FOURTH

REPORT OF THE

NATIONAL TRANSPLANT REGISTRY

2007

Editors
Hooi LS
Lela Yasmin Mansor

With contributions by:

Alan Teh KH, Chan LL, Shamala R, Choong YY, Michael Law SH, Chandramalar S, Mohamed Ezani, David Chew SP, Ashari Yunus, Ganesalingam K, Goh BL, Suzina Sheikh

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National Transplant Registry
1st Floor MMA House
124, Jalan Pahang
53000 Kuala Lumpur
Malaysia

Tel : (603) 4045 5948

Fax : (603) 4044 0613

e-mail : ntr@acrm.org.my

Website: http://www.mst.org.my

FOREWORD

Organ transplantation has made a slow but steady progress in Malaysia despite the various constraints. The awareness on organ donation and transplantation is certainly much better than it was about a decade ago. The organisational framework and various infrastructure facilities to enhance the development of transplantation have evolved with the setting up of a transplant unit in the Medical Development Division of the Ministry of Health Malaysia. It is thus vital to monitor this progress and development of transplantation in the country objectively through a database of the various activities linked to it.

The National Transplant Registry serves as a national database of the transplantation activity in the country. It was established in 2003 to document the experiences and outcomes of solid organ and tissue transplantation in Malaysia. Collection and analysis of data on the various organ and tissue transplants performed in Malaysia, in a continuing fashion is extremely useful to enhance progress and promote safety in transplantation. The National Transplant Registry is a member of the Association of Clinical Registries, Malaysia (ACRM), which was established in 2005.

The Malaysian Society of Transplantation is pleased to present this 4th Annual Report (2007) containing data from all the transplant programs in Malaysia since 2003. The 4th National Transplant Registry Report represents data of the transplantation activity for the year 2007. This report contains the updated statistics and information on the full range of transplant activity, from organ donation to transplantation and post-transplant outcomes such as graft and patient survival. This data is useful for monitoring the trends, progress and outcomes of transplantation in Malaysia.

The information contained in these reports is evidence based and hence highly useful to help develop and enhance the transplant programs in Malaysia. The annual registry reports can be used to formulate policies to address deficiencies and shortfalls in the delivery process so as to allow transplantation to be carried out more efficiently and effectively with improved graft survival and improved quality of life for the recipients. This wealth of information and data can serve to inspire further research on issues of importance to the development of transplantation in the country. The data from the previous registry reports has been referenced in various scientific publications both local and international. It is hoped that the data from the present report will also serve such needs of the scientific community.

The National Transplant Registry is administered and supported by the Malaysian Society of Transplantation since 2005 with professional and technical support from National Clinical Research Centre and the Ministry of Health Malaysia. This year's report as in the past has been prepared by Dr Hooi Lai Seong & Datin Dr Lela Yasmin Mansor with contributions from the various expert panels. I would like to express my gratitude to them for their valuable contributions in preparing, editing & proof reading this report.

I wish to thank all source data producers from the public and private hospitals and university medical centres for collaborating and contributing data to the National Transplant Registry over the years. We look forward to their continued participation, along with that of all centres and organisations active in transplantation in Malaysia.

Special thanks to the members of the expert panels, the Transplant Registry Unit and the Governance Board for their tremendous contributions to the success of this registry.

It is hoped that this registry will evolve with time into a useful warehouse of information and data of the transplantation activity in Malaysia.

Datuk (Mr) Harjit Singh
President
Malaysian Society of Transplantation

ACKNOWLEDGEMENTS

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

We would especially like to thank the following:

- 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 Roche (M) Sdn. Bhd. for their financial contribution to the registry yearly.

PARTICIPATING CENTRES

Discipline: Blood and Marrow Transplant

1. Ampang Puteri Specialist Hospital
2. Division of Haematology, Department of Medicine, University of Malaya Medical Centre
3. Haematology Department, Hospital Ampang
4. Haematology Department, Sime Darby Medical Centre Subang Jaya
5. Haemapoietic Stem Cell Transplant Unit, Hospital Universiti Sains Malaysia
6. Maybank BMT Centre, Hospital Universiti Kebangsaan Malaysia
7. Oncology-Haematology Department, Gleneagles Medical Centre, Penang
8. Oncology-Haematology Department, Lam Wah Ee Hospital
9. Paediatric BMT Unit, Department of Paediatrics, University of Malaya Medical Centre
10. Paediatric BMT Unit, Institute of Paediatrics, Hospital Kuala Lumpur
11. Paediatric BMT Unit, Sime Darby Medical Centre Subang Jaya

Discipline: Bone and Tissue Transplant

1. Bone Bank, Hospital Kuala Lumpur
2. Bone Bank, University of Malaya Medical Centre
3. Department of Orthopaedic & Traumatology, Hospital Kangar
4. Department of Orthopaedic Surgery, Hospital Sultanah Bahiyah
5. Department of Orthopaedic Surgery, Hospital Taiping
6. Department of Orthopaedic Surgery, University of Malaya Medical Centre
7. Department of Orthopaedics, Hospital Ipoh
8. Department of Orthopaedics, Hospital Kajang
9. Department of Orthopaedics, Hospital Kuantan
10. Department of Orthopaedics, Hospital Pulau Pinang
11. Department of Orthopaedics, Hospital Raja Perempuan Zainab II
12. Department of Orthopaedics, Hospital Seberang Jaya
13. Department of Orthopaedics, Hospital Sultanah Aminah
14. Department of Orthopaedics, Hospital Sultanah Nur Zahirah
15. Department of Orthopaedics, Hospital Tengku Ampuan Rahimah
16. Department of Orthopaedics, Hospital Universiti Sains Malaysia
17. Department of Orthopaedics, Sarawak General Hospital
18. Department of Orthopaedics, Sultanah Fatimah Specialist Hospital
19. Department of Orthopaedics, Traumatology and Rehabilitation, International Islamic University Malaysia
20. Department of Surgery, Hospital Raja Perempuan Zainab II
21. Hospital Fatimah, Ipoh
22. Institute of Orthopaedic & Traumatology, Hospital Kuala Lumpur
23. Island Hospital, Penang
24. Kota Bharu Medical Centre
25. Malaysian Nuclear Agency
26. National Tissue Bank, Universiti Sains Malaysia
27. Normah Medical Specialist Centre, Kuching
28. Ophthalmology Department, Hospital Kuala Lumpur
29. Ophthalmology Department, Hospital Sultanah Bahiyah
30. Ophthalmology Department, Hospital Sungai Buloh
31. Ophthalmology Department, Hospital Teluk Intan

Discipline: <u>Bone and Tissue Transplant</u>

32. Ophthalmology Department, Hospital Tengku Ampuan Afzan
33. Ophthalmology Department, Hospital Tengku Ampuan Rahimah
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

Discipline: <u>Cornea Transplant</u>

1. Eye Clinic, Mahkota Medical Centre
2. Hope Eye Centre, Gleneagles Intan Medical Centre, Kuala Lumpur
3. International Specialist Eye Centre, Kuala Lumpur
4. K.C. Yeo Eye Specialist Centre, Melaka
5. Ophthalmology Department, 94 Hospital Angkatan Tentera Kem Terendak
6. Ophthalmology Department, Gleneagles Medical Centre, Penang
7. Ophthalmology Department, Hospital Batu Pahat
8. Ophthalmology Department, Hospital Bukit Mertajam
9. Ophthalmology Department, Hospital Duchess of Kent
10. Ophthalmology Department, Hospital Ipoh
11. Ophthalmology Department, Hospital Kangar
12. Ophthalmology Department, Hospital Kuala Lipis
13. Ophthalmology Department, Hospital Kuala Lumpur
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15. Ophthalmology Department, Hospital Melaka
16. Ophthalmology Department, Hospital Mentakab
17. Ophthalmology Department, Hospital Miri
18. Ophthalmology Department, Hospital Pakar Sultanah Fatimah
19. Ophthalmology Department, Hospital Pantai Indah
20. Ophthalmology Department, Hospital Pulau Pinang
21. Ophthalmology Department, Hospital Putrajaya
22. Ophthalmology Department, Hospital Queen Elizabeth, Kota Kinabalu
23. Ophthalmology Department, Hospital Raja Perempuan Zainab II
24. Ophthalmology Department, Hospital Selayang
25. Ophthalmology Department, Hospital Sibu
26. Ophthalmology Department, Hospital Sultan Ismail Pandan
27. Ophthalmology Department, Hospital Sultanah Aminah
28. Ophthalmology Department, Hospital Sultanah Bahiyah
29. Ophthalmology Department, Hospital Sultanah Nur Zahirah
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
35. Ophthalmology Department, Hospital Tengku Ampuan Afzan
36. Ophthalmology Department, Hospital Tengku Ampuan Rahimah
37. Ophthalmology Department, Hospital Tuanku Ja'afar
38. Ophthalmology Department, Hospital Umum Sarawak
39. Ophthalmology Department, Hospital Universiti Kebangsaan Malaysia
40. Ophthalmology Department, Hospital Universiti Sains Malaysia

Discipline: <u>Cornea Transplant</u>

41. Ophthalmology Department, Sri Kota Medical Centre
42. Ophthalmology Department, University of Malaya Medical Centre
43. Pusat Pakar Mata Centre For Sight, PJ
44. Puteri Specialist Hospital, Johor Bahru
45. Sunway Medical Centre
46. Tan Eye Specialist Centre, Sunway Medical Centre
47. Tun Hussein Onn National Eye Hospital

Discipline: <u>Heart and Lung Transplant</u>

1. Cardiothoracic Department, Institut Jantung Negara
2. Institut Perubatan Respiratori, Hospital Kuala Lumpur

Discipline: <u>Heart Valve Transplant</u>

1. Cardiovascular Tissue Bank, Department of Cardiothoracic Surgery, Institut Jantung Negara

Discipline: <u>Liver Transplant</u>

1. Department of Paediatrics, University of Malaya Medical Centre
2. Hepatobiliary Department, Hospital Selayang
3. Paediatric Hepatology Unit, Hospital Selayang
4. Institute of Paediatrics, Hospital Kuala Lumpur
5. Sime Darby Medical Centre Subang Jaya

Discipline: <u>Renal Transplant</u>

1. 96 Hospital Angkatan Tentera Kem Lumut
2. C. S. Loo Kidney & Medical Specialist Centre
3. Fan Medical Renal Clinic
4. Nephrology Department, Hospital Batu Pahat
5. Nephrology Department, Hospital Bintulu
6. Nephrology Department, Hospital Duchess of Kent
7. Nephrology Department, Hospital Ipoh
8. Nephrology Department, Hospital Kangar
9. Nephrology Department, Hospital Kemaman
10. Nephrology Department, Hospital Kluang
11. Nephrology Department, Hospital Kuala Lumpur
12. Nephrology Department, Hospital Labuan
13. Nephrology Department, Hospital Melaka
14. Nephrology Department, Hospital Miri
15. Nephrology Department, Hospital Pakar Sultanah Fatimah
16. Nephrology Department, Hospital Pontian
17. Nephrology Department, Hospital Pulau Pinang
18. Nephrology Department, Hospital Queen Elizabeth

Discipline: <u>Renal Transplant</u>

19. Nephrology Department, Hospital Raja Perempuan Zainab II
20. Nephrology Department, Hospital Segamat
21. Nephrology Department, Hospital Selayang
22. Nephrology Department, Hospital Serdang
23. Nephrology Department, Hospital Sibu
24. Nephrology Department, Hospital Sultan Ismail Pandan
25. Nephrology Department, Hospital Sultanah Aminah
26. Nephrology Department, Hospital Sultanah Bahiyah
27. Nephrology Department, Hospital Sultanah Nur Zahirah
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, Hospital Tuanku Ja'afar
33. Nephrology Department, Sarawak General Hospital
34. Nephrology Department, UKM Hospital
35. Nephrology Department, University Malaya Medical Centre
36. Nephrology Department, USM Hospital
37. Nephrology Unit, Ampang Puteri Specialist Hospital
38. Nephrology Unit, Sime Darby Medical Centre Subang Jaya
39. Nephrology Unit, Sunway Medical Centre
40. Paediatric Renal Transplant Clinic, Hospital Kuala Lumpur
41. Paediatric Ward, Hospital Sultan Ismail Pandan
42. Renal Transplant Clinic, Sabah Medical Centre
43. Renal Transplant Clinic, Selangor Medical Centre
44. Renal Transplant Clinic, Sri Kota Medical Centre
45. Renal Transplant Unit, Hospital Pantai Mutiara
46. Simon Wong Medical & Kidney Clinic, Timberland Medical Centre
47. Tan Medical Renal Clinic
48. Wee Kidney & Medical Specialist 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
Dato' Dr Zaki Morad Mohd Zaher ***Co-chair***	Head, Department of Nephrology, Hospital Kuala Lumpur NTR Expert Panel Chairman of Renal Transplant
Datin Dr Fadhilah Zowyah Lela Yasmin Mansor ***Co-chair***	Chairperson, Registry Subcommittee National Transplant Coordinating Committee Ministry Of Health
Dr Teng Seng Chong	Medical Development Division, Ministry of Health
Dr Tan Chwee Choon	Malaysian Society of Transplantation
Dr Lim Teck Onn	Clinical Research Centre (CRC), Hospital Kuala Lumpur
Dr Jamaiyah Haniff	Clinical Research Centre (CRC), Hospital Kuala Lumpur
Mr Rohan Malek	Malaysian Urological Association
Dr Hooi Lai Seong	Malaysian Society of Nephrology
Dr Aizai Azan Abdul Rahim	National Heart Association of Malaysia
Dr Suzina Sheikh Ab. Hamid	Malaysian National Tissue Bank
Dr Wong Jun Shyan	Ophthalmological Society Of MMA
Tan Sri Datuk Dr Mohd. Ismail Merican	Malaysian Liver Foundation
Dr Hamidah Shaban	Malaysian Thoracic Society
Dr Wan Faisham	Malaysian Orthopaedic Association
Dr Gill Satwant Singh	National Kidney Foundation of Malaysia
Dr Chang Kian Meng	Malaysian Society of Haematology
Dr Kelvin Lim Lye Hock	Malaysian Association of Oral & Maxillofacial Surgeons
Dr R T Arasu	Malaysian Dental Association
Dr Alan Teh Kee Hean	NTR Expert Panel Co-chair of Blood and Marrow Transplant (Adult)
Prof Dr Chan Lee Lee	NTR Expert Panel Co-chair of Blood and Marrow Transplant (Paediatric)
Dato' Dr Zakaria Zahari	NTR Expert Panel Chairman of Liver Transplant
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:

Discipline: <u>Blood and Marrow Transplant</u>

Co-chair (Adult)	Dr Alan Teh Kee Hean
Co-chair (Paeds)	Prof Dr Chan Lee Lee
Members	Prof Dr Cheong Soon Keng
	Dr Chang Kian Meng
	Dr Gan Gin Gin @ Gan Shiaw Sze
	Dr Hishamshah Mohd Ibrahim
	Dr Jameela Sathar
	Prof Dr Lin Hai Peng
	Dr Mahfuzah Mohamed
	Dr Ng Soo Chin
	Dr S Visalachy Purushothaman
	Dr Vijaya Sangkar

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Co-chair	Dr Choong Yean Yaw
Members	Dato' Dr Veera Ramani
	Dr Jonathan Choon Siew Cheong
	Dr Chuah Kay Leong
	Dr Michael Law Sie Haur
	Dr Mariam Ismail

	Assoc Prof Dr SC Reddy
	Dr Sahimi Sulaiman
	Dr U Thiageswari
	Dr Chandramalar Santhirathelagan

Discipline: <u>Heart and Lung Transplant</u>

Chairman	Tan Sri Dato' Dr Yahya Awang
Co-chair	Mr Mohamed Ezani Hj Md. Taib
Members	Datin Dr Aziah Ahmad Mahayiddin
	Dr Ashari Yunus
	Dr Aizai Azan Abdul Rahim
	Dato' Dr David Chew Soon Ping
	Dr Hamidah Shaban

Discipline: <u>Liver Transplant</u>

Chairman	Dato' Dr Zakaria Zahari
Members	Dr Ganesalingam A/L Kanagasabai
	Dr Goon Hong Kooi
	Dr Lim Chooi Bee
	Prof Dr Lee Way Seah
	Dr Sushila Sivasubramaniam
	Dr Tan Soek Siam
	Dr S Thavaranjitham

Discipline: <u>Renal Transplant</u>

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Co-chair	Dr Goh Bak Leong
Members	Dr Fan Kin Sing
	Dr Lily Mushahar
	Mr Rohan Malek
	Dr S Prasad Menon
	Prof Dr Tan Si Yen

Discipline: <u>Heart Valve Transplant</u>

Chairman	Mr Mohamed Ezani Hj Md.Taib

Discipline: <u>Bone and Tissue Transplant</u>

Chairman	Prof Dr Zulmi Wan
Members	Dr Suzina Sheikh Ab Hamid
	Dr Badrul Shah Badaruddin
	Dato' Dr Hasim Mohamad
	Dr Norimah Yusof
	Dr Robert Penafort

NTR STAFF

Clinical Registry Coordinator	Ms Leong Wei Chee
Clinical Research Assistant	Mr Ahmad Fairuz Putra Bin Ahmad Zulkifli

SUPPORTING STAFF FROM THE CLINICAL RESEARCH CENTRE

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.

Clinical Epidemiologist	Dr Jamaiyah Haniff
Information & Communication Technology (ICT) Manager	Ms Celine Tsai Pao Chien
Network Administrator	Mr Kevin Ng Hong Heng
Assistant Network Administrator	Mr Adlan Ab. Rahman
Database Administrator	Ms Lim Jie Ying
Desktop publisher	Ms Azizah Alimat

BIOSTATISTICAL CONSULTANTS

Consultant Biostatistician	Dr Hoo Ling Ping

CONTENTS

REPORT SUMMARY

1. BLOOD AND MARROW TRANSPLANTATION

There were a total of 1312 haematopoietic stem cell transplantations performed by 11 centres between 1987 and 2007; 908 were functioning by the end of 2007.

The majority of all transplants (71%) 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 135 new transplantations done in Malaysia in 2007 with 11 follow-up centres for transplant recipients.

Mean age of new transplant patients in 2007 was 29 $\pm$ 21 years; 64% were male, 39% Malay, 41% Chinese, 10% Indian and 10% others. Autologous transplants accounted for 50%. Seventy-nine percent of the transplant source was from peripheral blood stem cells and 91% were from Human Leukocyte Antigen (HLA) identical donors.

In 2007, 24 of prevalent transplant recipients died. Underlying disease and infection were the commonest causes of death accounting for 42% and 21% respectively.

2. CORNEAL TRANSPLANTATION

There were 46 centres which provided corneal transplantation data.

One hundred and eighty-nine new corneal transplantations were reported in Malaysia in 2007. Mean age of new transplant recipients in 2007 was 47 $\pm$ 21 years. Of these, 66% were male. Thirty-three percent of recipients were Malay, 35% were Chinese, 19% were Indian and 13% were other races.

The primary diagnoses for corneal transplantation recipients in 2007 were pseudophakic bullous keratopathy (17%), cornea perforation (16%), keratoconus (15%), cornea scars (13%), failed previous cornea grafts (12%), microbial keratitis (7%) and corneal dystrophy (7%).

Fifty-eight percent of recipients were legally blind before their transplant surgery.

In 2007, 57% of donated corneas were from the USA, 27% from Sri Lanka and 16% from local sources. The mean age of the donors was 57 $\pm$ 14 years.

The commonest corneal transplantation surgery performed was penetrating keratoplasty (88%) i.e. transplantation of a full thickness cornea tissue. Graft survival at 1 year was 80%, 65% at 3 years.

3. HEART AND LUNG TRANSPLANTATION

There were a total of 18 patients with heart transplantations reported to the Registry between 1997 and 2007; eight grafts were functioning at the end of 2007 and all were followed up in Institut Jantung Negara.

In 2007 there were 2 heart transplants carried out on the same recipient whose first heart transplant failed; there was a second compatible donor organ within 24 hours and the second heart transplant succeeded.

Two thirds of the heart transplant recipients were males and 56% were Indians. The mean age of recipients was 35 $\pm$ 16 years. Ischaemic cardiomyopathy was the commonest primary diagnosis (9/18) followed by dilated cardiomyopathy (6/18).

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

The transplant patient survival rate was 63% and 44% at 1 year and 3 years respectively.

A double lung transplant and a heart-lung transplant were performed in 2007. The latter patient died of rejection and pneumonia after 2 weeks. At the end of 2007 there were 2 patients with lung transplants surviving with functioning graft.

4. LIVER TRANSPLANTATION

There were a total of 95 liver transplantations reported to the Registry between 1993 and 2007; 56 grafts were functioning by the end of 2007.

There were 7 new liver transplantations done in Malaysia in 2007.

There were 5 follow-up centres for liver transplant recipients in 2007.

Mean age of all transplant patients was 8 $\pm$ 13 years (range 3 months to 74 years); 53% were male, 48% Chinese, 37% Malay, 8% Indian, 69% were for biliary atresia. Majority were living donor liver transplantations (78%).

At the time of transplantation the main immunosuppressive drugs used were tacrolimus (78%) and steroids (62%).

Transplant patient survival rate for the cohort 1993 to 1998 was 71% at 1 year; survival rate for the cohort 1999 to 2006 was 69% at 1 year.

5. RENAL TRANSPLANTATION

There were 48 follow-up centres for renal transplant recipients in 2007. There were 86 new renal transplants in 2007, 3 per million population per year.

The number of functioning renal transplants in 2007 was 1726. The transplant prevalence rate was 64 per million population.

In 2007, the mean age for new transplant recipients was 35±15 years, 62% were male, 12% had diabetes, 11 were anti-HCV positive at the time of transplantation.

Ninety-seven percent of prevalent renal transplant recipients were on prednisolone, 72% on cyclosporine, 21% on tacrolimus, 54% mycophenolate mofetil and 29% on azathioprine.

In 2007, 34 (2%) of prevalent transplant recipients died and 34 (2%) lost their grafts. Infection and cardiovascular disease were the commonest causes of death accounting for 33% and 18% respectively. Death at home was the third commonest cause at 10%. Renal allograft rejection accounted for 69% of graft loss.

The overall transplant patient survival rate from 1994 to 2007 was 95%, 91%, 88% and 81% 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 64% respectively.

6. HEART VALVE TRANSPLANTATION

There were a total of 172 heart valve homografts reported to the Registry between 1996 and 2007; 153 grafts were functioning at the end of 2007. Eighty-five were aortic and 87 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, 90 bone allografts and 175 amniotic membranes were supplied by USM Tissue Bank.

Twenty hospitals used the bone grafts and 18 centres used the amniotic membranes. Characteristics were reported for only 36 of the recipients.

8. CADAVERIC ORGAN AND TISSUE DONATION

There were 25 donors in 2007 of which 15 were brain dead multi-organ and tissue donors and 10 were post cardiac death tissue donors. The donation rate was 0.99 donations per million population (pmp).

The mean age of the donors was 29.6 ± 18.75 years. The youngest was a 14.5 months old kidney donor while the oldest was a 68 year-old eye donor. Eighty percent were male, 56% were Chinese, 20% Malay, 12% Indian.

Six donors carried the donor pledge card. Sixteen of the donors died from accidents, 8 died from medical causes and one was a homicide. Eighty-four percent of donations took place in MOH hospitals, 8% in private hospitals and 8% from University hospitals.

CHAPTER 1

BLOOD AND MARROW TRANSPLANTATION

Editors:
Dr Alan Teh Kee Hean
Prof Dr Chan Lee Lee

Expert Panel
Dr Alan Teh Kee Hean (Chair - Adult)
Prof Dr Chan Lee Lee (Chair - Paediatric)
Prof Dr Cheong Soon Keng
Dr Chang Kian Meng
Dr Gan Gin Gin
Dr Hishamshah Mohd Ibrahim
Dr Jameela Sathar
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

Haematopoietic Stem Cell Transplantation (HSCT) in Malaysia continued at a steady pace in 2007 with minor changes in practice and outcome being reflected in this annual report. All participating centres continued their close cooperation and we believe that the numbers reported truly reflected the HSCT activity which occurred for the year 2007.

The recipients of HSCT continued to be largely a young population but access to patients aged more than 60 years widened. Indications for HSCT were concordant with worldwide practice where acute leukaemia tops the list. Unlike countries in USA, Europe and Japan, use of unrelated donors was still limited to a small percentage of the total HSCT performed perhaps reflecting the lack of human and medical resources available in Malaysia.

1.1 STOCK AND FLOW

The total number of HSCT performed in 2007 was 135, a number which was only marginally higher than the 127 transplants performed in the preceding year and not exceeding 147 which was the highest number achieved in the year 2005. In comparison to worldwide practice where an annual increase of 10 to 15% is being reported, that increment was not reflected in the Malaysian figures. Although the number of patients lost to follow-up had been reported as zero for the past 20 years, that figure probably requires closer study and attention.

Malaysia saw HSCT at a rate of 5 per million population which is relatively very low compared with developed countries. The low numbers reflect the lack of hospital beds for HSCT and the waiting list for patients requiring transplantation is a real challenge particularly in government hospitals.

The total number of centres performing HSCT remained at 11 as in the year 2006. The centre for adult transplantation in Hospital Kuala Lumpur was transferred to Ampang General Hospital in December 2006 and hence the number of HSCT in Hospital Kuala Lumpur saw a drastic decline in 2007. Out of the 11 centres, three dedicated to paediatric HSCT contributed 34% of the total HSCT activities. As the number of adult centres continue to increase this percentage is expected to decrease to mirror that seen in the developed world.

Table 1.1.1: Stock and Flow of Blood and Marrow Transplantation, 1987-2007

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 31st December	7	12	28	27	38	57	67	87	100	117

Year	**97**	**98**	**99**	**00**	**01***	**02**	**03**	**04**	**05**	**06**	**07**
New transplant patients	33	49	62	94	108	114	128	139	147	127	135
Deaths	15	16	15	31	47	30	51	45	40	25	24
Lost to follow- up	0	0	0	0	0	0	0	0	0	0	0
Alive at 31st December	135	168	215	278	338	422	499	592	698	800	908

*1 patient in year transplant 2001 with no death date
**Out of 1312 patients who underwent transplantation, there were 50 patients with early death before day 30 of transplant

Figure 1.1.1: Stock and Flow of Blood and Marrow Transplantation, 1987-2007

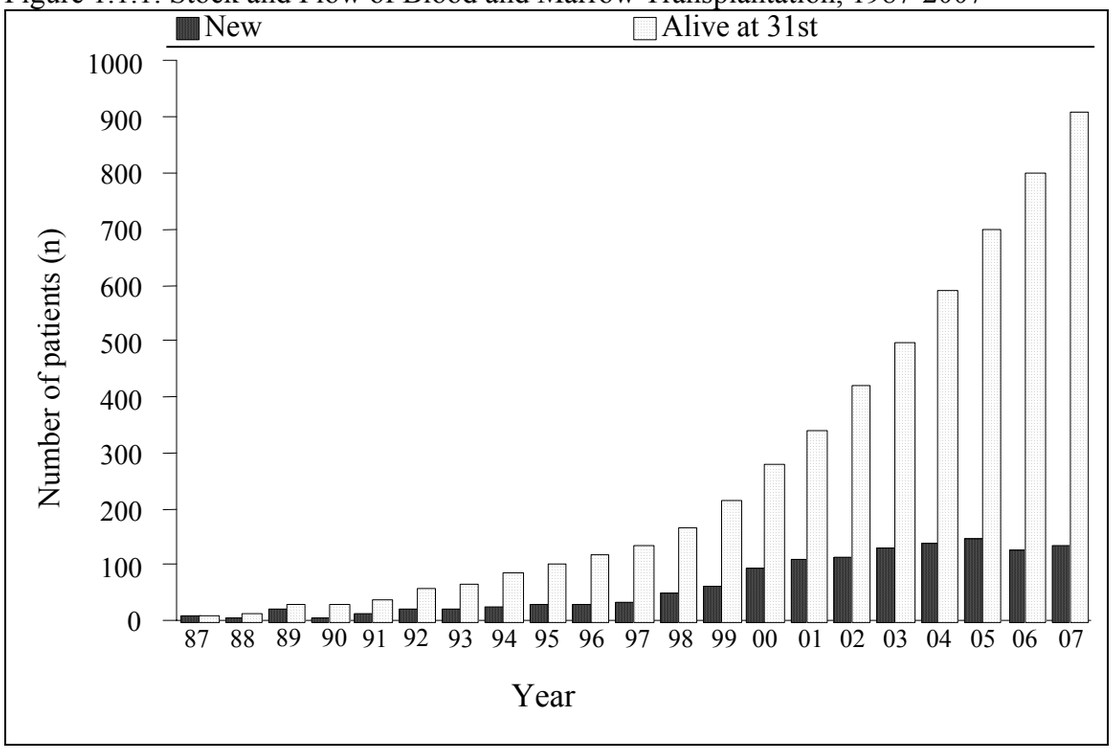


Table 1.1.2: New Transplant Rate per million population (pmp), 1987-2007

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	2007
New transplant patients	33	49	62	94	108	114	128	139	147	127	135
New transplant rate pmp	2	2	3	4	4	5	5	5	6	5	5

Figure 1.1.2: New Transplant Rate per million population (pmp), 1987-2007

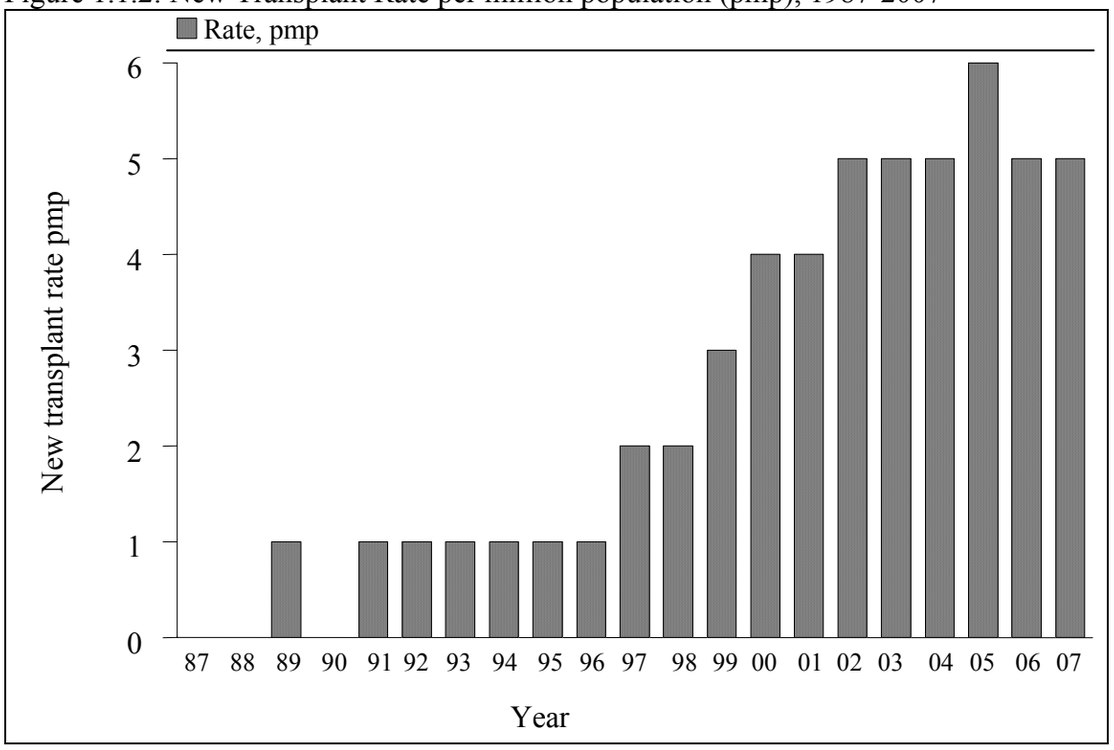


Table 1.1.3: Distribution of Patients by Centre, 1987-2007

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**

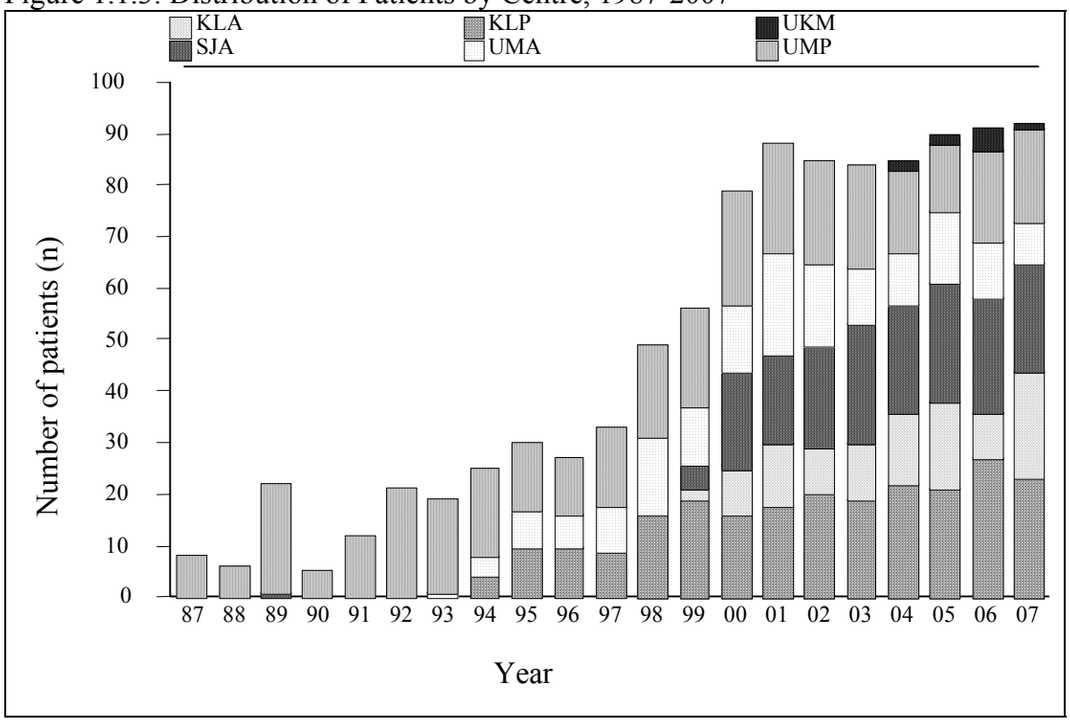
Year	2001		2002		2003		2004		2005		2006	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
KLA	20	19	28	25	35	27	41	29	44	30	20	16
KLP	18	17	20	18	19	15	22	16	21	14	27	21
UKM	12	11	9	8	11	9	14	10	17	12	9	7
SJA	17	16	20	18	23	18	21	15	23	16	22	17
UMA	20	19	16	14	11	9	10	7	14	10	11	9
UMP	21	19	20	18	20	16	16	12	13	9	18	14
GMC	0	0	0	0	0	0	2	1	2	1	4	3
LWE	0	0	0	0	0	0	6	4	1	1	2	2
SJP	0	0	1	1	9	7	6	4	12	8	6	5
ASH	0	0	0	0	0	0	0	0	0	0	1	1
Hospital Ampang	0	0	0	0	0	0	0	0	0	0	7	6
Others*	0	0	0	0	0	0	1	1	0	0	0	0
TOTAL	**108**	**100**	**114**	**100**	**128**	**100**	**139**	**100**	**147**	**100**	**127**	**100**

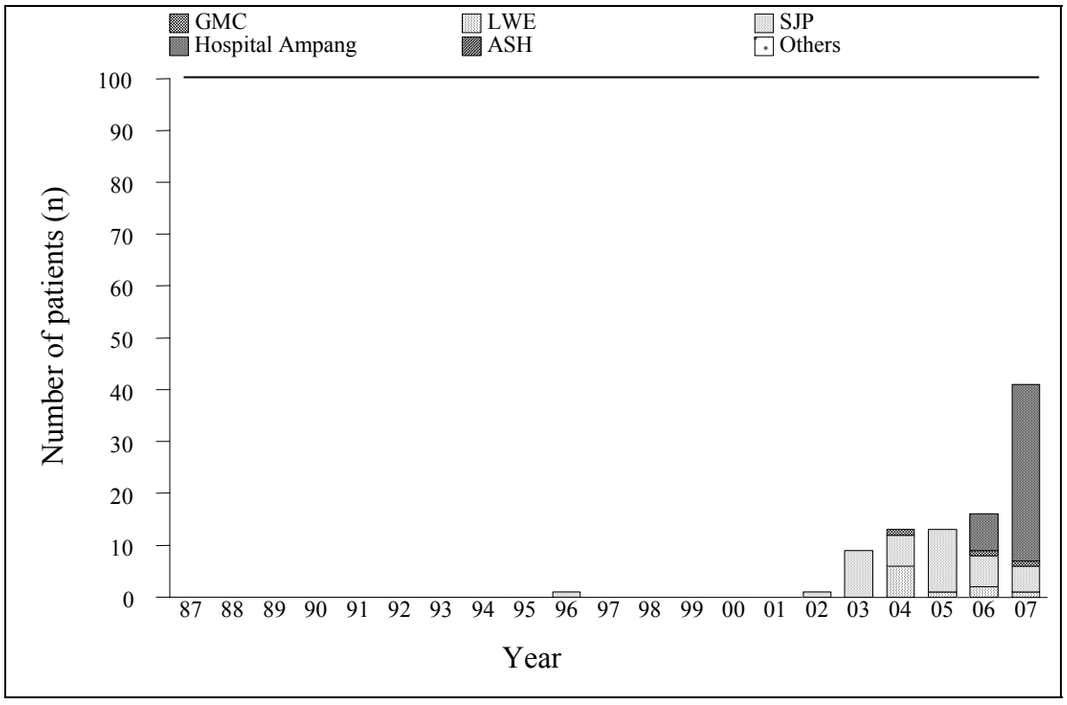
Year	2007		Total	
	No.	%	No.	%
KLA	2	1	211	16
KLP	23	17	234	18
UKM	21	16	104	8
SJA	21	16	172	13
UMA	8	6	156	12
UMP	18	13	332	25
GMC	1	1	9	1
LWE	1	1	10	1
SJP	5	4	40	3
ASH	1	1	2	0
Hospital Ampang	34	25	41	3
Others*	0	0	1	0
TOTAL	**135**	**100**	**1312**	**100**

*Others include Royal Perth Hospital

KLA	Hospital Kuala Lumpur, (Adult)
KLP	Hospital Kuala Lumpur, Institute Paediatrics (Paed)
UKM	Hospital Universiti Kebangsaan Malaysia
SJA	Sime Darby 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	Sime Darby Medical Centre (Paed)
ASH	Ampang Puteri Specialist Hospital

Figure 1.1.3: Distribution of Patients by Centre, 1987-2007





1.2 RECIPIENTS' CHARACTERISTICS

In 2007, 64% of recipients were male. The ethnic breakdown was 41%, 39% and 10% for Chinese, Malay and Indian patients respectively. Since 2000 when patients aged >60 years were offered HSCT, the number of patients in this age group steadily increased over the ensuing years and reached an all time high of 8% in 2007. The median age of recipients was 16 years with a range of 1 month to 70 years. Indications for HSCT were 69% for malignant disorders with the commonest diseases being acute leukaemia followed by lymphoma and multiple myeloma.

Table 1.2.1: Distribution of Patients by Gender, 1987-2007

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**		**2007**		**Total**	
Gender	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Male	71	55	83	60	69	47	75	59	87	64	755	58
Female	57	45	56	40	78	53	52	41	48	36	557	42
TOTAL	**128**	**100**	**139**	**100**	**147**	**100**	**127**	**100**	**135**	**100**	**1312**	**100**

Figure 1.2.1: Distribution of Patients by Gender, 1987-2007

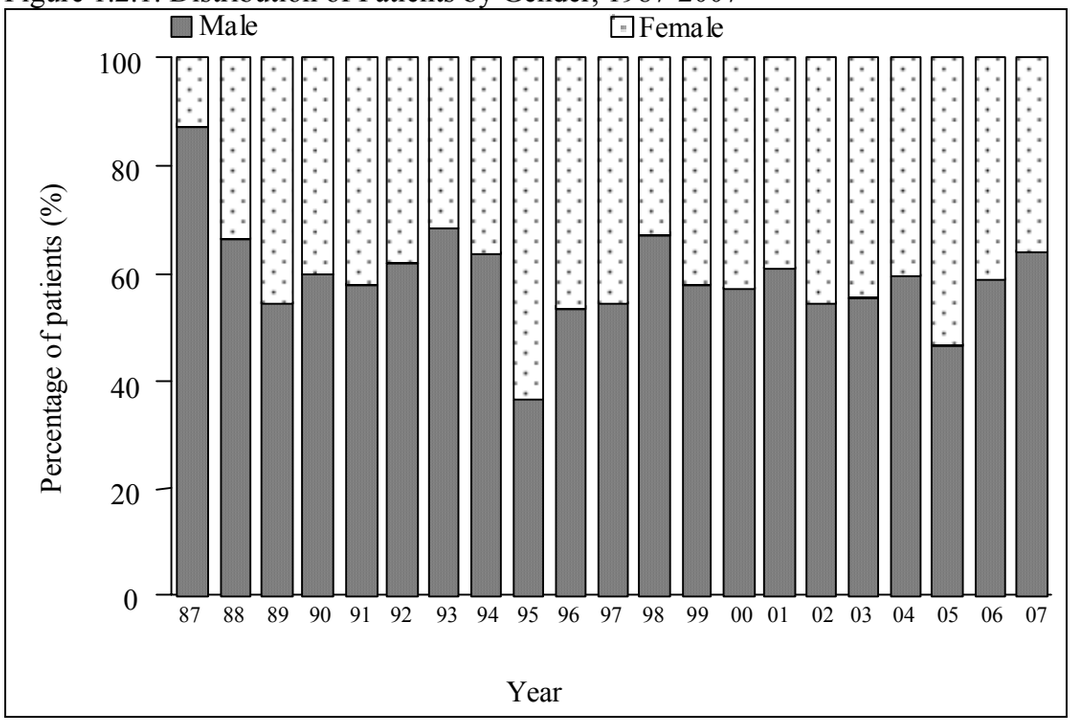


Table 1.2.2: Distribution of Patients by Ethnic Group, 1987-2007

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	
Race	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Malay	47	44	37	32	46	36	51	37	54	37	56	44
Chinese	48	44	65	57	65	51	63	45	67	46	48	38
Indian	8	7	8	7	6	5	9	6	14	10	9	7
Bumiputra Sabah	1	1	1	1	4	3	8	6	5	3	7	6
Bumiputra Sarawak	1	1	1	1	4	3	7	5	5	3	2	2
Others	3	3	2	2	3	2	1	1	2	1	5	4
TOTAL	**108**	**100**	**114**	**100**	**128**	**100**	**139**	**100**	**147**	**100**	**127**	**100**

Year	2007		Total	
Race	**No.**	**%**	**No.**	**%**
Malay	53	39	493	38
Chinese	55	41	611	47
Indian	14	10	99	8
Bumiputra Sabah	6	4	47	4
Bumiputra Sarawak	1	1	26	2
Others	6	4	36	3
TOTAL	**135**	**100**	**1312**	**100**

Figure 1.2.2: Distribution of Patients by Ethnic Group, 1987-2007

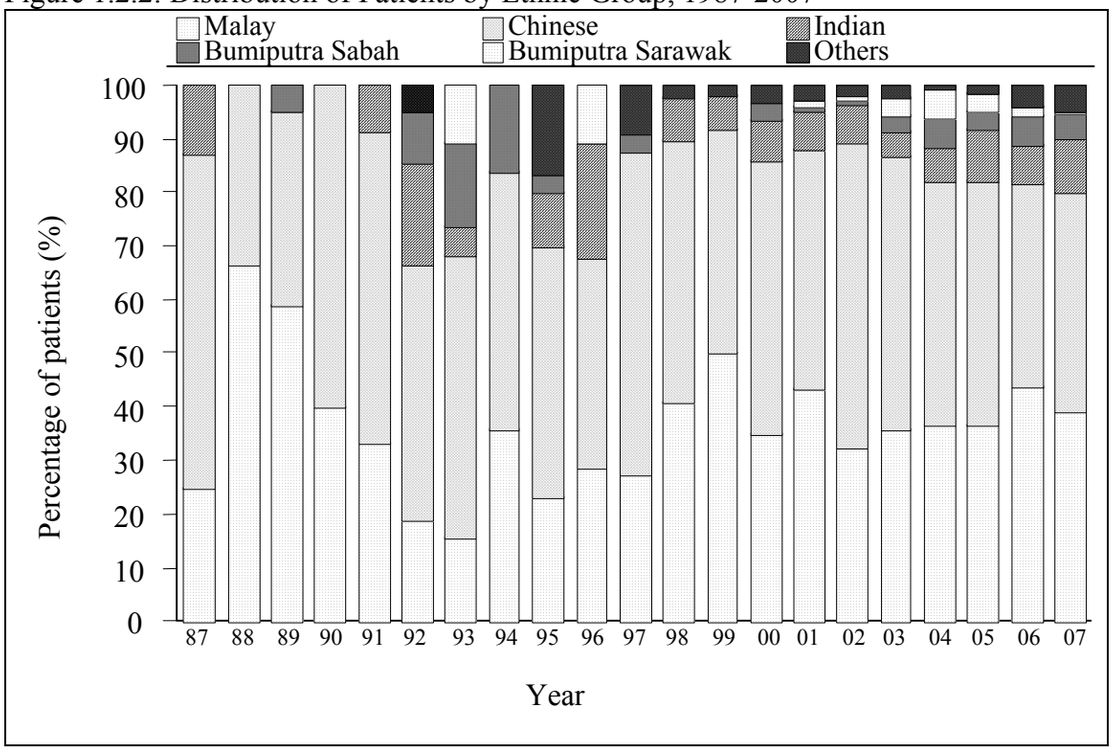


Table 1.2.3: Distribution of Patients by Age Group, 1987-2007

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**	
Age group	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
0-9	23	21	30	26	42	33	26	19	29	20	40	31
10-19	28	26	25	22	18	14	41	29	31	21	26	20
20-39	40	37	36	32	47	37	52	37	51	35	31	24
40-59	16	15	23	20	21	16	18	13	35	24	25	20
≥60	1	1	0	0	0	0	2	1	1	1	5	4
TOTAL	**108**	**100**	**114**	**100**	**128**	**100**	**139**	**100**	**147**	**100**	**127**	**100**
Mean	23		23		22		23		26		24	
SD	16		16		15		15		16		19	
Median	22		22		23		20		25		18	
Minimum	1 month		1		5 months		1		1		1	
Maximum	64		55		52		70		66		69	

Year	**2007**		**Total**	
Age group	**No.**	**%**	**No.**	**%**
0-9	38	28	423	32
10-19	22	16	322	25
20-39	25	19	340	26
40-59	39	29	206	16
≥60	11	8	21	2
TOTAL	**135**	**100**	**1312**	**100**
Mean	29		21	
SD	21		17	
Median	27		16	
Minimum	1		1 month	
Maximum	68		70	

Age=date of transplant – date of birth

Figure 1.2.3: Distribution of Patients by Age Group, 1987-2007

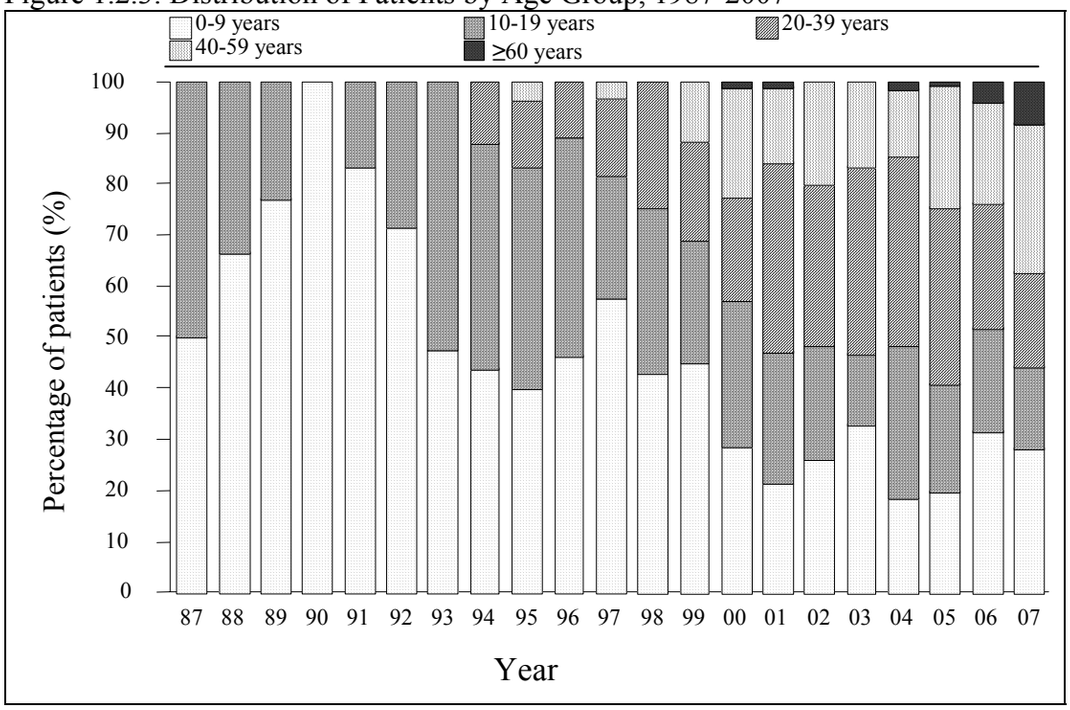


Table 1.2.4: Distribution of Patients by Primary Diagnosis, 1987-2007

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	
Diagnosis	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Acute leukaemia	48	44	48	42	42	33	46	33	54	37	38	30
Chronic leukaemia	18	17	19	17	19	15	22	16	13	9	11	9
Hypoplastic anaemia	7	6	4	4	5	4	12	9	5	3	14	11
Erythrocytic disorders	0	0	1	1	2	2	0	0	0	0	0	0
Lymphoma	23	21	20	18	28	22	35	25	34	23	23	18
Solid tumors	0	0	3	3	2	2	0	0	2	1	3	2
Myelodysplasia	4	4	4	4	3	2	6	4	4	3	4	3
Haemoglobinopathy	4	4	8	7	17	13	9	6	16	11	11	9
Multiple myeloma	1	1	4	4	4	3	3	2	8	5	10	8
Others	3	3	3	3	6	5	6	4	11	7	13	10
TOTAL	**108**	**100**	**114**	**100**	**128**	**100**	**139**	**100**	**147**	**100**	**127**	**100**

Year	2007		Total	
Diagnosis	**No.**	**%**	**No.**	**%**
Acute leukaemia	46	34	482	37
Chronic leukaemia	5	4	163	12
Hypoplastic anaemia	8	6	116	9
Erythrocytic disorders	0	0	8	1
Lymphoma	25	19	220	17
Solid tumors	3	2	29	2
Myelodysplasia	1	1	31	2
Haemoglobinopathy	10	7	130	10
Multiple myeloma	12	9	46	4
Others	25	19	87	7
TOTAL	**135**	**100**	**1312**	**100**

#	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 Dyserythropoeitic 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	Myelodyplastic 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

For the first time in 20 years, the number of allogeneic and autologous HSCT were equivalent whereas allogeneic transplants had previously dominated. Most of the autologous HSCT were for adult recipients.

The predominance of peripheral blood as the stem cell source was again seen in 79% of the total HSCT, a preference which had been shown since the year 2000. The HLA matching for the 67 allogeneic transplants were 91%, 4%, 3% and 1% respectively for 0, 1, 2 and 3 antigen mismatches. Sibling donors were seen in 58 HSCT while the remaining 9 were from unrelated donors with cord blood donors predominating.

