

# **CHAPTER 13**

## **Renal Transplantation**

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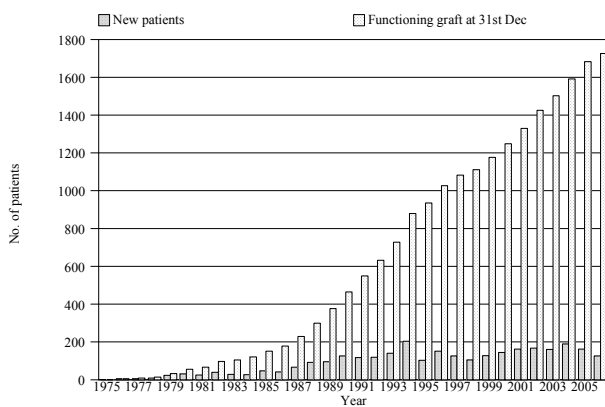
**13.1 STOCK AND FLOW**

New renal transplant patients showed a modest increase from 126 transplants per year in 1997 to 161 per year in 2005. By end of 2006, the number of functioning renal transplants reported to NRR has increased to 1725 (Table 13.1.1).

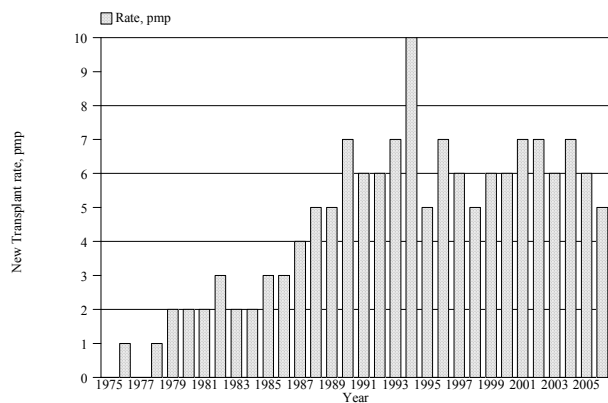
**Table 13.1.1:** Stock and Flow of Renal Transplantation, 1997-2006

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
New transplant patients	126	104	127	143	161	168	160	189	161	126
Died	31	26	25	30	37	32	37	41	41	49
Graft failure	38	49	36	32	40	38	41	44	20	30
Lost to follow up	0	1	1	9	2	3	5	16	7	5
Functioning graft at 31st December	1083	1111	1176	1248	1330	1425	1502	1590	1683	1725

**Figure 13.1.1:** Stock and Flow of Renal Transplantation, 1975-2006



**Figure 13.1.2:** New transplant rate, 1975-2006



Incident rate for renal transplantation stabilised at a modest rate of 5-7 per million population for the last decade (Table 13.1.2), while the transplant prevalence rate maintained at 50-65 per million population for the last 10 years (Table 13.1.3).

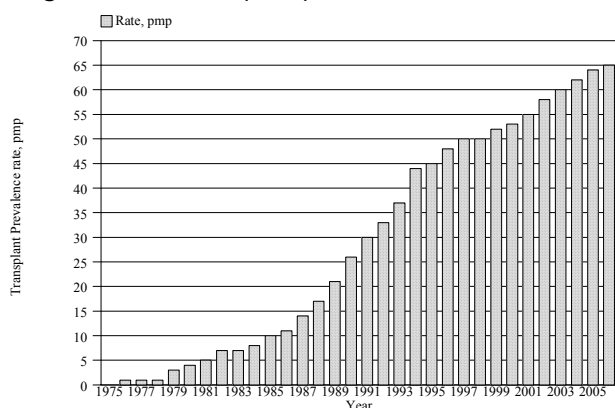
**Table 13.1.2:** New transplant rate per million population (pmp), 1997-2006

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
New transplant patients	126	104	127	143	161	168	160	189	161	126
New transplant rate, pmp	6	5	6	6	7	7	6	7	6	5

**Table 13.1.3:** Transplant prevalence rate per million population (pmp), 1997-2006

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Functioning graft at 31st December	1083	1111	1176	1248	1330	1425	1502	1590	1683	1725
Transplant prevalence rate, pmp	50	50	52	53	55	58	60	62	64	65

**Figure 13.1.3:** Transplant prevalence rate, 1975-2006



**Table 13.1.4:** Place of transplantation, 1997-2006

Year	1997		1998		1999		2000		2001	
	No.	%	No.	%	No.	%	No.	%	No.	%
HKL	29	23	33	32	36	28	28	20	33	20
UMMC	6	5	7	7	16	13	19	13	23	14
Selayang Hospital	0	0	0	0	0	0	4	3	11	7
Other local	0	0	0	0	1	1	3	2	4	2
China	79	63	50	48	62	49	80	56	82	51
India	7	6	7	7	5	4	9	6	7	4
Other overseas	3	2	3	3	2	2	0	0	1	1
Unknown	2	2	4	4	5	4	0	0	0	0
<b>TOTAL</b>	<b>126</b>	<b>100</b>	<b>104</b>	<b>100</b>	<b>127</b>	<b>100</b>	<b>143</b>	<b>100</b>	<b>161</b>	<b>100</b>

Year	2002		2003		2004		2005		2006		TOTAL	
	No.	%	No.	%	No.	No.	%	No.	%	No.	%	
HKL	28	17	26	16	20	11	32	20	34	27	331	20
UMMC	14	8	6	4	7	4	7	4	5	4	117	7
Selayang Hospital	11	7	11	7	11	6	5	3	7	6	60	4
Other local	1	1	1	1	2	1	5	3	2	2	19	1
China	102	61	111	69	136	72	107	66	71	56	985	61
India	12	7	4	3	11	6	5	3	6	5	79	5
Other overseas	0	0	1	1	2	1	0	0	0	0	13	1
Unknown	0	0	0	0	0	0	0	0	1	1	12	1
<b>TOTAL</b>	<b>168</b>	<b>100</b>	<b>160</b>	<b>100</b>	<b>189</b>	<b>100</b>	<b>161</b>	<b>100</b>	<b>126</b>	<b>100</b>	<b>1616</b>	<b>100</b>

**13.2 RECIPIENTS' CHARACTERISTICS****Table 13.2.1:** Renal Transplant Recipients' Characteristics, 1997-2006

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
New Transplant Patients	126	104	127	143	161	168	160	189	161	126
Age at transplant (years), Mean	36	37	37	40	41	41	42	41	38	37
Age at transplant (years), SD	12	11	13	13	13	13	13	13	14	16
% Male	63	58	61	64	63	57	66	62	70	68
% Diabetic (co-morbid / primary renal disease)	11	9	10	15	19	15	22	21	19	21
% HBsAg positive	6	6	4	5	5	7	8	5	4	7
% Anti-HCV positive	7	18	11	8	15	9	10	8	2	7

The mean age for new transplant recipients is between 36+6 years to 42+13 years over the last 10 years (Table 13.2.1). Men are still in the majority among renal transplant recipients and they made up 68% of all recipients in year 2006. Over the last 10 years, the proportion of diabetic transplant recipients has increased, from 11% in 1997 to about 21% in 2006.

