NATIONAL TRANSPLANT REGISTRY

6th REPORT OF THE NATIONAL TRANSPLANT REGISTRY 2009

Editors:
Hooi LS
Lela Yasmin Mansor

With contributions by:
Alan Teh K H, Chan L L, Shamala R, Chandramalar S, Mohamed Ezani, David Chew S P, Ashari Yunus, Ganesalingam K, Goh B L, Suzina Sheikh

Malaysian Society of Transplantation

Ministry of Health Malaysia

SIXTH

REPORT OF THE

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Disclaimer

There is a potential that data for previous years printed in this report are different from what were printed in previous reports. This is because analysis for this report is based on the latest dataset in the web which may have been updated by SDP.

Foreword

We, at The Malaysian Society of Transplantation, are both pleased and delighted to present the 6th National Transplant Registry Report which summarises the cumulative data related to organ donation & transplantation activities in Malaysia up to 31st December 2009. Though the data is collected, compiled and presented in a 'retrospective' manner, it nevertheless provides a useful means to monitor trends in organ donation and transplantation over the years. The information generated is highly relevant and essential to plan the future development of transplantation in this country.

The report includes chapters on kidney, liver, heart and lung transplantation, further chapters on cornea, bone, blood and marrow transplantation and a chapter on cadaveric organ & tissue donation. Each chapter outlines and presents epidemiological information, the types of immunosuppression and the outcomes for each of the different transplant modalities.

The National Transplant Registry Report is a product of the hard work, commitment and dedication of its editors, Dr Hooi Lai Seong & Datin (Dr) Fadhilah Zowyah Lela Yasmin Mansor, the members of the steering committee, the expert panels, the source data providers and the Registry coordinator, Ms Leong Wei Chee. Unfortunately Ms Leong will be resigning from the National Transplant Registry in December 2011 for personal reasons. Her resignation will bring to a close her remarkable career with the Registry for almost 8 years. The Registry wishes to acknowledge her enormous contribution to its success.

The editors have devoted much time and energies to the preparation of the report, and to ensure uniformity in the style of presentation of each of the organ / tissue specific reports. The expert panels, representing each area of clinical transplantation, completed their tasks with great precision and professionalism. I am indeed indebted to each and every individual who has contributed, in one way or another, towards the successful completion of the 6th NTR Report.

We are extremely grateful to the Ministry of Health Malaysia and the National Clinical Research Centre for their invaluable help and support. Without their assistance it would simply not be possible to maintain the registry and I sincerely hope they will continue to support the efforts of the Malaysian Society of Transplantation in maintaining this registry. It is hoped that with the continued cooperation and participation of all parties involved, it will be possible to ensure that the data remains available and relevant for studies in the future. It is thus vital to ensure that the quality and integrity of the database is maintained and supported in the long term. Efforts are continuing to develop a real-time web-based registry which will be able to seamlessly integrate the collection and tabulation of data from the various transplant related activities in the country in a much more rapid and efficient manner.

The data in the registry is copyrighted, but may be used in scientific and/or research publications; in compliance with current national and international guidelines on research ethics and data handling including the 'Vancouver Guidelines on Responsible Authorship'.

The 6th NTR Report is dedicated to the commitment of all individuals and source data providers throughout Malaysia. I wish to thank them all for their continued support and contributions to the successful release of this report. It would not have been possible to sustain the activities of the registry without the support of each and every individual including our corporate sponsors Roche & Janssen. We sincerely hope that you will find this report both informative and useful.

Datuk (Mr) Harjit Singh MBBS; FRCS Ed; FRCSI
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

- Roche (M) Sdn. Bhd. and Janssen-Cilag for their support in providing sponsorships

- Many others, whose names are not listed here, for their support.

PARTICIPATING CENTRES

Discipline: Blood and Marrow Transplant

1. Ampang Puteri Specialist Hospital
2. Division of Haematology, Department of Medicine, University of Malaya Medical Centre
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5. Haemapoietic Stem Cell Transplant Unit, Hospital Universiti Sains Malaysia
6. Maybank BMT Centre, Universiti Kebangsaan Malaysia Medical Centre
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
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9. Department of Orthopaedics, Hospital Kuantan
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11. Department of Orthopaedics, Hospital Raja Perempuan Zainab II
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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
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23. Island Hospital, Penang
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26. National Tissue Bank, Universiti Sains Malaysia
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29. Ophthalmology Department, Hospital Sultanah Bahiyah
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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
14. Ophthalmology Department, Hospital Kuala Pilah
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
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40. Ophthalmology Department, Hospital Universiti Sains Malaysia

Discipline: Cornea Transplant

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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: Heart and Lung Transplant

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

Discipline: Heart Valve Transplant

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

Discipline: Liver Transplant

1. Department of Paediatrics, University of Malaya Medical Centre
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4. Institute of Paediatrics, Hospital Kuala Lumpur
5. Sime Darby Medical Centre Subang Jaya

Discipline: Renal Transplant

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3. Fan Medical Renal Clinic
4. Kidney Unit, Assunta Hospital
5. Klinik Dr Choo & Liew
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9. Renal Transplant Clinic, Hospital Bintulu
10. Renal Transplant Clinic, Hospital Duchess of Kent
11. Renal Transplant Clinic, Hospital Dungun
12. Renal Transplant Clinic, Hospital Kemaman
13. Renal Transplant Clinic, Hospital Kluang
14. Renal Transplant Clinic, Hospital Labuan
15. Renal Transplant Clinic, Hospital Likas
16. Renal Transplant Clinic, Hospital Melaka
17. Renal Transplant Clinic, Hospital Mersing
18. Renal Transplant Clinic, Hospital Miri

Discipline: <u>Renal Transplant</u>

19. Renal Transplant Clinic, Hospital Pakar Sultanah Fatimah
20. Renal Transplant Clinic, Hospital Pantai Penang
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24. Renal Transplant Clinic, Hospital Raja Perempuan Zainab II
25. Renal Transplant Clinic, Hospital Raja Permaisuri Bainun
26. Renal Transplant Clinic, Hospital Segamat
27. Renal Transplant Clinic, Hospital Selayang
28. Renal Transplant Clinic, Hospital Serdang
29. Renal Transplant Clinic, Hospital Sibu
30. Renal Transplant Clinic, Hospital Sultan Ismail
31. Renal Transplant Clinic, Hospital Sultanah Aminah
32. Renal Transplant Clinic, Hospital Sultanah Bahiyah
33. Renal Transplant Clinic, Hospital Sultanah Nur Zahirah
34. Renal Transplant Clinic, Hospital Taiping
35. Renal Transplant Clinic, Hospital Tawau
36. Renal Transplant Clinic, Hospital Tengku Ampuan Afzan
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40. Renal Transplant Clinic, KPJ Selangor Specialist Hospital
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42. Renal Transplant Clinic, Prince Court Medical Centre
43. Renal Transplant Clinic, Pusat Perubatan Universiti Kebangsaan Malaysia
44. Renal Transplant Clinic, Renal Care (Ipoh Specialist Hospital)
45. Renal Transplant Clinic, Sabah Medical Centre
46. Renal Transplant Clinic, Sarawak General Hospital
47. Renal Transplant Clinic, Selangor Medical Centre
48. Renal Transplant Clinic, Sime Darby Medical Centre Subang Jaya
49. Renal Transplant Clinic, Sri Kota Medical Centre
50. Renal Transplant Clinic, Sunway Medical Centre
51. Renal Transplant Clinic, Universiti Sains Malaysia Hospital
52. Renal Transplant Clinic, University Malaya Medical Centre
53. Renal Transplant Clinic (Paed), Ward 8C&D, Hospital Sultan Ismail
54. Simon Wong Medical & Kidney Clinic, Timberland Medical Centre
55. Smartcare Dialysis Centre, Subang Jaya
56. Tan Medical Renal Clinic
57. 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 to govern the NTR and the terms of reference are as follows:

1. Provide the necessary leadership and direction for the National Transplant Registry.
2. Ensure that the vision, objectives and goals of the National Transplant Registry are clearly established and that strategies are in place for achieving them.
3. Establish policies and procedures for the proper functioning of the National Transplant Registry.
4. Seek input and feedback from all stakeholders and end users with regards to their expectations and the performance of the National Transplant Registry.
5. Secure funding and financial support for the National Transplant Registry.
6. Galvanize the commitment of all interested parties to the National Transplant Registry.
7. Receive and review the annual report from the steering committee.

Current members of the Governance Board are as follows:

Chairperson
Dato' Dr Zaki Morad Mohd Zaher

Vice Chairperson
Datin Dr Fadhilah Zowyah Lela Yasmin Mansor

Members:

Datuk (Mr) Harjit Singh	Malaysian Society of Transplantation
Dr Teng Seng Chong	Medical Development Division, Ministry of Health
Tan Sri Dato' Seri Dr Mohd. Ismail Merican	Malaysian Liver Foundation
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 Abdul Malik Hussein	Malaysian Orthopaedic Association
Dr Tan Chwee Choon	National Kidney Foundation of Malaysia
Dato' Dr Chang Kian Meng	Malaysian Society of Haematology
Dato' Dr M.Venugopal Balchand	Malaysian Association of Thoracic & Cardiovascular Surgeons
Dr Goh Pik Pin	Clinical Research Centre, Hospital Kuala Lumpur & Malaysian Society of Ophthalmology
Dr Jamaiyah Haniff	Clinical Research Centre, Hospital Kuala Lumpur

Secretariat:
Ms Leong Wei Chee

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 as deemed necessary.
2. To undertake quality control of the reported data.
3. To undertake literature review on 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's 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-chairperson (Adult)	Dr Alan Teh Kee Hean
Co-chairperson (Paeds)	Prof Dr Chan Lee Lee
Members	Prof Gan Gin Gin @ Gan Shiaw Sze
	Dr Hishamshah Mohd Ibrahim
	Prof Madya Dr S Fadilah Abdul Wahid
	Dr Ong Tee Chuan

Discipline: <u>Cornea Transplant</u>

Chairperson	Dr Shamala Retnasabapathy
Members	Prof Dato' Dr Veera Ramani
	Dr Choong Yean Yaw
	Dr Michael Law Sie Haur
	Dr Thiageswari Umapathy
	Dr Chandramalar Santhirathelagan
	Associate Prof Dr Mohtar Ibrahim

Discipline: Heart and Lung Transplant

Chairperson	Mr Mohamed Ezani Hj Md. Taib
Members	Dato' Dr David Chew Soon Ping
	Dr Aizai Azan Abdul Rahim
	Dr Abdul Rais Sanusi
	Dr Ashari Yunus

Discipline: Liver Transplant

Chairperson	Dr Ganesalingam A/L Kanagasabai
Members	Dr Lim Kin Foong
	Dr Haniza Omar
	Dr Lim Chooi Bee
	Prof Dr Lee Way Seah

Discipline: Renal Transplant

Chairperson	Dr Goh Bak Leong
Members	Dato' Dr Zaki Morad Mohd Zaher
	Dato' Dr (Mr) Rohan Malek
	Dr Fan Kin Sing
	Dr S Prasad Menon
	Dr Lily Mushahar
	Dr Lim Soo Kun

Discipline: Bone and Tissue Transplant

Chairperson	Dr Suzina Sheikh Ab Hamid
Members	Dr Abdul Malik Mohamed Hussein
	Assoc Prof Dr Ahmad Hafiz Zulkifly
	Dr Thiageswari Umapathy
	Dr Ewe Teong Wan
	Dr Norimah Yusof
	Assoc Prof Dr Vivek Ajit Singh

Discipline: Cadaveric Organ and Tissue Donations

Chairperson	Datin Dr Fadhilah Zowyah Lela Yasmin Mansor
Members	Dr Hooi Lai Seong
	Dr Omar Sulaiman
	Dr Muhammed Anis Bin Abdul Wahab
	Matron Jamaliah Kario
	Staff Nurse Santi A/P Krishanan

CONTENTS

REPORT SUMMARY

1. BLOOD AND MARROW TRANSPLANTATION

There were 213 new transplantations done in Malaysia in 2009 with 11 centres performing transplants.

The majority of all transplants were for malignant disorders and most of these are haematological malignancies like leukaemia (42%) and lymphoma (32%). The main non-malignant disorders transplanted were thalassaemia and aplastic anaemia (6% each).

Mean age of new transplant patients in 2009 was 31 $\pm$ 18 years; 58% were male, 46% Malay, 37% Chinese, 7% Indian and 9% others. Autologous transplants accounted for 48%. Eighty-five percent of the transplant source was from peripheral blood stem cells and 95% were from Human Leukocyte Antigen (HLA) identical donors.

In 2009, 43 of the transplant recipients died. Underlying disease and infection were the commonest causes of death accounting for 63% and 28% respectively.

2. CORNEAL TRANSPLANTATION

There were 47 centres which provided cornea transplantation data.

Two hundred and nine new cornea transplantations were reported in Malaysia in 2009. Mean age of new transplant recipients in 2009 was 44 $\pm$ 20 years. Of these, 63% were male. Twenty-nine percent of recipients were Malay, 33% were Chinese, 28% were Indian and 10% were other races.

The primary diagnoses for cornea transplantation recipients in 2009 were keratoconus (22%), microbial keratitis (22%), pseudophakic bullous keratopathy (13%), corneal perforation (9%) and corneal dystrophy (8%).

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

In 2009, 62% of donated corneas were from the USA, 20% from local sources and 18% from Sri Lanka. The mean age of the donors was 56 $\pm$ 16 years.

The commonest cornea transplantation surgery performed was penetrating keratoplasty (86%) i.e. transplantation of a full thickness cornea tissue. Graft survival at 1 year was 77%, 65% at 3 years.

3. HEART AND LUNG TRANSPLANTATION

There were a total of 19 patients with heart transplantations reported to the Registry between 1997 and 2009; 1 heart transplant was done in 2009. Eight grafts were functioning at the end of 2009 and all were followed up in Institut Jantung Negara.

The transplant patient survival rate was 59% and 42% at 1 year and 3 years respectively.

There were no lung transplants in 2009. At the end of the year there were 2 patients with lung transplants surviving with functioning graft (from a total of 4 done since 2005).

4. LIVER TRANSPLANTATION

There were a total of 109 liver transplantations reported to the Registry between 1993 and 2009; 62 grafts were functioning by the end of 2009.

There were 8 new liver transplantations done in Malaysia in 2009. There were 5 follow-up centres for liver transplant recipients in 2009.

Mean age of all transplant patients was 8.9 ± 14 years (range 9 months to 74 years); 50% were male, 54% Chinese, 37% Malay, 7% Indian, 70% were for biliary atresia. Majority were living donor liver transplantations (72%).

At the time of transplantation the main immunosuppressive drugs used were tacrolimus (77%) and steroids (63%).

Transplant patient survival rate for the cohort 1993 to 1998 was 71% at 1 year; survival rate for the cohort 1999 to 2009 was 65% at 1 year.

5. RENAL TRANSPLANTATION

There were 57 follow-up centres for renal transplant recipients in 2009. There were 109 new renal transplants in 2009, 4 per million population per year.

The number of functioning renal transplants in 2009 was 1779. The transplant prevalence rate was 63 per million population.

In 2009, the mean age for new transplant recipients was 37±13 years, 60% were male, 12% had diabetes, 7% were anti-HCV positive at the time of transplantation.

Ninety-four percent of prevalent renal transplant recipients were on prednisolone, 64% on cyclosporine, 27% on tacrolimus, 60% mycophenolate mofetil and 22% on azathioprine.

In 2009, 39 (2%) of prevalent transplant recipients died and 34 (2%) lost their grafts. Infection, cardiovascular causes and died at home were the commonest causes of death accounting for 35%, 23% and 21% respectively. Cancers were the fourth commonest cause at 14%. Renal allograft rejection accounted for 68% of graft loss.

The overall transplant patient survival rate from 2000 to 2009 was 95%, 90%, 87% and 79% at 1 year, 3 years, 5 years and 10 years respectively, while the overall graft survival rate for these years was 92%, 86%, 80% and 68% respectively.

6. HEART VALVE TRANSPLANTATION

There were a total of 237 heart valve homografts reported to the Registry between 1996 and 2009; 200 grafts were functioning at the end of 2009. One hundred and six were aortic and 121 were pulmonary valves.

Mean age of all heart valve transplant patients was 10.2 $\pm$ 10 years (range 1 month to 70 years); 50% were male, 64% Malay.

7. BONE AND TISSUE TRANSPLANTATION

In 2009, 42 bone allografts, 3 frozen tendons and 932 amniotic membranes were supplied by Tissue Bank, USM.

Eleven hospitals used the bone grafts and 1 centre used the amniotic membranes. Characteristics were reported for only 16 of the recipients.

8. CADAVERIC ORGAN AND TISSUE DONATION

There had been 143 referrals for donation with 39 donors in 2009, the highest recorded in Malaysia in a calendar year. This translated to a conversion rate of 27%. Eighteen were brain dead multi-organ and tissue donors and 21 were post cardiac death tissue donors. The donation rate was 1.38 donations per million population.

The mean age of the donors was 28.8 $\pm$ 16.7 years, age range 25 days – 68 years of age. Sixty-seven percent were male, 66% were Chinese, 26% Indian, 8% Malay.

Three donors carried the donor pledge card. Nineteen of the donors died from accidents, 13 died from medical causes. Eighty-two percent of donations took place in MOH hospitals, 10% from University hospitals and 8% private 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 (co-chairperson)
Prof Dr Chan Lee Lee (co-chairperson)
Dr Gan Gin Gin
Dr Hishamshah Mohd Ibrahim
Prof Dr S. Fadilah Abdul Wahid
Dr Ong Tee Chuan

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1.0 INTRODUCTION

Haematopoietic Stem Cell Transplantation (HSCT) activity in Malaysia continued to increase at a steady pace and for the first time exceeded 200 new transplants per year in 2009. Overall access to HSCT in the general population still remains low but has increased slightly to 8 per million population. This 6th annual report attempts to provide an accurate record of HSCT activity in 2009.

1.1 STOCK AND FLOW

In 2009 a total of 213 HSCTs were performed. The vast majority (87.7%) were performed in public/university hospitals, the single largest centre being Hospital Ampang which contributed to about 40% of transplants in 2009.

Table 1.1.1: Stock and Flow of Blood and Marrow Transplantation, 1987-2009

Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
New transplant patients	8	6	22	5	12	21	19	25	30	28	33
Deaths	1	1	6	6	1	2	9	5	17	11	15
Lost to follow- up	0	0	0	0	0	0	0	0	0	0	0
Alive at 31st December	7	12	28	27	38	57	67	87	100	117	135

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
New transplant patients	49	62	94	108	114	128	140	148	136	149	181	213
Deaths	17	16	31	47	34	56	52	63	42	50	70	43
Lost to follow- up	0	0	0	0	0	0	0	0	0	0	0	0
Alive at 31st December	167	213	276	337	417	489	577	662	756	855	966	1136

Figure 1.1.1: Stock and Flow of Blood and Marrow Transplantation, 1987-2009

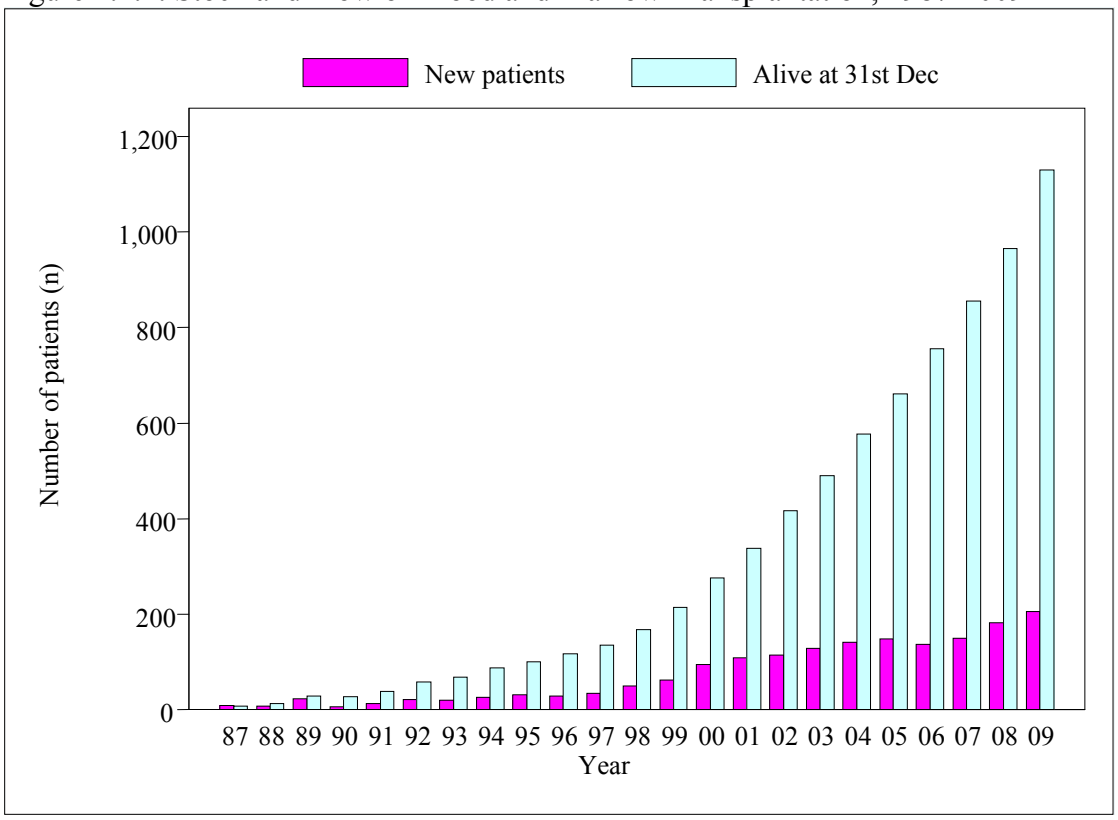


Table 1.1.2: New Transplant Rate per million population (pmp), 1987-2009

Year	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**
New transplant patients	8	6	22	5	12	21	19	25	30	28	33
New transplant rate pmp	1	0	1	0	1	1	1	1	1	1	2

Year	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
New transplant patients	49	62	94	108	114	128	140	148	136	149	181	213
New transplant rate pmp	2	3	4	5	5	5	5	6	5	5	7	8

Figure 1.1.2: New Transplant Rate per million population (pmp), 1987-2009

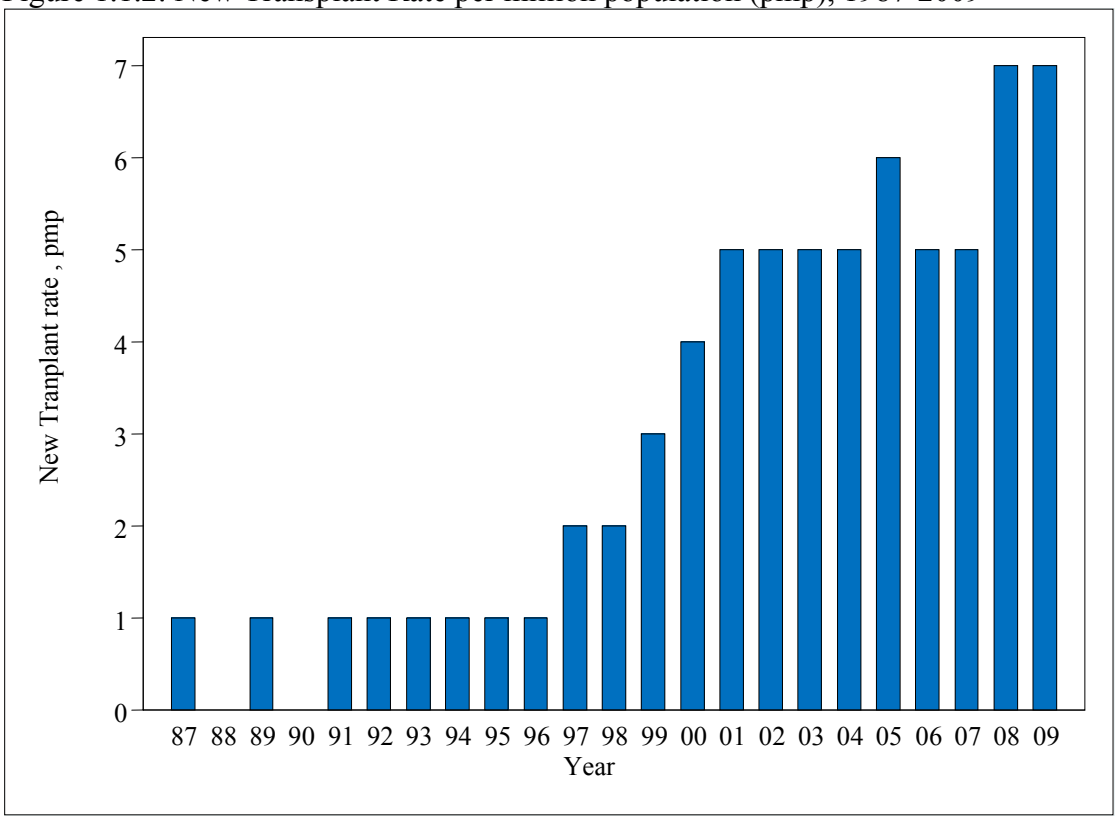


Table 1.1.3: Distribution of Patients by Transplant Centre, 1987-2009

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
SJMCA	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
SJMCP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HUSM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
APSH	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HPP	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	30	11	18	13	14
UMP	17	68	13	43	11	39	15	46	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
HUSM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
APSH	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HPP	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**

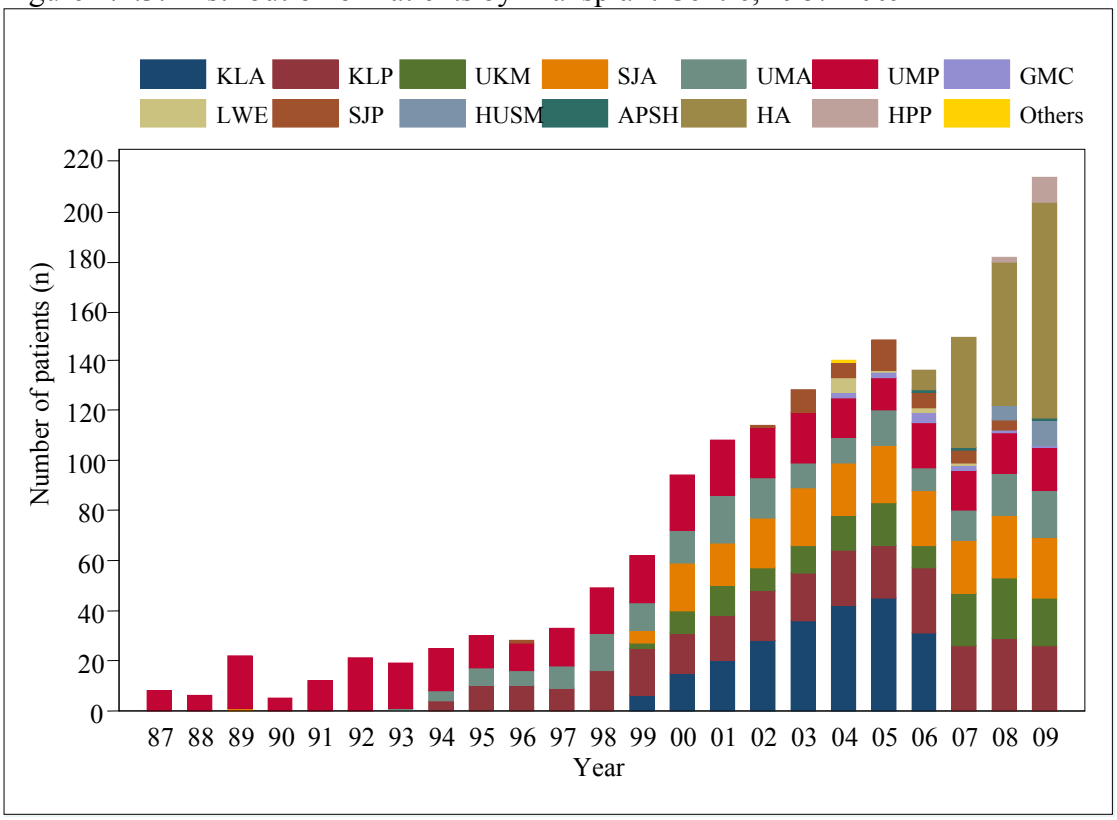
Year	2001		2002		2003		2004		2005		2006		2007	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
KLA	20	19	28	25	36	28	42	30	45	30	31	23	0	0
KLP	18	17	20	18	19	15	22	16	21	14	26	19	26	17
UKM	12	11	9	8	11	9	14	10	17	11	9	7	21	14
SJA	17	16	20	18	23	18	21	15	23	16	22	16	21	14
UMA	19	18	16	14	10	8	10	7	14	9	9	7	12	8
UMP	22	20	20	18	20	16	16	11	13	9	18	13	16	11
GMC	0	0	0	0	0	0	2	1	2	1	4	3	2	1
LWE	0	0	0	0	0	0	6	4	1	1	2	1	1	1
SJP	0	0	1	1	9	7	6	4	12	8	6	4	5	3
HUSM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
APSH	0	0	0	0	0	0	0	0	0	0	1	1	1	1
HA	0	0	0	0	0	0	0	0	0	0	8	6	44	30
HPP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Others	0	0	0	0	0	0	1	1	0	0	0	0	0	0
TOTAL	**108**	**100**	**114**	**100**	**128**	**100**	**140**	**100**	**148**	**100**	**136**	**100**	**149**	**100**

Year	2008		2009		Total	
	No.	%	No.	%	No.	%
KLA	0	0	0	0	223	13
KLP	29	16	26	12	291	17
UKM	24	13	19	9	147	8
SJA	25	14	24	11	221	13
UMA	17	9	19	9	192	11
UMP	16	9	17	8	364	21
GMC	1	1	1	0	12	1
LWE	0	0	0	0	10	1
SJP	4	2	0	0	44	3
HUSM	6	3	10	5	16	1
APSH	0	0	1	0	3	0
HA	57	31	86	40	195	11
HPP	2	1	10	5	12	1
Others	0	0	0	0	1	0
TOTAL	**181**	**100**	**213**	**100**	**1731**	**100**

*Others include Royal Perth Australia Hospital

KLA	Hospital Kuala Lumpur, (Adult)
KLP	Hospital Kuala Lumpur, Institute Paediatrics (Paed)
UKM	Hospital Universiti Kebangsaan Malaysia
SJA	Sime Darby Medical Centre, Subang Jaya (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, Subang Jaya (Paed)
HUSM	Hospital Universiti Sains Malaysia
APSH	Ampang Puteri Specialist Hospital
HA	Hospital Ampang
HPP	Hospital Pulau Pinang

Figure 1.1.3: Distribution of Patients by Transplant Centre, 1987-2009



1.2 RECIPIENTS' CHARACTERISTICS

Out of the 213 HSCTs, there was a male preponderance, the male:female ratio being 58:42, which is similar to the cumulative gender ratio since 1987. The ethnic breakdown was 46%, 37%, 7%, 7% and 2% for Malay, Chinese, Indian, Bumiputra East Malaysians and Others respectively. The proportion of patients aged younger than 20 years transplanted was lower in 2009 compared with the previous year (29% vs. 37%). This is consistent with the trend to an increasing number of adults being transplanted over the years. The commonest indications for HSCT were acute leukaemia, lymphoma and hypoplastic anaemia. There has been a significant drop in the number of patients transplanted for chronic leukemia, probably reflecting the use of medical (TKI) therapy in this group of patients in preference to HSCT.

Table 1.2.1: Distribution of Patients by Gender, 1987-2009

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**		**2008**		**2009**		**Total**	
Gender	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Male	71	55	84	60	71	48	80	59	90	60	99	55	124	58	989	57
Female	57	45	56	40	77	52	56	41	59	40	82	45	89	42	742	43
TOTAL	**128**	**100**	**140**	**100**	**148**	**100**	**136**	**100**	**149**	**100**	**181**	**100**	**213**	**100**	**1731**	**100**

Figure 1.2.1: Distribution of Patients by Gender, 1987-2009

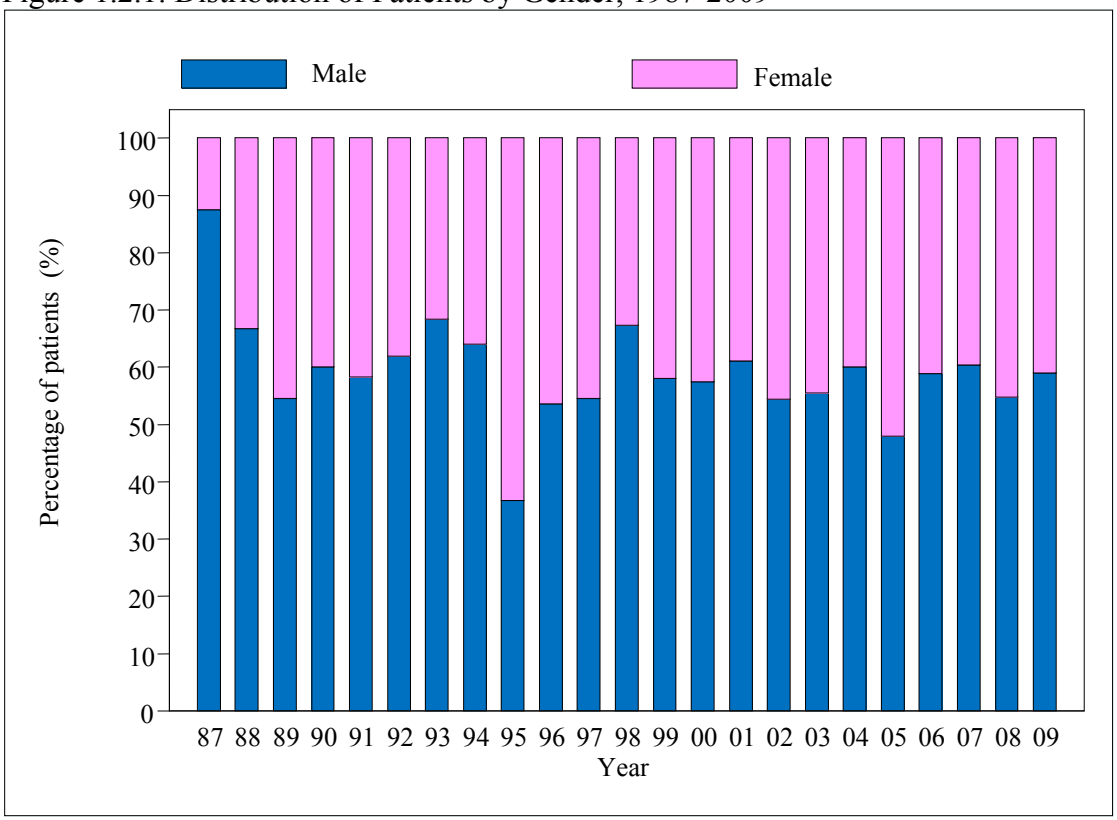


Table 1.2.2: Distribution of Patients by Ethnic Group, 1987-2009

Year	**1987**		**1988**		**1989**		**1990**		**1991**		**1992**		**1993**		**1994**	
Race	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Malay	2	25	4	67	13	59	2	40	4	33	4	19	3	16	9	36
Chinese	5	63	2	33	8	36	3	60	7	58	10	48	10	53	12	48
Indian	1	13	0	0	0	0	0	0	1	8	4	19	1	5	0	0
Bumiputra Sabah	0	0	0	0	1	5	0	0	0	0	2	10	3	16	4	16
Bumiputra Sarawak	0	0	0	0	0	0	0	0	0	0	0	0	2	10	0	0
Others	0	0	0	0	0	0	0	0	0	0	1	5	0	0	0	0
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**	
Race	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Malay	7	23	8	29	9	27	20	41	31	50	33	35	47	44	37	32
Chinese	14	47	11	39	20	61	24	49	26	42	48	51	48	44	65	57
Indian	3	10	6	21	0	0	4	8	4	6	7	7	8	7	8	7
Bumiputra Sabah	1	3	0	0	1	3	0	0	0	0	3	3	1	1	1	1
Bumiputra Sarawak	0	0	3	11	0	0	0	0	0	0	0	0	1	1	1	1
Others	5	17	0	0	3	9	1	2	1	2	3	3	3	3	2	2
TOTAL	**30**	**100**	**28**	**100**	**33**	**100**	**49**	**100**	**62**	**100**	**94**	**100**	**108**	**100**	**114**	**100**

Year	**2003**		**2004**		**2005**		**2006**		**2007**		**2008**		**2009**		**Total**	
Race	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Malay	46	36	51	36	53	36	61	45	59	40	77	43	99	46	679	39
Chinese	65	51	63	45	69	47	50	37	59	40	71	39	79	37	769	44
Indian	6	5	9	6	14	9	11	8	18	12	12	7	14	7	131	8
Bumiputra Sabah	4	3	9	6	5	3	7	5	6	4	14	8	9	4	71	4
Bumiputra Sarawak	4	3	7	5	5	3	2	1	1	1	5	3	7	3	38	2
Others	3	2	1	1	2	1	5	4	6	4	2	1	5	2	43	2
TOTAL	**128**	**100**	**140**	**100**	**148**	**100**	**136**	**100**	**149**	**100**	**181**	**100**	**213**	**100**	**1731**	**100**

Figure 1.2.2: Distribution of Patients by Ethnic Group, 1987-2009

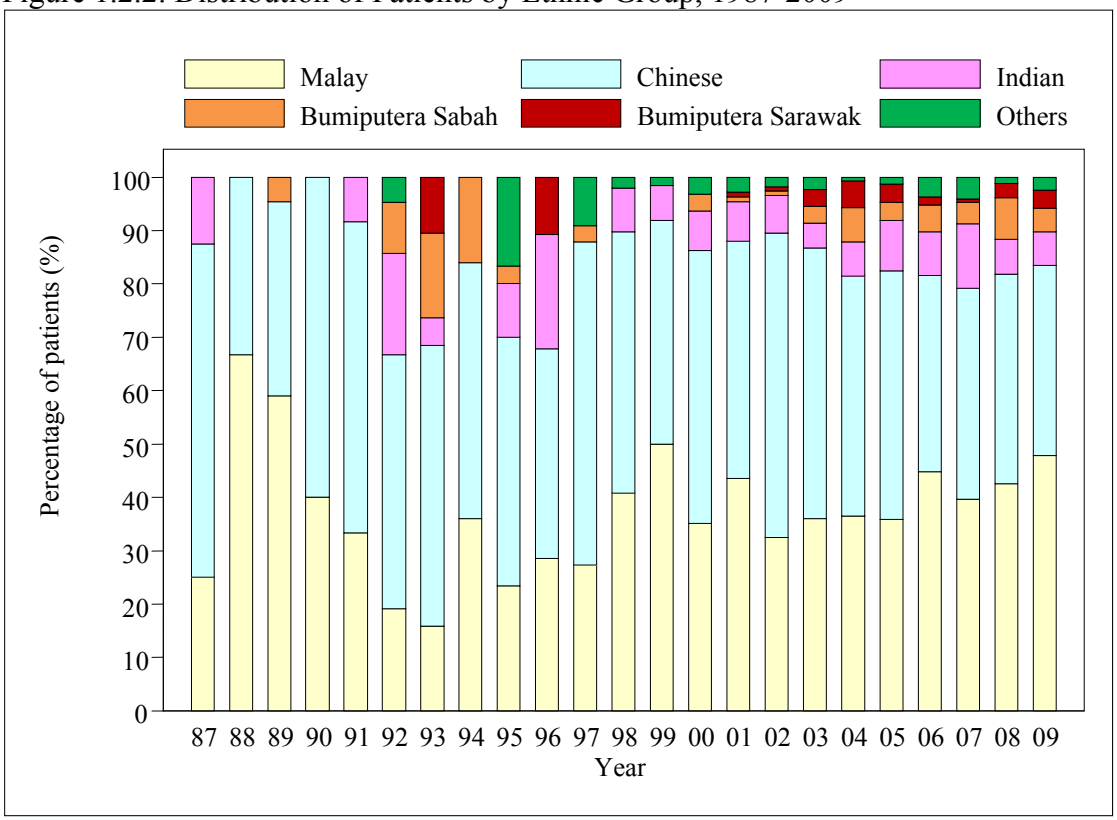


Table 1.2.3: Distribution of Patients by Age Group, 1987-2009

Year	**1987**		**1988**		**1989**		**1990**		**1991**		**1992**		**1993**		**1994**	
Age group	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
0-9	4	50	4	67	17	77	5	100	10	83	15	71	9	47	11	44
10-19	4	50	2	33	5	23	0	0	2	17	6	29	10	53	11	44
20-39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	12
40-59	0	0	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	0	0
TOTAL	**8**	**100**	**6**	**100**	**22**	**100**	**5**	**100**	**12**	**100**	**21**	**100**	**19**	**100**	**25**	**100**
Mean	9		7		8		6		6		7		9		11	
SD	4		3		3		3		4		4		5		7	
Median	9		8		8		6		6		6		10		11	
Minimum	2		2		1		2		1		1		1		1	
Maximum	15		10		13		9		13		14		17		29	

Year	**1995**		**1996**		**1997**		**1998**		**1999**		**2000**		**2001**		**2002**	
Age group	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
0-9	12	40	13	46	19	58	21	43	28	45	27	29	23	21	30	26
10-19	13	43	12	43	8	24	16	33	15	24	27	29	28	26	25	22
20-39	4	13	3	11	5	15	12	24	12	19	19	20	40	37	36	32
40-59	1	3	0	0	1	3	0	0	7	11	20	21	16	15	23	20
≥60	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0
TOTAL	**30**	**100**	**28**	**100**	**33**	**100**	**49**	**100**	**62**	**100**	**94**	**100**	**108**	**100**	**114**	**100**
Mean	13		11		12		13		17		23		23		23	
SD	9		9		12		10		15		17		16		16	
Median	11		11		6		10		11		18		22		22	
Minimum	3		1		1		5 months		1		1		1 month		1	
Max	41		37		45		39		57		61		64		55	

Year	**2003**		**2004**		**2005**		**2006**		**2007**		**2008**		**2009**		**Total**	
Age group	**No.**	**%**	**No.**	**%.**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
0-9	42	33	26	19	29	20	40	29	38	26	25	14	36	17	484	28
10-19	18	14	41	29	32	22	29	21	22	15	42	23	26	12	394	23
20-39	47	37	52	37	50	34	38	28	35	23	63	35	76	36	495	29
40-59	21	16	19	14	36	24	25	18	43	29	47	26	67	31	326	19
≥60	0	0	2	1	1	1	4	3	11	7	4	2	8	4	32	2
TOTAL	**128**	**100**	**140**	**100**	**148**	**100**	**136**	**100**	**149**	**100**	**181**	**100**	**213**	**100**	**1731**	**100**
Mean	22		23		26		24		29		28		31		23	
SD	15		15		16		18		20		17		18		17	
Median	23		20		24		19		28		25		28		19	
Minimum	5 months		1		1		1		1		2		1		1 month	
Max	52		70		66		69		68		66		72		72	

Figure 1.2.3: Distribution of Patients by Age Group, 1987-2009

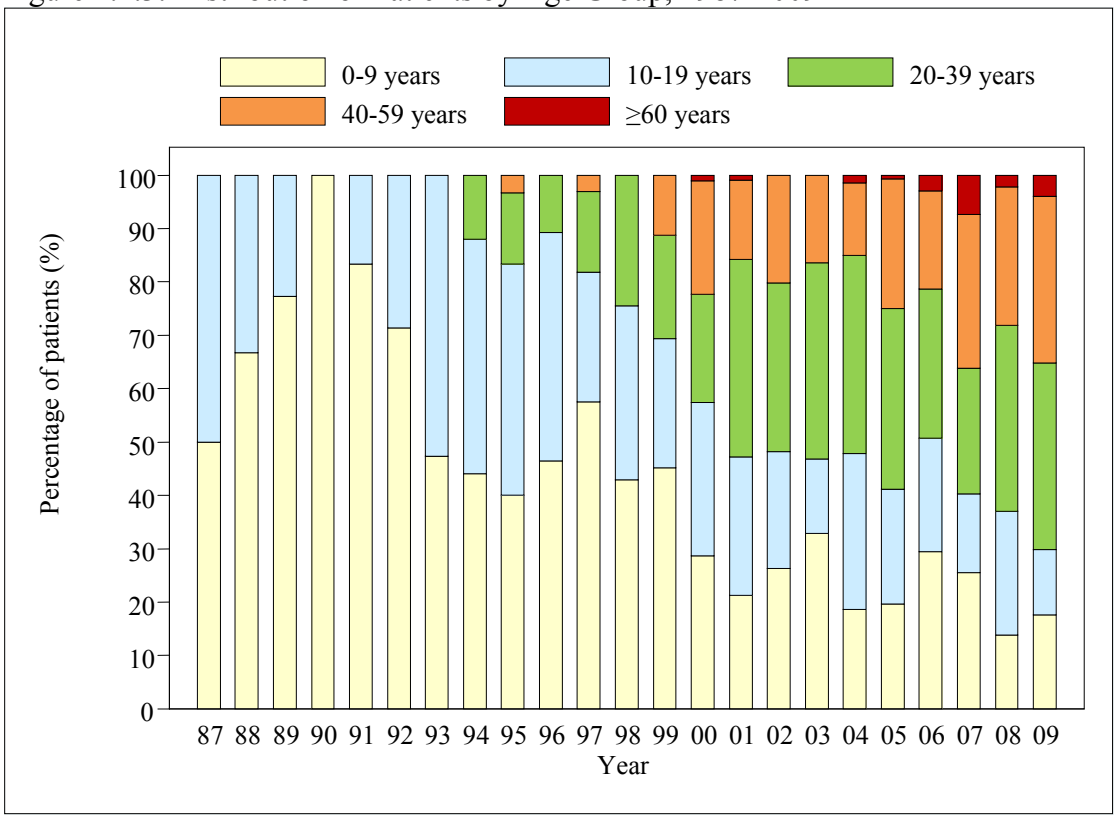


Table 1.2.4: Distribution of Patients by Primary Diagnosis, 1987-2009

Year	**1987**		**1988**		**1989**		**1990**		**1991**		**1992**		**1993**		**1994**	
Diagnosis	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Acute leukaemia	5	63	4	67	8	36	2	40	1	8	4	19	6	32	8	32
Chronic leukaemia	0	0	0	0	1	5	1	20	1	8	4	19	2	11	4	16
Hypoplastic anaemia	2	25	0	0	4	18	0	0	4	33	5	24	4	21	5	20
Erythrocytic disorders	0	0	0	0	1	5	1	20	1	8	1	5	0	0	0	0
Lymphoma	0	0	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	2	11	1	4
Myelodysplasia	0	0	0	0	0	0	0	0	0	0	0	0	1	5	2	8
Haemoglobinopathy	1	13	2	33	7	32	1	20	4	33	4	19	2	11	5	20
Multiple myeloma	0	0	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	2	11	0	0
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**	
Diagnosis	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Acute leukaemia	10	33	13	46	11	33	23	47	28	45	37	39	48	44	48	42
Chronic leukaemia	5	17	5	18	6	18	7	14	7	11	13	14	18	17	19	17
Hypoplastic anaemia	8	27	4	14	5	15	4	8	5	8	11	12	7	6	5	4
Erythrocytic disorders	0	0	1	4	0	0	0	0	0	0	0	0	0	0	1	1
Lymphoma	0	0	0	0	2	6	5	10	6	10	19	20	23	21	20	18
Solid tumors	1	3	0	0	2	6	5	10	7	11	2	2	1	1	4	4
Myelodysplasia	0	0	0	0	0	0	1	2	0	0	1	1	4	4	4	4
Haemoglobinopathy	5	17	5	18	6	18	2	4	4	6	7	7	4	4	8	7
Multiple myeloma	0	0	0	0	0	0	0	0	3	5	1	1	1	1	4	4
Others	1	3	0	0	1	3	2	4	2	3	3	3	2	2	1	1
TOTAL	**30**	**100**	**28**	**100**	**33**	**100**	**49**	**100**	**62**	**100**	**94**	**100**	**108**	**100**	**114**	**100**

Year	**2003**		**2004**		**2005**		**2006**		**2007**		**2008**		**2009**		**Total**	
Diagnosis	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Acute leukaemia	44	34	46	33	58	39	45	33	57	38	68	38	83	39	657	38
Chronic leukaemia	18	14	22	16	13	9	9	7	7	5	4	2	9	4	175	10
Hypoplastic anaemia	5	4	12	9	6	4	15	11	13	9	19	10	13	6	156	9
Erythrocytic disorders	2	2	0	0	0	0	0	0	0	0	1	1	1	0	10	1
Lymphoma	28	22	36	26	38	26	33	24	36	24	50	28	69	32	365	21
Solid tumors	3	2	2	1	2	1	6	4	5	3	1	1	2	1	49	3
Myelodysplasia	3	2	5	4	4	3	3	2	2	1	6	3	3	1	39	2
Haemoglobinopathy	17	13	9	6	17	11	12	9	13	9	12	7	12	6	159	9
Multiple myeloma	5	4	3	2	8	5	10	7	16	11	18	10	17	8	86	5
Others	3	2	5	4	2	1	3	2	0	0	2	1	4	2	35	2
TOTAL	**128**	**100**	**140**	**100**	**148**	**100**	**136**	**100**	**149**	**100**	**181**	**100**	**213**	**100**	**1731**	**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

There was a jump in the number of autologous transplants seen in 2009, the allogeneic:autologous ratio declining from 64:36 in 2008 to 52:48 in 2009. The commonest stem cell source was peripheral blood stem cells (PBSC) which formed 85% of HSCT done. Bone marrow and cord blood stem cells contributed 11% and 4% to the total, respectively.

