

## CHAPTER 5

### RENAL TRANSPLANTATION

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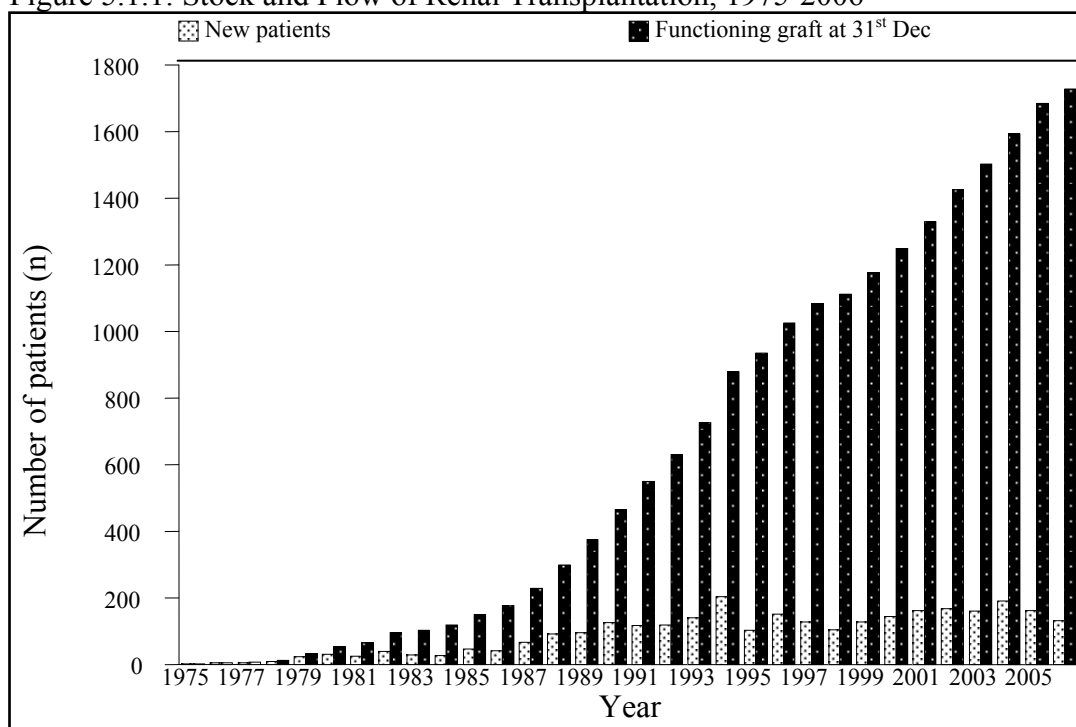
**5.1 STOCK AND FLOW**

New renal transplant patients showed an initial rise from 127 transplants per year in 1997 to peak at 190 transplants by 2004. This is a 50% rise but the number declined to 132 in 2006 (Table 5.1.1). As renal transplantation in the country is still dependant on the availability of commercial cadaveric transplantation done abroad, this drop was foreseeable. The number of functioning renal transplants reported to NTR had increased from 1083 in 1997 to 1728 (Table 5.1.1).

Table 5.1.1: Stock and Flow of Renal Transplantation, 1997-2006

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
New transplant patients	127	104	127	143	161	168	160	190	162	132
Died	31	26	25	30	37	32	37	41	43	49
Graft failure	38	49	36	32	40	38	41	44	19	35
Lost to follow up	0	1	1	9	2	3	4	16	7	4
Functioning graft at 31 <sup>st</sup> December	1083	1111	1176	1248	1330	1425	1503	1592	1684	1728

Figure 5.1.1: Stock and Flow of Renal Transplantation, 1975-2006



The incidence of renal transplantation stabilised at a modest rate of 5-7 per million population (Table 5.1.2) while transplant prevalence rate has grown slowly from 50 per million in 1997 to 65 per million population in 2006, an increase of 30% over the 1997 figures. However compared to growth in the number of dialysis patients (which has increased by 296% from 3698 in 1997 to 14647 in 2006), our transplant prevalence rate has not kept up (14<sup>th</sup> Report of The Malaysian Dialysis and Transplant Registry 2006).

Table 5.1.2: New Transplant Rate per million population (pmp), 1997-2006

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
New transplant patients	127	104	127	143	161	168	160	190	162	132
New transplant rate, pmp	6	5	6	6	7	7	6	7	6	5

Figure 5.1.2: New Transplant Rate, 1975-2006

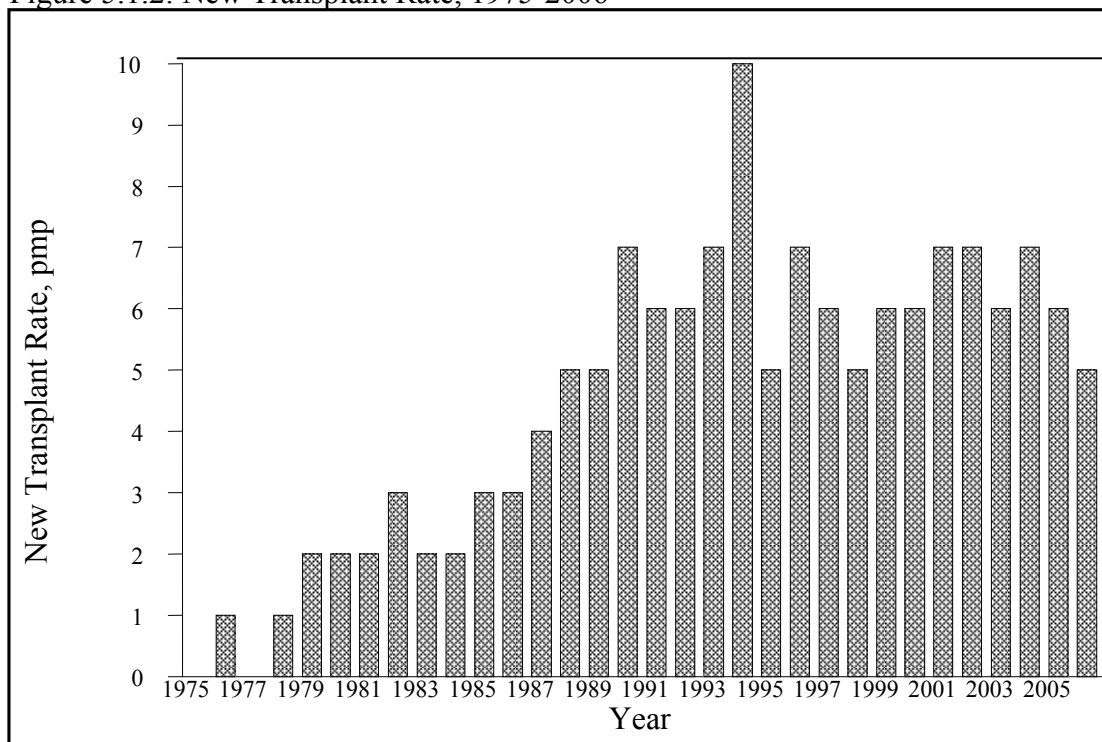
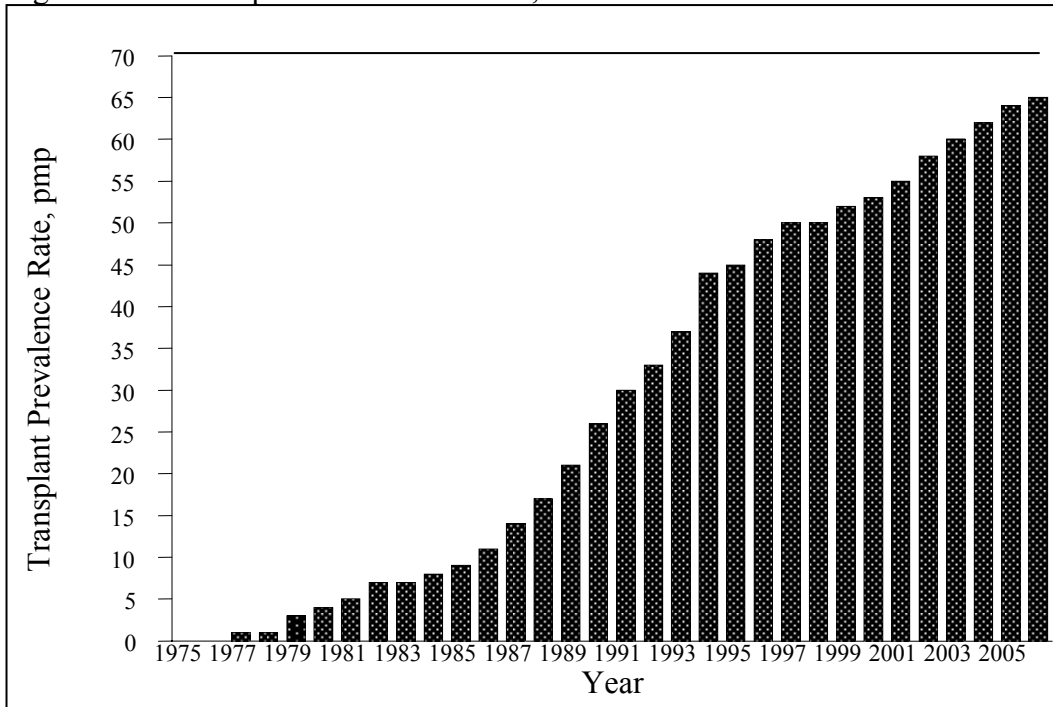


Table 5.1.3: Transplant Prevalence Rate per million population (pmp), 1997-2006

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Functioning graft at 31 <sup>st</sup> December	1083	1111	1176	1248	1330	1425	1503	1592	1684	1728
Transplant prevalence rate, pmp	50	50	52	53	55	58	60	62	64	65

Figure 5.1.3: Transplant Prevalence Rate, 1975-2006



In terms of location, transplantation within local centres has grown slightly from 35 cases (28% of renal transplants) in 1997 to 49 cases (38% of renal transplants) in 2006. This translates to a net increase of 1.4 cases per year over the 10 year period. This is disturbing as it underscores our failure to improve transplantation rates within the country. Transplantation in China in 2006 comprised the majority of renal transplant recipients with 75 patients (57% of transplants).

Table 5.1.4: 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	80	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>127</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	35	27	332	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	5	60	4
Other local	1	1	1	1	2	1	5	3	2	2	19	1
China	102	61	111	69	137	72	108	67	75	57	992	61
India	12	7	4	3	11	6	5	3	7	5	80	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>190</b>	<b>100</b>	<b>162</b>	<b>100</b>	<b>132</b>	<b>100</b>	<b>1625</b>	<b>100</b>

## 5.2 RECIPIENTS' CHARACTERISTICS

In terms of renal transplant recipients' characteristics, age at transplant have been stable at 36 to 42 years and between 64% and 68% of recipients are male. There has been an increase in diabetic patients undergoing transplantation from 11% in 1997 to 20% in 2006 (Table 5.2.1). For patients with hepatitis B and hepatitis C, the figures are static at around 7% although there was an initial increase up to 18% for the hepatitis C population. In terms of cause of end stage renal failure (Table 5.2.2), the primary cause was still glomerulonephritis, followed by hypertension and diabetes as the second and third causes. Up to 31% of transplant recipients had end stage renal disease due to unknown causes, belying the fact that we often diagnose these patients too late.

