CHAPTER 13

Renal Transplantation

Goh Bak Leong
Zaki Morad b Mohd Zaher
Fan Kin Sing
Lily Mushahar
Rohan Malek
S. Prasad Menon
Tan Si Yen

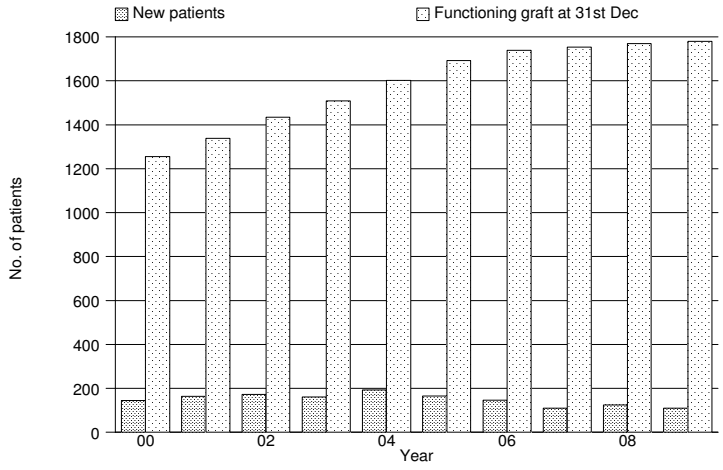
SECTION 13.1: STOCK AND FLOW

The number of new renal transplant patients shows an initial rise from 143 transplants per year in 2000 to a peak of 192 transplants in 2004. This is a rise of nearly 34% but the number declined subsequently to only 109 in 2009 (Table 13.1.1). This is due to reduction in the number of transplantations done in China. As renal transplantation in the country is still dependant on the availability of commercial cadaveric transplantation done abroad this drop was foreseeable. There may be an increase post 2008 Beijing Olympic Games. The number of functioning renal transplants reported to the National Transplant Registry (NTR) had increased from 1255 in 2000 to 1779 in 2009 (Table 13.1.1).

Table 13.1.1: Stock and Flow of Renal Transplantation, 2000-2009

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
New transplant patients	143	163	172	160	192	165	145	110	124	109
Died	30	37	35	39	42	44	55	41	52	39
Graft failure	32	40	39	42	44	21	38	38	40	34
Lost to Follow up	8	2	4	5	11	10	5	17	17	13
Functioning graft at 31st December	1255	1339	1433	1507	1602	1692	1739	1753	1768	1779

Figure 13.1.1: Stock and Flow of Renal Transplantation, 2000-2009



The incidence of renal transplantation shows a modest decline from of 6-7 per million population in the early 2000's to 4 per million population for the last 3 years (Table 13.1.2) while transplant prevalence rate has grown slowly from 53 per million in 2000 to 63 per million population in 2008 (Table 13.1.3), an increase of 19% over the 2000 figures. However compared to growth in the prevalence rate of dialysis patients (which has increased by 300% from 205 in 1998 to 615 in 2007) our transplant prevalence rate has not kept up. In fact, the incidence rate and prevalence rate seem to reduce in year 2009 (4 and 63 per million population respectively (Table 13.1.2 and 13.1.3).

Table 13.1.2: New transplant rate per million population (pmp), 2000-2009

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
New transplant patients	143	163	172	160	192	165	145	110	124	109
New transplant rate, pmp	6	7	7	6	8	6	5	4	4	4

Figure 13.1.2: New transplant rate, 2000-2009

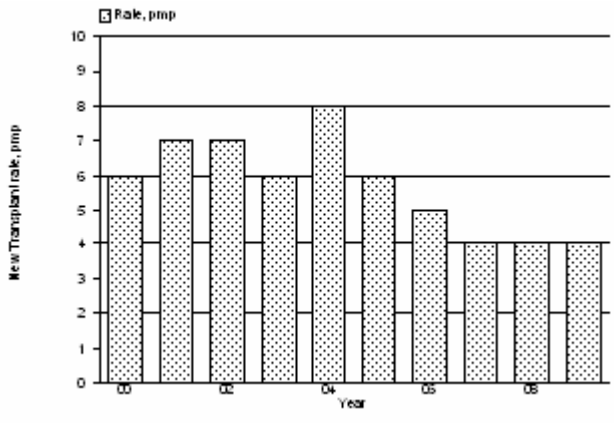


Figure 13.1.3: Transplant prevalence rate, 2000-2009

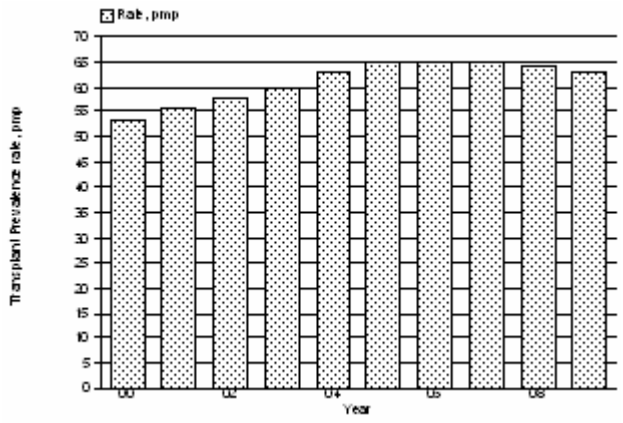


Table 13.1.3: Transplant prevalence rate per million population (pmp), 2000-2009

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Functioning graft at 31st Dec	1255	1339	1433	1507	1602	1692	1739	1753	1768	1779
Transplant prevalence rate, pmp	53	56	58	60	63	65	65	65	64	63

In terms of place of transplantation, transplantation within local centres has remained quite the same from 2000 to 2008, with 54 to 64 cases. This is disturbing data as it underscores our failure to improve transplantation rates within the country which is mainly due to the lack of both living as well as cadaver donors. Transplantation in China in 2008 comprised 49% of all of renal transplant recipients with 61 patients.

Table 13.1.4: Place of transplantation, 2000-2009

Year	2000		2001		2002		2003		2004	
	No.	%	No.	%	No.	%	No.	%	No.	%
HKL	28	20	33	20	30	17	26	16	20	10
UMMC	19	13	23	14	15	9	6	4	7	4
Selayang Hospital	4	3	11	7	11	6	11	7	11	6
Other local	3	2	4	3	1	1	1	1	2	1
China	80	56	83	51	103	60	111	69	139	72
India	9	6	8	5	12	7	4	3	11	6
Other overseas	0	0	1	1	0	0	1	1	2	1
Unknown	0	0	0	0	0	0	0	0	0	0
TOTAL	143	100	163	100	172	100	160	100	192	100

Year	2005		2006		2007		2008		2009		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
HKL	31	19	35	24	36	33	32	26	34	31	305	21
UMMC	7	4	5	3	3	3	10	8	6	6	101	7
Selayang Hospital	5	3	9	6	14	13	10	8	18	17	104	7
Other local	4	2	2	1	4	4	8	7	6	6	35	2
China	109	66	84	58	45	41	61	49	41	38	856	58
India	6	4	7	5	3	3	2	2	2	2	64	4
Other overseas	3	2	3	2	5	5	1	1	0	0	16	1
Unknown	0	0	0	0	0	0	0	0	2	2	2	0
TOTAL	165	100	145	100	110	100	124	100	109	100	1483	100

SECTION 13.2: RECIPIENTS' CHARACTERISTICS

In terms of renal transplant recipients' characteristics, age at transplant has been stable at 37 to 42 years. Between 58% and 70% of recipients were males over the last 10 years. There has been an increase in the proportion of diabetic patients undergoing transplantation from 11% in 1998 to 21% in 2006 (Table 13.2.1). However, there is a drastic drop in number of diabetic patients who underwent transplantation since 2007. This coincided with the drop in China transplants where the majority of the diabetic patients underwent their transplantation. Patients with hepatitis B and hepatitis C remained static. In terms of cause of end stage renal failure (Table 13.2.2), the primary cause was still glomerulonephritis, followed by hypertension and diabetes as the third cause. Up to 40% of transplant recipients had end stage renal disease due to unknown causes, belying the fact that majority of these patients presented late.

