

CHAPTER 7

RENAL TRANSPLANTATION

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SECTION 7.1: STOCK AND FLOW

The number of new transplant patients fluctuated between 78 to 151 from 2011 to 2021. This gives an average of 112 new transplants performed annually. The lowest incidence was in 2021 and this was contributed by the COVID-19 pandemic, where most healthcare resources were diverted to managing COVID-19 patients. In 2021, the number of new transplants performed locally reduced by about 50% and, the number of new transplants performed overseas reduced significantly in 2020 and 2021 due to COVID-19 travel restrictions. Overseas transplants used to contribute between 20 to 45% of all new transplants and this reduced to less than 4% in 2020 and 2021. The new transplant rate improved to 5 per million population in 2019 and 2020. Unfortunately, the rate reduced to 2 per million population in 2021 due to COVID-19 pandemic.

Hospital Kuala Lumpur performed the highest number of transplants for many years. In 2021, the number reduced significantly due to COVID-19 pandemic. There was limitation in access to operating theatres, intensive care unit (ICU) beds and, the availability of anesthesiologists to continue the service. During this period, all cases of deceased donor kidney transplants were directed to Hospital Selayang (Table 7.1.4).

Overseas transplants contributed 18 to 45% of all new transplants performed up until 2019. During the COVID-19 pandemic, the number of overseas transplants reduced significantly and contributed to 3.3% and 1.3% in the year 2020 and 2021 respectively. The number of transplants performed in China had reduced to zero in the year 2021. However, there was an increase in the number of transplants performed in other overseas countries, mainly Cambodia (Table 7.1.4).

The number of functioning renal transplants declined steadily from 1929 in 2011 to 1827 in 2016 and gradually increased to 1888 in 2020 (Table 7.1.1). The number declined again in 2021 to 1839 perhaps due to COVID-19-related death. The number of patients who developed allograft failure annually appears to be reducing (Table 7.1.1).

Table 7.1.1: Stock and flow of renal transplantation, 2011-2021

Year	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011
New transplant patients	78	152	160	97	112	89	113	91	100	107	130
Died	83	58	53	49	51	50	67	65	58	63	54
Graft failure	34	43	38	49	29	53	54	45	50	44	40
Lost to Follow up	4	28	22	19	7	10	6	16	9	10	4
Functioning graft at 31st December	1839	1888	1872	1823	1849	1827	1853	1867	1902	1919	1929

The incidence rate of renal transplantation had initially improved to 5 per million population in 2019 and 2020 but reduced again to 2 per million population in 2021 (Table & Figure 7.1.2).

The transplant prevalence rate continues to drop over the last 10 years from 67 per million population in 2011 to 56 per million population in 2021 (Table & Figure 7.1.3).

Figure 7.1.1: Stock and flow of renal transplantation, 1990-2021

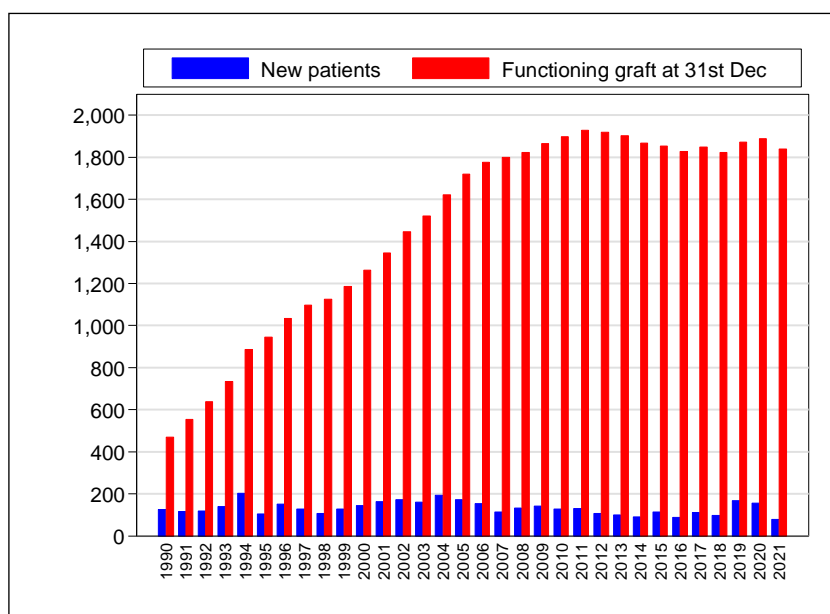


Table 7.1.2: New transplant rate per million population (pmp), 2011-2021

Year	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011
New transplant patients	78	152	160	97	112	89	113	91	100	107	130
New transplant rate, pmp	2	5	5	3	4	3	4	3	3	4	5

Table 7.1.3: Transplant prevalence rate per million population (pmp), 2011-2021

Year	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011
Functioning graft at 31 st December	1839	1888	1872	1823	1849	1827	1853	1867	1902	1919	1929
Transplant prevalence rate, pmp	56	58	59	58	59	60	61	63	65	66	67

Figure 7.1.2: New transplant rate, 1990-2021

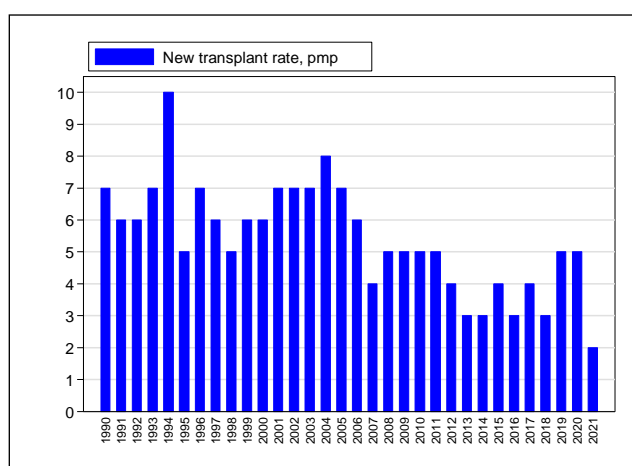
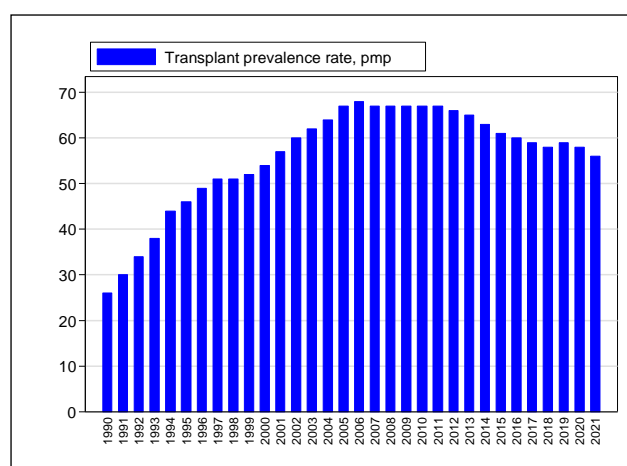


Figure 7.1.3: Transplant prevalence rate, 1990-2021



Transplantation in local centers increased with 62 transplants performed in 2011, 85 transplants in 2018, increased to 121 transplants in 2019. Unfortunately, this increase was not sustained, and the number of renal transplants performed in local centers had reduced to 72 transplants in 2021. This drop was predominantly contributed by COVID-19 pandemic. Similar patterns were seen globally.

It is encouraging to observe Hospital Kuala Lumpur was able to increase the number of transplants performed from 33 in the year 2018, 65 in the year 2019, and 75 in the year 2020. A similar trend was seen in Selayang where the transplant numbers increased from 24 in the year 2019 to 43 in the year 2020). This was achieved by several measures:

1. increasing the number of operating theatre slots from one to two times per week
2. utilising the general ward (instead of the intensive care unit) for postoperative care,
3. increasing slots for immunological testing
4. support from various other departments to expedite the transplant evaluation process. These include but are not limited to cardiology services, radiology services, and radio nuclear services.

Despite the initial small improvement, the transplant incidence rate in Malaysia continues to be the lowest in the world reflecting our failure to improve the rate of transplantation within the country. This is contributed by many factors such as:

1. lack of deceased donors
2. delays in living donors and recipients' evaluation process,
3. limited infrastructure (operating theatres times),
4. restriction in immunology services,
5. human resources (transplant surgeons, transplant nephrologists, immunologists, etc).

It was encouraging to see that the number of transplants performed in China continues to decline. However, it is concerning to see the number of transplants performed in other overseas centres, especially in Cambodia increased (Table 7.1.4 and Figure 7.1.4 (a)).