Of the 110 allogeneic HSCT performed in 2009, 104 (95%) were HLA-identical donors, the vast majority being sibling matched donors. The recourse to unrelated donors remains low at 10% in Malaysia compared with Japan, Singapore and Hong Kong where 40-60% of HSCT used unrelated donors.

Table 1.3.1: Distribution of Patients by Graft Number, 1987-2009

Year	1987		1988		1989		1990		1991		1992		1993		1994	
Graft number	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1	8	100	6	100	19	86	4	80	9	75	19	91	18	95	24	96
2	0	0	0	0	2	9	1	20	3	25	2	10	1	5	1	4
3	0	0	0	0	1	5	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**	**25**	**100**

Year	1995		1996		1997		1998		1999		2000		2001		2002	
Graft number	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1	29	97	28	100	31	94	47	96	61	98	91	97	103	95	113	99
2	1	3	0	0	1	3	1	2	1	2	3	3	5	5	1	1
3	0	0	0	0	1	3	1	2	0	0	0	0	0	0	0	0
TOTAL	**30**	**100**	**28**	**100**	**33**	**100**	**49**	**100**	**62**	**100**	**94**	**100**	**108**	**100**	**114**	**100**

Year	2003		2004		2005		2006		2007		2008		2009		Total	
Graft number	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1	125	98	135	98	137	99	132	98	122	98	159	92	205	97	1625	97
2	3	2	3	2	2	1	2	2	2	2	13	8	6	3	54	3
3	0	0	0	0	0	0	1	1	0	0	0	0	0	0	4	0
TOTAL	**128**	**100**	**138**	**100**	**139**	**100**	**135**	**100**	**124**	**100**	**172**	**100**	**211**	**100**	**1683**	**100**

Note: Data not available for graft number = 48 cases (3%)

Figure 1.3.1: Distribution of Patients by Graft Number, 1987-2009

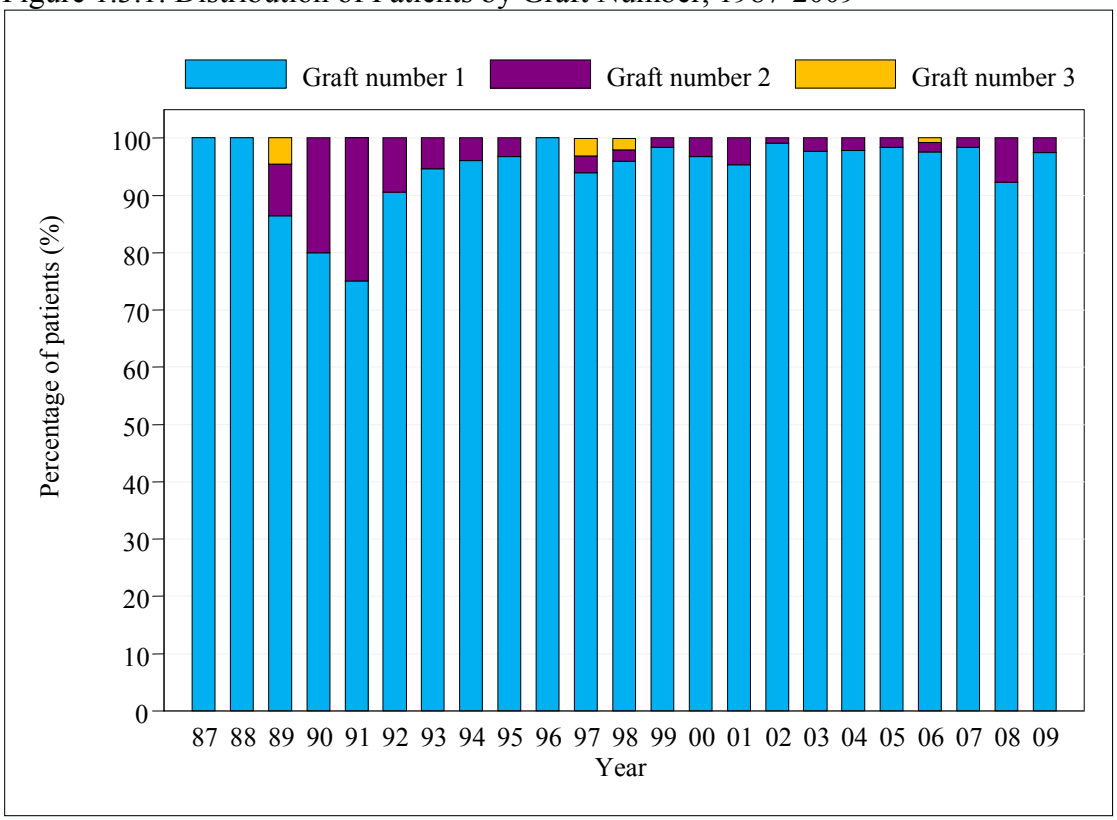


Table 1.3.2: Distribution of Patients by Transplantation Type, 1987-2009

Year	1987		1988		1989		1990		1991		1992		1993		1994	
Type of transplant	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Allogeneic + Syngeneic	8	100	6	100	21	95	5	100	12	100	20	95	18	95	24	96
Autologous	0	0	0	0	1	5	0	0	0	0	1	5	1	5	1	4
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	
Type of transplant	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Allogeneic + Syngeneic	29	97	26	93	27	82	32	65	44	71	56	60	75	69	75	66
Autologous	1	3	2	7	6	18	17	35	18	29	38	40	33	31	39	34
TOTAL	**30**	**100**	**28**	**100**	**33**	**100**	**49**	**100**	**62**	**100**	**94**	**100**	**108**	**100**	**114**	**100**

Year	2003		2004		2005		2006		2007		2008		2009		Total	
Type of transplant	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Allogeneic + Syngeneic	83	65	90	64	91	61	87	64	75	50	115	64	110	52	1129	65
Autologous	45	35	50	36	57	39	49	36	74	50	66	36	103	48	602	35
TOTAL	**128**	**100**	**140**	**100**	**148**	**100**	**136**	**100**	**149**	**100**	**181**	**100**	**213**	**100**	**1731**	**100**

Figure 1.3.2: Distribution of Patients by Transplantation Type, 1987-2009

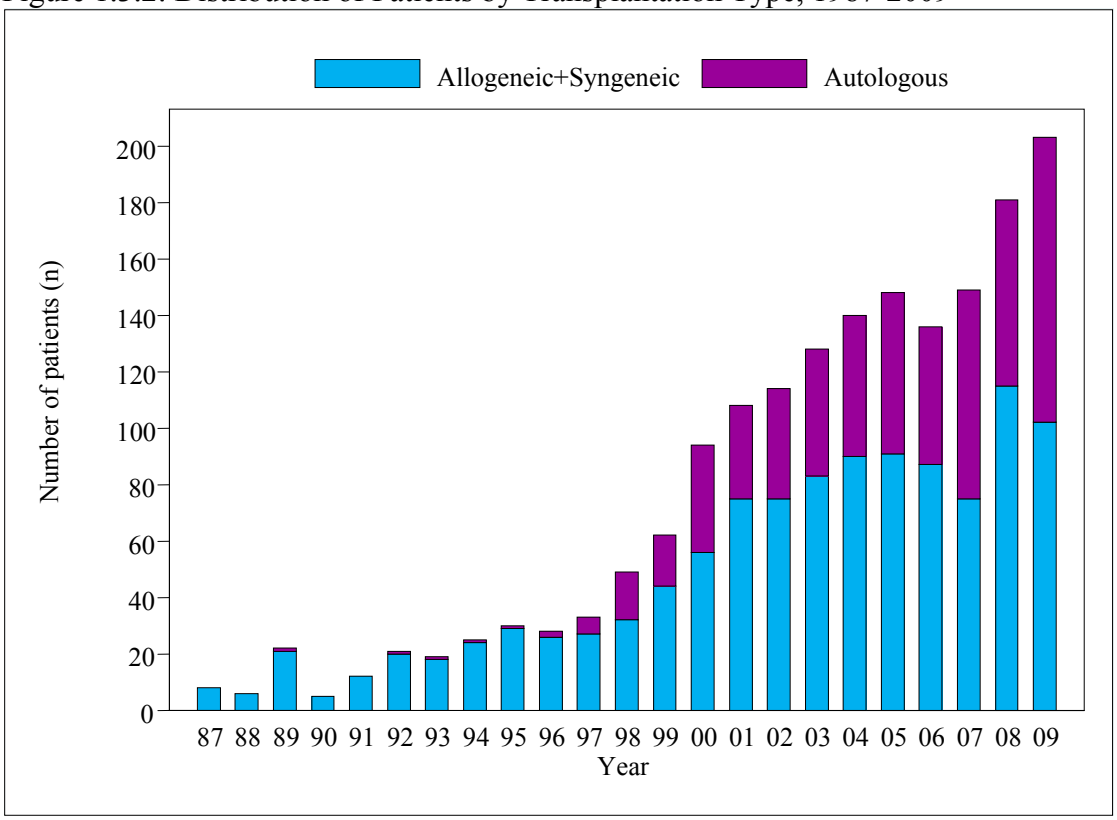


Table 1.3.3: Type of Transplant by Centre, 1987-2009

Type of transplant	Allogeneic + Syngeneic		Autologous		TOTAL	
Centre	**No.**	**%**	**No.**	**%**	**No.**	**%**
KLA	112	10	111	18	223	13
KLP	262	23	29	5	291	17
UKM	75	7	72	12	147	8
SJA	84	7	137	23	221	13
UMA	131	12	61	10	192	11
UMP	321	28	43	7	364	21
GMC	5	0	7	1	12	1
LWE	9	1	1	0	10	1
SJP	38	3	6	1	44	3
HUSM	0	0	16	3	16	1
APSH	2	0	1	0	3	0
HA	89	8	106	18	195	11
HPP	0	0	12	2	12	1
Other	1	0	0	0	1	0
TOTAL	**1129**	**100**	**602**	**100**	**1731**	**100**

Figure 1.3.3: Type of Transplant by Centre, 1987-2009

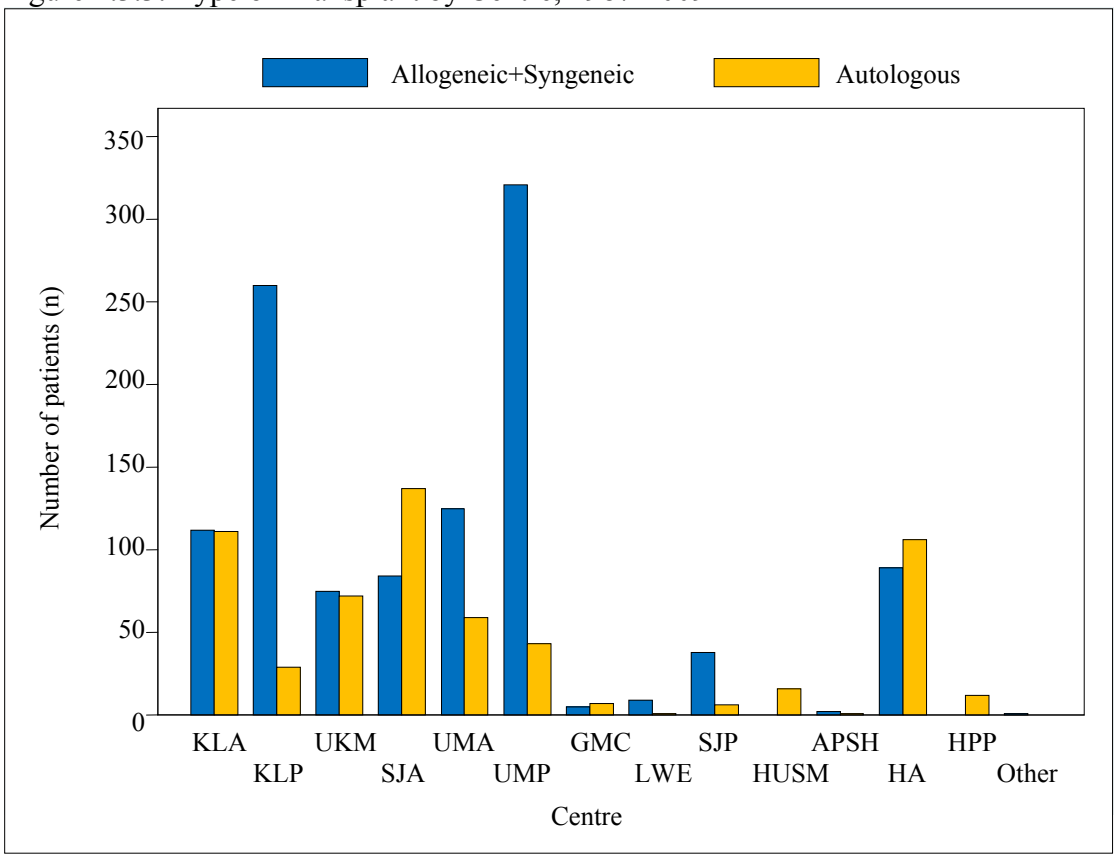


Table 1.3.4: Source of Stem Cells, 1987-2009

Year	**1987**		**1988**		**1989**		**1990**		**1991**		**1992**		**1993**		**1994**	
Transplant source	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Marrow	8	100	6	100	22	100	5	100	12	100	21	100	19	100	25	100
PBSC / Marrow + PBSC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cord blood / Marrow + cord	0	0	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**	**25**	**100**

Year	**1995**		**1996**		**1997**		**1998**		**1999**		**2000**		**2001**		**2002**	
Transplant source	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Marrow	30	100	28	100	24	73	25	51	37	60	31	33	30	28	31	27
PBSC / Marrow + PBSC	0	0	0	0	7	21	23	47	23	37	57	61	74	69	79	69
Cord blood / Marrow + cord	0	0	0	0	2	6	1	2	2	3	6	6	4	4	4	4
TOTAL	**30**	**100**	**28**	**100**	**33**	**100**	**49**	**100**	**62**	**100**	**94**	**100**	**108**	**100**	**114**	**100**

Year	**2003**		**2004**		**2005**		**2006**		**2007**		**2008**		**2009**		**Total**	
Transplant source	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Marrow	44	34	30	21	25	17	17	13	23	15	20	11	23	11	536	31
PBSC / Marrow + PBSC	79	62	101	72	116	78	109	80	119	80	152	84	181	85	1120	65
Cord blood / Marrow + cord	5	4	9	6	7	5	10	7	7	5	9	5	9	4	75	4
TOTAL	**128**	**100**	**140**	**100**	**148**	**100**	**136**	**100**	**149**	**100**	**181**	**100**	**213**	**100**	**1731**	**100**

Figure 1.3.4: Source of Stem Cells, 1987-2009

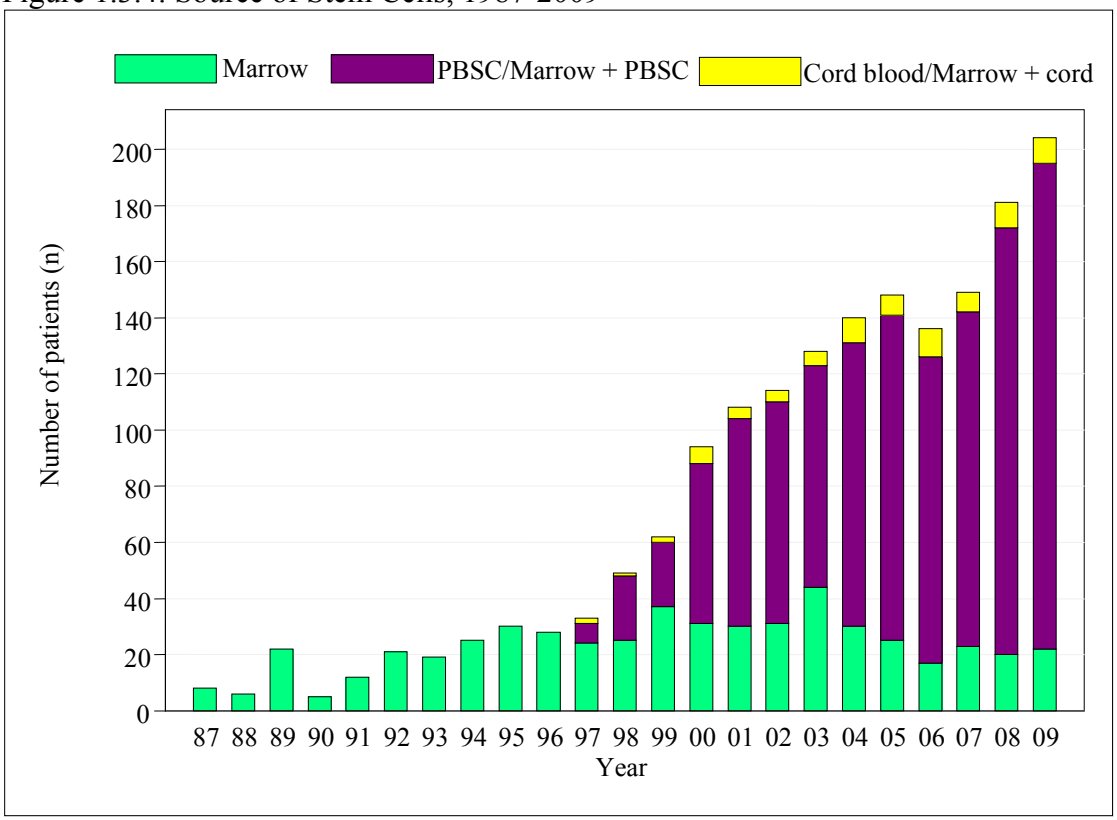


Table 1.3.5: Distribution of Patients by HLA Match, 1987-2009

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	78	94	83	92	86	95	81	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**	**83**	**100**	**90**	**100**	**91**	**100**	**87**	**100**

Year	**2007**		**2008**		**2009**		**Total**	
HLA Match	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Identical	68	91	102	89	104	95	1057	94
1 AG	4	5	7	6	2	2	40	4
2 AG	2	3	6	5	3	3	29	3
≥3 AG Disparate	1	1	0	0	1	1	3	0
TOTAL	**75**	**100**	**115**	**100**	**110**	**100**	**1129**	**100**

Table 1.3.6: Distribution of Patients by Allogeneic Donor Relationship, 1987-2009

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	80	96	81	90	83	91	76	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**	**83**	**100**	**90**	**100**	**91**	**100**	**87**	**100**

Year	**2007**		**2008**		**2009**		**Total**	
Allogeneic Donor Relationship	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Sibling	65	87	102	89	98	89	1051	93
Unrelated	10	13	13	11	11	10	74	7
▪ Marrow	1	10	0	0	0	0	6	8
▪ PBSC / Marrow + PBSC	2	20	5	38	2	18	13	18
▪ Cord blood / Marrow + cord	7	70	8	62	9	82	55	74
Others	0	0	0	0	1	1	4	0
TOTAL	**75**	**100**	**115**	**100**	**110**	**100**	**1129**	**100**

*excluding autologous, including syngeneic

1.4 TRANSPLANT OUTCOMES

A total of 43 deaths were reported for the 213 HSCT in 2009 making the mortality rate 20%. Underlying disease contributed to 63% of these deaths followed by sepsis in 28% and graft-versus-host disease in 2%.

Paediatric patients had better survival rates as shown in Figure 1.4.3. The survival curve for the most recent transplants (fig 1.4.1 1987-2009) compared with the previous decade is inferior most probably because of a higher proportion of older patients and poorer risk (e.g. more advanced disease) had access to HSCT and more complicated unrelated donor HSCT had been undertaken.

Table 1.4.1: Distribution of Patients by Cause of Death, 1987-2009

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	24	6	55
GVHD	0	0	0	0	0	0	4	24	0	0
Underlying disease	0	0	6	67	3	60	3	18	3	27
Haemorrhage	0	0	1	11	0	0	2	12	1	9
VOD	0	0	0	0	0	0	1	6	1	9
Organ Failure	1	50	0	0	1	20	2	12	0	0
Interstitial pneumonitis	0	0	0	0	0	0	0	0	0	0
Secondary malignancy	0	0	0	0	0	0	1	6	0	0
Others	0	0	0	0	0	0	0	0	0	0
Unknown	0	0	0	0	0	0	0	0	0	0
TOTAL	**2**	**100**	**9**	**100**	**5**	**100**	**17**	**100**	**11**	**100**

Year	1997		1998		1999		2000		2001	
Cause of death	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Sepsis	5	33	1	6	6	38	2	6	4	9
GVHD	0	0	2	12	1	6	2	6	4	9
Underlying disease	9	60	11	65	7	44	22	71	33	70
Haemorrhage	0	0	1	6	0	0	3	10	2	4
VOD	0	0	0	0	0	0	1	3	2	4
Organ Failure	1	7	0	0	1	6	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	1	6	1	6	0	0	0	0
Unknown	0	0	0	0	0	0	0	0	0	0
TOTAL	**15**	**100**	**17**	**100**	**16**	**100**	**31**	**100**	**47**	**100**

Year	2002		2003		2004		2005		2006	
Cause of death	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Sepsis	6	18	15	27	11	21	14	22	8	19
GVHD	3	9	5	9	9	17	7	11	2	5
Underlying disease	21	62	31	55	28	54	35	56	28	67
Haemorrhage	0	0	0	0	2	4	2	3	1	2
VOD	0	0	0	0	0	0	0	0	3	7
Organ Failure	3	9	2	4	0	0	2	3	0	0
Interstitial pneumonitis	0	0	1	2	0	0	2	3	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	1	3	2	4	2	4	1	2	0	0
TOTAL	**34**	**100**	**56**	**100**	**52**	**100**	**63**	**100**	**42**	**100**

Year	2007		2008		2009		Total	
Cause of death	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Sepsis	10	20	14	20	12	28	124	21
GVHD	3	6	7	10	1	2	51	9
Underlying disease	29	58	37	53	27	63	344	58
Haemorrhage	1	2	5	7	1	2	23	4
VOD	0	0	3	4	0	0	11	2
Organ Failure	0	0	0	0	1	2	14	2
Interstitial pneumonitis	0	0	2	3	1	2	10	2
Secondary malignancy	0	0	0	0	0	0	1	0
Others	6	12	1	1	0	0	9	2
Unknown	1	2	1	1	0	0	8	1
TOTAL	**50**	**100**	**70**	**100**	**43**	**100**	**595**	**100**

Figure 1.4.1: Patient Survival by Year of Transplant, 1987-2009

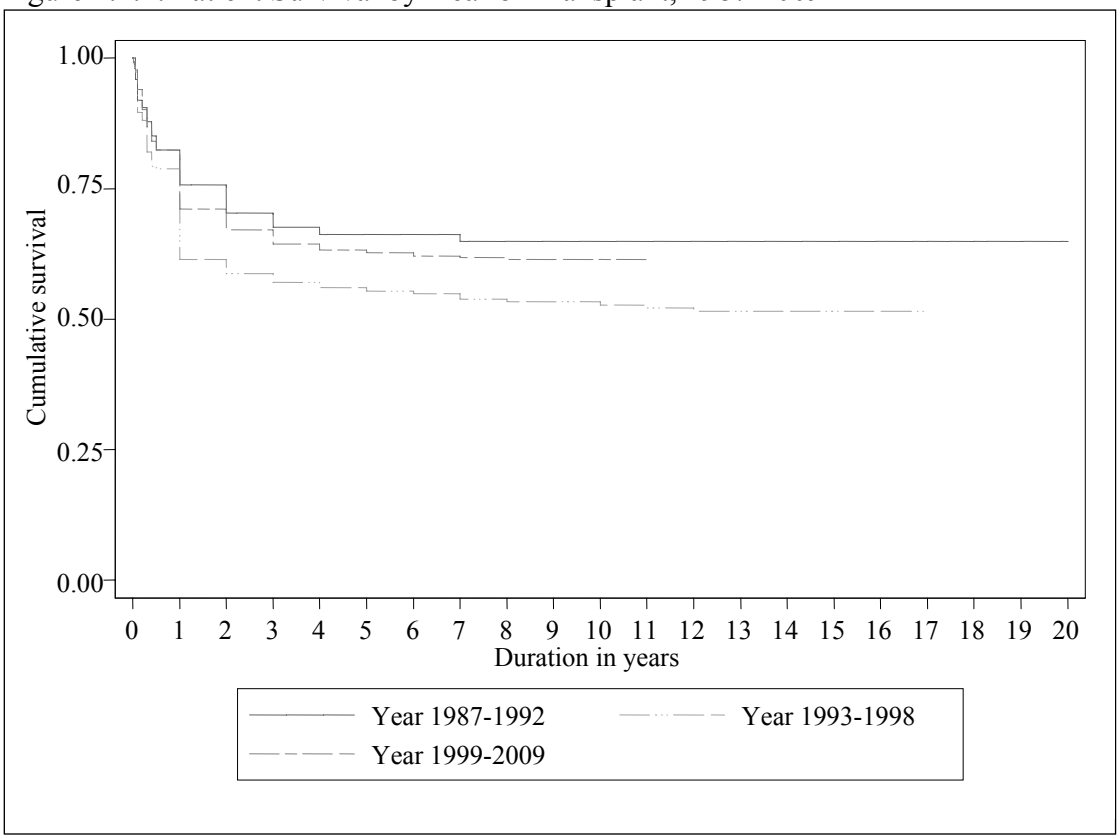


Figure 1.4.2: Patient Survival by Gender, 1987-2009

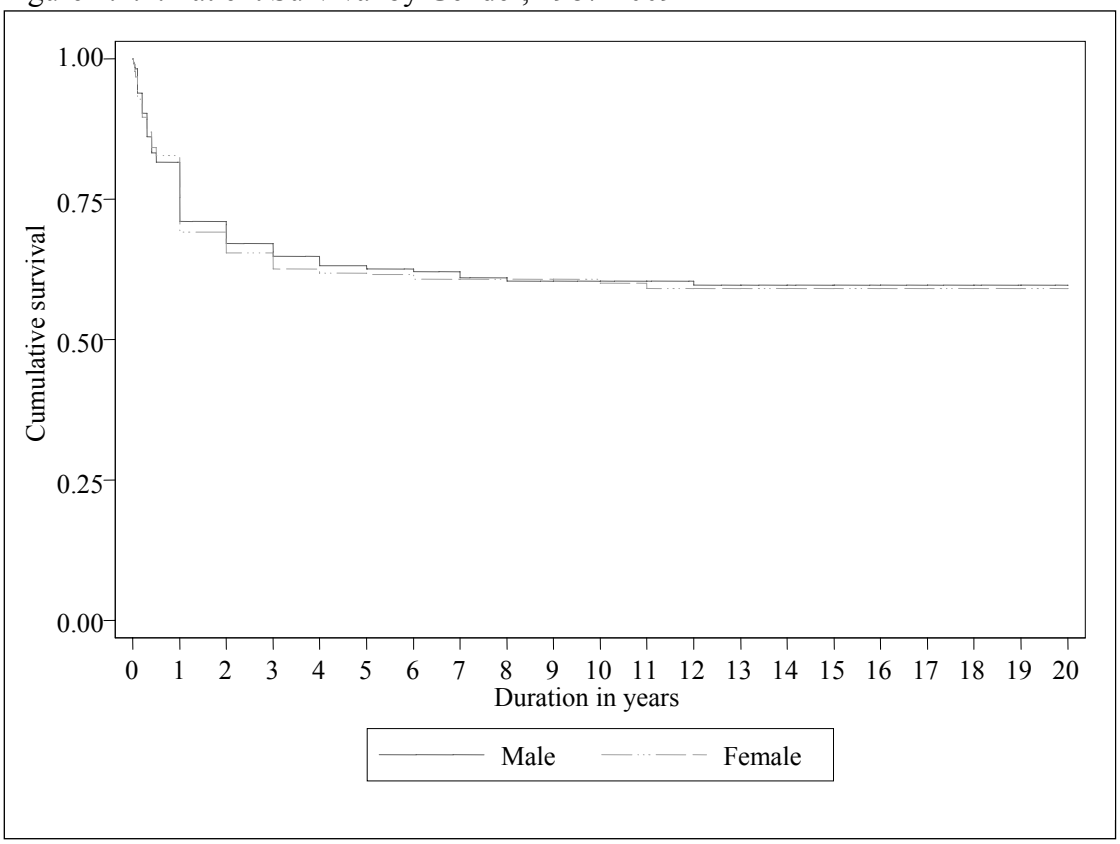


Figure 1.4.3: Patient Survival by Age Group, 1987-2009

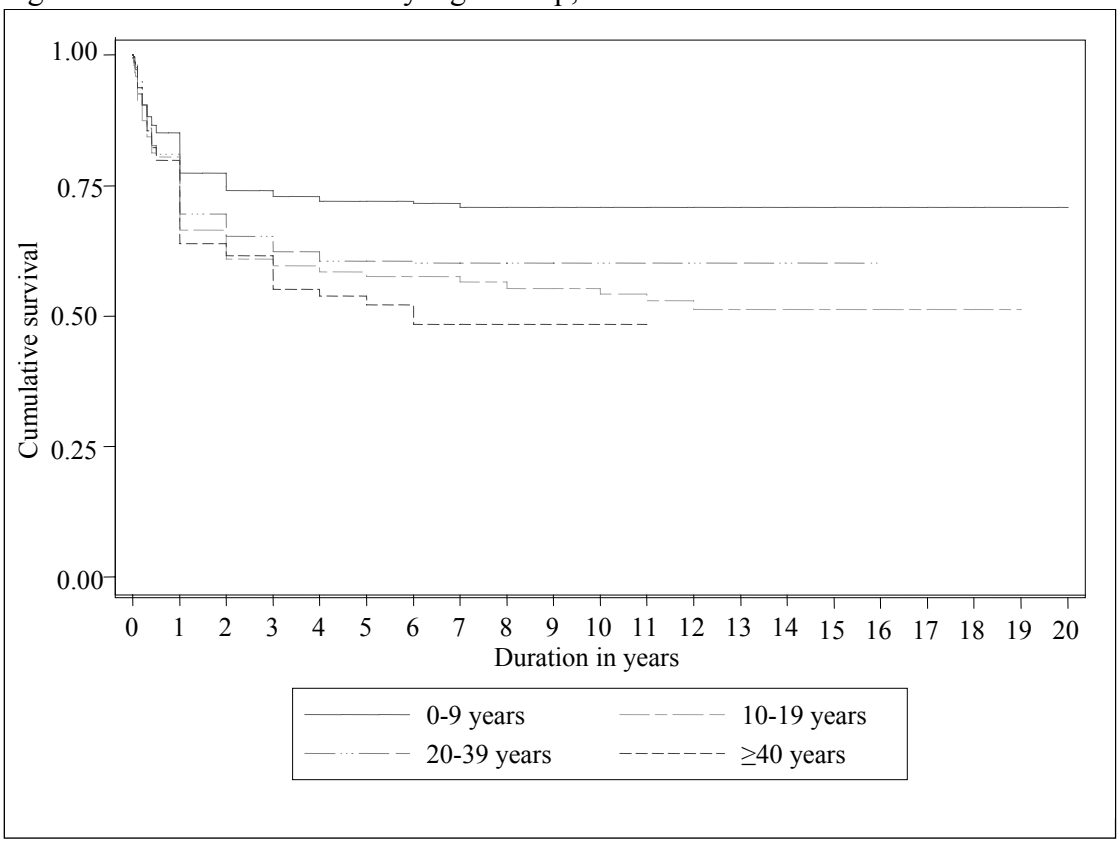
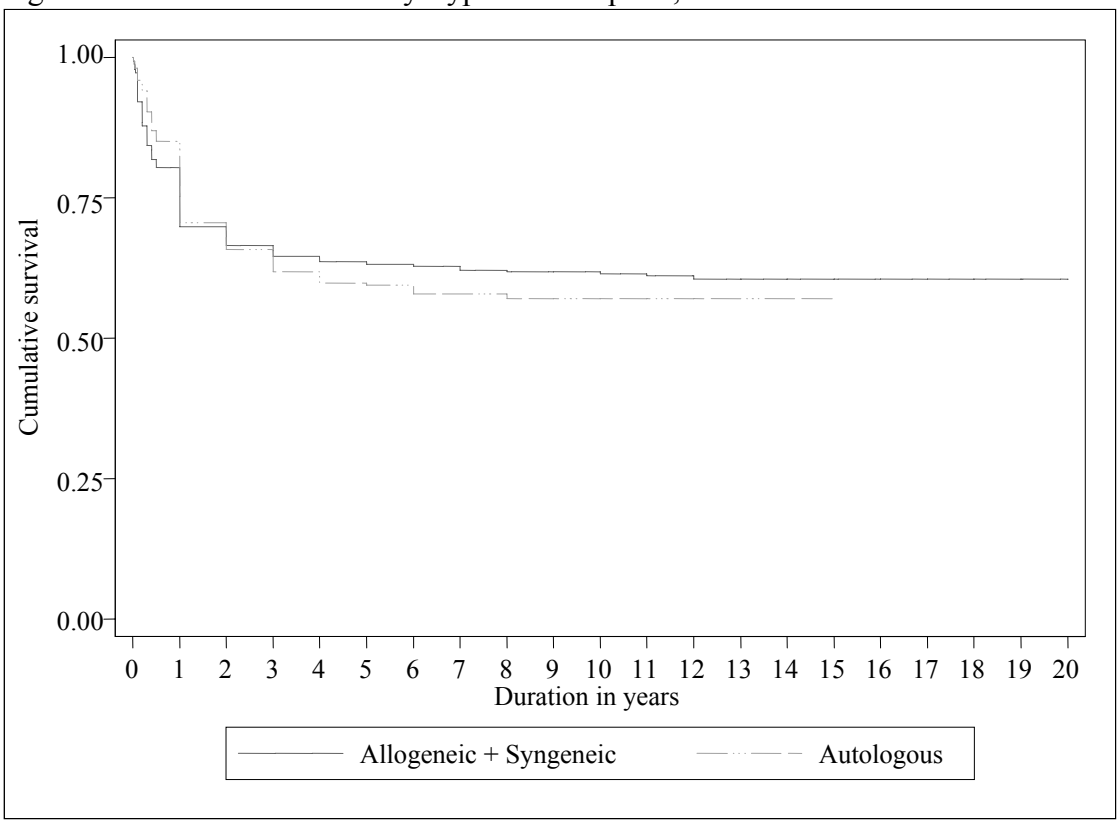


Figure 1.4.4: Patient Survival by Type of Transplant, 1987-2009



1.5 DISEASE-FREE SURVIVAL

Figures 1.5.1 to 1.5.7 show the disease free survival for individual diseases while Figures 1.5.8 to 1.5.13 show the breakdown between paediatric and adult patients.

It is difficult to interpret the survival curves for individual diseases (e.g. allogeniec vs autologous in AML and NHL) without analyses according to stage of disease (CR1 vs CR2) and prognostic risk factors. Similarly it is difficult to interpret differences in survival curves between paediatric and adult DFS curves e.g. the unexpected better adult survival in ALL. The survival data could be better analysed in the future when there is more detailed information on disease characteristics (particularly prognostic sub-groups) of the transplanted patients.

Figure 1.5.1: Disease-free Survival for Acute Myeloid Leukaemia, 1987-2009 (Allogeneic vs. Autologous)

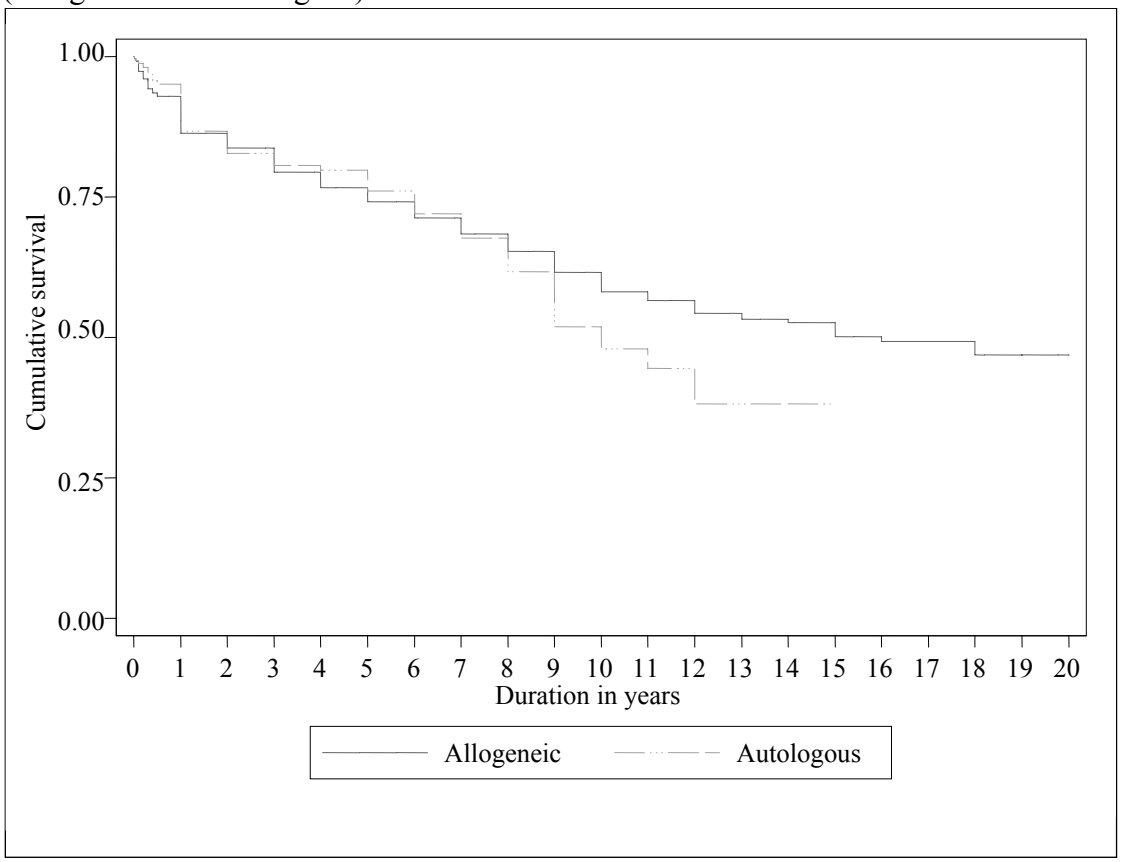


Figure 1.5.2: Disease-free Survival for Acute Lymphoblastic Leukaemia, 1987-2009 (Allogeneic)

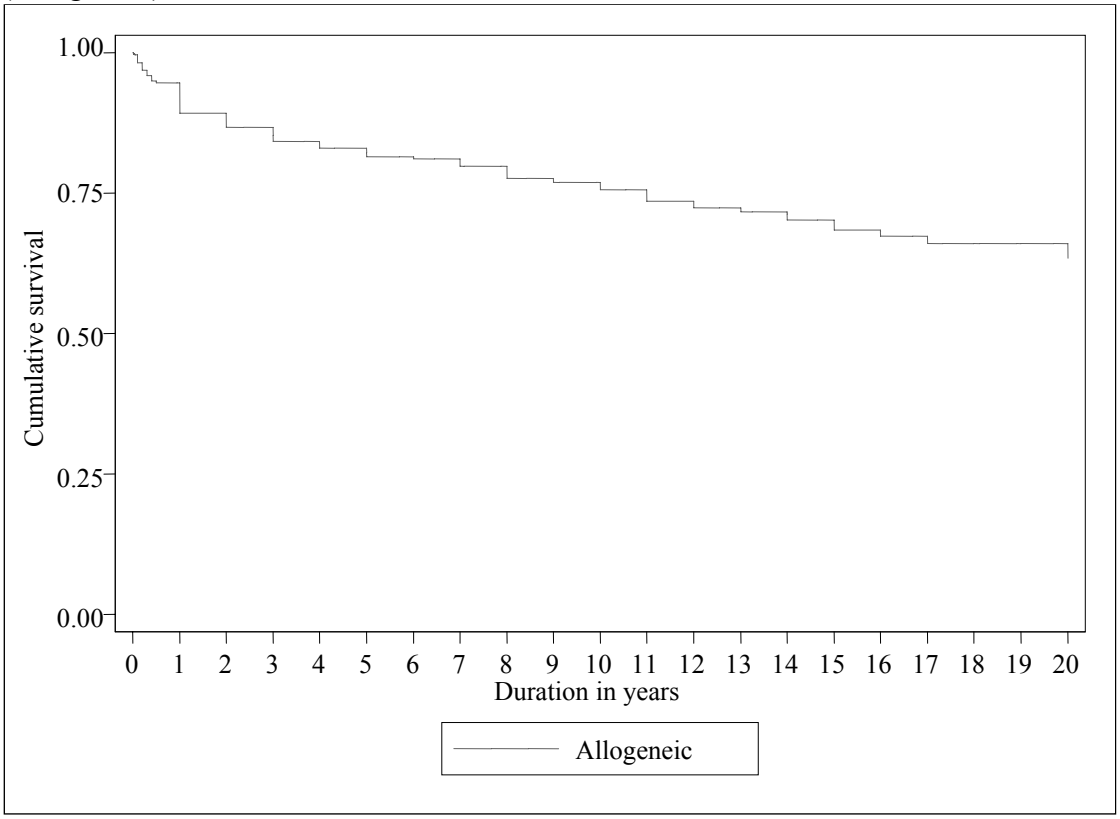


Figure 1.5.3: Disease-free Survival for Thalassaemia, 1987-2009 (Allogeneic)

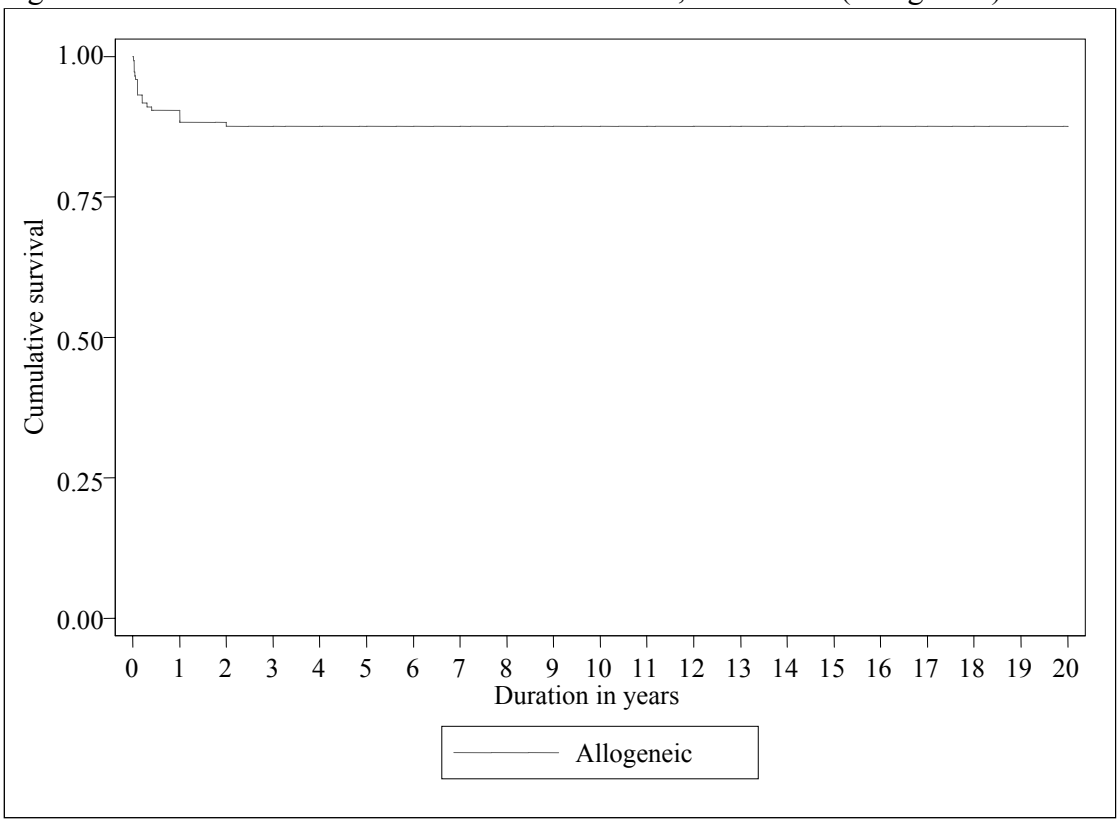


Figure 1.5.4: Disease-free Survival for Non-Hodgkin's Lymphoma, 1987-2009 (Allogeneic vs. Autologous)

