

CHAPTER 13

RENAL TRANSPLANTATION

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13.1. STOCK AND FLOW

New renal transplant patients showed a modest increase from 151 transplants per year in 1996 to 185 per year in 2004. By 2005, the number of functioning renal transplants has increased to 1657 (Table 13.1.1).

Table 13.1.1: Stock and Flow of Renal Transplantation, 1996-2005

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
New transplant patients	151	126	104	127	143	161	168	158	185	133
Died	31	29	23	25	27	35	31	36	37	37
Graft failure	28	38	48	36	32	40	38	41	44	14
Lost to follow up	1	0	2	4	10	2	7	9	20	5
Functioning graft at 31st December	1024	1083	1114	1176	1250	1334	1426	1498	1582	1659

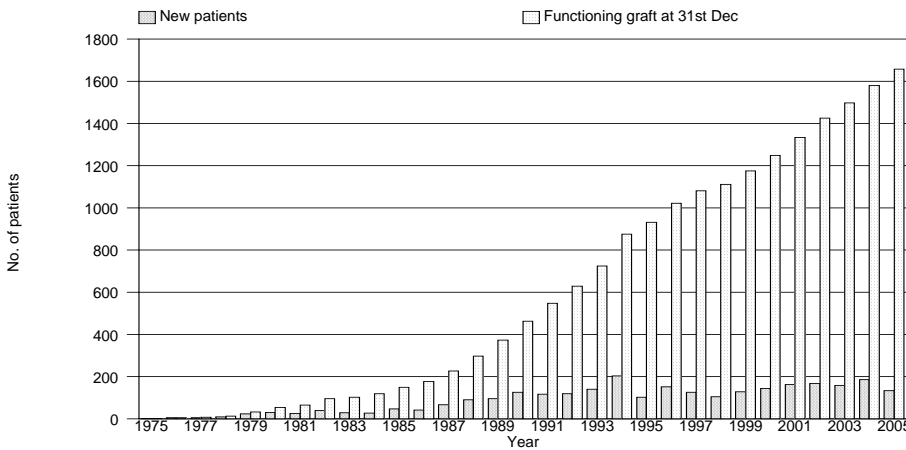


Figure 13.1.1: Stock and Flow of Renal Transplantation, 1975-2005

Incident rate for renal transplantation stabilised at a modest rate of 5-7 per million population (pmp) for the last decade (Table 13.1.2), while the transplant prevalence rate maintained at 48 -63 per million population for the last 10 years (Table 13.1.3).

Table 13.1.2: New transplant rate per million population (pmp), 1996-2005

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
New transplant patients	151	126	104	127	143	161	168	158	185	133
New transplant rate, pmp	7	6	5	6	6	7	7	6	7	5

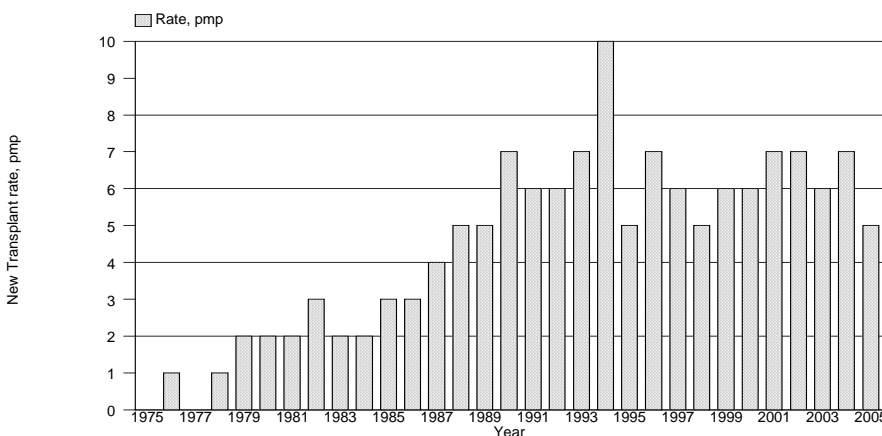
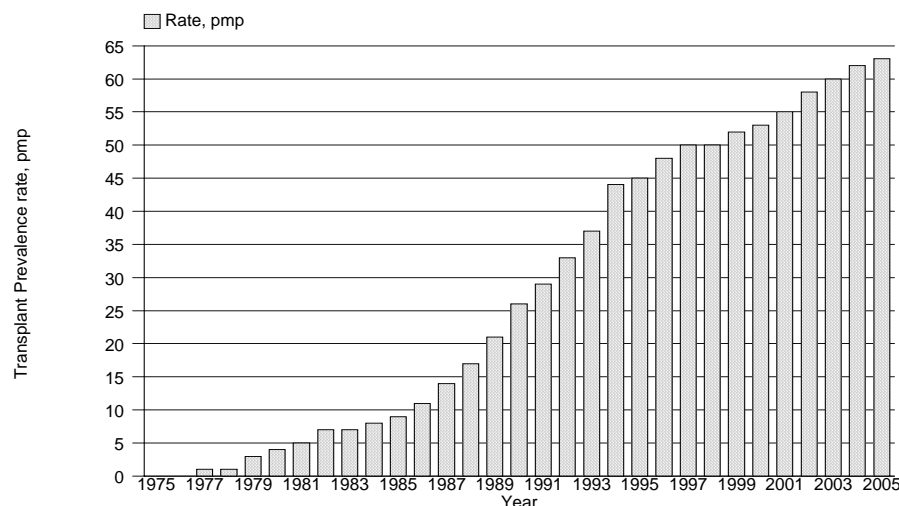