Table 1.3.1: Distribution of Patients by Graft Number, 1987-2007

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**	
Graft number	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
1	103	95	113	99	125	98	134	98	121	98	114	97
2	5	5	1	1	3	2	3	2	2	2	2	2
3	0	0	0	0	0	0	0	0	0	0	1	1
TOTAL	**108**	**100**	**114**	**100**	**128**	**100**	**137**	**100**	**123**	**100**	**117**	**100**

Year	**2007**		**Total**	
Graft number	**No.**	**%**	**No.**	**%**
1	107	98	1211	97
2	2	2	35	3
3	0	0	4	0
TOTAL	**109**	**100**	**1250**	**100**

Figure 1.3.1: Distribution of Patients by Graft Number, 1987-2007

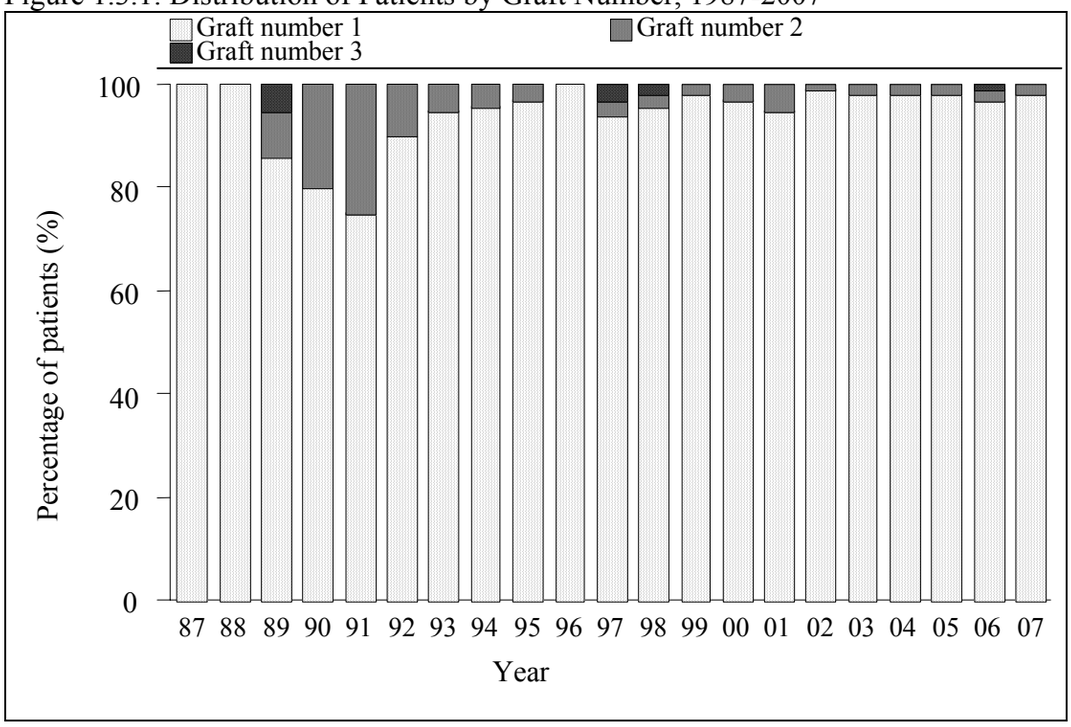


Table 1.3.2: Distribution of Patients by Transplantation Type, 1987-2007

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	
Type of transplant	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Allogeneic + Syngeneic	75	69	75	66	84	66	90	65	90	61	84	66
Autologous	33	31	39	34	44	34	49	35	57	39	43	34
TOTAL	**108**	**100**	**114**	**100**	**128**	**100**	**139**	**100**	**147**	**100**	**127**	**100**

Year	2007		TOTAL	
Type of transplant	**No.**	**%**	**No.**	**%**
Allogeneic + Syngeneic	67	50	893	68
Autologous	68	50	419	32
TOTAL	**135**	**100**	**1312**	**100**

Figure 1.3.2: Distribution of Patients by Transplantation Type, 1987-2007

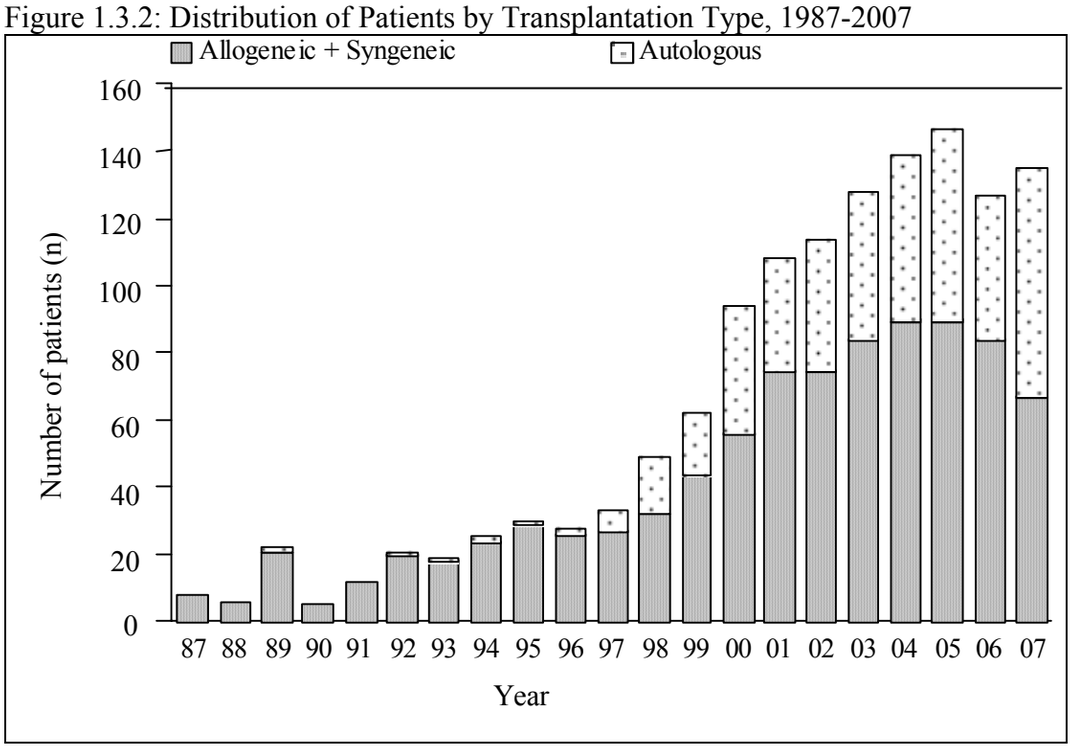


Table 1.3.3: Type of Transplant by Centre, 1987-2007

Type of transplant	Allogeneic + Syngeneic		Autologous		TOTAL	
Centre	**No.**	**%**	**No.**	**%**	**No.**	**%**
KLA	109	12	102	24	211	16
KLP	205	23	29	7	234	18
UKM	56	6	48	11	104	8
SJA	63	7	109	26	172	13
UMA	103	12	53	13	156	12
UMP	294	33	38	9	332	25
GMC	4	0	5	1	9	1
LWE	9	1	1	0	10	1
SJP	35	4	5	1	40	3
ASH	1	0	1	0	2	0
Hospital Ampang	13	1	28	7	41	3
Others*	1	0	0	0	1	0
TOTAL	**893**	**100**	**419**	**100**	**1312**	**100**

* Others include Royal Perth Hospital

Figure 1.3.3: Type of Transplant by Centre, 1987-2007

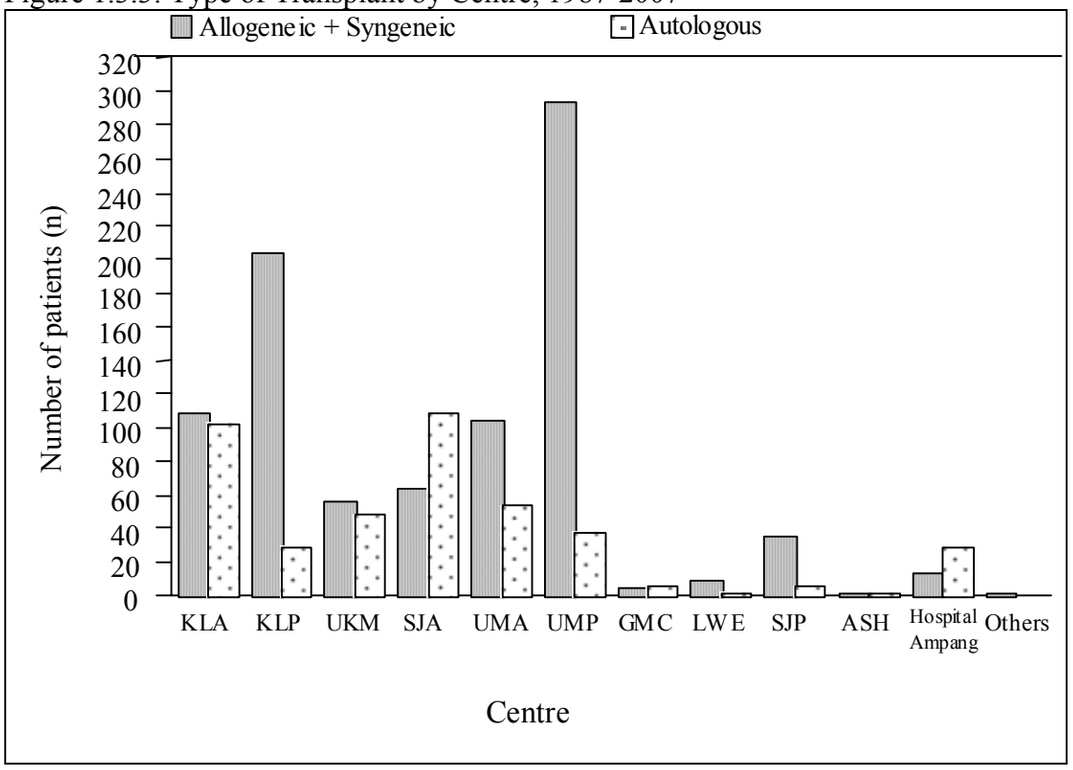


Table 1.3.4: Source of Stem Cells, 1987-2007

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	
Transplant source	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Marrow	31	27	44	34	30	22	24	16	17	13
PBSC / Marrow + PBSC	79	69	79	62	100	72	116	79	100	79
Cord blood / Marrow + cord	4	4	5	4	9	6	7	5	10	8
TOTAL	**114**	**100**	**128**	**100**	**139**	**100**	**147**	**100**	**127**	**100**

Year	2007		Total	
Transplant source	**No.**	**%**	**No.**	**%**
Marrow	23	17	492	38
PBSC / Marrow + PBSC	106	79	764	58
Cord blood / Marrow + cord	6	4	56	4
TOTAL	**135**	**100**	**1312**	**100**

Figure 1.3.4: Source of Stem Cells, 1987-2007

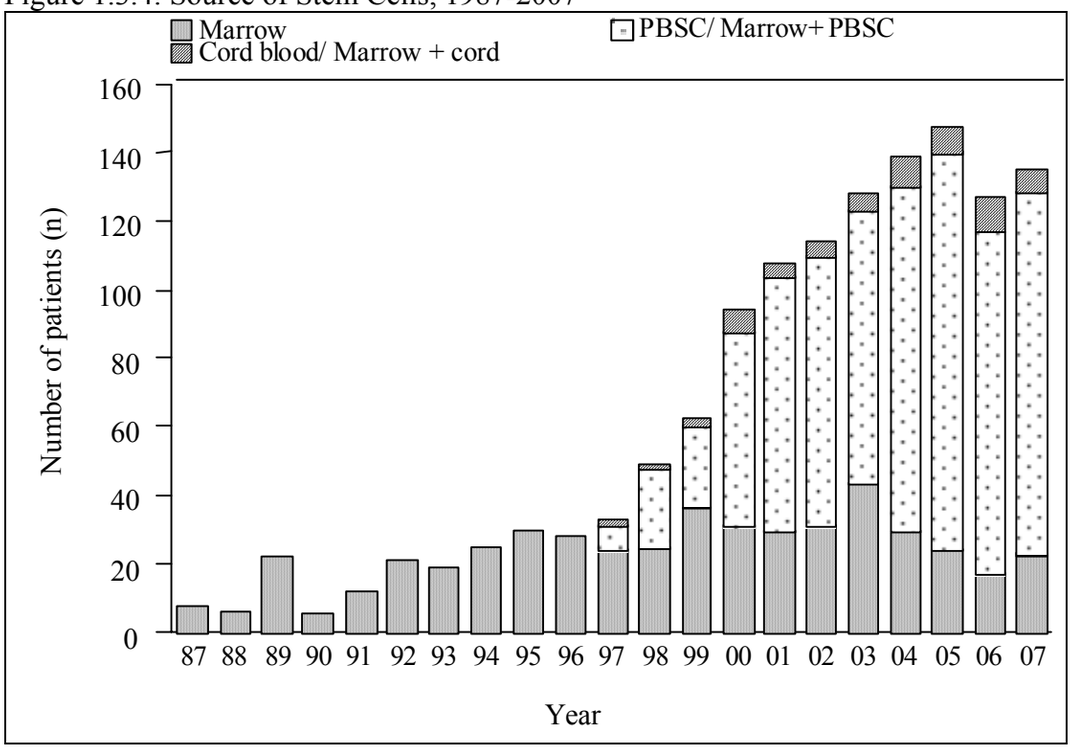


Table 1.3.5: Distribution of Patients by HLA Match, 1987-2007

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**	
HLA Match	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Identical	70	93	79	94	83	92	85	94	78	93
1 AG	3	4	3	4	3	3	4	4	4	5
2 AG	2	3	2	2	4	4	1	1	2	2
≥3 AG Disparate	0	0	0	0	0	0	0	0	0	0
TOTAL	**75**	**100**	**84**	**100**	**90**	**100**	**90**	**100**	**84**	**100**

Year	**2007**		**TOTAL**	
HLA Match	**No.**	**%**	**No.**	**%**
Identical	61	91	841	94
1 AG	3	4	30	3
2 AG	2	3	20	2
≥3 AG Disparate	1	1	2	0
TOTAL	**67**	**100**	**893**	**100**

Table 1.3.6: Distribution of Patients by Allogeneic Donor Relationship, 1987-2007

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	
Allogeneic Donor Relationship	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Sibling	71	95	81	96	81	90	82	91	73	87
Unrelated	4	5	3	4	9	10	8	9	11	13
▪ Marrow	0	0	0	0	1	11	2	25	2	18
▪ PBSC / Marrow + PBSC	0	0	0	0	2	22	1	13	1	9
▪ Cord blood / Marrow + cord	4	100	3	100	6	67	5	63	8	73
Others	0	0	0	0	0	0	0	0	0	0
TOTAL	**75**	**100**	**84**	**100**	**90**	**100**	**90**	**100**	**84**	**100**

Year	2007		TOTAL	
Allogeneic Donor Relationship	**No.**	**%**	**No.**	**%**
Sibling	58	87	841	94
Unrelated	9	13	49	5
▪ Marrow	1	11	6	12
▪ PBSC / Marrow + PBSC	2	22	6	12
▪ Cord blood / Marrow + cord	6	67	37	76
Others	0	0	3	0
TOTAL	**67**	**100**	**893**	**100**

*excluding autologous, including syngeneic

1.4 TRANSPLANT OUTCOMES

Mortality for the 135 HSCT was reported at 17.7%. The commonest causes of death were underlying disease, sepsis and graft-versus-host disease which accounted for 42%, 21% and 4% of all deaths respectively. These causes were similar to the results seen in the CIBMTR (Center for International Blood and Marrow Transplant Research) but the percentage of 21% for sepsis was disproportionately high. In fact the relatively high percentage of septic deaths over the past 5 years should alert transplant centres to audit their clinical practice and policies.

Table 1.4.1: Distribution of Patients by Cause of Death, 1987-2007

Year	**1987**		**1988**		**1989**		**1990**		**1991**	
Cause of death	**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**	
Cause of death	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Sepsis	1	50	2	22	1	20	4	23	6	55
GVHD	0	0	0	0	0	0	4	23	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**	
Cause of death	**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	46	22	72	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	
Cause of death	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Sepsis	4	13	14	27	10	22	9	23	8	32
GVHD	3	10	5	10	9	20	7	18	2	8
Underlying disease	19	64	28	55	23	51	16	40	11	44
Haemorrhage	0	0	0	0	2	5	2	5	1	4
VOD	0	0	0	0	0	0	0	0	3	12
Organ Failure	3	10	2	4	0	0	1	2	0	0
Interstitial pneumonitis	0	0	1	2	0	0	2	5	0	0
Secondary malignancy	0	0	0	0	0	0	0	0	0	0
Others	0	0	0	0	0	0	2	5	0	0
Unknown	1	3	1	2	1	2	1	2	0	0
TOTAL	**30**	**100**	**51**	**100**	**45**	**100**	**40**	**100**	**25**	**100**

Year	2007		Total	
Cause of death	**No.**	**%**	**No.**	**%**
Sepsis	5	21	84	21
GVHD	1	4	41	10
Underlying disease	10	42	215	54
Haemorrhage	0	0	16	4
VOD	0	0	8	2
Organ Failure	0	0	12	3
Interstitial pneumonitis	0	0	7	2
Secondary malignancy	0	0	1	0
Others	8	33	10	3
Unknown	0	0	4	1
TOTAL	**24**	**100**	**398**	**100**

Figure 1.4.1: Patient Survival by Year of Transplant, 1987-2007

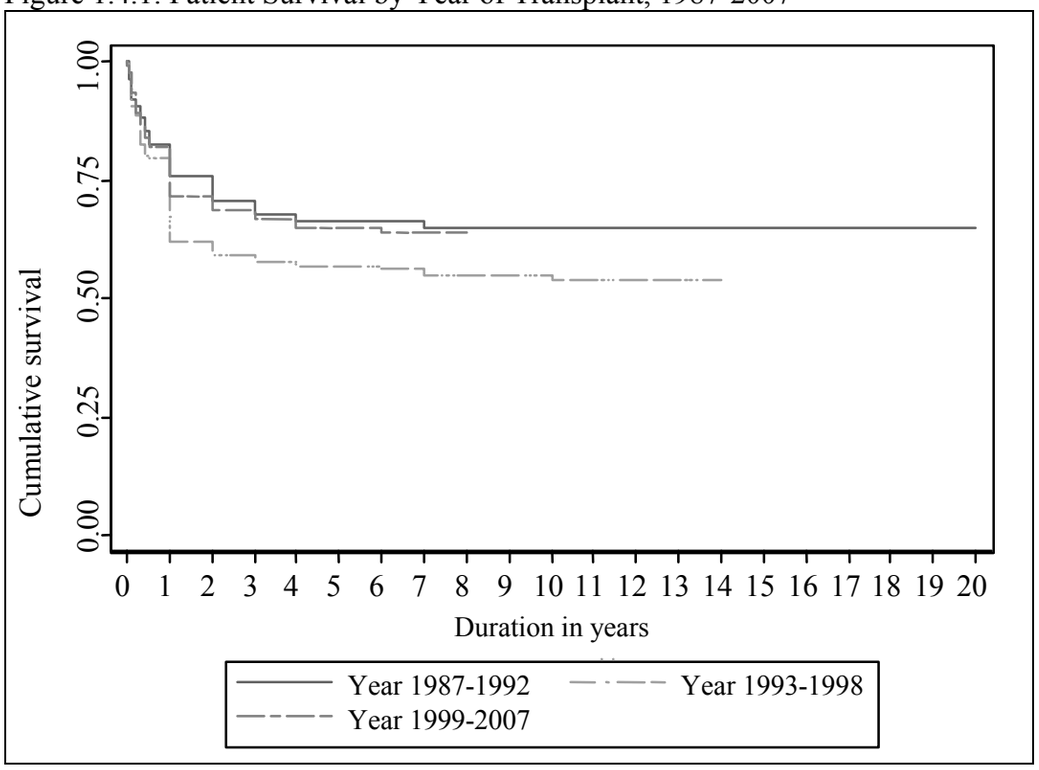


Figure 1.4.2: Patient Survival by Gender, 1987-2007

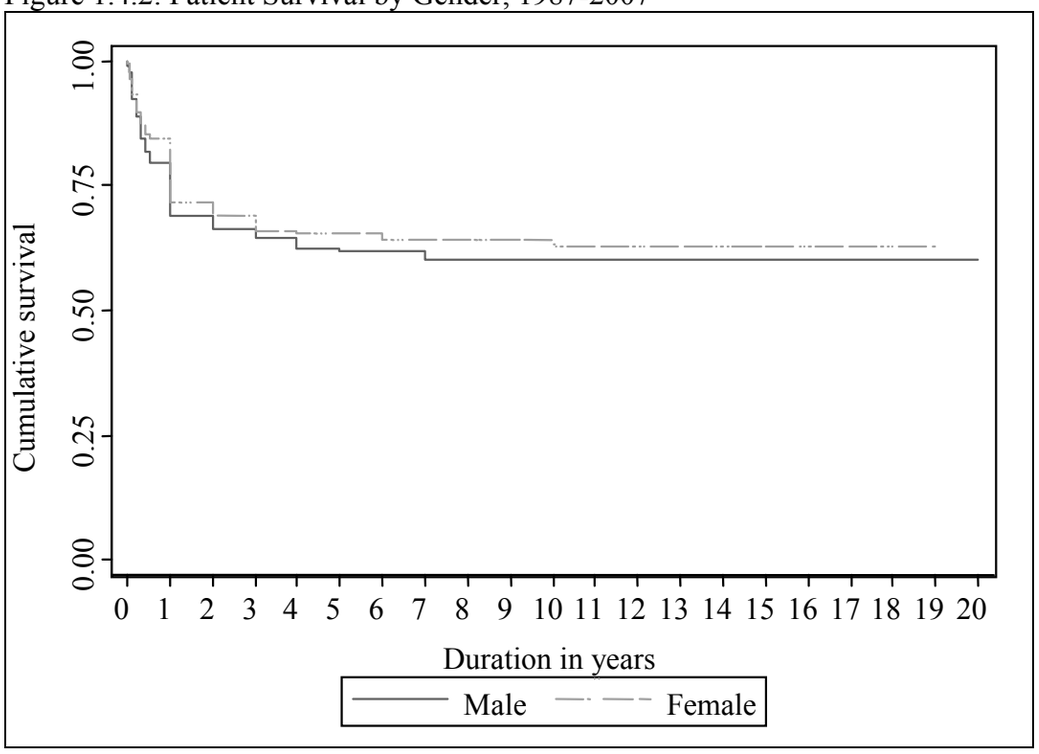


Figure 1.4.3: Patient Survival by Age Group, 1987-2007

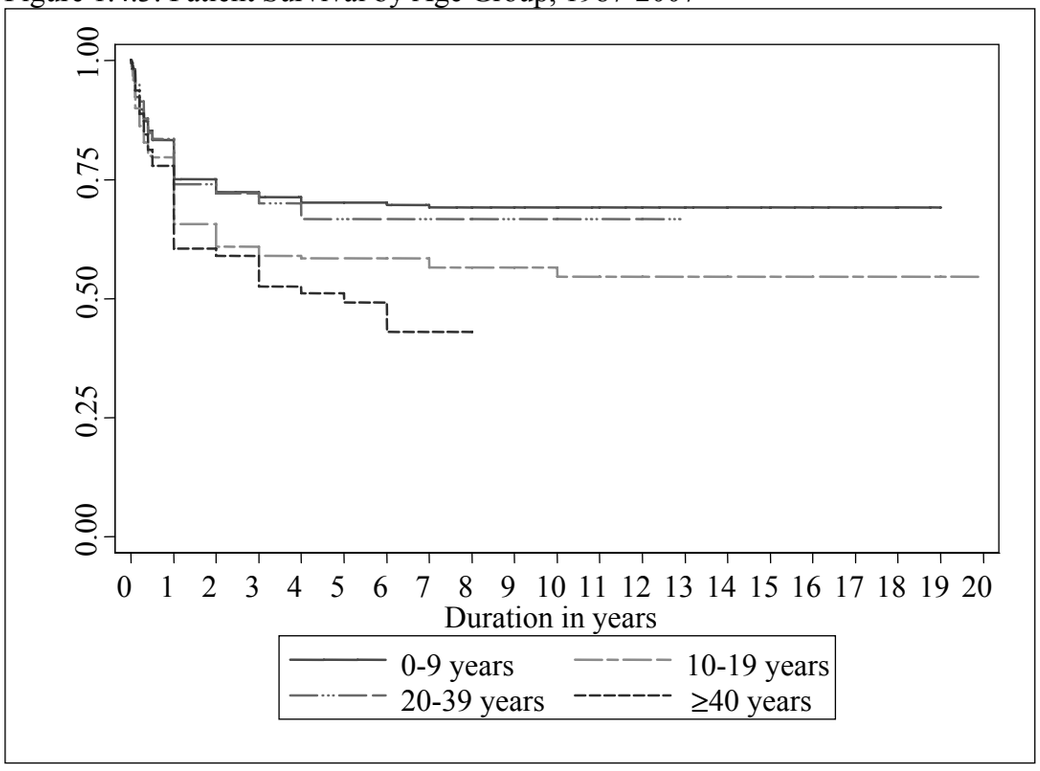
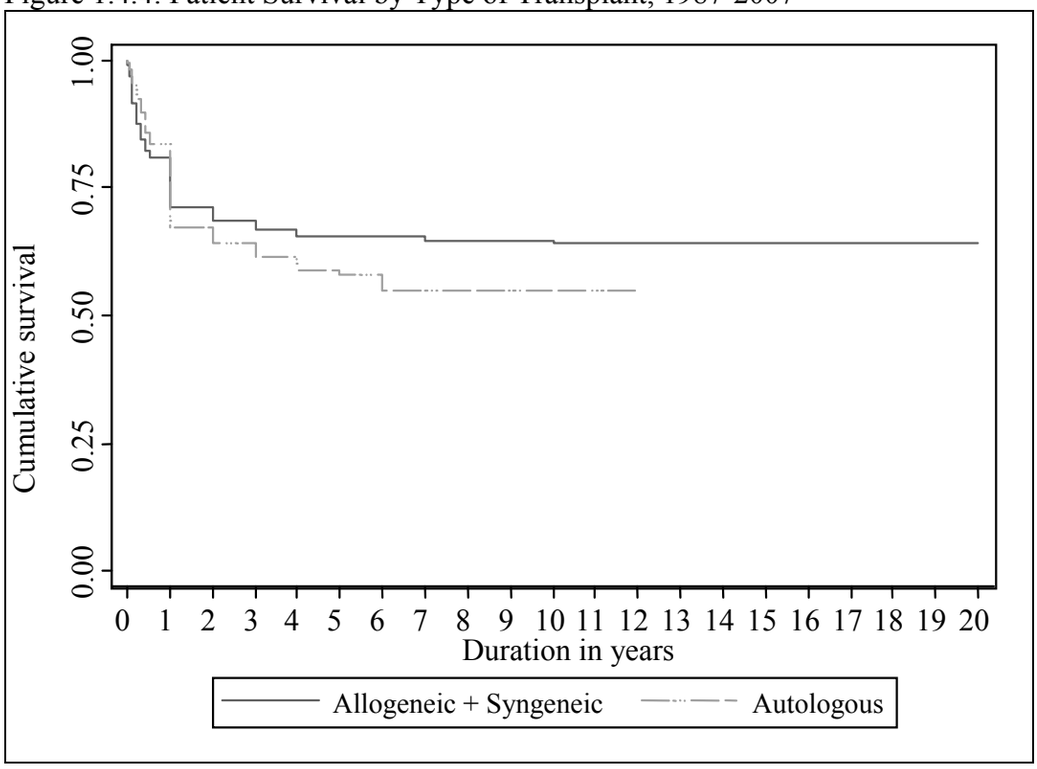


Figure 1.4.4: Patient Survival by Type of Transplant, 1987-2007



1.5 DISEASE-FREE SURVIVAL

Figures 1.5.1 to 1.5.7 depict the disease-free survival for individual diseases while figures 1.5.8 to 1.5.14 show the DFS between paediatric and adult patients. Superior DFS rates were seen in paediatric patients for all diseases except acute lymphoblastic leukaemia and aplastic anaemia. The reasons for the poorer outcome for paediatric recipients with these two disorders were not apparent but may be explained by the remission state at transplant and would merit further analysis in future reports.

Figure 1.5.1: Disease-free Survival for Acute Myeloid Leukaemia, 1987-2007 (Allogeneic vs. Autologous)

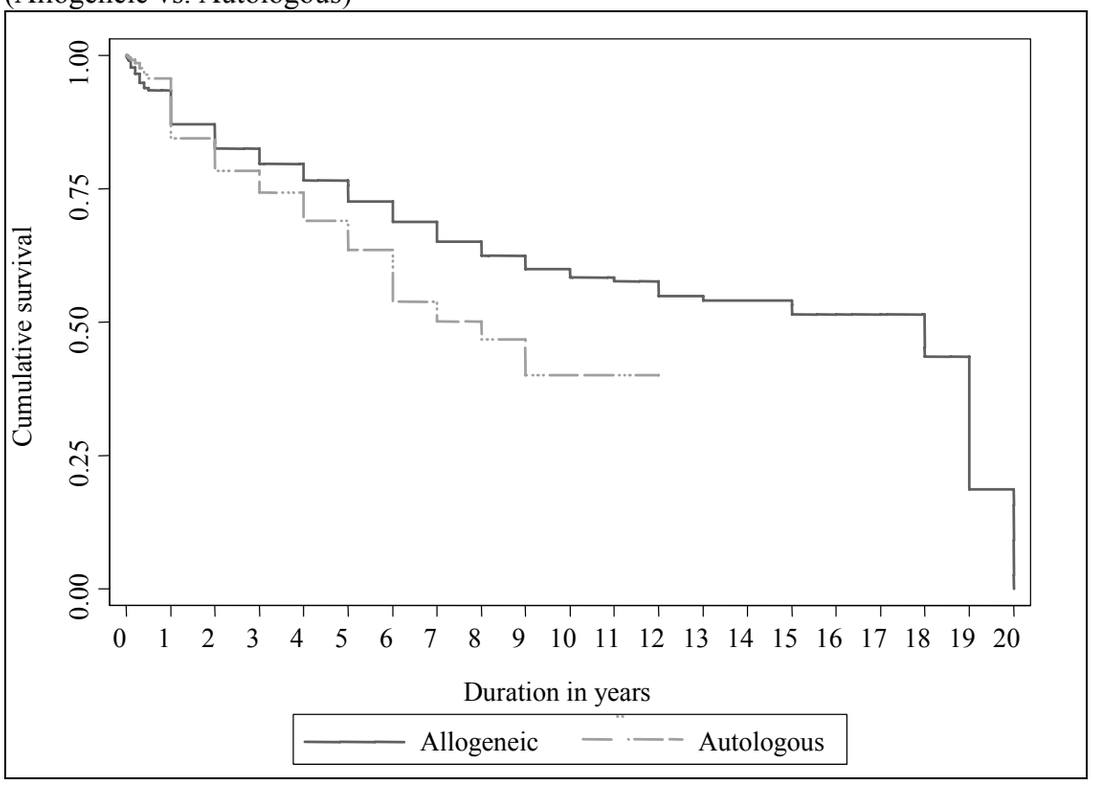


Figure 1.5.2: Disease-free Survival for Acute Lymphoblastic Leukaemia, 1987-2007 (Allogeneic)

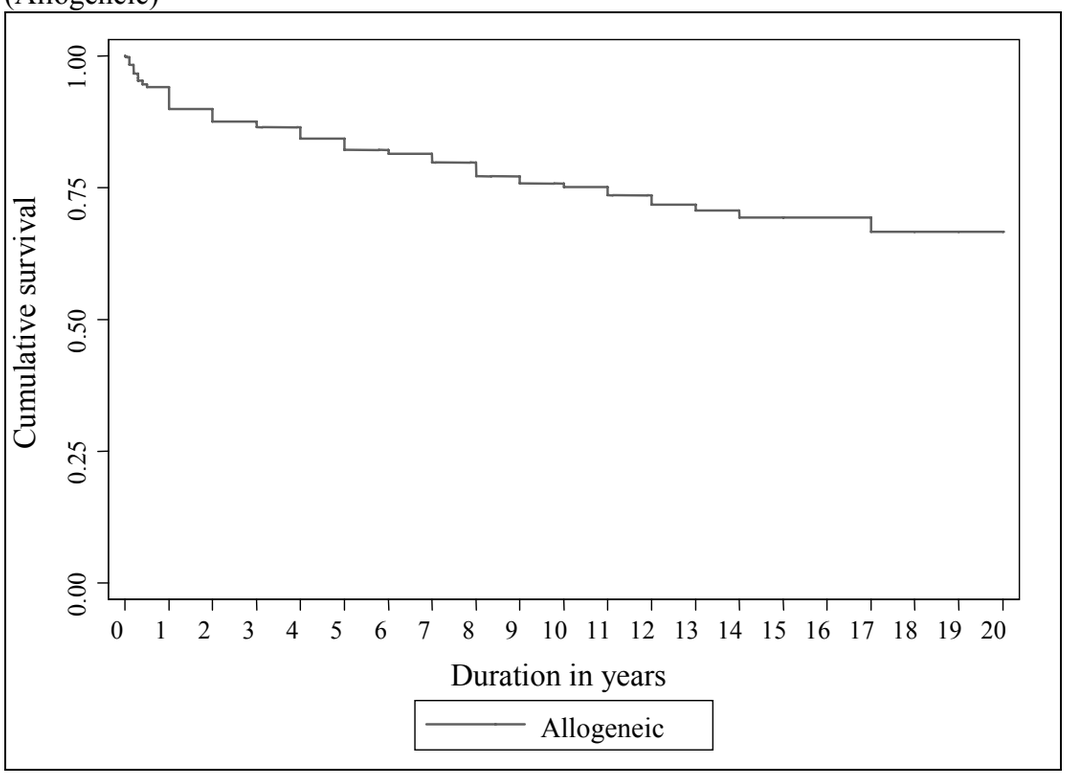


Figure 1.5.3: Disease-free Survival for Thalassaemia, 1987-2007 (Allogeneic)

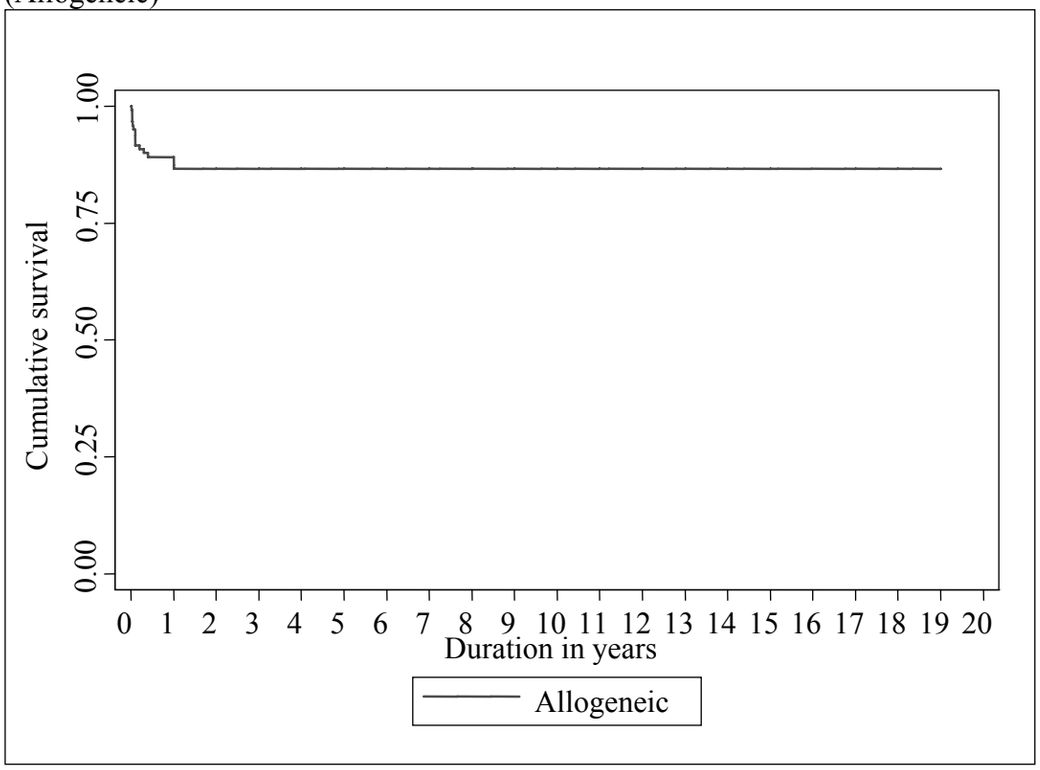


Figure 1.5.4: Disease-free Survival for Non-Hodgkin's Lymphoma, 1987-2007 (Allogeneic vs. Autologous)

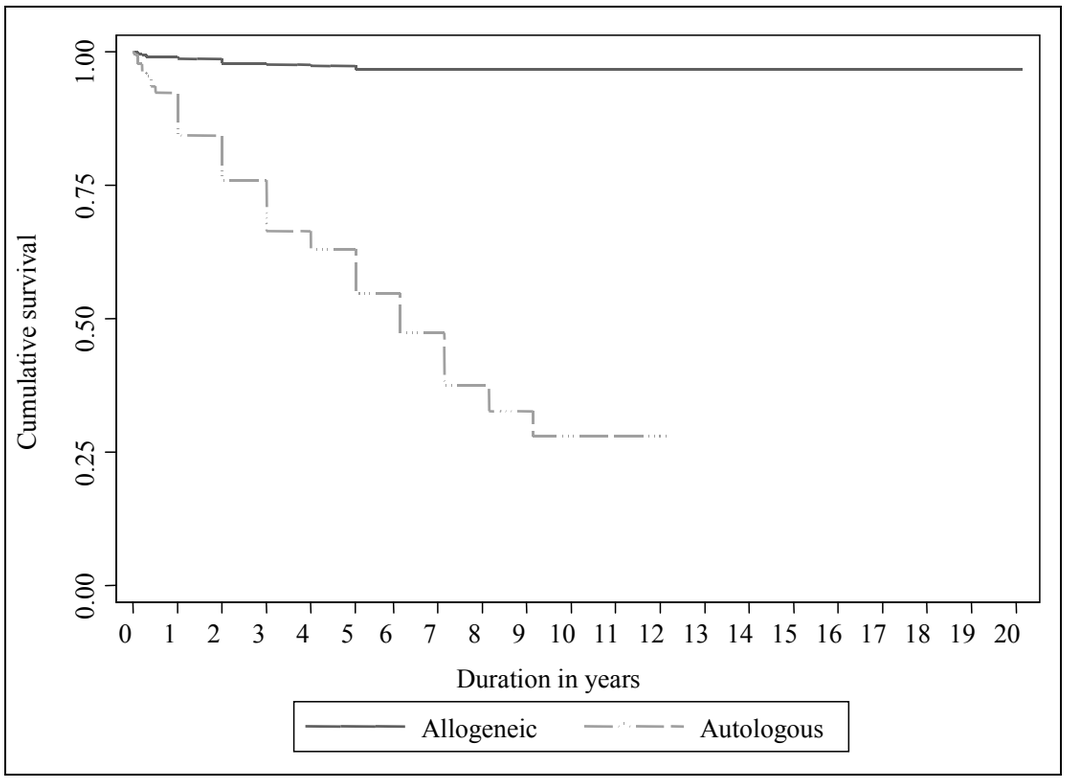


Figure 1.5.5: Disease-free Survival for Hodgkin's Disease, 1987-2007 (Autologous)

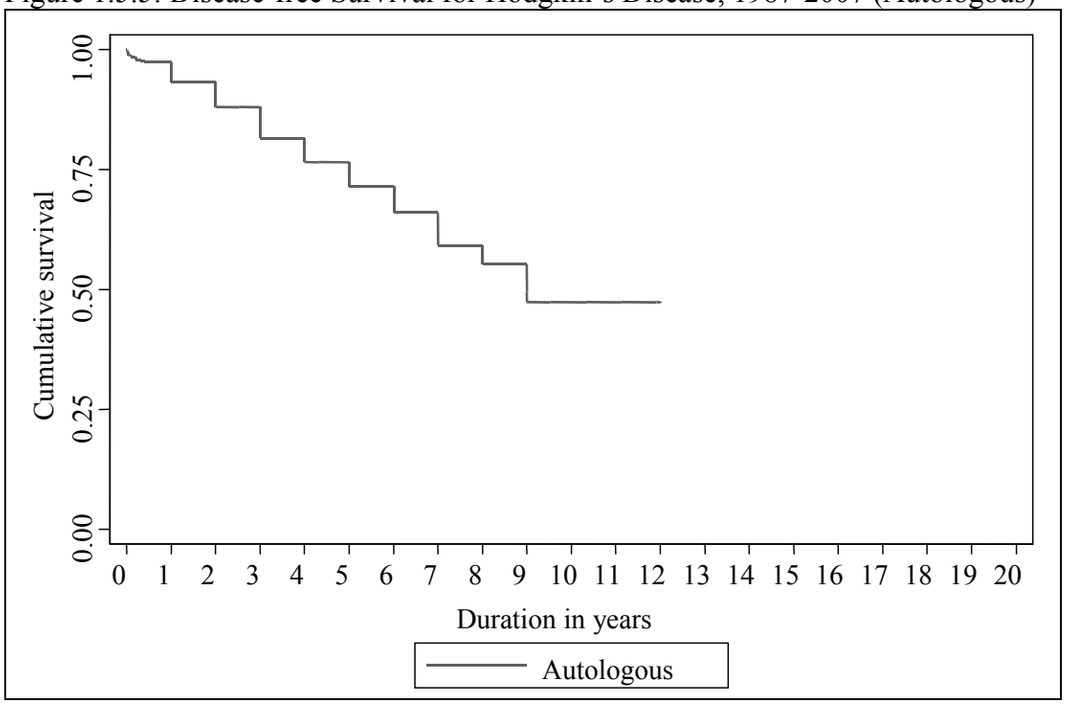


Figure 1.5.6: Disease-free Survival for Chronic Myeloid Leukaemia, 1987-2007 (Allogeneic)

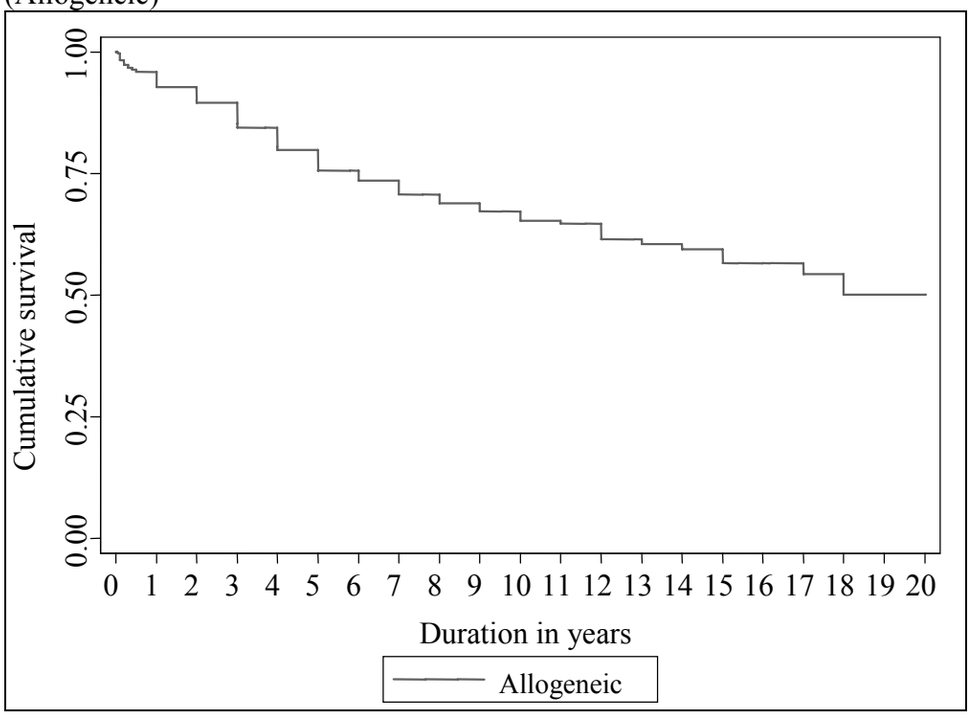


Figure 1.5.7: Disease-free Survival for Aplastic Anaemia, 1987-2007 (Allogeneic)

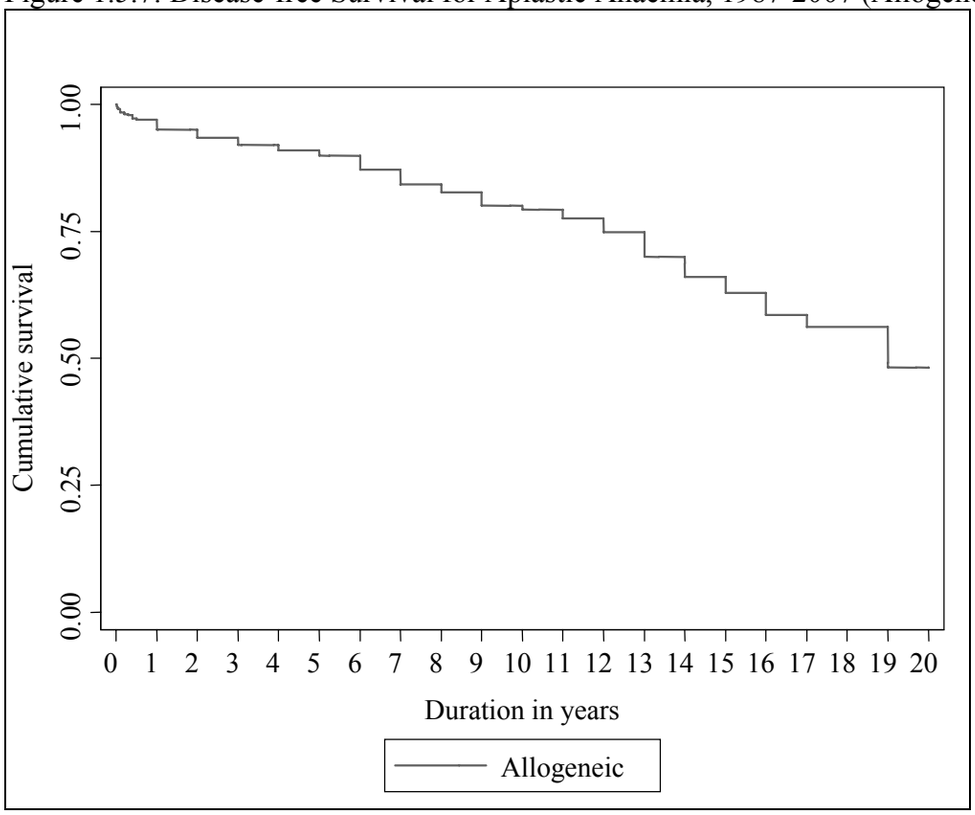
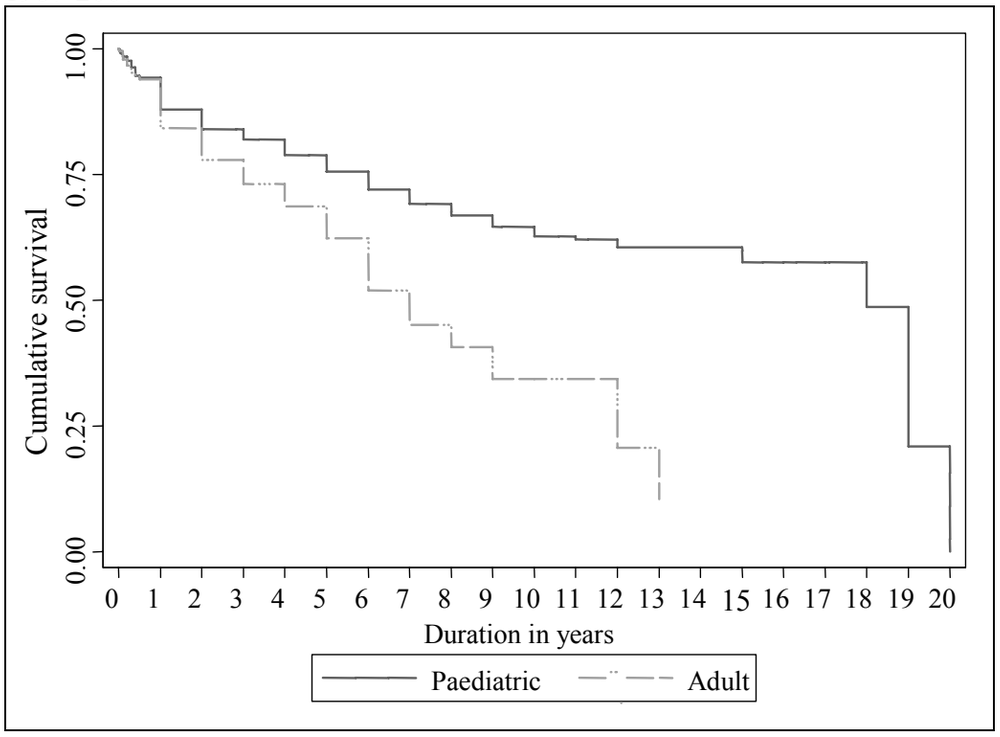
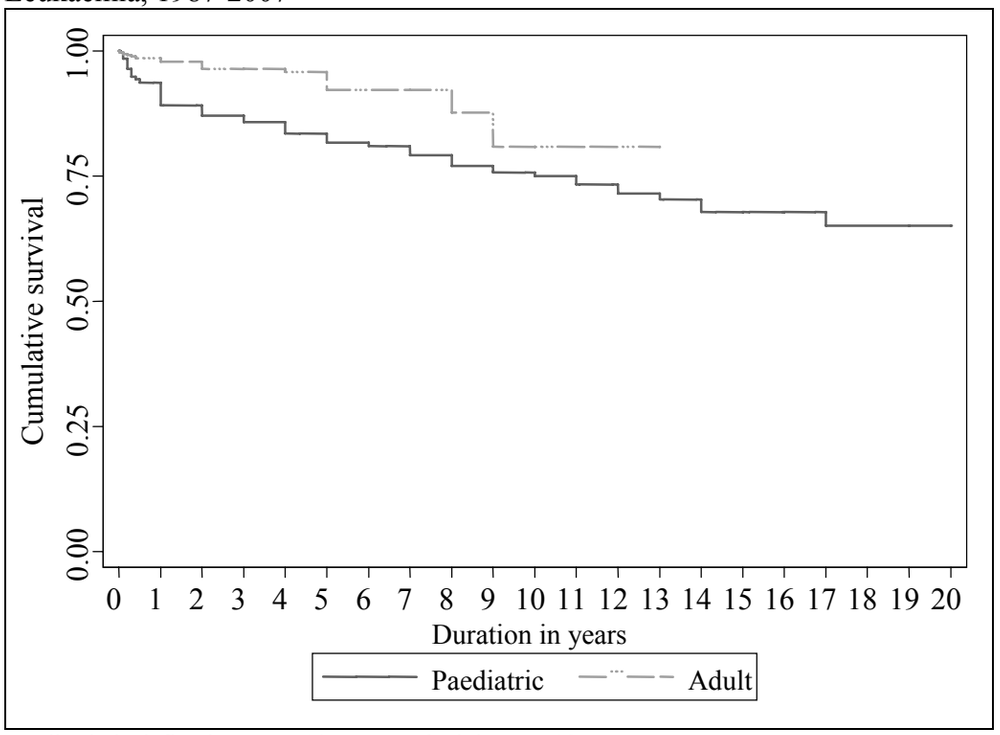


Figure 1.5.8: Disease-free Survival by Age Group for Acute Myeloid Leukaemia, 1987-2007



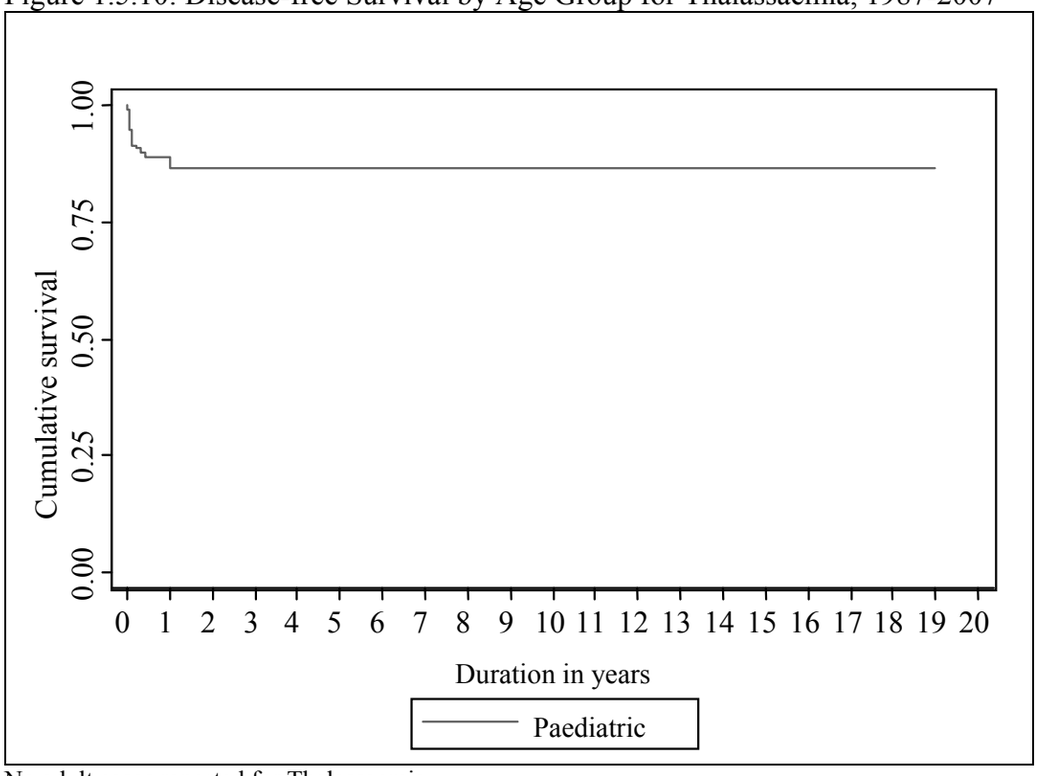
Paediatric is defined as age ≤18 years and adult age >18 years

Figure 1.5.9: Disease-free Survival by Age Group for Acute Lymphoblastic Leukaemia, 1987-2007



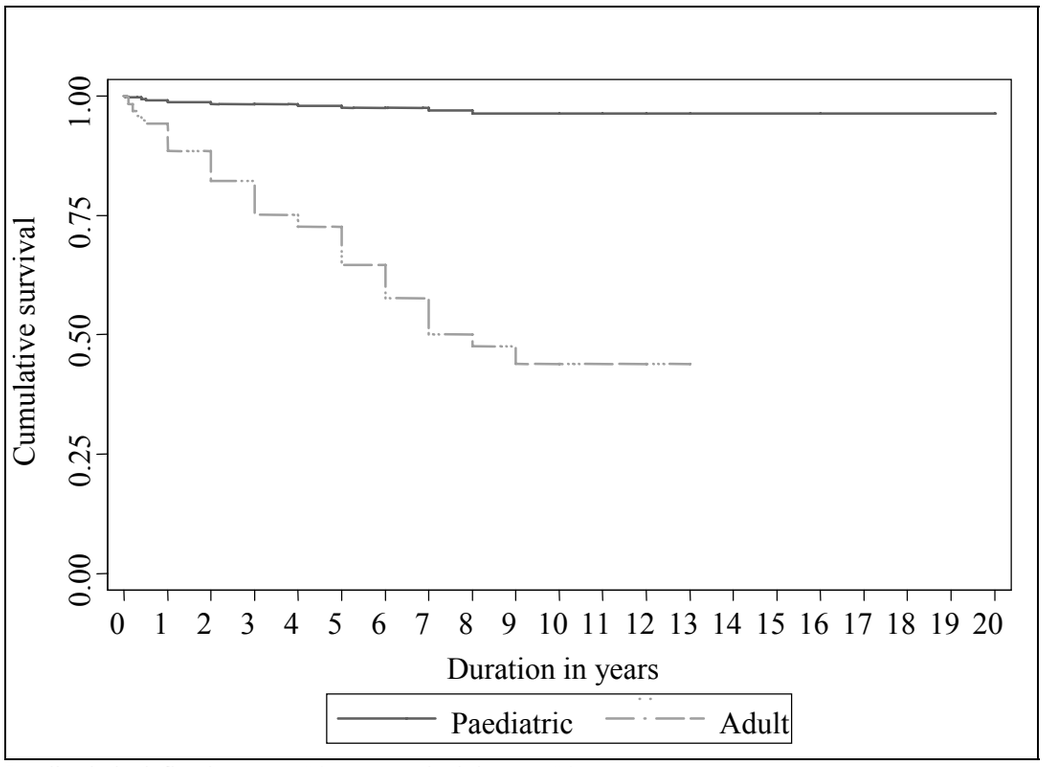
Paediatric is defined as age ≤18 years and adult age >18 years

Figure 1.5.10: Disease-free Survival by Age Group for Thalassaemia, 1987-2007



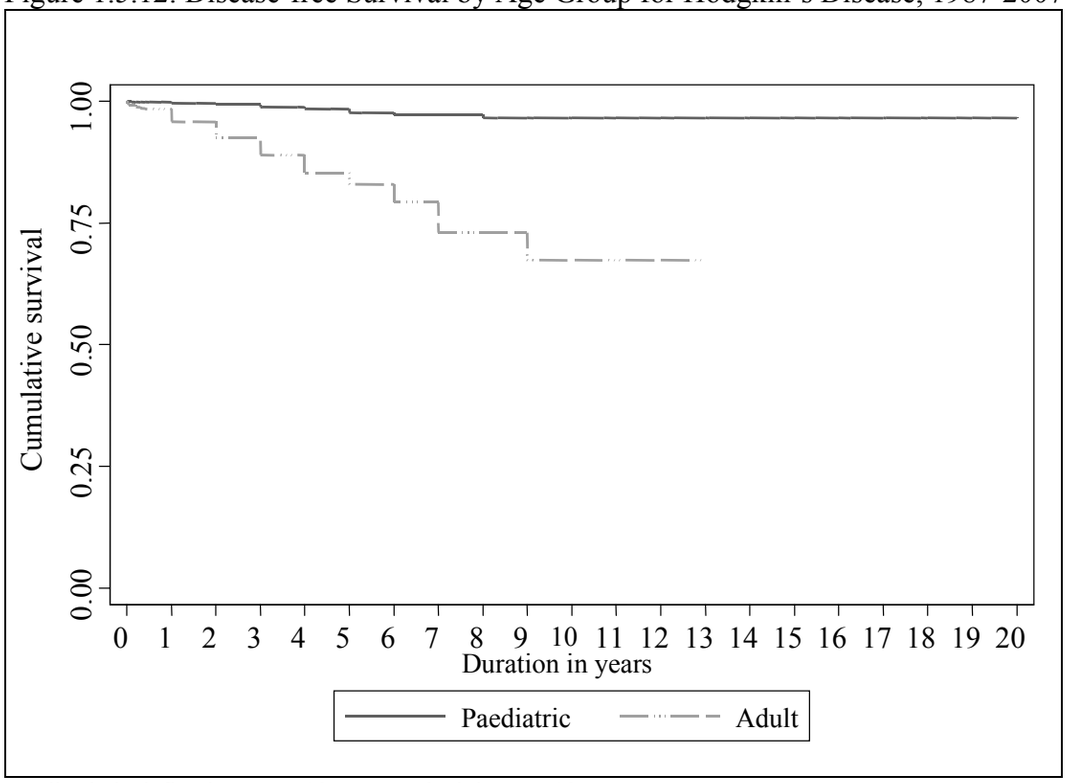
No adult cases reported for Thalassaemia
Paediatric is defined as age ≤18 years and adult age >18 years

Figure 1.5.11: Disease-free Survival by Age Group for Non-Hodgkin's Lymphoma, 1987-2007



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, 1987-2007



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, 1987-2007

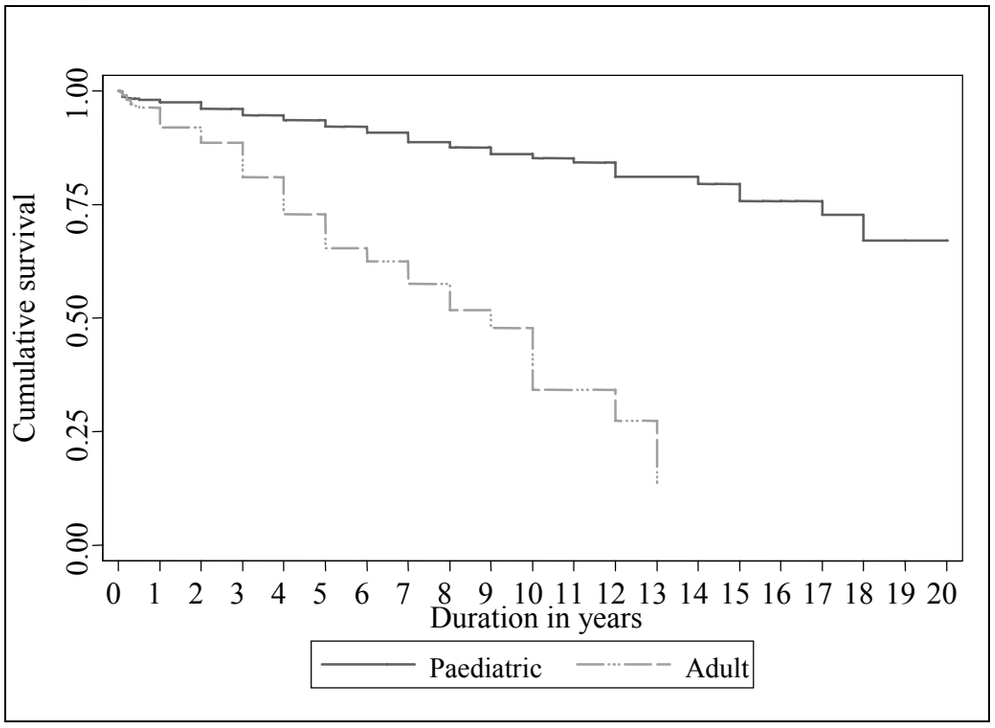
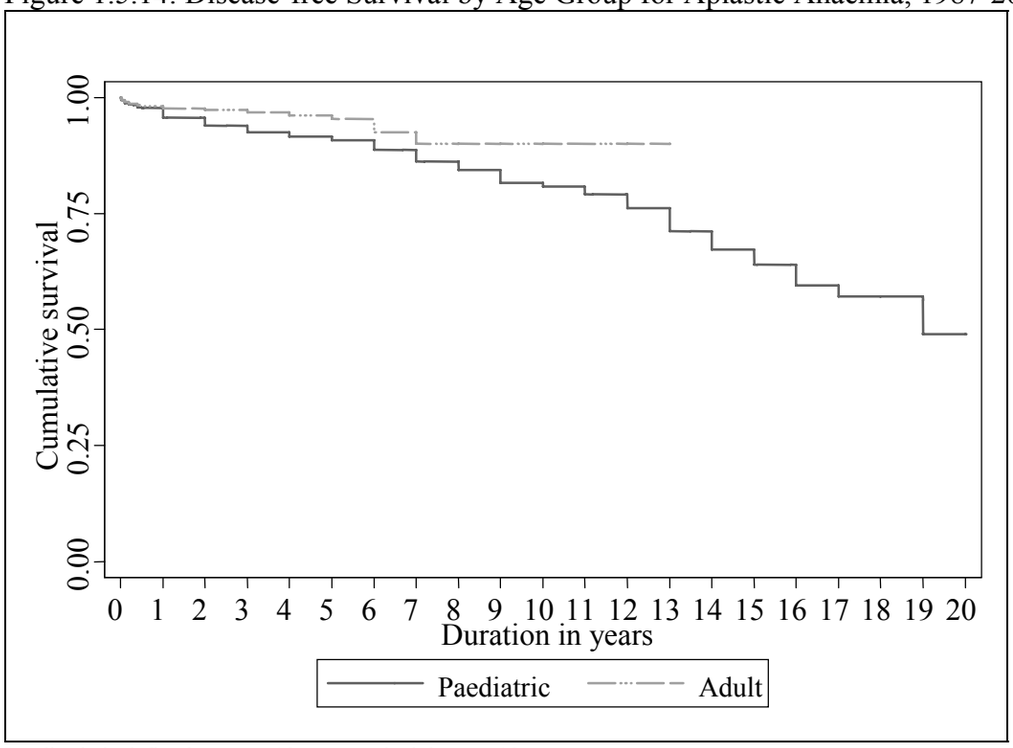


Figure 1.5.14: Disease-free Survival by Age Group for Aplastic Anaemia, 1987-2007



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

1.6 Conclusion

Most of the DFS outcomes reported were comparable to centres in the developed world. Our data did not show greater breakdown in terms of remission status for malignant diseases and we look forward to more detailed analysis in future reports.