In 2006, 7% were HbsAg positive and 7% 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 3-7% for the last 5 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 2-10% for the last 5 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%.

Chronic glomerulonephritis was the primary cause of ESRF in 25-37% 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 1997 to 17% in 2006. Majority of renal transplant recipients still presented late with unknown primary renal disease, contributing to 30-44% of all the recipients for the last 5 years.

**Table 13.2.2:** Primary causes of end stage renal failure, 1997-2006

Year	1997		1998		1999		2000	
	No.	%	No.	%	No.	%	No.	%
New transplant patients	126	100	104	100	127	100	143	100
Glomerulonephritis	30	24	28	27	41	32	49	34
Diabetes Mellitus	9	7	5	5	10	8	16	11
Hypertension	5	4	5	5	7	6	18	13
Obstructive uropathy	3	2	4	4	4	3	3	2
ADPKD	2	2	1	1	1	1	3	2
Drugs/toxic nephropathy	0	0	0	0	0	0	0	0
Hereditary nephritis	0	0	0	0	0	0	0	0
Unknown	63	50	55	53	62	49	54	38
Others	18	14	10	10	6	5	12	8

Year	2001		2002		2003		2004		2005		2006	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
New transplant patients	161	100	168	100	160	100	189	100	161	100	126	100
Glomerulonephritis	42	26	53	32	54	34	62	33	46	29	47	37
Diabetes Mellitus	23	14	16	10	26	16	32	17	27	17	21	17
Hypertension	17	11	24	14	25	16	51	27	38	24	26	21
Obstructive uropathy	3	2	2	1	2	1	4	2	3	2	4	3
ADPKD	1	1	3	2	5	3	4	2	3	2	1	1
Drugs/toxic nephropathy	0	0	0	0	2	1	2	1	0	0	0	0
Hereditary nephritis	0	0	0	0	0	0	1	1	0	0	0	0
Unknown	61	38	68	40	58	36	83	44	48	30	38	30
Others	23	14	15	9	12	8	27	14	18	11	15	12

### 13.3 TRANSPLANT PRACTICES

In 2006, commercial transplants from China constituted 57% of all new renal transplantation (dropped from 65% in 2005). While live donor transplantation made up 21% in 2006, local cadaveric transplants contributed 19% (increased from 6% in 2005) of all new renal transplantation in 2006 (Table 13.3.1).

**Table 13.3.1:** Type of Renal Transplantation, 1997-2006

Year	1997		1998		1999		2000	
	No.	%	No.	%	No.	%	No.	%
Commercial Cadaver	80	66	51	52	62	51	80	56
Commercial Live Donor	7	6	4	4	4	3	9	6
Live Donor (genetically related)	27	22	27	27	40	33	21	15
Live Donor (emotionally related)	0	0	2	2	5	4	6	4
Cadaver	8	7	15	15	10	8	27	19
<b>Total</b>	<b>122</b>	<b>100</b>	<b>99</b>	<b>100</b>	<b>121</b>	<b>100</b>	<b>143</b>	<b>100</b>

Year	2001		2002		2003		2004		2005		2006	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Commercial Cadaver	82	51	102	61	112	70	141	76	104	65	68	57
Commercial Live Donor	6	4	11	7	3	2	5	3	8	5	2	2
Live Donor (genetically related)	32	20	30	18	25	16	21	11	37	23	22	18
Live Donor (emotionally related)	4	2	3	2	5	3	2	1	3	2	4	3
Cadaver	37	23	22	13	15	9	17	9	9	6	23	19
<b>Total</b>	<b>161</b>	<b>100</b>	<b>168</b>	<b>100</b>	<b>160</b>	<b>100</b>	<b>186</b>	<b>100</b>	<b>161</b>	<b>100</b>	<b>119</b>	<b>100</b>

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

**Table 13.3.2:** Biochemical data, 2004-2006

Biochemical parameters	Summary	2004	2005	2006
Creatinine, umol/L	N	1550	1635	1559
	Mean	132	133.7	135.3
	SD	63.8	65.4	80.4
	Median	120	120	119
	Minimum	38	35	13.2
	Maximum	817	763	1152
Hb, g/dL	N	1550	1635	1559
	Mean	12.9	12.8	12.7
	SD	1.9	1.9	1.9
	Median	12.9	12.9	12.8
	Minimum	4.9	5.5	3.3
	Maximum	19.7	19	19.8
Albumin, g/L	N	1550	1635	1559
	Mean	39.4	39.5	39.5
	SD	1	0.5	0.7
	Median	39.4	39.4	39.4
	Minimum	22	34	29
	Maximum	50	46	48
Calcium, mmol/L	N	1550	1635	1559
	Mean	2.4	2.3	2.3
	SD	0.2	0.2	0.2
	Median	2.3	2.3	2.3
	Minimum	1.1	1.2	1.1
	Maximum	3.3	3.3	3.1

**Table 13.3.2:** Biochemical data, 2004-2006 (cont'd)

Biochemical parameters	Summary	2004	2005	2006
Phosphate, mmol/L	N	1550	1635	1559
	Mean	1.1	1.1	1.1
	SD	0.2	0.2	0.2
	Median	1.1	1.1	1.1
	Minimum	0.3	0.3	0.4
	Maximum	2.7	3.3	3.5
Alkaline Phosphate (ALP), U/L	N	1550	1635	1559
	Mean	79.5	78.9	78.1
	SD	46.5	46.6	42.6
	Median	73	73	70
	Minimum	10	18	6.3
	Maximum	994	831	700
ALT, U/L	N	1550	1635	1559
	Mean	31.4	30.8	29.9
	SD	32.6	30.9	30.7
	Median	25	24	21
	Minimum	4	4	4
	Maximum	563	613	433
Total cholesterol, mmol/L	N	1550	1635	1559
	Mean	5.5	5.4	5.3
	SD	1.1	1	1.1
	Median	5.4	5.4	5.4
	Minimum	2.6	2.1	2
	Maximum	20	13.1	14.7
LDL cholesterol, mmol/L	N	1550	1635	1559
	Mean	3.1	3	3
	SD	0.7	0.8	0.8
	Median	3	3	3
	Minimum	1	0.9	1
	Maximum	8.5	9.2	11.1
HDL cholesterol, mmol/L	N	1550	1635	1559
	Mean	1.6	1.6	1.6
	SD	0.4	0.5	0.5
	Median	1.6	1.6	1.6
	Minimum	0.2	0.2	0.2
	Maximum	4.3	5.6	5.8
Systolic Blood Pressure, mmHg	N	1550	1635	1559
	Mean	132.2	133.3	130.8
	SD	15.9	16.9	16
	Median	130	130	130
	Minimum	80	80	66
	Maximum	200	220	210
Diastolic Blood Pressure, mmHg	N	1550	1635	1559
	Mean	80.3	80.5	79
	SD	9.6	9.2	9.8
	Median	80	80	80
	Minimum	40	50	30
	Maximum	121	127	120