Figure 13.1.2: New transplant rate, 1975-2005

Table 13.1.3: Transplant prevalence rate per million population (pmp), 1996-2005

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Functioning graft at 31st December	1024	1083	1114	1176	1250	1334	1426	1498	1582	1659
Transplant prevalence rate, pmp	48	50	50	52	53	55	58	60	62	63

Figure 13.1.3: Transplant prevalence rate, 1975-2005



13.2. RECIPIENTS' CHARACTERISTICS

The mean age for new transplant recipients was between 36±6 years to 42±13 years over the last 10 years (Table 13.2.1). Men was still in the majority among renal transplant recipients and they made up 71% of all recipients in the year 2005. Over the last 10 years, the proportion of diabetic transplant recipients has increased, from 9% in 1996 to more than 20% for the last 3 years.

In 2005, 4% were HbsAg positive and 3% had anti-HCV antibodies at the time of transplantation. The proportion of HbsAg positivity had reduced from 10-20% in the period 1985-1994 to 5-10% for the last 10 years while the number of recipients with anti-HCV antibodies at the time of transplantation had also reduced from 20-30% in the early 1990's to 8-15% for the last 8 years since the screening test was introduced in 1989. For those transplanted prior to the screening test, anti-HCV antibodies were found in 40-60%.

Table 13.2.1: Renal Transplant Recipients' Characteristics, 1996-2005

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
New Transplant Patients	151	126	104	127	143	161	168	158	185	133
Age at transplant (years), Mean	39	36	37	37	40	41	41	42	41	39
Age at transplant (years), SD	11	12	11	13	13	13	13	13	13	14
% Male	57	63	59	61	64	63	57	66	62	71
% Diabetic (co-morbid/ primary renal disease)	9	11	9	10	14	19	15	22	21	20
% HBsAg positive	13	6	6	4	5	4	7	8	6	4
% Anti-HCV positive	20	7	18	11	8	15	9	10	8	3

Chronic glomerulonephritis was the primary cause of ESRF in 25-34% for the last 5 years (Table 13.2.2). As expected, patients with diabetes mellitus had become increasingly frequent renal transplant recipients, from 7% in 1996 to 18% in 2005. The majority of renal transplant recipients still presented late with unknown primary renal disease, contributing to 29-50% of all the recipients for the last decade.

Table 13.2.2: Primary causes of end stage renal failure, 1996-2005

Year	1996		1997		1998		1999		2000		2001		2002		2003		2004		2005	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
New transplant patients	151	100	126	100	104	100	127	100	143	100	161	100	168	100	158	100	185	100	133	100
Glomerulonephritis	47	31	29	23	28	27	41	32	49	34	41	25	53	32	53	34	62	34	37	28
Diabetes Mellitus	10	7	9	7	5	5	10	8	16	11	23	14	16	10	26	16	31	17	24	18
Hypertension	7	5	4	3	5	5	7	6	18	13	17	11	24	14	26	16	50	27	34	26
Obstructive uropathy	2	1	3	2	4	4	4	3	3	2	3	2	2	1	2	1	3	2	2	2
ADPKD	4	3	2	2	1	1	1	1	3	2	1	1	3	2	5	3	4	2	3	2
Drugs/toxic nephropathy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	1	0	0
Hereditary nephritis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
Unknown	76	50	64	51	55	53	62	49	54	38	61	38	68	40	57	36	80	43	38	29
Others	11	7	18	14	10	10	6	5	12	8	22	14	15	9	12	8	27	15	13	10

13.3. TRANSPLANT PRACTICES

In 2005, commercial transplants from China constituted 69% of all new renal transplantation, while live donor transplantation made up 26% and local cadaveric transplants contributed only 3% of all new renal transplantation (Table 13.3.1).

