

THIRD
REPORT OF THE
NATIONAL TRANSPLANT REGISTRY
2006

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FOREWORD

The development of organ and tissue transplantation in this country continues to make progress although at a pace many wish could be faster. Many factors continue to challenge the development of organ transplantation. The high cost of doing organ transplantation has been cited as a frequent impediment to doing more transplantation. Yet there has never been a case where organ transplantation in this country has been deferred or put off because the patient cannot afford it. We are fortunate in that the government has been supportive and subsidized heavily the cost of doing transplantation. Almost all solid organ transplantation is done in public hospitals either in the Ministry of Health or Ministry of Higher Education. There have been numerous campaigns in both the print and electronic media to create greater public awareness and although there is a surge of interest after each dramatic report of a donation by a cadaver donor, we are not seeing that many more donation as expected. The organ procurement team will no doubt continue with its efforts to promote cadaveric organ donation. Another factor that has been addressed recently is the organizational and support structure to facilitate transplantation. The Ministry of Health has now reorganized the structure of the transplantation service, developed a national policy on organ and tissue transplantation and allocated substantial funds for human resource development and improvement of facilities. These measures hopefully will bear fruit in the near future.

In recent years much attention were directed to the unsavory aspect of kidney transplantation – the commercial cadaveric transplantation in China and the live donor kidney transplantation in Pakistan and Philippines in particular. Authorities in these countries have now banned such transplantation. The number of kidney transplantations done in China has dropped dramatically and the overall figures for kidney transplantation reported to the National Transplant Registry (NTR) in 2007 was the lowest in many years. Many countries in the world have resorted to increasing the live related donor pool to overcome the shortage of kidneys. In some the number of live related kidney transplantation has overtaken that of cadaveric kidney transplantation. It is time that this country redirects its efforts to improve the live related kidney transplantation program. Many end stage renal failure (ESRF) patients have not been properly counseled on the benefits of transplantation but are often shunted straight to dialysis.

This report continues to document the progress made in organ and tissue transplantation in the country. We are grateful to the centres, the doctors and their staff who have painstakingly collected data and submitted them to NTR. We hoped the data in this registry will be of use to them and can assist them in planning future development, audit activities and stimulate research.

Tan Sri Dato Dr Yahya Awang
Chairperson

Dato Dr Zaki Morad
Co-chairperson

Datin Dr Lela Yasmin Mansor
Co-chairperson

NATIONAL TRANSPLANT REGISTRY

ACKNOWLEDGEMENTS

The National Transplant Registry would like to record its appreciation to everyone who have helped made this report possible.

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- Our source data providers that are the transplant surgeons, physicians and staff of all organ and tissue transplant centres and transplant follow up centres from the government, universities and private sectors, without whose commitment, hard work and timely data submission, there will be no report
- National Renal Registry for sharing the renal transplant data
- Clinical Research Centre, Hospital Kuala Lumpur
- Ministry of Health, Malaysia
- The members of the various expert panels for their expertise and for devoting their valuable time and effort in preparing and writing the various chapters
- And not forgetting our following supporters from the industry and other well-wishers:

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Norvartis Corporation (M) Sdn. Bhd.
Janssen-Cilag Div., Johnson & Johnson Sdn. Bhd.
GlaxoSmithKline Pharmaceutical Sdn. Bhd.

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12. Department of Orthopaedics, Hospital Pulau Pinang
13. Department of Orthopaedics, Hospital Seberang Jaya
14. Department of Orthopaedics, Hospital Sultanah Aminah
15. Department of Orthopaedics, Hospital Tengku Ampuan Rahimah
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23. Island Hospital, Penang
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29. Ophthalmology Department, Hospital Kuala Lumpur
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34. Ophthalmology Department, Hospital Universiti Sains Malaysia
35. Ophthalmology Department, Sri Kota Medical Centre
36. Timberland Medical Centre, Kuching
37. Wan Orthopaedic, Trauma & Sports Injury Centre, Seremban Specialist Hospital

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3. K.C. Yeo Eye Specialist Centre
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8. Ophthalmology Department, Hospital Bukit Mertajam
9. Ophthalmology Department, Hospital Duchess of Kent, Sandakan
10. Ophthalmology Department, Hospital Ipoh
11. Ophthalmology Department, Hospital Kangar
12. Ophthalmology Department, Hospital Kota Bharu
13. Ophthalmology Department, Hospital Kuala Lipis
14. Ophthalmology Department, Hospital Kuala Lumpur
15. Ophthalmology Department, Hospital Kuala Pilah
16. Ophthalmology Department, Hospital Kuala Terengganu
17. Ophthalmology Department, Hospital Melaka
18. Ophthalmology Department, Hospital Mentakab
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20. Ophthalmology Department, Hospital Pakar Sultanah Fatimah
21. Ophthalmology Department, Hospital Pantai Indah
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29. Ophthalmology Department, Hospital Sultanah Aminah
30. Ophthalmology Department, Hospital Sungai Buloh
31. Ophthalmology Department, Hospital Sungai Petani
32. Ophthalmology Department, Hospital Taiping
33. Ophthalmology Department, Hospital Tawau
34. Ophthalmology Department, Hospital Teluk Intan
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36. Ophthalmology Department, Hospital Tengku Ampuan Rahimah
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41. Ophthalmology Department, University of Malaya Medical Centre
42. Pusat Pakar Mata Centre For Sight, PJ
43. Puteri Specialist Hospital, Johor Bahru
44. Sunway Medical Centre
45. Tan Eye Specialist Centre, Sunway Medical Centre
46. Tun Hussein Onn National Eye Hospital

Discipline: Heart and Lung Transplant

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2. Institut Perubatan Respiratori, Hospital Kuala Lumpur

Discipline: Heart Valve Transplant

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Discipline: Liver Transplant

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5. Subang Jaya Medical Centre

Discipline: Renal Transplant

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4. Nephrology Department, Hospital Batu Pahat
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7. Nephrology Department, Hospital Ipoh
8. Nephrology Department, Hospital Kangar
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10. Nephrology Department, Hospital Kluang
11. Nephrology Department, Hospital Kuala Lumpur
12. Nephrology Department, Hospital Kuala Terengganu
13. Nephrology Department, Hospital Labuan
14. Nephrology Department, Hospital Melaka
15. Nephrology Department, Hospital Miri
16. Nephrology Department, Hospital Pakar Sultanah Fatimah
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18. Nephrology Department, Hospital Pulau Pinang
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23. Nephrology Department, Hospital Serdang
24. Nephrology Department, Hospital Seremban
25. Nephrology Department, Hospital Sibul
26. Nephrology Department, Hospital Sultan Ismail Pandan
27. Nephrology Department, Hospital Sultanah Aminah
28. Nephrology Department, Hospital Taiping
29. Nephrology Department, Hospital Tawau
30. Nephrology Department, Hospital Tengku Ampuan Afzan
31. Nephrology Department, Hospital Tengku Ampuan Rahimah
32. Nephrology Department, Sarawak General Hospital
33. Nephrology Department, UKM Hospital
34. Nephrology Department, University Malaya Medical Centre
35. Nephrology Department, USM Hospital
36. Nephrology Unit, Ampang Puteri Specialist Hospital
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38. Nephrology Unit, Subang Jaya Medical Centre
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44. Renal Transplant Clinic, Selangor Medical Centre
45. Renal Transplant Clinic, Sri Kota Medical Centre
46. Renal Transplant Unit, Hospital Pantai Mutiara
47. S.P. Menon Dialysis Centre, Klang
48. Simon Wong Medical & Kidney Clinic, Timberland Medical Centre
49. Smartcare Dialysis Centre, Cheras
50. Smartcare Dialysis Centre, Subang Jaya
51. Tan Medical Renal Clinic

ABOUT THE NATIONAL TRANSPLANT REGISTRY

The National Transplant Registry (NTR) is a Ministry of Health (MOH) supported registry whose aim is to collect information about organ and tissue transplantations in Malaysia. The information allows us to estimate the magnitude of transplant activity in the country. Such information besides being useful to transplantation practitioners, can be used in assisting the MOH, non-governmental organisations, private providers and industry in program planning and evaluation of transplantation services.

The objectives of NTR are to:

1. Determine the frequency and distribution of all types of transplantation activity in Malaysia.
2. Determine the outcomes of transplantation.
3. Determine the factors influencing outcomes of transplantation.
4. Evaluate transplantation services in the country.
5. Stimulate and facilitate research on transplantation and its management.

The NTR receives data on organ / tissue transplantation from 3 main sources:

1. The individual doctors who provide transplantation services, who voluntarily report data to the NTR. Data collection will be from seven main types of transplantation services:
 - Blood and Marrow Transplant
 - Cornea Transplant
 - Heart and Lung Transplant
 - Liver Transplant
 - Renal Transplant
 - Heart Valve Transplant
 - Bone and Tissue Transplant
2. The National Vital Registration system (Jabatan Pendaftaran Negara). Their data is useful for determining or verifying mortality outcomes of transplant patients.
3. Information Documentation Unit of the MOH, which operates the Health Management Information System (HMIS).

NTR SPONSORS

- Medical Development Division, MOH
- National Transplant Coordinating Committee
- Malaysian Society Of Transplantation
- Clinical Research Centre, Hospital Kuala Lumpur

GOVERNANCE BOARD

The Governance Board is established by NTR sponsors to govern the NTR. Current members of the Governance Board are as follows:

Name	Representation
Tan Sri Dato' Dr Yahya Awang Chairperson	Cardiothoracic Consultant, Damansara Specialist Hospital NTR Expert Panel Chairman of Heart / Lung Transplant
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Prof Dr Chan Lee Lee	NTR Expert Panel Co-chair of Blood and Marrow Transplant (Paediatric)
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Dr Shamala Retnasabapathy	NTR Expert Panel Chairperson of Cornea Transplant
Dr Goh Bak Leong	NTR Expert Panel Co-chair of Renal Transplant
Mr Mohamed Ezani Hj Md. Taib	NTR Expert Panel Co-chair of Heart / Lung / Heart Valve Transplant
Prof Zulmi Wan	NTR Expert Panel Chairman of Bone and Tissue Transplant

EXPERT PANEL

NTR has established seven groups of Expert Panel comprising members of the medical profession and allied health with expert knowledge in these various disciplines:

- Blood and Marrow Transplant
- Cornea Transplant
- Heart and Lung Transplant
- Liver Transplant
- Renal Transplant
- Heart Valve Transplant
- Bone and Tissue Transplant

The role of the Expert Panel is:

1. To undertake quality control of the clinical registry form and the data dictionary.
2. To undertake quality control of the reported data.
3. To undertake literature review in the relevant area.
4. To interpret the results generated by NTR's statisticians.
5. To write the section of the NTR report relevant to the panel expertise.
6. To specify the data reporting procedure.
7. To facilitate access to source documents for Transplant Registry Unit (TRU) staff to do data verification.

List of Expert Panel members for each respective discipline:

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Discipline: Bone and Tissue Transplant

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The Clinical Research Centre (CRC) of the Ministry of Health provides technical support for the National Transplant Registry. The clinical epidemiologists provide methodological and epidemiological input while the database is supported on CRC's IT infrastructure.

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REPORT SUMMARY

1. BLOOD AND MARROW TRANSPLANTATION

There were a total of 1174 haematopoietic stem cell transplantations reported to the Registry between 1987 and 2006; 797 were functioning by the end of 2006.

The majority of all transplants (72%) were for malignant disorders and most of these are haematological malignancies like leukaemia and lymphoma. The main non-malignant disorders transplanted were thalassaemia and aplastic anaemia.

There were 124 new transplantations done in Malaysia in 2006 with 11 follow-up centres for transplant recipients.

Mean age of new transplant patients in 2006 was 24 ± 19 years; 59% were male, 44% Malay, 38% Chinese, 7% Indian and 11% others. Autologous transplants accounted for 33%. Seventy-eight percent of the transplant source was from peripheral blood stem cells and 93% were from Human Leukocyte Antigen (HLA) identical donors.

In 2006, 25 of prevalent transplant recipients died. Underlying disease and infection were the commonest causes of death accounting for 44% and 32% respectively.

2. CORNEA TRANSPLANTATION

There were 46 centres which provided cornea transplantation data.

One hundred and seventy-four new cornea transplantations were reported in Malaysia in 2006. Mean age of new transplant recipients in 2006 was 44 ± 22 years. Of these, 67% were male. Thirty-five percent of recipients were Malay, 33% were Chinese, 23% were Indian and 9% were other races.

The primary diagnoses for cornea transplantation recipients in 2006 were keratoconus (19%), pseudophakic bullous keratopathy (17%), cornea perforation (15%), cornea scars (10%), microbial keratitis (6%), other (non-pseudophakic) bullous keratopathy (6%), and failed previous cornea grafts (5%).

Sixty percent of recipients were legally blind before their transplant surgery.

In 2006, 55% of donated corneas were from the USA, 24% from Sri Lanka and 20% from local sources. The mean age of the donors was 55 ± 16 years.

The commonest cornea transplantation surgery performed was penetrating keratoplasty (86%) i.e. transplantation of a full thickness cornea tissue.

3. HEART AND LUNG TRANSPLANTATION

There were a total of 17 heart transplantations reported to the Registry between 1997 and 2006; seven grafts were functioning at the end of 2006 and all were followed up in Institut Jantung Negara.

There was only 1 heart transplantation done in 2006.

Two thirds of the heart transplant recipients were males and 58% were Indians. The mean age of recipients was 36 ± 16 years. Ischaemic cardiomyopathy was the commonest primary diagnosis (9/17) followed by dilated cardiomyopathy (6/17).

Six recipients died in hospital following heart transplantation; four patients succumbed to late deaths after their heart transplant.

The transplant patient survival rate was 59% and 40% at 1 year and 3 years respectively.

Two lung transplantations were performed, one in 2005 and one in 2006. Both of the patients were Indian males and both of them had Idiopathic Pulmonary Fibrosis. Single lung transplantation was performed for the 1st patient and patient remained alive with good quality of life. Double Lung transplantation was performed in the second case in 2006. Unfortunately, this patient succumbed 8 weeks after transplantation due to Cytomegalovirus infection.

4. LIVER TRANSPLANTATION

There were a total of 88 liver transplantations reported to the Registry between 1993 and 2006; 50 grafts were functioning by the end of 2006.

There were 8 new liver transplantations done in Malaysia in 2006.

There were 5 follow-up centres for liver transplant recipients in 2006.

Mean age of all transplant patients was 7 ± 14 years (range 3 months to 74 years); 57% were male, 50% Chinese, 72% were for biliary atresia. Majority were living donor liver transplantations (80.7%).

At the time of transplantation the main immunosuppressive drugs used were tacrolimus (77%) and steroids (59%).

Transplant patient survival rate for the cohort 1993 to 1998 was 71% at 1 year; survival rate for the cohort 1999 to 2006 was 70% at 1 year.

5. RENAL TRANSPLANTATION

There were 51 follow-up centres for renal transplant recipients in 2006. Incident rates for renal transplantation were static, from 6 per million population in 1997 to 5 per million in 2006. There were 132 new renal transplants in 2006.

The number of functioning renal transplants has increased steadily from 1083 in 1997 to 1728. The transplant prevalence rate was 65 per million population in 2006.

In 2006, the mean age for new transplant recipients was 37 ± 15 years, 68% were male and 20% had diabetes at the time of transplantation.

Ninety-seven percent of prevalent renal transplant recipients were on prednisolone, 75% on cyclosporine, 17% on tacrolimus, 48% mycophenolate mofetil and 34% on azathioprine.

In 2006, 49 (3%) of prevalent transplant recipients died and 35 (2%) lost their grafts. Infection and cardiovascular disease were the commonest causes of death accounting for 41% and 19% respectively. Death at home was the third commonest cause at 13%. Renal allograft rejection accounted for 71% of graft loss.

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 for these years was 92%, 85%, 79% and 63% respectively.

6. HEART VALVE TRANSPLANTATION

There were a total of 167 heart valve homografts reported to the Registry between 1996 and 2006; 148 grafts were functioning at the end of 2006. Eighty-three were aortic and 84 were pulmonary valves.

Mean age of all heart valve transplant patients was 11 ± 10 years (range 3 months to 70 years); 51% were male, 61% Malay.

7. BONE AND TISSUE TRANSPLANTATION

In 2006, 127 bone allografts and 379 amniotic membranes were supplied by National Tissue Bank, USM.

Twenty-two hospitals used the bone grafts and 17 centres used the amniotic membranes. Characteristics were reported for only 35 of the recipients (7%).

8. CADAVERIC ORGAN AND TISSUE DONATION

There were 25 donors in 2006 of which 14 were brain dead multi-organ and tissue donors and 11 were post cardiac death tissue donors. The donation rate was 1.01 donations per million population (pmp), a twofold rise from 0.53 donations pmp in 2005.

The mean age of the donors was 35.7 ± 22.5 years. The youngest was a three-year old multi-organ and tissue donor while the oldest was a 77 year-old eye donor. Seventy-six percent were male, 48% were Chinese, 44% Indian, 8% Malay.

One donor carried the donor pledge card. Thirteen of the donors died from medical causes, 10 died from accidents and two were homicides. Sixty-eight percent of donations took place in MOH state hospitals, 16% in private hospitals and 12% from University hospitals.

CHAPTER 1

BLOOD AND MARROW TRANSPLANTATION

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Prof Dr Chan Lee Lee

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Prof Dr Lin Hai Peng

Dr Mahfuzah Mohamed

Dr Ng Soo Chin

Dr Visalachy Purushothaman

Dr Vijaya Sangkar

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1.0 INTRODUCTION

This is the third report on Blood and Marrow Transplant activities in Malaysia up to December 2006 as recorded by the Blood and Marrow Transplant Registry under the umbrella of the National Transplant Registry.

The registry continues to be vital as it would serve the following purpose:

1. Provide an accurate record of the number of haematopoietic stem cell transplantations performed in the country.
2. Reflect the changing trends in patient numbers, indications for transplant, mode of transplants and centres involved.
3. Report on the outcome of haematopoietic stem cell transplantation which would enable national and international comparisons.
4. Provide data which could guide future needs and directions in the field of haematopoietic stem cell transplantation.

Data collected in our Blood and Marrow Transplant Registry had enabled participation in the data collection of the Asia Pacific Blood and Marrow Transplantation Group in 2005 and 2006.

1.1 STOCK AND FLOW

At the time of the third report, a cumulative total of 1174 transplants had been conducted by transplant centres in the country. The number of transplants recorded in 2006 was 124, which was a slight decrease from the previous year's total of 147. In 2006, Ampang Puteri Specialist Hospital began transplantation services to add to the number of transplant centres. Meanwhile Hospital Kuala Lumpur (adult transplants) moved to a new premise in Hospital Ampang.

Table 1.1.1: Stock and Flow of Blood and Marrow Transplantation, 1987-2006

Year	87	88	89	90	91	92	93	94	95	96
New transplant patients	8	6	22	5	12	21	19	25	30	28
Deaths	1	1	6	6	1	2	9	5	17	11
Lost to follow-up	0	0	0	0	0	0	0	0	0	0
Alive at 31 st December	7	12	28	27	38	57	67	87	100	117

Year	97	98	99	00	01*	02	03	04	05	06
New transplant patients	33	49	62	94	108	114	128	139	147	124
Deaths	15	16	15	31	47	30	51	45	40	25
Lost to follow-up	0	0	0	0	0	0	0	0	0	0
Alive at 31 st December	135	168	215	278	338	422	499	592	698	797

*1 patient in year transplant 2001 with no death date

*Out of 1174 patients who underwent transplantation, there were 49 patients with early death before day 30 of transplant

Figure 1.1.1: Stock and Flow of Blood and Marrow Transplantation, 1987-2006

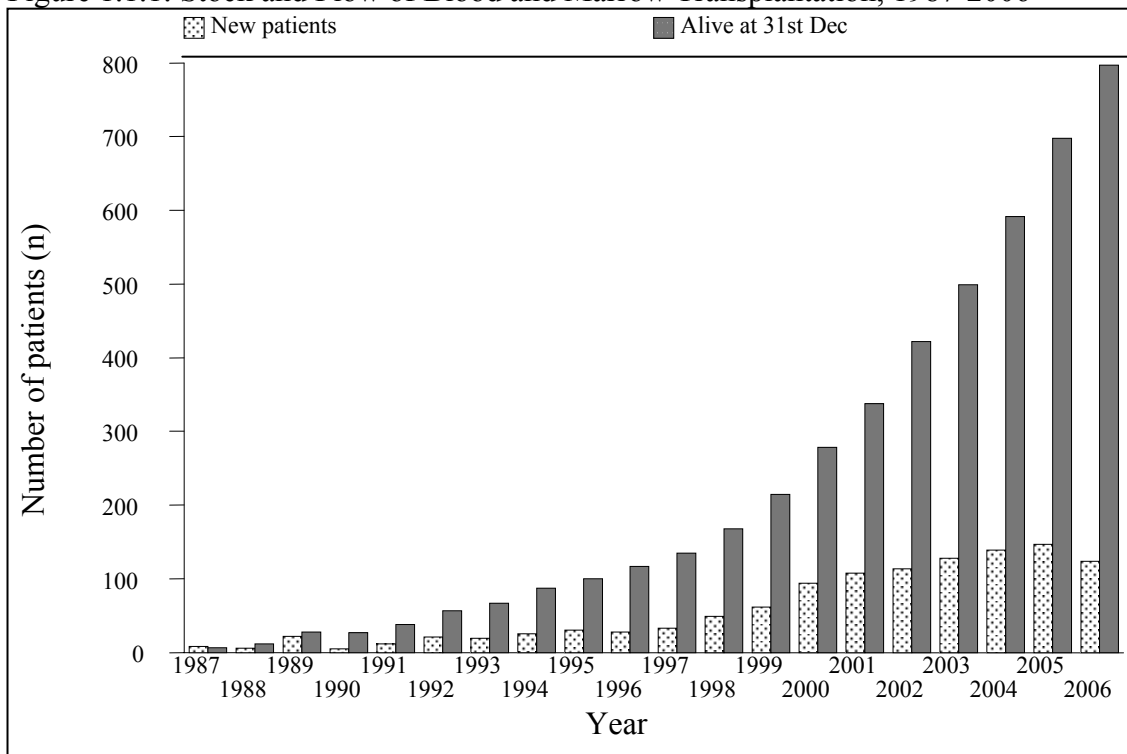


Table 1.1.2: New Transplant Rate per million population (pmp), 1987-2006

Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
New transplant patients	8	6	22	5	12	21	19	25	30	28
New transplant rate pmp	0	0	1	0	1	1	1	1	1	1

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
New transplant patients	33	49	62	94	108	114	128	139	147	124
New transplant rate pmp	2	2	3	4	4	5	5	5	6	5

Figure 1.1.2: New Transplant Rate per million population (pmp), 1987-2006

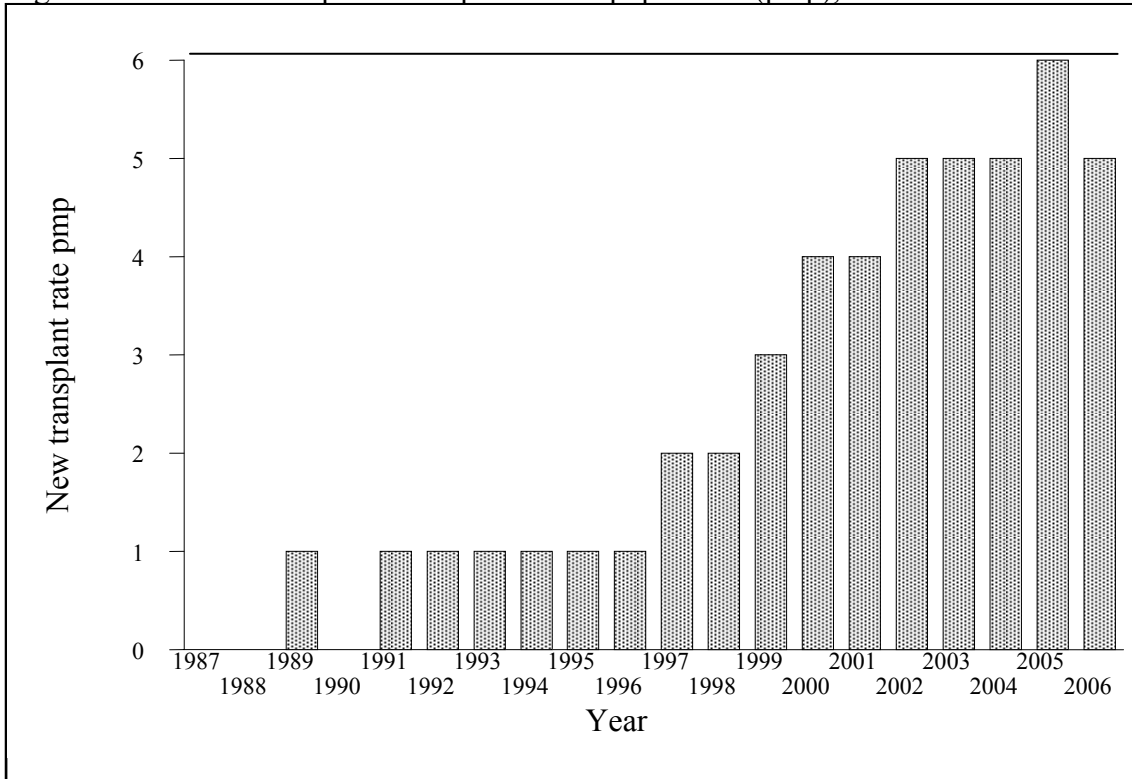


Table 1.1.3: Distribution of Patients by Centre, 1987-2006

Year	1987		1988		1989		1990		1991		1992		1993	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
KLA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KLP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UKM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SJA	0	0	0	0	1	5	0	0	0	0	0	0	0	0
UMA	0	0	0	0	0	0	0	0	0	0	0	0	1	5
UMP	8	100	6	100	21	95	5	100	12	100	21	100	18	95
GMC	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LWE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SJP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ASH	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hospital Ampang	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Others*	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	8	100	6	100	22	100	5	100	12	100	21	100	19	100

Year	1994		1995		1996		1997		1998		1999		2000	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
KLA	0	0	0	0	0	0	0	0	0	0	6	10	15	16
KLP	4	16	10	33	10	36	9	27	16	33	19	31	16	17
UKM	0	0	0	0	0	0	0	0	0	0	2	3	9	10
SJA	0	0	0	0	0	0	0	0	0	0	5	8	19	20
UMA	4	16	7	23	6	21	9	27	15	31	11	18	13	14
UMP	17	68	13	43	11	39	15	45	18	37	19	31	22	23
GMC	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LWE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SJP	0	0	0	0	1	4	0	0	0	0	0	0	0	0
ASH	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hospital Ampang	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Others*	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	25	100	30	100	28	100	33	100	49	100	62	100	94	100

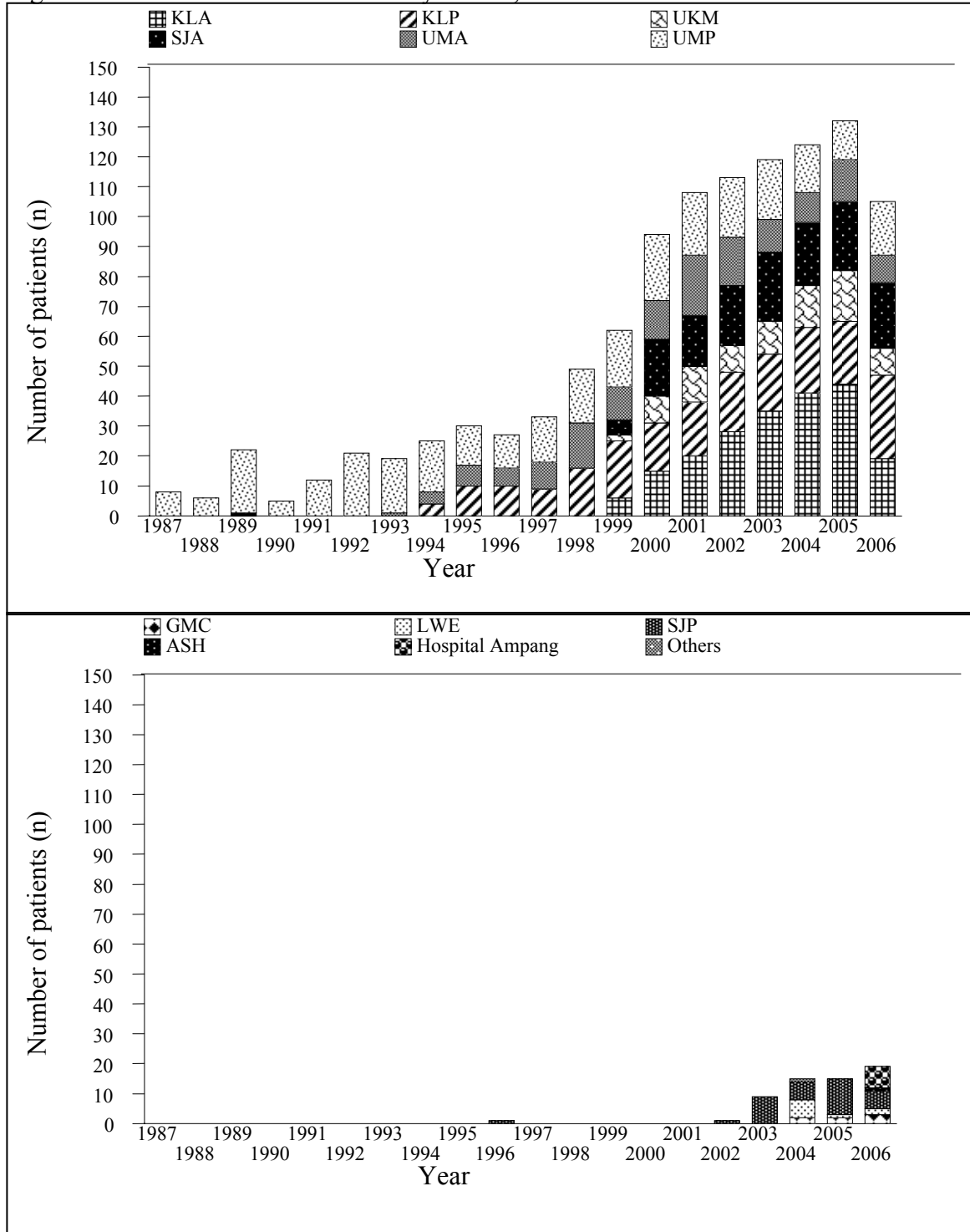
Year	2001		2002		2003		2004		2005		2006		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
KLA	20	19	28	25	35	27	41	29	44	30	19	15	208	18
KLP	18	17	20	18	19	15	22	16	21	14	28	23	212	18
UKM	12	11	9	8	11	9	14	10	17	12	9	7	83	7
SJA	17	16	20	18	23	18	21	15	23	16	22	18	151	13
UMA	20	19	16	14	11	9	10	7	14	10	9	7	146	12
UMP	21	19	20	18	20	16	16	12	13	9	18	15	314	27
GMC	0	0	0	0	0	0	2	1	2	1	3	2	7	1
LWE	0	0	0	0	0	0	6	4	1	1	2	2	9	1
SJP	0	0	1	1	9	7	6	4	12	8	6	5	35	3
ASH	0	0	0	0	0	0	0	0	0	0	1	1	1	0
Hospital Ampang	0	0	0	0	0	0	0	0	0	0	7	6	7	1
Others*	0	0	0	0	0	0	1	1	0	0	0	0	1	0
TOTAL	108	100	114	100	128	100	139	100	147	100	124	100	1174	100

Note: Distribution is according to transplant centre

*Others include Royal Perth Hospital

KLA	Hospital Kuala Lumpur, (Adult)
KLP	Hospital Kuala Lumpur, Institute Paediatrics (Paed)
UKM	Hospital Universiti Kebangsaan Malaysia
SJA	Subang Jaya Medical Centre (Adult)
UMA	University of Malaya Medical Centre (Adult)
UMP	University of Malaya Medical Centre (Paed)
GMC	Gleneagles Medical Centre, Penang
LWE	Lam Wah Ee Hospital, Penang
SJP	Subang Jaya Medical Centre (Paed)
ASH	Ampang Puteri Specialist Hospital

Figure 1.1.3: Distribution of Patients by Centre, 1987-2006



1.2 RECIPIENTS' CHARACTERISTICS

Recipients were predominantly male (59% males, 41% females) (Table 1.2.1). The largest ethnic group of transplant recipients was Malay (44%) followed by Chinese and Indians (Table 1.2.2). The young median age reflected the paediatric bias in the registry as transplants first started in paediatric patients while the adult centres started later in 1993 (Table 1.2.3). However over the past 10 years there has been a gradual increase in the median age of recipients and patients older than 60 years of age have had access to transplantation.

The majority of transplants (about two-thirds) were for malignant disorders and most of these were haematological malignancies like leukaemia and lymphoma (Table 1.2.4). The number of patients transplanted for chronic leukaemia (mostly chronic myeloid leukaemia) showed a steady decline over the past few years. This probably reflected the preferential usage of imatinib mesylate as first line management of chronic myeloid leukaemia. The bulk of non-malignant disorders requiring transplants were thalassaemia and aplastic anaemia.

Table 1.2.1: Distribution of Patients by Gender, 1987-2006

Year	1987		1988		1989		1990		1991		1992		1993		1994	
Gender	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Male	7	88	4	67	12	55	3	60	7	58	13	62	13	68	16	64
Female	1	13	2	33	10	45	2	40	5	42	8	38	6	32	9	36
TOTAL	8	100	6	100	22	100	5	100	12	100	21	100	19	100	25	100

Year	1995		1996		1997		1998		1999		2000		2001		2002	
Gender	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Male	11	37	15	54	18	55	33	67	36	58	54	57	66	61	62	54
Female	19	63	13	46	15	45	16	33	26	42	40	43	42	39	52	46
TOTAL	30	100	28	100	33	100	49	100	62	100	94	100	108	100	114	100

Year	2003		2004		2005		2006		TOTAL	
Gender	No.	%	No.	%	No.	%	No.	%	No.	%
Male	71	55	83	60	69	47	73	59	666	57
Female	57	45	56	40	78	53	51	41	508	43
TOTAL	128	100	139	100	147	100	124	100	1174	100

Figure 1.2.1: Distribution of Patients by Gender, 1987-2006

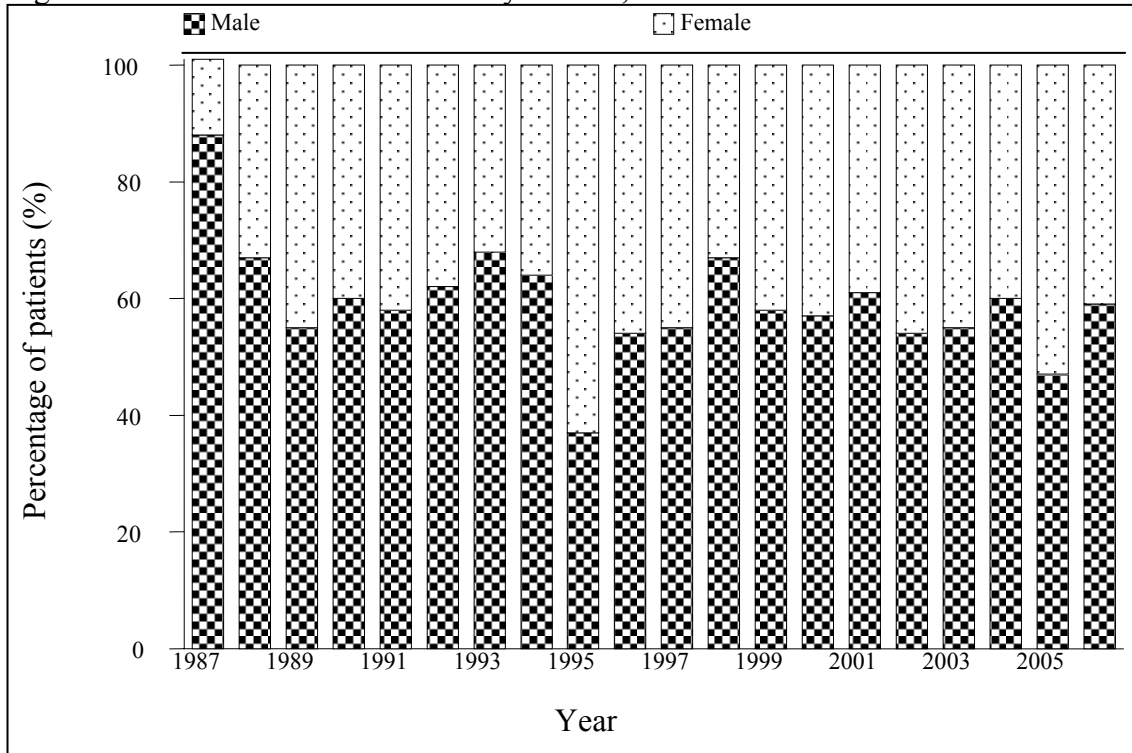


Table 1.2.2: Distribution of Patients by Ethnic Group, 1987-2006

Year	1987		1988		1989		1990		1991		1992		1993	
Race	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Malay	2	25	4	67	13	59	2	40	4	33	4	19	3	16
Chinese	5	63	2	33	8	36	3	60	7	58	10	48	10	53
Indian	1	13	0	0	0	0	0	0	1	8	4	19	1	5
Bumiputra Sabah	0	0	0	0	1	5	0	0	0	0	2	10	3	16
Bumiputra Sarawak	0	0	0	0	0	0	0	0	0	0	0	0	2	11
Others	0	0	0	0	0	0	0	0	0	0	1	5	0	0
TOTAL	8	100	6	100	22	100	5	100	12	100	21	100	19	100

Year	1994		1995		1996		1997		1998		1999		2000	
Race	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Malay	9	36	7	23	8	29	9	27	20	41	31	50	33	35
Chinese	12	48	14	47	11	39	20	61	24	49	26	42	48	51
Indian	0	0	3	10	6	21	0	0	4	8	4	6	7	7
Bumiputra Sabah	4	16	1	3	0	0	1	3	0	0	0	0	3	3
Bumiputra Sarawak	0	0	0	0	3	11	0	0	0	0	0	0	0	0
Others	0	0	5	17	0	0	3	9	1	2	1	2	3	3
TOTAL	25	100	30	100	28	100	33	100	49	100	62	100	94	100

Year	2001		2002		2003		2004		2005		2006		TOTAL	
Race	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Malay	47	44	37	32	46	36	51	37	54	37	54	44	438	37
Chinese	48	44	65	57	65	51	63	45	67	46	47	38	555	47
Indian	8	7	8	7	6	5	9	6	14	10	9	7	85	7
Bumiputra Sabah	1	1	1	1	4	3	8	6	5	3	7	6	41	3
Bumiputra Sarawak	1	1	1	1	4	3	7	5	5	3	2	2	25	2
Others	3	3	2	2	3	2	1	1	2	1	5	4	30	3
TOTAL	108	100	114	100	128	100	139	100	147	100	124	100	1174	100

Figure 1.2.2: Distribution of Patients by Ethnic Group, 1987-2006

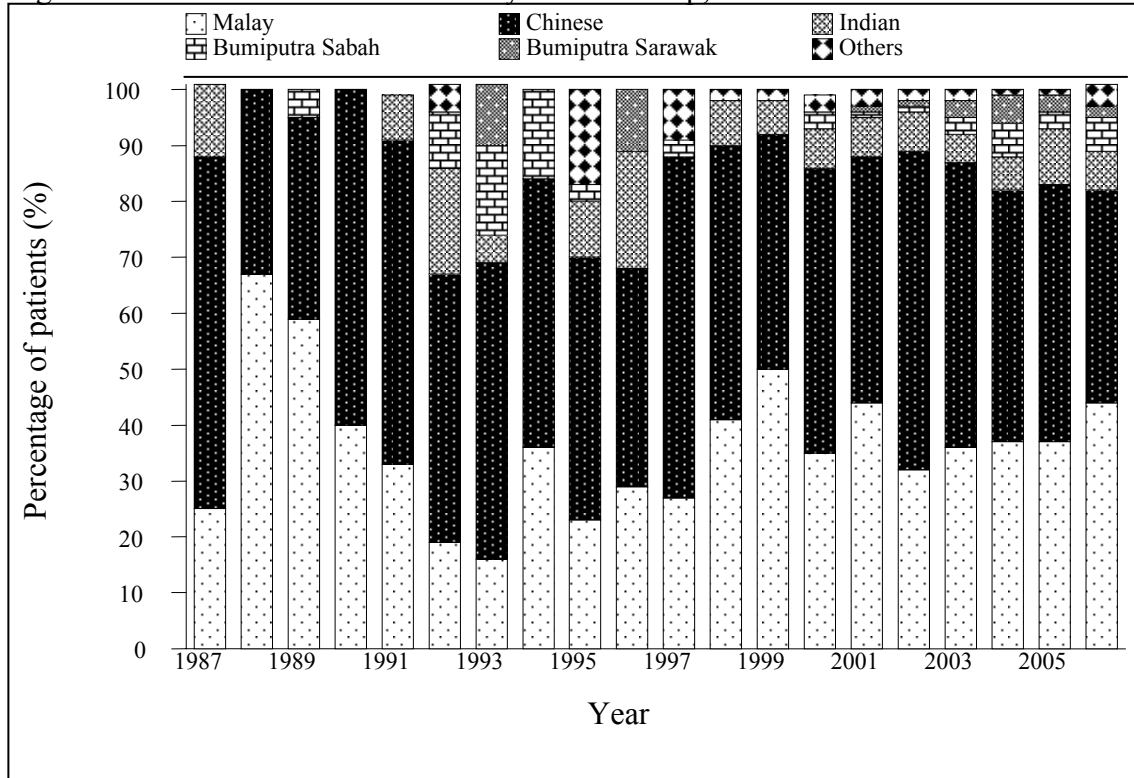


Table 1.2.3: Distribution of Patients by Age Group, 1987-2006

Year	1987		1988		1989		1990		1991		1992		1993	
Age group	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0-9	4	50	4	67	17	77	5	100	10	83	15	71	9	47
10-19	4	50	2	33	5	23	0	0	2	17	6	29	10	53
20-39	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40-59	0	0	0	0	0	0	0	0	0	0	0	0	0	0
≥60	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	8	100	6	100	22	100	5	100	12	100	21	100	19	100
Mean	9		7		8		6		6		7		9	
SD	4		3		3		3		4		4		5	
Median	9		8		8		6		6		6		10	
Minimum	2		2		1		2		1		1		1	
Maximum	15		10		13		9		13		14		17	

Year	1994		1995		1996		1997		1998		1999		2000	
Age group	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0-9	11	44	12	40	13	46	19	58	21	43	28	45	27	29
10-19	11	44	13	43	12	43	8	24	16	33	15	24	27	29
20-39	3	12	4	13	3	11	5	15	12	24	12	19	19	20
40-59	0	0	1	3	0	0	1	3	0	0	7	11	20	21
≥60	0	0	0	0	0	0	0	0	0	0	0	0	1	1
TOTAL	25	100	30	100	28	100	33	100	49	100	62	100	94	100
Mean	11		13		11		12		13		17		23	
SD	7		9		9		12		10		15		17	
Median	11		11		11		6		10		11		18	
Minimum	1		3		1		1		5 months		1		1	
Maximum	29		41		37		45		39		57		61	

Year	2001		2002		2003		2004		2005		2006		Total	
Age group	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0-9	23	21	30	26	42	33	26	19	29	20	41	33	386	33
10-19	28	26	25	22	18	14	41	29	31	21	24	19	298	25
20-39	40	37	36	32	47	37	52	37	51	35	31	25	315	27
40-59	16	15	23	20	21	16	18	13	35	24	24	19	166	14
≥60	1	1	0	0	0	0	2	1	1	1	4	3	9	1
TOTAL	108	100	114	100	128	100	139	100	147	100	124	100	1174	100
Mean	23		23		22		23		26		24		20	
SD	16		16		15		15		16		19		16	
Median	22		22		23		20		25		18		16	
Minimum	1 month		1		5 months		1		1		2 months		1 month	
Maximum	64		55		52		70		66		69		70	

Age=date of transplant – date of birth

Figure 1.2.3: Distribution of Patients by Age Group, 1987-2006

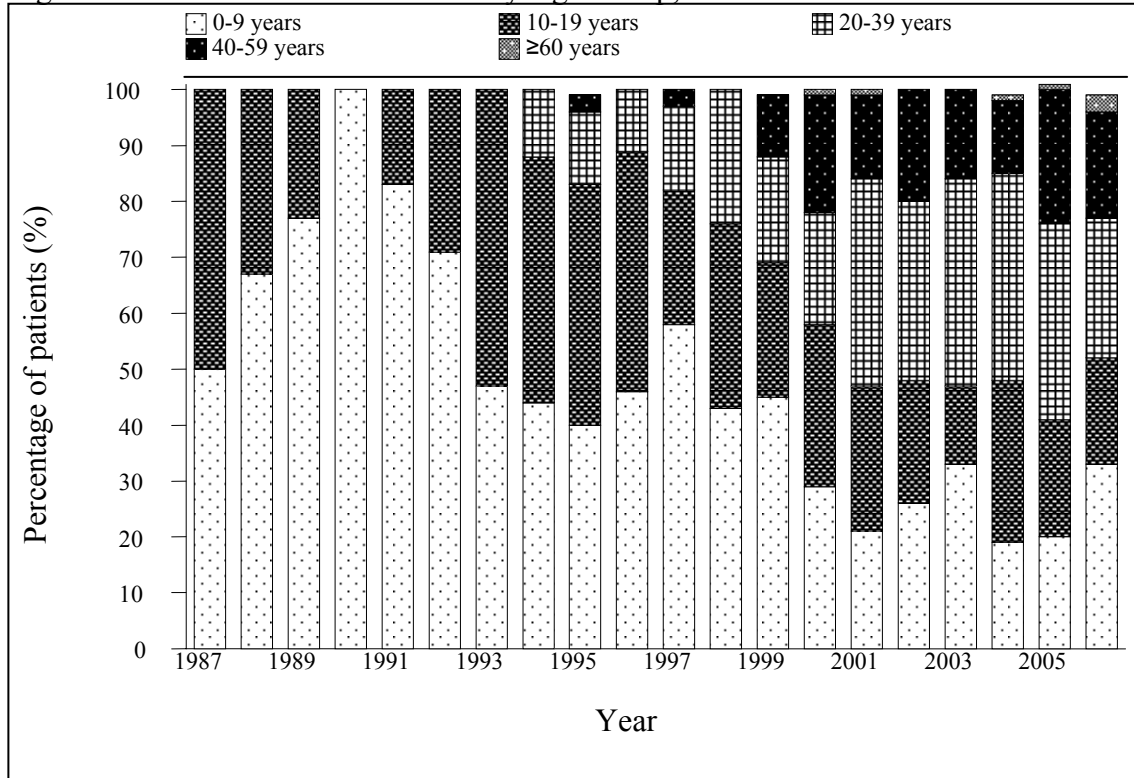


Table 1.2.4: Distribution of Patients by Primary Diagnosis, 1987-2006

Year	1987		1988		1989		1990		1991		1992		1993	
Diagnosis	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Acute leukaemia	5	63	4	67	8	36	2	40	1	8	4	19	6	32
Chronic leukaemia	0	0	0	0	1	5	1	20	1	8	4	19	2	11
Hypoplastic anaemia	2	25	0	0	4	18	0	0	4	33	5	24	4	21
Erythrocytic disorders	0	0	0	0	1	5	1	20	1	8	1	5	0	0
Lymphoma	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Solid tumors	0	0	0	0	0	0	0	0	0	0	3	14	1	5
Myelodysplasia	0	0	0	0	0	0	0	0	0	0	0	0	1	5
Haemoglobinopathy	1	13	2	33	7	32	1	20	4	33	4	19	2	11
Multiple myeloma	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Others	0	0	0	0	1	5	0	0	1	8	0	0	3	16
TOTAL	8	100	6	100	22	100	5	100	12	100	21	100	19	100

Year	1994		1995		1996		1997		1998		1999		2000	
Diagnosis	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Acute leukaemia	8	32	10	33	13	46	11	33	23	47	28	45	37	39
Chronic leukaemia	4	16	5	17	5	18	6	18	7	14	7	11	13	14
Hypoplastic anaemia	5	20	8	27	4	14	5	15	4	8	5	8	11	12
Erythrocytic disorders	0	0	0	0	1	4	0	0	0	0	0	0	0	0
Lymphoma	0	0	0	0	0	0	2	6	5	10	6	10	19	20
Solid tumors	1	4	1	3	0	0	1	3	2	4	5	8	2	2
Myelodysplasia	2	8	0	0	0	0	0	0	1	2	0	0	1	1
Haemoglobinopathy	5	20	5	17	5	18	6	18	2	4	4	6	7	7
Multiple myeloma	0	0	0	0	0	0	0	0	0	0	3	5	1	1
Others	0	0	1	3	0	0	2	6	5	10	4	6	3	3
TOTAL	25	100	30	100	28	100	33	100	49	100	62	100	94	100

Year	2001		2002		2003		2004		2005		2006		TOTAL	
Diagnosis	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Acute leukaemia	48	44	48	42	42	33	46	33	54	37	38	31	436	37
Chronic leukaemia	18	17	19	17	19	15	22	16	13	9	11	9	158	13
Hypoplastic anaemia	7	6	4	4	5	4	12	9	5	3	14	11	108	9
Erythrocytic disorders	0	0	1	1	2	2	0	0	0	0	0	0	8	1
Lymphoma	23	21	20	18	28	22	35	25	34	23	23	19	195	17
Solid tumors	0	0	3	3	2	2	0	0	2	1	3	2	26	2
Myelodysplasia	4	4	4	4	3	2	6	4	4	3	4	3	30	3
Haemoglobinopathy	4	4	8	7	17	13	9	6	16	11	11	9	120	10
Multiple myeloma	1	1	4	4	4	3	3	2	8	5	10	8	34	3
Others	3	3	3	3	6	5	6	4	11	7	10	8	59	5
TOTAL	108	100	114	100	128	100	139	100	147	100	124	100	1174	100

Diagnosis list in the web-application

#	Diagnosis	Categorisation
1	Acute leukaemia, unclassified	Acute leukaemia
2	Acute undifferentiated leukaemia	
3	Acute Lymphocytic Leukaemia (ALL)	
4	Acute Myelogenous Leukaemia (AML) denovo	
5	AML post-chemotherapy	
6	AML post-MDS	
7	Chronic lymphocytic leukaemia	Chronic leukaemia
8	Chronic myeloid leukaemia	
9	Aplastic anaemia	Hypoplastic anaemia
10	Fanconi's anaemia	
11	Diamond-Blackfan anaemia	Erythrocytic Disorders
12	Congenital Dyserythropoietic Anaemia (CDA)	
13	Hodgkin's lymphoma	Lymphoma
14	Non-Hodgkin's lymphoma, Aggressive	
15	Non-Hodgkin's lymphoma, Indolent	
16	Carcinoma, breast	Solid tumors
17	Carcinoma, ovary	
18	Germ Cell Tumour (GCT)-testicular	
19	GCT-primary non-testis	
20	Ewing's sarcoma	
21	Glioma	
22	Hepatoblastoma	
23	Neuroblastoma	
24	Rhabdomyosarcoma	
25	Soft tissue sarcoma (non-RMS)	
26	Wilms tumour	
27	Primitive Neuroectodermal Tumour (NET)	
28	Juvenile Myelomonocytic leukaemia	Myelodysplasia
29	Myelodysplastic syndrome (MDS)	
30	Myelofibrosis	
31	Thalassaemia major	Haemoglobinopathy
32	Sickle Cell Anaemia	
33	Multiple myeloma	Multiple myeloma
34	Haemophagocytic Lymphohistiocytosis Syndrome	Others
35	Congenital Immunodeficiencies	
36	Osteopetrosis	
37	Others	

1.3 TRANSPLANT PRACTICES

The majority of transplants (67%) done remained allogeneic with 83 patients transplanted compared with 41 patients who underwent autologous transplants. Donors for allogeneic transplants were HLA matched in 93% of cases while 1 and 2 antigen mismatches made up the remaining 7%. No patient received a graft with > 2 antigen mismatches. Although most donors were siblings, the number of unrelated donors had increased and contributed to 13% of all allogeneic transplants performed in 2006. There was a predilection to use of peripheral blood stem cells compared with bone marrow or cord blood and this was reflected in the 78% of transplants using this stem cell source. Not unlike global trends, the number of cord blood transplantations also showed a slight increase.