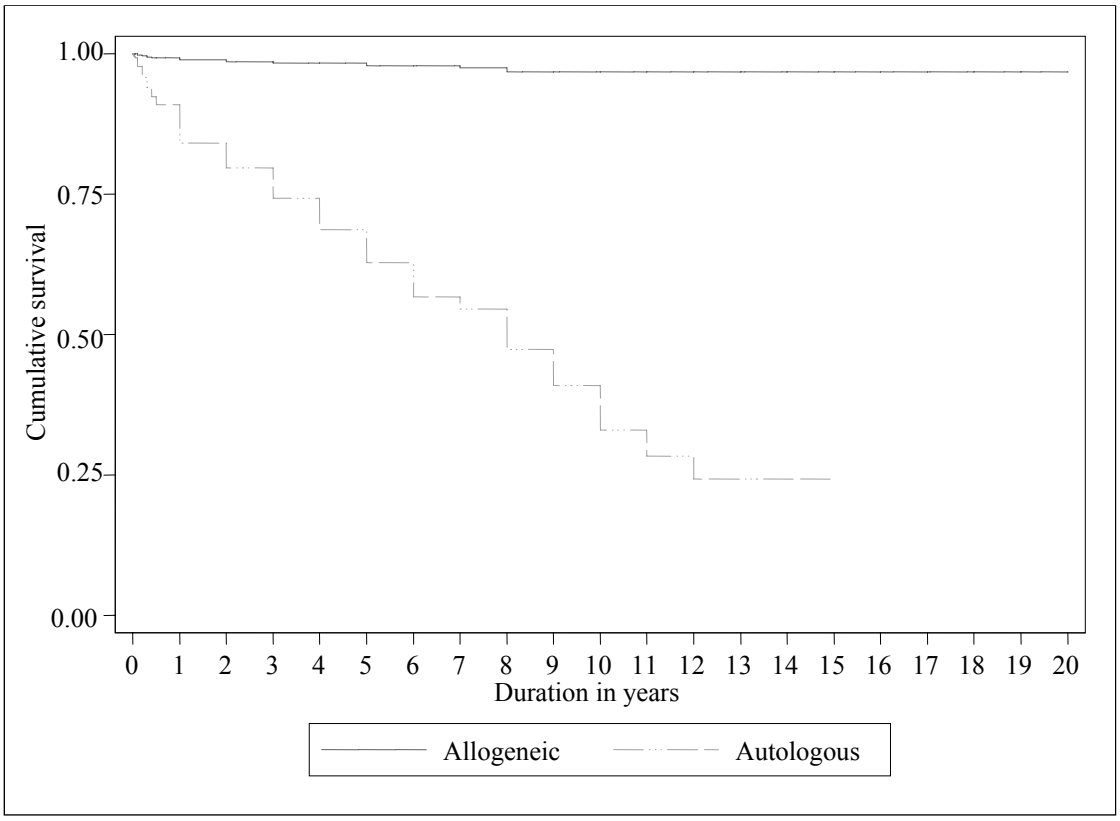


Figure 1.5.5 Disease-free Survival for Hodgkin's Disease, 1987-2009 (Autologous)

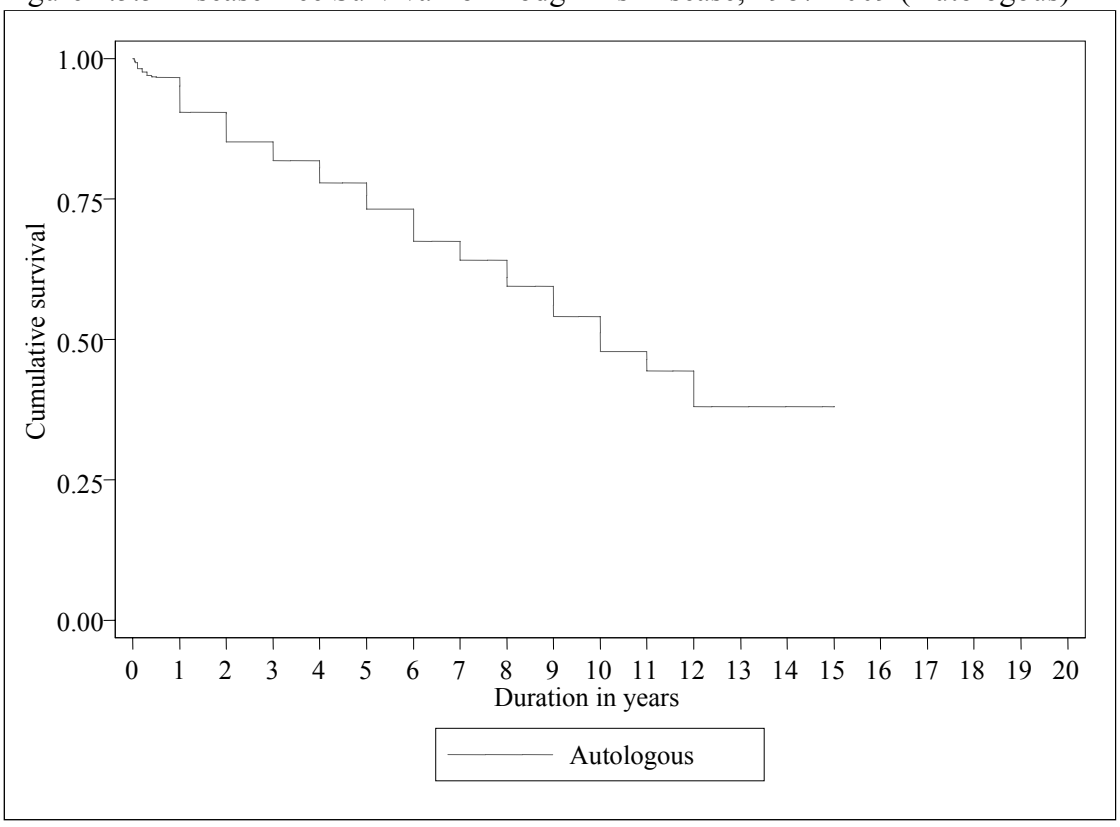


Figure 1.5.6: Disease-free Survival for Chronic Myeloid Leukaemia, 1987-2009 (Allogeneic)

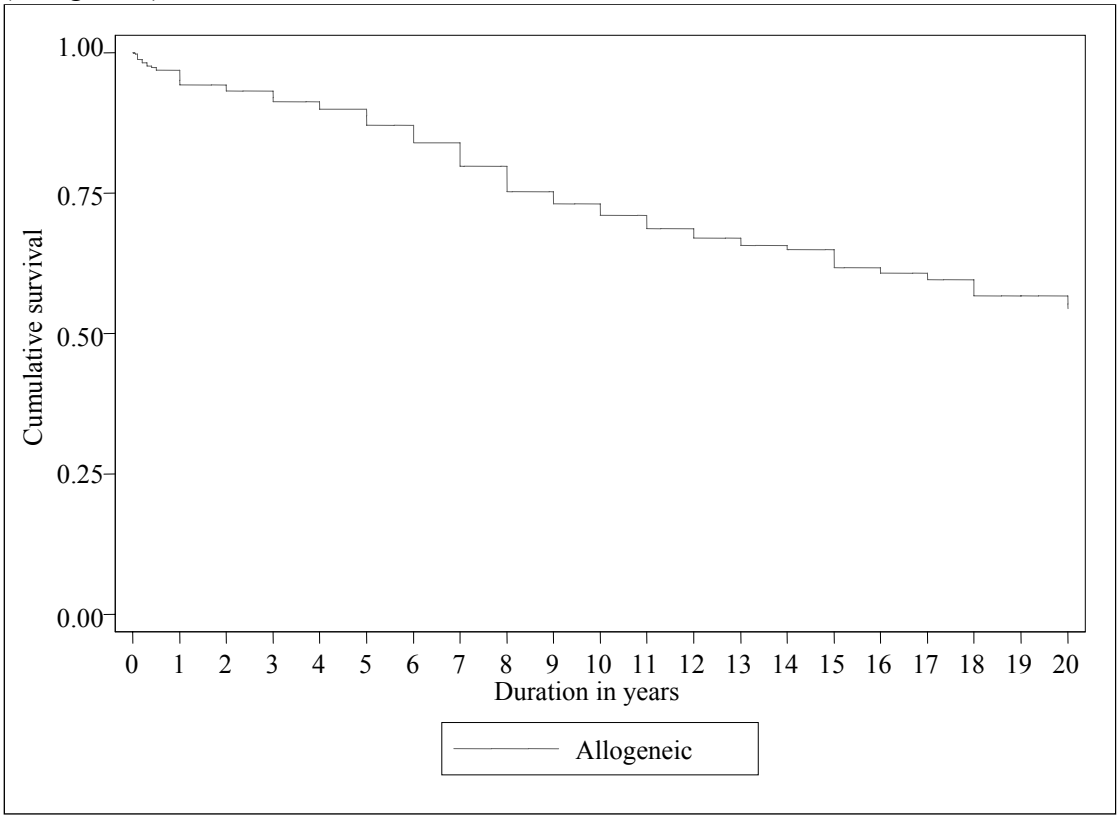


Figure 1.5.7: Disease-free Survival for Aplastic Anaemia, 1987-2009 (Allogeneic)

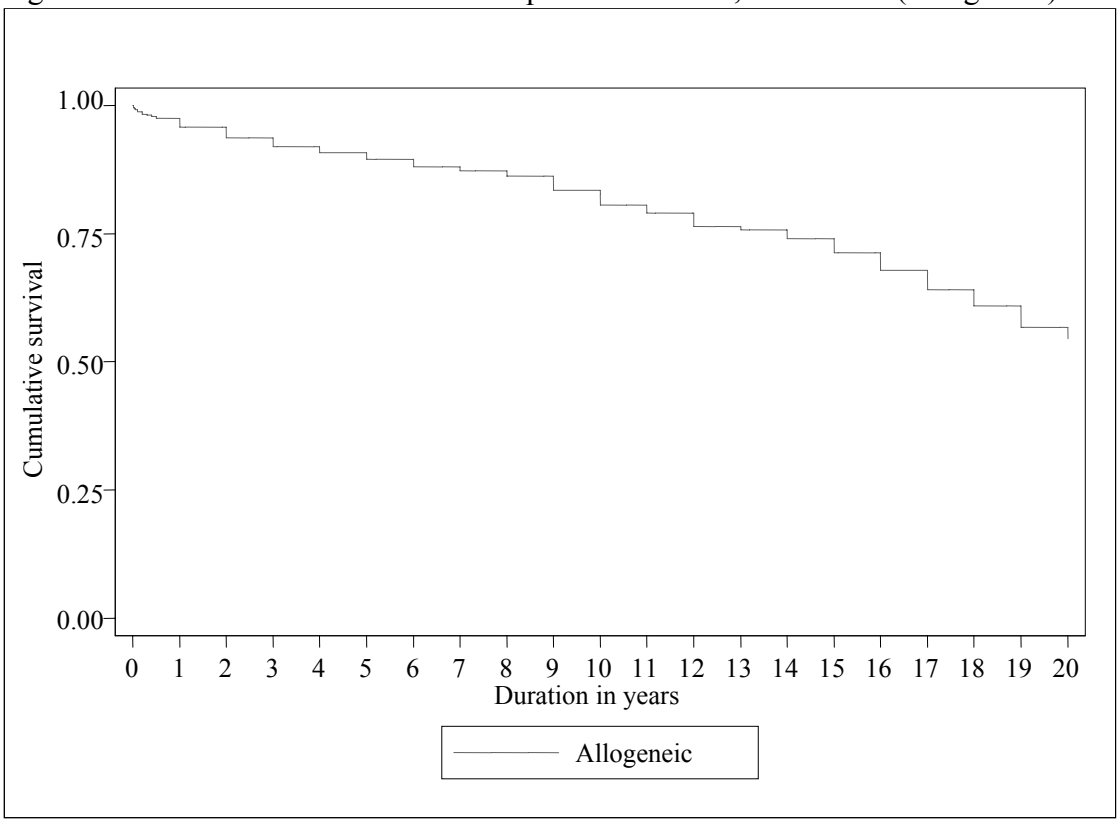
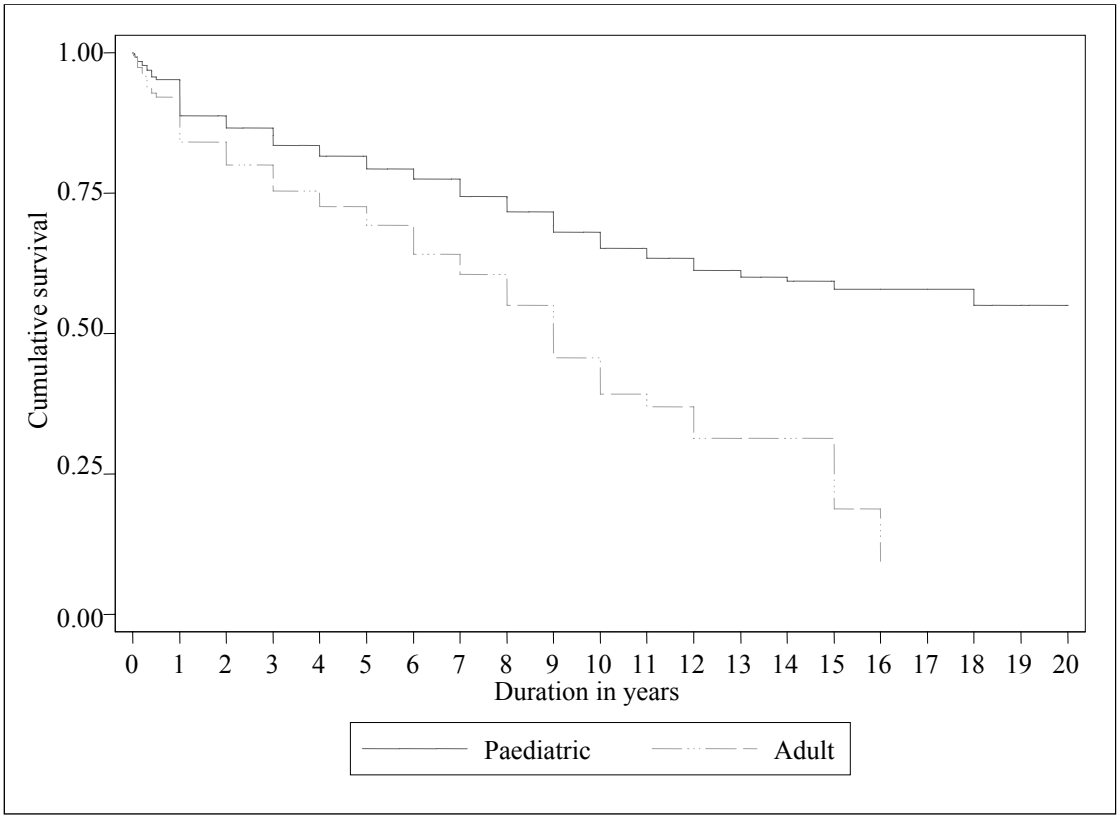
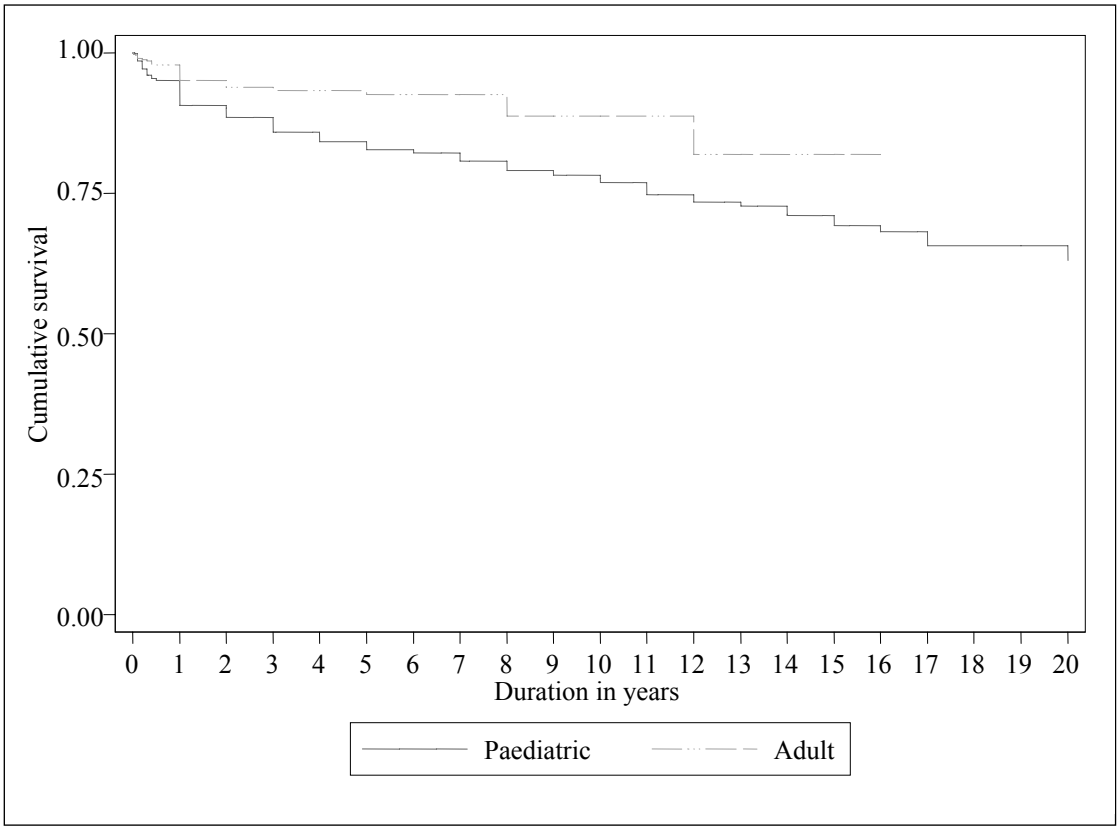


Figure 1.5.8: Disease-free Survival by Age Group for Acute Myeloid Leukaemia, 1987-2009



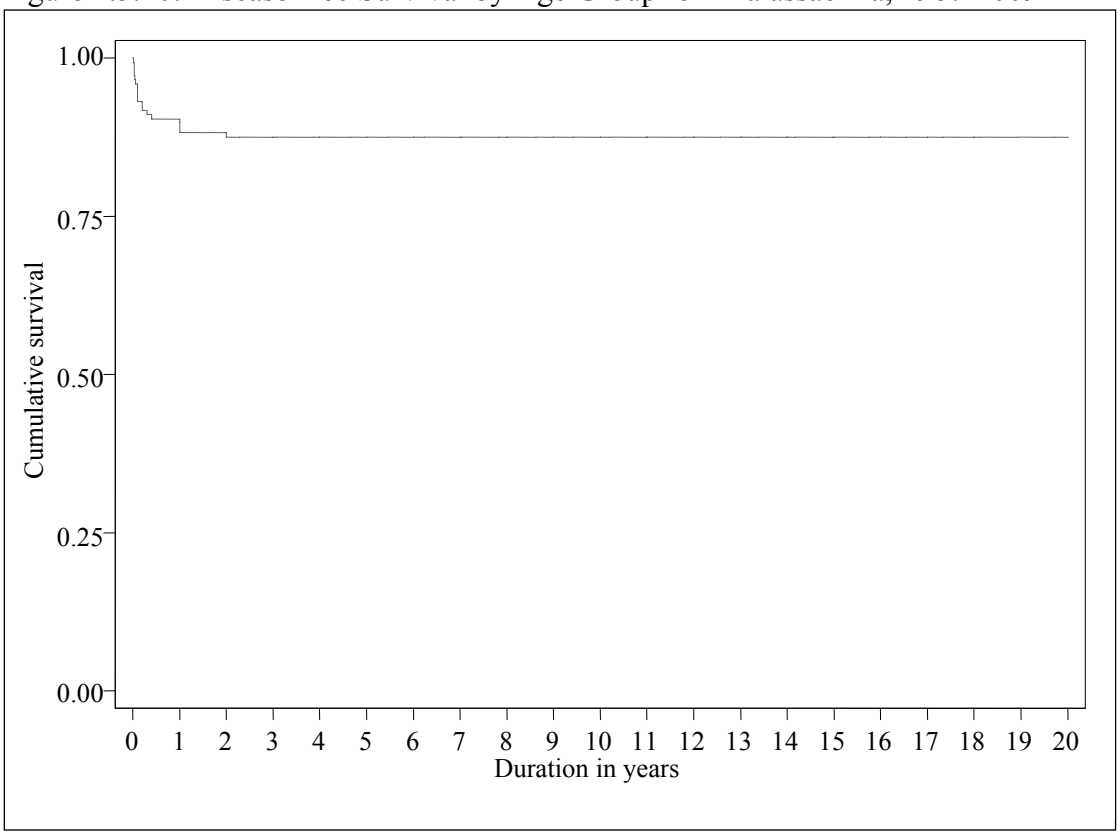
Paediatric is defined as age ≤18 years and adult age >18 years

Figure 1.5.9: Disease-free Survival by Age Group for Acute Lymphoblastic Leukaemia, 1987-2009



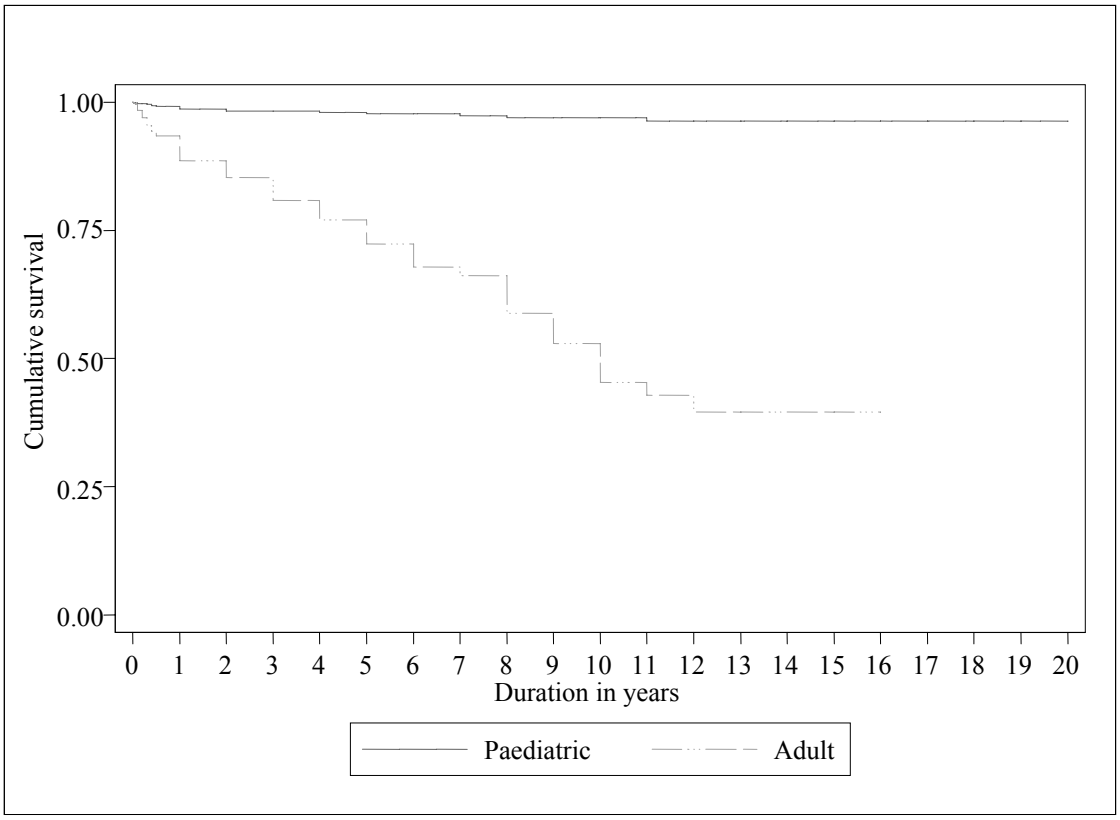
Pediatric is defined as age ≤18 years and adult age >18 years

Figure 1.5.10: Disease-free Survival by Age Group for Thalassaemia, 1987-2009



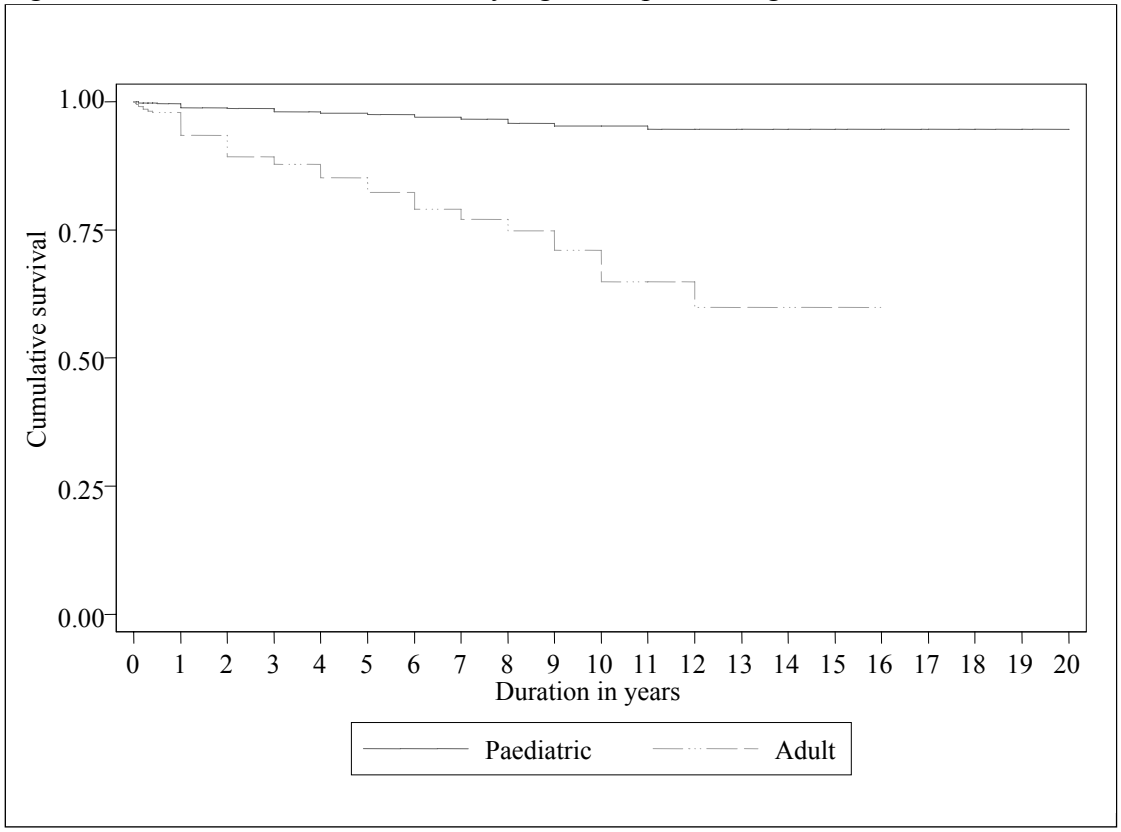
*No adult cases reported for Thalassaemia

Figure 1.5.11: Disease-free Survival by Age Group for Non-Hodgkin's Lymphoma, 1987-2009



Pediatric 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, 1987-2009



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, 1987-2009

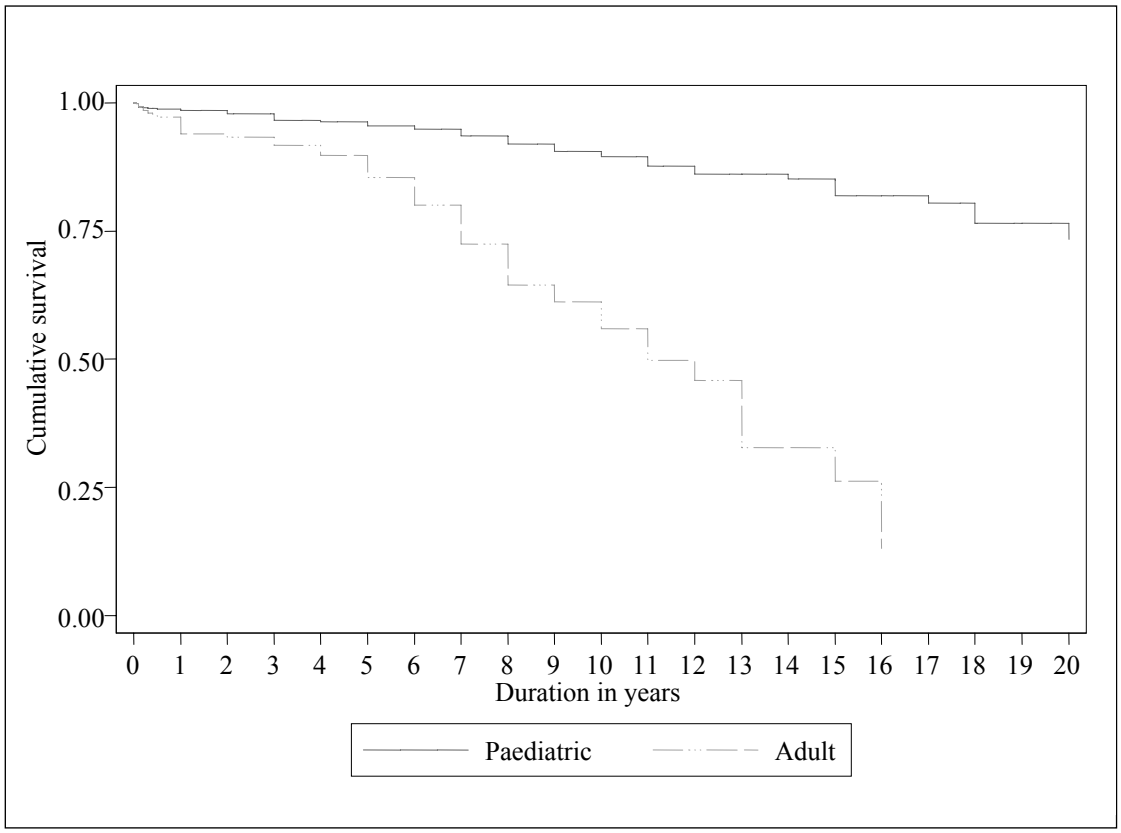
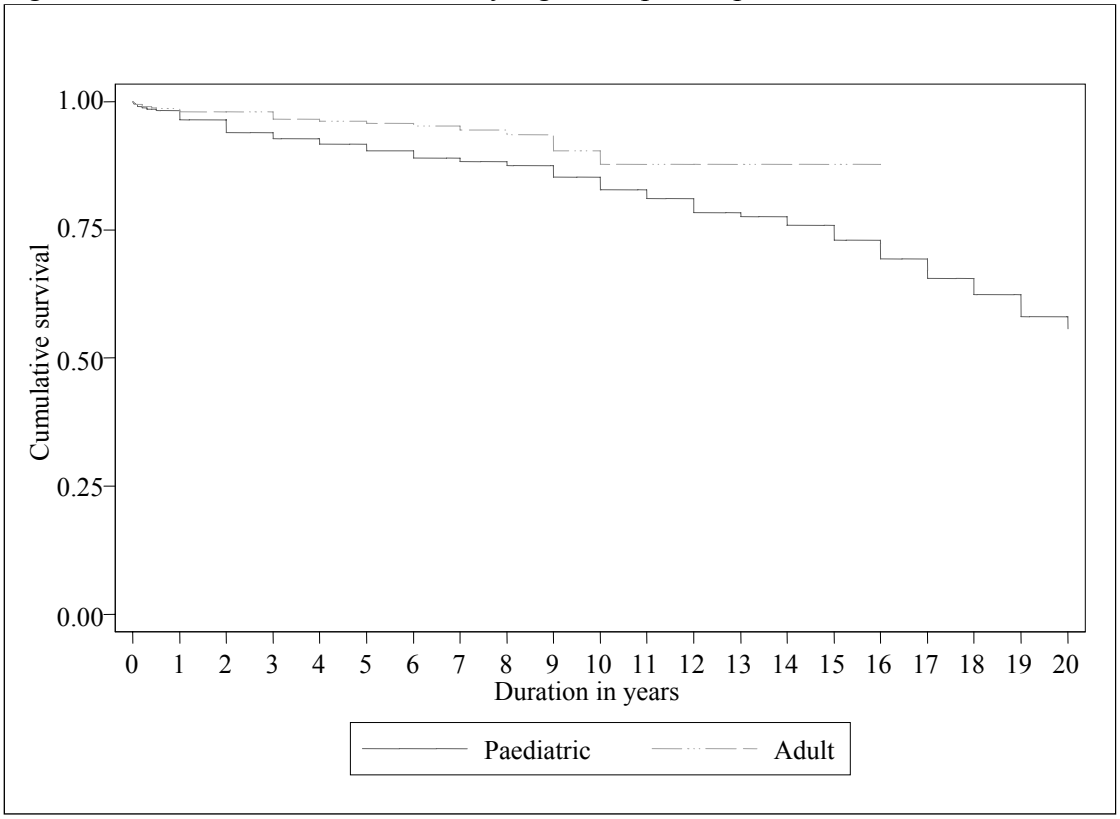


Figure 1.5.14: Disease-free Survival by Age Group for Aplastic Anaemia, 1987-2009



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

CHAPTER 2

CORNEAL TRANSPLANTATION

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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 performed by ophthalmologists both in the government and private sectors with each centre contributing data towards the National Transplant Registry.

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 transplantations performed in the country.

A total of 47 centres registered and agreed to provide information on retrospective and prospective corneal transplant activities. A total of 75 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** cover notification data on corneal transplantation over 12 years from 1998 to 2009. 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 – 2009)

The annual number of corneal transplants performed between 1998 and 2009 ranged from 119 to 231. In 2009 the number of cases reported was 209 (Table 2.1.1). Penetrating keratoplasty was the most frequent type of transplant surgery performed (Table 2.1.2).

Table 2.1.1: Number of Corneal Transplantation and Transplant Rate per million population (pmp), 1998-2009

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
No. of new transplants	119	122	126	221	203	165	184	192	177	196	231	209
New transplant rate, pmp	5	5	5	9	8	7	7	7	7	7	8	7

Table 2.1.2: Types of Corneal Transplant, 1998-2009

Surgery type	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=196)		2008 (N=231)		2009 (N=209)		TOTAL (N=2145)	
	No.	%	No.	%	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	175	89	189	82	173	83	1937	91
Lamellar Keratoplasty	1	1	5	4	4	3	14	6	5	2	8	4	10	5	13	7	16	9	7	4	21	9	15	8	119	6
Patch Graft for Corneal	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	1	5	3	10	5	12	5	9	4	41	2
Patch Graft for Sclera	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	2	1	1	0	4	0
Cornea Scleral Keratopalsty	0	0	1	1	0	0	0	0	0	0	1	1	7	4	2	1	3	2	4	2	4	2	10	5	32	1
Endothelial keratoplasty	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	3	0
Others	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
No Data	4	3	0	0	2	2	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0

2.2 RECIPIENTS' CHARACTERISTICS

There was a preponderance of male recipients every year and this ranged from 60 % to 69% (Table 2.2.1). Ethnic Chinese (37%) were the predominant race undergoing corneal transplant surgery followed by Malays (32%) and Indians (22%) (Table 2.2.2). The mean age was 45 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 corneal scar (14%), pseudophakic bullous keratopathy (14%), other non-pseudophakic bullous keratopathy (10%) and microbial keratitis (10%) (Table 2.2.4). There may be one or more indications for corneal transplant surgery. The most frequent indication was ***optical***, followed by ***tectonic*** and/or ***therapeutic*** indications (Table 2.2.5).

Table 2.2.1: Gender Distribution, 1998-2009

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=196)		2008 (N=231)		2009 (N=209)		TOTAL (N=2145)	
Gender	**No.**	**%**	**No.**	**%**	**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	129	66	143	62	132	63	1366	64
Female	41	34	42	34	45	36	79	36	81	40	51	31	72	39	77	40	59	33	67	34	88	38	77	37	779	36

Table 2.2.2: Ethnic Distribution, 1998-2009

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=196)		2008 (N=231)		2009 (N=209)		TOTAL (N=2145)	
Ethnic group	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Malay	28	24	34	28	41	32	70	32	74	37	52	31	66	36	62	32	60	34	64	33	79	34	61	29	691	32
Chinese	47	39	46	38	50	40	92	42	83	41	67	41	58	31	73	38	59	33	70	36	84	36	69	33	798	37
Indian	36	30	35	28	28	22	49	22	35	17	34	21	43	23	41	21	40	23	38	19	41	18	58	28	478	22
Bumiputra Sabah	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	3	2	2	1	2	1	3	1	12	1
Bumiputra Sarawak	0	0	0	0	0	0	1	0	0	0	0	0	4	2	5	3	4	2	4	2	7	3	6	3	31	2
Others	8	7	7	6	7	6	9	4	11	5	12	7	12	7	10	5	11	6	18	9	18	8	12	6	135	6

Table 2.2.3: Age Distribution of Corneal Transplant Recipient Patients, 1998-2009

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=196)		2008 (N=231)		2009 (N=209)		TOTAL (N=2145)	
Age group (years)	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
0-9	4	3	5	4	6	5	8	4	9	4	6	3	6	3	8	4	7	4	4	2	5	2	6	3	74	3
10-19	13	11	17	14	9	7	29	13	16	8	21	13	15	8	14	7	23	13	13	7	20	9	27	13	217	10
20-39	28	24	34	28	34	27	49	22	53	26	36	22	55	30	59	31	53	30	48	24	68	29	54	26	571	27
40-59	38	32	32	26	40	32	61	28	57	28	51	31	52	28	45	24	41	23	66	34	69	30	64	30	616	29
≥60	36	30	34	28	37	29	74	33	68	34	51	31	56	31	66	34	53	30	65	33	69	30	58	28	667	31
Mean	45		43		44		45		46		45		45		46		44		47		46		44		45	
SD	21		22		20		21		21		21		21		21		22		21		20		20		21	
Median	45		43		45		50		46		46		44		49		43		49		48		45		46	
Minimum	4 month		5		2 months		5 month		1		5 month		2 month		2 month		2 month		3		1		3		2 month	
Maximum	82		92		86		85		86		84		86		84		96		102		87		86		102	

Table 2.2.4: Diagnosis, 1998-2009

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=196)		2008 (N=231)		2009 (N=209)		TOTAL (N=2145)	
Primary Diagnosis	**No.**	**%**	**No.**	**%**	**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	28	14	37	16	46	22	363	17
Corneal scar	33	28	25	20	21	17	34	15	28	14	21	13	26	14	20	10	18	10	25	13	29	13	14	7	294	14
Microbial keratitis	11	9	11	9	19	15	30	14	31	15	21	13	18	10	13	7	11	6	14	7	18	8	19	9	216	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	12	5	28	13	116	5
Corneal perforation (non microbial)	6	5	7	6	8	6	12	5	12	6	27	16	13	7	18	9	20	11	21	11	18	8	19	9	181	8
Pseudophakic Bullous keratopathy	10	8	16	13	17	13	23	10	15	7	19	12	19	10	35	18	30	17	36	18	46	20	28	13	294	14
Other (non pseudophakic) bullous keratopathy	14	12	4	3	19	15	37	17	47	23	25	15	16	9	14	7	11	6	8	4	14	6	8	4	217	10
Failed previous graft	14	12	12	10	13	10	17	8	15	7	14	8	12	7	14	7	10	6	23	12	16	7	12	6	172	8
Corneal dystrophy	5	4	6	5	5	4	12	5	9	4	7	4	8	4	6	3	10	6	12	6	10	4	17	8	107	5
Congenital opacity	1	1	1	1	1	1	1	0	0	0	1	1	8	4	4	2	1	1	1	1	5	2	2	1	26	1
Others	3	3	8	7	7	6	15	7	14	7	10	6	34	18	34	18	36	20	39	20	48	21	29	14	277	13
No data	0	0	2	2	1	1	1	0	0	0	0	0	0	0	0	0	0	0	4	2	0	0	0	0	8	0

* Each patient may have more than one diagnosis.

Table 2.2.5: Indications of Corneal Transplant, 2004-2009

Indication of transplant	2004 (N=184)		2005 (N=192)		2006 (N=177)		2007 (N=196)		2008 (N=231)		2009 (N=209)		TOTAL (N=1189)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Optical	120	65	135	70	124	70	139	71	154	67	101	48	773	65
Tectonic	26	14	23	12	20	11	17	8	25	11	25	12	136	11
Therapeutic	27	14	19	10	17	9	24	12	24	11	42	20	153	13
Tectonic+Therapeutic	9	5	9	4	4	2	8	4	6	3	22	11	58	5
Optical+Tectonic	1	1	1	1	1	1	0	0	1	0	0	0	4	0
Optical+Tectonic+Therapeutic	0	0	1	1	0	0	1	1	1	0	2	1	5	1
Optical+Therapeutic	0	0	0	0	5	3	6	3	8	4	7	3	26	2
Optical+Others	0	0	0	0	1	1	0	0	1	0	0	0	2	0
Therapeutic+Others	0	0	0	0	0	0	0	0	1	0	0	0	1	0
Others	1	1	4	2	4	2	1	1	9	4	7	3	26	2
No data	0	0	0	0	1	1	0	0	1	0	3	2	5	1

* Each patient may have more than one indication.

2.3 TRANSPLANT DATA, 2004-2009

2.3.1 Recipient Data

Regrafts were performed in 12% of cases (Table 2.3.1.1). Ocular co-morbidity was noted in 53% of the patients and corneal vascularisation was the most frequently encountered (Table 2.3.1.2). From data available 63% of the eyes had a vision of 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, 2004-2009

Year	**2004* (N=138)**		**2005 (N=192)**		**2006 (N=177)**		**2007 (N=196)**		**2008 (N=231)**		**2009 (N=209)**		**TOTAL (N=1143)**	
Graft Number	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
0	123	89	171	89	160	90	161	82	203	88	188	90	1006	88
1	11	8	15	8	15	8	30	15	21	9	12	6	104	9
2	3	2	2	1	1	1	4	2	5	3	5	2	20	2
3	0	0	1	1	1	1	0	0	0	0	0	0	2	0
4	1	1	0	0	0	0	1	1	0	0	0	0	2	0
Not Available	0	0	3	1	0	0	0	0	2	0	4	2	9	1

*In the year 2004 there are total of 185 corneal transplants performed but complete data set was only received for 138 patients.

Table 2.3.1.2: Ocular Co-morbidity, 2004-2009

Year	**2004* (N=138)**		**2005 (N=192)**		**2006 (N=177)**		**2007 (N=196)**		**2008 (N=231)**		**2009 (N=209)**		**TOTAL (N=1143)**	
Ocular co-morbidity	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Any ocular co-morbidity (a to d below)	88	64	103	54	82	46	89	45	126	55	118	56	606	53
a) Superficial corneal vascularisation	44	50	48	47	44	54	53	60	70	56	62	53	321	53
b) Deep corneal vascularisation	43	49	39	38	22	27	28	31	31	25	38	32	201	33
c) History of glaucoma	29	33	36	35	36	44	39	44	68	54	54	46	262	43
d) Current ocular inflammation	42	48	50	49	41	50	39	44	66	52	63	53	301	50

*Patient might have multiple ocular co-morbidities.

Table 2.3.1.3: Pre-operative Vision, 2004-2009

Year	2004* (N=138)		2005 (N=192)		2006 (N=177)		2007 (N=196)		2008 (N=231)		2009 (N=209)		TOTAL (N=1143)	
Unaided VA	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6/6	3	2	0	0	1	1	1	1	1	1	1	1	7	1
6/9	1	1	1	1	1	1	2	1	6	2	2	1	13	1
6/12	0	0	2	1	3	1	0	0	2	1	2	1	9	1
6/18	0	0	1	1	0	0	2	1	1	1	3	1	7	1
6/24	3	2	5	2	4	2	2	1	3	1	4	2	21	2
6/36	4	3	6	3	5	3	3	1	6	2	6	3	30	3
6/60	7	5	16	8	17	10	11	5	14	6	17	8	82	7
5/60	1	1	0	0	0	0	0	0	0	0	0	0	1	0
4/60	3	2	1	1	2	1	2	1	0	0	0	0	8	1
3/60	2	1	2	1	1	1	4	2	5	2	5	2	19	2
2/60	1	1	2	1	4	2	1	1	2	1	4	2	14	1
1/60	4	3	9	4	7	4	2	1	1	1	6	3	29	2
CF	47	34	47	24	45	25	43	22	40	17	70	33	292	25
HM	47	34	46	24	37	21	48	24	48	21	55	26	281	24
PL	13	10	15	8	12	7	17	9	20	9	15	7	92	8
NPL	2	1	1	1	0	0	1	1	0	0	1	1	5	1
Others	0	0	0	0	0	0	0	0	0	0	1	1	1	0
No data	0	0	38	20	38	21	57	29	82	35	17	8	232	20

2.3.2: Donor details

Eye Banks in the United States of America (USA) were the most frequent source of the corneal tissues (Table 2.3.2.1). The majority of donors were elderly patients with a median age of 59 years (Table 2.3.2.2). Optisol GS was the commonest corneal tissue storage medium used at 76% (Table 2.3.2.3). The major cause of death of the donors were related to the cardiac/circulatory system (30%) followed by malignancy (15%) (Table 2.3.2.4).