Table 5.2.1: Renal Transplant Recipients' Characteristics, 1997-2006

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
New Transplant Patients	127	104	127	143	161	168	160	190	162	132
Age at transplant (years), Mean	36	37	37	40	41	41	42	41	38	37
Age at transplant (years), SD	12	11	13	14	13	13	13	13	14	15
% Male	64	58	62	64	63	57	66	62	69	68
% Diabetic (co-morbid / primary renal disease)	11	10	10	15	19	15	22	21	19	20
% HBsAg positive	5	6	4	5	5	7	8	5	4	7
% Anti-HCV positive	7	18	11	8	15	9	10	8	2	7

Table 5.2.2: Primary Causes of End Stage Renal Failure, 1997-2006

Year	1997		1998		1999		2000	
	No.	%	No.	%	No.	%	No.	%
New transplant patients	127	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	64	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	190	100	162	100	132	100
Glomerulonephritis	42	26	53	32	54	34	62	33	46	28	48	36
Diabetes Mellitus	23	14	16	10	26	16	32	17	27	17	21	16
Hypertension	17	11	24	14	25	16	51	27	38	23	28	21
Obstructive uropathy	3	2	2	1	2	1	4	2	3	2	4	3
ADPKD	1	1	3	2	5	3	5	3	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	50	31	41	31
Others	23	14	15	9	12	8	27	14	17	10	15	11



### 5.3 TRANSPLANT PRACTICES

In 2006, 62% of the renal transplant recipients received their grafts from commercial sources. Fifty-nine percent of these were from commercial cadavers. Live donor transplantation made up 20% of transplants (26 recipients) in the same year which was down from 45 cases (37%) in 1999 and 40 cases (25%) in 2005. 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.

Table 5.3.1: Type of Renal Transplantation, 1997-2006

Year	1997		1998		1999		2000		2001	
	No.	%	No.	%	No.	%	No.	%	No.	%
Commercial Cadaver	81	66	51	52	62	51	80	56	82	51
Commercial Live Donor	7	6	4	4	4	3	9	6	6	4
Live Donor (genetically related)	27	22	27	27	40	33	21	15	32	20
Live Donor (emotionally related)	0	0	2	2	5	4	6	4	4	2
Cadaver	8	7	15	15	10	8	27	19	37	23
<b>TOTAL</b>	<b>123</b>	<b>100</b>	<b>99</b>	<b>100</b>	<b>121</b>	<b>100</b>	<b>143</b>	<b>100</b>	<b>161</b>	<b>100</b>

Year	2002		2003		2004		2005		2006	
	No.	%	No.	%	No.	%	No.	%	No.	%
Commercial Cadaver	102	61	112	70	142	76	105	65	78	59
Commercial Live Donor	11	7	3	2	5	3	8	5	4	3
Live Donor (genetically related)	30	18	25	16	21	11	37	23	22	17
Live Donor (emotionally related)	3	2	5	3	2	1	3	2	4	3
Cadaver	22	13	15	9	17	9	9	6	24	18
<b>TOTAL</b>	<b>168</b>	<b>100</b>	<b>160</b>	<b>100</b>	<b>187</b>	<b>100</b>	<b>162</b>	<b>100</b>	<b>132</b>	<b>100</b>

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

Table 5.3.2: Biochemical Data, 2004-2006

Biochemical parameters	Summary	2004	2005	2006
Creatinine, umol/L	No.	1550	1634	1592
	Mean	132.1	133.7	135.7
	SD	63.8	65.5	81.4
	Median	120	120	120
	Minimum	38	35	42
	Maximum	817	763	1152
Hb, g/dL	No.	1550	1634	1592
	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	No.	1550	1634	1592
	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	No.	1550	1634	1592
	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

<b>Biochemical parameters</b>	<b>Summary</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>
Phosphate, mmol/L	No.	1550	1634	1592
	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	No.	1550	1634	1592
	Mean	79.5	78.9	78.7
	SD	46.5	46.6	43.5
	Median	73	73	71
	Minimum	10	18	6.3
	Maximum	994	831	700
ALT, U/L	No.	1550	1634	1592
	Mean	31.4	30.8	29.9
	SD	32.6	31	30.4
	Median	25	24	22
	Minimum	4	4	4
	Maximum	563	613	433
Total cholesterol, mmol/L	No.	1550	1634	1592
	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	No.	1550	1634	1592
	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	No.	1550	1634	1592
	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	No.	1550	1634	1592
	Mean	132.2	133.3	130.8
	SD	15.9	16.9	15.9
	Median	130	130	130
	Minimum	80	80	66
	Maximum	200	220	210
Diastolic Blood Pressure, mmHg	No.	1550	1634	1592
	Mean	80.3	80.5	78.9
	SD	9.6	9.2	9.8
	Median	80	80	80
	Minimum	40	50	30
	Maximum	121	127	120

In 2006, Cyclosporine-based regimes remained the mainstay of immunosuppressive therapy with 75% of patients receiving it. Tacrolimus-based regimes accounted for 17%. There has been an increase in the use of Mycophenolate Mofetil as the second immunosuppressive agent in 48% of patients in 2006 compared to 37% of patients in 2004. During the same period, the use of Azathioprine declined from 43% to 34%. Monotherapy of immunosuppression is mostly not noted except in a small number of patients.

In terms of non-immunosuppressive medications, only 34% of patients were on Angiotensin Converting Enzyme Inhibitor (ACEI) or Angiotensin II Receptor Blocker (AIIRB)'s or both and this trend has been relatively static since 2004. Calcium Channel blockers appeared to be the mainstay of antihypertensive therapy in 66% of patients whilst Beta blockers use was reported in 45% of patients. Other antihypertensives were reported in 12% 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 5.3.3: Medication Data, 2004-2006

Medication data	Single drug treatment						Combined drug treatment					
	2004		2005		2006		2004		2005		2006	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
All patients	1416	100	1562	100	1477	100	1416	100	1562	100	1477	100
(i) Immunosuppressive drug treatment(s)												
Prednisolone	13	1	12	1	8	1	1394	98	1528	98	1439	97
Azathioprine	0	0	1	0	0	0	603	43	605	39	496	34
Cyclosporine	4	0	4	0	5	0	1135	80	1221	78	1115	75
Tacrolimus (FK506)	0	0	0	0	0	0	185	13	224	14	254	17
Mycophenolate Mofetil (MMF)	1	0	0	0	0	0	524	37	682	44	705	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 treatment(s)												
Beta blocker	104	7	105	7	77	5	650	46	667	43	596	40
Calcium channel blocker	188	13	195	12	199	13	795	56	822	53	785	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	140	9
Anti-lipid	74	5	67	4	155	10	567	40	601	38	675	46
Other anti-hypertensive	5	0	5	0	11	1	130	9	158	10	159	11

**5.4 TRANSPLANT OUTCOMES****5.4.1 Post transplant Complications**

Sixty-five percent of patients were hypertensive prior to transplantation whereas 22% developed hypertension post transplantation. Thirteen percent of patients had diabetes mellitus prior to transplant whereas only 8% of patients developed post transplant diabetes mellitus. In terms of cardiovascular and cerebrovascular disease, 5% had either or both prior to transplant whereas 3% developed these post transplantation.

Table 5.4.1: 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	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
All patients	1550	100	1634	100	1592	100	1550	100	1634	100	1592	100
Diabetes (either as primary renal disease or co-morbid)	190	12	216	13	211	13	126	8	123	8	126	8
Cancer	3	0	2	0	2	0	17	1	19	1	20	1
Cardiovascular disease + cerebrovascular disorder	82	5	78	5	73	5	83	5	45	3	45	3
Hypertension	1005	65	1046	64	1031	65	396	26	438	27	356	22

Note: Hypertension: BP systolic > 140 and BP diastolic > 90 mmHg

OR had either Beta blocker / Calcium channel blocker / ACE inhibitor / AIIRB / Other anti-hypertensive

### 5.4.2 Deaths and Graft Loss

In 2006, 49 transplant recipients died and 35 lost their grafts. The rates of transplant death and graft loss have remained static for the past 10 years (Table 5.4.2). The main known causes of death have been infection (41%) and cardiovascular disease (19%). Thirteen percent of patients died at home.

Cancer death rates have been on the decline since 2004 contributing to only 7% of deaths in 2006 as compared to 18% in 2004. Death due to liver disease has remained relatively static at 7% as well (Table 5.4.3).

In terms of graft loss, 71% were due to rejection with 8% apiece for vascular causes and infections in 2006 and these figures have remained relatively stable for the last 3 years (Table 5.4.4).

Table 5.4.2: Transplant Patients Death Rate and Graft Loss, 1997-2006

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
No. at risk	1054	1097	1144	1212	1289	1378	1464	1548	1638	1706
Transplant death	31	26	25	30	37	32	37	41	43	49
Transplant death rate (%)	3	2	2	2	3	2	3	3	3	3
Graft loss	38	49	36	32	40	38	41	44	19	35
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	78	85	62	84
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 5.4.2(i): Transplant Recipient Death Rate, 1975-2006