Cyclosporine/prednisolone based triple therapy has remained the backbone of maintenance immunosuppressive therapy. In year 2006, 76% of renal transplant recipients were on cyclosporine while 97% were on prednisolone. Only 17% were on tacrolimus. However, 48% of the recipients were on MMF as opposed to 33% on azathioprine.

**Table 13.3.3:** Medication data, 2004-2006

Medication data	Single drug treatment						Combined drug treatment					
	2004		2005		2006		2004		2005		2006	
	N	%	N	%	N	%	N	%	N	%	N	%
All patients	1416	100	1562	100	1470	100	1416	100	1562	100	1470	100
(i) Immunosuppressive drug(s) treatment												
Prednisolone	13	1	12	1	7	0	1394	98	1528	98	1433	97
Azathioprine	0	0	1	0	0	0	603	43	605	39	492	33
Cyclosporin A	4	0	4	0	5	0	1135	80	1221	78	1111	76
Tacrolimus (FK506)	0	0	0	0	0	0	185	13	224	14	252	17
Mycophenolate Mofetil (MMF)	1	0	0	0	0	0	524	37	682	44	704	48
Rapamycin	0	0	0	0	0	0	5	0	8	1	6	0
Others	1	0	0	0	0	0	16	1	10	1	18	1
(ii) Non-Immunosuppressive drug(s) treatment												
Beta blocker	104	7	105	7	77	5	650	46	667	43	594	40
Calcium channel blocker	188	13	195	12	199	14	795	56	822	53	784	53
ACE inhibitor	35	2	60	4	39	3	272	19	342	22	292	20
AIIRB	11	1	20	1	27	2	76	5	160	10	139	9
Anti-lipid	74	5	67	4	154	10	567	40	601	38	672	46
Other anti-hypertensive	5	0	5	0	11	1	130	9	158	10	159	11

In 2006, 65% of the recipients had hypertension as co-morbidity before transplantation while another 22% developed hypertension post transplantation (Table 13.4.1). Among these patients, only 30% were on monotherapy while the rest were on multiple drug treatment. For those on combination therapy, majority was on calcium channel blockers (53%) and beta blockers (40%). Only 20% were on ACE inhibitors while another 9% were on AIIRBs.

**13.4 TRANSPLANT OUTCOMES****13.4.1 Post-transplant complications****Table 13.4.1:** Post transplant complications, 2004-2006

Post transplant complications	Complication developed before transplant (regardless of complication after transplantation)						Complication developed only after transplantation					
	2004		2005		2006		2004		2005		2006	
	N	%	N	%	N	%	N	%	N	%	N	%
All patients	1558	100	1637	100	1559	100	1558	100	1637	100	1559	100
Diabetes (either as Primary Renal Disease or co-morbid)	520	33	532	32	527	34	128	8	123	8	125	8
Cancer	3	0	2	0	1	0	17	1	19	1	20	1
Cardiovascular disease + cerebrovascular disorder	208	13	209	13	207	13	83	5	45	3	45	3
Hypertension	1010	65	1047	64	1016	65	397	25	439	27	346	22

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

In 2006, 34% of the prevalent renal transplant recipients had diabetes mellitus before transplantation (either as primary renal disease or co-morbidity), while another 8% of them developed diabetes mellitus post transplantation (PTDM).



### 13.4.2 Deaths and Graft loss

In 2006, 49 (3%) transplant recipients died and 30 (2%) 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 2006, they accounted for 41%, 19% and 13% of the causes of death respectively (Table 13.4.3). Death secondary to cancer has become more common from 2001 to 2004, whereby cancer death accounted for 13% to 18% of all causes of death during that period. However, in 2006, death due to cancer has dropped to 7% of all deaths. Renal allograft rejection accounted for 50-78% of graft losses for the last 10 years (Table 13.4.4).

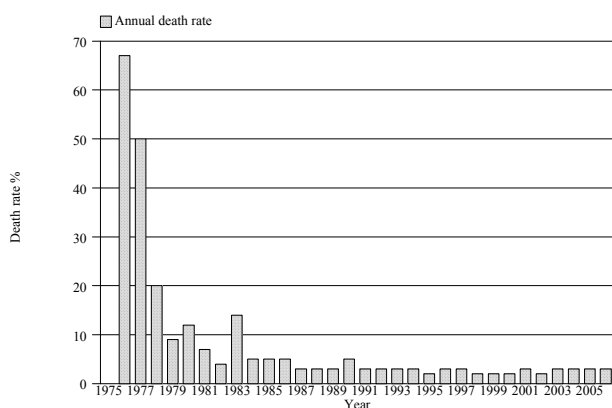
**Table 13.4.2:** Transplant Patients Death Rate and Graft Loss, 1997-2006

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
No. at risk	1054	1096	1143	1211	1288	1377	1463	1545	1636	1703
Transplant death	31	26	25	30	37	32	37	41	41	49
Transplant death rate %	3	2	2	2	3	2	3	3	3	3
Graft loss	38	49	36	32	40	38	41	44	20	30
Graft loss rate %	4	4	3	3	3	3	3	3	1	2
Acute rejection	0	0	0	0	0	0	3	19	14	17
Acute rejection rate %	0	0	0	0	0	0	0	1	1	1
All losses	69	75	61	62	77	70	81	104	75	96
All losses rate %	7	7	5	5	6	5	6	7	5	6