Figure 7.1.4(a): Places of transplantation, 2011-2021

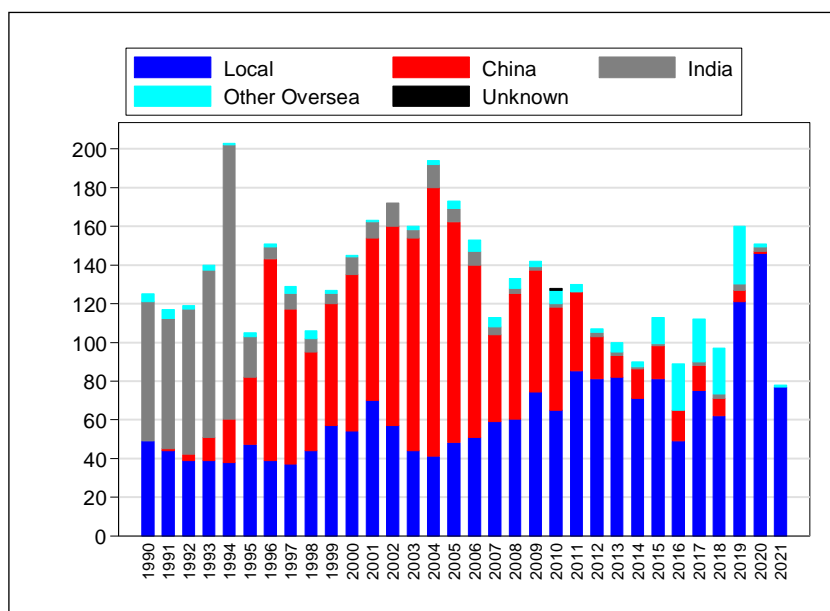


Figure 7.1.4(b): Place of transplantation within Malaysia

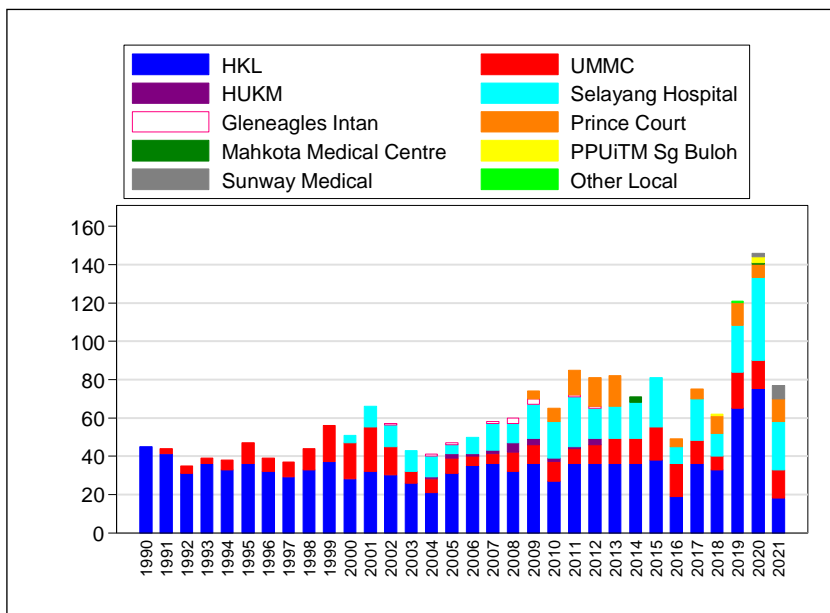


Table 7.1.4: Places of transplantation, 2011-2021

	2021		2020		2019		2018		2017		2016		2015		2014		2013		2012		2011	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
HKL	18	23.1	75	49.3	65	40.6	33	34	36	32.1	19	21.3	38	33.6	36	39.6	36	36	36	33.6	36	27.7
UMMC	15	19.2	15	9.9	19	11.9	7	7.2	12	10.7	17	19.1	17	15	13	14.3	13	13	10	9.3	8	6.2
HUKM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2.8	1	0.8
Selayang Hospital	25	32.1	43	28.3	24	15	12	12.4	22	19.6	9	10.1	26	23	20	22	17	17	16	15	26	20
Gleneagles Intan Medical Centre	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.9	1	0.8
Prince Court Medical Centre	12	15.4	7	4.6	12	7.5	9	9.3	5	4.5	4	4.5	0	0	0	0	16	16	15	14	13	10
Mahkota Medical Centre	0	0	1	0.7	0	0	0	0	0	0	0	0	0	0	3	3.3	0	0	0	0	0	0
PPUiTM Sg Buloh	0	0	3	2	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sunway Medical	7	9	2	1.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UMSC	0	0	0	0	1	0.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal	77	98.8	146	96.1	121	75.6	62	63.9	75	66.9	49	55	81	71.7	72	79.2	82	82	81	75.6	85	65.5
Bangladesh	0	0	0	0	1	0.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brunei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
Cambodia	0	0	3	2	28	17.5	21	21.6	17	15.2	17	19.1	5	4.4	0	0	0	0	0	0	0	0
China	0	0	1	0.7	6	3.8	9	9.3	13	11.6	16	18	17	15	15	16.5	11	11	22	20.6	41	31.5
France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
Germany	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.8
India	0	0	2	1.3	3	1.9	2	2.1	2	1.8	0	0	1	0.9	1	1.1	2	2	2	1.9	0	0
Indonesia	0	0	0	0	0	0	0	0	1	0.9	0	0	0	0	0	0	0	0	0	0	0	0
Iran	0	0	0	0	0	0	0	0	0	0	1	1.1	0	0	0	0	0	0	0	0	0	0
Iraq	0	0	0	0	0	0	0	0	1	0.9	0	0	0	0	0	0	0	0	0	0	0	0
Jordan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.9	0	0
Pakistan	1	1.3	0	0	0	0	1	1	0	0	1	1.1	4	3.5	0	0	0	0	0	0	0	0
Philippine	0	0	0	0	0	0	0	0	1	0.9	0	0	1	0.9	0	0	0	0	0	0	0	0
Singapore	0	0	0	0	1	0.6	2	2.1	2	1.8	2	2.2	1	0.9	0	0	2	2	0	0	3	2.3
Sri Lanka	0	0	0	0	0	0	0	0	0	0	3	3.4	2	1.8	3	3.3	1	1	1	0.9	0	0
UK	0	0	0	0	0	0	0	0	0	0	0	0	1	0.9	0	0	0	0	0	0	0	0
Subtotal	1	1.3	6	4	39	24.4	35	36.1	37	33.1	40	44.9	32	28.3	19	20.8	18	18	26	24.4	45	34.5
Total	78	100	152	100	160	100	97	100	112	100	89	100	113	100	91	100	100	100	107	100	130	100

SECTION 7.2: RECIPIENTS' CHARACTERISTICS

Over the last 10 years, the mean age of recipients at the time of transplantation remained relatively unchanged, ranging from 35 to 42 years. The percentage of incident transplant recipients having diabetes mellitus also remained relatively static, ranging from 17% to 24% (Table 7.2.1).

However, over the last decade, there has been a marked improvement in gender equality where the percentage of male patients undergoing transplants has decreased from 70% to 49%. The percentage of incident transplant recipients with hepatitis B antigenemia has also decreased with no cases in the last 2 years while the overall incidence of new transplant recipients with positive hepatitis C antibody has remained low. This is probably a reflection of the low incidence of hepatitis B antigenemia and positive hepatitis C antibody among the new and prevalent ESKD patients in this country (Table 7.2.1).

The primary renal disease of incidence transplant recipients has shown a gradual change over the last decade with a gradual reduction of glomerulonephritis as the primary disease and a gradual increase in diabetes and other causes of ESKD. (Table 7.2.2)

Table 7.2.1: Renal transplant recipients' characteristics, 2011-2021

Year	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011
New Transplant Patients	78	152	160	97	112	89	113	91	100	107	130
Age at transplant (years), Mean	38	36	41	41	42	44	42	39	35	37	38
Age at transplant (years), SD	12	11	13	15	12	14	13	13	13	13	15
% Male	49	54	58	65	67	67	58	54	61	61	70
% Diabetic (co-morbid/ primary renal disease)	18	15	20	24	19	17	21	22	24	23	17
% HBsAg positive	0	0	2	0	1	0	3	1	6	3	3
% Anti-HCV positive	2	4	2	1	6	3	0	6	5	5	3

Table 7.2.2: Primary causes of end stage renal failure, 2011-2021

Year	2021		2020		2019		2018		2017		2016		2015		2014		2013		2012		2011	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
New transplant patients	78	100	152	100	160	100	97	100	112	100	89	100	113	100	91	100	100	100	107	100	130	100
Glomerulonephritis	16	20.5	49	32.2	47	29.4	22	22.7	32	28.6	34	38.2	51	45.1	30	33	41	41	37	34.6	35	26.9
Diabetes Mellitus	15	19.2	12	7.9	23	14.4	19	19.6	21	18.8	16	18	12	10.6	9	9.9	14	14	18	16.8	19	14.6
Hypertension	12	15.4	37	24.3	32	20	28	28.9	30	26.8	17	19.1	23	20.4	18	19.8	5	5	16	15	31	23.8
Obstructive uropathy	0	0	1	0.7	5	3.1	3	3.1	6	5.4	0	0	4	3.5	2	2.2	4	4	10	9.3	7	5.4
ADPKD	1	1.3	0	0	5	3.1	3	3.1	5	4.5	3	3.4	3	2.7	2	2.2	4	4	2	1.9	3	2.3
Drugs/ toxic nephropathy	0	0	3	2	2	1.3	1	1	0	0	1	1.1	0	0	1	1.1	2	2	0	0	0	0
Hereditary nephritis	2	2.6	1	0.7	2	1.3	3	3.1	3	2.7	0	0	1	0.9	4	4.4	0	0	0	0	0	0
Unknown	16	20.5	34	22.4	32	20	10	10.3	10	8.9	16	18	17	15	17	18.7	29	29	21	19.6	31	23.8
Others	16	20.5	15	9.9	12	7.5	8	8.2	5	4.5	2	2.2	2	1.8	8	8.8	1	1	3	2.8	4	3.1

SECTION 7.3: TRANSPLANT PRACTICES**7.3.1: Type of renal transplantation**

The proportion of commercial transplantation fluctuated over the past 10 years. Fortunately, less commercial deceased donor transplants were performed (less than 6%) over this period. This may reflect the global stand on unethical transplant practices. The proportion of living commercial transplantation dropped from 2011 onwards but started to rise again slowly to a peak in 2018 (27.2%) before starting to drop again from 2019 onwards. There was no commercial transplantation in 2021. The COVID-19 pandemic was likely responsible for this.

The local deceased donor transplant rate also had fluctuations over the last 10 years (ranging from 6% in 2018 to 52% in 2015). Despite the COVID-19 pandemic, the proportion of local deceased donor transplants was 19.2% in 2021. The formation of Unit Perolehan Organ Hospital (UPOH) in 2019 in 16 focused hospitals throughout the country hopefully may see a rise in the number of deceased donor transplants in the future.

Local living donor transplantation had shown a steady rise for the last 5 years. From 2018 onwards, Malaysia performed more than 50 living transplants yearly. Most of them were genetically related (more than 40% since 2018). The highest number of living transplants was seen in 2020 (103 which is 69.6% of all transplantations). Unfortunately, the COVID-19 pandemic saw a drop in the total numbers in 2021 but still better than what we had achieved before 2018. Sixty-three living transplantation were performed in 2021 (80.8% of the total transplant for the year).

Table 7.3.1: Type of renal transplantation, 2011-2021

Year	2021		2020		2019		2018		2017		2016	
	n	%	n	%	n	%	n	%	n	%	n	%
Commercial cadaver	0	0	1	0.7	2	1.4	2	2.2	2	2.2	3	5
Commercial live donor	0	0	4	2.7	19	13.6	25	27.2	11	12.2	6	10
Live donor (genetically related)	39	50	62	41.9	58	41.4	37	40.2	36	40	29	48.3
Live donor (emotionally related)	24	30.8	41	27.7	31	22.1	17	18.5	15	16.7	13	21.7
Cadaver	15	19.2	40	27	30	21.4	11	12	26	28.9	9	15
Total	78	100	148	100	140	99.9	92	100	90	100	60	100

Year	2015		2014		2013		2012		2011	
	n	%	n	%	n	%	n	%	n	%
Commercial cadaver	1	1	1	1.2	1	1.1	6	5.8	6	4.8
Commercial live donor	15	15.3	11	13.3	7	7.4	16	15.5	30	24.2
Live donor (genetically related)	23	23.5	24	28.9	48	51.1	37	35.9	32	25.8
Live donor (emotionally related)	8	8.2	8	9.6	15	16	16	15.5	16	12.9
Cadaver	51	52	39	47	23	24.5	28	27.2	40	32.3
Total	98	100	83	100	94	100	103	100	124	100

*Commercial Cadaver (China, India, other oversea) *Commercial live donor (living unrelated) *Cadaver (local)

7.3.2: Biochemical data

Table 7.3.2 summarised the biochemical data for all the transplant recipients from 2017 to 2021.