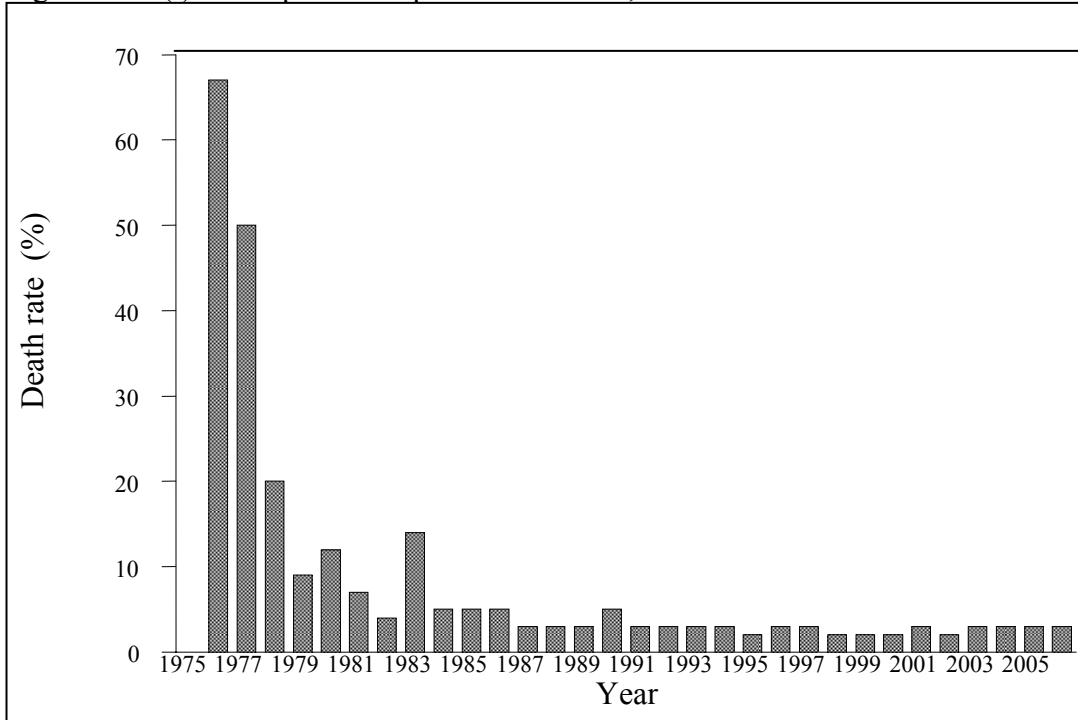


Figure 5.4.2(ii): Transplant Recipient Graft Loss Rate, 1975-2006

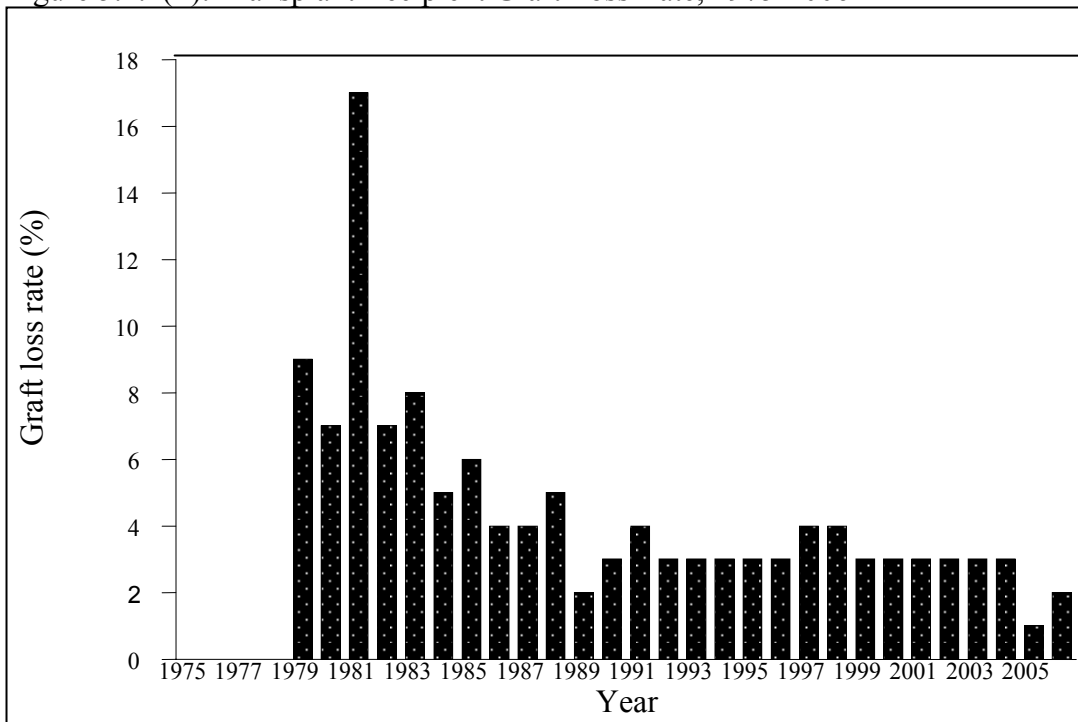


Table 5.4.3: Causes of Death in Transplant Recipients, 1997-2006

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	11	10	19
Died at home	2	6	4	15	6	19	1	3	5	12	5	16	5	13	6	13	5	11	7	13
Infection	14	45	10	37	7	23	12	35	20	47	9	28	11	28	11	24	22	50	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	9	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	2	5	3	6
TOTAL	31	100	27	100	31	100	34	100	43	100	32	100	40	100	45	100	44	100	54	100

Note: Some patients may have more than one cause of death.

Table 5.4.4: 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	20	48	31	71	15	75	26	71
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	0	0	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	5	2	5
Vascular causes	4	10	3	6	1	3	3	9	1	2	0	0	3	7	4	9	2	10	3	8
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	5	2	5
Unknown	7	18	15	28	12	33	7	22	11	27	12	30	15	36	7	16	1	5	2	5
TOTAL	39	100	53	100	36	100	32	100	41	100	40	100	42	100	44	100	20	100	37	100

Note: Some patients may have more than one cause of graft failure.

### 5.5 PATIENT AND GRAFT SURVIVAL

Overall patient survival rates from 1993 to 2006 were high at years 1 (95%), 3 (91%), 5 (88%) and 10 (80%). Overall graft survival rate has been 92%, 85%, 79% and 63% at year 1, 3, 5 and 10 respectively.

Table 5.5.1: Patient Survival, 1993-2006

Interval (years)	No.	% Survival	SE
1	1781	95	1
3	1344	91	1
5	972	88	1
10	349	80	1

SE=standard error

Figure 5.5.1: Patient Survival, 1993-2006

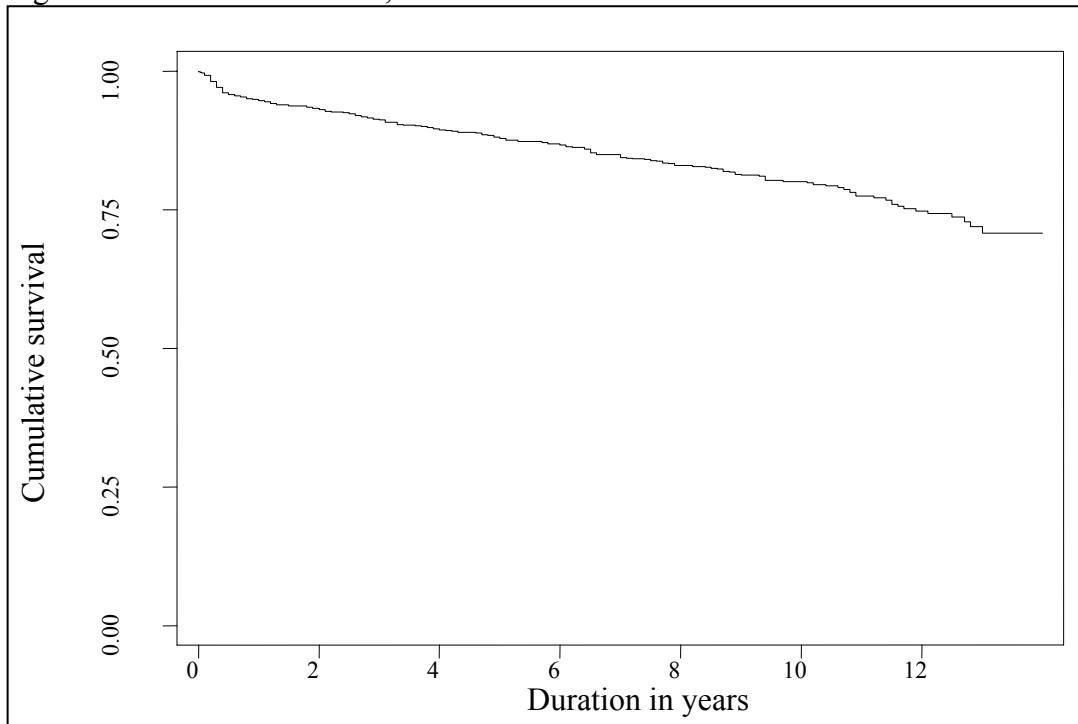


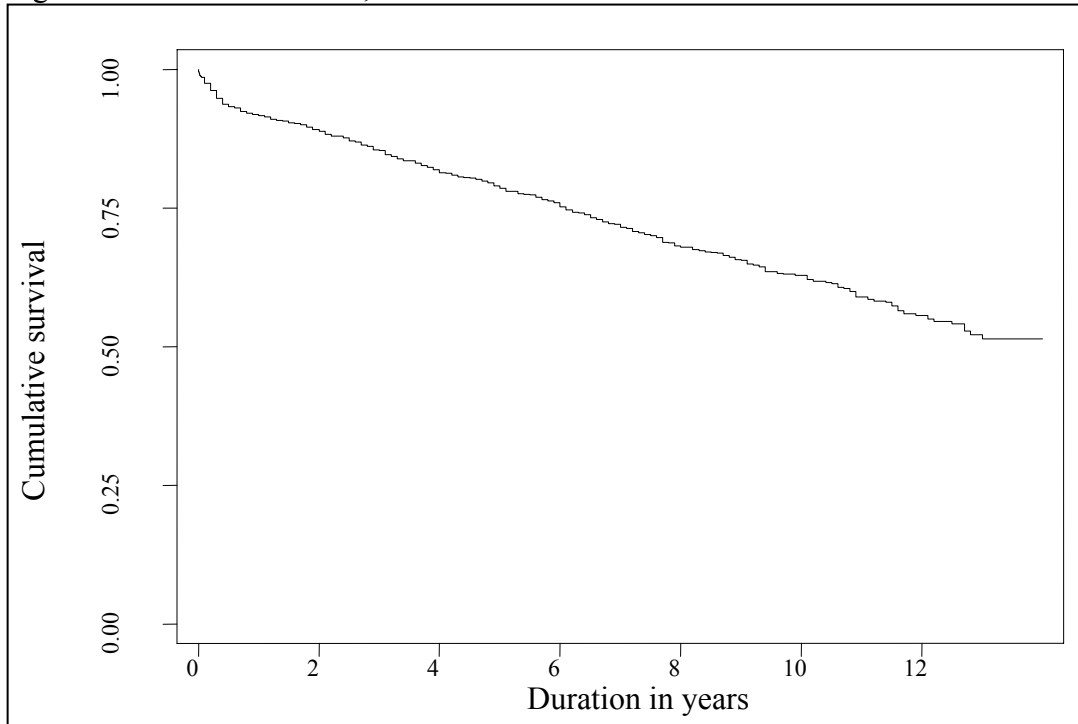


Table 5.5.2: Graft Survival, 1993-2006

Interval (years)	No.	% survival	SE
1	1781	92	1
3	1344	85	1
5	972	79	1
10	349	63	1

SE=standard error

Figure 5.5.2: Graft Survival, 1993-2006



Outcomes of renal transplantation from the 4 donor groups are shown in respect to patient and graft survival in the Kaplan Meier survival graphs in Figures 5.5.3 and 5.5.4 respectively. In terms of patient survival, live donor grafts maintained the best survival rates at years 1 (97%), 3 (95%), 5 (94%) and 10 (90%). However in terms of graft survival, commercial cadaver grafts performed marginally better with a survival at years 1 (94%), 3 (89%), 5 (82%) and 10 (70%) compared to 92%, 88%, 83% and 69% for the same intervals for live donor grafts.