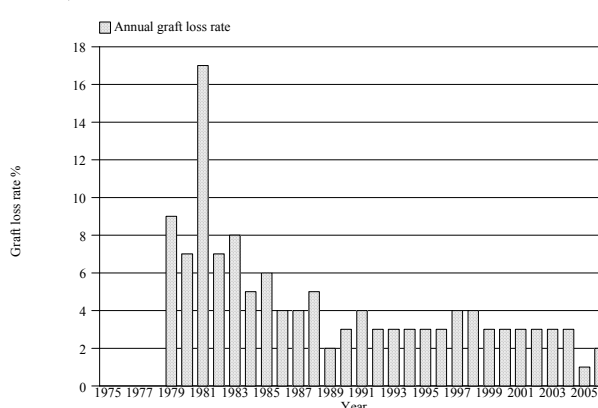
\*Graft loss=graft failure

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

**Figure 13.4.2(i):** Transplant Recipient Death Rate, 1975-2006



**Figure 13.4.2(ii):** Transplant Recipient Graft Loss Rate, 1975-2006



**Table 13.4.3: Causes of Death in Transplant Recipients, 1997-2006**

Year	1997		1998		1999		2000		2001		2002		2003		2004		2005		2006	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Cardiovascular	4	13	3	11	4	13	10	29	7	16	5	16	9	23	4	9	5	12	10	19
Died at home	2	6	4	15	6	19	1	3	5	12	5	16	5	13	6	13	4	10	7	13
Infection	14	45	10	37	7	23	12	35	20	47	9	28	11	28	11	24	22	52	22	41
Graft failure	1	3	0	0	0	0	2	6	0	0	0	0	0	0	2	4	0	0	0	0
Cancer	0	0	3	11	3	10	2	6	6	14	4	13	6	15	8	18	4	10	4	7
Liver disease	2	6	2	7	3	10	1	3	1	2	3	9	2	5	3	7	3	7	4	7
Accidental death	0	0	0	0	1	3	1	3	1	2	1	3	0	0	0	0	0	0	0	0
Others	4	13	2	7	5	16	3	9	2	5	3	9	5	13	10	22	3	7	4	7
Unknown	4	13	3	11	2	6	2	6	1	2	2	6	2	5	1	2	1	2	3	6
TOTAL	31	100	27	100	31	100	34	100	43	100	32	100	40	100	45	100	42	100	54	100

**Table 13.4.4: Causes of Graft Failure, 1997-2006**

Year	1997		1998		1999		2000		2001		2002		2003		2004		2005		2006	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Rejection	21	54	28	53	23	64	19	59	25	61	22	55	22	50	33	70	18	78	23	66
Calcineurin toxicity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3
Other drug toxicity	1	3	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	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	1	2	0	0	1	3	2	5	0	0	2	5	1	2	1	4	3	9
Vascular causes	4	10	3	6	1	3	3	9	1	2	0	0	3	7	4	9	2	9	3	9
Recurrent/de novo renal disease	1	3	1	2	0	0	0	0	2	5	2	5	1	2	1	2	0	0	1	3
Others	5	13	5	9	0	0	2	6	0	0	4	10	1	2	0	0	1	4	2	6
Unknown	7	18	15	28	12	33	7	22	11	27	12	30	15	34	7	15	1	4	2	6
TOTAL	39	100	53	100	36	100	32	100	41	100	40	100	44	100	47	100	23	100	35	100

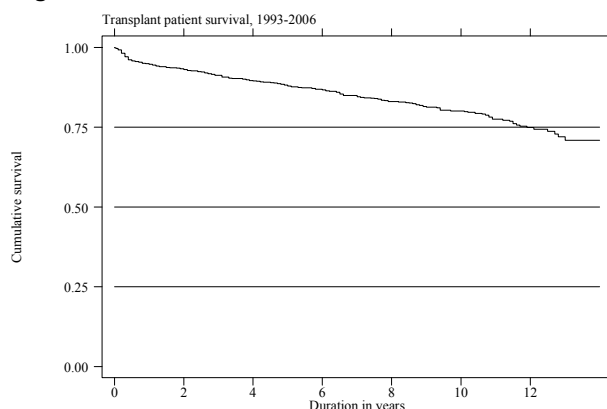
### 13.5 Patient and Graft Survival

**Table 13.5.1:** Patient survival, 1993-2006

Interval (years)	No.	% Survival	SE
1	1778	95	1
3	1342	91	1
5	971	88	1
10	349	80	1

\* No.=Number at risk SE=standard error

**Figure 13.5.1:** Patient survival, 1993-2006

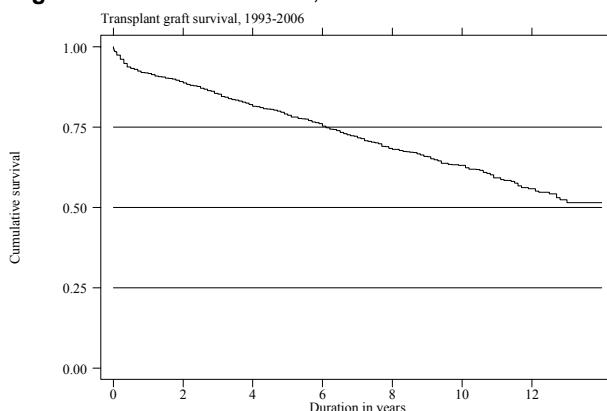


**Table 13.5.2:** Graft survival, 1993-2006

Interval (years)	No.	% survival	SE
1	1778	92	1
3	1342	85	1
5	971	79	1
10	349	63	1

\* No.=Number at risk SE=standard error

**Figure 13.5.2:** Graft survival, 1993-2006



The overall transplant patient survival rate from 1993 to 2006 was 95%, 91%, 88% and 80% at 1 year, 3 years, 5 years and 10 years respectively, while the overall graft survival rate was 92%, 85%, 79% and 63% respectively.

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 and 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 90% 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, 1993-2006

Type of Transplant	Commercial Cadaver			Commercial Live Donor			Live Donor			Cadaver		
	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE
1	935	96	1	285	96	1	398	96	1	131	84	2
3	659	92	1	240	90	1	323	95	1	100	79	3
5	428	87	1	203	87	2	252	94	1	71	76	4
10	117	83	2	126	72	3	100	90	2	7	70	5