Table 1.3.1: Distribution of Patients by Graft Number, 1987-2006

Year	1987		1988		1989		1990		1991		1992		1993	
Graft number	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1	8	100	6	100	19	86	4	80	9	75	19	90	18	95
2	0	0	0	0	2	9	1	20	3	25	2	10	1	5
3	0	0	0	0	1	5	0	0	0	0	0	0	0	0
TOTAL	8	100	6	100	22	100	5	100	12	100	21	100	19	100

Year	1994		1995		1996		1997		1998		1999		2000	
Graft number	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1	24	96	29	97	28	100	31	94	47	96	61	98	91	97
2	1	4	1	3	0	0	1	3	1	2	1	2	3	3
3	0	0	0	0	0	0	1	3	1	2	0	0	0	0
TOTAL	25	100	30	100	28	100	33	100	49	100	62	100	94	100

Year	2001		2002		2003		2004		2005		2006		TOTAL	
Graft number	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1	103	95	113	99	125	98	134	98	121	98	111	97	1101	97
2	5	5	1	1	3	2	3	2	2	2	2	2	33	3
3	0	0	0	0	0	0	0	0	0	0	1	1	4	0
TOTAL	108	100	114	100	128	100	137	100	123	100	114	100	1138	100

Figure 1.3.1: Distribution of Patients by Graft Number, 1987-2006

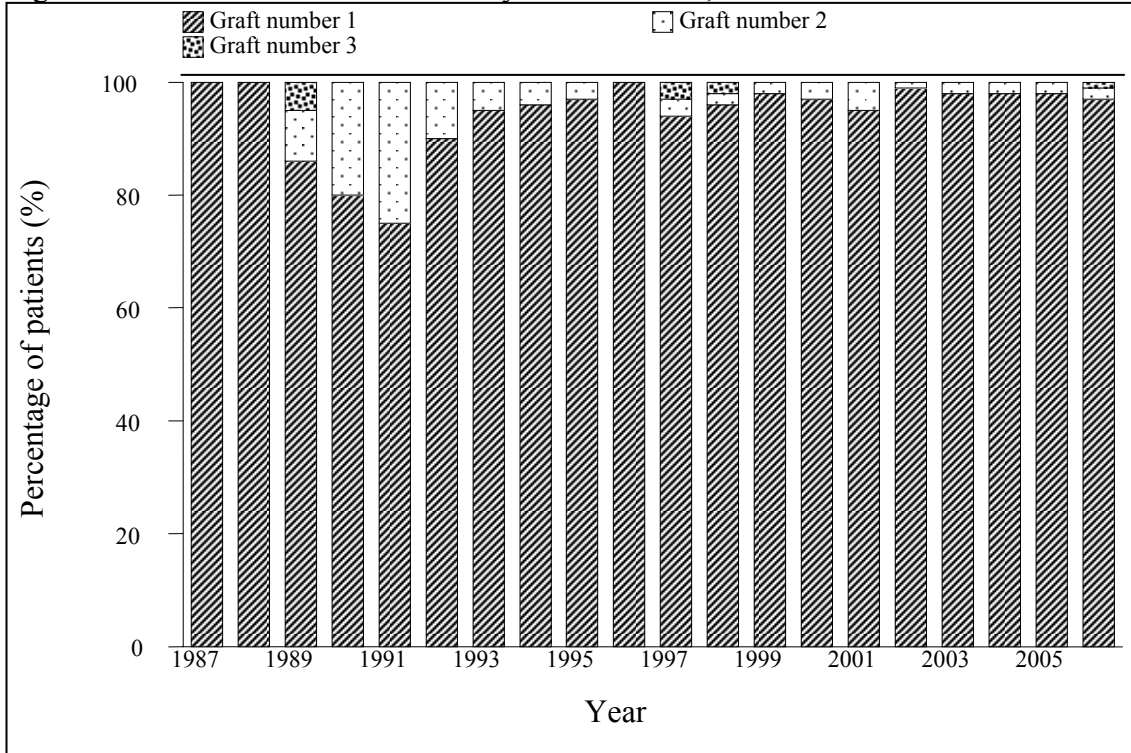


Table 1.3.2: Distribution of Patients by Transplantation Type, 1987-2006

Year	1987		1988		1989		1990		1991		1992		1993	
Type of transplant	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Allogeneic + Syngeneic	8	100	6	100	21	95	5	100	12	100	20	95	18	95
Autologous	0	0	0	0	1	5	0	0	0	0	1	5	1	5
TOTAL	8	100	6	100	22	100	5	100	12	100	21	100	19	100

Year	1994		1995		1996		1997		1998		1999		2000	
Type of transplant	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Allogeneic + Syngeneic	24	96	29	97	26	93	27	82	32	65	44	71	56	60
Autologous	1	4	1	3	2	7	6	18	17	35	18	29	38	40
TOTAL	25	100	30	100	28	100	33	100	49	100	62	100	94	100

Year	2001		2002		2003		2004		2005		2006		TOTAL	
Type of transplant	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Allogeneic + Syngeneic	75	69	75	66	84	66	90	65	90	61	83	67	825	70
Autologous	33	31	39	34	44	34	49	35	57	39	41	33	349	30
TOTAL	108	100	114	100	128	100	139	100	147	100	124	100	1174	100

Note: 6 patients with syngeneic type of transplant

Figure 1.3.2: Distribution of Patients by Transplantation Type, 1987-2006

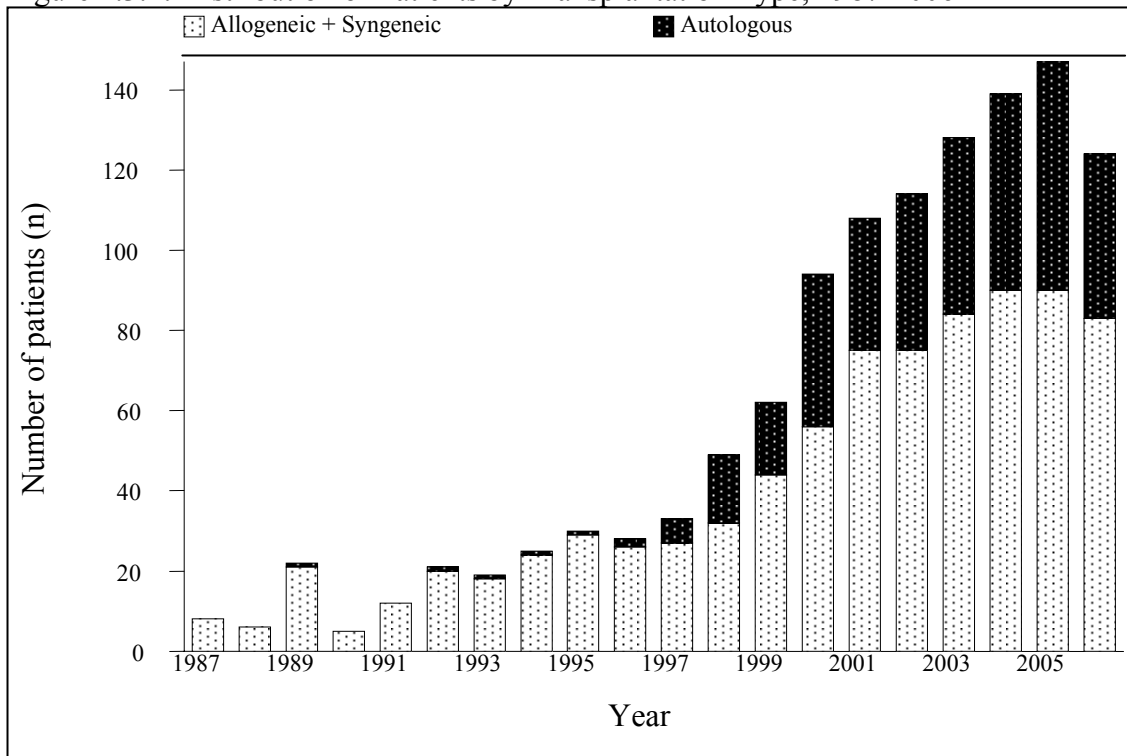


Table 1.3.3: Type of Transplant by Centre, 1987-2006

Type of transplant Centre	Allogeneic + Syngeneic		Autologous		TOTAL	
	No.	%	No.	%	No.	%
KLA	106	13	102	29	208	18
KLP	184	22	28	8	212	18
UKM	50	6	33	9	83	7
SJA	57	7	94	27	151	13
UMA	102	12	44	13	146	12
UMP	281	34	33	9	314	27
GMC	3	0	4	1	7	1
LWE	8	1	1	0	9	1
SJP	31	4	4	1	35	3
ASH	1	0	0	0	1	0
Hospital Ampang	1	0	6	2	7	1
Others*	1	0	0	0	1	0
TOTAL	825	100	349	100	1174	100

* Others include Royal Perth Hospital

Figure 1.3.3: Type of Transplant by Centre, 1987-2006

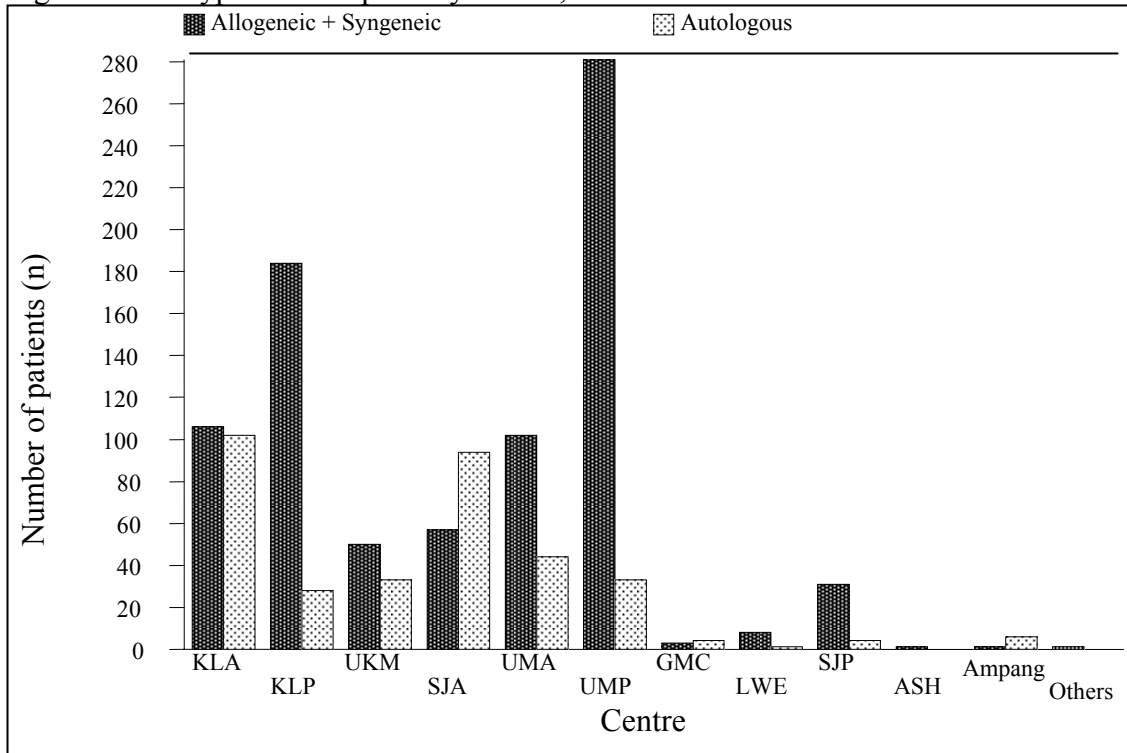


Table 1.3.4: Source of Transplant, 1987-2006

Year	1987		1988		1989		1990		1991	
Transplant source	No.	%	No.	%	No.	%	No.	%	No.	%
Marrow	8	100	6	100	22	100	5	100	12	100
PBSC / Marrow + PBSC	0	0	0	0	0	0	0	0	0	0
Cord blood / Marrow + cord	0	0	0	0	0	0	0	0	0	0
TOTAL	8	100	6	100	22	100	5	100	12	100

Year	1992		1993		1994		1995		1996	
Transplant source	No.	%	No.	%	No.	%	No.	%	No.	%
Marrow	21	100	19	100	25	100	30	100	28	100
PBSC / Marrow + PBSC	0	0	0	0	0	0	0	0	0	0
Cord blood / Marrow + cord	0	0	0	0	0	0	0	0	0	0
TOTAL	21	100	19	100	25	100	30	100	28	100

Year	1997		1998		1999		2000		2001	
Transplant source	No.	%	No.	%	No.	%	No.	%	No.	%
Marrow	24	73	25	51	37	60	31	33	30	28
PBSC / Marrow + PBSC	7	21	23	47	23	37	57	61	74	69
Cord blood / Marrow + cord	2	6	1	2	2	3	6	6	4	4
TOTAL	33	100	49	100	62	100	94	100	108	100

Year	2002		2003		2004		2005		2006		TOTAL	
Transplant source	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Marrow	31	27	44	34	30	22	24	16	17	14	469	40
PBSC / Marrow + PBSC	79	69	79	62	100	72	116	79	97	78	655	56
Cord blood / Marrow + cord	4	4	5	4	9	6	7	5	10	8	50	4
TOTAL	114	100	128	100	139	100	147	100	124	100	1174	100

PBSC = Peripheral Blood Stem Cells

Figure 1.3.4: Source of Transplant, 1987-2006

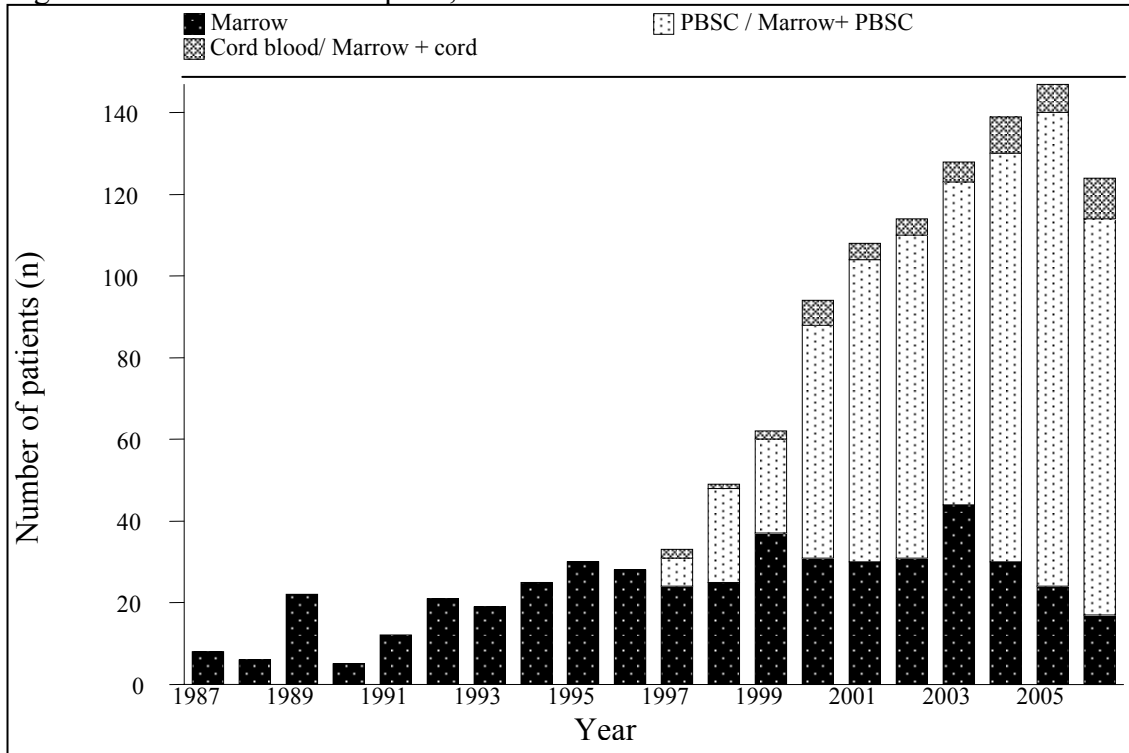


Table 1.3.5: Distribution of Patients by HLA Match, 1987-2006

Year	1987		1988		1989		1990		1991	
HLA Match	No.	%	No.	%	No.	%	No.	%	No.	%
Identical	8	100	6	100	21	100	5	100	12	100
1 AG	0	0	0	0	0	0	0	0	0	0
2 AG	0	0	0	0	0	0	0	0	0	0
≥3 AG Disparate	0	0	0	0	0	0	0	0	0	0
TOTAL	8	100	6	100	21	100	5	100	12	100

Year	1992		1993		1994		1995		1996	
HLA Match	No.	%	No.	%	No.	%	No.	%	No.	%
Identical	20	100	18	100	23	96	29	100	26	100
1 AG	0	0	0	0	1	4	0	0	0	0
2 AG	0	0	0	0	0	0	0	0	0	0
≥3 AG Disparate	0	0	0	0	0	0	0	0	0	0
TOTAL	20	100	18	100	24	100	29	100	26	100

Year	1997		1998		1999		2000		2001	
HLA Match	No.	%	No.	%	No.	%	No.	%	No.	%
Identical	25	93	31	97	40	91	52	93	69	92
1 AG	2	7	0	0	3	7	0	0	4	5
2 AG	0	0	1	3	1	2	4	7	1	1
≥3 AG Disparate	0	0	0	0	0	0	0	0	1	1
TOTAL	27	100	32	100	44	100	56	100	75	100

Year	2002		2003		2004		2005		2006		TOTAL	
HLA Match	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Identical	70	93	79	94	83	92	85	94	77	93	779	94
1 AG	3	4	3	4	3	3	4	4	4	5	27	3
2 AG	2	3	2	2	4	4	1	1	2	2	18	2
≥3 AG Disparate	0	0	0	0	0	0	0	0	0	0	1	0
TOTAL	75	100	84	100	90	100	90	100	83	100	825	100

*excluding autologous

Table 1.3.6: Distribution of Patients by Allogeneic Donor Relationship, 1987-2006

Year	1987		1988		1989		1990		1991	
Allogeneic Donor Relationship	No.	%	No.	%	No.	%	No.	%	No.	%
Sibling	8	100	6	100	21	100	5	100	11	92
Unrelated	0	0	0	0	0	0	0	0	0	0
▪ Marrow	0	0	0	0	0	0	0	0	0	0
▪ PBSC / Marrow + PBSC	0	0	0	0	0	0	0	0	0	0
▪ Cord blood / Marrow + cord	0	0	0	0	0	0	0	0	0	0
Others	0	0	0	0	0	0	0	0	1	8
TOTAL	8	100	6	100	21	100	5	100	12	100

Year	1992		1993		1994		1995		1996	
Allogeneic Donor Relationship	No.	%	No.	%	No.	%	No.	%	No.	%
Sibling	20	100	18	100	22	92	29	100	26	100
Unrelated	0	0	0	0	0	0	0	0	0	0
▪ Marrow	0	0	0	0	0	0	0	0	0	0
▪ PBSC / Marrow + PBSC	0	0	0	0	0	0	0	0	0	0
▪ Cord blood / Marrow + cord	0	0	0	0	0	0	0	0	0	0
Others	0	0	0	0	2	8	0	0	0	0
TOTAL	20	100	18	100	24	100	29	100	26	100

Year	1997		1998		1999		2000		2001	
Allogeneic Donor Relationship	No.	%	No.	%	No.	%	No.	%	No.	%
Sibling	26	96	32	100	44	100	55	98	72	96
Unrelated	1	4	0	0	0	0	1	2	3	4
▪ Marrow	0	0	0	0	0	0	0	0	0	0
▪ PBSC / Marrow + PBSC	0	0	0	0	0	0	0	0	0	0
▪ Cord blood / Marrow + cord	1	100	0	0	0	0	1	100	3	100
Others	0	0	0	0	0	0	0	0	0	0
TOTAL	27	100	32	100	44	100	56	100	75	100

Year	2002		2003		2004		2005		2006		TOTAL	
Allogeneic Donor Relationship	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Sibling	71	95	81	96	81	90	82	91	72	87	782	95
Unrelated	4	5	3	4	9	10	8	9	11	13	40	5
▪ Marrow	0	0	0	0	1	11	2	25	2	18	5	13
▪ PBSC / Marrow + PBSC	0	0	0	0	2	22	1	13	1	9	4	10
▪ Cord blood / Marrow + cord	4	100	3	100	6	67	5	63	8	73	31	78
Others	0	0	0	0	0	0	0	0	0	0	3	0
TOTAL	75	100	84	100	90	100	90	100	83	100	825	100

*excluding autologous, including syngeneic

1.4 TRANSPLANT OUTCOMES

The major cause of death continued to be relapse/underlying disease (44%) with sepsis (32%) being the second commonest cause of death. Surprisingly veno-occlusive disease of the liver contributed 12% of deaths while graft-versus-host disease became the fourth most common cause of death (8%) (Table 1.4.1). Overall Kaplan Meier survival analysis showed a trend in favour of younger patients (Fig 1.4.3).

Table 1.4.1: Distribution of Patients by Cause of Death, 1987-2006

Year	1987		1988		1989		1990		1991	
	No.	%	No.	%	No.	%	No.	%	No.	%
Sepsis	1	100	0	0	0	0	0	0	1	100
GVHD	0	0	0	0	0	0	1	17	0	0
Underlying disease	0	0	0	0	6	100	5	83	0	0
Haemorrhage	0	0	1	100	0	0	0	0	0	0
VOD	0	0	0	0	0	0	0	0	0	0
Organ Failure	0	0	0	0	0	0	0	0	0	0
Interstitial pneumonitis	0	0	0	0	0	0	0	0	0	0
Secondary malignancy	0	0	0	0	0	0	0	0	0	0
Others	0	0	0	0	0	0	0	0	0	0
Unknown	0	0	0	0	0	0	0	0	0	0
TOTAL	1	100	1	100	6	100	6	100	1	100

Year	1992		1993		1994		1995		1996	
	No.	%	No.	%	No.	%	No.	%	No.	%
Sepsis	1	50	2	22	1	20	4	24	6	55
GVHD	0	0	0	0	0	0	4	24	0	0
Underlying disease	0	0	6	67	3	60	3	18	3	27
Haemorrhage	0	0	1	11	0	0	2	12	1	9
VOD	0	0	0	0	0	0	1	6	1	9
Organ Failure	1	50	0	0	1	20	2	12	0	0
Interstitial pneumonitis	0	0	0	0	0	0	0	0	0	0
Secondary malignancy	0	0	0	0	0	0	1	6	0	0
Others	0	0	0	0	0	0	0	0	0	0
Unknown	0	0	0	0	0	0	0	0	0	0
TOTAL	2	100	9	100	5	100	17	100	11	100

Year	1997		1998		1999		2000		2001	
	No.	%	No.	%	No.	%	No.	%	No.	%
Sepsis	5	33	1	6	6	40	2	6	4	9
GVHD	0	0	2	13	1	7	2	6	4	9
Underlying disease	9	60	11	69	7	47	22	71	33	70
Haemorrhage	0	0	1	6	0	0	3	10	2	4
VOD	0	0	0	0	0	0	1	3	2	4
Organ Failure	1	7	0	0	1	7	0	0	0	0
Interstitial pneumonitis	0	0	1	6	0	0	1	3	2	4
Secondary malignancy	0	0	0	0	0	0	0	0	0	0
Others	0	0	0	0	0	0	0	0	0	0
Unknown	0	0	0	0	0	0	0	0	0	0
TOTAL	15	100	16	100	15	100	31	100	47	100

Year	2002		2003		2004		2005		2006		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Sepsis	4	13	14	27	10	22	9	23	8	32	79	21
GVHD	3	10	5	10	9	20	6	15	2	8	39	10
Underlying disease	19	63	28	55	23	51	16	41	11	44	205	55
Haemorrhage	0	0	0	0	2	4	2	5	1	4	16	4
VOD	0	0	0	0	0	0	0	0	3	12	8	2
Organ Failure	3	10	2	4	0	0	1	3	0	0	12	3
Interstitial pneumonitis	0	0	1	2	0	0	2	5	0	0	7	2
Secondary malignancy	0	0	0	0	0	0	0	0	0	0	1	0
Others	0	0	0	0	0	0	2	5	0	0	2	1
Unknown	1	3	1	2	1	2	1	3	0	0	4	1
TOTAL	30	100	51	100	45	100	39	100	25	100	373	100

Note: 1 patient with missing cause of death reported

Figure 1.4.1: Patient Survival by Year of Transplant, 1987-2006

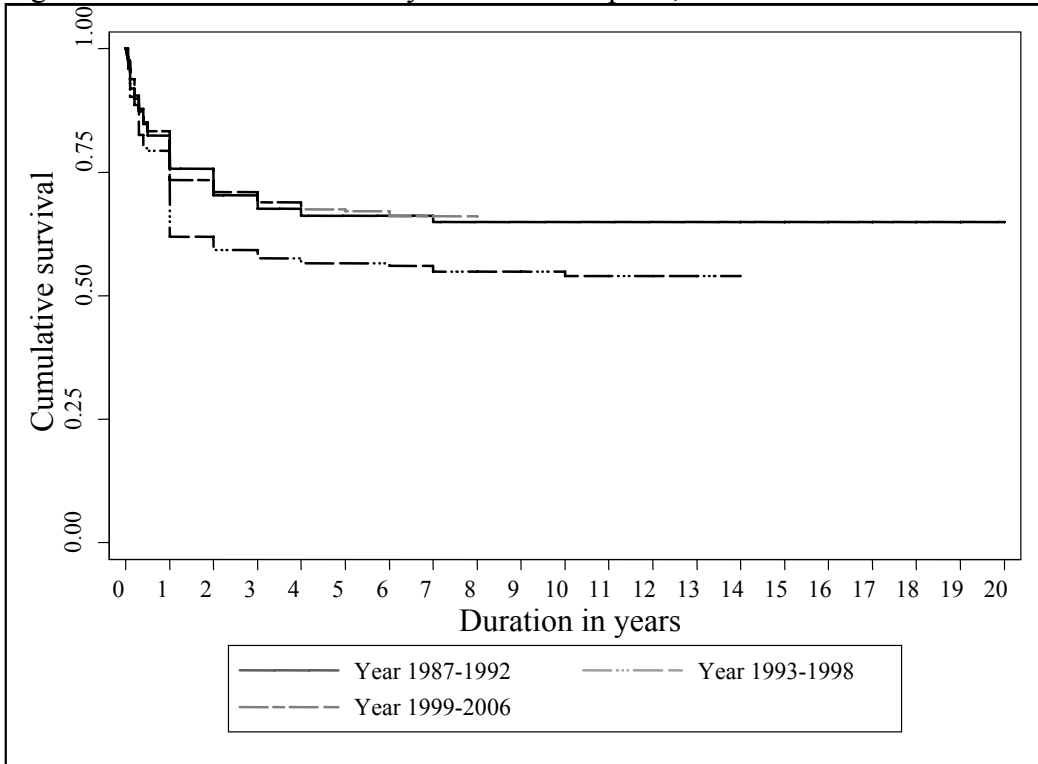


Figure 1.4.2: Patient Survival by Gender, 1987-2006

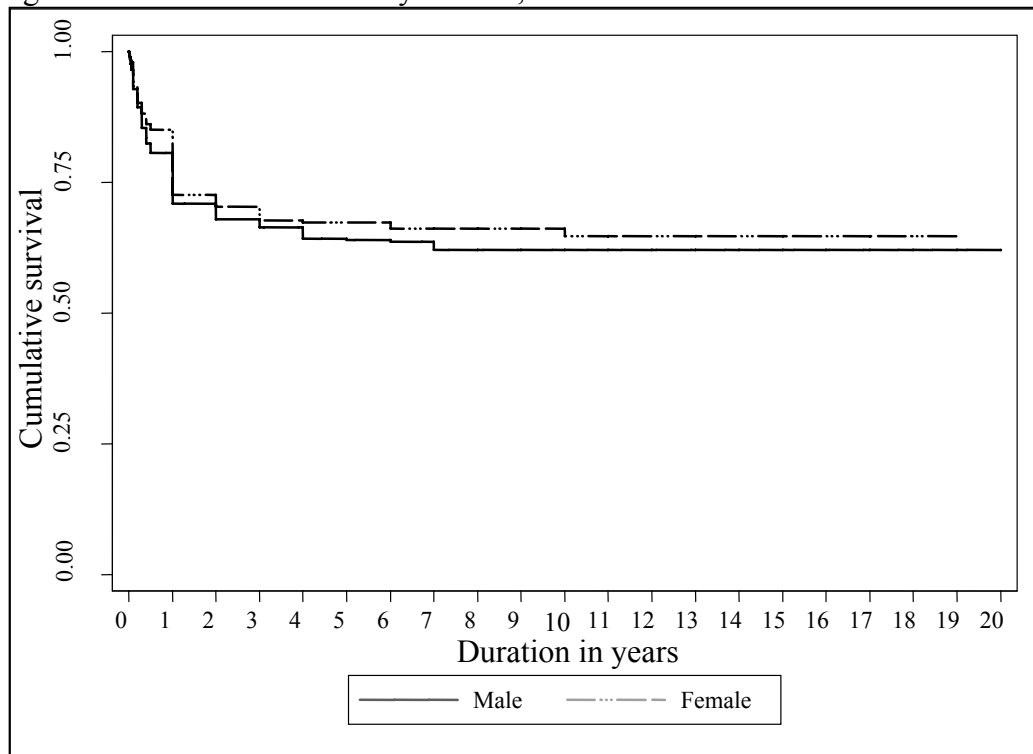


Figure 1.4.3: Patient Survival by Age Group, 1987-2006

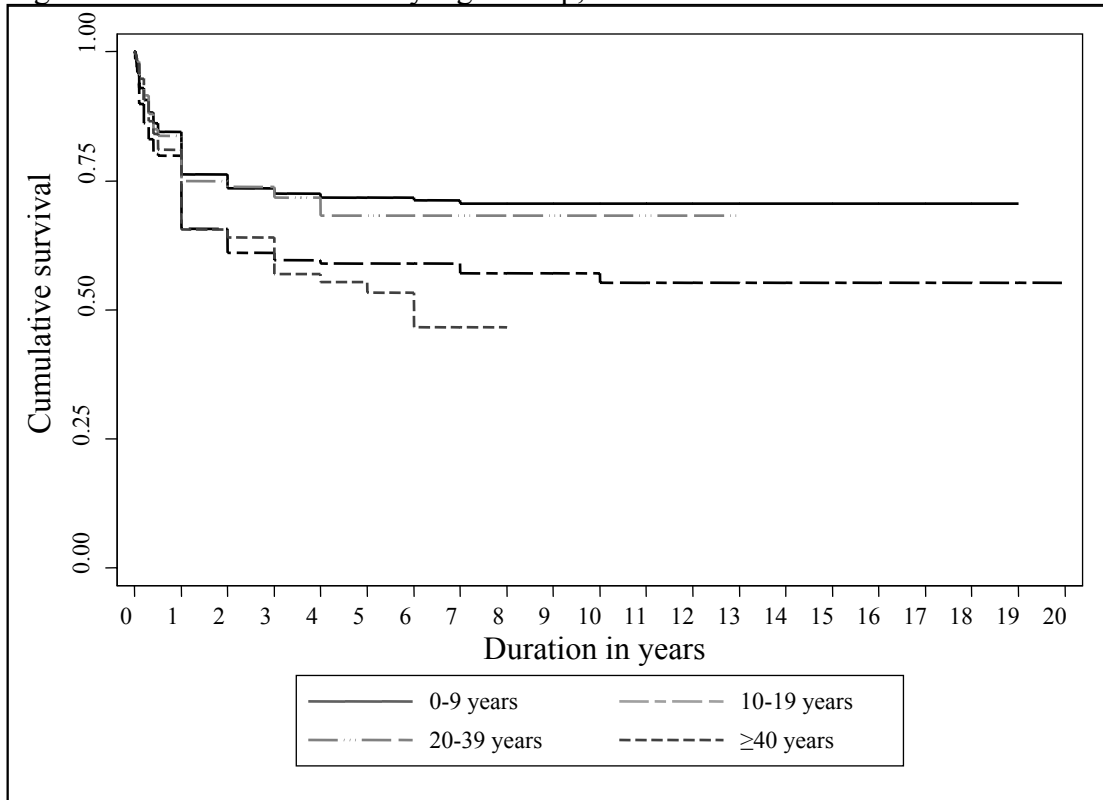
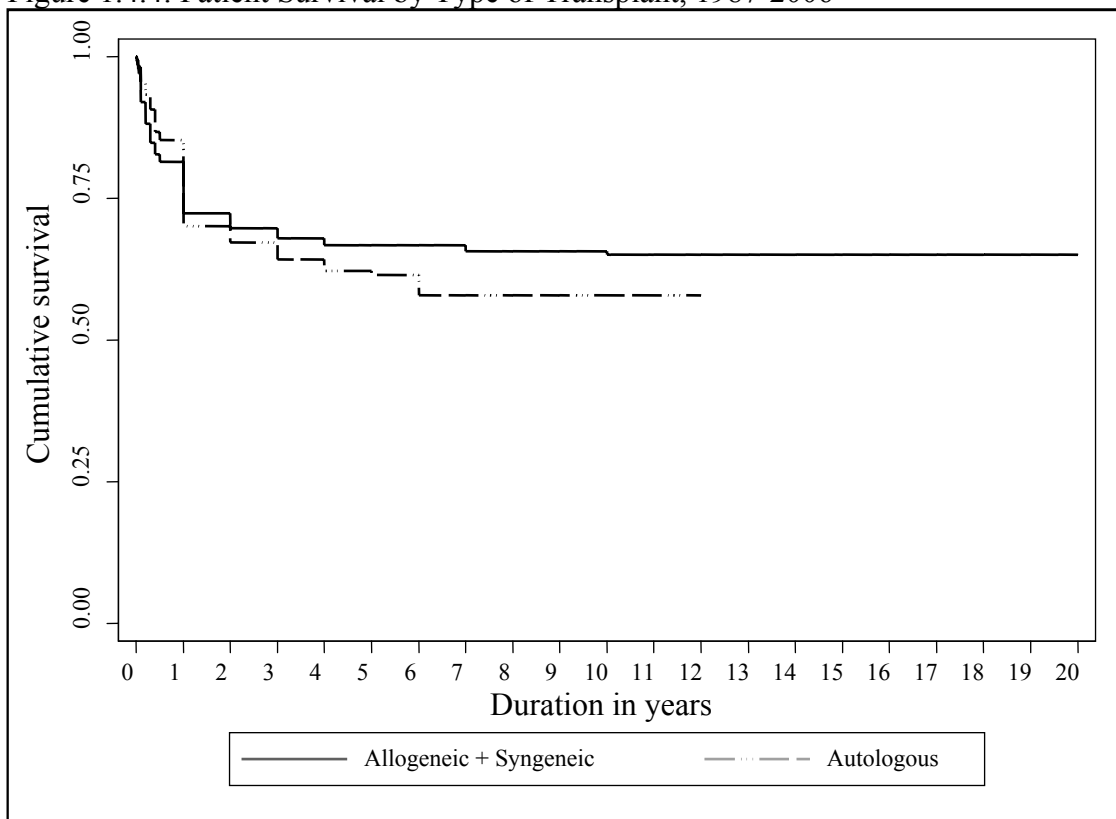


Figure 1.4.4: Patient Survival by Type of Transplant, 1987-2006



1.5 DISEASE-FREE SURVIVAL

This section shows the breakdown of disease-free survival by disease category. For malignant disorders like Acute Myeloid Leukaemia and Non-Hodgkin’s Lymphoma, where there were allogeneic or autologous donors, the outcome with allogeneic transplants was superior to autologous transplants. The remaining malignant disorders were all treated with allogeneic transplants.

Generally outcome for paediatric patients was superior to adult patients for most diseases except for Acute Lymphoblastic Leukaemia and Aplastic Anaemia.

Figure 1.5.1: Disease-free Survival for Acute Myeloid Leukaemia, 1987-2006 (Allogeneic vs. Autologous)

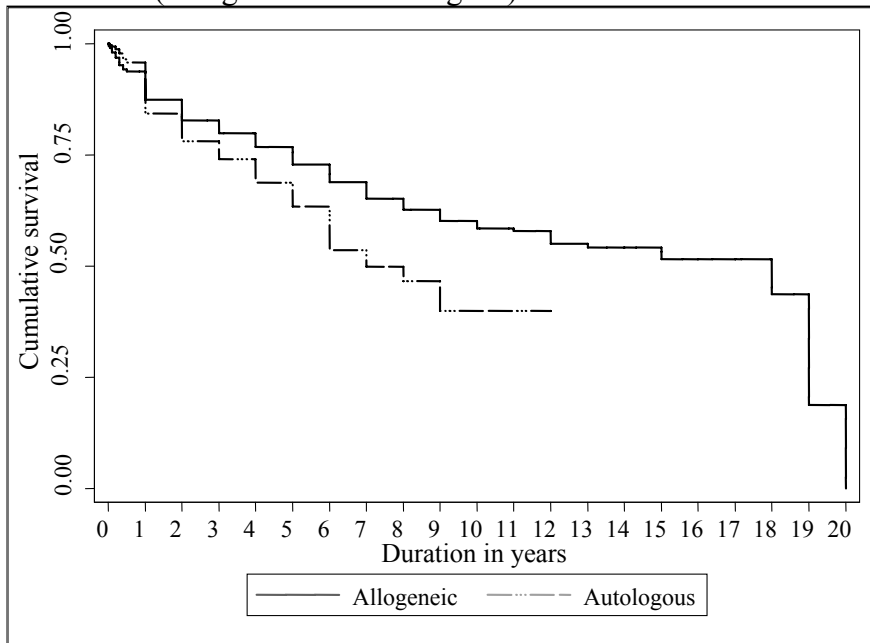


Figure 1.5.2: Disease-free Survival for Acute Lymphoblastic Leukaemia, 1987-2006 (Allogeneic)

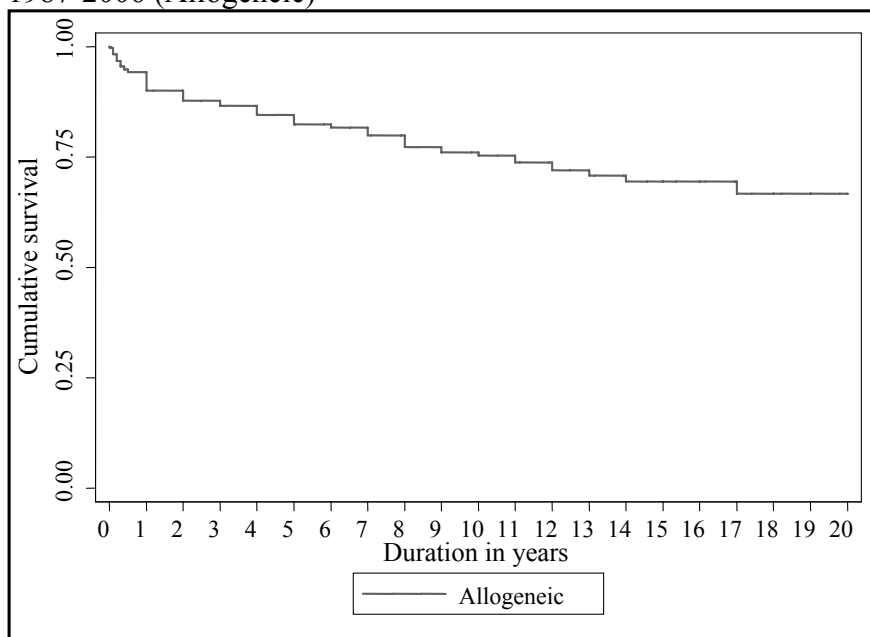


Figure 1.5.3: Disease-free Survival for Thalassaemia, 1987-2006 (Allogeneic)

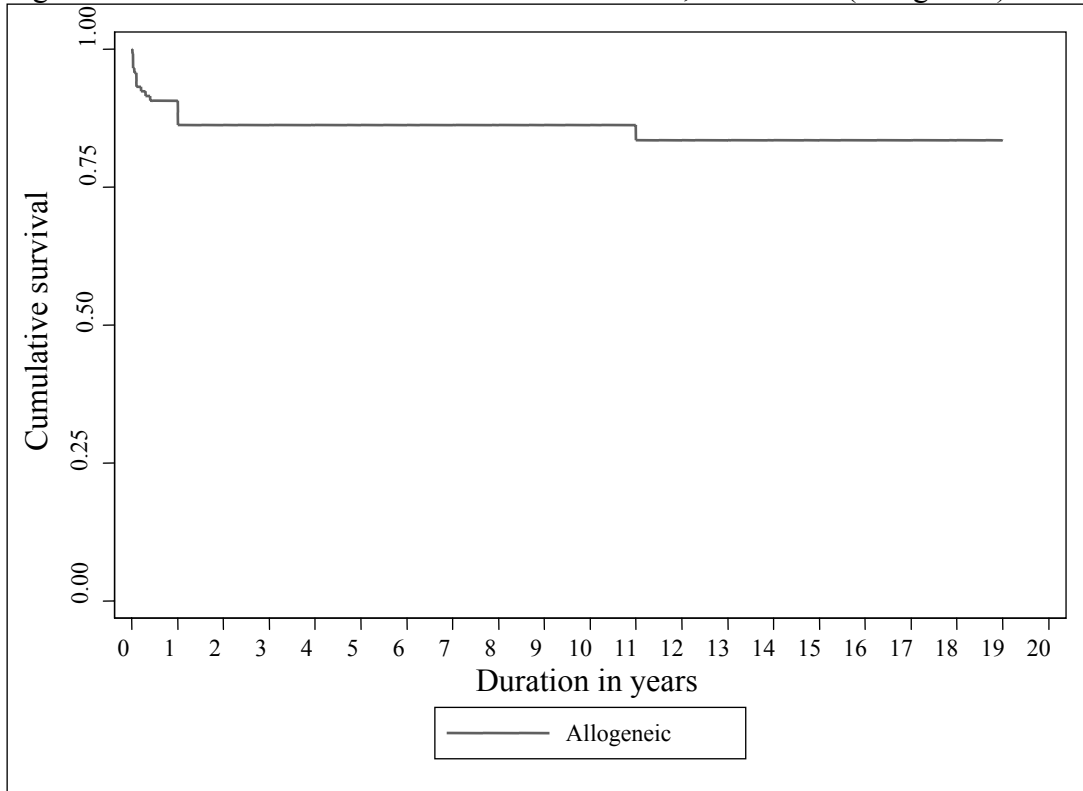


Figure 1.5.4: Disease-free Survival for Non-Hodgkin's Lymphoma, 1987-2006 (Allogeneic vs. Autologous)

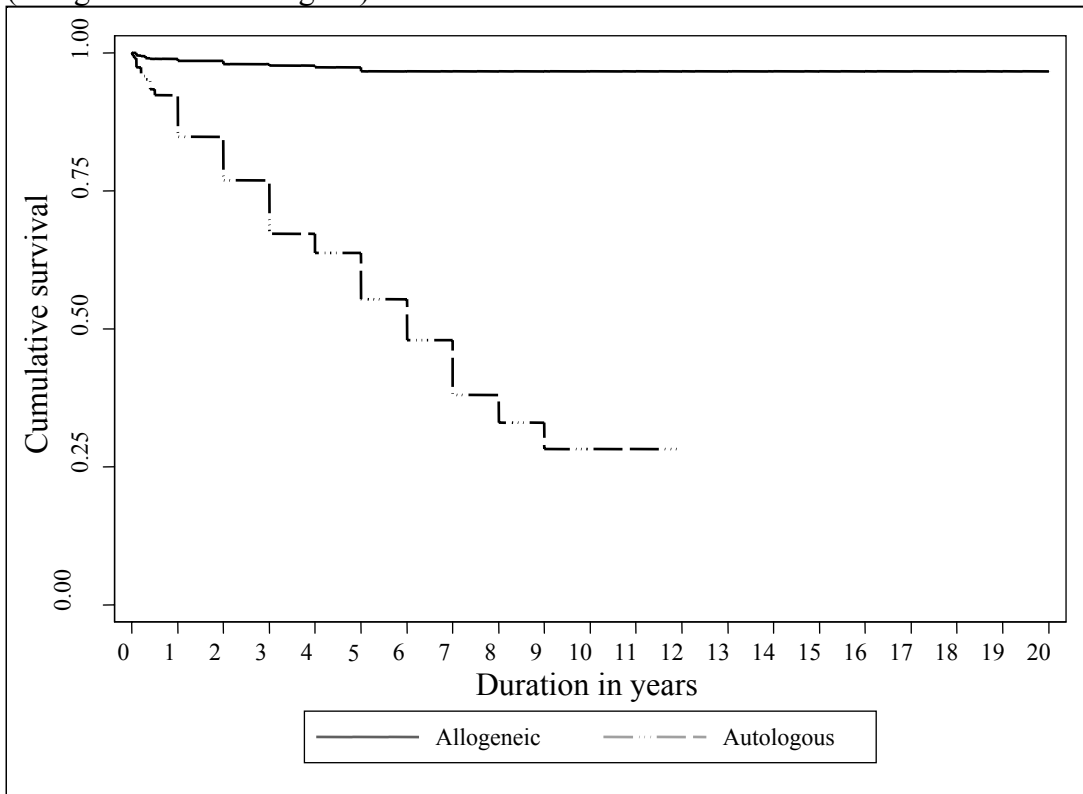


Figure 1.5.5: Disease-free Survival for Hodgkin’s Disease, 1987-2006 (Autologous)

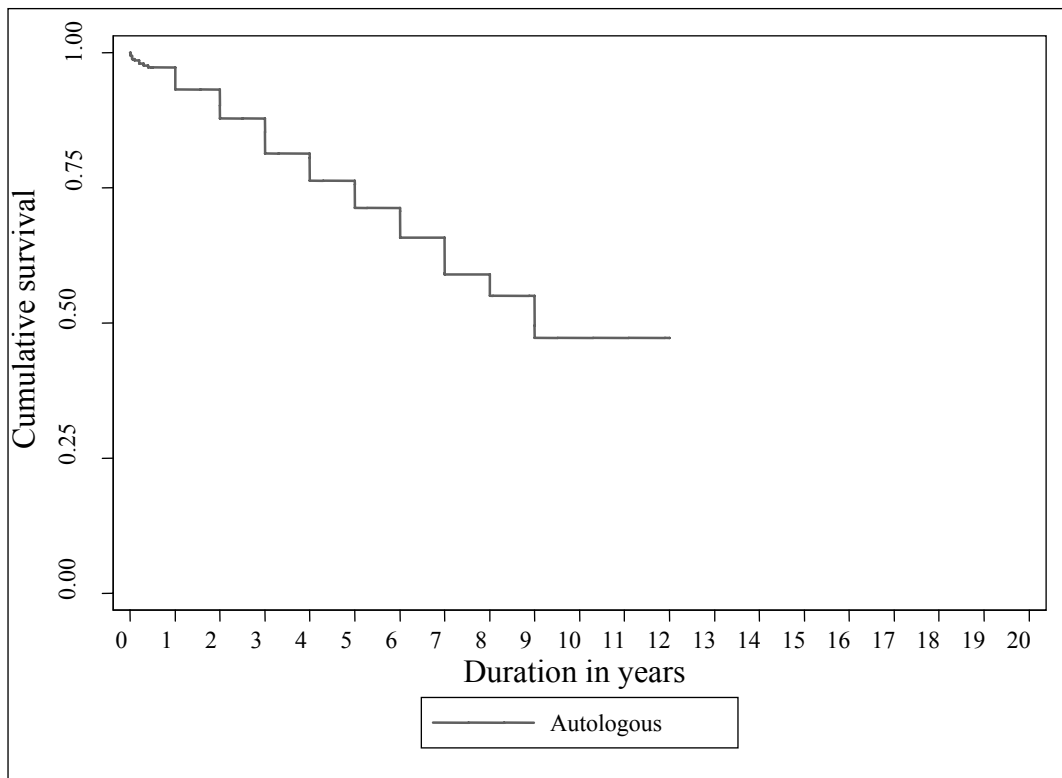


Figure 1.5.6: Disease-free Survival for Chronic Myeloid Leukaemia, 1987-2006 (Allogeneic)