Table 13.3.1: Type of Renal Transplantation, 1996-2005

Year	1996		1997		1998		1999		2000		2001		2002		2003		2004		2005	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Commercial Cadaver	106	72	80	66	51	52	61	51	79	55	82	51	102	61	109	69	136	75	87	69
Commercial Live Donor	4	3	7	6	4	4	4	3	10	7	6	4	11	7	3	2	5	3	3	2
Live Donor (genetically related)	36	24	27	22	27	27	40	33	21	15	32	20	30	18	25	16	21	12	30	24
Live Donor (emotionally related)	0	0	0	0	2	2	5	4	6	4	4	2	3	2	5	3	2	1	3	2
Cadaver	2	1	8	7	15	15	10	8	27	19	37	23	22	13	15	10	17	9	4	3
Total	148	100	122	100	99	100	120	100	143	100	161	100	168	100	157	100	181	100	127	100

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

Table13.3.2: Biochemical data and Vital signs, 2004-2005

Biochemical parameters	Summary	2004	2005	Biochemical parameters	Summary	2004	2005
Creatinine, umol/L	N	1557	1623	Total cholesterol, mmol/L	N	1557	1623
	Mean	132	133.7		Mean	5.5	5.4
	SD	63.6	65.4		SD	1.1	1
	Median	120	120		Median	5.4	5.4
	Minimum	38	35		Minimum	2.6	2.1
	Maximum	817	763		Maximum	20	13.1
Hb, g/dL	N	1557	1623	LDL cholesterol, mmol/L	N	1557	1623
	Mean	12.9	12.9		Mean	3.1	3
	SD	1.9	1.9		SD	0.7	0.8
	Median	12.9	12.9		Median	3.1	3.1
	Minimum	4.9	5.5		Minimum	1	0.9
	Maximum	19.7	20.6		Maximum	8.5	9.2
Albumin, g/L	N	1557	1623	HDL cholesterol, mmol/L	N	1557	1623
	Mean	39.3	39.3		Mean	1.6	1.6
	SD	1	0.5		SD	0.4	0.5
	Median	39.3	39.3		Median	1.6	1.6
	Minimum	22	34		Minimum	0.2	0.2
	Maximum	50	46		Maximum	4.3	5.6
Calcium, mmol/L	N	1557	1623	Systolic Blood Pressure, mmHg	N	1557	1623
	Mean	2.4	2.3		Mean	132.3	133.4
	SD	0.2	0.2		SD	15.9	17
	Median	2.3	2.3		Median	130	130
	Minimum	1.1	1.2		Minimum	80	56
	Maximum	3.3	3.3		Maximum	200	220
Phosphate, mmol/L	N	1557	1623	Diastolic Blood Pressure, mmHg	N	1557	1623
	Mean	1.1	1.1		Mean	80.4	80.6
	SD	0.2	0.2		SD	9.6	9.2
	Median	1.1	1.1		Median	80	80
	Minimum	0.3	0.3		Minimum	40	45.7
	Maximum	2.7	3.3		Maximum	121	127
Alkaline Phosphate (ALP), U/L	N	1557	1623	Weight (kg)	N	1557	1623
	Mean	79.4	78.6		Mean	64.3	64.5
	SD	46.4	43.7		SD	13.5	14.2
	Median	73	73		Median	64.4	64.4
	Minimum	8	18		Minimum	15.1	18.4
	Maximum	994	831		Maximum	116	130
ALT, U/L	N	1557	1623				
	Mean	31.4	30.7				
	SD	32.6	29.9				
	Median	25	24				
	Minimum	4	4				
	Maximum	563	613				

Cyclosporine/prednisolone based triple therapy has remained the backbone of maintenance immunosuppressive therapy. In year 2004-2005, 78% of renal transplant recipients were on Cyclosporine while 97% were on prednisolone. Only 14% were on tacrolimus. However, 41% of the recipients were on MMF as opposed to 40% on azathioprine