Table 2.3.2.1: Source of Donor Cornea Tissue, 2004-2009

Year	**2004* (N=138)**		**2005 (N=192)**		**2006 (N=177)**		**2007 (N=196)**		**2008 (N=231)**		**2009 (N=209)**		**TOTAL (N=1143)**	
Source of donor	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Local	20	14	19	10	36	20	31	16	41	18	41	20	188	16
USA	95	69	133	69	98	56	114	58	150	65	130	62	720	63
Sri Lanka	22	16	38	20	41	23	51	26	37	16	38	18	227	19
Others	0	0	0	0	2	1	0	0	2	1	0	0	4	1
No data	1	1	2	1	0	0	0	0	1	0	0	0	4	1
If Local, ethnic group:														
• Malay	0	0	4	21	1	3	5	16	0	0	0	0	10	5
• Chinese	14	70	8	42	12	33	16	52	22	54	29	71	101	54
• Indian	5	25	7	37	23	64	4	13	9	22	12	29	60	32
• Others	0	0	0	0	0	0	4	13	10	24	0	0	14	7
• Unknown	1	5	0	0	0	0	2	6	0	0	0	0	3	2

* 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, 2004-2009

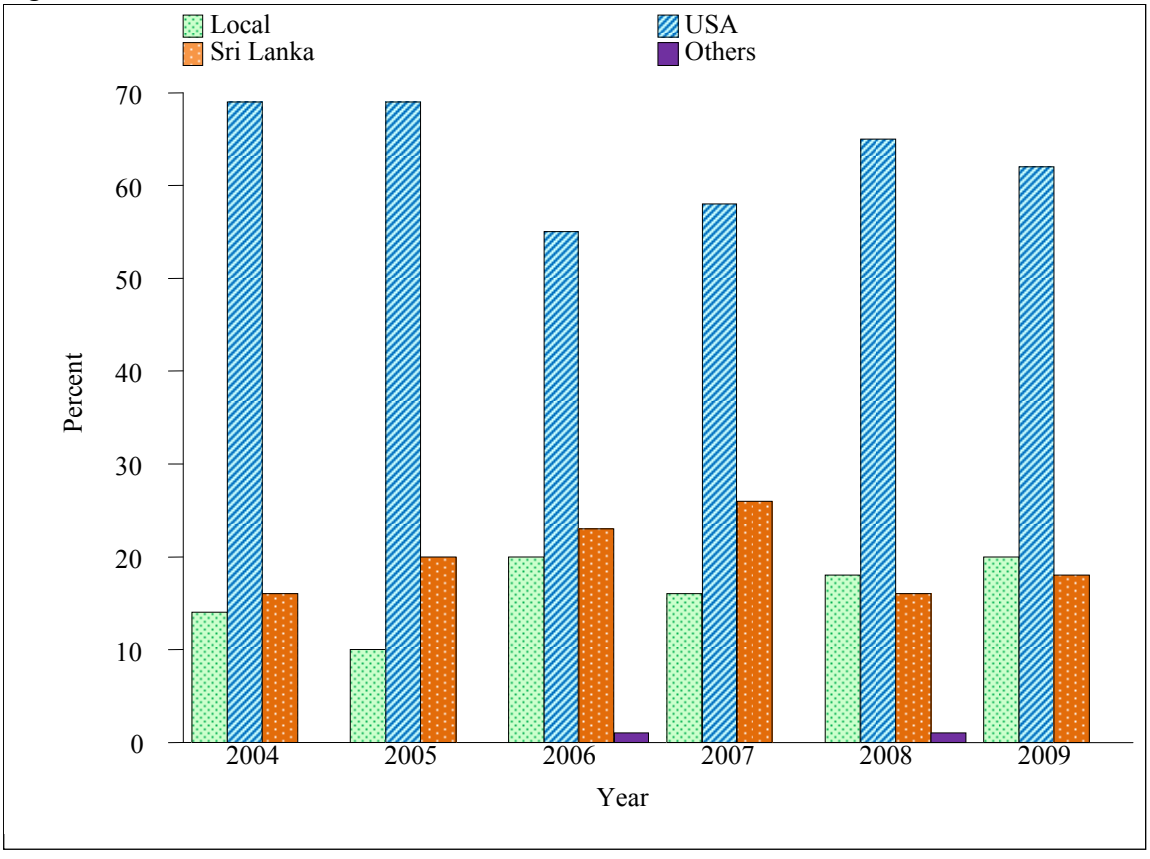


Table 2.3.2.2: Donor Age Distribution, 2004-2009

Year	2004* (N=138)		2005 (N=192)		2006 (N=177)		2007 (N=196)		2008 (N=231)		2009 (N=209)		TOTAL (N=1143)	
Age group (years)	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
0-9	2	2	3	2	2	1	2	1	7	3	2	1	18	2
10-19	6	4	4	2	9	5	5	3	7	3	9	4	40	3
20-39	11	8	7	4	11	6	13	7	19	8	17	8	78	7
40-59	51	37	89	46	81	46	83	42	80	35	85	41	469	41
≥60	68	49	89	46	74	42	93	47	118	51	96	46	538	47
Mean	57		58		56		57		56		56		57	
SD	15		14		16		14		17		16		15	
Median	59		58		56		59		60		58		59	
Minimum	8		3		6		4		1		1		1	
Maximum	78		79		78		78		76		77		79	

Table 2.3.2.3: Preservation Media, 2004-2009

Year	2004* (N=138)		2005 (N=192)		2006 (N=177)		2007 (N=196)		2008 (N=231)		2009 (N=209)		TOTAL (N=1143)	
Preservation media	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Optisol GS	90	65	145	75	128	72	134	68	189	82	183	88	869	76
MK Medium	22	16	37	19	40	23	51	26	35	15	15	7	200	17
Moist Chamber	4	3	3	2	7	4	8	4	4	2	8	4	34	3
Others*	0	0	1	1	0	0	3	2	1	0	0	0	5	1
No data	22	16	6	3	2	1	0	0	2	1	3	1	35	3

*Others (specify) Eusol-C

Figure 2.3.2.3: Preservation Media, 2004-2009

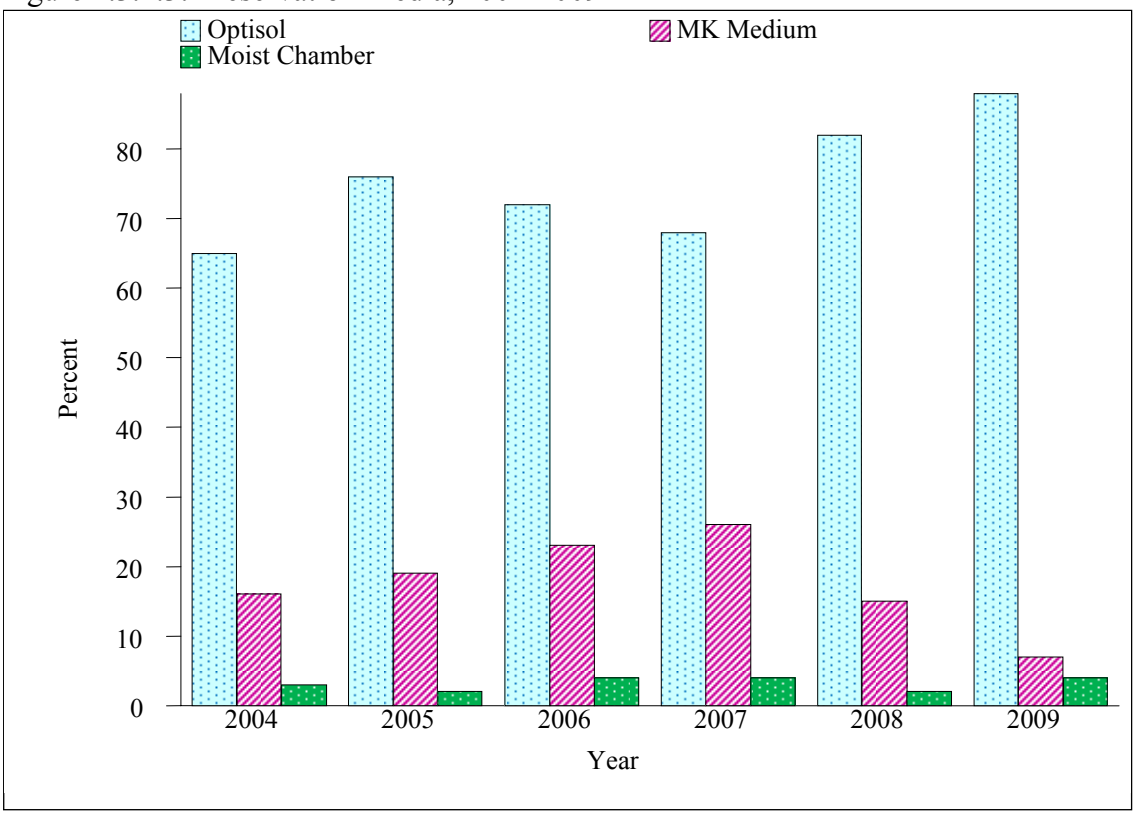


Table 2.3.2.4: Cause of Death in Corneal Donors, 2004-2009

Year	2004* (N=138)		2005 (N=192)		2006 (N=177)		2007 (N=196)		2008 (N=231)		2009 (N=209)		TOTAL (N=1143)	
Cause of death	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Cardiac / Circulatory System	47	34	49	26	59	33	75	38	61	26	58	28	349	30
Cerebrovascular System	17	12	25	13	11	6	23	12	35	15	18	9	129	11
Malignancy	19	14	31	16	25	14	26	13	41	18	27	13	169	15
Trauma / Accident	20	15	13	7	19	11	24	12	21	9	28	13	125	11
Respiratory System	15	11	8	4	8	5	13	7	10	4	25	12	79	7
Others	17	12	21	11	27	15	32	16	59	26	49	23	205	18
No data	3	2	45	23	28	16	3	2	4	2	4	2	87	8

2.3.3: Transplant Practices

Penetrating Keratoplasty (PK) was the commonest type of surgery performed (86%) (Table 2.3.3.1). Corneal transplantation was performed in combination with other surgical procedures in 18% of cases. Cataract extraction, with or without intraocular lens implantation (IOL), was the commonest combined procedure (Table 2.3.3.2).The recipient graft size ranged from 2mm to 10mm, with the median recipient cornea graft size being 7.5mm.(Table 2.3.3.3). The majority of cases had the donor tissue over-sized by 0.5mm (Table 2.3.3.4). The commonest suturing technique was interrupted sutures (Table 2.3.3.5).

Table 2.3.3.1: Types of Surgeries, 2004-2009

Year	2004* (N=138)		2005 (N=192)		2006 (N=177)		2007 (N=196)		2008 (N=231)		2009 (N=209)		TOTAL (N=1143)	
Type of surgery	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Penetrating Keratoplasty	120	87	173	90	153	86	175	89	189	82	173	82	983	86
Lamellar Keratoplasty	10	7	13	7	16	9	7	4	21	9	15	7	82	7
Patch Graft for Corneal	2	2	3	1	5	3	10	5	12	5	9	4	41	4
Patch Graft for Scleral	0	0	1	1	0	0	0	0	2	1	1	1	4	0
Cornea Scleral Keratoplasty	6	4	2	1	3	2	4	2	4	2	10	5	29	3
Endothelial keratoplasty	0	0	0	0	0	0	0	0	3	1	0	0	3	0
Others	0	0	0	0	0	0	0	0	0	0	1	1	1	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 2.3.3.2: Types of Combined Surgeries, 2004-2009

Year	2004* (N=138)		2005 (N=192)		2006 (N=177)		2007 (N=196)		2008 (N=231)		2009 (N=209)		TOTAL (N=1143)	
Combined surgeries	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
No. of patients with corneal transplant surgery combined with another surgical procedure	30	22	27	14	41	23	35	18	46	20	32	15	211	18
(a) Glaucoma surgery	2	7	3	11	1	2	0	0	3	7	2	6	11	5
(b) Cataract Extraction	15	50	13	48	21	51	13	37	17	37	15	47	94	45
(c) IOL	13	43	10	37	24	59	19	54	23	50	10	31	99	47
(d) Cataract extraction and IOL	9	30	8	30	15	37	10	29	16	35	9	28	67	32
(e) Retinal Surgery ± Internal Tamponade	1	3	1	4	2	5	4	11	10	22	0	0	18	9
(f) Anterior vitrectomy	9	30	3	11	4	10	10	29	6	13	9	28	41	19
(g) Others	5	17	8	30	8	20	16	46	14	30	11	34	62	29

*Patients may have more than one combined surgery.

Table 2.3.3.3: Recipient Cornea Trephine Size, 2004-2009

Year	2004 (N=138)		2005 (N=192)		2006 (N=177)		2007 (N=196)		2008 (N=231)		2009 (N=209)		TOTAL (N=1143)	
Graft size, mm	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
2	1	1	1	1	2	1	1	1	0	0	1	1	6	1
3	0	0	1	1	2	1	1	1	1	1	2	1	7	1
4	1	1	2	1	1	1	5	2	2	1	1	1	12	1
5	0	0	0	0	0	0	1	1	1	0	1	1	3	1
5.5	1	1	0	0	0	0	0	0	0	0	0	0	1	0
6	3	2	0	0	5	3	4	2	4	1	7	3	23	2
6.25	0	0	1	1	0	0	0	0	0	0	0	0	1	0
6.5	2	1	5	2	4	2	8	4	7	3	9	4	35	3
6.7	0	0	0	0	0	0	0	0	1	1	0	0	1	0
6.75	1	1	3	1	2	1	1	1	1	1	2	1	10	1
7	25	18	36	19	25	14	29	15	38	16	35	16	188	16
7.2	1	1	0	0	0	0	0	0	1	1	0	0	2	0
7.25	9	7	10	5	14	8	5	2	5	2	10	5	53	5
7.5	36	26	18	9	26	15	37	19	50	21	33	16	200	17
7.75	8	5	11	6	6	3	12	6	14	6	47	22	98	8
7.8	2	1	0	0	0	0	0	0	0	0	0	0	2	0
8	18	13	7	4	13	7	19	10	26	11	25	12	108	9
8.15	0	0	0	0	0	0	0	0	1	1	0	0	1	0
8.25	4	3	4	2	5	3	4	2	4	2	4	2	25	2
8.5	6	4	6	3	2	1	11	5	10	4	5	2	40	3
8.75	0	0	1	1	0	0	0	0	0	0	0	0	1	0
9	9	7	3	1	1	1	4	2	3	1	6	3	26	2
9.5	0	0	2	1	0	0	0	0	1	0	2	1	5	1
10	1	1	0	0	0	0	0	0	2	1	3	1	6	1
10.5	0	0	0	0	0	0	0	0	0	0	1	1	1	0
11	0	0	0	0	0	0	0	0	1	1	2	1	3	1
12	0	0	0	0	0	0	0	0	1	1	0	0	1	0
No data	10	7	81	42	69	39	54	27	57	24	13	6	284	25
Mean		7.5		7.3		7.2		7.3		7.5		7.5		7.4
SD		0.9		1		1.1		1.1		0.9		1		1
Median		7.5		7.3		7.3		7.5		7.5		7.5		7.5
Minimum		2		2		2		2		3		2		2
Maximum		10		9.5		9		9		12		11		12

Table 2.3.3.4: Difference in Trephined Sizes of Recipient and Donor Corneas, 2004-2009

Year	**2004 (N=138)**		**2005 (N=192)**		**2006 (N=177)**		**2007 (N=196)**		**2008 (N=231)**		**2009 (N=209)**		**TOTAL (N=1143)**	
Difference in Graft size, mm	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Same Size	9	6	8	4	8	4	12	6	19	8	51	24	107	9
0.2	2	1	0	0	0	0	0	0	2	1	0	0	4	0
0.25	22	16	19	10	30	17	27	14	27	12	36	17	161	14
0.3	5	4	0	0	0	0	0	0	0	0	1	1	6	1
0.4	1	1	0	0	0	0	0	0	0	0	0	0	1	0
0.5	86	62	84	44	67	38	95	48	117	51	99	47	548	48
0.55	0	0	0	0	0	0	0	0	1	0	0	0	1	0
0.6	0	0	0	0	0	0	0	0	1	0	0	0	1	0
0.75	0	0	0	0	1	1	1	1	2	1	1	1	5	1
0.8	1	1	0	0	0	0	0	0	0	0	0	0	1	0
1	1	1	0	0	1	1	4	2	2	1	5	2	13	1
1.5	0	0	0	0	0	0	0	0	1	0	1	1	2	0
2	1	1	0	0	0	0	0	0	0	0	0	0	1	0
Not Available	10	7	81	42	70	39	57	29	59	26	15	7	292	26

Table 2.3.3.5: Suture Technique, 2004-2009

Year	**2004 (N=138)**		**2005 (N=192)**		**2006 (N=177)**		**2007 (N=196)**		**2008 (N=231)**		**2009 (N=209)**		**TOTAL (N=1143)**	
Suture Technique	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Interrupted only	132	96	139	73	124	70	138	70	171	74	175	84	879	77
Continuous only	0	0	0	0	5	3	1	1	6	3	7	3	19	2
Combined	6	4	18	9	18	10	12	6	10	4	25	12	89	8
No data	0	0	35	18	30	17	45	23	44	19	2	1	156	13

2.4 CORNEAL TRANSPLANT OUTCOME 2004-2009

Table 2.4.1: Stock and Flow - Graft Status (Whole Database)

		Optical		Non optical		Total	
		No.	**%**	**No.**	**%**	**No.**	**%**
Number registered		810	68	379	32	1189	100
Number followed	**Total**	**327**		**156**		**483**	
	1 year	201	62	121	78	322	67
	2 year	70	21	24	15	94	19
	3 year	42	13	7	5	49	10
	4 year	10	3	4	2	14	3
	5year	4	1	0	0	4	1
Graft status	**Total**	**327**		**156**		**483**	
-Surviving graft		260	80	84	54	344	71
-Failed graft		67	20	72	46	139	29
Recipient status	**Total**	**810**		**379**		**1189**	
-Recipient with complete follow up		99	12	78	20	177	15
-Recipient deaths		3	0	1	0	4	0
-Recipient loss - followed		224	28	77	21	301	25
-Recipient loss - not followed		374	46	124	33	499	42
-Graft not yet followed (Transplant duration less than 1 year)		110	14	99	26	209	18

2.4.2 Outcome – Graft Survival 2004-2009

Graft survival for both optical and non-optical indications at 12 months was 77.2% but this declined to 64.5% 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 86.8% at 12 months in the optical group and 57.1% in the non-optical group. This declined to 72.3% at 36 months in the optical group and 48.5% in the non-optical group (Table 2.4.2.2). Primary graft failure was the commonest cause of graft failure.(Table 2.4.2.5).

Table 2.4.2.1: Graft Survival, 2004-2009

Interval (months)	No.	% success	SE
0	483	100	-
12	375	77.2	2
24	161	70.4	2
36	67	64.5	3
48	18	53. 4	6
60	4	47.5	8

Figure 2.4.2.1: Graft Survival, 2004-2009

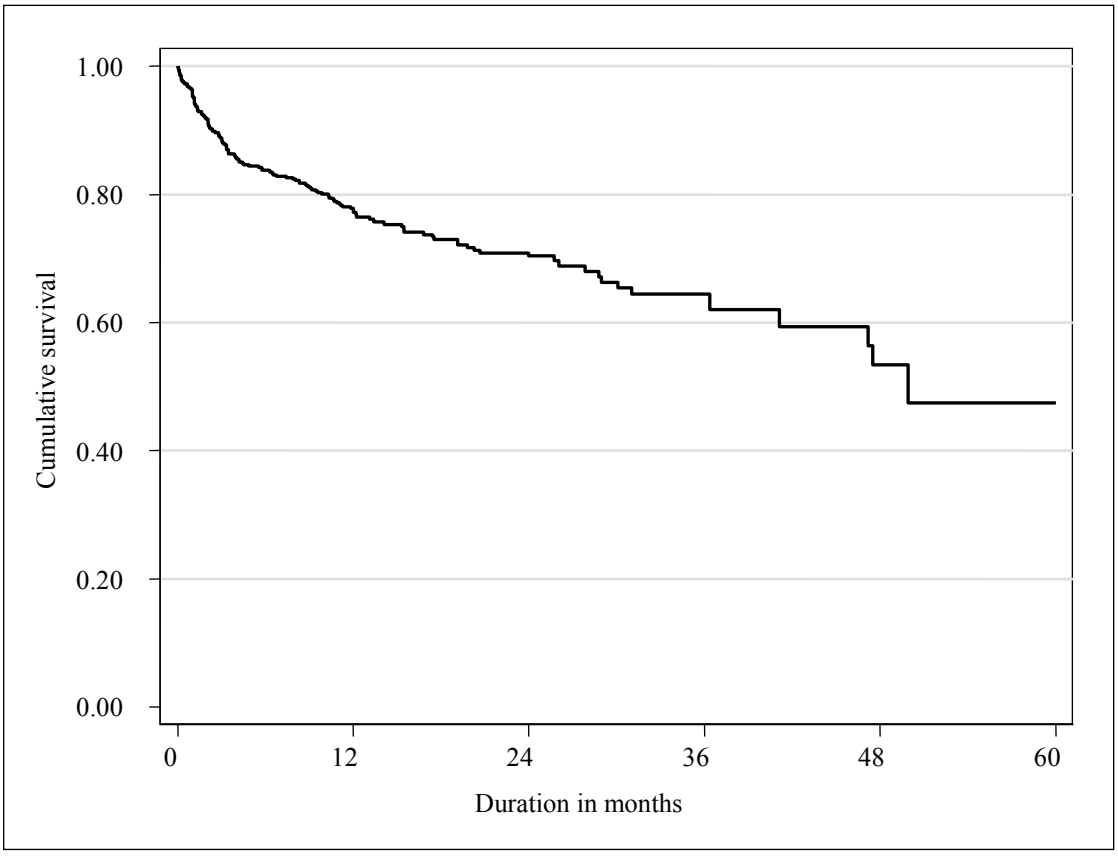


Table 2.4.2.2: Graft Survival by Optical and Non-optical Indication, 2004-2009

	Optical			Non-Optical		
Interval (months)	**No.**	**% success**	**SE**	**No.**	**% success**	**SE**
0	327	100	-	156	100	-
12	284	86.8	2	91	57.1	4
24	126	79.2	3	35	52.2	4
36	56	72.3	4	11	48.5	5
48	14	56.9	8	4	48.5	5
60	4	48.8	10	1	.	.

Figure 2.4.2.2: Graft Survival by Optical and Non-optical Indication, 2004-2009

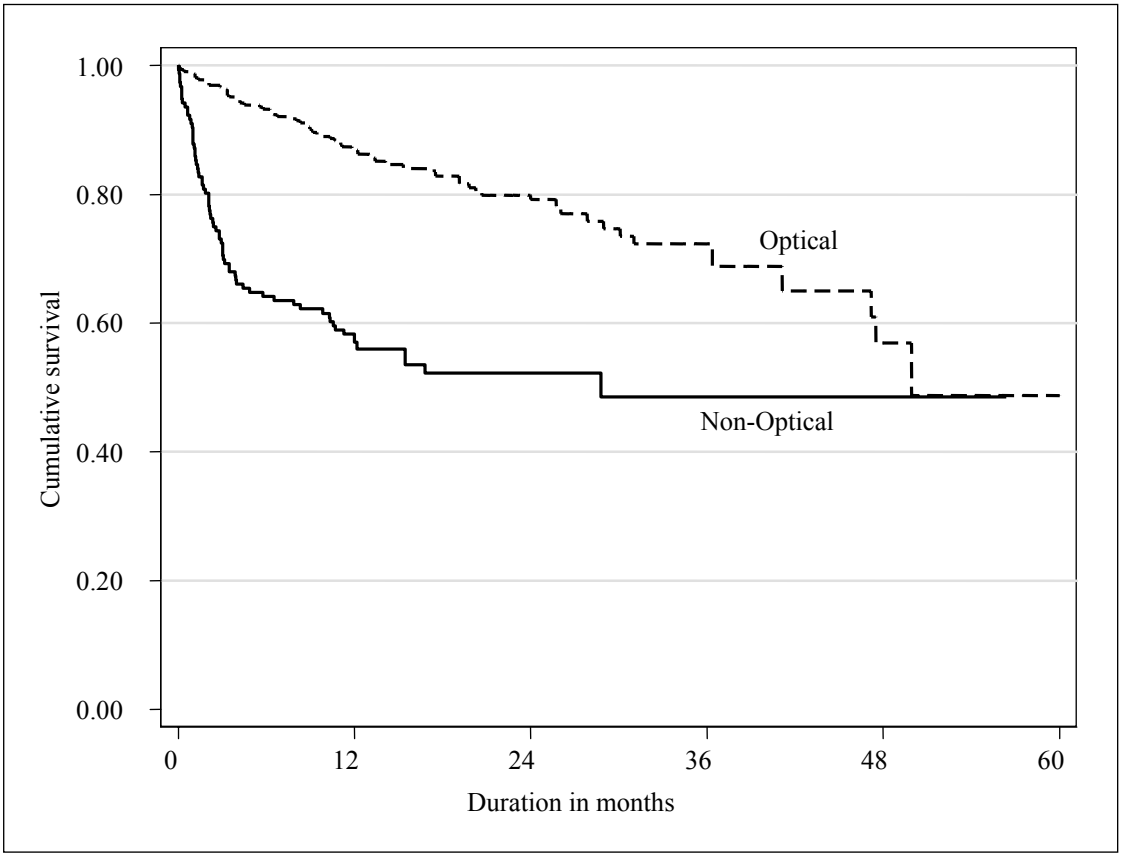


Table 2.4.2.3 Graft Success by Gender, 2004-2009

	Male			Female		
Interval (months)	**No.**	**% success**	**SE**	**No.**	**% success**	**SE**
0	303	100	-	180	100	-
12	231	75.9	2	144	79.4	3
24	91	69.2	3	70	72.5	4
36	42	62.6	4	25	67.9	5
48	13	58.7	5	5	48.1	12
60	3	58.7	5	1	21.5	16

Figure 2.4.2.3 Graft Success by Gender, 2004-2009

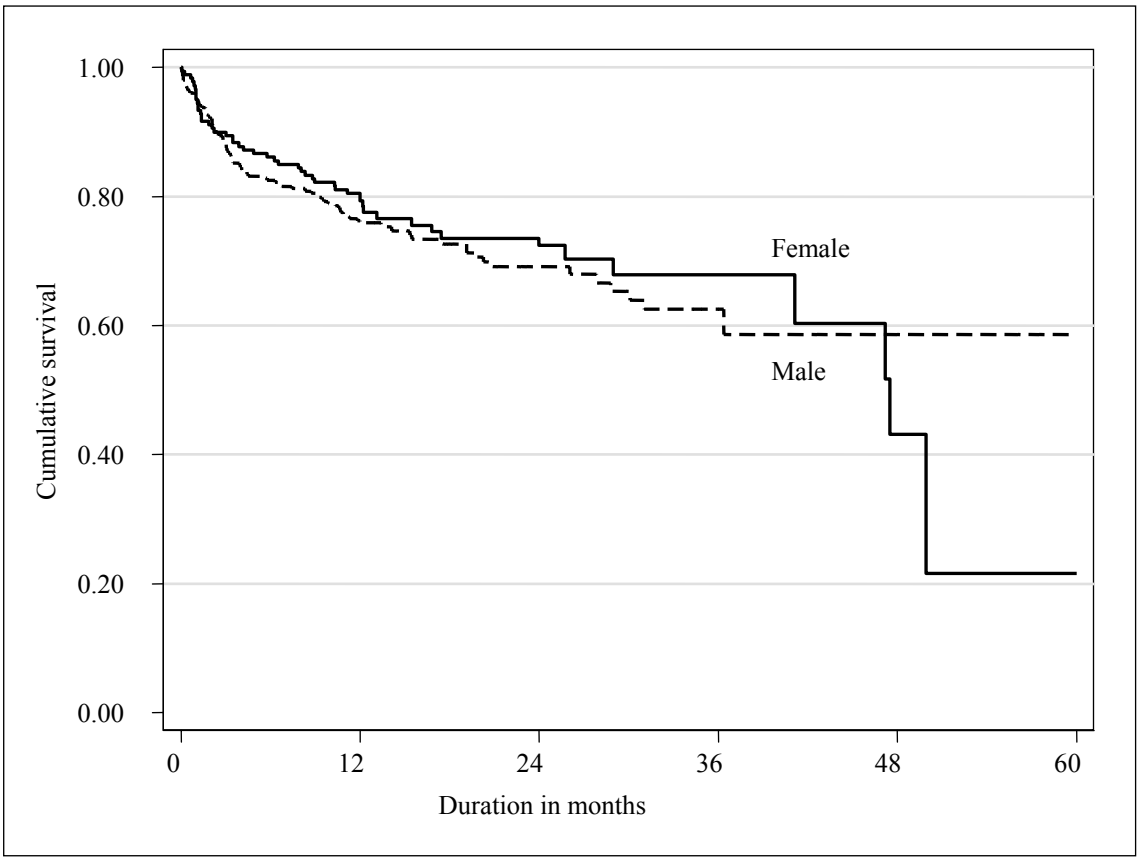


Table 2.4.2.4 Graft Survival by Age, 2004-2009

	0-9			10-19		
Interval (months)	**No.**	**% success**	**SE**	**No.**	**% success**	**SE**
0	7	100	-	21	100	-
12	6	85.7	13	18	85.7	8
24	3	42.9	22	14	85.7	8
36	3	42.9	22	11	85.7	8
48	1	42.9	22	1	.	.
60	1	.	.	1	.	.
	20-39			**≥40**		
Interval (months)	**No.**	**% success**	**SE**	**No.**	**% success**	**SE**
0	27	100	-	428	100	-
12	21	77.8	8	330	76.6	2
24	5	77.8	8	139	68.9	3
36	3	77.8	8	52	62.6	3
48	2	77.8	8	16	50.6	6
	1	.	.	4	44.2	8

Figure 2.4.2.4 Graft Survival by Age, 2004-2009

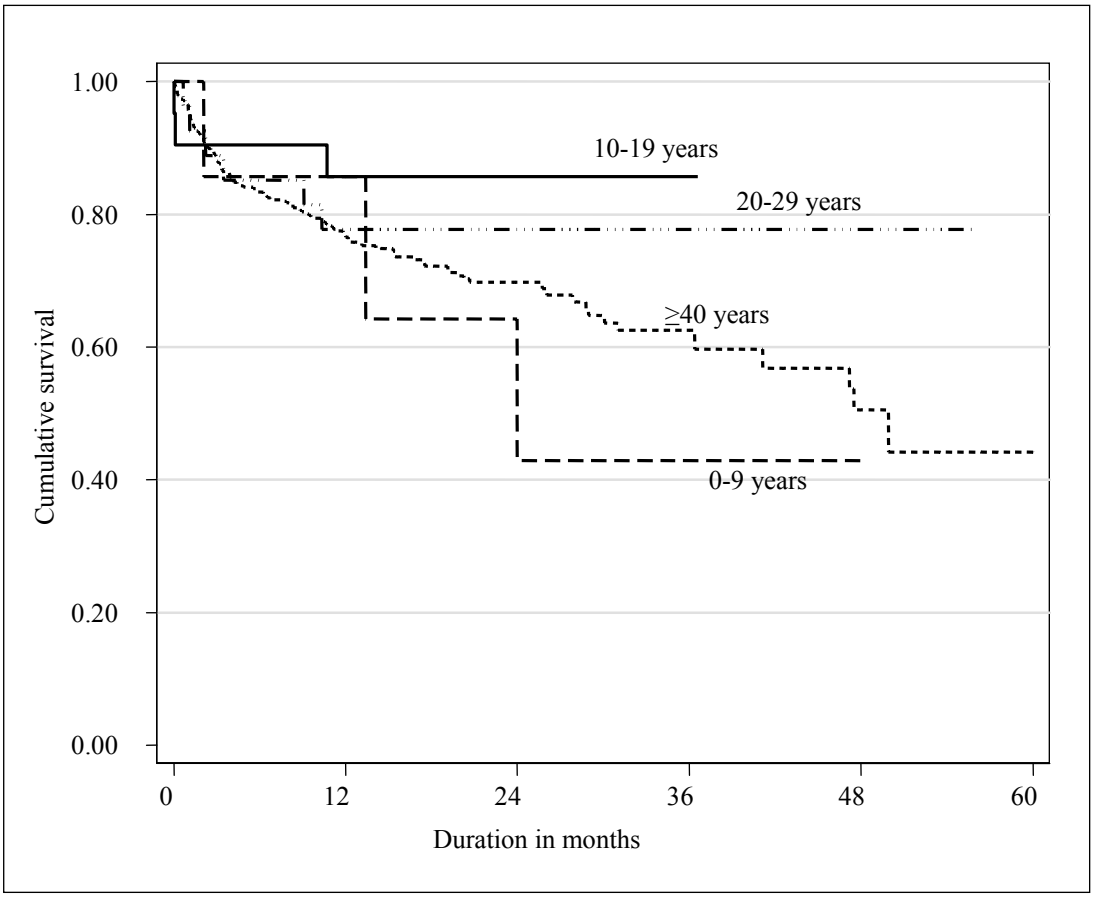


Table 2.4.2.5: Causes of Graft Failure

		Total (N=139)	
		No.	**%**
Graft Failure		139	30
Cause of Failure	Primary graft failure or Primary Endothelial decompensation	37	27
	Recurrence of primary disease	13	9
	Late Endothelial decompensation	23	17
	Glaucoma	29	21
	Infection	26	19
	Graft rejection	30	22
	Others	31	22
	No data	6	4

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

2.4.3 Visual Outcome

Visual outcome of corneal transplants was analysed in cases where post corneal transplant unaided vision was available. Data on post corneal transplant best corrected vision was only available in a limited number of the cases (Table 2.4.3.1). Forty nine percent of optical and 41% of non-optical cases had improved unaided vision after surgery (Table 2.4.3.2).

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

	Unaided Vision (N =1189)	
	No.	**%**
Data available	451	38
Lost to follow up	699	59
No data	39	3

Table 2.4.3.2 Unaided Visual Outcome After Cornea Transplant Surgery

Reason for graft	**Optical (n=313)**		**Non-optical (n=138)**	
	No.	**%**	**No.**	**%**
Vision better	153	49	57	41
Vision same	55	18	37	27
Vision worse	47	15	33	24
Not known*	58	18	11	8

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

Figure 2.4.3.2 Unaided Visual Outcome After Corneal Transplant Surgery

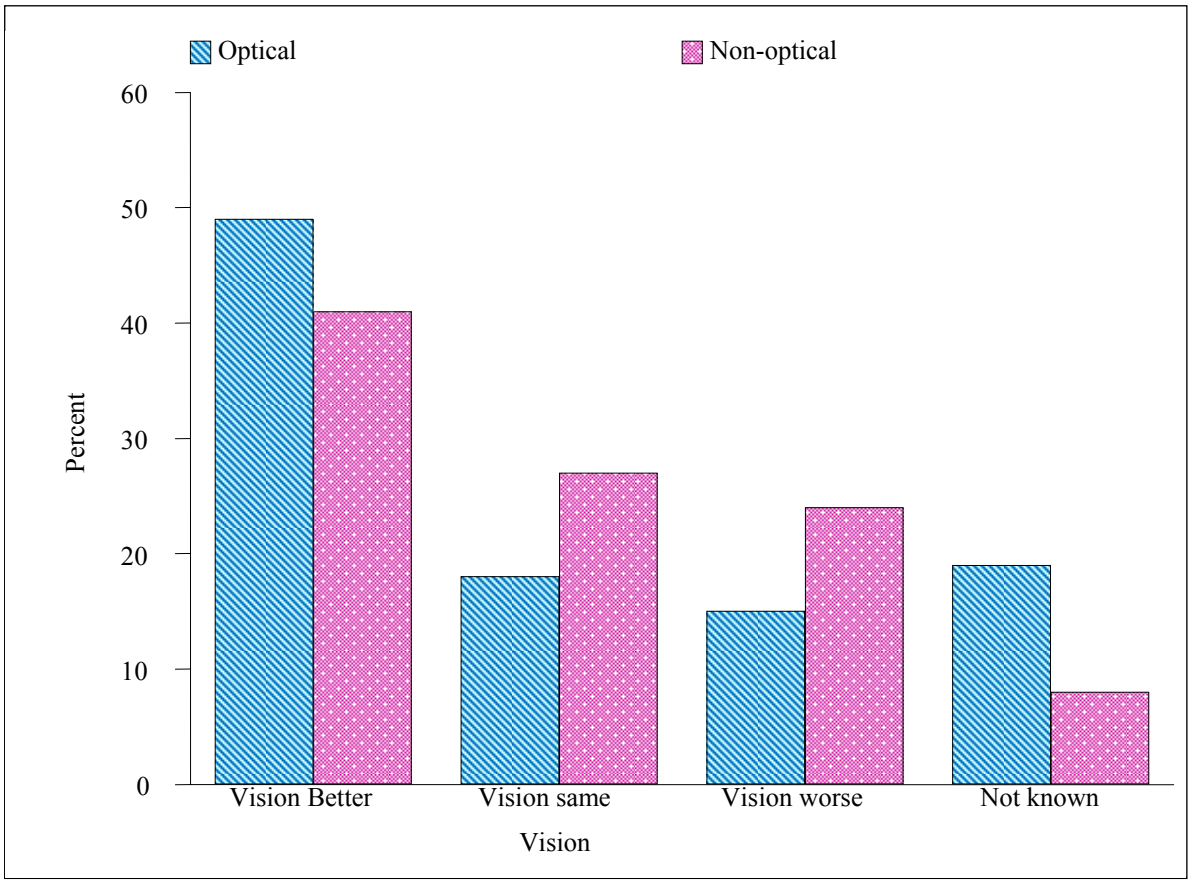
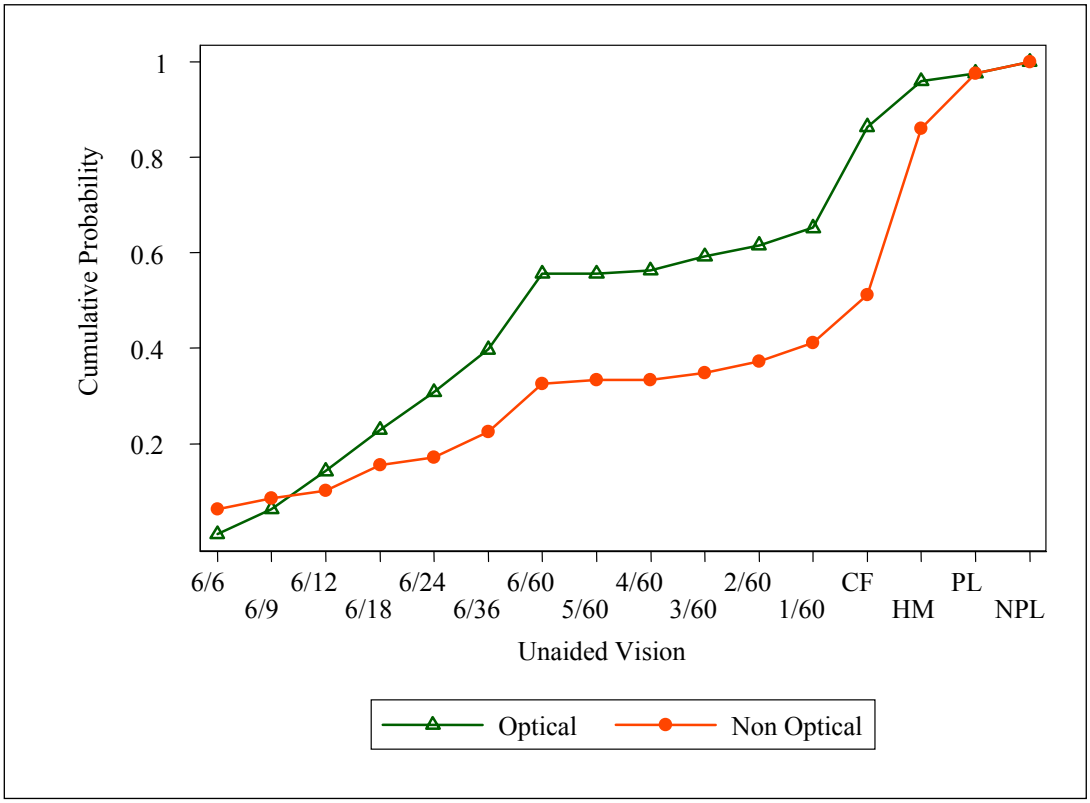


Table 2.4.3.3 Unaided Vision for Optical and Non Optical Cases

	Optical				Non Optical			
Vision	**Graft Survival (253)**		**Graft Failure (60)**		**Graft Survival (76)**		**Graft Failure (62)**	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6/18 or Better	69	27	0	0	18	24	2	3
6/24 – 6/60	95	38	4	7	19	25	3	5
Less than 6/60	78	31	56	93	30	39	57	92
Data not available	11	4	0	0	9	12	0	0

Figure 2.4.3.3 Cumulative Probability for Unaided Vision in Grafts



2.5 POST CORNEA TRANSPLANT COMPLICATIONS

The common complications observed at one year were post-keratoplasty glaucoma, graft vascularisation, epithelial problems and graft rejection. Rejection was seen in 20% who were on follow-up (Table 2.5.1). Endothelial rejection was present in 39% of the patients on follow-up. (Table 2.5.2).

Table 2.5.1: Post Transplant Complications

		One year outcome (N=215)		2nd year outcome (N=75)		3rd year outcome (N=43)		4th year outcome (N=11)		Total (N=344)	
		No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Any complications		**157**	**73**	**48**	**64**	**28**	**65**	**7**	**64**	**240**	**70**
Complication	Epithelial Problem	43	27	13	27	10	36	4	57	70	29
	Wound Dehiscence	2	1	0	0	0	0	0	0	2	1
	Suture infiltration / abscess	27	17	6	13	5	18	2	29	40	17
	Endophthalmitis	1	1	1	2	0	0	0	0	2	1
	Microbial keratitis	26	17	6	13	2	7	0	0	34	14
	Vascularisation	55	35	18	38	11	39	3	43	87	36
	Post-keratoplasty glaucoma	63	40	21	44	13	46	2	29	99	41
	Graft Rejection	36	23	9	19	3	11	1	14	49	20
	No data	58	37	27	56	15	54	4	57	104	43

* Each patient may have more than one complication

Table 2.5.2: Post Transplant Graft Rejection Types

		One year outcome (N=215)		2nd year outcome (N=75)		3rd year outcome (N=43)		4th year outcome (N=11)		Total (N = 344)	
		No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Graft Rejection		**36**		**9**		**3**		**1**		**49**	
Types	Epithelial	14	39	4	44	2	67	0	0	20	41
	Stromal	12	33	0	0	0	0	0	0	12	24
	Endothelial	13	36	4	44	1	33	1	100	19	39
	No data	4	11	1	11	0	0	0	0	5	10

* Each patient may have more than one type of rejection

CHAPTER 3

HEART AND LUNG TRANSPLANTATION

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3.0 INTRODUCTION

Following the introduction of heart transplant in 1997 and lung transplant in 2005, the number of thoracic organ transplants have been few and far in between. The main limitation to the performance of heart and lung transplants has been the lack of success in obtaining viable donor thoracic organs. As a result of the infrequent performance of transplant, the results of thoracic organ transplant would not be expected to improve.

In 2009, 1 thoracic organ transplant (heart transplant) was conducted. For end stage heart failure patients, a new approach to keep the patients alive while awaiting heart transplant has been the use of ventricular assist devices (VADs) as a bridge to transplant. Indeed, the patient who received the heart transplant in 2009 was bridged from cardiogenic shock to heart transplant by a Thoratec paracorporeal VAD (implanted in 2008) for over a year.

One patient who was more than 10 years post heart transplant and had graft coronary artery disease died suddenly outside the hospital in 2009.

The rest of the report that follows will review the results of heart and lung transplantation in Malaysia till end of 2009.

HEART TRANSPLANTATION

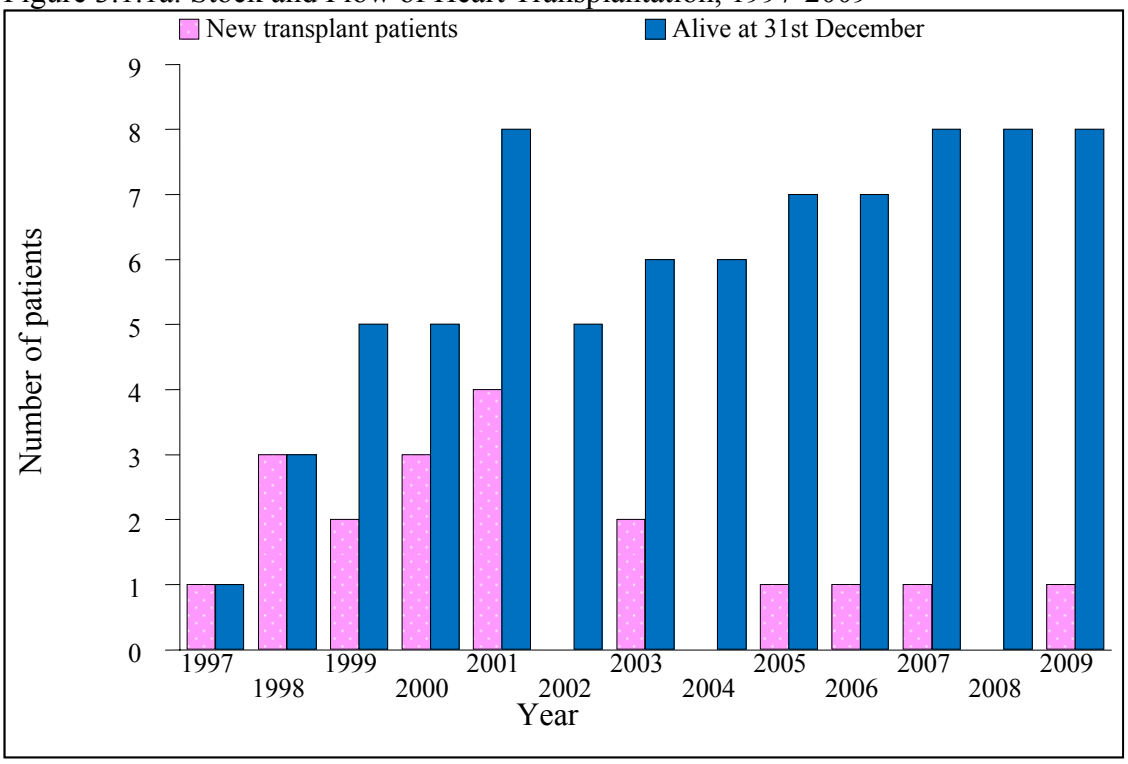
3.1 STOCK AND FLOW

Table 3.1.1a: Stock and Flow of Heart Transplantation, 1997-2009

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
New transplant patients	1	3	2	3	4	0	2	0	1	1	1	0	1
Deaths	0	1	0	3	1	3	1	0	0	1	0	0	1
Retransplanted	0	0	0	0	0	0	0	0	0	0	1	0	0
Lost to follow up	0	0	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	8	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, 1997-2009



3.2 RECIPIENTS' CHARACTERISTICS

Table 3.2.1a: Distribution of Patients by Gender, 1997-2009

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	TOTAL
Gender	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
Male	1	3	0	2	2	0	2	0	1	1	0	0	0	12
Female	0	0	2	1	2	0	0	0	0	0	1	0	1	7
TOTAL	**1**	**3**	**2**	**3**	**4**	**0**	**2**	**0**	**1**	**1**	**1**	**0**	**1**	**19**

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, 1997-2009

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	TOTAL
Ethnic group	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
Malay	0	0	1	1	2	0	0	0	1	0	0	0	0	5
Chinese	0	0	0	1	0	0	1	0	0	0	1	0	1	4
Indian	1	3	1	1	2	0	1	0	0	1	0	0	0	10
TOTAL	**1**	**3**	**2**	**3**	**4**	**0**	**2**	**0**	**1**	**1**	**1**	**0**	**1**	**19**

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, 1997-2009

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	TOTAL
Age, years	**No.**	**No.**	**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	0	0	6
20-39	0	2	0	0	0	0	0	0	0	0	0	0	0	2
40-59	1	1	0	2	3	0	2	0	0	1	0	0	1	11
≥60	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	**1**	**3**	**2**	**3**	**4**	**0**	**2**	**0**	**1**	**1**	**1**	**0**	**1**	**19**
Mean	51	40	15	37	38	-	46	-	15	44	15	-	41	35
SD	-	9	1	22	17	-	8	-	-	-	-	-		16
Median	51	37	15	44	43	-	46	-	15	44	15	-	41	40
Minimum	51	33	15	13	14	-	40	-	15	44	15	-	41	13
Maximum	51	50	16	55	54	-	52	-	15	44	15	-	41	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, 1997-2009

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	TOTAL
Primary diagnosis	**No.**	**No.**	**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	0	0	9
Idiopathic Dilated Cardiomyopathy	0	0	2	1	2	0	0	0	1	0	0	0	0	6
Restrictive Cardiomyopathy	0	0	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	0	0	1
Hypertrophic Cardiomyopathy	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Others	0	0	0	0	0	0	0	0	0	0	1	0	1	2
TOTAL	**1**	**3**	**2**	**3**	**4**	**0**	**2**	**0**	**1**	**1**	**1**	**0**	**1**	**19**

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, 1997-2009

Year	**97**	**98**	**99**	**00**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**TOTAL**
Heart Procedure	**No.**	**No.**	**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	0	0	2
Orthotopic Traditional	0	2	2	3	4	0	2	0	1	1	2	0	1	18
Heterotopic	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	**1**	**3**	**2**	**3**	**4**	**0**	**2**	**0**	**1**	**1**	**2**	**0**	**1**	**20**

Table 3.3.2a: Distribution of Patients by Immunosuppressive Used, 1997-2009

Year	**97**	**98**	**99**	**00**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**Total**
Type of immunosuppressive	**No.**	**No.**	**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	0	1	17
Methylprednisolone	1	3	2	3	4	0	2	0	1	1	2	0	1	20
Calcineurin Inhibitors														
Neoral®	1	3	2	3	4	0	1	0	1	1	0	0	1	17
Tacrolimus (FK506)	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Antimetabolites														
Azathioprine (AZA)	1	3	2	3	4	0	2	0	0	1	0	0	0	16
Mycophenolate Mofetil (MMF)	0	0	0	0	1	0	0	0	1	0	1	0	1	4
Anti-lymphocyte Receptor Antibodies														
Anti-thymocyte globulin (ATG)	0	0	0	0	0	0	0	0	0	0	2	0	0	2
TOTAL patients at notification	**1**	**3**	**2**	**3**	**4**	**0**	**2**	**0**	**1**	**1**	**1**	**0**	**1**	**19**

Table 3.3.3a: Immunosuppressive Used at Time of Last Follow-up up to 2009

Year of follow up*	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Type of immunosuppressive	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
Steroids						
Prednisolone	3	4	4	3	4	3
Methylprednisolone	1	1	0	0	1	2
Calcineurin Inhibitors						
Neoral®	6	6	7	7	7	7
FK506	0	0	0	0	1	1
Antimetabolites						
Azathioprine (AZA)	3	3	3	3	3	2
Mycophenolate Mofetil (MMF)	3	3	5	5	5	6
TOTAL patients at follow-up	6	6	7	7	8	8