All participating centres should be congratulated for their efforts in maintaining good data for this registry. Some of the data have been used for presentations at international conferences and also contribute to the Asia-Pacific Bone Marrow Transplant Registry. A small number of transplant units in Malaysia report individually to the European BMT Registry or the CIBMTR (Center for International Blood and Marrow Transplant Research).

The challenges which we faced in meeting the needs of patients who require HSCT in 2007 included a lack of HSCT beds resulting in a significant waiting list even for patients who have matched sibling donors identified. Some patients lacked financial resources to pursue the option of unrelated donor transplantations and hence were deprived of a potential chance of cure. Hopefully these challenges will spur the HSCT community in Malaysia to greater efforts to meet the needs of patients.

CHAPTER 2

CORNEAL TRANSPLANTATION

Editors:
Dr Shamala Retnasabapathy
Dr Choong Yean Yaw
Dr Michael Law Sie Haur
Dr Chandramalar Santhirathelagan

Expert Panel:
Dr Shamala Retnasabapathy (Chairperson)
Dr Choong Yean Yaw (Co-chairperson)
Dr Jonathan Choon Siew Cheong
Dr Chuah Kay Leong
Dr Michael Law Sie Haur
Dr Mariam Ismail
Assoc Prof. S C Reddy
Dato' Dr Veera Ramani
Dr Sahimi Sulaiman
Dr U Thiageswari
Dr Chandramalar Santhirathelagan

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2.0 INTRODUCTION

Corneal transplantation surgery allows restoration of vision in patients with corneal blindness. Corneal 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 corneal transplant section of the NTR is a systematic centralised data collection of all corneal transplantation performed in the country.

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

Retrospective data (from 1998 to 2003) on corneal transplant activities were collected to identify the trend of corneal transplant surgery in the recent past. ***Prospective data*** (from the year 2004) on corneal transplant activities involved gathering information on all cornea transplants performed in Malaysia on two forms. The first form is the i) **Corneal 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. The second form is the ii) **Corneal 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.

The Corneal section of the NTR will be discussed under 5 sections.

Section 2.1 and *Section 2.2* covers notification data on corneal transplantation over 10 years from 1998 to 2007. Effort was made to ensure that all cases of corneal transplantation were reported. To the best of our knowledge, this report provides information on all corneal transplants performed in the country.

Section 2.3 covers prospective notification data on corneal transplantation performed (*from 2004 onwards*).

Section 2.4 covers prospective outcome data on corneal transplantation performed (*from 2004 onwards*).

Section 2.5 covers prospective outcome data on corneal transplantation complications (*from 2004 onwards*).

2.1 CORNEAL TRANSPLANT ACTIVITIES AND TRENDS (1998 – 2007)

The number of corneal transplants performed between the years 1998 to 2007 varied annually, 1998 had the least number of cases (119 cases) and 2001 had the highest number of cases (221 cases). (Table 2.1.1)

Penetrating keratoplasty was the most frequent type of corneal transplant surgery and was performed in 92% of cases (Table 2.1.2).

Table 2.1.1: Number of Corneal Transplantation and Transplant Rate per million population (pmp), 1998-2007

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
No. of new transplants	119	122	126	221	203	165	184	192	177	189
New transplant rate pmp	5	5	5	9	8	7	7	7	7	7

Table 2.1.2: Types of Corneal Transplant, 1998-2007

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=177)		2007 (N=189)		TOTAL (N=1698)	
	No.	%	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	153	86	168	88	1568	92
Lamellar Keratoplasty	1	1	5	4	5	4	14	6	5	2	8	5	10	5	13	7	16	9	5	3	82	5
Patch Graft for Corneal	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	2	5	3	10	5	20	1
Patch Graft for Sclera	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	3	2	5	0
Cornea Scleral Keratopalsty	0	0	1	1	0	0	0	0	0	0	1	0	7	4	2	1	2	1	3	2	16	1
No data	4	3	0	0	1	1	0	0	2	1	0	0	0	0	0	0	0	0	0	0	7	1

2.2 RECIPIENTS' CHARACTERISTICS

There was a preponderance of male recipients each year and this ranged from 59% to 69% (Table 2.2.1). Ethnic Chinese (38%) were the predominant race undergoing corneal transplant surgery followed by Malays (32%) and Indians (22%) (Table 2.2.2) The mean age was 46 years (SD 21) with a range from as young as 2 months of age to as old as 102 years (Table 2.2.3)

The commonest primary indication for surgery was keratoconus (17%) followed by cornea scar (15%), pseudophakic bullous keratopathy (13%) and other (non-pseudophakic) bullous keratopathy (11%) (Table 2.2.4). There may be one or more indications for corneal transplant surgery. The most frequent indication was optical (69%). (Table 2.2.5)

Table 2.2.1: Gender Distribution, 1998-2007

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=177)		2007 (N=189)		TOTAL (N=1698)	
Gender	**No.**	**%**	**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	118	67	124	66	1086	64
Female	41	34	42	34	45	36	79	36	81	40	51	31	72	39	77	40	59	33	65	34	612	36

Table 2.2.2: Ethnic Distribution, 1998-2007

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=177)		2007 (N=189)		TOTAL (N=1698)	
Ethnic group	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Malay	28	24	34	28	41	33	70	32	74	36	52	32	66	36	62	32	60	34	62	33	549	32
Chinese	47	39	46	38	50	40	92	42	83	41	67	41	58	32	73	38	59	33	65	35	641	38
Indian	36	30	35	29	28	22	49	22	35	17	34	20	43	23	41	21	40	23	38	19	378	22
Bumiputra Sabah	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	3	2	2	1	7	0
Bumiputra Sarawak	0	0	0	0	0	0	1	0	0	0	0	0	4	2	5	3	4	2	4	2	18	1
Others	8	7	7	5	6	5	5	2	9	5	11	7	10	5	10	5	11	6	18	10	95	6
No Data	0	0	0	0	1	0	4	2	2	1	1	0	2	1	0	0	0	0	0	0	10	1

Table 2.2.3: Age Distribution of Corneal Transplant Recipient Patients, 1998-2007

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=177)		2007 (N=189)		TOTAL (N=1698)	
Age group (years)	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
0-9	4	3	5	4	6	5	8	4	9	4	6	4	6	3	8	4	7	4	4	2	63	4
10-19	13	11	17	14	9	7	29	13	16	8	21	13	15	8	14	7	23	13	13	7	170	10
20-39	28	24	34	28	34	27	49	22	53	26	36	22	55	30	59	31	53	30	48	26	449	26
40-59	38	22	32	26	40	32	61	28	57	28	51	31	52	28	45	23	41	23	63	33	480	28
≥ 60	36	30	34	28	37	29	74	33	68	33	51	31	56	30	66	34	53	30	61	32	536	32
Mean	45		43		44		45		46		45		45		46		44		47		45	
SD	21		22		20		21		21		21		21		21		22		21		21	
Median	45		43		45		50		46		46		44		49		43		49		46	
Minimum	4 months		5		2 months		5 months		1		5 months		2 months		2 months		2 months		3		2 months	
Maximum	82		92		86		85		86		84		86		84		96		102		102	

Table 2.2.4: Primary Diagnosis, 1998-2007

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=177)		2007 (N=189)		TOTAL (N=1698)	
Primary Diagnosis	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Keratoconus	24	20	24	20	15	12	38	17	32	16	18	11	34	18	34	18	33	19	29	15	281	17
Corneal scar	33	28	25	20	21	17	34	15	28	14	21	13	26	14	20	10	18	10	25	13	251	15
Microbial keratitis	11	9	11	9	19	15	30	14	31	15	21	13	18	10	13	7	11	6	13	7	178	10
Microbial keratitis+Cornea perforation	1	1	6	5	1	1	6	3	4	2	4	2	17	9	20	10	7	4	10	5	76	4
Corneal perforation (non microbial)	6	5	7	6	8	6	12	5	12	6	27	16	13	7	18	9	20	11	21	11	144	8
Pseudophakic Bullous keratopathy	10	8	16	13	17	13	23	10	15	7	19	12	19	10	35	18	30	17	32	17	216	13
Other (non psedophakic) bullous keratopathy	14	12	4	3	19	15	37	17	47	23	25	15	16	9	14	7	11	6	8	4	195	11
Failed previous graft	14	12	12	10	13	10	17	8	15	7	14	8	12	7	14	7	10	6	23	12	144	8
Corneal dystrophy	5	4	6	5	5	4	12	5	9	4	7	4	8	4	6	3	10	6	13	7	81	5
Congenital opacity	1	1	1	1	1	1	1	0	0	0	1	1	8	4	4	2	1	1	1	1	19	1
Others	3	3	8	7	7	6	15	7	14	7	10	6	34	18	34	18	36	20	38	20	199	12
No data	0	0	2	2	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	5	0

*1650 patients have 1 primary diagnosis, 168 have 2 primary diagnoses, 11 patients had 3 diagnoses, and 1 patient had 4 diagnoses

Table 2.2.5: Indications of Corneal Transplant, 2004-2007

Indication of transplant	2004 (N=184)		2005 (N=192)		2006 (N=177)		2007 (N=189)		TOTAL (N=742)	
	No.	%	No.	%	No.	%	No.	%	No.	%
Optical	120	65	135	70	124	70	132	69	511	69
Tectonic	26	14	23	12	20	11	17	9	86	12
Therapeutic	27	14	19	10	17	9	24	13	87	12
Tectonic + Therapeutic	9	5	9	5	4	2	8	4	30	4
Optical + Tectonic	1	1	1	1	1	1	0	0	3	0
Optical + Tectonic + Therapeutic	0	0	1	1	0	0	1	1	2	0
Optical + Therapeutic	0	0	0	0	5	3	6	3	11	2
Optical + Others	0	0	0	0	1	1	0	0	1	0
Others	1	1	4	2	4	2	1	1	10	1
No data	0	0	0	0	1	1	0	0	1	0

2.3 TRANSPLANT DATA, 2004-2007

2.3.1 Recipient data

Re-grafts were performed in 12% of cases (Table 2.3.1.1). Corneal vascularisation was the most frequently encountered pre-operative ocular co-morbidity, followed by ocular inflammation and glaucoma (raised intraocular pressure) (Table 2.3.1.2)

Sixty four percent of cases were legally blind (vision 3/60 or worse) prior to corneal transplantation (Table 2.3.1.3).

Table 2.3.1.1: No of Previous Grafts in Grafted Eye, 2004-2007

Graft Number	2004 * (N=138)		2005 (N=192)		2006 (N=177)		2007 (N=189)		Total (N=696)	
	No.	%	No.	%	No.	%	No.	%	No.	%
0	123	89	171	89	160	90	156	83	610	88
1	11	8	15	8	15	8	28	15	69	10
2	3	2	2	1	1	1	4	2	10	1
3	0	0	4	2	1	1	0	0	5	1
4	1	1	0	0	0	0	1	0	2	0

* In the year 2004 there were a total of 184 corneal transplants performed but complete data set was only received for 138 patients.

Table 2.3.1.2: Ocular Co-morbidity, 2004-2007

	2004 (N=138)		2005 (N=192)		2006 (N=177)		2007 (N=189)		Total (N=696)	
Ocular co-morbidity	No.	%	No.	%	No.	%	No.	%	No.	%
Any ocular co-morbidity (a to d below)	88	64	103	54	81	46	83	44	355	51
a) Superficial corneal vascularisation	44	57	48	61	43	73	49	74	184	65
b) Deep corneal vascularisation	42	55	39	49	22	37	26	39	129	46
c) History of glaucoma	29	33	36	35	35	43	36	43	136	38
d) Current ocular inflammation	41	47	50	49	41	51	39	47	171	48

*Patient might have multiple ocular co-morbidities.

Table 2.3.1.3: Pre-operative Vision, 2004-2007

	2004 (N=138)		2005 (N=192)		2006 (N=177)		2007 (N=189)		Total (N=696)	
Unaided VA	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6/6	3	2	0	0	1	1	1	1	5	1
6/9	1	1	1	1	1	1	2	1	5	1
6/12	0	0	2	1	3	2	0	0	5	1
6/18	0	0	1	1	0	0	2	1	3	0
6/24	3	2	5	3	4	2	2	1	14	2
6/36	4	3	6	3	5	3	3	1	18	3
6/60	7	5	16	8	17	9	11	6	51	8
5/60	1	1	0	0	0	0	0	0	1	0
4/60	3	2	1	1	2	1	2	1	8	1
3/60	2	1	1	1	2	1	3	1	8	1
2/60	1	1	2	1	4	2	1	1	8	1
1/60	4	3	9	5	7	4	1	1	21	3
CF	47	34	47	24	44	25	42	22	180	26
HM	47	34	46	24	37	21	46	24	176	25
PL	13	9	15	8	12	7	16	8	56	8
NPL	2	1	1	1	0	0	0	0	3	0
Others	0	0	1	1	0	0	1	1	2	0
No data	0	0	38	20	38	21	56	30	132	19

2.3.2: Donor details

The most frequent of source of the cornea tissues were from Eye Banks in the United States of America. (Table 2.3.2.1). The majority of donors were elderly patients with a median age of 58 years (Table 2.3.2.2). Optisol GS was the commonest corneal tissue storage medium used at 74% (Table 2.3.2.3). The major cause of death of the donors were related to the cardiac or circulatory system (33%) followed by malignancy (14%) (Table 2.3.2.4)

Table 2.3.2.1: Source of Donor Cornea Tissue, 2004-2007

	2004* (N=138)		2005 (N=192)		2006 (N=177)		2007 (N=189)		Total (N=696)	
Source of donor	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Local	20	14	19	10	36	20	31	16	106	15
USA	95	69	133	69	98	56	107	57	433	62
Sri Lanka	22	16	38	20	41	23	51	27	152	22
Others	0	0	0	0	2	1	0	0	2	0
No data	1	1	2	1	0	0	0	0	3	1
If Local, ethnic group:										
• Malay	0	0	4	21	1	3	5	16	10	9
• Chinese	14	70	8	42	12	33	18	58	52	49
• Indian	5	25	7	37	23	64	4	13	39	37
• Others	0	0	0	0	0	0	4	13	4	4
• No data	1	5	0	0	0	0	0	0	1	1

* In the year 2004 there were a total of 184 corneal transplants performed but complete data set was only received for 138 patients.

Figure 2.3.2.1: Source of Donor Corneal Tissue, 2004-2007

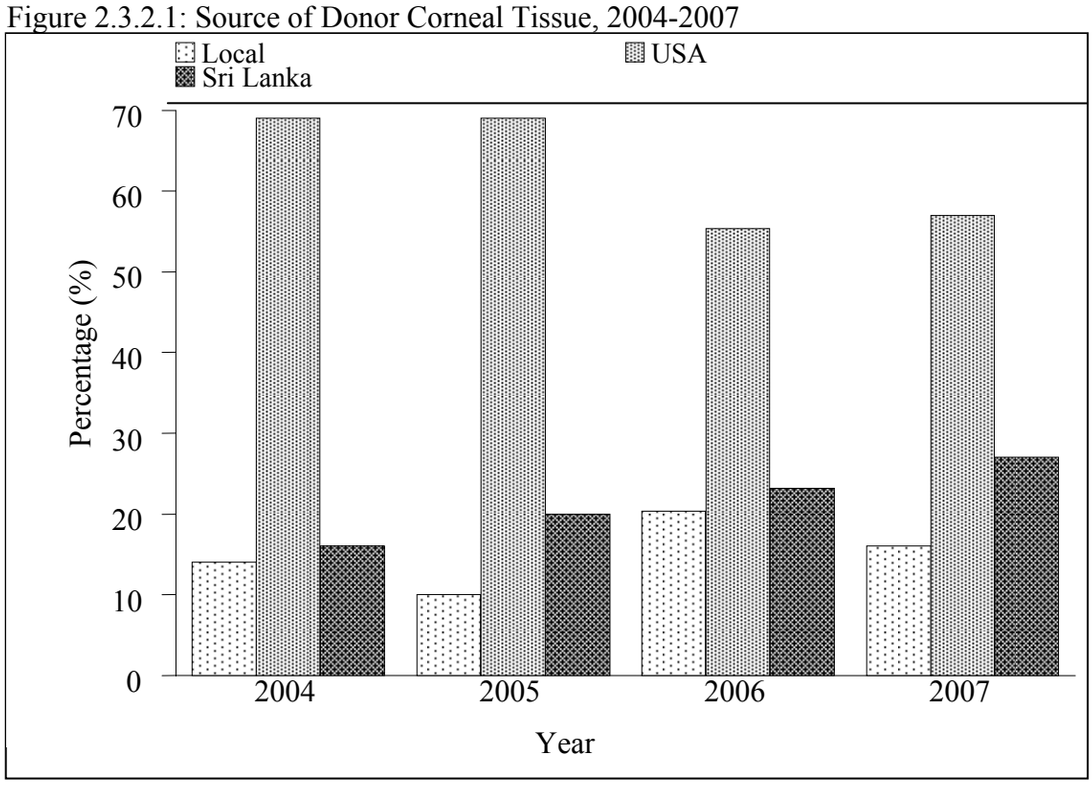


Table 2.3.2.2: Donor Age Distribution, 2004-2007

	2004 (N=138)		2005 (N=192)		2006 (N=174)		2007 (N=189)		Total (N=696)	
Age, years	**No.**	**%**	**No.**	**%**	**No.**	**No.**	**%**	**No.**	**%**	**No.**
0-9	2	1	3	2	2	1	2	1	9	1
10-19	6	4	4	2	9	5	5	3	24	4
20-39	11	8	7	4	11	6	13	7	42	6
40-59	52	38	89	46	81	46	79	41	301	43
≥60	67	49	89	46	74	42	90	48	320	46
Mean	56		58		56		57		57	
SD	15		14		16		14		15	
Median	59		58		56		59		58	
Minimum	8		3		6		4		3	
Maximum	78		79		78		78		79	

Table 2.3.2.3: Preservation Media, 2004-2007

	2004 (N=138)		2005 (N=192)		2006 (N=177)		2007 (N=189)		Total (N=696)	
Preservation media	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Optisol GS	110	80	147	77	129	73	127	67	513	74
MK Medium	22	16	37	19	40	23	51	27	150	21
Moist Chamber	4	3	3	2	7	4	8	4	22	3
Others*	0	0	1*	0	0	0	3	2	4	1
No data	2	1	4	2	1	0	0	0	7	1

*Others : Eusol-C

Figure 2.3.2.3: Preservation Media, 2004-2007

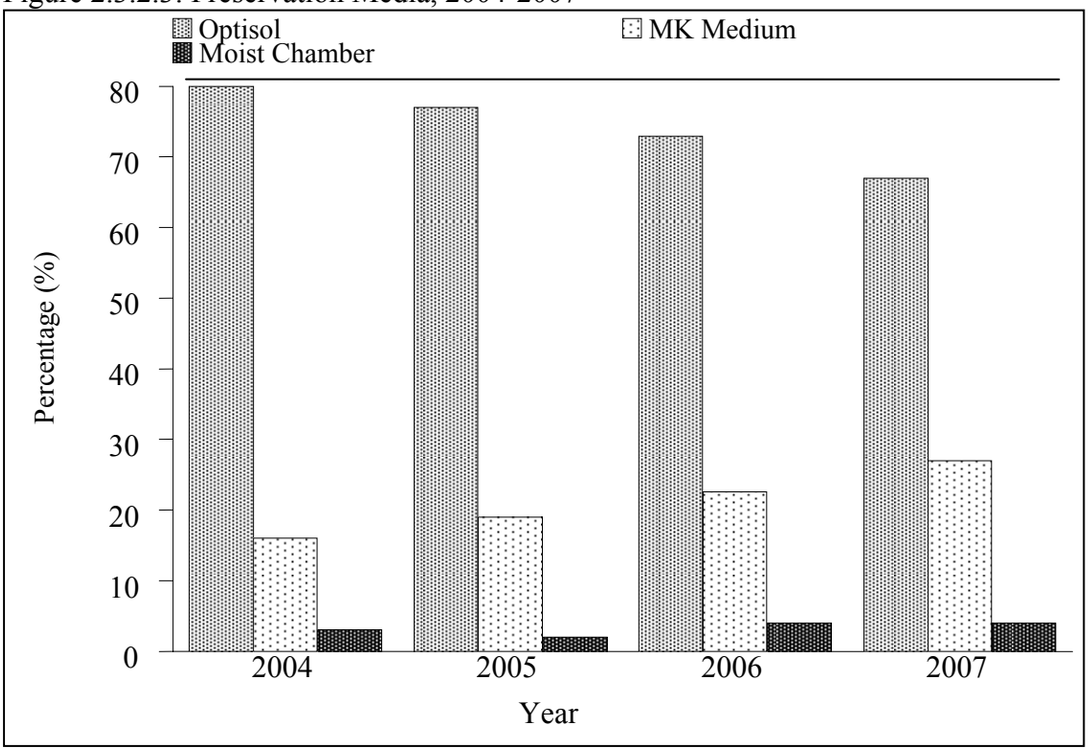


Table 2.3.2.4: Cause of Death in Corneal Donors, 2004-2007

	2004 (N=138)		2005 (N=192)		2006 (N=177)		2007 (N=189)		Total (N=696)	
Cause of death	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Cardiac / Circulatory System	47	34	49	26	59	33	74	39	229	33
Cerebrovascular System	17	12	25	13	11	6	23	12	76	11
Malignancy	19	14	31	16	25	14	23	12	98	14
Trauma / Accident	20	14	13	7	19	11	24	13	76	11
Respiratory System	15	11	8	4	8	5	13	7	44	6
Others	17	12	21	11	27	15	31	16	96	14
No data	3	2	45	23	28	16	1	1	77	11

2.3.3: Transplant Practices

Penetrating Keratoplasty (PK) was the commonest type of surgery performed (88%)* (Table2.3.3.1). Cornea transplantation was performed in combination with other surgical procedures in 19% of cases. Cataract extraction with or without intraocular lens implantation were the commonest combined procedures performed with corneal transplant surgery. (Table 2.3.3.2).

The recipient graft size ranged from 2 mm to 10 mm, with the median recipient cornea graft size being 7.5 mm.(Table 2.3.3.3). The majority of cases had the donor tissue over-sized by 0.5 mm (Table 2.3.3.4). The commonest suture technique was interrupted suturing. (Table 2.3.3.5).

Table 2.3.3.1: Types of Surgeries, 2004-2007

	2004 (N=138)		2005 (N=192)		2006 (N=177)		2007 (N=189)		Total (N=696)	
Type of surgery	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Penetrating Keratoplasty	120	88	173	90	153	86	168	89	614	88
Lamellar Keratoplasty	10	7	13	7	16	9	5	2	44	6
Patch graft for corneal	2	1	3	2	5	3	10	5	20	3
Patch graft for scleral	0	0	1	0	1	1	3	2	5	1
Cornea Scleral Lamellar Keratoplasty	6	4	2	1	2	1	3	2	13	2

* In the year 2004 there were a total of 184 corneal transplants performed but complete data set was only received for 138 patients.

Table 2.3.3.2: Types of Combined Surgeries, 2004-2007

	2004 (N=138)		2005 (N=192)		2006 (N=177)		2007 (N=189)		Total (N=696)	
Combined surgeries	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
No. of patients with corneal transplant surgery combined with another surgical procedure	31	22	27	14	42	24	33	17	133	19
(a) Glaucoma surgery	2	6	3	11	2	5	0	0	7	5
(b) Cataract Extraction	16	52	13	48	22	52	13	39	64	48
(c) IOL	14	45	10	37	24	57	17	52	65	49
(d) Cataract extraction and IOL	10	32	8	30	16	38	10	30	44	33
(e) Retinal Surgery $\pm$ Internal Tamponade	1	3	1	4	2	5	4	12	8	6
(f) Anterior vitrectomy	9	29	3	11	5	12	10	30	27	20
(g) Others	5	16	8	30	8	19	16	48	37	28

*Patients may have more than one combined surgery.

Table 2.3.3.3: Recipient Cornea Trephine Size, 2005-2007

	2004 (N=138)		2005 (N=192)		2006 (N=177)		2007 (N=189)		Total (N=696)	
Graft size, mm	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
2	1	1	1	1	2	1	1	1	5	1
3	0	0	1	1	2	1	1	1	4	1
4	1	1	2	1	1	1	5	3	9	1
5	0	0	0	0	0	0	1	1	1	0
5.5	1	1	0	0	0	0	0	0	1	0
6	3	2	0	0	5	3	4	2	12	2
6.25	0	0	1	1	0	0	0	0	1	0
6.50	2	1	5	2	4	2	8	4	19	3
6.75	1	1	3	2	2	1	1	1	7	1
7	25	18	36	18	25	14	28	15	114	16
7.25	10	7	10	5	14	8	5	3	39	6
7.50	36	26	18	9	26	15	35	18	115	17
7.75	10	7	11	5	6	3	10	5	37	5
8	19	14	7	4	13	7	17	9	56	8
8.25	4	3	4	2	5	3	4	2	17	2
8.50	6	4	6	3	2	1	11	5	25	4
8.75	0	0	1	1	0	0	0	0	1	0
9	8	6	3	2	1	1	4	2	16	2
9.25	0	0	0	0	0	0	0	0	0	0
9.50	0	0	2	1	0	0	0	0	2	0
9.75	0	0	0	0	0	0	0	0	0	0
10	1	1	0	0	0	0	0	0	1	0
No data	10	7	81	42	69	39	54	28	214	31
Mean	7.5		7.3		7.2		7.3		7.3	
SD	0.9		1		1.1		1.1		1	
Median	7.5		7.3		7.3		7.5		7.5	
Minimum	2		2		2		2		2	
Maximum	10		9.5		9		9		10	

Table 2.3.3.4: Difference in Trephined Sizes of Recipient and Donor Corneas, 2004-2007

	2004 (N=138)		2005 (N=192)		2006 (N=177)		2007 (N=189)		Total (N=696)	
Difference in Graft size, mm	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Same size	9	7	8	4	8	5	12	6	37	5
0.25	29	21	19	10	30	17	25	13	103	15
0.5	87	63	84	44	67	38	90	48	328	47
0.75	1	1	0	0	1	0	1	1	3	1
1	1	1	0	0	1	0	4	2	6	1
2	1	1	0	0	0	0	0	0	1	0
Not available	10	7	81	42	70	40	57	30	218	31

Table 2.3.3.5: Suture Technique, 2004-2007

	2004 (N=138)		2005 (N=192)		2006 (N=177)		2007 (N=189)		Total (N=696)	
Suture Technique	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Interrupted only	132	96	139	73	123	69	132	70	526	75
Continuous only	0	0	0	0	5	3	1	0	6	1
Combined	6	4	18	9	19	11	11	6	54	8
No data	0	0	35	18	30	17	45	24	110	16

2.4 CORNEAL TRANSPLANT OUTCOME 2004-2007

Table 2.4.1: Stock and Flow - Graft status (whole database)

		Optical		Non optical		Total	
		No.	**%**	**No.**	**%**	**No.**	**%**
Number registered		528	71	214	29	742	100
Number followed	**Total**	**258**		**120**		**378**	
	1 year	174	67	101	84	275	73
	2 year	58	23	14	12	72	19
	3 year	23	9	3	2	26	7
	4 year	3	1	2	2	5	1
Graft status	**Total**	**258**		**120**		**378**	
-Surviving graft		215	83	69	58	284	75
-Failed graft		43	17	51	42	94	25
Recipient status	**Total**	**528**		**214**		**742**	
-Recipient with complete follow up		70	13	56	26	126	17
-Recipient deaths		3	1	1	1	4	1
-Recipient loss – followed		185	35	63	29	248	33
-Recipient loss – not followed		145	27	47	22	192	26
-Graft not yet followed (Transplant duration less than 1 year)		125	24	47	22	172	23

2.4.2 Outcome – Graft Survival 2004-2007

Graft survival for both optical and non-optical indications at 12 months was 80% but this declined to 65% at 36 months. (Table 2.4.2.1) The cases were grouped into two groups based on the indication for surgery – i) Optical and ii) Non-Optical. Graft survival was 89% after 12 months in the optical group and 60% in the non-optical group. This declined to 72% after 36 months in the optical group and 53% in the non-optical group. (Table 2.4.2.2) Graft survival was similar between the men and women. (Table 2.4.2.3) Poorer graft survival was observed in children less than 10 years of age. (Table 2.4.2.4) Rejection was the commonest cause of graft failure. (Table 2.4.2.6)

Table 2.4.2.1: Graft Survival, 2004-2007*

Interval (months)	No.	% success	SE
0	378	100	-
12	303	80	2
24	103	72	3
36	31	65	4
48	5	55	11

* Outcome data were not submitted for 192 corneal transplant patients in year 2004-2006, while outcome data at 1 year for 172 corneal transplant patients with notification in year 2007 is still on going.

Figure 2.4.2.1: Graft Survival, 2004-2007

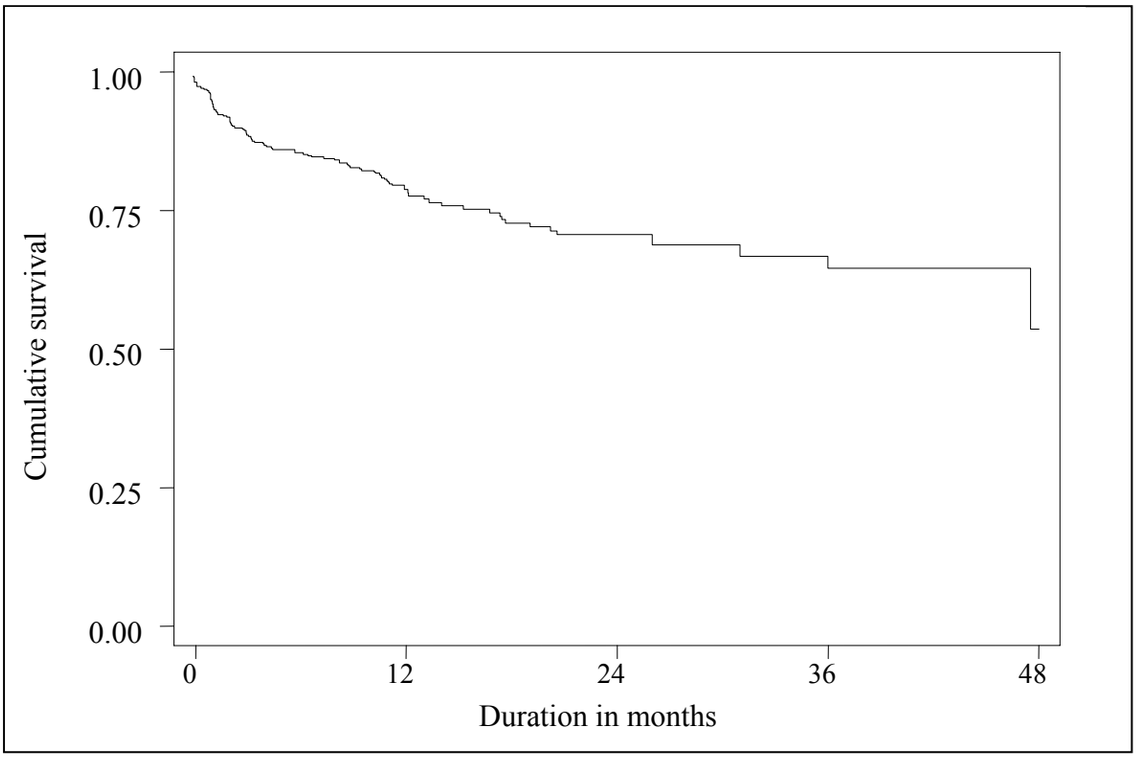


Table 2.4.2.2: Graft Survival by Optical and Non-optical Indication, 2004-2007

	Optical			Non-Optical		
Interval (months)	**No.**	**% success**	**SE**	**No.**	**% success**	**SE**
0	258	100	-	120	100	-
12	229	89	2	74	60	4
24	84	80	3	19	53	6
36	26	72	5	5	53	6
48	3	54	16	2	53	6

* Outcome data were not submitted for 192 corneal transplant patients in year 2004-2006, while outcome data at 1 year for 172 corneal transplant patients with notification in year 2007 is still on going.

Figure 2.4.2.2: Graft Survival by Optical and Non-optical Indication, 2004-2007

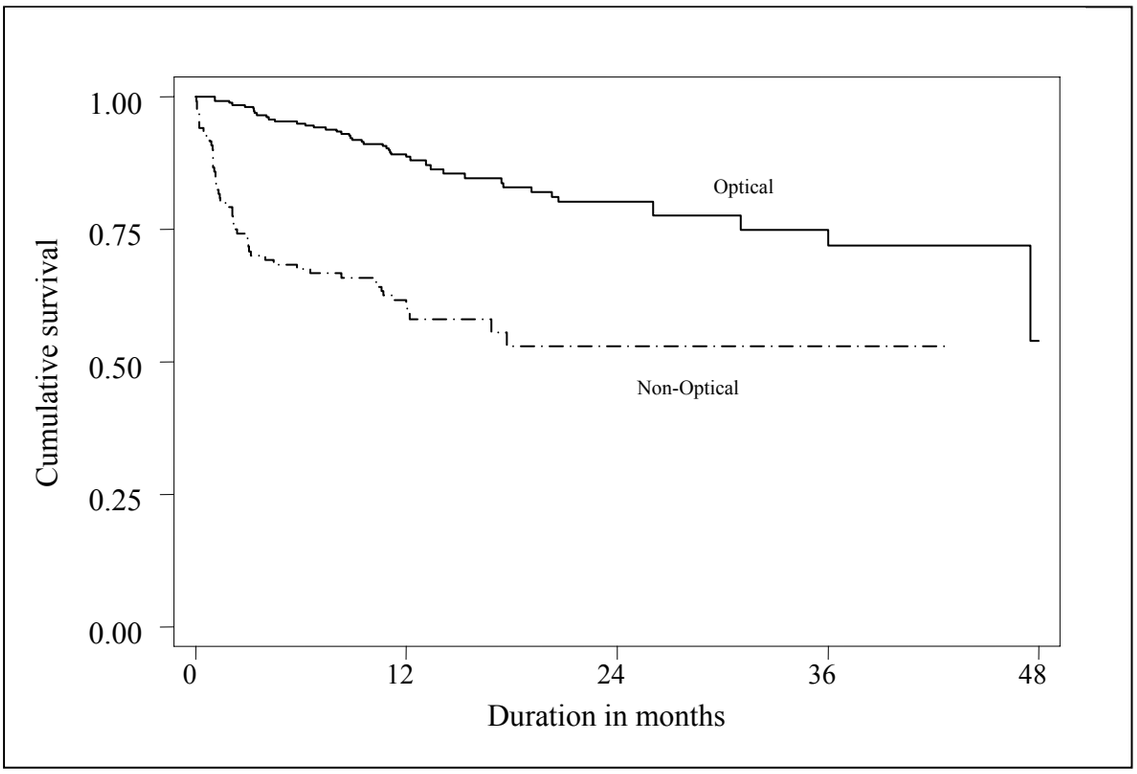


Table 2.4.2.3 Graft Success by Gender, 2004-2007

	Male			Female		
Interval (months)	**No.**	**% success**	**SE**	**No.**	**% success**	**SE**
0	237	100	-	141	100	-
12	189	79	3	114	80	3
24	56	71	4	47	73	4
36	20	65	5	11	66	7
48	5	65	5	-	-.	-

* Outcome data were not submitted for 192 corneal transplant patients in year 2004-2006, while outcome data at 1 year for 172 corneal transplant patients with notification in year 2007 is still on going.

Figure 2.4.2.3 Graft Success by Gender, 2004-2007

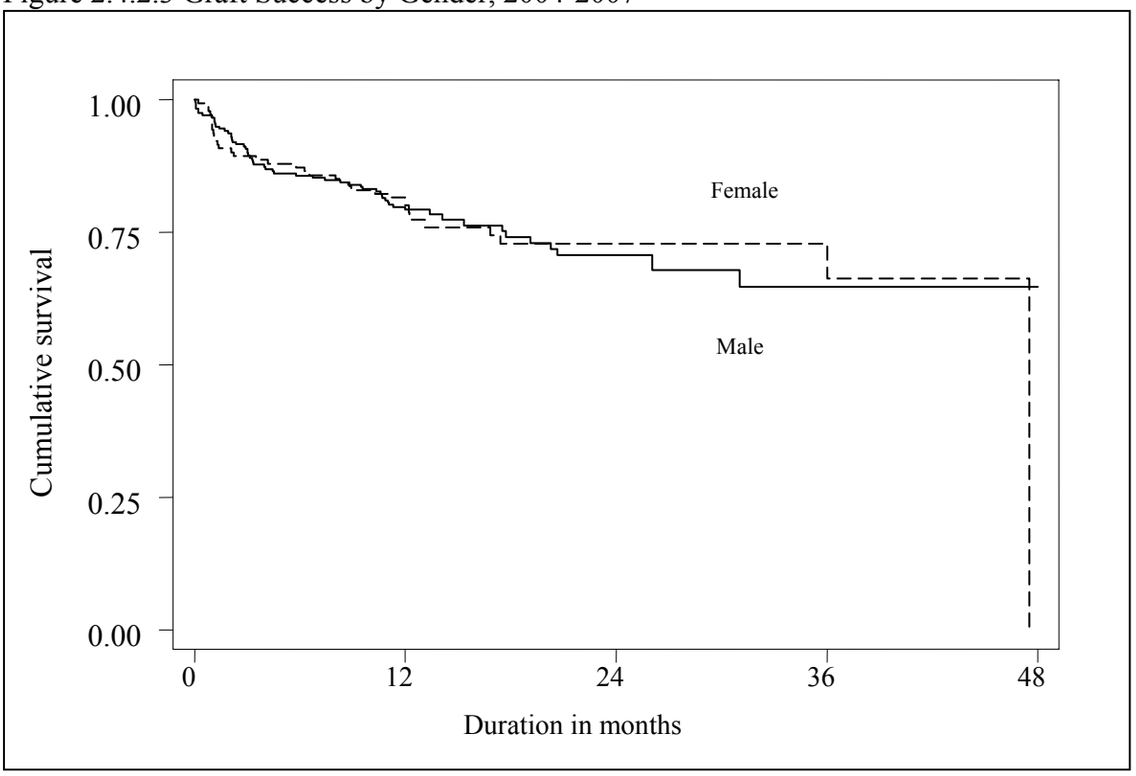


Table 2.4.2.4 Graft Survival by Age, 2004-2007

	0-9			10-19		
Interval (months)	**No.**	**% success**	**SE**	**No.**	**% success**	**SE**
0	7	100	-	16	100	-
12	6	86	13	13	81	10
24	1	43	31	8	81	10
36	-	-	-	5	81	10
48	-	-	-	-	-	-

	20-39			≥40		
Interval (months)	**No.**	**% success**	**SE**	**No.**	**% success**	**SE**
0	19	100	-	336	100	-
12	16	84	8	268	79	2
24	5	84	8	89	71	3
36	3	84	8	23	63	5
48	1	84	8	4	50	12

* Outcome data were not submitted for 192 corneal transplant patients in year 2004-2006, while outcome data at 1 year for 172 corneal transplant patients with notification in year 2007 is still on going.

Figure 2.4.2.4 Graft Survival by Age, 2004-2007

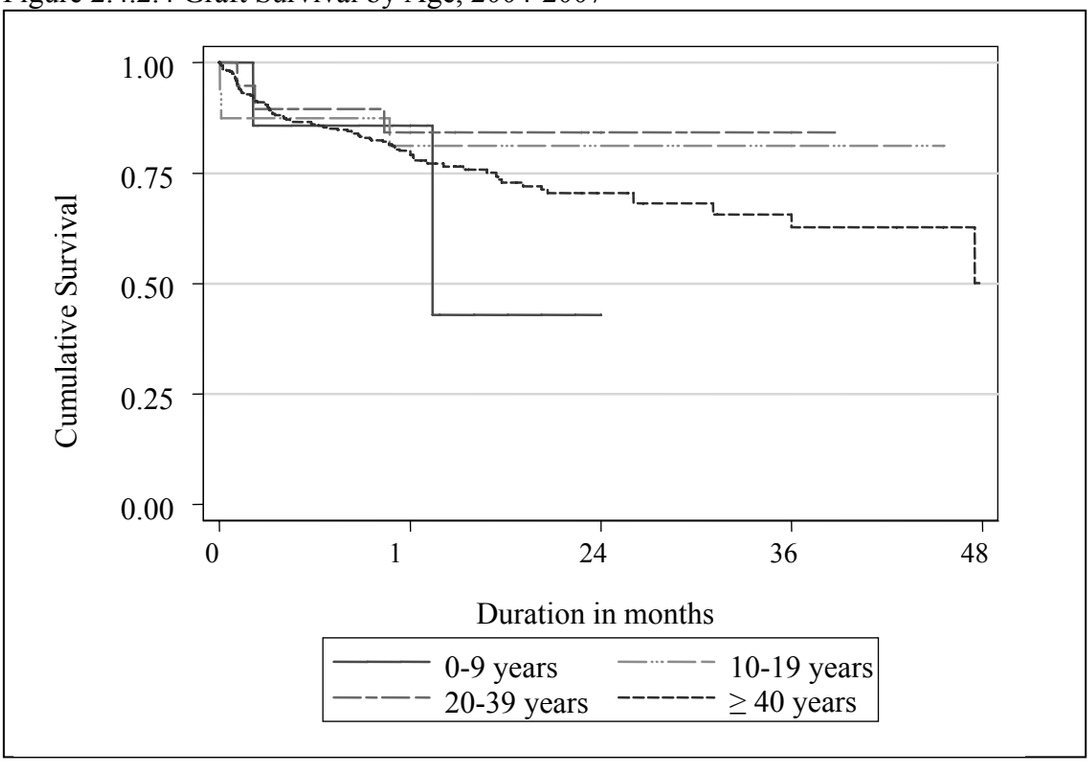


Table 2.4.2.5: Causes of Graft Failure

		Total (N=94)	
		No.	**%**
Graft Failure		94	25
Cause of Failure	Primary graft failure or Primary Endothelial decompensation	16	17
	Recurrence of primary disease	6	6
	Late Endothelial decompensation	19	20
	Glaucoma	13	14
	Infection	18	19
	Graft rejection	22	23
	Others	25	27
	No data	8	9

*Each Patient may have more than one cause of graft failure.

56 patients have 1 cause
28 patients have 2 causes
1 patient has 3 causes
1 patient has 4 causes

2.4.3 Visual Outcome

Visual outcome of corneal transplants was analysed in cases where post cornea transplant unaided vision was available as data on post corneal transplant best corrected vision was only available in a limited number of the cases. (Table 2.4.3.1) Forty seven percent of both optical and non-optical cases had improved unaided vision after surgery. (Table 2.4.3.2) Majority of surviving optical grafts had an unaided vision of 6/24-6/60, whereas the majority in the non optical group had an unaided vision of less than 6/60. (Table2.4.3.3) (Figure 2.4.3.3)

Table 2.4.3.1: Availability of Data on Post Corneal Transplant Unaided Vision

	Unaided Vision (N =742)	
	No.	**%**
Data available	326	44
Lost to follow up	306	41
No data	110	15

Table 2.4.3.2 Unaided Visual Outcome After Cornea Transplant Surgery

Reason for graft	**Optical (228)**		**Non-optical (98)**	
	No.	**%**	**No.**	**%**
Vision better	107	47	46	47
Vision same	40	17	25	26
Vision worse	27	12	20	20
Not known*	54	24	7	7

* Either pre op vision and/or post op vision is not available

Figure 2.4.3.2 Unaided Visual Outcome After Corneal Transplant Surgery

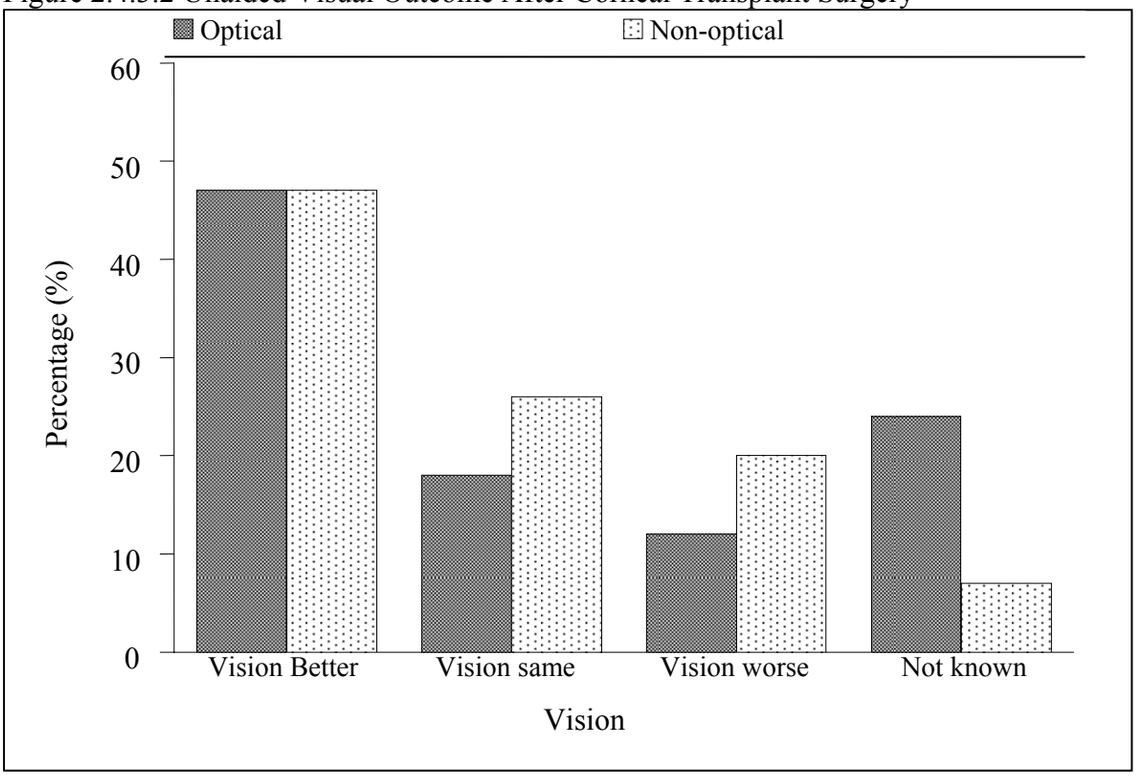
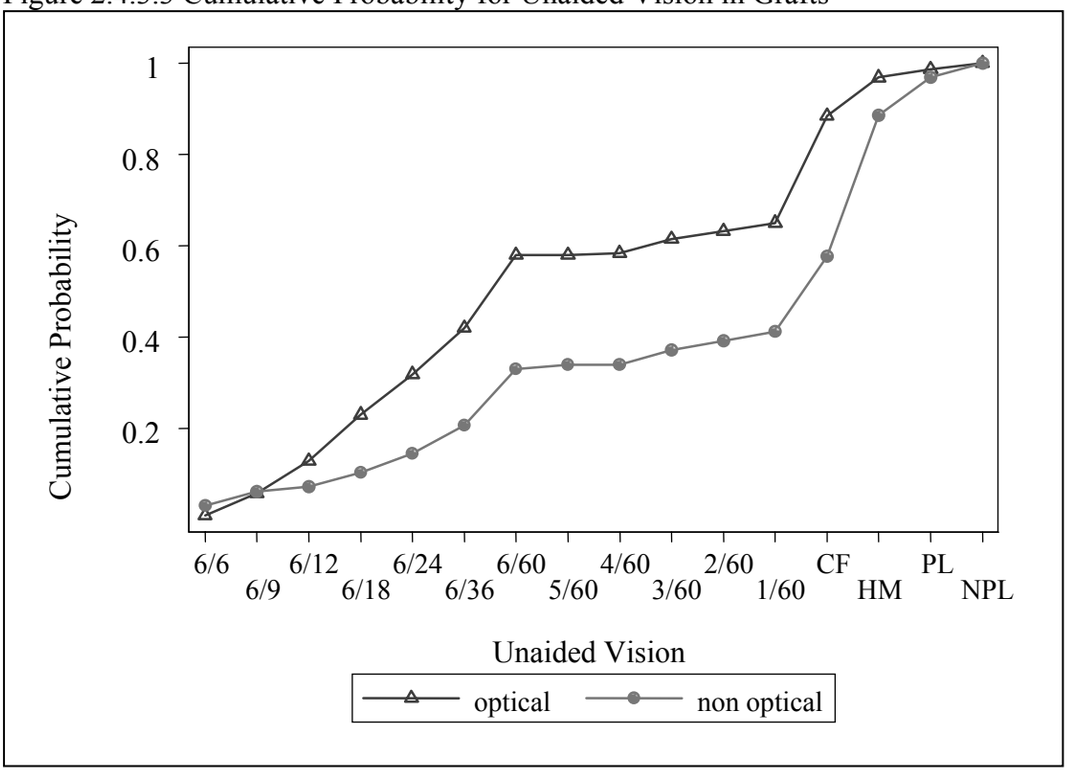


Table 2.4.3.3 Unaided Vision for Optical and Non Optical Cases

Vision	Optical				Non Optical			
	Graft Survival (192)		Graft Failure (36)		Graft Survival (58)		Graft Failure (40)	
	n	%	n	%	n	%	n	%
6/18 or Better	52	27	0	0	9	15	1	3
6/24 – 6/60	79	41	0	0	21	36	1	3
Less than 6/60	59	31	36	100	27	47	38	94
Data not available	2	1	0	0	1	2	0	0

Figure 2.4.3.3 Cumulative Probability for Unaided Vision in Grafts



2.5 POST CORNEA TRANSPLANT COMPLICATIONS

The commonest complications observed at one year were post-keratoplasty glaucoma, graft vascularisation, epithelial problems and graft rejection. Rejection was seen in 15%. (Table 2.5.1) Endothelial rejection is the commonest graft rejection. (Table 2.5.2)

Table 2.5.1: Post Transplant Complications

		One year outcome (N=275)		2nd year outcome (N=72)		3rd year outcome (N=26)		4th year outcome (N=5)		Total (N=378)	
		No.	%	No.	%	No.	%	No.	%	No.	%
Any complications		157		54		24		8		243	
Complication	Epithelial Problem	28	18	4	7	2	8	1	13	35	14
	Wound Dehiscence	2	1	0	0	0	0	0	0	2	1
	Suture infiltration / abscess	15	10	3	6	2	8	0	0	20	8
	Endophthalmitis	1	1	1	2	0	0	0	0	2	1
	Microbial keratitis	17	11	2	4	0	0	0	0	19	8
	Vascularisation	28	18	4	7	0	0	0	0	32	13
	Post-keratoplasty glaucoma	28	18	9	17	3	13	1	13	41	17
	Graft Rejection	26	17	5	9	0	0	0	0	31	13
	No data	62	39	32	59	17	71	6	75	117	48

* Each patient may have more than one complication

Table 2.5.2: Post Transplant Graft Rejection Types

		One year outcome (N=275)		2nd year outcome (N=72)		3rd year outcome (N=26)		4th year outcome (N=5)		Total (N = 378)	
		No.	%	No.	%	No.	%	No.	%	No.	%
Graft Rejection		26		5		0		0		31	
Types	Epithelial	10	38	2	40	0	0	0	0	12	39
	Stromal	6	23	0	0	0	0	0	0	6	19
	Endothelial	11	42	3	60	0	0	0	0	14	45
	No data	4	15	0	0	0	0	0	0	4	13

* Each patient may have more than one type of rejection

CHAPTER 3

HEART AND LUNG TRANSPLANTATION

Editors:
Mr Mohamed Ezani Md. Taib
Dato' Dr David Chew Soon Ping
Dr Ashari Yunus

Expert Panel:
Tan Sri Dato' Dr Yahya Awang (Chair)
Mr Mohamed Ezani Md. Taib (Co-chair)
Datin Dr Aziah Ahmad Mahayuddin
Dr Aizai Azan Abdul Rahim
Dr Ashari Yunus
Dato' Dr David Chew Soon Ping
Dr Hamidah Shaban

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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 first lung transplant was carried out in December 2005 at IJN in collaboration with Institut Perubatan Respiratori (IPR) of the Ministry of Health.

The main limitation to the performance of heart and lung transplants has been the lack of success in obtaining viable donor organs. As a result of the infrequent performance of transplant, the results of transplant would not be expected to improve.

In 2007, the first heart lung transplant was carried out in November 2007. There were 2 heart transplants carried out on the same recipient whose 1st heart transplant failed, but fortunately, there was a second compatible donor organ within 24 hours and the 2nd heart transplant succeeded. 1 double lung transplant was carried out as well.

The rest of the report that follows will review the results of heart and lung transplantation in Malaysia till end of 2007.