Table 13.3.3: Medication data, 2004-2005

Medication data	Single drug treatment		Drug treatment	
	No.	%	No.	%
All patients	3180	100	3180	100
(i) Immunosuppressive drug(s)				
Prednisolone	27	1	3082	97
Azathioprine	1	0	1260	40
Cyclosporin A	9	0	2493	78
Tacrolimus (FK506)	0	0	435	14
Mycophenolate Mofetil (MMF)	1	0	1290	41
Rapamycin	0	0	14	0
Others	1	0	26	1
(ii) Non-Immunosuppressive drug(s)				
Beta blocker	222	7	1380	43
Calcium channel blocker	400	13	1704	54
ACE inhibitor	100	3	637	20
AIIRB	34	1	260	8
Anti-lipid	145	5	1234	39
Other anti-hypertensive	11	0	317	10

13.4. TRANSPLANT OUTCOMES

13.4.1 Post-transplant complications

64% of the recipients had hypertension as a co-morbidity before transplantation while another 26% developed hypertension post transplantation (Table 13.4.1). Among these patients, only 29% were on monotherapy while the rest were on multiple drug treatment. For those on combination therapy, majority was on calcium channel blockers (54%) and beta blockers (43%). Only 20% were on ACE inhibitors while another 8% were on angiotensin II receptor blockers (AIIRB).

It is also interesting to note while 13% of the prevalent renal transplant recipients had diabetes mellitus before transplantation (either as primary renal disease or co-morbidity), another 8% of them developed diabetes mellitus post transplantation (PTDM).

Table 13.4.1: Post transplant complications, 2004-2005

Post transplant complications	Complication developed before transplant (regardless of complication after transplantation)		Complication developed only after transplantation	
	No.	%	No.	%
All patients	3180	100	3180	100
Diabetes (either as Primary Renal Disease or co-morbid)	401	13	252	8
Cancer	5	0	36	1
Cardiovascular disease + cerebrovascular disorder	161	5	128	4
Hypertension	2047	64	832	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 losses

In 2004, 37 (2%) of transplant recipients died and 44 (3%) lost their grafts. These rates of transplant death and graft loss have remained constant for the last 10 years (Table 13.4.2). Infection, cardiovascular disease and death at home were among the commonest causes of death for the last decade and in 2004; they accounted for 25%, 10% and 15% of the causes of death respectively (Table 13.4.3). However, death secondary to cancer has become more common over the last 5 years and in 2004, cancer death accounted for 18% of all causes of death. Renal allograft rejection accounted for 50-60% of graft loss for the last 10 years (Table 13.4.4).

Table 13.4.2: Transplant Patients Death Rate and Graft Loss, 1996-2005

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
No. at risk	977	1052	1097	1143	1211	1290	1378	1460	1538	1619
Transplant death	31	29	23	25	27	35	31	36	37	37
Transplant death rate %	3	3	2	2	2	3	2	2	2	2
Graft loss	28	38	48	36	32	40	38	41	44	14
Graft loss rate %	3	4	4	3	3	3	3	3	3	1
Acute rejection	0	0	0	0	0	0	0	3	18	13
Acute rejection rate %	0	0	0	0	0	0	0	0	1	1
All losses	59	67	71	61	59	75	69	80	99	64
All losses rate %	6	6	6	5	5	6	5	5	6	4

* Graft loss=graft failure

* All losses=death/graft loss (Acute rejection happened concurrently with graft failure/ death)