*Data according to year of follow up of transplanted patients

Table 3.3.4a: Duration of Waiting Time on Waiting List, 1997-2009

Year	**97**	**98**	**99**	**00**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**TOTAL**
Duration (months)*	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
<5	0	2	1	0	1	0	1	0	0	0	0	0	0	5
5≤10	1	0	1	0	1	0	0	0	1	0	0	0	0	4
10≤15	0	0	0	1	0	0	0	0	0	1	2	0	1	5
15≤20	0	0	0	1	0	0	0	0	0	0	0	0	0	1
20≤25	0	0	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	0	0
30≤35	0	0	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	0	0	1
TOTAL	**1**	**2**	**2**	**2**	**2**	**0**	**2**	**0**	**1**	**1**	**2**	**0**	**1**	**16**
Mean	6	2	4	15	5	-	20	-	9	10	13	-	13	10
SD	-	0	1	6	5	-	25	-	-	-	0	-	-	9
Median	6	2	4	15	5	-	20	-	9	10	13	-	13	9
Minimum	6	2	3	10	1	-	2	-	9	10	13	-	13	1
Maximum	6	2	5	19	8	-	37	-	9	10	13	-	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 2009

Year of transplant*	**97**	**98**	**99**	**00**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**TOTAL**
Type of post transplant events	**No.**	**No.**	**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	0	0	10
Bone Disease (Symptomatic)	1	0	0	0	1	0	0	0	0	0	0	0	0	2
Chronic Liver Disease	0	0	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	0	0
Diabetes	1	2	0	0	0	0	1	0	0	0	0	0	0	4
Renal Dysfunction	1	1	0	0	0	0	0	0	0	0	0	0	0	2
Stroke	0	0	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	0	0	11
TOTAL patients at follow-up	**1**	**2**	**2**	**1**	**3**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**13**

*Data according to year of transplant of patient

Table 3.4.2: Post Transplant Malignancies at Follow-up up to 2009

Year of transplant*	**97**	**98**	**99**	**00**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**TOTAL**
Type of post transplant malignancies	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
Donor related	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Recurrence of pre-transplant tumor	0	0	0	0	0	0	0	0	0	0	0	0	0	0
De novo solid tumor	1	0	0	0	0	0	0	0	0	0	0	0	0	1
De novo lymphoproliferative	0	0	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	0	0
Total patients at follow up	**1**	**2**	**2**	**1**	**3**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**13**

*Data according to year of transplant of patient

Table 3.4.3: Non-compliance at Follow-up up to 2009

Year of transplant*	**97**	**98**	**99**	**00**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**TOTAL**
Non-compliance during follow-up	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
• Yes	0	0	2	0	0	0	1	0	0	0	0	0	0	3
• No	1	2	0	1	3	0	0	0	1	0	1	0	1	9
TOTAL patients at follow-up	**1**	**2**	**2**	**1**	**3**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**13**
Areas of non-compliance:														
• Immunosuppression medication	0	0	1	0	0	0	1	0	0	0	0	0	0	2
• Patient unable to afford immunosuppression medications	0	0	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	0	0
• Other therapeutic regimen	0	0	1	0	0	0	0	0	0	0	0	0	0	1
TOTAL patients with noncompliance	**0**	**0**	**2**	**0**	**0**	**0**	**1**	**0**	**0**	**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 2009

Year of transplant*	**97**	**98**	**99**	**00**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**TOTAL**
Patient treated for rejection	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
• Yes	0	1	1	0	1	0	0	0	1	0	0	0	0	4
• No	1	1	1	1	2	0	1	0	0	0	1	0	1	8
TOTAL patients at follow-up	**1**	**2**	**2**	**1**	**3**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**13**
Number of rejection events														
• 1	0	1	0	0	1	0	0	0	1	0	0	0	0	3
• 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
• 3	0	0	1	0	0	0	0	0	0	0	0	0	0	1
TOTAL patients with rejection	**0**	**1**	**1**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**4**

*Data according to year of transplant of patient

Table 3.4.5a: Distribution of Patients by Time of Deaths, 1997-2009

Year of discharge	**97**	**98**	**99**	**00**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**TOTAL**
Time of deaths*	**No.**	**No.**	**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	0	0	6
3-<6 months	0	0	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	0	0	1
>1 year	0	0	0	1	1	1	0	0	0	0	0	0	1	4
TOTAL patients who died	0	1	0	3	1	3	1	0	0	1	0	0	1	11

*Time=Date of death-date of transplant

Table 3.4.6: Patient Survival, 1997-2009

Year of Transplant	**1997-2009**	
Interval	**% Survival**	**SE**
6 months	70	10
1 year	59	11
2 year	48	11
3 year	42	11
4 year	42	11
5 year	42	11
6 year	42	11
7 year	42	11
8 year	42	11
9 year	42	11
10 year	42	11
11 year	28	14

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, 1997-2009

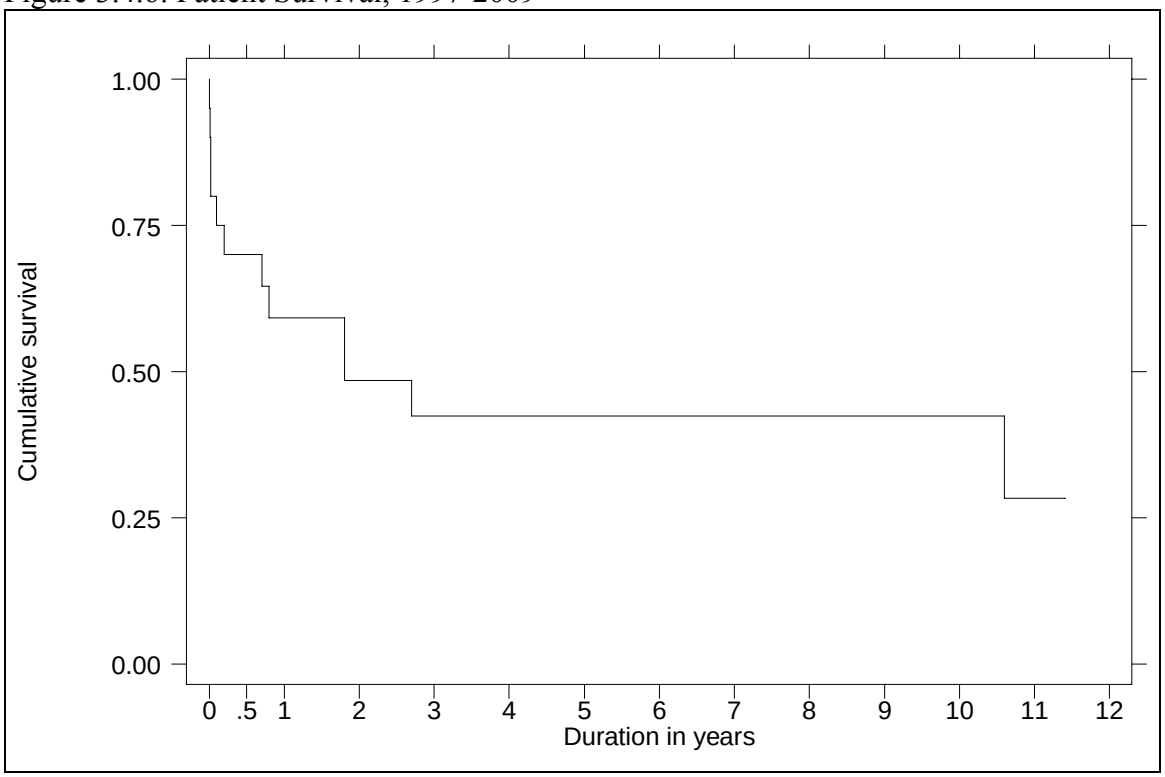


Table 3.4.7: Cause of Death at Discharge, 1997-2009

Year	97	98	99	00	01	02	03	04	05	06	07	08	09	TOTAL
Cause of death	**No.**	**No.**	**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	0	0	1
Multi organ failure	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Respiratory failure secondary to septicaemia	0	0	0	0	0	1	0	0	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	0	0	1
Septicaemia, multiorgan failure	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Graft failure	0	0	0	0	0	0	0	0	0	1	0	0	0	1
TOTAL patients who died at discharge	**0**	**1**	**0**	**2**	**0**	**1**	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**6**

Table 3.4.8: Severe bleeding

Year	97	98	99	00	01	02	03	04	05	06	07	08	09	TOTAL
Cause of death	**No.**	**No.**	**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	0	0	1
Lung cancer, septicaemia, small cell type bronchopneumonia	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Rejection due to non compliance	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Sudden death due to graft CAD	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Unknown	0	0	0	0	0	1	0	0	0	0	0	0	0	1
TOTAL patients who died at follow up	**0**	**0**	**0**	**1**	**1**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**5**

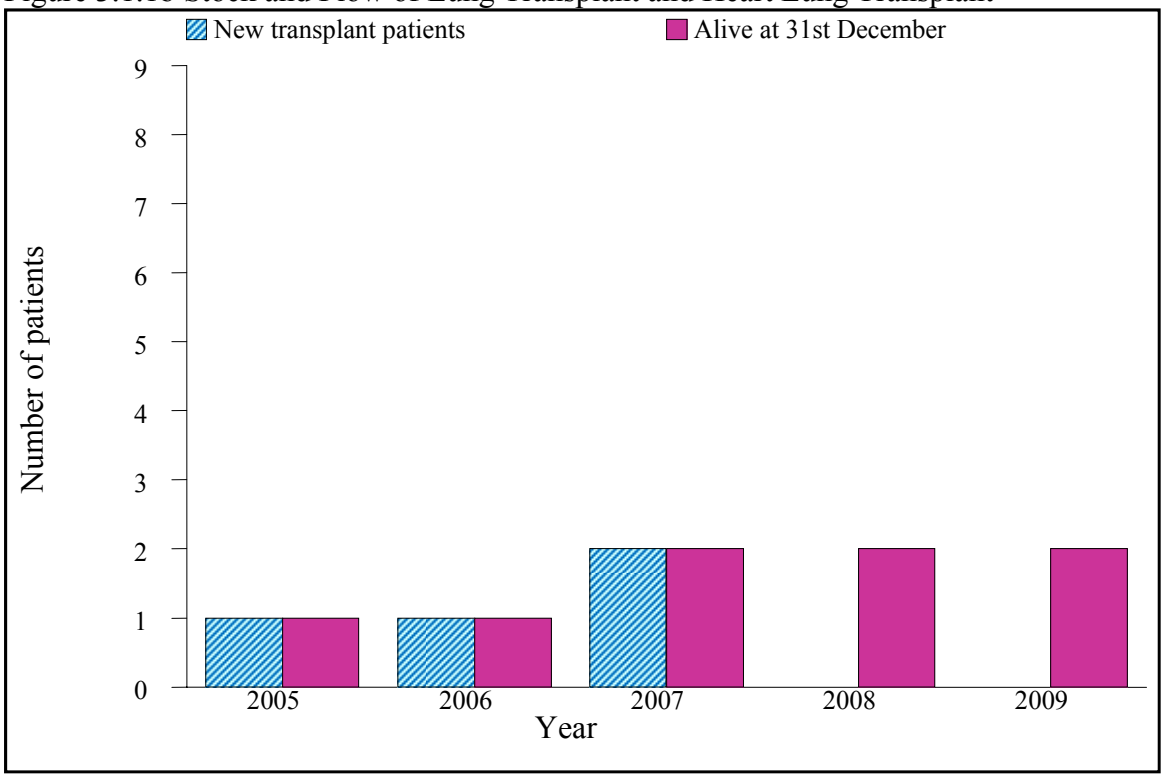
LUNG TRANSPLANTATION

3.1 STOCK AND FLOW

Table 3.1.1b: Stock and Flow of Lung Transplantation, 2005-2009

Year	**2005**	**2006**	**2007**	**2008**	**2009**
New transplant patients	1	1	2	0	0
Deaths	0	1	1	0	0
Retransplanted	0	0	0	0	0
Lost to follow up	0	0	0	0	0
Alive at 31st December	**1**	**1**	**2**	**2**	**2**

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



3.2 RECIPIENTS' CHARACTERISTICS

Table 3.2.1b: Distribution of Patients by Gender, 2005-2009

Year	2005	2006	2007	2008	2009	TOTAL
Gender	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
Male	1	1	1	0	0	3
Female	0	0	1	0	0	1
TOTAL	**1**	**1**	**2**	**0**	**0**	**4**

Table 3.2.2b: Distribution of Patients by Ethnic Group, 2005-2009

Year	2005	2006	2007	2008	2009	TOTAL
Ethnic group	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
Malay	0	0	1	0	0	1
Chinese	0	0	0	0	0	0
Indian	1	1	0	0	0	2
Bumiputra Sarawak	0	0	1	0	0	1
TOTAL	**1**	**1**	**2**	**0**	**0**	**4**

Table 3.2.3b: Distribution of Patients by Age, 2005-2009

Year	2005	2006	2007	2008	2009	TOTAL
Age, years	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
0-19	0	0	1	0	0	1
20-39	0	1	1	0	0	2
40-59	1	0	0	0	0	1
≥60	0	0	0	0	0	0
TOTAL	**1**	**1**	**2**	**0**	**0**	**4**

Age=date of transplant-date of birth

Table 3.2.4b: Distribution of Patients by Primary Diagnosis, 2005-2009

Year	2005	2006	2007	2008	2009	TOTAL
Primary diagnosis	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
Idiopathic pulmonary fibrosis	1	1	1	0	0	3
Idiopathic pulmonary arterial hypertension	0	0	1	0	0	1
Chronic obstructive pulmonary disease	0	0	0	0	0	0
Bronchiectasis	0	0	0	0	0	0
TOTAL	**1**	**1**	**2**	**0**	**0**	**4**

3.3 TRANSPLANT PRACTICES

Table 3.3.1b: Heart-Lung Transplant

Year	**2005**	**2006**	**2007**	**2008**	**2009**	**TOTAL**
Heart Procedure	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
Single lung transplant	1	0	0	0	0	1
Double lung transplant	0	1	1	0	0	2
Heart-Lung tranplant	0	0	1	0	0	1
TOTAL	**1**	**1**	**2**	**0**	**0**	**4**

Table 3.3.3b: Immunosuppressive Used at Time of Last Follow-up up to 2009

Year of follow up*	**2005**	**2006**	**2007**	**2008**	**2009**
Type of immunosuppressive	**No.**	**No.**	**No.**	**No.**	**No.**
Steroids:					
Prednisolone	1	2	2	1	0
Methylprednisolone	1	1	2	0	0
Calcineurin Inhibitors:					
Neoral®	1	2	3	0	0
FK506 (Tacrolimus)	0	0	0	2	2
Antimetabolites:					
Mycophenolate Mofetil (MMF)	1	2	3	2	0
TOTAL patients at follow-up	**1**	**2**	**3**	**2**	**2**

*Data according to year of follow up of transplanted patients

3.4 TRANSPLANT OUTCOMES

Table 3.4.5b: Distribution of Patients by Time of Deaths, 2005-2009

Year of discharge	**2005**	**2006**	**2007**	**2008**	**2009**	**TOTAL**
Time of deaths*	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
<3 months (at discharge)	0	1	1	0	0	2
3-<6 months	0	0	0	0	0	0
6 months-1 year	0	0	0	0	0	0
>1 year	0	0	0	0	0	0
TOTAL patients who died	0	1	1	0	0	2

*Time=Date of death-date of transplant

CHAPTER 4

LIVER TRANSPLANTATION

Editor:
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Dr Lim Kin Foong
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4.1 STOCK AND FLOW

The number of liver transplants performed from 1993 to 2009 is one hundred and nine. Ninety two (84%) were performed locally and seventeen (16%) were performed at overseas centres. Eight new liver transplants were done in 2009 of which six were done locally at Selayang Hospital and two were done overseas.

Table 4.1.1 Stock and Flow of Liver Transplantation, 1993-2009

Year	93	94	95	96	97*	98	99	00	01	02	03**	04	05	06	07	08	09
New transplant patients	1	1	8	13	3	2	8	3	5	10	5	16	5	8	7	6	8
Deaths	0	0	3	4	1	1	4	1	2	5	1	5	6	4	3	2	4
Re-Transplant	0	0	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	0	0	0	0	0	1	0	0	0	0
Functioning graft at 31st December	1	2	7	16	18	19	23	25	28	33	37	48	46	50	54	58	62

*1 patient who was alive until 5/12/1997 is recorded dead with missing date of death
** 1 patient who had transplanted in 2003 is recorded as dead with missing date of death

Figure 4.1.1 Stock and Flow of Liver Transplantation, 1993-2009

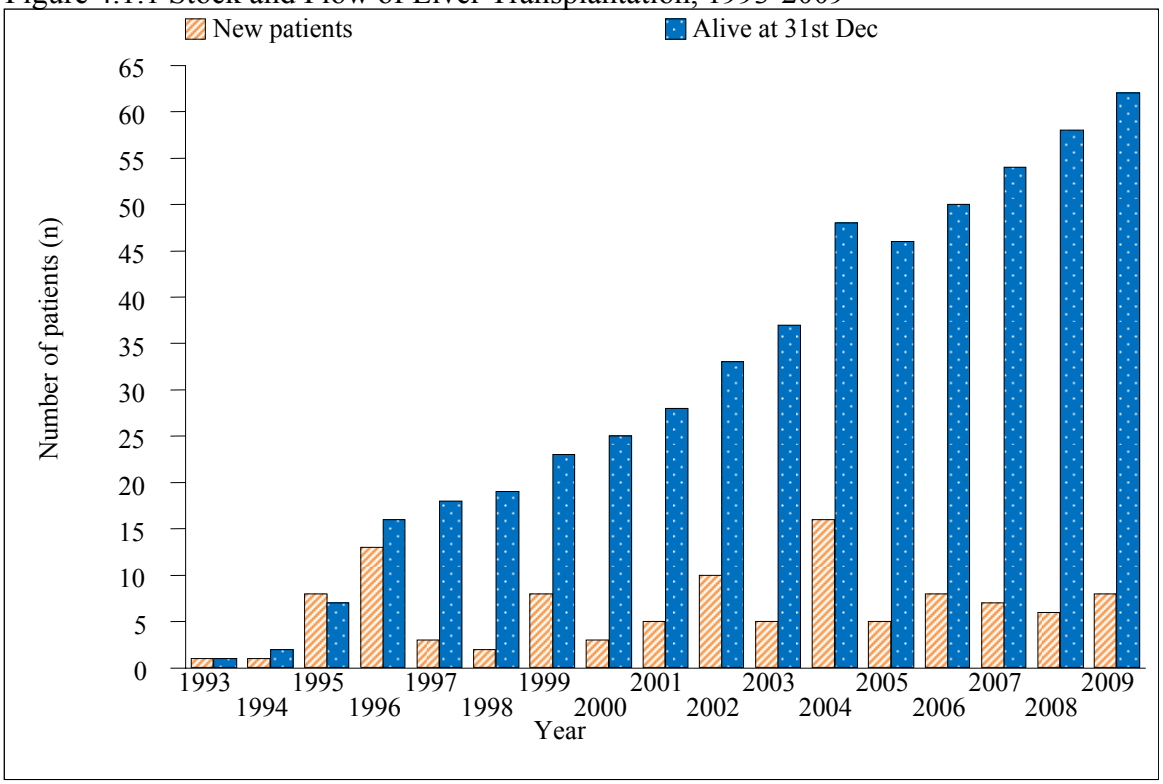

Table 4.1.2 Distribution of Patients by Place of Transplant, 1993-2009

Place of Transplant	Year (No.)																	
	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	Total
Local	0	0	8	10	1	1	8	3	5	9	2	14	5	8	7	5	6	92
Oversea	1	1	0	3	2	1	0	0	0	1	3	2	0	0	0	1	2	17
TOTAL	**1**	**1**	**8**	**13**	**3**	**2**	**8**	**3**	**5**	**10**	**5**	**16**	**5**	**8**	**7**	**6**	**8**	**109**

Table 4.1.3 Distribution of Patients by Centres for Liver Transplantation, 1993-2009

Transplant Centre	Year (No.)																	
	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	TOTAL
Sime Darby Medical Centre, Subang Jaya	0	0	8	10	1	1	8	3	5	6	2	7	0	0	0	0	0	51
Hospital Selayang	0	0	0	0	0	0	0	0	0	3	0	7	5	8	7	5	6	41
Royal Children's Hospital, Brisbane	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	3
National University Hospital, Singapore	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	2	5
Queensland Liver Transplant Service, Australia	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
King Collage Hospital, UK	0	1	0	0	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	0	0	2
Asian Centre for Liver Disease & Transplantation, Singapore	0	0	0	0	0	0	0	0	0	1	2	1	-	-	-	-	-	4
TOTAL	**1**	**1**	**8**	**13**	**3**	**2**	**8**	**3**	**5**	**10**	**5**	**16**	**5**	**8**	**7**	**6**	**8**	**109**

4.2 RECIPIENTS' CHARACTERISTICS

Fifty five (50%) were males and fifty four (50%) were females. The ethnic distribution of the liver transplant recipients are as follows: Chinese 59 (54%), Malays 40 (37%), Indians 8 (7%), Others 2 (2%).

Eighty seven (80%) 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 seventy six (70%) 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. (37%)

Table 4.2.1 Distribution of Patients by Gender, 1993-2009

Gender	Year (No.)																	
	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	TOTAL
Male	0	0	6	5	2	1	3	1	2	7	5	10	2	6	3	1	1	55
Female	1	1	2	8	1	1	5	2	3	3	0	6	3	2	4	5	7	54
TOTAL	**1**	**1**	**8**	**13**	**3**	**2**	**8**	**3**	**5**	**10**	**5**	**16**	**5**	**8**	**7**	**6**	**8**	**109**

Figure 4.2.1 Distribution of Patients by Gender, 1993-2009

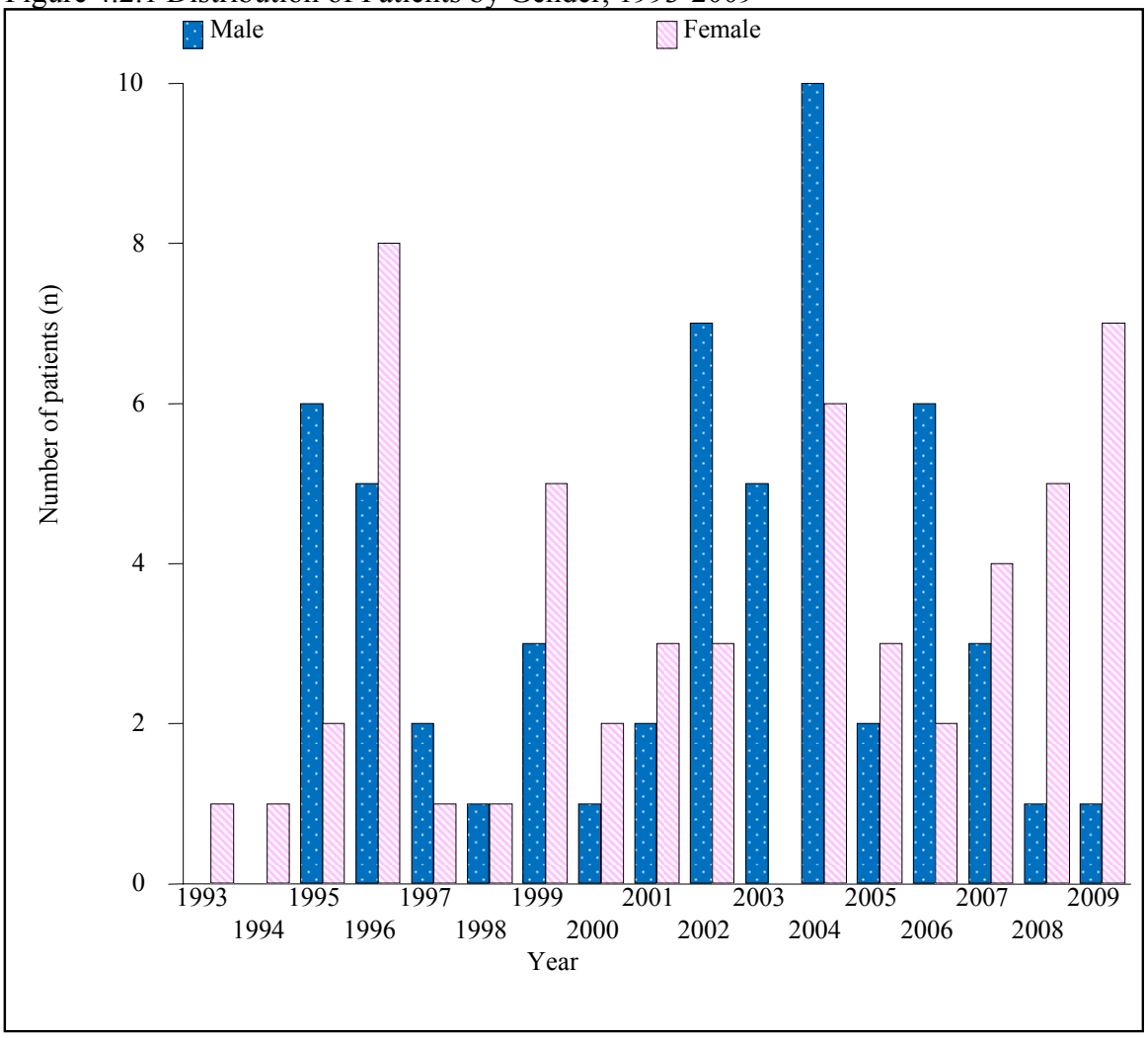

Table 4.2.2 Distribution of Patients by Ethnic Group, 1993-2009

Ethnic group	Year (No.)																	
	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	TOTAL
Malay	0	1	2	3	1	0	4	1	2	3	1	11	3	3	2	2	1	40
Chinese	1	0	6	8	2	1	2	2	3	6	4	5	1	3	4	4	7	59
Indian	0	0	0	2	0	1	1	0	0	0	0	0	1	2	1	0	0	8
Others	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	2
TOTAL	**1**	**1**	**8**	**13**	**3**	**2**	**8**	**3**	**5**	**10**	**5**	**16**	**5**	**8**	**7**	**6**	**8**	**109**

Figure 4.2.2 Distribution of Patients by Ethnic Group, 1993-2009

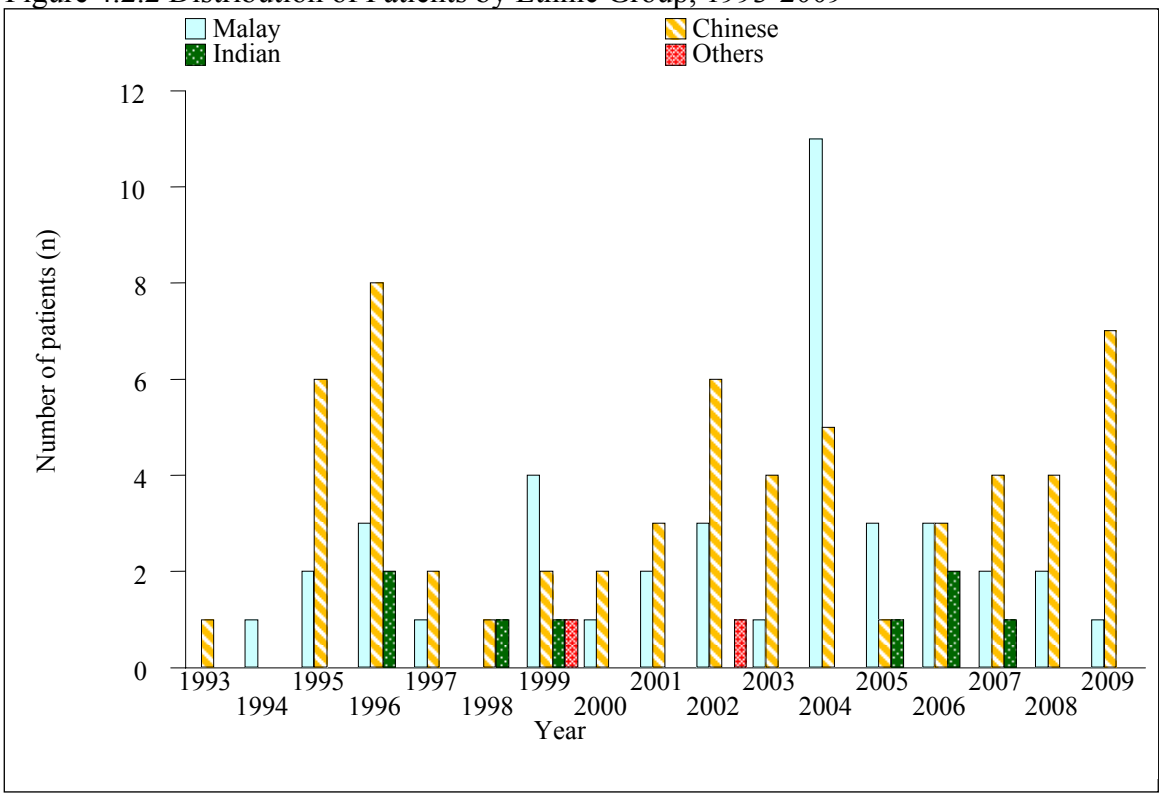

Table 4.2.3 Distribution of Patients by Age, 1993-2009

Age group	Year (No.)															
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	TOTAL
<1	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1	1	5
1-4	1	1	3	11	3	2	5	3	5	6	1	8	2	4	4	1	3	63
5-9	0	0	3	1	0	0	2	0	0	2	1	3	2	1	1	1	2	19
10-14	0	0	1	1	0	0	0	0	0	0	0	1	0	1	1	0	1	6
15-19	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	2
20-39	0	0	1	0	0	0	0	0	0	1	0	0	0	2	1	3	1	9
40-59	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	3
≥60	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	2
TOTAL	**1**	**1**	**8**	**13**	**3**	**2**	**8**	**3**	**5**	**10**	**5**	**16**	**5**	**8**	**7**	**6**	**8**	**109**
Mean	2	4.4	9.2	3.8	1.8	2.3	4.4	1.4	2.2	10.4	26.8	12.5	4.5	12.2	9.5	13.9	8.6	8.9
SD	-	-	9.2	3.6	0.7	1.4	4.8	0.1	1.6	14.2	32.8	21.6	2.9	15.2	12.8	11.3	8.2	14
Median	2	4.4	5.4	2.3	2	2.3	2.2	1.5	1.8	4	8.9	3.4	4.5	4.3	4.7	15.7	6.6	3.2
Minimum	2	4.4	2.2	1.6	1.1	1.4	1.1	1.3	1	1.3	11.8 months	11.8 months	11.9 months	1.5	1.5	10.6 months	8.9 months	8.9 months
Maximum	2	4.4	30	14.1	2.4	3.3	15	1.6	4.9	46	72.7	73.9	8.1	38.8	37.5	25.9	26.9	73.9

** Age=date if transplant – date of birth

Table 4.2.4 Primary Diagnosis, 1993-2009 (N=109)

Primary diagnosis	Year (No.)																	
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	TOTAL
Biliary atresia	1	1	7	12	3	1	7	2	5	6	2	10	4	2	6	4	3	76
Metabolic liver disease	0	0	1	1	0	0	0	0	0	2	0	2	0	0	0	0	1	7
Cholestatic liver disease	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	3
Primary biliary cirrhosis	0	0	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	0	0
Autoimmune hepatitis	0	0	0	0	0	0	1	0	0	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	0	0	5
Chronic hepatitis C	0	0	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	0	0
Malignancies	0	0	0	0	0	0	0	0	0	1	2	1	0	0	0	0	0	4
Acute liver failure	0	0	0	0	0	0	0	0	0	0	0	1	0	3	0	0	0	4
Idiopathic/ Cryptogenic	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Others	0	0	0	0	0	0	0	0	0	2	0	1	1	4	1	3	4	16
TOTAL	**1**	**1**	**8**	**13**	**3**	**2**	**8**	**3**	**5**	**11**	7	**17**	**6**	**9**	7	7	**9**	**117**

** 8 patients have more than one primary disease

Table 4.2.5 Indication for Transplantation, 1993-2009 (N=109)

Indication for transplantation	Year (No.)																	
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	TOTAL
Recurrent encephalopathy	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	3
Uncontrolled bleeding varices	0	0	0	7	1	0	4	1	1	0	0	2	0	0	0	0	0	16
Intractable ascites	0	0	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	0	0
Poor liver function	1	1	7	11	3	1	8	3	5	9	3	11	4	1	4	1	4	77
Malignancy	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Unacceptable quality of life	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	2	5
Failure to thrive and growth retardation in paediatric patients	0	0	6	10	3	2	6	3	5	7	2	10	3	1	0	1	5	64
Others	0	0	0	0	0	0	0	0	0	0	0	1	2	8	3	5	6	25
No data	0	0	0	0	0	0	0	0	0	1	1	2	0	0	0	0	0	4
TOTAL	**1**	**1**	**14**	**28**	**7**	**3**	**19**	**7**	**11**	**19**	**7**	**26**	**10**	**10**	**7**	**8**	**17**	**195**

** 36 patients had 1 indication for transplant, 73 had more than 1 indication for transplantation

Table 4.2.6 Recipients' Blood Group, 1993-2009

Blood group	Year (No.)																	
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	TOTAL
A	0	1	2	0	0	0	3	0	1	3	1	4	1	4	2	1	1	24
B	0	0	1	2	0	1	2	0	1	1	0	1	1	3	3	1	1	18
AB	0	0	0	1	0	1	0	0	0	0	0	1	1	0	0	0	1	5
O	0	0	2	5	1	0	3	3	3	5	1	8	2	1	2	2	2	40
No Data	1	0	3	5	2	0	0	0	0	1	3	2	0	0	0	2	3	22
TOTAL	**1**	**1**	**8**	**13**	**3**	**2**	**8**	**3**	**5**	**10**	**5**	**16**	**5**	**8**	**7**	**6**	**8**	**109**

4.3 TRANSPLANT PRACTICES

72% of liver transplants were living donor transplants while 28% were from cadaveric donors. 60% 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, 1993-2009

Type of donor	Year (No.)																	
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	TOTAL
Cadaveric	1	0	0	3	1	0	0	0	0	1	1	4	2	4	4	4	6	31
Living Related - Mother	0	1	5	2	1	2	5	2	2	2	2	7	1	1	0	0	2	35
Living Related - Father	0	0	2	7	1	0	2	0	2	3	0	1	1	3	3	2	0	27
Living Related - Daughter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Living Related - Son	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	2
Living Related - Brother	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Living Related - Sister	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Living Related - Monozygotic twin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Living Related - Dizygotic twin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Living Related - Others	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Living Related - Emotionally	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Living Unrelated	0	0	1	1	0	0	1	1	1	3	0	3	0	0	0	0	0	11
TOTAL patients	**1**	**1**	**8**	**13**	**3**	**2**	**8**	**3**	**5**	**10**	**5**	**16**	**5**	**8**	**7**	**6**	**8**	**109**

Table 4.3.2 Immunosuppresive Drug Treatment at Transplantation, 1993-2009 (N=109)

Immunosuppressive drugs	Year (No.)																
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	TOTAL
Steroids	0	0	2	5	0	2	5	2	5	5	1	12	5	8	6	5	6	69
Azathioprine	0	0	0	0	0	0	0	0	0	0	0	4	5	8	4	2	0	23
Cyclosporin A	1	1	1	2	0	0	0	1	0	0	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	4	7	84
Mycophenolate Mofetil (MMF)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	4
Rapamycin	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	3
Monocional/Polyclonal Antiodies	0	0	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	0	0
Others	0	0	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	0	0	14
TOTAL patients	**1**	**1**	**8**	**13**	**3**	**2**	**8**	**3**	**5**	**10**	**5**	**16**	**5**	**8**	**7**	**6**	**8**	**109**

Note: 26 patients had 1 type if drug, 44 patients had 2 types, 25 patients had 3 types

4.4 TRANSPLANT OUTCOME

The 1 year survival rate for the period 1993 - 1998 and 1999 – 2009 was 71% and 65% respectively. The most common cause of death was sepsis.

Table 4.4.1 Patient Survival by Year of Transplant, 1993-2009 (N=109)

Interval (months)	Year of transplant			
	1993-1998		1999-2009	
	% Survival	SE	% Survival	SE
1	82	7	79	5
6	71	9	67	6
12	71	9	65	6

Figure 4.4.1 Patient Survival by Year of Transplant, 1993-2009

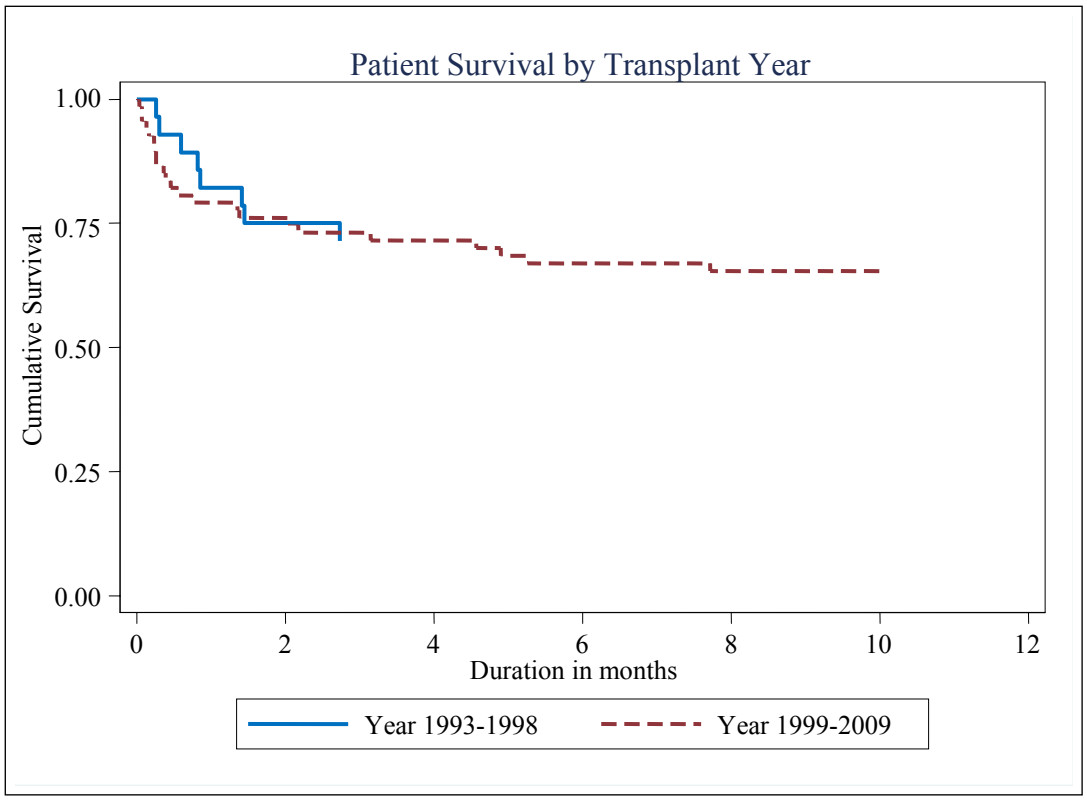

Table 4.4.2 Patient Survival by Gender, 1993-2009 (N=109)

Interval (months)	Gender			
	Male		Female	
	% Survival	SE	% Survival	SE
1	82	5	77	6
6	71	6	66	7
12	69	7	66	7

Figure 4.4.2 Patient Survival by Gender, 1993-2009

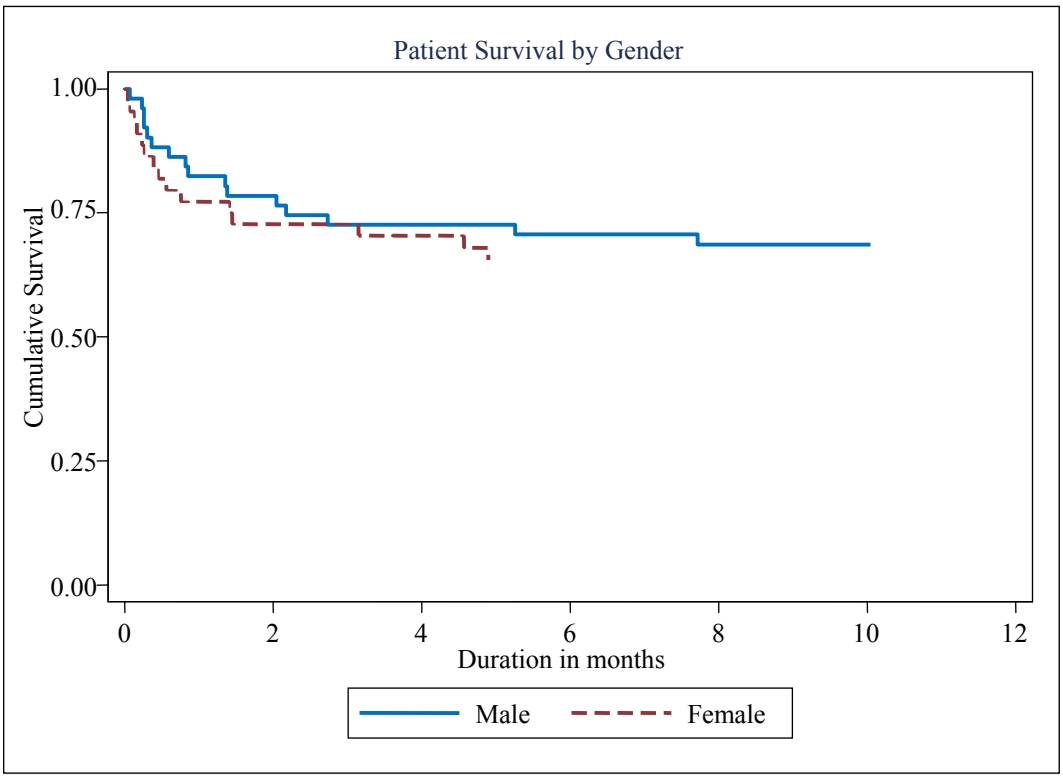

Table 4.4.3 Patient Survival by Age Group, 1993-2009 (N=109)

Interval (months)	Age Group			
	0-9 years		≥10 years	
	% Survival	SE	% Survival	SE
1	79	5	88	8
6	66	5	82	9
12	66	5	75	11

Figure 4.4.3 Patient Survival by Age Group, 1993-2009

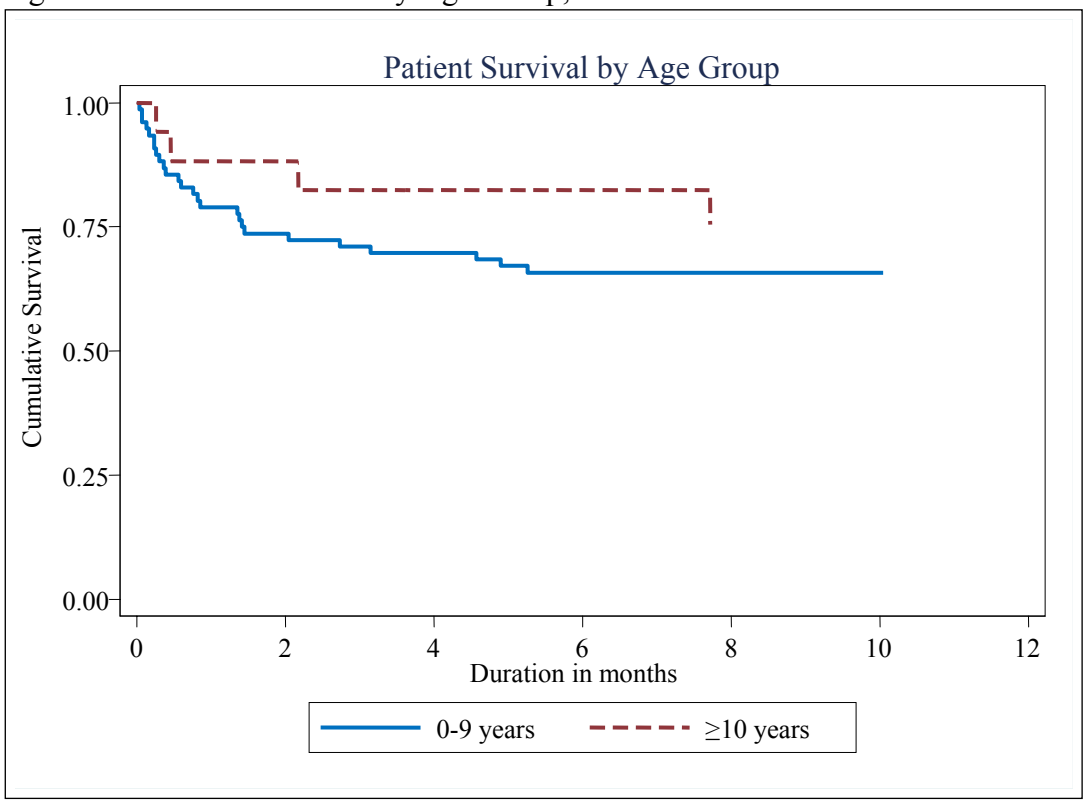

Table 4.4.4 Distribution of Patients by Cause of Death, 1993-2009 (N=109)

Cause of death	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
Graft failure	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	3
Portal Vein Thrombosis	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Chronic graft rejection	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Intra-abdominal Bleeding	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Ischaemic liver necrosis	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Peritonitis and Septicaemia	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Graft versus host reaction	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
CMV Pneumonia	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Decompensated Liver cirrhosis post liver transplant with DIVC	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Died at home	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Intra-cerebral Haemorrhage	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Intracranial Haemorrhage	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Metastasis to scalp and chest	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Oesophageal Varices / Bleeding	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Pneumonia and Respiratory Failure	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Post Transplant Lymphoproliferative Disease and Septicaemia	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Sepsis	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Sepsis severe and multi-organ failure	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Bleeding oesophageal	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	2
Septicaemia	0	0	0	0	0	0	0	0	0	0	0	1	1	2	0	0	0	4
Septicemia and DIVC	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	2
Gram negative Septicaemia	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Acute liver failure secondary to portal vein thrombosis post liver transplant	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Cholelithiasis	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
End stage liver failure recurrent ascending cholangitis	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Retroperitoneal Hematoma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Viral Bronchopneumonia	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Acute on Chronic Liver Failure	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2
Staph aureus Septicaemia, Drug induced immunodeficiency	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Hepatitis B	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Unknown	0	0	3	0	0	0	0	0	0	1	0	0	0	0	0	0	0	4
Acute graft rejection, post-transplant lymphoproferative disorder, massive upper GI bleed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Chronic rejection complicated by Pneumocytis pneumonia infection	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Total death	**0**	**0**	**3**	**4**	**1**	**1**	**4**	**1**	**2**	**5**	**1**	**5**	**6**	**4**	**3**	**2**	**2**	**44**

CHAPTER 5

RENAL TRANSPLANTATION

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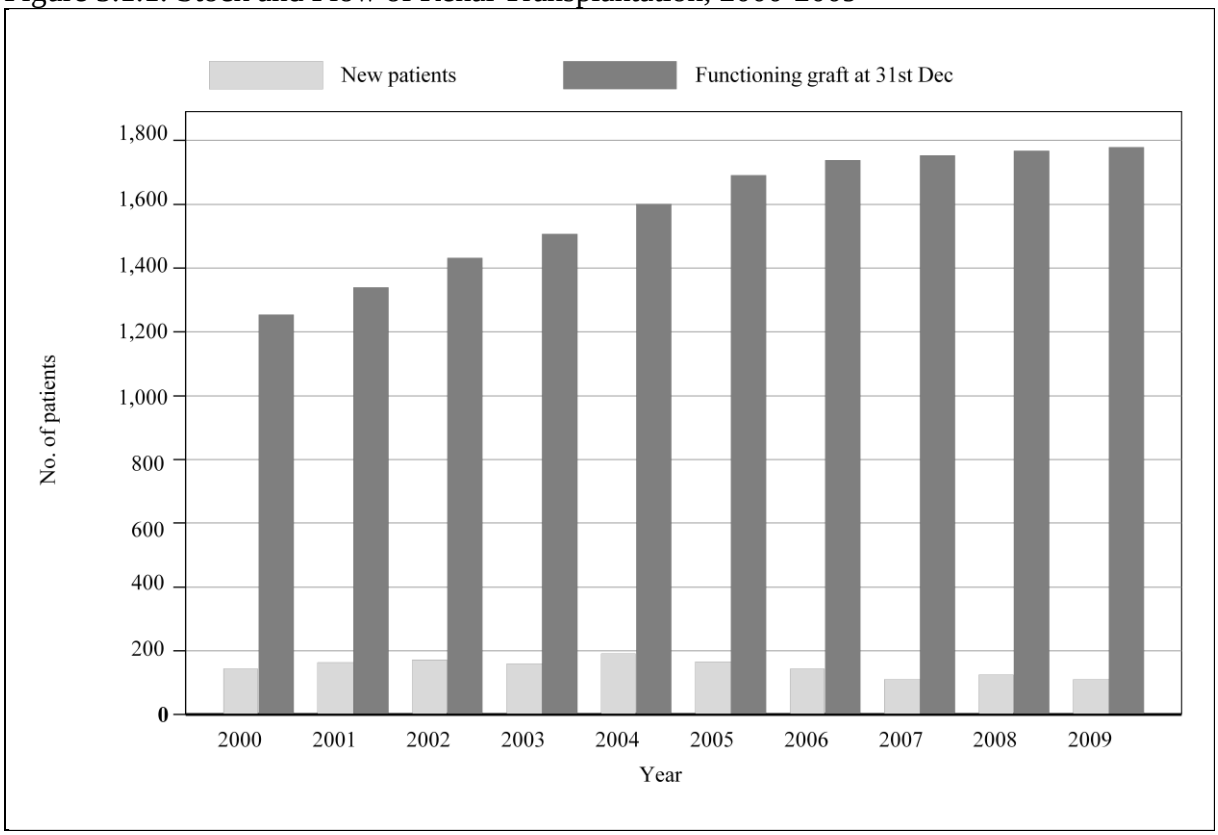
SECTION 5.1: STOCK AND FLOW

The number of new renal transplant patients shows an initial rise from 143 transplants per year in 2000 to a peak of 192 transplants in 2004. This is a rise of nearly 34% but the number declined subsequently to only 109 in 2009 (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. There may be an increase post 2008 Beijing Olympic Games. The number of functioning renal transplants reported to the National Transplant Registry (NTR) had increased from 1255 in 2000 to 1779 in 2009 (Table 5.1.1).