HEART TRANSPLANTATION

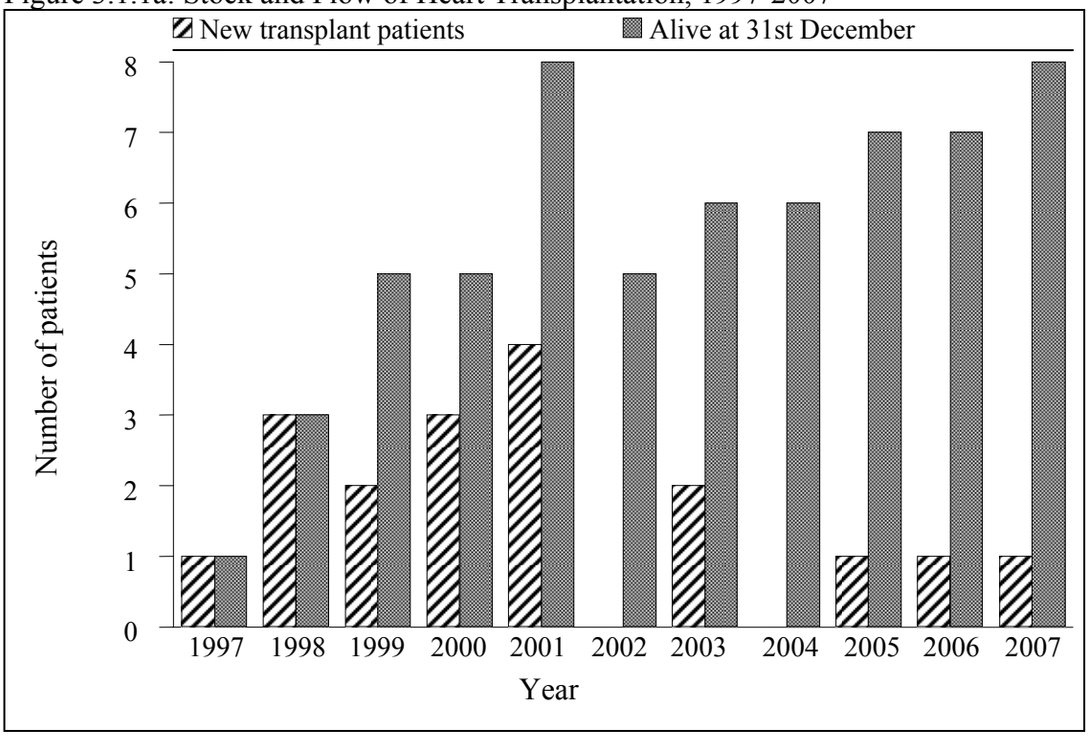
3.1 STOCK AND FLOW

Table 3.1.1a: Stock and Flow of Heart Transplantation, 1997-2007

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
New transplant patients	1	3	2	3	4	0	2	0	1	1	1
Deaths	0	1	0	3	1	3	1	0	0	1	0
Retransplanted	0	0	0	0	0	0	0	0	0	0	1
Lost to follow up	0	0	0	0	0	0	0	0	0	0	0
Alive at 31st December	1	3	5	5	8	5	6	6	7	7	8

Note: The same patient was re-transplanted in the year 2007, thus only counted as one.

Figure 3.1.1a: Stock and Flow of Heart Transplantation, 1997-2007



3.2 RECIPIENTS' CHARACTERISTICS

Table 3.2.1a: Distribution of Patients by Gender, 1997-2007

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	TOTAL
Gender	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
Male	1	3	0	2	2	0	2	0	1	1	0	12
Female	0	0	2	1	2	0	0	0	0	0	1	6
TOTAL	**1**	**3**	**2**	**3**	**4**	**0**	**2**	**0**	**1**	**1**	**1**	**18**

Note: The same patient was re-transplanted in the year 2007, thus only counted as one.

Table 3.2.2a: Distribution of Patients by Ethnic Group, 1997-2007

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	TOTAL
Ethnic group	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
Malay	0	0	1	1	2	0	0	0	1	0	0	5
Chinese	0	0	0	1	0	0	1	0	0	0	1	3
Indian	1	3	1	1	2	0	1	0	0	1	0	10
TOTAL	**1**	**3**	**2**	**3**	**4**	**0**	**2**	**0**	**1**	**1**	**1**	**18**

Note: The same patient was re-transplanted in the year 2007, thus only counted as one.

Table 3.2.3a: Distribution of Patients by Age, 1997-2007

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	TOTAL
Age, years	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
0-19	0	0	2	1	1	0	0	0	1	0	1	6
20-39	0	2	0	0	0	0	0	0	0	0	0	2
40-59	1	1	0	2	3	0	2	0	0	1	0	10
≥60	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	**1**	**3**	**2**	**3**	**4**	**0**	**2**	**0**	**1**	**1**	**1**	**18**
Mean	51	40	16	37	38	-	46	-	15	44	15	35
SD	-	9	1	22	17	-	8	-	-	-	0	16
Median	51	37	16	44	43	-	46	-	15	44	15	40
Minimum	51	33	15	13	14	-	40	-	15	44	15	13
Maximum	51	50	16	55	54	-	52	-	15	44	15	55

Age=date of transplant-date of birth
Note: The same patient was re-transplanted in the year 2007, thus only counted as one.
Age for 2007 patient was same for 1st and 2nd transplant

Table 3.2.4a: Distribution of Patients by Primary Diagnosis, 1997-2007

Year	97	98	99	00	01	02	03	04	05	06	07	TOTAL
Primary diagnosis	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
Ischaemic Cardiomyopathy	1	3	0	1	1	0	2	0	0	1	0	9
Idiopathic Dilated Cardiomyopathy	0	0	2	1	2	0	0	0	1	0	0	6
Restrictive Cardiomyopathy	0	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	0	1
Hypertrophic Cardiomyopathy	0	0	0	1	0	0	0	0	0	0	0	1
Others	0	0	0	0	0	0	0	0	0	0	1	1
TOTAL	**1**	**3**	**2**	**3**	**4**	**0**	**2**	**0**	**1**	**1**	**1**	**18**

Note: The same patient was re-transplanted in the year 2007, thus only counted as one.

3.3 TRANSPLANT PRACTICES

Table 3.3.1a: Distribution of Patients by Heart Procedure, 1997-2007

Year	97	98	99	00	01	02	03	04	05	06	07	TOTAL
Heart Procedure	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
Orthotopic Bicaval	1	1	0	0	0	0	0	0	0	0	0	2
Orthotopic Traditional	0	2	2	3	4	0	2	0	1	1	2	17
Heterotopic	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	**1**	**3**	**2**	**3**	**4**	**0**	**2**	**0**	**1**	**1**	**2**	**19**

Table 3.3.2: Distribution of Patients by Immunosuppressive Used, 1997-2007

Year	97	98	99	00	01	02	03	04	05	06	07	Total
Type of immunosuppressive	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
Steroids												
Prednisolone	1	3	2	3	4	0	1	0	1	0	1	16
Methylprednisolone	1	3	2	3	4	0	2	0	1	1	2	19
Calcineurin Inhibitors												
Cyclosporin A	0	0	0	0	0	0	1	0	0	1	0	2
Neoral®	1	3	2	3	4	0	0	0	1	0	0	14
Tacrolimus (FK506)	0	0	0	0	0	0	0	0	0	0	1	1
Antimetabolites												
Azathioprine (AZA)	1	3	2	3	4	0	2	0	0	1	0	16
Mycophenolate Mofetil (MMF)	0	0	0	0	1	0	0	0	1	0	1	3
Anti-lymphocyte Receptor Antibodies												
Anti-thymocyte globulin (ATG)	0	0	0	0	0	0	0	0	0	0	2	2
TOTAL patients at notification	**1**	**3**	**2**	**3**	**4**	**0**	**2**	**0**	**1**	**1**	**2**	**19**

Table 3.3.3a: Immunosuppressive Used at Time of Last Follow-up up to 2007

Year of follow up*	2004	2005	2006	2007
Type of immunosuppressive	**No.**	**No.**	**No.**	**No.**
Steroids				
Prednisolone	1	3	2	2
Methylprednisolone	0	0	0	0
Calcineurin Inhibitors				
Neoral®	1	6	7	5
Antimetabolites				
Azathioprine (AZA)	1	3	2	1
Mycophenolate Mofetil (MMF)	3	3	5	4
TOTAL patients at follow-up	**6**	**6**	**7**	**7**

*Data according to year of follow up of transplanted patients
Note: The patient transplanted in year 2007 was still in the ward by year-end and the first follow-up data was only in the subsequent year

Table 3.3.4: Duration of Waiting Time on Waiting List, 1997-2007

Year	**97**	**98**	**99**	**00**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**TOTAL**
Duration (months)*	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
<5	0	2	1	0	1	0	1	0	0	0	0	5
5≤10	1	0	1	0	1	0	0	0	1	0	0	4
10≤15	0	0	0	1	0	0	0	0	0	1	2	4
15≤20	0	0	0	1	0	0	0	0	0	0	0	1
20≤25	0	0	0	0	0	0	0	0	0	0	0	0
25≤30	0	0	0	0	0	0	0	0	0	0	0	0
30≤35	0	0	0	0	0	0	0	0	0	0	0	0
35≤40	0	0	0	0	0	0	1	0	0	0	0	1
TOTAL	**1**	**2**	**2**	**2**	**2**	**0**	**2**	**0**	**1**	**1**	**2**	**15**
Mean	6	2	4	15	5		20		9	10	13	9
SD		0	1	6	5		25				0	9
Median	6	2	4	15	5		20		9	10	13	8
Minimum	6	2	3	10	1		2		9	10	13	1
Maximum	6	2	5	19	8		37		9	10	13	37

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

3.4 TRANSPLANT OUTCOMES

Table 3.4.1: Post Transplant Events at Last Follow-up up to 2007

Year of transplant*	**97**	**98**	**99**	**00**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**TOTAL**
Type of post transplant events	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
Drug Treated Hypertension	1	2	2	1	3	0	1	0	0	0	0	10
Bone Disease (Symptomatic)	1	0	0	0	1	0	0	0	0	0	0	2
Chronic Liver Disease	0	0	0	0	0	0	0	0	0	0	0	0
Cataracts	0	0	0	0	0	0	0	0	0	0	0	0
Diabetes	1	2	0	0	0	0	1	0	0	0	0	4
Renal Dysfunction	1	1	0	0	1	0	0	0	0	0	0	3
Stroke	0	0	0	0	0	0	0	0	0	0	0	0
Drug-Treated Hyperlipidaemia	1	2	2	1	3	0	1	0	1	0	0	11
TOTAL patients at follow-up	**1**	**2**	**2**	**1**	**3**	**0**	**1**	**0**	**1**	**0**	**0**	**11**

*Data according to year of transplant of patient

Table 3.4.2: Post Transplant Malignancies at Follow-up up to 2007

Year of transplant*	**97**	**98**	**99**	**00**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**TOTAL**
Type of post transplant malignancies	**No.**	**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	0
De Novo solid tumour	1	0	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	0
Skin	0	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**	**0**	**11**

*Data according to year of transplant of patient

Table 3.4.3: Non-compliance at Follow-up up to 2007

Year of transplant*	**97**	**98**	**99**	**00**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**TOTAL**
Non-compliance during follow-up	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
• Yes	0	0	2	0	0	0	1	0	0	0	0	3
• No	1	2	0	1	3	0	0	0	1	0	0	8
TOTAL patients at follow-up	**1**	**2**	**2**	**1**	**3**	**0**	**1**	**0**	**1**	**0**	**0**	**11**
Areas of non-compliance:												
• Immunosuppression medication	0	0	1	0	0	0	1	0	0	0	0	2
• Patient unable to afford immunosuppression medications	0	0	0	0	0	0	0	0	0	0	0	0
• Other medication	0	0	0	0	0	0	0	0	0	0	0	0
• Other therapeutic regimen	0	0	1	0	0	0	0	0	0	0	0	1
TOTAL patients with noncompliance	**0**	**0**	**2**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**3**

*Data according to year of transplant of patient

Table 3.4.4: Patient Treated for Rejection at Follow-up up to 2007

Year of transplant*	**97**	**98**	**99**	**00**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**TOTAL**
Patient treated for rejection	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
• Yes	0	2	1	0	1	0	0	0	0	0	0	4
• No	1	0	1	1	2	0	1	0	1	0	0	7
TOTAL patients at follow-up	**1**	**2**	**2**	**1**	**3**	**0**	**1**	**0**	**1**	**0**	**0**	**11**
Number of rejection events												
• 1	0	1	0	0	1	0	0	0	0	0	0	2
• 2	0	1	0	0	0	0	0	0	0	0	0	1
• 3	0	0	1	0	0	0	0	0	0	0	0	1
TOTAL patients with rejection	**0**	**2**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**4**

*Data according to year of transplant of patient

Table 3.4.5a: Distribution of Patients by Time of Death, 1997-2007

Year of discharge	**97**	**98**	**99**	**00**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**TOTAL**
Time of deaths*	**No.**	**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	0	6
3-<6 months	0	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	0	1
>1 year	0	0	0	1	1	1	0	0	0	0	0	3
TOTAL patients who died	**0**	**1**	**0**	**3**	**1**	**3**	**1**	**0**	**0**	**1**	**0**	**10**

*Time=Date of death–date of transplant

Table 3.4.6: Patient Survival, 1997-2007

Year of Transplant	1997-2007	
Interval	**% Survival**	**SE**
6 months	68	11
1 year	63	11
2 year	50	12
3 year	44	12
4 year	44	12
5 year	44	12
6 year	44	12
7 year	44	12
8 year	44	12
9 year	44	12
10 year	44	12

SE=standard error

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

= date of discharge-date of transplant, if alive but lost to follow up

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

Figure 3.4.6: Patient Survival, 1997-2007

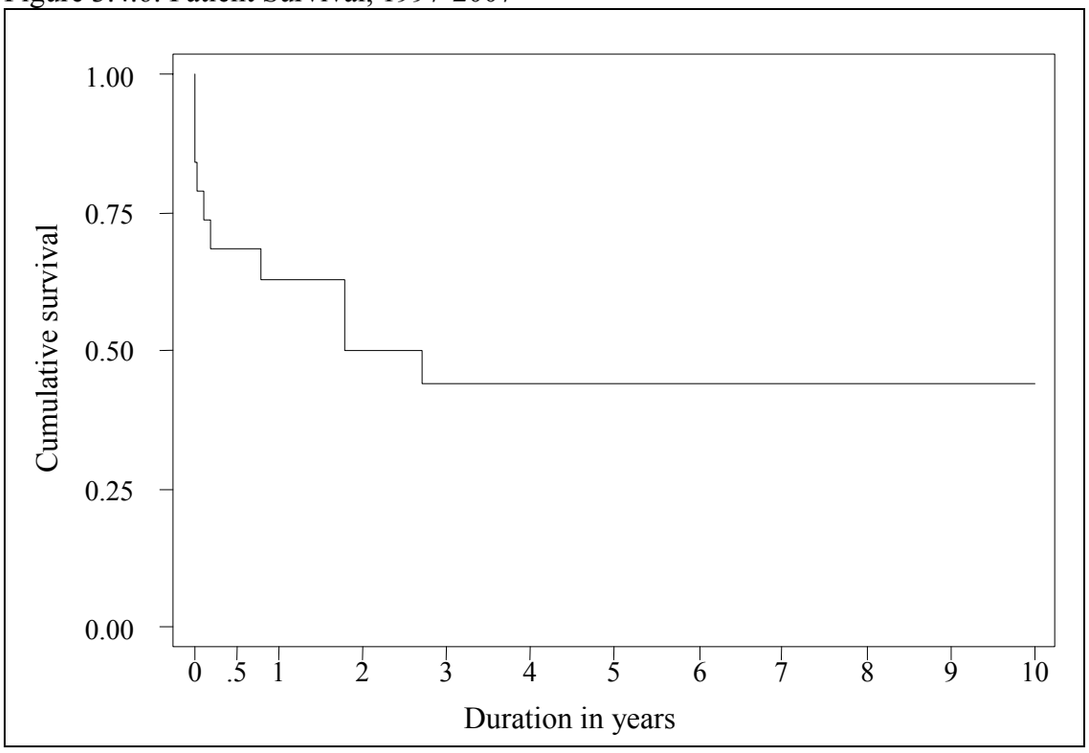


Table 3.4.7: Cause of Death at Discharge, 1997-2007

Year	97	98	99	00	01	02	03	04	05	06	07	TOTAL
Cause of death	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
Hyperacute rejection	0	0	0	0	0	0	1	0	0	0	0	1
Multi organ failure	0	0	0	1	0	0	0	0	0	0	0	1
Respiratory failure secondary to septicaemia	0	0	0	0	0	1	0	0	0	0	0	1
Respiratory failure, renal function and liver failure, ARDS, septicaemia	0	0	0	1	0	0	0	0	0	0	0	1
Septicaemia, multiorgan failure	0	1	0	0	0	0	0	0	0	0	0	1
Graft failure	0	0	0	0	0	0	0	0	0	1	0	1
TOTAL patients who died at discharge	**0**	**1**	**0**	**2**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**6**

Table 3.4.8: Cause of Death at Follow-up, 1997-2007

Year	97	98	99	00	01	02	03	04	05	06	07	TOTAL
Cause of death	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
Severe bleeding	0	0	0	0	0	1	0	0	0	0	0	1
Lung cancer, small cell type, septicaemia, bronchopneumonia	0	0	0	1	0	0	0	0	0	0	0	1
Rejection due to non-compliance	0	0	0	0	1	0	0	0	0	0	0	1
Unknown	0	0	0	0	0	1	0	0	0	0	0	1
TOTAL patients who died at follow-up	**0**	**0**	**0**	**1**	**1**	**2**	**0**	**0**	**0**	**0**	**0**	**4**

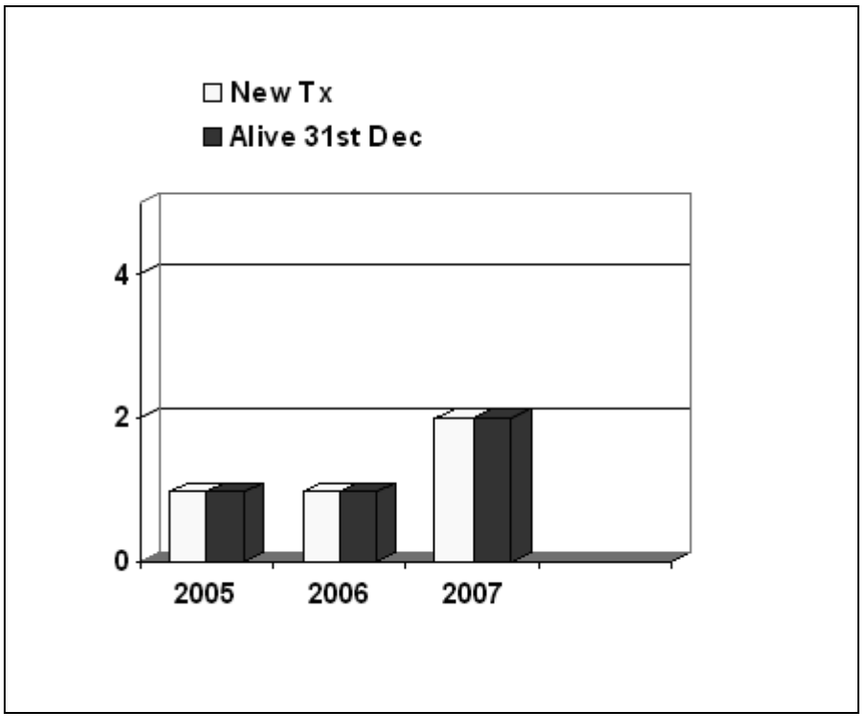
LUNG TRANSPLANTATION & HEART-LUNG TRANSPLANTATION

3.1 STOCK AND FLOW

Table 3.1.1b: Stock and Flow of Lung Transplantation, 2005-2007

Year	2005	2006	2007
New transplant patients	1	1	2
Deaths	0	1	1
Retransplanted	0	0	0
Lost to follow up	0	0	0
Alive at 31st December	1	1	2

Figure 3.1.1b: Stock and Flow of Lung Transplant and Heart Lung Transplant



3.2 RECIPIENTS' CHARACTERISTICS

Table3.2.1b: Distribution of Patients by Gender, 2005-2007

Year	**2005**	**2006**	**2007**
Gender	**No.**	**No.**	**No.**
Male	1	1	1
Female	0	0	1
TOTAL	**1**	**1**	**2**

Table3.2.2b: Distribution of Patients by Ethnic Group, 2005-2007

Year	**2005**	**2006**	**2007**
Race	**No.**	**No.**	**No.**
Malay	0	0	1
Chinese	0	0	0
Indian	1	1	0
Iban	0	0	1
TOTAL	**1**	**1**	**2**

Table 3.2.3b: Distribution of Patients by Age, 2005-2007

Year	**2005**	**2006**	**2007**
Age (years)	**No.**	**No.**	**No.**
0-19	0	0	1
20-39	0	1	1
40-59	1	0	0
≥ 60	0	0	0
TOTAL	**1**	**1**	**2**

Table 3.2.4b: Distribution of Patients by Primary Diagnosis, 2005 -2007

Year	**2005**	**2006**	**2007**
Diagnosis	**No.**	**No.**	**No.**
Idiopathic pulmonary fibrosis	1	1	1
Idiopathic pulmonary arterial hypertension	0	0	1
Chronic obstructive pulmonary disease	0	0	0
TOTAL	**1**	**1**	**2**

3.3 TRANSPLANT PRACTICES

Table 3.3.1b: Distribution of Patients by Lung Procedure, 2005-2007

Year	**2005**	**2006**	**2007**
Procedure	**No.**	**No.**	**No.**
Single Lung Transplant	1	0	0
Double Lung Transplant	0	1	1
Heart – Lung Transplant	0	0	1
TOTAL	**1**	**1**	**2**

Table 3.3.3b: Immunosuppressive Used at Time Follow-up to 2007

Year	**2005**	**2006**	**2007**
Type of immunosuppressive	**No.**	**No.**	**No.**
Steroids			
Prednisolone	1	2	2
Methylprednisolone	1	1	2
Neoral	1	2	3
Antimetabolites			
Azathioprine (AZA)	0		0
Mycophenolate (MMF)	1	2	3
Tacrolimus	0	0	0
TOTAL patients at follow -up	1	2	3

3.4 TRANSPLANT OUTCOMES

On follow up complications such as hypertension, renal dysfunction, malignancy, non-compliance was not noted in patients with lung transplants.

Table 3.4.5b: Distribution of patients by time of deaths, 2005-2007

Year of Transplant	**2005**	**2006**	**2007**
Time of death	**No.**	**No.**	**No.**
< 3 months	0	1	1
3 - < 6 months	0	0	0
6 – 12 months	0	0	0
> 12 months	0	0	0
TOTAL	**0**	**1**	**1**

In 2007 two of a total of 4 patients are alive. The first patient transplanted on 16/5/2005 is alive and so is the third patient who was transplanted in 2007.
The second patient (transplanted in 2006) died of pneumonia with septicaemia and CMV infection at day 39.
The fourth patient with the heart-lung transplant died of pneumonia and graft rejection at day 16 in 2007.

CHAPTER 4

LIVER TRANSPLANTATION

Editor:
Dr Ganesalingam A/L Kanagasabai

Expert panel:
Dato' Dr Zakaria Zahari (Chairman)
Dr Ganesalingam A/L Kanagasabai
Dr Goon Hong Kooi
Professor Dr Lee Way Seah
Dr Lim Chooi Bee
Dr Sushila Siva Subramaniam
Dr Tan Soek Siam
Dr Thavaranjitham

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4.0 INTRODUCTION

Liver transplantation represents a great conquest of medical science, and certainly gives hope to those suffering serious, and often grave, liver diseases.

Unfortunately, the problem of the lack of available cadaveric organs is a considerable and practical one; one can see this in the long waiting list of those whose only hope for survival is linked to the small number of organ donations. Malaysia continues to struggle with its liver transplantation program simply because of a lack of cadaveric donors.

It is necessary to overcome prejudices and misunderstanding, dispel suspicions and fears and substitute them with certainties and guarantees, so as to create in all Malaysians an awareness, ever more widespread, of the great gift of life.

4.1 STOCK AND FLOW

The number of liver transplants performed from 1993 to 2007 is ninety five. Eighty one (85%) were performed locally and fourteen (15%) were performed at overseas centres. Seven new liver transplants were done in 2007 and they were all done locally at Selayang Hospital.

Table 4.1.1: Stock and Flow of Liver Transplantation, 1993-2007

Year	**93**	**94**	**95**	**96**	***97**	**98**	**99**	**00**	**01**	**02**	****03**	**04**	**05**	**06**	**07**
New transplant patients	1	1	8	13	3	2	8	3	5	10	5	16	5	8	7
Deaths	0	0	3	4	1	0	4	1	2	5	1	4	4	3	1
Re-transplant	0	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	0
Functioning graft at 31st December	1	2	7	16	17	19	23	24	27	31	34	45	45	50	56

* 1 patient who was alive until 05/12/1997 is recorded died with missing date of death
** 1 patient transplanted in 2003 is recorded as death with missing date of death

Figure 4.1.1: Stock and Flow of Liver Transplantation, 1993-2007

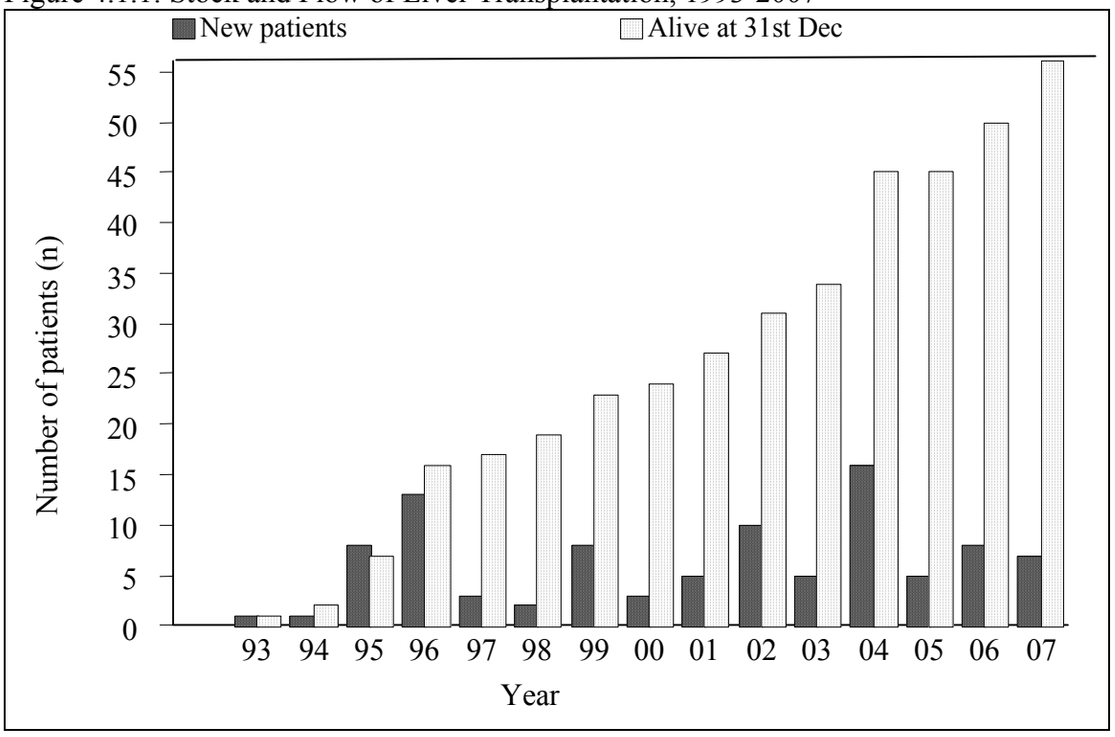

Table 4.1.2: Distribution of Patients by Place of Transplant, 1993-2007

Year	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**00**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**TOTAL**
	No.	**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	7	81
Overseas	1	1	0	3	2	1	0	0	0	1	3	2	0	0	0	14
TOTAL	**1**	**1**	**8**	**13**	**3**	**2**	**8**	**3**	**5**	**10**	**5**	**16**	**5**	**8**	**7**	**95**

Table 4.1.3: Distribution of Patients by Centres for Liver Transplantation, 1993-2007

Year	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**00**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**TOTAL**
Centre	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
Sime Darby Medical Centre	0	0	8	10	1	1	8	3	5	6	2	7	0	0	0	51
Hospital Selayang	0	0	0	0	0	0	0	0	0	3	0	7	5	8	7	30
Australia	1	0	0	3	1	0	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	0	2
Kings College Hospital, UK	0	1	0	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	0	2
Asian Centre for Liver Disease, Singapore	0	0	0	0	0	0	0	0	0	1	2	1	0*	0*	0*	4
TOTAL	**1**	**1**	**8**	**13**	**3**	**2**	**8**	**3**	**5**	**10**	**5**	**16**	**5**	**8**	**7**	**95**

* Data was not reported

Table 4.1.4: Distribution of Transplant Recipients by Follow-up Centres, 2007

Centre	**No.**	**%**
Number of patient with functioning graft at 31st December 2007	56	100
Kuala Lumpur Hospital	2	4
Sime Darby Medical Centre	27	48
Selayang Hospital	23	41
Singapore	1	2
Univeristy of Malaya Medical Centre	3	5

4.2 RECIPIENTS' CHARACTERISTICS

Fifty three (56%) were males and 42 (44%) were females. The ethnic distribution of the liver transplant recipients are as follows: Chinese 48 (50%), Malays 37 (39%), Indians 8 (9%), Others 2 (2%).

Eighty (84%) 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 69 (73%) 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. (38%)

Table 4.2.1: Distribution of Patients by Gender, 1993-2007

Year	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**00**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**TOTAL**
Gender	**No.**	**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	3	53
Female	1	1	2	8	1	1	5	2	3	3	0	6	3	2	4	42
TOTAL	**1**	**1**	**8**	**13**	**3**	**2**	**8**	**3**	**5**	**10**	**5**	**16**	**5**	**8**	**7**	**95**

Figure 4.2.1: Distribution of Patients by Gender, 1993-2007

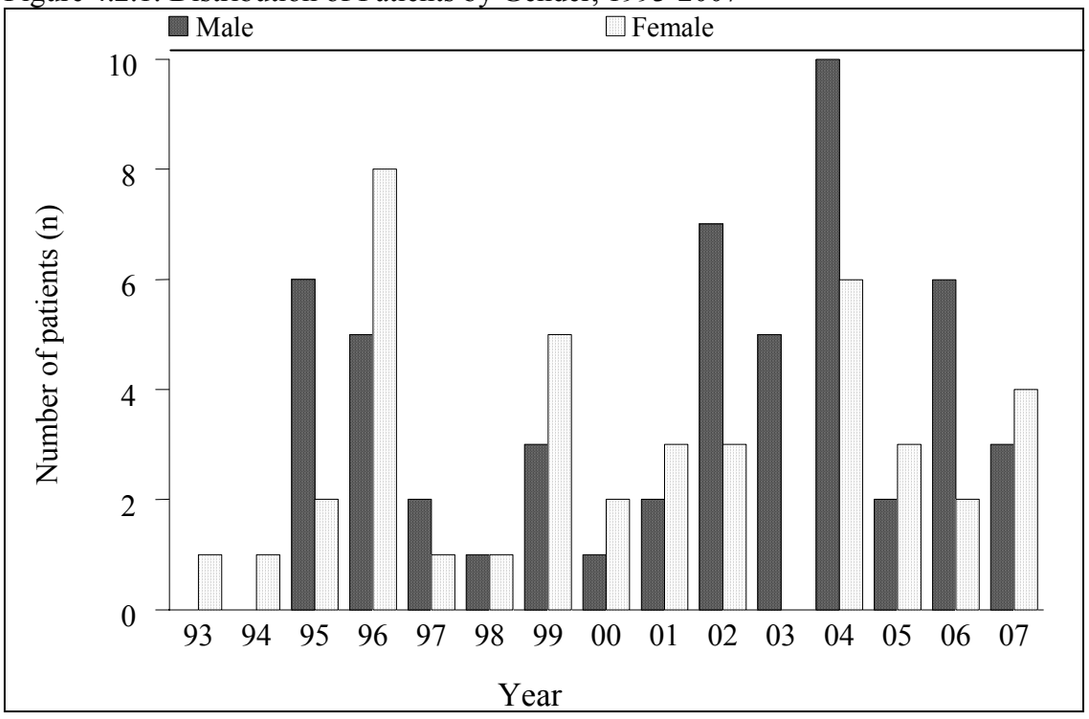

Table 4.2.2: Distribution of Patients by Ethnic Group, 1993-2007

Year	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**00**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**TOTAL**
Ethnic group	**No.**	**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	2	37
Chinese	1	0	6	8	2	1	2	2	3	6	4	5	1	3	4	48
Indian	0	0	0	2	0	1	1	0	0	0	0	0	1	2	1	8
Others	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	2
TOTAL	**1**	**1**	**8**	**13**	**3**	**2**	**8**	**3**	**5**	**10**	**5**	**16**	**5**	**8**	**7**	**95**

Figure 4.2.2: Distribution of Patients by Ethnic Group, 1993-2007

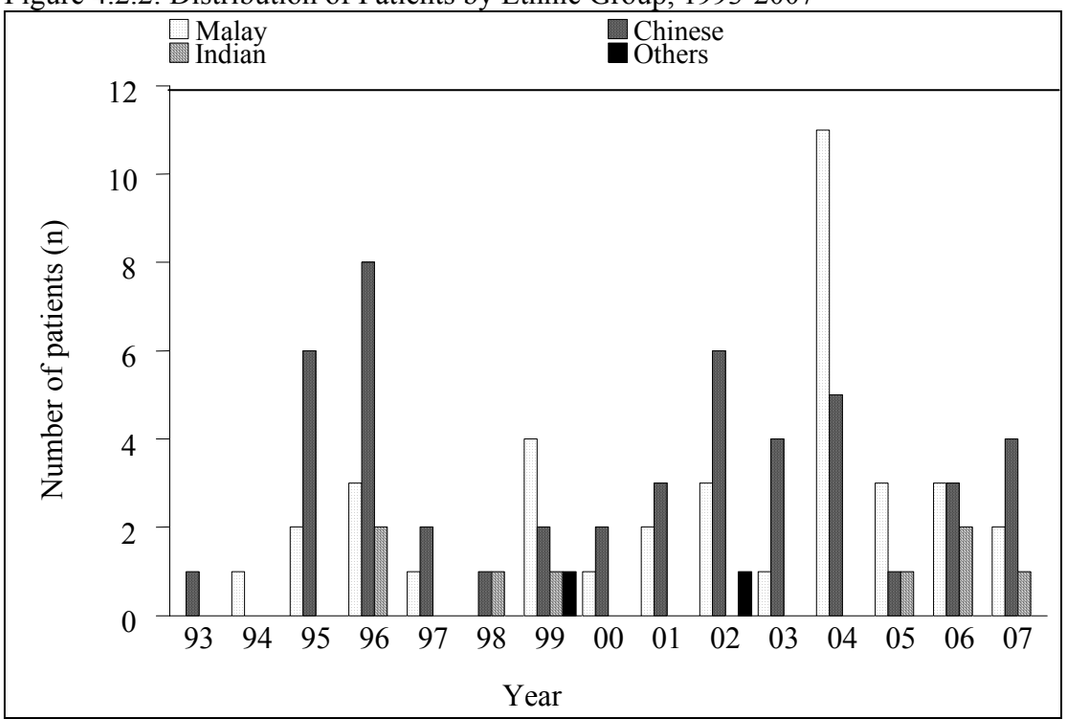

Table 4.2.3: Distribution of Patients by Age, 1993-2007

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	TOTAL
Age, years*	**No.**	**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	0	2
1-4	1	1	3	11	3	1	5	3	4	4	2	9	2	4	3	56
5-9	0	0	3	1	0	0	2	0	1	4	2	3	3	1	2	22
10-14	0	0	1	1	0	0	0	0	0	0	0	1	0	1	1	5
15-19	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	2
20-39	0	0	1	0	0	0	0	0	0	1	0	0	0	2	1	5
40-59	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
≥60	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	2
TOTAL	**1**	**1**	**8**	**13**	**3**	**2**	**8**	**3**	**5**	**10**	**5**	**16**	**5**	**8**	**7**	**95**
Mean	2	4	9	4	2	1	4	1	2	6	18	12	4	12	9	8
SD	-	-	9	4	1	1	5	1	2	7	31	22	3	15	13	13
Median	2	4	6	2	2	1	3	1	2	4	7	3	5	5	5	2
Minimum	2	4	2	2	1	3 months	1	1	1	4 months	1	1	1	2	1	3 months
Maximum	2	4	30	14	2	1	15	2	5	24	73	74	8	39	37	74

* Age=date of transplant – date of birth

Table 4.2.4: Primary Diagnosis, 1993-2007 (N=95)

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	TOTAL
Primary Diagnosis	**No.**	**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	6	69
Metabolic liver disease	0	0	1	1	0	0	0	0	0	2	0	2	0	0	0	6
Cholestatic liver disease	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	3
Primary biliary cirrhosis	0	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	0
Autoimmune hepatitis	0	0	0	0	0	0	1	0	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	0	5
Chronic hepatitis C	0	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	0
Malignancies	0	0	0	0	0	0	0	0	0	1	2	1	0	0	0	4
Acute liver failure	0	0	0	0	0	0	0	0	0	0	0	1	0	3	0	4
Idiopathic / Cryptogenic	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	2	0	1	1	4	1	9

Note: 6 patients have more than one primary disease

Table 4.2.5: Indication for Transplantation, 1993-2007 (N=95)

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	TOTAL
Indication for Transplantation	**No.**	**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	0	3
Uncontrolled bleeding varices	0	0	0	7	1	0	4	1	1	0	0	2	0	0	0	16
Intractable ascites	0	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	0
Poor liver function	1	1	7	11	3	1	8	3	5	9	3	11	4	1	4	72
Malignancy	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Unacceptable quality of life	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	2
Failure to thrive, growth retardation in paediatric patients	0	0	6	10	3	2	6	3	5	7	2	10	3	1	0	58
Others	0	0	0	0	0	0	0	0	0	0	0	1	2	8	3	14
No data	0	0	0	0	0	0	0	0	0	1	1	2	0	0	0	4

Note: 28 patients had 1 indication for transplantation, 63 had more than 1 indication for transplantation

Table 4.2.6: Recipient Blood Group, 1993-2007 (N=95)

Year	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Blood group	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
A	0	1	2	0	0	0	3	0
B	0	0	1	2	0	1	2	0
AB	0	0	0	1	0	1	0	0
O	0	0	2	5	1	0	3	3
No data	1	0	3	5	2	0	0	0
TOTAL	**1**	**1**	**8**	**13**	**3**	**2**	**8**	**3**

Year	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**TOTAL**
Blood group	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
A	1	3	1	4	1	4	2	22
B	1	1	0	1	1	3	3	16
AB	0	0	0	1	1	0	0	4
O	3	5	1	8	2	1	2	36
No data	0	1	3	2	0	0	0	17
TOTAL	**5**	**10**	**5**	**16**	**5**	**8**	**7**	**95**

TRANSPLANT PRACTICES

Seventy eight percent of liver transplants were living donor transplants while 22% were from cadaveric donors. 65.9% 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, 1993-2007 (N=95)

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	TOTAL
Type of Transplant	**No.**	**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	4	21
Living related - Mother	0	1	5	2	1	2	5	2	2	2	2	7	1	1	0	33
Living related - Father	0	0	2	7	1	0	2	0	2	3	0	1	1	3	3	25
Living related - Son	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	2
Living related - Brother	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Living related - emotionally	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Living unrelated	0	0	1	1	0	0	1	1	1	3	0	3	0	0	0	11
TOTAL	**1**	**1**	**8**	**13**	**3**	**2**	**8**	**3**	**5**	**10**	**5**	**16**	**4**	**8**	**7**	**94**

* 1 patient in year 2005 is Living related - Other

Table 4.3.2: Immunosuppressive Drug Treatment at Transplantation, 1993-2007 (N=95)

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	TOTAL
Immunosuppressive drugs	**No.**	**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	6	58
Azathioprine	0	0	0	0	0	0	0	0	0	0	0	4	5	8	4	21
Cyclosporin A	1	1	1	2	0	0	0	1	0	0	0	0	0	0	0	6
Tacrolimus (FK506)	0	0	3	7	2	2	8	2	5	9	5	12	5	8	5	73
Mycophenolate Mofetil (MMF)	0	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	0	3
Monoclonal / Polyclonal antibody	0	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	0
Others	0	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	1	14
TOTAL patients	**1**	**1**	**8**	**13**	**3**	**2**	**8**	**3**	**5**	**10**	**5**	**16**	**5**	**8**	**7**	**95**

Note: 22 patients had 1 type of drug, 38 patients had 2 types, 21 patients had 3 types

4.3 TRANSPLANT OUTCOMES

The 1 year survival rate for the period 1993 - 1998 and 1999 - 2006 was 71% and 69% respectively. The most common cause of death was sepsis.

Table 4.4.1: Patient Survival by Year of Transplant, 1993-2007 (N=95)

Year of Transplant	**1993 - 1998**		**1999 - 2007**	
Interval (months)	**% Survival**	**SE**	**% Survival**	**SE**
1	82	7	82	5
6	71	9	69	6
12	71	9	69	6

SE=standard error

Figure 4.4.1: Patient Survival by Year of Transplant, 1993-2007

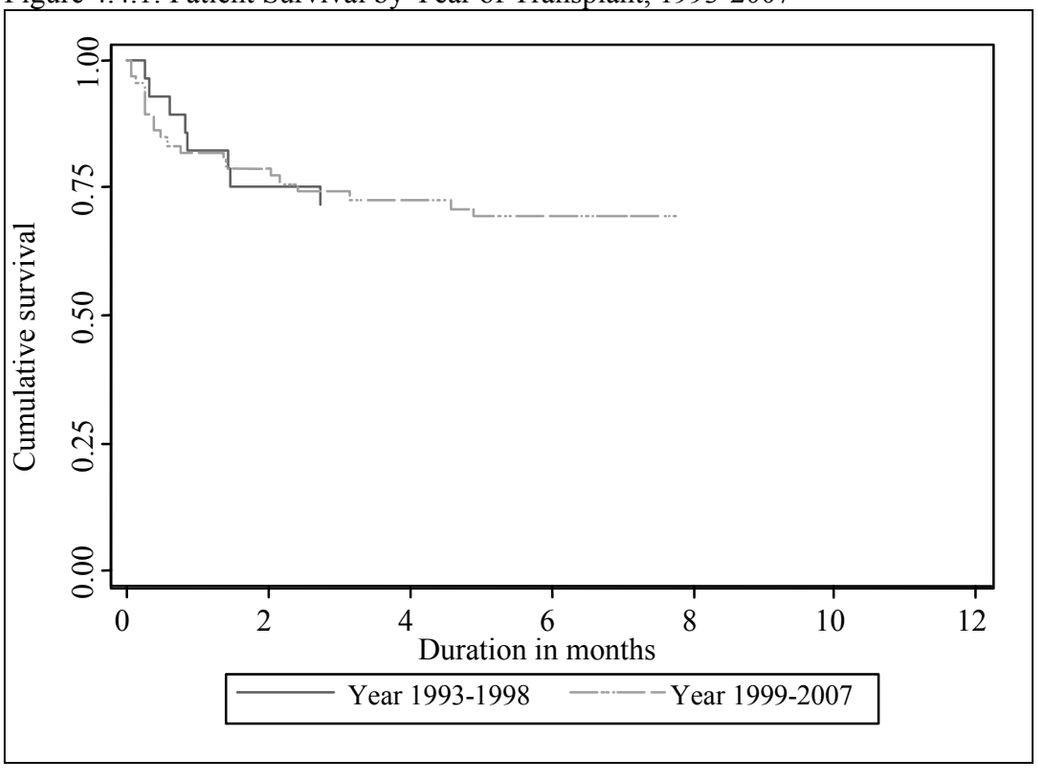

Table 4.4.2: Patient Survival by Gender, 1993-2007 (N=95)

Gender	**Male**		**Female**	
Interval (months)	**% Survival**	**SE**	**% Survival**	**SE**
1	83	5	81	6
6	71	6	69	7
12	71	6	69	7

SE=standard error

Figure 4.4.2: Patient Survival by Gender, 1993-2007

Table 4.4.3: Patient Survival by Age Group, 1993-2007 (N=95)

Age group	0-9 years		≥10 years	
Interval (months)	% Survival	SE	% Survival	SE
1	82	4	85	10
6	69	5	77	12
12	69	5	77	12

SE=standard error

Figure 4.4.3: Patient Survival by Age Group, 1993-2007

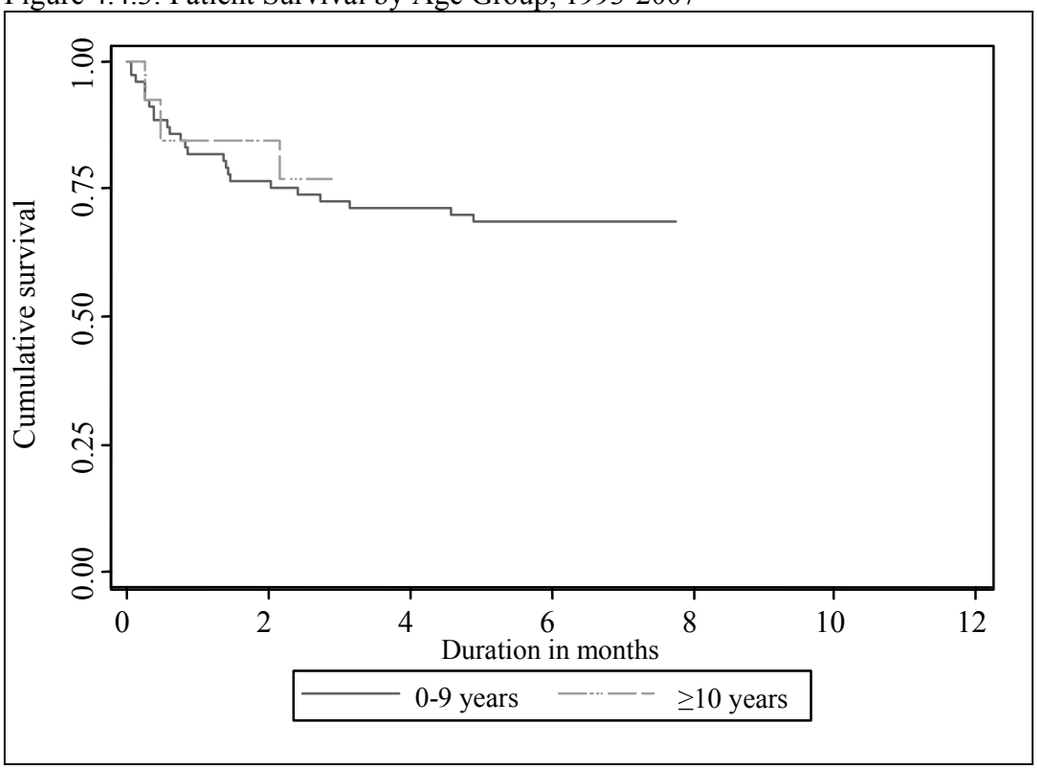

Table 4.4.4: Distribution of Patients by Cause of Death, 1993-2007 (N=95)

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	TOTAL
Causes of death	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
Graft failure	0	0	0	0	0	1	0	0	0	1	2	0	1	4
Chronic graft rejection	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Intra-abdominal Bleeding	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Peritonitis	0	0	0	0	0	0	0	1	0	0	0	0	0	1
CMV Pneumonia	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Decompensated liver cirrhosis	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Intracranial hemorrhage	0	1	0	0	1	0	0	0	0	0	0	0	0	2
Malignancy	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Ivariceal bleed	0	0	1	0	2	0	0	0	0	0	0	0	0	3
Pneumonia and respiratory failure	0	1	0	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	0	1
Sepsis	0	2	0	0	0	0	0	2	0	1	1	3	0	9
Unknown	3	0	0	0	0	0	0	1	0	2	0	0	0	7
TOTAL	**3**	**4**	**1**	**0**	**4**	**1**	**2**	**5**	**1**	**4**	**4**	**3**	**1**	**33**

CHAPTER 5

RENAL TRANSPLANTATION

Editor:
Dr Goh Bak Leong

Expert Panel:
Dato' Dr Zaki Morad (Chair)
Dr Goh Bak Leong (Co-Chair)
Dr Fan Kin Sing
Dr Lily Mushahar
Mr Rohan Malek
Dr S Prasad Menon
Prof Dr Tan Si Yen

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RENAL TRANSPLANTATION

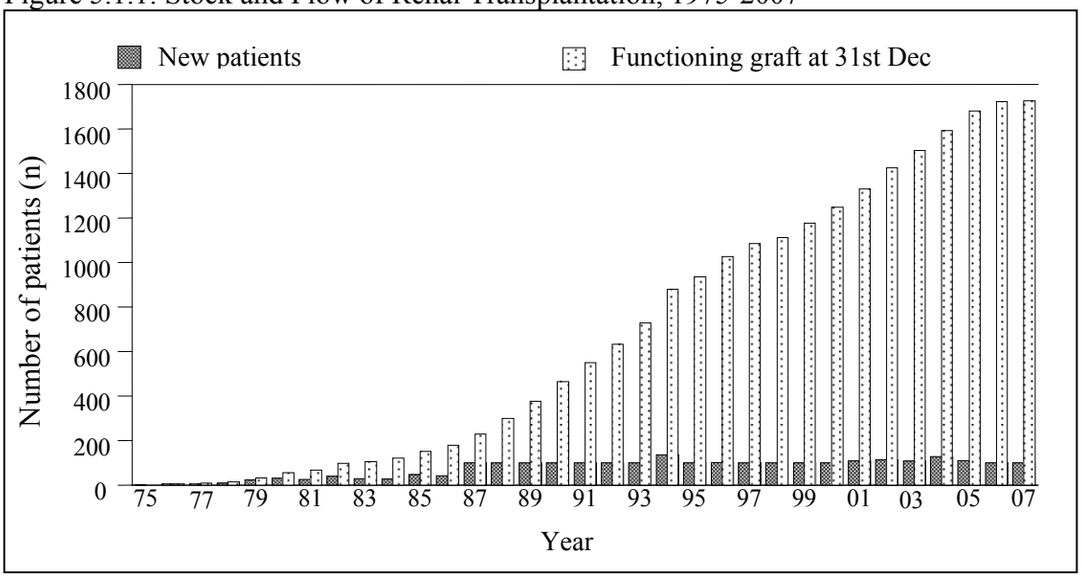
SECTION 5.1 STOCK AND FLOW

The number of new renal transplant patients shows an initial rise from 104 transplants per year in 1998 to a peak of 190 transplants in 2004. This is a rise of >80% but the number declined subsequently to only 86 in 2007 (Table 5.1.1). This is due to reduction in the number of transplantations done in China. As renal transplantation in the country is still dependant on the availability of commercial cadaveric transplantation done abroad this drop was foreseeable. The number of functioning renal transplants reported to the National Transplant Registry (NTR) had increased from 1112 in 1998 to 1726 in 2007 (Table 5.1.1).

Table 5.1.1: Stock and Flow of Renal Transplantation, 1998-2007

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
New transplant patients	104	127	143	162	169	160	190	163	138	86
Died	26	25	30	37	32	37	41	43	50	34
Graft failure	49	36	32	40	38	41	44	21	36	36
Lost to Follow up	1	1	9	4	5	4	14	11	11	12
Functioning graft at 31st December	1112	1177	1249	1330	1424	1502	1593	1681	1722	1726

Figure 5.1.1: Stock and Flow of Renal Transplantation, 1975-2007



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 1998 to 64 per million population in 2007, an increase of 30% over the 1998 figures. However compared to growth in the prevalence rate of dialysis patients (which has increased by 300% from 205 in 1998 to 615 in 2007) our transplant prevalence rate has not kept up.

Table 5.1.2: New Transplant Rate per million population (pmp), 1998-2007

Year	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
New transplant patients	104	127	143	162	169	160	190	163	138	86
New transplant rate, pmp	5	6	6	7	7	6	7	6	5	3

Figure 5.1.2: New Transplant Rate, 1975-2007

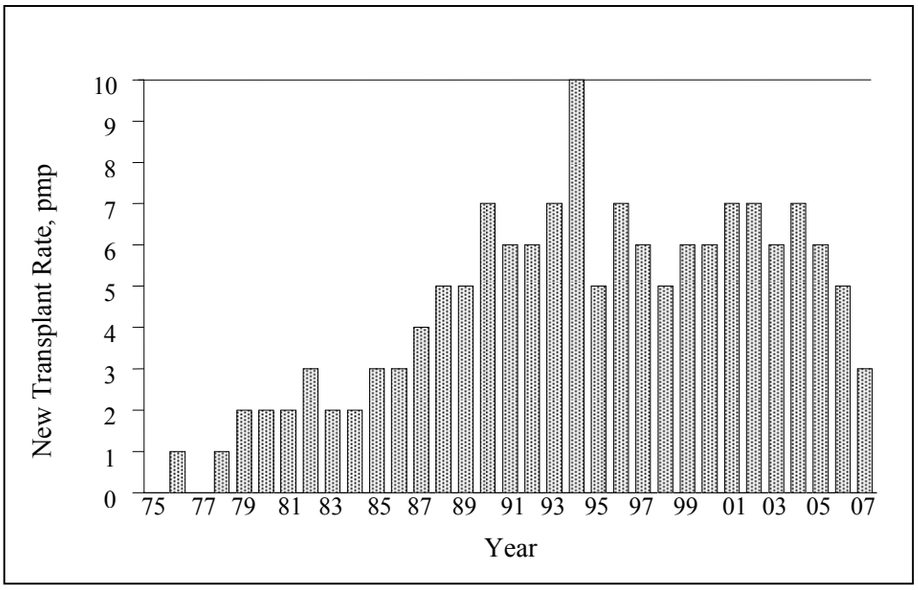
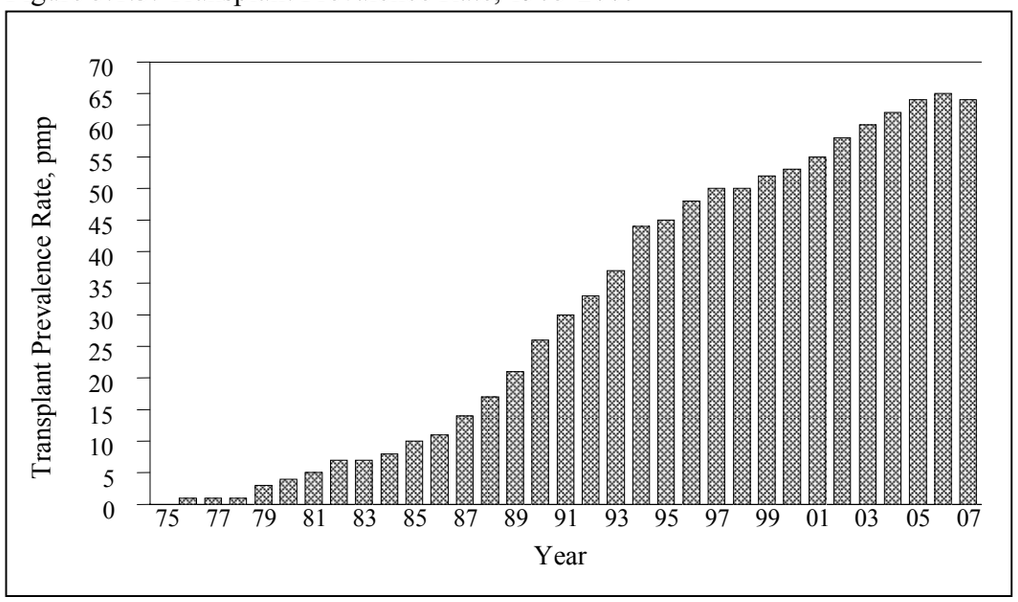


Table 5.1.3: Transplant Prevalence Rate per million population (pmp), 1998-2007

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Functioning graft at 31st Dec	1112	1177	1249	1330	1424	1502	1593	1681	1722	1726
Transplant prevalence rate, pmp	50	52	53	55	58	60	62	64	65	64

Figure 5.1.3: Transplant Prevalence Rate, 1975-2007



In terms of place of transplantation, transplantation within local centres has grown slightly from 40 cases (39% of renal transplants) in 1998 to 52 cases (60% of renal transplants) in 2007. This translates to a net increase of 1 case per year over the 10 year period. This is disturbing data as it underscores our failure to improve transplantation rates within the country which is mainly due to the lack of both living as well as cadaver donors. Transplantation in China in 2007 only comprised 34% of all of renal transplant recipients with 29 patients. In fact this is the first time local transplantation out-performed China transplantation over the last decade.