Figure 13.4.2(a): Transplant Recipient Death Rate, 1975-2005

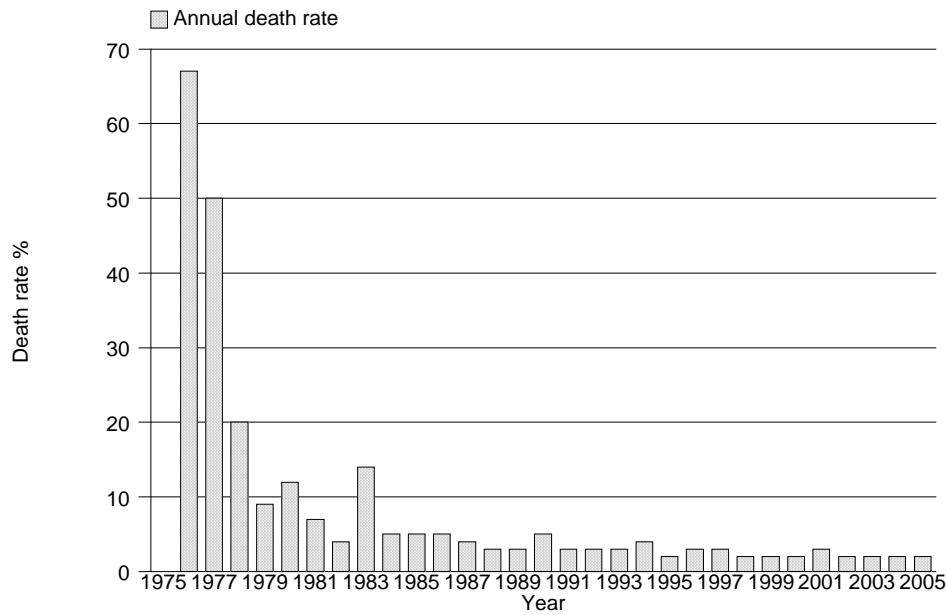


Figure 13.4.2(b): Transplant Recipient Graft Loss Rate, 1975-2005

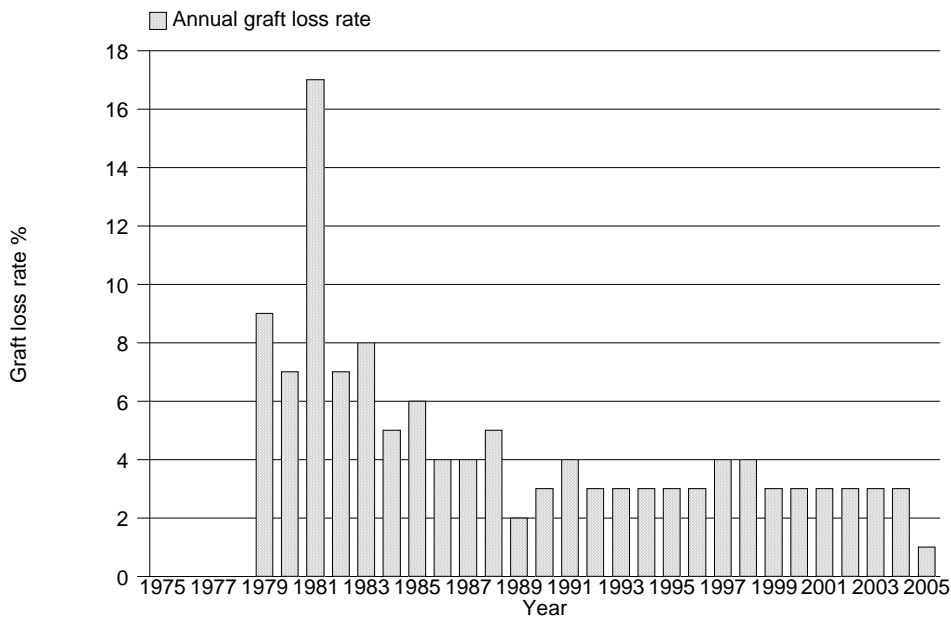


Table 13.4.3: Causes of Death in Transplant Recipients, 1996-2005

Year	1996		1997		1998		1999		2000		2001		2002		2003		2004		2005	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Cardiovascular	4	13	3	10	3	13	4	13	10	32	6	15	5	16	9	23	4	10	4	11
Died at home	3	9	2	7	4	17	6	19	1	3	5	12	5	16	5	13	6	15	4	11
Infection	18	56	14	48	9	38	7	23	11	35	19	46	9	29	10	26	10	25	20	54
Graft failure	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cancer	2	6	0	0	3	13	3	10	2	6	6	15	4	13	6	15	7	18	2	5
Liver disease	3	9	2	7	2	8	3	10	1	3	1	2	3	10	2	5	3	8	2	5
Accidental death	0	0	0	0	0	0	1	3	1	3	1	2	1	3	0	0	0	0	0	0
Others	1	3	4	14	0	0	5	16	3	10	2	5	2	6	5	13	9	23	3	8
Unknown	1	3	4	14	3	13	2	6	2	6	1	2	2	6	2	5	1	3	2	5
TOTAL	32	100	29	100	24	100	31	100	31	100	41	100	31	100	39	100	40	100	37	100