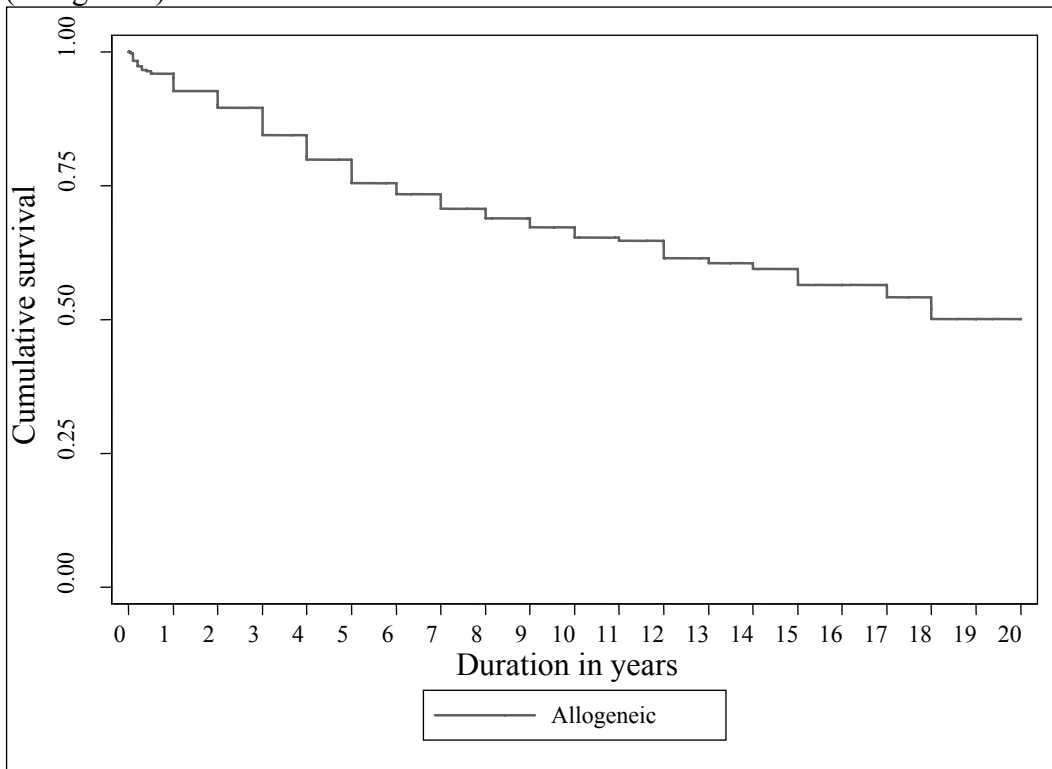


Figure 1.5.7: Disease-free Survival for Aplastic Anaemia, 1987-2006 (Allogeneic)

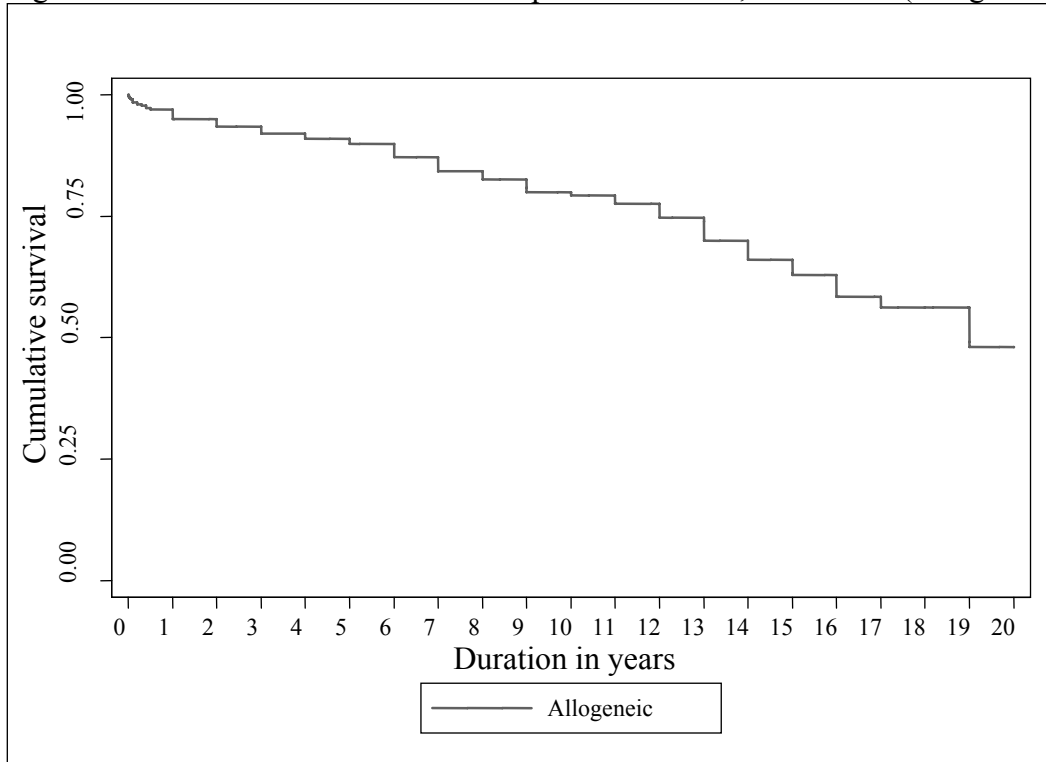
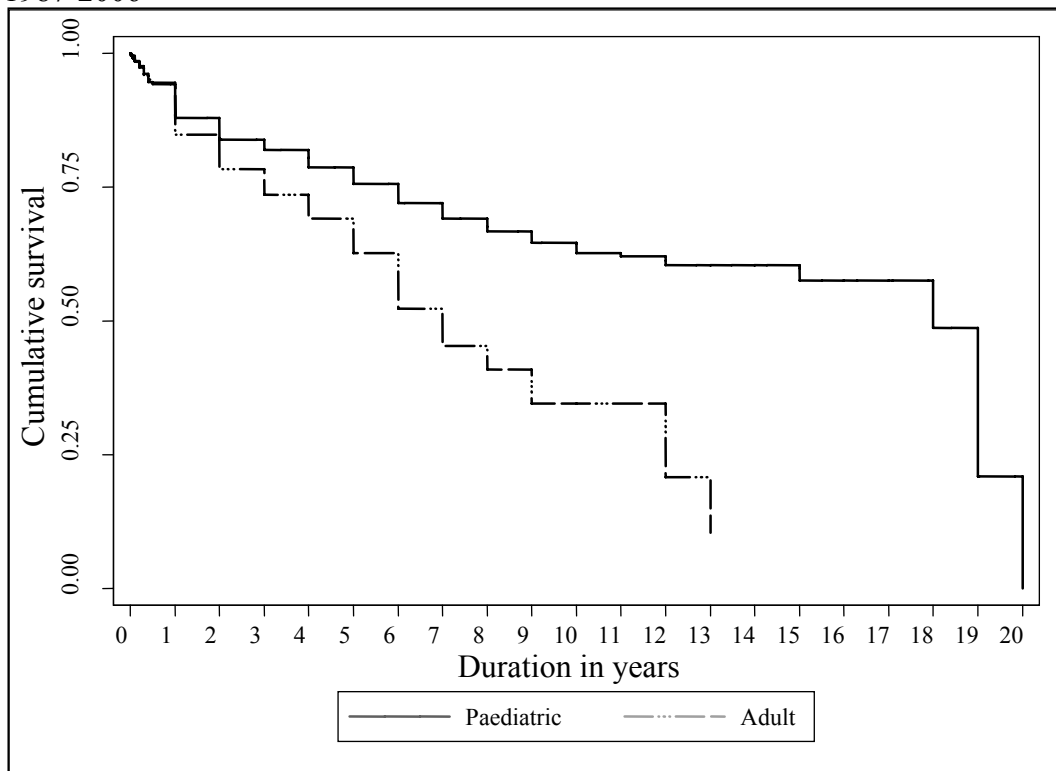
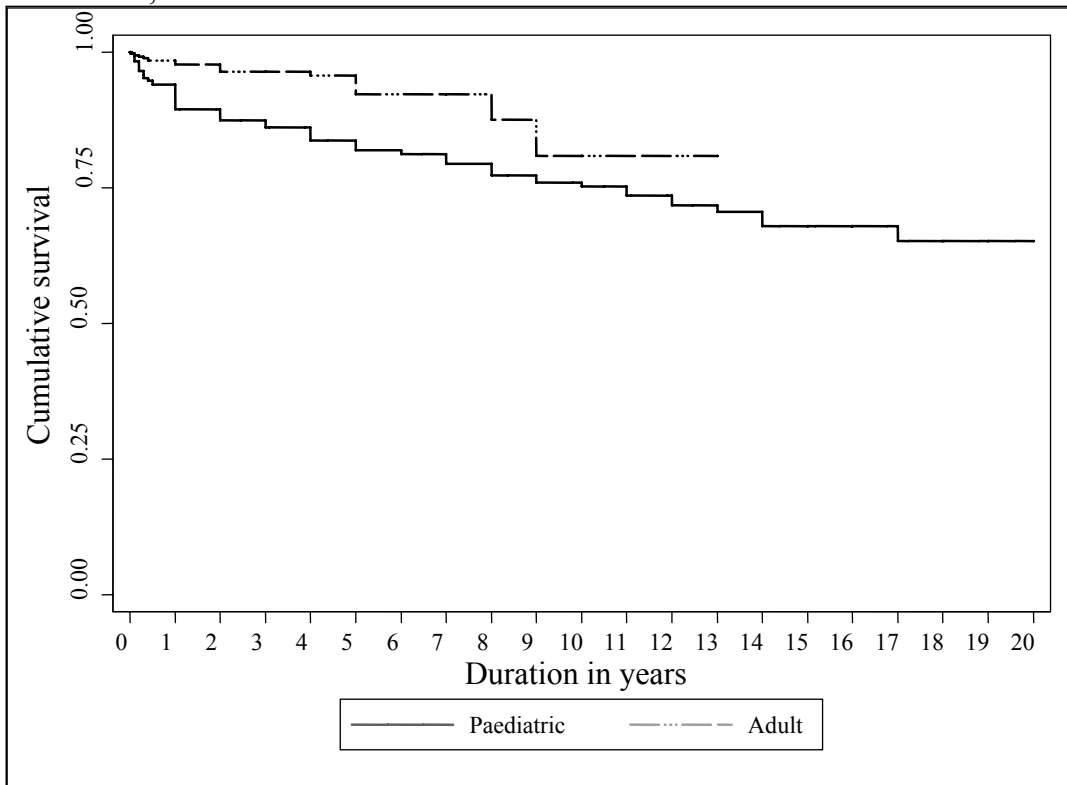


Figure 1.5.8: Disease-free Survival by Age Group for Acute Myeloid Leukaemia, 1987-2006



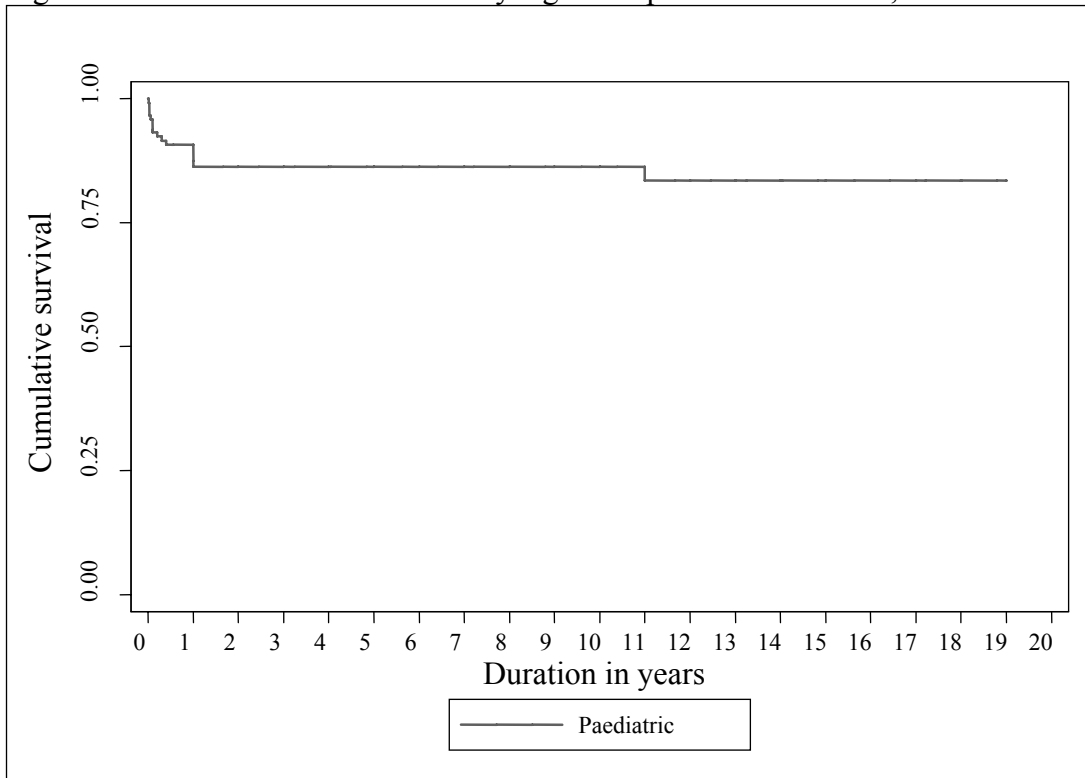
Paediatric is defined as age ≤ 18 years and adult age > 18 years

Figure 1.5.9: Disease-free Survival by Age Group for Acute Lymphoblastic Leukaemia, 1987-2006



Paediatric is defined as age ≤ 18 years and adult age > 18 years

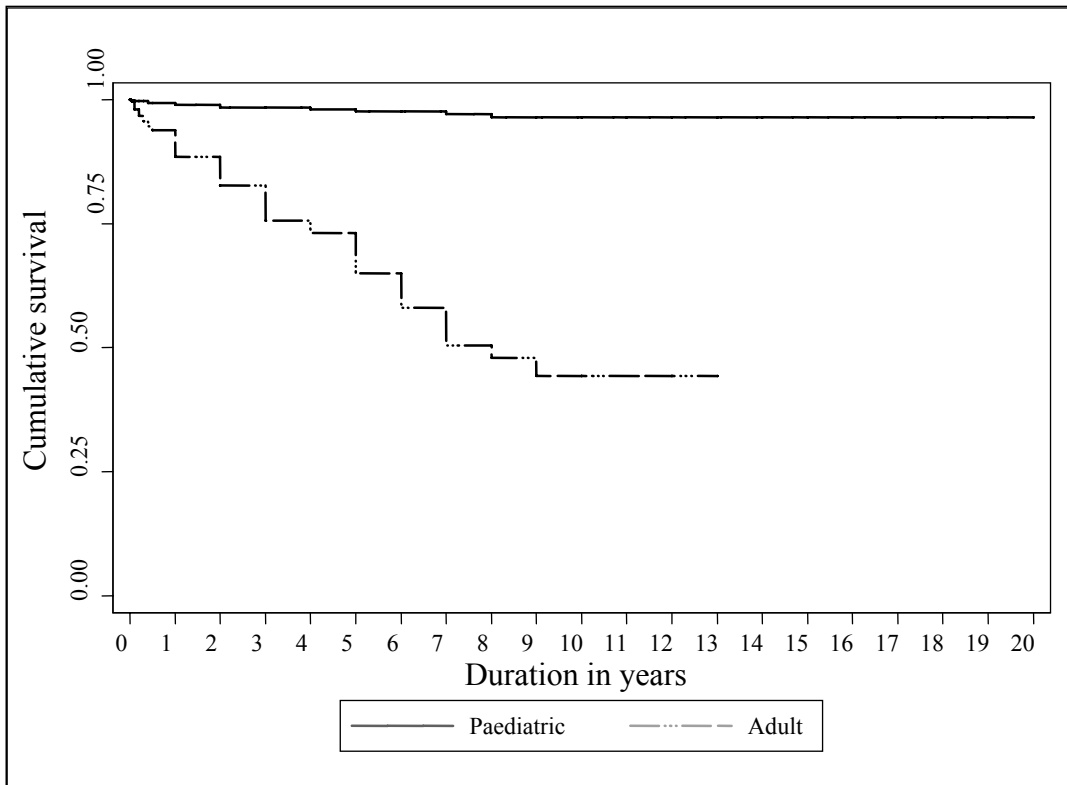
Figure 1.5.10: Disease-free Survival by Age Group for Thalassaemia, 1987-2006



* No adult cases reported for Thalassaemia

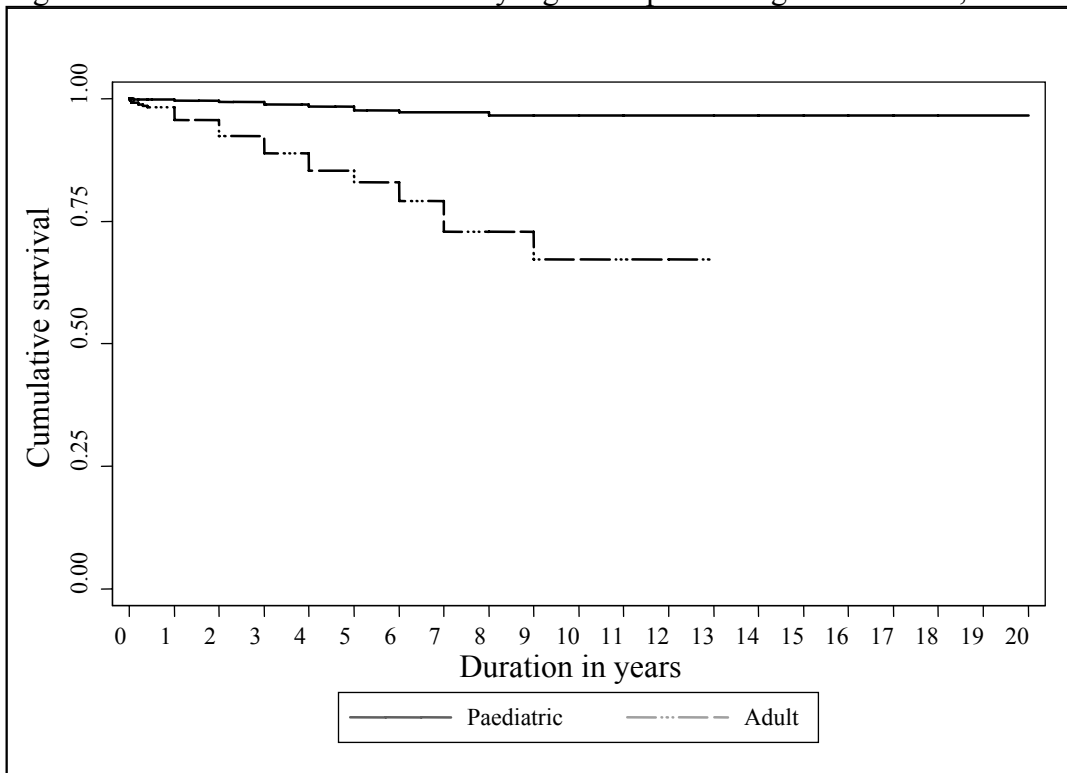
Paediatric is defined as age ≤ 18 years and adult age > 18 years

Figure 1.5.11: Disease-free Survival by Age Group for Non-Hodgkin's Lymphoma, 1987-2006



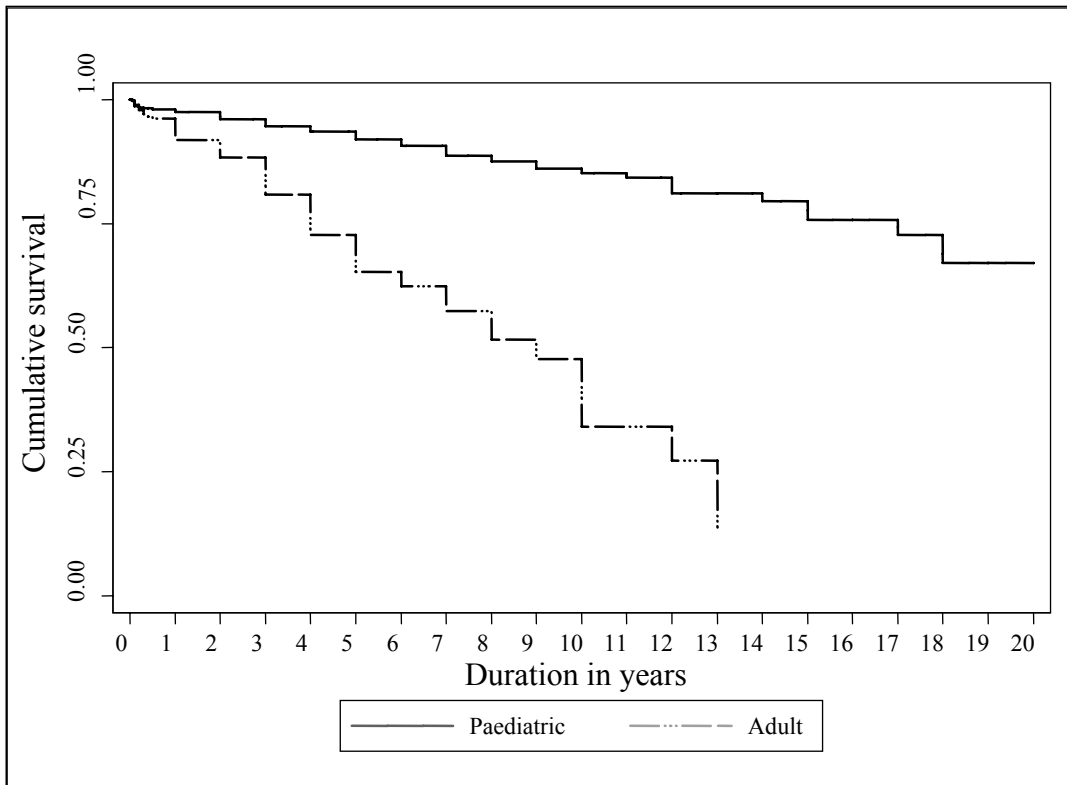
Paediatric is defined as age ≤ 18 years and adult age > 18 years

Figure 1.5.12: Disease-free Survival by Age Group for Hodgkin's Disease, 1987-2006



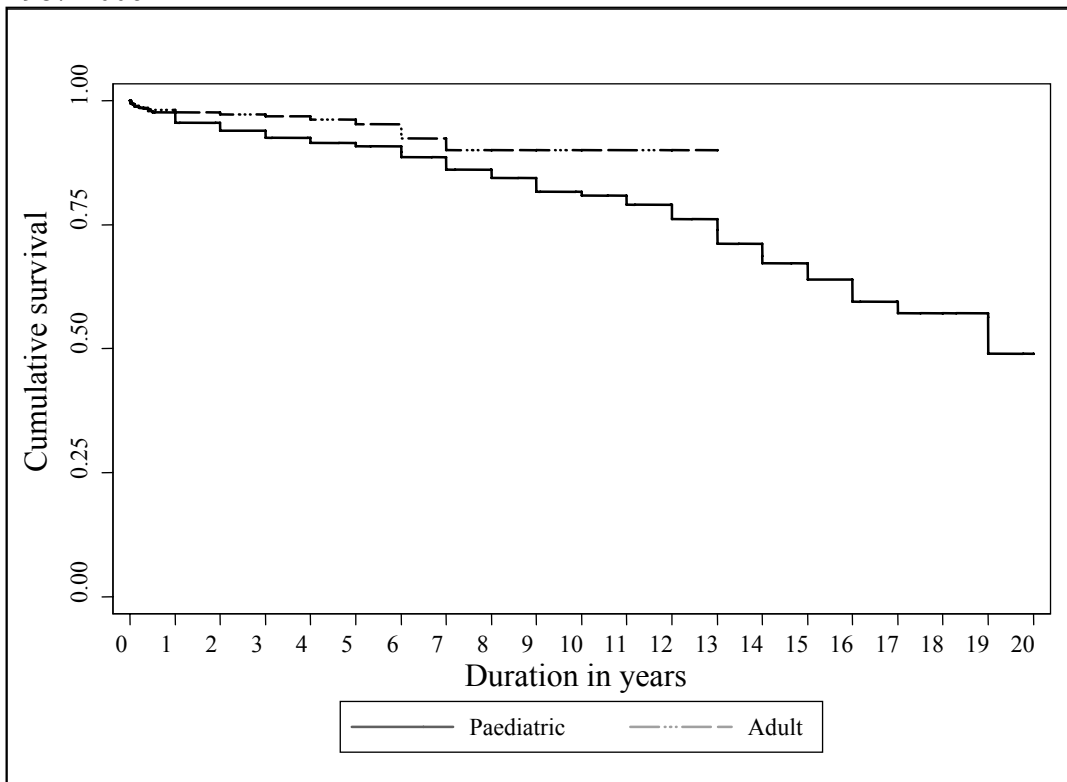
Paediatric is defined as age ≤ 18 years and adult age > 18 years

Figure 1.5.13: Disease-free Survival by Age Group for Chronic Myeloid Leukaemia, 1987-2006



Paediatric is defined as age ≤ 18 years and adult age > 18 years

Figure 1.5.14: Disease-free Survival by Age Group for Aplastic Anaemia, 1987-2006



Paediatric is defined as age ≤ 18 years and adult age > 18 years

CHAPTER 2

CORNEA TRANSPLANTATION

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2.0 INTRODUCTION

Cornea transplantation surgery allows restoration of vision in patients with corneal blindness. Cornea transplantation in Malaysia dates back to the 1970's. Today it is widely performed by ophthalmologists throughout the country both in the government and private sectors with each centre maintaining its own data.

The National Transplant Registry (NTR) was established in December 2003. The cornea transplant section of the NTR was given the task of establishing a systematic centralised data collection centre for all cornea transplantation performed in the country.

A total of 46 centres registered and agreed to provide information on retrospective and prospective cornea transplant activities. A total of 46 contributing surgeons participated in the NTR – Cornea Transplant section. Participation was voluntary.

Retrospective data (from 1998 to 2003) on cornea transplant activities were collected to identify the trend of cornea transplant surgery in the past few years. Retrospective data collected was recorded on the **Retrospective Cornea Transplant Notification Form (Form R-mds)**. This was limited to *minimal data set* which were i) demographic data, ii) type of cornea transplant surgery and iii) primary diagnosis for cornea transplantation. All surgeons agreed to provide all information required in the Retrospective Cornea Transplant Notification Form.

Prospective data (from the year 2004) on cornea transplant activities involved gathering information on all cornea transplants performed in Malaysia on two forms. The first form was the i) **Cornea Transplant Notification Form (Form N-cds)** which is completed at the time of surgery and gathers information on the recipient, operative procedure and the donor. Most surgeons sent a complete data set from 2004 as required in the prospective Cornea Transplant Notification Form. Some surgeons chose to provide only minimal data set as per Retrospective Cornea Transplant Notification Form (Form R-mds). The second form was the ii) **Cornea Transplant Outcome Form (Form O-cds)** which is completed at the end of 12 months and annually thereafter. Follow-up only ceases upon failure of graft, death or loss to follow-up of the patient. Most surgeons sent a complete data set from 2004 as required in the prospective Cornea Transplant Outcome Forms. Some surgeons chose to provide only minimal data set as in the Cornea Transplant Outcome minimal data set Form (Form O-mds).

The Cornea section of the NTR will be discussed under 3 sections.

Section 2.1 and *Section 2.2* covers notification data on cornea transplantation over 9 years from 1998 to 2005. Effort was made to ensure that all cases of cornea transplantation were reported. To the best of our knowledge, this report provides information on all cornea transplants performed in the country.

Section 2.3 covers prospective notification data on cornea transplantation (*from 2004 onwards*) from surgeons who sent a complete data set.

* Outcome data will be presented in next years' report.

2.1 CORNEA TRANSPLANT ACTIVITIES AND TRENDS (1998-2006)

The number of cornea transplants performed showed an increasing trend from 119 in 1998 to 221 in 2001, following which there was a slight decline in 2003 followed by a progressive increase each year to 192 in 2005 but this declined to 174 in 2006 (Table 2.1.1).

Penetrating keratoplasty was the most frequent type of cornea transplant surgery and was performed in 93% of cases (Table 2.1.2).

Table 2.1.1: Number of Cornea Transplantation and Transplant Rate per million population (pmp), 1998-2006

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006
No. of new transplants	119	122	126	221	203	165	184	192	174
New transplant rate pmp	5	5	5	9	8	7	7	7	7

Figure 2.1.1: New Transplant Rate, 1998-2006

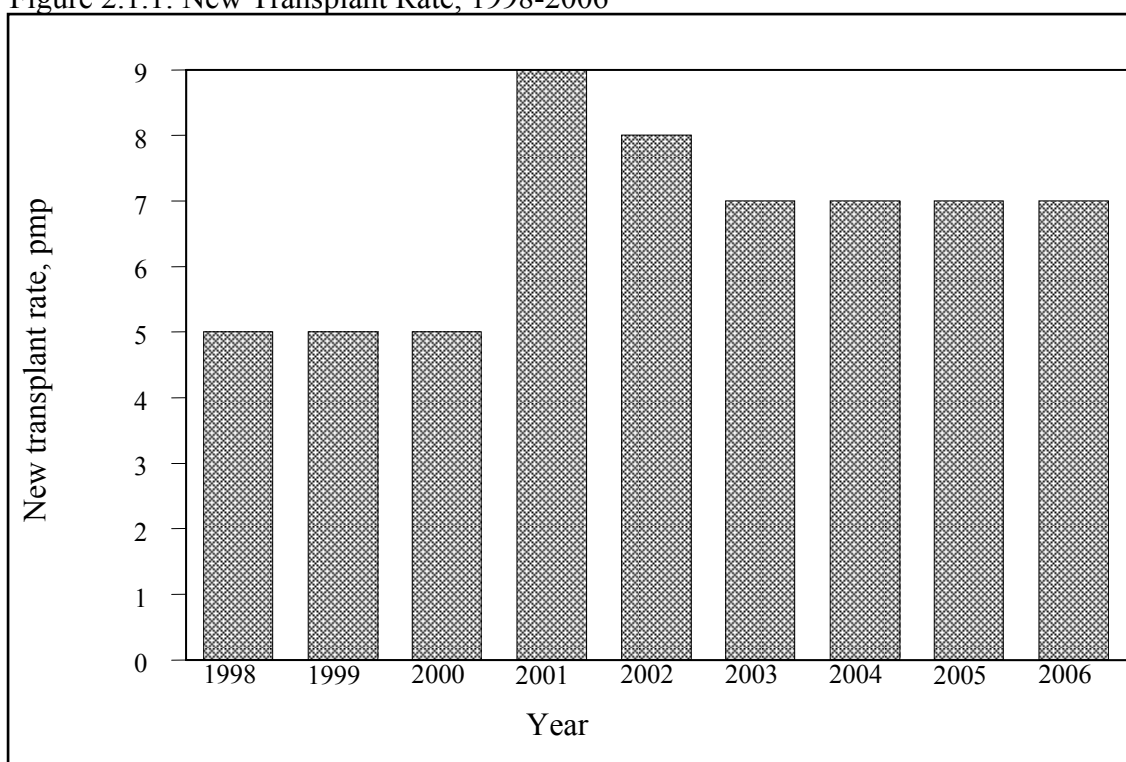


Table 2.1.2: Types of Cornea Transplant, 1998-2006

Year	1998 (N=119)		1999 (N=122)		2000 (N=126)		2001 (N=221)		2002 (N=203)		2003 (N=165)		2004 (N=184)		2005 (N=192)		2006 (N=174)		TOTAL (N=1506)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Penetrating Keratoplasty	114	96	116	95	120	95	207	94	196	97	156	95	165	90	173	90	150	86	1397	93
Lamellar Keratoplasty	1	1	5	4	5	4	14	6	5	2	8	5	10	5	13	7	16	9	77	5
Patch Graft for Corneal	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	2	5	3	10	1
Patch Graft for Sclera	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	2	0
Cornea Scleral Keratoplasty	0	0	1	1	0	0	0	0	0	0	1	0	7	4	2	1	2	1	13	1
No data	4	3	0	0	1	1	0	0	2	1	0	0	0	0	0	0	0	0	7	0

2.2 RECIPIENTS' CHARACTERISTICS

Recipients were predominantly male each year and this ranged from 60% to 69% (Table 2.2.1).

Ethnic Chinese (38%) were the predominant race undergoing cornea transplant surgery followed by Malays (32%) and Indians (23%) (Table 2.2.2).

The mean age was 45 ± 21 years with a range from as young as 2 months of age to as old as 96 years (Table 2.2.3).

The commonest primary indication for surgery was keratoconus (17%) followed by cornea scar (15%), pseudophakic bullous keratopathy (12%) and other (non-pseudophakic) bullous keratopathy (12%) (Table 2.2.4).

There may be one or more indications for cornea transplant surgery. The most frequent indication was optical (Table 2.2.5).

Table 2.2.1: Distribution of Patients by Gender, 1998-2006

Year	1998 (N=119)		1999 (N=122)		2000 (N=126)		2001 (N=221)		2002 (N=203)		2003 (N=165)		2004 (N=184)		2005 (N=192)		2006 (N=174)		TOTAL (N=1505)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Male	78	66	80	66	81	64	142	64	122	60	114	69	112	61	115	60	116	67	960	64
Female	41	34	42	34	45	36	79	36	81	40	51	31	72	39	77	40	58	33	546	36

Table 2.2.2: Distribution of Patients by Ethnic Group, 1998-2006

Year	1998 (N=119)		1999 (N=122)		2000 (N=126)		2001 (N=221)		2002 (N=203)		2003 (N=165)		2004 (N=184)		2005 (N=192)		2006 (N=174)		TOTAL (N=1506)		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
Ethnic group																					
Malay	28	24	34	28	41	33	70	32	74	36	52	32	66	36	62	32	61	35	488	32	
Chinese	47	39	46	38	50	40	92	42	83	41	67	41	58	32	73	38	57	33	573	38	
Indian	36	30	35	29	28	22	49	22	35	17	34	20	43	23	41	21	40	23	341	23	
Bumiputra Sabah	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	3	2	5	0	
Bumiputra Sarawak	0	0	0	0	0	0	1	0	0	0	0	0	4	2	5	3	4	2	14	1	
Others*	8	7	7	5	6	5	5	2	9	5	11	7	10	5	10	5	9	5	75	5	
No data	0	0	0	0	1	0	4	2	2	1	1	0	2	1	0	0	0	0	10	1	

*Others: Non Malaysian

Table 2.2.3: Distribution of Patients by Age, 1998-2006

Year	1998 (N=119)		1999 (N=122)		2000 (N=126)		2001 (N=221)		2002 (N=203)		2003 (N=165)		2004 (N=184)		2005 (N=192)		2006 (N=174)		TOTAL (N=1506)		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
Age group (years)																					
0-9	4	3	5	4	6	5	8	4	9	4	6	4	6	3	8	4	7	4	59	4	
10-19	13	11	17	14	9	7	29	13	16	8	21	13	15	8	14	7	22	13	156	10	
20-39	28	24	34	28	34	27	49	22	53	26	36	22	55	30	59	31	52	30	400	27	
40-59	38	32	32	26	40	32	61	28	57	28	51	31	52	28	45	23	42	24	418	28	
≥60	36	30	34	28	37	29	74	33	68	33	51	31	56	30	66	34	51	29	473	31	
Mean	45		43		44		45		46		45		45		46		44		45		
SD	21		22		20		21		21		21		21		21		22		21		
Median	45		43		45		50		46		46		44		49		43		45		
Minimum	4 months		5		2 months		5 months		1		5 months		2 months		2 months		2 months		2 months		
Maximum	82		92		86		85		86		84		86		84		96		96		

Age=date transplant-date birth; age if provided

Table 2.2.4: Primary Diagnosis, 1998-2006

Year	1998 (N=119)		1999 (N=122)		2000 (N=126)		2001 (N=221)		2002 (N=203)		2003 (N=165)		2004 (N=184)		2005 (N=192)		2006 (N=174)		TOTAL (N=1506)		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
Primary Diagnosis																					
Keratoconus	24	20	24	20	15	12	38	17	32	16	18	11	34	18	34	18	33	19	252	17	
Corneal scar	33	28	25	20	21	17	34	15	28	14	21	13	26	14	20	10	18	10	226	15	
Microbial keratitis	11	9	11	9	19	15	30	14	31	15	21	13	18	10	13	7	11	6	165	11	
Microbial keratitis+Cornea perforation	1	1	6	5	1	1	6	3	4	2	4	2	17	9	20	10	7	4	66	4	
Corneal perforation (non microbial)	6	5	7	6	8	6	12	5	12	6	27	16	13	7	18	9	20	11	123	8	
Pseudophakic Bullous keratopathy	10	8	16	13	17	13	23	10	15	7	19	12	19	10	35	18	30	17	184	12	
Other (non pseudophakic) bullous keratopathy	14	12	4	3	19	15	37	17	47	23	25	15	16	9	14	7	10	6	186	12	
Failed previous graft	14	12	12	10	13	10	17	8	15	7	14	8	12	7	14	7	9	5	120	8	
Corneal dystrophy	5	4	6	5	5	4	12	5	9	4	7	4	8	4	6	3	10	6	68	5	
Congenital opacity	1	1	1	1	1	1	1	0	0	0	1	1	8	4	4	2	1	1	18	1	
Others	3	3	8	7	7	6	15	7	14	7	10	6	34	18	34	18	35	20	160	11	
No data	0	0	2	2	1	1	1	0	0	0	0	0	0	0	0	0	0	0	4	0	

*1377 patients have 1 primary diagnosis, 119 have 2 primary diagnoses, 5 patients had 3 diagnoses, and 1 patient had 4 diagnoses

Table 2.2.5: Indications for Cornea Transplant, 2004-2006

Indication for transplant	2004 (N = 184)		2005 (N=192)		2006 (N=174)		Total (N =550)	
	No.	%	No.	%	No.	%	No.	%
Optical	120	65	135	70	122	70	377	69
Tectonic	26	14	23	11	19	11	68	12
Therapeutic	27	14	19	10	17	9	63	11
Tectonic + Therapeutic	9	5	9	5	4	2	22	4
Optical + Tectonic	1	1	1	1	1	1	3	1
Optical + Tectonic + Therapeutic	0	0	1	1	0	0	1	0
Optical + Therapeutic	0	0	0	0	5	3	5	1
Optical + Others	0	0	0	0	1	1	1	0
Others	1	1	4	2	4	2	9	2
No data	0	0	0	0	1	1	1	0

2.3 TRANSPLANT DATA, 2004-2006

2.3.1 Stock and Flow

There was an increase in the number of cornea transplant notification - complete data sets returned from 75% in 2004 to 100% in 2005 and 2006 (Table 2.3.1.1). Data in this section covers notification data from surgeons who sent a complete data set.

Table 2.3.1.1: Number of Cornea Transplants with Complete Data Set

	2004		2005		2006		Total	
	No.	%	No.	%	No.	%	No.	%
Total number of cornea transplantations performed	184	100	192	100	174	100	550	100
No. of cornea transplantations with complete data set	138	75	192	100	174	100	504	92

2.3.2 Pre-transplant Data

Regrfts were performed in 10% of cases (Table 2.3.2.1). Corneal vascularisation was the most frequently encountered pre-operative ocular co-morbidity, followed by ocular inflammation and glaucoma (raised intraocular pressure).

Sixty-eight percent of cases were legally blind (vision 3/60 or worse) prior to cornea transplantation (Table 2.3.2.3).

Table 2.3.2.1: No of Previous Grafts in Grafted Eye, 2004-2006

Graft Number	2004 (N=138)		2005 (N=192)		2006 (N=174)		Total (N=504)	
	No.	%	No.	%	No.	%	No.	%
0	123	89	171	89	158	91	452	90
1	11	8	15	8	15	8	41	8
2	3	2	2	1	1	1	6	1
3	0	0	4	2	0	0	4	1
4	1	1	0	0	0	0	1	0

Table 2.3.2.2: Ocular Co-morbidity, 2004-2006

	2004 (N=138)		2005 (N=192)		2006 (N=174)		Total (N=504)	
	No.	%	No.	%	No.	%	No.	%
Ocular co-morbidity								
Any ocular co-morbidity (a to d below)	88	64	103	54	78	45	269	53
a) Superficial cornea vascularisation	44	57	48	61	41	72	133	62
b) Deep cornea vascularisation	42	55	39	49	22	39	103	48
c) History of glaucoma	29	33	36	35	33	42	98	36
d) Current ocular inflammation	41	47	50	49	40	51	131	49

*Patient might have multiple ocular co-morbidities

Table 2.3.2.3: Pre-operative Vision, 2004-2006

Unaided VA	2004 (N=138)		2005 (N=192)		2006 (N=174)		Total (N=504)	
	No.	%	No.	%	No.	%	No.	%
6/6	3	2	0	0	1	1	4	1
6/9	1	1	1	1	1	1	3	1
6/12	0	0	2	1	3	2	5	1
6/18	0	0	1	1	0	0	1	0
6/24	3	2	5	3	4	2	12	2
6/36	4	3	6	3	5	3	15	3
6/60	7	5	16	8	17	10	40	8
5/60	1	1	0	0	0	0	1	0
4/60	3	2	1	1	2	1	6	1
3/60	2	1	1	1	2	1	5	1
2/60	1	1	2	1	3	2	6	1
1/60	4	3	9	5	7	4	20	4
CF	47	34	47	24	44	25	138	27
HM	47	34	46	24	37	21	130	26
PL	13	9	15	8	11	6	39	8
NPL	2	1	1	1	0	0	3	1
Others	0	0	1	1	0	0	1	0
No data	0	0	38	20	37	21	75	15

2.3.3 Donor Details

Eye Banks in the United States of America (USA) were the most frequent source of the corneal tissues (Table 2.3.3.1). The majority of donors were elderly patients with a median age of 58 years (Table 2.3.3.2). Optisol GS was the commonest cornea tissue storage medium used at 76% (Table 2.3.3.3). The major causes of death of the donors were related to the cardiac or circulatory system (30%) followed by malignancy (15%) (Table 2.3.3.4).

Table 2.3.3.1: Source of Donor Corneal Tissue, 2004-2006

Source of donor	2004 (N=138)		2005 (N=192)		2006 (N=174)		Total (N=504)	
	No.	%	No.	%	No.	%	No.	%
Local	20	14	19	10	35	20	74	15
USA	95	69	133	69	96	55	324	64
Sri Lanka	22	16	38	20	41	24	101	20
Others	0	0	0	0	2*	1	2	0
No data	1	1	2	1	0	0	3	1
Ethnic group, if local:								
• Malay	0	0	4	21	1	3	5	7
• Chinese	14	70	8	42	12	34	34	46
• Indian	5	25	7	37	22	63	34	46
• Others	0	0	0	0	0	0	0	0
• No data	1	5	0	0	0	0	1	1

*Others: Taiwanese Chinese

Figure 2.3.3.1: Source of Donor Corneal Tissue, 2004-2006

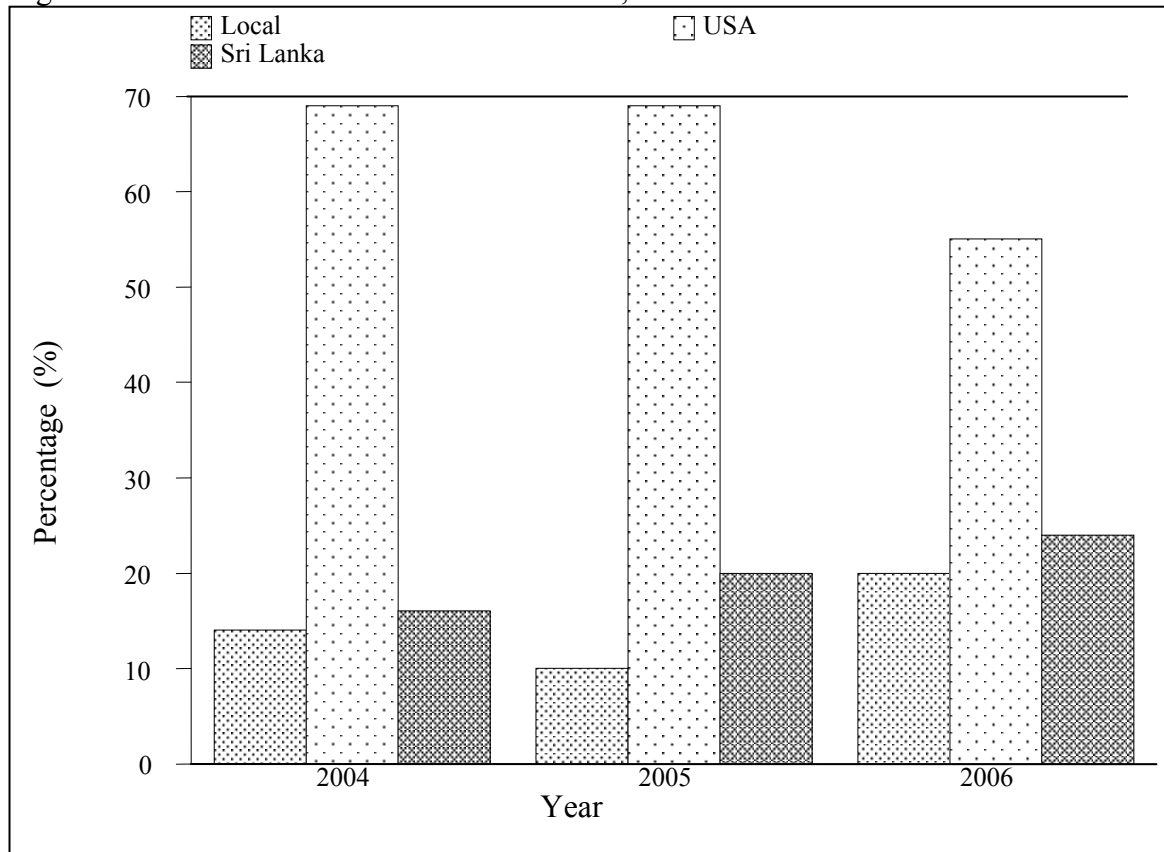


Table 2.3.3.2: Distribution of Donors by Age Group, 2004-2006

Age, years	2004 (N=138)		2005 (N=192)		2006 (N=174)		Total (N=504)	
	No.	%	No.	%	No.	%	No.	%
0-9	2	1	3	2	2	1	7	1
10-19	6	4	4	2	9	5	19	4
20-39	11	8	7	4	11	6	29	6
40-59	52	38	89	46	80	46	221	44
≥60	67	49	89	46	72	42	228	45
Mean	56		58		55		57	
SD	15		14		16		15	
Median	59		58		56		58	
Minimum	8		3		6		3	
Maximum	78		79		78		79	

Table 2.3.3.3: Preservation Media, 2004-2006

Preservation media	2004 (N=138)		2005 (N=192)		2006 (N=174)		Total (N=504)	
	No.	%	No.	%	No.	%	No.	%
Optisol GS	110	80	147	77	126	72	383	76
MK Medium	22	16	37	19	40	23	99	20
Moist Chamber	4	3	3	2	7	4	14	3
Others	0	0	1*	0	0	0	1	0
No data	2	1	4	2	1	1	7	1

*Others: Eusol-C

Figure 2.3.3.3: Preservation Media, 2004-2006

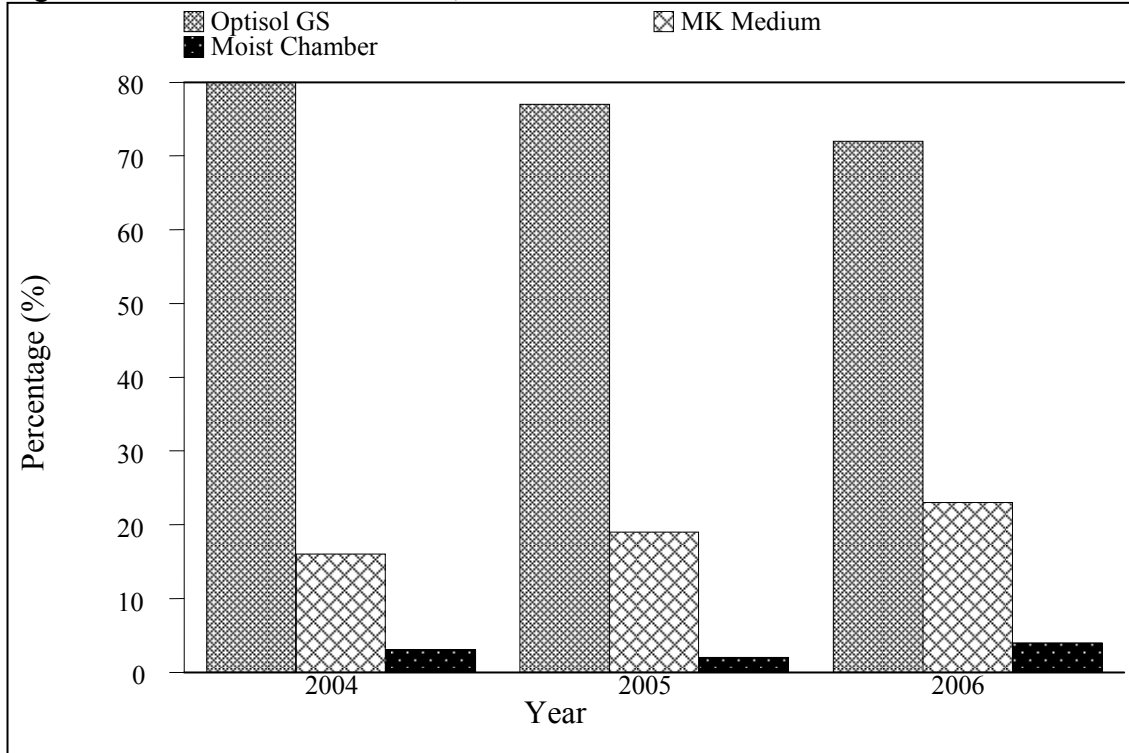


Table 2.3.3.4: Cause of Death in Cornea Donors, 2004-2006

Cause of death	2004 (N=138)		2005 (N=192)		2006 (N=174)		Total (N=504)	
	No.	%	No.	%	No.	%	No.	%
Cardiac / Circulatory System	47	35	49	26	58	33	154	31
Cerebrovascular System	17	12	25	13	11	6	53	10
Malignancy	19	14	31	16	24	14	74	15
Trauma / Accident	20	14	13	7	19	11	52	10
Respiratory System	15	11	8	4	8	5	31	6
Others	17	12	21	11	26	15	64	13
No data	3	2	45	23	28	16	76	15

2.3.4 Transplant Practices

Penetrating Keratoplasty (PK) was the commonest type of surgery performed (88%) (Table 2.3.4.1). Cornea transplantation was performed in combination with other surgical procedures in 20% of cases. Cataract extraction, with or without intraocular lens implantation (IOL), was the commonest combined procedure (Table 2.3.4.2).

The recipient graft size ranged from 2mm to 10mm, with the median recipient cornea graft size being 7.5mm (Table 2.3.4.3). The majority of cases had the donor tissue oversized by 0.5mm (Table 2.3.4.4). The commonest suture technique was interrupted sutures (Table 2.3.4.5).