Table 5.5.3: 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	938	96	1	285	96	1	398	97	1	131	84	2
3	661	92	1	240	90	1	323	95	1	100	79	3
5	429	87	1	203	87	2	252	94	1	71	76	4
10	118	82	2	126	72	3	99	90	2	7	70	5

SE=standard error

Figure 5.5.3: Patient Survival by Type of Transplant, 1993-2006

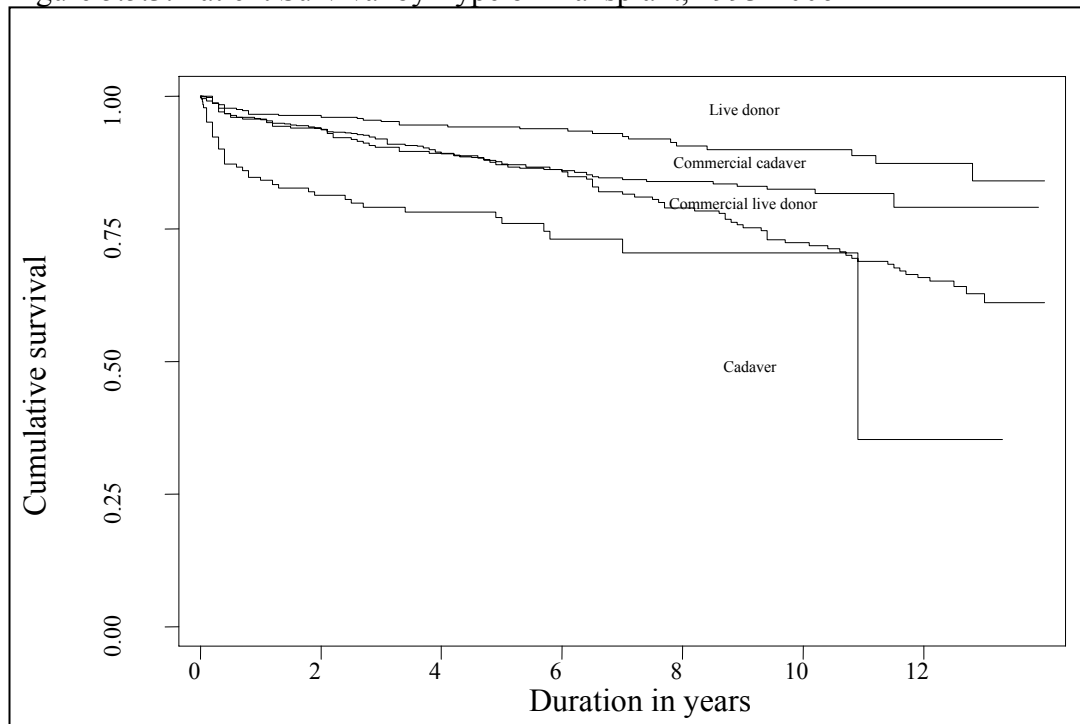
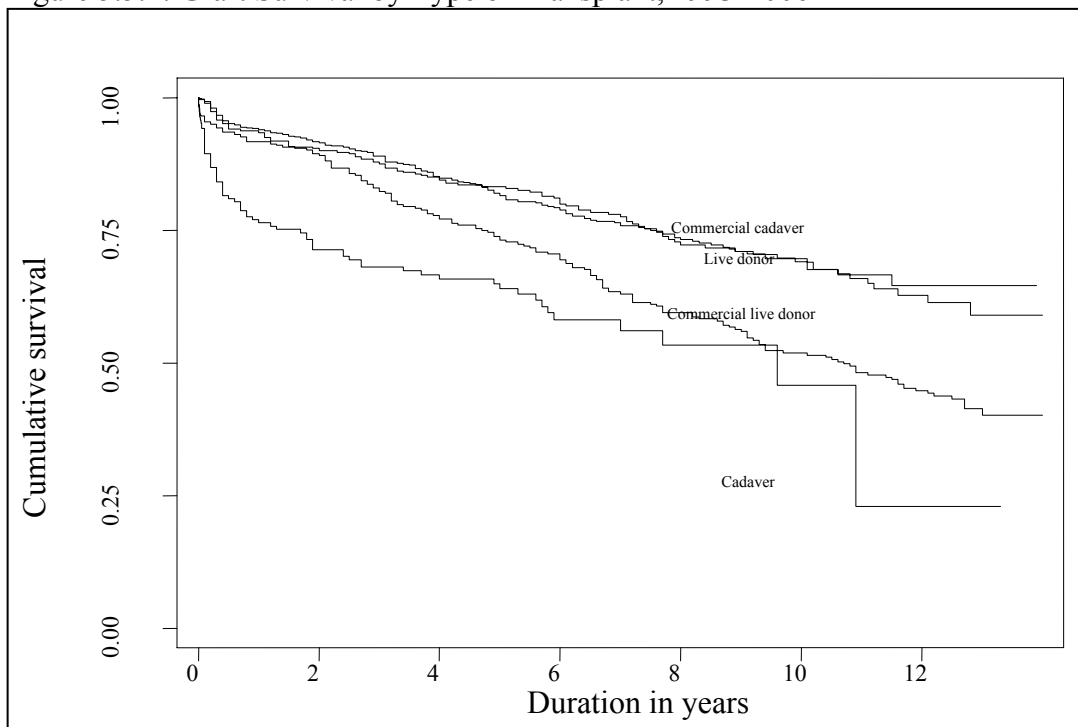


Table 5.5.4: Graft Survival by Type of Transplant, 1993-2006

Type of Transplant	Commercial Cadaver			Commercial Live Donor			Live Donor			Cadaver		
	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE
1	938	94	1	285	93	1	398	92	1	131	76	3
3	661	89	1	240	82	2	323	88	2	100	68	4
5	429	82	1	203	73	2	252	83	2	71	64	4
10	118	70	2	126	52	3	99	69	3	7	46	8

SE=standard error

Figure 5.5.4: Graft Survival by Type of Transplant, 1993-2006



Patient and graft survival for living related transplants were compared for two 7 year cohorts. The 1993-1998 cohort and the 1999-2005 cohort were compared for patient survival (Figures 5.5.5) but both were comparable and survival remained excellent for both groups.

Graft survival for living related transplants (Figure 5.5.6) however was much better in patients in the 1999-2006 cohort even from the outset probably due to increased usage of newer immunosuppressive agents such as MMF and Tacrolimus.

Table 5.5.5: 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

SE=standard error

Figure 5.5.5: Patient Survival by Year of Transplant (Living Related Transplant, 1993-2006)

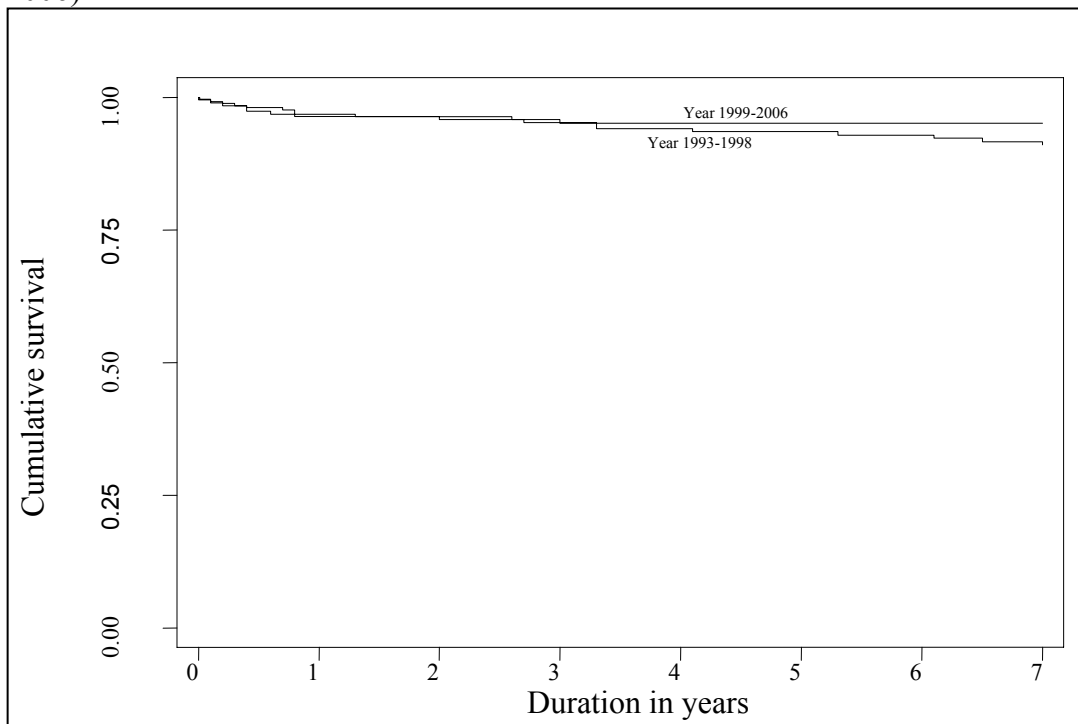
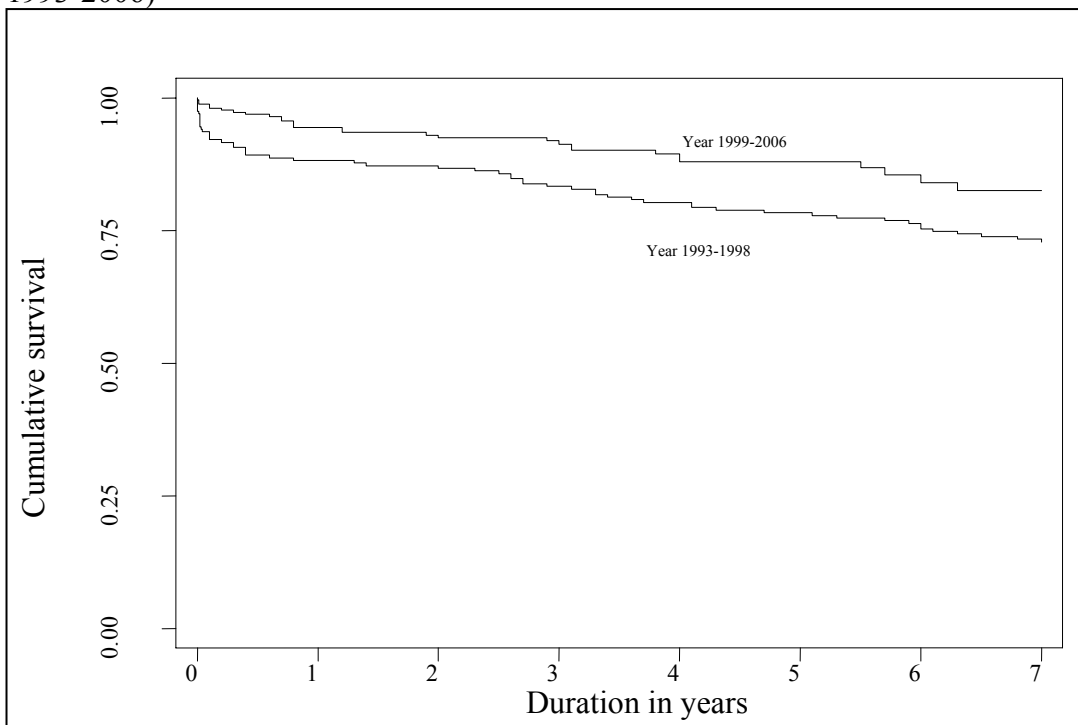


Table 5.5.6: Graft Survival by Year of Transplant (Living Related Transplant, 1993-2006)

Year of Transplant Interval (years)	1993-1998			1999-2006		
	No.	% Survival	SE	No.	% Survival	SE
1	181	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

SE=standard error

Figure 5.5.6: Graft Survival by Year of Transplant (Living Related Transplant, 1993-2006)



In terms of commercial cadaveric transplantation, the comparison between the 1993-1998 cohort and 1999 – 2006 cohort was performed. Both showed comparable results to living related transplants done within the country.