Table 5.1.4: Place of Transplantation, 1998-2007

Year	**1998**		**1999**		**2000**		**2001**		**2002**	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
HKL	33	32	36	28	28	20	33	20	28	17
UMMC	7	7	16	13	19	13	23	14	14	8
Selayang Hospital	0	0	0	0	4	3	11	7	11	7
Other local	0	0	1	1	3	2	4	2	1	1
China	50	48	62	49	80	56	83	51	103	61
India	7	7	5	4	9	6	7	4	12	7
Other overseas	3	3	2	2	0	0	1	1	0	0
Unknown	4	4	5	4	0	0	0	0	0	0
TOTAL	**104**	**100**	**127**	**100**	**143**	**100**	**162**	**100**	**169**	**100**

Year	**2003**		**2004**		**2005**		**2006**		**2007**		**TOTAL**	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
HKL	26	16	20	11	32	20	35	25	35	41	306	21
UMMC	6	4	7	4	7	4	5	4	0	0	104	7
Selayang Hospital	11	7	11	6	5	3	8	6	14	16	75	5
Other local	1	1	2	1	5	3	2	1	3	3	22	2
China	111	69	137	72	108	66	79	57	29	34	842	58
India	4	3	11	6	5	3	7	5	1	1	68	5
Other overseas	1	1	2	1	1	1	2	1	4	5	16	1
Unknown	0	0	0	0	0	0	0	0	0	0	9	1
TOTAL	**160**	**100**	**190**	**100**	**163**	**100**	**138**	**100**	**86**	**100**	**1442**	**100**

SECTION 5.2 RECIPIENTS' CHARACTERISTICS

In terms of renal transplant recipients' characteristics, age at transplant has been stable at 35 to 42 years and between 57% and 67% of recipients are males over the last 10 years. There has been an increase in the population of diabetic patients undergoing transplantation from 10% in 1998 to 20% in 2006 (Table 5.2.1). However, there is a drastic drop in number of diabetic patients who underwent transplantation in 2007 (12%). This coincided with the drop in China transplants where the majority of the diabetic patients underwent their transplantation. Patients with hepatitis B and hepatitis C remained static at around 7%. 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 third cause. Up to 40% 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, 1998-2007

Year	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
New Transplant Patients	104	127	143	162	169	160	190	163	138	86
Age at transplant (years), Mean	37	37	39	41	41	42	41	38	37	35
Age at transplant (years), SD	11	13	14	13	12	13	13	14	15	15
% Male	58	62	64	62	57	66	62	70	67	62
% Diabetic (co-morbid/ primary renal disease)	10	11	15	19	15	22	22	20	20	12
% HBsAg positive	6	4	5	5	7	8	5	4	7	5
% Anti-HCV positive	18	11	8	15	9	10	8	2	7	11

Table 5.2.2: Primary Causes of End Stage Renal Failure, 1998-2007

Year	**1998**		**1999**		**2000**		**2001**		**2002**	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
New transplant patients	104	100	127	100	143	100	162	100	169	100
Glomerulonephritis	28	27	41	32	49	34	43	27	53	31
Diabetes Mellitus	5	5	10	8	16	11	23	14	16	9
Hypertension	5	5	7	6	20	14	17	10	24	14
Obstructive uropathy	4	4	4	3	3	2	3	2	2	1
ADPKD	1	1	1	1	3	2	1	1	3	2
Drugs / toxic nephropathy	0	0	0	0	0	0	0	0	0	0
Hereditary nephritis	0	0	0	0	0	0	0	0	0	0
Unknown	54	52	62	49	54	38	61	38	68	40
Others	11	11	6	5	12	8	23	14	16	9

Year	**2003**		**2004**		**2005**		**2006**		**2007**	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
New transplant patients	160	100	190	100	163	100	138	100	86	100
Glomerulonephritis	54	34	62	33	45	28	51	37	26	30
Diabetes Mellitus	26	16	32	17	29	18	21	15	6	7
Hypertension	25	16	51	27	38	23	29	21	20	23
Obstructive uropathy	2	1	4	2	3	2	4	3	1	1
ADPKD	5	3	5	3	3	2	1	1	0	0
Drugs / toxic nephropathy	2	1	2	1	0	0	1	1	0	0
Hereditary nephritis	0	0	1	1	0	0	0	0	0	0
Unknown	58	36	83	44	50	31	42	30	32	37
Others	12	8	27	14	17	10	16	12	12	14

In 2006, 62% of the renal transplant recipients received their grafts from commercial sources. Fifty-eight percent of these were from commercial cadavers. Live donor transplantation made up 21% of transplants (28 recipients) in the same year which was down from 29 cases (29%) in 1998 and 41 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. 2007 marked the first time in 10 years there were more local transplantations (37%) compared to commercial transplantations in China (34%).

Table 5.3.1: Type of Renal Transplantation, 1998-2007

Year	**1998**		**1999**		**2000**		**2001**		**2002**	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Commercial cadaver	51	51	62	51	80	56	83	51	103	61
Commercial live donor	4	4	4	3	9	6	6	4	11	7
Live donor (genetically related)	28	28	40	33	21	15	32	20	30	18
Live donor (emotionally related)	2	2	5	4	6	4	4	2	3	2
Cadaver	15	15	10	8	27	19	37	23	22	13
Total	**100**	**100**	**121**	**100**	**143**	**100**	**162**	**100**	**169**	**100**

Year	**2003**		**2004**		**2005**		**2006**		**2007**	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Commercial cadaver	112	70	143	76	105	64	80	58	28	33
Commercial live donor	3	2	6	3	8	5	5	4	2	2
Live donor (genetically related)	25	16	21	11	38	23	24	17	20	24
Live donor (emotionally related)	5	3	2	1	3	2	4	3	11	13
Cadaver	15	9	17	9	9	6	25	18	24	28
Total	**160**	**100**	**189**	**100**	**163**	**100**	**138**	**100**	**85**	**100**

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

Table 5.3.2: Biochemical Data, 2005-2007

Biochemical parameters	Summary	2005	2006	2007
Creatinine, umol/L	N	1635	1592	1685
	Mean	133.6	135.7	131.9
	SD	65.4	81.3	77.6
	Median	120	120	116
	Minimum	35	21.7	36
	Maximum	763	1152	1186
Hb, g/dL	N	1635	1592	1685
	Mean	12.8	12.7	12.8
	SD	1.9	1.9	1.9
	Median	12.9	12.8	12.8
	Minimum	5.5	3.3	4.4
	Maximum	19	19.8	18.7
Albumin, g/L	N	1635	1592	1685
	Mean	39.9	39.9	39.9
	SD	0.5	0.7	0.8
	Median	39.9	39.9	39.9
	Minimum	34	29	29
	Maximum	46	48	48
Calcium, mmol/L	N	1635	1592	1685
	Mean	2.3	2.3	2.3
	SD	0.2	0.2	0.2
	Median	2.3	2.3	2.3
	Minimum	1.2	1.1	1.4
	Maximum	3.3	3.1	3.2
Phosphate, mmol/L	N	1635	1592	1685
	Mean	1.1	1.1	1.1
	SD	0.2	0.2	0.3
	Median	1.1	1.1	1.1
	Minimum	0.5	0.5	0.5
	Maximum	3.3	3.5	3.9
Alkaline Phosphate (ALP), U/L	N	1635	1592	1685
	Mean	79	79.1	79.1
	SD	46.5	43.2	38.4
	Median	73	71	72
	Minimum	20	24	22
	Maximum	831	700	439
ALT, U/L	N	1635	1592	1685
	Mean	30.8	29.9	29.9
	SD	30.9	30.4	25.7
	Median	24	22	23
	Minimum	4	4	4
	Maximum	613	433	356

Biochemical parameters	Summary	2005	2006	2007
Total cholesterol, mmol/L	N	1635	1592	1685
	Mean	5.3	5.3	5.2
	SD	1	1	1
	Median	5.3	5.3	5.3
	Minimum	1.7	1.5	1.7
	Maximum	10.1	11.1	11.4
LDL cholesterol, mmol/L	N	1635	1592	1685
	Mean	3	3	3
	SD	0.8	0.8	0.8
	Median	3	3	3
	Minimum	0.9	1	1
	Maximum	9.2	11.1	8.9
HDL cholesterol, mmol/L	N	1635	1592	1685
	Mean	1.6	1.6	1.5
	SD	0.5	0.5	0.4
	Median	1.6	1.6	1.6
	Minimum	0.4	0.4	0.4
	Maximum	5.6	5.8	7.5
Systolic Blood Pressure, mmHg	N	1635	1592	1685
	Mean	133.3	130.8	131.7
	SD	16.9	15.9	15.7
	Median	130	130	130
	Minimum	80	66	80
	Maximum	220	210	210
Diastolic Blood Pressure, mmHg	N	1635	1592	1685
	Mean	80.5	78.9	78.8
	SD	9.2	9.8	9.4
	Median	80	80	80
	Minimum	50	30	20
	Maximum	127	120	116

In 2007, Cyclosporine based regimes remained the mainstay of immunosuppressive therapy with 72% of patients receiving it. Tacrolimus based regimes accounted for 21%. There has been continuous increase in the use of Mycophenolate Mofetil as the second immunosuppressive agent in 54% of patients in 2007 compared to 37% of patients in 2004. During the same period, the use of Azathioprine declined from 43% in 2004 to 29% in 2007. Monotherapy of immunosuppresion is mostly not noted except in a small number of patients. Sirolimus was used in 2% of all transplant recipients in 2007.

In terms of non immunosuppressive medications, only 36% of patients were on ACEI or AIIRBs or both and this trend has been relatively static since 2004. Calcium channel blockers appeared to be the mainstay of antihypertensive therapy in 65% of patients whilst beta blocker use was reported in 49% of patients. Other antihypertensives were reported in 8% 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, 2005-2007

Medication data	**Single drug treatment**						**Combined drug treatment**					
	2005		**2006**		**2007**		**2005**		**2006**		**2007**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
All	1563	100	1480	100	1661	100	1563	100	1480	100	1661	100
(i) Immunosuppressive drug(s) treatment												
Prednisolone	12	1	8	1	9	1	1529	98	1442	97	1607	97
Azathioprine	1	0	0	0	0	0	605	39	496	34	478	29
Cyclosporin A	4	0	5	0	8	0	1221	78	1118	76	1188	72
Tacrolimus (FK506)	0	0	0	0	4	0	225	14	254	17	347	21
Mycophenolate Mofetil (MMF)	0	0	0	0	1	0	683	44	708	48	903	54
Rapamycin	0	0	0	0	0	0	8	1	6	0	33	2
Others	0	0	0	0	0	0	10	1	18	1	4	0
(ii) Non-Immunosuppressive drug(s) treatment												
Beta blocker	105	7	77	5	90	5	667	43	597	40	735	44
Calcium channel blocker	195	12	199	13	183	11	822	53	787	53	903	54
ACE inhibitor	60	4	39	3	38	2	342	22	292	20	384	23
AIIRB	20	1	27	2	18	1	161	10	141	10	210	13
Anti-lipid	67	4	155	10	94	6	602	39	678	46	730	44
Other anti-hypertensive	5	0	11	1	6	0	158	10	159	11	140	8

SECTION 5.4: TRANSPLANT OUTCOMES

5.4.1 Post Transplant Complications

Sixty-three percent of patients were hypertensive prior to transplantation whereas 27% developed hypertension post transplantation. Fourteen percent of patients had diabetes mellitus prior to transplant whereas only 7% of patients developed post transplant diabetes mellitus. In terms of cardiovascular and cerebrovascular disease 4% had either or both prior to transplant whereas 3% developed these post transplantation.

Table 5.4.1: Post Transplant Complications, 2005-2007

Post transplant complications	**Complication developed before transplant (regardless of complication after transplantation)**						**Complication developed only after transplantation**					
	2005		**2006**		**2007**		**2005**		**2006**		**2007**	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
All patients	1637	100	1592	100	1685	100	1637	100	1592	100	1685	100
Diabetes (either as Primary Renal Disease or co-morbid)	219	13	215	14	228	14	122	7	125	8	113	7
Cancer	2	0	2	0	3	0	19	1	20	1	21	1
Cardiovascular disease + cerebrovascular disorder	78	5	73	5	72	4	45	3	45	3	54	3
Hypertension	1049	64	1032	65	1059	63	438	27	355	22	453	27

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

5.4.2 Deaths and Graft Loss

In 2007, 34 transplant recipients died and 36 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 and cardiovascular disease with 33% and 18% respectively. Another 10% of patients died at home, which is usually presumed to be cardiovascular death as well.

Cancer death rates have been significantly high since 2003 contributing to 15% of all deaths in 2003, 18% in 2004 and 15% in 2007. Death due to liver disease has remained relatively static at 5-9% from 2003 to 2006.

In terms of graft loss, 69% were due to rejection with 3% apiece for vascular causes and infections in 2007 and these figures have remained relatively stable for the last 4 years.

Table 5.4.2: Transplant Patients Death Rate and Graft Loss, 1998– 2007

Year	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
No. at risk	1097	1144	1212	1289	1376	1462	1547	1636	1701	1723
Transplant death	26	25	30	37	32	37	41	43	50	34
Transplant death rate %	2	2	2	3	2	3	3	3	3	2
Graft loss	49	36	32	40	38	41	44	21	36	36
Graft loss rate %	4	3	3	3	3	3	3	1	2	2
Acute rejection	0	0	0	0	0	3	19	14	18	10
Acute rejection rate %	0	0	0	0	0	0	1	1	1	1
All losses	75	61	62	77	70	78	85	64	86	70
All losses rate %	7	5	5	6	5	5	5	4	5	4

*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, 1976-2007

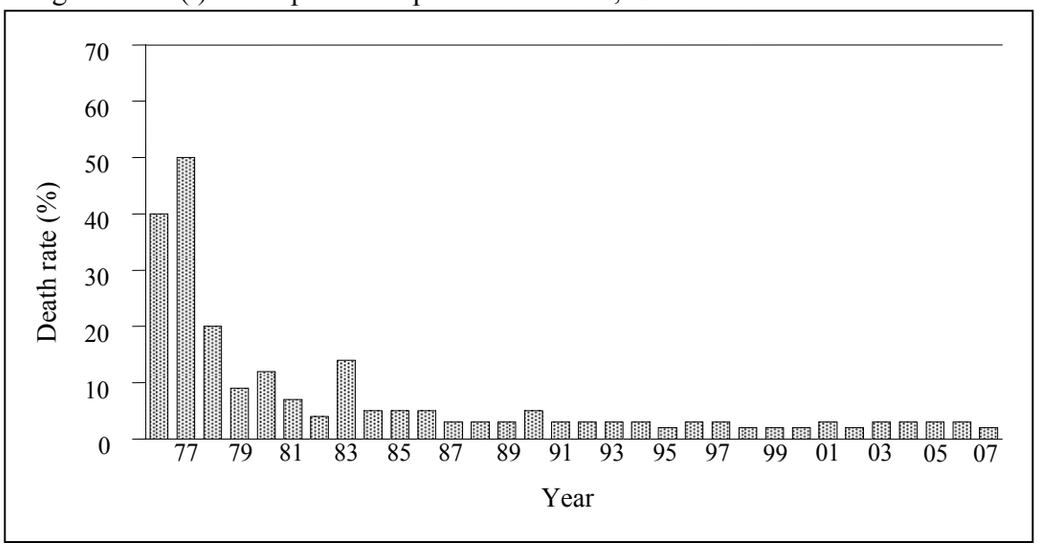


Figure 5.4.2 (ii): Transplant Recipient Graft Loss Rate, 1976-2007

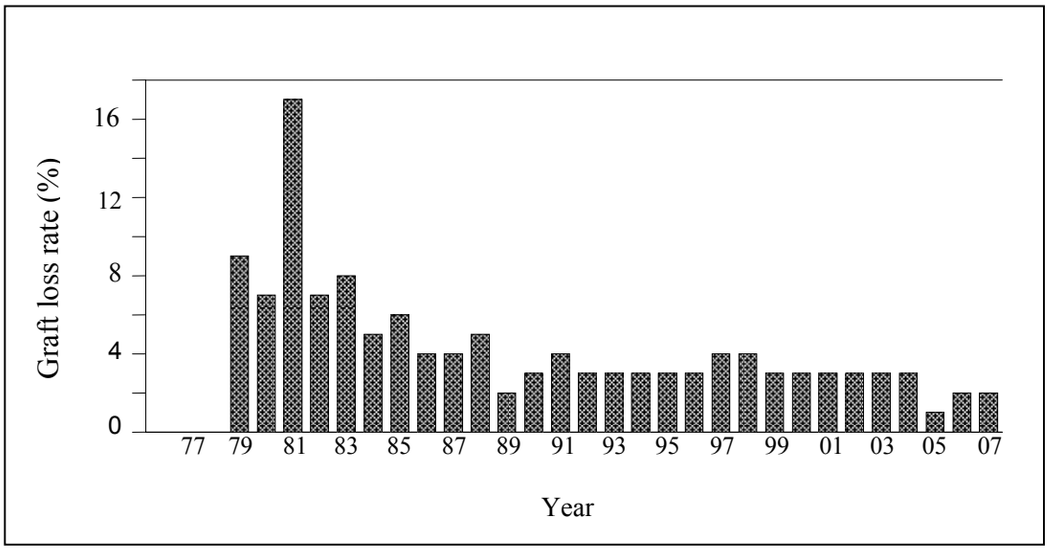


Table 5.4.3: Causes of Death in Transplant Recipients, 1998-2007

Year	**1998**		**1999**		**2000**		**2001**		**2002**	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Cardiovascular	3	11	4	13	10	29	7	16	5	16
Died at home	4	15	6	19	1	3	5	12	5	16
Infection	10	37	7	23	12	35	20	47	9	28
Graft failure	0	0	0	0	2	6	0	0	0	0
Cancer	3	11	3	10	2	6	6	14	4	13
Liver disease	2	7	3	10	1	3	1	2	3	9
Accidental death	0	0	1	3	1	3	1	2	1	3
Others	2	7	5	16	3	9	2	5	3	9
Unknown	3	11	2	6	2	6	1	2	2	6
TOTAL	**27**	**100**	**31**	**100**	**34**	**100**	**43**	**100**	**32**	**100**

Year	**2003**		**2004**		**2005**		**2006**		**2007**	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Cardiovascular	9	23	4	9	5	11	10	18	7	18
Died at home	5	12	6	13	5	11	7	13	4	10
Infection	11	28	11	24	22	50	22	40	13	33
Graft failure	0	0	2	4	0	0	0	0	3	8
Cancer	6	15	8	18	5	11	4	7	6	15
Liver disease	2	5	3	7	3	7	5	9	0	0
Accidental death	0	0	0	0	0	0	0	0	0	0
Others	5	12	10	22	3	7	4	7	2	5
Unknown	2	5	1	2	1	2	3	5	4	10
TOTAL	**40**	**100**	**45**	**100**	**44**	**100**	**55**	**100**	**39**	**100**

Table 5.4.4: Causes of Graft Failure, 1998-2007

Year	1998		1999		2000		2001		2002	
	No.	%	No.	%	No.	%	No.	%	No.	%
Rejection	28	53	23	64	19	59	25	61	22	55
Calcineurin toxicity	0	0	0	0	0	0	0	0	0	0
Other drug toxicity	0	0	0	0	0	0	0	0	0	0
Ureteric obstruction	0	0	0	0	0	0	0	0	0	0
Infection	1	2	0	0	1	3	2	5	0	0
Vascular causes	3	6	1	3	3	9	1	2	0	0
Recurrent / de novo renal disease	1	2	0	0	0	0	2	5	2	5
Others	5	9	0	0	2	6	0	0	4	10
Unknown	15	28	12	33	7	22	11	27	12	30
TOTAL	**53**	**100**	**36**	**100**	**32**	**100**	**41**	**100**	**40**	**100**

Year	2003		2004		2005		2006		2007	
	No.	%	No.	%	No.	%	No.	%	No.	%
Rejection	21	48	33	70	18	75	28	68	25	69
Calcineurin toxicity	0	0	0	0	0	0	1	2	0	0
Other drug toxicity	0	0	1	2	0	0	0	0	0	0
Ureteric obstruction	0	0	0	0	0	0	0	0	1	3
Infection	2	5	1	2	1	4	3	7	1	3
Vascular causes	3	7	4	9	2	8	3	7	1	3
Recurrent / de novo renal disease	2	5	1	2	0	0	1	2	0	0
Others	1	2	0	0	1	4	3	7	4	11
Unknown	15	34	7	15	2	8	2	5	4	11
TOTAL	**44**	**100**	**47**	**100**	**24**	**100**	**41**	**100**	**36**	**100**

SECTION 5.5: PATIENT AND GRAFT SURVIVAL

Overall patient survival rates from 1994 to 2007 have been 95%, 91%, 88% and 81% at year 1, 3, 5 and 10 respectively. Overall graft survival rate has been 92%, 85%, 79% and 64% at year 1, 3, 5 and 10 respectively.

Table 5.5.1: Patient Survival, 1994-2007

Interval (years)	No.	% Survival	SE
1	1777	95	1
3	1380	91	1
5	993	88	1
10	349	81	1
12	151	76	2

No.=Number at risk SE=standard error

Figure 5.5.1: Patient Survival, 1994-2007

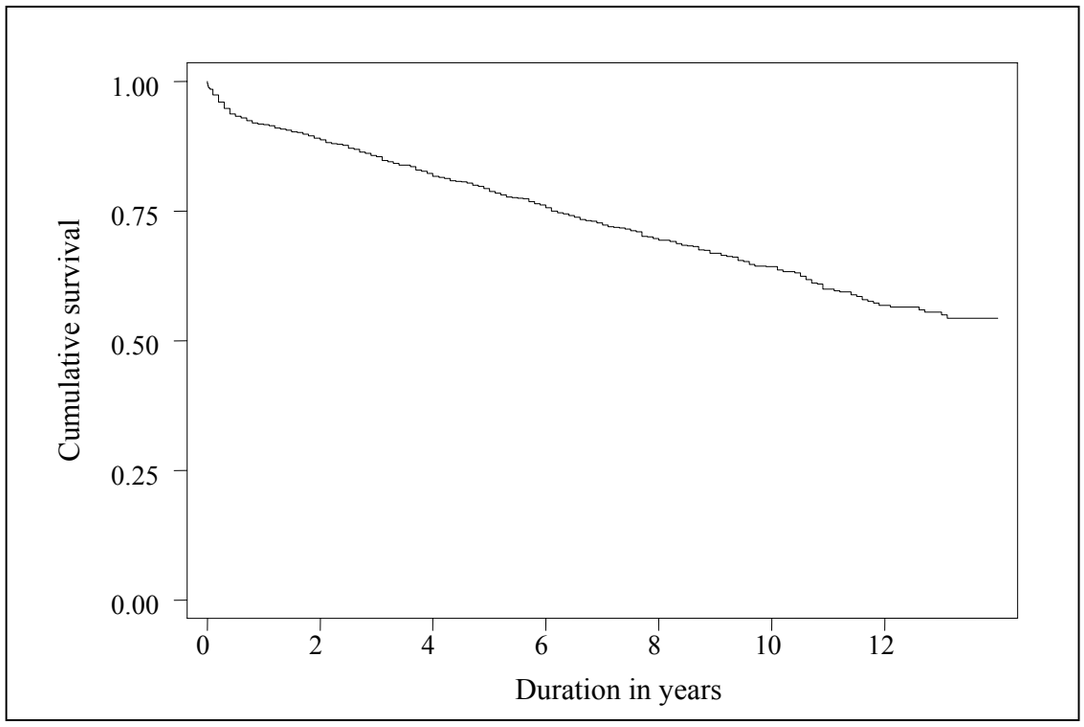
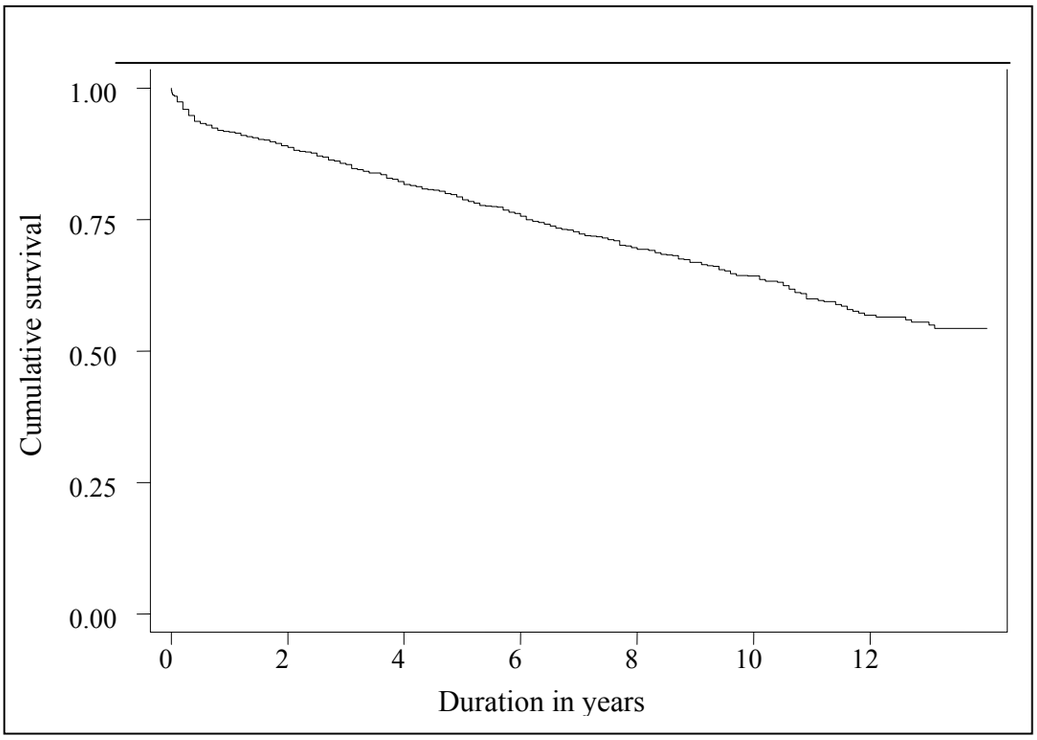


Table 5.5.2: Graft Survival, 1994-2007

Interval (years)	No.	% Survival	SE
1	1777	92	1
3	1380	85	1
5	993	79	1
10	349	64	1
12	151	57	2

No.=Number at risk SE=standard error

Figure 5.5.2: Graft Survival, 1994-2007



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 with 97%, 95%, 94% and 90% at years 1, 3, 5 and 10 respectively. In terms of graft survival, commercial cadaver grafts performed similarly well with a survival of 94%, 89%, 82% and 70% at year 1, 3, 5 and 10 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, 1994-2007

Type of Transplant	Commercial Cadaver			Commercial Live Donor			Live Donor			Cadaver		
Interval (years)	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE
1	997	96	1	212	96	1	395	96	1	146	84	3
3	770	92	1	174	90	2	312	95	1	104	79	3
5	500	88	1	144	87	2	254	94	1	80	75	3
10	161	82	2	86	70	4	91	91	2	7	70	4
12	34	77	3	70	65	4	45	87	3	2	-	-

No.=Number at risk SE=standard error

Figure 5.5.3: Patient Survival by Type of Transplant, 1994-2007

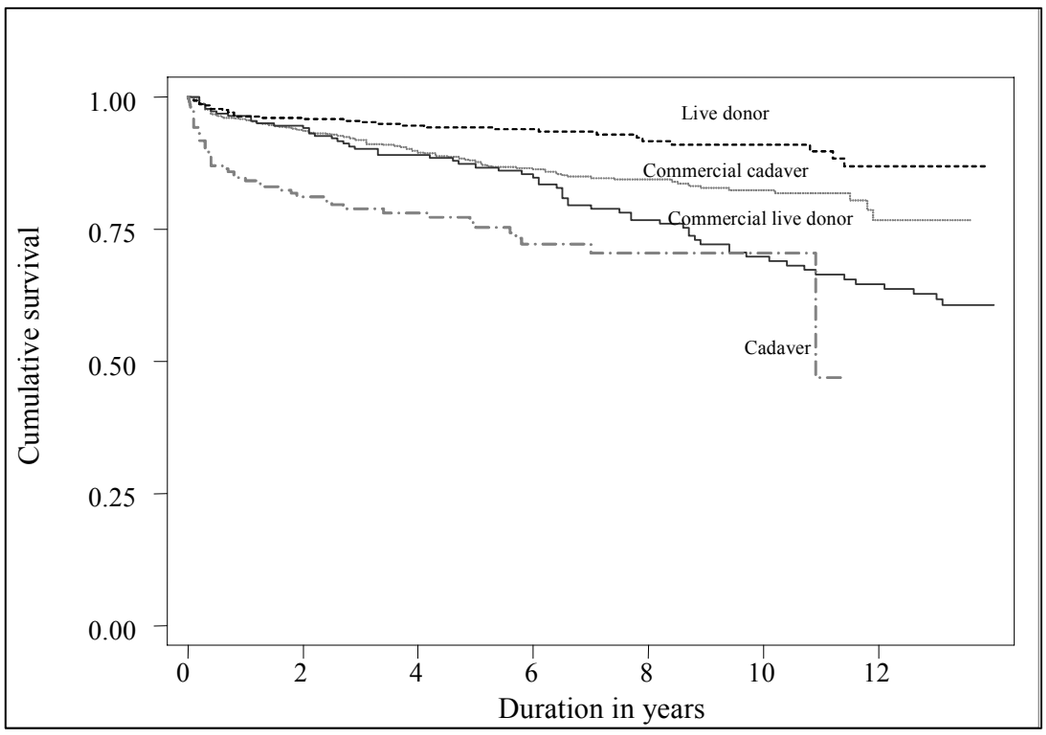
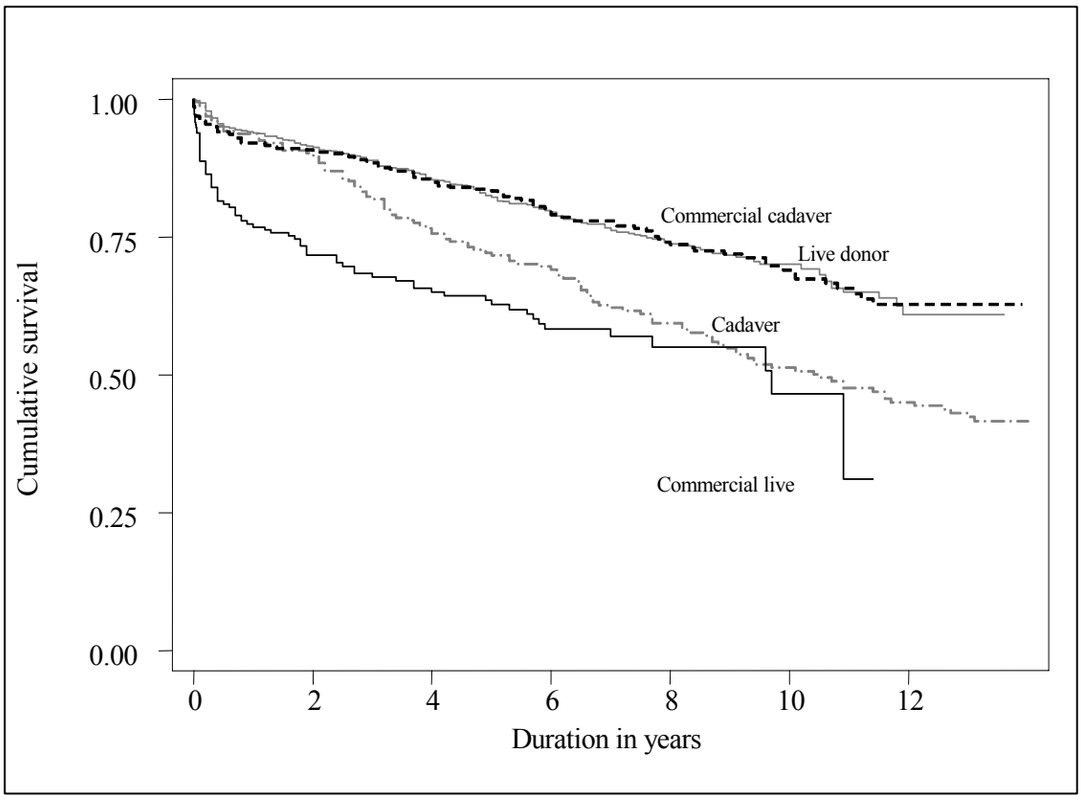


Table 5.5.4: Graft Survival by Type of Transplant, 1994-2007

Type of Transplant	Commercial Cadaver			Commercial Live Donor			Live Donor			Cadaver		
Interval (years)	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE
1	997	94%	1%	212	94%	2%	395	92%	1%	146	77%	3%
3	770	89%	1%	174	82%	3%	312	88%	2%	104	68%	3%
5	500	82%	1%	144	72%	3%	254	83%	2%	80	63%	4%
10	161	70%	2%	86	51%	4%	91	69%	3%	7	47%	7%
12	34	61%	3%	70	45%	4%	45	63%	4%	2	-	-

No.=Number at risk SE=standard error

Figure 5.5.4: Graft Survival by Type of Transplants, 1994-2007



Patient and graft survival for living related transplants were compared for two cohorts. The 1994-1999 cohort and the 2000-2007 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 2000-2007 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, 1994-2007)

Year of Transplant	**1994-1999**			**2000-2007**		
(years)	**No.**	**% Survival**	**SE**	**No.**	**% Survival**	**SE**
1	192	98	1	204	95	1
3	181	96	1	132	94	2
5	169	95	2	86	93	2
7	159	94	2	21	93	2

No.=Number at risk SE=standard error

Figure 5.5.5: Patient Survival by Year of Transplant (Living Related Transplant, 1994-2007)

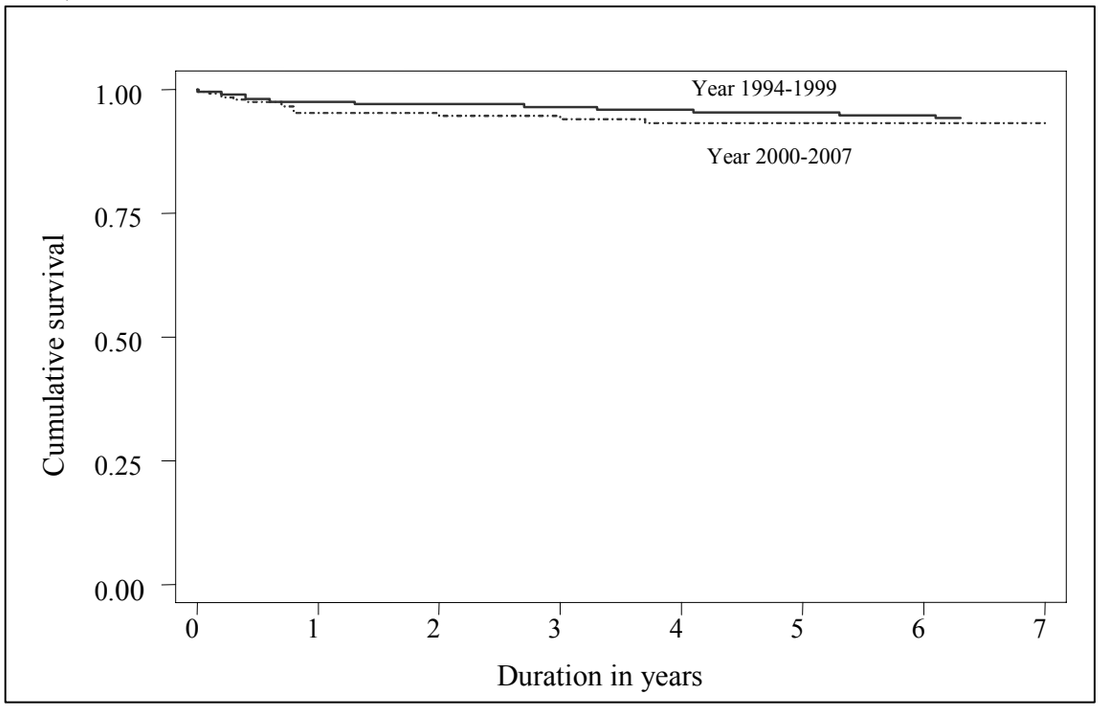
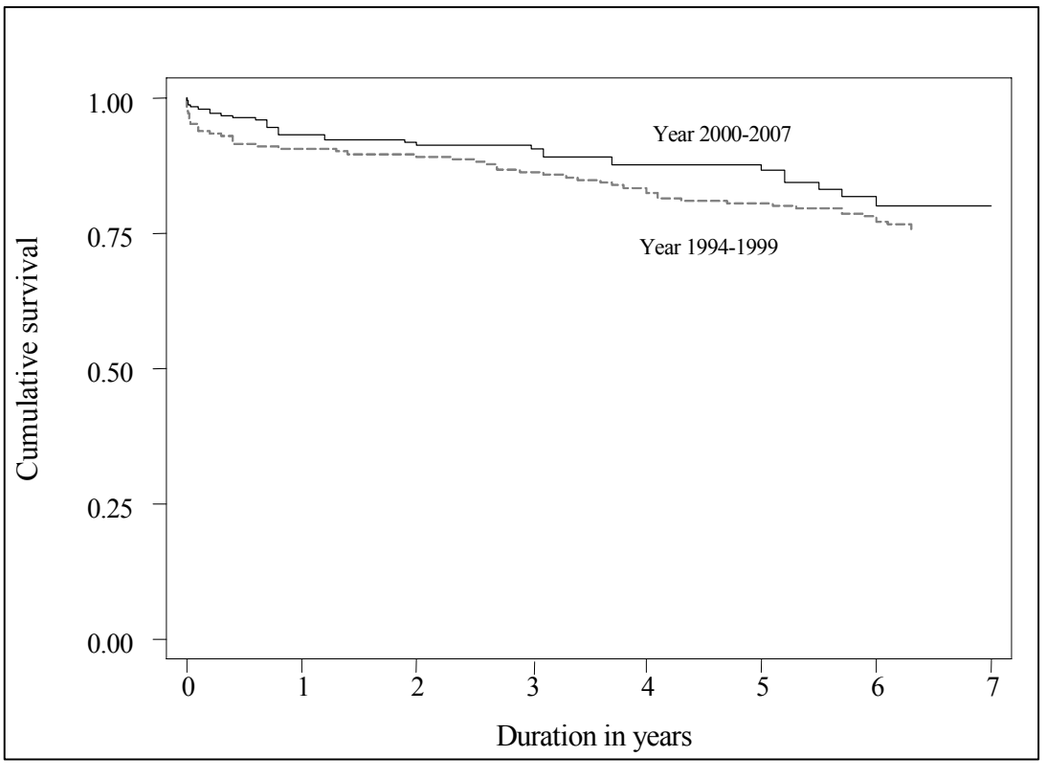


Table 5.5.6: Graft Survival by Year of Transplant (Living Related Transplant, 1994-2007)

Year of Transplant	1994-1999			2000-2007		
(years)	No.	% Survival	SE	No.	% Survival	SE
1	192	91	2	204	93	2
3	181	86	2	132	91	2
5	169	81	3	86	87	3
7	159	76	3	21	80	4

SE=standard error

Figure 5.5.6: Graft Survival by Year of Transplant (Living Related Transplant, 1994-2007)



In terms of commercial cadaveric transplantation, the comparison between the 1994-1999 cohort and 2000 – 2007 cohort was performed. Both patient and graft survival showed comparable results to living related transplants done within the country.

Table 5.5.7: Patient Survival by Year of Transplant (Commercial Cadaver Transplant,1994-2007)

Year of Transplant	**1994-1999**			**2000-2007**		
(years)	**No.**	**% Survival**	**SE**	**No.**	**% Survival**	**SE**
1	335	95	1	663	96	1
3	317	92	1	453	92	1
5	289	88	2	211	87	2
7	262	85	2	59	85	2

No.=Number at risk SE=standard error

Figure 5.5.7: Patient Survival by Year of Transplant (Commercial Cadaver Transplant, 1994-2007)

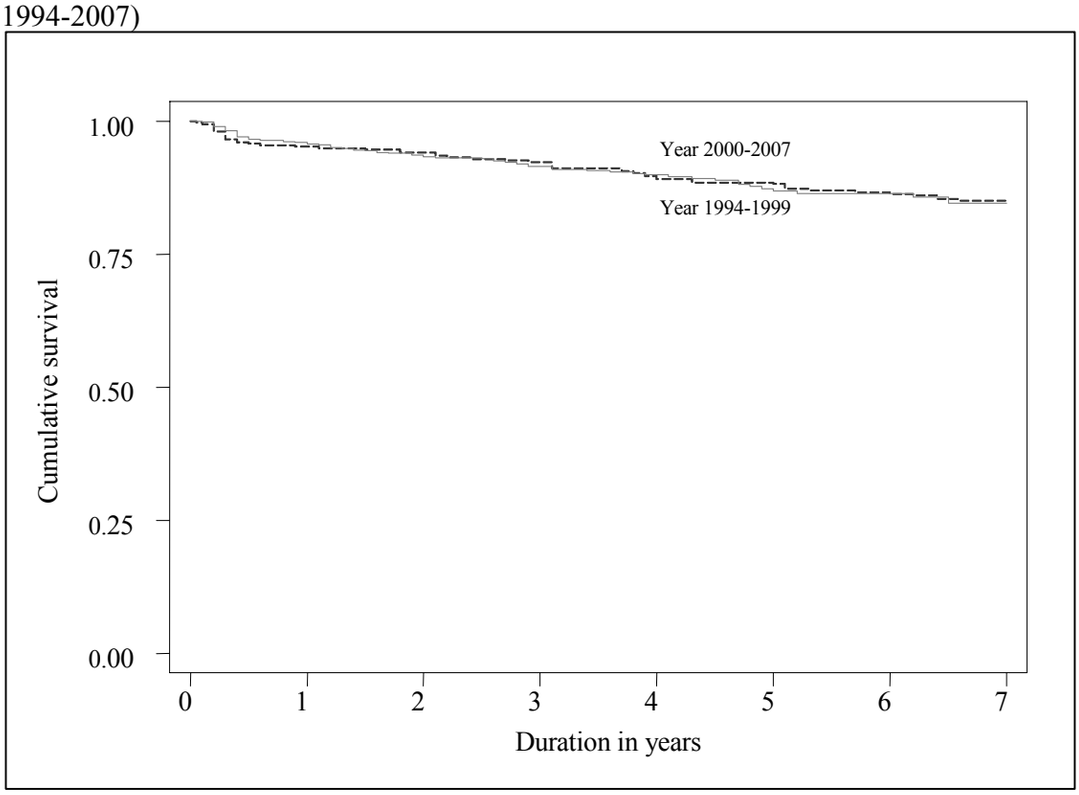
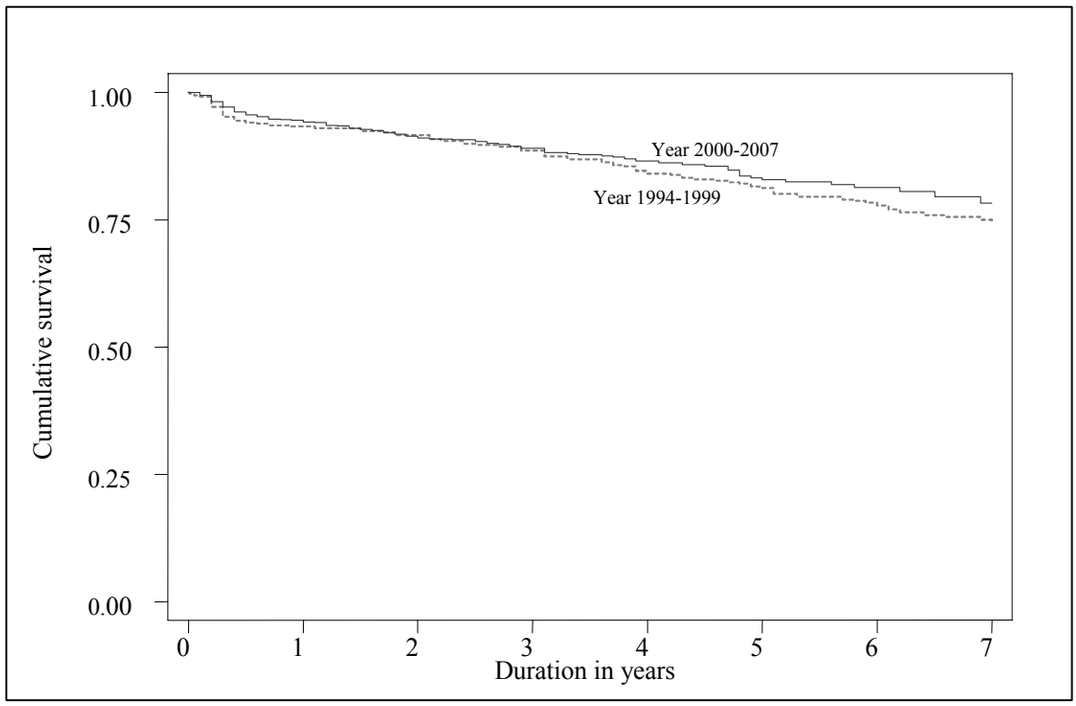


Table 5.5.8: Graft Survival by Year of Transplant (Commercial Cadaver Transplant, 1994-2007)

Year of Transplant	1994-1999			2000-2007		
Interval (years)	No.	% Survival	SE	No.	% Survival	SE
1	335	93	1	663	94	1
3	317	89	2	453	89	1
5	289	81	2	211	83	2
7	262	74	2	59	78	3

No.=Number at risk SE=standard error

Figure 5.5.8: Graft Survival by Year of Transplant (Commercial Cadaver Transplant, 1994-2007)



SECTION 5.6 CARDIOVASCULAR RISK IN RENAL TRANSPLANT RECIPIENTS

5.6.1 Risk Factors for Ischaemic Heart Disease

In 2007, 89.7% of patients were hypertensive, 21.7% were diabetic and 49.8% had renal insufficiency fulfilling CKD III and above. Forty-five percent of patients had 2 cardiovascular risk factors while 8.3% had all 3 major risk factors.

Table 5.6.1: Risk Factors for IHD in Renal Transplant Recipients at Year 2005, 2006 and 2007

	2005	**2006**	**2007**
Diabetes	19 (1.2)	21 (1.4)	25 (1.6)
Hypertension**	511 (33.4)	456 (31.2)	590 (37.5)
CKD	142 (9.3)	177 (12.1)	126 (8.0)
Diabetes + Hypertension**	160 (10.4)	154 (10.5)	174 (11.1)
Diabetes + CKD	20 (1.3)	18 (1.2)	11 (0.7)
CKD + Hypertension**	538 (35.1)	490 (33.5)	517 (32.8)
Diabetes + CKD + Hypertension**	142 (9.3)	147 (10.0)	131 (8.3)

**Hypertension: BP systolic > 140 and BP diastolic > 90
OR have either Beta blocker / Calcium channel blocker / ACE inhibitor / AIIRB / Other anti-hypertensive drugs
GFR (mL/min/1.73m2) = 1.2*(140-age(year))*weight(kg) / creatinine (µmol/L) if male
GFR (mL/min/1.73m2) = 0.85*(1.2*(140-age(year))*weight(kg) / creatinine (µmol/L) if female
CKD stage III-GFR, 30-60
CKD stage IV-GFR, 15-30
CKD stage V-GFR, <15

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

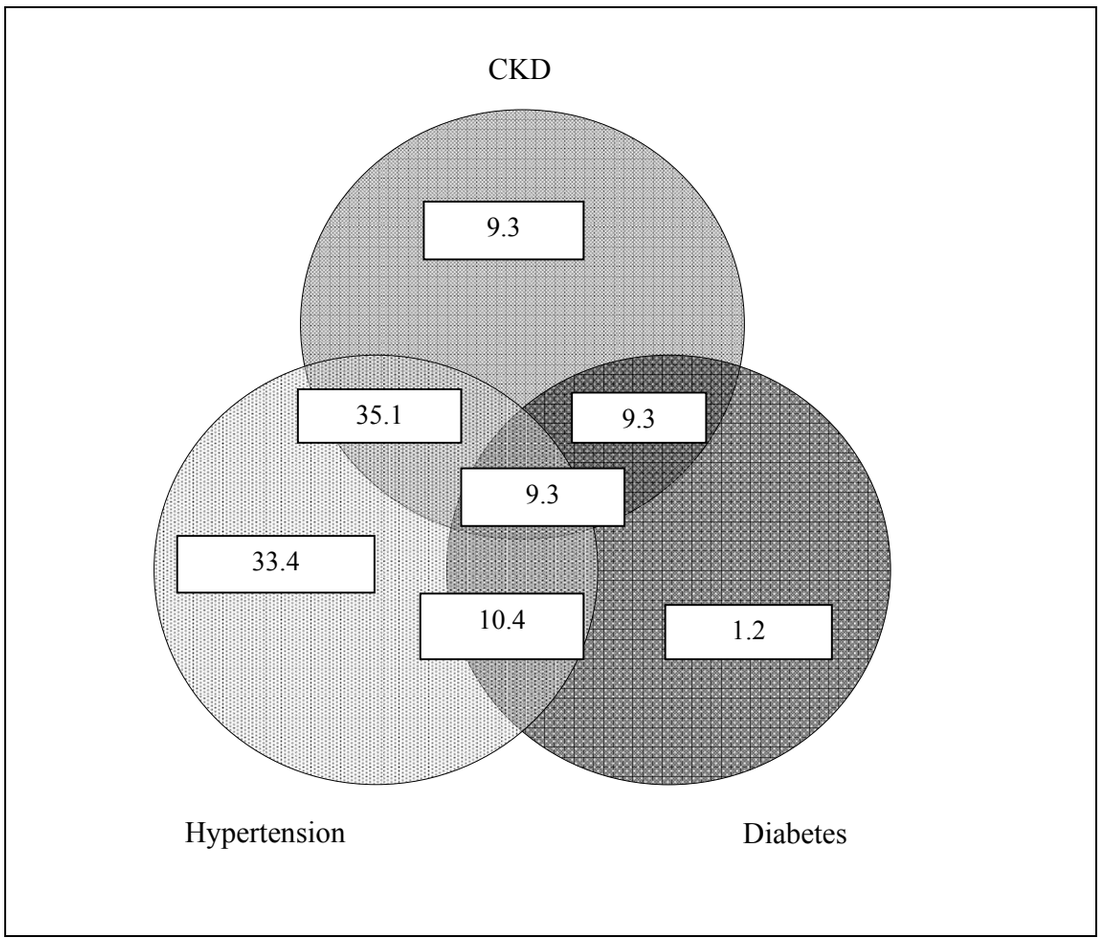


Figure 5.6.1 b: Venn Diagram for Pre and Post Transplant Complications (in %) at Year 2006

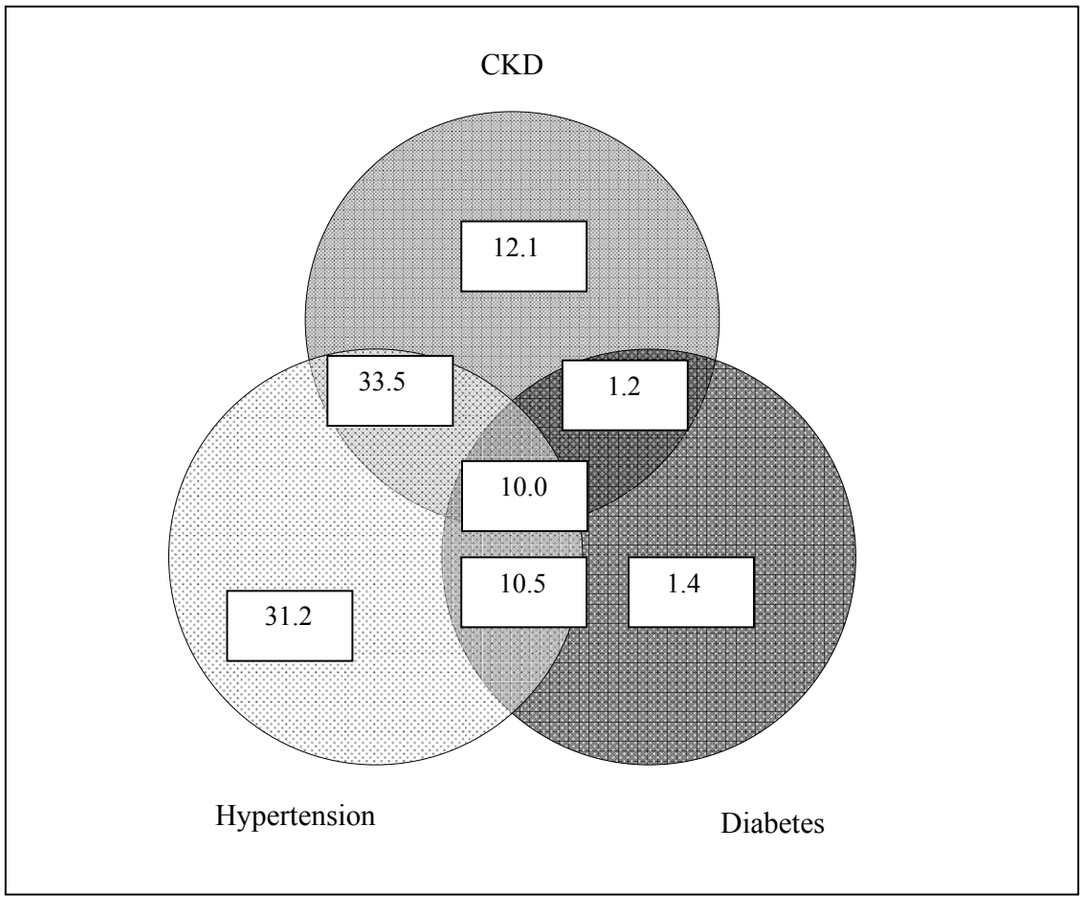
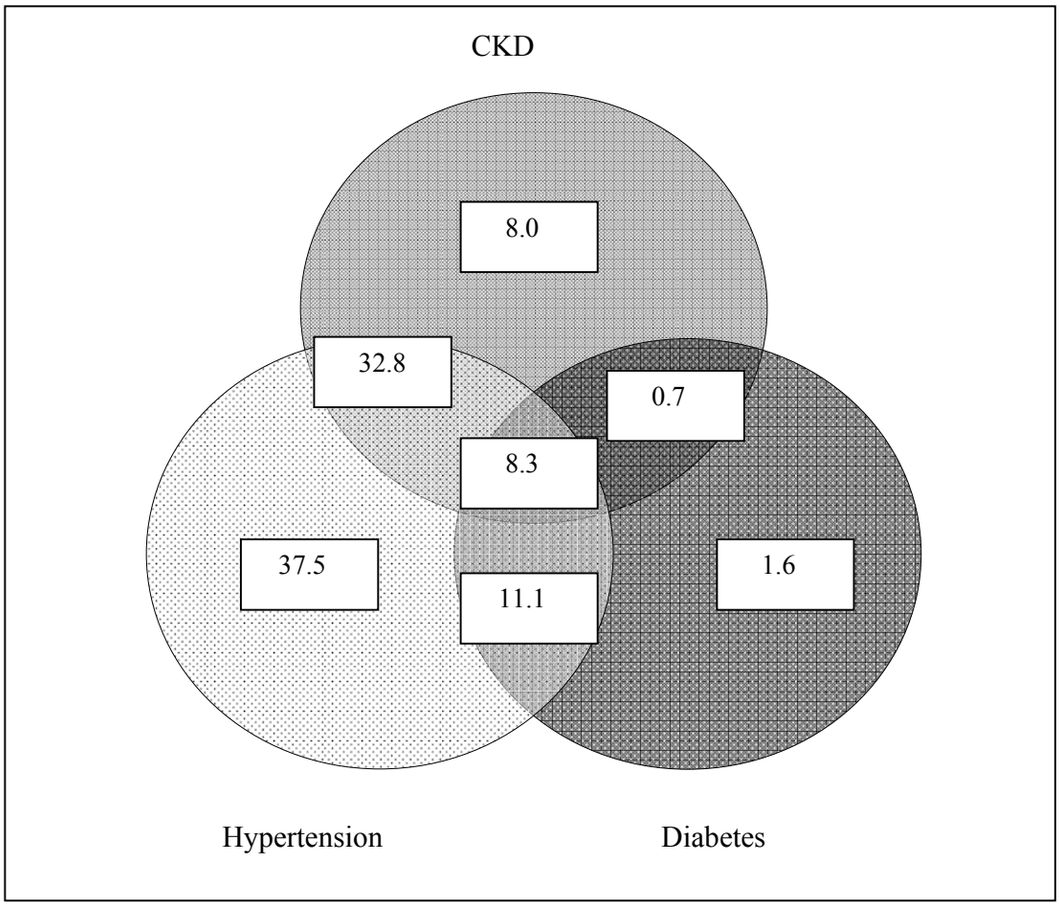


Figure 5.6.1 c: Venn Diagram for Pre and Post Transplant Complications (in %) at Year 2007



5.6.2 Blood Pressure classification according to JNC VI criteria, 2005, 2006, and 2007

In 2007, 24.3% of renal transplant recipients had stage I hypertension whereas 5.9% had stage II hypertension and 1% had stage III hypertension despite being on treatment. In terms of diastolic hypertension 15.5% had stage I hypertension, 2.3% of patients had stage II diastolic hypertension and 0.3% of patients had stage III diastolic hypertension despite being on treatment.