Table 7.3.2: Biochemical data, 2017-2021

Biochemical parameter	Summary	2021	2020	2019	2018	2017
Creatinine, umol/L	n	1976	2054	1945	1879	1859
	Mean	131	129.6	128.7	129.8	128
	SD	83.2	82.3	80.9	89.3	79.5
	Median	109	108.1	109	107.5	109
	Minimum	41.7	40	41	17.6	38
	Maximum	970	899	964	988	920
Hb, g/dL	n	1976	2054	1945	1879	1859
	Mean	12.9	12.8	12.9	12.9	12.8
	SD	1.9	1.9	1.9	1.8	1.9
	Median	12.9	12.9	12.8	12.9	12.9
	Minimum	5.5	4.1	5.9	6.5	5.9
	Maximum	19.3	18.8	18.2	18.5	18.8
Albumin, g/L	n	1976	2054	1945	1879	1859
	Mean	39.8	40.3	40.7	40.3	40.5
	SD	4	4.2	4.6	4.4	4.2
	Median	40.1	40.5	41	40.8	40.7
	Minimum	18.5	16	16.5	16	15
	Maximum	50.8	51.3	52.5	51.3	56.3
Calcium, mmol/L	n	1976	2054	1945	1879	1859
	Mean	2.3	2.3	2.4	2.3	2.3
	SD	0.1	0.1	0.1	0.1	0.1
	Median	2.3	2.3	2.4	2.3	2.3
	Minimum	1.6	1	1.5	1.2	1.5
	Maximum	3.3	3	2.9	3.4	2.9
Phosphate, mmol/L	n	1976	2054	1945	1879	1859
	Mean	1.1	1.1	1.1	1.1	1.1
	SD	0.2	0.3	0.2	0.2	0.2
	Median	1.1	1.1	1.1	1.1	1.1
	Minimum	0.5	0.5	0.5	0.5	0.5
	Maximum	2.9	4	3	3.3	2.9
Alkaline phosphate (ALP), U/L	n	1976	2054	1945	1879	1859
	Mean	84.1	85.3	84.1	82.5	80.8
	SD	43.9	42.7	38.7	43.1	40.7
	Median	76	76.2	76.5	73.8	72.3
	Minimum	21	21.7	20.5	22	21
	Maximum	758.8	651	405	716.3	608.5
ALT, U/L	n	1976	2054	1945	1879	1859
	Mean	24.1	24.6	23.9	23.8	25.1
	SD	21.4	19.7	18.5	16.9	19
	Median	19.7	20	20	19.8	20.5
	Minimum	4.2	4	4	4	4.8
	Maximum	482.5	371	291	203.5	230.5
Total cholesterol, mmol/L	n	1976	2054	1945	1879	1859
	Mean	5	5.1	5.1	5	5
	SD	1	1.1	1	1	1.1
	Median	5.1	5.1	5.1	5.1	5
	Minimum	1.6	1.5	1.5	1.5	0.9
	Maximum	12.2	10.3	9.7	11.2	12

Biochemical parameter	Summary	2021	2020	2019	2018	2017
LDL cholesterol, mmol/L	n	1976	2054	1945	1879	1859
	Mean	2.8	2.8	2.8	2.8	2.7
	SD	0.9	0.9	0.8	0.8	0.8
	Median	2.8	2.8	2.8	2.8	2.8
	Minimum	1	0.9	0.9	0.9	0.9
	Maximum	8.4	7.3	6.7	8.2	7
HDL cholesterol, mmol/L	n	1976	2054	1945	1879	1859
	Mean	1.5	1.6	1.5	1.5	1.5
	SD	0.5	0.5	0.4	0.5	0.5
	Median	1.5	1.5	1.5	1.5	1.5
	Minimum	0.6	0.4	0.6	0.4	0.4
	Maximum	8	6.1	5.8	6	5.2
Systolic blood pressure, mmHg	n	1976	2054	1945	1879	1859
	Mean	134	135.8	134.7	133.5	133.3
	SD	15.3	15.8	14.6	14.8	14.4
	Median	132.2	134.9	133.3	132.2	132
	Minimum	89	95	91.7	89.5	93.5
	Maximum	201.7	213	204	220	203
Diastolic blood pressure, mmHg	n	1976	2054	1945	1879	1859
	Mean	79.6	80.1	79.5	79.4	79.7
	SD	9.2	9.9	9.1	9.1	8.7
	Median	80	80	80	79.8	80
	Minimum	46.9	40	47	37	46.5
	Maximum	115.3	115	115	113	115

7.3.3: Immunosuppression medications

Most patients were on combination immunosuppression with very small numbers on single immunosuppression drugs either prednisolone predominantly, followed by calcineurin inhibitors, proliferation signal inhibitor (PSI), and antiproliferative agents. Calcineurin-inhibitor-based therapy with corticosteroids remained the mainstay immunosuppressive therapy with 86.6 % and 89.7% of patients receiving it respectively in 2021. The usage of antimetabolites made up 67.3% of the immunosuppression regimen in 2021. (Figure 7.3.3). Azathioprine usage dropped over the years and mycophenolic acid was the main antimetabolite used in 2021. Like the trend seen over the last 5 years, more patients were on mycophenolate mofetil than mycophenolate sodium (34.1% vs 27.5 %) in 2021. The use of proliferation signal inhibitor (PSI) had increased over time from 10.8% in 2017 to 16.1% in 2021. The publication of the transplant efficacy and safety outcomes with an everolimus-based regimen (TRANSFORM trial) in 2018 and 2019 could have explained the increment in its usage.

Table 7.3.3 (a): Immunosuppressive Medications, 2017-2021

Medication data	Single drug treatment									
	2021		2020		2019		2018		2017	
	n	%	n	%	n	%	n	%	n	%
All (i) Immunosuppressive drug(s) treatment	1976		2054		1945		1879		1859	
Prednisolone	47	2.4	82	4	14	0.7	15	0.8	13	0.7
Calcineurin inhibitors	22	1.1	50	2.4	65	3.3	49	2.6	45	2.4
Antimetabolites	2	0.1	3	0.1	32	1.6	22	1.2	15	0.8
mTOR inhibitors	6	0.3	12	0.6	16	0.8	11	0.6	5	0.3
Others	2	0.1	2	0.1	0	0	1	0.1	0	0

Medication data	Combined drug treatment									
	2021		2020		2019		2018		2017	
	n	%	n	%	n	%	n	%	n	%
All (i) Immunosuppressive drug(s) treatment	1976		2054		1945		1879		1859	
Prednisolone	1772	89.7	1829	89	1470	75.6	1448	77.1	1559	83.9
Calcineurin inhibitors	1711	86.6	1787	87	1487	76.5	1432	76.2	1531	82.4
Antimetabolites	1330	67.3	1381	67.2	1268	65.2	1226	65.2	1321	71.1
mTOR inhibitors	318	16.1	299	14.6	221	11.4	198	10.5	200	10.8
Others	47	2.4	53	2.6	2	0.1	3	0.2	0	0

Table 7.3.3(b): Immunosuppressive Medications, 2017-2021

Medication data	Single drug treatment									
	2021		2020		2019		2018		2017	
	n	%	n	%	n	%	n	%	n	%
All (i) Immunosuppressive drug(s) treatment	1976		2054		1945		1879		1859	
Azathioprine	0	0	0	0	3	0.2	3	0.2	3	0.2
Mycophenolic acid	0	0	0	0	0	0	0	0	0	0
Mycophenolate Sodium	3	0.2	0	0	20	1	11	0.6	6	0.3
Mycophenolic Mofetil	2	0.1	5	0.2	9	0.5	8	0.4	6	0.3
Everolimus	8	0.4	6	0.3	16	0.8	10	0.5	4	0.2
Sirolimus	1	0.1	6	0.3	1	0.1	1	0.1	1	0.1
Cyclosporine	9	0.5	24	1.2	29	1.5	28	1.5	31	1.7
Tacrolimus	17	0.9	34	1.7	39	2	24	1.3	16	0.9
Prednisolone	43	2.2	79	3.8	13	0.7	14	0.7	12	0.6
Others	4	0.2	2	0.1	0	0	1	0.1	0	0

Medication data	Combine drug treatment									
	2021		2020		2019		2018		2017	
	n	%	n	%	n	%	n	%	n	%
All (i) Immunosuppressive drug(s) treatment	1976		2054		1945		1879		1859	
Azathioprine	0	0	48	2.3	190	9.8	199	10.6	215	11.6
Mycophenolic acid	10	0.5	17	0.8	15	0.8	15	0.8	15	0.8
Mycophenolate Sodium	539	27.3	571	27.8	464	23.9	429	22.8	453	24.4
Mycophenolic Mofetil	672	34	689	33.5	650	33.4	625	33.3	682	36.7
Everolimus	307	15.5	286	13.9	205	10.5	183	9.7	185	10
Sirolimus	8	0.4	11	0.5	15	0.8	14	0.7	14	0.8
Cyclosporine	467	23.6	515	25.1	562	28.9	596	31.7	639	34.4
Tacrolimus	1244	63	1271	61.9	938	48.2	846	45	901	48.5
Prednisolone	1693	85.7	1769	86.1	1437	73.9	1424	75.8	1540	82.8
Others	152	7.7	112	5.5	37	1.9	40	2.1	41	2.2

7.3.4: Non immunosuppression medications

In terms of non-immunosuppressive medications, calcium channel blockers remained the most used antihypertensive as a single or combination agent contributing to 18% and 53.4% of usage respectively. This is followed by beta blockers with 42% of patients on it either alone or in combination with other medications in 2021.

The use of ACE inhibitor or angiotensin receptor blocker or both were reducing slightly over the last 5 years; 47.9 % of patients were on ACE inhibitors (ACEI) or angiotensin II receptor blockers (AIIRB) or both in 2017 and 44.6% in 2021. More AIIRB being used in 2021 compared to ACEI (25.2% vs 19.4%). The usage of alpha blockers either as single drug or in combination has been consistently low for the last 5 years (less than 10%).

Table 7.3.4: Non immunosuppressive medications, 2017-2021

Medication data	Single drug treatment									
	2021		2020		2019		2018		2017	
	n	%	n	%	n	%	n	%	n	%
All Non Immunosuppressive drug(s) treatment	1976		2054		1945		1879		1859	
Calcium Channel Blocker (CCB)	356	18	373	18.2	316	16.2	306	16.3	329	17.7
Beta Blocker	129	6.5	146	7.1	125	6.4	123	6.5	133	7.2
ACE Inhibitor	79	4	67	3.3	64	3.3	65	3.5	81	4.4
Direct Renin Inhibitors (DRI)	0	0	0	0	0	0	0	0	0	0
Alpha Blocker	10	0.5	13	0.6	11	0.6	8	0.4	13	0.7
ARB	103	5.2	104	5.1	101	5.2	92	4.9	101	5.4
Other Treatment	3	0.2	2	0.1	2	0.1	4	0.2	1	0.1

Medication data	Combined drug treatment									
	2021		2020		2019		2018		2017	
	n	%	n	%	n	%	n	%	n	%
All Non Immunosuppressive drug(s) treatment	1976		2054		1945		1879		1859	
Calcium Channel Blocker (CCB)	1055	53.4	1036	50.4	985	50.6	973	51.8	993	53.4
Beta Blocker	702	35.5	685	33.3	641	33	640	34.1	668	35.9
ACE Inhibitor	305	15.4	300	14.6	358	18.4	352	18.7	357	19.2
Direct Renin Inhibitors (DRI)	0	0	0	0	1	0.1	1	0.1	2	0.1
Alpha Blocker	146	7.4	153	7.4	125	6.4	131	7	137	7.4
ARB	395	20	351	17.1	370	19	365	19.4	351	18.9
Other Treatment	75	3.8	60	2.9	80	4.1	62	3.3	44	2.4

SECTION 7.4: TRANSPLANT OUTCOMES**7.4.1: Post transplant complications**

Hypertension remained the most common comorbidity among kidney transplant recipients before and after transplantation, 58.4% and 29.6% respectively. Approximately 13% had diabetes as the primary kidney disease or comorbid pre-transplant and 3% post-transplant (Table 7.4.1).