Table 13.2.1: Renal Transplant Recipients' Characteristics, 2000-2009

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
New Transplant Patients	143	163	172	160	192	165	145	110	124	109
Age at transplant (years), Mean	39	41	41	42	42	38	37	38	37	37
Age at transplant (years), SD	14	13	12	13	13	14	15	16	14	13
% Male	64	63	58	66	63	70	67	64	58	60
% Diabetic (co-morbid/ primary renal disease)	15	18	15	23	21	21	20	14	18	12
% HBsAg positive	5	5	7	8	5	4	7	6	3	3
% Anti-HCV positive	8	15	9	10	8	2	8	9	3	7

Table 13.2.2: Primary causes of end stage renal failure, 2000-2009

Year	2000		2001		2002		2003		2004	
	No.	%	No.	%	No.	%	No.	%	No.	%
New transplant patients	143	100	163	100	172	100	160	100	192	100
Glomerulonephritis	50	35	44	27	54	31	55	34	64	33
Diabetes Mellitus	16	11	23	14	16	9	27	17	32	17
Hypertension	20	14	17	10	24	14	26	16	52	27
Obstructive uropathy	3	2	3	2	2	1	2	1	4	2
ADPKD	3	2	1	1	3	2	5	3	5	3
Drugs/ toxic nephropathy	0	0	0	0	0	0	2	1	2	1
Hereditary nephritis	0	0	0	0	0	0	0	0	1	1
Unknown	54	38	61	37	70	41	58	36	82	43
Others	12	8	23	14	15	9	12	8	28	15

Year	2005		2006		2007		2008		2009	
	No.	%	No.	%	No.	%	No.	%	No.	%
New transplant patients	165	100	145	100	110	100	124	100	109	100
Glomerulonephritis	45	27	53	37	29	26	30	24	35	32
Diabetes Mellitus	30	18	22	15	10	9	18	15	12	11
Hypertension	41	25	32	22	27	25	22	18	25	23
Obstructive uropathy	3	2	6	4	1	1	2	2	4	4
ADPKD	3	2	1	1	2	2	0	0	5	5
Drugs/ toxic nephropathy	0	0	1	1	0	0	2	2	1	1
Hereditary nephritis	0	0	0	0	0	0	0	0	0	0
Unknown	52	32	44	30	42	38	54	44	42	39
Others	16	10	16	11	14	13	13	10	2	2

SECTION 13.3: TRANSPLANT PRACTICES

In 2009, only 29% of the renal transplant recipients received their grafts from commercial sources, compare to 79% in 2004. Live donor transplantation made up 33% of transplants (30 recipients) in 2009. Since 2006, the number of life donor has remained low - 33 in 2007 and 38 in 2008. Local cadaveric donation made up 18% of transplants (24 recipients) in 2006 although it had shown an initial promising rise to 37 recipients in 2001. 2009 marked the first time in 10 years where there were more local cadaver transplantations (37%) compared to local life transplantations (33%).

Table 13.3.1: Type of Renal Transplantation, 2000-2009

Year	2000		2001		2002		2003		2004	
	No.	%	No.	%	No.	%	No.	%	No.	%
Commercial cadaver	80	56	83	51	103	60	112	70	145	76
Commercial live donor	9	6	7	4	11	6	3	2	6	3
Live donor (genetically related)	21	15	32	20	33	19	25	16	21	11
Live donor (emotionally related)	6	4	4	2	3	2	5	3	2	1
Cadaver	27	19	37	23	22	13	15	9	17	9
TOTAL	143	100	163	100	172	100	160	100	191	100

Year	2005		2006		2007		2008		2009	
	No.	%	No.	%	No.	%	No.	%	No.	%
Commercial cadaver	105	64	84	59	45	42	53	46	17	19
Commercial live donor	9	6	5	4	3	3	1	1	9	10
Live donor (genetically related)	37	23	24	17	20	19	32	28	20	22
Live donor (emotionally related)	3	2	4	3	13	12	6	5	10	11
Cadaver	9	6	26	18	27	25	23	20	33	37
TOTAL	163	100	143	100	108	100	115	100	89	100

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

Table 13.3.2: Biochemical data, 2006-2009

Biochemical parameter	Summary	2006	2007	2008	2009
Creatinine, umol/L	N	1592	1688	1697	1692
	Mean	135.7	131.8	131.9	128.2
	SD	81.3	77.6	80.8	62.8
	Median	120	116	115	115
	Minimum	21.7	36	29	10.7
	Maximum	1152	1186	1181	657
Hb, g/dL	N	1592	1688	1697	1692
	Mean	12.7	12.8	12.8	12.6
	SD	1.9	1.9	1.9	1.8
	Median	12.8	12.8	12.8	12.8
	Minimum	3.3	4.4	6.2	5.3
	Maximum	19.8	18.7	18.6	18.5
Albumin, g/L	N	1592	1688	1697	1692
	Mean	39.6	39.7	39.7	39.6
	SD	0.7	0.8	0.8	1.2
	Median	39.6	39.6	39.6	39.6
	Minimum	29	29	30	21
	Maximum	48	48	50	50
Calcium, mmol/L	N	1592	1688	1697	1692
	Mean	2.3	2.3	2.3	2.3
	SD	0.2	0.2	0.2	0.2
	Median	2.3	2.3	2.3	2.3
	Minimum	1.1	1.4	1	1.1
	Maximum	3.1	3.2	3.5	3.3

Table 13.3.2: Biochemical data, 2006-2009 *(cont.)*

Biochemical parameter	Summary	2006	2007	2008	2009
Phosphate, mmol/L	N	1592	1688	1697	1692
	Mean	1.1	1.1	1.1	1.1
	SD	0.2	0.3	0.3	0.2
	Median	1.1	1.1	1.1	1.1
	Minimum	0.5	0.5	0.5	0.5
	Maximum	3.5	3.9	3.2	2.8
Alkaline Phosphate (ALP), U/L	N	1592	1688	1697	1692
	Mean	79.1	79.4	78.9	79.9
	SD	43.2	39.8	46.5	45.3
	Median	71	72.5	72	73
	Minimum	24	22	20	21
	Maximum	700	508	985	732
ALT, U/L	N	1592	1688	1697	1692
	Mean	29.9	29.9	30.1	29.9
	SD	30.4	25.6	37.8	32.6
	Median	22	23	23	24
	Minimum	4	4	4	4
	Maximum	433	356	881	881
Total cholesterol, mmol/L	N	1592	1688	1697	1692
	Mean	5.3	5.2	5.2	5.2
	SD	1	1	1	1.1
	Median	5.3	5.3	5.3	5.3
	Minimum	1.5	1.7	2	1.9
	Maximum	11.1	11.4	11.2	10.6
LDL cholesterol, mmol/L	N	1592	1688	1697	1692
	Mean	3	2.9	2.9	2.8
	SD	0.8	0.8	0.8	1
	Median	2.9	2.9	2.9	2.9
	Minimum	1	1	0.9	0.9
	Maximum	11.1	8.9	7.7	10.8
HDL cholesterol, mmol/L	N	1592	1688	1697	1692
	Mean	1.6	1.5	1.6	1.5
	SD	0.5	0.4	0.5	0.5
	Median	1.6	1.6	1.6	1.6
	Minimum	0.4	0.4	0.5	0.4
	Maximum	5.8	7.5	7.5	6.9
Systolic Blood Pressure, mmHg	N	1592	1688	1697	1692
	Mean	130.7	131.6	129.5	130.1
	SD	15.9	15.7	15.3	14.7
	Median	130	130	130	130
	Minimum	66	80	80	65
	Maximum	210	210	245	210
Diastolic Blood Pressure, mmHg	N	1592	1688	1697	1692
	Mean	78.9	78.8	77.5	78.3
	SD	9.8	9.4	9.2	8.7
	Median	80	80	79	79
	Minimum	30	20	20	40
	Maximum	120	116	133	120

In 2009, Cyclosporine based regimes remained the mainstay of immunosuppressive therapy with 64% of patients receiving it. This showed a gradual declining trend which coincided with increasing trend in Tacrolimus usage. Tacrolimus based regimes accounted for 27%. There has been continuous increase in the use of Mycophenolate Mofetil as the second immunosuppressive agent with 60% of patients on it in 2009. During the same period, the use of Azathioprine declined to 22% in 2009. Monotherapy of immunosuppresion is mostly not noted except in a small number of patients. Sirolimus was used in 2% of all transplant recipients in 2008 and 2009.

In terms of non immunosuppressive medications, in year 2009 only 28% of patients were on ACE inhibitors or Angiotensin II receptor blockers (AIIRB) or both and this trend has been relatively static since 2006. Calcium Channel blockers appeared to be the mainstay of antihypertensive therapy with 42% of patients on ot whilst Beta Blockers use was reported in 39% of patients. Other antihypertensives were reported in 10% of patients. The widespread use of Calcium Channel blockers either as monotherapy or combination may be due to the use of the dihydropyridine group to minimise the dose of Cyclosporine, which remains the main immunosuppressive drug.

Table 13.3.3: Medication data, 2006-2009

Medication data	Single drug treatment								Combined drug treatment							
	2006		2007		2008		2009		2007		2007		2008		2009	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
All	1482	100	1665	100	1427	100	1739	100	1482	100	1665	100	1427	100	1739	100
(i) Immunosuppressive drug(s) treatment																
Prednisolone	8	1	9	1	6	0	6	0	1444	97	1611	97	1384	97	1638	94
Azathioprine	0	0	0	0	0	0	1	0	497	34	479	29	382	27	383	22
Cyclosporin A	5	0	8	0	2	0	15	1	1119	76	1191	72	983	69	1116	64
Tacrolimus (FK506)	0	0	4	0	3	0	14	1	254	17	348	21	344	24	473	27
Mycophenolate Mofetil (MMF)	0	0	1	0	2	0	0	0	708	48	907	54	775	54	1043	60
Rapamycin	0	0	0	0	1	0	0	0	7	0	33	2	30	2	32	2
Others	0	0	0	0	0	0	1	0	18	1	4	0	1	0	26	1
(ii) Non-Immunosuppressive drug(s) treatment																
Beta blocker	77	5	90	5	88	6	118	7	597	40	735	44	615	43	679	39
Calcium channel blocker	199	13	184	11	138	10	161	9	787	53	905	54	687	48	736	42
ACE inhibitor	39	3	38	2	29	2	40	2	292	20	384	23	287	20	309	18
AIIRB	27	2	18	1	17	1	21	1	141	10	210	13	141	10	146	8
Anti-lipid	156	11	95	6	89	6	115	7	679	46	732	44	627	44	706	41
Other anti-hypertensive	11	1	6	0	25	2	26	1	159	11	140	8	191	13	167	10

SECTION 13.4: TRANSPLANT OUTCOMES

13.4.1 Post-transplant complications

In the year 2009, sixty percent of patients were hypertensive prior to transplantation whereas 26% developed hypertension post transplantation. Twelve percent of patients had diabetes mellitus prior to transplant whereas only 5% of patients develorped post transplant diabetes mellitus. These trends have been quite the same since 2006. In terms of cardiovascular and cerebrovascular disease 3% had either or both prior to transplant whereas another 3% developed these complications post transplantation.