Table 2.3.4.1: Distribution of Patients by Type of Surgery, 2004-2006

Type of surgery	2004 (N=138)		2005 (N=192)		2006 (N=174)		Total (N=504)	
	No.	%	No.	%	No.	%	No.	%
Penetrating Keratoplasty	120	88	173	90	150	86	443	88
Lamellar Keratoplasty	10	7	13	7	16	9	39	8
Patch graft for cornea	2	1	3	2	5	3	10	2
Patch graft for sclera	0	0	1	0	1	1	2	0
Cornea Scleral Lamellar Keratoplasty	6	4	2	1	2	1	10	2

Table 2.3.4.2: Type of Combined Surgery, 2004-2006

Combined surgery	2004 (N=138)		2005 (N=192)		2006 (N=174)		Total (N=504)	
	No.	%	No.	%	No.	%	No.	%
No. of patients with combined surgery	31	22	27	14	42	24	100	20
(a) Glaucoma surgery	2	6	3	11	2	5	7	7
(b) Cataract Extraction	16	52	13	48	22	52	51	51
(c) IOL	14	45	10	37	24	57	48	48
(d) Cataract extraction and IOL	10	32	8	30	16	38	34	34
(e) Retinal Surgery ± Internal Tamponade	1	3	1	4	2	5	4	4
(f) Anterior vitrectomy	9	29	3	11	5	12	17	17
(g) Others	5	16	8	30	8	19	21	21

*Patients may have more than one combined surgery

Table 2.3.4.3: Recipient Cornea Trephine Size, 2004-2006

Graft size, mm	2004 (N=138)		2005 (N=192)		2006 (N=174)		Total (N=504)	
	No.	%	No.	%	No.	%	No.	%
2	1	1	1	1	2	1	4	1
3	0	0	1	1	2	1	3	1
4	1	1	2	1	1	1	4	1
5	0	0	0	0	0	0	0	0
5.5	1	1	0	0	0	0	1	0
6	3	2	0	0	5	3	8	2
6.25	0	0	1	1	0	0	1	0
6.50	2	1	5	2	4	2	11	2
6.75	1	1	3	2	2	1	6	1
7	25	18	36	18	24	14	85	17
7.25	10	7	10	5	14	8	34	7
7.50	36	26	18	9	24	14	78	15
7.75	10	7	11	5	6	3	27	5
8	19	14	7	4	13	7	39	8
8.25	4	3	4	2	5	3	13	3
8.50	6	4	6	3	2	1	14	3
8.75	0	0	1	1	0	0	1	0
9	8	6	3	2	1	1	12	2
9.25	0	0	0	0	0	0	0	0
9.50	0	0	2	1	0	0	2	0
9.75	0	0	0	0	0	0	0	0
10	1	1	0	0	0	0	1	0
No data	10	7	81	42	69	40	160	32
Mean	7.5		7.3		7.2		7.3	
SD	0.9		1		1.1		1	
Median	7.5		7.3		7.3		7.5	
Minimum	2		2		2		2	
Maximum	10		9.5		9		10	

Table 2.3.4.4: Difference in Trephined Sizes of Recipient and Donor Corneas, 2004-2006

Difference in Graft size, mm	2004 (N=138)		2005 (N=192)		2006 (N=174)		Total (N=504)	
	No.	%	No.	%	No.	%	No.	%
Same size	9	7	8	4	8	4	25	5
0.25	29	21	19	10	29	17	77	16
0.5	87	62	84	44	65	37	236	47
0.75	1	1	0	0	1	1	2	0
1	1	1	0	0	1	1	2	0
2	1	1	0	0	0	0	1	0
Not available	10	7	81	42	70	40	161	32

Table 2.3.4.5: Suture Technique, 2004-2006

Suture Technique	2004 (N=138)		2005 (N=192)		2006 (N=174)		Total (N=504)	
	No.	%	No.	%	No.	%	No.	%
Interrupted only	132	96	139	73	122	70	393	78
Continuous only	0	0	0	0	5	3	5	1
Combined	6	4	18	9	17	10	41	8
No data	0	0	35	18	30	17	65	13

CHAPTER 3

HEART AND LUNG TRANSPLANTATION

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3.0 INTRODUCTION

The first heart transplant in Malaysia was carried out at Institut Jantung Negara (IJN) Kuala Lumpur in December 1997. The main limitation to the performance of heart transplants has been the lack of donor organs. Since 2004, IJN in collaboration with Institut Perubatan Respiratori (IPR) of the Ministry of Health has been preparing to perform lung transplantation as well as heart lung transplant and the first lung transplant was carried out in December 2005.

The rest of the report that follows will review the results of heart and lung transplantation in Malaysia till end of 2006.

Only 1 heart transplant and 1 double lung transplant were carried out in 2006.

3.1 STOCK AND FLOW

Table 3.1.1: Stock and Flow of Heart Transplantation, 1997-2006

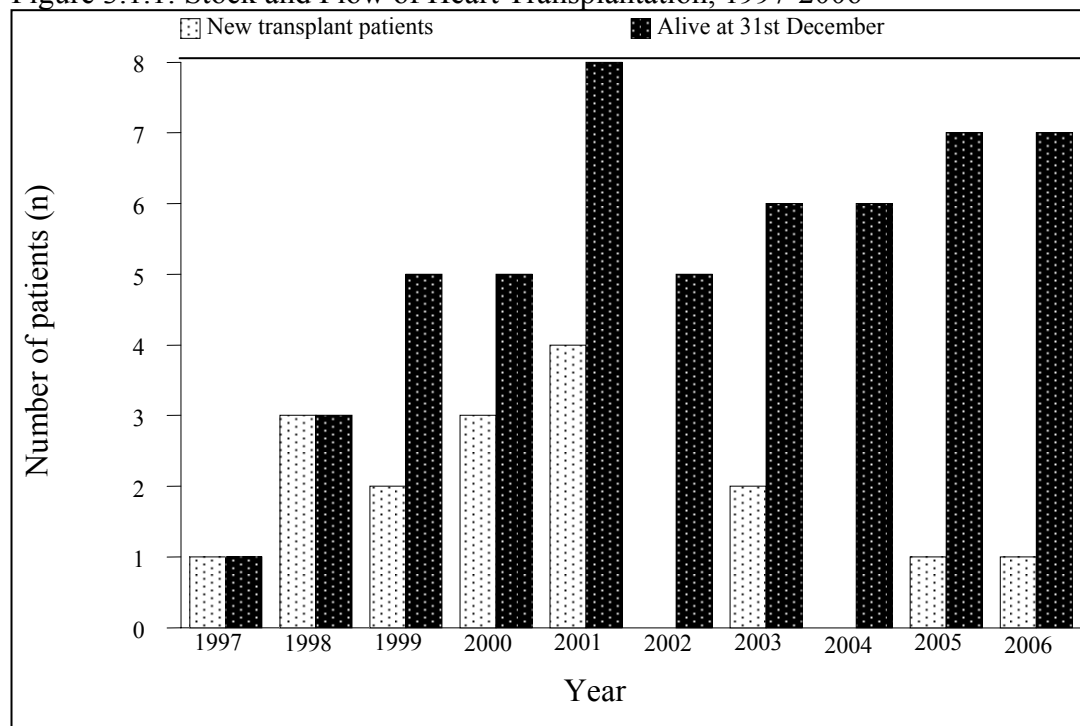
Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
New transplant patients	1	3	2	3	4	0	2	0	1	1
Deaths	0	1	0	3	1	3	1	0	0	1
Retransplanted	0	0	0	0	0	0	0	0	0	0
Lost to follow up	0	0	0	0	0	0	0	0	0	0
Alive at 31 st December	1	3	5	5	8	5	6	6	7	7

N.B. There was no heart transplants carried out in 2004

Table 3.1.2: Stock and Flow of Lung Transplantation, 2005-2006

Year	2005	2006
New transplant patients	1	1
Deaths	0	1
Retransplanted	0	0
Lost to follow up	0	0
Alive at 31 st December	1	1

Figure 3.1.1: Stock and Flow of Heart Transplantation, 1997-2006



3.2 RECIPIENTS' CHARACTERISTICS

A total of 17 heart transplants have been carried out from 1997 to 2006. Two thirds of the recipients were males and over half were Indians. The mean age of recipients was 36 years (range 13-55 years) (Table 3.2.3). The aetiology of heart failure is as listed in Table 3.2.4. Ischaemic cardiomyopathy was the commonest aetiology followed by dilated cardiomyopathy.

Table 3.2.1: Distribution of Patients by Gender, 1997-2006

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	TOTAL
Gender	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Male	1	3	0	2	2	0	2	0	1	1	12
Female	0	0	2	1	2	0	0	0	0	0	5
TOTAL	1	3	2	3	4	0	2	0	1	1	17

Table 3.2.2: Distribution of Patients by Ethnic Group, 1997-2006

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	TOTAL
Ethnic group	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Malay	0	0	1	1	2	0	0	0	1	0	5
Chinese	0	0	0	1	0	0	1	0	0	0	2
Indian	1	3	1	1	2	0	1	0	0	1	10
TOTAL	1	3	2	3	4	0	2	0	1	1	17

Table 3.2.3: Distribution of Patients by Age, 1997-2006

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	TOTAL
Age, years	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
0-19	0	0	2	1	1	0	0	0	1	0	5
20-39	0	2	0	0	0	0	0	0	0	0	2
40-59	1	1	0	2	3	0	2	0	0	1	10
>=60	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1	3	2	3	4	0	2	0	1	1	17
Mean	51	40	16	37	38	-	46	-	15	44	36
SD	-	9	1	22	17	-	8	-	-	-	16
Median	51	37	16	44	43	-	46	-	15	44	40
Minimum	51	33	15	13	14	-	40	-	15	44	13
Maximum	51	50	16	55	54	-	52	-	15	44	55

Age=date of transplant-date of birth

Table 3.2.4: Distribution of Patients by Primary Diagnosis, 1997-2006

Year	97	98	99	00	01	02	03	04	05	06	TOTAL
Primary diagnosis	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Ischaemic Cardiomyopathy	1	3	0	1	1	0	2	0	0	1	9
Idiopathic Dilated Cardiomyopathy	0	0	2	1	2	0	0	0	1	0	6
Restrictive Cardiomyopathy	0	0	0	0	0	0	0	0	0	0	0
End Stage Valvular Heart Disease	0	0	0	0	1	0	0	0	0	0	1
Hypertrophic Cardiomyopathy	0	0	0	1	0	0	0	0	0	0	1
Others	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1	3	2	3	4	0	2	0	1	1	17

Two lung transplantations were carried out from 2005 to 2006. Both the recipients were Indian males, age 56 year old and 43 year old. Both had idiopathic pulmonary fibrosis. The first patient underwent single lung transplantation and the second patient underwent double lung transplantation.

3.3 TRANSPLANT PRACTICES

The majority of heart transplant patients received orthotopic biatrial and only 2 had orthotopic bicaval procedure (Table 3.3.1).

At the time of transplant all patients received methylprednisolone followed by prednisolone. All also received cyclosporine and azathioprine, but in 3 patients, azathioprine was later replaced by mycophenolate mofetil (Table 3.3.2).

All surviving heart transplant recipients were on Neoral[®]. Only 2/7 patients were maintained on steroids and azathioprine, while 5/7 patients were on mycophenolate mofetil (Table 3.3.3).

Four of the recipients were transplanted when they presented with severe heart failure, before they were formally listed on the waiting list. The other 13 recipients were transplanted from the waiting list and their average waiting time was 9 months (Table 3.3.4). The patient who had heart transplant in 2005 received a Thoratec implantable Ventricular Assist Device (VAD) support for 4.5 months as a bridge to eventual transplant.

The 2 lung transplant patients received Neoral[®] and Mycophenolate Mofetil as immunosuppressive agents.

Table 3.3.1: Distribution of Patients by Heart Procedure, 1997-2006

Year	97	98	99	00	01	02	03	04	05	06	TOTAL
Heart Procedure	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Orthotopic Bicaval	1	1	0	0	0	0	0	0	0	0	2
Orthotopic Traditional	0	2	2	3	4	0	2	0	1	1	15
Heterotopic	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1	3	2	3	4	0	2	0	1	1	17

Table 3.3.2: Distribution of Patients by Immunosuppressive Used, 1997-2006

Year	97	98	99	00	01	02	03	04	05	06	Total
Type of immunosuppressive	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Steroids											
Prednisolone	1	3	2	3	4	0	1	0	1	0	15
Methylprednisolone	1	3	2	3	4	0	2	0	1	1	17
Calcineurin Inhibitors											
Neoral [®]	1	3	2	3	4	0	1	0	1	0	15
Antimetabolites											
Azathioprine (AZA)	1	3	2	3	4	0	2	0	0	1	16
Mycophenolate Mofetil (MMF)	0	0	0	0	1	0	1	0	1	0	3
TOTAL patients at notification	1	3	2	3	4	0	2	0	1	1	17

Table 3.3.3: Immunosuppressive Used at Time of Last Follow-up up to 2006

Year of follow up*	2004	2005	2006
Type of immunosuppressive	No.	No.	No.
Steroids			
Prednisolone	1	3	2
Methylprednisolone	0	0	0
Calcineurin Inhibitors			
Neoral [®]	1	6	7
Antimetabolites			
Azathioprine (AZA)	1	3	2
Mycophenolate Mofetil (MMF)	3	3	5
TOTAL patients at follow-up	6	6	7

*Data according to year of follow up of transplanted patients

Table 3.3.4: Duration of Waiting Time on Waiting List, 1997-2006

Year	97	98	99	00	01	02	03	04	05	06	TOTAL
Duration (months)*	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
<5	0	2	1	0	1	0	1	0	0	0	5
5-<10	1	0	1	0	1	0	0	0	1	0	4
10-<15	0	0	0	1	0	0	0	0	0	1	2
15-<20	0	0	0	1	0	0	0	0	0	0	1
20-<25	0	0	0	0	0	0	0	0	0	0	0
25-<30	0	0	0	0	0	0	0	0	0	0	0
30-<35	0	0	0	0	0	0	0	0	0	0	0
35-<40	0	0	0	0	0	0	1	0	0	0	1
TOTAL	1	2	2	2	2	0	2	0	1	1	13
Mean	6	2	4	15	5	-	20	-	9	10	9
SD		0	1	6	5	-	25	-	-	-	10
Median	6	2	4	15	5	-	20	-	9	10	6
Minimum	6	2	3	10	1	-	2	-	9	10	1
Maximum	6	2	5	19	8	-	37	-	9	10	37

*Duration=date of transplant-date added to wait list

3.4 TRANSPLANT OUTCOMES

Hypertension and hyperlipidaemia requiring drug treatment was common post transplant with high incidence in recipients (Table 3.4.1). Two patients were treated for rejection out of the 11 patients who were discharged from hospital (Table 3.4.4).

Six (35%) of the heart transplant recipients died in hospital following transplant (Table 3.4.5). One died of hyperacute graft rejection and another from graft failure. The other 4 died of multiorgan failure with septicaemia (Table 3.4.7).

Four patients had succumbed to late deaths after their heart transplant. One of the deaths occurred within a year (sudden death, cause unclear), while the other 3 deaths occurred more than a year post transplant. The 1 year Kaplan Meier patient survival rate was 59% (Fig 3.4.6). One patient died of small cell lung cancer (he was a smoker, but stopped before his transplant). Another patient died suddenly but autopsy showed cardiac allograft rejection which was due to non-compliance to immunosuppression. Another death in a peripheral hospital was classified as severe bleeding but the actual cause of death was unclear (Table 3.4.8).

The first lung transplant patient survived with good quality of life. Unfortunately, the second patient succumbed 8 weeks after transplantation with cause of death due to Cytomegalovirus infection.

Table 3.4.1: Post Transplant Events at Last Follow-up up to 2006

Year of transplant*	97	98	99	00	01	02	03	04	05	06	TOTAL
Type of post transplant events	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Drug-Treated Hypertension	1	2	2	1	3	0	1	0	1	0	11
Bone Disease (Symptomatic)	1	0	0	0	1	0	0	0	0	0	2
Chronic Liver Disease	0	0	0	0	0	0	0	0	0	0	0
Cataracts	0	0	0	0	0	0	0	0	0	0	0
Diabetes	1	2	0	0	0	0	1	0	0	0	4
Renal Dysfunction	1	0	0	0	1	0	0	0	0	0	2
Stroke	0	0	0	0	0	0	0	0	0	0	0
Drug-Treated Hyperlipidaemia	1	2	2	1	3	0	1	0	1	0	11
TOTAL patients at follow-up	1	2	2	1	3	0	1	0	1	0	11

*Data according to year of transplant of patient

Table 3.4.2: Post Transplant Malignancies at Follow-up up to 2006

Year of transplant*	97	98	99	00	01	02	03	04	05	06	TOTAL
Type of post transplant malignancies	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Recurrence of pre-transplant tumour	0	0	0	0	0	0	0	0	0	0	0
De Novo solid tumour	1	0	0	0	0	0	0	0	0	0	1
De Novo lymphoproliferative disorder	0	0	0	0	0	0	0	0	0	0	0
Skin	0	0	0	0	0	0	0	0	0	0	0
TOTAL patients at follow-up	1	2	2	1	3	0	1	0	1	0	11

*Data according to year of transplant of patient

Table 3.4.3: Non-compliance at Follow-up up to 2006

Year of transplant*	97	98	99	00	01	02	03	04	05	06	TOTAL
Non-compliance during follow-up	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
• Yes	0	0	1	0	0	0	0	0	0	0	1
• No	1	2	1	1	3	0	1	0	1	0	10
TOTAL patients at follow-up	1	2	2	1	3	0	1	0	1	0	11
<i>Areas of non-compliance:</i>											
• Immunosuppression medication	0	0	1	0	0	0	0	0	0	0	1
• Patient unable to afford immunosuppression medications	0	0	1	0	0	0	0	0	0	0	1
• Other medication	0	0	0	0	0	0	0	0	0	0	0
• Other therapeutic regimen	0	0	0	0	0	0	0	0	0	0	0
TOTAL patients with noncompliance	0	0	1	0	0	0	0	0	0	0	1

*Data according to year of transplant of patient

Table 3.4.4: Patient Treated for Rejection at Follow-up up to 2006

Year of transplant*	97	98	99	00	01	02	03	04	05	06	TOTAL
Patient treated for rejection	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
• Yes	0	1	0	0	0	0	0	0	0	0	1
• No	1	1	2	1	3	0	1	0	1	0	10
TOTAL patients at follow-up	1	2	2	1	3	0	1	0	1	0	11
<i>Number of rejection events</i>											
• 1	0	1	0	0	0	0	0	0	0	0	1
• 2	0	0	0	0	0	0	0	0	0	0	0
• 3	0	0	0	0	0	0	0	0	0	0	0
TOTAL patients with rejection	0	1	0	0	0	0	0	0	0	0	1

*Data according to year of transplant of patient

Table 3.4.5: Distribution of Patients by Time of Deaths, 1997-2006

Year of discharge	97	98	99	00	01	02	03	04	05	06	TOTAL
Time of deaths*	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
<3 months (at discharge)	0	1	0	2	0	1	1	0	0	1	6
3-<6 months	0	0	0	0	0	0	0	0	0	0	0
6 months-1 year	0	0	0	0	0	1	0	0	0	0	1
>1 year	0	0	0	1	1	1	0	0	0	0	3
TOTAL patients who died	0	1	0	3	1	3	1	0	0	1	10

*Time=Date of death–date of transplant

Table 3.4.6: Patient Survival, 1997-2006

Year of Transplant	1997-2005	
Interval	% Survival	SE
6 months	65	12
1 year	59	12
2 year	47	12
3 year	40	12

SE=standard error

Duration =date follow up-date transplant, if alive at discharge

=date of discharge-date of transplant, if dead at discharge

Figure 3.4.6: Patient Survival, 1997-2006

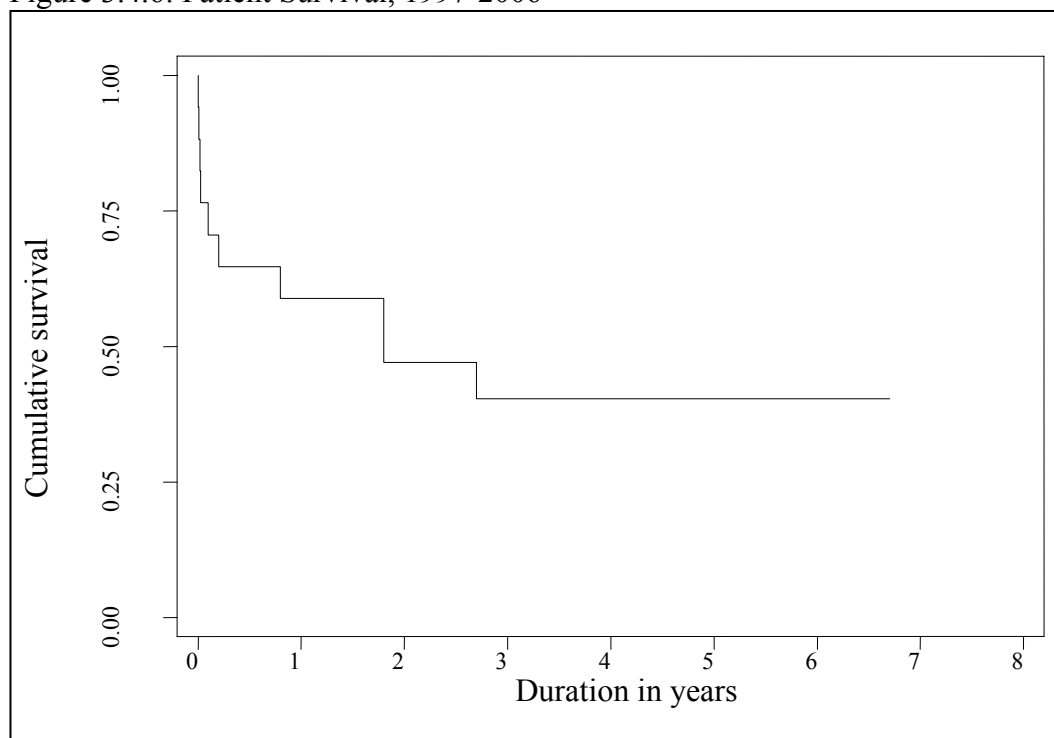


Table 3.4.7: Cause of Death at Discharge, 1997-2006

Year	97	98	99	00	01	02	03	04	05	06	TOTAL
Cause of death	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Hyperacute rejection	0	0	0	0	0	0	1	0	0	0	1
Multi organ failure	0	0	0	1	0	0	0	0	0	0	1
Respiratory failure secondary to septicaemia	0	0	0	0	0	1	0	0	0	0	1
Respiratory failure, renal function and liver failure, ARDS, septicaemia	0	0	0	1	0	0	0	0	0	0	1
Septicaemia, multiorgan failure	0	1	0	0	0	0	0	0	0	0	1
Graft failure	0	0	0	0	0	0	0	0	0	1	1
TOTAL patients who died at discharge	0	1	0	2	0	1	1	0	0	0	6

Table 3.4.8: Cause of Death at Follow-up, 1997-2006

Year	97	98	99	00	01	02	03	04	05	06	TOTAL
Cause of death	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Severe bleeding	0	0	0	0	0	1	0	0	0	0	1
Lung cancer, small cell type, septicaemia, bronchopneumonia	0	0	0	1	0	0	0	0	0	0	1
Rejection due to non-compliance	0	0	0	0	1	0	0	0	0	0	1
Unknown	0	0	0	0	0	1	0	0	0	0	1
TOTAL patients who died at follow-up	0	0	0	1	1	2	0	0	0	0	4

CHAPTER 4

LIVER TRANSPLANTATION

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4.0 INTRODUCTION

Liver transplantation is the treatment of choice in many patients with end stage liver failure and in some patients with acute liver failure. Liver transplantation in Malaysia has evolved significantly in the recent years. Although the expertise is available in Malaysia, the lack of cadaveric organs has significantly hindered the development of the transplant programme in Malaysia. The poor cadaveric organ donation rate in Malaysia is due to several reasons including public apathy and the reluctance of medical personnel to explore this option in a brain dead patient.

4.1 STOCK AND FLOW

The number of liver transplants performed from 1993 to 2006 is 88. Seventy-four (84%) were performed locally and 14 (16%) were performed at overseas centres. Eight new liver transplants were done in 2006 and they were all done locally.

Table 4.1.1: Stock and Flow of Liver Transplantation, 1993-2006

Year	93	94	95	96	*97	98	99	00	01	02	**03	04	05	06
New transplant patients	1	1	8	13	3	2	8	3	5	10	5	16	5	8
Deaths	0	0	3	4	1	0	4	1	2	5	1	4	4	3
Re-transplant	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lost to follow up	0	0	0	0	0	0	0	1	0	1	0	1	1	0
Functioning graft at 31 st December	1	2	7	16	17	19	23	24	27	31	34	45	45	50

* 1 patient who was alive until 05/12/1997 is recorded dead with missing date of death

** 1 patient who had transplanted in 2003 is recorded as death with missing date of death

Figure 4.1.1: Stock and Flow of Liver Transplantation, 1993-2006

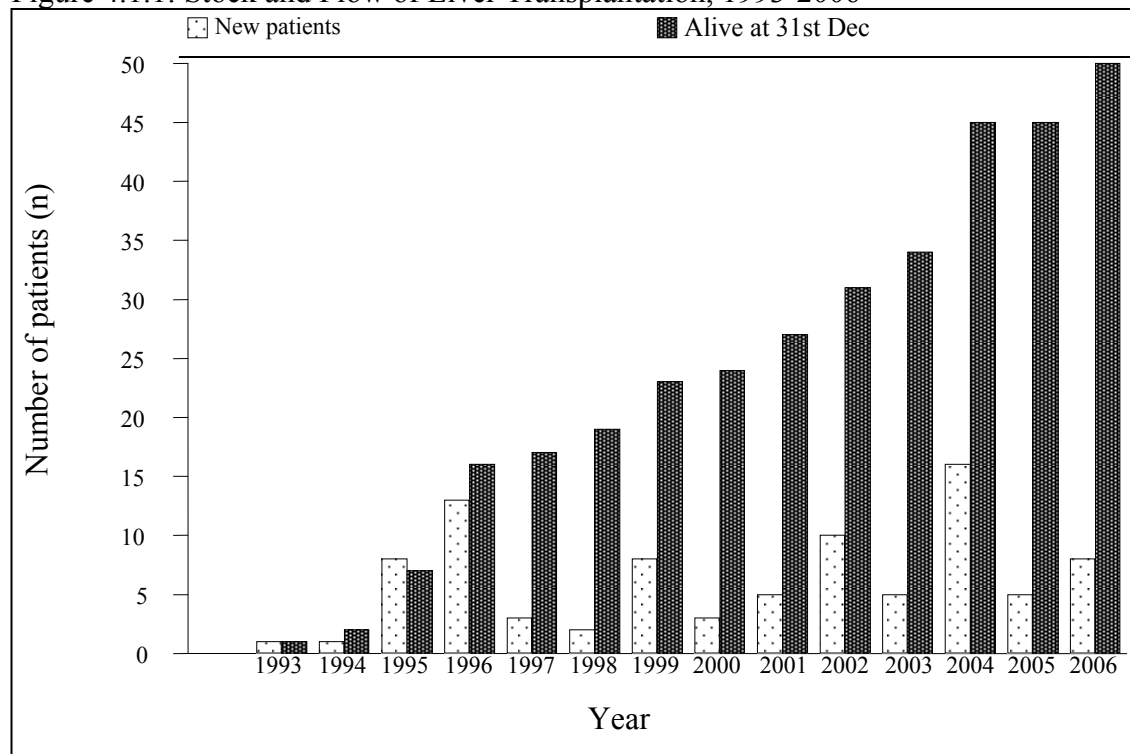


Table 4.1.2: Distribution of Patients by Place of Transplant, 1993-2006

Year	93	94	95	96	97	98	99	00	01	02	03	04	05	06	TOTAL
	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Local	0	0	8	10	1	1	8	3	5	9	2	14	5	8	74
Overseas	1	1	0	3	2	1	0	0	0	1	3	2	0	0	14
TOTAL	1	1	8	13	3	2	8	3	5	10	5	16	5	8	88

Table 4.1.3: Distribution of Patients by Centres for Liver Transplantation, 1993-2006

Year	93	94	95	96	97	98	99	00	01	02	03	04	05	06	TOTAL
Centre	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Subang Jaya Medical Centre	0	0	8	10	1	1	8	3	5	6	2	7	0	0	51
Hospital Selayang	0	0	0	0	0	0	0	0	0	3	0	7	5	8	23
Australia	1	0	0	3	1	0	0	0	0	0	0	0	0	0	5
National University Hospital, Singapore	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2
Kings College Hospital, UK	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Tianjin, China	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2
Asian Centre for Liver Disease & Transplantation, Singapore	0	0	0	0	0	0	0	0	0	1	2	1	0*	0*	4
TOTAL	1	1	8	13	3	2	8	3	5	10	5	16	5	8	88

* Data not reported

Table 4.1.4: Distribution of Transplant Recipients by Follow-up Centres, 2006

Centre	No.	%
Number of patient with functioning graft at 31st December 2006	50	100
Kuala Lumpur Hospital	2	4
SJMC	27*	54
Selayang Hospital	17	34
Singapore	1*	2
UMMC	3	6

*Follow-up data not reported

4.2 RECIPIENTS' CHARACTERISTICS

Fifty (57%) were males and 38 (43%) were females. The ethnic distribution of the liver transplant recipients are as follows: Chinese 44 (50%), Malays 35 (40%), Indians 7 (8%), Others 2 (2%).

Seventy-five (85%) of the transplant recipients were between 1 and 9 years of age at the time of transplantation. Biliary atresia was the primary liver disease in 63 (72%) of the recipients. The commonest indication for liver transplantation was failure to thrive with growth retardation and poor liver function. The commonest blood group amongst the liver transplant recipients was group O.

Table 4.2.1: Distribution of Patients by Gender, 1993-2006

Year	93	94	95	96	97	98	99	00	01	02	03	04	05	06	TOTAL
Gender	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Male	0	0	6	5	2	1	3	1	2	7	5	10	2	6	50
Female	1	1	2	8	1	1	5	2	3	3	0	6	3	2	38
TOTAL	1	1	8	13	3	2	8	3	5	10	5	16	5	8	88

Figure 4.2.1: Distribution of Patients by Gender, 1993-2006

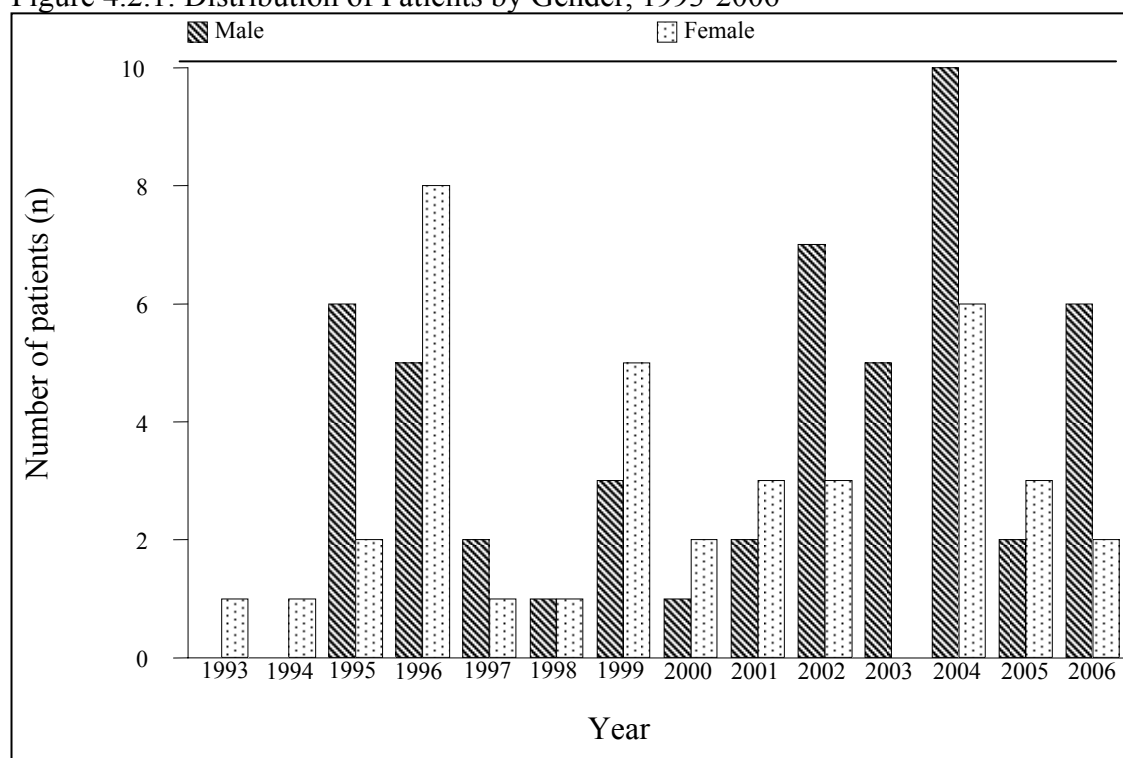


Table 4.2.2: Distribution of Patients by Ethnic Group, 1993-2006

Year	93	94	95	96	97	98	99	00	01	02	03	04	05	06	TOTAL
Ethnic group	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Malay	0	1	2	3	1	0	4	1	2	3	1	11	3	3	35
Chinese	1	0	6	8	2	1	2	2	3	6	4	5	1	3	44
Indian	0	0	0	2	0	1	1	0	0	0	0	0	1	2	7
Others	0	0	0	0	0	0	1	0	0	1	0	0	0	0	2
TOTAL	1	1	8	13	3	2	8	3	5	10	5	16	5	8	88

Figure 4.2.2: Distribution of Patients by Ethnic Group, 1993-2006

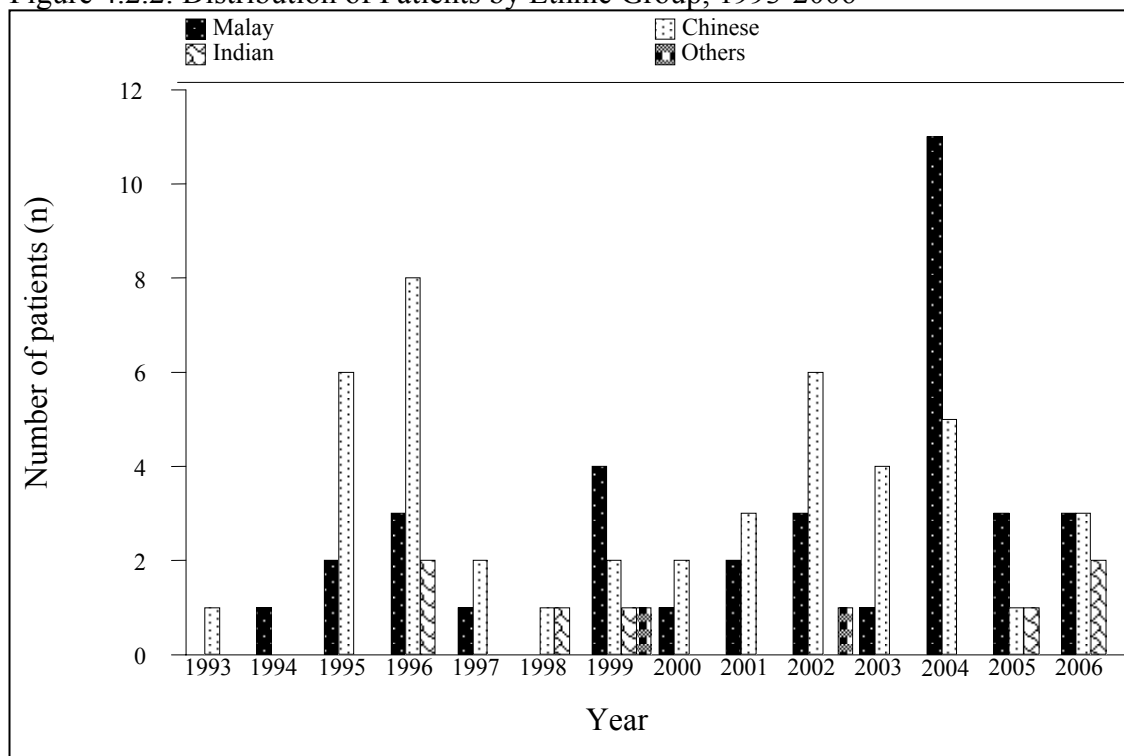


Table 4.2.3: Distribution of Patients by Age, 1993-2006

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	TOTAL
Age, years*	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
<1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	2
1-4	1	1	3	11	3	1	5	3	4	4	2	9	2	4	53
5-9	0	0	3	1	0	0	2	0	1	4	2	3	3	1	20
10-14	0	0	1	1	0	0	0	0	0	0	0	1	0	1	4
15-19	0	0	0	0	0	0	1	0	0	0	0	1	0	0	2
20-39	0	0	1	0	0	0	0	0	0	1	0	0	0	2	4
40-59	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
>=60	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2
TOTAL	1	1	8	13	3	2	8	3	5	10	5	16	5	8	88
Mean	2	4	9	4	2	1	4	1	2	6	18	12	4	12	7
SD	-	-	9	4	1	1	5	1	2	7	31	22	3	15	14
Median	2	4	6	2	2	1	3	1	2	4	7	3	5	5	2
Minimum	2	4	2	2	1	1	1	1	1	4 months	1	1	1	2	3 months
Maximum	2	4	30	14	2	1	15	2	5	24	73	74	8	39	74

* Age=date of transplant - date of birth

Table 4.2.4: Primary Diagnosis, 1993-2006 (N=88)

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	TOTAL
Primary Diagnosis	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Biliary atresia	1	1	7	12	3	1	7	2	5	6	2	10	4	2	63
Metabolic liver disease	0	0	1	1	0	0	0	0	0	2	0	2	0	0	6
Cholestatic liver disease	0	0	0	0	0	1	0	1	0	0	0	0	1	0	3
Primary biliary cirrhosis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Primary sclerosing cholangitis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Autoimmune hepatitis	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Chronic hepatitis B	0	0	0	0	0	0	0	0	0	0	3	2	0	0	5
Chronic hepatitis C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alcoholic liver disease	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malignancies	0	0	0	0	0	0	0	0	0	1	2	1	0	0	4
Acute liver failure	0	0	0	0	0	0	0	0	0	0	0	1	0	3	4
Idiopathic / Cryptogenic	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Others	0	0	0	0	0	0	0	0	0	2	0	1	1	4	8

Note: 6 patients have more than one primary disease

Table 4.2.5: Indication for Transplantation, 1993-2006 (N=88)

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	TOTAL
Indication for Transplantation	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Recurrent encephalopathy	0	0	1	0	0	0	1	0	0	1	0	0	0	0	3
Uncontrolled bleeding varices	0	0	0	7	1	0	4	1	1	0	0	2	0	0	16
Intractable ascites	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spontaneous bacterial peritonitis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Poor liver function	1	1	7	11	3	1	8	3	5	9	3	11	4	1	68
Malignancy	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Unacceptable quality of life	0	0	0	0	0	0	0	0	0	1	0	0	1	0	2
Failure to thrive, growth retardation in paediatric patients	0	0	6	10	3	2	6	3	5	7	2	10	3	1	58
Others	0	0	0	0	0	0	0	0	0	0	0	1	2	8	11
No data	0	0	0	0	0	0	0	0	0	1	1	2	0	0	4

Note: 21 patients had 1 indication for transplantation, 63 had more than 1 indication for transplantation

Table 4.2.6: Recipient Blood Group, 1993-2006 (N=88)

Year	93	94	95	96	97	98	99	00	01	02	03	04	05	06	TOTAL
Blood group	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
A	0	1	2	0	0	0	3	0	1	3	1	4	1	4	20
B	0	0	1	2	0	1	2	0	1	1	0	1	1	3	13
AB	0	0	0	1	0	1	0	0	0	0	0	1	1	0	4
O	0	0	2	5	1	0	3	3	3	5	1	8	2	1	34
No data	1	0	3	5	2	0	0	0	0	1	3	2	0	0	17
TOTAL	1	1	8	13	3	2	8	3	5	10	5	16	5	8	88

4.3 TRANSPLANT PRACTICES

Eighty-one percent of liver transplants were living donor transplants while 19.3% were from cadaveric donors. Sixty-six percent of living donors were first degree relatives with mother-to-child being the most common.

The immunosuppressive medications most commonly used are tacrolimus and steroids.

Table 4.3.1: Distribution of Patients by Type of Donors, 1993-2006 (N=88)

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	TOTAL
Type of Donors	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Cadaveric	1	0	0	3	1	0	0	0	0	1	1	4	2	4	17
Living related - Mother	0	1	5	2	1	2	5	2	2	2	2	7	1	1	33
Living related - Father	0	0	2	7	1	0	2	0	2	3	0	1	1	3	22
Living related - Son	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2
Living related - Brother	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Living related - emotionally	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Living unrelated	0	0	1	1	0	0	1	1	1	3	0	3	0	0	11
TOTAL	1	1	8	13	3	2	8	3	5	10	5	16	4	8	87

* 1 patient is Living related - Other

Table 4.3.2: Immunosuppressive Drug Treatment at Transplantation, 1993-2006 (N=88)

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	TOTAL
Immunosuppressive drugs	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Steroids	0	0	2	5	0	2	5	2	5	5	1	12	5	8	52
Azathioprine	0	0	0	0	0	0	0	0	0	0	0	4	5	8	17
Cyclosporin A	1	1	1	2	0	0	0	1	0	0	0	0	0	0	6
Tacrolimus (FK506)	0	0	3	7	2	2	8	2	5	9	5	12	5	8	68
Mycophenolate Mofetil (MMF)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rapamycin	0	0	0	0	0	0	0	0	0	1	2	0	0	0	3
Monoclonal / Polyclonal antibody	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anti IL2R Antibodies	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Others	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No data	0	0	4	3	1	0	0	0	0	1	0	4	0	0	13
TOTAL patients	1	1	8	13	3	2	8	3	5	10	5	16	5	8	88

Note: 21 patients had 1 type of drug, 37 patients had 2 types, 17 patients had 3 types

4.4 TRANSPLANT OUTCOMES

The 1-year survival rate for the periods of 1993-1998 and 1999-2006 was 71% and 70% respectively. The most common cause of death was sepsis.

Table 4.4.1: Patient Survival by Year of Transplant, 1993-2006 (N=88)

Year of Transplant Interval (months)	1993 - 1998		1999 - 2006	
	% Survival	SE	% Survival	SE
1	82	7	83	5
6	71	9	70	6
12	71	9	70	6

SE=standard error

Figure 4.4.1: Patient Survival by Year of Transplant, 1993-2006

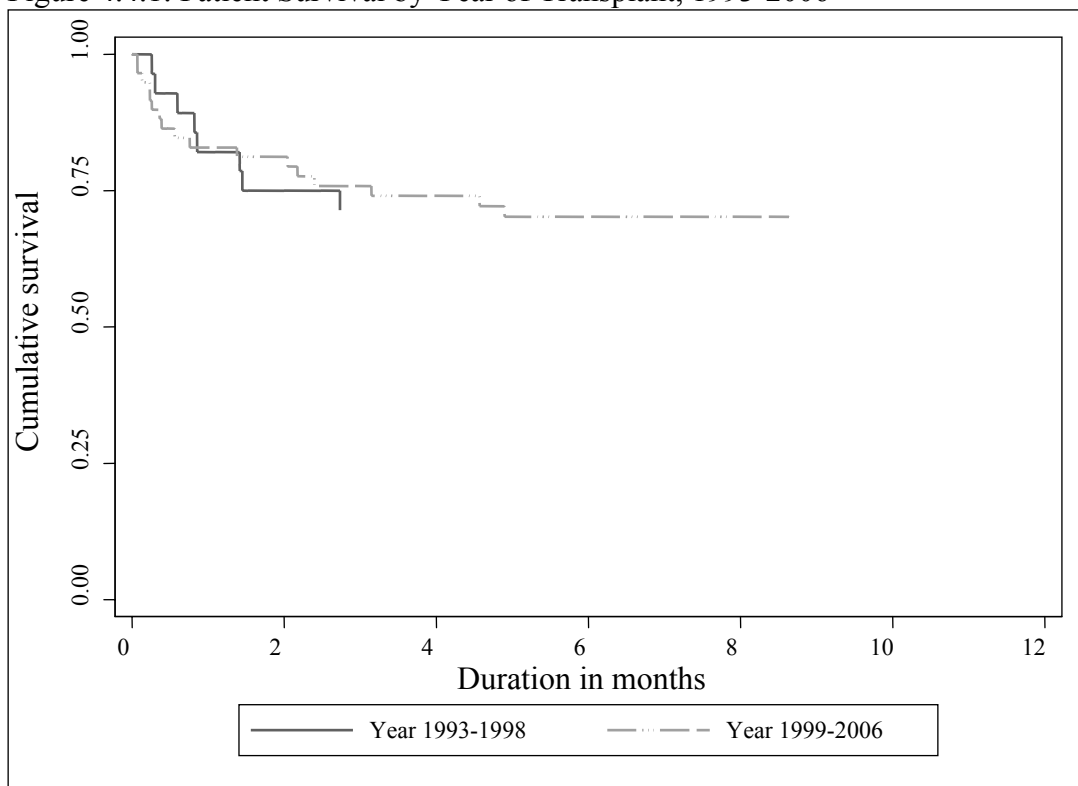


Table 4.4.2: Patient Survival by Gender, 1993-2006 (N=88)

Gender	Male		Female	
	% Survival	SE	% Survival	SE
Interval (months)				
1	82	5	84	6
6	71	6	70	8
12	71	6	70	8

SE=standard error

Figure 4.4.2: Patient Survival by Gender, 1993-2006

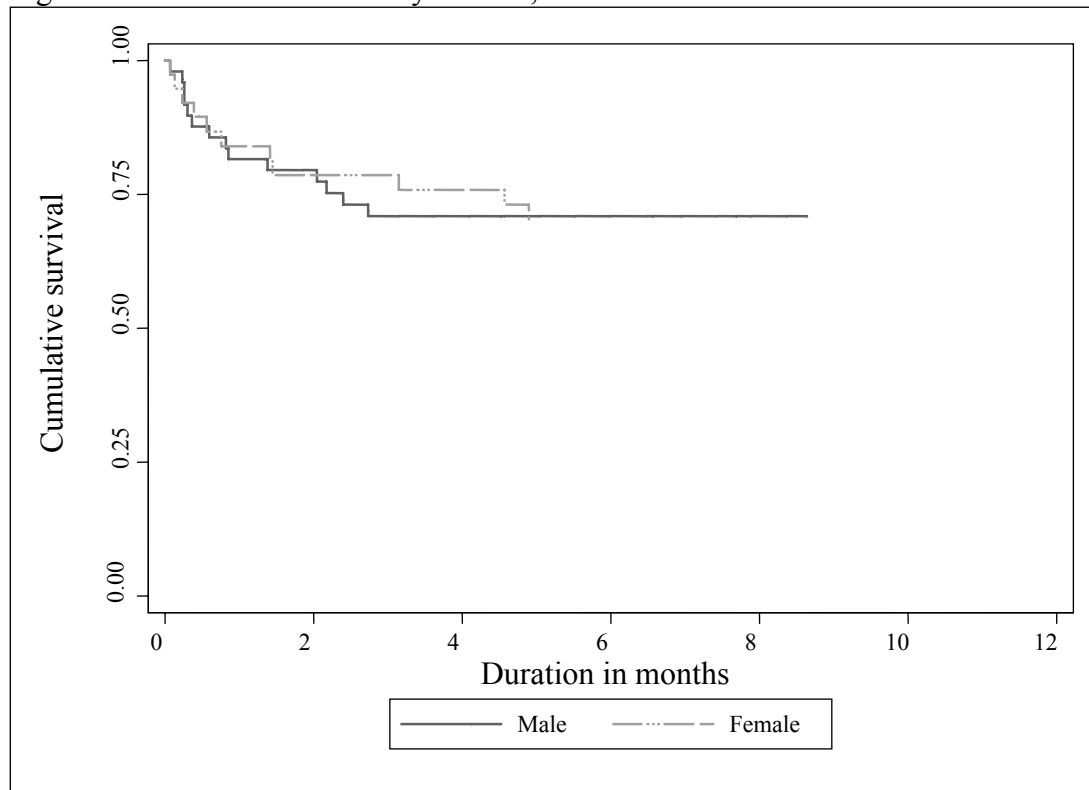


Table 4.4.3: Patient Survival by Age Group, 1993-2006 (N=88)

Age group	0-9 years		≥10 years	
Interval (months)	% Survival	SE	% Survival	SE
1	81	5	100	-
6	68	6	89	10
12	68	6	89	10

SE=standard error

Figure 4.4.3: Patient Survival by Age Group, 1993-2006

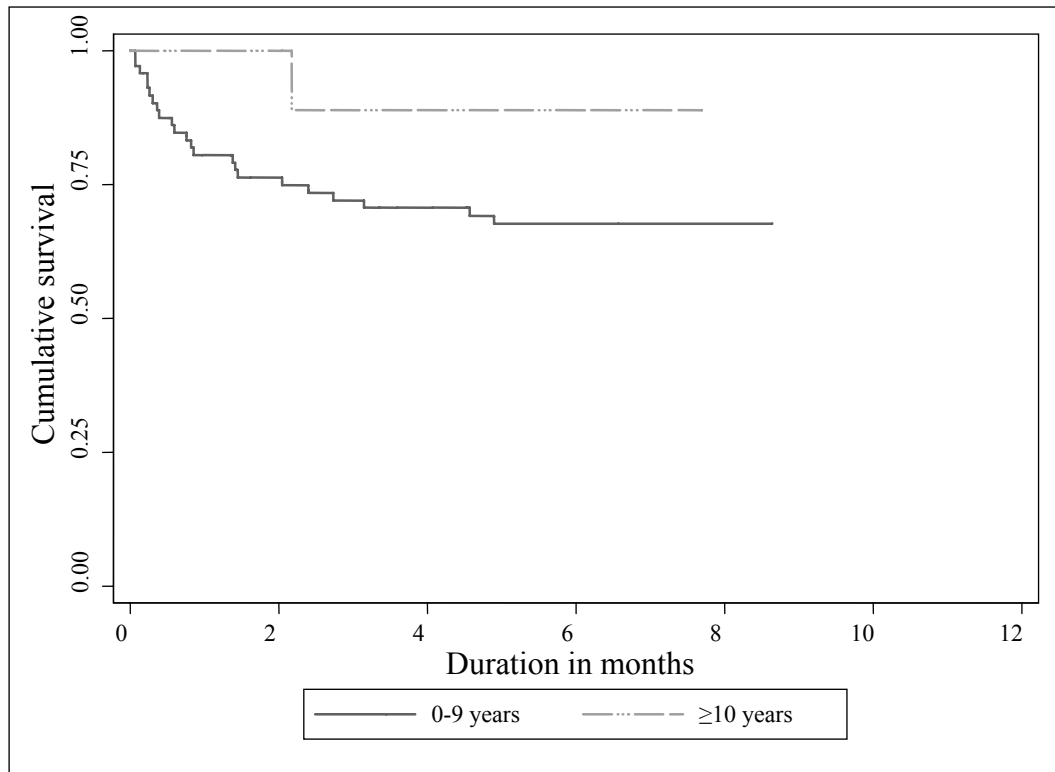


Table 4.4.4: Distribution of Patients by Cause of Death, 1993-2006 (N=88)