Only 1% developed cardiovascular and/or cerebrovascular disease pre- and post-transplantation. The low figure may be due to under-reporting of these comorbidities. Although cancer was rare, it was more common after transplant compared to pre-transplant, 0.7% versus 0.1%. (Table 7.4.1)

Table 7.4.1: Post transplant complications, 2011-2021

	Pre transplant									
	2021		2020		2019		2018		2017	
	n	%	n	%	n	%	n	%	n	%
All patients	1867		1944		1856		1821		1794	
Diabetes (Either as primary renal disease or comorbid)	249	13.3	266	13.7	258	13.9	273	15	261	14.5
Cancer	1	0.1	1	0.1	1	0.1	2	0.1	4	0.2
Cardiovascular disease + cerebrovascular disorder	19	1	19	1	20	1.1	20	1.1	19	1.1
Hypertension	1090	58.4	1142	58.7	1118	60.2	1097	60.2	1091	60.8

	Post transplant									
	2021		2020		2019		2018		2017	
	n	%	n	%	n	%	n	%	n	%
All patients	1867		1944		1856		1821		1794	
Diabetes (Either as primary renal disease or comorbid)	59	3.2	73	3.8	89	4.8	66	3.6	74	4.1
Cancer	14	0.7	12	0.6	21	1.1	21	1.2	22	1.2
Cardiovascular disease + cerebrovascular disorder	17	0.9	27	1.4	33	1.8	17	0.9	31	1.7
Hypertension	553	29.6	549	28.2	504	27.2	512	28.1	538	30

*Hypertension: BP systolic >140 and BP diastolic >90

or have either Beta blocker/ Calcium channel blocker / ACE inhibitor / ARBs/ Other antihypertensive

7.4.2: Deaths and graft loss

The death rate of transplant recipients peaked in 2021 with 83 deaths (4.3%). This was the highest death rate recorded since 1990. In contrast, allograft loss dropped slightly to 1.7% in 2021, compared to the previous years. (Table 7.4.2)

The main cause of death was infection (56.6%), of which almost half were attributed to COVID-19. Approximately 25% died of either cardiovascular disease (10.8%) or died at home (14.5%). Mortality due to malignancy showed a reducing trend in the last few years and contributed to only 6% of all deaths in 2021. (Table 7.4.3)

There were 34 allograft loss in 2021. The most common causes of allograft loss were due to IFTA (n=13, 38.2%), followed by rejection (n=9, 26.5%) and de novo or recurrent renal diseases (n=6, 17.6%). These three main causes showed an increasing trend in the recent few years. Infection accounted for two allograft loss (5.9%) and one (2.9%) was attributed to calcineurin toxicity (Table 7.4.4).

Table 7.4.2: Transplant patient death rate and graft loss, 2011-2021

Year	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011
Number at risk	1864	1880	1848	1836	1838	1840	1860	1885	1911	1924	1913
Transplant death	83	58	53	49	51	50	67	65	58	63	54
Transplant death rate %	4.3	3.1	2.8	2.7	2.8	2.7	3.6	3.4	3	3.3	2.8
Graft loss	32	38	37	48	28	52	54	44	50	44	40
Graft loss rate %	1.7	2	2	2.6	1.5	2.8	2.9	2.3	2.6	2.3	2.1
Acute rejection	5	4	6	5	5	20	26	30	32	28	20
Acute rejection rate %	0.3	0.2	0.3	0.3	0.3	1.1	1.4	1.6	1.7	1.5	1
All losses	113	96	89	97	79	102	121	109	108	107	94
All losses rate %	6.1	5.1	4.8	5.3	4.3	5.5	6.5	5.8	5.7	5.6	4.9

*Graft loss=graft failure

*All losses=death / graft loss (acute rejection happens concurrently with graft failure / death)

Figure 7.4.2(a): Transplant recipient death rate, 1990-2021

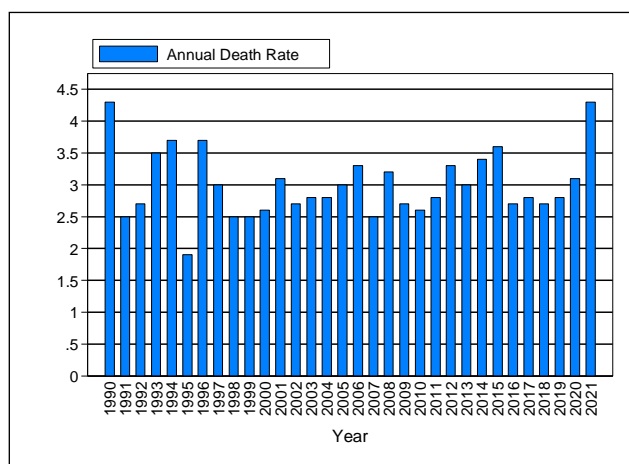


Figure 7.4.2(b): Transplant recipient allograft loss rate, 1990-2021

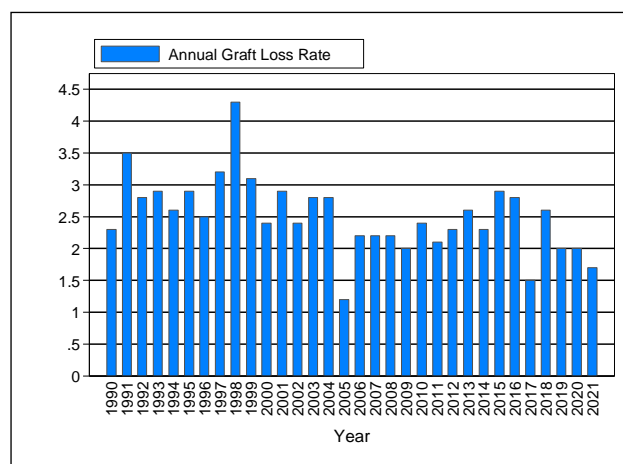


Table 7.4.3: Causes of death in transplant recipients, 2011-2021

Year	2021		2020		2019		2018		2017		2016	
	n	%	n	%	n	%	n	%	n	%	n	%
Cardiovascular	9	10.8	7	12.1	11	20.8	5	10.2	6	11.8	14	28
Died at home	12	14.5	3	5.2	5	9.4	6	12.2	4	7.8	5	10
Infection	47*	56.6	27	46.6	17	32.1	9	18.4	19	37.3	13	26
Cancer	5	6	6	10.3	11	20.8	8	16.3	6	11.8	5	10
Liver disease	0	0	1	1.7	0	0	2	4.1	1	2	0	0
Accidental death	0	0	1	1.7	0	0	0	0	0	0	2	4
Others	6	7.2	8	13.8	6	11.3	12	24.5	9	17.6	2	4
Unknown	4	4.8	5	8.6	3	5.7	7	14.3	6	11.8	9	18
Total	83	100	58	100	53	100	49	100	51	100	50	100

*Death due to COVID-19 = 22

Year	2015		2014		2013		2012		2011	
	n	%	n	%	n	%	n	%	n	%
Cardiovascular	16	23.9	14	21.5	10	17.2	12	19	8	14.8
Died at home	4	6	4	6.2	6	10.3	7	11.1	5	9.3
Infection	30	44.8	31	47.7	22	37.9	27	42.9	21	38.9
Cancer	9	13.4	5	7.7	8	13.8	8	12.7	6	11.1
Liver disease	0	0	1	1.5	2	3.4	1	1.6	1	1.9
Accidental death	0	0	0	0	0	0	0	0	0	0
Others	2	3	3	4.6	2	3.4	1	1.6	2	3.7
Unknown	6	9	7	10.8	8	13.8	7	11.1	11	20.4
Total	67	100	65	100	58	100	63	100	54	100

Table 7.4.4: Causes of graft failure, 2011-2021

Year	2021		2020		2019		2018		2017		2016	
	n	%	n	%	n	%	n	%	n	%	n	%
Rejection	9	26.5	4	9.3	6	15.8	5	10.2	4	13.8	20	37.7
Calcineurin toxicity	1	2.9	1	2.3	1	2.6	1	2	1	3.4	4	7.5
Other drug toxicity	0	0	0	0	0	0	0	0	0	0	0	0
Ureteric obstruction	0	0	0	0	0	0	0	0	0	0	0	0
Infection	2	5.9	2	4.7	0	0	0	0	0	0	2	3.8
Vascular causes	0	0	0	0	0	0	0	0	0	0	3	5.7
Recurrent/ de novo renal disease	6	17.6	0	0	0	0	1	2	1	3.4	4	7.5
Chronic allograft nephropathy / IFTA	13	38.2	9	20.9	5	13.2	7	14.3	3	10.3	8	15.1
Technical problem	0	0	0	0	0	0	0	0	0	0	1	1.9
Others	1	2.9	5	11.6	5	13.2	3	6.1	1	3.4	1	1.9
Unknown	2	5.9	22	51.2	21	55.3	32	65.3	19	65.5	10	18.9
Total	34	100	43	100	38	100.1	49	99.9	29	99.8	53	100

Year	2015		2014		2013		2012		2011	
	n	%	n	%	n	%	n	%	n	%
Rejection	24	44.4	29	64.4	31	62	27	61.4	20	50
Calcineurin toxicity	2	3.7	0	0	2	4	1	2.3	0	0
Other drug toxicity	0	0	0	0	0	0	0	0	0	0
Ureteric obstruction	0	0	0	0	1	2	1	2.3	0	0
Infection	1	1.9	0	0	1	2	0	0	0	0
Vascular causes	3	5.6	2	4.4	2	4	1	2.3	1	2.5
Recurrent/ de novo renal disease	3	5.6	2	4.4	2	4	0	0	0	0
Chronic allograft nephropathy / IFTA	6	11.1	1	2.2	0	0	0	0	0	0
Technical problem	0	0	0	0	0	0	0	0	0	0
Others	3	5.6	2	4.4	2	4	0	0	2	5
Unknown	12	22.2	9	20	9	18	14	31.8	17	42.5
Total	54	100.1	45	99.8	50	100	44	100.1	40	100

SECTION 7.5: PATIENT AND ALLOGRAFT SURVIVAL

7.5.1: Patient survival

Patient survival rates have improved from 2011 – 2021 with 98% at 1-year, 94% at 5-years and 81% at 10-years post transplantation (Table and Figure 7.5.1(a)).

Risk factors affecting patient survival were positive hepatitis C status of kidney recipients, ADPKD patients and age (>40 years). Interestingly, patients with deceased donor renal transplantation had higher risk of mortality compared to living renal transplant but statistically not significant (Table 7.5.1(b)).

7.5.2: Allograft survival

Allograft loss rates reported below were not censored for death. Allograft survival rates were 97% at 1-year, 91% at 5-years and 82% at 10 years post transplantation. The renal allograft survival was significantly better from 2017 onwards. Older age and patients with hepatitis infection had higher risk of graft loss.