Table 13.4.1: Post-transplant complications, 2006-2009

Post transplant complications	Complication developed before transplant (regardless of complication after transplantation)								Complication developed only after transplantation							
	2006		2007		2008		2009		2006		2007		2008		2009	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
All patients	1592	100	1688	100	1704	100	1708	100	1592	100	1688	100	1704	100	1708	100
Diabetes (either as Primary Renal Disease or co-morbid)	218	14	232	14	233	14	211	12	124	8	113	7	119	7	88	5
Cancer	2	0	3	0	2	0	1	0	20	1	21	1	24	1	16	1
Cardiovascular disease + cerebrovascular disorder	73	5	72	4	67	4	51	3	45	3	54	3	72	4	56	3
Hypertension	1036	65	1063	63	1054	62	1025	60	354	22	451	27	413	24	448	26

*Hypertension: BP systolic>140 and BP diastolic >90
OR have either Beta blocker/ Calcium channel blocker / ACE inhibitor / AIIRB / Other anti-hypertensive

13.4.2 Deaths and Graft loss

In 2008, 52 transplant recipients died and 40 lost their grafts. The rates of transplant death and graft loss have remained static for the past 10 years (Table 13.4.2). The main known causes of death have been infection and cardiovascular disease with 35% and 23% respectively. Another 21% of patients died at home, which is usually presumed to be cardiovascular death as well.

Cancer death rates have been significantly high since 2000 contributing to 13% of all death in 2007 and 19% in 2008. Death due to liver disease has remained relatively static.

In terms of graft loss, majority were due to rejection.

Table 13.4.2: Transplant Patients Death Rate and Graft Loss, 2000-2009

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Number at risk	1218	1296	1385	1469	1554	1646	1715	1745	1760	1821
Transplant death	30	37	35	39	42	44	55	41	52	39
Transplant death rate %	3	3	3	3	3	3	3	2	3	2
Graft loss	32	40	39	42	44	21	38	38	40	34
Graft loss rate %	3	3	3	3	3	1	2	2	2	2
Acute rejection	0	0	0	3	19	14	18	12	14	20
Acute rejection rate %	0	0	0	0	1	1	1	1	1	1
All losses	62	77	74	81	86	65	93	79	92	73
All losses rate %	5	6	5	6	6	4	5	5	5	4

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

Figure 13.4.2(a): Transplant Recipient Death Rate, 2000-2009

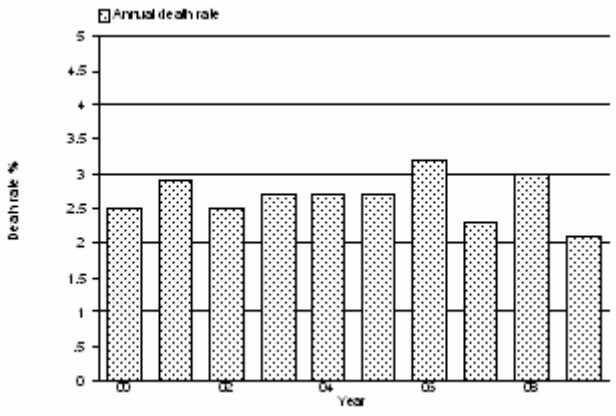


Figure 13.4.2(b): Transplant Recipient Graft Loss Rate, 2000 – 2009

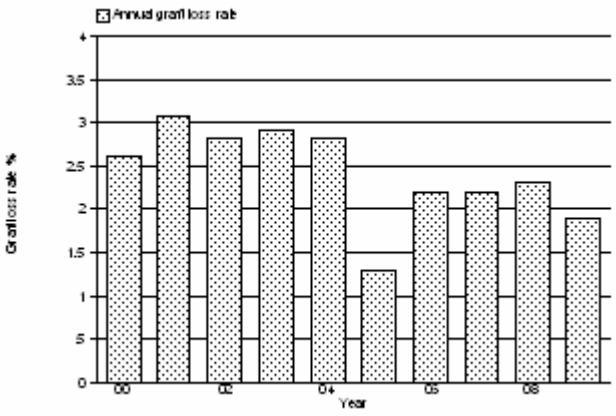


Table 13.4.3: Causes of Death in Transplant Recipients, 2000-2009

Year	2000		2001		2002		2003		2004	
	No.	%	No.	%	No.	%	No.	%	No.	%
Cardiovascular	10	30	7	16	5	14	12	27	6	14
Died at home	1	3	5	12	5	14	5	11	5	11
Infection	12	36	21	49	12	34	13	30	15	34
Graft failure	2	6	0	0	0	0	0	0	3	7
Cancer	2	6	6	14	5	14	7	16	8	18
Liver disease	1	3	2	5	3	9	3	7	3	7
Accidental death	1	3	1	2	1	3	1	2	0	0
Others	2	6	0	0	2	6	1	2	3	7
Unknown	2	6	1	2	2	6	2	5	1	2
TOTAL	33	100	43	100	35	100	44	100	44	100

Year	2005		2006		2007		2008		2009	
	No.	%	No.	%	No.	%	No.	%	No.	%
Cardiovascular	5	11	12	20	8	17	10	17	10	23
Died at home	6	13	7	12	5	11	12	21	9	21
Infection	25	56	24	40	15	33	20	34	15	35
Graft failure	0	0	0	0	4	9	0	0	1	2
Cancer	5	11	5	8	6	13	11	19	6	14
Liver disease	3	7	5	8	0	0	0	0	2	5
Accidental death	0	0	1	2	0	0	0	0	0	0
Others	0	0	2	3	1	2	4	7	0	0
Unknown	1	2	4	7	7	15	1	2	0	0
TOTAL	45	100	60	100	46	100	58	100	43	100

Table 13.4.4: Causes of Graft Failure, 2000-2009

Year	2000		2001		2002		2003		2004	
	No.	%	No.	%	No.	%	No.	%	No.	%
Rejection	19	59	25	61	23	56	21	48	31	70
Calcineurin toxicity	0	0	0	0	1	2	1	2	0	0
Other drug toxicity	0	0	0	0	0	0	0	0	0	0
Ureteric obstruction	0	0	0	0	0	0	0	0	0	0
Infection	1	3	2	5	0	0	2	5	1	2
Vascular causes	3	9	1	2	0	0	3	7	4	9
Recurrent/ de novo renal disease	0	0	2	5	2	5	2	5	1	2
Others	2	6	0	0	4	10	1	2	0	0
Unknown	7	22	11	27	11	27	14	32	7	16
TOTAL	32	100	41	100	41	100	44	100	44	100

Year	2005		2006		2007		2008		2009	
	No.	%	No.	%	No.	%	No.	%	No.	%
Rejection	15	68	26	67	26	68	22	61	15	68
Calcineurin toxicity	0	0	0	0	0	0	1	3	0	0
Other drug toxicity	0	0	0	0	0	0	0	0	0	0
Ureteric obstruction	0	0	0	0	1	3	0	0	0	0
Infection	1	5	2	5	1	3	1	3	1	5
Vascular causes	2	9	4	10	1	3	1	3	2	9
Recurrent/ de novo renal disease	0	0	1	3	0	0	0	0	0	0
Others	1	5	3	8	4	11	0	0	1	5
Unknown	3	14	3	8	5	13	11	31	3	14
TOTAL	22	100	39	100	38	100	36	100	22	100

13.5: PATIENT AND GRAFT SURVIVAL

Overall patient survival rates from 2000 to 2009 have been 95%, 90%, 87% and 79% at year 1, 3, 5 and 10 respectively. Overall graft survival rate has been 92%, 86%, 80% and 68% at year 1, 3, 5 and 10 respectively.

