analysis was performed using R software and the report was produced in Markdown. It is our hope that this report will inform people of the educational opportunities afforded by the various NKTS reports. Any appropriate data requests will be accommodated using our request protocols.

Acknowledgements

We are indebted to our colleagues in the renal centers around Ireland for continuing to provide long term follow up data to the Renal Transplant and Living Donor registries in order to produce this report. In particular, we wish to acknowledge the continued support from Transplant Coordinators and the Clinical Nurse Specialists in the regional centers in providing us with timely data, without which this report could not be produced.

Staff List

In preparing this Annual Report, the Directorate Team would like to acknowledge the generosity of all the kidney donors and their families whose "Gift of Life" makes each transplant a reality. We also recognise the extremely hard work of the Transplant Team and indeed all the staff in Beaumont Hospital.

Consultants

Ms Dilly Little Consultant Transplant Surgeon
Mr Gordon Smyth Consultant Transplant Surgeon
Mr Ponnusamy Mohan Consultant Transplant Surgeon
Mr Richard Power Consultant Transplant Surgeon
Mr James Forde Consultant Transplant Surgeon
Mr Ian Robertson Consultant Transplant Surgeon
Mr Ati Ferede Consultant Transplant Surgeon
Mr Neal Dugal Consultant Transplant Surgeon
Mr Niall Davis Consultant Transplant Surgeon
Prof Conall O'Seaghdha Consultant Nephrologist
Prof Peter Conlon Consultant Nephrologist
Dr Colm Magee Consultant Nephrologist
Prof Declan DeFreitas Consultant Nephrologist
Dr Mark Denton Consultant Nephrologist
Dr Carol Traynor Consultant Nephrologist
Dr Ciara Magee Consultant Nephrologist
Dr Amy Hudson Consultant Nephrologist
Mr Denis Murphy Independent Medical Assessor
All Consultant nephrologists nationally
NCHD staff at Beaumont Hospital for Urology and Nephrology Services

Nursing team

Annette Butler Directorate Nurse Manager
Mr Enda Maguire CNM2 St Damiens Transplant Unit
Ms Emer O'Rourke CNM1 St Damiens Transplant Unit
Ms Fiona Kiely CNM1 Damiens Transplant Unit
Ms Marisa Pinheiro Transplant CNS
All transplant nursing, healthcare and household staff

Transplant Co-ordinators

Ms Laura Austin CMN3
Ms Andrea Fitzmaurice CMN2
Ms Laura Lynch CNM2
Ms Aoife Carolan CNM2
Ms Laura Motherway CNM2
Ms Patricia Murtagh CNM2 Locum

Renal day care nursing team

Ms Fiona Manning CNM2 Renal Day Care
Ms Ciara Tolan CNM1 Renal day care
Ms Olive McEnroe CNS Ambulatory care
Ms Caitriona McNamara CNM1 Ambulatory care
Ms Louise McSkeane CNM Ambulatory care
Ms Ruth O'Malley CNM Ambulatory care
Ms Brenda Groarke Patient Care Co-ordinator
Ms Andrea Scully Patient Care Co-ordinator
Ms Sarah McCormac Renal Patient Care Coordinator
Ms Michelle Noonan Renal Patient Care Coordinator
All renal day care nursing staff

St Peters and Acute Dialysis Team

Mr Colm Fox CNM3 Haemodialysis and Nephrology Services
Ms Lincy Joseph CNM2 St Peters AHD
All dialysis nursing, healthcare and household staff

TUN Directorate Staff

Mr Tom Moran Directorate Business Manager
Mr Binu Vasu Renal IT Manager
Mr Patrick O'Kelly Statistician
Ms Anne Cooney Renal Transplant Data Manager
Ms Sinead Cronnolly Quality Manager
Ms Caroline Hughes
Ms Mary Sullivan
Ms Claire Kavanagh
Ms Laura Byrne