Table 5.6.2 a: Distribution of Patients by Systolic BP Levels, 2005-2007

	2005		**2006**		**2007**	
	No.	**(%)**	**No.**	**(%)**	**No.**	**(%)**
Systolic BP<120	233	(14.25)	249	(15.64)	239	(14.18)
Systolic BP <130	318	(19.45)	395	(24.81)	392	(23.26)
Systolic BP 130-139	475	(29.05)	483	(30.34)	529	(31.39)
Systolic BP 140-159	452	(27.65)	353	(22.17)	409	(24.27)
Systolic BP 160-179	133	(8.13)	93	(5.84)	99	(5.88)
Systolic BP >=180	24	(1.47)	19	(1.19)	17	(1.01)

Figure 5.6.2 a: Distribution of Patients by Systolic BP Levels, 2005-2007

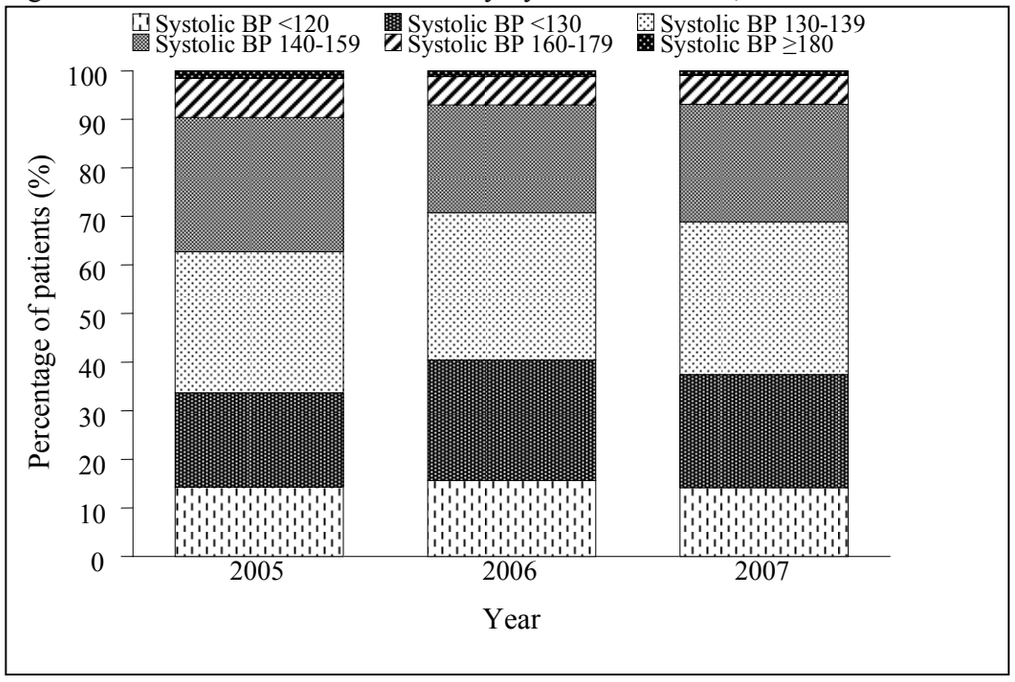


Table 5.6.2 b: Distribution of Patients by Diastolic BP Levels, 2005-2007

Year	2005		2006		2007	
	No.	(%)	No.	(%)	No.	(%)
Diastolic BP<80	522	(31.93)	624	(39.20)	697	(41.36)
Diastolic BP <85	657	(40.18)	586	(36.81)	609	(36.14)
Diastolic BP 85-89	73	(4.46)	73	(4.59)	74	(4.39)
Diastolic BP 90-99	308	(18.84)	244	(15.33)	261	(15.49)
Diastolic BP 100-109	65	(3.98)	61	(3.83)	39	(2.31)
Diastolic BP ≥110	10	(0.61)	4	(0.25)	5	(0.30)

Figure 5.6.2 b: Distribution of Patients by Diastolic BP Levels, 2005-2007

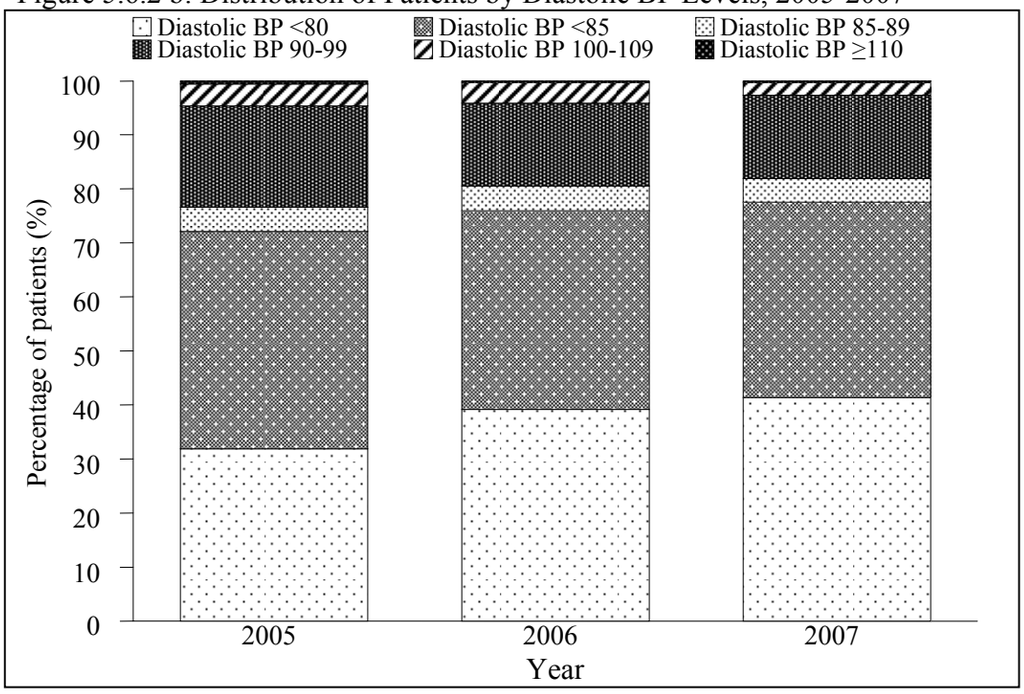
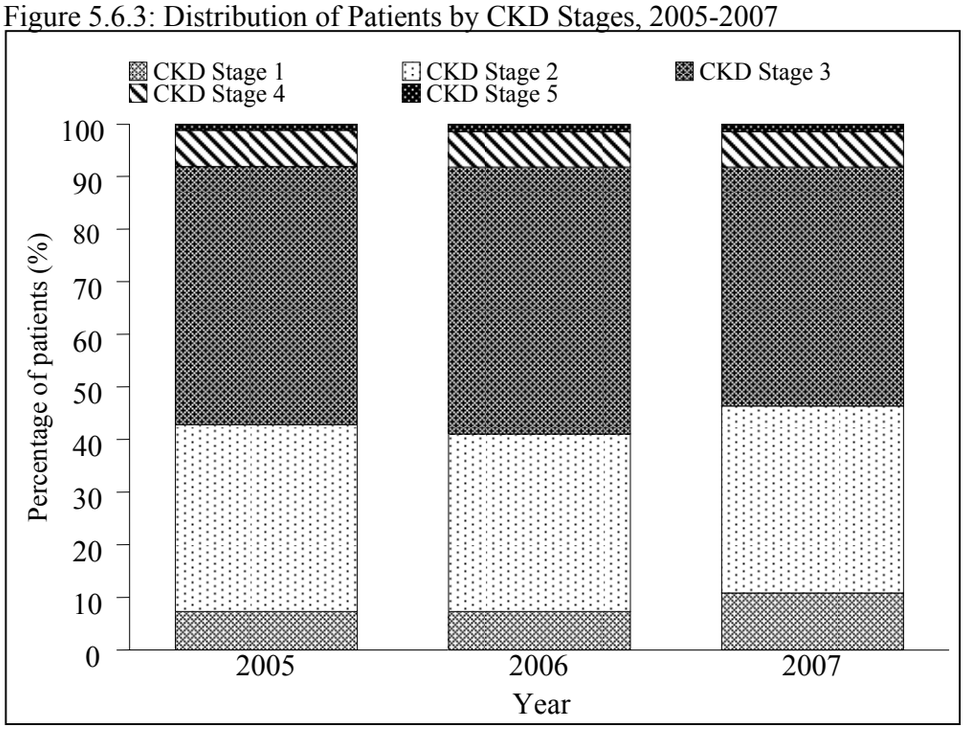


Table 5.6.3 shows the CKD Stage classification by year and in 2007, 45.5% of renal transplant recipients had CKD Stage III whilst another 6.8% had CKD Stage IV. CKD Stage V (impending renal replacement therapy) was found in 1.4% of renal transplant recipients.

Table 5.6.3: Distribution of Patients by CKD Stages, 2005-2007

	2005		**2006**		**2007**	
	No.	**(%)**	**No.**	**(%)**	**No.**	**(%)**
CKD stage 1	118	(7.25)	116	(7.33)	180	(10.80)
CKD stage 2	579	(35.59)	534	(33.73)	593	(35.57)
CKD stage 3	799	(49.11)	804	(50.79)	758	(45.47)
CKD stage 4	112	(6.88)	107	(6.76)	113	(6.78)
CKD stage 5	19	(1.17)	22	(1.39)	23	(1.38)

Figure 5.6.3: Distribution of Patients by CKD Stages, 2005-2007

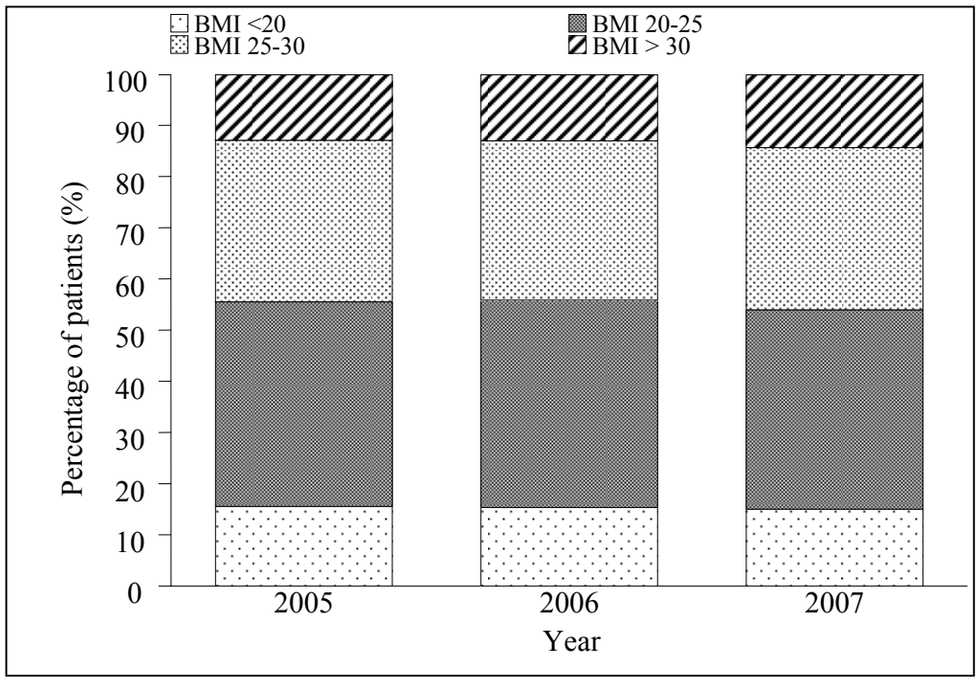


In terms of BMI for 2007, 54% of renal transplant recipients had BMIs of 25 or below. However 31.7% were overweight and 14.3% were obese. There seems to be a slow but steady increase in numbers of obese patients over the last 3 years.

Table 5.6.4: Distribution of Patients by BMI Levels, 2005-2007

	2005		2006		2007	
	No.	**(%)**	**No.**	**(%)**	**No.**	**(%)**
BMI <20	254	(15.54)	243	(15.26)	253	(15.01)
BMI 20-25	655	(40.06)	646	(40.58)	657	(38.99)
BMI 25-30	515	(31.50)	497	(31.22)	534	(31.69)
BMI > 30	211	(12.91)	206	(12.94)	241	(14.30)

Figure 5.6.4: Distribution of Patients by BMI Levels, 2005-2007

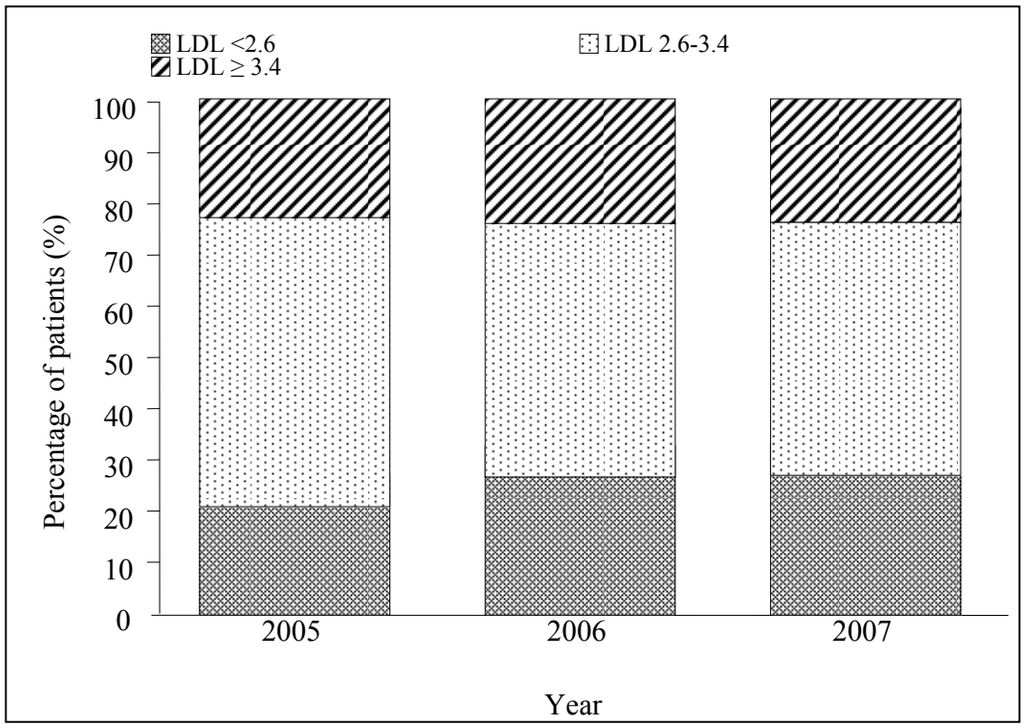


LDL cholesterol has been identified as the primary lipid target for prevention of coronary heart disease by NCEP with a log linear relationship between risk of CHD and level of LDL cholesterol. In terms of renal transplant recipients in 2007 31% have LDL levels below 2.6 mol/l and this shows an increasing trend from 18.1% in 2004, possibly due to the more widespread use of statins. Whether or not this translates into less cardiovascular mortality in the transplant population is still questionable. Patients with serum LDL >3.4 remained fairly static during the study period at 22.6%.

Table 5.6.5 a: Distribution of Patinets by LDL Levels, 2005-2007

	2005		**2006**		**2007**	
	No.	**(%)**	**No.**	**(%)**	**No.**	**(%)**
LDL < 2.6	418	(25.57)	492	(30.90)	527	(31.28)
LDL 2.6-3.4	862	(52.72)	738	(46.36)	777	(46.11)
LDL ≥ 3.4	355	(21.71)	362	(22.74)	381	(22.61)

Figure 5.6.5a: Distribution of Patients by LDL Levels, 2005-2007



In terms of other cholesterol parameters for 2007, 55.6% had total cholesterol levels more than 5.2 and 6.4% had HDL cholesterol levels <1.0.

Table 5.6.5 b: Distribution of Patients by Total Cholesterol Levels, 2005-2007

Year	2005		2006		2007	
	No.	(%)	No.	(%)	No.	(%)
Total Cholesterol <4.1	159	(9.72)	160	(10.05)	210	(12.46)
Total Cholesterol 4.1-5.1	455	(27.83)	490	(30.78)	539	(31.99)
Total Cholesterol 5.1-6.2	774	(47.34)	700	(43.97)	717	(42.55)
Total Cholesterol 6.2- 7.2	173	(10.58)	173	(10.87)	159	(9.44)
Total Cholesterol > 7.2	74	(4.53)	69	(4.33)	60	(3.56)

Figure 5.6.5b: Distribution of Patients by Total Cholesterol Levels, 2005-2007

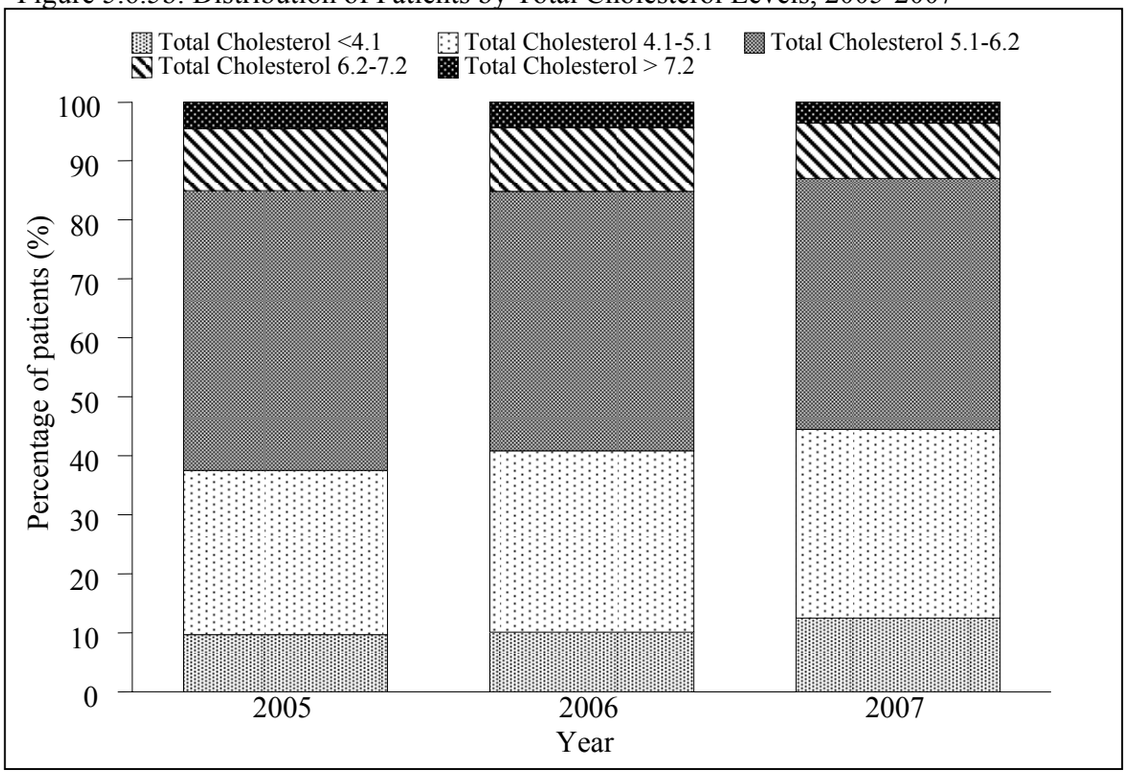
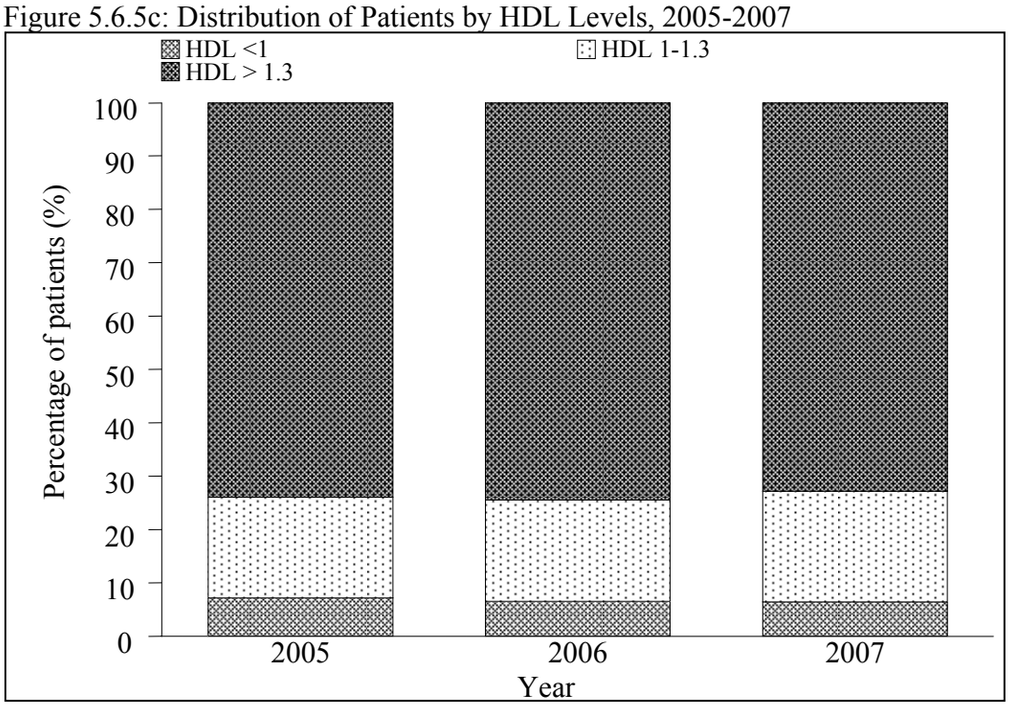


Table 5.6.5 c: Distribution of Patients by HDL Levels, 2005-2007

Year	2005		2006		2007	
	No.	**(%)**	**No.**	**(%)**	**No.**	**(%)**
HDL <1	118	7.22	104	6.53	108	6.41
HDL 1-1.3	308	18.84	302	18.96	350	20.77
HDL >1.3	1209	73.94	1186	74.50	1227	72.82

Figure 5.6.5c: Distribution of Patients by HDL Levels, 2005-2007



Eighty-five percent of patients in 2007 were on antihypertensives and the majority was on more than 1 antihypertensive drug with 31% on 2 antihypertensives and 21% on 3 antihypertensives. Eight percent of patients still had systolic BP of > 160 mmHg and 20% had diastolic BP of > 90 mmHg despite given antihypertensive(s).

Table 5.6.6 a: Treatment for Hypertension, 2005-2007

Year	No.	% on anti-hypertensives	% on 1 anti-hypertensive drug	% on 2 anti-hypertensives	% on 3 anti-hypertensives
2005	1635	85	28	30	19
2006	1592	86	34	26	17
2007	1685	85	25	31	21

Table 5.6.6 b: Distribution of Systolic BP without Anti-hypertensives, 2005-2007

Year	No.	Mean	SD	Median	LQ	UQ	% Patients = 160mmHg
2005	229	126.9	15	130	120	137	3
2006	189	123.8	14.4	120	117	130	4
2007	195	125.3	16.5	120	114	134	4

Table 5.6.6 c: Distribution of Diastolic BP without Anti-hypertensives, 2005-2007

Year	No.	Mean	SD	Median	LQ	UQ	% patients = 90mmHg
2005	229	79	9	80	70	80	18
2006	189	76.4	10.3	80	70	80	11
2007	195	76.6	10	80	70	80	12

Table 5.6.6 d: Distribution of Systolic BP on Anti-hypertensives, 2005-2007

Year	No.	Mean	SD	Median	LQ	UQ	% Patients = 160mmHg
2005	1350	134.5	17.3	130	120	143	11
2006	1334	131.7	16.3	130	120	140	8
2007	1388	132.6	16	130	120	140	8

Table 5.6.6 e: Distribution of Diastolic BP on Anti hypertensives, 2005-2007

Year	No.	Mean	SD	Median	LQ	UQ	% Patients = 90 mmHg
2005	1350	80.8	9.4	80	76	90	25
2006	1334	79.2	9.9	80	70	86	22
2007	1387	79.1	9.6	80	70	85	20

SECTION 5.7 QOL INDEX SCORE IN RENAL TRANSPLANT RECIPIENTS

1151 patients who were transplanted between 1998 and 2007 were analysed for QoL index score. They reported median QoL index score of 10 (Table 5.7.1 and Figure 5.7.1). It was interesting to note that for those who underwent renal transplantation between this period, diabetics and non-diabetics had the same median QoL index score of 10 (Table 5.7.2 and Figure 5.7.2), and this is in contrast to HD and CAPD patients where diabetics reported lower QoL index score than non-diabetics. There was also no difference seen between gender (Table 5.7.3 and Figure 5.7.3) and age (Table 5.7.4 and Figure 5.7.4). It is worthwhile to note that those above 60 years old also enjoyed the same QoL index score (10) as their younger counterparts (Table 5.7.4 and Figure 5.7.4). This trend of high QoL index score among renal transplant patients was maintained over the last 10 years (Table 5.7.5 and Figure 5.7.5).

Table 5.7.1: Cumulative Distribution of QoL-Index Score Transplant Recipient Patients 1998 - 2007

Dialysis modality	**TX**
Number of patients	**1151**
Centile	
0	0
0.05	9
0.1	10
0.25 (LQ)	10
0.5 (median)	10
0.75 (UQ)	10
0.9	10
0.95	10
1	10

Figure 5.7.1: Cumulative Distribution of QoL-Index Score Transplant Recipient Patients 1998 - 2007

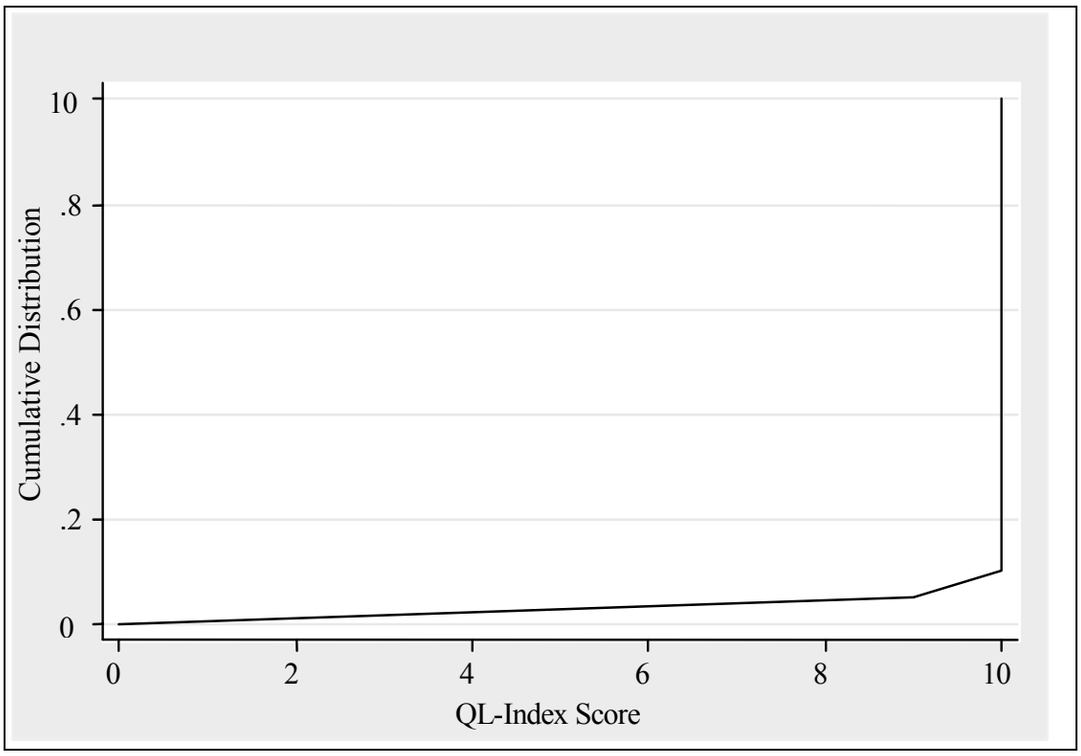


Table 5.7.2: Cumulative Distribution of QoL-Index Score in Relation to Diabetes Mellitus, Transplant Recipient Patients 1998 - 2007

Diabetes mellitus	**No**	**Yes**
Number of patients	**990**	**161**
Centile		
0	0	0
0.05	9	8
0.1	10	9
0.25 (LQ)	10	10
0.5 (median)	10	10
0.75 (UQ)	10	10
0.9	10	10
0.95	10	10
1	10	10

Figure 5.7.2: Cumulative Distribution of QoL-Index Score in Relation to Diabetes Mellitus, Transplant Recipient Patients 1998 – 2007

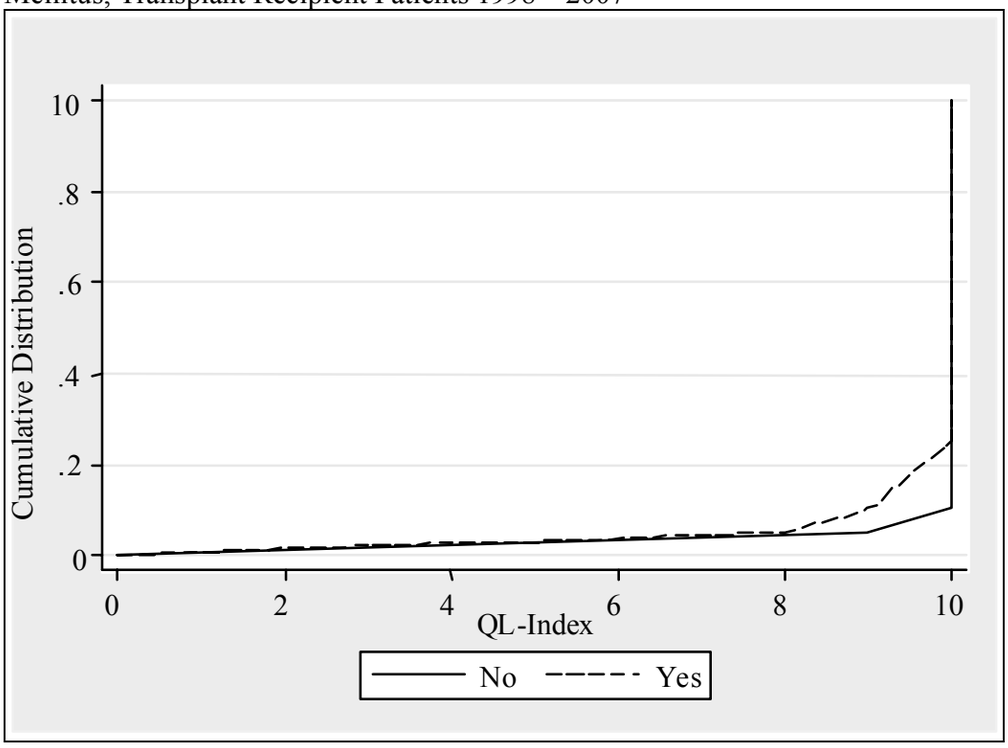


Table 5.7.3: Cumulative Distribution of QoL-Index Score in Relation to Gender, Transplant Recipient Patients 1998-2007

Gender	**Male**	**Female**
Number of patients	**722**	**429**
Centile		
0	0	0
0.05	9	9
0.1	10	9
0.25 (LQ)	10	10
0.5 (median)	10	10
0.75 (UQ)	10	10
0.9	10	10
0.95	10	10
1	10	10

Figure 5.7.3: Cumulative Distribution of QoL-Index Score in Relation to Gender, Transplant Recipient Patients 1998 – 2007

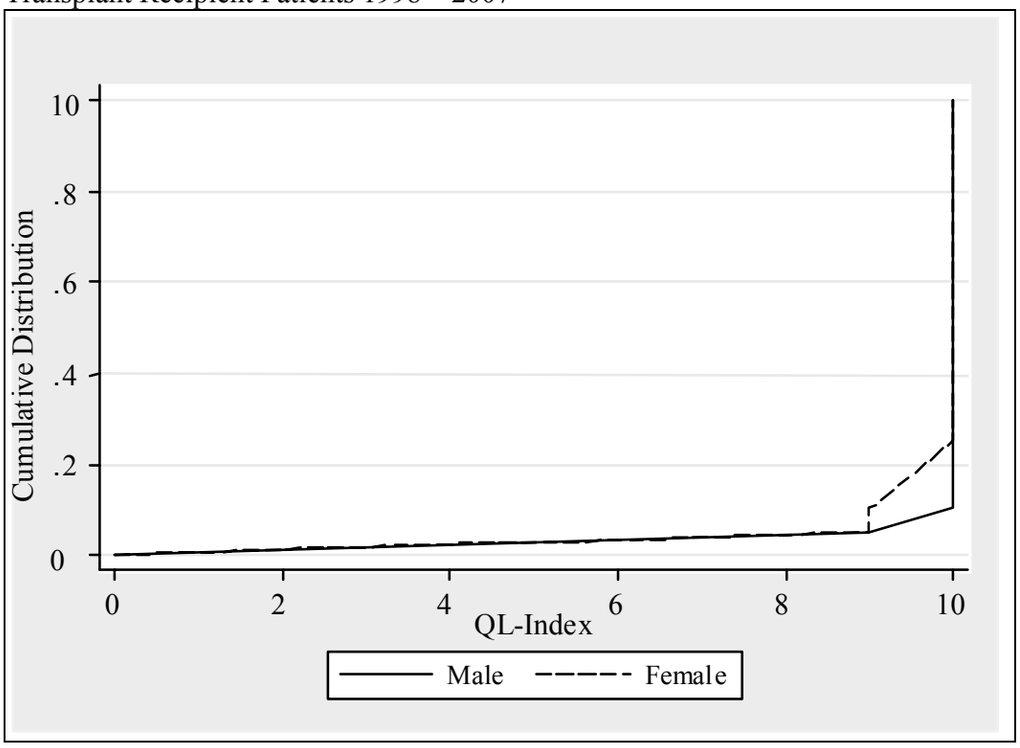


Table 5.7.4: Cumulative Distribution of QoL-Index Score in Relation to Age, Transplant Recipient Patients 1998 – 2007

Age group (years)	**<20**	**20-39**	**40-59**	**≥60**
Number of patients	**99**	**464**	**516**	**72**
Centile				
0	0	0	0	0
0.05	9	9	9	7
0.1	10	10	9	8
0.25 (LQ)	10	10	10	9
0.5 (median)	10	10	10	10
0.75 (UQ)	10	10	10	10
0.9	10	10	10	10
0.95	10	10	10	10
1	10	10	10	10

Figure 5.7.4: Cumulative Distribution of QoL-Index Score in Relation to Age, Transplant Recipient Patients 1998 – 2007

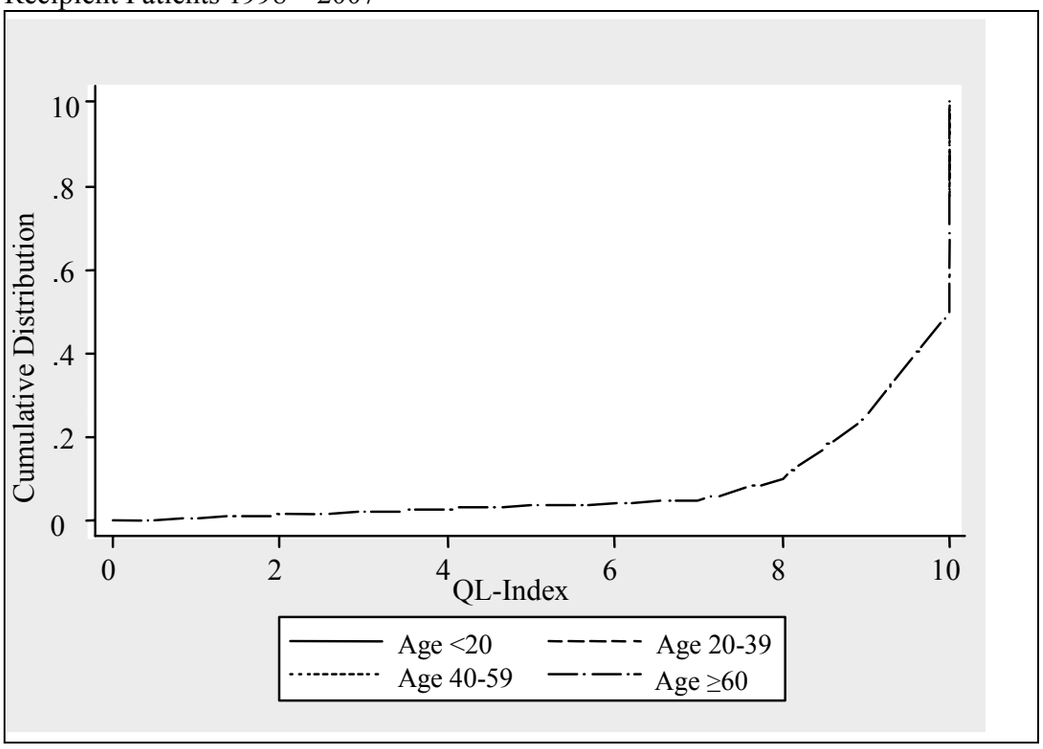
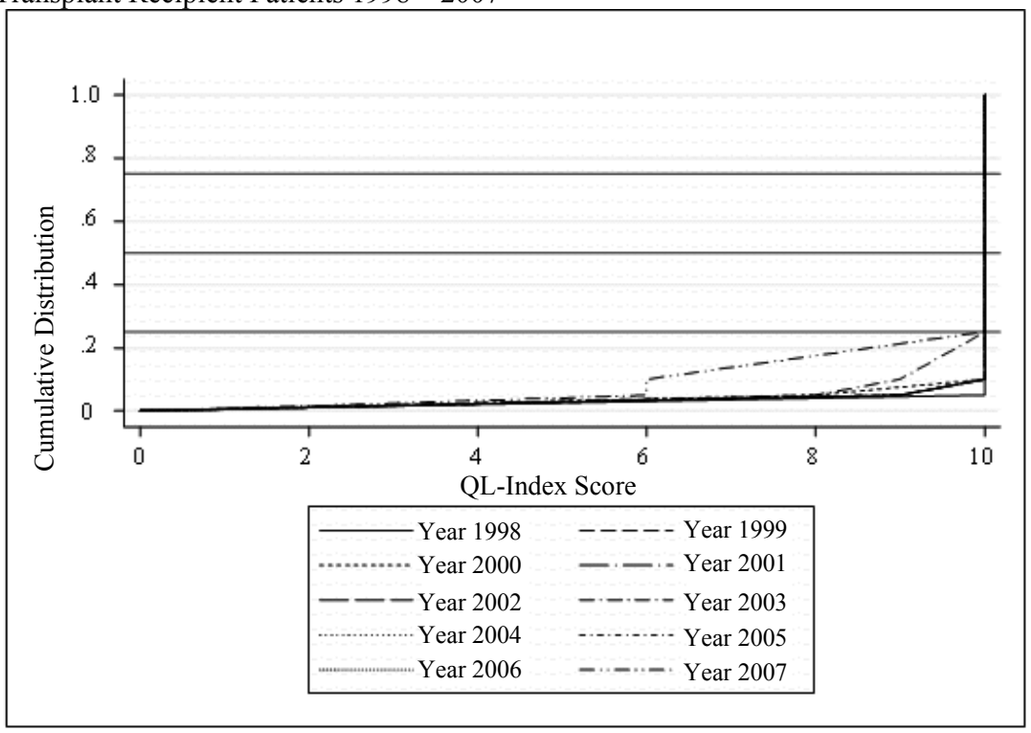


Table 5.7.5: Cumulative Distribution of QoL-Index Score in Relation to Year of Entry, Transplant Recipient Patients 1998 – 2007

Year of Entry	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Number of patients	**72**	**101**	**110**	**125**	**143**	**136**	**167**	**137**	**123**	**37**
Centile										
0	0	0	0	0	0	0	0	0	0	0
0.05	10	9	8	9	9	8	9	9	9	6
0.1	10	10	10	10	10	9	10	10	10	6
0.25 (LQ)	10	10	10	10	10	10	10	10	10	10
0.5 (median)	10	10	10	10	10	10	10	10	10	10
0.75 (UQ)	10	10	10	10	10	10	10	10	10	10
0.9	10	10	10	10	10	10	10	10	10	10
0.95	10	10	10	10	10	10	10	10	10	10
1	10	10	10	10	10	10	10	10	10	10

Figure 5.7.5: Cumulative Distribution of QoL-Index score in Relation to Year of Entry, Transplant Recipient Patients 1998 – 2007



CHAPTER 6

HOMOGRAFT - HEART VALVE TRANSPLANTATION

Editor:
Mr Mohamed Ezani Hj Md Taib

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6.0 INTRODUCTION

The Homograft unit in Institut Jantung Negara (IJN) was established in 1995. This was in response to the rising need for homografts and also the rising cost of importing homografts from overseas. The team comprises of surgeons and medical technicians who are involved in retrieving, processing and cryopreserving the homografts for storage. They maintain a detailed record of each homograft obtained and utilised.

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.

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.

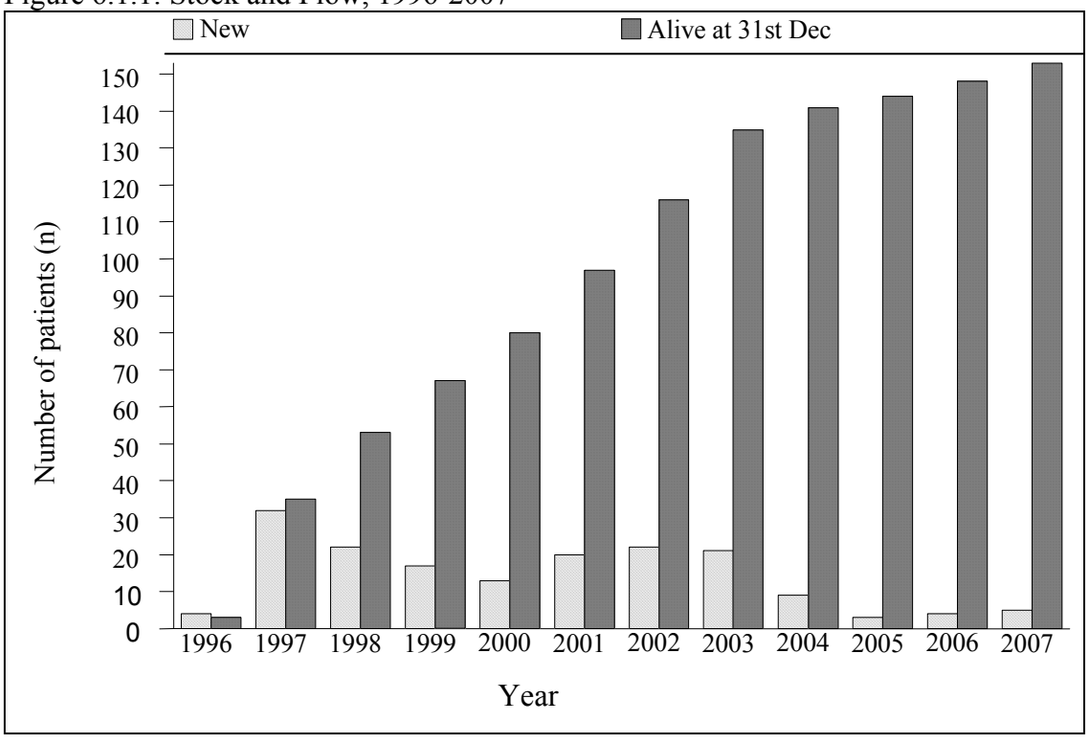
6.1 STOCK AND FLOW

Table 6.1.1: Stock and Flow, 1996-2007

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
New transplant	4	32	22	17	13	20	22	21	9	3	4	5
Deaths*	1	0	4	3	0	3	3	2	3	0	0	0
Lost to follow up	0	0	0	0	0	0	0	0	0	0	0	0
Alive with functioning graft at 31st December	3	35	53	67	80	97	116	135	141	144	148	153

*based on year of death

Figure 6.1.1: Stock and Flow, 1996-2007



6.2 RECIPIENTS' CHARACTERISTICS

Table 6.2.1: Distribution of Patients by Gender, 1996-2007

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	TOTAL
Gender	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
Male	2	19	9	9	10	6	9	14	3	0	4	2	87
Female	2	13	13	8	3	14	13	7	6	3	0	3	85
TOTAL	**4**	**32**	**22**	**17**	**13**	**20**	**22**	**21**	**9**	**3**	**4**	**5**	**172**

Figure 6.2.1: Distribution of Patients by Gender, 1996-2007

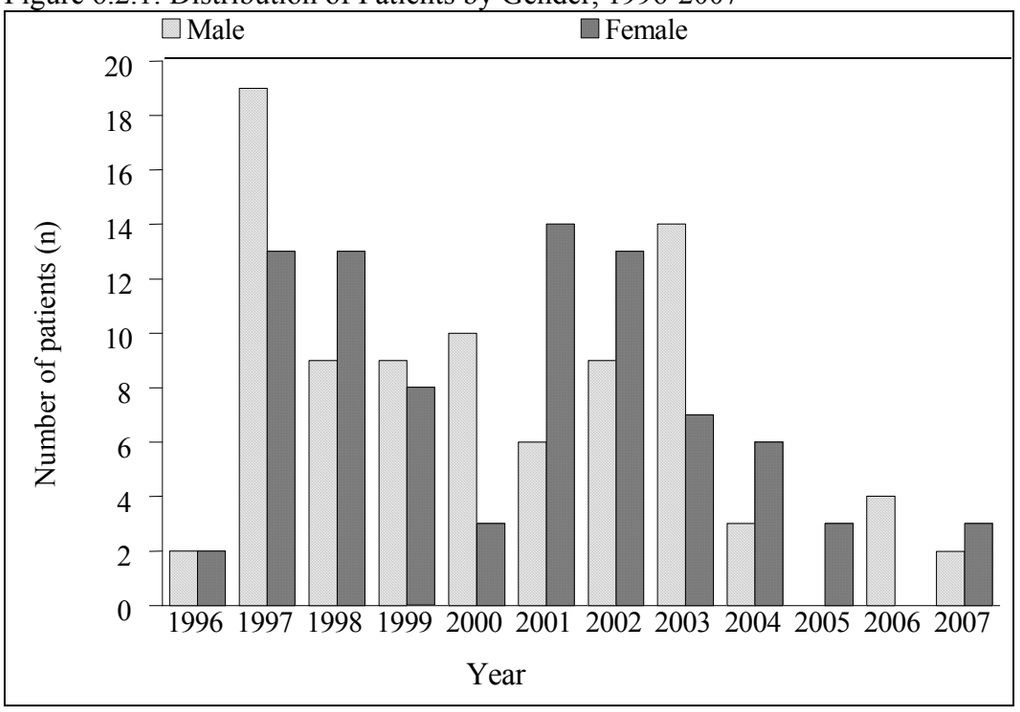


Table 6.2.2: Distribution of Patients by Ethnic Group, 1996-2007

Year	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**TOTAL**
Ethnic group	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
Malay	1	19	15	9	9	10	16	12	6	3	2	3	105
Chinese	3	11	4	3	2	9	4	6	1	0	1	0	44
Indian	0	2	2	2	0	1	2	2	1	0	1	0	13
Others	0	0	1	3	2	0	0	1	1	0	0	2	10
TOTAL	**4**	**32**	**22**	**17**	**13**	**20**	**22**	**21**	**9**	**3**	**4**	**5**	**172**

Figure 6.2.2: Distribution of Patients by Ethnic Group, 1996-2007

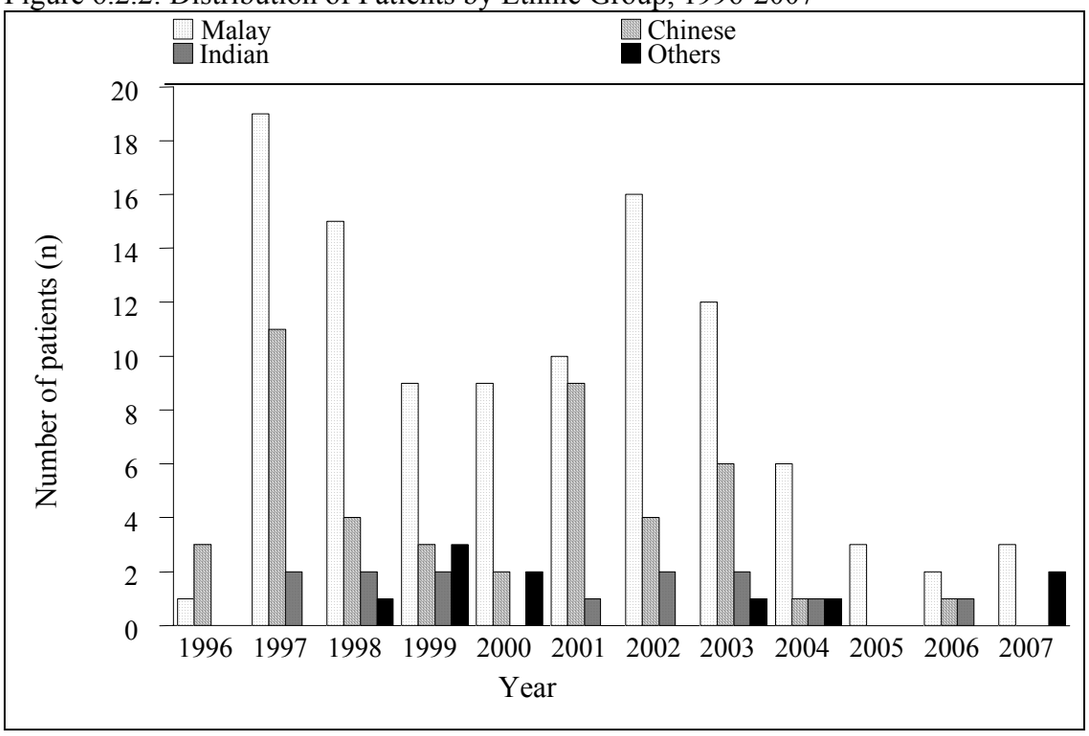
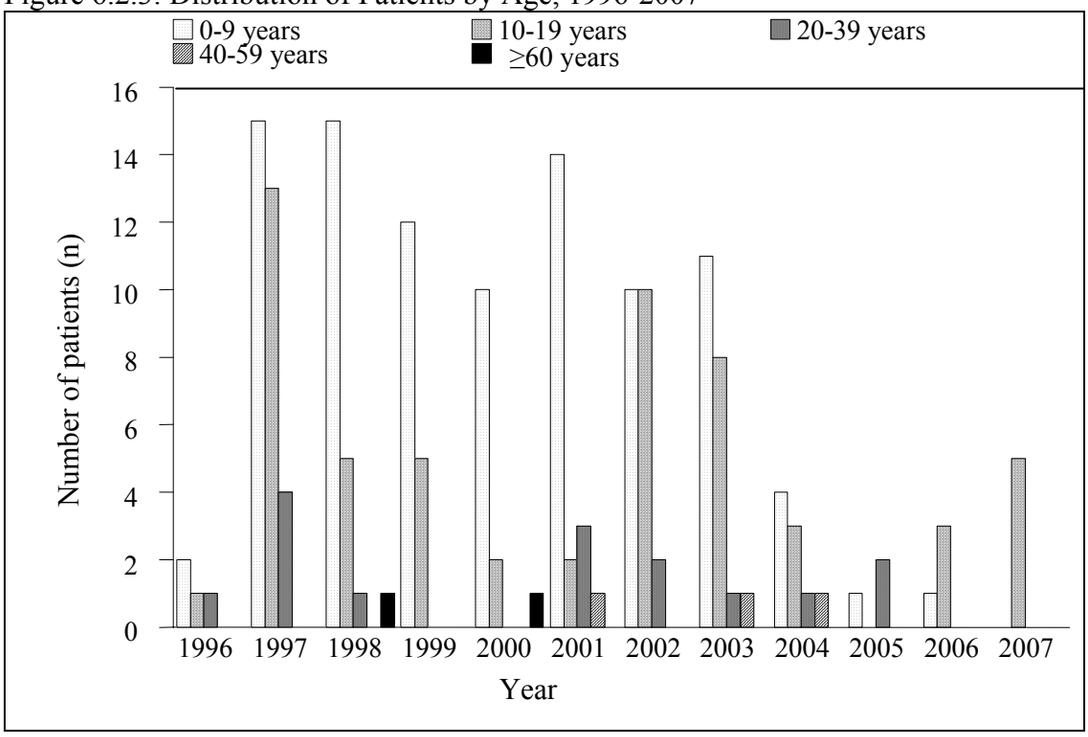


Table 6.2.3: Distribution of Patients by Age, 1996-2007

Year	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**TOTAL**
Age group	**No.**	**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	0	95
10-19	1	13	5	5	2	2	10	8	3	0	3	5	57
20-39	1	4	1	0	0	3	2	1	1	2	0	0	15
40-59	0	0	0	0	0	1	0	1	1	0	0	0	3
≥60	0	0	1	0	1	0	0	0	0	0	0	0	2
TOTAL	**4**	**32**	**22**	**17**	**13**	**20**	**22**	**21**	**9**	**3**	**4**	**5**	**172**
Mean	12	11	11	7	12	11	10	12	15	15	10	11	11
SD	7	7	15	4	17	14	6	11	11	8	3	0	10
Median	11	10	8	7	8	5	10	9	10	20	11	11	10
Min	5	3 months	3 months	1	2	5 months	3	2	5	6	6	11	3 months
Max	21	30	70	17	67	53	28	53	42	20	11	11	70

* Age=date of implantation – date birth

Figure 6.2.3: Distribution of Patients by Age, 1996-2007



6.3 TRANSPLANT PRACTICES

6.3.1 Donor Details

Table 6.3.1: Number of Valves Harvested by Type of Homograft, 1996-2007

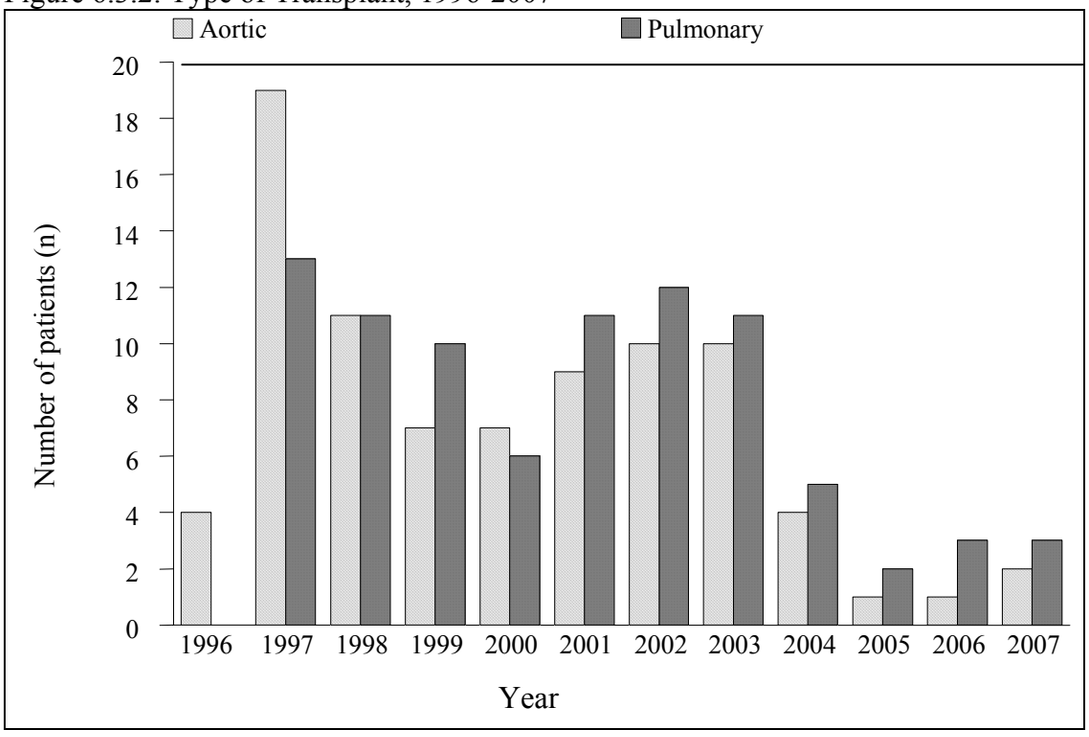
Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	TOTAL
Type of homograft	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
Aortic	8	17	10	8	11	14	10	8	7	4	15	9	121
Pulmonary	1	14	11	10	12	12	14	9	8	5	15	8	119
TOTAL	**9**	**31**	**21**	**18**	**23**	**26**	**24**	**17**	**15**	**9**	**30**	**17**	**240**