Table 13.5.1(a): Patient survival, 2000-2009

Interval (years)	No.	% Survival	SE
0	1483	100	-
1	1263	95	1
2	1102	92	1
3	962	90	1
4	805	89	1
5	639	87	1
6	462	85	1
7	321	82	1
8	200	82	1
9	95	79	2
10	1	79	2

*No.=Number at risk SE=standard error

Figure 13.5.1(a): Patient survival, 2000-2009

Table 13.5.1(b): Risk factors for transplant patient survival 2000-2009

Factors	N	Hazard Ratio	95% CI	P value
Year of transplant:				
2000-2004 (ref*)	830	1.00		
2005-2009	653	1.38	(0.92; 2.06)	0.121
Age at transplant:				
<20	153	0.42	(0.18; 0.97)	0.043
20-39 (ref*)	552	1.00		
40-54	680	1.97	(1.34; 2.90)	0.001
>=55	98	2.09	(1.20; 3.65)	0.010
Gender:				
Male (ref*)	937	1.00		
Female	546	0.90	(0.64; 1.26)	0.528
Primary diagnosis:				
Unknown primary (ref*)	755	1.00		
Diabetes mellitus	133	1.32	(0.85; 2.04)	0.218
GN/SLE	356	0.81	(0.54; 1.23)	0.321
Polycystic kidney	25	0.37	(0.05; 2.67)	0.323
Obstructive nephropathy	36	2.22	(0.95; 5.20)	0.066
Others	178	1.26	(0.80; 1.97)	0.314
Type of transplant:				
Commercial cadaver (ref*)	827	1.00		
Commercial live donor	60	1.09	(0.56; 2.11)	0.796
Living donor	324	0.83	(0.49; 1.38)	0.466
Cadaver	236	3.55	(2.44; 5.16)	<0.001
HbsAg:				
Negative (ref*)	1447	1.00		
Positive	36	1.86	(0.96; 3.62)	0.068
Anti-HCV:				
Negative (ref*)	1428	1.00		
Positive	55	1.67	(0.97; 2.85)	0.063

Figure 13.5.1(b): Risk factors for transplant patient survival 2000-2009
(adjusted for age, gender, primary diagnosis, type of transplant, HBsAg and Anti-HCV status)

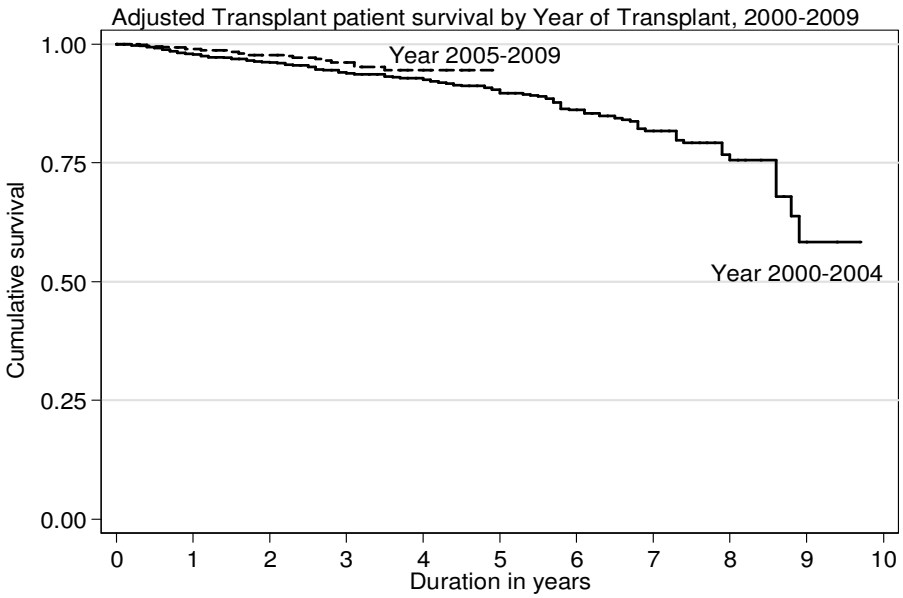


Table 13.5.2 (a): Graft survival, 2000-2009

Interval (years)	No.	% Survival	SE
0	0	100	-
1	1263	92	1
2	1102	88	1
3	962	86	1
4	805	83	1
5	639	80	1
6	462	77	1
7	321	73	2
8	200	72	2
9	95	68	2
10	1	68	2

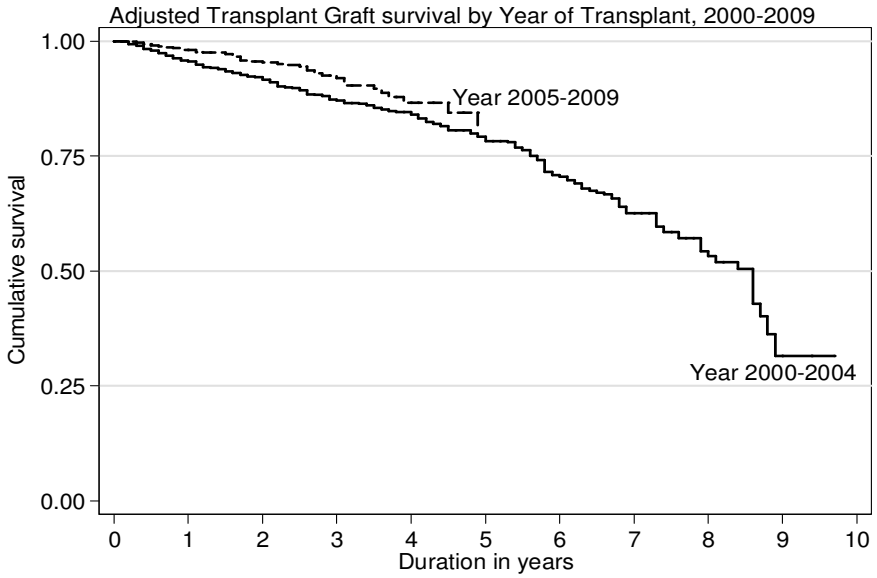
*No.=Number at risk SE=standard error

Figure 13.5.2 (a): Graft survival, 2000-2009

Table 13.5.2(b): Risk factors for transplant graft survival 2000 - 2009

Factors	N	Hazard Ratio	95% CI	P value
Year of transplant:				
2000-2004 (ref*)	830	1.00		
2005-2009	653	1.47	(1.07; 2.00)	0.016
Age at transplant:				
<20	153	0.86	(0.55; 1.34)	0.493
20-39 (ref*)	552	1.00		
40-54	680	1.26	(0.94; 1.67)	0.117
>=55	98	1.26	(0.79; 2.02)	0.329
Gender:				
Male (ref*)	937	1.00		
Female	546	0.89	(0.69; 1.16)	0.394
Primary diagnosis:				
Unknown primary (ref*)	755	1.00		
Diabetes mellitus	133	1.29	(0.89; 1.89)	0.181
GN/SLE	356	0.87	(0.63; 1.19)	0.378
Polycystic kidney	25	0.91	(0.33; 2.48)	0.851
Obstructive nephropathy	36	1.52	(0.73; 3.17)	0.267
Others	178	1.54	(1.10; 2.15)	0.011
Type of transplant:				
Commercial cadaver (ref*)	827	1.00		
Commercial live donor	60	1.14	(0.67; 1.92)	0.629
Living donor	324	0.94	(0.65; 1.35)	0.735
Cadaver	236	3.32	(2.47; 4.47)	<0.001
HbsAg:				
Negative (ref*)	1447	1.00		
Positive	36	1.68	(0.92; 3.05)	0.091
Anti-HCV:				
Negative (ref*)	1428	1.00		
Positive	55	1.71	(1.12; 2.60)	0.013

Figure 13.5.2(b): Adjusted Transplant Graft Survival related to Year of Transplant, 2000-2009 (adjusted for age, gender, primary diagnosis, type of transplant, HBsAg and Anti-HCV status)



Outcomes of renal transplantation from the 4 donor groups are shown in Figures 13.5.3 and 13.5.4. In terms of patient survival, live donor grafts maintained good survival rates with 96%, 94%, 93% and 90% at years 1, 3, 5 and 9 respectively. In terms of graft survival, commercial cadaver grafts performed similarly well with a survival of 95%, 89%, 83% and 72% at year 1, 3, 5 and 10 compared to 93%, 90%, 87% and 76% for the same intervals for live donor grafts.

Table 13.5.3: Unadjusted Patient survival by type of transplant, 2000-2009

Type of Transplant	Commercial Cadaver			Commercial Live Donor			Live Donor			Cadaver		
Interval (years)	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE
0	827	100	-	63	100	-	321	100	-	236	100	-
1	761	96	1	54	98	2	271	96	1	159	86	2
2	684	93	1	50	95	3	234	95	1	130	80	3
3	620	92	1	44	93	4	195	94	1	99	77	3
4	524	90	1	37	93	4	163	93	2	78	77	3
5	415	87	1	29	89	5	127	93	2	67	74	3
6	290	86	1	18	78	7	97	92	2	59	72	4
7	188	82	2	13	68	9	73	92	2	48	72	4
8	109	82	2	8	68	9	47	92	2	36	69	4
9	53	81	2	5	68	9	20	90	3	17	63	5
10	1	81	2	-	-	-	-	-	-	-	-	-