Table 5.5.7: Patient Survival by Year of Transplant (Commercial Cadaver Transplant, 1993-2006)

Year of Transplant Interval (years)	1993-1998			1999-2006		
	No.	% Survival	SE	No.	% Survival	SE
1	289	94	1	650	96	1
3	276	92	2	385	92	1
5	248	87	2	181	87	2
7	226	83	2	50	85	2

SE=standard error

Figure 5.5.7: Patient Survival by Year of Transplant (Commercial Cadaver Transplant, 1993-2006)

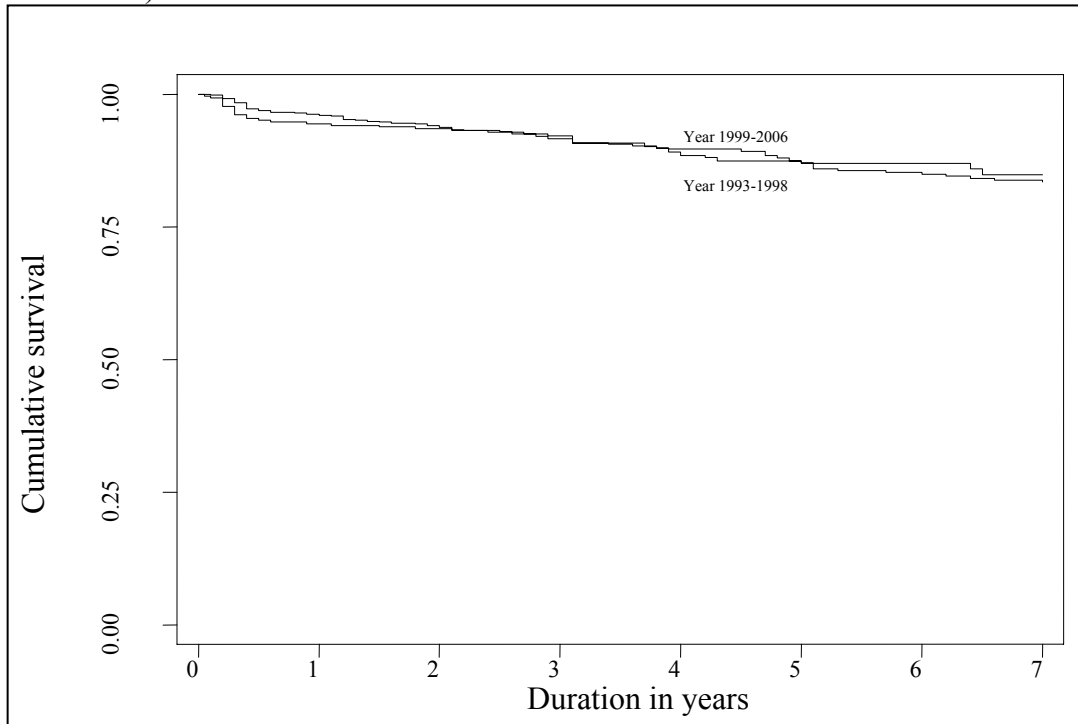
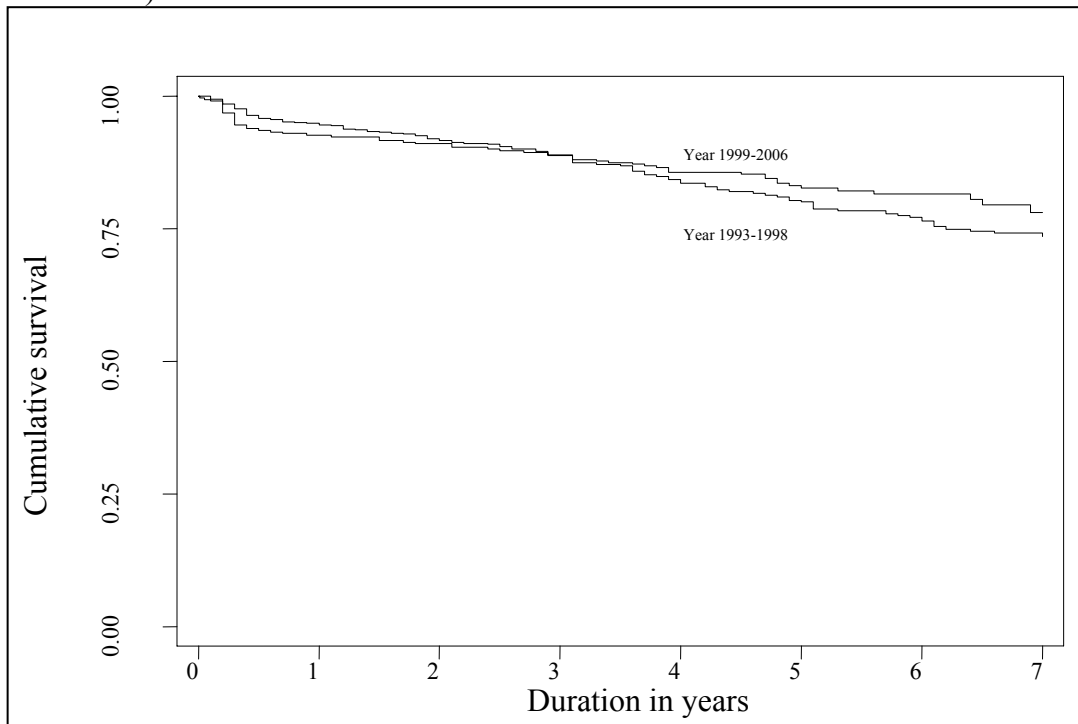


Table 5.5.8: Graft Survival by Year of Transplant (Commercial Cadaver Transplant, 1993-2006)

Year of Transplant Interval (years)	1993-1998			1999-2005		
	No.	% Survival	SE	No.	% Survival	SE
1	289	93	1	650	95	1
3	276	89	2	385	89	1
5	248	80	2	181	83	2
7	226	74	3	50	78	3

SE=standard error

Figure 5.5.8: Graft Survival by Year of Transplant (Commercial Cadaver Transplant, 1993-2006)



**5.6 CARDIOVASCULAR RISK IN RENAL TRANSPLANT RECIPIENTS****5.6.1 Risk Factors for IHD**

In 2006, 85.2% of patients were hypertensive, 23.0% were diabetic and 56.7% had renal insufficiency fulfilling Chronic Kidney Disease (CKD) III and above. Forty-five percent of patients had at least 2 cardiovascular risk factors while 10% had all 3 major risk factors.

Table 5.6.1: Risk Factors for IHD in Renal Transplant Recipients at Year 2004, 2005, and 2006

	<b>2004</b>	<b>2005</b>	<b>2006</b>
	<b>No. (%)</b>	<b>No. (%)</b>	<b>No. (%)</b>
Diabetes	27 (1.8)	19 (1.2)	21 (1.4)
Hypertension**	503 (34.2)	511 (33.4)	460 (31.4)
CKD	121 (8.2)	142 (9.3)	177 (12.1)
Diabetes + Hypertension**	147 (10.0)	159 (10.4)	152 (10.4)
Diabetes + CKD	21 (1.4)	20 (1.3)	18 (1.2)
CKD + Hypertension**	529 (36.0)	539 (35.2)	489 (33.4)
Diabetes + CKD + Hypertension**	121 (8.2)	141 (9.2)	146 (10.0)

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

OR had either Beta blocker / Calcium channel blocker/ ACE inhibitor/ AIIRB / Other anti-hypertensive drugs

Glomerular Filtration Rate,  $GFR(mL/min/1.73m^2) = 1.2*(140-age(year))* weight(kg) / creatinine(\mu mol/L)$  if male

$GFR(mL/min/1.73m^2) = 0.85*(1.2*(140-age(year))* weight(kg) / creatinine(\mu mol/L)$  if female

CKD stage III – GFR, 30- 60 mL/min

CKD stage IV – GFR, 15- 30 mL/min

CKD stage V – GFR, < 15 mL/min



Figure 5.6.1a: Venn Diagram for Pre and Post Transplant Complications (in %) at Year 2004

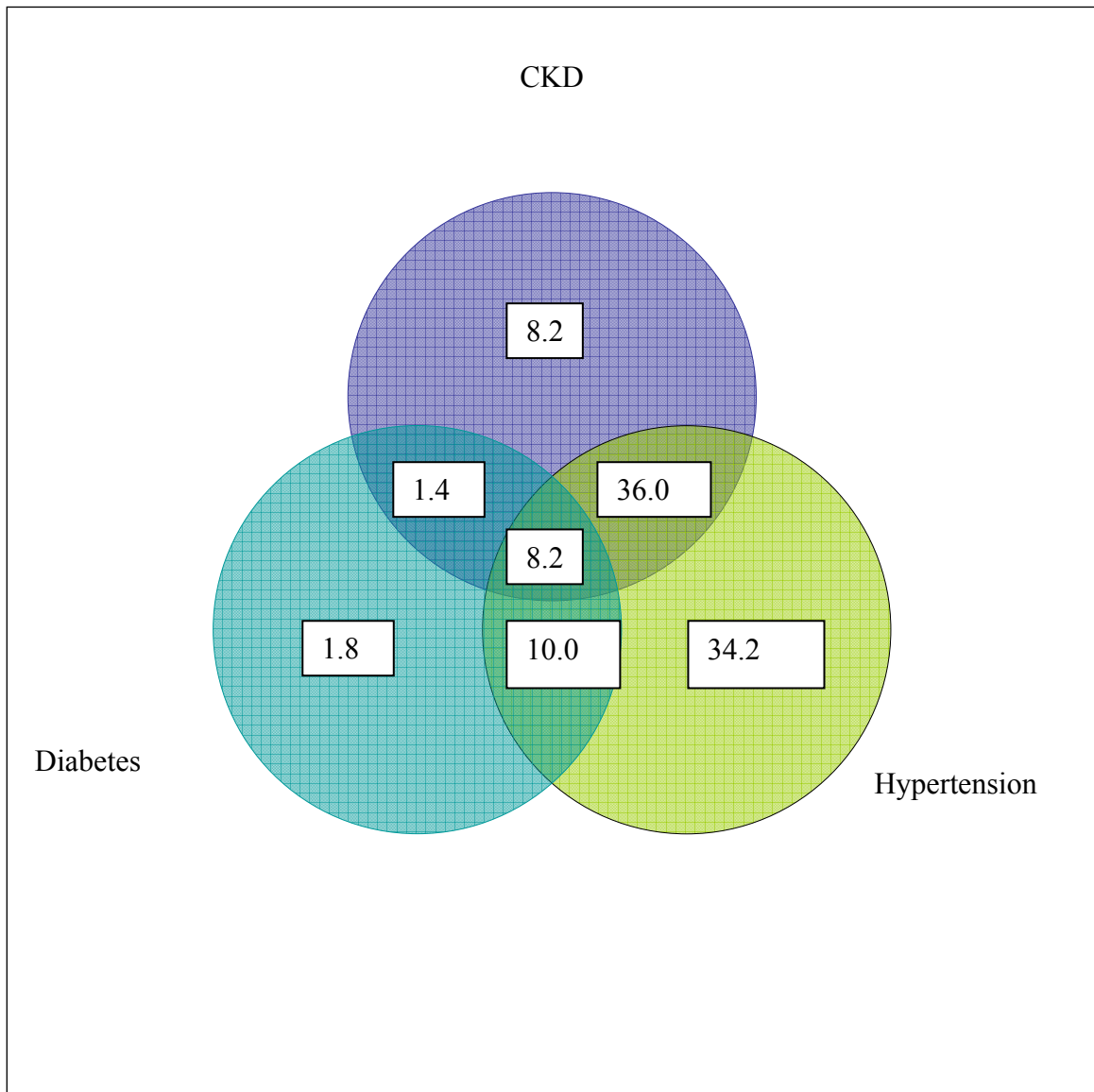


Figure 5.6.1b: Venn Diagram for Pre and Post Transplant Complications (in %) at Year 2005