Table 7.5.1(a): Patient survival, 2011-2021

Interval (years)	N	% Survival	SE
0	1241	100	
1	1058	98	0
2	882	97	1
3	710	96	1
4	597	95	1
5	480	94	1
6	401	92	1
7	308	90	1
8	231	88	1
9	156	87	2
10	83	81	2

*n=Number at risk SE=standard error

Figure 7.5.1(a): Patient survival, 2011-2021

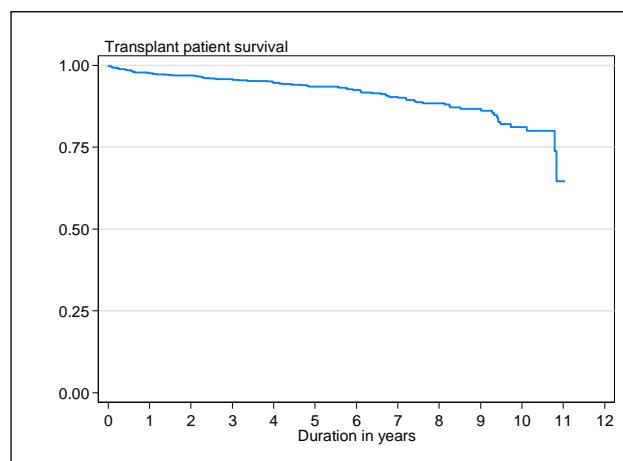


Table 7.5.2(a): Allograft survival, 2011-2021

Interval (years)	n	% Survival	SE
0	1241	100	
1	1058	97	1
2	882	96	1
3	710	94	1
4	597	92	1
5	480	91	1
6	401	89	1
7	308	87	1
8	231	85	2
9	156	83	2
10	83	82	2

*n=Number at risk SE=standard error

Figure 7.5.2(a): Allograft survival, 2011-2021

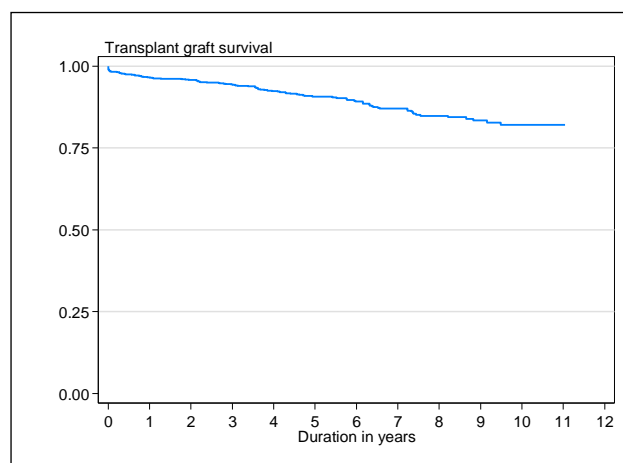


Table 7.5.1(b): Risk factors for transplant recipient mortality 2011-2021

Factors	n	Hazard Ratio	95% CI	P value
Year of transplant				
2011-2016 (ref*)	614	1.000		
2017-2021	590	0.746	(0.399, 1.397)	0.360
Age at transplant				
20-39 (ref*)	515	1.000		
40-54	513	2.561	(1.534, 4.274)	0.000
>=55	80	3.823	(1.733, 8.433)	0.001
Gender				
Male (ref*)	726	1.000		
Female	475	1.324	(0.867, 2.022)	0.194
Primary diagnosis				
Unknown primary (ref*)	224	1.000		
Diabetes mellitus	176	1.987	(0.961, 4.101)	0.064
GN/SLE	384	1.427	(0.741, 2.741)	0.286
Polycystic kidney	30	3.412	(1.211, 9.621)	0.020
Obstructive nephropathy	41	0.981	(0.281, 3.441)	0.976
Others	345	1.359	(0.671, 2.741)	0.391
Type of transplant				
Commercial deceased donor (ref*)	24	1.000		
Commercial living donor	138	1.294	(0.161, 10.531)	0.810
Living donor	623	1.249	(0.171, 9.301)	0.828
Deceased donor	304	4.861	(0.671, 35.291)	0.118
HBsAg				
Negative (ref*)	862	1.000		
Positive	12	NA	NA	NA
Anti-HCV				
Negative (ref*)	848	1.000		
Positive	12	3.449	(0.436, 27,268)	0.0241

Table 7.5.2(b): Risk factors for allograft loss 2011-2021

Factors	n	Hazard Ratio	95% CI	P value
Year of transplant				
2011-2016 (ref*)	614	1.000		
2017-2021	590	0.344	(0.211, 0.561)	<0.001
Age at transplant				
20-39 (ref*)	515	1.000		
40-54	513	1.571	(1.141, 2.161)	0.006
>=55	80	1.474	(0.771, 2.811)	0.238
Gender				
Male (ref*)	726	1.000		
Female	475	1.190	(0.891, 1.591)	0.242
Primary diagnosis				
Unknown primary (ref*)	224	1.000		
Diabetes mellitus	176	1.512	(0.901, 2.541)	0.12
GN/SLE	384	1.278	(0.821, 2.001)	0.285
Polycystic kidney	30	2.083	(0.911, 4.781)	0.083
Obstructive nephropathy	41	1.234	(0.561, 2.711)	0.599
Others	345	1.679	(1.061, 2.651)	0.026
Type of transplant				
Commercial cadaver (ref*)	24	1.000		
Commercial living donor	138	0.611	(0.201, 1.871)	0.389
Living donor	623	0.969	(0.351, 2.661)	0.951
Deceased Donor	304	2.211	(0.811, 6.031)	0.121
HBsAg				
Negative (ref*)	862	1.000		
Positive	12	NA	NA	NA
Anti-HCV				
Negative (ref*)	848	1.000		
Positive	12	3.237	(1.311, 8.001)	0.011

7.5.3: Patient survival according to type of transplant

Patient survival of local deceased donor kidney transplant was worse in comparison to other types of transplant (Table & Figure 7.5.3).

The patient survival of local living renal transplant was 98% and 97% at 1-year and 5-years respectively. In comparison, the patients who had commercial live donor kidney transplant had slightly equal survival beyond 5-years post-transplant. Overall, patient survival of local cadaveric transplant is worst among all types of transplants, likely due to older age, longer dialysis vintage and more comorbidity.

7.5.4: Allograft survival according to type of transplant

The allograft survival rates reported were not censored for death. Local living donor allograft survival at 1-year, 3-years and 5-years was 97%, 95% and 92% respectively. The allograft survival of commercial living donor and commercial deceased donor transplant were similar to that of local living transplant. Local deceased transplant had the worst allograft survival; 93% at 1-year and 87% at 5-years.

Table 7.5.3: Unadjusted patient survival by type of transplant, 2011-2021

Type of Transplant Interval (years)	Commercial Deceased Donor			Commercial Living Donor			Living Donor			Deceased Donor		
	n	% Survival	SE	n	% Survival	SE	n	% Survival	SE	n	% Survival	SE
0	30	100		144	100		638	100		312	100	
1	28	97	3	131	99	1	536	98	1	263	96	1
2	26	97	3	121	99	1	431	98	1	217	94	1
3	21	97	3	102	98	1	343	98	1	183	93	2
4	19	97	3	83	98	1	281	97	1	163	91	2
5	15	97	3	68	97	2	223	97	1	135	89	2
6	14	97	3	65	97	2	179	96	1	126	87	2
7	12	89	8	52	95	2	146	94	1	87	85	3
8	11	89	8	37	95	2	114	92	2	62	82	3
9	10	89	8	33	95	2	66	92	2	44	76	4
10	6	89	8	22	89	5	33	89	3	22	69	5

*n=number at risk SE=standard error

Figure 7.5.3: Patient survival by type of transplant, 2011-2021

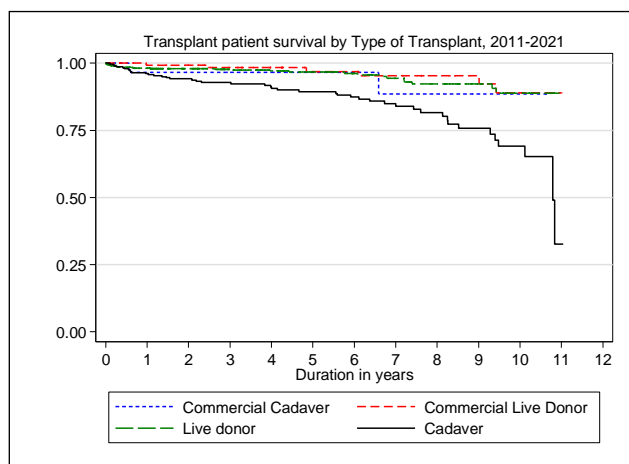


Figure 7.5.4: Graft survival by type of transplants, 2011-2021

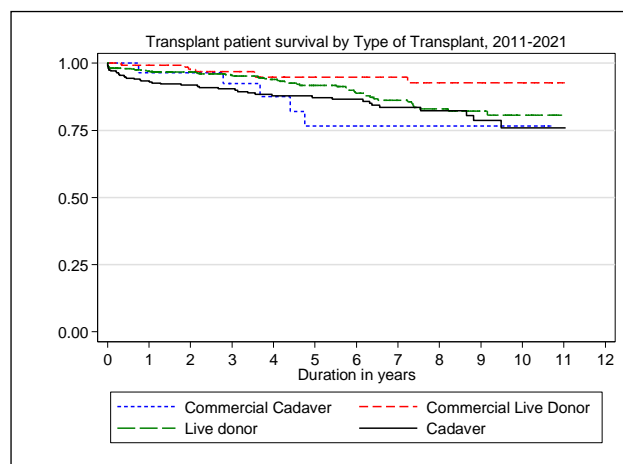


Table 7.5.4: Allograft survival by type of transplant, 2011-2021

Type of Transplant Interval (years)	Commercial Deceased Donor			Commercial Living Donor			Living Donor			Deceased		
	n	% Survival	SE	n	% Survival	SE	n	% Survival	SE	n	% Survival	SE
0	30	100		144	100		638	100		312	100	30
1	28	96	4	131	99	1	536	97	1	263	93	1
2	26	96	4	121	98	1	431	97	1	217	92	2
3	21	92	5	102	97	2	343	95	1	183	90	2
4	19	88	7	83	95	2	281	94	1	163	88	2
5	15	77	9	68	95	2	223	92	1	135	87	2
6	14	77	9	65	95	2	179	89	2	126	87	2
7	12	77	9	52	95	2	146	86	2	87	83	3
8	11	77	9	37	93	3	114	83	2	62	82	3
9	10	77	9	33	93	3	66	82	3	44	79	4
10	6	77	9	22	93	3	33	81	3	22	76	4

*n=Number at risk SE=standard error

7.5.5: Outcome of living donor kidney transplantation

Patient survival of local living donor kidney transplant appeared to be similar in those transplanted in 2011-2016 compared to those transplanted in 2017-2021. However, allograft survival (not censored for death) was better for the cohort that had transplantation done from 2017-2021 (Table & Figure 7.5.5 (a)&(b)).

Table 7.5.5(a): Patient survival by year of transplant (Living related transplant, 2011-2021)

Year of Transplant Interval (years)	2011-2016			2017-2021		
	n	% Survival	SE	n	% Survival	SE
0	269	100		369	100	
1	250	98	1	287	98	1
2	247	98	1	185	98	1
3	240	97	1	104	98	1
4	231	97	1	51	97	1
5	223	97	1	1		
6	179	96	1	1		
7	146	95	2	1		
8	114	92	2	1		
9	66	92	2	1		
10	33	89	3	1		

*n=number at risk SE=standard error

Figure 7.5.5(a): Patient survival by year of transplant (Living related transplant, 2011-2021)

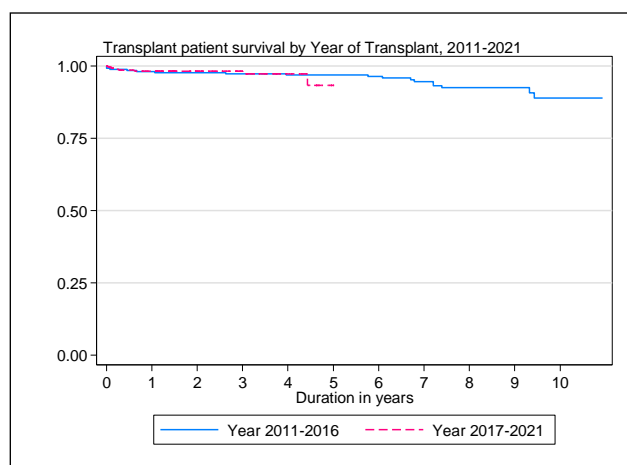


Figure 7.5.5(b): Allograft survival by year of transplant (Living related transplant, 2011-2021)

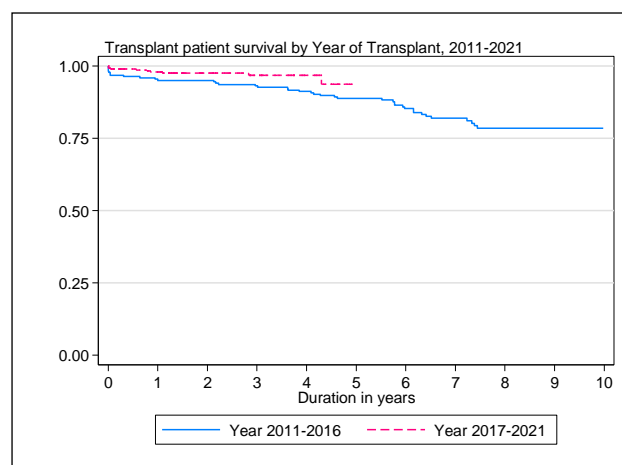


Table 7.5.5(b): Allograft survival by year of transplant (Living related transplant, 2011-2021)

Year of Transplant Interval (years)	2011-2016			2017-2021		
	n	% Survival	SE	n	% Survival	SE
0	269	100		369	100	
1	206	95	1	287	98	1
2	204	95	1	185	98	1
3	197	93	2	104	97	1
4	190	91	2	51	97	1
5	182	89	2	1		
6	138	85	3	1		
7	107	82	3	1		
8	78	78	3	1		
9	31	78	3	1		
10	1			1		

*n=number at risk SE=standard error

7.5.6: Outcome of commercial deceased donor transplantation

Patient and allograft survival (not censored for death) of commercial deceased donor transplant appeared to be better in those transplanted in 2017-2021 compared to 2011-2016. However, the small number of commercial renal transplants in the cohort may have skewed the result (Table & Figure 7.5.6 (a & b)).