*No.=Number at risk SE=standard error

Figure 13.5.3: Patient survival by type of transplant, 2000-2009

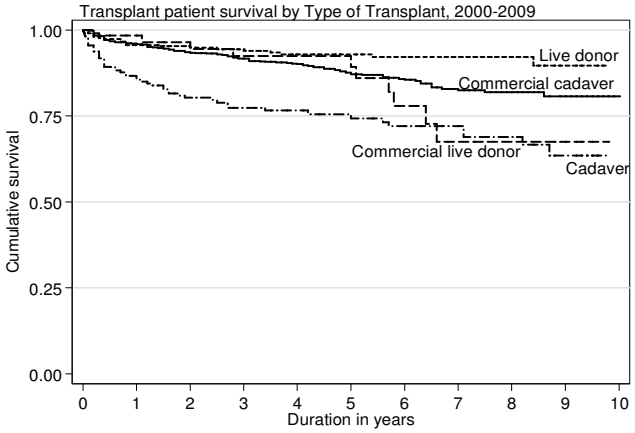


Figure 13.5.4: Graft survival by type of transplants, 2000-2009

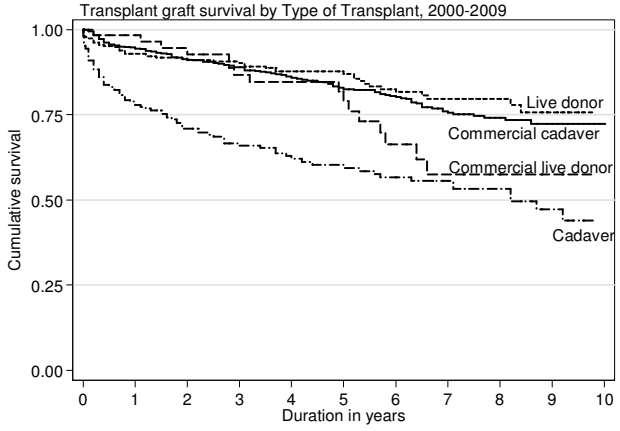


Table 13.5.4: Graft survival by type of transplant, 2000-2009

Type of Transplant	Commercial Cadaver			Commercial Live Donor			Live Donor			Cadaver		
Interval (years)	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE
0	827	100	-	63	100	-	321	100	-	236	100	-
1	761	95	1	54	98	2	271	93	1	159	78	3
2	684	91	1	50	93	3	234	91	2	130	71	3
3	620	89	1	44	87	5	195	90	2	99	66	3
4	524	86	1	37	85	5	163	88	2	78	62	4
5	415	83	1	29	79	6	127	87	2	67	59	4
6	290	80	2	18	66	8	97	82	3	59	57	4
7	188	76	2	13	58	9	73	80	3	48	56	4
8	109	74	2	8	58	9	47	80	3	36	53	4
9	53	72	2	5	58	9	20	76	4	17	47	5
10	1	72	2	-	-	-	-	-	-	-	-	-

*No.=Number at risk SE=standard error

Patient and graft survival for living related transplants were compared for two cohorts. The 2000-2004 cohort and the 2005-2009 cohort were compared for patient survival (Figures 13.5.5) but both were comparable and survival remained excellent for both groups.

Graft survival for living related transplants (Figure 13.5.6) however was much better in patients in the 2005-2009 cohort even from the outset probably due to increased usage of newer immunosuppressive agents.

Table 13.5.5: Patient survival by year of transplant (Living related transplant, 2000-2009)

Year of Transplant Interval (years)	2000-2004			2005-2009		
	No.	% Survival	SE	No.	% Survival	SE
0	152	100	-	169	100	-
1	140	93	2	134	98	1
2	135	93	2	99	97	1
3	130	91	2	65	97	1
4	127	90	2	38	95	2
5	125	90	2	2	95	2
6	97	90	3	-	-	-
7	73	90	3	-	-	-
8	47	90	3	-	-	-
9	20	87	3	-	-	-
10	-	-	-	-	-	-

*No.=Number at risk SE=standard error

Figure 13.5.5: Patient survival by year of transplant (Living related transplant, 2000-2009)

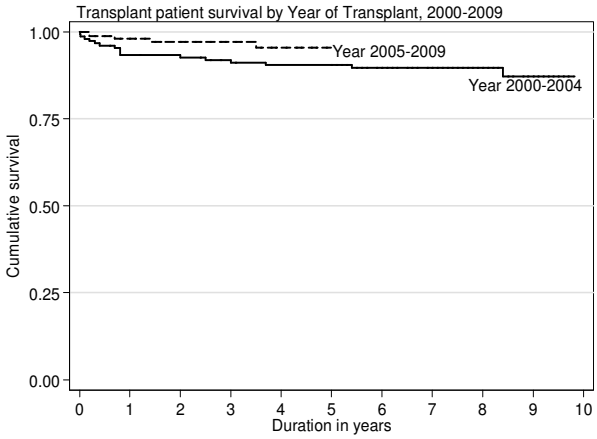


Figure 13.5.6: Graft survival by year of transplant (Living related transplant, 2000-2009)

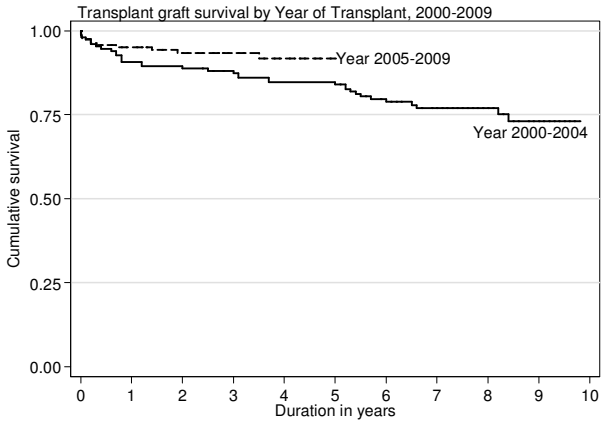


Table13.5.6: Graft survival by year of transplant (Living related transplant, 2000-2009)

Year of Transplant Interval (years)	2000-2004			2005-2009		
	No.	% Survival	SE	No.	% Survival	SE
0	152	100	-	169	100	-
1	140	90.73	2.36	134	95.1	1.69
2	135	88.74	2.57	99	93.38	2.05
3	130	87.4	2.7	65	93.38	2.05
4	127	84.69	2.94	38	91.71	2.61
5	125	84.01	2.99	2	91.71	2.61
6	97	78.86	3.39	-	-	-
7	73	76.94	3.57	-	-	-
8	47	76.94	3.57	-	-	-
9	20	73.12	4.3	-	-	-
10	-	-	-	-	-	-

*No.=Number at risk SE=standard error

In terms of commercial cadaveric transplantation, the comparison between the 2000-2004 cohort and 2005 – 2009 cohort was performed. Both patient and graft survival showed comparable results to living related transplants done within the country.

Table 13.5.7: Patient survival by year of transplant (Commercial cadaver transplant, 2000-2009)

Year of Transplant	2000-2004			2005-2009		
Interval (years)	No.	% Survival	SE	No.	% Survival	SE
0	523	100	-	304	100	-
1	488	95	1	273	97	1
2	468	93	1	216	95	1
3	454	91	1	168	94	1
4	433	89	1	91	94	1
5	414	86	2	1	94	1
6	290	86	2	-	-	-
7	188	83	2	-	-	-
8	109	82	2	-	-	-
9	53	81	2	-	-	-
10	1	81	2	-	-	-

*No.=Number at risk SE=standard error

Figure 13.5.7: Patient survival by year of transplant (Commercial cadaver transplant, 2000-2009)

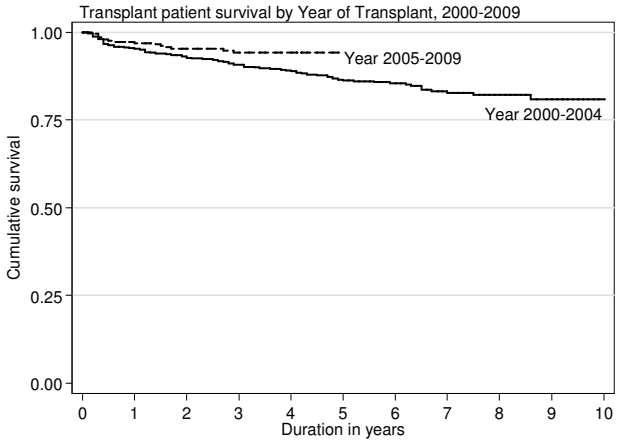


Figure 13.5.8: Graft survival by year of transplant (Commercial cadaver transplant, 2000-2009)

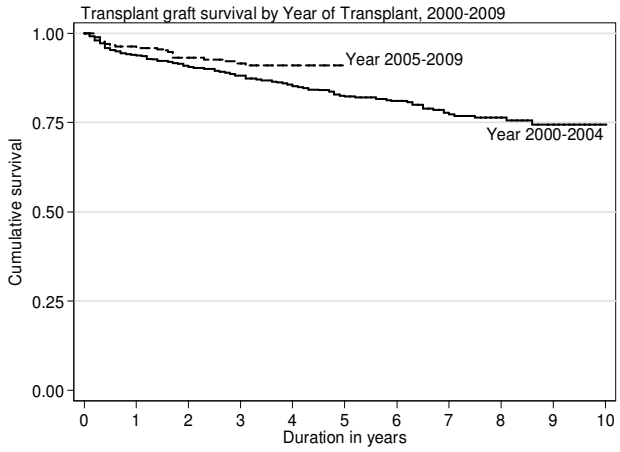


Table 13.5.8: Graft survival by year of transplant (Commercial cadaver transplant, 2000-2009)

Year of Transplant	2000-2004			2005-2009		
Interval (years)	No.	% Survival	SE	No.	% Survival	SE
0	523	100	-	304	100	-
1	488	94	1	273	96	1
2	468	91	1	216	93	2
3	454	88	1	168	92	2
4	433	85	2	91	91	2
5	414	82	2	1	91	2
6	290	81	2	-	-	-
7	188	77	2	-	-	-
8	109	76	2	-	-	-
9	53	75	2	-	-	-
10	1	75	2	-	-	-

*No.=Number at risk SE=standard error

SECTION 13.6: CARDIOVASCULAR RISK IN RENAL TRANSPLANT RECIPIENTS

13.6.1 Risk factors for ischaemic heart disease

In 2009, 87.2% of patients were hypertensive, 17.7% were diabetic and 46.7% had renal insufficiency fulfilling CKD III and above. Forty-two percent of patients had 2 cardiovascular risk factors while 5.5% had all 3 major risk factors.