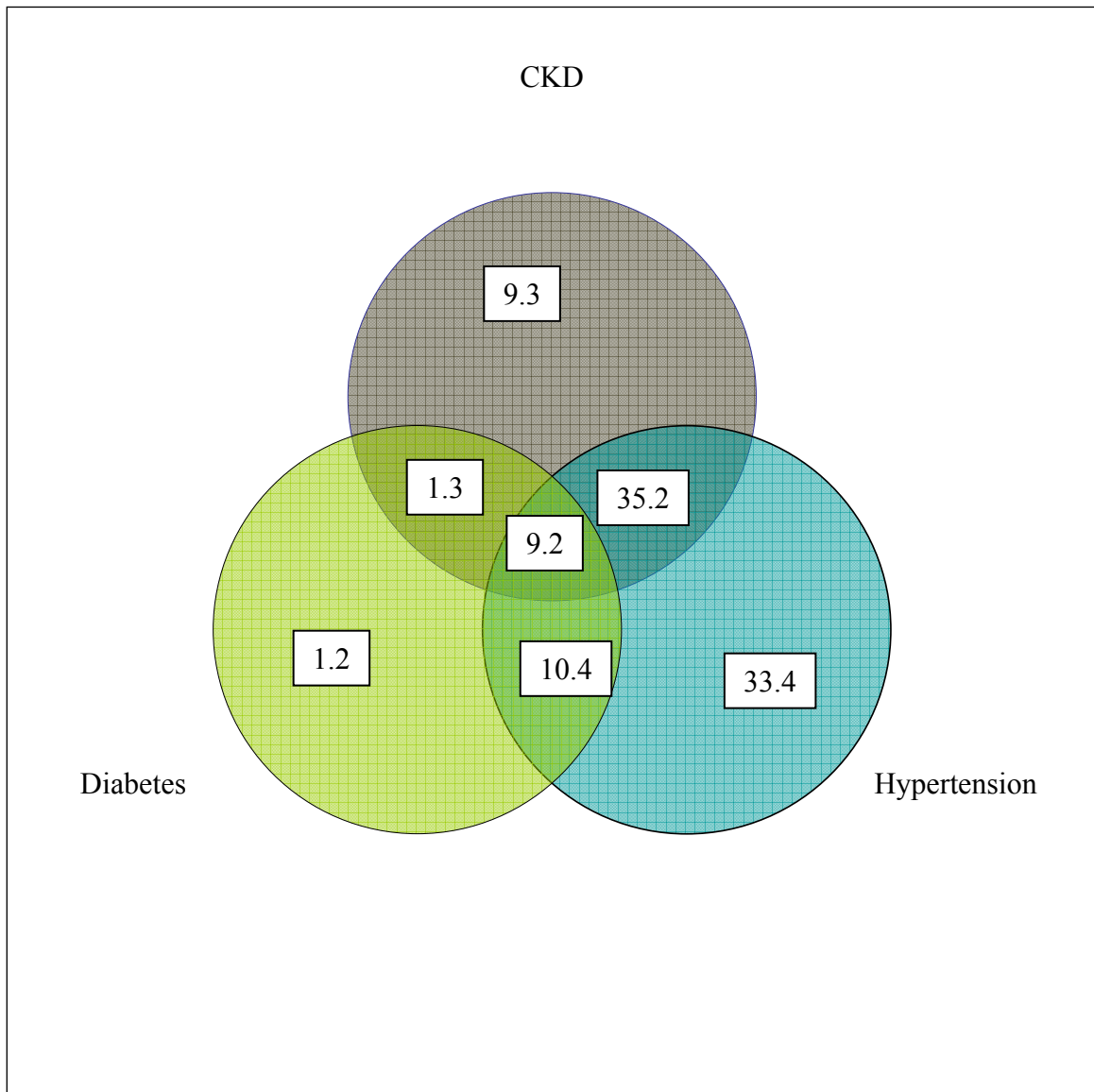
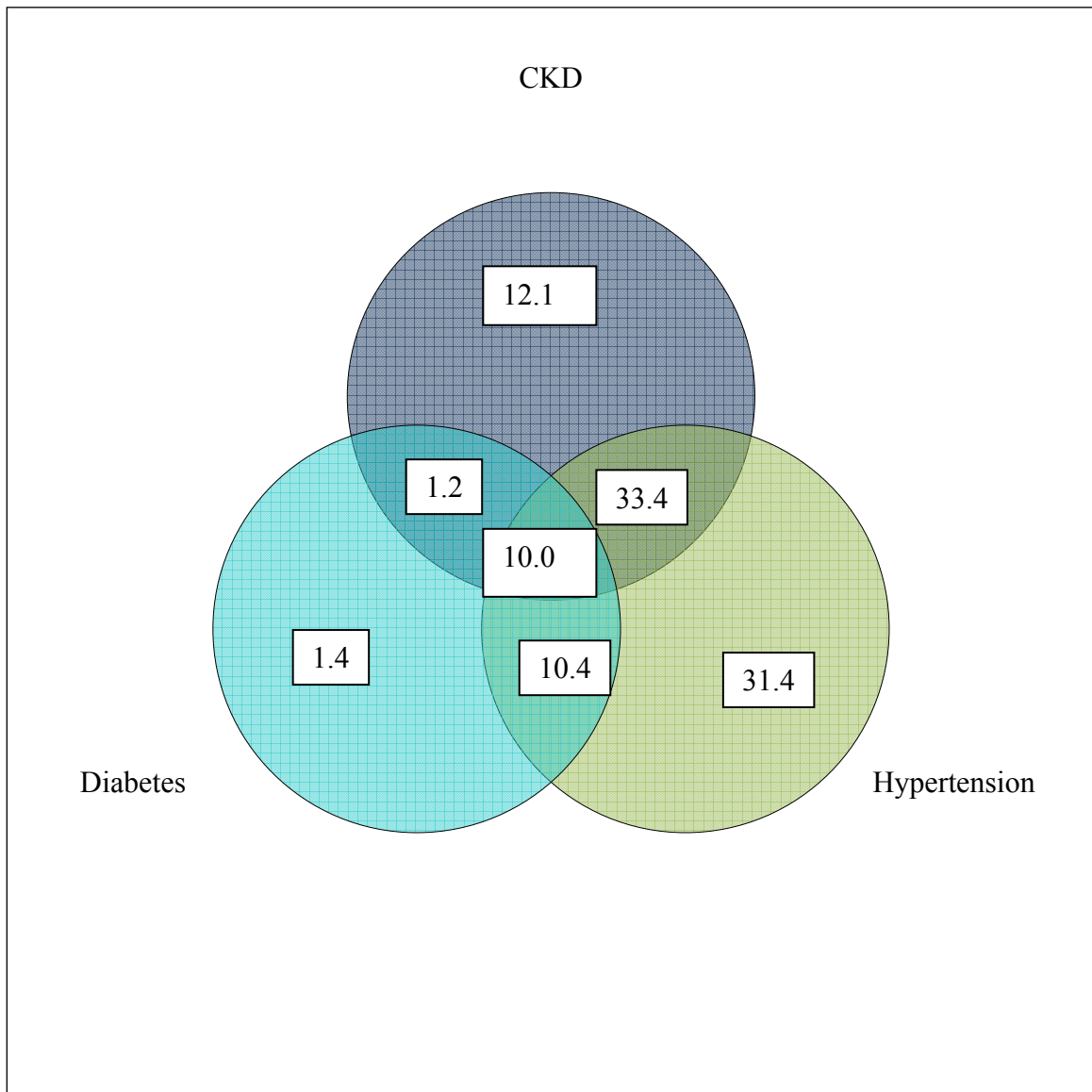


Figure 5.6.1c: Venn Diagram for Pre and Post Transplant Complications (in %) at Year 2006



5.6.2 Blood Pressure Classification according to Joint National Committee (JNC) VI criteria, 2004, 2005, and 2006

In 2006, 22.2% of renal transplant recipients had stage I hypertension whereas 5.8% had stage II hypertension and 1.2% had stage III hypertension despite being on treatment. In terms of diastolic hypertension 3.8% of patients had stage II and 0.3% of patients had stage III despite being on treatment.

Table 5.6.2a: Distribution of Patients by Systolic BP Levels, 2004-2006

	2004	2005	2006
	No. (%)	No. (%)	No. (%)
Systolic BP <120	207 (13.4)	233 (14.3)	249 (15.6)
Systolic BP <130	341 (22.0)	318 (19.5)	395 (24.8)
Systolic BP 130-139	459 (29.6)	474 (29.0)	483 (30.3)
Systolic BP 140-159	418 (27.0)	452 (27.7)	353 (22.2)
Systolic BP 160-179	102 (6.6)	133 (8.1)	93 (5.8)
Systolic BP ≥180	23 (1.5)	24 (1.5)	19 (1.2)

Figure 5.6.2a: Distribution of Patients by Systolic BP Levels, 2004-2006

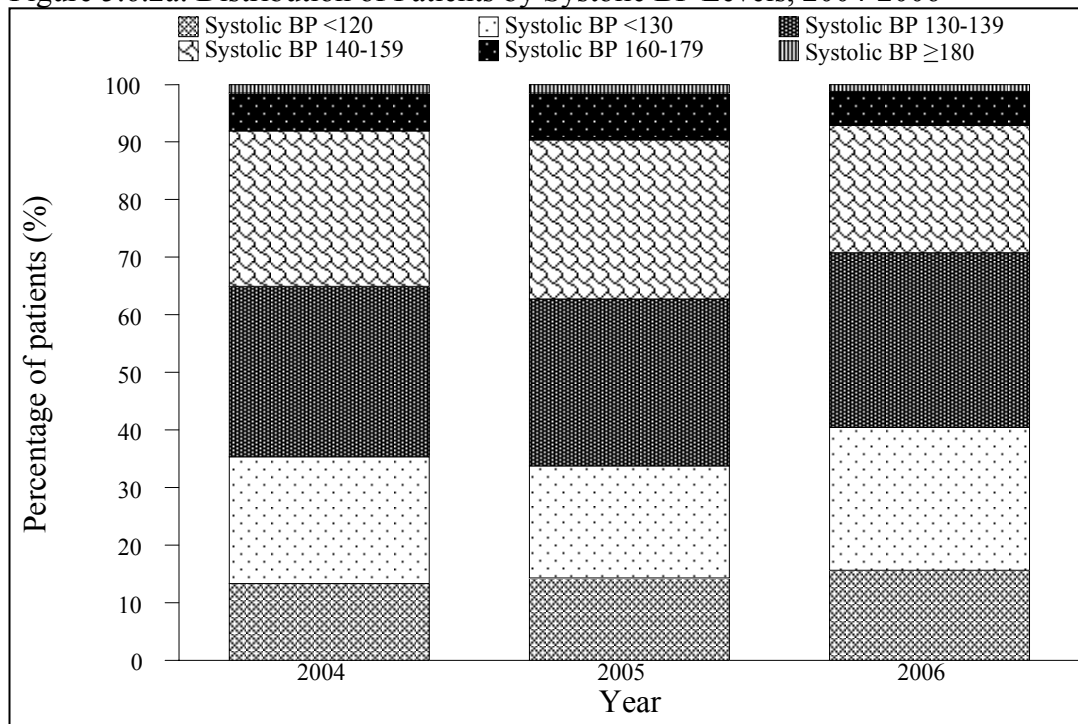


Table 5.6.2b: Distribution of Patients by Diastolic BP Levels, 2004-2006

	2004	2005	2006
	No. (%)	No. (%)	No. (%)
Diastolic BP<80	513 (33.1)	521 (31.9)	624 (39.2)
Diastolic BP<85	602 (38.8)	657 (40.2)	586 (36.8)
Diastolic BP 85-89	48 (3.1)	73 (4.5)	73 (4.6)
Diastolic BP 90-99	319 (20.6)	308 (18.8)	244 (15.3)
Diastolic BP 100-109	56 (3.6)	65 (4.0)	61 (3.8)
Diastolic BP $\geq$ 110	12 (0.8)	10 (0.6)	4 (0.3)