6.3.2 Transplant Details

Table 6.3.2: Type of Transplant, 1996-2007

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	TOTAL
Type of transplant	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
Aortic	4	19	11	7	7	9	10	10	4	1	1	2	85
Pulmonary	0	13	11	10	6	11	12	11	5	2	3	3	87
TOTAL	**4**	**32**	**22**	**17**	**13**	**20**	**22**	**21**	**9**	**3**	**4**	**5**	**172**

Figure 6.3.2: Type of Transplant, 1996-2007



6.4 TRANSPLANT OUTCOMES

Table 6.4.1: Patient Survival by Gender, 1996-2007

Gender	Male		Female	
Interval (years)	**% 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, 1996-2007

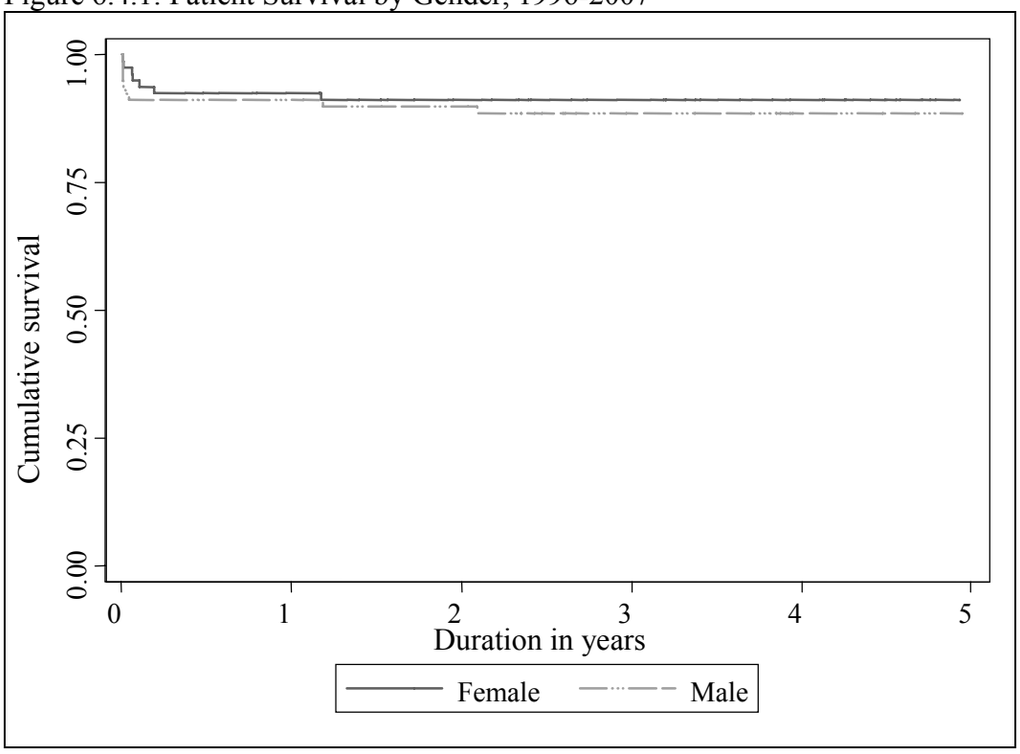


Table 6.4.2: Patient Survival by Age Group, 1996-2007

Age group	**0-9 years**		**10-19 years**		**≥20 years**	
Interval (months)	**% 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, 1996-2007

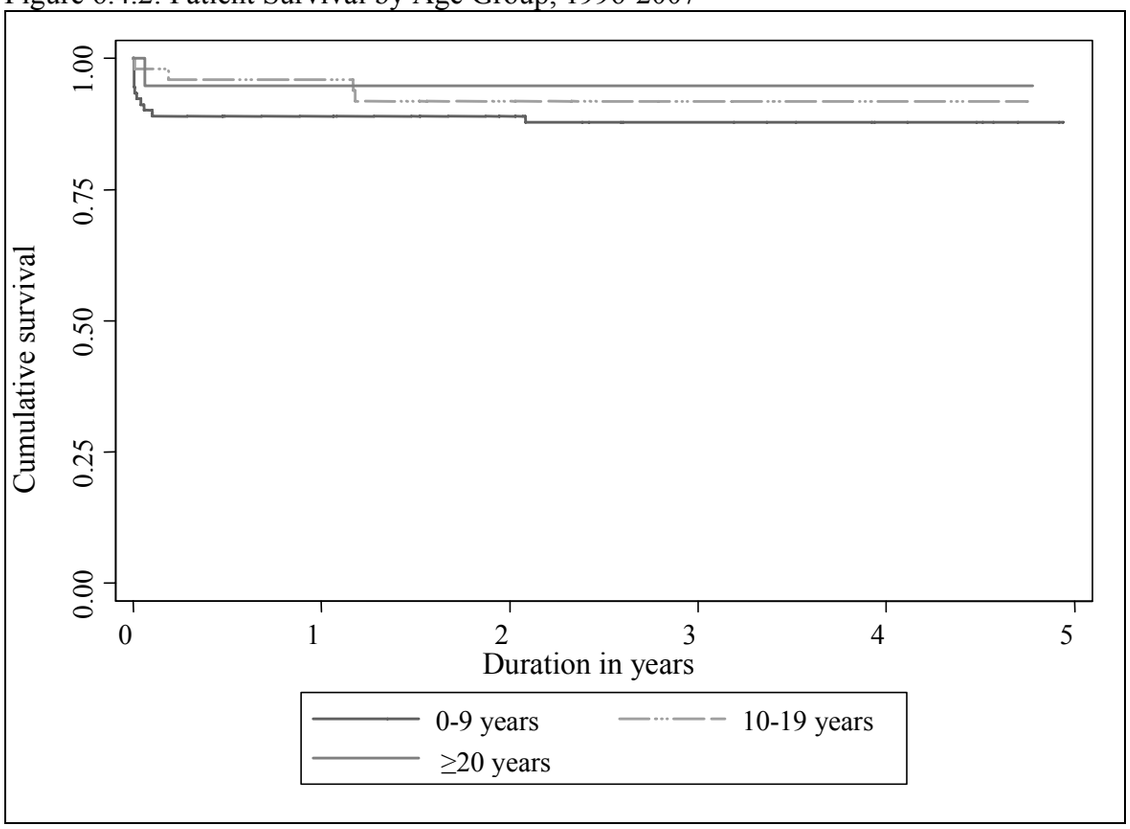
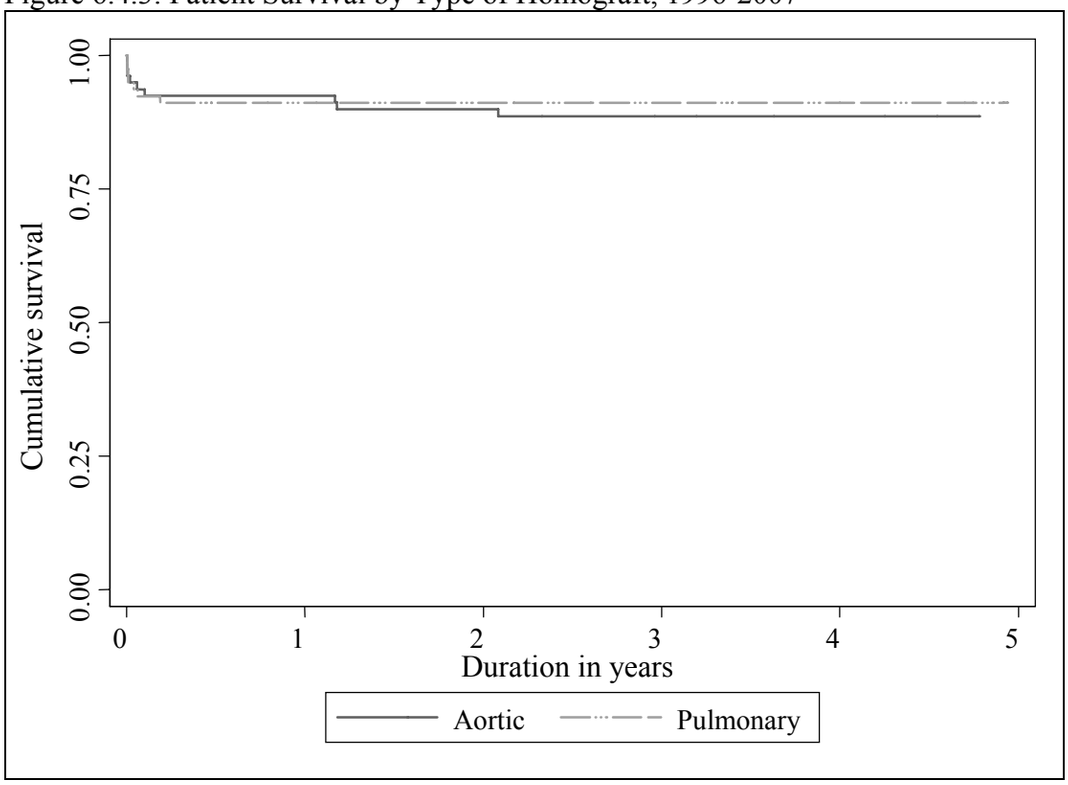


Table 6.4.3: Patient Survival by Type of Homograft, 1996-2007

Type of homograft	**Aortic**		**Pulmonary**	
Interval (years)	**% 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, 1996-2007



CHAPTER 7

BONE AND TISSUE TRANSPLANTATION

Editor:
Dr Suzina Sheikh Ab Hamid

Expert Panel:
Prof Dr Zulmi Wan (Chairman)
Dr Suzina Sheikh Ab Hamid
Dr Badrul Shah Badaruddin
Dato' Dr Hasim Mohamad
Dr Norimah Yusof
Dr Robert Penafort

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7.0 INTRODUCTION

This chapter presents data provided by centres that distributed tissue allografts, data about recipient centres and data provided on the Bone and Tissue Transplant Notification Form by surgeons. Only Universiti Sains Malaysia (USM) Tissue Bank provided information on tissue allografts that had been supplied and data on bone and other tissue allograft transplantation is still lacking. Thus, the report does not reflect the actual magnitude of transplant activity in the country.

The limited data that were notified to NTR has restricted further analysis and definitive conclusions could not be made. Data relating to recipients pre and post transplantation depends on factors such as location of hospitals and surgeons' expertise/experience and preference in tissue transplantation.

However a continuous effort has to be made to ensure that all cases of bone and tissue allograft transplantation are reported as the data would be useful in assisting the Ministry of Health, non-governmental organisations, private providers and industry in planning and evaluation of the tissue transplant programme and service.

7.1 STOCK OF BONE, AMNIOTIC MEMBRANE AND OTHER TISSUE ALLOGRAFTS AND HOSPITALS WHERE TISSUES ARE UTILISED IN 2007

In 2007 data was only provided by USM Tissue Bank, as a centre that supplied tissues. The main tissue allografts that were distributed were amniotic membranes and deep-frozen femoral heads (Table 7.1.1). Majority on the bone/tendon allografts were provided to private hospitals and other sectors and to the Ministry of Health hospitals (Table 7.1.2). The amniotic membranes were mainly used by surgeons in Ministry of Health hospitals (Table 7.1.3).

Table 7.1.1: Types of Tissue Allografts Supplied by USM Tissue Bank in 2007

Types of Tissue Allograft	**No. (pieces)**
DF Femur	2
DF Femoral head	65
DF Humerus	2
DF Tibia	4
DF Radius	0
DF Ulna	0
FD Cancellous	2
FD Cortical	0
FD Cortico-cancellous	0
Other FD Bones	8
Patella	2
Achilles	2
Other tendon / fascia / cartilage	3
Amniotic membranes	175
TOTAL	**265**

DF – Deep-frozen
FD – Freeze-dried

Table 7.1.2: Hospitals/Other Sectors Using Bone/Tendon Allografts in 2007

	USM Tissue Bank
	No. (pieces)
Ministry of Health Hospitals	
Hospital Sultanah Aminah, Johor Bahru	1
Hospital Melaka	3
Hospital Pulau Pinang	10
Hospital Raja Permaisuri Bainun, Ipoh	3
Hospital Sultanah Bahiyah, Alor Setar	2
Hospital Umum Sarawak, Kuching	6
Queen Elizabeth Hospital, Kota Kinabalu	2
TOTAL	**27**
University Hospitals	
HUKM	5
HUSM	3
TOTAL	**8**
Private and other sectors	
Amin Dental Surgery, Johor Bahru	5
Chong Dental Surgery, Seri Kembangan Selangor	1
Hospital Fatimah, Ipoh	2
Hospital Sultan Ismail, Johor Bahru	2
Hospital Tawakal, Kuala Lumpur	3
Johnson & Johnson Medical	2
Kemajuan Abadi Sdn. Bhd.	2
Klinik Pergigian Chong, Tangkak, Johor	1
Normah Medical Center, Kuching	1
Stryker	12
Zimmer	21
TOTAL	**52**

Table 7.1.3: Hospitals/Other Sectors Using Amniotic Membranes in 2007

	USM Tissue Bank
	No. (pieces)
Ministry of Health Hospitals	
Hospital Kuala Lumpur	40
Hospital Sultan Ismail, Johor Bahru	50
Hospital Miri, Sarawak	5
Hospital Sultanah Bahiyah, Alor Setar	7
Hospital Pulau Pinang	3
Hospital Sultanah Nurzahirah, Kuala Terengganu	5
Hospital Sungai Buloh, Selangor	21
Hospital Teluk Intan, Perak	4
Hospital Raja Perempuan Zainab II, Kota Bharu	2
Hospital Umum Sarawak, Kuching	6
Hospital Queen Elizabeth, Kota Kinabalu	1
TOTAL	**144**
University Hospitals	
HUKM	7
HUSM	7
IIUM	6
TOTAL	**20**
Private and other sectors	
Puteri Specialist Hospital, Johor Bahru	5
ISEC Sdn. Bhd.	2
Kuala Terengganu Specialist Center, Kuala Terengganu	3
Putra Medical Centre, Alor Setar	1
TOTAL	**11**

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. Even though the number of reporting centres in 2007 has not decreased compared to previous years, some of the surgeons had submitted incomplete forms.

Table 7.2.1: Distribution of Reporting Centre by Year

Centre	2004	2005	2006	2007	TOTAL
	No.	No.	No.	No.	
Orthopaedics Department					
Department of Orthopaedics, HUSM	1	7	2	1	11
Department of Orthopaedic Surgery, UMMC	1	0	0	0	1
Institute of Orthopaedics & Traumatology, HKL	2	0	0	0	2
Department of Orthopaedics, Hospital Ipoh	0	1	0	0	1
Department of Orthopaedics, Hospital Kota Bharu	9	3	0	0	12
Department of Orthopaedics, Hospital Umum Sarawak	1	0	1	0	2
Department of Orthopaedics, Hospital Sultanah Aminah, Johor Bahru	0	1	0	0	1
Wan Orthopaedic, Trauma & Sports Injury Centre (WOTSIC), Seremban Specialist Hospital	0	0	2	0	2
Department of Orthopaedics, Hospital Island, Penang	0	1	0	0	1
Department of Orthopaedics, Hospital Fatimah, Ipoh	0	3	0	1	4
Department of Orthopaedics, Hospital Kuantan	0	0	0	1	1
Department of Orthopaedics, Kota Bharu Medical Centre	0	0	2	0	2
Department of Orthopaedics, Hospital Pulau Pinang	0	0	0	1	1
Normah Medical Specialist Centre, Kuching	0	1	0	0	1
Spine Unit, HUSM	0	0	1	0	1
Ophthalmology Department					
Department of Ophthalmology, Hospital Tengku Ampuan Rahimah, Klang	1	1	0	0	2
Department of Ophthalmology, Hospital Tengku Ampuan Afzan, Kuantan	1	1	0	0	2
Department of Ophthalmology, Hospital Teluk Intan	0	0	1	0	1
Department of Ophthalmology, HKL	0	0	23	20	43
Department of Ophthalmology, Hospital Alor Setar	0	0	1	0	1
Department of Ophthalmology, Hospital Sungai Buloh	0	0	0	9	9
Department of Ophthalmology, Sri Kota Medical Centre	0	1	0	0	1
Department of Ophthalmology, HUSM	0	0	1	2	3
Others Department					
Maxillofacial Surgery, HUSM	1	1	0	0	2
Timberland Medical Centre	0	1	0	0	1
Sri Kota Medical Centre, Klang	0	0	1	0	1
Pantai Medical Centre, Kuala Lumpur	0	0	0	1	1
TOTAL	**17**	**22**	**35**	**36**	**110**

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		2007		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%
Male	9	53	10	45	27	77	21	58	67	61
Female	8	47	12	55	8	23	15	42	43	39
TOTAL	**17**	**100**	**22**	**100**	**35**	**100**	**36**	**100**	**110**	**100**

Table 7.3.2: Distribution of Patients by Ethnic Group

Ethnic Group	2004		2005		2006		2007		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%
Malay	11	65	14	64	26	74	18	50	69	63
Chinese	3	18	5	23	7	20	12	33	27	25
Indian	1	6	1	5	1	3	4	11	7	6
Bumiputra Sabah	0	0	0	0	0	0	0	0	0	0
Bumiputra Sarawak	1	6	0	0	0	0	1	3	2	2
Others	1	6	2	9	1	3	1	3	5	4
TOTAL	**17**	**100**	**22**	**100**	**35**	**100**	**36**	**100**	**110**	**100**

Table 7.3.3: Distribution of Patients by Age Group

Age Group	2004		2005		2006		2007		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%
0-9	0	0	1	5	4	11	5	14	10	9
10-19	1	6	6	27	2	6	1	3	10	9
20-39	9	53	6	27	16	46	8	22	39	35
40-59	5	29	3	14	8	23	11	30	27	25
≥60	1	6	5	23	4	11	11	31	21	19
Missing	1	6	1	5	1	3	0	0	3	3
TOTAL	**17**	**100**	**22**	**100**	**35**	**100**	**36**	**100**	**110**	**100**
Mean	35		34		36		42		37	
SD	13		22		19		23		20	
Median	33		26		35		49		36	
Min	15		7		0		0		0	
Max	60		75		75		80		80	

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

Diagnosis	2004		2005		2006		2007		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%
Congenital deformity	1	5	0	0	1	3	1	3	3	3
Infection	0	0	0	0	3	8	3	8	6	5
Trauma	5	28	1	5	6	16	1	3	13	12
Degenerative disease	1	5	2	10	0	0	1	3	4	4
Tumour-benign	5	28	4	20	1	3	1	3	11	10
Tumour-malignant	0	0	6	30	1	3	0	0	7	6
Burn	0	0	1	5	2	5	0	0	3	3
Scald	0	0	0	0	1	3	0	0	1	1
Sports injury	0	0	1	5	0	0	1	3	2	2
Failed primary surgery	1	5	2	10	1	3	2	5	6	5
Ophthalmological	0	0	0	0	16	42	7	19	23	20
Others	5	28	3	15	6	16	20	54	34	30
TOTAL	**18**	**100**	**20**	**100**	**38**	**100**	**37**	**100**	**113**	**100**

Note: 5 patients with 2 diagnosis and 2 missing diagnosis.

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		2007		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%
USM Tissue Bank	13	76	18	82	31	89	34	94	96	87
Bone Bank, UMMC	1	6	0	0	0	0	0	0	1	1
Bone Bank, HKL	3	18	0	0	0	0	0	0	3	3
Eucara Pharmaceutical	0	0	0	0	2	6	0	0	2	2
Osteo Tech Inc	0	0	1	5	0	0	0	0	1	1
Missing	0	0	3	14	2	6	2	6	7	6
TOTAL	**17**	**100**	**22**	**100**	**35**	**100**	**36**	**100**	**110**	**100**

Table 7.4.2: Distribution of Patients by Origin of Tissue Graft

Origin of Tissue Graft	2004		2005		2006		2007		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%
Local	17	100	15	68	31	89	34	94	97	88
Imported	0	0	3	14	2	6	0	0	5	5
Missing	0	0	4	18	2	6	2	6	8	7
TOTAL	**17**	**100**	**22**	**100**	**35**	**100**	**36**	**100**	**110**	**100**

Table 7.4.3: Distribution of Tissue Graft Used by Type

Tissue Graft Type		2004		2005		2006		2007		TOTAL	
		No.	%	No.	%	No.	%	No.	%	No.	%
Deep-frozen tissues	Femur	3	25	3	10	0	0	0	0	6	5
	Femoral Head	2	17	12	41	2	6	7	18	23	20
	Humerus	0	0	1	4	3	10	0	0	4	4
	Tibia	1	7	1	4	1	3	0	0	3	3
	Radius	2	17	5	17	0	0	0	0	7	6
Freeze-dried/ Air-dried	Amniotic membranes	2	17	3	10	25	78	31	82	61	55
Not Available		2	17	2	7	0	0	0	0	4	4
Missing		0	0	2	7	1	3	0	0	3	3
TOTAL		**12**	**100**	**29**	**100**	**32**	**100**	**38**	**100**	**111**	**100**

Table 7.4.4: Distribution of Type of Sterilisation of the Graft

Type Graft Sterilisation	2004		2005		2006		2007		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%
Gamma Irradiation	16	94	15	68	30	86	27	75	88	80
Glycerol	0	0	0	0	2	6	0	0	2	2
Sterile Freeze Dried Bone	0	0	1	5	0	0	0	0	1	1
Missing	1	6	6	27	3	8	9	25	19	17
TOTAL	**17**	**100**	**22**	**100**	**35**	**100**	**36**	**100**	**110**	**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		2007		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%
By Flight	1	6	1	5	2	6	2	5	6	5
By Courier	2	12	3	14	24	69	23	64	52	47
By Hand	4	24	8	36	1	3	0	0	13	12
Dry Ice Box	5	29	4	18	0	0	0	0	9	8
Sterile package	0	0	0	0	2	6	0	0	2	2
Missing	5	29	6	27	6	17	11	31	28	26
TOTAL	**17**	**100**	**22**	**100**	**35**	**100**	**36**	**100**	**110**	**100**

Table 7.4.6: Distribution of Temperature of Storage during Transportation

Temperature of storage during transportation (^{o}C)	2004		2005		2006		2007		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%
-80	2	12	0	0	0	0	0	0	2	2
-40	0	0	1	5	0	0	0	0	1	1
-20	4	23	4	18	0	0	1	3	9	8
-10	0	0	6	27	2	6	1	3	9	8
0	2	12	0	0	0	0	0	0	2	2
37	0	0	0	0	2	6	0	0	2	2
Room Temperature	3	18	4	18	25	71	22	61	54	49
Missing	6	35	7	32	6	17	12	33	31	28
TOTAL	**17**	**100**	**22**	**100**	**35**	**100**	**36**	**100**	**110**	**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		2007		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%
Refrigerator	0	0	1	5	25	71	28	78	54	49
Deep freezer-20 ^{o}C	0	0	3	14	2	6	3	8	8	7
Deep freezer-40 ^{o}C	1	6	2	9	0	0	0	0	3	3
Deep freezer-80 ^{o}C	3	18	4	18	1	3	1	3	9	8
Glycerol	0	0	1	5	3	9	4	11	8	7
Room temperature	0	0	1	5	1	3	0	0	2	2
Others	12	71	5	23	2	6	0	0	19	17
Not available	1	6	0	0	0	0	0	0	1	1
Missing	0	0	5	23	1	3	0	0	6	6
TOTAL	**17**	**100**	**22**	**100**	**35**	**100**	**36**	**100**	**110**	**100**

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

Additional tissue usage (composite graft)	2004		2005		2006		2007		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%
No	6	35	12	55	32	91	33	92	83	75
Yes	9	53	7	32	1	3	2	5	19	17
Not available	2	12	1	5	0	0	0	0	3	3
Missing	0	0	2	9	2	6	1	3	5	5
TOTAL	**17**	**100**	**22**	**100**	**35**	**100**	**36**	**100**	**110**	**100**

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

Type of additional tissue used (composite graft)	2004		2005		2006		2007		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%
Autografts	7	78	3	43	0	0	0	0	10	53
Allografts	1	11	2	29	1	100	2	100	6	32
Others	1	11	1	14	0	0	0	0	2	10
Missing	0	0	1	14	0	0	0	0	1	5
TOTAL	**9**	**100**	**7**	**100**	**1**	**100**	**2**	**100**	**19**	**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		2007		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%
No	15	88	21	95	31	89	27	75	94	85
Yes	0	0	0	0	4	11	9	25	13	12
Not Available	2	12	0	0	0	0	0	0	2	2
Missing	0	0	1	5	0	0	0	0	1	1
TOTAL	**17**	**100**	**22**	**100**	**35**	**100**	**36**	**100**	**110**	**100**

Table 7.5.5: Distribution of Pre Implant Graft Culture Swab

Pre implant graft culture swab	2004		2005		2006		2007		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%
No	15	88	16	73	17	49	22	61	70	63
Yes	0	0	1	5	0	0	1	3	2	2
Not Available	2	12	0	0	6	17	5	14	13	12
Missing	0	0	5	23	12	34	8	22	25	23
TOTAL	**17**	**100**	**22**	**100**	**35**	**100**	**36**	**100**	**110**	**100**

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

Type of infection of pre implant graft	2004		2005		2006		2007		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%
Cytomegalovirus	0	0	1	100	0	0	0	0	1	50
Proteus	0	0	0	0	0	0	1	100	1	50
TOTAL	**0**	**0**	**1**	**100**	**0**	**0**	**1**	**100**	**2**	**100**

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

Grafts soaked in antibiotics prior to transplantation	2004		2005		2006		2007		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%
No	8	47	5	23	28	80	28	78	69	62
Yes	7	41	16	73	6	17	6	17	35	32
Not Available	2	12	0	0	1	3	0	0	3	3
Missing	0	0	1	5	0	0	2	5	3	3
TOTAL	**17**	**100**	**22**	**100**	**35**	**100**	**36**	**100**	**110**	**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		2007		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%
Ceftriazone	4	57	9	56	3	50	0	0	16	46
Gentamycin	3	43	4	25	3	50	4	66	14	40
Ceftriazone and Gentamycin	0	0	0	0	0	0	1	17	1	3
Vancomycin, Postome iodine	0	0	1	6	0	0	0	0	1	3
Povidone iodine, Ceftriazone	0	0	1	6	0	0	0	0	1	3
Missing	0	0	1	6	0	0	1	17	2	5
TOTAL	**7**	**100**	**16**	**100**	**6**	**100**	**6**	**100**	**35**	**100**

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

Systemic antibiotics prior to transplantation	2004		2005		2006		2007		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%
No	4	24	3	14	26	74	26	72	59	54
Yes	12	71	17	77	9	26	10	28	48	43
Not Available	1	6	0	0	0	0	0	0	1	1
Missing	0	0	2	9	0	0	0	0	2	2
TOTAL	**17**	**100**	**22**	**100**	**35**	**100**	**36**	**100**	**110**	**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		2007		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%
Cefeperazone	2	17	2	12	0	0	0	0	4	9
Ceftriazone	0	0	0	0	1	11	0	0	1	2
Cefuroxine	7	58	7	40	4	45	2	25	20	44
Ciproflaxacin	0	0	2	12	0	0	2	25	4	9
Chloramphenicol	0	0	0	0	1	11	0	0	1	2
Metronidazole	1	8	1	6	0	0	0	0	2	4
Ceftazidine	0	0	0	0	1	11	0	0	1	2
Ceftriazone/Imipenam	2	17	2	12	2	22	2	25	8	18
Ampicillin/Sulbactam	0	0	0	0	0	0	1	12	1	2
T. Augmentin	0	0	0	0	0	0	1	12	1	2
T. Flurariazole	0	0	2	12	0	0	0	0	2	4
Missing	0	0	1	6	0	0	0	0	1	2
TOTAL	**12**	**100**	**17**	**100**	**9**	**100**	**8**	**100**	**46**	**100**

CHAPTER 8

CADAVERIC ORGAN AND TISSUE DONATION

Editor:
Datin Dr Lela Yasmin Mansor

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CADAVERIC ORGAN AND TISSUE DONATION

There was a decline in the number of potential cadaveric donors referred to the National Transplant Procurement Unit (NTPMU) nationwide from 112 the previous year to 73 in 2007. However, the number of actual donors remained the same at 25 for the year, which translated to a conversion rate of 34% and a donation rate of 0.99 per million population (Table 8.1). Of these 15 (60%) were brain dead donors who donated organs and tissues which were procured in the operating theatre, while another 10 were tissue donations after cardiac death, two being eye donations in the ward and the others multi-tissue procurement in the mortuary (table 8.2). In total 83 organs and tissues were procured, comprising 32 corneas, 28 kidneys, 3 hearts, 2 lungs, 5 livers, 8 pairs of heart valves and 5 sets of long bones.

The pattern of distribution of the donations throughout the year showed an interesting trend (Figure 8.2). The month of March recorded the highest number of potential donors identified and referred to the NTPMU (14/75) as well as the highest number of actual donations (6/25), but majority (4/6) were tissue donations after cardiac death. These six donors together with another multi-tissue donor in early April and a brain dead organ donor in June were the only cases of successful donations in the first half of 2007.

The second half of the year saw an increasing number of brain dead multi-organ organ donations particularly from the month of September onwards. This was in response to the almost daily media blitz in the mainstream and vernacular newspapers and television focusing on the 13 year old Chinese girl who had been put on the Left Ventricular Assist Device (LVAD) while awaiting her heart transplant. As a result there were several referrals and donations occurring quite close together during that period, sometimes two to three cases in a day, and many of which were family initiated. The girl received her heart transplant on 4th October, and her donor was a 15 year old Malay boy, a Quranic scholar whose parents were religious teachers who also donated his lungs, liver, kidneys and corneas after receiving clearance from the state Mufti (religious leader). When that transplant failed as a result of hyperacute rejection, she received a second heart within 24 hours from another 21 year old deceased Chinese motor vehicle accident victim.

Because of the prominent write up about the heart transplant case and the Muslim boy's donation in the Malay media and particularly after the public declaration of support by three state Muftis and the director general of JAKIM (Department of Islamic Development), there were subsequently four other Malay donors who donated multiple organs and tissues after brain death within a short space of time. With the age of these donors mainly in the teens, two of the donations were initiated by the parents. These 5 donors constitute the highest number of Malay (five-fold rise from the previous year) or Muslim donors (two and a half times increase) in a year and for the first time there were more Malay than Indian donors (20% vs 12%) (Table 8.5) although the Chinese still remained the most common ethnic group (56%) and Buddhist the most common religious group (52%) (Table 8.6).

There were more paediatric donors compared to previous years with three donors under the age of five years and another 6 donors in their mid-teens, which together constitute 36% of the total number of donors (Table 8.3). Another 24% (6/25) were in

their twenties which mean that 60% of the donors were under the age of thirty. The mean age was 29.6 years with the youngest being a 14 month old who donated kidneys and the eldest 68 years old Canadian lady who donated corneas. As previously, males exceed females four to one (Table 8.4).

Majority of the donors came from Selangor (24%) followed by Johor (20%) and Kuala Lumpur (12%) (Table 8.8). Most of the donations (84%) took place in Ministry of Health hospitals with a three-fold increase in donations from district hospitals with only 2 cases each occurring in private or university hospitals (Table 8.13a). Sixty-eight percent of the donors were found in the ICU, but there were also five direct referrals for tissue donation from the mortuary with one each from the ward and emergency department ("brought in dead" BID) (Table 8.13b). Six out of the 25 actual donors (24%) had pledged to donate before and carried the donor card (Table 8.9).

Road accident related injuries still remain the most common cause of death, accounting for 60% of the brain death and 40 % of the cardiac death. Another 40% of post-cardiac death tissue donors died from heart related diseases while there was one case of homicide who became a brain dead multi-organ and tissue donor (Table 8.11).

In 2007, the most common blood group among the 15 organ donors was group A rhesus positive (40%), followed by 0 positive (33%) and B positive (7%), and only 1 (7%) from group A negative and no AB group (Table 8.12). But when considered in totality since 1997, blood group O positive remained the most common group (41%) followed by B positive and A positive.

Table 8.1: Number of Procurement by Year, 1997-2007

Number of procurement by year N=187											
Year	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Number of donors	5	7	4	13	24	30	25	16	13	25	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	0.99
Organs procured											
Cornea	4	10	6	18	34	48	40	20	22	38	32
Heart	1	3	2	3	4	0	2	0	1	1	3
Liver	0	0	2	1	1	2	1	3	3	6	5
Kidney	8	10	6	22	38	25	16	18	8	26	28
Heart valve	0	1	2	8	11	11	10	20	6	15	8
Bone	0	1	0	3	2	6	5	5	2	5	5
Skin	0	0	0	2	2	3	0	1	0	3	0
Lung	0	0	0	0	0	0	0	0	1	1	2

Figure 8.1: Number of Procurement by Year, 1997-2007

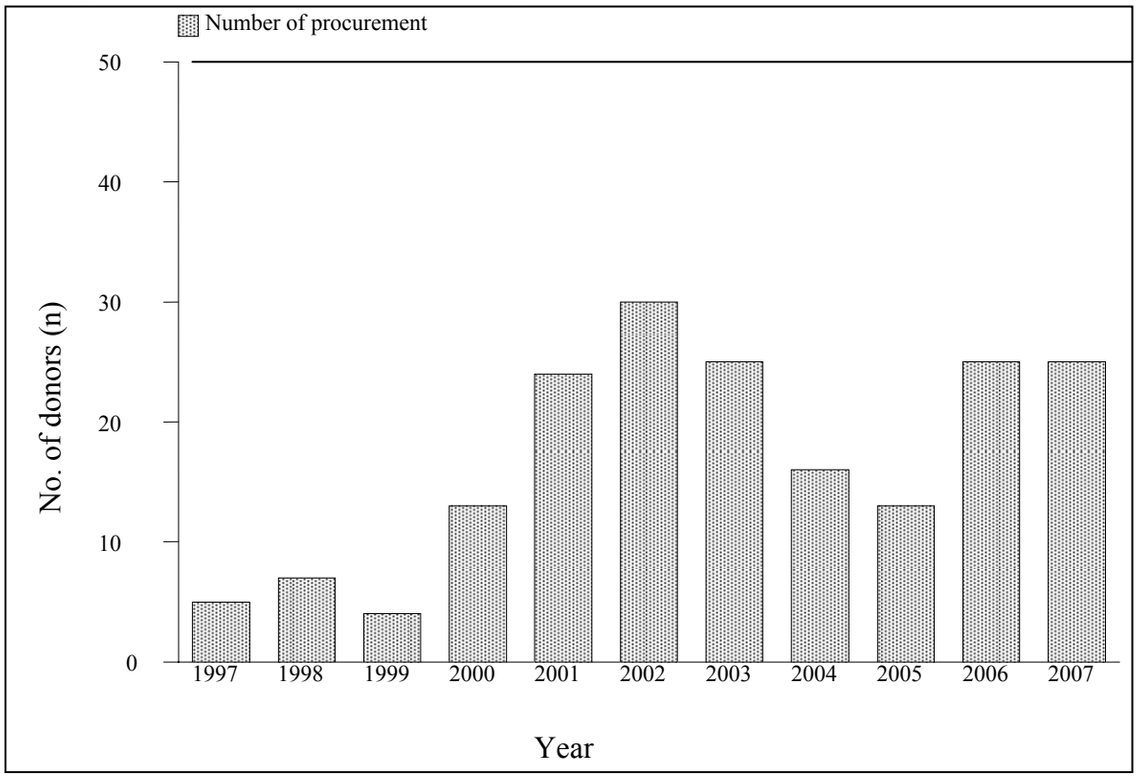


Table 8.2: Potential Donor Referrals and Actual Donations by month, 2007

Month	No. of donors					
	Potential Donors			Actual Donors		
	Brain Death (BD)	Cardiac Death (CD)	Total	Brain Death Organ Donors (BD)	Cardiac Death Tissue Donors (CD)	Total
Jan	1	3	4	0	0	0
Feb	2	3	5	0	0	0
Mar	7	7	14	2	4	6
Apr	0	6	6	0	1	1
May	0	1	1	0	0	0
Jun	3	2	5	1	0	1
Jul	4	2	6	2	1	3
Aug	3	5	8	1	0	1
Sep	3	5	8	2	2	4
Oct	4	3	7	4	1	5
Nov	4	2	6	3	0	3
Dec	0	3	3	0	1	1
TOTAL	**31**	**42**	**73**	**15**	**10**	**25**

Figure 8.2: Potential Donor Referrals and Actual Donations by month, 2007

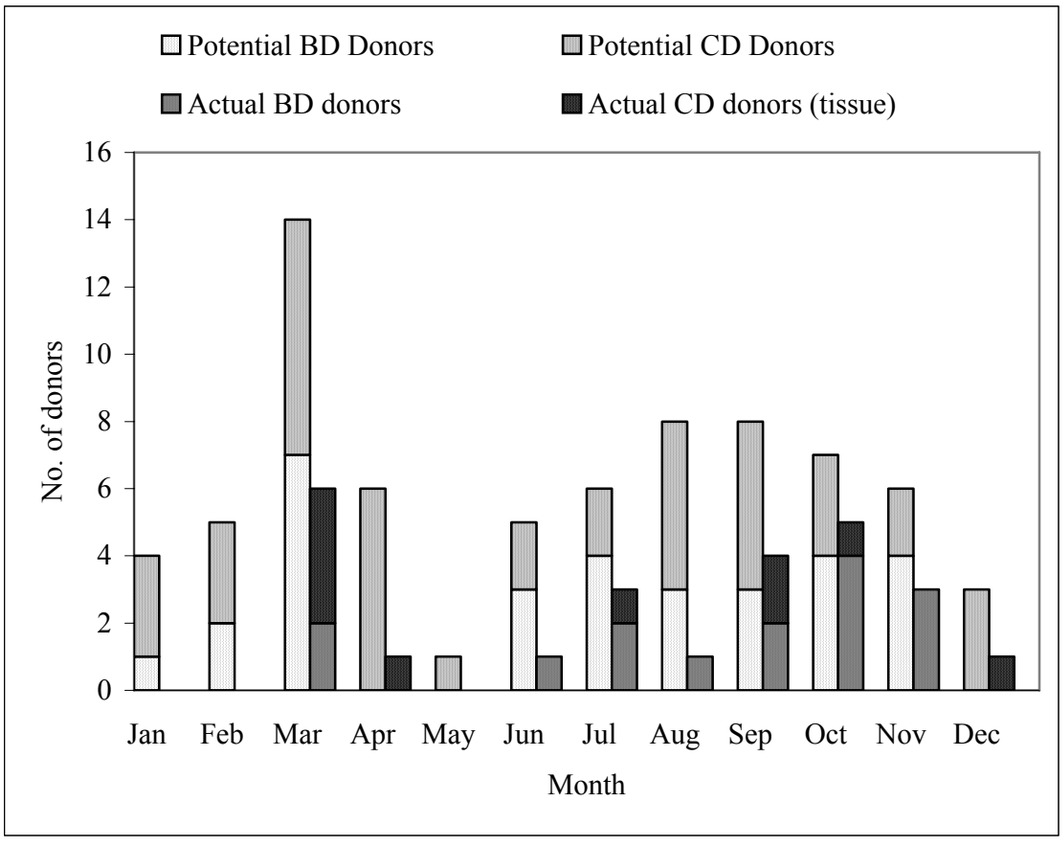


Table 8.3: Distribution of Donors by Age, 1997-2007

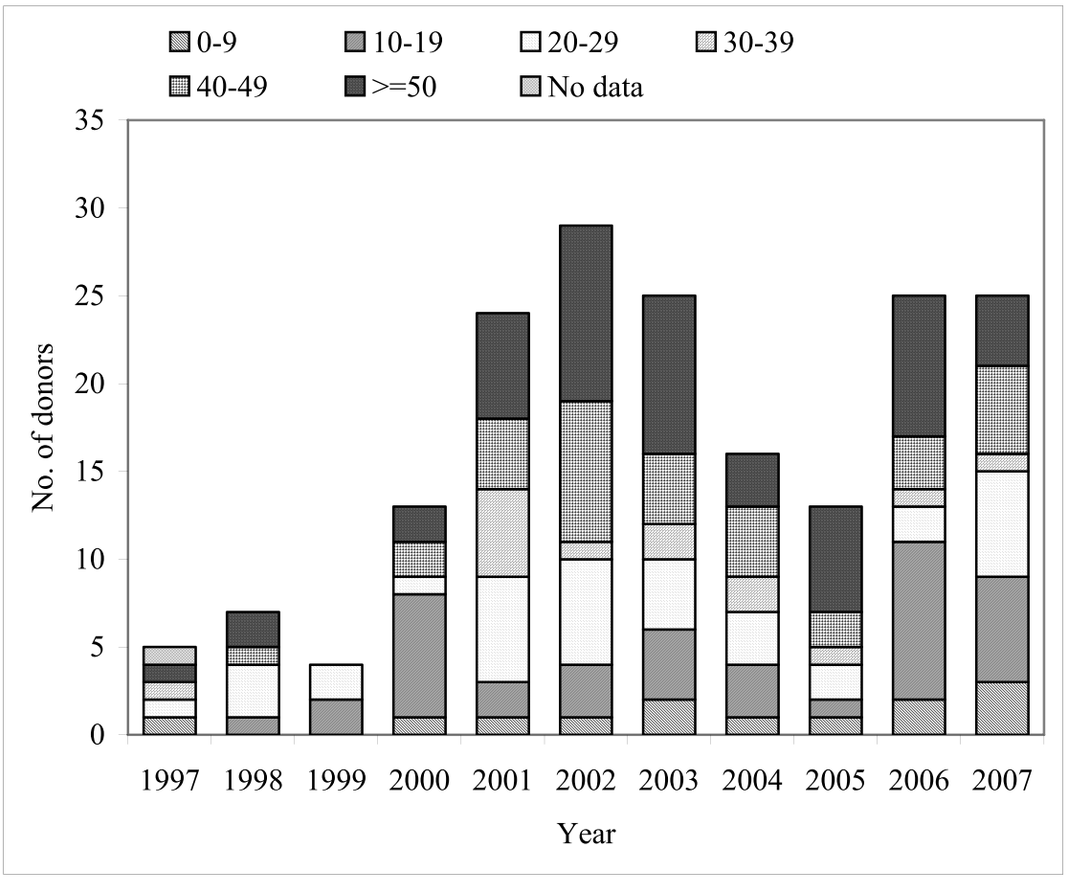
Donor's age (years)	1997 N=5		1998 N=7		1999 N=4		2000 N=13		2001 N=24		2002 N=30		2003 N=25		2004 N=16		2005 N=13		2006 N=25		2007 N=25		Total N=187	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
<1	0	0	0	0	0	0	0	0	0	0	0	0	1	4	0	0	0	0	0	0	0	0	1	1
1-9	1	20	0	0	0	0	1	8	1	4	1	3	1	4	1	6	1	8	2	8	3	12	12	6
10-19	0	0	1	14	2	50	7	54	2	8	3	10	4	16	3	19	1	8	9	36	6	24	38	20
20-29	1	20	3	43	2	50	1	8	6	25	6	20	4	16	3	19	2	15	2	8	6	24	36	19
30-39	1	20	0	0	0	0	0	0	5	21	1	3	2	8	2	13	1	8	1	4	1	4	14	7
40-49	0	0	1	14	0	0	2	15	4	17	8	27	4	16	4	25	2	15	3	12	5	20	33	18
50-59	1	20	2	29	0	0	1	8	4	17	7	23	3	12	3	19	1	8	2	8	2	8	26	14
60-69	0	0	0	0	0	0	1	8	2	8	1	3	3	12	0	0	3	23	4	16	2	8	16	9
70-79	0	0	0	0	0	0	0	0	0	0	3	10	3	12	0	0	1	8	2	8	0	0	9	5
80-89	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	8	0	0	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	0	1	1
Total	**5**		**7**		**4**		**13**		**24**		**30**		**25**		**16**		**13**		**25**		**25**		**187**	
Mean	27.25		34.43		20.50		25.23		36.83		41.87		39.36		32.50		46.38		35.72		29.6		35.70	
SD	21.06		17.12		4.43		18.71		15.71		18.92		22.26		15.57		24.78		22.45		18.75		20.09	
Median	28.00		25.00		21.00		17.00		37.00		46.00		40.00		31.50		48.00		23.00		29.60		34.00	
Minimum	2		16		15		5		8		4		<1*		8		3		3		1**		<1*	
Maximum	21		57		25		60		66		79		77		55		81***		77		68		81***	

* The youngest tissue donor was 37-days old donated heart valves in 2003

** The youngest organ donor was 14.5-month old donated kidneys 2007

*** 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 8.3: Distribution of Donors by Age, 1997-2007



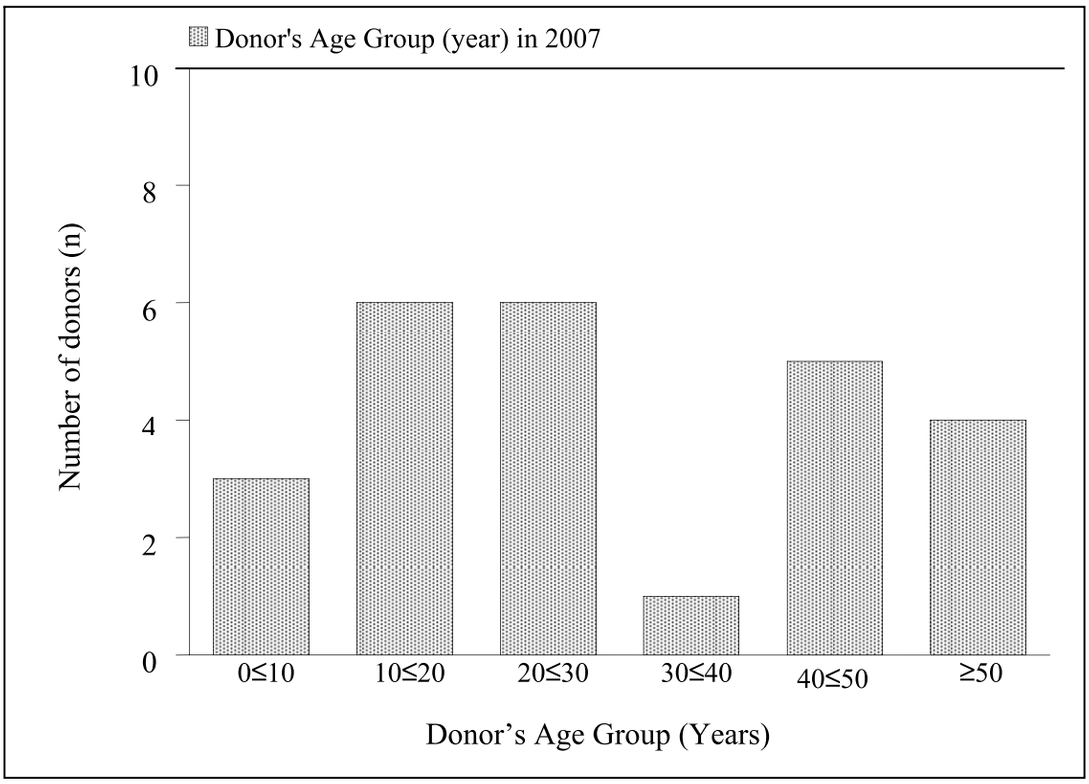


Table 8.4: Distribution of Donors by Gender, 1997-2007

Donor's gender	1997 N=5		1998 N=7		1999 N=4		2000 N=13		2001 N=24		2002 N=30	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Male	3	60	7	100	3	75	11	85	20	83	27	90
Female	2	40	0	0	1	25	2	15	4	17	3	10

Donor's gender	2003 N=25		2004 N=16		2005 N=13		2006 N=25		2007 N=25		Total N=187	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Male	21	84	12	75	8	62	19	76	20	80	151	81
Female	4	16	4	25	5	38	6	24	5	20	36	19

Figure 8.4: Distribution of Donors by Gender, 1997-2007

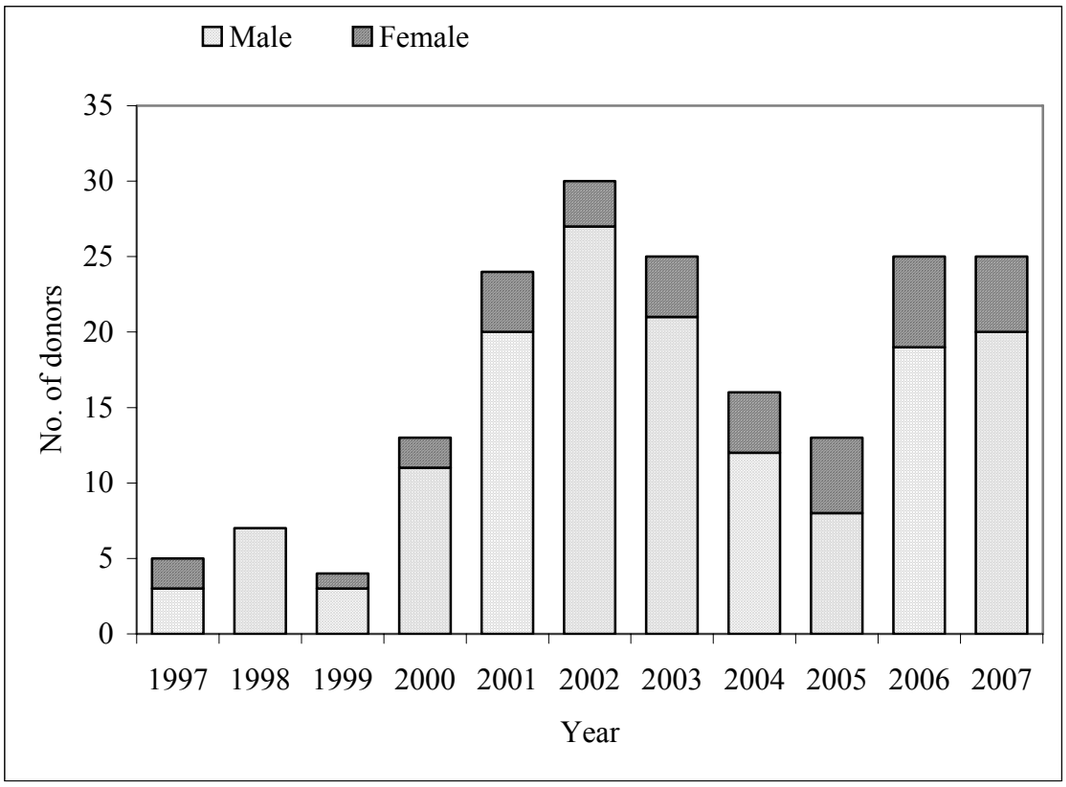


Table 8.5: Distribution of Donors by Ethnic Group, 1997-2007

Donor's ethnic group	1997 N=5		1998 N=7		1999 N=4		2000 N=13		2001 N=24		2002 N=30	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Malay	1	20	0	0	0	0	2	15	1	4	0	0
Chinese	3	60	4	57	4	100	7	54	17	71	13	43
Indian	1	20	3	43	0	0	3	23	4	17	15	50
Others	0	0	0	0	0	0	1	8	2	8	2	7

Donor's ethnic group	2003 N=25		2004 N=16		2005 N=13		2006 N=25		2007 N=25		Total N=187	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Malay	0	0	1	6	1	8	1	4	5	20	12	6
Chinese	14	56	14	88	5	38	12	48	14	56	107	57
Indian	9	36	1	6	7	54	11	44	3	12	57	30
Others	2	8	0	0	0	0	1	4	3	12	11	7

Figure 8.5: Distribution of Donors by Ethnic Group, 1997-2007

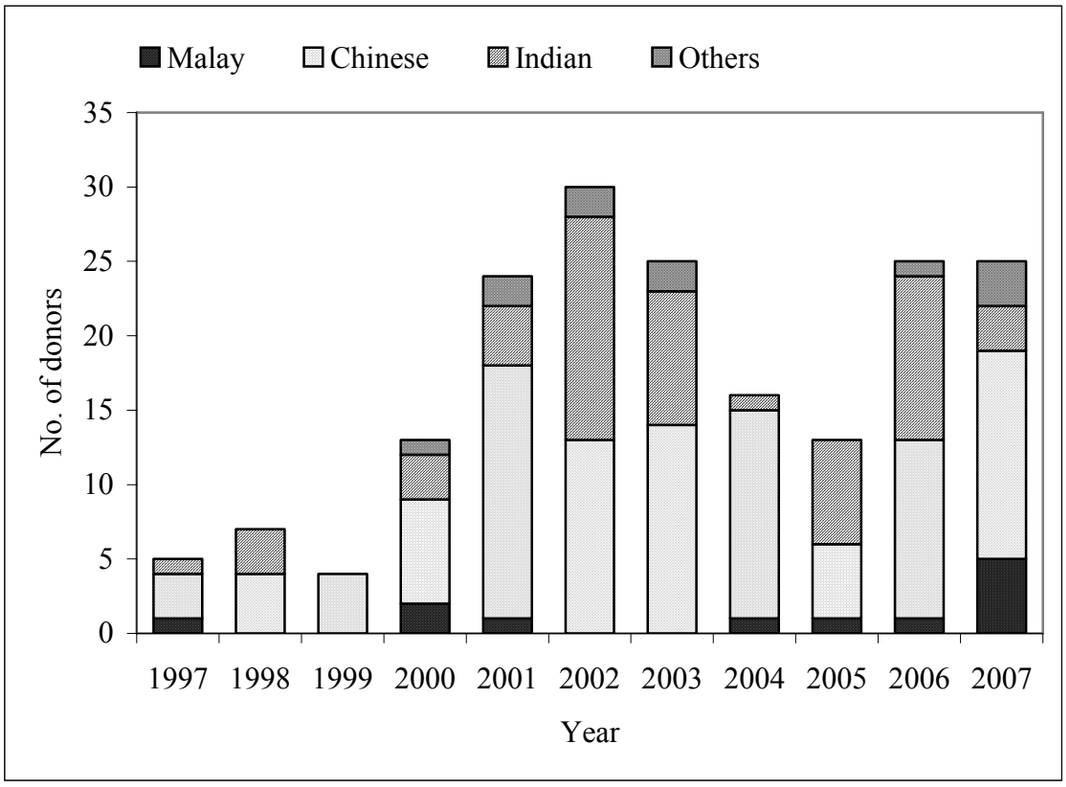


Table 8.6: Distribution of Donors by Religion, 1997-2007

Donor's religion	1997 N=5		1998 N=7		1999 N=4		2000 N=13		2001 N=24		2002 N=30	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Islam	1	20	0	0	0	0	2	15	1	4	0	0
Buddhism	3	60	3	43	0	0	0	0	1	4	5	17
Hinduism	1	20	3	43	0	0	3	23	3	13	13	43
Christianity	0	0	0	0	0	0	1	8	0	0	1	3
Others	0	0	0	0	0	0	0	0	0	0	0	0
Unknown	0	0	1	14	4	100	7	54	19	79	11	37

Donor's religion	2003 N=25		2004 N=16		2005 N=13		2006 N=25		2007 N=25		Total N=187	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Islam	1	4	2	13	1	8	2	8	5	20	15	8
Buddhism	15	60	14	88	5	38	12	48	13	52	71	38
Hinduism	8	32	0	0	5	38	10	40	2	8	48	26
Christianity	1	4	0	0	0	0	0	0	4	16	7	4
Others	0	0	0	0	2	15	0	0	1	4	3	2
Unknown	0	0	0	0	0	0	1	4	0	0	43	23

Figure 8.6: Distribution of Donors by Religion, 1997-2007

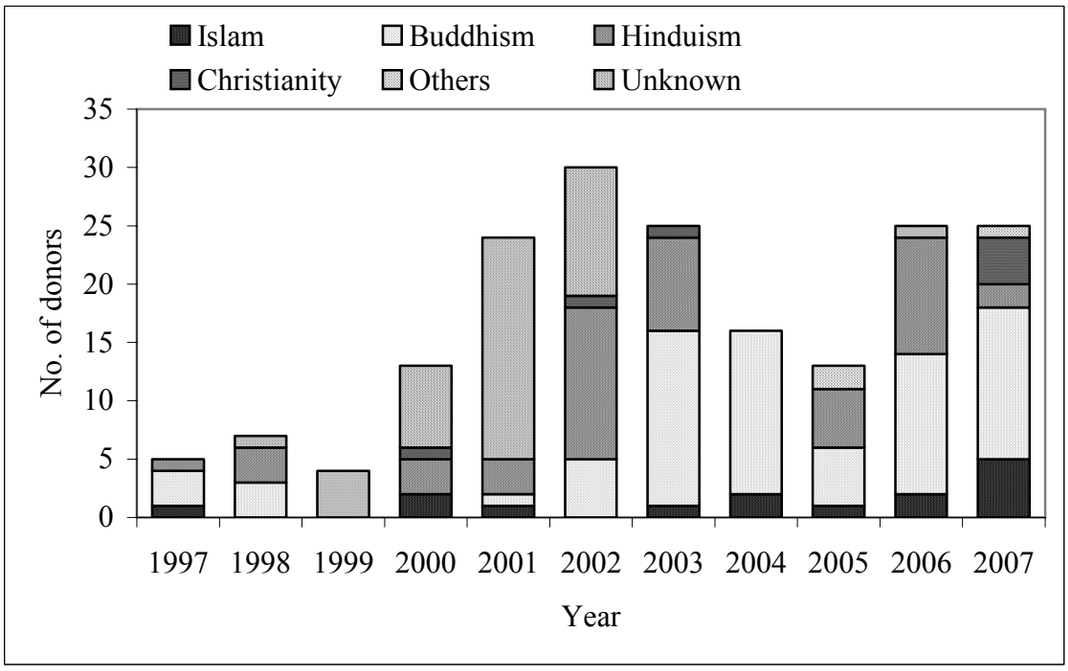


Table 8.7: Distribution of Donors by Nationality, 1997-2007

Donor's nationality	1997 N=5		1998 N=7		1999 N=4		2000 N=13		2001 N=24		2002 N=30	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Malaysian	5	100	7	100	4	100	13	100	21	88	29	97
Non-Malaysian	0	0	0	0	0	0	0	0	3	13	1	3

Donor's nationality	2003 N=25		2004 N=16		2005 N=13		2006 N=25		2007 N=25		Total N=187	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Malaysian	24	96	16	100	13	100	24	96	24	96	180	96
Non-Malaysian	1	4	0	0	0	0	1	4	1	4	7	4

Figure 8.7: Distribution of Donors by Nationality, 1997-2007

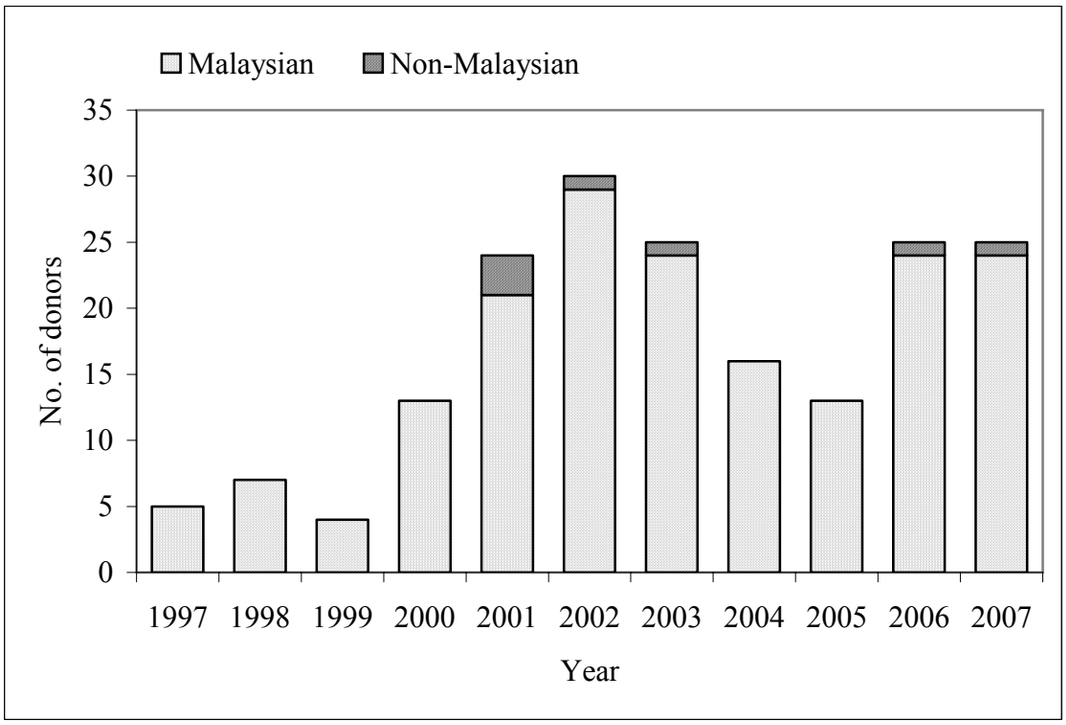


Table 8.8: Distribution of Donors by State, 1997-2007

Donor's state of residence*	1997 N=5		1998 N=7		1999 N=4		2000 N=13		2001 N=24		2002 N=30	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Johor	0	0	0	0	0	0	3	23	0	0	2	7
Malacca	0	0	1	14	1	25	0	0	0	0	1	3
Negeri Sembilan	0	0	1	14	0	0	1	8	0	0	1	3
Selangor	2	40	1	14	0	0	0	0	3	13	9	30
WP Kuala Lumpur	1	20	1	14	2	50	0	0	0	0	5	17
WP Putrajaya	0	0	0	0	0	0	0	0	0	0	1	3
Perak	1	20	2	29	1	25	3	23	0	0	4	13
Kedah	0	0	0	0	0	0	2	15	3	13	1	3
Perlis	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
Pahang	0	0	1	14	0	0	0	0	3	13	2	7
Terengganu	0	0	0	0	0	0	0	0	1	4	0	0
Kelantan	0	0	0	0	0	0	1	8	0	0	0	0
Sabah	0	0	0	0	0	0	2	15	1	4	0	0
Sarawak	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
Unknown	1	20	0	0	0	0	0	0	10	42	3	10

Donor's state of residence*	2003 N=25		2004 N=16		2005 N=13		2006 N=25		2007 N=25		Total N=187	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Johor	3	12	1	6	1	8	1	4	5	20	16	9
Malacca	2	8	0	0	1	8	2	8	1	4	9	5
Negeri Sembilan	4	16	0	0	1	8	2	8	1	4	11	6
Selangor	6	24	6	38	7	54	2	8	6	24	42	22
WP Kuala Lumpur	2	8	3	19	2	15	6	24	3	12	25	13
WP Putrajaya	0	0	0	0	0	0	0	0	0	0	1	0
Perak	0	0	2	13	1	8	4	16	2	8	20	11
Kedah	0	0	1	6	0	0	1	4	2	8	10	5
Perlis	0	0	0	0	0	0	0	0	0	0	0	0
Pulau Pinang	3	12	2	13	0	0	4	16	2	8	16	9
Pahang	2	8	0	0	0	0	1	4	1	4	10	5
Terengganu	0	0	0	0	0	0	0	0	1	4	2	1
Kelantan	0	0	0	0	0	0	1	4	0	0	2	1
Sabah	1	4	1	7	0	0	0	0	0	0	5	3
Sarawak	0	0	0	0	0	0	0	0	0	0	0	0
Others**	1	4	0	0	0	0	1	4	1	4	3	2
Unknown	1	4	0	0	0	0	0	0	0	0	15	8

*State of residence according to home address

**Others constitute donors who were foreigners, one from Yangon, Myanmar (2003), one from Taiwan (2006), and one from Canada (2007).