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	TOTAL
Causes of death	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Graft failure	0	0	0	0	0	1	0	0	0	0	2	0	3
Chronic graft rejection	0	0	0	0	0	0	1	0	0	0	0	0	1
Intra-abdominal Bleeding	0	0	0	0	0	0	0	0	1	0	0	0	1
Peritonitis	0	0	0	0	0	0	0	1	0	0	0	0	1
CMV Pneumonia	0	0	0	0	1	0	0	0	0	0	0	0	1
Decompensated liver cirrhosis	0	0	0	0	0	0	0	1	0	0	0	0	1
Intracranial haemorrhage	0	1	0	0	1	0	0	0	0	0	0	0	2
Malignancy	0	0	0	0	0	0	0	0	0	0	1	0	1
V ariceal bleed	0	0	1	0	2	0	0	0	0	0	0	0	3
Pneumonia and respiratory failure	0	1	0	0	0	0	0	0	0	0	0	0	1
Post transplant lymphoproliferative disease	0	0	0	0	0	0	1	0	0	0	0	0	1
Sepsis	0	2	0	0	0	0	0	2	0	1	1	3	9
Unknown	3	0	0	0	0	0	0	1	0	3	0	0	7
TOTAL	3	4	1	0	4	1	2	5	1	4	4	3	32

Note : 2 patients with no date of death

CHAPTER 5

RENAL TRANSPLANTATION

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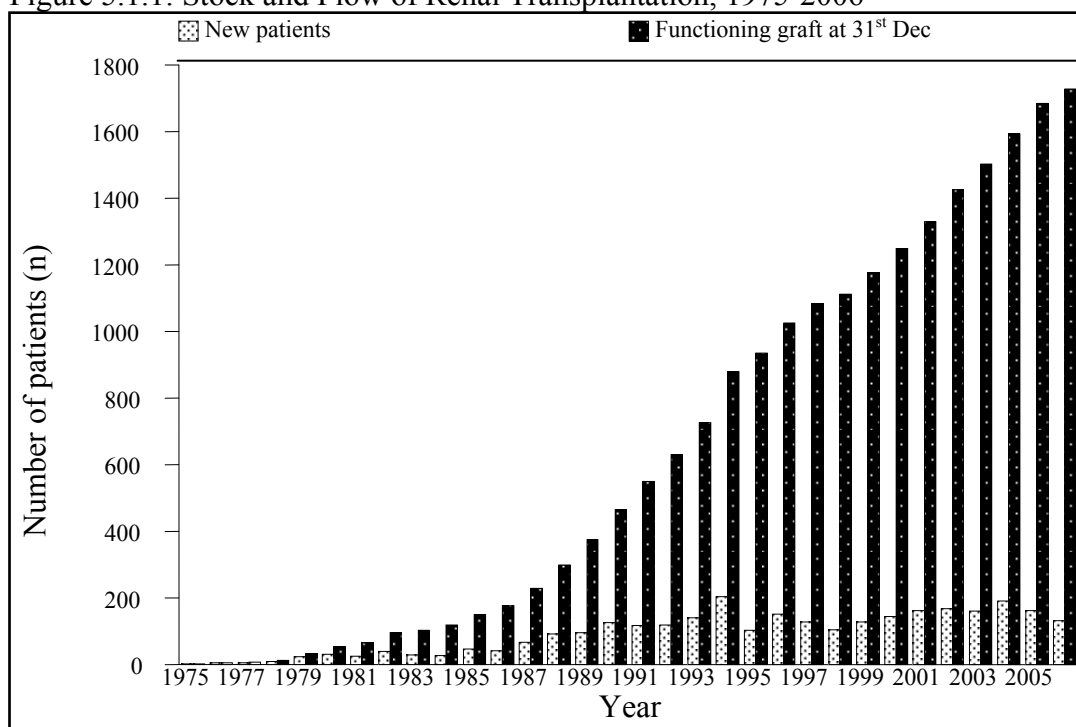
5.1 STOCK AND FLOW

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 st 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 (14th 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

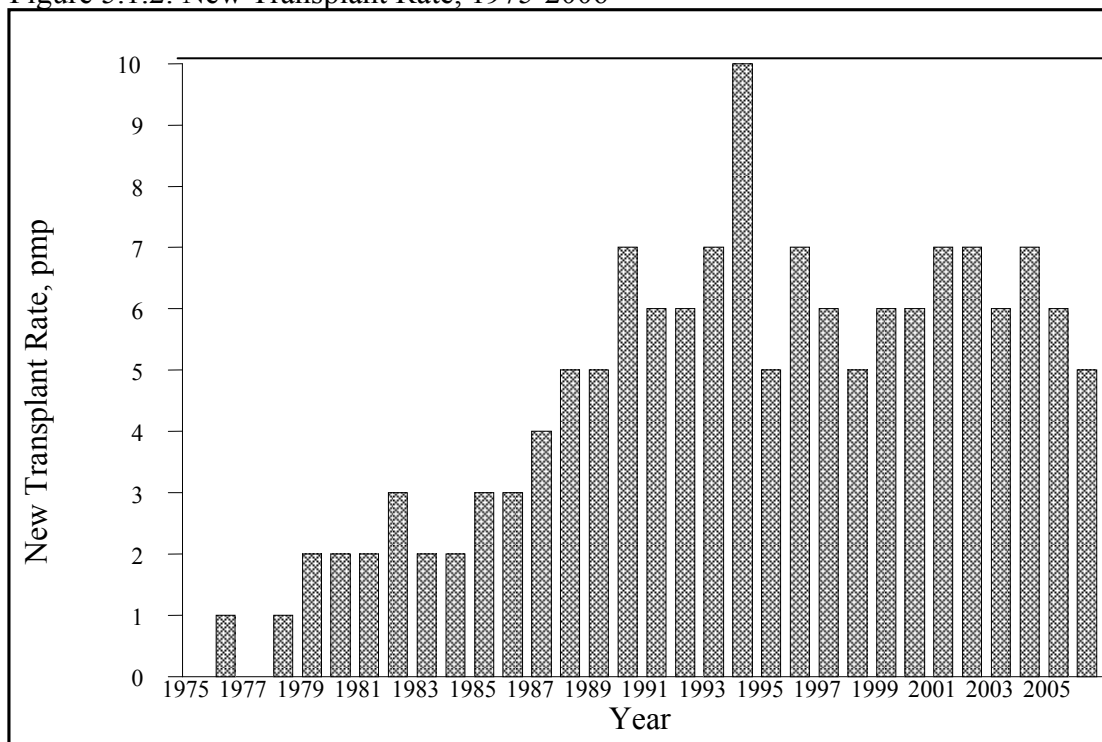
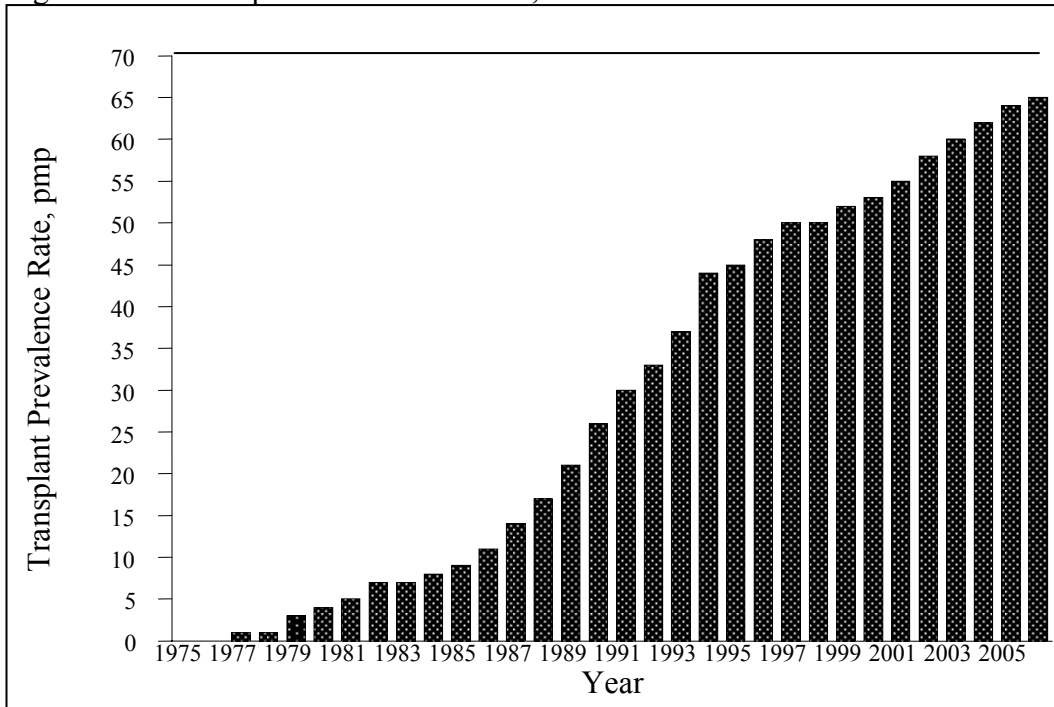


Table 5.1.3: Transplant Prevalence Rate per million population (pmp), 1997-2006

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Functioning graft at 31 st 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
TOTAL	127	100	104	100	127	100	143	100	161	100

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
TOTAL	168	100	160	100	190	100	162	100	132	100	1625	100

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
TOTAL	123	100	99	100	121	100	143	100	161	100

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
TOTAL	168	100	160	100	187	100	162	100	132	100

*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

Biochemical parameters	Summary	2004	2005	2006
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

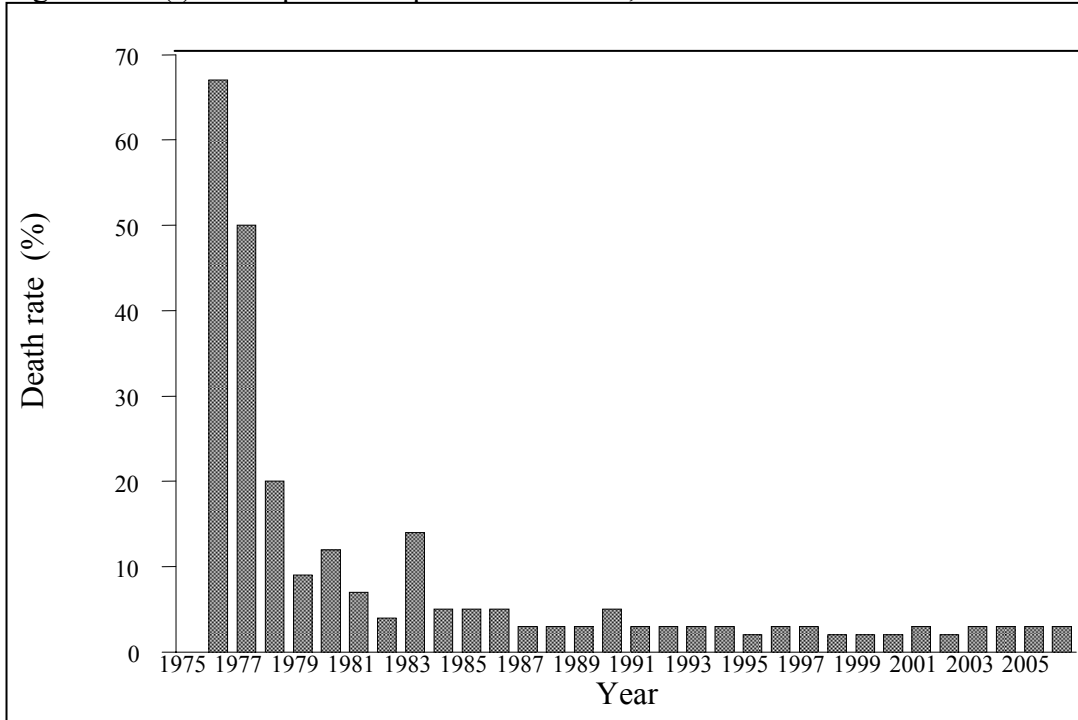


Figure 5.4.2(ii): Transplant Recipient Graft Loss Rate, 1975-2006

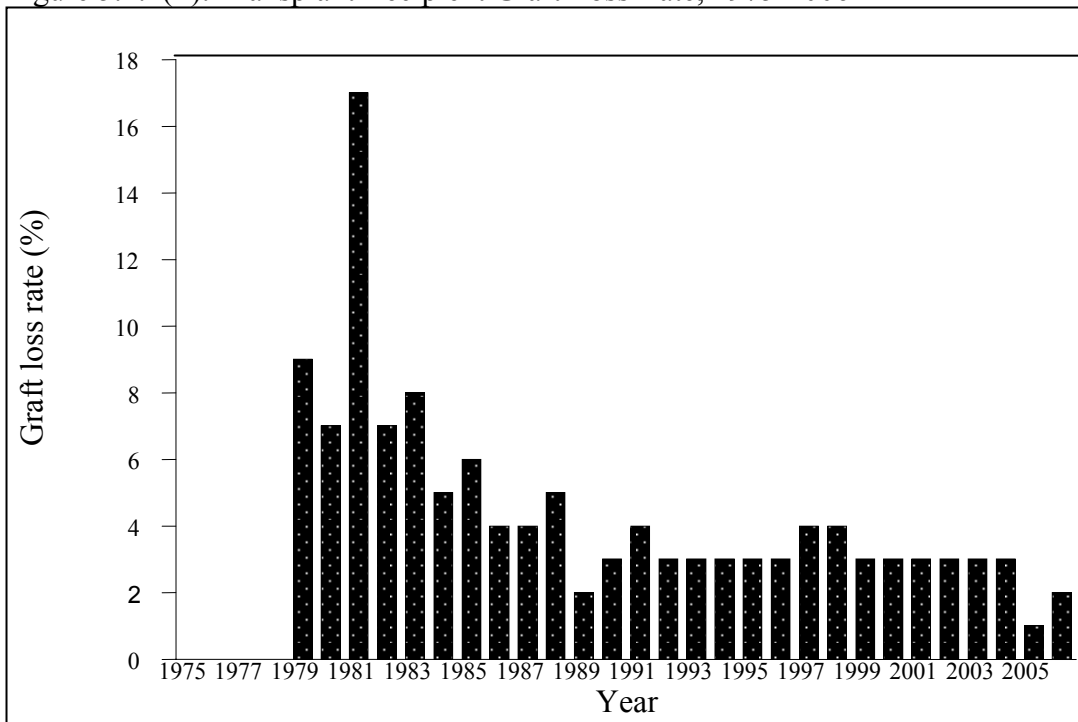


Table 5.4.3: Causes of Death in Transplant Recipients, 1997-2006

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

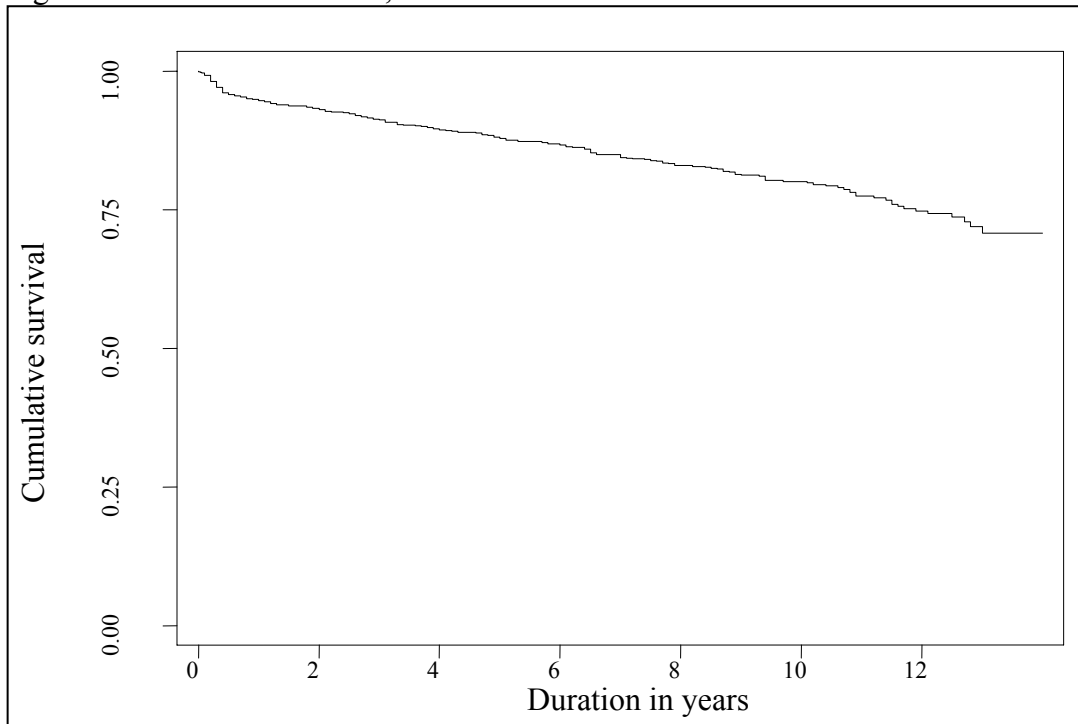
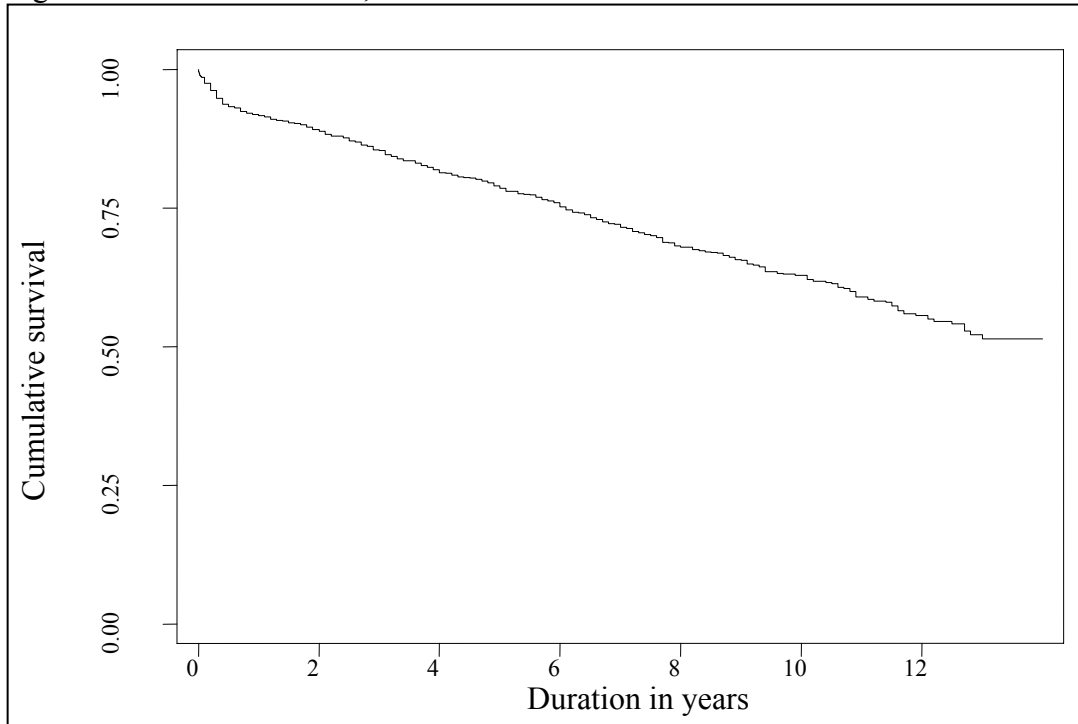


Table 5.5.2: Graft Survival, 1993-2006

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

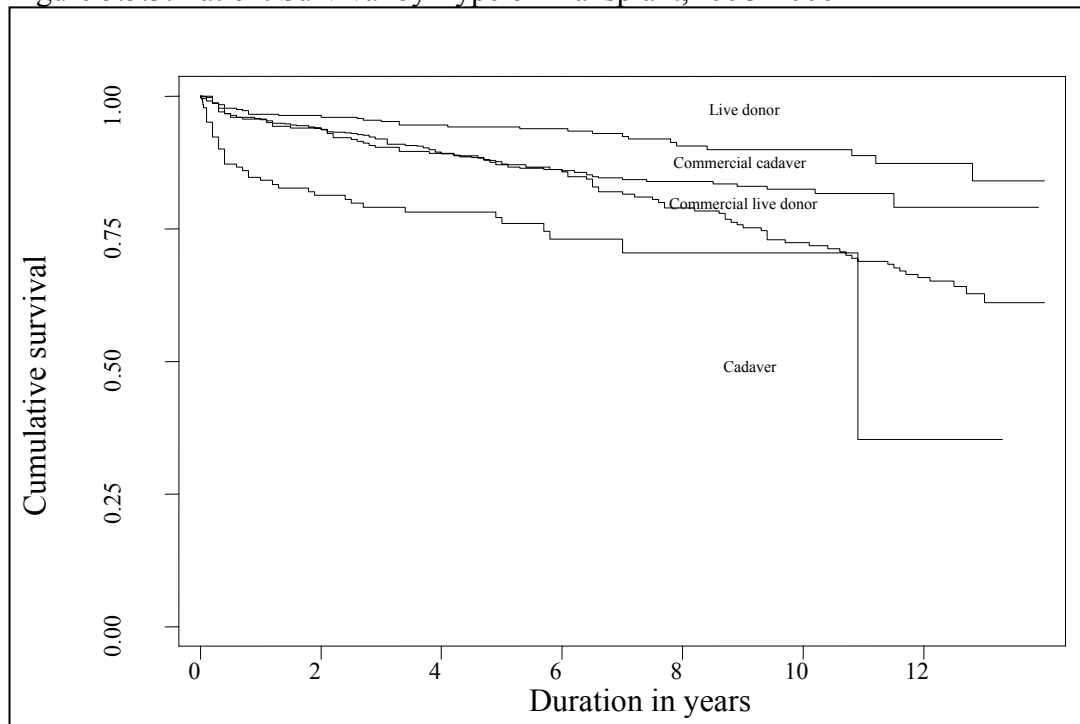
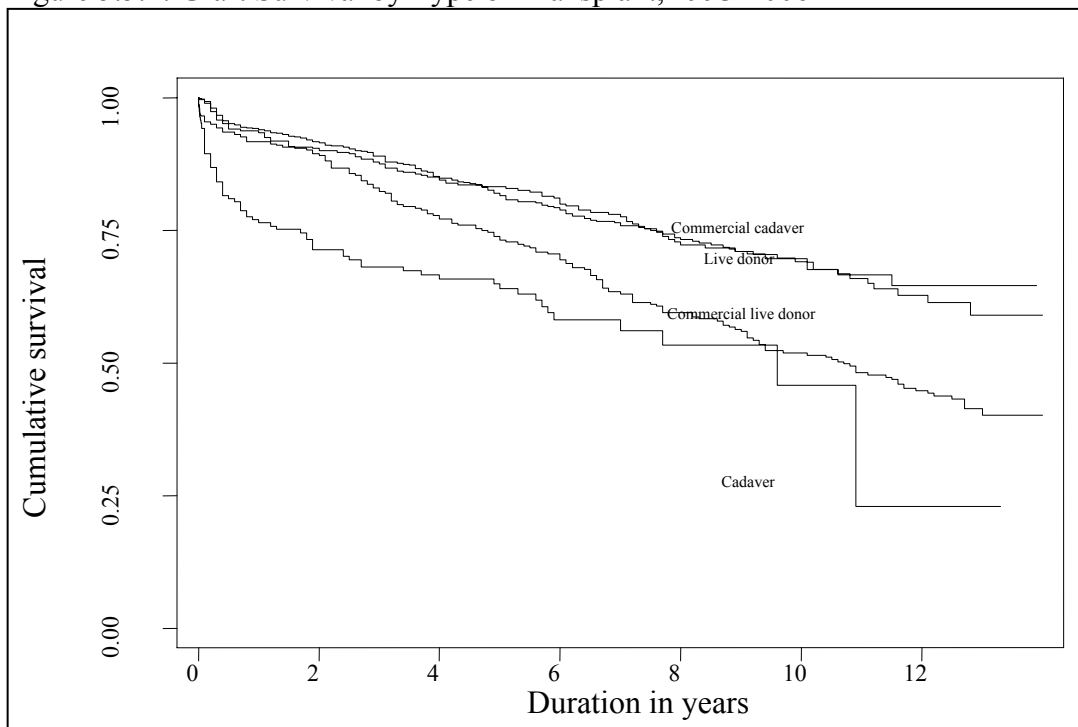


Table 5.5.4: Graft Survival by Type of Transplant, 1993-2006

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)

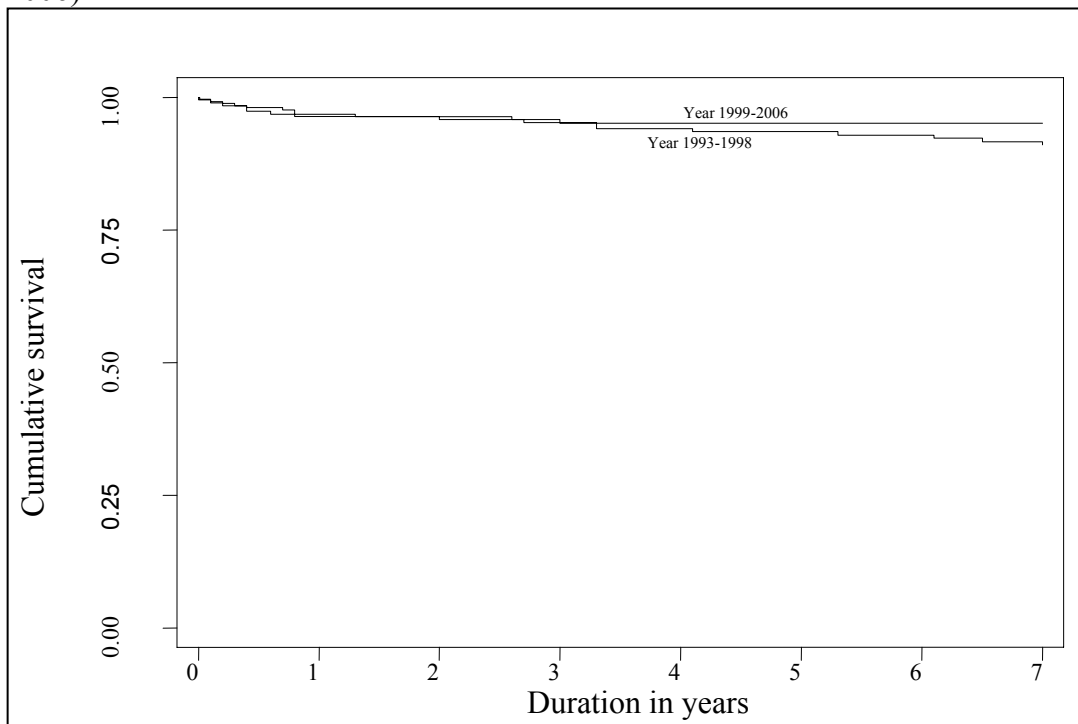
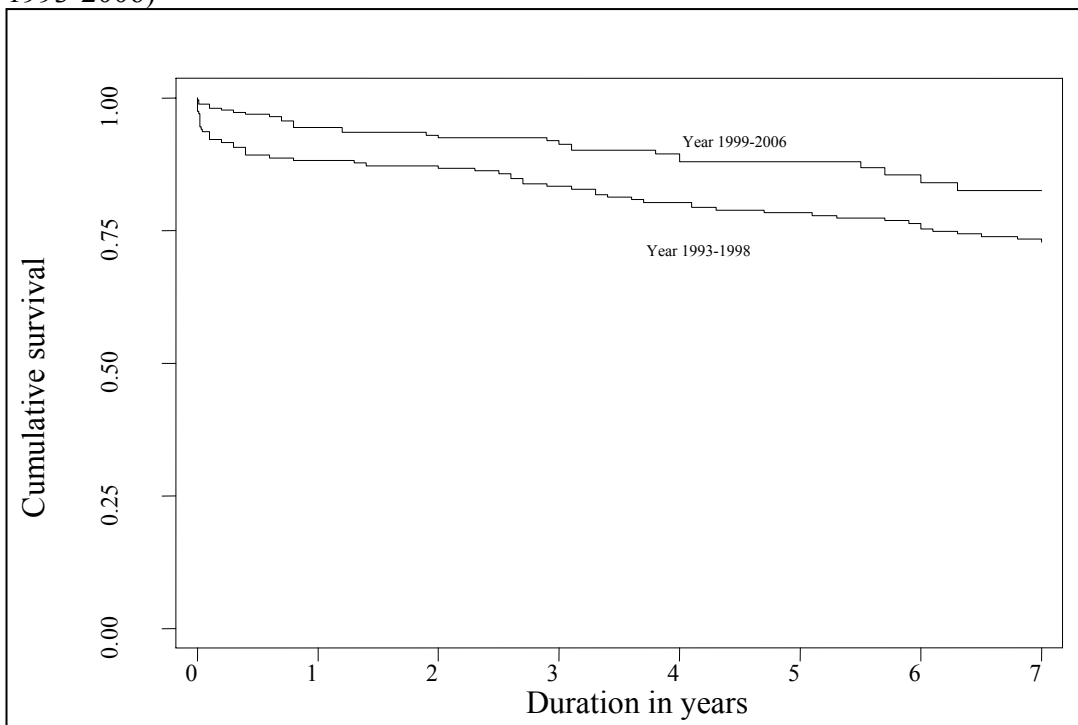


Table 5.5.6: Graft Survival by Year of Transplant (Living Related Transplant, 1993-2006)

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)

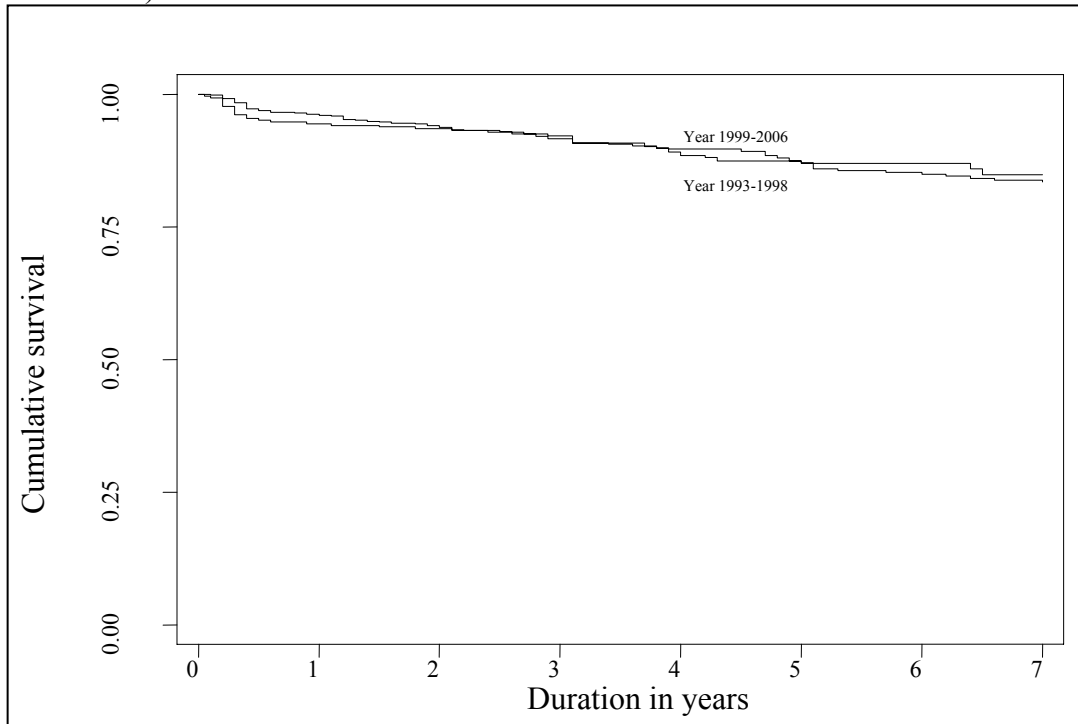
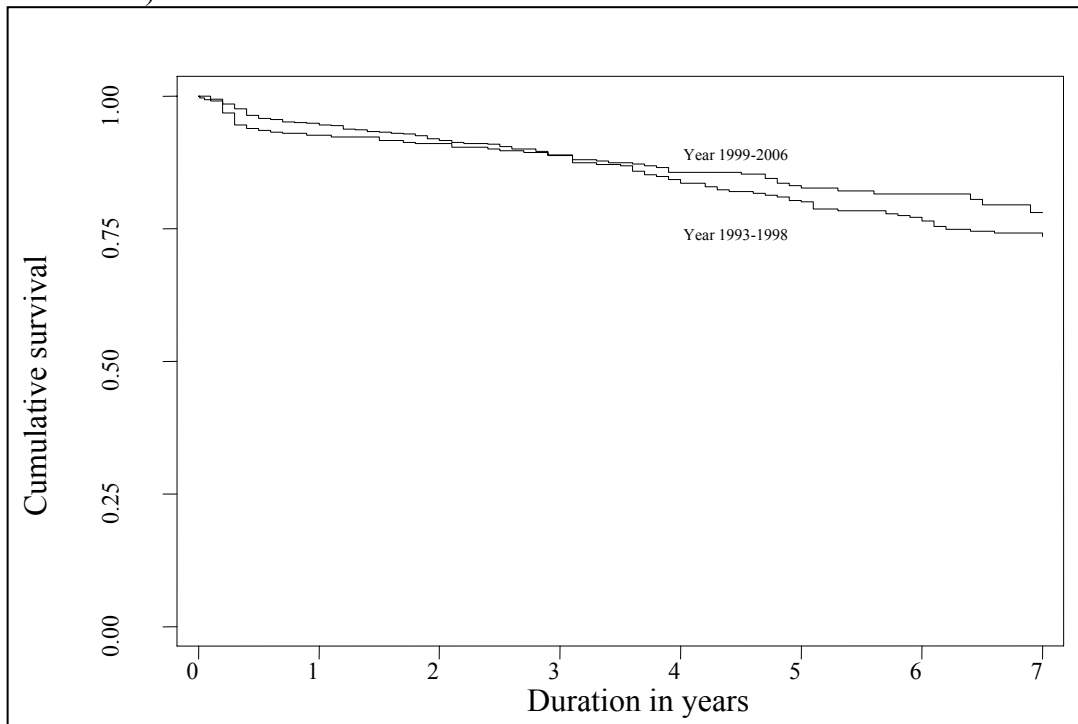


Table 5.5.8: Graft Survival by Year of Transplant (Commercial Cadaver Transplant, 1993-2006)

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

	2004	2005	2006
	No. (%)	No. (%)	No. (%)
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

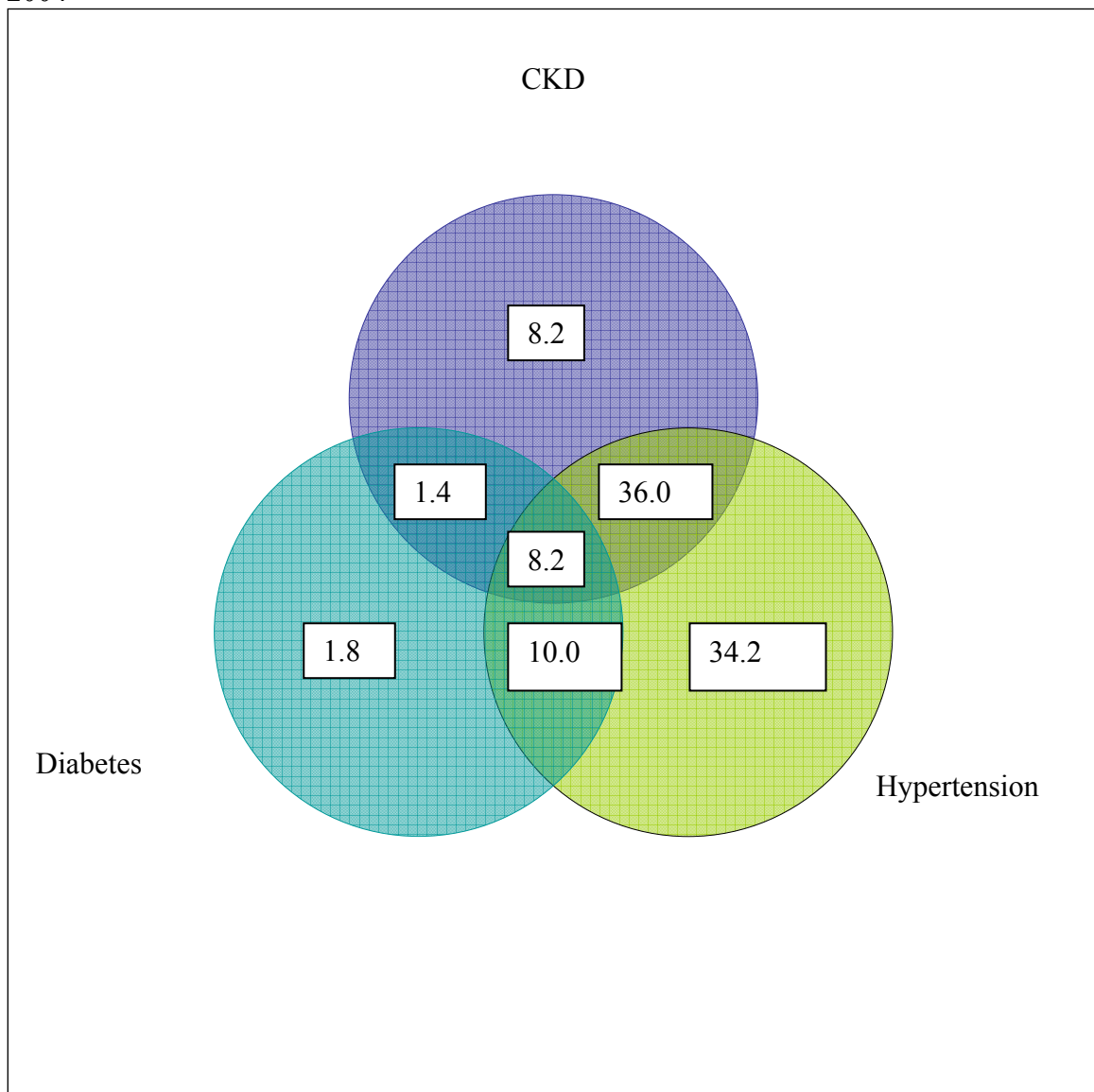


Figure 5.6.1b: Venn Diagram for Pre and Post Transplant Complications (in %) at Year 2005

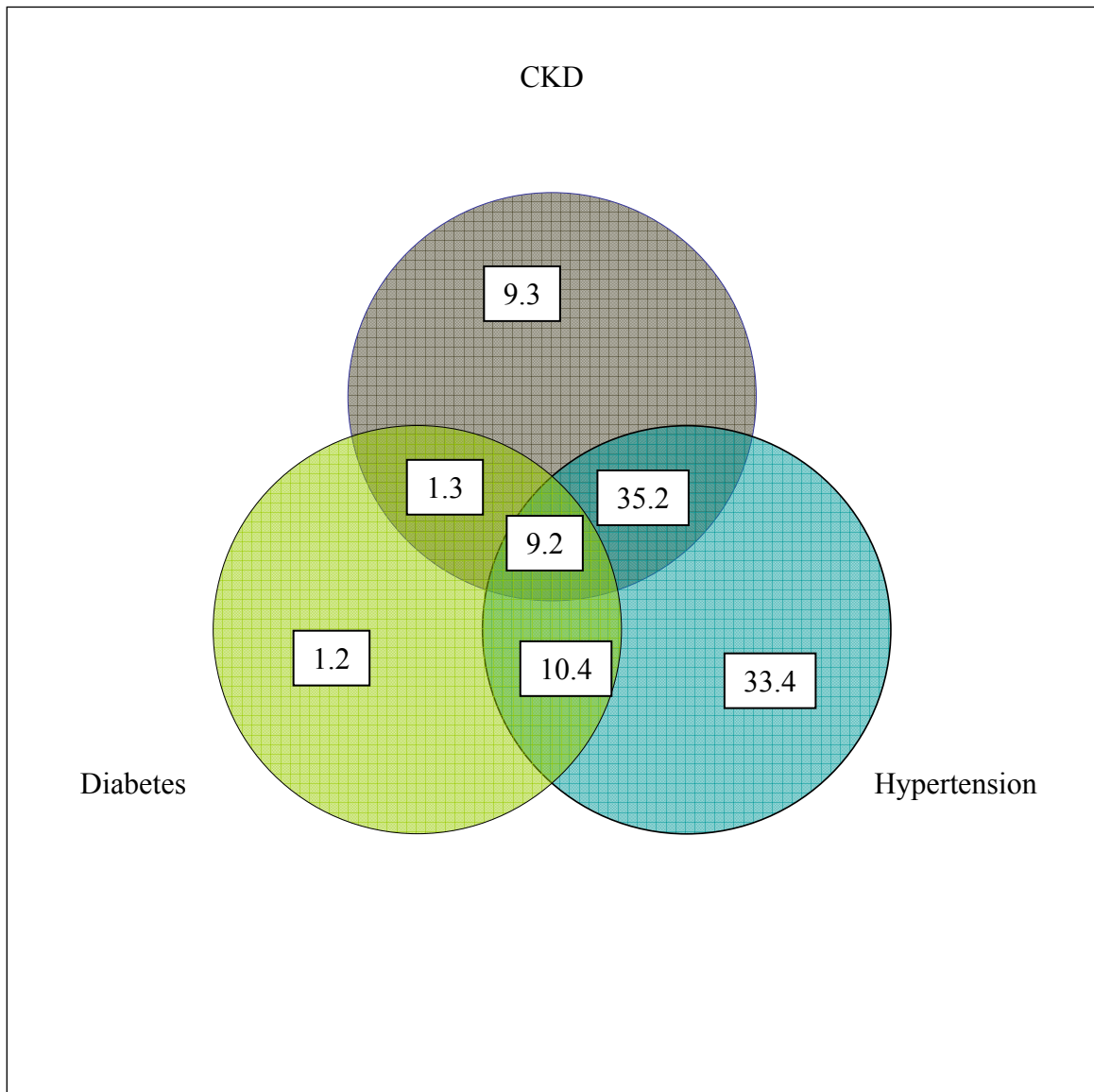
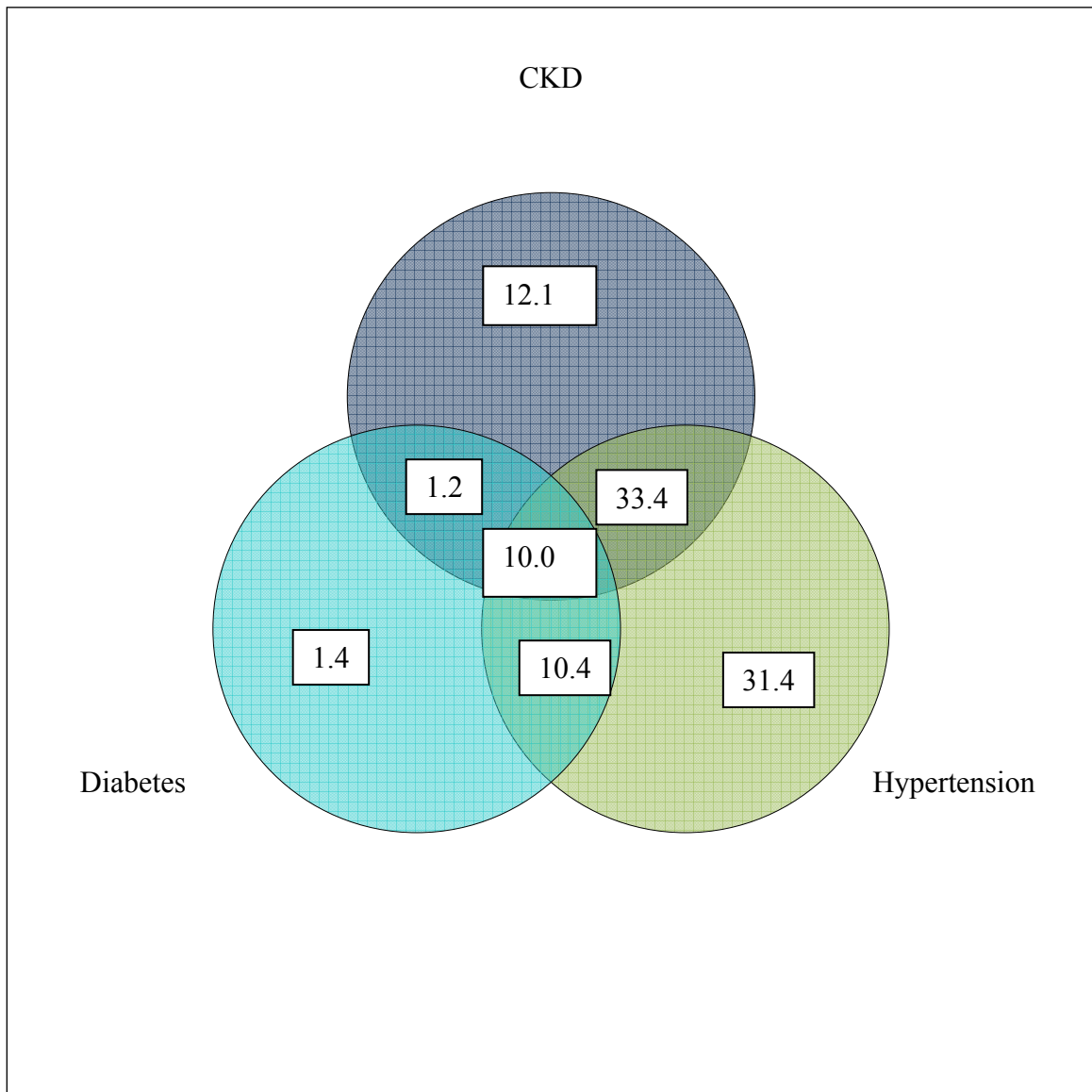


Figure 5.6.1c: Venn Diagram for Pre and Post Transplant Complications (in %) at Year 2006



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

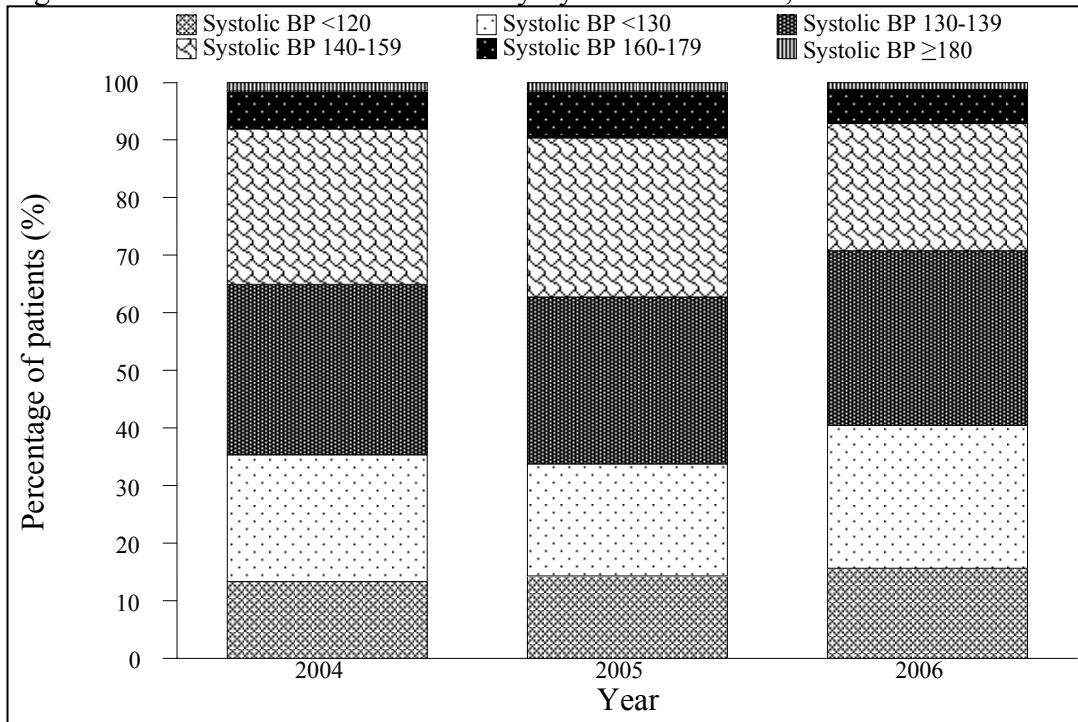


Table 5.6.2b: Distribution of Patients by Diastolic BP Levels, 2004-2006

	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 ≥110	12 (0.8)	10 (0.6)	4 (0.3)

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

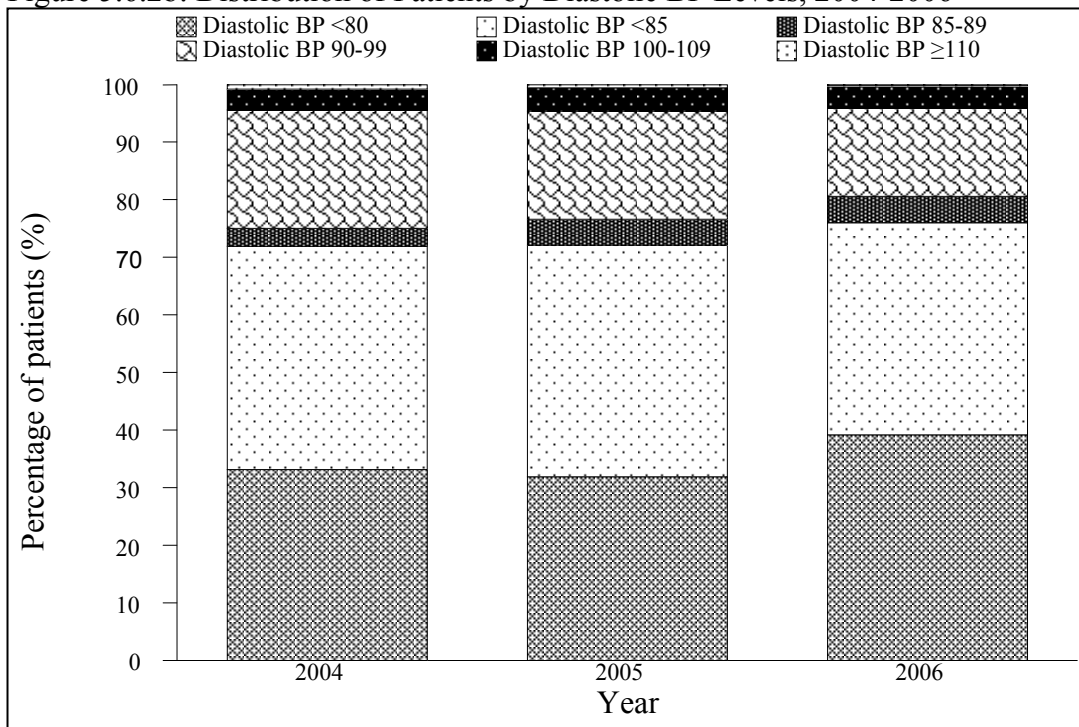
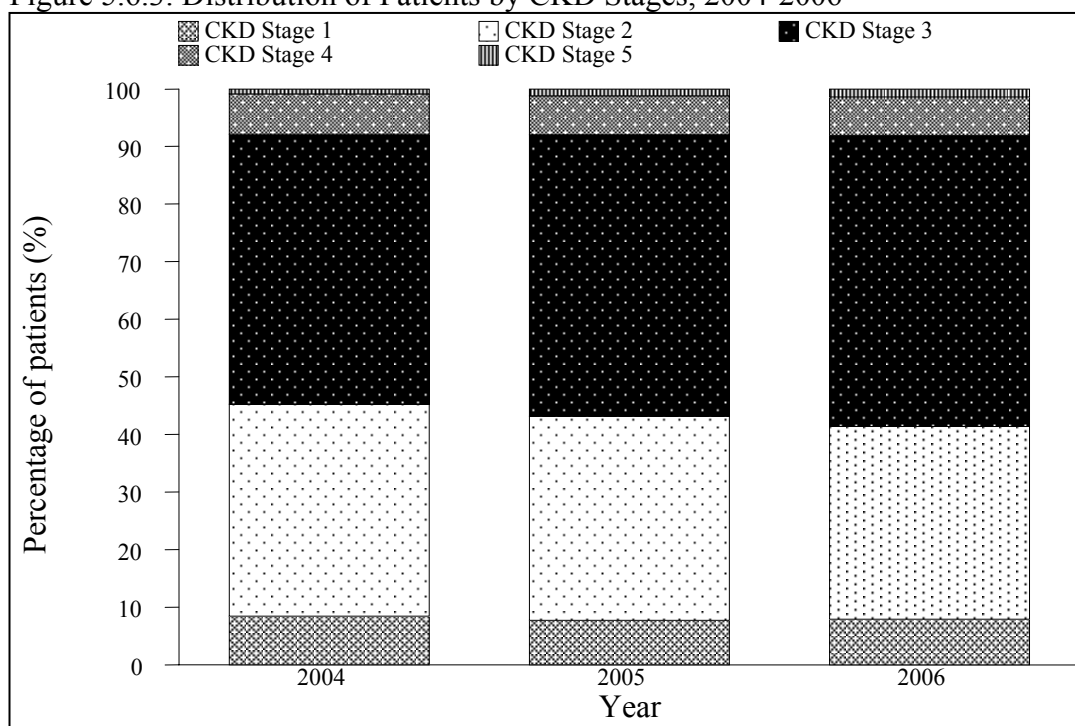


Table 5.6.3 shows the CKD Stage classification by year and in 2006, 50.5% of renal transplant recipients had CKD Stage III whilst another 6.7% had CKD Stage IV. CKD Stage V (impending renal replacement therapy) was found in 1.4% of renal transplant recipients.