Table 7.5.6(a): Patient survival by year of transplant (Commercial deceased donor transplant, 2011-2021)

Year of Transplant Interval (years)	2011-2016			2017-2021		
	n	% Survival	SE	n	% Survival	SE
0	21	100		9	100	
1	19	95	5	0	100	19
2	18	95	5	9	100	18
3	18	95	5	4	100	18
4	17	95	5	3	100	17
5	15	95	5	1		15
6	14	95	5	1		14
7	12	87	9	1		12
8	11	87	9	1		11
9	10	87	9	1		10
10	6	87	9	1		6

*n=Number at risk SE=standard error

Figure 7.5.6(a): Patient survival by year of transplant (Commercial deceased donor transplant, 2011-2021)

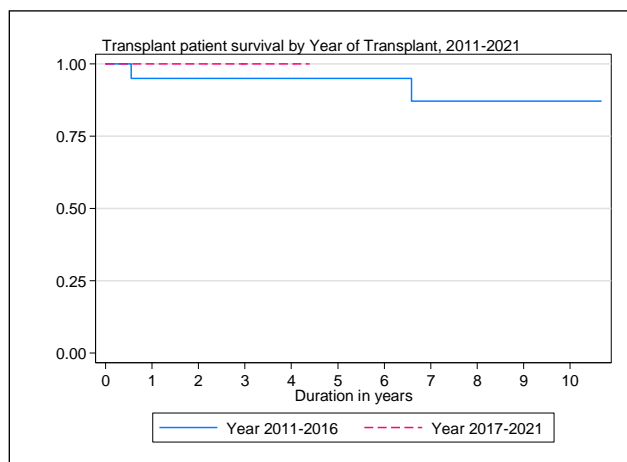


Figure 7.5.6(b): Graft survival by year of transplant (Commercial deceased donor transplant, 2011-2021)

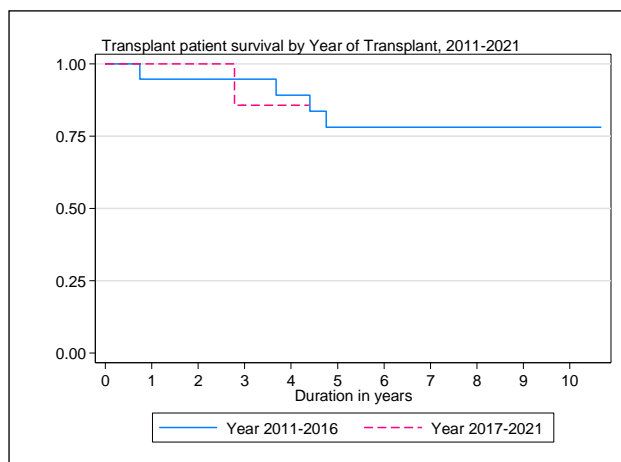


Table 7.5.6(b): Allograft survival by year of transplant (commercial deceased donor transplant, 2011-2021)

Year of Transplant Interval (years)	2011-2016			2017-2021		
	n	% Survival	SE	n	% Survival	SE
0	21	100		9	100	
1	19	95	5	0	100	
2	18	95	5	9	100	
3	18	95	5	4	86	13
4	17	89	7	3	86	13
5	15	78	10	1		
6	14	78	10	1		
7	12	78	10	1		
8	11	78	10	1		
9	10	78	10	1		
10	6	78	10	1		

*n=number at risk SE=standard error

SECTION 7.6: CARDIOVASCULAR RISK IN RENAL TRANSPLANT RECIPIENTS

7.6.1: Risk factors for ischaemic heart disease (IHD)

The prevalence of hypertension among renal transplant recipients stood at 93.2% in 2021, while 19.5% were diagnosed with diabetes and 35.9% had chronic kidney disease (CKD) stage III and above. Notably, 8.5% of these patients had all three major risk factors for cardiovascular disease (CVD). Although hypertension appears to be on the rise, the prevalence of CKD, diabetes, and composite major risk factors for CVD has shown a declining trend in recent years.

Table 7.6.1: Risk factors for IHD in renal transplant recipients at year 2017-2021

	2017	2018	2019	2020	2021
Diabetes	27 (1.7)	33 (2.1)	41 (2.5)	35 (2.0)	28 (1.7)
Hypertension**	707 (43.8)	712 (44.6)	750 (45.9)	867 (50.3)	914 (54.4)
CKD	91 (5.6)	97 (6.1)	106 (6.5)	88 (5.1)	70 (4.2)
Diabetes + Hypertension**	115 (7.1)	121 (7.6)	113 (6.9)	140 (8.1)	137 (8.2)
Diabetes + CKD	22 (1.4)	27 (1.7)	31 (1.9)	34 (2.0)	18 (1.1)
CKD + Hypertension**	474 (29.3)	441 (27.6)	419 (25.6)	412 (23.9)	371 (22.1)
Diabetes + CKD + Hypertension**	179 (11.1)	167 (10.5)	175 (10.7)	146 (8.5)	142 (8.5)

**Hypertension: BP systolic > 140 and BP diastolic > 90

OR have either Beta blocker / Calcium channel blocker / ACE inhibitor / AIIRB / Other antihypertensive drugs

GFR (mL/min/1.73m²) = 1.2*(140-age(year))*weight(kg) / creatinine (µmol/L) if male

GFR (mL/min/1.73m²) = 0.85*(1.2*(140-age(year))*weight(kg) / creatinine (µmol/L) if female

CKD stage III-GFR, 30-60

CKD stage IV-GFR, 15-30

CKD stage V-GFR, <15

Figure 7.6.1(a): Venn diagram for pre and post transplant complications (in %) at year 2017

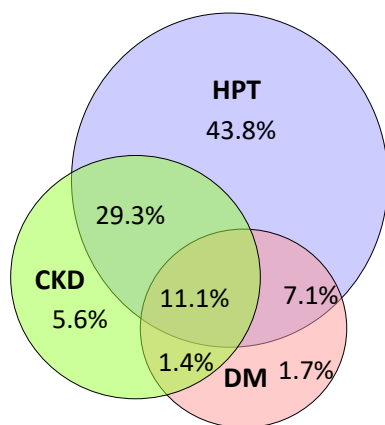


Figure 7.6.1(b): Venn diagram for pre and post transplant complications (in %) at year 2018

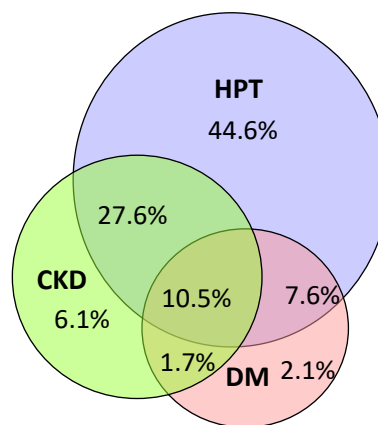


Figure 7.6.1(c): Venn diagram for pre and post transplant complications (in %) at year 2019

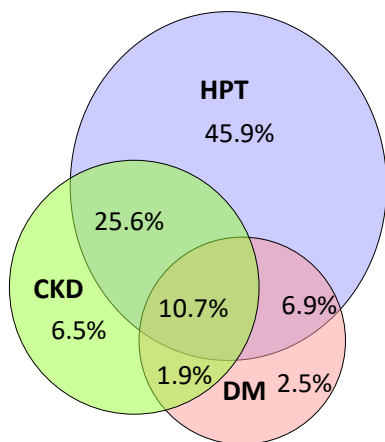


Figure 7.6.1(d): Venn diagram for pre and post transplant complications (in %) at year 2020

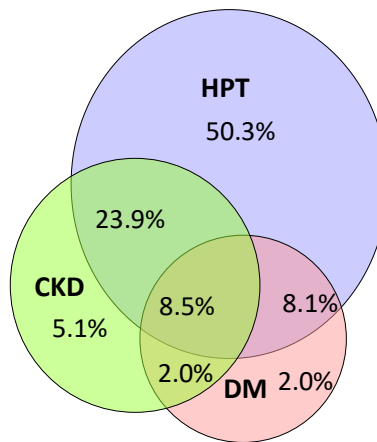
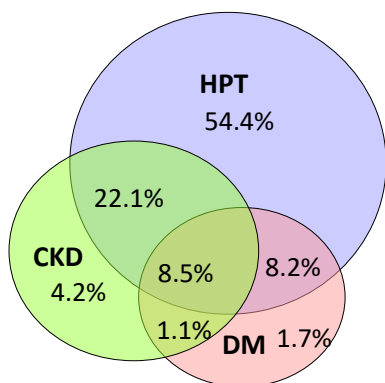


Figure 7.6.1(e): Venn diagram for pre and post transplant complications (in %) at year 2021



7.6.2: Blood Pressure

Despite the increasing prevalence of hypertension among renal transplant recipients, their blood pressure has remained stable over the last 5 years. In 2021, approximately one-third of recipients had a systolic blood pressure of ≥ 140 mmHg, and 12.2% had a diastolic blood pressure of ≥ 90 mmHg.