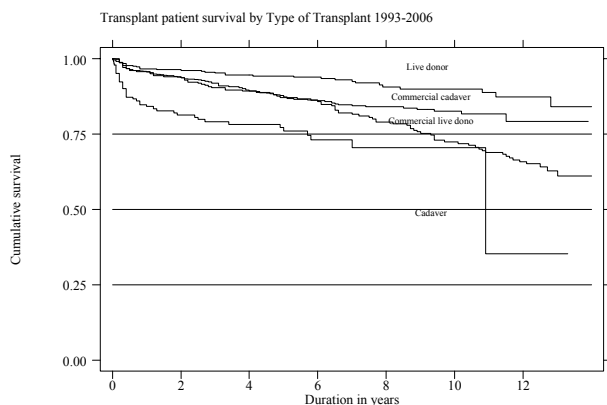
\* No.=Number at risk SE=standard error

**Table 13.5.4:** Graf survival by type of transplant, 1993-2006

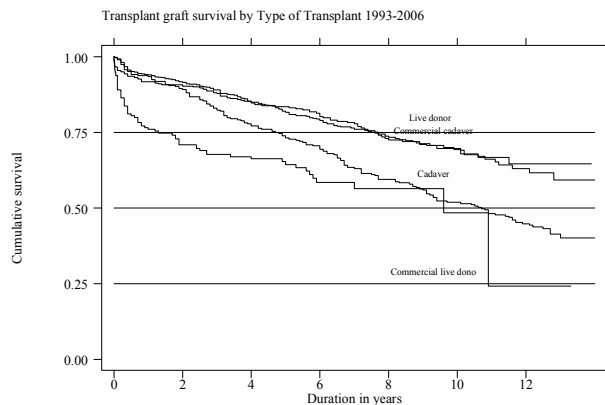
Type of Transplant Interval (years)	Commercial Cadaver			Commercial Live Donor			Live Donor			Cadaver		
	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE
1	935	94	1	285	93	1	398	92	1	131	76	3
3	659	89	1	240	82	2	323	88	2	100	68	4
5	428	82	1	203	73	3	252	84	2	71	64	4
10	117	70	2	126	52	3	100	69	3	7	48	8

\* No.=Number at risk SE=standard error

**Figure 13.5.3:** Patient survival by type of transplant, 1993-2006

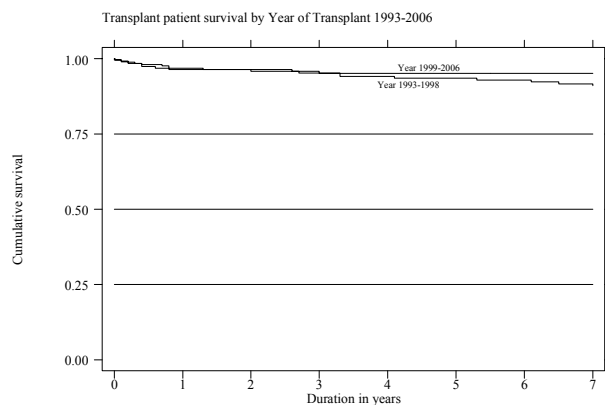


**Figure 13.5.4:** Graf survival by type of transplants, 1993-2006



The patient and graft survival rates for 1993-1998 cohort and 1999-2005 cohort were compared. Patient survival rate for living related donor renal transplants has remained excellent and unchanged for these two cohorts (Figure 13.5.5).

**Figure 13.5.5:** Patient survival by year of transplant (Living related transplant, 1993-2006)



**Table 13.5.5:** Patient survival by year of transplant (Living related transplant, 1993-2006)

Year of Transplant Interval (years)	1993-1998			1999-2006		
	No.	% Survival	SE	No.	% Survival	SE
1	181	97	1	218	96	1
3	169	95	2	155	95	1
5	159	93	2	94	95	1
7	147	91	2	37	95	1

\* No.=Number at risk SE=standard error

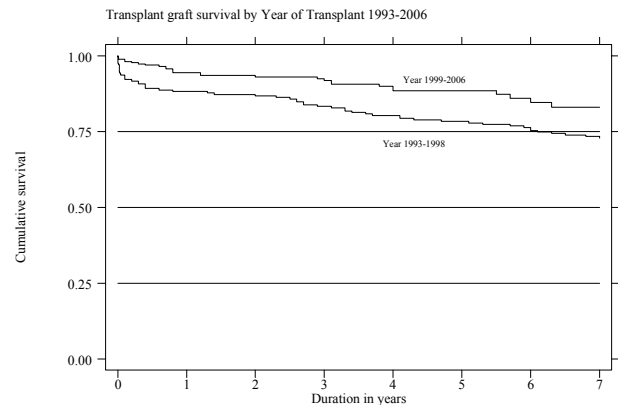
Interestingly, the risk of graft failure for living related donor renal transplantation improved for the 1999-2006 cohort compared to the 1993-1998 cohort (Table & Figure 13.5.6). One possible explanation, among others, is the increasing use of newer immunosuppressive agents such as MMF and FK506 in recent years.

**Table 13.5.6:** Graft survival by year of transplant (Living related transplant, 1993-2006)

Year of Transplant	1993-1998			1999-2006		
Interval (years)	No.	% Survival	SE	No.	% Survival	SE
1	181	88	2	218	94	1
3	169	83	3	155	92	2
5	159	78	3	94	89	2
7	147	73	3	37	83	3

\* No.=Number at risk SE=standard error

**Figure 13.5.6:** Graft survival by year of transplant (Living related transplant, 1993-2006)



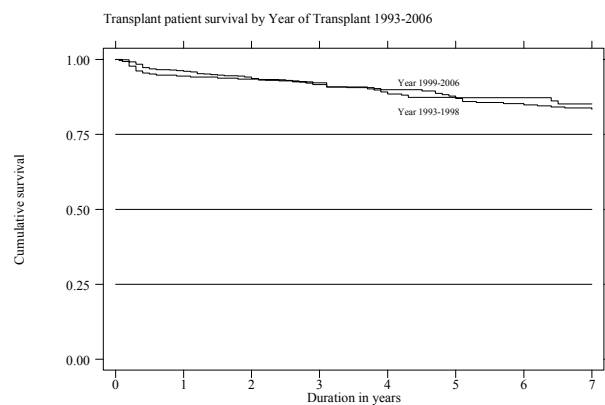
Interestingly, our data showed that commercial cadaveric transplants have excellent patient and graft survival rates, which are comparable to living related donor transplants for both 1993-1998 and 1999-2006 cohorts (Figure 13.5.7 and 13.5.8).