Table 5.1.1: Stock and Flow of Renal Transplantation, 2000-2009

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
New transplant patients	143	163	172	160	192	165	145	110	124	109
Died	30	37	35	39	42	44	55	41	52	39
Graft failure	32	40	39	42	44	21	38	38	40	34
Lost to Follow up	8	2	4	5	11	10	5	17	17	13
Functioning graft at 31st Dec	1255	1339	1433	1507	1602	1692	1739	1753	1768	1779

Figure 5.1.1: Stock and Flow of Renal Transplantation, 2000-2009



The incidence of renal transplantation shows a modest decline from 6-7 per million population in the early 2000's to 4 per million population for the last 3 years (Table 5.1.2) while transplant prevalence rate has grown slowly from 53 per million in 2000 to 63 per million population in 2008 (Table 5.1.3), an increase of 19% over the 2000 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. In fact, the incidence rate and prevalence rate seem to reduce in year 2009 (4 and 63 per million population respectively)(Table 5.1.2 and 5.1.3).

Table 5.1.2: New transplant rate per million population (pmp), 2000-2009

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
New transplant patients	143	163	172	160	192	165	145	110	124	109
New transplant rate, pmp	6	7	7	6	8	6	5	4	4	4

Figure 5.1.2: New transplant rate, 2000-2009

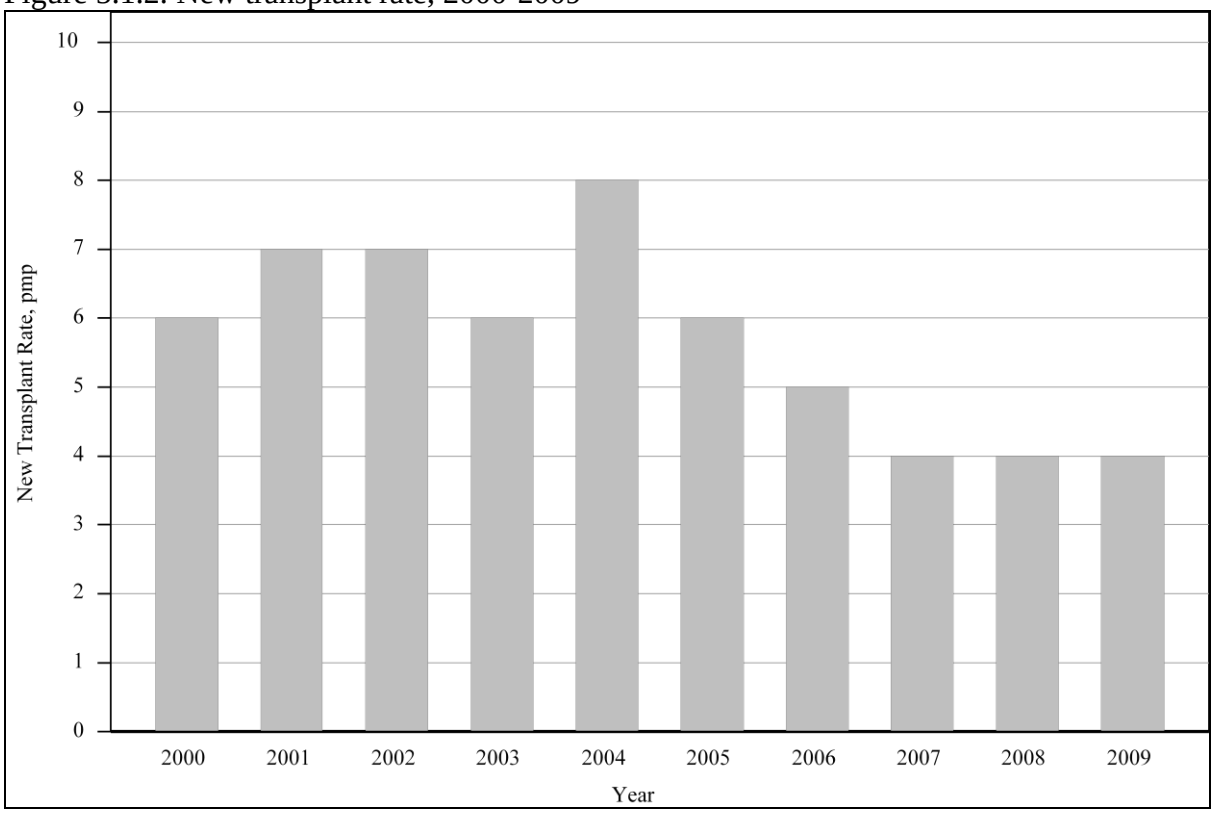
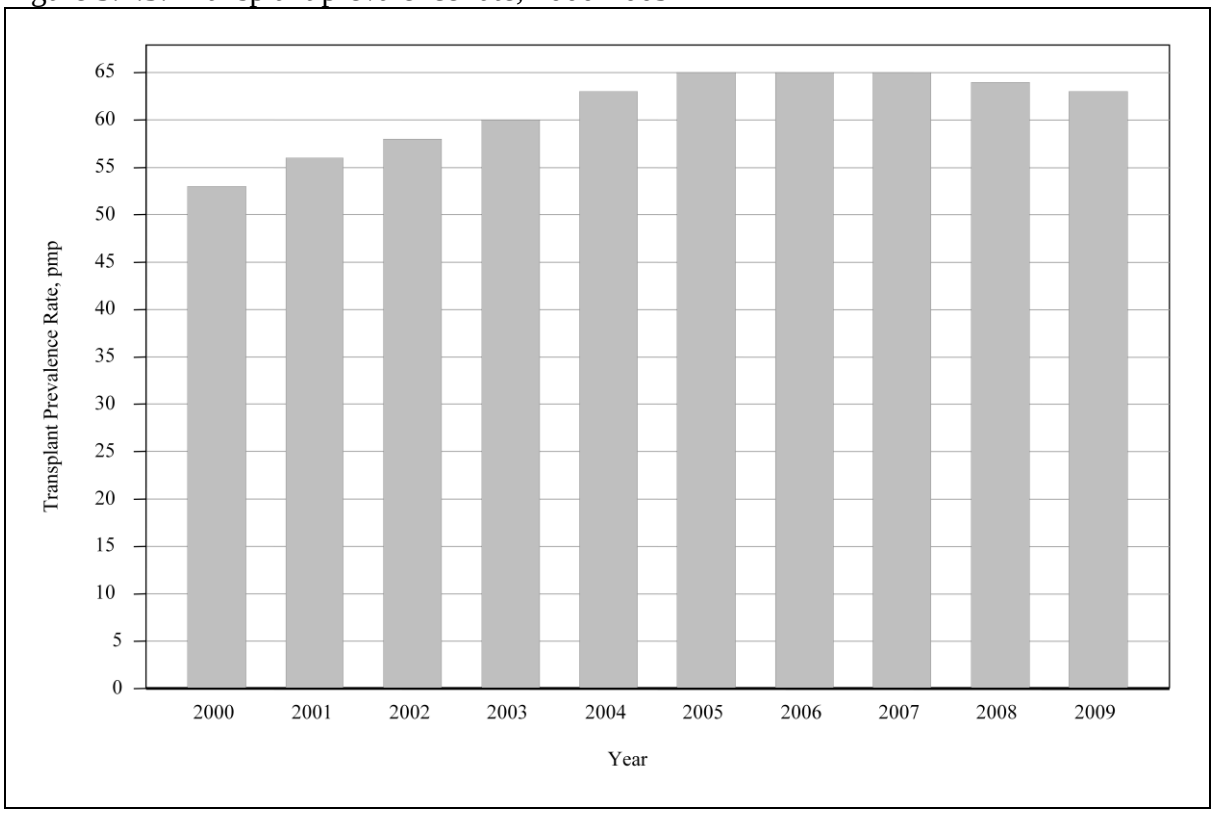


Table 5.1.3: Transplant prevalence rate per million population (pmp), 2000-2009

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Functioning graft at 31st Dec	1255	1339	1433	1507	1602	1692	1739	1753	1768	1779
Transplant prevalence rate, pmp	53	56	58	60	63	65	65	65	64	63

Figure 5.1.3: Transplant prevalence rate, 2000-2009



Transplantation within local centres has remained quite the same from 2000 to 2008, with 54 to 64 cases. 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 2008 comprised 49% of all of renal transplant recipients with 61 patients.

Table 5.1.4: Place of transplantation, 2000-2009

Year	2000		2001		2002		2003		2004	
	No.	%	No.	%	No.	%	No.	%	No.	%
HKL	28	20	33	20	30	17	26	16	20	10
UMMC	19	13	23	14	15	9	6	4	7	4
Selayang Hospital	4	3	11	7	11	6	11	7	11	6
Other local	3	2	4	3	1	1	1	1	2	1
China	80	56	83	51	103	60	111	69	139	72
India	9	6	8	5	12	7	4	3	11	6
Other overseas	0	0	1	1	0	0	1	1	2	1
Unknown	0	0	0	0	0	0	0	0	0	0
TOTAL	143	100	163	100	172	100	160	100	192	100

Year	2005		2006		2007		2008		2009		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
HKL	31	19	35	24	36	33	32	26	34	31	305	21
UMMC	7	4	5	3	3	3	10	8	6	6	101	7
Selayang Hospital	5	3	9	6	14	13	10	8	18	17	104	7
Other local	4	2	2	1	4	4	8	7	6	6	35	2
China	109	66	84	58	45	41	61	49	41	38	856	58
India	6	4	7	5	3	3	2	2	2	2	64	4
Other overseas	3	2	3	2	5	5	1	1	0	0	16	1
Unknown	0	0	0	0	0	0	0	0	2	2	2	0
TOTAL	165	100	145	100	110	100	124	100	109	100	1483	100

SECTION 5.2: RECIPIENTS' CHARACTERISTICS

Age at transplant has been stable at 37 to 42 years. Between 58% and 70% of recipients were males over the last 10 years. There has been an increase in the proportion of diabetic patients undergoing transplantation from 11% in 1998 to 21% in 2006 (Table 5.2.1). However, there is a drastic drop in the number of diabetic patients who underwent transplantation since 2007. This coincided with the drop in China transplants where the majority of diabetic patients underwent transplantation. Patients with hepatitis B and hepatitis C remained static. In terms of cause of end stage renal failure (Table 5.2.2), the primary cause was still glomerulonephritis, followed by hypertension and diabetes. Up to 40% of transplant recipients had end stage renal disease due to unknown causes, belying the fact that majority of these patients presented late.

Table 5.2.1: Renal Transplant Recipients' Characteristics, 2000-2009

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
New Transplant Patients	143	163	172	160	192	165	145	110	124	109
Age at transplant (years), Mean	39	41	41	42	42	38	37	38	37	37
Age at transplant (years), SD	14	13	12	13	13	14	15	16	14	13
% Male	64	63	58	66	63	70	67	64	58	60
% Diabetic (co-morbid/ primary renal disease)	15	18	15	23	21	21	20	14	18	12
% HBsAg positive	5	5	7	8	5	4	7	6	3	3
% Anti-HCV positive	8	15	9	10	8	2	8	9	3	7

Table 5.2.2: Primary causes of end stage renal failure, 2000-2009

Year	2000		2001		2002		2003		2004	
	No.	%	No.	%	No.	%	No.	%	No.	%
New transplant patients	143	100	163	100	172	100	160	100	192	100
Glomerulonephritis	50	35	44	27	54	31	55	34	64	33
Diabetes Mellitus	16	11	23	14	16	9	27	17	32	17
Hypertension	20	14	17	10	24	14	26	16	52	27
Obstructive uropathy	3	2	3	2	2	1	2	1	4	2
ADPKD	3	2	1	1	3	2	5	3	5	3
Drugs/ toxic nephropathy	0	0	0	0	0	0	2	1	2	1
Hereditary nephritis	0	0	0	0	0	0	0	0	1	1
Unknown	54	38	61	37	70	41	58	36	82	43
Others	12	8	23	14	15	9	12	8	28	15

Year	2005		2006		2007		2008		2009	
	No.	%	No.	%	No.	%	No.	%	No.	%
New transplant patients	165	100	145	100	110	100	124	100	109	100
Glomerulonephritis	45	27	53	37	29	26	30	24	35	32
Diabetes Mellitus	30	18	22	15	10	9	18	15	12	11
Hypertension	41	25	32	22	27	25	22	18	25	23
Obstructive uropathy	3	2	6	4	1	1	2	2	4	4
ADPKD	3	2	1	1	2	2	0	0	5	5
Drugs/ toxic nephropathy	0	0	1	1	0	0	2	2	1	1
Hereditary nephritis	0	0	0	0	0	0	0	0	0	0
Unknown	52	32	44	30	42	38	54	44	42	39
Others	16	10	16	11	14	13	13	10	2	2

SECTION 5.3: TRANSPLANT PRACTICES

In 2009, only 29% of renal transplant recipients received their grafts from commercial sources, compare to 79% in 2004. Live donor transplantation made up 33% of transplants (30 recipients) in 2009. Since 2006, the number of live donor transplants has remained low - 33 in 2007 and 38 in 2008. 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. 2009 marked the first time in 10 years where there was more local cadaver transplantations (37%) compared to local live transplantations (33%).

Table 5.3.1: Type of Renal Transplantation, 2000-2009

Year	2000		2001		2002		2003		2004	
	No.	%	No.	%	No.	%	No.	%	No.	%
Commercial cadaver	80	56	83	51	103	60	112	70	145	76
Commercial live donor	9	6	7	4	11	6	3	2	6	3
Live donor (genetically related)	21	15	32	20	33	19	25	16	21	11
Live donor (emotionally related)	6	4	4	2	3	2	5	3	2	1
Cadaver	27	19	37	23	22	13	15	9	17	9
TOTAL	143	100	163	100	172	100	160	100	191	100

Year	2005		2006		2007		2008		2009	
	No.	%	No.	%	No.	%	No.	%	No.	%
Commercial cadaver	105	64	84	59	45	42	53	46	17	19
Commercial live donor	9	6	5	4	3	3	1	1	9	10
Live donor (genetically related)	37	23	24	17	20	19	32	28	20	22
Live donor (emotionally related)	3	2	4	3	13	12	6	5	10	11
Cadaver	9	6	26	18	27	25	23	20	33	37
TOTAL	163	100	143	100	108	100	115	100	89	100

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

Table 5.3.2: Biochemical data, 2006-2009

Biochemical parameter	Summary	2006	2007	2008	2009
Creatinine, umol/L	N	1592	1688	1697	1692
	Mean	135.7	131.8	131.9	128.2
	SD	81.3	77.6	80.8	62.8
	Median	120	116	115	115
	Minimum	21.7	36	29	10.7
	Maximum	1152	1186	1181	657
Hb, g/dL	N	1592	1688	1697	1692
	Mean	12.7	12.8	12.8	12.6
	SD	1.9	1.9	1.9	1.8
	Median	12.8	12.8	12.8	12.8
	Minimum	3.3	4.4	6.2	5.3
	Maximum	19.8	18.7	18.6	18.5
Albumin, g/L	N	1592	1688	1697	1692
	Mean	39.6	39.7	39.7	39.6
	SD	0.7	0.8	0.8	1.2
	Median	39.6	39.6	39.6	39.6
	Minimum	29	29	30	21
	Maximum	48	48	50	50

Table 5.3.2: Biochemical data, 2006-2009

Biochemical parameter	Summary	2006	2007	2008	2009
Calcium, mmol/L	N	1592	1688	1697	1692
	Mean	2.3	2.3	2.3	2.3
	SD	0.2	0.2	0.2	0.2
	Median	2.3	2.3	2.3	2.3
	Minimum	1.1	1.4	1	1.1
	Maximum	3.1	3.2	3.5	3.3
Phosphate, mmol/L	N	1592	1688	1697	1692
	Mean	1.1	1.1	1.1	1.1
	SD	0.2	0.3	0.3	0.2
	Median	1.1	1.1	1.1	1.1
	Minimum	0.5	0.5	0.5	0.5
	Maximum	3.5	3.9	3.2	2.8
Alkaline Phosphate (ALP), U/L	N	1592	1688	1697	1692
	Mean	79.1	79.4	78.9	79.9
	SD	43.2	39.8	46.5	45.3
	Median	71	72.5	72	73
	Minimum	24	22	20	21
	Maximum	700	508	985	732
ALT, U/L	N	1592	1688	1697	1692
	Mean	29.9	29.9	30.1	29.9
	SD	30.4	25.6	37.8	32.6
	Median	22	23	23	24
	Minimum	4	4	4	4
	Maximum	433	356	881	881
Total cholesterol, mmol/L	N	1592	1688	1697	1692
	Mean	5.3	5.2	5.2	5.2
	SD	1	1	1	1.1
	Median	5.3	5.3	5.3	5.3
	Minimum	1.5	1.7	2	1.9
	Maximum	11.1	11.4	11.2	10.6
LDL cholesterol, mmol/L	N	1592	1688	1697	1692
	Mean	3	2.9	2.9	2.8
	SD	0.8	0.8	0.8	1
	Median	2.9	2.9	2.9	2.9
	Minimum	1	1	0.9	0.9
	Maximum	11.1	8.9	7.7	10.8
HDL cholesterol, mmol/L	N	1592	1688	1697	1692
	Mean	1.6	1.5	1.6	1.5
	SD	0.5	0.4	0.5	0.5
	Median	1.6	1.6	1.6	1.6
	Minimum	0.4	0.4	0.5	0.4
	Maximum	5.8	7.5	7.5	6.9
Systolic Blood Pressure, mmHg	N	1592	1688	1697	1692
	Mean	130.7	131.6	129.5	130.1
	SD	15.9	15.7	15.3	14.7
	Median	130	130	130	130
	Minimum	66	80	80	65
	Maximum	210	210	245	210
Diastolic Blood Pressure, mmHg	N	1592	1688	1697	1692
	Mean	78.9	78.8	77.5	78.3
	SD	9.8	9.4	9.2	8.7
	Median	80	80	79	79
	Minimum	30	20	20	40
	Maximum	120	116	133	120

In 2009, Cyclosporine based regimes remained the mainstay of immunosuppressive therapy with 64% of patients receiving it. This showed a gradual declining trend which coincided with increasing trend in Tacrolimus usage. Tacrolimus based regimes accounted for 27%. There has been continuous increase in the use of Mycophenolate Mofetil as the second immunosuppressive agent with 60% of patients on it in 2009. During the same period, the use of Azathioprine declined to 22%. Monotherapy of immunosuppresion is mostly not noted except in a small number of patients. Sirolimus was used in 2% of all transplant recipients in 2008 and 2009.

In terms of non immunosuppressive medications, in year 2009 only 28% of patients were on ACE inhibitors or Angiotensin II receptor blockers (AIIRB) or both and this trend has been relatively static since 2006. Calcium channel blockers appeared to be the mainstay of antihypertensive therapy with 42% of patients whilst beta blockers use was reported in 39% of patients. Other antihypertensives were reported in 10% 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, 2006-2009

Medication data	Single drug treatment								Combined drug treatment							
	2006		2007		2008		2009		2007		2007		2008		2009	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
All	1482	100	1665	100	1427	100	1739	100	1482	100	1665	100	1427	100	1739	100
(i) Immunosuppressive drug(s) treatment																
Prednisolone	8	1	9	1	6	0	6	0	1444	97	1611	97	1384	97	1638	94
Azathioprine	0	0	0	0	0	0	1	0	497	34	479	29	382	27	383	22
Cyclosporin A	5	0	8	0	2	0	15	1	1119	76	1191	72	983	69	1116	64
Tacrolimus (FK506)	0	0	4	0	3	0	14	1	254	17	348	21	344	24	473	27
Mycophenolate Mofetil (MMF)	0	0	1	0	2	0	0	0	708	48	907	54	775	54	1043	60
Rapamycin	0	0	0	0	1	0	0	0	7	0	33	2	30	2	32	2
Others	0	0	0	0	0	0	1	0	18	1	4	0	1	0	26	1
(ii) Non-Immunosuppressive drug(s) treatment																
Beta blocker	77	5	90	5	88	6	118	7	597	40	735	44	615	43	679	39
Calcium channel blocker	199	13	184	11	138	10	161	9	787	53	905	54	687	48	736	42
ACE inhibitor	39	3	38	2	29	2	40	2	292	20	384	23	287	20	309	18
AIIRB	27	2	18	1	17	1	21	1	141	10	210	13	141	10	146	8
Anti-lipid	156	11	95	6	89	6	115	7	679	46	732	44	627	44	706	41
Other anti-hypertensive	11	1	6	0	25	2	26	1	159	11	140	8	191	13	167	10

SECTION 5.4: TRANSPLANT OUTCOMES

5.4.1 Post-transplant complications

In the year 2009, sixty percent of patients were hypertensive prior to transplantation whereas 26% developed hypertension post transplantation. Twelve percent of patients had diabetes mellitus prior to transplant whereas 5% of patients developed post transplant diabetes mellitus. These trends have been quite the same since 2006. In terms of cardiovascular and cerebrovascular disease 3% had either or both prior to transplant whereas another 3% developed these complications post transplantation.

Table 5.4.1: Post-transplant complications, 2006-2009

Post transplant complications	Complication developed before transplant (regardless of complication after transplantation)								Complication developed only after transplantation							
	2006		2007		2008		2009		2006		2007		2008		2009	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
All patients	1592	100	1688	100	1704	100	1708	100	1592	100	1688	100	1704	100	1708	100
Diabetes (either as Primary Renal Disease or co-morbid)	218	14	232	14	233	14	211	12	124	8	113	7	119	7	88	5
Cancer	2	0	3	0	2	0	1	0	20	1	21	1	24	1	16	1
Cardiovascular disease – cerebrovascular disorder	73	5	72	4	67	4	51	3	45	3	54	3	72	4	56	3
Hypertension	1036	65	1063	63	1054	62	1025	60	354	22	451	27	413	24	448	26

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

5.4.2 Deaths and Graft loss

In 2009, 39 transplant recipients died and 34 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 35% and 23% respectively. Another 21% of patients died at home, which is presumed to be cardiovascular death as well.

Cancer death rates have been significantly high since 2000 contributing to 19% of all deaths in 2008 and 14% in 2009. Death due to liver disease has remained relatively static.

In terms of graft loss, majority were due to rejection.

Table 5.4.2: Transplant Patients Death Rate and Graft Loss, 2000-2009

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Number at risk	1218	1296	1385	1469	1554	1646	1715	1745	1760	1821
Transplant death	30	37	35	39	42	44	55	41	52	39
Transplant death rate %	3	3	3	3	3	3	3	2	3	2
Graft loss	32	40	39	42	44	21	38	38	40	34
Graft loss rate %	3	3	3	3	3	1	2	2	2	2
Acute rejection	0	0	0	3	19	14	18	12	14	20
Acute rejection rate %	0	0	0	0	1	1	1	1	1	1
All losses	62	77	74	81	86	65	93	79	92	73
All losses rate %	5	6	5	6	6	4	5	5	5	4

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

Figure 5.4.2(a): Transplant Recipient Death Rate, 2000-2009

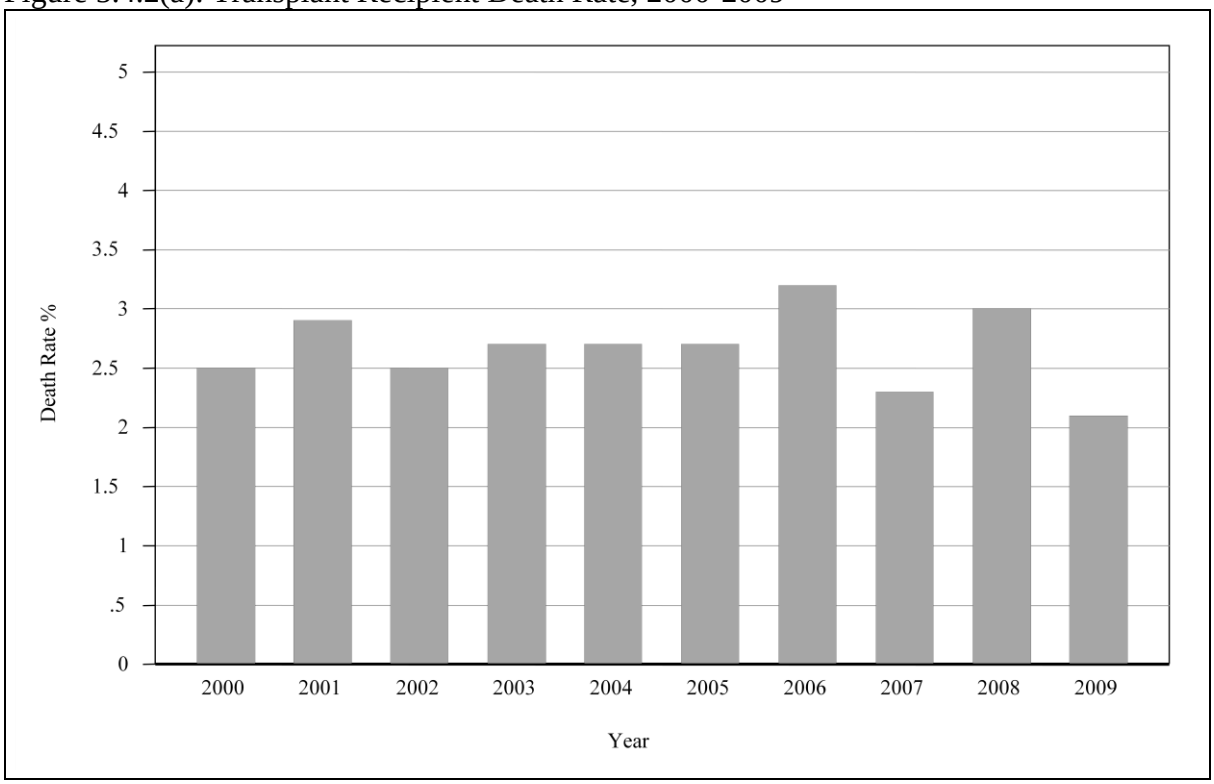


Figure 5.4.2(b): Transplant Recipient Graft Loss Rate, 2000-2009

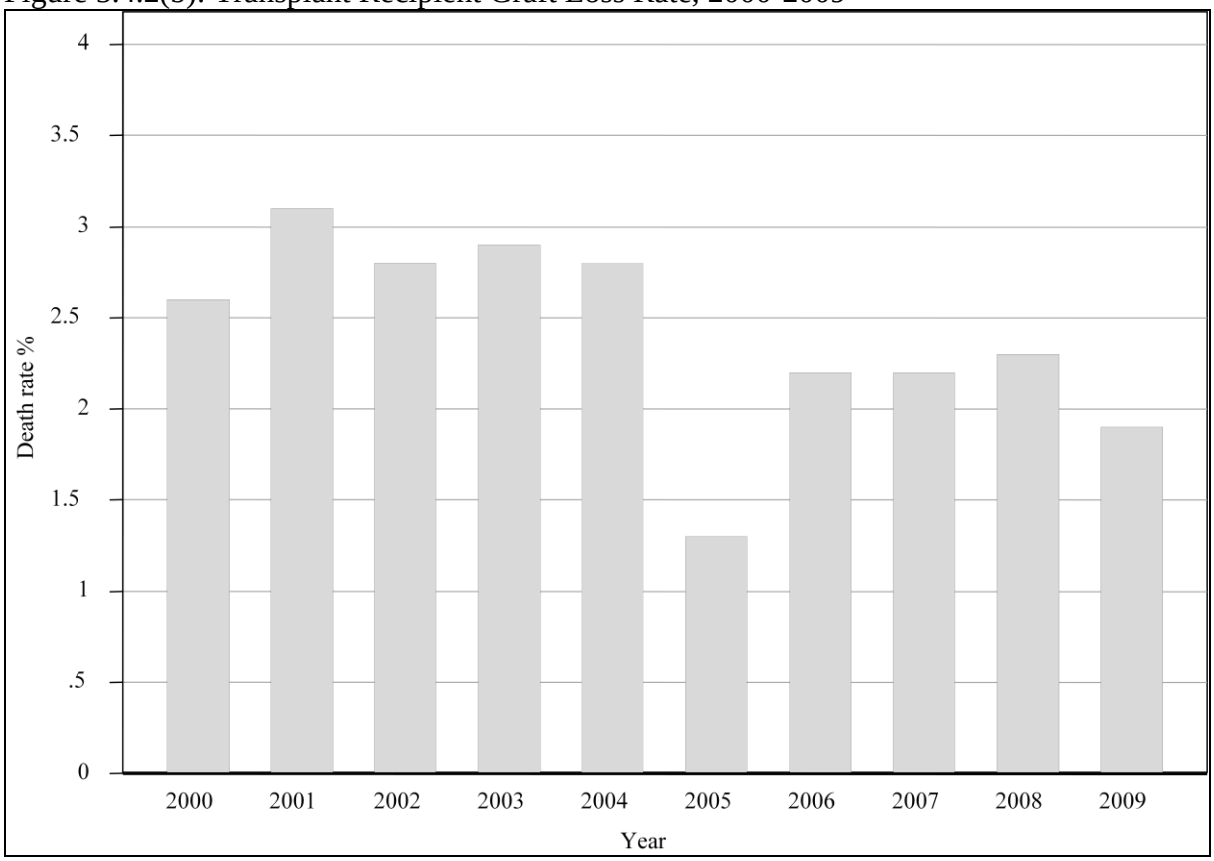


Table 5.4.3: Causes of Death in Transplant Recipients, 2000-2009

Year	2000		2001		2002		2003		2004	
	No.	%	No.	%	No.	%	No.	%	No.	%
Cardiovascular	10	30	7	16	5	14	12	27	6	14
Died at home	1	3	5	12	5	14	5	11	5	11
Infection	12	36	21	49	12	34	13	30	15	34
Graft failure	2	6	0	0	0	0	0	0	3	7
Cancer	2	6	6	14	5	14	7	16	8	18
Liver disease	1	3	2	5	3	9	3	7	3	7
Accidental death	1	3	1	2	1	3	1	2	0	0
Others	2	6	0	0	2	6	1	2	3	7
Unknown	2	6	1	2	2	6	2	5	1	2
TOTAL	33	100	43	100	35	100	44	100	44	100

Year	2005		2006		2007		2008		2009	
	No.	%	No.	%	No.	%	No.	%	No.	%
Cardiovascular	5	11	12	20	8	17	10	17	10	23
Died at home	6	13	7	12	5	11	12	21	9	21
Infection	25	56	24	40	15	33	20	34	15	35
Graft failure	0	0	0	0	4	9	0	0	1	2
Cancer	5	11	5	8	6	13	11	19	6	14
Liver disease	3	7	5	8	0	0	0	0	2	5
Accidental death	0	0	1	2	0	0	0	0	0	0
Others	0	0	2	3	1	2	4	7	0	0
Unknown	1	2	4	7	7	15	1	2	0	0
TOTAL	45	100	60	100	46	100	58	100	43	100

Table 5.4.4: Causes of Graft Failure, 2000-2009

Year	2000		2001		2002		2003		2004	
	No.	%	No.	%	No.	%	No.	%	No.	%
Rejection	19	59	25	61	23	56	21	48	31	70
Calcineurin toxicity	0	0	0	0	1	2	1	2	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	3	2	5	0	0	2	5	1	2
Vascular causes	3	9	1	2	0	0	3	7	4	9
Recurrent / de novo renal disease	0	0	2	5	2	5	2	5	1	2
Others	2	6	0	0	4	10	1	2	0	0
Unknown	7	22	11	27	11	27	14	32	7	16
TOTAL	32	100	41	100	41	100	44	100	44	100

Year	2005		2006		2007		2008		2009	
	No.	%	No.	%	No.	%	No.	%	No.	%
Rejection	15	68	26	67	26	68	22	61	15	68
Calcineurin toxicity	0	0	0	0	0	0	1	3	0	0
Other drug toxicity	0	0	0	0	0	0	0	0	0	0
Ureteric obstruction	0	0	0	0	1	3	0	0	0	0
Infection	1	5	2	5	1	3	1	3	1	5
Vascular causes	2	9	4	10	1	3	1	3	2	9
Recurrent / de novo renal disease	0	0	1	3	0	0	0	0	0	0
Others	1	5	3	8	4	11	0	0	1	5
Unknown	3	14	3	8	5	13	11	31	3	14
TOTAL	22	100	39	100	38	100	36	100	22	100

SECTION 5.5: PATIENT AND GRAFT SURVIVAL

Overall patient survival rates from 2000 to 2009 have been 95%, 90%, 87% and 79% at year 1, 3, 5 and 10 respectively. Overall graft survival rate has been 92%, 86%, 80% and 68% at year 1, 3, 5 and 10 respectively.

Table 5.5.1(a): Patient survival, 2000-2009

Interval (years)	No.	% Survival	SE
0	1483	100	-
1	1263	95	1
2	1102	92	1
3	962	90	1
4	805	89	1
5	639	87	1
6	462	85	1
7	321	82	1
8	200	82	1
9	95	79	2
10	1	79	2

*No.=Number at risk SE=standard error

Figure 5.5.1(a): Patient survival, 2000-2009

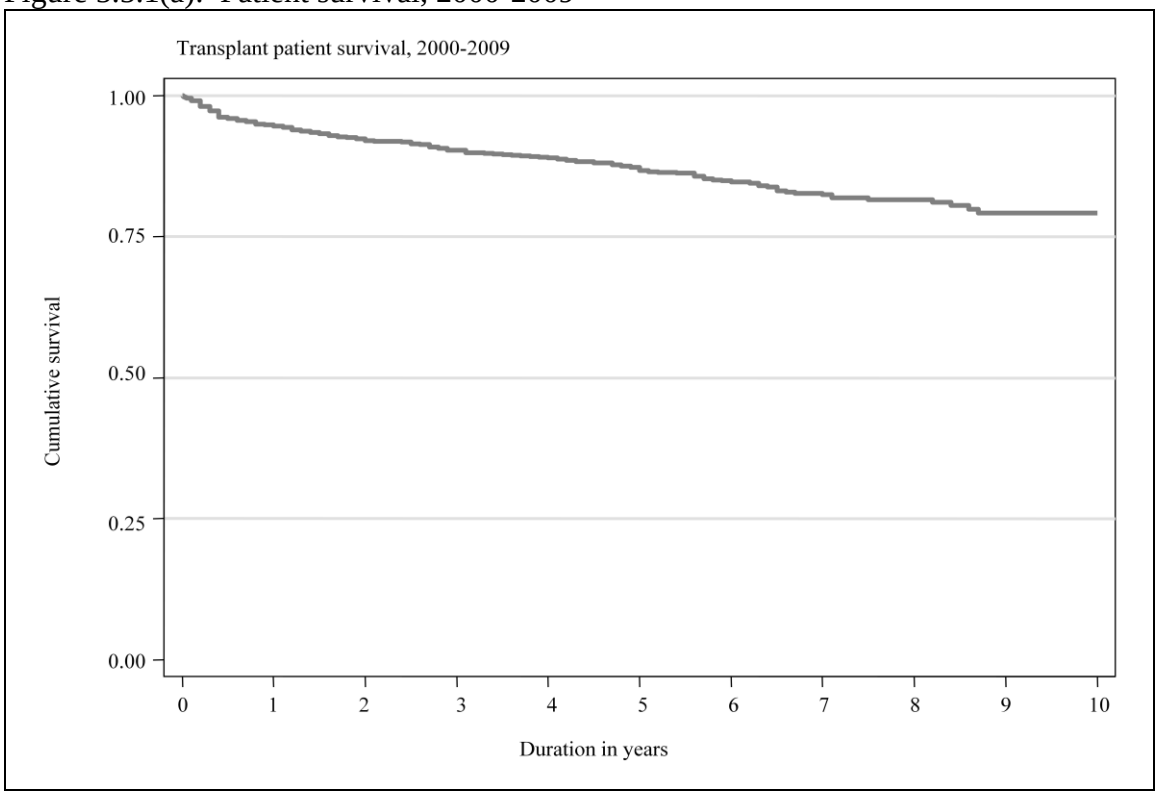


Table 5.5.1(b): Risk factors for transplant patient survival 2000-2009

Factors	N	Hazard Ratio	95% CI	P value
Year of transplant:				
2000-2004 (ref*)	830	1.00		
2005-2009	653	1.38	(0.92; 2.06)	0.121
Age at transplant:				
<20	153	0.42	(0.18; 0.97)	0.043
20-39 (ref*)	552	1.00		
40-54	680	1.97	(1.34; 2.90)	0.001
>=55	98	2.09	(1.20; 3.65)	0.010
Gender:				
Male (ref*)	937	1.00		
Female	546	0.90	(0.64; 1.26)	0.528
Primary diagnosis:				
Unknown primary (ref*)	755	1.00		
Diabetes mellitus	133	1.32	(0.85; 2.04)	0.218
GN/SLE	356	0.81	(0.54; 1.23)	0.321
Polycystic kidney	25	0.37	(0.05; 2.67)	0.323
Obstructive nephropathy	36	2.22	(0.95; 5.20)	0.066
Others	178	1.26	(0.80; 1.97)	0.314
Type of transplant:				
Commercial cadaver (ref*)	827	1.00		
Commercial live donor	60	1.09	(0.56; 2.11)	0.796
Living donor	324	0.83	(0.49; 1.38)	0.466
Cadaver	236	3.55	(2.44; 5.16)	<0.001
HbsAg:				
Negative (ref*)	1447	1.00		
Positive	36	1.86	(0.96; 3.62)	0.068
Anti-HCV:				
Negative (ref*)	1428	1.00		
Positive	55	1.67	(0.97; 2.85)	0.063

Figure 5.5.1(b): Risk factors for transplant patient survival 2000-2009
(adjusted for age, gender, primary diagnosis, type of transplant, HBsAg and Anti-HCV status)

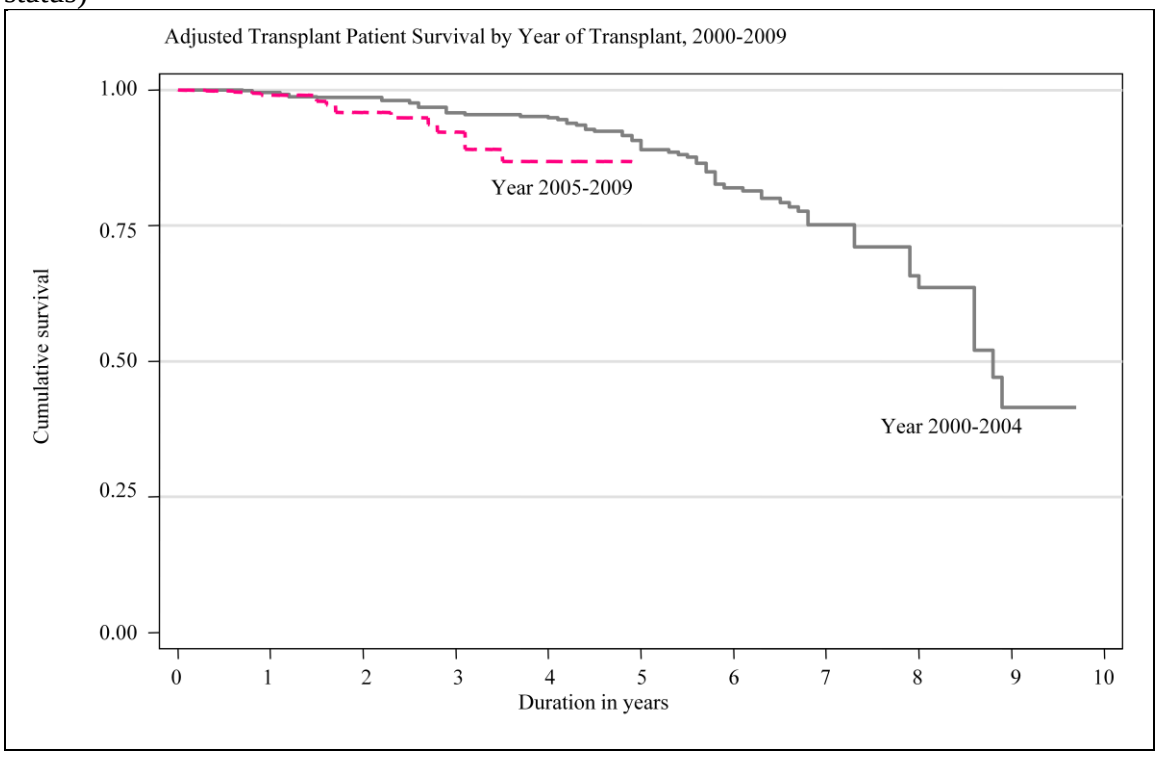


Table 5.5.2(a): Graft survival, 2000-2009

Interval (years)	No.	% Survival	SE
0	0	100	-
1	1263	92	1
2	1102	88	1
3	962	86	1
4	805	83	1
5	639	80	1
6	462	77	1
7	321	73	2
8	200	72	2
9	95	68	2
10	1	68	2

*No.=Number at risk SE=standard error

Figure 5.5.2(a): Graft survival, 2000-2009

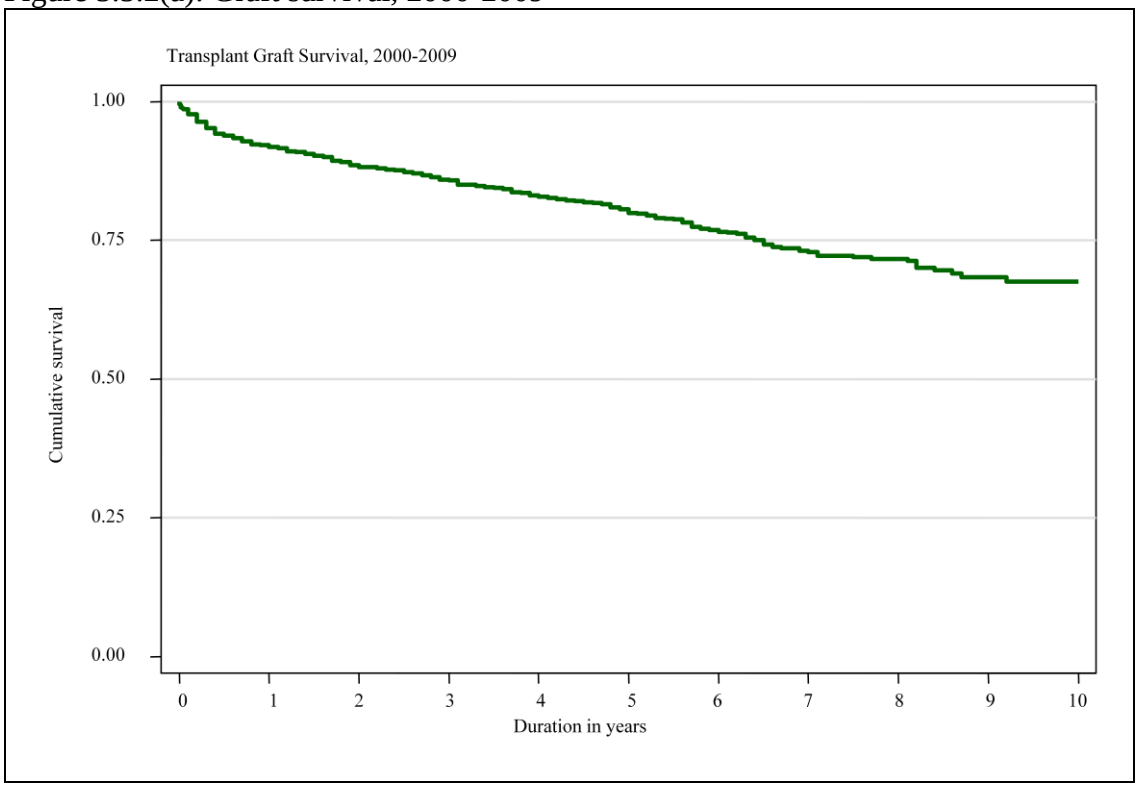
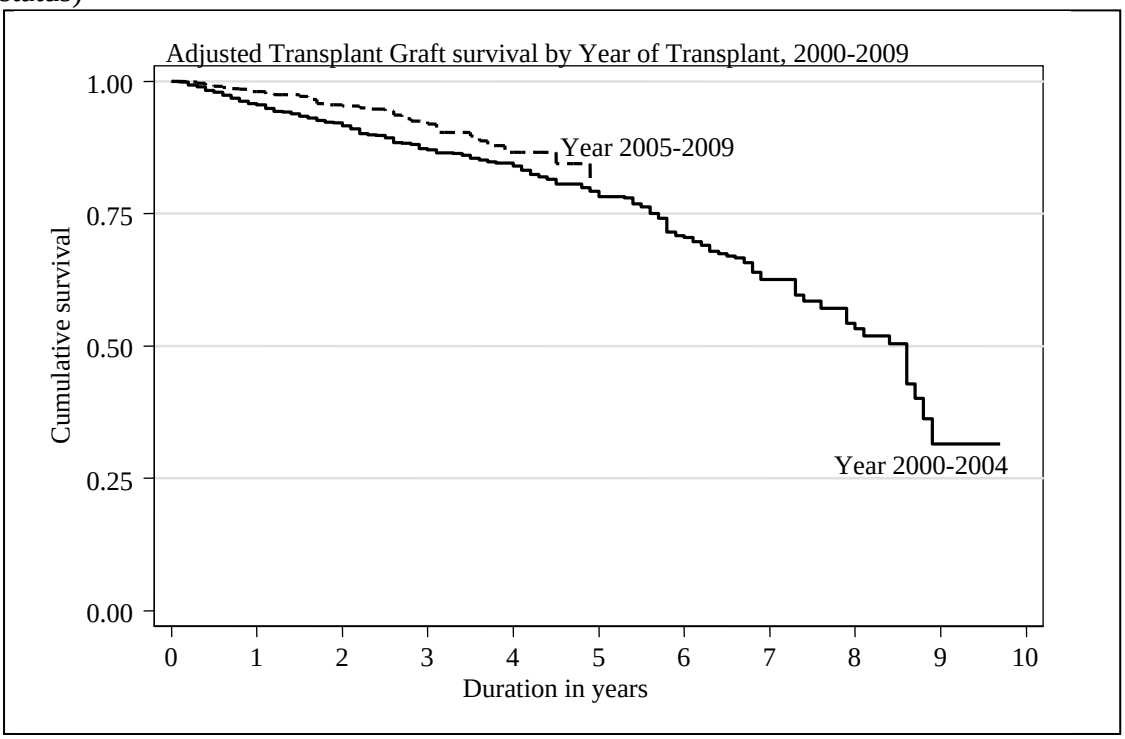


Table 5.5.2(b): Risk factors for transplant graft survival 2000-2009

Factors	N	Hazard Ratio	95% CI	P value
Year of transplant:				
2000-2004 (ref*)	830	1.00		
2005-2009	653	1.47	(1.07; 2.00)	0.016
Age at transplant:				
<20	153	0.86	(0.55; 1.34)	0.493
20-39 (ref*)	552	1.00		
40-54	680	1.26	(0.94; 1.67)	0.117
>=55	98	1.26	(0.79; 2.02)	0.329
Gender:				
Male (ref*)	937	1.00		
Female	546	0.89	(0.69; 1.16)	0.394
Primary diagnosis:				
Unknown primary (ref*)	755	1.00		
Diabetes mellitus	133	1.29	(0.89; 1.89)	0.181
GN/SLE	356	0.87	(0.63; 1.19)	0.378
Polycystic kidney	25	0.91	(0.33; 2.48)	0.851
Obstructive nephropathy	36	1.52	(0.73; 3.17)	0.267
Others	178	1.54	(1.10; 2.15)	0.011
Type of transplant:				
Commercial cadaver (ref*)	827	1.00		
Commercial live donor	60	1.14	(0.67; 1.92)	0.629
Living donor	324	0.94	(0.65; 1.35)	0.735
Cadaver	236	3.32	(2.47; 4.47)	<0.001
HbsAg:				
Negative (ref*)	1447	1.00		
Positive	36	1.68	(0.92; 3.05)	0.091
Anti-HCV:				
Negative (ref*)	1428	1.00		
Positive	55	1.71	(1.12; 2.60)	0.013

Figure 5.5.2(b): Adjusted Transplant Graft Survival related to Year of Transplant, 2000-2009 (adjusted for age, gender, primary diagnosis, type of transplant, HBsAg and Anti-HCV status)



Outcomes of renal transplantation from the 4 donor groups are shown in Figures 5.5.3 and 5.5.4. In terms of patient survival, live donor grafts maintained good survival rates with 96%, 94%, 93% and 90% at years 1, 3, 5 and 9 respectively. In terms of graft survival, commercial cadaver grafts performed similarly well with a survival of 95%, 89%, 83% and 72% at year 1, 3, 5 and 10 compared to 93%, 90%, 87% and 76% for the same intervals for live donor grafts.