Table 7.6.2(a): Systolic BP, 2017-2021

Year	2021		2020		2019		2018		2017	
	n	%	n	%	n	%	n	%	n	%
<120	293	15.2	287	14.2	238	12.4	294	16	269	14.6
120-129	555	28.7	453	22.4	480	25.1	478	26	533	29.0
130-139	491	25.4	530	26.2	549	28.7	535	29	498	27.1
140-159	470	24.3	617	30.5	543	28.4	446	24.2	452	24.6
160-179	105	5.4	109	5.4	88	4.6	76	4.1	76	4.1
≥ 180	18	0.9	26	1.3	14	0.7	13	0.7	12	0.7

Table 7.6.2(b): Diastolic BP, 2017-2021

Year	2021		2020		2019		2018		2017	
	n	%	n	%	n	%	n	%	n	%
<80	955	49	972	48	938	48.9	949	51.2	887	48.1
80-84	481	24.7	426	21	473	24.6	428	23.1	498	27
85-89	276	14.2	298	14.7	272	14.2	259	14	249	13.5
90-99	202	10.4	282	13.9	213	11.1	186	10	184	10
100-109	32	1.6	41	2	22	1.1	28	1.5	22	1.2
≥ 110	3	0.2	6	0.3	1	0.1	3	0.2	4	0.2

Figure 7.6.2(a): Systolic BP, 2017-2021

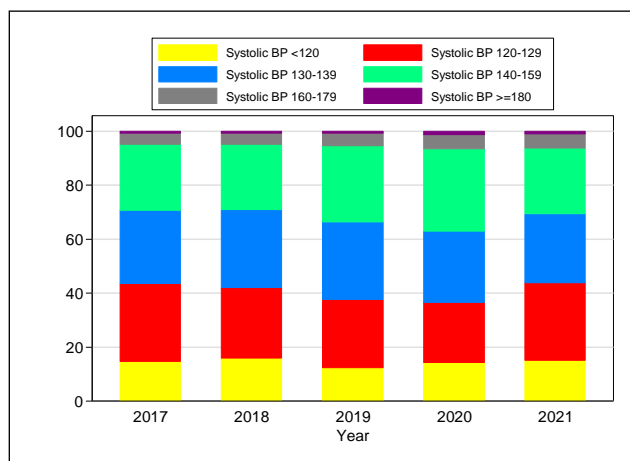
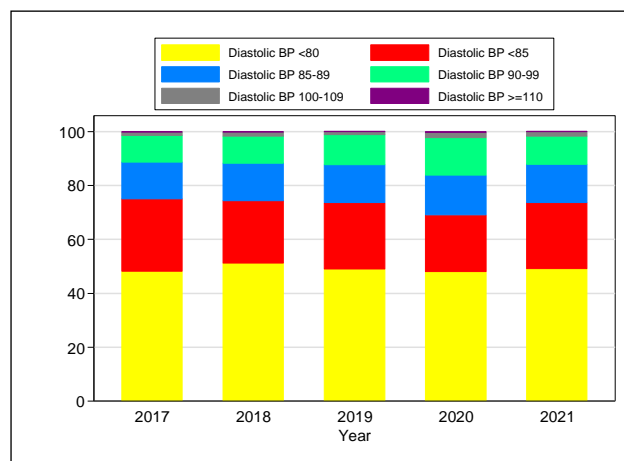


Figure 7.6.2(b): Diastolic BP, 2017-2021



7.6.3: Blood pressure control

The proportion of renal transplant recipients receiving treatment for hypertension has remained consistent over the past 5 years. More than three-quarter of renal transplant recipients received treatment for hypertension in 2021, including 30% who required two or more antihypertensive agents. However, a concerning increment up to 7% of patients had systolic blood pressure of ≥ 160 mmHg and 13% had diastolic blood pressure of ≥ 90 mmHg despite being on treatment.

Table 7.6.3(a): Treatment for hypertension, 2017-2021

Year	n	% on anti-hypertensives	% on 1 antihypertensive drug	% on 2 antihypertensives	% on 3 antihypertensives
2017	1859	78	35	28	12
2018	1879	74	32	27	12
2019	1945	73	32	27	11
2020	2054	74	34	29	9
2021	1976	77	34	30	11

Table 7.6.3(b): Distribution of systolic BP without antihypertensives, 2017-2021

Year	n	Mean	SD	Median	LQ	UQ	% Patients ≥ 160 mmHg
2017	405	128.5	14.5	127.5	119.7	136.8	3
2018	473	129.3	15.4	128	119.3	137.8	3
2019	517	131.2	15.6	130	121.3	140	4
2020	530	130.7	16.3	129	120	139	5
2021	437	129.1	15.6	127	119	136.8	5

Table 7.6.3(c): Distribution of diastolic BP without antihypertensives, 2017-2021

Year	n	Mean	SD	Median	LQ	UQ	% Patients ≥ 90 mmHg
2017	405	79.2	8.7	80	73	84.8	10
2018	473	79.3	9.2	79.3	73	85	13
2019	517	79.4	8.9	79.8	73.2	85	12
2020	530	79.6	9.7	80	72.5	86	15
2021	437	79.3	9.1	80	73.3	85.5	11

Table 7.6.3(d): Distribution of systolic BP on antihypertensives, 2017-2021

Year	n	Mean	SD	Median	LQ	UQ	% Patients ≥ 160 mmHg
2017	1438	134.6	14.2	132.8	125	142.5	5
2018	1373	134.9	14.5	133	125	142.8	6
2019	1413	136.1	14	135	127	144.3	6
2020	1518	137.5	15.2	136.7	127.8	146.8	7
2021	1519	135.5	15	134	125.5	143.9	7

Table 7.6.3(e): Distribution of diastolic BP on antihypertensives, 2017-2021

Year	n	Mean	SD	Median	LQ	UQ	% Patients ≥ 90 mmHg
2017	1438	79.9	8.8	80	75	85	12
2018	1373	79.5	9.2	80	74	85.3	12
2019	1413	79.6	9.2	80	73.8	85.3	13
2020	1518	80.3	10	80.5	74	86.8	17
2021	1519	79.8	9.4	80	74	85.5	13

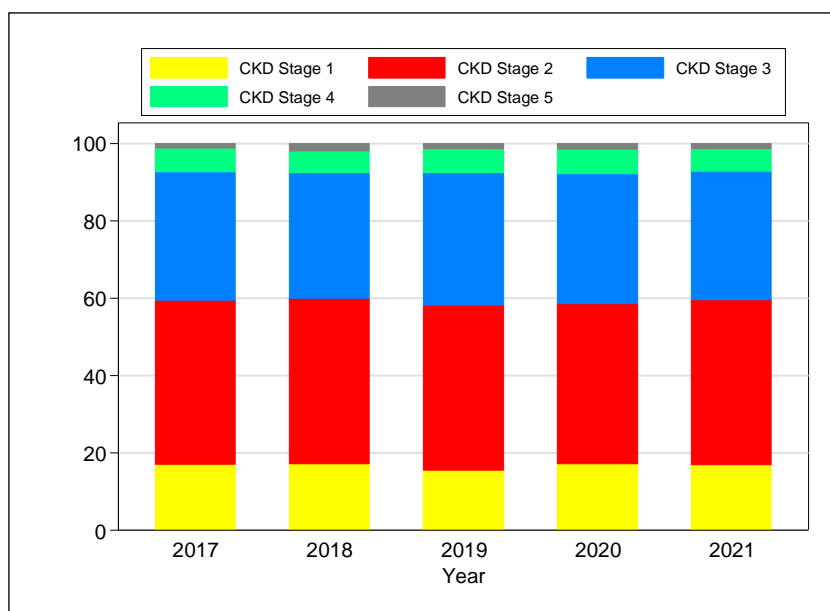
7.6.4: Allograft function

Prevalence of CKD in renal transplant recipients according to CKD stage over the last 5 years was similar. In 2021, 33.1% had CKD stage III and 7.3 % had CKD stage IV and above.

Table 7.6.4: CKD stages, 2017-2021

Year	2021		2020		2019		2018		2017	
	n	%	n	%	n	%	n	%	n	%
Stage 1	327	16.9	342	17.1	295	15.6	316	17.2	307	17
Stage 2	827	42.7	831	41.5	803	42.5	785	42.8	766	42.5
Stage 3	642	33.1	671	33.5	647	34.2	593	32.3	596	33.1
Stage 4	114	5.9	127	6.3	119	6.3	107	5.8	110	6.1
Stage 5	28	1.4	33	1.6	27	1.4	33	1.8	23	1.3

Figure 7.6.4: CKD stages by year



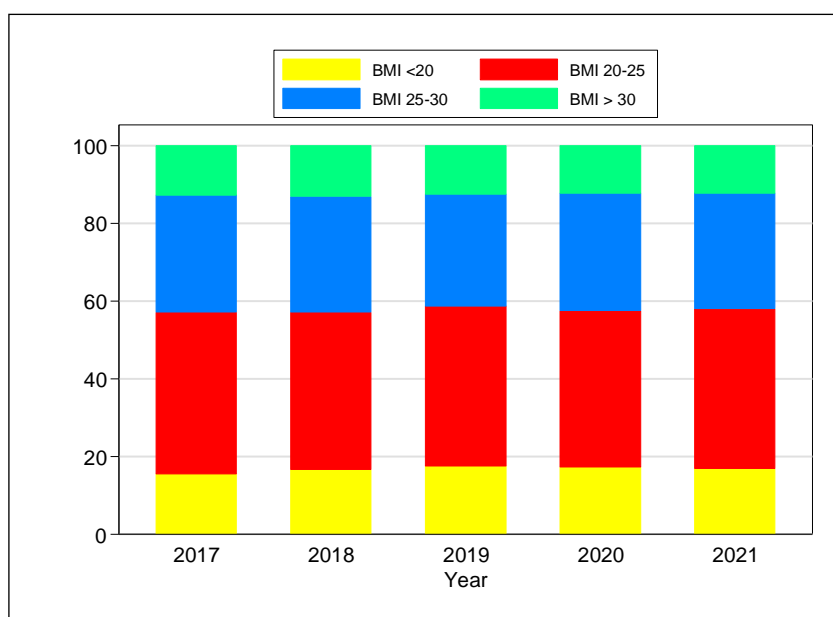
7.6.5: Body mass index (BMI)

The body mass index (BMI) of renal transplant recipients in the recent 5 years remains static. In 2021, 30% were overweight and 12.2% were obese.

Table 7.6.5: BMI, 2017-2021

Year	2021		2020		2019		2018		2017	
	n	%	n	%	n	%	n	%	n	%
<20	246	16.9	283	17.4	264	17.6	272	16.6	264	15.6
20-25	596	41	651	40	616	41.1	666	40.5	703	41.5
25-30	433	29.8	492	30.3	432	28.8	490	29.8	510	30.1
> 30	177	12.2	200	12.3	188	12.5	215	13.1	217	12.8

Figure 7.6.5: BMI, 2017-2021



7.6.6: LDL cholesterol

The latest data reveals a concerning trend in the lipid profile of renal transplant recipients, with a worsening of lipid parameters between 2017 and 2021. In 2021, 56.9% of these recipients had LDL \geq 2.6mmol/L, while 11.7% had total cholesterol $>$ 6.2mmol/L and 6.3% had HDL $<$ 1mmol/L.