Table 13.4.4: Causes of Graft Failure, 1996-2005

Year	1996		1997		1998		1999		2000		2001		2002		2003		2004		2005	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Rejection	14	50	21	54	27	52	23	64	19	59	25	61	22	55	22	50	33	70	14	78
Calcineurin toxicity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other drug toxicity	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0
Ureteric obstruction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Infection	0	0	0	0	1	2	0	0	1	3	2	5	0	0	2	5	1	2	1	6
Vascular causes	1	4	4	10	3	6	1	3	3	9	1	2	0	0	3	7	4	9	1	6
Recurrent/ de novo renal disease	2	7	1	3	1	2	0	0	0	0	2	5	2	5	1	2	1	2	0	0
Others	0	0	5	13	5	10	0	0	2	6	0	0	4	10	1	2	0	0	1	6
Unknown	11	39	7	18	15	29	12	33	7	22	11	27	12	30	15	34	7	15	1	6
TOTAL	28	100	39	100	52	100	36	100	32	100	41	100	40	100	44	100	47	100	18	102

13.5. Patient and Graft Survival

The overall transplant patient survival rate from 1993 to 2005 was 95%, 92%, 88% and 81% at 1 year, 3 years, 5 years and 10 years respectively, while the overall graft survival rate was 92%, 85%, 79% and 63% respectively.

Table 13.5.1: Patient survival, 1993-2005

Interval (years)	No.	% survival	SE
1	1616	95	1
3	1208	92	1
5	848	88	1
10	257	81	1
12	72	75	2

* No.=Number at risk SE=standard error

Figure 13.5.1: Patient survival, 1993-2005

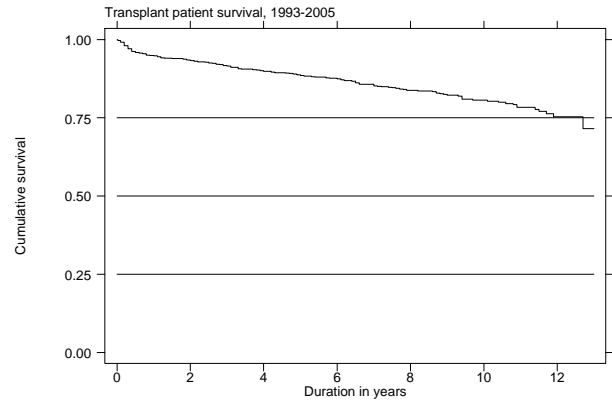
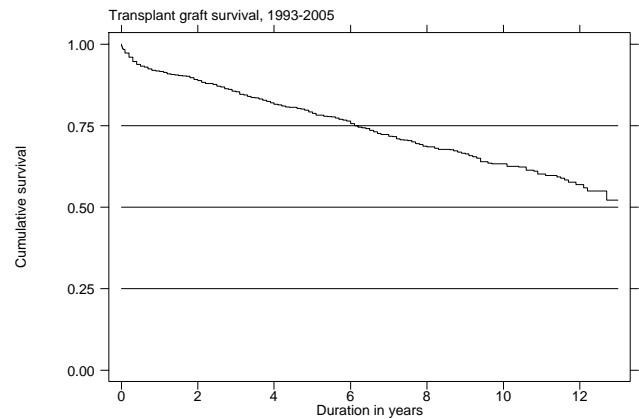


Table 13.5.2: Graft survival, 1993-2005

Interval (years)	No.	% survival	SE
1	1616	92	1
3	1208	85	1
5	848	79	1
10	257	63	2
12	72	57	2

* No.=Number at risk SE=standard error

Figure 13.5.2: Graft survival, 1993-2005



Outcomes of renal transplantation from the four donor groups are shown in Figures 13.5.3 and 13.5.4 and demonstrate substantially different patient & graft survival rates. Living donor grafts maintained the best patient and graft survival rates. The 1, 3, 5 and 10 year patient survival rate for recipients of living donor grafts were 96%, 95%, 94% and 89% respectively. The graft survival rates also differed between these 4 groups; living and commercial cadaver donor graft had the best outcomes.