Table 5.5.3: Unadjusted Patient survival by type of transplant, 2000-2009

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
0	827	100	-	63	100	-	321	100	-	236	100	-
1	761	96	1	54	98	2	271	96	1	159	86	2
2	684	93	1	50	95	3	234	95	1	130	80	3
3	620	92	1	44	93	4	195	94	1	99	77	3
4	524	90	1	37	93	4	163	93	2	78	77	3
5	415	87	1	29	89	5	127	93	2	67	74	3
6	290	86	1	18	78	7	97	92	2	59	72	4
7	188	82	2	13	68	9	73	92	2	48	72	4
8	109	82	2	8	68	9	47	92	2	36	69	4
9	53	81	2	5	68	9	20	90	3	17	63	5
10	1	81	2	-	-	-	-	-	-	-	-	-

*No.=Number at risk SE=standard error

Figure 5.5.3: Patient survival by type of transplant, 2000-2009

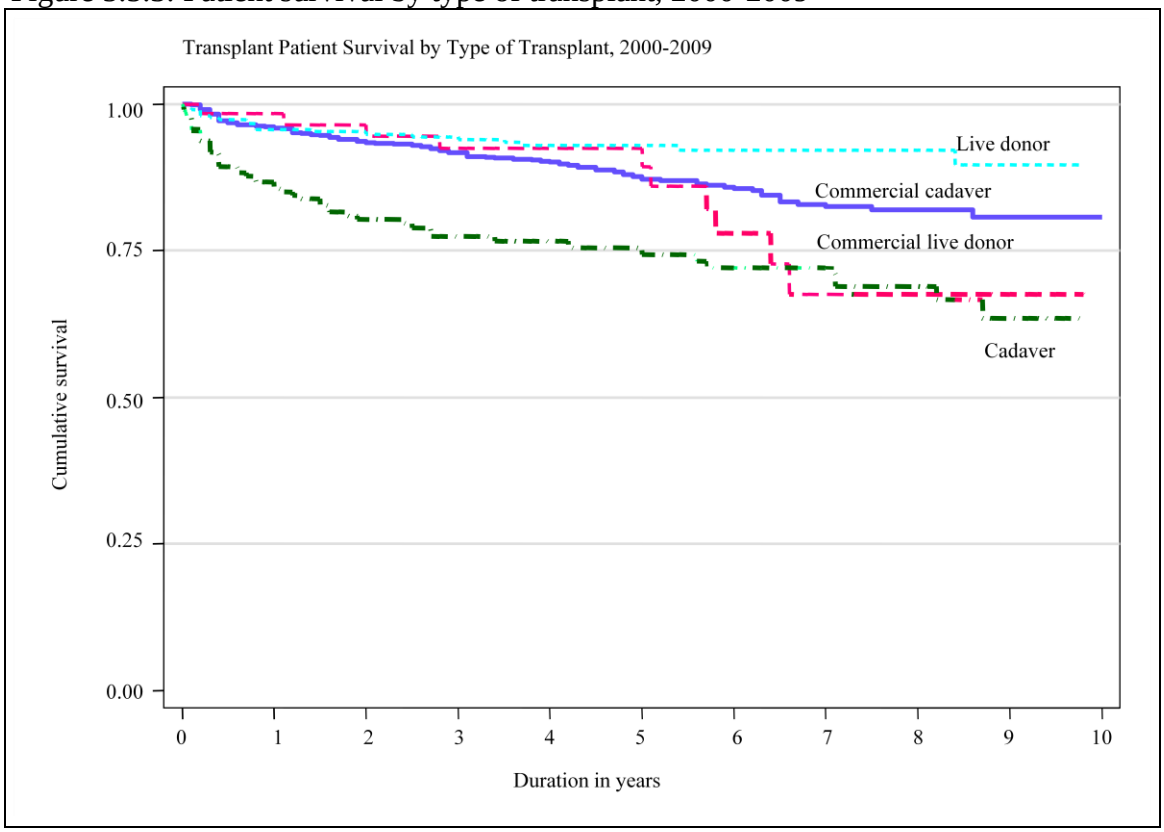
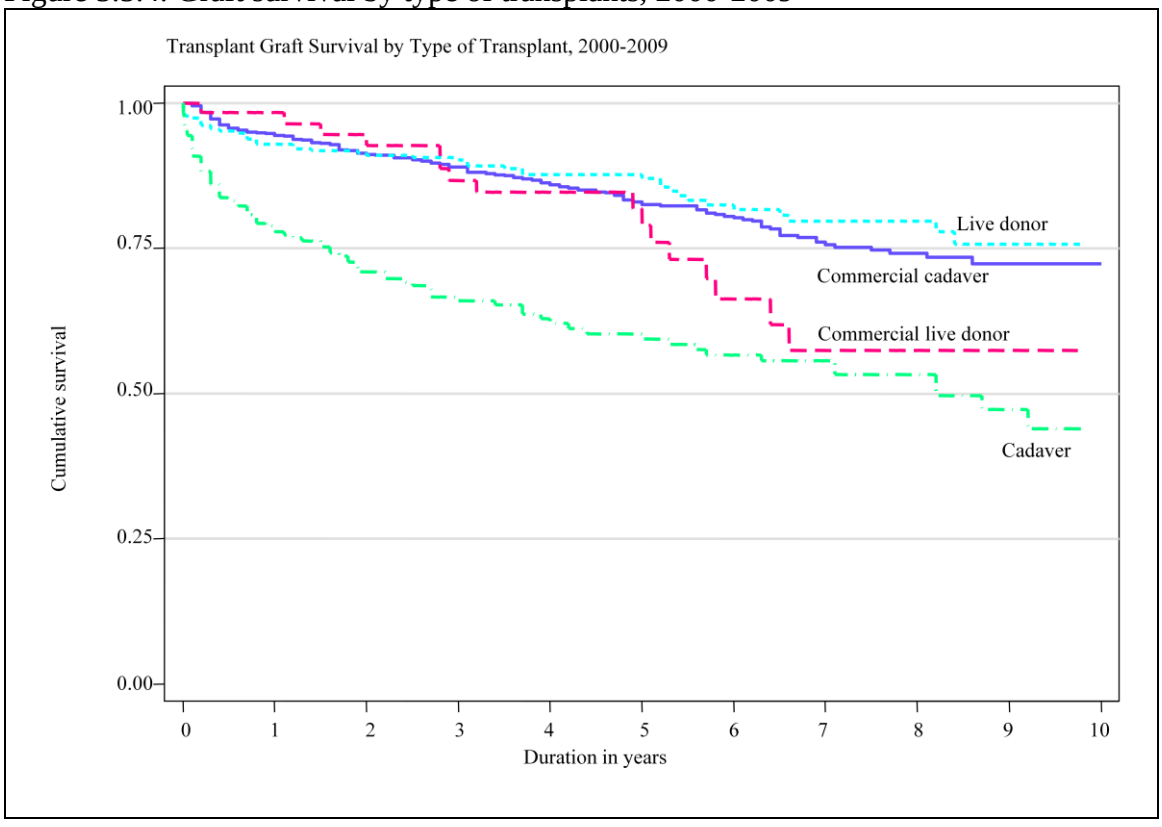


Table 5.5.4: Graft survival by type of transplant, 2000-2009

Type of Transplant Interval (years)	Commercial Cadaver			Commercial Live Donor			Live Donor			Cadaver		
	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE
0	827	100	-	63	100	-	321	100	-	236	100	-
1	761	95	1	54	98	2	271	93	1	159	78	3
2	684	91	1	50	93	3	234	91	2	130	71	3
3	620	89	1	44	87	5	195	90	2	99	66	3
4	524	86	1	37	85	5	163	88	2	78	62	4
5	415	83	1	29	79	6	127	87	2	67	59	4
6	290	80	2	18	66	8	97	82	3	59	57	4
7	188	76	2	13	58	9	73	80	3	48	56	4
8	109	74	2	8	58	9	47	80	3	36	53	4
9	53	72	2	5	58	9	20	76	4	17	47	5
10	1	72	2	-	-	-	-	-	-	-	-	-

*No.=Number at risk SE=standard error

Figure 5.5.4: Graft survival by type of transplants, 2000-2009



Patient and graft survival for living related transplants were compared for two cohorts. The 2000-2004 cohort and the 2005-2009 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 2005-2009 cohort even from the outset probably due to increased usage of newer immunosuppressive agents.

Table 5.5.5: Patient survival by year of transplant (Living related transplant, 2000-2009)

Year of Transplant Interval (years)	2000-2004			2005-2009		
	No.	% Survival	SE	No.	% Survival	SE
0	152	100	-	169	100	-
1	140	93	2	134	98	1
2	135	93	2	99	97	1
3	130	91	2	65	97	1
4	127	90	2	38	95	2
5	125	90	2	2	95	2
6	97	90	3	-	-	-
7	73	90	3	-	-	-
8	47	90	3	-	-	-
9	20	87	3	-	-	-
10	-	-	-	-	-	-

Figure 5.5.5: Patient survival by year of transplant (Living related transplant, 2000-2009)

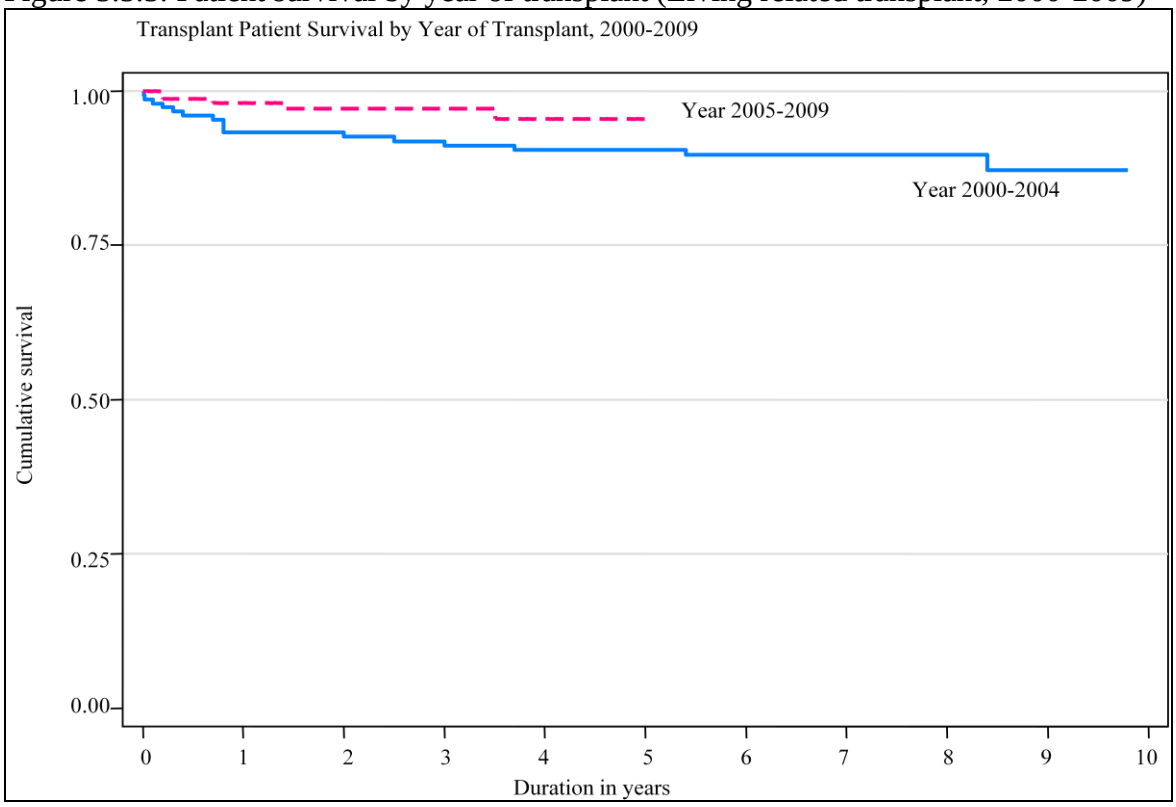
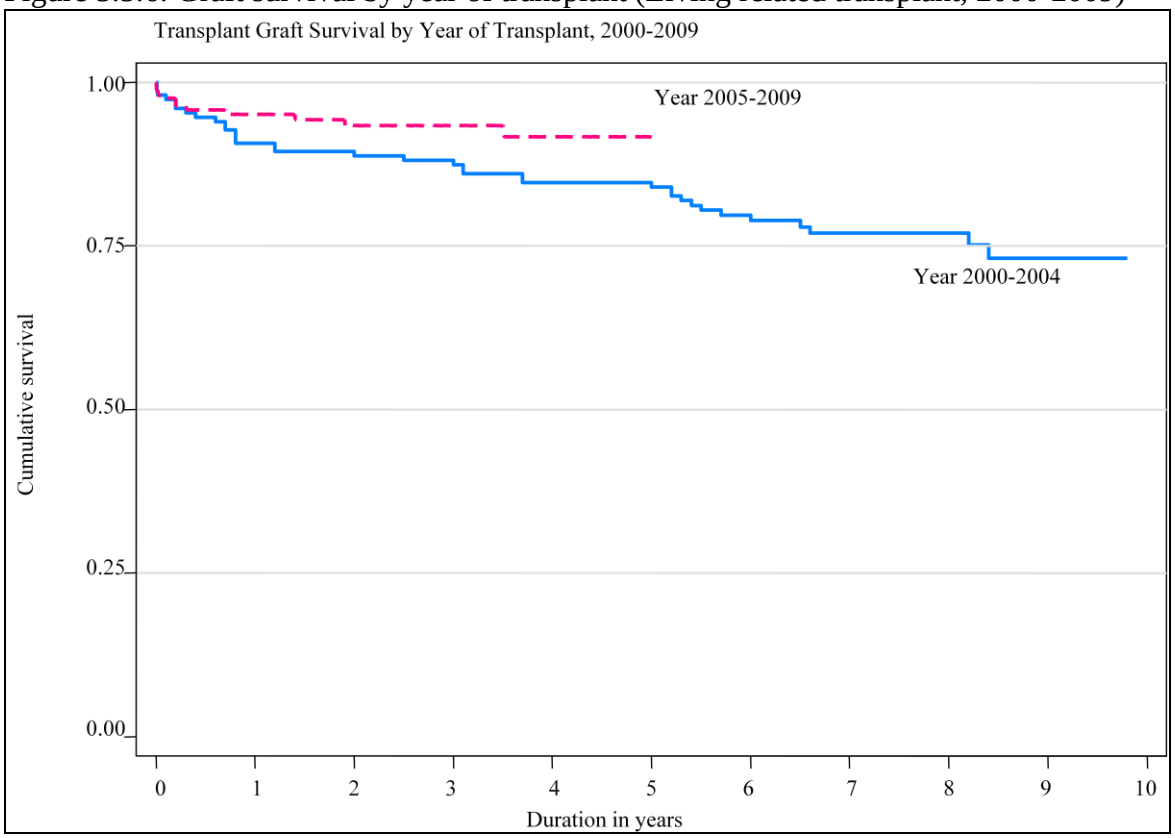


Table 5.5.6: Graft survival by year of transplant (Living related transplant, 2000-2009)

Year of Transplant Interval (years)	2000-2004			2005-2009		
	No.	% Survival	SE	No.	% Survival	SE
0	152	100	-	169	100	-
1	140	90.73	2.36	134	95.1	1.69
2	135	88.74	2.57	99	93.38	2.05
3	130	87.4	2.7	65	93.38	2.05
4	127	84.69	2.94	38	91.71	2.61
5	125	84.01	2.99	2	91.71	2.61
6	97	78.86	3.39	-	-	-
7	73	76.94	3.57	-	-	-
8	47	76.94	3.57	-	-	-
9	20	73.12	4.3	-	-	-
10	-	-	-	-	-	-

*No.=Number at risk SE=standard error

Figure 5.5.6: Graft survival by year of transplant (Living related transplant, 2000-2009)



In terms of commercial cadaveric transplantation, the comparison between the 2000-2004 cohort and 2005-2009 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, 2000-2009)

Year of Transplant	2000-2004			2005-2009		
Interval (years)	No.	% Survival	SE	No.	% Survival	SE
0	523	100	-	304	100	-
1	488	95	1	273	97	1
2	468	93	1	216	95	1
3	454	91	1	168	94	1
4	433	89	1	91	94	1
5	414	86	2	1	94	1
6	290	86	2	-	-	-
7	188	83	2	-	-	-
8	109	82	2	-	-	-
9	53	81	2	-	-	-
10	1	81	2	-	-	-

*No.=Number at risk SE=standard error

Figure 5.5.7: Patient survival by year of transplant (Commercial cadaver transplant, 2000-2009)

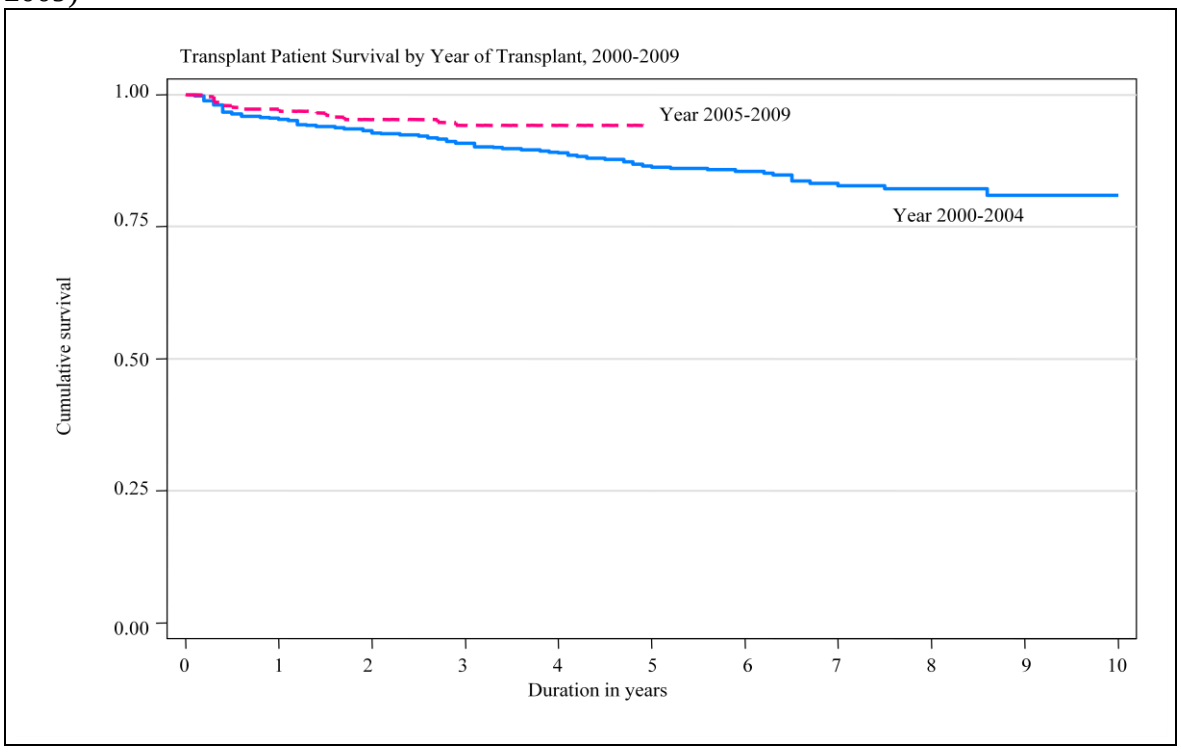
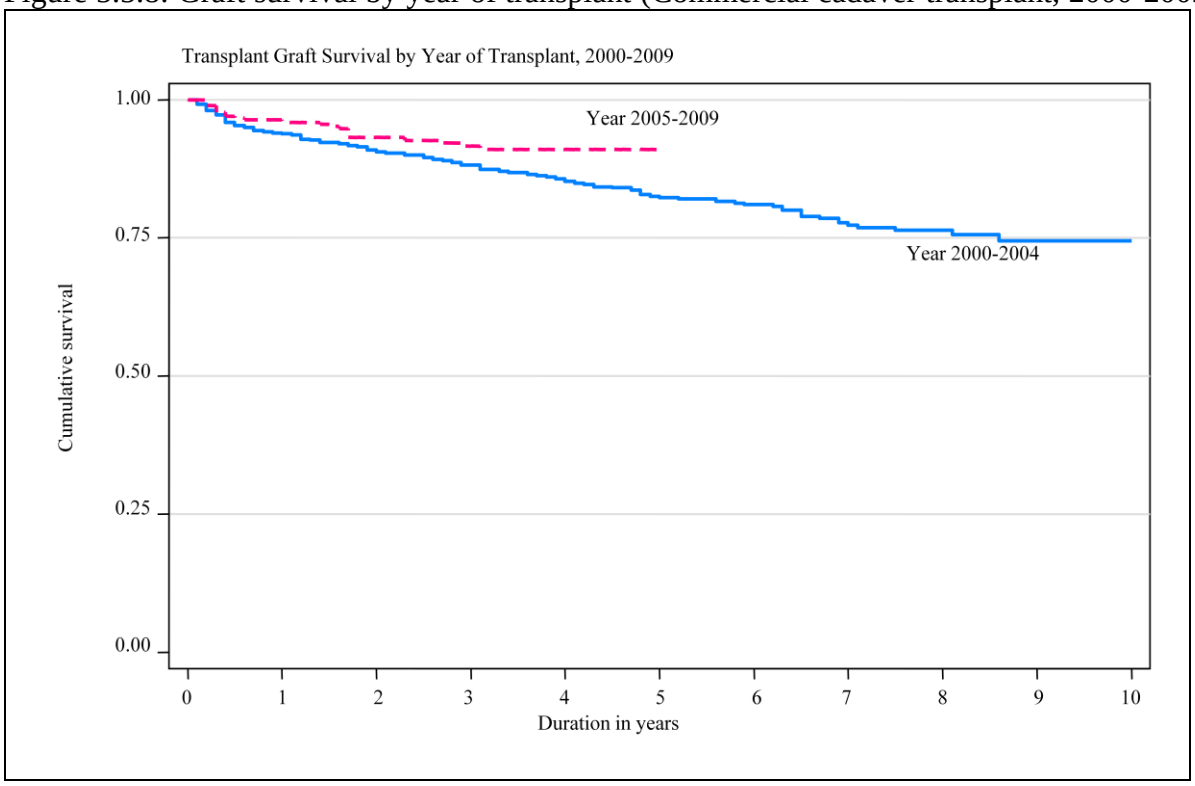


Table 5.5.8: Graft survival by year of transplant (Commercial cadaver transplant, 2000-2009)

Year of Transplant Interval (years)	2000-2004			2005-2009		
	No.	% Survival	SE	No.	% Survival	SE
0	523	100	-	304	100	-
1	488	94	1	273	96	1
2	468	91	1	216	93	2
3	454	88	1	168	92	2
4	433	85	2	91	91	2
5	414	82	2	1	91	2
6	290	81	2	-	-	-
7	188	77	2	-	-	-
8	109	76	2	-	-	-
9	53	75	2	-	-	-
10	1	75	2	-	-	-

*No.=Number at risk SE=standard error

Figure 5.5.8: Graft survival by year of transplant (Commercial cadaver transplant, 2000-2009



SECTION 5.6: CARDIOVASCULAR RISK IN RENAL TRANSPLANT RECIPIENTS

5.6.1 Risk factors for ischaemic heart disease

In 2009, 87.2% of patients were hypertensive, 17.7% were diabetic and 46.7% had renal insufficiency fulfilling CKD III and above. Forty-two percent of patients had 2 cardiovascular risk factors while 5.5% had all 3 major risk factors.

Table 5.6.1: Risk factors for IHD in renal transplant recipients at year 2006, 2007, 2008 and 2009

	2006	2007	2008	2009
Diabetes	21 (1.4)	25 (1.6)	18 (1.1)	28 (1.8)
Hypertension**	454 (31.0)	589 (37.3)	663 (41.7)	644 (41.1)
CKD	177 (12.1)	127 (8.1)	117 (7.4)	155 (9.9)
Diabetes + Hypertension**	156 (10.7)	177 (11.2)	203 (12.8)	163 (10.4)
Diabetes + CKD	18 (1.2)	11 (0.7)	22 (1.4)	18 (1.1)
CKD + Hypertension**	490 (33.5)	516 (32.7)	457 (28.8)	474 (30.2)
Diabetes + CKD + Hypertension**	147 (10.0)	132 (8.4)	109 (6.9)	86 (5.5)

**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 2006

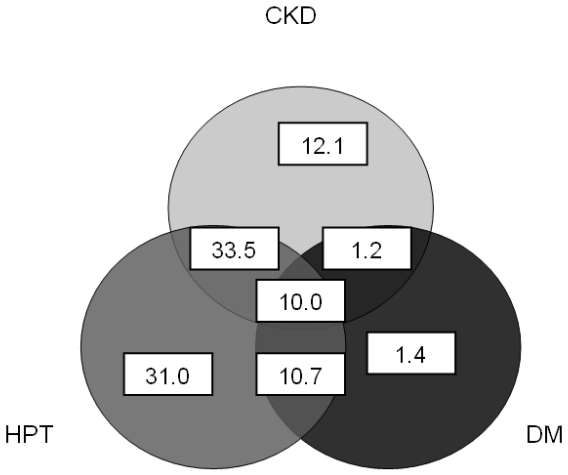


Figure 5.6.1(b): Venn Diagram for Pre and Post Transplant Complications (in %) at year 2007

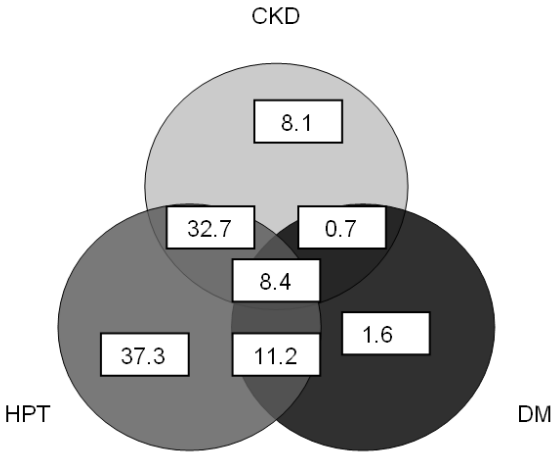


Figure 5.6.1(c): Venn Diagram for Pre and Post Transplant Complications (in %) at year 2008

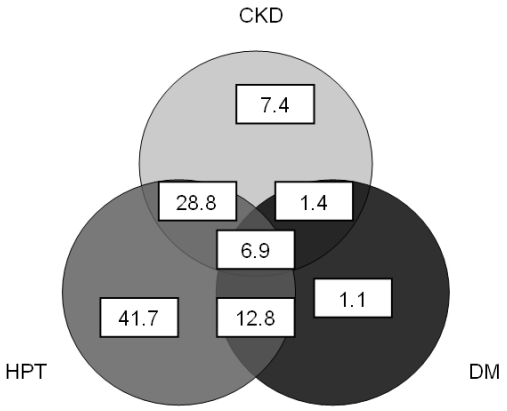
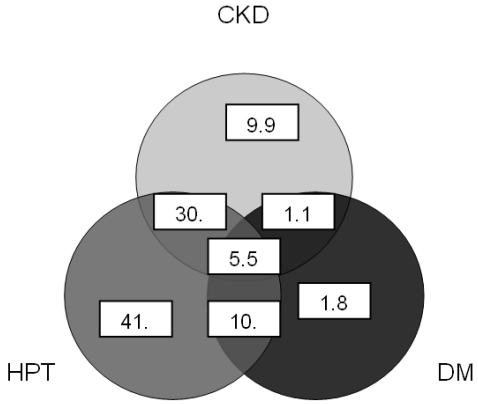


Figure 5.6.1(d): Venn Diagram for Pre and Post Transplant Complications (in %) at year 2009



5.6.2: Blood Pressure classification according to JNC VI criteria, 2006-2009

In 2009, 20% of renal transplant recipients had stage I hypertension whereas 4% had stage II hypertension and 0.6% had stage III hypertension despite being on treatment. In terms of diastolic hypertension 12% had stage I hypertension, 1.6% 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): Systolic BP, 2006-2009

Year	2006		2007		2008		2009	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Systolic BP<120	249	(15.64)	240	(14.22)	289	(17.03)	269	(15.90)
Systolic BP 120-129	395	(24.81)	392	(23.22)	377	(22.22)	375	(22.16)
Systolic BP 130-139	483	(30.34)	531	(31.46)	611	(36.00)	636	(37.59)
Systolic BP 140-159	353	(22.17)	409	(24.23)	335	(19.74)	340	(20.09)
Systolic BP 160-179	93	(5.84)	99	(5.86)	75	(4.42)	62	(3.66)
Systolic BP >=180	19	(1.19)	17	(1.01)	10	(0.59)	10	(0.59)

Figure 5.6.2(a): Systolic BP, 2006-2009

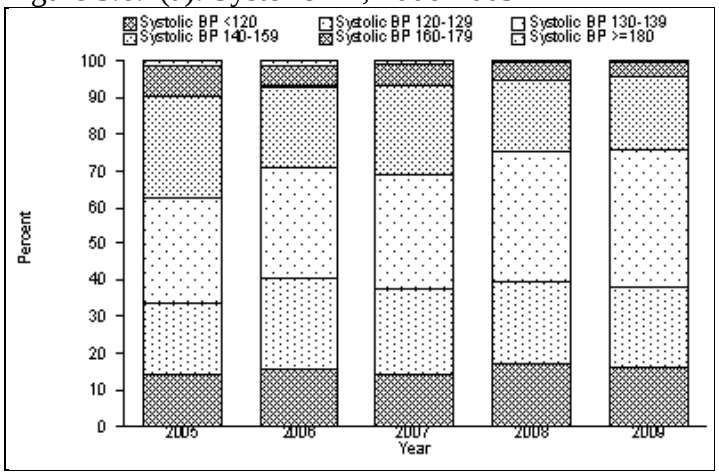


Table 5.6.2(b): Diastolic BP, 2006-2009

Year	2006		2007		2008		2009	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Diastolic BP<80	624	(39.20)	699	(41.41)	897	(52.86)	854	(50.47)
Diastolic BP 80-84	586	(36.81)	610	(36.14)	525	(30.94)	527	(31.15)
Diastolic BP 85-89	73	(4.59)	74	(4.38)	50	(2.95)	84	(4.96)
Diastolic BP 90-99	244	(15.33)	261	(15.46)	198	(11.67)	195	(11.52)
Diastolic BP 100-109	61	(3.83)	39	(2.31)	22	(1.30)	27	(1.60)
Diastolic BP >=110	4	(0.25)	5	(0.30)	5	(0.29)	5	(0.30)

Figure 5.6.2(b): Diastolic BP, 2006-2009

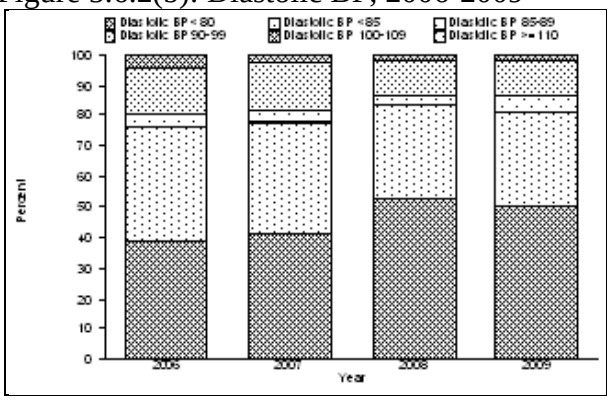
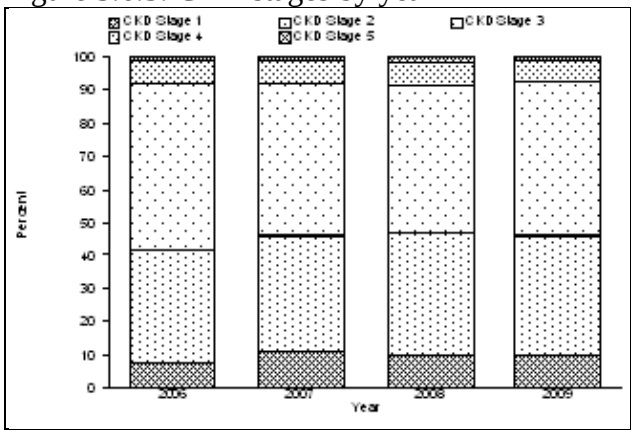


Table 5.6.3 shows the CKD Stage classification by year and in 2009, 46.4% of renal transplant recipients had CKD Stage III whilst another 7% had CKD Stage IV. CKD Stage V (impending renal replacement therapy) was found in 1.1% of renal transplant recipients.

Table 5.6.3: CKD stages, 2006-2009

Year	2006		2007		2008		2009	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
CKD stage 1	116	(7.33)	180	(10.78)	164	(9.81)	165	(9.94)
CKD stage 2	535	(33.80)	593	(35.51)	626	(37.44)	601	(36.20)
CKD stage 3	802	(50.66)	761	(45.57)	738	(44.14)	770	(46.39)
CKD stage 4	108	(6.82)	113	(6.77)	118	(7.06)	106	(6.39)
CKD stage 5	22	(1.39)	23	(1.38)	26	(1.56)	18	(1.08)

Figure 5.6.3: CKD stages by year

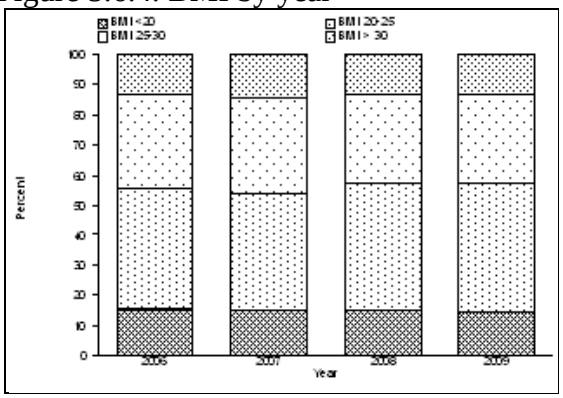


In terms of BMI for 2009, 57% of renal transplant recipients had BMIs of 25 or below. However 29% were overweight and another 13.3% were obese. There seems to be a slow but steady increase in numbers of obese patients over the last few years.

Table 5.6.4: BMI, 2006-2009

Year	2006		2007		2008		2009	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
BMI <20	242	(15.20)	254	(15.05)	251	(14.79)	243	(14.36)
BMI 20-25	648	(40.70)	659	(39.04)	724	(42.66)	726	(42.91)
BMI 25-30	496	(31.16)	532	(31.52)	502	(29.58)	498	(29.43)
BMI > 30	206	(12.94)	243	(14.40)	220	(12.96)	225	(13.30)

Figure 5.6.4: BMI by year

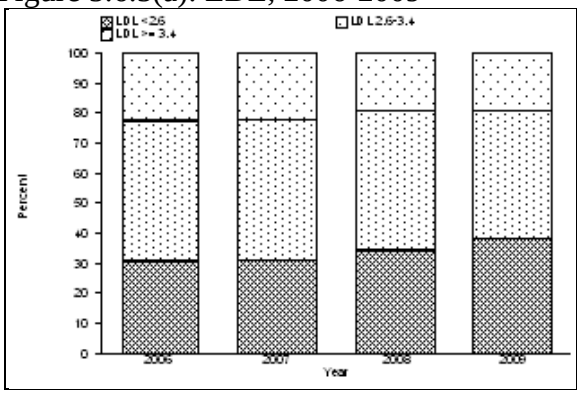


LDL cholesterol has been identified as the primary lipid target for prevention of coronary heart disease by NCEP with a log linear relationship between risk of CHD and level of LDL cholesterol. In terms of renal transplant recipients in 2009 38% have LDL levels below 2.6 mol/l and this shows an increasing trend from 18.1% in 2004, possibly due to the more widespread and aggressive 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 also demonstrated downward trend over the last few years.

Table 5.6.5(a): LDL, 2006-2009

Year	2006		2007		2008		2009	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
LDL < 2.6	492	(30.90)	528	(31.28)	585	(34.47)	646	(38.18)
LDL 2.6-3.4	738	(46.36)	779	(46.15)	779	(45.90)	714	(42.20)
LDL >= 3.4	362	(22.74)	381	(22.57)	333	(19.62)	332	(19.62)

Figure 5.6.5(a): LDL, 2006-2009



In terms of other cholesterol parameters for 2009, 56% had total cholesterol levels >= 5.2 and 9% had HDL cholesterol levels <1.0.

Table 5.6.5(b): Total Cholesterol, 2006-2009

Year	2006		2007		2008		2009	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Total Cholesterol <4.1	160	(10.05)	210	(12.44)	208	(12.26)	233	(13.77)
Total Cholesterol 4.1-5.1	490	(30.78)	539	(31.93)	529	(31.17)	506	(29.91)
Total Cholesterol 5.1-6.2	700	(43.97)	721	(42.71)	728	(42.90)	720	(42.55)
Total Cholesterol 6.2- 7.2	173	(10.87)	159	(9.42)	160	(9.43)	159	(9.40)
Total Cholesterol > 7.2	69	(4.33)	59	(3.50)	72	(4.24)	74	(4.37)

Figure 5.6.5(b): Total Cholesterol, 2006-2009

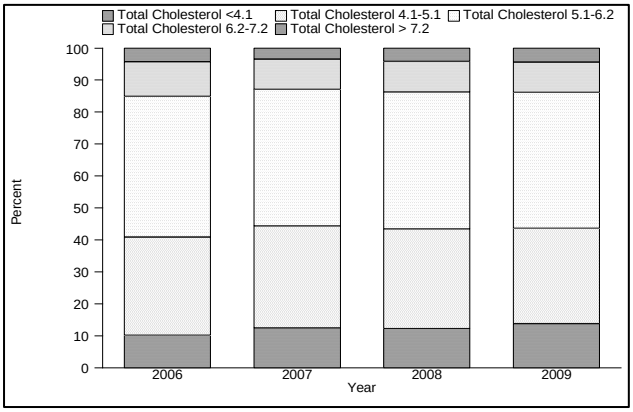


Figure 5.6.5(c): HDL, 2006-2009

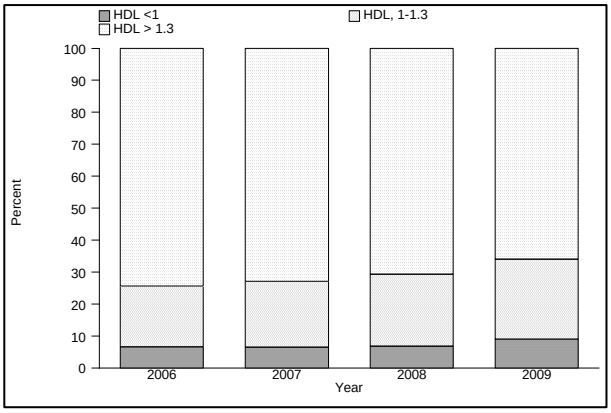


Table 5.6.5(c): HDL, 2006-2009

Year	2006		2007		2008		2009	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
HDL <1	104	(6.53)	108	(6.40)	114	(6.72)	153	(9.04)
HDL 1-1.3	302	(18.97)	350	(20.73)	382	(22.51)	421	(24.88)
HDL >1.3	1186	(74.50)	1230	(72.87)	1201	(70.77)	1118	(66.08)

Eighty-one percent of patients in 2009 were on antihypertensives and the majority was on more than 1 antihypertensive drug with 29% on 2 antihypertensives and 17% on 3 antihypertensives. Five percent of patients still had systolic BP of > 160 mmHg and 16% had diastolic BP of > 90 mmHg despite being given antihypertensive(s), however, this is an improvement over previous years.