**Table 13.5.7:** Patient survival by year of transplant (Commercial cadaver transplant, 1993-2006)

Year of Transplant	1993-1998			1999-2006		
Interval (years)	No.	% Survival	SE	No.	% Survival	SE
1	288	94	1	648	96	1
3	275	92	2	384	92	1
5	247	87	2	181	87	2
7	225	84	2	50	85	2

\* No.=Number at risk SE=standard error

**Figure 13.5.7:** Patient survival by year of transplant (Commercial cadaver transplant, 1993-2006)

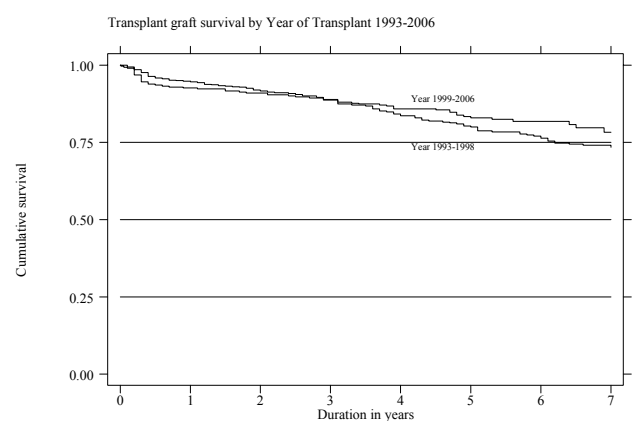


**Table 13.5.8:** Graft survival by year of transplant (Commercial cadaver transplant, 1993-2006)

Year of Transplant	1993-1998			1999-2006		
Interval (years)	No.	% Survival	SE	No.	% Survival	SE
1	288	93	1	648	95	1
3	275	89	2	384	89	1
5	247	80	2	181	83	2
7	225	73	3	50	78	3

\* No.=Number at risk SE=standard error

**Figure 13.5.8:** Graft survival by year of transplant (Commercial cadaver transplant, 1993-2006)



### 13.6 CARDIOVASCULAR RISK IN RENAL TRANSPLANT RECIPIENTS

#### 13.6.1 Risk factors for Ischaemic Heart Disease.

In year 2006, 85.5% of recipients were hypertensive, 22.9% had diabetes and 57.1% had renal insufficiency fulfilling the criteria for CKD III and above. A majority had 2 or more cardiovascular risk factors with 10.2% having 3 major risk factors.

**Table 13.6.1:** Risk factors for IHD in renal transplant recipients at year 2004, 2005, and 2006

	2004	2005	2006
Diabetes	27 (1.9)	19 (1.3)	21 (1.4)
Hypertension**	504 (34.3)	513 (33.5)	452 (31.5)
CKD	121 (8.2)	142 (9.3)	169 (11.8)
Diabetes + Hypertension**	146 (9.9)	157 (10.2)	144 (10.0)
Diabetes + CKD	21 (1.4)	20 (1.3)	18 (1.3)
CKD + Hypertension**	530 (36.1)	540 (35.2)	484 (33.8)
Diabetes + CKD + Hypertension**	120 (8.2)	141 (9.2)	146 (10.2)

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

OR have either Beta blocker / Calcium channel blocker/ ACE inhibitor/ AIIIRB / Other anti-hypertensive drugs

GFR(mL/min/1.73m<sup>2</sup>) = 1.2\*(140-age(year))\* weight(kg) / creatinine(μmol/L) if male

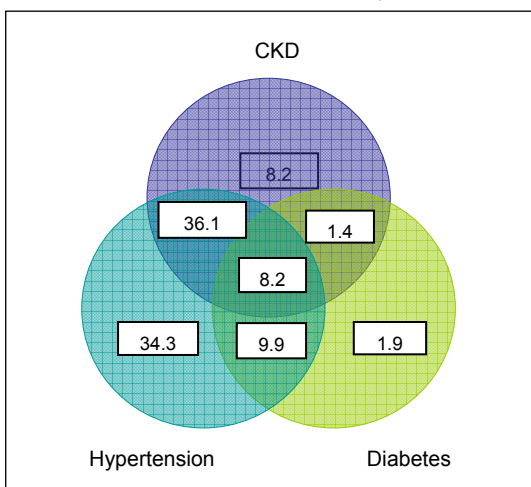
GFR(mL/min/1.73m<sup>2</sup>) = 0.85\*(1.2\*(140-age(year))\* weight(kg) / creatinine(μmol/L) ) if female.

CKD stage III – GFR, 30- 60

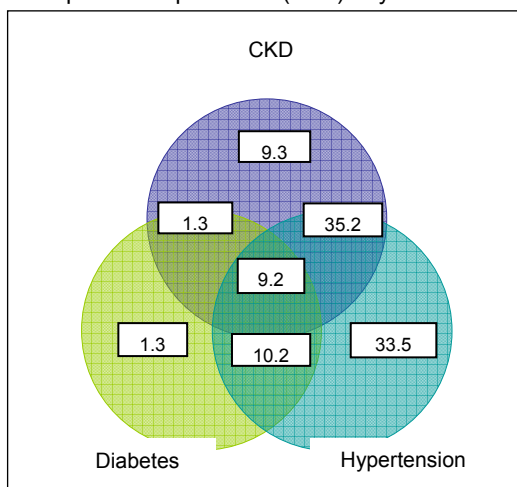
CKD stage IV – GFR, 15- 30

CKD stage V – GFR, < 15

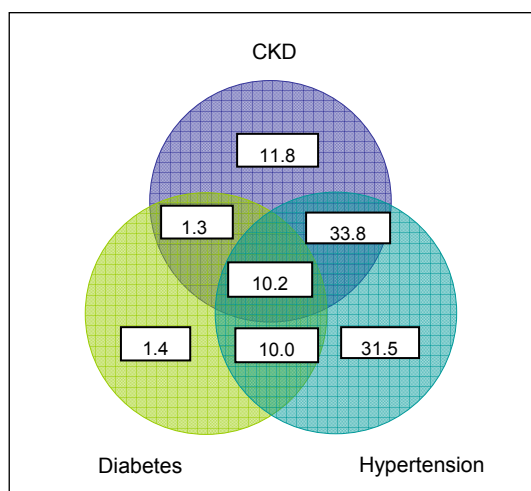
**Figure 13.6.1(a):** Venn Diagram for Pre and Post Transplant Complications (in %) at year 2004



**Figure 13.6.1(b):** Venn Diagram for Pre and Post Transplant Complications (in %) at year 2005



**Figure 13.6.1(c):** Venn Diagram for Pre and Post Transplant Complications (in %) at year 2006



### 13.6.2 Blood Pressure classification according to JNC VI criteria, 2004, 2005, and 2006

In 2006, 5.8% had stage II systolic hypertension while another 1.2% had stage III systolic hypertension despite being on treatment. Four percent had stage II diastolic hypertension while another 0.3% had stage III diastolic hypertension despite being on treatment.