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

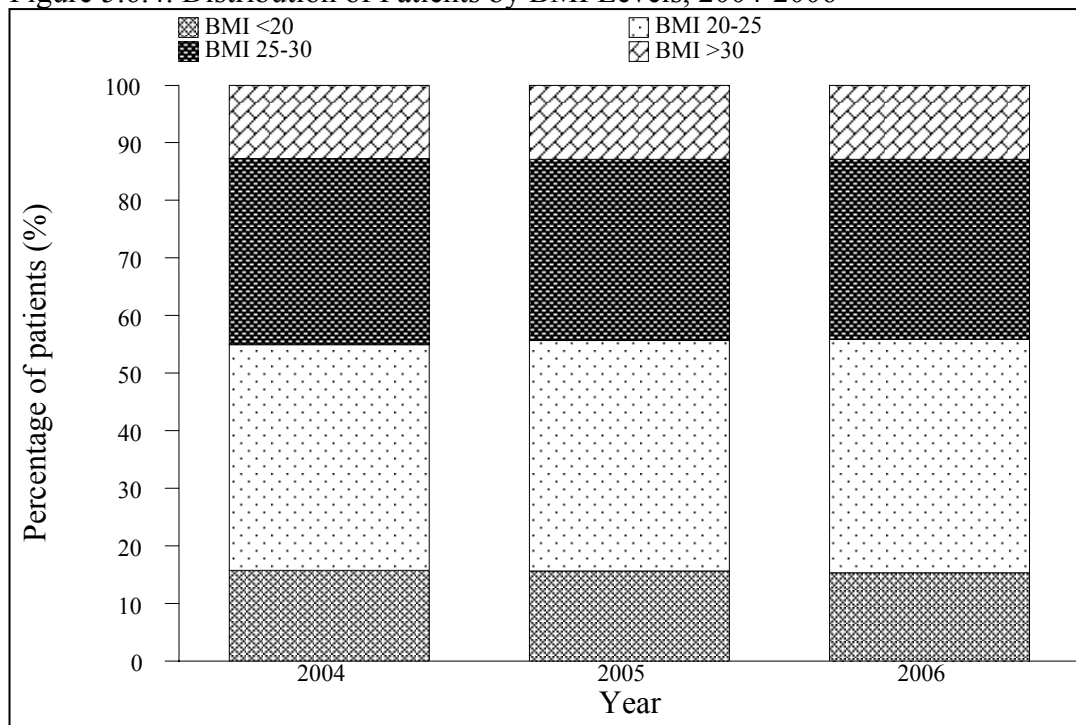


In terms of BMI for 2006, 55.9% of renal transplant recipients had BMIs of 25 or below. However 31.2% were overweight and 12.9% were obese.

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

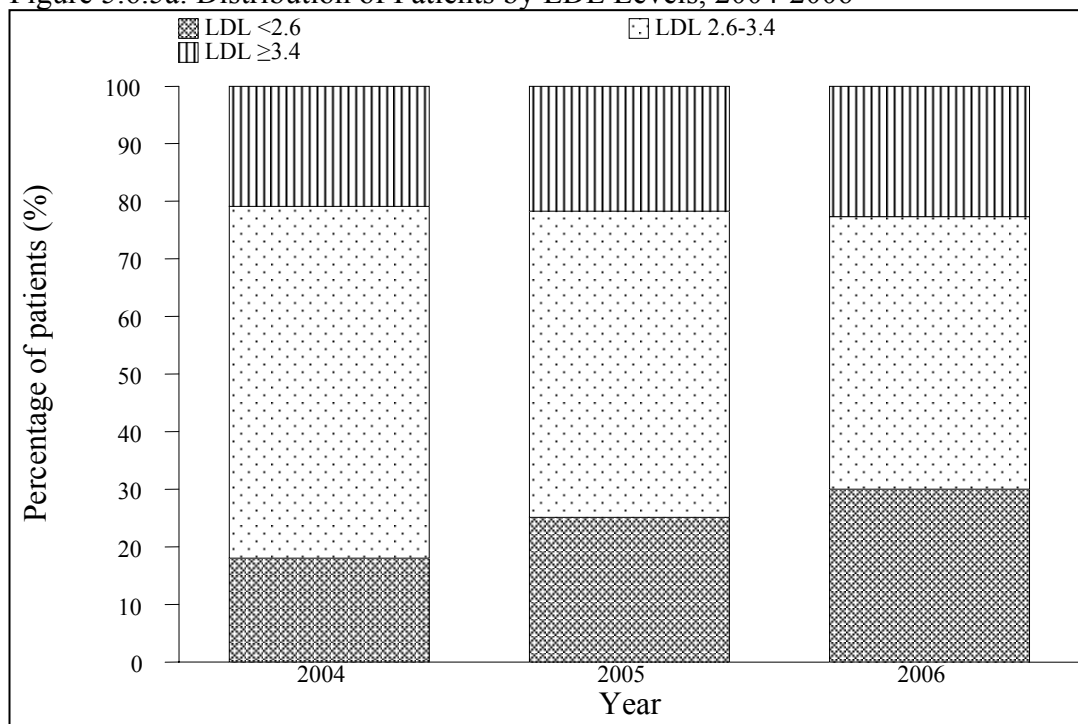


LDL cholesterol has been identified as the primary lipid target for prevention of coronary heart disease by National Cholesterol Education Program (NCEP) with a log linear relationship between risk of CHD and level of LDL cholesterol. In terms of renal transplant recipients in 2006, 30% have LDL levels 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

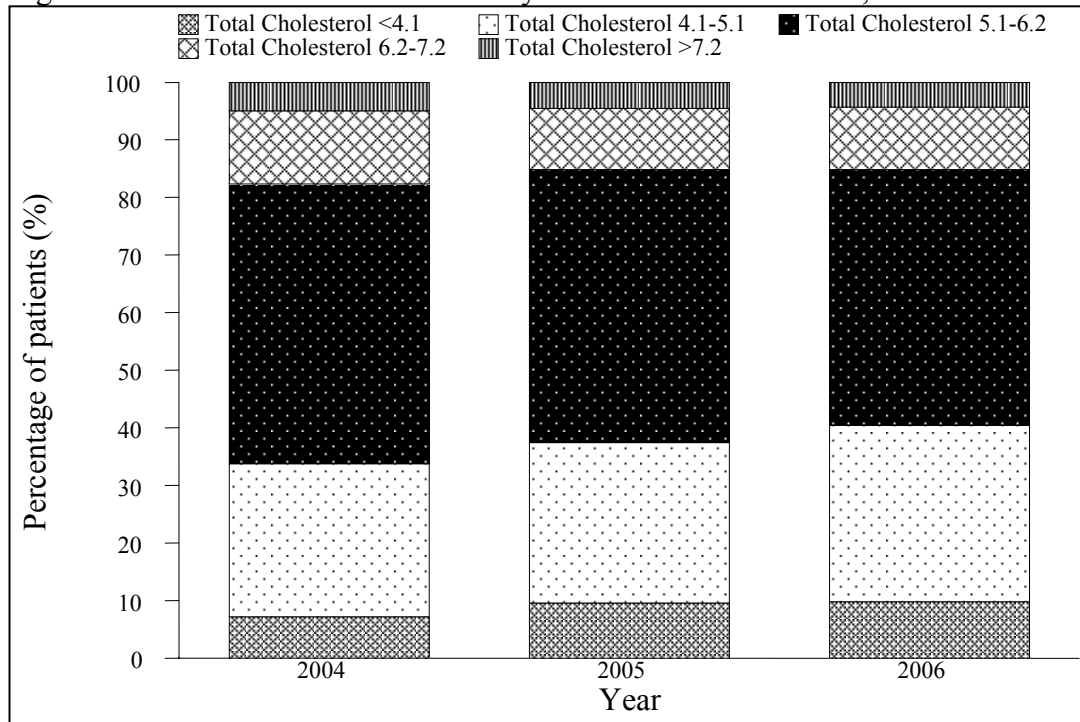
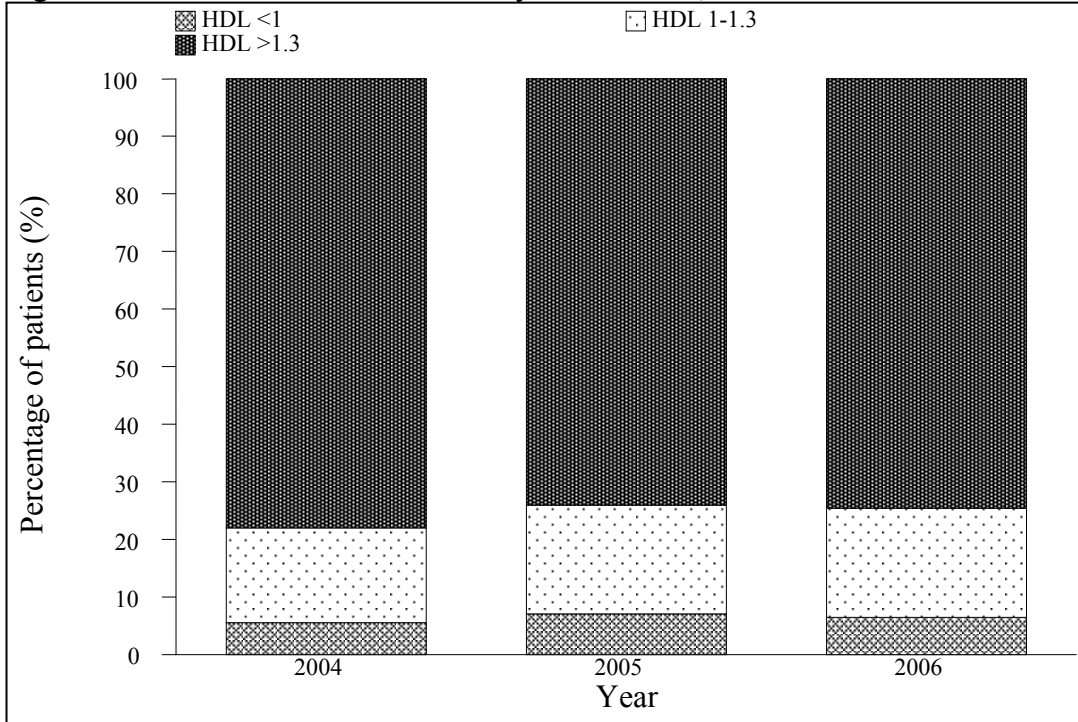


Table 5.6.5c: Distribution of Patients by HDL Levels, 2004-2006

	2004	2005	2006
	No. (%)	No. (%)	No. (%)
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 ≥ 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 ≥ 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 ≥ 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 ≥ 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

CHAPTER 6

HOMOGRAFT - HEART VALVE TRANSPLANTATION

Editor:

Mr Mohamed Ezani Hj Md Taib

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6.0 INTRODUCTION

Valvular homografts are used routinely in cardiac surgery especially for patients with congenital valvular heart disease. They are used as biological conduits to replace absent valves or to reconstruct outflow tracks in the heart. Homografts are superior to artificial valves due to their inherent traits such as superior perfusion parameters, durability, ease of handling and reduced risk of thrombo-embolic phenomenon. This removes the need for tight anticoagulation treatment post operatively and is extremely convenient for children and women of childbearing age in whom anticoagulation is contraindicated. Homografts have inherent resistance to infection and are preferred in an environment where sepsis is of concern.

Institut Jantung Negara (IJN) established the cardiovascular tissue bank in 1995. This was in response to the rising need for homografts and also the rising cost of importing homografts from overseas.

The Homograft Unit in IJN comprises of surgeons and medical technicians who are involved in retrieving, processing and cryopreserving the homografts for storage. The detailed records of the size of the homografts are documented. The infective state and the serology status of the donors are also documented.

The continued efforts by the Ministry of Health in promoting organ and tissue donation have helped to improve the availability of homografts in the country. The efficient and better streamlining of organisation structure has improved networking between various hospitals and transplant units with better public and medical staff awareness.

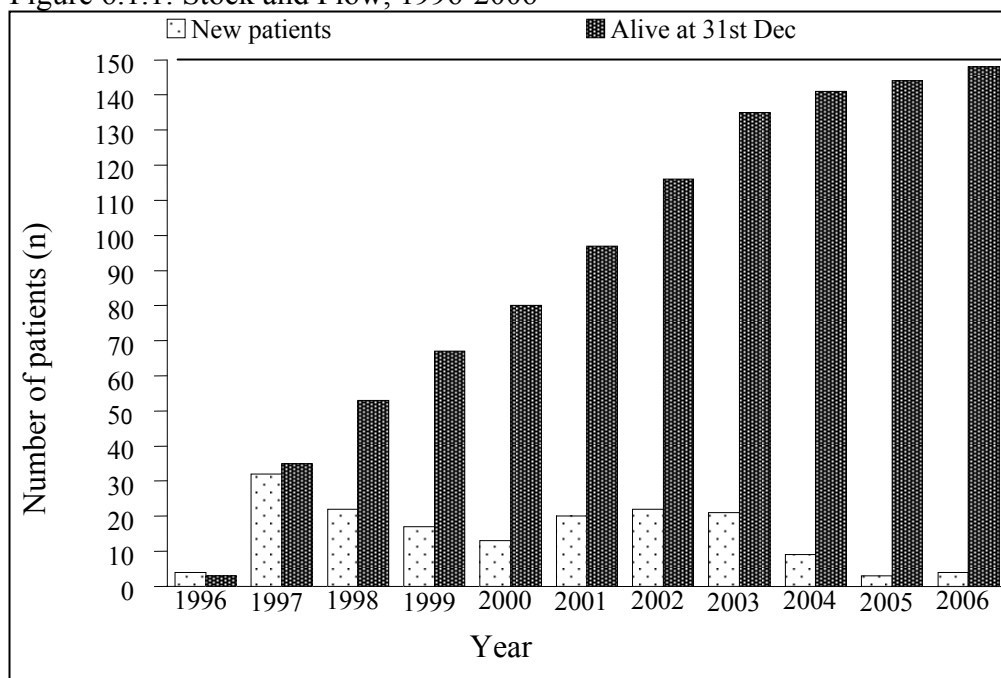
6.1 STOCK AND FLOW

Table 6.1.1: Stock and Flow, 1996-2006

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
New transplant	4	32	22	17	13	20	22	21	9	3	4
Deaths*	1	0	4	3	0	3	3	2	3	0	0
Lost to follow up	0	0	0	0	0	0	0	0	0	0	0
Alive with functioning graft at 31 st December	3	35	53	67	80	97	116	135	141	144	148

*based on year of death

Figure 6.1.1: Stock and Flow, 1996-2006



6.2 RECIPIENTS' CHARACTERISTICS

Table 6.2.1: Distribution of Patients by Gender, 1996-2006

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	TOTAL
Gender	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Male	2	19	9	9	10	6	9	14	3	0	4	85
Female	2	13	13	8	3	14	13	7	6	3	0	82
TOTAL	4	32	22	17	13	20	22	21	9	3	4	167

Figure 6.2.1: Distribution of Patients by Gender, 1996-2006

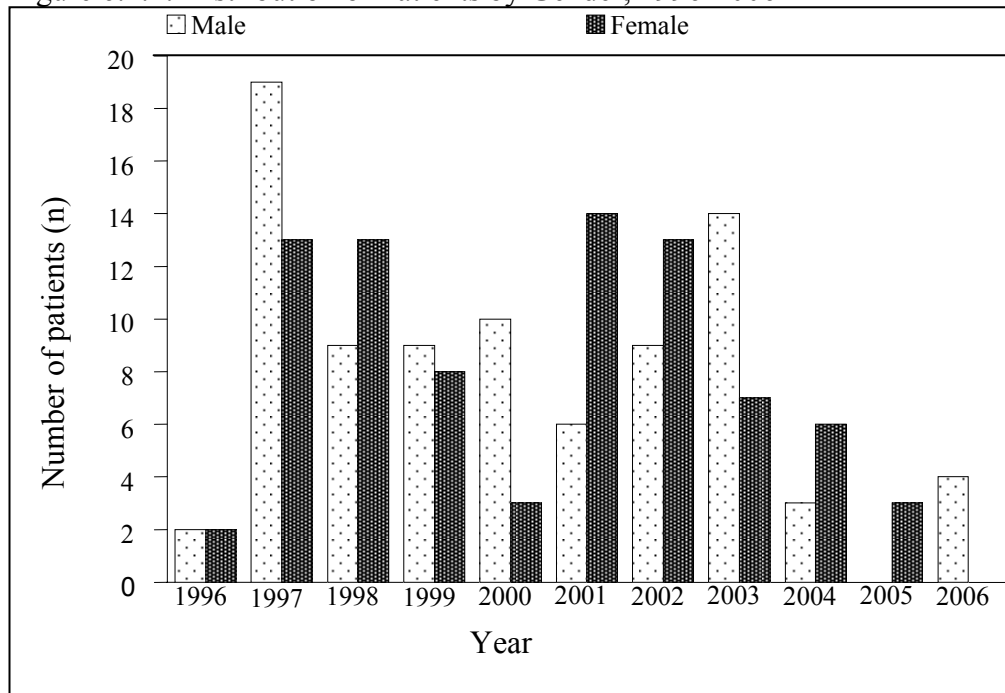


Table 6.2.2: Distribution of Patients by Ethnic Group, 1996-2006

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	TOTAL
Ethnic group	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Malay	1	19	15	9	9	10	16	12	6	3	2	102
Chinese	3	11	4	3	2	9	4	6	1	0	1	44
Indian	0	2	2	2	0	1	2	2	1	0	1	13
Others	0	0	1	3	2	0	0	1	1	0	0	8
TOTAL	4	32	22	17	13	20	22	21	9	3	4	167

Figure 6.2.2: Distribution of Patients by Ethnic Group, 1996-2006

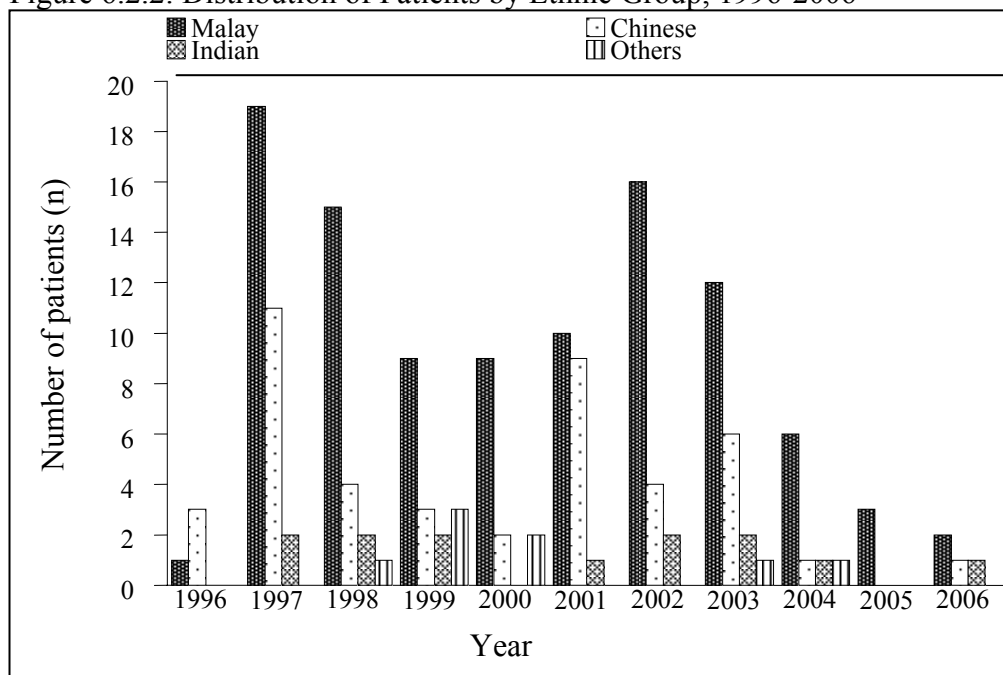
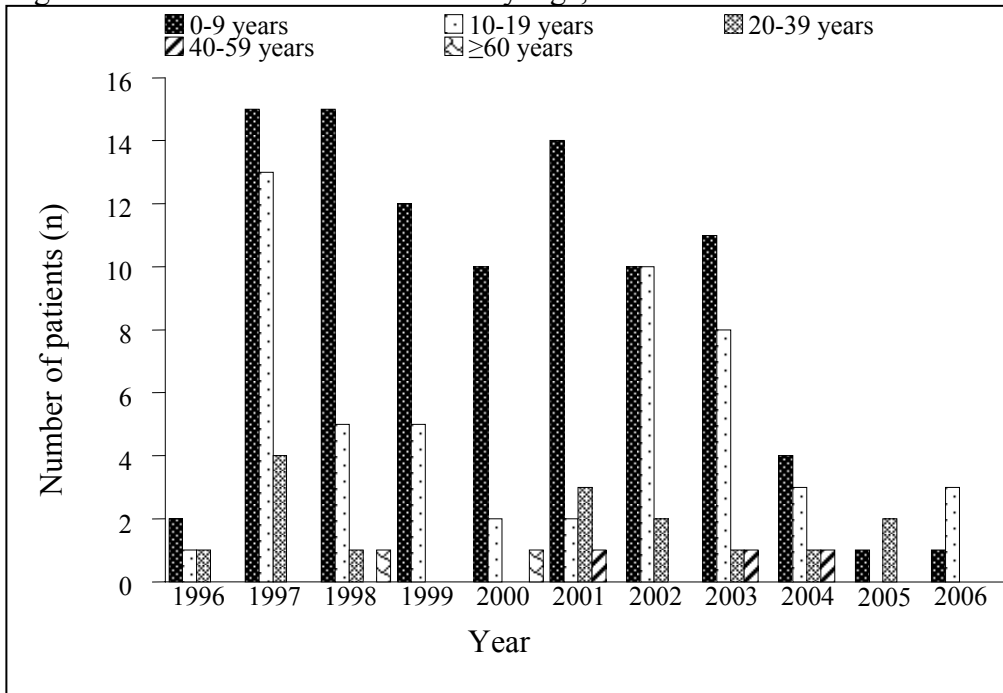


Table 6.2.3: Distribution of Patients by Age, 1996-2006

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	TOTAL
Age group	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
0-9	2	15	15	12	10	14	10	11	4	1	1	95
10-19	1	13	5	5	2	2	10	8	3	0	3	52
20-39	1	4	1	0	0	3	2	1	1	2	0	15
40-59	0	0	0	0	0	1	0	1	1	0	0	3
≥60	0	0	1	0	1	0	0	0	0	0	0	2
TOTAL	4	32	22	17	13	20	22	21	9	3	4	167
Mean	12	11	11	7	12	11	10	12	15	15	10	11
SD	7	7	15	4	17	14	6	11	11	8	3	10
Median	11	10	8	7	8	5	10	9	10	20	11	9
Min	5	3	3	1	2	5	3	2	5	6	6	3
Max	21	30	70	17	67	53	28	53	42	20	11	70

* Age=date of implantation – date birth

Figure 6.2.3: Distribution of Patients by Age, 1996-2006



6.3 TRANSPLANT PRACTICES

6.3.1 Donor Details

Table 6.3.1: Number of Valves Harvested by Type of Homograft, 1996-2006

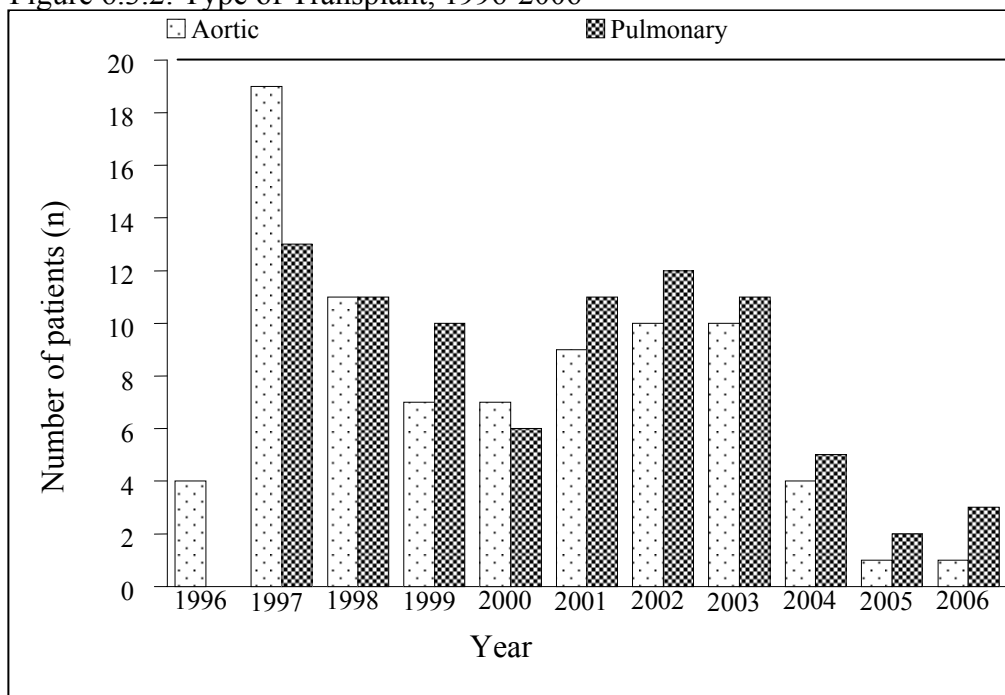
Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	TOTAL
Type of homograft	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Aortic	8	17	10	8	11	14	10	8	7	4	15	112
Pulmonary	1	14	11	10	12	12	14	9	8	5	15	111
TOTAL	9	31	21	18	23	26	24	17	15	9	30	223

6.3.2 Transplant Details

Table 6.3.2: Type of Transplant, 1996-2006

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	TOTAL
Type of transplant	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Aortic	4	19	11	7	7	9	10	10	4	1	1	83
Pulmonary	0	13	11	10	6	11	12	11	5	2	3	84
TOTAL	4	32	22	17	13	20	22	21	9	3	4	167

Figure 6.3.2: Type of Transplant, 1996-2006



6.4 TRANSPLANT OUTCOMES

Table 6.4.1: Patient Survival by Gender, 1996-2006

Gender	Male		Female	
	% Survival	SE	% Survival	SE
1	91	3	93	3
3	89	4	91	3
5	89	4	91	3

SE=standard error

Figure 6.4.1: Patient Survival by Gender, 1996-2006

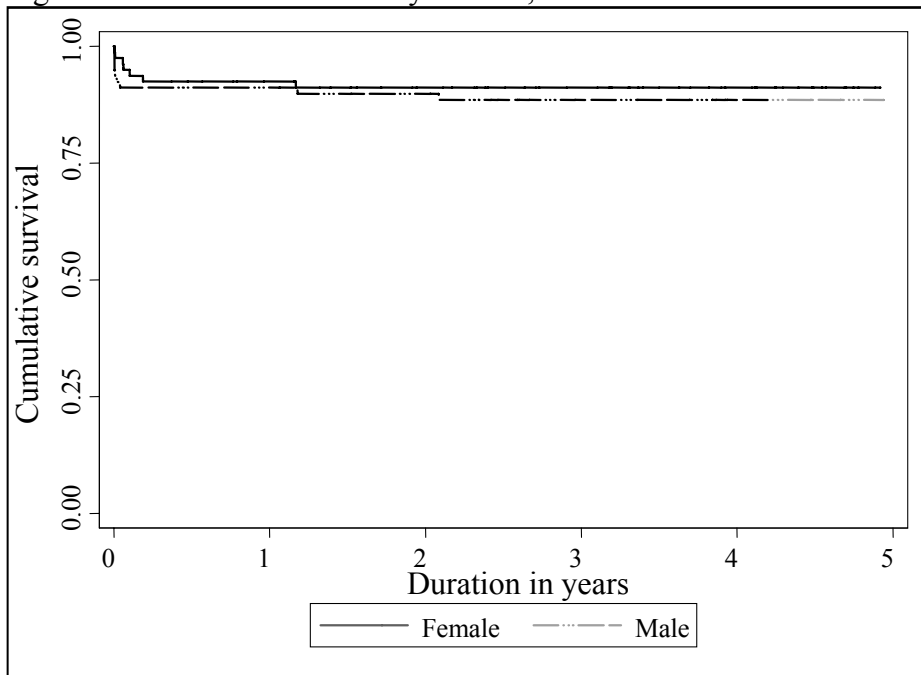


Table 6.4.2: Patient Survival by Age Group, 1996-2006

Age group Interval (months)	0-9 years		10-19 years		≥20 years	
	% Survival	SE	% Survival	SE	% Survival	SE
1	89	3	96	3	95	5
3	88	3	92	4	95	5
5	88	3	92	4	95	5

SE=standard error

Figure 6.4.2: Patient Survival by Age Group, 1996-2006

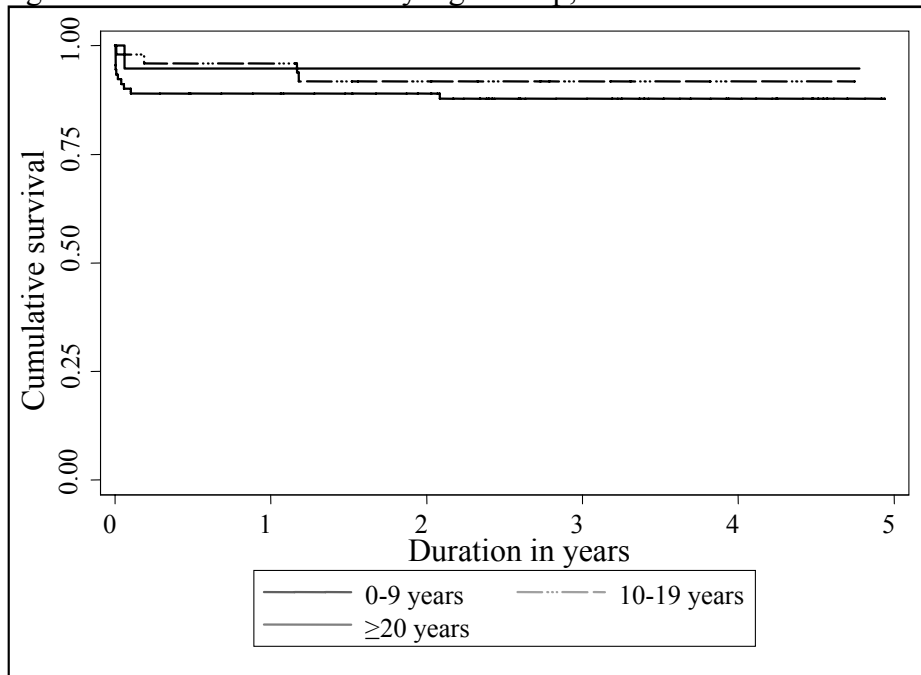
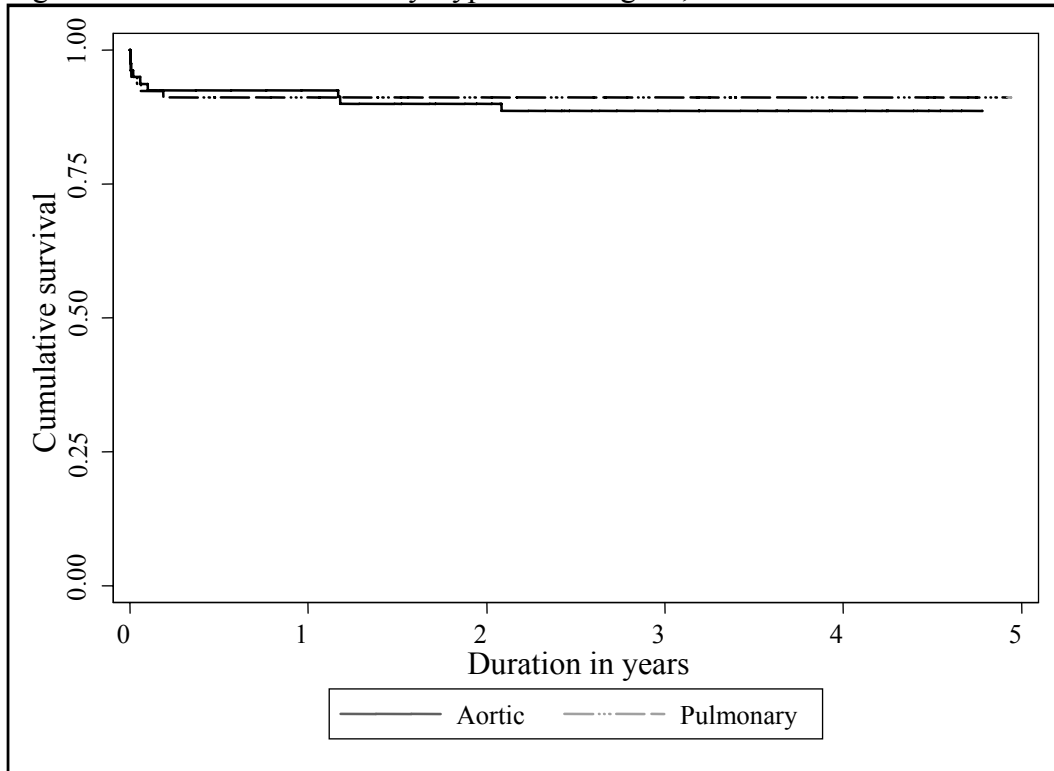


Table 6.4.3: Patient Survival by Type of Homograft, 1996-2006

Type of homograft Interval (years)	Aortic		Pulmonary	
	% Survival	SE	% Survival	SE
1	93	3	91	3
3	89	4	91	3
5	89	4	91	3

SE=Standard error

Figure 6.4.3: Patient Survival by Type of Homograft, 1996-2006



CHAPTER 7

BONE AND TISSUE TRANSPLANTATION

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INTRODUCTION

The initial part of this Bone and Tissue section presents data on bone and tissue allografts supplied in 2006. The chapter also presents data obtained from the Bone and Tissue Transplant Notification Form collected from the year 2004 until 2006.

Data on bone and tissue allograft transplantation is still lacking. Although the number of these transplantations is increasing over the years, many surgeons have not submitted the forms. Some surgeons chose to provide incomplete and minimal data. Most of the surgeons have not completed the Post Transplant Data form.

7.1 STOCK OF BONE AND AMNIOTIC MEMBRANE ALLOGRAFTS AND HOSPITALS WHERE TISSUES ARE UTILISED IN 2006

In 2006 data was only provided by National Tissue Bank, Universiti Sains Malaysia (USM) as a centre that supplied tissues (Table 7.1.2, Table 7.1.2 and Table 7.1.3). The National Transplant Registry did not receive data from the other bone banks.

Table 7.1.1: Types Of Tissue/Bone Allografts Supplied by National Tissue Bank, USM in 2006

Types of Tissue/Bone Allograft	Tissue/Bone Bank
	(National Tissue Bank, USM)
	No. (pieces)
DF Knee slices	0
DF Femur	5
DF Femoral head	75
DF Humerus	0
DF Tibia	4
DF Radius	1
DF Ulna	0
FD Cancellous	37
FD Cortical	0
FD Cortico-cancellous	0
Patella	4
Other tendon / fascia / cartilage	1
Amniotic membranes	379
TOTAL	506

DF – Deep-frozen

FD – Freeze-dried

Table 7.1.2: Hospitals/Other Sectors Using Bone Allografts in 2006

	Tissue/Bone Bank (National Tissue Bank, USM) No. (pieces)
MOH	
Hospital Selayang	3
Hospital Seremban	1
Hospital Sultanah Aminah, Johor Bahru	11
Hospital Pantai Air Keroh, Melaka	4
Hospital Pulau Pinang	7
Hospital Ipoh	9
Hospital Alor Setar	6
Hospital Umum Sarawak	10
Hospital Kuala Terengganu	2
Hospital Kemaman	10
Hospital Tengku Ampuan Afzan, Kuantan	2
Hospital Raja Perempuan Zainab II, Kota Bharu	1
Queen Elizabeth Hospital, Sabah	12
TOTAL	78
University	
HUKM	3
HUSM	29
TOTAL	32
Private and other sectors	
Antal Rastu Sdn Bhd	2
Kota Bharu Medical Centre	2
Kota Medical Centre, Melaka	1
Lam Wah Ee Penang	3
Pantai Medical Centre, Air Keroh	1
Stryker	6
Sunway Medical Centre	1
TOTAL	16

Table 7.1.3: Hospitals/Other Sectors Using Amniotic Membranes in 2006

	Tissue/Bone Bank
	(National Tissue Bank, USM)
	No. (pieces)
MOH	
Hospital Kuala Lumpur	13
Hospital Selayang	1
Hospital Sultanah Aminah, Johor Bahru	200
Hospital Melaka	10
Hospital Alor Setar	2
Hospital Teluk Intan	1
Hospital Tengku Ampuan Afzan, Kuantan	7
Hospital Queen Elizabeth	4
TOTAL	238
University	
HUSM	8
UMMC	4
HUKM	2
TOTAL	14
Private and other sectors	
Gleneagles Medical Centre, Penang	8
Hospital Pakar Johor	100
Sri Kota Medical Centre, Klang	4
Pusat Rawatan Islam Al-Zahirah, Bangi Selangor	10
Hospital Tawakal, Kuala Lumpur	4
Putra Medical Centre	1
TOTAL	127

7.2 REPORTING CENTRES

The recipient centres that reported to the National Transplant Registry using the Bone and Tissue Transplant Notification Form are shown on Table 7.2.1.

Table 7.2.1: Distribution of Reporting Centre by Year

Centre	2004	2005	2006	TOTAL
	No.	No.	No.	
Orthopaedics Department				
Orthopaedics Department, HUSM	1	7	2	10
Department of Orthopaedics Surgery, UMMC	1	0	0	1
Institute of Orthopaedic & Traumatology, HKL	2	0	0	2
Department of Orthopaedics, Hospital Ipoh	0	1	0	1
Department of Orthopaedics, Hospital Kota Bharu	9	3	0	12
Orthopaedic Department, Hospital Umum Sarawak	1	0	1	2
Orthopaedics Department, Hospital Sultanah Aminah, Johor Bahru	0	1	0	1
Wan Orthopaedic, Trauma & Sports Injury Centre (WOTSIC), Seremban Specialist Hospital	0	0	2	2
Orthopaedics Department, Hospital Island, Penang	0	1	0	1
Orthopaedics Department, Hospital Fatimah, Ipoh	0	3	0	3
Orthopaedics Department, Kota Bharu Medical Centre	0	0	2	2
Normah Medical Specialist Centre, Kuching	0	1	0	1
Spine Unit, HUSM	0	0	1	1
Ophthalmology Department				
Ophthalmology Department, Hospital Tengku Ampuan Rahimah, Klang	1	1	0	2
Ophthalmology Department, Hospital Tengku Ampuan Afzan, Kuantan	1	1	0	2
Ophthalmology Department, Hospital Teluk Intan	0	0	1	1
Ophthalmology Department, HKL	0	0	23	23
Ophthalmology Department, Hospital Alor Setar	0	0	1	1
Ophthalmology Department, Sri Kota Medical Centre, Klang	0	1	0	1
Ophthalmology Department, HUSM	0	0	1	1
Others Department				
Maxillofacial Surgery, HUSM	1	1	0	2
Timberland Medical Centre	0	1	0	1
Sri Kota Medical Centre, Klang	0	0	1	1
TOTAL	17	22	35	74

7.3 RECIPIENT DETAILS

The bone and tissue allografts recipients' gender (Table 7.3.1), ethnicity (Table 7.3.1), age (Table 7.3.3) and diagnosis (Table 7.3.4) are presented in this section.

Table 7.3.1: Distribution of Patients by Gender

Gender	2004		2005		2006		TOTAL	
	No.	%	No.	%	No.	%	No.	%
Male	9	53	10	45	27	77	46	62
Female	8	47	12	55	8	23	28	38
TOTAL	17	100	22	100	35	100	74	100

Table 7.3.2: Distribution of Patients by Ethnic Group

Ethnic Group	2004		2005		2006		TOTAL	
	No.	%	No.	%	No.	%	No.	%
Malay	11	65	14	64	26	74	51	69
Chinese	3	18	5	23	7	20	15	20
Indian	1	6	1	5	1	3	3	4
Bumiputra Sabah	0	0	0	0	0	0	0	0
Bumiputra Sarawak	1	6	0	0	0	0	1	1
Others	1	6	2	9	1	3	4	5
TOTAL	17	100	22	100	35	100	74	100

Table 7.3.3: Distribution of Patients by Age Group

Age Group	2004		2005		2006		TOTAL	
	No.	%	No.	%	No.	%	No.	%
0-9	0	0	1	5	4	11	5	7
10-19	1	6	6	27	2	6	9	12
20-39	9	53	6	27	16	46	31	42
40-59	5	29	3	14	8	23	16	22
≥60	1	6	5	23	4	11	10	14
Missing	1	6	1	5	1	3	3	4
TOTAL	17	100	22	100	35	100	74	100
Mean	35		34		36		35	
SD	13		22		19		19	
Median	33		26		35		33	
Min	15		7		0		0	
Max	60		75		75		75	

Table 7.3.4: Distribution of Patients by Diagnosis Warranting Tissue Graft Transplantation

Diagnosis	2004		2005		2006		TOTAL	
	No.	%	No.	%	No.	%	No.	%
Congenital deformity	1	6	0	0	1	3	2	3
Infection	0	0	0	0	3	9	3	4
Trauma	5	29	1	5	6	17	12	16
Degenerative disease	1	6	2	9	0	0	3	4
Tumour-benign	5	29	4	18	1	3	10	14
Tumour-malignant	0	0	6	27	1	3	7	9
Burn	0	0	1	5	2	6	3	4
Scald	0	0	0	0	1	3	1	1
Sports injury	0	0	1	5	0	0	1	1
Failed primary surgery	1	6	2	9	1	3	4	5
Ophthalmological	0	0	0	0	16	46	16	22
Others	5	29	3	14	6	17	14	19
TOTAL	17	100	22	100	35	100	74	100

7.4 PRE TRANSPLANT DATA

This section presents data on the tissue provider (Table 7.4.1), origin of tissue graft (Table 7.4.2), tissue graft type (Table 7.4.3), type of sterilisation of the graft (Table 7.4.4), mode of transport storage of tissue graft to recipient hospital (Table 7.4.5) and temperature of storage tissue graft during transportation (Table 7.4.6).

Table 7.4.1: Distribution of Patients According to Tissue Provider

Name Tissue Bank	2004		2005		2006		TOTAL	
	No.	%	No.	%	No.	%	No.	%
Tissue Bank, USM	13	76	18	82	31	89	62	84
Bone Bank, UMMC	1	6	0	0	0	0	1	1
Bone Bank, HKL	3	18	0	0	0	0	3	4
Eucara Pharmaceutical	0	0	0	0	2	6	2	3
Osteo Tech Inc	0	0	1	5	0	0	1	1
Missing	0	0	3	14	2	6	5	7
TOTAL	17	100	22	100	35	100	74	100

Table 7.4.2: Distribution of Patients by Origin of Tissue Graft

Origin of Tissue Graft	2004		2005		2006		TOTAL	
	No.	%	No.	%	No.	%	No.	%
Local	17	100	15	68	31	89	63	85
Imported	0	0	3	14	2	6	5	7
Missing	0	0	4	18	2	6	6	8
TOTAL	17	100	22	100	35	100	74	100

Table 7.4.3: Distribution of Patients by Tissue Graft Type

Tissue Graft Type	Tissue Graft Types	2004		2005		2006		TOTAL	
		No.	%	No.	%	No.	%	No.	%
Deep-frozen tissues		9	53	14	64	5	14	28	38
	Femur	3	33	3	21	0	0	6	21
	Femoral Head	2	22	12	86	2	40	16	57
	Humerus	0	0	1	7	3	60	4	14
	Tibia	1	11	1	7	1	20	3	11
	Radius	2	22	5	36	0	0	7	25
Freeze-dried (Lyophilised)		6	35	4	18	29	83	39	53
	Amniotic membranes	2	33	3	75	25	86	30	77
Not Available		2	12	2	9	0	0	4	5
Missing		0	0	2	9	1	3	3	4
TOTAL		17	100	22	100	35	100	74	100

Table 7.4.4: Distribution of Type of Sterilisation of the Graft

Type Graft Sterilisation	2004		2005		2006		TOTAL	
	No.	%	No.	%	No.	%	No.	%
Gamma Irradiation	16	94	8	36	0	0	24	32
Glycerol	0	0	0	0	2	6	2	3
Sterile Freeze Dried Bone	0	0	1	5	0	0	1	1
Missing	1	6	13	59	33	94	47	64
TOTAL	17	100	22	100	35	100	74	100

Table 7.4.5: Distribution of Mode of Transport Storage to Recipient Hospital during Transportation

Mode of Transport Storage to recipient hospital	2004		2005		2006		TOTAL	
	No.	%	No.	%	No.	%	No.	%
By Flight	1	6	1	5	2	6	4	5
By Courier	2	12	3	14	24	69	29	39
By Hand	4	24	8	36	1	3	13	18
Dry Ice Box	5	29	4	18	0	0	9	12
Sterile package	0	0	0	0	2	6	2	3
Missing	5	29	6	27	6	17	17	23
TOTAL	17	100	22	100	35	100	74	100

Table 7.4.6: Distribution of Temperature of Storage during Transportation

Temperature of storage during transportation (°C)	2004		2005		2006		TOTAL	
	No.	%	No.	%	No.	%	No.	%
-80	2	12	0	0	0	0	2	3
-40	0	0	1	5	0	0	1	1
-20	4	24	4	18	0	0	8	11
-10	0	0	6	27	2	6	8	11
0	2	12	0	0	0	0	2	3
37	0	0	0	0	2	6	2	3
Missing	9	53	11	50	31	89	51	69
TOTAL	17	100	22	100	35	100	74	100

7.5 TRANSPLANT SURGERY DATA

The data on mode of storage of tissues in recipient hospitals are presented in Table 7.5.1. This section also presents the data on the use of composite graft (Tables 7.5.2 and 7.5.3), presence of pre operative infection at implant site (Table 7.5.4), presence of infection of pre implanted grafts (Tables 7.5.5 and 7.5.6) and the usage of antibiotics (Tables 7.5.7, 7.5.8, 7.5.9, and 7.5.10).