Table 13.6.1: Risk factors for IHD in renal transplant recipients at year 2006, 2007, 2008 and 2009

	2006	2007	2008	2009
Diabetes	21 (1.4)	25 (1.6)	18 (1.1)	28 (1.8)
Hypertension**	454 (31.0)	589 (37.3)	663 (41.7)	644 (41.1)
CKD	177 (12.1)	127 (8.1)	117 (7.4)	155 (9.9)
Diabetes + Hypertension**	156 (10.7)	177 (11.2)	203 (12.8)	163 (10.4)
Diabetes + CKD	18 (1.2)	11 (0.7)	22 (1.4)	18 (1.1)
CKD + Hypertension**	490 (33.5)	516 (32.7)	457 (28.8)	474 (30.2)
Diabetes + CKD + Hypertension**	147 (10.0)	132 (8.4)	109 (6.9)	86 (5.5)

**Hypertension: BP systolic > 140 and BP diastolic > 90
OR have either Beta blocker / Calcium channel blocker / ACE inhibitor / AIIRB / Other anti-hypertensive 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 13.6.1(a): Venn Diagram for Pre and Post Transplant Complications (in %) at year 2006

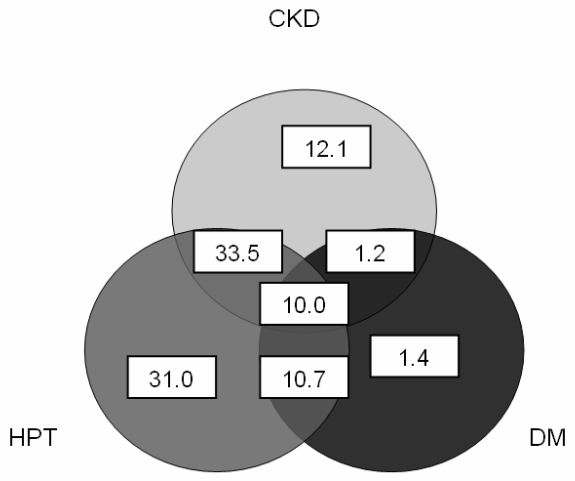


Figure 13.6.1(b): Venn Diagram for Pre and Post Transplant Complications (in %) at year 2007

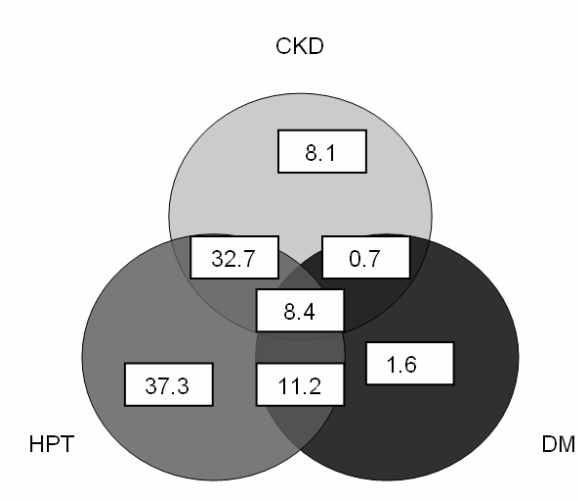


Figure 13.6.1(c): Venn Diagram for Pre and Post Transplant Complications (in %) at year 2008

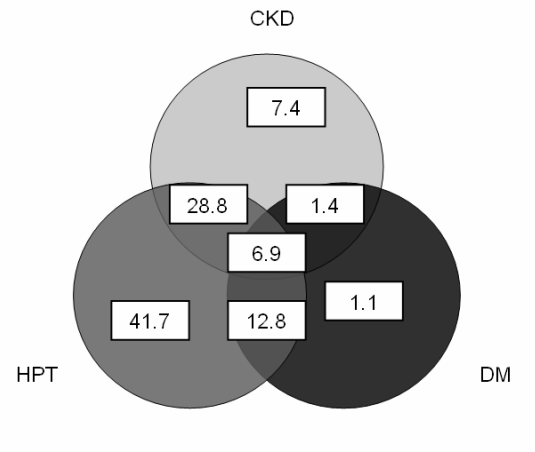
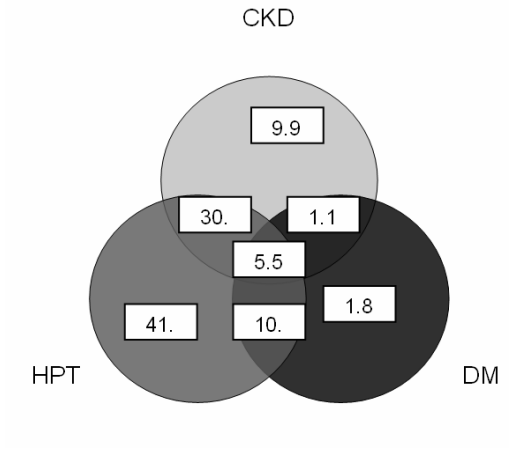


Figure 13.6.1(d): Venn Diagram for Pre and Post Transplant Complications (in %) at year 2009



13.6.2: Blood Pressure classification according to JNC VI criteria, 2006-2009

In 2009, 20% of renal transplant recipients had stage I hypertension whereas 4% had stage II hypertension and 0.6% had stage III hypertension despite being on treatment. In terms of diastolic hypertension 12% had stage I hypertension, 1.6% of patients had stage II diastolic hypertension and 0.3% of patients had stage III diastolic hypertension despite being on treatment.

Table 13.6.2(a): Systolic BP, 2006-2009

Year	2006		2007		2008		2009	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Systolic BP<120	249	(15.64)	240	(14.22)	289	(17.03)	269	(15.90)
Systolic BP 120-129	395	(24.81)	392	(23.22)	377	(22.22)	375	(22.16)
Systolic BP 130-139	483	(30.34)	531	(31.46)	611	(36.00)	636	(37.59)
Systolic BP 140-159	353	(22.17)	409	(24.23)	335	(19.74)	340	(20.09)
Systolic BP 160-179	93	(5.84)	99	(5.86)	75	(4.42)	62	(3.66)
Systolic BP >=180	19	(1.19)	17	(1.01)	10	(0.59)	10	(0.59)

Figure 13.6.2(a): Systolic BP, 2006-2009

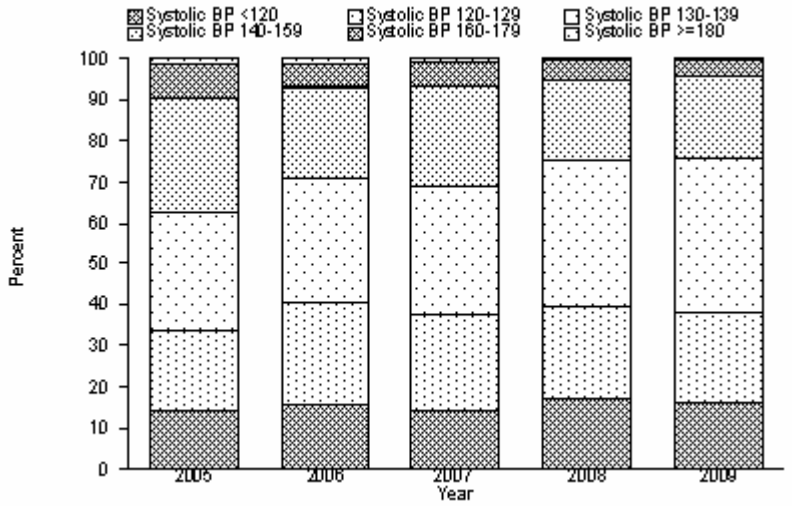


Table 13.6.2(b): Diastolic BP, 2006-2009

Year	2006		2007		2008		2009	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Diastolic BP<80	624	(39.20)	699	(41.41)	897	(52.86)	854	(50.47)
Diastolic BP 80-84	586	(36.81)	610	(36.14)	525	(30.94)	527	(31.15)
Diastolic BP 85-89	73	(4.59)	74	(4.38)	50	(2.95)	84	(4.96)
Diastolic BP 90-99	244	(15.33)	261	(15.46)	198	(11.67)	195	(11.52)
Diastolic BP 100-109	61	(3.83)	39	(2.31)	22	(1.30)	27	(1.60)
Diastolic BP >=110	4	(0.25)	5	(0.30)	5	(0.29)	5	(0.30)