Clerical Staff

Ms Amanda Whelan
Ms Anna Farley
Ms Alison McNeill
Ms Rita Mather
Ms Joan Long
Ms Rebecca Kavanagh
Ms Tammy Walsh
Ward clerks Marie Fitzpatrick, Clare Ward,
Amanda Walsh, Rachael McGuinness and Emma Duke

Critical Care and Anaesthetic Directorate, Beaumont Hospital

Prof Ger Curley Clinical Director
Prof Michael Moore Consultant Anaesthetist
Dr Sinead Galvin Consultant Anaesthetist
Dr Tanya O'Neill Consultant Anaesthetist (Anaesthetic Chair)
Dr James O'Rourke Consultant Anaesthetist
Dr Alan Gaffney Consultant Anaesthetist
Ms Niamh Sheilds Directorate Nurse Manager
Ms Clare Morris ADON
Ms Sinead Edney CNM 3
Ms Eileen Buckley CNM2
Ms Ruth Purcell CNM2
Ms Grace Matthew CNM 2
And all the Beaumont Theatre Nursing Staff

Department of Histopathology

Dr T Dorman Consultant Pathologist
Dr B Doyle Consultant Pathologist
Histopathology Scientists

Department of NHISSOT

Prof Mary Keogan Consultant Immunologist
Dr Khairin Khalib Consultant Immunologist
Mr Joseph Kelly Chief Medical Scientist
Mr James Kelleher Specialist Medical Scientist
Mr David Keegan Specialist Medical Scientist
All Scientists and staff in NHISSOT

Laboratory

All Scientists and staff in the Laboratory Directorate

Department of Radiology

Dr Martina Morrin Consultant Radiologist
Dr Ruth Dunne Consultant Radiologist
Dr Aoife McErlean Consultant Radiologist
Dr Jane Cunningham Consultant Radiologist
Dr Andrew McGrath Consultant Radiologist
Dr Mark Given Clinical Director
Prof Michael Lee Consultant Radiologist
And all Radiologists and Radiographers

Dept of Psychiatry & Psychology

Prof Siobhan MacHale Consultant Liaison Psychiatrist
Dr Paul Horgan Senior Psychologist
Ms Tara Power Social Worker
Ms Alison Larkin Renal Counsellor/Psychotherapist

Paediatric Services at Temple Street and Crumlin

Dr Atif Awan Consultant Nephrologist Temple Street Children's University Hospital
Dr Mary Waldron Consultant Nephrologist Crumlin Hospital
Dr Niamh Dolan Consultant Nephrologist Temple Street Children's University Hospital
Dr Clodagh Sweeney Consultant Nephrologist Temple Street Children's University Hospital
Dr Maria Stack Consultant Nephrologist Temple Street Children's University Hospital
Dr Michael Riordan Consultant Nephrologist Temple Street Children's University Hospital
Mr Feargal Quinn Consultant Paediatric Urologist Crumlin Hospital
Mairead Kinlough CNM3 Nephrology
Marie Bates Renal Clinical Nurse Specialist
Joan Flynn Renal Clinical Nurse Specialist
Suzanne Kernan CNM2
Claire Mc Cabe Haemodialysis CNM2/CNS
Dept of Anaesthesia and all Theatre and nursing staff Temple Street Children's University Hospital

Transplant Porters

Mark Dooner Supervisor Robert Dooley, Noel Flood, Rory Page And all the Portering Staff in Beaumont Hospital

National Kidney Transplant Service

Beaumont Hospital, Dublin 9.
T: (01) 809 3119 or (01) 809 2759
E: transplantcoordinators@beaumont.ie
www.beaumont.ie/kidneycentre

Please Donate Today

Online at Beaumont Hospital Foundation website at: www.beaumontfundraising.ie

By phone using credit/debit cards by calling BHF 01 809 2161

In person at the BHF desk in main reception

By post making cheques payable to Beaumont Hospital Foundation and posting to FAO Kidney Transplant Unit, Beaumont Hospital Foundation, Beaumont Hospital, Dublin 9.

BEAUMONT HOSPITAL FOUNDATION