Table 7.5.1: Distribution of Mode of Storage in Recipient Hospitals

Mode of storage in recipient hospital	2004		2005		2006		TOTAL	
	No.	%	No.	%	No.	%	No.	%
Refrigerator	0	0	1	5	25	71	26	35
Deep freezer-20 degree Celsius	0	0	3	14	2	6	5	7
Deep freezer-40 degree Celsius	1	6	2	9	0	0	3	4
Deep freezer-80 degree Celsius	3	18	4	18	1	3	8	11
Glycerol	0	0	1	5	3	9	4	5
Room temperature	0	0	1	5	1	3	2	3
Others	12	71	5	23	2	6	19	26
Not available	1	6	0	0	0	0	1	1
Missing	0	0	5	23	1	3	6	8
TOTAL	17	100	22	100	35	100	74	100

Table 7.5.2: Distribution of Additional Tissue Usage (Composite Graft)

Additional tissue usage (composite graft)	2004		2005		2006		TOTAL	
	No.	%	No.	%	No.	%	No.	%
No	6	35	12	55	32	91	50	68
Yes	9	53	7	32	1	3	17	23
Not available	2	12	1	5	0	0	3	4
Missing	0	0	2	9	2	6	4	5
TOTAL	17	100	22	100	35	100	74	100

Table 7.5.3: Distribution of Type of Additional Tissue Used (Composite Graft)

Type of additional tissue used (composite graft)	2004		2005		2006		TOTAL	
	No.	%	No.	%	No.	%	No.	%
Autografts	7	78	3	43	0	0	10	59
Allografts	1	11	2	29	1	100	4	24
Others	1	11	1	14	0	0	2	12
Missing	0	0	1	14	0	0	1	6
TOTAL	9	100	7	100	1	100	17	100

Table 7.5.4: Distribution of Presence of Pre Operative Infection at Implant Site

Presence of pre operative infection at implant site	2004		2005		2006		TOTAL	
	No.	%	No.	%	No.	%	No.	%
No	15	88	21	95	31	89	67	91
Yes	0	0	0	0	4	11	4	5
Not Available	2	12	0	0	0	0	2	3
Missing	0	0	1	5	0	0	1	1
TOTAL	17	100	22	100	35	100	74	100

Table 7.5.5: Distribution of Pre Implant Graft Culture Swab

Pre implant graft culture swab	2004		2005		2006		TOTAL	
	No.	%	No.	%	No.	%	No.	%
No	15	88	16	73	17	49	48	65
Yes	0	0	1	5	0	0	1	1
Not Available	2	12	0	0	6	17	8	11
Missing	0	0	5	23	12	34	17	23
TOTAL	17	100	22	100	35	100	74	100

Table 7.5.6: Distribution of Type of Infection of Pre Implant Graft

Type of infection of pre implant graft	2004		2005		2006		TOTAL	
	No.	%	No.	%	No.	%	No.	%
Cytomegalovirus	0	0	1	100	0	0	1	100
Proteus	0	0	0	0	0	0	0	0
TOTAL	0	0	1	100	0	0	1	100

Table 7.5.7: Distribution of Grafts Soaked in Antibiotics Prior to Transplantation

Grafts soaked in antibiotics prior to transplantation	2004		2005		2006		TOTAL	
	No.	%	No.	%	No.	%	No.	%
No	8	47	5	23	28	80	41	55
Yes	7	41	16	73	6	17	29	39
Not Available	2	12	0	0	1	3	3	4
Missing	0	0	1	5	0	0	1	1
TOTAL	17	100	22	100	35	100	74	100

Table 7.5.8: Distribution of Antibiotics Used to Soak the Grafts in Prior to Transplantation

Antibiotics used to soak the grafts in prior to transplantation	2004		2005		2006		TOTAL	
	No.	%	No.	%	No.	%	No.	%
Ceftriazone	4	57	9	56	3	50	16	55
Gentamycin	3	43	4	25	3	50	10	34
Ceftriazone and Gentamycin	0	0	0	0	0	0	0	0
Vancomycin, Postome iodine	0	0	1	6	0	0	1	3
Povidone iodine, Ceftriazone	0	0	1	6	0	0	1	3
Missing	0	0	1	6	0	0	1	3
TOTAL	7	100	16	100	6	100	29	100

Table 7.5.9: Distribution of Patients by Systemic Antibiotics Given Prior to Transplantation

Systemic antibiotics prior to transplantation	2004		2005		2006		TOTAL	
	No.	%	No.	%	No.	%	No.	%
No	4	24	3	14	26	74	33	45
Yes	12	71	17	77	9	26	38	51
Not Available	1	6	0	0	0	0	1	1
Missing	0	0	2	9	0	0	2	3
TOTAL	17	100	22	100	35	100	74	100

Table 7.5.10: Distribution of Patients by Type of Systemic Antibiotics Given Prior to Transplantation

Type of systemic antibiotics given to patient prior to transplantation	2004		2005		2006		TOTAL	
	No.	%	No.	%	No.	%	No.	%
Cefepirazole	2	17	2	12	0	0	4	11
Ceftriazone	0	0	0	0	1	11	1	3
Cefuroxime	7	58	7	41	4	44	18	47
Ciproflaxacin	0	0	2	12	0	0	2	5
Chloramphenicol	0	0	0	0	1	11	1	3
Metronidazole	1	8	1	6	0	0	2	5
Ceftazidime	0	0	0	0	1	11	1	3
Ceftriazone/Imipenam	2	17	2	12	2	22	6	16
Ampicillin/Sulbactam	0	0	2	12	0	0	2	5
Missing	0	0	1	6	0	0	1	3
TOTAL	12	100	17	100	9	100	38	100

7.6 POST TRANSPLANT DATA

Post transplant data such as early post operative complications (≤ 3 weeks) and post operative systemic antibiotics given to patients were not available.

CHAPTER 8

CADAVERIC ORGAN AND TISSUE DONATION

Editor:

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CADAVERIC ORGAN AND TISSUE DONATION

Compared with 2005, there was a marked increase in the number of potential donors referred to the National Transplant Procurement Unit (NTPMU) nationwide in 2006 with the consequent increase in cadaveric organ and tissue donations. Out of a total of 112 potential donor referrals (a rise of 80% from 2005), 25 actual donations materialised. This represents a twofold rise from 0.53 donations per million population (pmp) in 2005 to 1.01 donations per million population in 2006. Of these, 14 (56%) were multi-organ and tissue donations after brain death which were procured in the operating theatre, while 11 (44%) were tissue donations after cardiac death. Six of the tissue donations after cardiac death were for cornea only, one of which was carried out in the general ward, while the rest were multi-tissue donations which took place in the mortuary. In total 95 organs and tissues were procured in 2006 which included 38 eyes, 1 heart, 1 lung, 6 livers, 26 kidneys, 15 heart valves, 5 bones and 3 skin donations.

All the donors in 2006 were Malaysians except for one Taiwanese man who died while on a business visit here. Almost a quarter (6/25) came from Kuala Lumpur, followed by Perak (4/25) and Penang (4/25). As before, there were more male donors (76%) and the ethnic composition was formed mainly by the Chinese (48%) and Indians (44%) with a single Malay donor. Muslim donors made up 8% (2/25) of the total. The mean age was 35.7 ± 22.5 years with the majority (36%) being from the 10-19 years age group while almost a third of the donors (8/25) were 50 years and older. The oldest donor in 2006 was 77 years old who donated eyes only, while the youngest was a 3-year-old multi-organ and tissue donor.

Majority of the donors (64%) were found in the ICU, but there were also three direct referrals for tissue donation from the mortuary. Only 1 out of the 25 donors (4%) carried the donor card. 68% (17/25) of the donations took place in MOH state hospitals, with 4 donations (16%) occurring in private hospitals, and 3 (12%) from University hospitals.

Half of the brain dead organ donors died from road accident-related injuries while majority (45%) of post-cardiac death tissue donors died from heart-related diseases. Forty percent (10/25) of the deaths of the donors in 2006 were from trauma-related injuries while 2 were homicide cases. Of the 14 brain dead donors in 2006, group B rhesus positive was the most common blood group (36%), followed by A positive (29%) and O positive (21%), and only 2 (14%) from AB group. But when considered in totality from 1997 to 2006, blood group O positive was the most common (41%) followed by B positive and A positive.

Table 8.1: Number of Procurement by Year, 1997-2006

Number of procurement by year N=162										
Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Number of donors	5	7	4	13	24	30	25	16	13	25
Rate of procurement (per million population)	0.25	0.34	0.19	0.59	1.07	1.31	1.07	0.67	0.53	1.01
Organs procured										
Cornea	4	10	6	18	34	48	40	20	22	38
Heart	1	3	2	3	4	0	2	0	1	1
Liver	0	0	2	1	1	2	1	3	3	6
Kidney	8	10	6	22	38	25	16	18	8	26
Heart valve	0	1	2	8	11	11	10	20	6	15
Bone	0	1	0	3	2	6	5	5	2	5
Skin	0	0	0	2	2	3	0	1	0	3
Lung	0	0	0	0	0	0	0	0	1	1

Figure 8.1: Number of Procurement by Year, 1997-2006

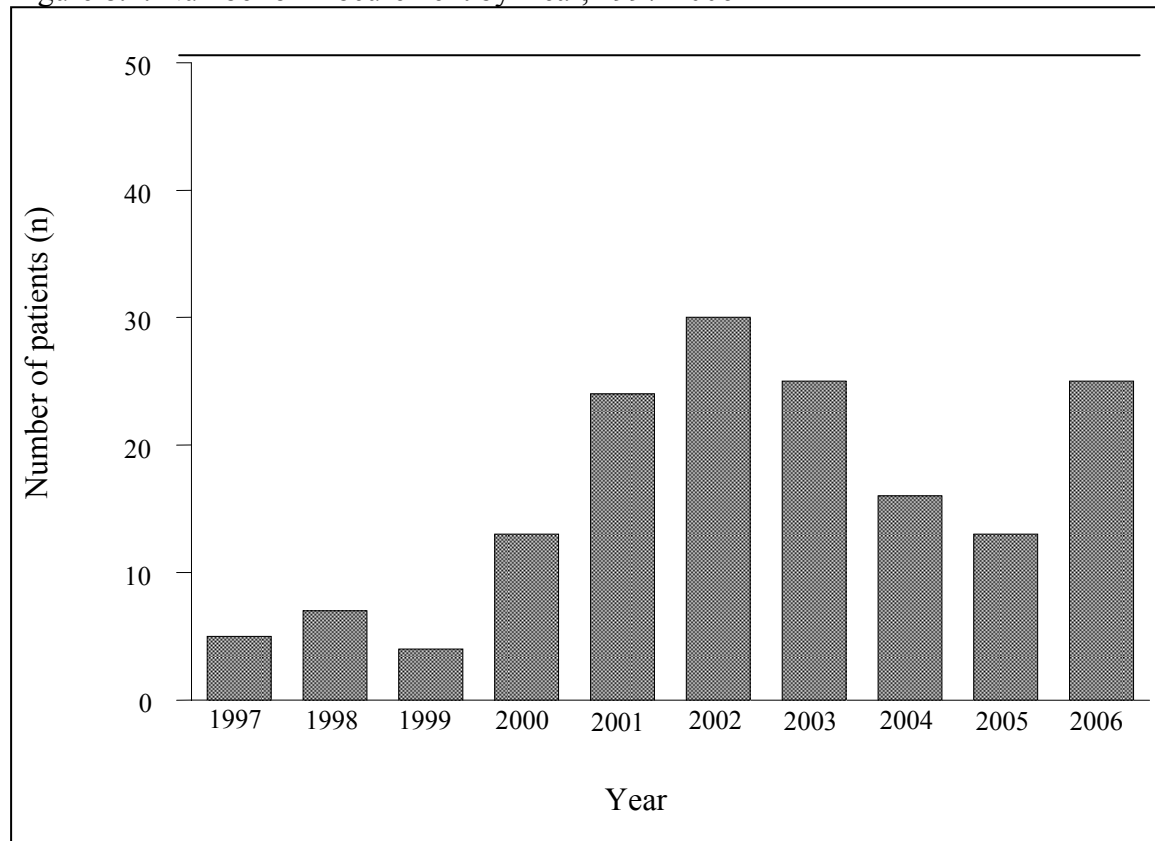


Table 8.2: Distribution of Donors by Age, 1997-2006

Donor's age (years)	1997 N=5		1998 N=7		1999 N=4		2000 N=13		2001 N=24		2002 N=30		2003 N=25		2004 N=16		2005 N=13		2006 N=25		Total N=162		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
<1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	0	0	0	0	0	0	1	1
1-9	1	20	0	0	0	0	1	8	1	4	1	3	1	4	1	6	1	8	2	8	2	9	6
10-19	0	0	1	14	2	50	7	54	2	8	3	10	4	16	3	19	1	8	9	36	32	20	
20-29	1	20	3	43	2	50	1	8	6	25	6	20	4	16	3	19	2	15	2	8	30	19	
30-39	1	20	0	0	0	0	0	0	5	21	1	3	2	8	2	13	1	8	1	4	13	8	
40-49	0	0	1	14	0	0	2	15	4	17	8	27	4	16	4	25	2	15	3	12	28	17	
50-59	1	20	2	29	0	0	1	8	4	17	7	23	3	12	3	19	1	8	2	8	24	15	
60-69	0	0	0	0	0	0	1	8	2	8	1	3	3	12	0	0	3	23	4	16	14	9	
70-79	0	0	0	0	0	0	0	0	0	0	3	10	3	12	0	0	1	8	2	8	9	6	
80-89	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	8	0	0	1	1	
No data	1	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Total	5		7		4		13		24		30		25		16		13		25		162		
Mean	27.25		34.43		20.50		25.23		36.83		41.87		39.36		32.50		46.38		35.72		36.65		
SD	21.06		17.12		4.43		18.71		15.71		18.92		22.26		15.57		24.78		22.45		20.18		
Median	28.00		25.00		21.00		17.00		37.00		46.00		40.00		31.50		48.00		23.00		37.00		
Minimum	2		16		15		5		8		4		<1*		8		3		3		<1*		
Maximum	21		57		25		60		66		79		77		55		81**		77		81**		

* The youngest tissue donor was 37-days-old donated heart valves in 2003; the youngest organ donor was 2.5-years-old donated kidneys and eyes in 2005.

** The oldest tissue donor was 81-years-old donated eyes in 2005; the oldest organ donor was 65-years-old donated kidneys in 2001.

Figure 8.2: Distribution of Donors by Age, 1997-2006

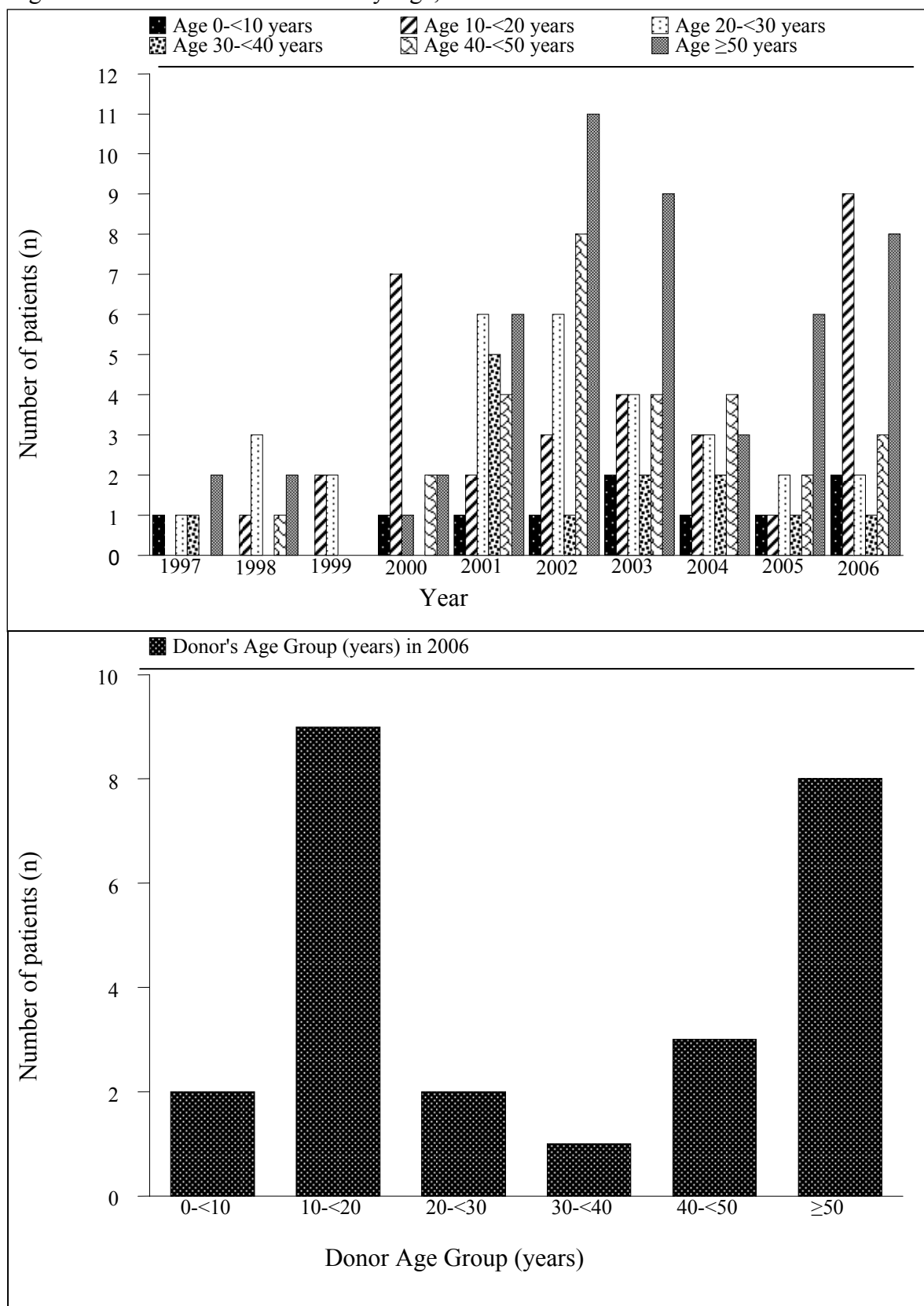


Table 8.3: Distribution of Donors by Gender, 1997-2006

Donor's gender	1997 N=5		1998 N=7		1999 N=4		2000 N=13		2001 N=24	
	No.	%	No.	%	No.	%	No.	%	No.	%
Male	3	60	7	100	3	75	11	85	20	83
Female	2	40	0	0	1	25	2	15	4	17

Donor's gender	2002 N=30		2003 N=25		2004 N=16		2005 N=13		2006 N=25		Total N=162	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Male	27	90	21	84	12	75	8	62	19	76	131	81
Female	3	10	4	16	4	25	5	38	6	24	31	19

Figure 8.3: Distribution of Donors by Gender, 1997-2006

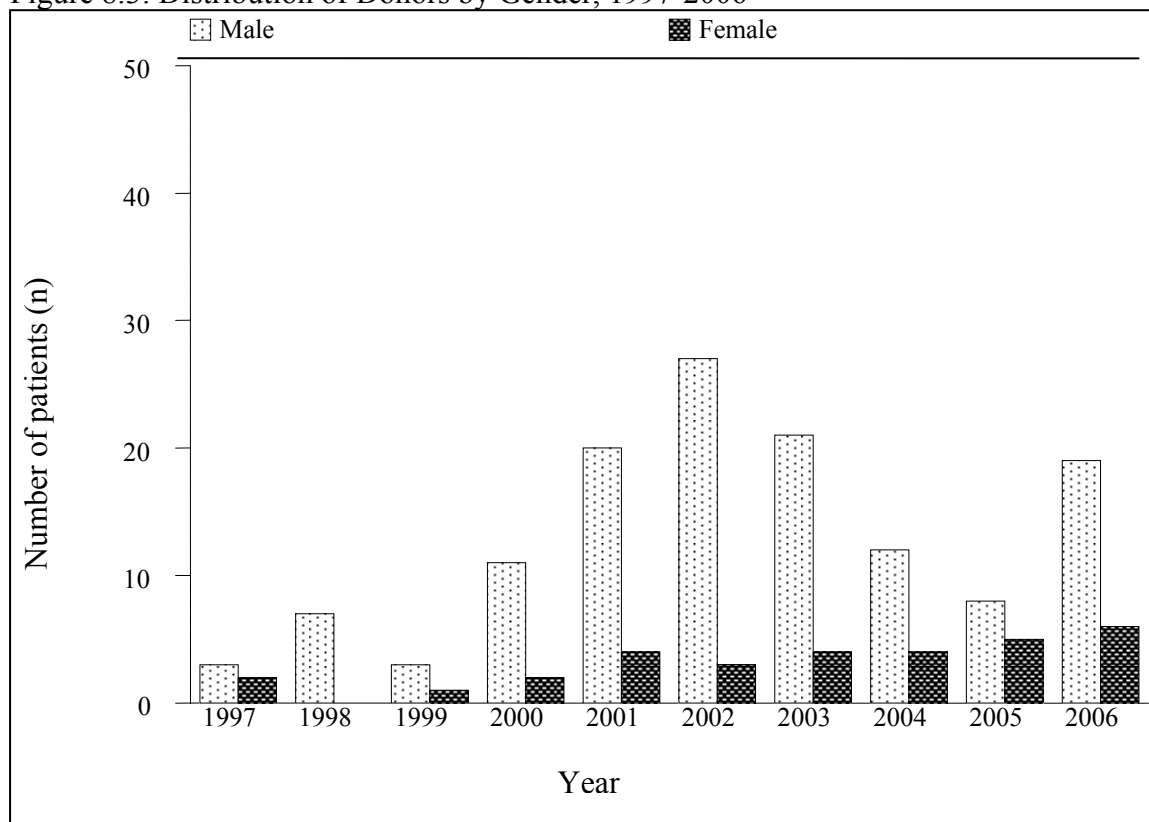


Table 8.4: Distribution of Donors by Ethnic Group, 1997-2006

Donor's ethnic group	1997 N=5		1998 N=7		1999 N=4		2000 N=13		2001 N=24	
	No.	%	No.	%	No.	%	No.	%	No.	%
Malay	1	20	0	0	0	0	2	15	1	4
Chinese	3	60	4	57	4	100	7	54	17	71
Indian	1	20	3	43	0	0	3	23	4	17
Others	0	0	0	0	0	0	1	8	2	8

Donor's ethnic group	2002 N=30		2003 N=25		2004 N=16		2005 N=13		2006 N=25		Total N=162	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Malay	0	0	0	0	1	6	1	8	1	4	7	4
Chinese	13	43	14	56	14	88	5	38	12	48	93	57
Indian	15	50	9	36	1	6	7	54	11	44	54	33
Others	2	7	2	8	0	0	0	0	1	4	8	5

Figure 8.4: Distribution of Donors by Ethnic Group, 1997-2006

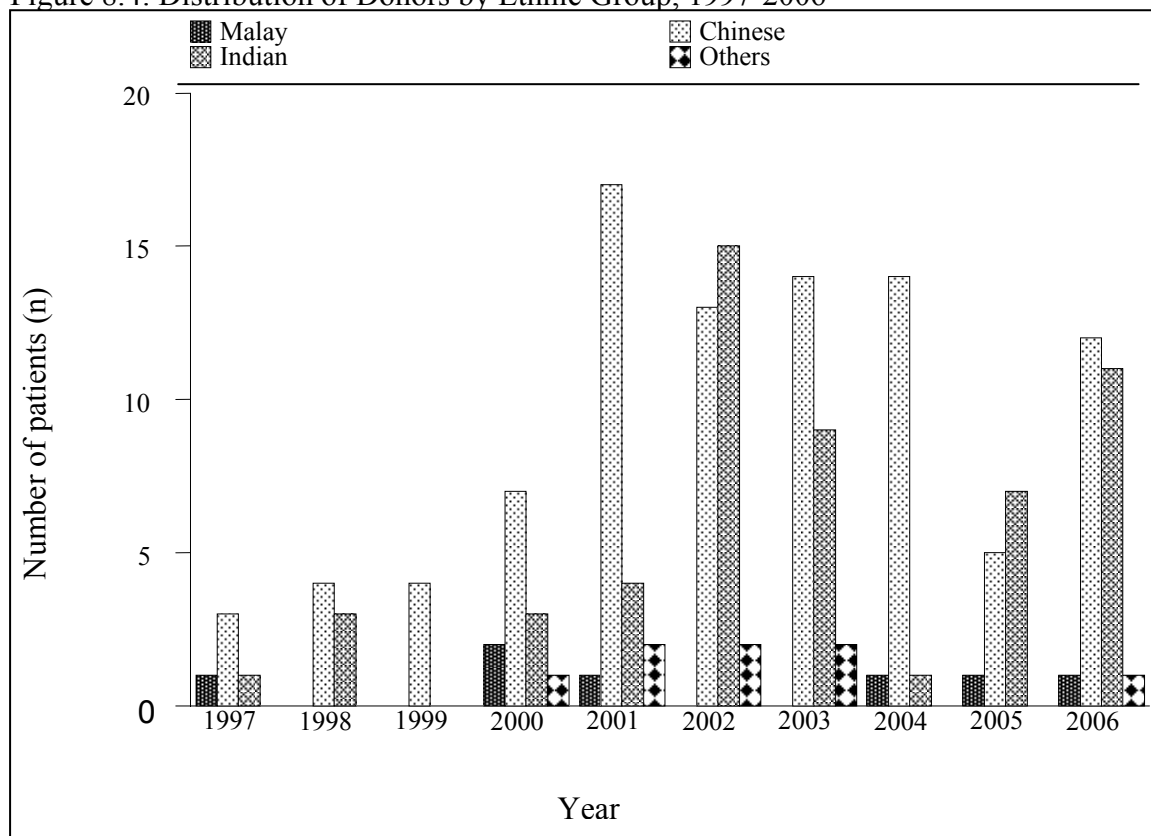


Table 8.5: Distribution of Donors by Religion, 1997-2006

Donor's religion	1997 N=5		1998 N=7		1999 N=4		2000 N=13		2001 N=24	
	No.	%	No.	%	No.	%	No.	%	No.	%
Islam	1	20	0	0	0	0	2	15	1	4
Buddhism	3	60	3	43	0	0	0	0	1	4
Hinduism	1	20	3	43	0	0	3	23	3	13
Christianity	0	0	0	0	0	0	1	8	0	0
Others	0	0	0	0	0	0	0	0	0	0
Unknown	0	0	1	14	4	100	7	54	19	79

Donor's religion	2002 N=30		2003 N=25		2004 N=16		2005 N=13		2006 N=25		Total N=162	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Islam	0	0	1	4	2	13	1	8	2	8	10	6
Buddhism	5	17	15	60	14	88	5	38	12	48	58	36
Hinduism	13	43	8	32	0	0	5	38	10	40	46	28
Christianity	1	3	1	4	0	0	0	0	0	0	3	2
Others	0	0	0	0	0	0	2	15	0	0	2	1
Unknown	11	37	0	0	0	0	0	0	1	4	43	27

Figure 8.5: Distribution of Donors by Religion, 1997-2006

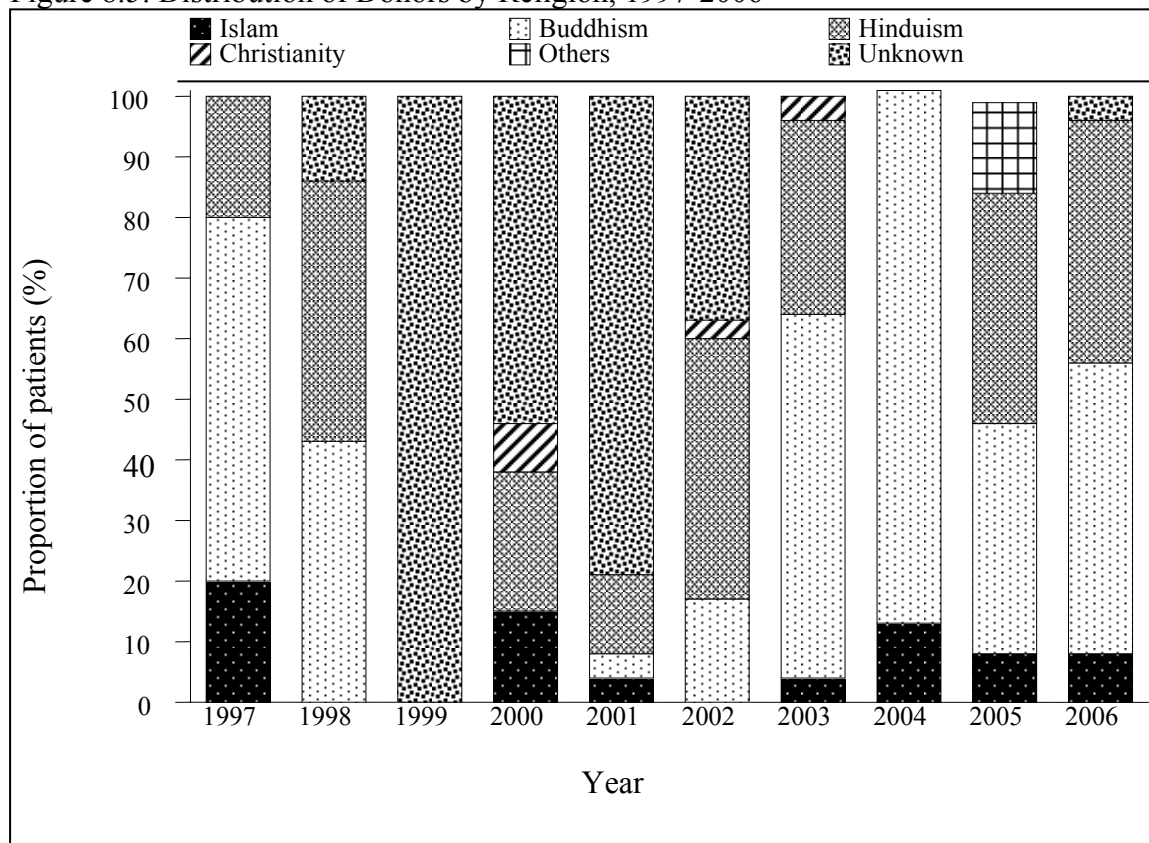


Table 8.6: Distribution of Donors by Nationality, 1997-2006

Donor's nationality	1997 N=5		1998 N=7		1999 N=4		2000 N=13		2001 N=24	
	No.	%	No.	%	No.	%	No.	%	No.	%
Malaysian	5	100	7	100	4	100	13	100	21	88
Non-Malaysian	0	0	0	0	0	0	0	0	3	13

Donor's nationality	2002 N=30		2003 N=25		2004 N=16		2005 N=13		2006 N=25		Total N=162	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Malaysian	29	97	24	96	16	100	13	100	24	96	156	96
Non-Malaysian	1	3	1	4	0	0	0	0	1	4	6	4

Figure 8.6: Distribution of Donors by Nationality, 1997-2006

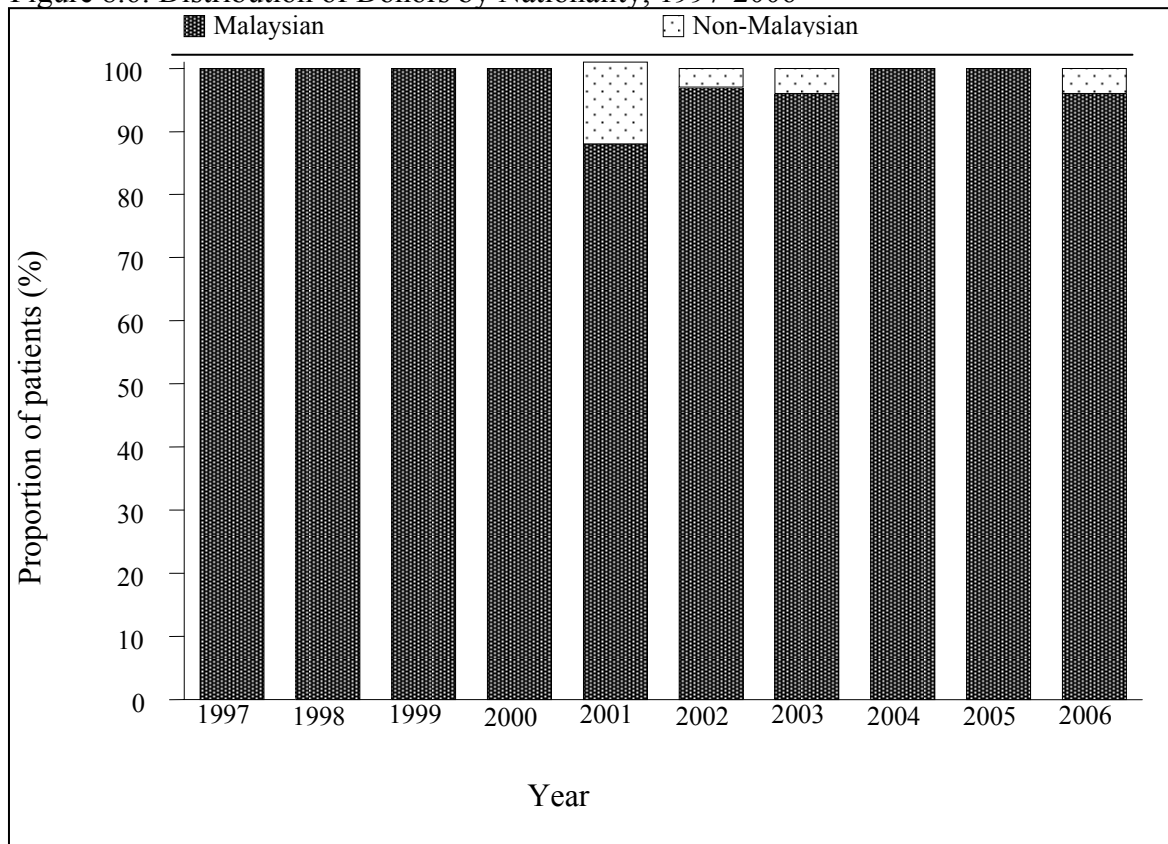


Table 8.7: Distribution of Donors by State of Residence, 1997-2006

Donor's state of residence*	1997 N=5		1998 N=7		1999 N=4		2000 N=13		2001 N=24		2002 N=30		2003 N=25		2004 N=16		2005 N=13		2006 N=25		Total N=162	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Johor	0	0	0	0	0	0	3	23	0	0	2	7	3	12	1	6	1	8	1	4	11	7
Malacca	0	0	1	14	1	25	0	0	0	0	1	3	2	8	0	0	1	8	2	8	8	5
Negeri Sembilan	0	0	1	14	0	0	1	8	0	0	1	3	4	16	0	0	1	8	2	8	10	6
Selangor	2	40	1	14	0	0	0	0	3	13	9	30	6	24	6	38	7	54	2	8	36	22
WP Kuala Lumpur	1	20	1	14	2	50	0	0	0	0	5	17	2	8	3	19	2	15	6	24	22	14
WP Putrajaya	0	0	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	1	1
Perak	1	20	2	29	1	25	3	23	0	0	4	13	0	0	2	13	1	8	4	16	18	11
Kedah	0	0	0	0	0	0	2	15	3	13	1	3	0	0	1	6	0	0	1	4	8	5
Perlis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulau Pinang	0	0	0	0	0	0	1	8	3	13	1	3	3	12	2	13	0	0	4	16	14	9
Pahang	0	0	1	14	0	0	0	0	3	13	2	7	2	8	0	0	0	0	1	4	9	6
Terengganu	0	0	0	0	0	0	0	0	1	4	0	0	0	0	0	0	0	0	0	0	1	1
Kelantan	0	0	0	0	0	0	1	8	0	0	0	0	0	0	0	0	0	0	1	4	2	1
Sabah	0	0	0	0	0	0	2	15	1	4	0	0	1	4	1	7	0	0	0	0	5	3
Sarawak	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Others**	0	0	0	0	0	0	0	0	0	0	0	0	1	4	0	0	0	0	1	4	2	1
Unknown	1	20	0	0	0	0	0	0	10	42	3	10	1	4	0	0	0	0	0	0	15	9

*State of residence according to home address

** Others constitute donors who were foreigners, one from Yangon, Myanmar (2003) and another from Taiwan (2006)

Table 8.8: Donor's Pledged Status, 1997-2006

Donor's pledged status	1997 N=5		1998 N=7		1999 N=4		2000 N=13		2001 N=24	
	No.	%	No.	%	No.	%	No.	%	No.	%
Pledged donors	0	0	0	0	0	0	0	0	0	0
Non-pledged donors	5	100	7	100	4	100	13	100	24	100

Donor's pledged status	2002 N=30		2003 N=25		2004 N=16		2005 N=13		2006 N=25		Total N=162	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Pledged donors	5	17	6	24	2	13	3	23	1	4	17	10
Non-pledged donors	25	83	19	76	14	88	10	77	24	96	145	90

Figure 8.8: Donor's Pledged Status, 1997-2006

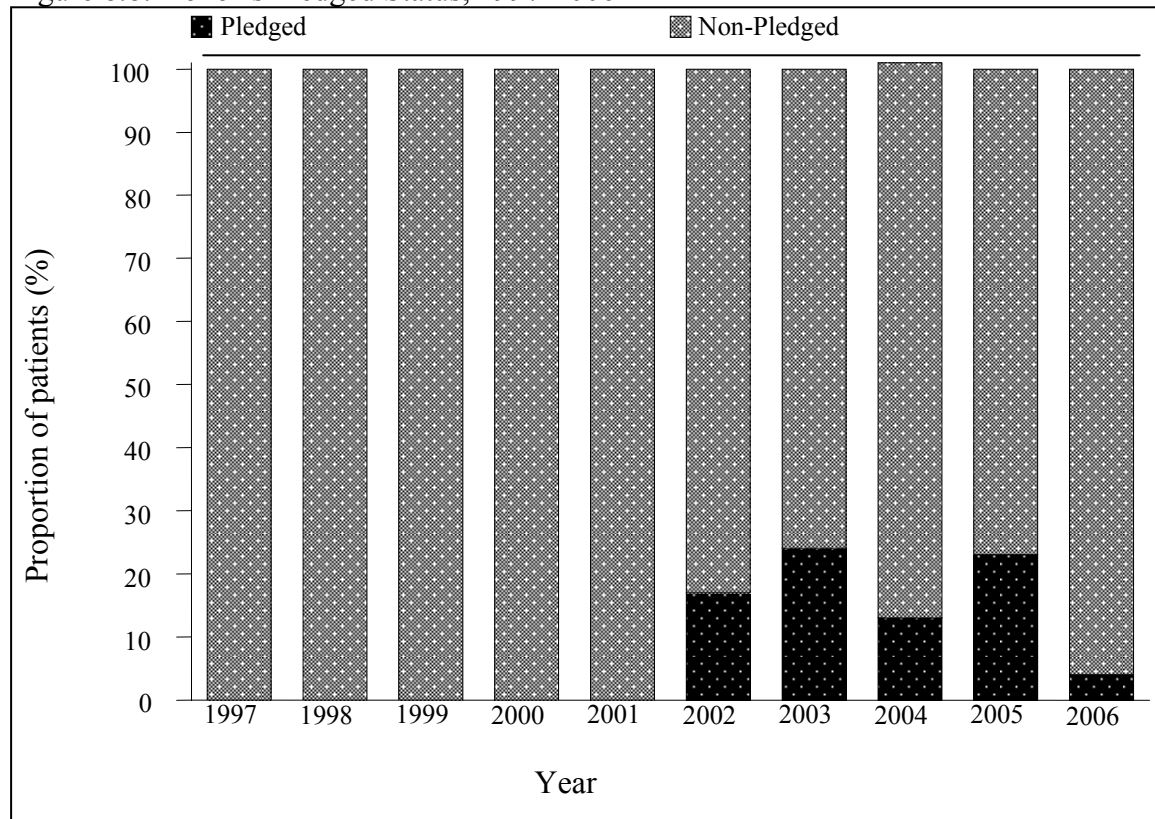


Table 8.9: Distribution of Donors by Type, 1997-2006

Type of donors	1997 N=5		1998 N=7		1999 N=4		2000 N=13		2001 N=24	
	No.	%	No.	%	No.	%	No.	%	No.	%
BD (Brain Death)	4	80	6	86	4	100	11	85	20	83
DCD (Donations after Cardiac Death) *	1	20	1	14	0	0	2	15	4	17

Type of donors	2002 N=30		2003 N=25		2004 N=16		2005 N=13		2006 N=25		Total N=162	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
BD (Brain Death)	17	57	8	32	10	63	5	38	14	56	99	61
DCD (Donations after Cardiac Death) *	13	43	17	68	6	38	8	62	11	44	63	39

*DCD involve tissue donation only

Figure 8.9: Distribution of Donors by Type, 1997-2006

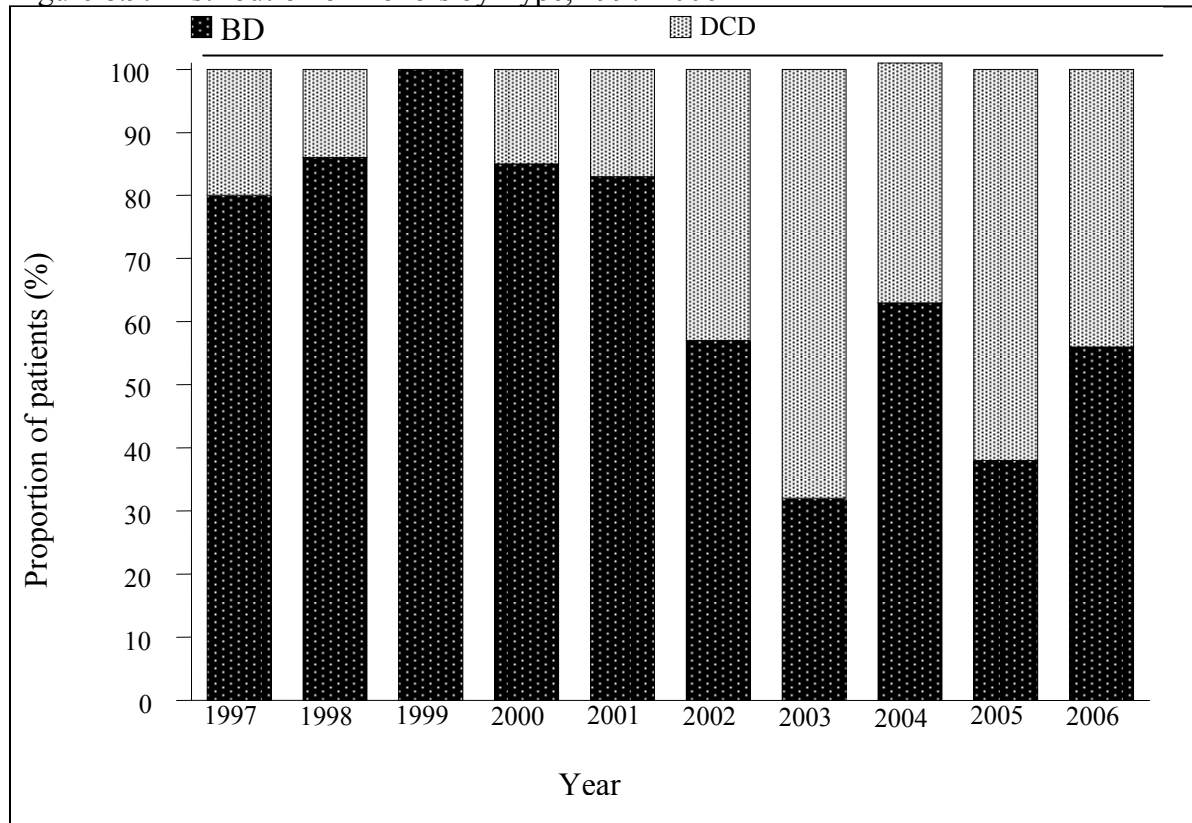


Table 8.10: Distribution of Donors by Cause of Death, 1997-2006

Causes of death	1997 N=5				1998 N=7				1999 N=4				2000 N=13				2001 N=24			
	Brain dead donors N=4		Cardiac death tissue donors N=1		Brain dead donors N=6		Cardiac death tissue donors N=1		Brain dead donors N=4		Cardiac death tissue donors N=0		Brain dead donors N=11		Cardiac death tissue donors N=2		Brain dead donors N=20		Cardiac death tissue donors N=4	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Injury from MVA	1	25	0	0	5	83	0	0	3	75	0	0	0	0	2	100	11	55	0	0
Injury from fall	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	0	0
Injury from assault	0	0	0	0	1	17	0	0	0	0	0	0	0	0	0	0	1	5	0	0
Injury from industrial accident	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spontaneous hypertensive intracranial bleed	2	50	0	0	0	0	0	0	0	0	0	0	0	2	18	0	3	15	1	25
Spontaneous AVM/Aneurysm intracranial bleed	0	0	0	0	0	0	0	0	0	0	0	0	0	1	9	0	1	5	0	0
Brain anoxia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brain tumour	1	25	0	0	0	0	0	0	0	0	0	0	0	1	9	0	0	0	0	0
Thrombo embolic brain infarct	0	0	0	0	0	0	1	100	0	0	0	0	0	1	9	0	0	0	1	25
Cardiac disease	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drowning	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Others	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	1	25
Unknown	0	0	1	100	0	0	0	0	1	25	0	0	1	9	0	0	2	10	1	25

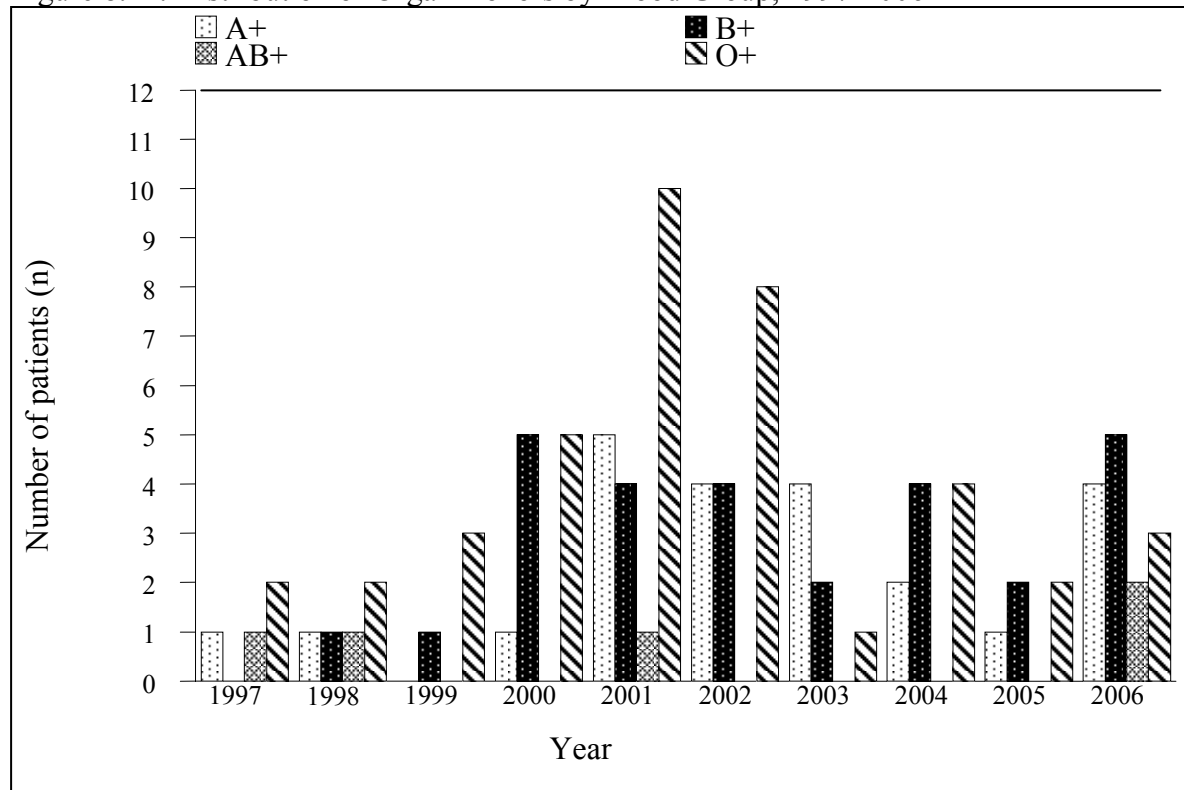
Causes of death	2002 N=30		2003 N=25		2004 N=16		2005 N=13		2006 N=25		Total N=162													
	Brain dead donors N=17	Cardiac death tissue donors N=13	Brain dead donors N=8	Cardiac death tissue donors N=17	Brain dead donors N=10	Cardiac death tissue donors N=6	Brain dead donors N=5	Cardiac death tissue donors N=8	Brain dead donors N=14	Cardiac death tissue donors N=11	Brain dead donors N=99	Cardiac death tissue donors N=63												
													No.	%	No.	%	No.	%	No.	%	No.	%		
Injury from MVA	10	59	7	54	6	75	3	18	2	20	3	50	1	20	2	25	7	50	1	9	51	52	18	29
Injury from fall	0	0	0	0	1	13	0	0	2	20	0	0	0	0	0	0	0	1	7	1	7	5	1	2
Injury from assault	0	0	0	0	0	0	0	0	1	10	1	17	1	20	0	0	0	1	7	1	7	5	2	3
Injury from industrial accident	1	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
Spontaneous hypertensive intracranial bleed	1	6	0	0	0	0	1	6	1	10	2	33	1	20	0	0	0	1	7	0	11	4	6	
Spontaneous AVM/Aneurysm intracranial bleed	2	12	0	0	0	0	1	6	3	30	0	0	0	0	0	0	0	0	0	0	7	1	2	
Brain anoxia	1	6	0	0	0	0	1	6	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	
Brain tumour	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	14	0	4	4	0	0
Thrombo embolic brain infarct	1	6	0	0	1	13	0	0	0	0	0	0	1	20	0	0	0	0	0	2	4	4	4	6
Cardiac disease	0	0	5	38	0	0	7	41	1	10	0	0	1	20	3	38	2	14	5	45	4	4	20	32
Drowning	0	0	0	0	0	0	1	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Others	0	0	1	8	0	0	3	18	0	0	0	0	0	0	3	38	0	0	0	0	1	1	8	13
Unknown	1	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	9	5	5	3	5

Table 8.11: Distribution of Organ Donors by Blood Group, 1997-2006

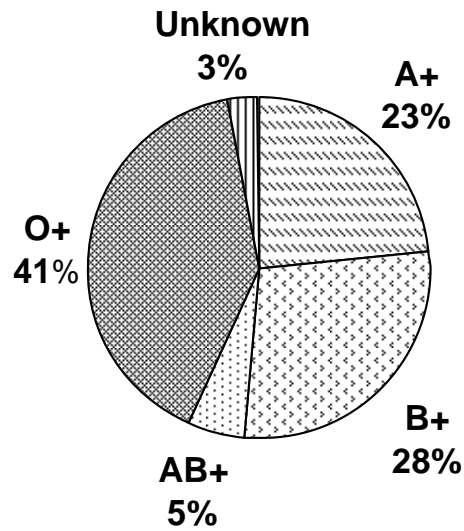
Blood group	No. (%)										
	1997 N=4	1998 N=6	1999 N=4	2000 N=11	2001 N=20	2002 N=17	2003 N=8	2004 N=10	2005 N=5	2006 N=14	Total N=99
A positive	1(25)	1(17)	0(0)	1(9)	5(25)	4(24)	4(50)	2(20)	1(20)	4(29)	23(23)
B positive	0(0)	1(17)	1(25)	5(45)	4(20)	4(24)	2(25)	4(40)	2(40)	5(36)	28(28)
AB positive	1(25)	1(17)	0(0)	0(0)	1(5)	0(0)	0(0)	0(0)	0(0)	2(14)	5(5)
O positive	2(50)	2(33)	3(75)	5(45)	10(50)	8(47)	1(13)	4(40)	2(40)	3(21)	40(41)
Unknown	0(0)	1(17)	0(0)	0(0)	0(0)	1(6)	1(13)	0(0)	0(0)	0(0)	3(3)

Blood group is only ascertained in brain dead donors and is not done for tissue donors post - cardiac deaths