Table 8.9: Donor's Pledged Status, 1997-2007

Donor's pledged status	1997 N=5		1998 N=7		1999 N=4		2000 N=13		2001 N=24		2002 N=30	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Pledged donors	0	0	0	0	0	0	0	0	0	0	5	17
Non-pledged donors	5	100	7	100	4	100	13	100	24	100	25	83

Donor's pledged status	2003 N=25		2004 N=16		2005 N=13		2006 N=25		2007 N=25		Total N=187	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Pledged donors	6	24	2	13	3	23	1	4	6	24	23	12
Non-pledged donors	19	76	14	88	10	77	24	96	19	76	164	88

Figure 8.9: Donor's Pledged Status, 1997-2007

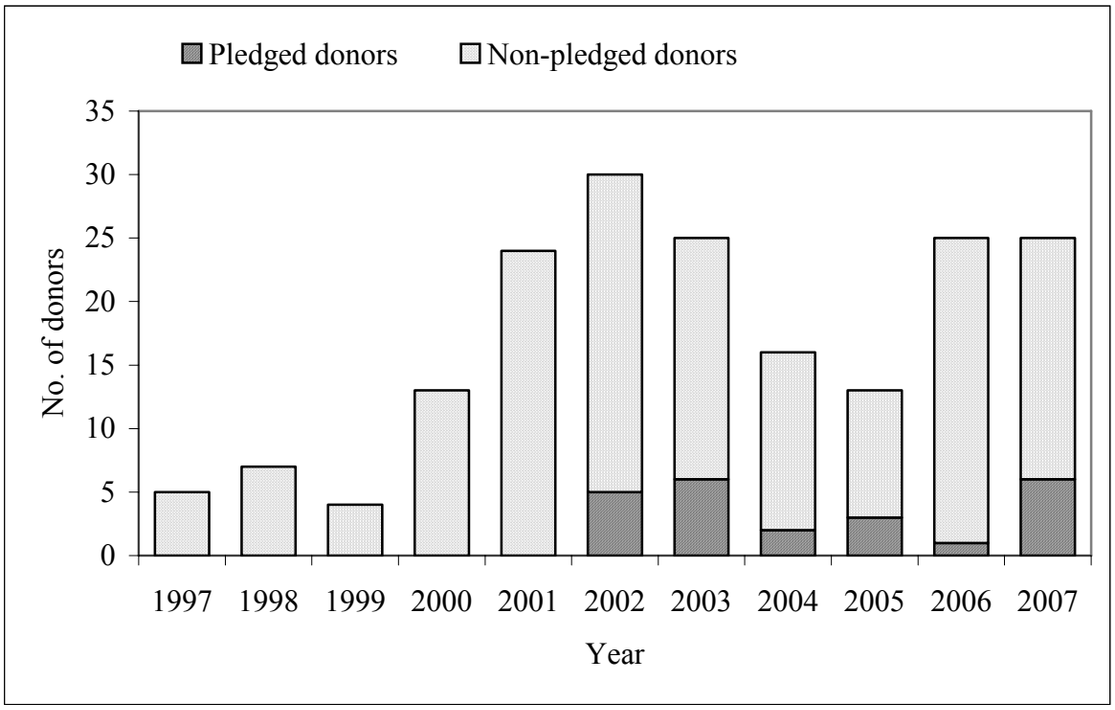


Table 8.10: Distribution of Donors by Type, 1997-2007

Type of donors	**1997 N=5**		**1998 N=7**		**1999 N=4**		**2000 N=13**		**2001 N=24**		**2002 N=30**	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
BD (Brain Dead donors)	4	80	6	86	4	100	11	85	20	83	17	57
CD (Tissue Donors after Cardiac Death)*	1	20	1	14	0	0	2	15	4	17	13	43

Type of donors	**2003 N=25**		**2004 N=16**		**2005 N=13**		**2006 N=25**		**2007 N=25**		**Total N=187**	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
BD (Brain Dead donors)	8	32	10	63	5	38	14	56	15	60	114	61
CD (Tissue Donors after Cardiac Death) *	17	68	6	38	8	62	11	44	10	40	73	39

* CD involve tissue donations only

Figure 8.10: Distribution of Donors by Type, 1997-2007

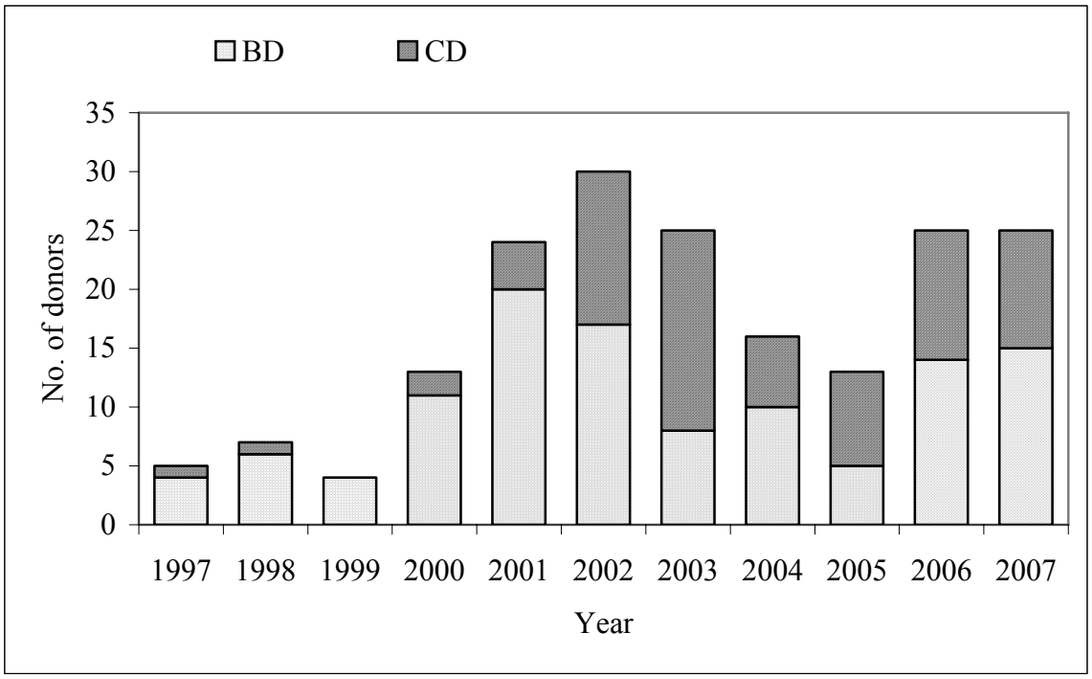


Table 8.11: Distribution of Donors by Cause of Death, 1997-2007

Causes of death	1997 N=5				1998 N=7				1999 N=4				2000 N=13				2001 N=24				2002 N=30			
	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		Brain dead donors N=17		Cardiac death tissue donors N=13	
	No.	%	No.	%	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	5	45	2	100	11	55	0	0	10	59	7	54
Injury from fall	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	0	0	0	0	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	0	0	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	1	6	0	0
Spontaneous hypertensive intracranial bleed	2	50	0	0	0	0	0	0	0	0	0	0	2	18	0	0	3	15	1	25	1	6	0	0
Spontaneous AVM/Aneurysm intracranial bleed	0	0	0	0	0	0	0	0	0	0	0	0	1	9	0	0	1	5	0	0	2	12	0	0
Brain anoxia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6	0	0
Brain tumour	1	25	0	0	0	0	0	0	0	0	0	0	1	9	0	0	0	0	0	0	0	0	0	0
Thrombo embolic brain infarct	0	0	0	0	0	0	1	100	0	0	0	0	1	9	0	0	0	0	1	25	1	6	0	0
Cardiac disease	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	38
Others	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	1	25	0	0	1	8
Unknown	0	0	1	100	0	0	0	0	1	25	0	0	1	9	0	0	2	10	1	25	1	6	0	0

Causes of death	2003 N=25				2004 N=16				2005 N=13				2006 N=25				2007 N=25				Total N=187			
	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=15		Cardiac death tissue donors N=10		Brain dead donors N=114		Brain death tissue donors N=73	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Injury from MVA	6	75	3	18	2	20	3	50	1	20	2	25	7	50	1	9	9	60	4	40	60	53	22	30
Injury from fall	1	13	0	0	2	20	0	0	0	0	0	0	1	7	1	9	1	7	2	20	6	5	3	4
Injury from assault	0	0	0	0	1	10	1	17	1	20	0	0	1	7	1	9	1	7	0	0	6	5	2	3
Injury from industrial accident	0	0	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	0	0	1	6	1	10	2	33	1	20	0	0	1	7	0	0	1	7	0	0	12	11	4	5
Spontaneous AVM/Aneurysm intracranial bleed	0	0	1	6	3	30	0	0	0	0	0	0	0	0	0	0	2	13	0	0	9	8	1	1
Brain anoxia	0	0	1	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
Brain tumour	0	0	0	0	0	0	0	0	0	0	0	0	2	14	0	0	0	0	0	0	4	4	0	0
Thrombo embolic brain infarct	1	13	0	0	0	0	0	0	1	20	0	0	0	0	2	18	0	0	0	0	4	4	4	5
Cardiac disease	0	0	7	41	1	10	0	0	1	20	3	38	2	14	5	45	0	0	4	40	4	4	24	33
Others	0	0	4	24	0	0	0	0	0	0	3	38	0	0	0	0	1	7	0	0	2	2	9	12
Unknown	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	9	0	0	0	0	5	4	3	4

Table 8.12: Distribution of Organ Donors by Blood Group, 1997-2007

Blood group	No. (%)					
	1997 N=4	1998 N=6	1999 N=4	2000 N=11	2001 N=20	2002 N=13
A positive	1(25)	1(17)	0(0)	1(9)	5(25)	3(23)
B positive	0(0)	1(17)	1(25)	5(45)	4(20)	3(23)
AB positive	1(25)	1(17)	0(0)	0(0)	1(5)	0(0)
O positive	2(50)	3(50)	3(75)	5(45)	10(50)	7(54)
A negative	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

Blood group	No. (%)					
	2003 N=8	2004 N=10	2005 N=5	2006 N=14	2007 N=15	Total N=110
A positive	4(50)	2(20)	1(20)	4(29)	6 (40)	28 (25)
B positive	3(38)	4(40)	2(40)	5(36)	3 (20)	31 (28)
AB positive	0(0)	0(0)	0(0)	2(14)	0 (0)	5 (5)
O positive	1(12)	4(40)	2(40)	3(21)	5 (33)	45 (41)
A negative	0(0)	0(0)	0(0)	0(0)	1 (7)	1 (1)

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

Figure 8.12a: Distribution of Organ Donors by Blood Group, 1997-2007

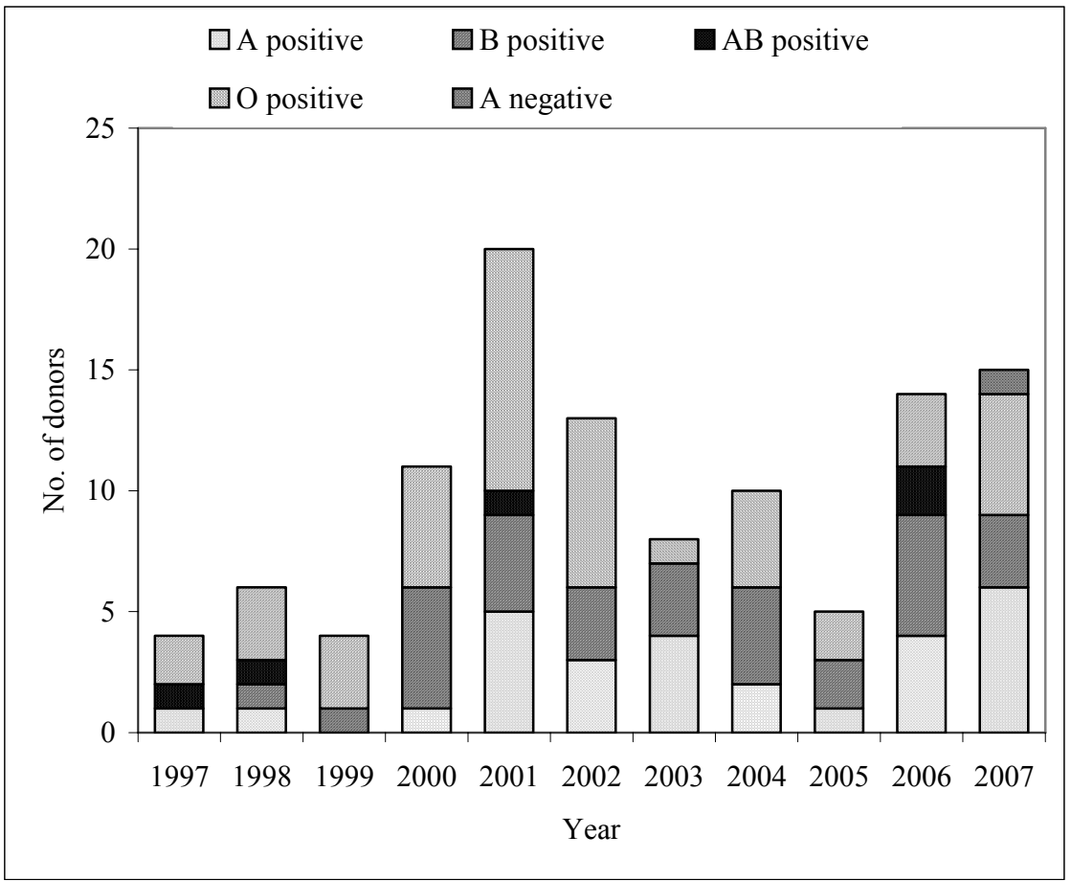


Figure 8.12b: Distribution of Organ Donors by Blood Group (pie chart), 1997-2007

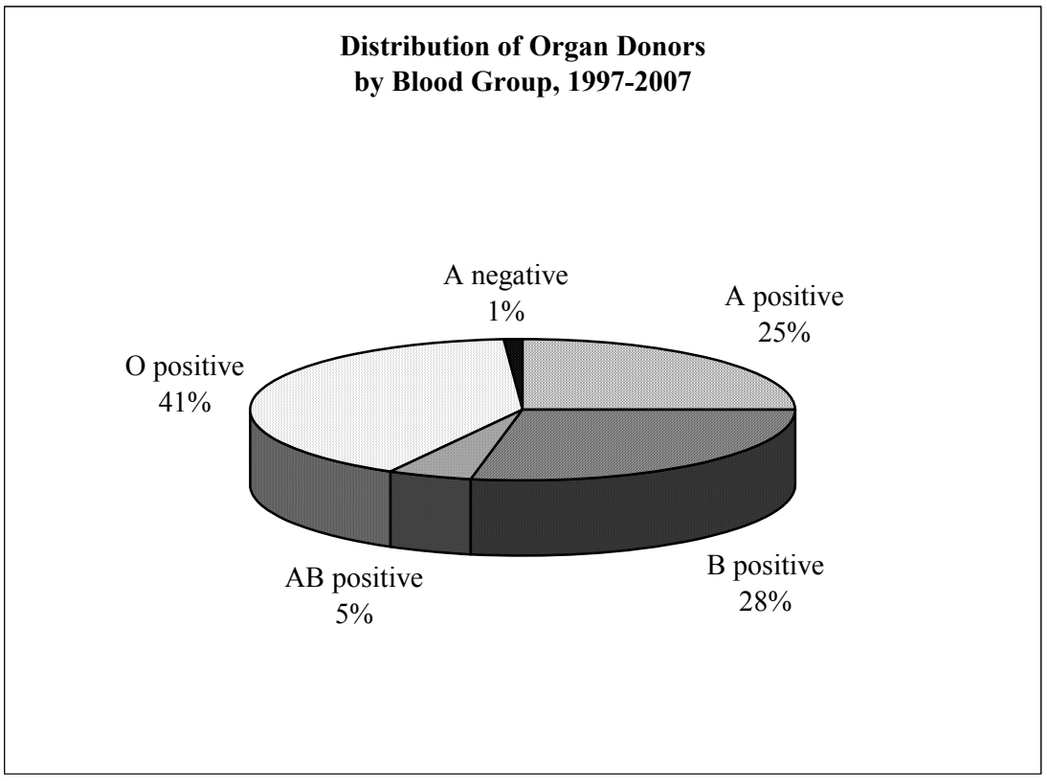


Figure 8.12c: Distribution of Organ Donors by Blood Group (pie chart), 2007

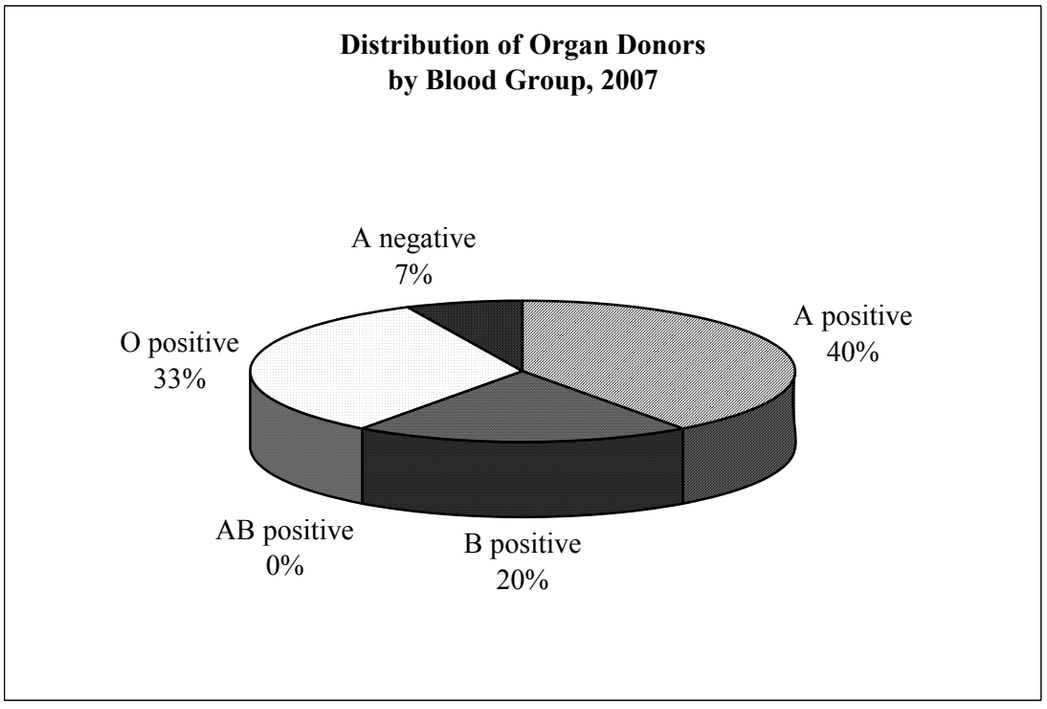


Table 8.13a: Type of Hospital/Institution Where Donors Originated, 1997-2007

Hospital/Institution	1997 N=5		1998 N=7		1999 N=4		2000 N=13		2001 N=24		2002 N=30	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
MOH state/general hospitals	2	40	5	71	1	25	10	77	16	67	19	63
MOH district hospitals	0	0	0	0	0	0	2	15	0	0	2	7
University hospitals	1	20	1	14	0	0	0	0	6	25	4	13
Private hospitals	1	20	1	14	3	75	1	8	2	8	4	13
Home (eye donors only)	1	20	0	0	0	0	0	0	0	0	1	3

Hospital/Institution	2003 N=25		2004 N=16		2005 N=13		2006 N=25		2007 N=25		Total N=187	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
MOH state/general hospitals	15	60	12	75	7	54	17	68	18	72	105	66
MOH district hospitals	4	16	2	13	0	0	1	4	3	12	10	7
University hospitals	3	12	1	6	1	8	3	12	2	8	20	12
Private hospitals	3	12	1	6	5	38	4	16	2	8	25	14
Home (eye donors only)	0	0	0	0	0	0	0	0	0	0	2	1

Figure 8.13a: Type of Hospital/Institution Where Donors Originated, 1997-2007

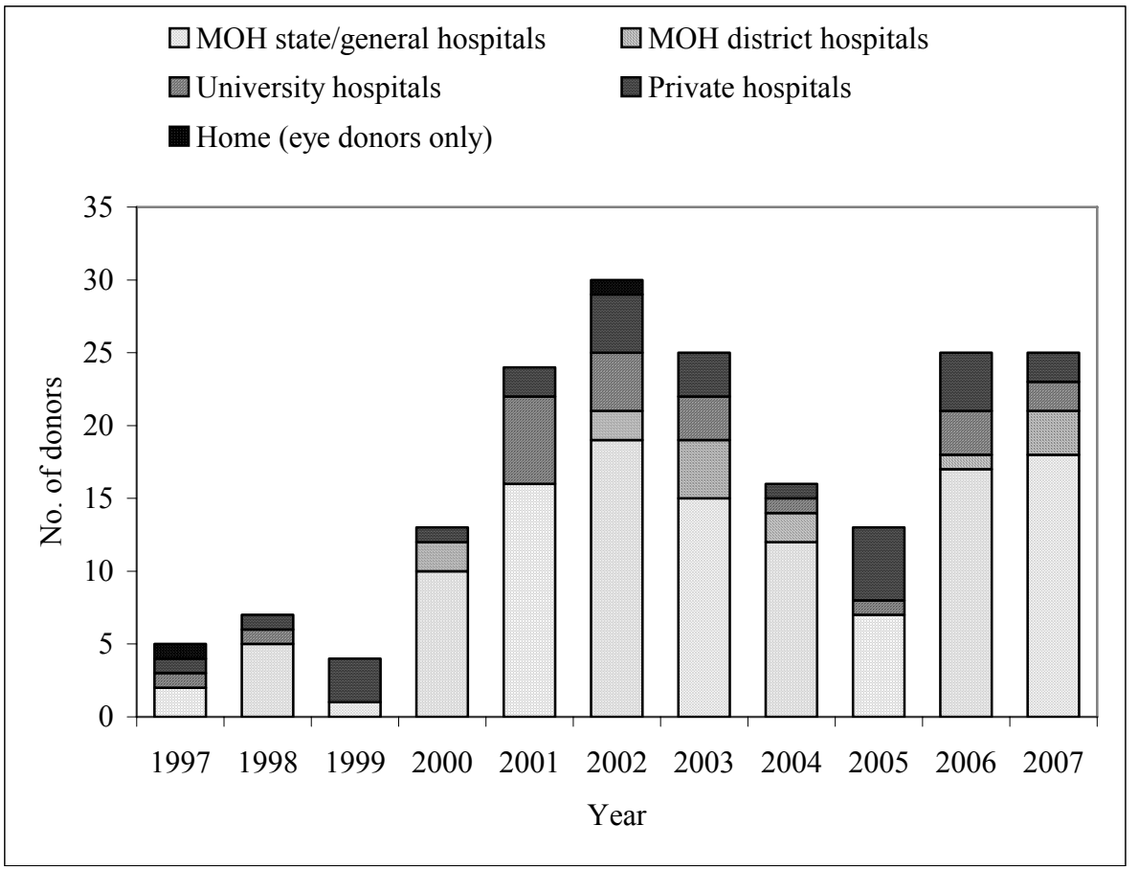


Table 8.13b: Location Where Donors Were Referred From, 1997-2007

Location	1997 N=5		1998 N=7		1999 N=4		2000 N=13		2001 N=24		2002 N=30	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
ICU	1	20	0	0	0	0	1	8	14	58	16	53
Ward	0	0	0	0	0	0	0	0	0	0	1	3
Emergency department	0	0	0	0	0	0	0	0	3	13	4	13
Mortuary	0	0	0	0	0	0	0	0	0	0	3	10
Home	0	0	0	0	0	0	0	0	0	0	1	3
Data not available	4	80	7	100	4	100	12	92	7	29	5	17

Location	2003 N=25		2004 N=16		2005 N=13		2006 N=25		2007 N=25		Total N=187	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
ICU	13	52	12	75	8	62	16	64	17	68	98	52
Ward	3	12	1	6	3	23	3	12	1	4	12	6
Emergency department	1	4	0	0	0	0	3	12	1	4	12	6
Mortuary	6	24	3	19	1	8	3	12	5	20	21	11
Home	0	0	0	0	0	0	0	0	0	0	1	1
Data not available	2	8	0	0	1	8	0	0	1	4	43	23

Figure 8.13b: Location Where Donors Were Referred From, 1997-2007

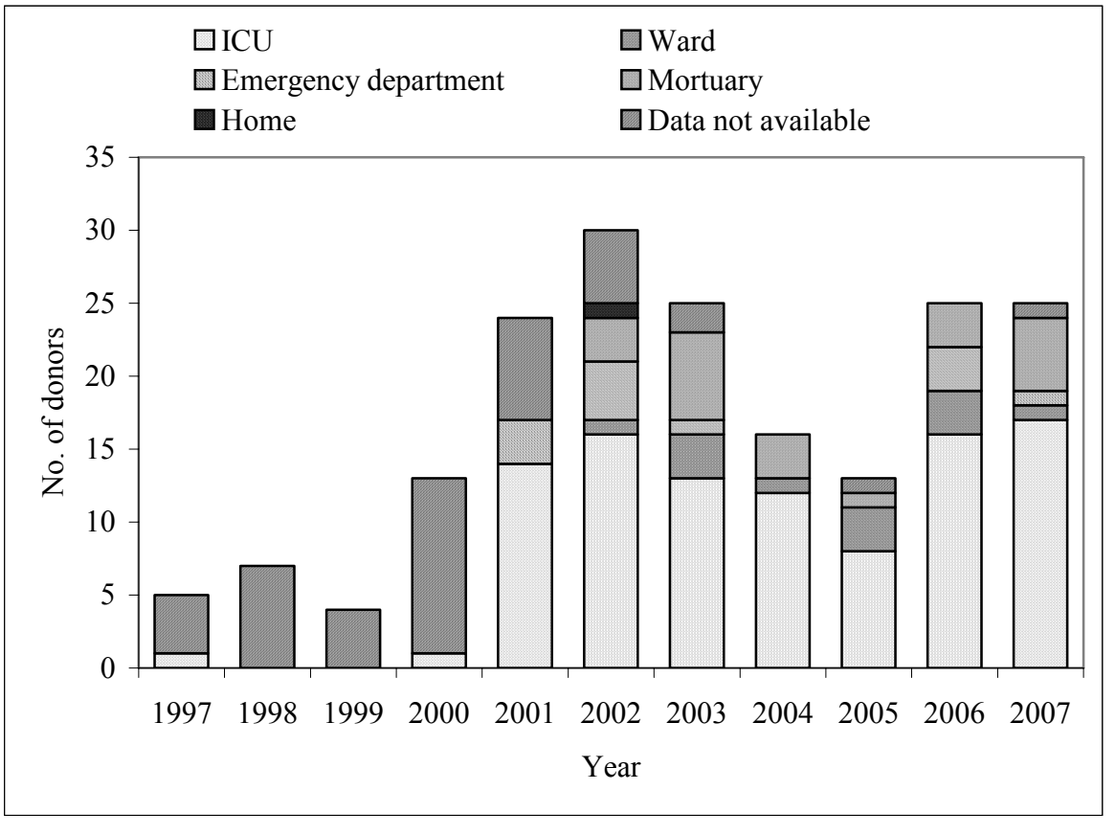
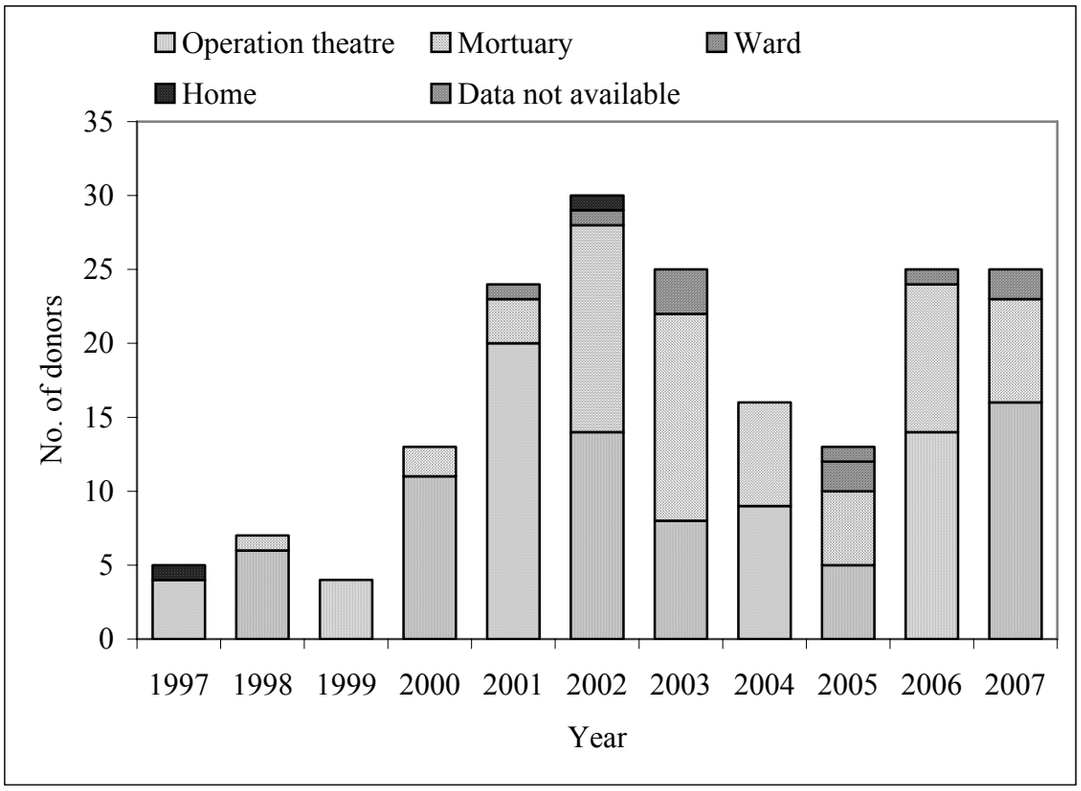


Table 8.13c: Location Where Procurement Was Carried Out, 1997-2007

Donor Procurement Site	1997 N=5		1998 N=7		1999 N=4		2000 N=13		2001 N=24		2002 N=30	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Operation theatre	4	80	6	86	4	100	11	85	20	83	14	47
Mortuary	0	0	1	14	0	0	2	15	3	13	14	47
Ward	0	0	0	0	0	0	0	0	1	4	1	3
Home	1	20	0	0	0	0	0	0	0	0	1	3
Data not available	0	0	0	0	0	0	0	0	0	0	0	0

Donor Procurement Site	2003 N=25		2004 N=16		2005 N=13		2006 N=25		2007 N=25		Total N=187	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Operation theatre	8	32	9	56	5	38	14	56	16	64	111	59
Mortuary	14	56	7	44	5	38	10	40	7	28	63	34
Ward	3	12	0	0	2	15	1	4	2	8	10	5
Home	0	0	0	0	0	0	0	0	0	0	2	1
Data not available	0	0	0	0	1	8	0	0	0	0	1	1

Figure 8.13c: Location Where Procurement Was Carried Out, 1997-2007



APPENDIX A

DATA MANAGEMENT

Data integrity of a register begins from the data source, data collection tools, data verification and data entry process. Registry data is never as perfect as the clinical trial data. Caution should be used when interpreting the result.

The data management personnel in the Register are trained based on the standard operating procedure (SOP). The data entry process is also designed to enhance data quality. Quality assurance procedures are in place at all stages to ensure the quality of data.

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 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 and at Jalan Pahang, Kuala Lumpur. 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.

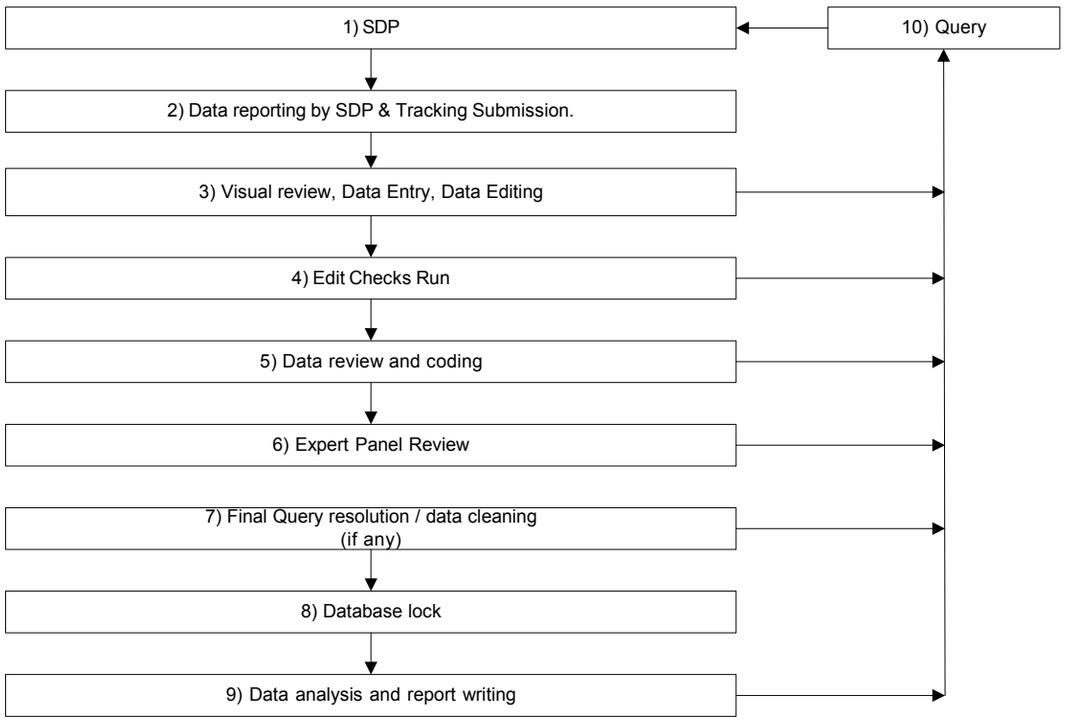
Data sources

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.

Visual review will then be performed to check for completeness and obvious errors or problems. Data without obvious problems were entered into the relevant NTR organ's system. Data entry will not be performed if a critical variable on the CRF is missing or ambiguous. The CRF is returned to the SDP for verification. Prior to registering patient, a verification process is done to ensure there are no duplicate patients and/or notifications. After verification, data is then entered into the relevant NTR organ system.

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. It could be due to request by user, correction of data based on checking from data query or after

receiving results for preliminary data analysis. Any data discrepancy found is verified against the source CRF and resolved within the Register office where possible. Otherwise the specific data query report will be generated and forwarded to the SDP to clarify and resolve the data discrepancy. 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
ACRM	Association of Clinical Registries, Malaysia
ADPKD	Autosomal Dominant Polycystic Kidney Disease
AG	Antigen
ALL	Acute Lymphocytic Leukaemia
ALP	Alkaline Phosphatase
ALT	Alanine Transferase
AML	Acute Myelogenous Leukaemia
ARDS	Acute Respiratory Distress Syndrome
ASH	Ampang Puteri Specialist Hospital
AVM	Arterio-venous Malformation
AZA	Azathioprine
BMI	Body Mass Index
BMT	Blood and Marrow Transplantation
BP	Blood Pressure
BD	Brain Death
BID	brought in dead
CAPD	Continuous Ambulatory Peritoneal Dialysis
CDA	Congenital Dyserythropoeitic Anaemia
CF	Counting Fingers
CHD	Coronary Heart Disease
CIBMTR	Center For International Blood and Marrow Transplant Research
CKD	Chronic Kidney Disease
CMV	Cytomegalovirus
CRC	Clinical Research Centre
CRF	Case Report Form
DCD	Donations after Cardiac Death
DF	Deep Frozen
DFS	Disease-free Survival
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
HD	Haemodialysis
HDL	High Density Lipoprotein
HKL	Hospital Kuala Lumpur

HLA	Human Leukocyte Antigen
HLT	Heart Lung Transplant
HM	Hand Movement
HSCT	Haematopoietic Stem Cell Transplantation
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
JAKIM	Jabatan Kemajuan Islam Malaysia
JNC	Joint National Committee
KLA	HKL, Adult
KLP	HKL, Paediatric
LDL	Low Density Lipoprotein
LQ	Lower Quartile
LVAD	Left Ventricular Assist Device
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
NTPMU	National Transplant Procurement and Management Unit
NTR	National Transplant Registry
PBSC	Peripheral Blood Stem Cells
PK	Penetrating Keratoplastry
PL	Perception of Light
pmp	per million population
QoL	Quality of Life
RMS	Rhabdomyosarcoma
SD	Standard Deviation
SDP	Source Data Provider
SJA	SJMC, Adult
SJMC	Subang Jaya Medical Centre
SJP	SJMC, Paediatric
SQL	Structured Query Language
TRU	Transplant Registry Unit
UK	United Kingdom

UKM	Universiti Kebangsaan Malaysia
UMA	UMMC, Adult
UMMC	University Malaya Medical Centre
UMP	UMMC, Paediatric
UQ	Upper Quartile
USA	United States of America
USM	Universiti Sains Malaysia
VOD	Veno-Occlusive Disease
vs	versus
WP	Wilayah Persekutuan (Federal Territory)

APPENDIX D

DIRECTORY OF PARTICIPATING CENTRES

Blood and Marrow Transplant Services

MOH

Hospital Ampang
Jalan Mewah Utara
Pandan Mewah
68000 Ampang
Kuala Lumpur
Tel : (03)42896000 Ext : 6381
Fax : (03)42970059

Hospital Kuala Lumpur
Paediatrics BMT Unit
Institute Paediatrics
Jalan Pahang
50586 Kuala Lumpur
Tel : (03)26155555 Ext : 6905
Fax : (03)26948187

PRIVATE

Ampang Puteri Specialist Hospital
1 Jalan Mamanda 9
68000 Ampang
Selangor Darul Ehsan
Tel : (03)42702500 Ext : 4478
Fax : (03)42702938

Gleneagles Medical Centre, Penang
Oncology-Haematology Department
1, Jalan Pangkor
10050 Penang
Tel : (04)2202189
Fax : (04)2262994

Lam Wah Ee Hospital
Oncology-Haematology Department
Jalan Tan Sri Teh Ewe Lim
11600 Penang
Tel : (04)6528836
Fax : (04)6570940

Sime Darby Medical Centre Subang Jaya
Haematology Department
1, Jalan SS 12/1A
47500 Subang Jaya
Selangor Darul Ehsan
Tel : (03)56391212
Fax : (03)56391209

Sime Darby Medical Centre Subang Jaya
Paediatrics BMT Unit
1, Jalan SS 12/1A
47500 Subang Jaya
Selangor Darul Ehsan
Tel : (03)56306361
Fax : (03)56306209

Blood and Marrow Transplant Services

UNIVERSITY

Hospital Universiti Kebangsaan Malaysia
Maybank BMT Centre
Jalan Yaacob Latif
Bandar Tun Razak, Cheras
56000 Kuala lumpur
Tel : (03)91455555 Ext : 6336
Fax : (03)91738255

Hospital Universiti Sains Malaysia
Haemapoietic Stem Cell Transplant Unit
Jalan Sultanah Zainab II
16150 Kota Bharu
Kelantan Darul Naim
Tel : (09) 7663349

University of Malaya Medical Centre
Division of Haematology
Department of Medicine
Jalan Universiti
59100 Kuala Lumpur
Tel : (03)79492741
Fax : (03)79557740

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

Bone and Tissue Transplant Services

MOH

Hospital Ipoh
Department of Orthopaedics
Jalan Hospital
30990 Ipoh
Perak Darul Ridzuan
Tel : (05)5222460
Fax : (05)2412826

Hospital Kajang
Orthopaedics Department
Jalan Semenyih
43000 Kajang
Selangor Darul Ehsan
Tel : (03)87363333

Hospital Kangar
Jabatan Ortopedik & Traumatologi
Jalan Kolam
01000 Kangar
Perlis Indera Kayangan
Tel : (04)9763333 Ext : 1184
Fax : (04)9767237

Hospital Kuala Lumpur
Institute of Orthopaedic &
Traumatology
Jalan Pahang
50586 Kuala Lumpur
Tel : (03)26155555 Ext : 5543/5534
Fax : (03)26927281

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

Hospital Kuantan
Department of Orthopaedics
Jalan Tanah Puteh
25100 Kuantan
Pahang Darul Makmur
Tel : (09)5133333 Ext : 2903
Fax : (09)5142712

Hospital Pakar Sultanah Fatimah
Orthopaedics Department
Jalan Salleh
84000 Muar
Johor Darul Takzim
Tel : (06)9521901

Hospital Pulau Pinang
Department of Orthopaedics
Jalan Residensi
10990 Pulau Pinang
Tel : (04)2225127
Fax : (04)2226127

Hospital Raja Perempuan Zainab II
Department of Surgery
Jalan Hospital
15590 Kota Bharu
Kelantan Darul Naim
Tel : (09)7452000 Ext : 2013/2237
Fax : (09) 7475418

Hospital Raja Perempuan Zainab II
Department of Orthopaedics
Jalan Hospital
15590 Kota Bharu
Kelantan Darul Naim
Tel : (09)7485533 Ext : 2374/2364
Fax : (09)7486951

Bone and Tissue Transplant Services

MOH

Hospital Seberang Jaya
Orthopaedics Department
Bandar Baru
13700 Seberang Jaya
Pulau Pinang
Tel : (04)3983333

Hospital Sultanah Aminah
Orthopaedics Department
80100 Johor Bahru
Johor Darul Takzim
Tel : (07)2231666

Hospital Sultanah Bahiyah
Ophthalmology Department
06550 Alor Setar
Kedah Darul Aman
Tel : (04)7002248
Fax : (04)7323770

Hospital Sultanah Bahiyah
Department of Orthopaedic Surgery
06550 Alor Setar
Kedah Darul Aman
Tel : (04)7303333 Ext : 179
Fax : (04)7323770

Hospital Sultanah Nur Zahirah
Orthopaedic Department
Jalan Sultan Mahmud
20400 Kuala Terengganu
Terengganu Darul Iman
Tel : (09)6212121

Hospital Sungai Buloh
Ophthalmology Department
47000 Sungai Buloh
Selangor Darul Ehsan
Tel : (03)61561324

Hospital Taiping
Department of Orthopaedic Surgery
Jalan Taming Sari
34000 Taiping
Perak Darul Ridzuan
Tel : (05)8408037
Fax : (05)8073894

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
41200 Klang
Selangor Darul Ehsan
Tel : (03)33723333 Ext : 1336
Fax : (03)33729089

Bone and Tissue Transplant Services

MOH

Hospital Tengku Ampuan Rahimah
Orthopaedic Clinic
41200 Klang
Selangor Darul Ehsan
Tel : (03)33723333 Ext : 1225
Fax : (03)33729089

Hospital Umum Sarawak
Orthopaedic Department
93586 Kuching
Sarawak
Tel : (082)276433
Fax : (082)419495

PRIVATE

Hospital Fatimah
1, Jalan Chew Peng Loon
Ipoh Garden
31400 Ipoh
Perak Darul Ridzuan
Tel : (05)5455777
Fax : (05)5477050

Island Hospital
308, Macalister Road
10450 Penang
Pulau Pinang
Tel : (04)2205527
Fax : (04)2267989

Kota Bharu Medical Centre
Lot 179-184, Section 24
Jalan Sultan Yahya Petra
15200 Lundang, Kota Bharu
Kelantan Darul Naim
Tel : (09)7433399
Fax : (09)7433800

Normah Medical Specialist Centre
P.O Box 3298
93764 Kuching
Sarawak
Tel : (082)440055
Fax : (082)442600

Seremban Specialist Hospital
Wan Orthopaedic, Trauma & Sports
Injury Centre (WOTSIC)
Suite 17, Seremban Specialist Hospital,
Jalan Toman 1, Kemayan Square
70200 Seremban
Negeri Sembilan Darul Khusus
Tel : (06)7677800 Ext : 130 / 131
Fax : (06)7675900

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

Timberland Medical Centre
Lorong 2, 2 1/2 miles Rock Road
93250 Kuching
Sarawak
Tel : (082)234466 Ext : 503
Fax : (082)232259

Bone and Tissue Transplant Services

UNIVERSITY

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

Hospital Universiti Sains Malaysia
Orthopaedics Department
16150 Kota Bharu
Kelantan Darul Naim
Tel : (09) 7664509
Fax : (09) 7653370

International Islamic University Malaysia
Department of Orthopaedics,
Traumatology and Rehabilitation
Kulliyah of Medicine
Jalan Hospital
25100 Kuantan
Pahang Darul Makmur
Tel : (09)5132797
Fax : (09)5151518

University of Malaya Medical Centre
Department of Orthopaedics Surgery
Jalan Universiti
59100 Kuala Lumpur
Tel : (03)79492061
Fax : (03)79535642

TISSUE BANK

National Tissue Bank
Universiti Sains Malaysia
Health Campus
16150 Kota Bharu
Kelantan Darul Naim
Tel : (09)7664344
Fax : (09)7653307

Bone and Tissue Transplant Services

BONE BANK

Bone Bank, Hospital Kuala Lumpur
Institute of Orthopaedic &
Traumatology
Jalan Pahang
50586 Kuala Lumpur
Tel : (03)26155555 Ext : 5543/5534
Fax : (03)26927281

Bone Bank, University of Malaya
Medical Centre
Department of Orthopaedics Surgery
Jalan Universiti
59100 Kuala Lumpur
Tel : (03)79492061
Fax : (03)79535642

IRRADIATION CENTRE

Malaysian Nuclear Agency
Research Tissue Bank
Nuclear Agensi Malaysia
Bangi
43000 Kajang
Selangor Darul Ehsan
Tel : (03) 89250510 Ext : 1611
Fax : (03) 89282956

Cornea Transplant Services

MOH

Hospital Batu Pahat
Ophthalmology Department
83000 Batu Pahat
Johor Darul Takzim
Tel : (07)4341999
Fax : (07)4322544

Hospital Bukit Mertajam
Ophthalmology Department
Jalan Kulim
14000 Bukit Mertajam
Pulau Pinang
Tel : (04)5383333 Ext : 256 / 259
Fax : (04)5388435

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

Hospital Ipoh
Ophthalmology Department
Jalan Hospital
30990 Ipoh
Perak Darul Ridzuan
Tel : (05)5222034
Fax : (05)2531541

Hospital Kangar
Ophthalmology Department
Jalan Kolam
01000 Kangar
Perlis Indera Kayangan
Tel : (04)9763333 Ext : 2031
Fax : (04)9767237

Hospital Kuala Lipis
Ophthalmology Department
27200 Kuala Lipis
Pahang Darul Makmur
Tel : (09)3123333 Ext : 114
Fax : (09)3121787

Hospital Kuala Lumpur
Ophthalmology Department
Jalan Pahang
50586 Kuala Lumpur
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 Residensi
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 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 Sibu
Ophthalmology Department
Batu 5 1/2 Jalan Ulu Oya
96000 Sibu
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

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

Cornea Transplant Services

MOH

Hospital Sultanah Bahiyah
Ophthalmology Department
05460 Alor Setar
Kedah Darul Aman
Tel : (04)7407873
Fax : (04)7406154

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 Department
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
Opthalmology 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

International Specialist Eye Centre
Level 8, Centrepoint South,
The Boulevard, Midvalley City
Lingkaran Syed Putra
59200 Kuala Lumpur
Tel : (03)22848989
Fax : (03)22844330

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

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

Hospital Pantai Indah
Ophthalmology Department
Jalan Perubatan 1
Pandan Indah
55100 Kuala Lumpur
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
Tel : (06)2833510

Mahkota Medical Centre
Suite 101, 1st Floor,
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)2233377
(07)2238833

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

Tan Eye Specialist Centre
Sunway Medical 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
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
Tel : (03) 79502060
Fax : (03) 79535635

Heart and Lung Transplant Services

MOH

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

Institute Jantung Negara
Cardiothoracic Department
145, Jalan Tun Razak
50400 Kuala Lumpur
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
Tel : (03)2617 8200
Fax : (03)2692 8418

Kidney Transplant Services

MOH

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

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

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

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

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

Hospital Kuala Lumpur
Paediatric Renal Transplant Clinic
Jalan Pahang
50586 Kuala Lumpur
Tel : (03)26155555 Ext : 5910
Fax : (03)26938953

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

Kidney Transplant Services

MOH

Hospital Melaka
Nephrology Clinic
c/o Haemodialysis Unit
Jalan Pringgit
70060 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 Residensi
10990 Georgetown
Pulau Pinang
Tel : (04)22253333 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 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

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

Kidney Transplant Services

MOH

Hospital Sibu
Renal Transplant Clinic
c/o Haemodialysis Unit
96000 Sibu
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 Sultan Ismail Pandan
Renal Transplant Clinic (Paeds)
c/o Paediatrics Ward
Jalan Persiaran Mutiara Emas Utama
Taman Mount Austin
81100 Johor Bahru
Johor Darul Takzim
Tel : (07)3565000
Fax : (07)3565034

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

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

Fan Medical Renal Clinic
Gleneagles Intan Medical Centre
Suite 7.01, 7th Floor
Medical Office Building
282, Jalan Ampang
50450 Kuala Lumpur
Tel : (03)42578822
Fax : (03)42523823

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

Kidney Transplant Services

PRIVATE

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 Haemodislysis 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

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

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

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

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

Kidney Transplant Services

UNIVERSITY

Hospital Universiti Kebangsaan Malaysia
Renal Transplant Clinic
c/o Haemodialysis Unit
Jalan Yaacob Latif,
Bandar Tun Razak, Cheras
56000 Kuala lumpur
Tel : (03)91455555 Ext : 7606
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
Tel : (03)79492497
Fax : (03)79568822

Liver Transplant Services

MOH

Hospital Kuala Lumpur
Institute Paediatric
Jalan Pahang
50586 Kuala Lumpur
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

Sime Darby Medical Centre Subang Jaya
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
Tel : (03)79492065
Fax : (03)79556114

APPENDIX D