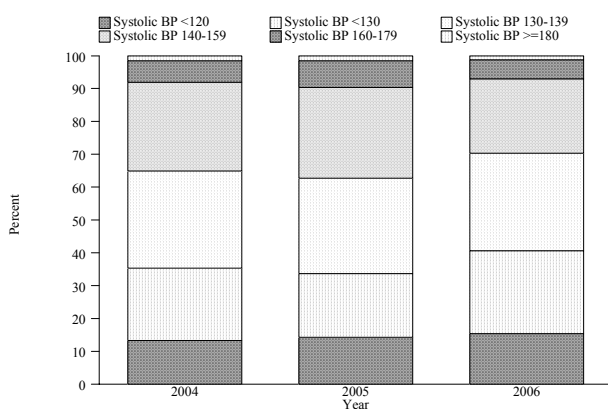
**Table 13.6.2(a):** Systolic BP, 2004 – 2006

Year	2004	2005	2006
	No. (%)	No. (%)	No. (%)
Systolic BP <120	207 (13.4)	233 (14.3)	241 (15.5)
Systolic BP <130	341 (22.0)	318 (19.4)	393 (25.2)
Systolic BP 130-139	459 (29.6)	475 (29.1)	463 (29.7)
Systolic BP 140-159	418 (27.0)	452 (27.6)	352 (22.6)
Systolic BP 160-179	102 (6.6)	133 (8.1)	91 (5.8)
Systolic BP ≥180	23 (1.5)	24 (1.5)	19 (1.2)

**Table 13.6.2(b):** Diastolic BP, 2004 – 2006

Year	2004	2005	2006
	No. (%)	No. (%)	No. (%)
Diastolic BP <80	513 (33.1)	522 (31.9)	600 (38.5)
Diastolic BP <85	602 (38.8)	657 (40.2)	580 (37.2)
Diastolic BP 85-89	48 (3.1)	73 (4.5)	73 (4.7)
Diastolic BP 90-99	319 (20.6)	308 (18.8)	241 (15.5)
Diastolic BP 100-109	56 (3.6)	65 (4.0)	61 (3.9)
Diastolic BP ≥110	12 (0.8)	10 (0.6)	4 (0.3)

**Figure 13.6.2(a):** Systolic BP, 2004 - 2006



**Figure 13.6.2(b):** Diastolic BP, 2004 - 2006

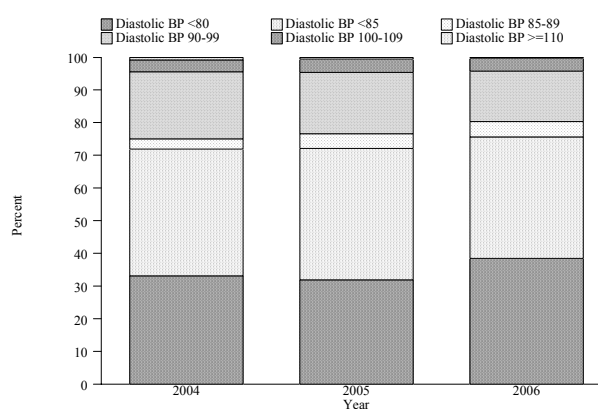
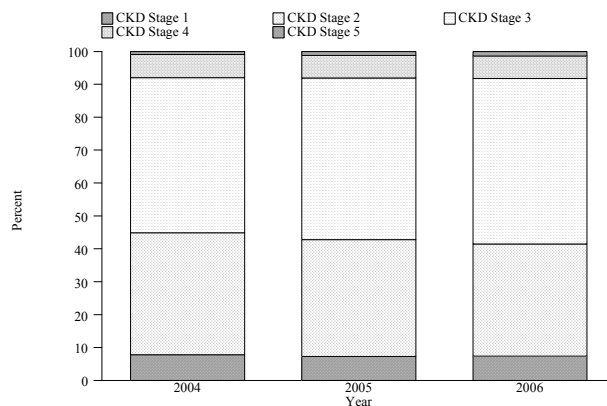


Table 13.6.3 shows classification of renal function according to CKD classification. Estimated GFR is calculated using the Cockcroft and Gault equation. In 2006, 50.4% had CKD III while another 8.2% had CKD IV or V.

**Table 13.6.3:** CKD stages, 2004 - 2006

	2004	2005	2006
	No. (%)	No. (%)	No. (%)
CKD stage 1	120 (7.8)	118 (7.3)	114 (7.4)
CKD stage 2	571 (37.1)	578 (35.5)	528 (34.1)
CKD stage 3	727 (47.2)	800 (49.2)	779 (50.4)
CKD stage 4	109 (7.1)	112 (6.9)	105 (6.8)
CKD stage 5	13 (0.8)	19 (1.2)	21 (1.4)

**Figure 13.6.3:** CKD stages by year

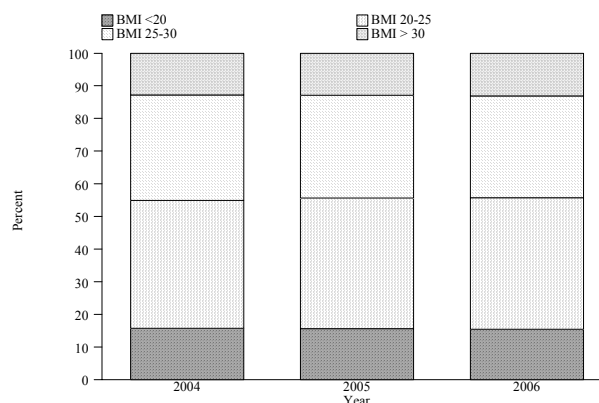


In year 2006, 31.1% were overweight while another 13.1% were obese with BMI above 30.

**Table 13.6.4:** BMI, 2004 – 2006

Year	2004	2005	2006
	No. (%)	No. (%)	No. (%)
BMI <20	243 (15.7)	255 (15.6)	241 (15.5)
BMI 20-25	609 (39.3)	655 (40.1)	629 (40.3)
BMI 25-30	500 (32.3)	514 (31.4)	485 (31.1)
BMI > 30	198 (12.8)	211 (12.9)	204 (13.1)

**Figure 13.6.4:** BMI by year

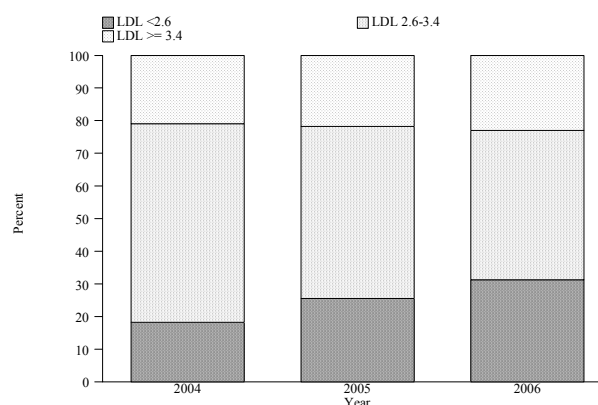


In year 2006, 23% had LDL cholesterol  $\geq 3.4$  mmol/L, 58.9% had total cholesterol  $> 5.2$  while 6.5% had HDL cholesterol  $< 1$ .