Figure 13.6.2(b): Diastolic BP, 2006-2009

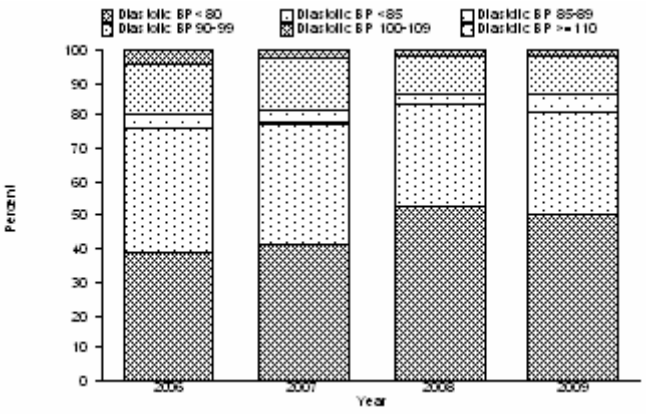
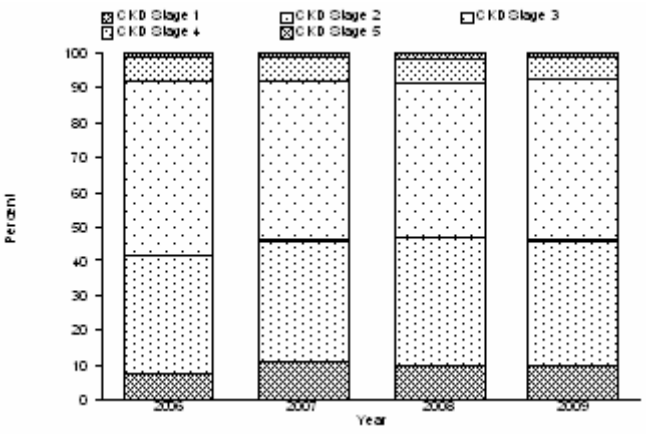


Table 13.6.3 shows the CKD Stage classification by year and in 2009, 46.4% of renal transplant recipients had CKD Stage III whilst another 7% had CKD Stage IV. CKD Stage V (impending renal replacement therapy) was found in 1.1% of renal transplant recipients.

Table 13.6.3: CKD stages, 2006-2009

Year	2006		2007		2008		2009	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
CKD stage 1	116	(7.33)	180	(10.78)	164	(9.81)	165	(9.94)
CKD stage 2	535	(33.80)	593	(35.51)	626	(37.44)	601	(36.20)
CKD stage 3	802	(50.66)	761	(45.57)	738	(44.14)	770	(46.39)
CKD stage 4	108	(6.82)	113	(6.77)	118	(7.06)	106	(6.39)
CKD stage 5	22	(1.39)	23	(1.38)	26	(1.56)	18	(1.08)

Figure 13.6.3: CKD stages by year

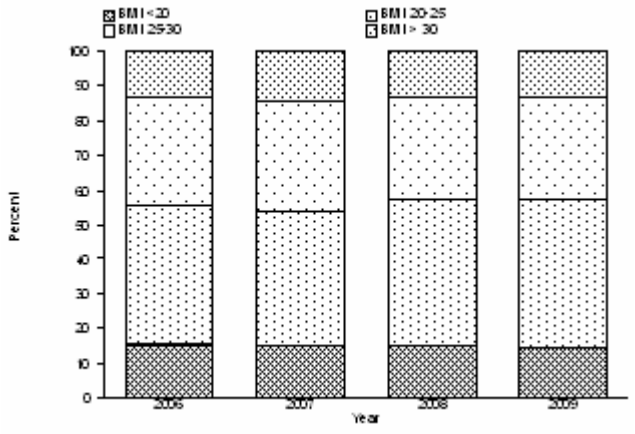


In terms of BMI for 2009, 57% of renal transplant recipients had BMIs of 25 or below. However 29% were overweight and another 13.3% were obese. There seems to be a slow but steady increase in numbers of obese patients over the last few years.

Table 13.6.4: BMI, 2006-2009

Year	2006		2007		2008		2009	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
BMI <20	242	(15.20)	254	(15.05)	251	(14.79)	243	(14.36)
BMI 20-25	648	(40.70)	659	(39.04)	724	(42.66)	726	(42.91)
BMI 25-30	496	(31.16)	532	(31.52)	502	(29.58)	498	(29.43)
BMI > 30	206	(12.94)	243	(14.40)	220	(12.96)	225	(13.30)

Figure 13.6.4: BMI by year

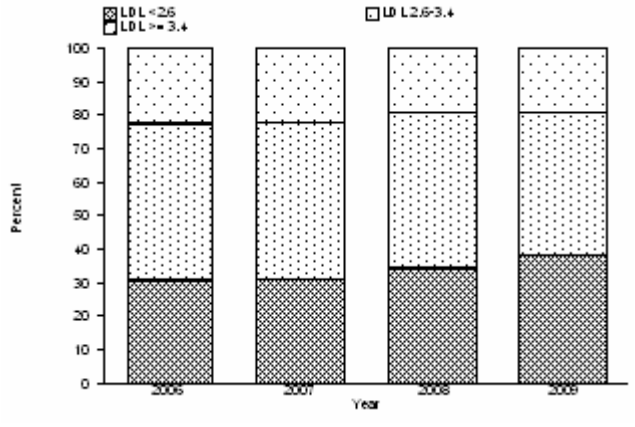


LDL cholesterol has been identified as the primary lipid target for prevention of coronary heart disease by NCEP with a log linear relationship between risk of CHD and level of LDL cholesterol. In terms of renal transplant recipients in 2009 38% have LDL levels below 2.6 mol/l and this shows an increasing trend from 18.1% in 2004, possibly due to the more widespread and aggressive use of statins. Whether or not this translates into less cardiovascular mortality in the transplant population is still questionable. Patients with serum LDL >3.4 also demonstrated downward trend over the last few years.

Table 13.6.5(a): LDL, 2006-2009

Year	2006		2007		2008		2009	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
LDL < 2.6	492	(30.90)	528	(31.28)	585	(34.47)	646	(38.18)
LDL 2.6-3.4	738	(46.36)	779	(46.15)	779	(45.90)	714	(42.20)
LDL >= 3.4	362	(22.74)	381	(22.57)	333	(19.62)	332	(19.62)

Figure 13.6.5(a): LDL, 2006-2009



In terms of other cholesterol parameters for 2009, 56% had total cholesterol levels >= 5.2 and 9% had HDL cholesterol levels <1.0.

Table 13.6.5(b): Total Cholesterol, 2006-2009

Year	2006		2007		2008		2009	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Total Cholesterol <4.1	160	(10.05)	210	(12.44)	208	(12.26)	233	(13.77)
Total Cholesterol 4.1-5.1	490	(30.78)	539	(31.93)	529	(31.17)	506	(29.91)
Total Cholesterol 5.1-6.2	700	(43.97)	721	(42.71)	728	(42.90)	720	(42.55)
Total Cholesterol 6.2- 7.2	173	(10.87)	159	(9.42)	160	(9.43)	159	(9.40)
Total Cholesterol > 7.2	69	(4.33)	59	(3.50)	72	(4.24)	74	(4.37)

Figure 13.6.5(b): Total Cholesterol, 2006-2009

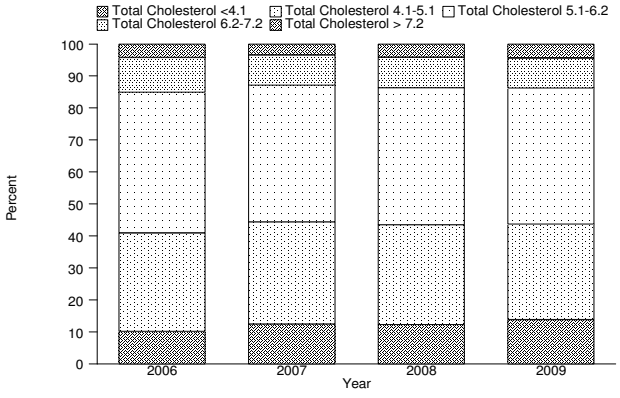


Figure 13.6.5(c): HDL by year

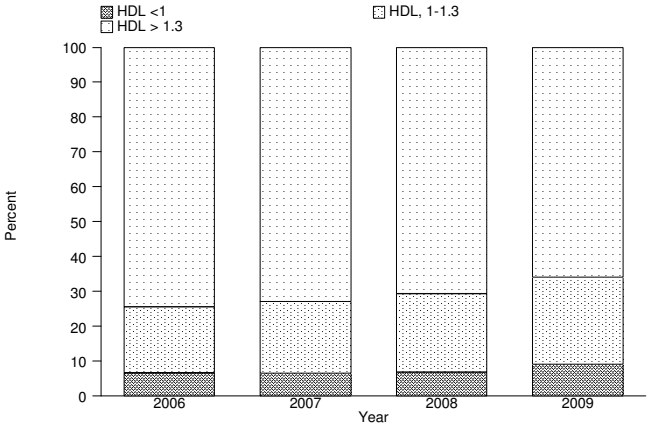


Table 13.6.5(c): HDL, 2006-2009

Year	2006		2007		2008		2009	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
HDL <1	104	(6.53)	108	(6.40)	114	(6.72)	153	(9.04)
HDL 1-1.3	302	(18.97)	350	(20.73)	382	(22.51)	421	(24.88)
HDL >1.3	1186	(74.50)	1230	(72.87)	1201	(70.77)	1118	(66.08)

Eighty-one percent of patients in 2009 were on antihypertensives and the majority were on more than 1 antihypertensive drug with 29% on 2 antihypertensives and 17% on 3 antihypertensives. Five percent of patients still had systolic BP of > 160 mmHg and 16% had diastolic BP of > 90 mmHg despite being given antihypertensive(s), however, this is an improvement from previous years.