Figure 5.6.2b: Distribution of Patients by Diastolic BP Levels, 2004-2006

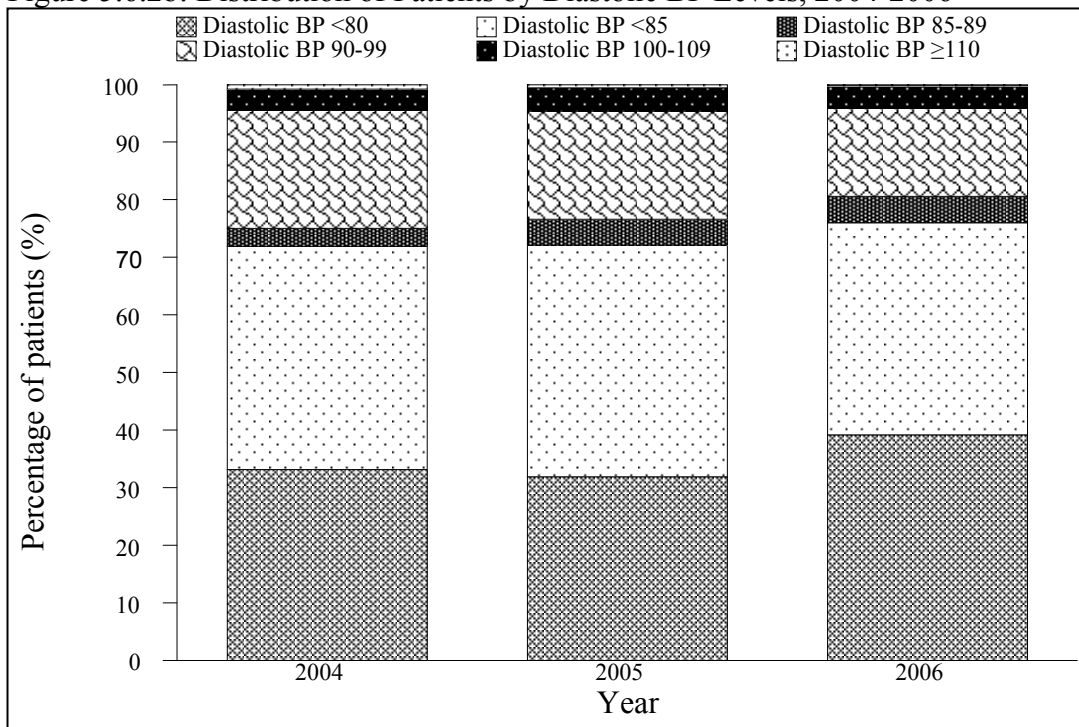
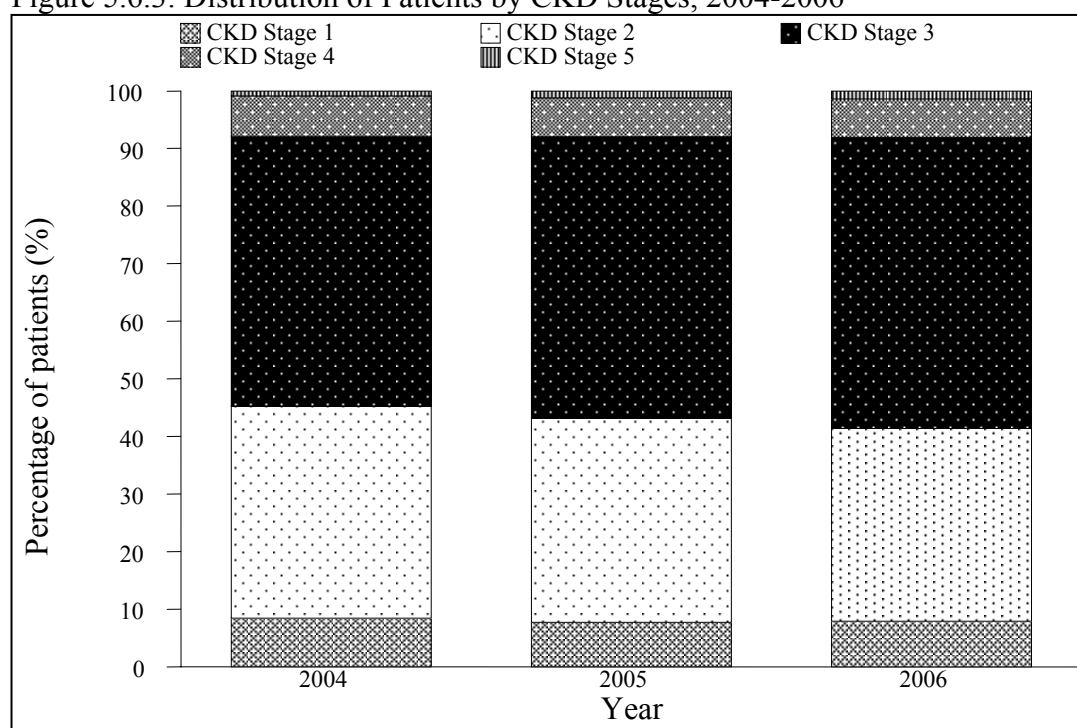


Table 5.6.3 shows the CKD Stage classification by year and in 2006, 50.5% of renal transplant recipients had CKD Stage III whilst another 6.7% had CKD Stage IV. CKD Stage V (impending renal replacement therapy) was found in 1.4% of renal transplant recipients.

Table 5.6.3: Distribution of Patients by CKD Stages, 2004-2006

	2004	2005	2006
	No. (%)	No. (%)	No. (%)
CKD stage 1	130 (8.4)	126 (7.7)	126 (7.9)
CKD stage 2	571 (36.8)	579 (35.4)	533 (33.5)
CKD stage 3	727 (46.9)	798 (48.8)	804 (50.5)
CKD stage 4	109 (7.0)	112 (6.9)	107 (6.7)
CKD stage 5	13 (0.8)	19 (1.2)	22 (1.4)

Figure 5.6.3: Distribution of Patients by CKD Stages, 2004-2006

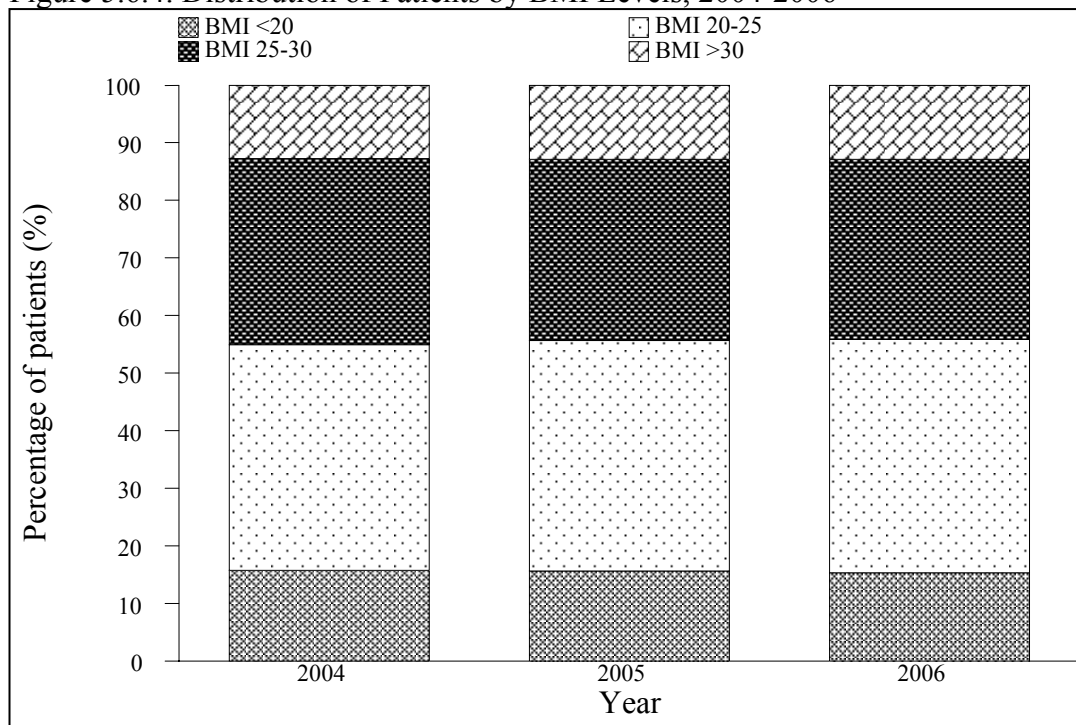


In terms of BMI for 2006, 55.9% of renal transplant recipients had BMIs of 25 or below. However 31.2% were overweight and 12.9% were obese.