Figure 8.11: Distribution of Organ Donors by Blood Group, 1997-2006



Distribution of Organ Donors by Blood Group 1997-2006



Distribution of Organ Donors by Blood Group 2006

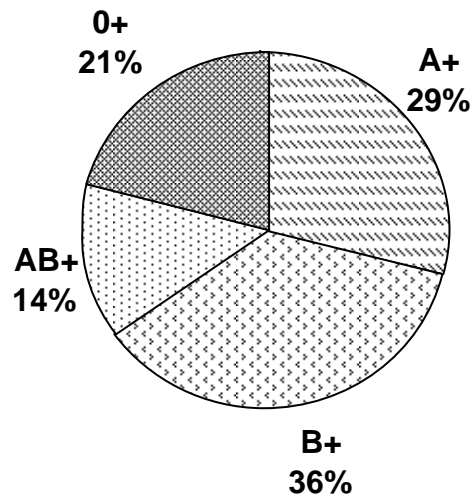


Table 8.12a: Distribution of Donors by Institution of Origin, 1997-2006

Donors' Institution of Origin	1997 N=5		1998 N=7		1999 N=4		2000 N=13		2001 N=24	
	No.	%	No.	%	No.	%	No.	%	No.	%
MOH state/general hospitals	2	40	5	71	1	25	10	77	16	67
MOH district hospitals	0	0	0	0	0	0	2	15	0	0
University hospitals	1	20	1	14	0	0	0	0	6	25
Private hospitals	1	20	1	14	3	75	1	8	2	8
Home	1	20	0	0	0	0	0	0	0	0

Donors' Institution of Origin	2002 N=30		2003 N=25		2004 N=16		2005 N=13		2006 N=25		Total N=162	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
MOH state/general hospitals	19	63	15	60	12	75	7	54	17	68	105	65
MOH district hospitals	2	7	4	16	2	13	0	0	1	4	10	6
University hospitals	4	13	3	12	1	6	1	8	3	12	20	12
Private hospitals	4	13	3	12	1	6	5	38	4	16	25	15
Home	1	3	0	0	0	0	0	0	0	0	2	1

Figure 8.12a: Distribution of Donors by Institution of Origin, 1997-2006

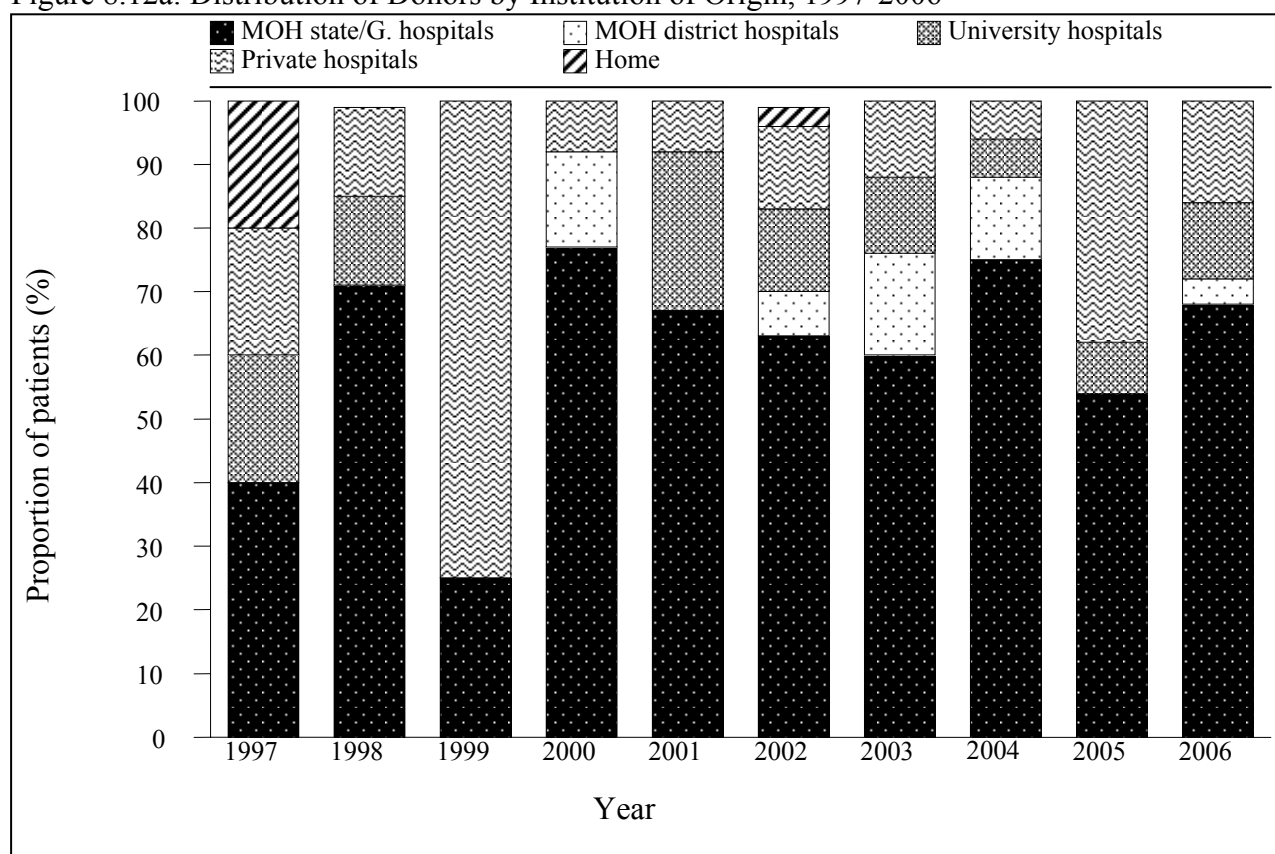


Table 8.12b: Distribution of Donors by Referral Site, 1997-2006

Donor Referral Site	1997 N=5		1998 N=7		1999 N=4		2000 N=13		2001 N=24	
	No.	%	No.	%	No.	%	No.	%	No.	%
ICU	1	20	0	0	0	0	1	8	14	58
Ward	0	0	0	0	0	0	0	0	0	0
Emergency department	0	0	0	0	0	0	0	0	3	13
Mortuary	0	0	0	0	0	0	0	0	0	0
Home	0	0	0	0	0	0	0	0	0	0
Data not available	4	80	7	100	4	100	12	92	7	29

Donor Referral Site	2002 N=30		2003 N=25		2004 N=16		2005 N=13		2006 N=25		Total N=162	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
ICU	16	53	13	52	12	75	8	62	16	64	81	50
Ward	1	3	3	12	1	6	3	23	3	12	11	7
Emergency department	4	13	1	4	0	0	0	0	3	12	11	7
Mortuary	3	10	6	24	3	19	1	8	3	12	16	10
Home	1	3	0	0	0	0	0	0	0	0	1	1
Data not available	5	17	2	8	0	0	1	8	0	0	42	26

Figure 8.12b: Distribution of Donors by Referral Site, 1997-2006

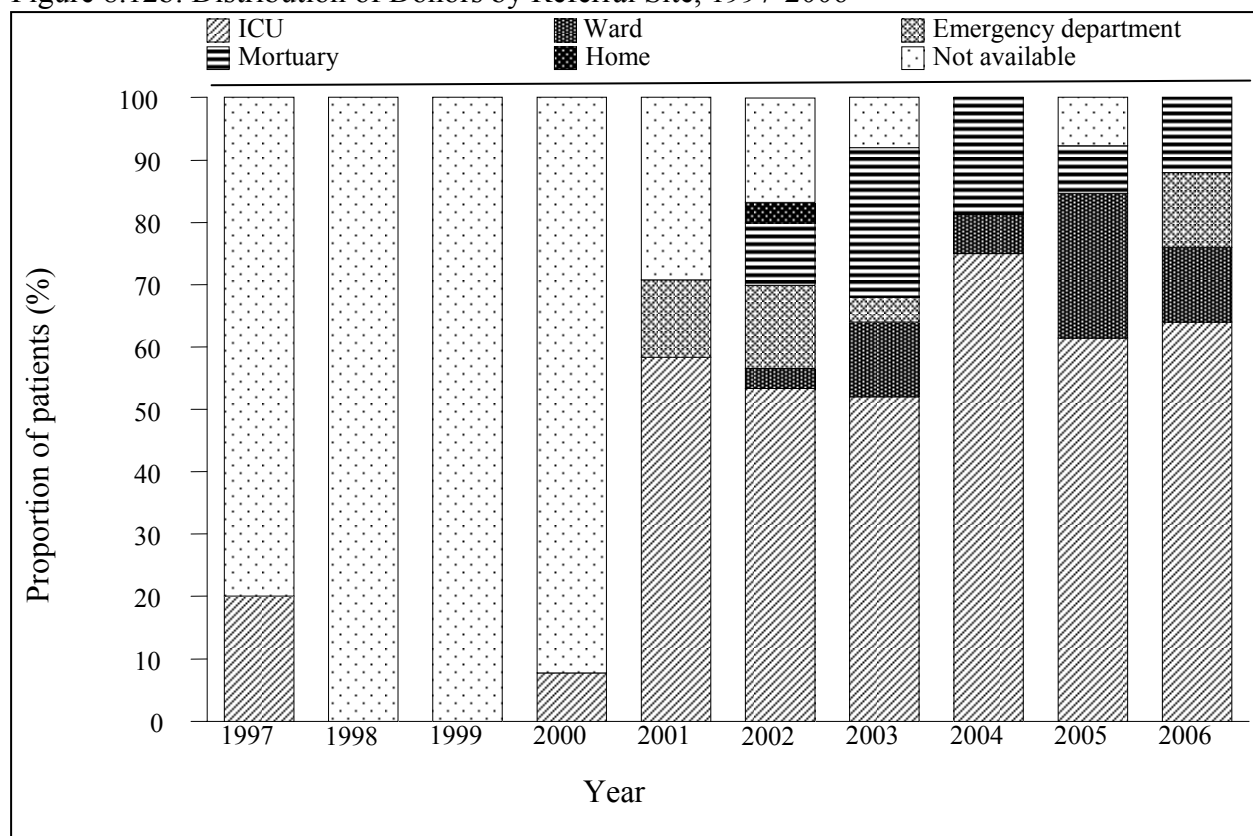
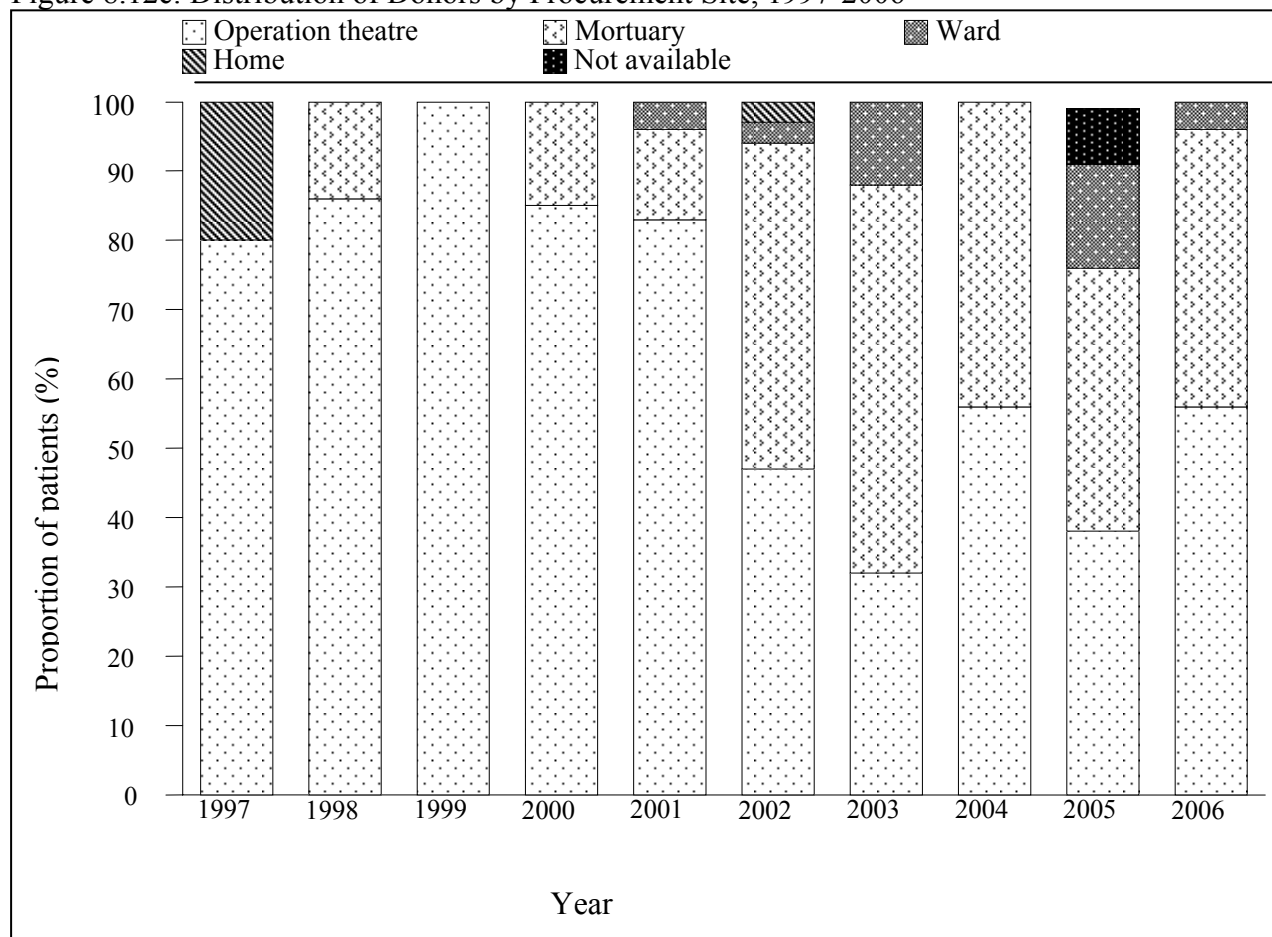


Table 8.12c: Distribution of Donors by Procurement Site, 1997-2006

Donor Procurement Site	1997 N=5		1998 N=7		1999 N=4		2000 N=13		2001 N=24	
	No.	%	No.	%	No.	%	No.	%	No.	%
Operation theatre	4	80	6	86	4	100	11	85	20	83
Mortuary	0	0	1	14	0	0	2	15	3	13
Ward	0	0	0	0	0	0	0	0	1	4
Home	1	20	0	0	0	0	0	0	0	0
Data not available	0	0	0	0	0	0	0	0	0	0

Donor Procurement Site	2002 N=30		2003 N=25		2004 N=16		2005 N=13		2006 N=25		Total N=162	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Operation theatre	14	47	8	32	9	56	5	38	14	56	95	69
Mortuary	14	47	14	56	7	44	5	38	10	40	56	35
Ward	1	3	3	12	0	0	2	15	1	4	8	5
Home	1	3	0	0	0	0	0	0	0	0	2	1
Data not available	0	0	0	0	0	0	1	8	0	0	1	1

Figure 8.12c: Distribution of Donors by Procurement Site, 1997-2006



APPENDIX A

DATA MANAGEMENT

The NTR maintains different databases for each of the organs i.e. blood and marrow transplant, bone and tissue transplant, cornea transplant, heart and lung transplant, kidney transplant and liver transplant. Depending on the volume of data, each organ's data were stored in either Microsoft Access or SQL Server 2000.

Registry ICT infrastructure and data centre

The operations of the NTR-BMT and NTR-HLT are supported by an extensive ICT infrastructure to ensure operational efficiency and effectiveness.

NTR subscribes to co-location service with a high availability and highly secured data centre at Cyberjaya. This is in order to provide NTR with quality assured internet hosting services and state-of-the-art physical and logical security features without having to invest in costly data centre setup internally. State-of-the-art physical security features implemented includes anti-static raised flooring, fire protection with smoke and heat alarm warning system, biometric security access, video camera surveillance system, uninterrupted power supply, environmental control.

Other managed security services include patch management of the servers, antivirus signature monitoring and update, firewall traffic monitoring and intrusion detection, security incidence response, data backup service done on a daily, weekly and monthly basis, data recovery simulation to verify that backup works which is done at least once yearly, network security scan and penetration test done on a half-yearly basis, security policy maintenance, maintenance and monitoring of audit trail. Managed system services are also provided such as usage and performance report, operating system maintenance and monitoring, bandwidth monitoring and systems health monitoring.

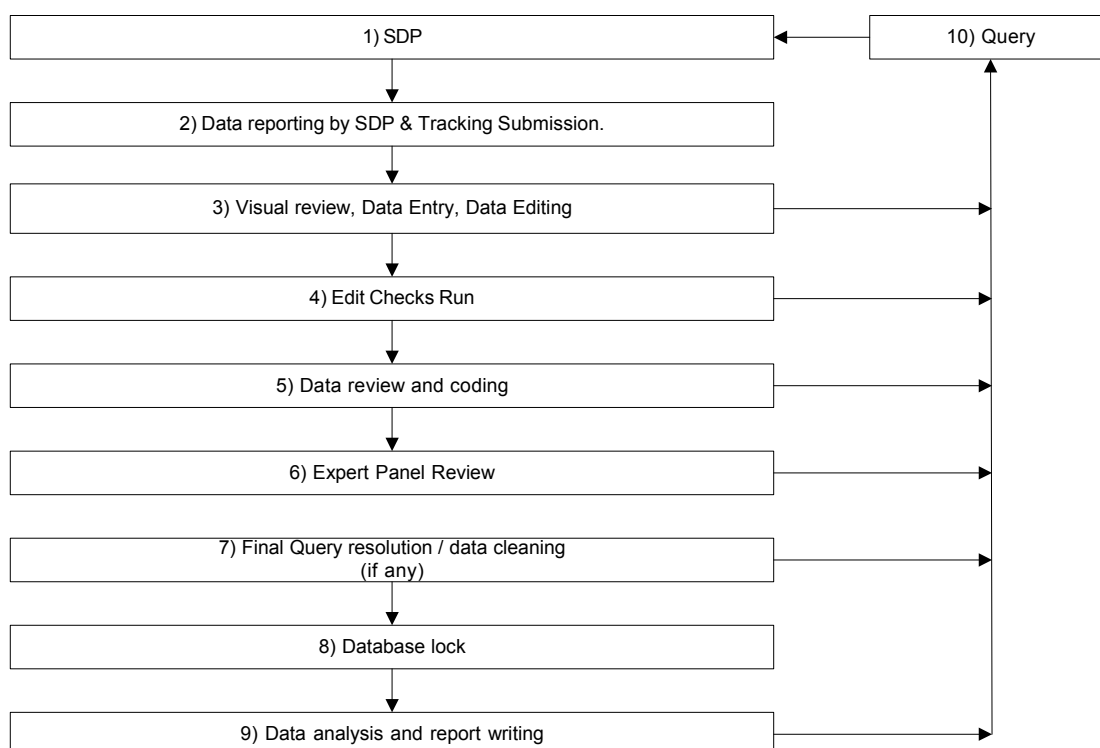
Data sources

SDPs or Source Data Providers of the National Transplant Registry comprise of centres for various transplanted organs throughout Malaysia. Bone and tissue transplant, cornea transplant, kidney transplant and liver transplant SDPs submit Case Report Forms (CRFs) to NTR. Blood and marrow transplant (BMT) and heart and lung transplant (HLT) SDPs submit data via web applications NTR-BMT and NTR-HLT respectively.

For the purpose of verifying patient's outcome regarding death and lost to follow-up, NTR uses data from the National Vital Registration System.

Data Flow Process

This section describes the data management flow process of the National Transplant Registry.



SDP Data reporting and Submission tracking

Data reporting by SDP is done via Case Report Forms or Web Applications e-Case Report Forms. Different types of forms are used for different organs/tissues.

For blood and marrow transplant, NTR collects data via Blood and Marrow Transplant Notification Form and Blood and Marrow Ad Hoc Event Notification Form through web application NTR-BMT. Data collected from NTR-BMT is synchronised daily to a master database in CRC to track data submission and generate queries to site. All retrospective data was mapped and transferred to the current system.

For bone and tissue transplant, NTR collects data via Bone and Tissue Transplant Notification Form.

For cornea transplant, NTR collects data via Cornea Transplant Notification Form and Cornea Transplant Outcome Form.

For heart and lung transplant, NTR collects data via Malaysian Heart and Lung Transplant Notification Form and Malaysian Heart and Lung Transplant Follow-Up Form through web application NTR-HLT. Data collected from NTR-HLT is synchronised daily to a master database in NTR to track data submission and generate queries to site.

For kidney transplant, NTR collects data via Renal Transplant Notification Form and Renal Transplant Outcome Form. For annual survey purposes, NTR also collects data

via Renal Transplant Annual Return Form and Renal Transplant Annual Quality of Life and Rehabilitation Assessment Form. To further ensure timeliness of notification, any patient who has been notified to National Renal Registry as transplanted will be automatically flagged to NTR. Similarly, NTR also automatically flags to NRR if there's a patient with graft failure.

For liver transplant, NTR collects data via Liver Transplant Notification Form.

Data submissions by SDPs of Bone and Tissue, Cornea, Kidney and Liver Transplant were tracked by NTR Computer System collectively.

There are a few in-built functionalities at the data entry page that serve to improve data quality. One such function is auto calculation functionality to reduce error of human calculation. There is also inconsistency check functionality that disables certain fields if they are answered in a certain manner. When value entered is out of range, user is prompted for correct value.

Real time reports are also provided in the web application. The aggregated data reports are presented in the form of tables and graphs. The aggregated data reports are typically presented in two manners, one as centre's own data aggregated data report and second as registry's overall aggregated data report. Each participating site submitting data via the web application is therefore able to compare itself against the overall registry's average.

Visual Review, Data Entry, Data Editing

Data received by the NTR was logged in and manually reviewed to check for completeness and obvious errors or problems. Data without obvious problems was entered into the relevant NTR's organ transplant system. Data with problems was sent to SDP as queries. As data for kidney transplant is inter-related with National Renal Registry's patient data, an additional verification process is performed to ensure no duplicate patient and renal replacement therapy is reported.

Edit Check Run

Edit checks were performed periodically to identify missing data, out of range values, inconsistent data, invalid values and error with duplication. Data cleaning is then performed based on the results of edit checks. Data discrepancies that were resolved were then entered into the system. Data update and data checking of the dataset is performed when there is a query of certain fields when necessary. Data standardisation process is also done for missing data based on derivation from existing data.

Data Review and Coding

Data coding of retrospective data and free text data was performed by registry manager and further verified by expert panel member. The expert panel comprising of members with expertise and knowledge in the relevant area provided the quality control on the assessment of coding by data manager. They ensure that complex medical data are reviewed and assessed to detect clinical nuances in the data.

Final Query Resolution / Data Cleaning / Database Lock

A final edit check run was performed to ensure that data is clean. All queries were resolved before the database is locked to ensure data quality and integrity. Data is subsequently exported to the statistician for analysis.

Data Release Policy

One of the primary objectives of the Registry is to make data available to the transplant community. The Registry would appreciate that users acknowledge the Registry for the use of the data. Any request for data that requires a computer run must be made in writing (by e-mail, fax, or registered mail) accompanied with a Data Release Application Form and signed Data Release Agreement Form. These requests need prior approval by the Advisory Board before data can be released.

Distribution of Report

The MST has made a grant towards the cost of running the registry and report printing to allow distribution to all members of the association and the source data producers. The report will also be distributed to Health Authorities and international registries.

Further copies of the report can be made available with a donation of RM60.00 to offset the cost of printing.

APPENDIX B

STATISTICAL METHODS FOR NTR

The statistical methods described were used to summarise the data collected from the National Transplant Registry (NTR). These analyses were generated for different types of transplant, such as bone and marrow, bone and tissue, cornea, heart and lung, liver and kidney.

1. Overall

The stock and flow tables summarised transplant activity in Malaysia. Places and centres of transplant activities were also reported. Treatment rate was calculated by the ratio of the count of number of new patients or prevalent patients in a given year to the mid-year population of Malaysia in that year, and expressed in per million-population. Annual death rates are calculated by dividing the number of deaths in a year by the estimated mid-year patient population.

2. Recipient's Characteristics

The information on recipient's characteristics was summarised in this section. These tables included the recipient's age, gender, ethnic group, serology data, primary disease(s), indication for transplantation, current immunosuppressive drug(s) treatment, etc. For summarising continuous data, the mean, standard deviation, median, minimum and maximum were reported. On the other hand, both the count and percentages were reported for discrete data. Invariably, there are situations where there is missing data. For purposes of analysis, subjects with missing continuous data had their values imputed by using the mean from measures of other records. For discrete data, analysis was confined to available data and no imputation was done.

3. Transplant Activity

These tables provided the information on transplant activity, such as the time of transplant, type of transplant, duration of surgery etc.

4. Outcome

The outcome of a transplant activity was tabulated in this section. Kaplan Meier method was used to estimate the probability of survival at different durations.

Time trend analysis was used to assess the association between time (e.g. year) and response variables (e.g. outcome). Statistical tests such as Spearman correlation test and chi-square test may be used to test whether or not the linear trend is statistically significant. Unfortunately, this was not performed as the registry is in its third year of operation. As more data is accrued to its database over time, time trend analysis will be of interest in future.

APPENDIX C

GLOSSARY

AIIRB	Angiotensin II Receptor Blocker
ACE	Angiotensin Converting Enzyme
ADPKD	Autosomal Dominant Polycystic Kidney Disease
AG	Antigen
ALL	Acute Lymphocytic Leukaemia
ALP	Alkaline Phosphatase
ALT	Alanine Transferase
AML	Acute Myelogenous Leukaemia
ASH	Ampang Puteri Specialist Hospital
AVM	Arterio-venous Malformation
BMI	Body Mass Index
BMT	Blood and Marrow Transplantation
BP	Blood Pressure
BD	Brain Death
CF	Counting Fingers
CKD	Chronic Kidney Disease
CMV	Cytomegalovirus
CRC	Clinical Research Centre
CRF	Case Report Form
DCD	Donations after Cardiac Death
DF	Deep Frozen
ESRF	End Stage Renal Failure
FD	Freeze Dried
FK506	Tacrolimus
GCT	Germ Cell Tumour
GFR	Glomerular Filtration Rate
GMC	Gleneagles Medical Centre
GS	Gentamicin and Streptomycin
GVHD	Graft Versus Host Disease
Hb	Haemoglobin
HbsAg	Hepatitis B surface Antigen
HCV	Hepatitis C Virus
HDL	High Density Lipoprotein
HKL	Hospital Kuala Lumpur
HLA	Human Leukocyte Antigen
HLT	Heart Lung Transplant
HM	Hand Movement
HUKM	Hospital Universiti Kebangsaan Malaysia
HUSM	Hospital Universiti Sains Malaysia
ICT	Information and Communication Technology
ICU	Intensive Care Unit
IHD	Ischaemic Heart Disease
IJN	Institut Jantung Negara (National Heart Institute)
IL2R	Interleukin 2 Receptor
IOL	Intraocular Lens

IPR	Institut Perubatan Respiratori
IT	Information Technology
JNC	Joint National Committee
KLA	HKL, Adult
KLP	HKL, Paediatric
LDL	Low Density Lipoprotein
LWE	Lam Wah Ee Hospital
MDS	Myelodysplastic Syndrome
MK	McCarey and Kaufman
mm	millimetres
MMA	Malaysian Medical Association
MMF	Mycophenolate Mofetil
MOH	Ministry of Health, Malaysia
MVA	Motor Vehicle Accident
NCEP	National Cholesterol Education Program
NET	Neuroectodermal Tumour
NPL	No Perception of Light
NRR	National Renal Registry
NTPU	National Transplant Procurement Unit
NTR	National Transplant Registry
PBSC	Peripheral Blood Stem Cells
PL	Perception of Light
pmp	per million population
RMS	Rhabdomyosarcoma
SD	Standard Deviation
SDP	Source Data Provider
SJA	SJMC, Adult
SJMC	Subang Jaya Medical Centre
SJP	SJMC, Paediatric
SQL	Structured Query Language
UK	United Kingdom
UKM	Universiti Kebangsaan Malaysia
UMA	UMMC, Adult
UMMC	University Malaya Medical Centre
UMP	UMMC, Paediatric
USM	Universiti Sains Malaysia
VA	Visual Acuity
VAD	Ventricular Assist Device
VOD	Veno-Occlusive Disease
WP	Wilayah Persekutuan (Federal Territory)

APPENDIX D

DIRECTORY OF PARTICIPATING CENTRES**Blood and Marrow Transplant Services****MOH**

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Institute Paediatrics
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Haematology Department
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Fax : (03)26155310

PRIVATE

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Fax : (03)42702938

Gleneagles Medical Centre, Penang
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10050 Pulau Pinang
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Fax : (04)2262994

Lam Wah Ee Hospital
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Research Tissue Bank
Nuclear Agensi Malaysia
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Cornea Transplant Services

MOH

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Fax : (04)9767237

Hospital Kuala Lipis
Ophthalmology Department
27200 Kuala Lipis
Pahang Darul Makmur
Tel : (09)3123333 Ext : 114
Fax : (09)312 1787

Hospital Kuala Lumpur
Ophthalmology Department
Jalan Pahang
50586 Kuala Lumpur
Wilayah Persekutuan
Tel : (03)26155555 Ext : 6801
Fax : (03)26925276

Hospital Kuala Pilah
Ophthalmology Department
72000 Kuala Pilah
Negeri Sembilan Darul Khusus
Tel : (06)4818001 Ext : 170 / 175
Fax : (06)4818010

Hospital Melaka
Ophthalmology Department
Jalan Mufti Haji Khalil
75400 Melaka
Melaka
Tel : (06)2707215
Fax : (06)2818488

Hospital Mentakab
Ophthalmology Department
Jalan Maran
28900 Temerloh
Pahang Darul Makmur
Tel : (09)2955333 Ext : 1570
Fax : (09)2972468

Cornea Transplant Services**MOH**

Hospital Miri
Ophthalmology Department
Jalan Cahaya
98000 Miri
Sarawak
Tel : (085)420033 Ext : 148
Fax : (085)416514

Hospital Pakar Sultanah Fatimah
Ophthalmology Department
Jalan Salleh
84000 Muar
Johor Darul Takzim
Tel : (07)9521901 Ext : 147 / 227

Hospital Pulau Pinang
Eye Clinic
Jalan Resideni
10990 Georgetown
Pulau Pinang
Tel : (04)2002283
Fax : (04)2281737

Hospital Putrajaya
Ophthalmology Department
Pusat Pentadbiran Kerajaan
Persekutuan Presint 7
62250 Putra Jaya
Selangor Darul Ehsan
Tel : (03)83124200 Ext : 4231/4279
Fax : (03)88880137

Hospital Queen Elizabeth
Ophthalmology Department
88586 Kota Kinabalu
Sabah
Tel : (088)206153
Fax : (088)252827

Hospital Raja Perempuan Zainab II
Ophthalmology Department
Jalan Hospital
15586 Kota Bharu
Kelantan Darul Naim
Tel : (09)7485533 Ext : 2254
Fax : (09)7502236

Hospital Sandakan (Duchess of Kent)
Ophthalmology Department
KM 3.2 Jalan Utara
90000 Sandakan
Sabah
Tel : (089)212111
Fax : (089)213607

Hospital Selayang
Ophthalmology Department
Lebuhraya Selayang-Kepong
Batu Caves
68100 Bandar Baru Selayang
Selangor Darul Ehsan
Tel : (03)61367788 Ext : 4069/3254
Fax : (03)61207564

Hospital Sibul
Ophthalmology Department
Batu 5 1/2 Jalan Ulu Oya
96000 Sibul
Sarawak
Tel : (084)343333 Ext : 1008/1009
Fax : (084)337354

Hospital Sultan Ismail
Ophthalmology Department
Jalan Persiaran Mutiara Emas Utama
81100 Johor Bahru
Johor Darul Takzim
Tel : (07)3565000
Fax : (07)3565034

Cornea Transplant Services

MOH

Hospital Sultanah Aminah
Ophthalmology Department
80100 Johor Bahru
Johor Darul Takzim
Tel : (07)2231666 Ext : 2690
Fax : (07)2242694

Hospital Sultanah Nur Zahirah
Ophthalmology Department
Jalan Sultan Mahmud
20400 Kuala Terengganu
Terengganu Darul Iman
Tel : (09)6212121 Ext : 2727/2024
Fax : (09)6317871

Hospital Sungai Buloh
Ophthalmology, Hospital Sungai Buloh
Jalan Hospital
47000 Sungai Buloh
Selangor Darul Ehsan
Tel : (03)61561324
Fax : (03)61562470

Hospital Sungai Petani
Ophthalmology Department
08000 Sungai Petani
Kedah Darul Aman
Tel : (04)4213333 Ext : 127
Fax : (04)4212403

Hospital Taiping
Ophthalmology Department
Jalan Taming Sari
34000 Taiping
Perak Darul Ridzuan
Tel : (05)8083333 Ext : 8050/8053
Fax : (05)8073894

Hospital Tawau
Ophthalmology Department
P.O. Box 67
91007 Tawau
Sabah
Tel : (089)773533 Ext : 179
Fax : (089)768626

Hospital Teluk Intan
Ophthalmology Department
Jalan Changkat Jong
36000 Teluk Intan
Perak Darul Ridzuan
Tel : (05)6213333 Ext : 1330
Fax : (05)6237343

Hospital Tengku Ampuan Afzan
Ophthalmology Department
25100 Kuantan
Pahang Darul Makmur
Tel : (09)5133333 Ext : 2454
Fax : (09)5142712

Hospital Tengku Ampuan Rahimah
Ophthalmology Department
Jalan Langat
41200 Klang
Selangor Darul Ehsan
Tel : (03)33723333 Ext : 1336/1338
Fax : (03)33729089

Hospital Tuanku Ja'afar
Ophthalmology Department
Jalan Rasah
70300 Seremban
Negeri Sembilan Darul Khusus
Tel : (06)7623333 Ext : 5120
Fax : (06)7625771

Cornea Transplant Services**MOH**

Hospital Umum Sarawak
Ophthalmology Department
Jalan Tun Ahmad Zaidi Adruce
93586 Kuching
Sarawak
Tel : (082)276513
Fax : (082)419495

ARMED FORCES

94 Hospital Angkatan Tentera Kem
Terendak
Ophthalmology Department
76200 Melaka
Melaka
Tel : (06)3573201 Ext : 1134/1127
Fax : (06)3572108

PRIVATE

Gleneagles Intan Medical Centre
Hope Eye Centre
Suite 618
282, Jalan Ampang
50450 Kuala Lumpur
Wilayah Persekutuan
Tel : (03)42578112
Fax : (03)42576112

Gleneagles Medical Centre
Ophthalmology Department
Pulau Pinang Clinic Sdn Bhd
1, Jalan Pangkor
10050 Pulau Pinang
Pulau Pinang
Tel : (04)2202147
Fax : (04)2272498

Hospital Pantai Indah
Ophthalmology Department
Jalan Perubatan 1
Pandan Indah
55100 Kuala Lumpur
Wilayah Persekutuan
Tel : (03)42892947

Cornea Transplant Services

PRIVATE

K. C. Yeo Eye Specialist Centre
No. 309-310, Jalan Melaka Raya 1
Tmn Melaka Raya
75000 Melaka
Melaka
Tel : (06)2833510

Mahkota Medical Centre
Suite 101, 1st Floor, Mahkota Medical
Centre
3, Mahkota Melaka, Jalan Merdeka
75000 Melaka
Tel : (06)2818222

Pusat Pakar Mata Centre For Sight
1-1, Jalan SS23/15,
Taman SEA
47400 Petaling Jaya
Selangor Darul Ehsan
Tel : (03)78044051

Puteri Specialist Hospital, JB
33, Jalan Tun Abdul Razak (Susur 5)
80350 Johor Bahru
Johor Darul Takzim
(07)223 3377
(07)223 8833

Sri Kota Medical Centre
Ophthalmology Department
Jalan Mohet
41000 Klang
Selangor Darul Ehsan
Tel : (03)33733636 Ext : 7206
Fax : (03)33736888

Sunway Medical Centre
No 5, Jln Lagoon Selatan
Bandar Sunway
46150 Petaling Jaya
Selangor Darul Ehsan
Tel : (03)74919191 Ext : 6612/6613

Sunway Medical Centre
Tan Eye Specialist Centre
No 5, Jln Lagoon Selatan
Bandar Sunway
46150 Petaling Jaya
Selangor Darul Ehsan
Tel : (03)74919191 Ext : 1602
Fax : (03)79826025

Tun Hussein Onn National Eye
Hospital
Lorong Utara B
46200 Petaling Jaya
Selangor Darul Ehsan
Tel : (03)79561511
Fax : (03)79576128

Cornea Transplant Services**UNIVERSITY**

Hospital Universiti Kebangsaan
Malaysia
Ophthalmology Department
Faculty of Medicine
Jalan Yaacob Latif
Bandar Tun Razak, Cheras
56000 Kuala Lumpur
Wilayah Persekutuan
Tel : (03)91702497
Fax : (03)91737836

Hospital Universiti Sains Malaysia
Ophthalmology Department
16150 Kubang Kerian
Kelantan Darul Naim
Tel : (09)7664370
Fax : (09)7653370

University of Malaya Medical Centre
Ophthalmology Department
Faculty of Medicine
59100 Kuala Lumpur
Wilayah Persekutuan
Tel : (03) 79502060
Fax : (03) 79535635

Heart and Lung Transplant Services

MOH

Hospital Kuala Lumpur
Institut Perubatan Respiratori
Jalan Pahang
50586 Kuala Lumpur
Wilayah Persekutuan
Tel : (03)40232966
Fax : (03)40218807

Institute Jantung Negara
Cardiothoracic Department
145, Jalan Tun Razak
50400 Kuala Lumpur
Wilayah Persekutuan
Tel : (03)26178200
Fax : (03)26928418

Heart Valve Transplant Services

MOH

Institute Jantung Negara
Cardiovascular Tissue Bank
Department Of Cardiothoracic Surgery
145, Jalan Tun Razak
50400 Kuala Lumpur
Wilayah Persekutuan
Tel : (03)2617 8200
Fax : (03)2692 8418

Kidney Transplant Services**MOH**

Hospital Alor Setar
Renal Transplant Clinic
c/o Haemodialysis Unit
06550 Alor Setar
Kedah Darul Aman
Tel : (04)7303333 Ext : 169 / 167
Fax : (04)7323770

Hospital Bintulu
Renal Transplant Clinic
c/o Haemodialysis unit
Jalan Nyabau
97000 Bintulu
Sarawak
Tel : (086)255899
Fax : (086)255866

Hospital Kangar
Nephrology Department
Jalan Kolam
01000 Kangar
Perlis Indera Kayangan
Tel : (04)9763333 Ext : 2165
Fax : (04)9767237

Hospital Kluang
Renal Transplant Clinic
c/o Haemodialysis Unit
Jalan Hospital
86000 Kluang
Johor Darul Takzim
Tel : (07)7723333 Ext : 266 / 313
Fax : (07)7734498

Hospital Kuala Lumpur
Institute Paediatric
Paediatric Renal Transplant Clinic
c/o Ward KK1
50586 Kuala Lumpur
Wilayah Persekutuan
Tel : (03)26921044 Ext : 6021
Fax : (03)26948187

Hospital Batu Pahat
Renal Transplant Clinic
c/o Haemodialysis Unit
83000 Batu Pahat
Johor Darul Takzim
Tel : (07)4341999 Ext : 149
Fax : (07)4322544

Hospital Ipoh
Nephrology Unit
Jalan Hospital
30990 Ipoh
Perak Darul Ridzuan
Tel : (05)5222372
Fax : (05)2531541

Hospital Kemaman
Renal Transplant Clinic
c/o Haemodialysis Unit
24000 Kemaman
Terengganu Darul Iman
Tel : (09)8593333 Ext : 2025
Fax : (09)8595512

Hospital Kuala Lumpur
Renal Transplant Unit
Jalan Pahang
50586 Kuala Lumpur
Wilayah Persekutuan
Tel : (03)26155555 Ext : 5910
Fax : (03)26938953

Hospital Labuan
Nephrology Department
Peti Surat 6
87008 Labuan
Wilayah Persekutuan
Tel : (087)423919 Ext : 274
Fax : (087)423928

Kidney Transplant Services

MOH

Hospital Melaka
Nephrology Clinic
c/o Haemodialysis Unit
Jalan Pringgit
70060 Melaka
Melaka
Tel : (06)2707648
Fax : (06)2813240

Hospital Miri
Renal Transplant Clinic
c/o Haemodialysis Unit
98000 Miri
Sarawak
Tel : (085)420033 Ext : 251
Fax : (085)416514

Hospital Pakar Sultanah Fatimah
Renal Transplant Clinic
c/o Haemodialysis Unit
84000 Muar
Johor Darul Takzim
Tel : (06)9521901 Ext : 116
Fax : (06)9526003

Hospital Pontian
Renal Transplant Clinic
c/o Haemodialysis unit
Jalan Alfagoff
82000 Pontian
Johor Darul Takzim
Tel : (07)6873333 Ext : 154
Fax : (07)6876211

Hospital Pulau Pinang
Renal Transplant Clinic
c/o Haemodialysis Unit
Jalan Resideni
10990 Georgetown
Pulau Pinang
Tel : (04)2293333 Ext : 2397
Fax : (04)2281737

Hospital Queen Elizabeth
Renal Transplant Clinic
c/o CADP Unit
88586 Kota Kinabalu
Sabah
Tel : (088)218166 Ext : 284
Fax : (088)211999

Hospital Raja Perempuan Zainab II
Renal Transplant Clinic
c/o Haemodialysis Unit
15590 Kota Bharu
Kelantan Darul Naim
Tel : (09)7452000 Ext : 2234
Fax : (09)7452235

Hospital Sandakan (Duchess of Kent)
Renal Transplant Clinic
c/o Haemodialysis unit
KM3.2, Jalan Utara
90007 Sandakan
Sabah
Tel : (089)212111 Ext : 5190
Fax : (089)213607

Hospital Segamat
Renal Transplant Clinic
c/o Haemodialysis Unit
KM 6 Jalan Genuang
85000 Segamat
Johor Darul Takzim
Tel : (07)9433333 Ext : 147
Fax : (07)9434641

Hospital Selayang
Nephrology Department
Lebuhraya Selayang-Kepong
68100 Batu Caves
Selangor Darul Ehsan
Tel : (03)61203233 Ext : 7011/7018
Fax : (03)61207564

Kidney Transplant Services**MOH**

Hospital Serdang
Nephrology Department
Jalan Puchong
43000 Kajang
Selangor Darul Ehsan
Tel : (03)89475555 Ext : 1256
Fax : (03)89475050

Hospital Sibul
Renal Transplant Clinic
c/o Haemodialysis Unit
96000 Sibul
Sarawak
Tel : (084)343333 Ext : 2102
Fax : (084)337354

Hospital Sultan Ismail Pandan
Renal Transplant Clinic
c/o Haemodialysis Unit
Jalan Persiaran Mutiara Emas Utama
Taman Mount Austin
81100 Johor Bahru
Johor Darul Takzim
Tel : (07)3565000 Ext : 3508
Fax : (07)3565034

Hospital Sultanah Aminah
Renal Transplant Clinic (Paediatrics)
Paediatric Ward
80590 Johor Bahru
Johor Darul Takzim
Tel : (07)2257121
Fax : (07)2276146

Hospital Sultanah Aminah
Renal Transplant Clinic
c/o Haemodialysis Unit
Bangunan Bakawali
80590 Johor Bahru
Johor Darul Takzim
Tel : (07)2231666 Ext : 2055/2033
Fax : (07)2242694

Hospital Sultanah Nur Zahirah
Nephrology Unit
20400 Kuala Terengganu
Terengganu Darul Iman
Tel : (09)6212121 Ext : 2054
Fax : (09)6221820

Hospital Taiping
Renal Transplant Clinic
c/o Haemodialysis unit
Jalan Taming Sari
34000 Taiping
Perak Darul Ridzuan
Tel : (05)8083333 Ext : 8173
Fax : (05)8073894

Hospital Tawau
Renal Transplant Clinic
c/o Haemodialysis Unit
91007 Tawau
Sabah
Tel : (089)773183
Fax : (089)778626

Hospital Tengku Ampuan Afzan
Renal Transplant Clinic
c/o Haemodialysis Unit
25100 Kuantan
Pahang Darul Makmur
Tel : (09)5133333 Ext : 2340
Fax : (09)5164272

Hospital Tengku Ampuan Rahimah
Renal Transplant Clinic
c/o Haemodialysis Unit
Jalan Langat
41200 Klang
Selangor Darul Ehsan
Tel : (03)33757000 Ext : 1411
Fax : (03)33710008

Kidney Transplant Services

MOH

Hospital Tuanku Ja'afar
Renal Transplant Clinic
c/o Haemodialysis Unit
Jalan Rasah
70300 Seremban
Negeri Sembilan Darul Khusus
Tel : (06)7684743
Fax : (06)7625771

Hospital Umum Sarawak
Renal Transplant Clinic
c/o Haemodialysis Unit
Jalan Tun Ahmad Zaidi Adruce
93586 Kuching
Sarawak
Tel : (082)276800 Ext : 5215/5216
Fax : (082)276734

ARMED FORCES

96 Hospital Angkatan Tentera
Kem Lumut
Pengkalan TLDM
32100 Lumut
Perak Darul Ridzuan
(05)6819200 Ext : 9541/9448
(05)6819558

PRIVATE

Ampang Puteri Specialist Hospital
Nephrology Unit
Suite 1-7, First Floor
Jalan Mamanda 9, Tmn Dato'Ahmad
Razali
68000 Ampang
Selangor Darul Ehsan
Tel : (03)42722500 Ext : 1250
Fax : (03)42702443

C. S. Loo Kidney & Medical Specialist
Centre
Perak Community Specialist Hospital
227, Jalan Kampar
30250 Ipoh
Perak Darul Ridzuan
Tel : (05)2458918 Ext : 118
Fax : (05)2429324

Pantai Mutiara Hospital
Renal Transplant Clinic
No. 82, Jalan Tengah, Bayan Baru
11900 Bayan Lepas
Pulau Pinang
Tel : (04)6433888 Ext : 155
Fax : (04)6432888

Renal Dialysis Centre Sdn. Bhd.
Gleneagles Intan Medical Centre
Suite 7.01, 7th Floor
Medical Office Building
282, Jalan Ampang
50450 Kuala Lumpur
Wilayah Persekutuan
Tel : (03)42578822
Fax : (03)42523823

Kidney Transplant Services**PRIVATE**

Smartcare Dialysis Centre
46, Jalan Cerdas, Taman Connaught
56100 Cheras, Kuala Lumpur
Wilayah Persekutuan
Tel : (03)91003657
Fax : (03)91003658

Smartcare Dialysis Centre
52G, Jalan USJ 10/1B
47620 Subang Jaya
Selangor Darul Ehsan
Tel : (03)56337618
Fax : (03)56330618

S.P. Menon Dialysis Centre
No. 5, Jalan Rengas
Southern Park
41200 Klang
Selangor Darul Ehsan
Tel : (03)33738122
Fax : (03)33716475

Sabah Medical Centre
Renal Transplant Clinic
c/o Haemodialysis Unit
P.O. Box 13393
88838 Kota Kinabalu
Sabah
Tel : (088)322159
Fax : (088)272817

Selangor Medical Centre
Renal Transplant Clinic
c/o Haemodialysis Unit
Lot. 1, Jalan Singa 20/1, Seksyen 20
40300 Shah Alam
Selangor Darul Ehsan
Tel : (03)55431111 Ext : 4533/4464
Fax : (03)55431722

Simon Wong Medical & Kidney Clinic
Timberland Medical Centre
Lot 5160, Ground Floor
Lorong 2, 2 1/2 miles Rock Road
93250 Kuching
Sarawak
Tel : (082)241242
Fax : (082)254242

Sri Kota Medical Centre
Renal Transplant Clinic
c/o Haemodialysis Centre
Jalan Mohet
41000 Klang
Selangor Darul Ehsan
Tel : (03)33733636 Ext : 7106
Fax : (03)33736888

Subang Jaya Medical Centre
Nephrology Unit
1, Jalan SS 12/1A
47500 Subang Jaya
Selangor Darul Ehsan
Tel : (03)56306194
Fax : (03)56335910

Sunway Medical Centre
Nephrology Unit
Suite A1-28, First Floor
No 5, Jln Lagoon Selatan
Bandar Sunway
46150 Petaling Jaya
Selangor Darul Ehsan
Tel : (03)74919191 Ext : 7784
Fax : (03)74918181

Tan Medical Renal Clinic
No. 41, Tingkat 1
Jalan 6/31
46300 Petaling Jaya
Selangor Darul Ehsan
Tel : (03)77836423
Fax : (03)77836422

Kidney Transplant Services

PRIVATE

Wee Kidney & Medical Specialist
Clinic S/B
Suite 303A, 3rd Floor
Mahkota Medical Centre
No.3, Mahkota Melaka, Jalan Merdeka
75000 Melaka
Tel : (06)2818222 Ext : 3309
Fax : (06)2810560

UNIVERSITY

Hospital Universiti Kebangsaan
Malaysia
Renal Transplant Clinic
c/o Haemodialysis Unit
Jalan Yaacob Latif,
Bandar Tun Razak, Cheras
56000 Kuala Lumpur
Wilayah Persekutuan
Tel : (03)91733333 Ext : 2630
Fax : (03)91735316

Hospital Universiti Sains Malaysia
Renal Transplant Clinic
c/o Haemodialysis Unit
16150 Kubang Kerian
Kelantan Darul Naim
Tel : (09)7663000 Ext : 4657/4660
Fax : (09)7652198

University of Malaya Medical Centre
Nephrology Ward (Ward 8TE)
8th Floor, Haemodialysis Unit
Jalan Universiti
59100 Kuala Lumpur
Wilayah Persekutuan
Tel : (03)79492497
Fax : (03)79568822

APPENDIX D

Liver Transplant Services

MOH

Hospital Kuala Lumpur
Institute Paediatric
Jalan Pahang
50586 Kuala Lumpur
Wilayah Persekutuan
Tel : (03)26906211
Fax : (03)26913815

Hospital Selayang
Department of Hepatobiliary
Lebuhraya Selayang-Kepong
68100 Batu Caves
Selangor Darul Ehsan
Tel : (03)61203233 Ext : 3314
Fax : (03)61207564

Hospital Selayang
Paediatric Hepatology Unit
Lebuhraya Selayang-Kepong
68100 Batu Caves
Selangor Darul Ehsan
Tel : (03)61203233
Fax : (03)61207564

PRIVATE

Subang Jaya Medical Centre
1, Jalan SS 12/1A
47500 Subang Jaya
Selangor Darul Ehsan
Tel : (03)56306193
Fax : (03)56306209

UNIVERSITY

University of Malaya Medical Centre
Department of Paediatrics
Jalan Universiti
59100 Kuala Lumpur
Wilayah Persekutuan
Tel : (03)79492065
Fax : (03)79556114