Table 13.5.3: Patient survival by type of transplant, 1993-2005

Type of Transplant Interval (years)	Commercial Cadaver			Commercial Live Donor			Live Donor			Cadaver		
	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE
1	822	96	1	279	96	1	362	96	1	121	83	3
3	562	93	1	239	91	2	298	95	1	88	79	3
5	360	89	1	201	87	2	219	94	1	50	75	4
10	53	85	2	125	73	3	74	89	2	3	69	6
12	9	85	2	39	66	4	22	89	2	2	34	25

* No.=Number at risk SE=standard error

Figure 13.5.3: Patient survival by type of transplant, 1993-2005

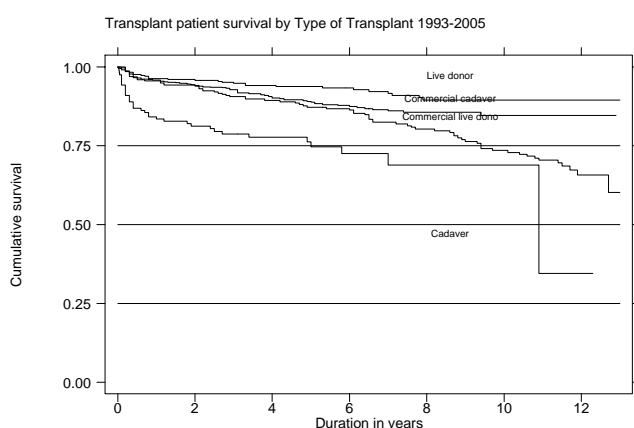


Figure 13.5.4: Graft survival by type of transplant, 1993-2005

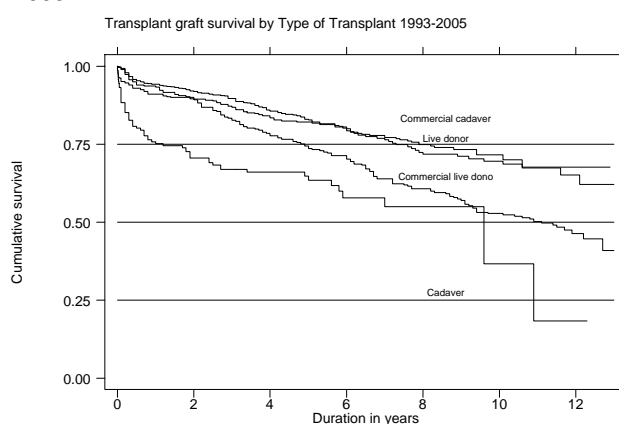


Table 13.5.4: Graft survival by type of transplant, 1993-2005

Type of Transplant Interval (years)	Commercial Cadaver			Commercial Live Donor			Live Donor			Cadaver		
	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE
1	822	94	1	279	93	1	362	91	1	121	75	3
3	562	90	1	239	83	2	298	87	2	88	67	4
5	360	83	1	201	74	3	219	82	2	50	63	4
10	53	72	2	125	53	3	74	70	3	3	37	15
12	9	68	4	39	46	3	22	65	4	2	18	15

* No.=Number at risk SE=standard error

We compare the patient and graft survival rates for 1993-1998 cohort and 1999-2005 cohort. We found that patient survival rate for living related donor renal transplants has remained excellent and unchanged for these two cohorts (Figure 13.5.5)

Table 13.5.5: Patient survival by year of transplant (Living related transplant, 1993-2005)

Year of Transplant Interval (years)	1993-1998			1999-2005		
	No.	% Survival	SE	No.	% Survival	SE
1	181	97	1	182	96	1
3	168	95	2	131	94	2
5	158	93	2	62	94	2
7	146	91	2	1	94	2

* No.=Number at risk SE=standard error

Figure 13.5.5: Patient survival by year of transplant (Living related transplant, 1993-2005)

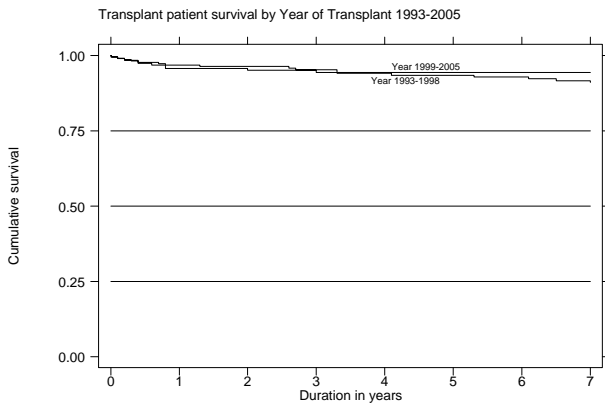
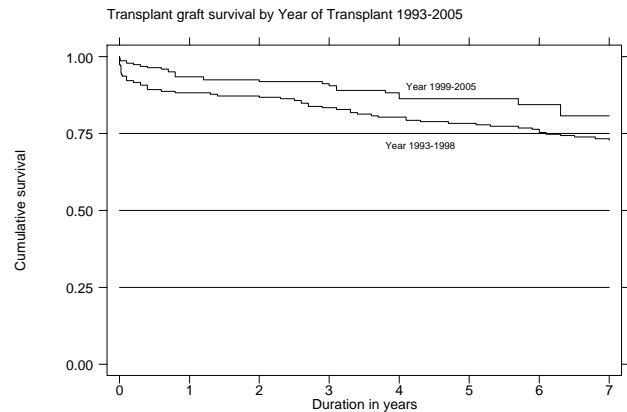