Table 13.6.6(a): Treatment for hypertension, 2006-2009

Year	No.	% on anti-hypertensives	% on 1 anti-hypertensive drug	% on 2 anti-hypertensives	% on 3 anti-hypertensives
2006	1592	86	34	26	17
2007	1688	85	25	31	21
2008	1697	78	25	28	19
2009	1692	81	29	29	17

Table 13.6.6(b): Distribution of Systolic BP without anti-hypertensives, 2006-2009

Year	No.	Mean	SD	Median	LQ	UQ	% Patients ≥ 60mmHg
2006	189	123.8	14.4	120	117	130	4
2007	196	125.2	16.5	120	113	134	4
2008	178	123.7	15.5	120	110	130	3
2009	229	124	15.3	120	111	130	3

Table 13.6.6(c): Distribution of Diastolic BP without anti-hypertensives, 2006-2009

Year	No.	Mean	SD	Median	LQ	UQ	% patients ≥ 90mmHg
2006	189	76.4	10.3	80	70	80	11
2007	196	76.6	10.0	80	70	80	12
2008	177	75.1	10.0	80	70	80	10
2009	229	77.4	9.1	80	70	80	12

Table 13.6.6(d): Distribution of Systolic BP on anti-hypertensives, 2006-2009

Year	No.	Mean	SD	Median	LQ	UQ	% Patients ≥ 160mmHg
2006	1334	131.7	16.3	130	120	140	8
2007	1389	132.6	16.0	130	120	140	8
2008	1269	129.9	16.6	130	120	140	6
2009	1221	131.0	15.9	130	120	140	5

Table 13.6.6(e): Distribution of Diastolic BP on anti-hypertensives, 2006-2009

Year	No.	Mean	SD	Median	LQ	UQ	% Patients ≥ 90 mmHg
2006	1334	79.2	9.9	80	70	86	22
2007	1388	79.1	9.6	80	70	85	20
2008	1255	77.6	10	80	70	80	16
2009	1219	78.3	9.5	80	70	82	16

SECTION 13.7: QOL INDEX SCORE IN RENAL TRANSPLANT RECIPIENTS

1231 patients who were transplanted between 2000-2009 were analysed for QoL index score. They reported median QoL index score of 10 (Table 13.7.1 and Figure 13.7.1). It was interesting to note that for those who underwent renal transplantation between this period, diabetics and non-diabetics had the same median QoL index score of 10 (Table 13.7.2 and Figure 13.7.2), and this is in contrast to HD and CAPD patients where diabetics reported lower QoL index score than non-diabetics. There was also no difference seen between gender (Table 13.7.3 and Figure 13.7.3) and age (Table 13.7.4 and Figure 13.7.4). It is worth while to note that those above 60 year-old also enjoyed the same QoL index score (10) as their younger counterpart (Table 13.7.4 and Figure 13.7.4). This trend of high QoL index score among renal transplant patients was maintained over the last 10 years (Table 13.7.5 and Figure 13.7.5).

Table 13.7.1: Cumulative distribution of QoL-Index score in relation to Dialysis Modality, Transplant recipient patients 2000- 2009

Dialysis modality	QoL score
Number of patients	1231
Centile	
0	0
0.05	9
0.1	9
0.25 (LQ)	10
0.5 (median)	10
0.75 (UQ)	10
0.9	10
0.95	10
1	10

Figure 13.7.1: Cumulative distribution of QoL-Index score in relation to Dialysis Modality, Transplant recipient patients 2000 - 2009

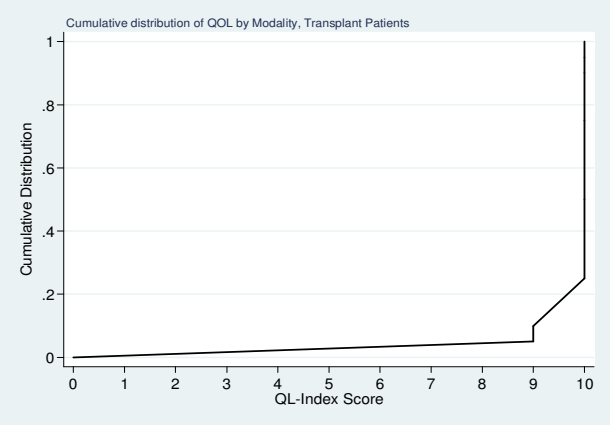


Figure 13.7.2: Cumulative distribution of QoL-Index score in relation to Diabetes mellitus, Transplant recipient patients 2000 – 2009

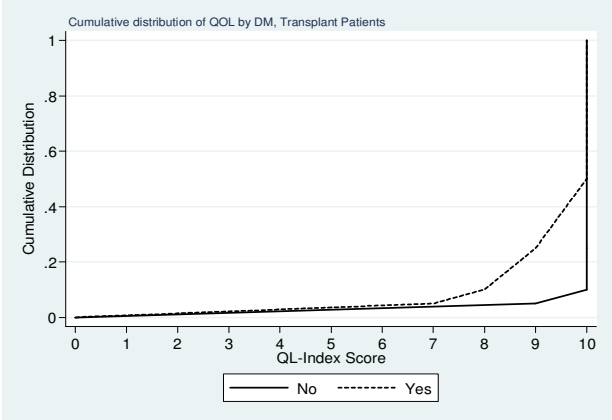


Table 13.7.2: Cumulative distribution of QoL-Index score in relation to Diabetes mellitus, Transplant recipient patients 2000 - 2009

Diabetes mellitus	No	Yes
Number of patients	1166	65
Centile		
0	0	0
0.05	9	7
0.1	10	8
0.25 (LQ)	10	9
0.5 (median)	10	10
0.75 (UQ)	10	10
0.9	10	10
0.95	10	10
1	10	10

Table 13.7.3: Cumulative distribution of QoL-Index score in relation to Gender, Transplant recipient patients 2000 - 2009

Gender	Male	Female
Number of patients	767	464
Centile		
0	0	0
0.05	9	8
0.1	9	9
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 13.7.3: Cumulative distribution of QoL-Index score in relation to Gender, Transplant recipient patients 2000 - 2009

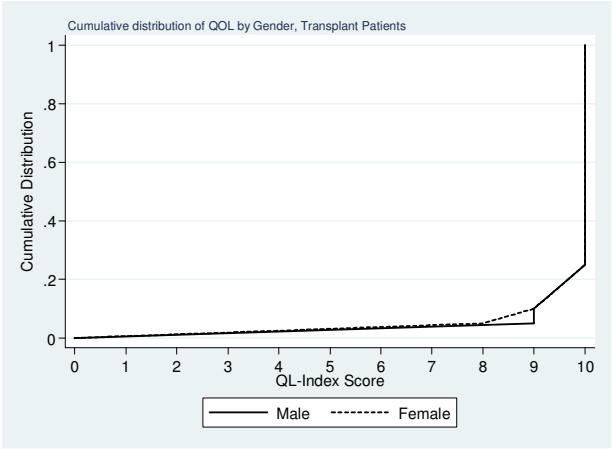


Figure 13.7.4: Cumulative distribution of QoL-Index score in relation to Age, Transplant recipient patients 2000 - 2009

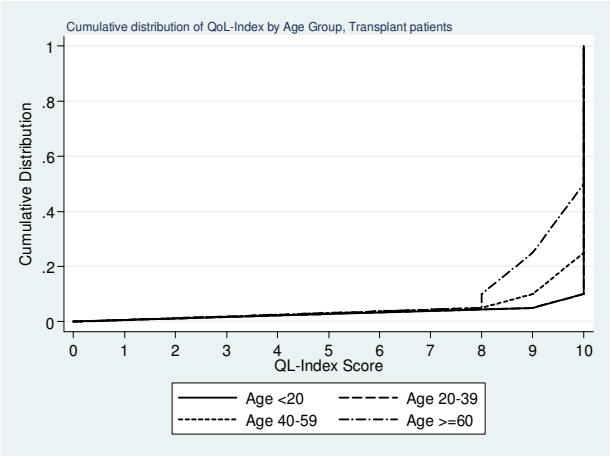


Table 13.7.4: Cumulative distribution of QoL-Index score in relation to Age, Transplant recipient patients 2000-2009

Age group (years)	<20	20-39	40-59	>=60
Number of patients	129	481	541	80
Centile				
0	0	0	0	0
0.05	9	9	8	8
0.1	10	10	9	8
0.25 (LQ)	10	10	10	9
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

Table 13.7.5: Cumulative distribution of QoL-Index score in relation to Year of entry, Transplant recipient patients 2000 - 2009

Year of Entry	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Number of patients	110	126	144	136	167	145	133	91	99	80
Centile										
0	0	0	0	0	0	0	0	0	0	0
0.05	8	9	9	8	9	9	9	8	7	8
0.1	9	9	10	9	10	10	10	9	9	9
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

Figure 13.7.5: Cumulative distribution of QoL-Index score in relation to Year of entry, Transplant recipient patients 2000 - 2009