Table 7.6.6(a): LDL, 2017-2021

Year	2021		2020		2019		2018		2017	
	n	%	n	%	n	%	n	%	n	%
< 2.6	854	43.2	851	41.4	684	35.2	787	41.9	840	45.1
2.6-3.4	720	36.4	803	39.1	941	48.4	725	38.6	686	36.8
\geq 3.4	405	20.5	400	19.5	320	16.5	368	19.6	336	18

Table 7.6.6(b): Total cholesterol, 2017-2021

Year	2021		2020		2019		2018		2017	
	n	%	n	%	n	%	n	%	n	%
<4.1	348	17.6	350	17	287	14.8	330	17.6	383	20.6
4.1-5.1	849	42.9	871	42.4	972	50	820	43.6	746	40.1
5.1-6.2	549	27.7	569	27.7	462	23.8	511	27.2	544	29.2
6.2- 7.2	177	8.9	190	9.3	163	8.4	163	8.7	133	7.1
> 7.2	56	2.8	74	3.6	61	3.1	56	3	56	3

Table 7.6.6(c): HDL, 2017-2021

Year	2021		2020		2019		2018		2017	
	n	%	n	%	n	%	n	%	n	%
<1	125	6.3	118	5.7	133	6.8	134	7.1	148	7.9
1-1.3	504	25.5	486	23.7	435	22.4	488	26	524	28.1
>1.3	1350	68.2	1450	70.6	1377	70.8	1258	66.9	1190	63.9

Figure 7.6.6(a): LDL, 2017-2021

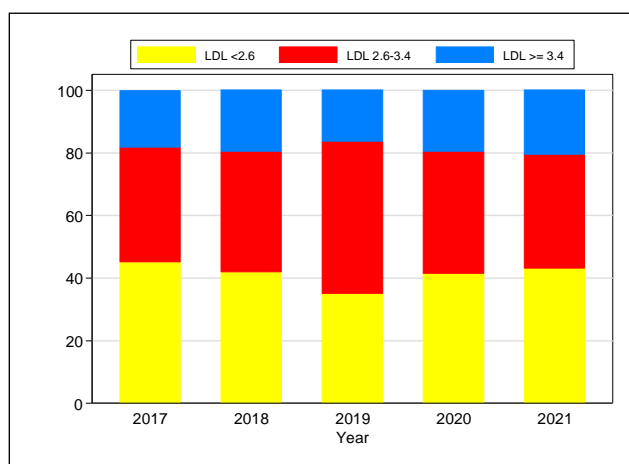


Figure 7.6.6(b): Total cholesterol, 2017-2021

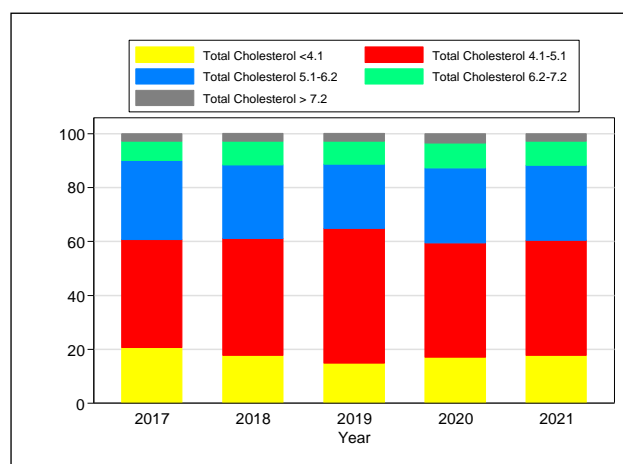
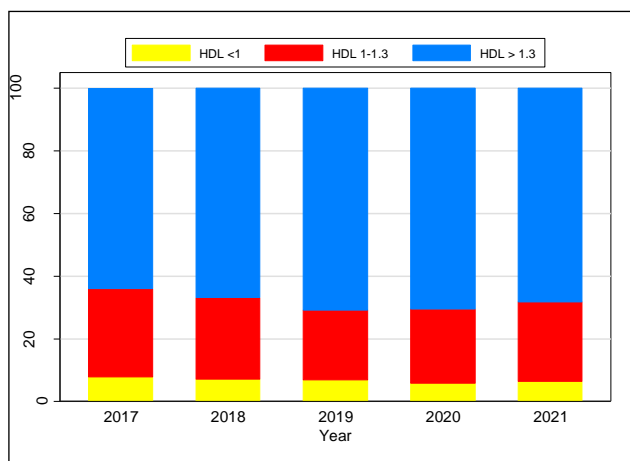


Figure 7.6.6(c): HDL, 2017-2021



SECTION 7.7: QOL INDEX SCORE IN RENAL TRANSPLANT RECIPIENTS

The QoL index score analysis of 907 renal transplant recipients who underwent transplantation between 2011 and 2021 are highly encouraging, as the overall QoL was found to be excellent, with a median QoL index score of 10 (Table & Figure 7.7.1). Further analysis revealed no significant differences in QoL index scores between diabetics and non-diabetics (Table & Figure 7.7.2), gender (Table & Figure 7.7.3), or age groups (Table & Figure 7.7.4), with patients aged 60 and above reporting the same median QoL index score of 10 as their younger counterparts. Importantly, this positive trend in QoL index scores has remained consistent over the last decade.

Table 7.7.1: Cumulative distribution of QoL-Index score in relation to dialysis modality, transplant recipient patients 2011-2021

Dialysis modality	QoL score
Number of patients	907
Centile	
0	0
0.05	10
0.1	10
0.25 (LQ)	10
0.5 (median)	10
0.75 (UQ)	10
0.9	10
0.95	10
1	10

Table 7.7.2: Cumulative distribution of QoL-Index score in relation to diabetes mellitus, transplant recipient patients 2011-2021

Diabetes mellitus	No	Yes
Number of patients	770	137
Centile		
0	0	0
0.05	10	9
0.1	10	10
0.25 (LQ)	10	10
0.5 (median)	10	10
0.75 (UQ)	10	10
0.9	10	10
0.95	10	10
1	10	10

Figure 7.7.1: Cumulative distribution of QoL-Index score in relation to dialysis modality, transplant recipient patients 2011-2021

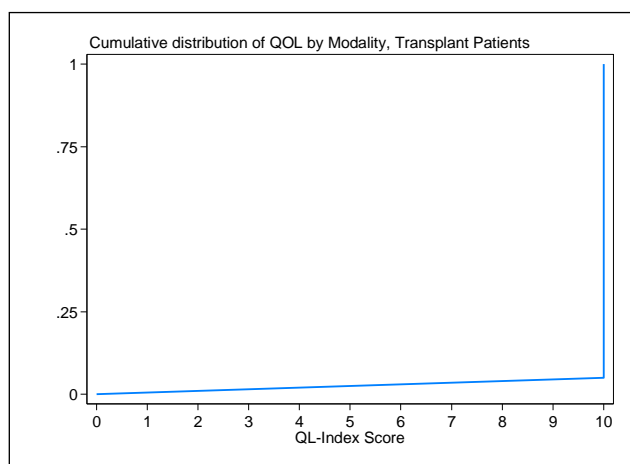


Figure 7.7.2: Cumulative distribution of QoL-Index score in relation to diabetes mellitus, transplant recipient patients 2011-2021

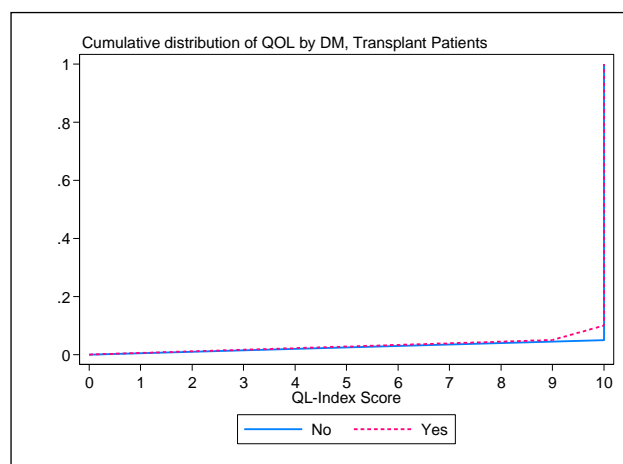


Table 7.7.3: Cumulative distribution of QoL-Index score in relation to gender, transplant recipient patients 2011-2021

Gender	Male	Female
Number of patients	539	368
Centile		
0	0	0
0.05	10	10
0.1	10	10
0.25 (LQ)	10	10
0.5 (median)	10	10
0.75 (UQ)	10	10
0.9	10	10
0.95	10	10
1	10	10

Figure 7.7.3: Cumulative distribution of QoL-Index score in relation to gender, transplant recipient patients 2011-2021

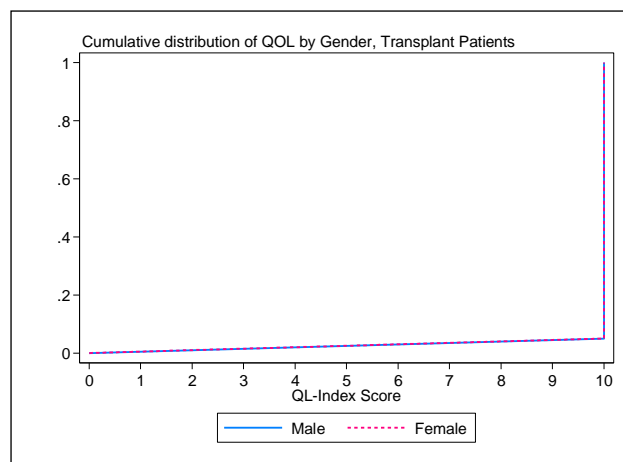


Table 7.7.4: Cumulative distribution of QoL-Index score in relation to age, transplant recipient patients 2011-2021

Age group (years)	<20	20-39	40-59	>=60
Number of patients	78	417	363	49
Centile				
0	0	0	0	0
0.05	9	10	10	9
0.1	10	10	10	10
0.5 (median)	10	10	10	10
0.75 (UQ)	10	10	10	10
0.9	10	10	10	10
0.95	10	10	10	10
1	10	10	10	10

Figure 7.7.4: Cumulative distribution of QoL-Index score in relation to age, transplant recipient patients 2011-2021

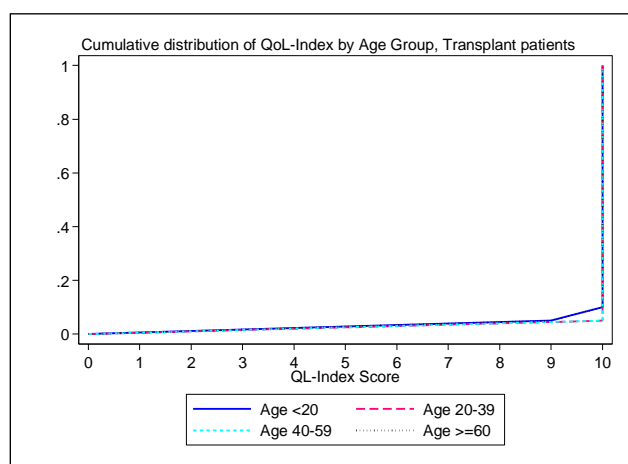


Figure 7.7.5: Cumulative distribution of QoL-Index score in relation to year of entry, transplant recipient patients 2011-2021

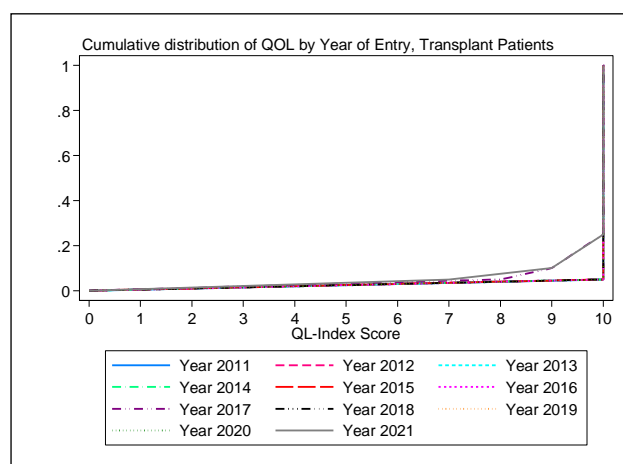


Table 7.7.5: Cumulative distribution of QoL-Index score in relation to year of entry, transplant recipient patients 2011-2021

Year of Entry	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012
Number of patients	70	143	145	81	89	61	72	47	62	62
Centile										
0	0	0	0	0	0	0	0	0	0	0
0.05	10	10	10	10	10	10	8	10	10	10
0.1	10	10	10	10	10	10	9	10	10	10
0.25 (LQ)	10	10	10	10	10	10	10	10	10	10
0.5 (median)	10	10	10	10	10	10	10	10	10	10
0.75 (UQ)	10	10	10	10	10	10	10	10	10	10
0.9	10	10	10	10	10	10	10	10	10	10
0.95	10	10	10	10	10	10	10	10	10	10
1	10	10	10	10	10	10	10	10	10	10