**Table 13.6.5(a):** LDL, 2004 – 2006

	2004	2005	2006
	No. (%)	No. (%)	No. (%)
LDL < 2.6	282 (18.2)	418 (25.6)	487 (31.2)
LDL 2.6-3.4	944 (60.9)	862 (52.7)	713 (45.7)
LDL $\geq 3.4$	324 (20.9)	355 (21.7)	359 (23.0)

**Figure 13.6.5(a):** LDL by year

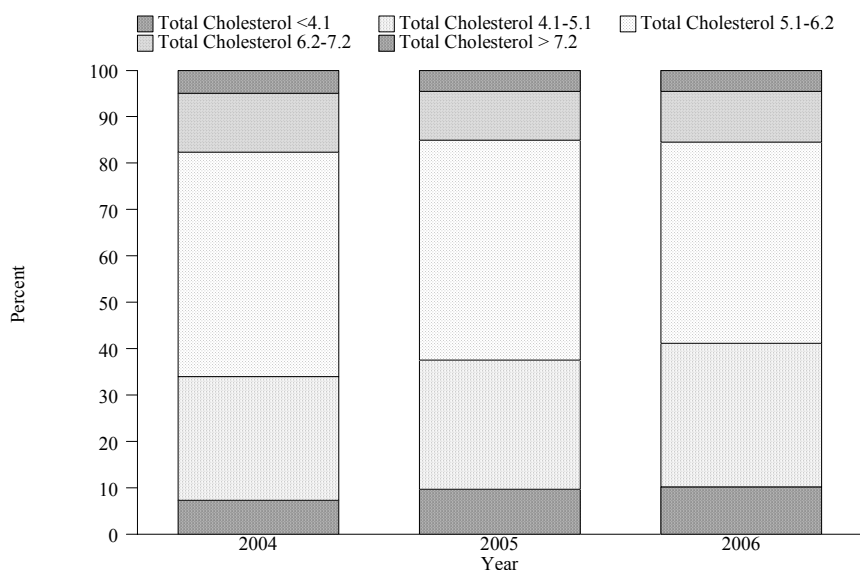




**Table 13.6.5(b): Total Cholesterol, 2004 - 2006**

4Year	2004	2005	2006
	No. (%)	No. (%)	No. (%)
Total Cholesterol <4.1	113 (7.3)	159 (9.7)	159 (10.2)
Total Cholesterol 4.1-5.1	413 (26.6)	455 (27.8)	482 (30.9)
Total Cholesterol 5.2-6.2	751 (48.5)	774 (47.3)	677 (43.4)
Total Cholesterol 6.3- 7.2	197 (12.7)	173 (10.6)	171 (11.0)
Total Cholesterol > 7.2	76 (4.9)	74 (4.5)	70 (4.5)

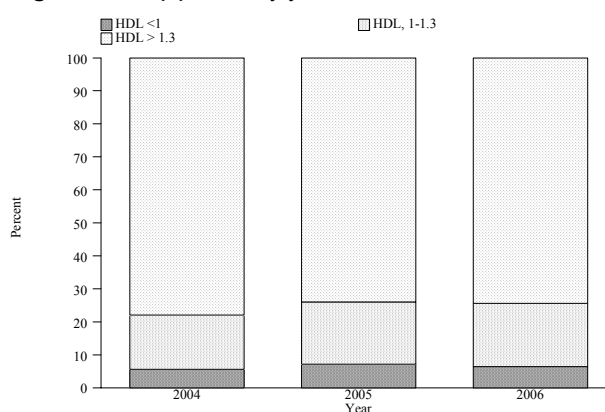
**Figure 13.6.5(b): Total Cholesterol by year**



**Table 13.6.5(c): HDL, 2004 - 2006**

Year	2004	2005	2006
	No. (%)	No. (%)	No. (%)
HDL <1	87 (5.6)	118 (7.2)	101 (6.5)
HDL 1-1.3	255 (16.5)	308 (18.8)	299 (19.2)
HDL >1.3	1208 (77.9)	1209 (73.9)	1159 (74.3)

**Figure 13.6.5(c): HDL by year**



Majority of patients were on more than one anti-hypertensive drug with 34% on 2 anti-hypertensives while 18% required 3. In 2005, despite being on treatment, a substantial number of patients had SBP  $\geq$ 160 (11%) and DBP  $\geq$ 90 (25%) (Table 13.6.6d and 13.6.6e)

**Table 13.6.6(a):** Treatment for hypertension, 2004 – 2006

Year	No.	% on anti-hypertensives	% on 1 anti-hypertensive drug	% on 2 anti-hypertensives	% on 3 anti-hypertensives
2004	1550	87	30	34	18
2005	1635	85	28	30	19
2006	1559	86	34	26	17

**Table 13.6.6(b):** Distribution of Systolic BP without anti-hypertensives, 2004 – 2006

Year	No.	Mean	SD	Median	LQ	UQ	% Patients $\geq$ 160 mmHg
2004	179	126.3	13.6	130	120	130	4
2005	229	126.9	15	130	120	137	3
2006	184	124.1	14.4	120	118.5	130	4

**Table 13.6.6(c):** Distribution of Diastolic BP without anti-hypertensives, 2004 – 2006

Year	No.	Mean	SD	Median	LQ	UQ	% Patients $\geq$ 90 mmHg
2004	179	78.9	9.1	80	73	80	17
2005	229	79	9	80	70	80	18
2006	184	76.6	10.2	80	70	80	11

**Table 13.6.6(d):** Distribution of Systolic BP on anti-hypertensives, 2004 – 2006

Year	No.	Mean	SD	Median	LQ	UQ	% Patients $\geq$ 160 mmHg
2004	1312	133.1	16.3	130	120	140	9
2005	1350	134.5	17.3	130	120	143	11
2006	1321	131.7	16.3	130	120	140	8

**Table 13.6.6(e):** Distribution of Diastolic BP on anti-hypertensives, 2004 – 2006

Year	No.	Mean	SD	Median	LQ	UQ	% Patients $\geq$ 90 mmHg
2004	1312	80.5	9.9	80	74	90	27
2005	1350	80.8	9.4	80	76	90	25
2006	1321	79.3	9.9	80	70	86	22