Figure 13.5.6: Graft survival by year of transplant (Living related transplant, 1993-2005)



Interestingly, the risk of graft failure for living related donor renal transplantation improved for the 1999-2004 cohort compared to the 1993-1998 cohort (Table & Figure 13.5.6). One possible explanation, among others, is the increasing use of newer immunosuppressive agents such as MMF and FK506 in recent years.

Table 13.5.6: Graft survival by year of transplant (Living related transplant, 1993-2005)

Year of Transplant Interval (years)	1993-1998			1999-2005		
	No.	% Survival	SE	No.	% Survival	SE
1	181	88	2	182	93	2
3	168	83	3	131	90	2
5	158	78	3	62	86	3
7	146	73	3	1	81	5

* No.=Number at risk SE=standard error

Interestingly, our data showed that commercial cadaveric transplants have excellent patient and graft survival rates, which are comparable to living related donor transplants for both 1993-1998 and 1999-2004 cohorts (Figure 13.5.7 and 13.5.8).

Table 13.5.7: Patient survival by year of transplant (Commercial cadaver transplant, 1993-2005)

Year of Transplant Interval (years)	1993-1998			1999-2005		
	No.	% Survival	SE	No.	% Survival	SE
1	287	94	1	536	96	1
3	274	92	2	288	93	1
5	247	87	2	113	90	2
7	225	84	2	-	-	-

* No.=Number at risk SE=standard error

Figure 13.5.7: Patient survival by year of transplant (Commercial cadaver transplant, 1993-2005)

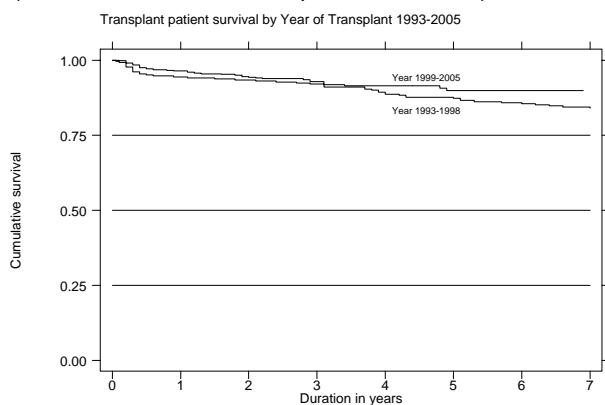


Figure 13.5.8: Graft survival by year of transplant (Commercial cadaver transplant, 1993-2005)

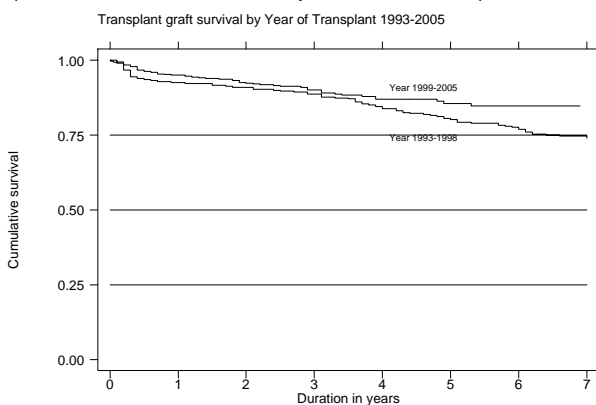


Table 13.5.8: Graft survival by year of transplant (Commercial cadaver transplant, 1993-2005)

Year of Transplant Interval (years)	1993-1998			1999-2005		
	No.	% Survival	SE	No.	% Survival	SE
1	287	93	1	536	95	1
3	274	89	2	288	90	1
5	247	80	2	113	86	2
7	225	74	3	-	-	-

* No.=Number at risk SE=standard error