Table 5.6.4: Distribution of Patients by BMI Levels, 2004-2006

	2004	2005	2006
	No. (%)	No. (%)	No. (%)
BMI <20	243 (15.7)	255 (15.6)	243 (15.3)
BMI 20-25	609 (39.3)	654 (40.0)	647 (40.6)
BMI 25-30	500 (32.3)	514 (31.5)	497 (31.2)
BMI >30	198 (12.8)	211 (12.9)	205 (12.9)

Figure 5.6.4: Distribution of Patients by BMI Levels, 2004-2006

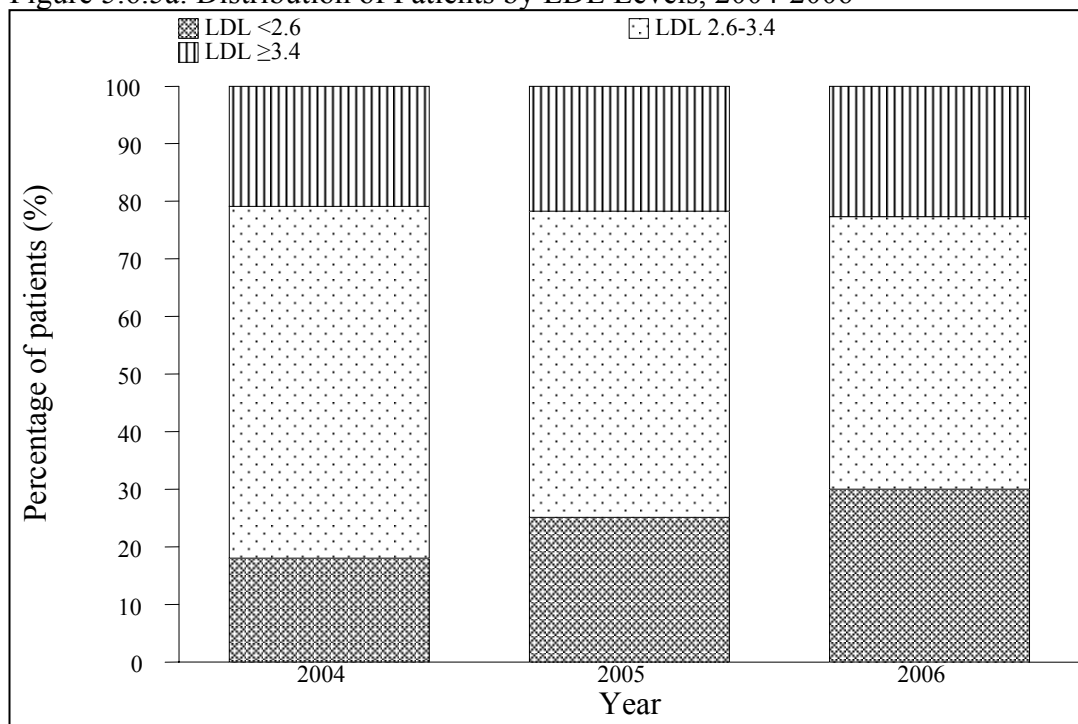


LDL cholesterol has been identified as the primary lipid target for prevention of coronary heart disease by National Cholesterol Education Program (NCEP) with a log linear relationship between risk of CHD and level of LDL cholesterol. In terms of renal transplant recipients in 2006, 30% have LDL levels below 2.6 mmol/l and this shows an increasing trend from 18.1% in 2004, possibly due to the more widespread use of statins. However, whether this translates into less cardiovascular mortality in the transplant population is still questionable. Patients with serum LDL >3.4 remained fairly static during the study period at 22.7%.

Table 5.6.5a: Distribution of Patients by LDL Levels, 2004-2006

	2004	2005	2006
	No. (%)	No. (%)	No. (%)
LDL < 2.6	280 (18.1)	411 (25.2)	478 (30.0)
LDL 2.6-3.4	946 (61.0)	868 (53.1)	753 (47.3)
LDL ≥ 3.4	324 (20.9)	355 (21.7)	361 (22.7)

Figure 5.6.5a: Distribution of Patients by LDL Levels, 2004-2006





In terms of other cholesterol parameters for 2006, 59.5% had total cholesterol levels more than 5.2 and 6.4% had HDL cholesterol levels <1.0.

Table 5.6.5b: Distribution of Patients by Total Cholesterol Levels, 2004-2006

	2004	2005	2006
	No. (%)	No. (%)	No. (%)
Total Cholesterol <4.1	111 (7.2)	156 (9.5)	155 (9.7)
Total Cholesterol 4.1-5.1	413 (26.6)	455 (27.8)	489 (30.7)
Total Cholesterol 5.2-6.2	753 (48.6)	776 (47.5)	706 (44.3)
Total Cholesterol 6.3- 7.2	197 (12.7)	173 (10.6)	173 (10.9)
Total Cholesterol > 7.2	76 (4.9)	74 (4.5)	69 (4.3)

Figure 5.6.5b: Distribution of Patients by Total Cholesterol Levels, 2004-2006

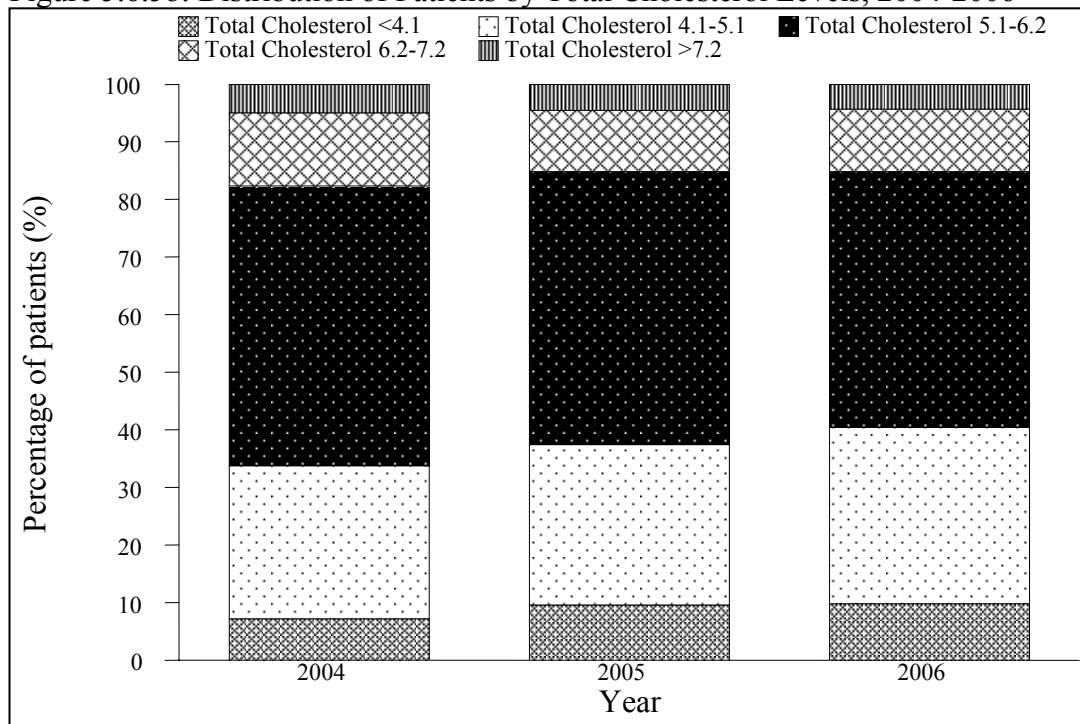
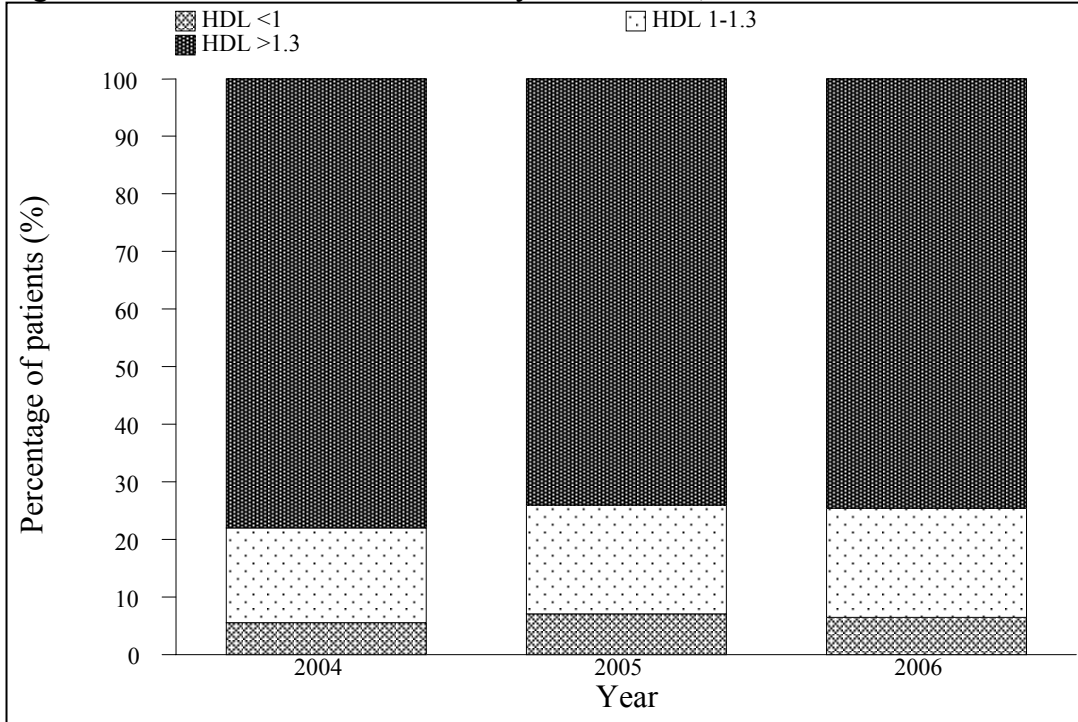


Table 5.6.5c: Distribution of Patients by HDL Levels, 2004-2006

	<b>2004</b>	<b>2005</b>	<b>2006</b>
	<b>No. (%)</b>	<b>No. (%)</b>	<b>No. (%)</b>
HDL <1	86 (5.5)	116 (7.1)	102 (6.4)
HDL 1-1.3	255 (16.5)	308 (18.8)	302 (19.0)
HDL >1.3	1209 (78.0)	1210 (74.1)	1188 (74.6)

Figure 5.6.5c: Distribution of Patients by HDL Levels, 2004-2006



Eighty-six percent of patients in 2006 were on anti-hypertensives and the majority was on more than 1 anti-hypertensive drug with 26% on 2 anti-hypertensives and 17% on 3 anti-hypertensives. Despite this 8% of patients had systolic BP of > 160 mmHg and 22% had diastolic BP of > 90 mmHg.

Table 5.6.6a: 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	1634	85	28	30	19
2006	1592	86	34	26	17

Table 5.6.6b: Distribution of Systolic BP without Anti-hypertensives, 2004-2006

Year	No.	Mean	SD	Median	LQ	UQ	% Patients $\geq 160$ mmHg
2004	179	126	14	130	120	130	4
2005	229	127	15	130	120	137	3
2006	189	124	14	120	117	130	4

Table 5.6.6c: Distribution of Diastolic BP without Anti-hypertensives, 2004-2006

Year	No.	Mean	SD	Median	LQ	UQ	% Patients $\geq 90$ mmHg
2004	179	79	9	80	73	80	17
2005	229	79	9	80	70	80	18
2006	189	76	10	80	70	80	11

Table 5.6.6d: Distribution of Systolic BP on Anti-hypertensives, 2004-2006

Year	No.	Mean	SD	Median	LQ	UQ	% Patients $\geq 160$ mmHg
2004	1312	133	16	130	120	140	9
2005	1350	134	17	130	120	143	11
2006	1334	132	16	130	120	140	8

Table 5.6.6e: Distribution of Diastolic BP on Anti-hypertensives, 2004-2006

Year	No.	Mean	SD	Median	LQ	UQ	% Patients $\geq 90$ mmHg
2004	1312	81	10	80	74	90	27
2005	1350	81	9	80	76	90	25
2006	1334	79	10	80	70	86	22