Table 5.6.6(a): Treatment for hypertension, 2006-2009

Year	No.	% on anti-hypertensives	% on 1 anti-hypertensive drug	% on 2 anti-hypertensives	% on 3 anti-hypertensives
2006	1592	86	34	26	17
2007	1688	85	25	31	21
2008	1697	78	25	28	19
2009	1692	81	29	29	17

Table 5.6.6(b): Distribution of Systolic BP without anti-hypertensives, 2006-2009

Year	No.	Mean	SD	Median	LQ	UQ	% Patients ≥ 60mmHg
2006	189	123.8	14.4	120	117	130	4
2007	196	125.2	16.5	120	113	134	4
2008	178	123.7	15.5	120	110	130	3
2009	229	124	15.3	120	111	130	3

Table 5.6.6(c): Distribution of Diastolic BP without anti-hypertensives, 2006-2009

Year	No.	Mean	SD	Median	LQ	UQ	% patients ≥ 90mmHg
2006	189	76.4	10.3	80	70	80	11
2007	196	76.6	10.0	80	70	80	12
2008	177	75.1	10.0	80	70	80	10
2009	229	77.4	9.1	80	70	80	12

Table 5.6.6(d): Distribution of Systolic BP on anti-hypertensives, 2006-2009

Year	No.	Mean	SD	Median	LQ	UQ	% Patients ≥ 160mmHg
2006	1334	131.7	16.3	130	120	140	8
2007	1389	132.6	16.0	130	120	140	8
2008	1269	129.9	16.6	130	120	140	6
2009	1221	131.0	15.9	130	120	140	5

Table 5.6.6(e): Distribution of Diastolic BP on anti-hypertensives, 2006-2009

Year	No.	Mean	SD	Median	LQ	UQ	% Patients ≥ 90 mmHg
2006	1334	79.2	9.9	80	70	86	22
2007	1388	79.1	9.6	80	70	85	20
2008	1255	77.6	10	80	70	80	16
2009	1219	78.3	9.5	80	70	82	16

SECTION 5.7: QOL INDEX SCORE IN RENAL TRANSPLANT RECIPIENTS

1231 patients who were transplanted between 2000-2009 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 in relation to Dialysis Modality, Transplant recipient patients 2000-2009

Dialysis modality	QoL score
Number of patients	1231
Centile	
0	0
0.05	9
0.1	9
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 in relation to Dialysis Modality, Transplant recipient patients 2000-2009

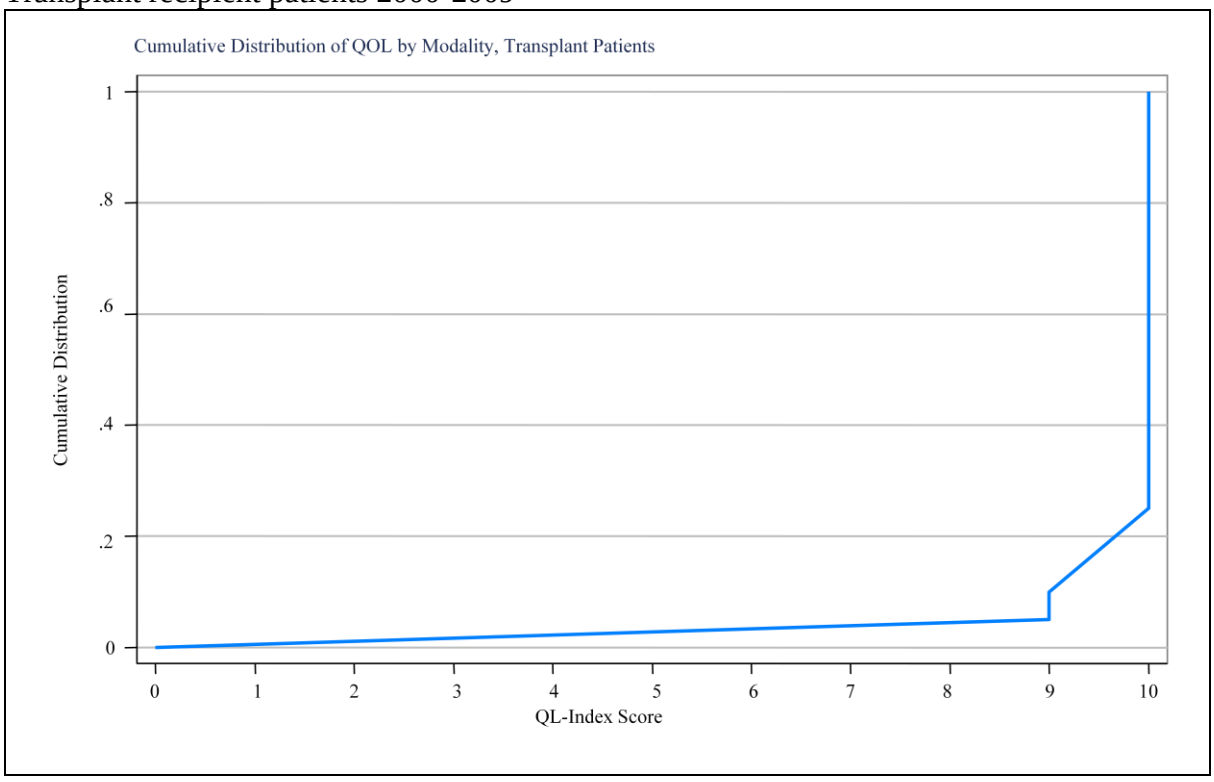


Table 5.7.2: Cumulative distribution of QoL-Index score in relation to Diabetes mellitus, Transplant recipient patients 2000-2009

Diabetes mellitus	No	Yes
Number of patients	1166	65
Centile		
0	0	0
0.05	9	7
0.1	10	8
0.25 (LQ)	10	9
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 2000-2009

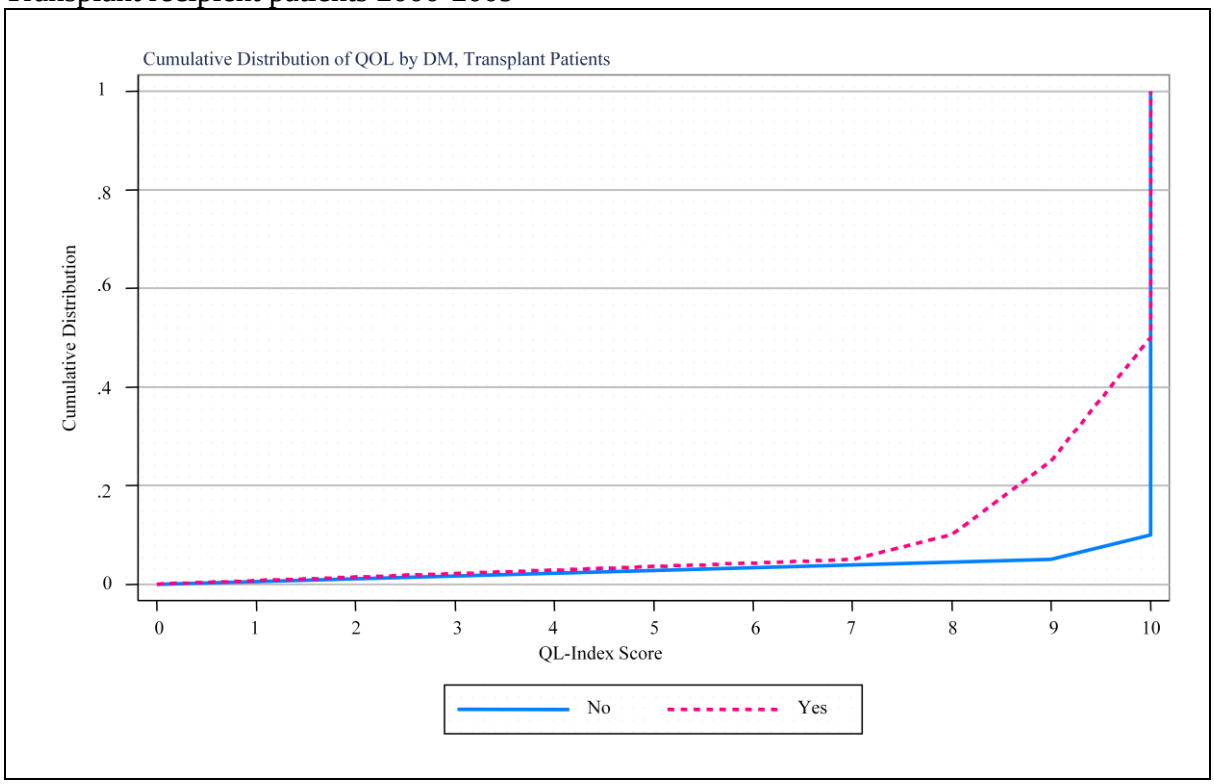


Table 5.7.3: Cumulative distribution of QoL-Index score in relation to Gender, Transplant recipient patients 2000-2009

Gender	Male	Female
Number of patients	767	464
Centile		
0	0	0
0.05	9	8
0.1	9	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 2000-2009

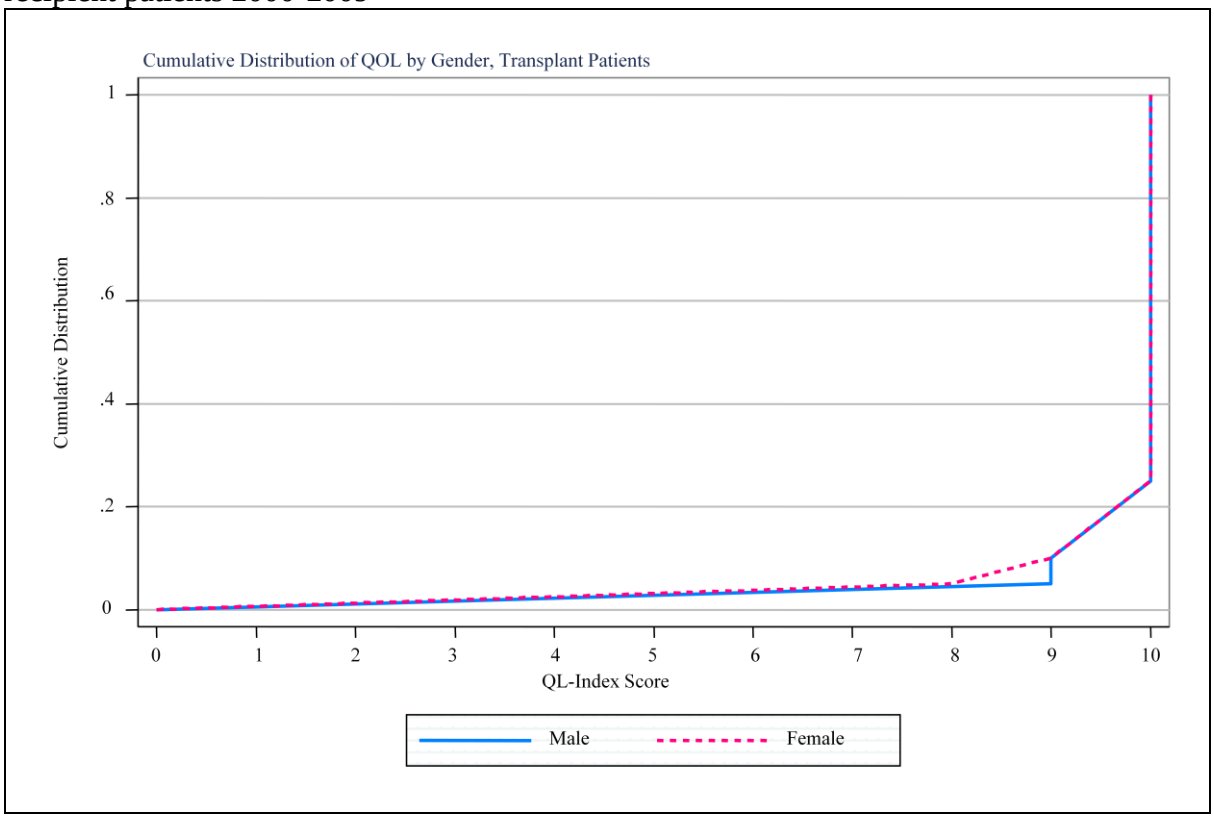


Table 5.7.4: Cumulative distribution of QoL-Index score in relation to Age, Transplant recipient patients 2000-2009

Age group (years)	<20	20-39	40-59	>=60
Number of patients	129	481	541	80
Centile				
0	0	0	0	0
0.05	9	9	8	8
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 2000-2009

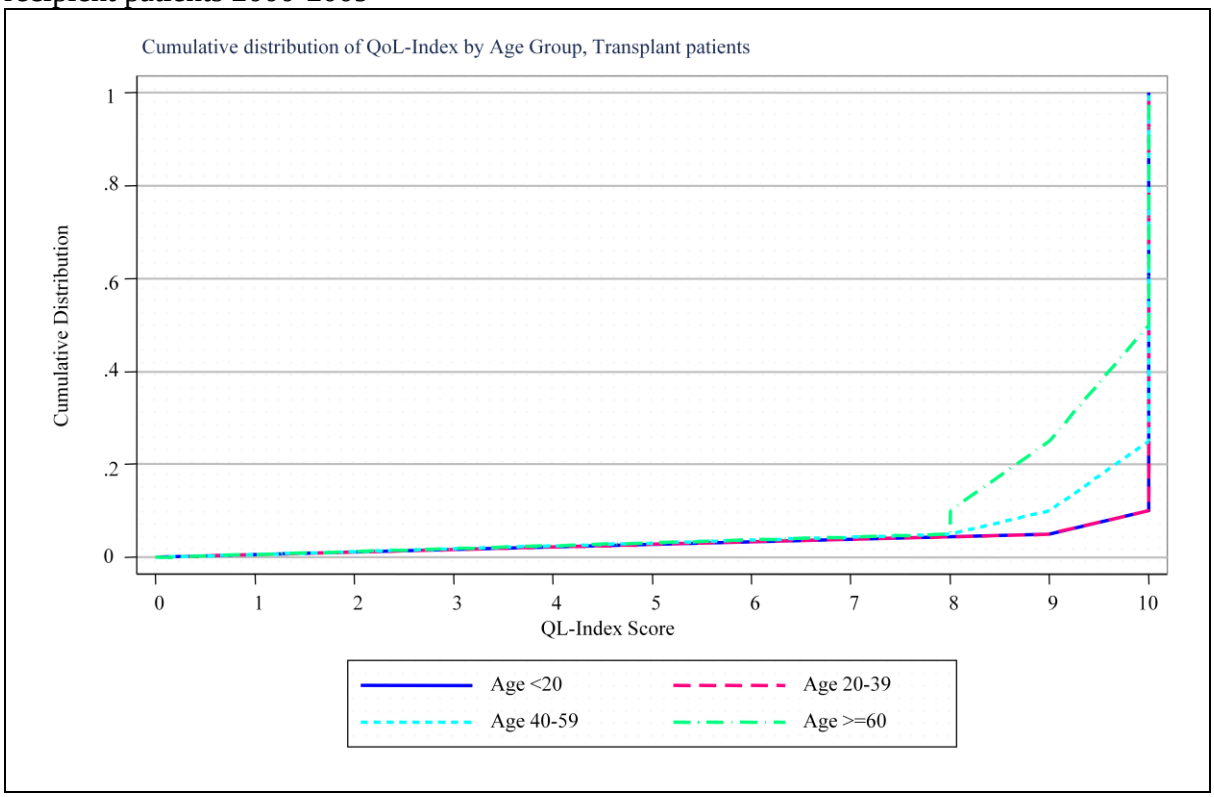
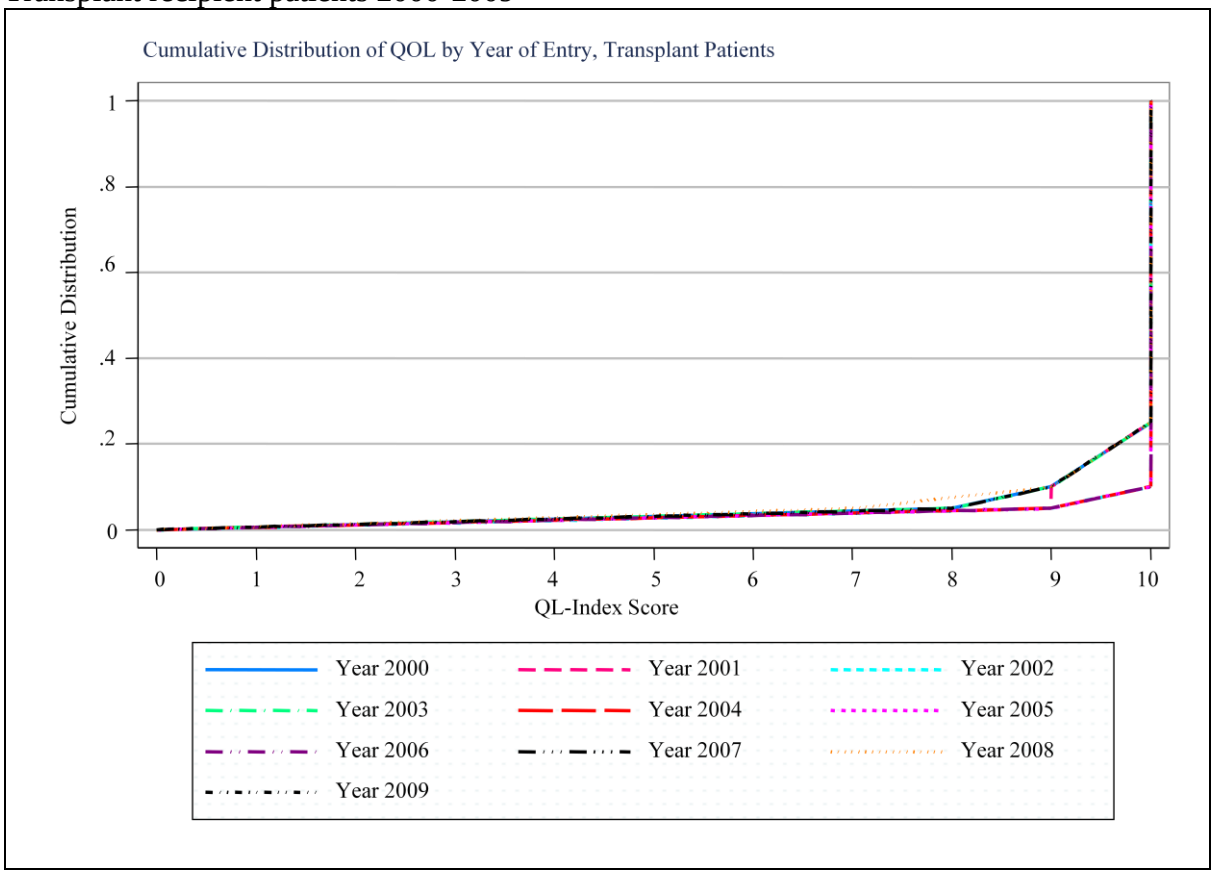


Table 5.7.5: Cumulative distribution of QoL-Index score in relation to Year of entry, Transplant recipient patients 2000-2009

Year of Entry	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Number of patients	110	126	144	136	167	145	133	91	99	80
Centile										
0	0	0	0	0	0	0	0	0	0	0
0.05	8	9	9	8	9	9	9	8	7	8
0.1	9	9	10	9	10	10	10	9	9	9
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 2000-2009



CHAPTER 6

HOMOGRAFT - HEART VALVE TRANSPLANTATION

Editor:
Mr. Mohamed Ezani Hj Md Taib

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6.0 INTRODUCTION

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

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

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

As of 31st December 2009, a total 200 patients were alive with functioning graft and 38 new implantations were performed in 2009.

The continued effort by the National Transplant Resource Center has been instrumental in improving the number of heart valve homograft procurements in the country. The Ministry of Health role in promoting organ and tissue donation nationwide is greatly appreciated.

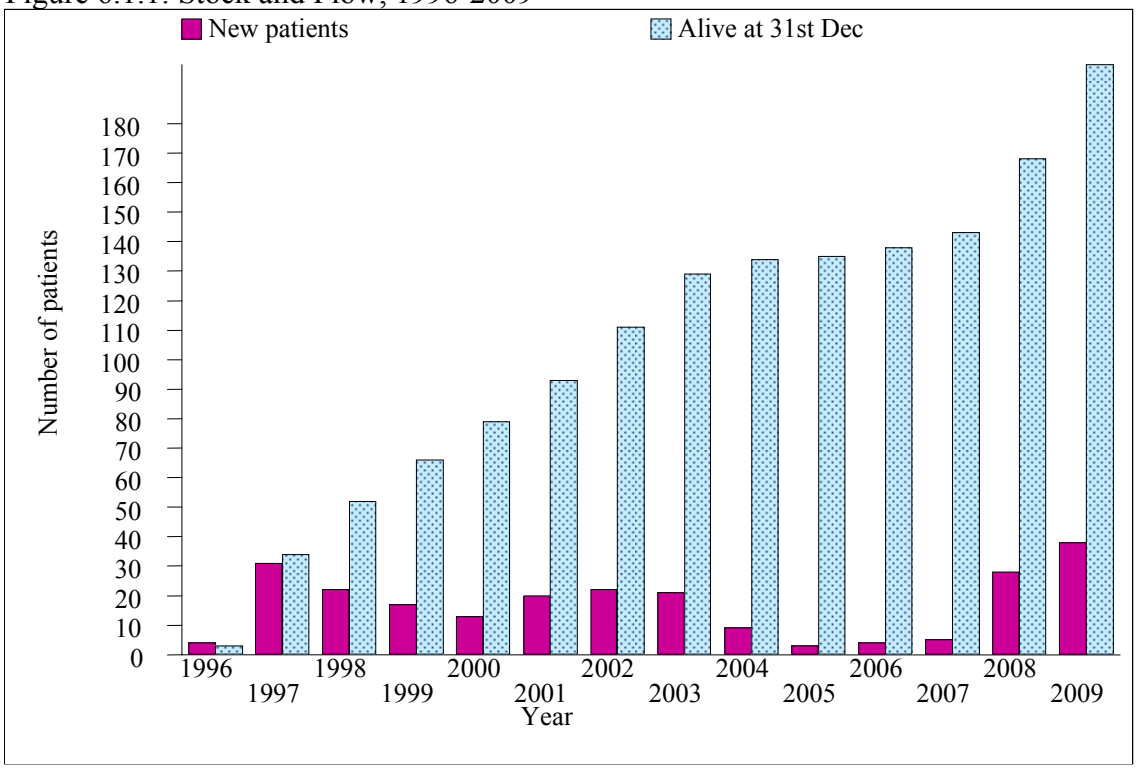
6.1 STOCK AND FLOW

Table 6.1.1: Stock and Flow, 1996-2009

Year	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
New transplant	4	31	22	17	13	20	22	21	9	3	4	5	28	38
Deaths*	1	0	4	3	0	6	4	3	4	2	1	0	3	6
Lost to follow up	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alive with functioning graft at 31st December	3	34	52	66	79	93	111	129	134	135	138	143	168	200

*based on year of death

Figure 6.1.1: Stock and Flow, 1996-2009



6.2 RECIPIENTS' CHARACTERISTICS

Table 6.2.1: Gender Distribution, 1996-2009

Year	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**TOTAL**
Gender	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
Male	2	18	9	9	10	6	9	14	3	0	4	2	13	20	119
Female	2	13	13	8	3	14	13	7	6	3	0	3	15	18	118
TOTAL	**4**	**31**	**22**	**17**	**13**	**20**	**22**	**21**	**9**	**3**	**4**	**5**	**28**	**38**	**237**

Figure 6.2.1: Gender Distribution, 1996-2009

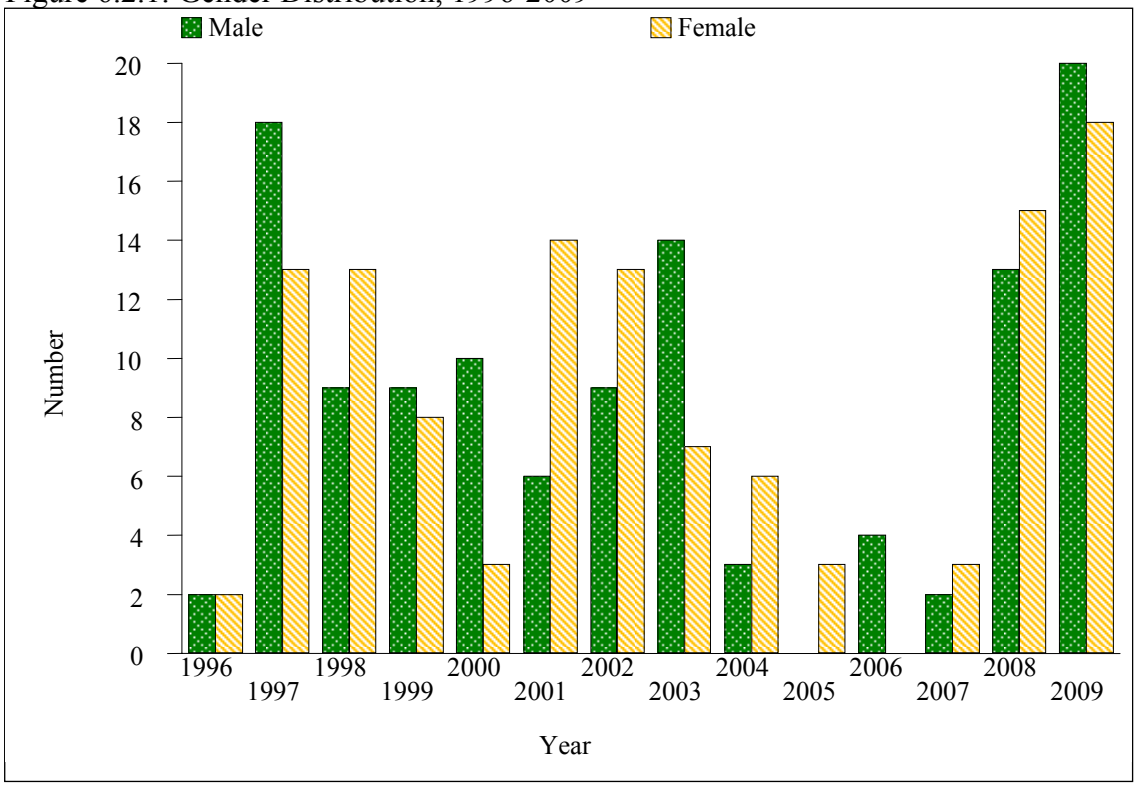


Table 6.2.2: Ethnic Group Distribution, 1996-2009

Year	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**TOTAL**
Ethnic group	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
Malay	1	18	15	9	9	10	16	12	6	3	2	3	18	29	151
Chinese	3	11	4	3	2	9	4	6	1	0	1	0	7	6	57
Indian	0	2	2	2	0	1	2	2	1	0	1	0	1	3	17
Others	0	0	1	3	2	0	0	1	1	0	0	2	2	0	12
TOTAL	**4**	**31**	**22**	**17**	**13**	**20**	**22**	**21**	**9**	**3**	**4**	**5**	**28**	**38**	**237**

Figure 6.2.2: Ethnic Group Distribution, 1996-2009

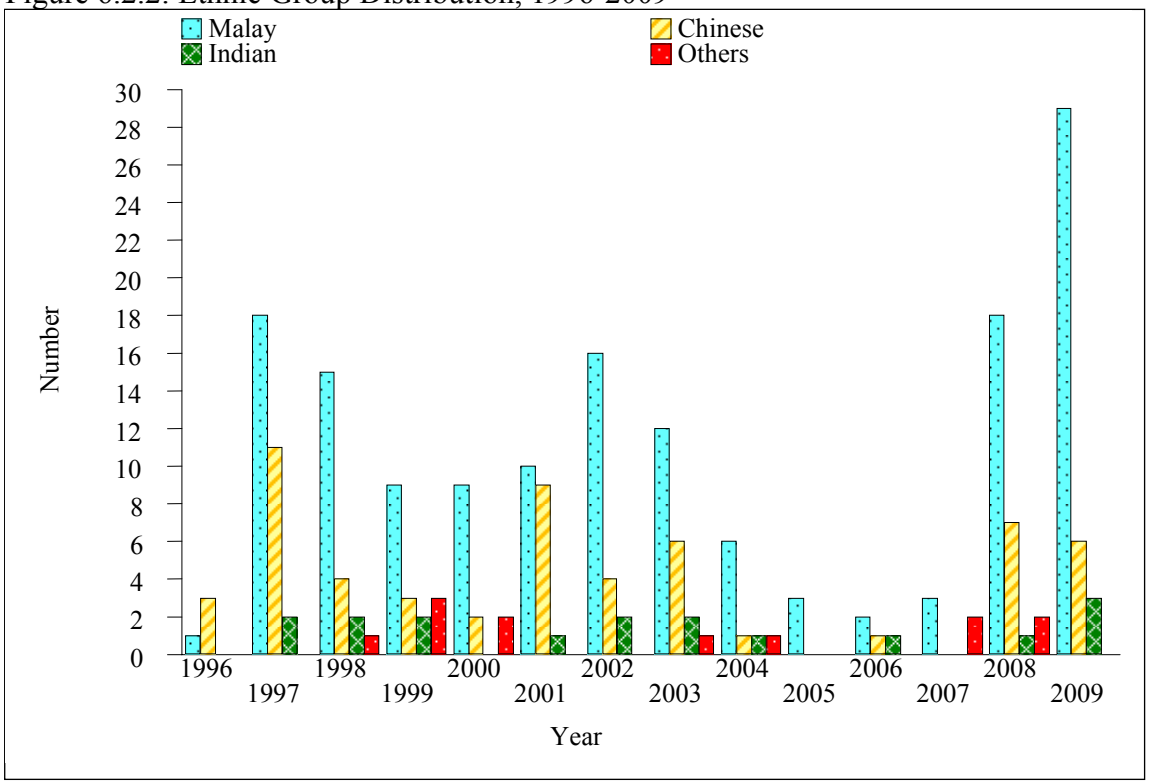
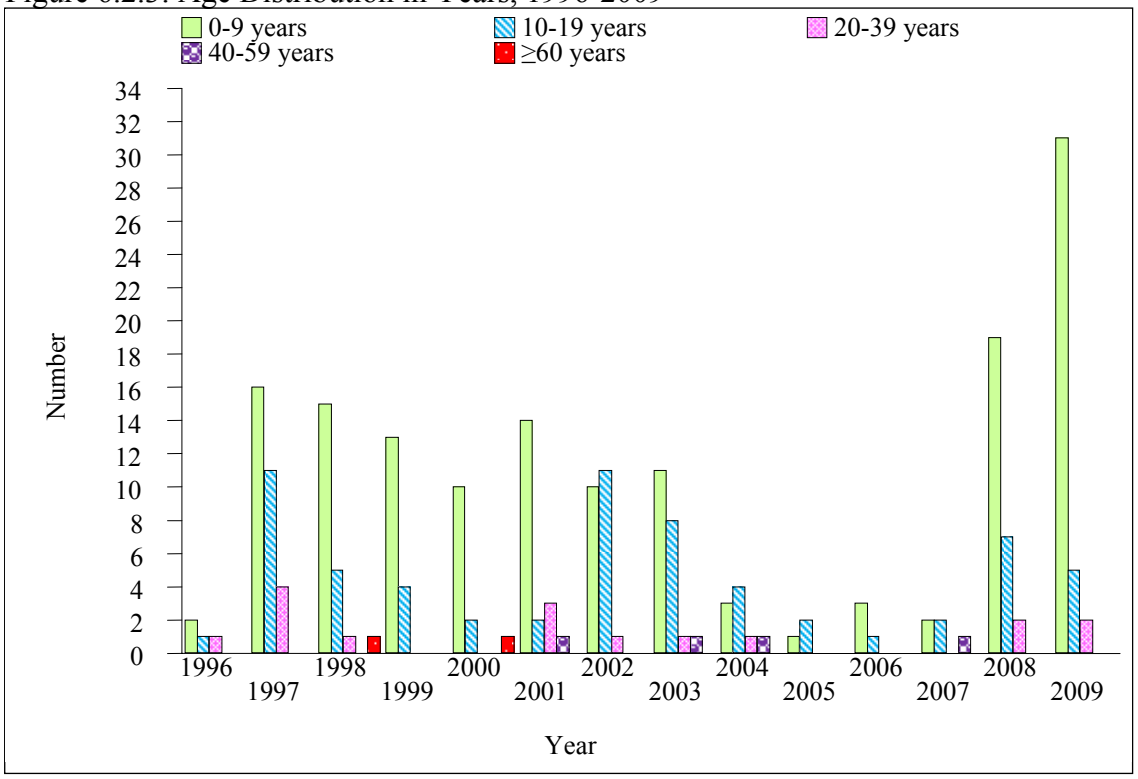


Table 6.2.3: Age Distribution in Years, 1996-2009

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	TOTAL
Age group	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
0-9	2	16	15	13	10	14	10	11	3	1	3	2	19	31	150
10-19	1	11	5	4	2	2	11	8	4	2	1	2	7	5	65
20-39	1	4	1	0	0	3	1	1	1	0	0	0	2	2	16
40-59	0	0	0	0	0	1	0	1	1	0	0	1	0	0	4
≥60	0	0	1	0	1	0	0	0	0	0	0	0	0	0	2
TOTAL	**4**	**31**	**22**	**17**	**13**	**20**	**22**	**21**	**9**	**3**	**4**	**5**	**28**	**38**	**237**
Mean	11.9	11.5	11	6.9	12.3	10.9	10.2	12.3	15.2	15	5.7	15.8	6.8	8.4	10.2
SD	6.6	6.7	14.5	4.1	17	14.2	6.1	11	11.4	7.8	4.6	18.4	6.2	6.9	10
Median	11.2	9.9	7.8	7	8.3	4.8	10.4	9	10.3	19.5	4.9	10.5	6.3	7.1	8
Min	4.9	2.4 months	2.4 months	7.2 months	1.6	4.8 months	2.6	1.8	4.9	6	1	2.4 months	1.2 months	2.4 months	1.2 months
Max	20.5	29.6	69.7	17.1	66.8	52.8	27.5	53.4	42	19.5	11.8	47.4	21.5	36	69.7

* Age=date of implantation – date birth

Figure 6.2.3: Age Distribution in Years, 1996-2009



6.3 TRANSPLANT PRACTICES

6.3.1 Donor Details

Table 6.3.1: Number of Valves Harvested by Type of Homograft, 1996-2009

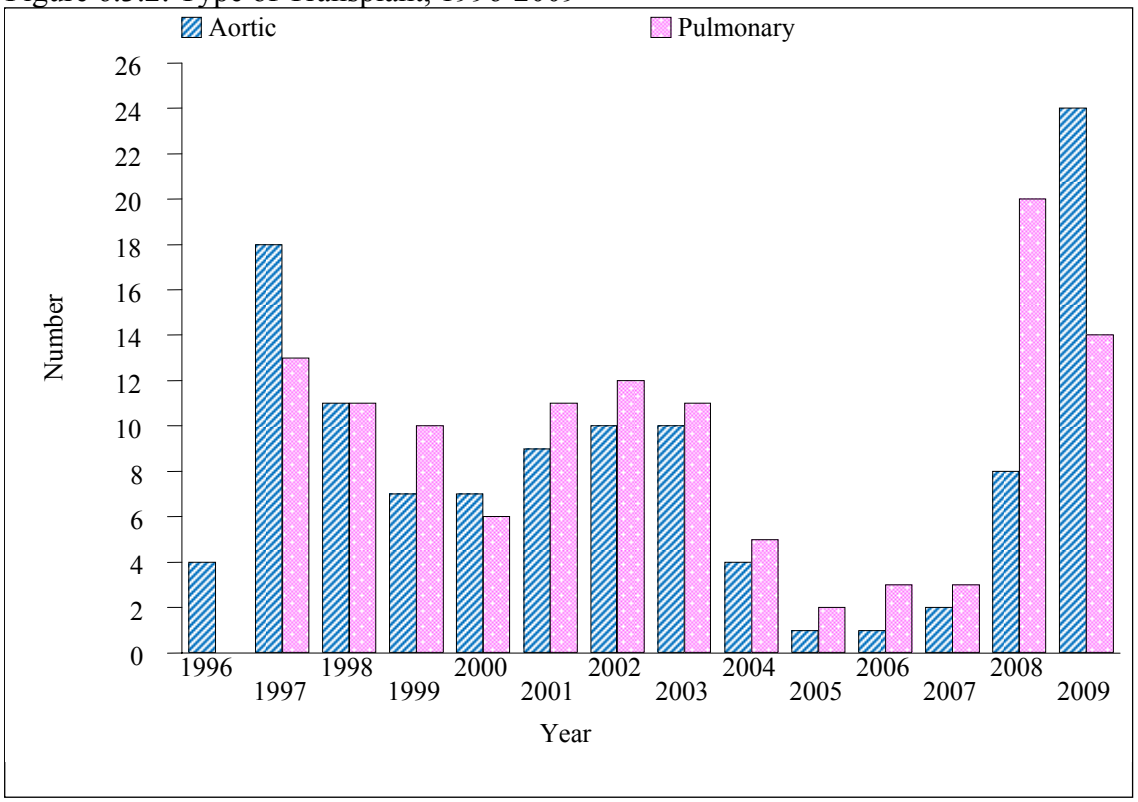
Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	TOTAL
Type of homograft	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
Aortic	8	17	10	8	11	14	10	8	7	5	14	9	15	17	153
Pulmonary	1	14	11	10	12	12	14	9	8	5	15	8	13	19	151
TOTAL	**9**	**31**	**21**	**18**	**23**	**26**	**24**	**17**	**15**	**10**	**29**	**17**	**28**	**36**	**304**

6.3.2 Transplant Details

Table 6.3.2: Type of Transplant, 1996-2009

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	TOTAL
Type of transplant	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
Aortic	4	18	11	7	7	9	10	10	4	1	1	2	8	24	116
Pulmonary	0	13	11	10	6	11	12	11	5	2	3	3	20	14	121
TOTAL	**4**	**31**	**22**	**17**	**13**	**20**	**22**	**21**	**9**	**3**	**4**	**5**	**28**	**38**	**237**

Figure 6.3.2: Type of Transplant, 1996-2009



6.4 TRANSPLANT OUTCOMES

Table 6.4.1: Patient Survival by Gender, 1996-2009

Gender	Male		Female	
Interval (years)	% Survival	SE	% Survival	SE
1	90	3	90	3
3	88	3	86	3
5	86	4	86	3
7	86	4	86	3
9	86	4	83	4
11	86	4	83	4
13	86	4	83	4

SE=standard error

Figure 6.4.1: Patient Survival by Gender, 1996-2009

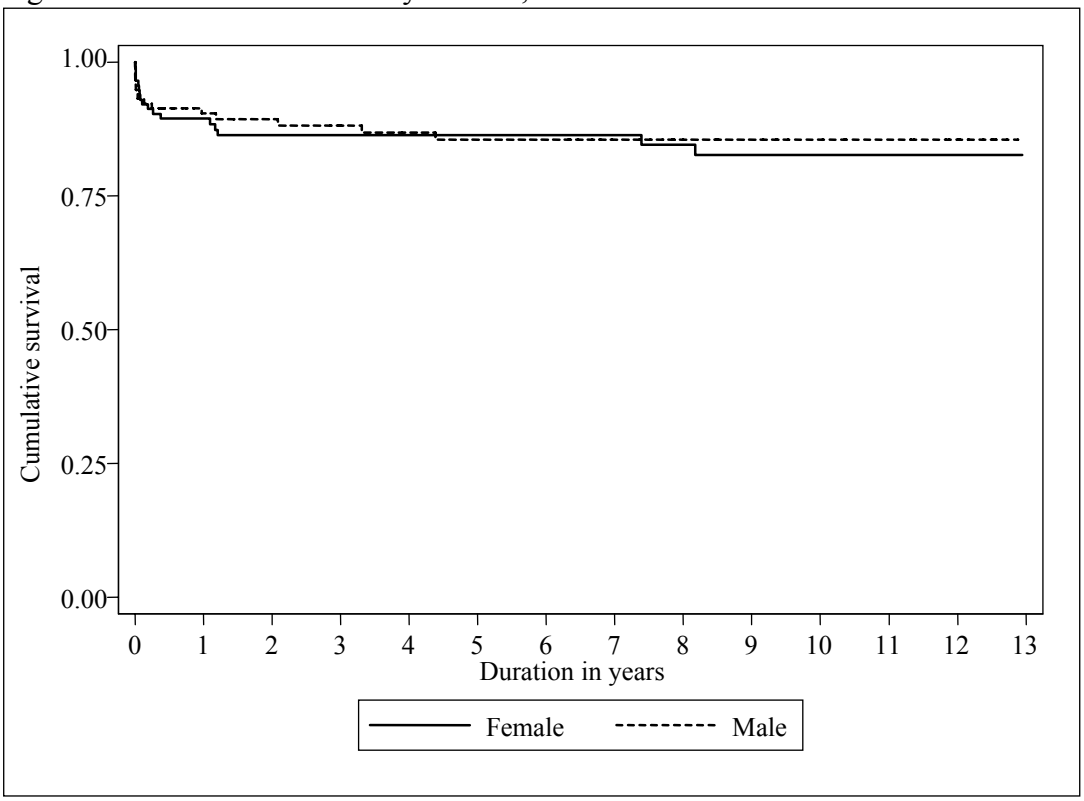


Table 6.4.2: Patient Survival by Age Group, 1996-2009

Age group	**0-9 years**		**10-19 years**		**≥20 years**	
Interval (months)	**% Survival**	**SE**	**% Survival**	**SE**	**% Survival**	**SE**
1	88	3	94	3	90	6
3	87	3	88	4	85	8
5	87	3	86	5	79	9
7	87	3	86	5	79	9
9	86	3	83	5	79	9
11	86	3	83	5	79	9
13	86	3	83	5	79	9

SE=standard error

Figure 6.4.2: Patient Survival by Age Group, 1996-2009

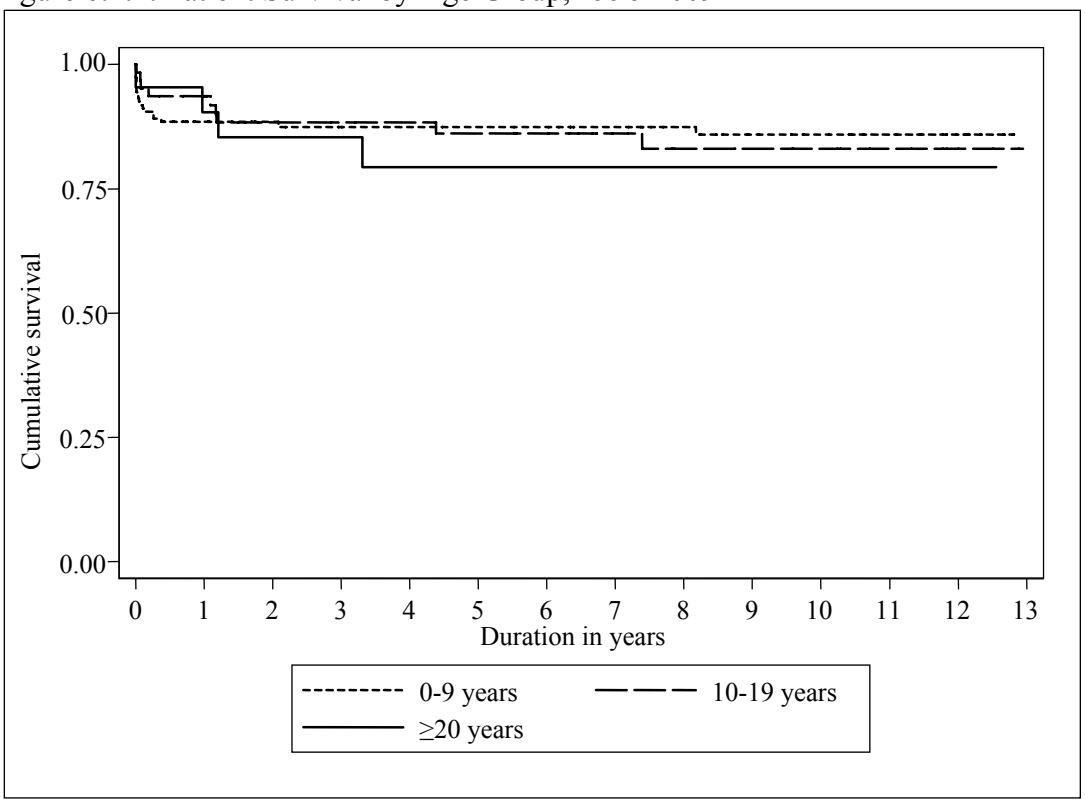
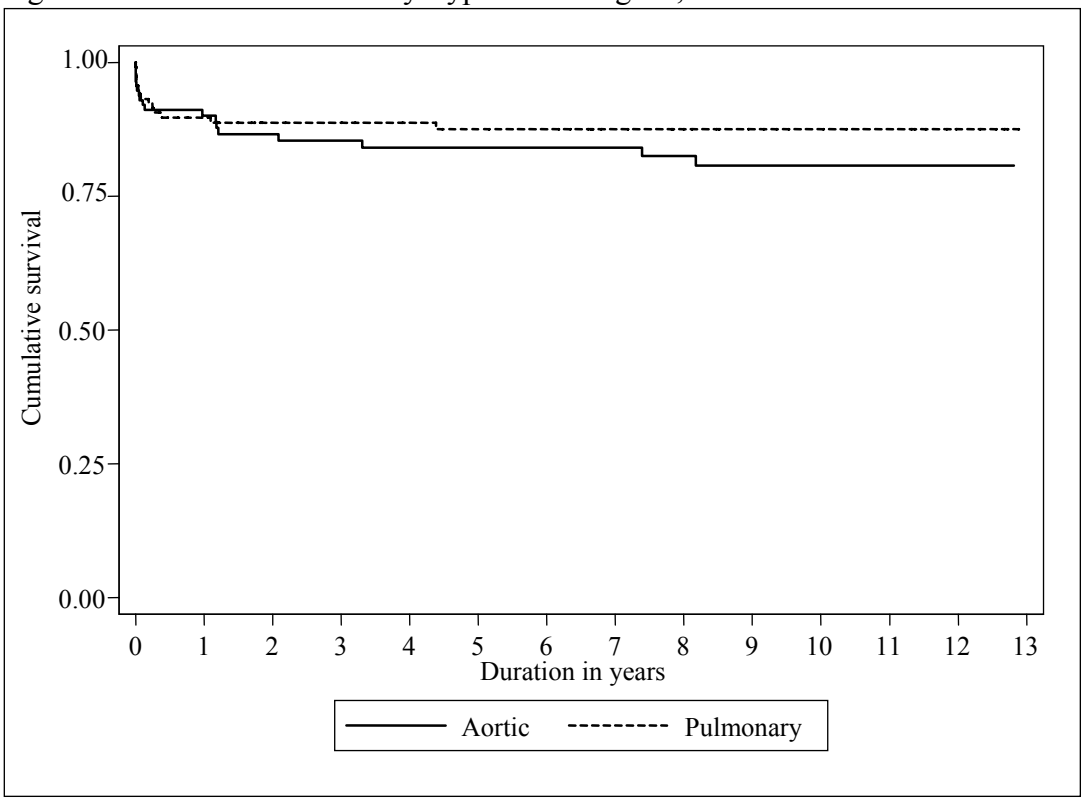


Table 6.4.3: Patient Survival by Type of Homograft, 1996-2009

Type of homograft	Aortic		Pulmonary	
Interval (years)	% Survival	SE	% Survival	SE
1	90	3	90	3
3	85	4	89	3
5	84	4	88	3
7	84	4	88	3
9	81	4	88	3
11	81	4	88	3
13	81	4	88	3

SE=standard error

Figure 6.4.3: Patient Survival by Type of Homograft, 1996-2009



CHAPTER 7

BONE AND TISSUE TRANSPLANTATION

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7.0 INTRODUCTION

The first part of this chapter presents data on tissue allografts that have been distributed and data about recipient centres. The second part presents data obtained from the Bone and Tissue Transplant Notification Form. Bone and tissue transplantation notification is poor.

Centres and hospitals that are involved in human tissue procurement, processing, storage and distribution may not know that they have to report their data. Some had failed to provide data when requested by NTR. The Ministry of Health does not have the database on human tissue providers.

Limited outcome data was collected as very few surgeons submitted the Bone and Tissue Transplant Notification Form to NTR. These deficiencies are due to poor participation of human tissue providers and health professionals who perform bone and tissue transplantation (Source Data Provider, SDP), ineffective enforcement of notification and networking.

7.1 STOCK OF TISSUE ALLOGRAFTS AND HOSPITALS WHERE TISSUES ARE UTILISED FROM 2004 TO 2009

Table 7.1.1 presents the various types of tissue allografts supplied by USM Tissue Bank from 2004 until 2009. The number of deep frozen bones, deep frozen tendons, freeze dried bones, deep frozen skin and preserved amniotic membranes were markedly reduced in 2009 compared to 2008. The reason for this is unknown. It may be due to limited stock attributable to reduced number of donors, there may be other centres and hospitals providing tissue allografts or tissue allografts were imported by the surgeons.

Table 7.1.1: Types of Tissue Allografts Supplied by USM Tissue Bank, 2004-2009

Types of Tissue Allograft	**No. of pieces**						
	2004	**2005**	**2006**	**2007**	**2008**	**2009**	**Total**
Deep Frozen Bone							
Knee Slices	1	0	0	0	0	0	**1**
Femur	10	7	5	2	8	7	**39**
Femoral Head	50	88	80	65	54	24	**361**
Humerus	1	3	0	2	2	1	**9**
Tibia	9	1	4	4	9	2	**29**
Radius	1	2	1	0	4	0	**8**
Ulna	0	3	0	0	0	0	**3**
Patella/ Bone-Patella-Bone	2	1	4	2	1	0	**10**
Others	4	0	0	0	5	0	**9**
Deep Frozen Tendon							
Achilles Tendon	0	0	0	2	1	1	**4**
Quadriceps Tendon	0	0	0	0	0	0	**0**
Others	0	0	1	3	6	2	**12**
Freeze Dried Bone							
Cancellous chip	17	19	37	2	27	5	**107**
Cortical	2	0	0	0	0	0	**2**
Cortico-cancellous	5	2	0	0	0	3	**10**
Others	0	0	0	8	0	0	**8**
Skin							
Deep Frozen Skin	0	0	0	0	72	0	**72**
Amniotic membrane							
Air-dried & Glycerol Preserved	1128	64	379	175	2082	932	**4760**
Total	**1230**	**190**	**511**	**265**	**2271**	**977**	**5444**

USM Tissue Bank continues to provide tissue allografts to Ministry of Health hospitals, private hospitals and other sectors (Table 7.1.2 and 7.1.3).

Table 7.1.2: Hospitals/Other Sectors Using Bone, Tendon and Skin Allografts Provided by USM Tissue Bank, 2004-2009

Recipients	No. of pieces						
	2004	2005	2006	2007	2008	2009	Total
MOH							
Hospital Sultanah Bahiyah, Alor Setar	1	10	6	2	0	0	**19**
Hospital Umum Sarawak, Kuching	3	13	10	6	3	0	**35**
Hospital Ipoh	0	4	9	3	0	0	**16**
Hospital Kemaman	0	0	10	0	0	0	**10**
Hospital Sultanah Nurzahirah, Kuala Terengganu	0	0	2	0	0	3	**5**
Hospital Melaka	1	0	0	3	0	0	**4**
Hospital Pulau Pinang	5	1	7	7	0	0	**20**
Queen Elizabeth Hospital, Kota Kinabalu	0	0	12	2	0	0	**14**
Hospital Raja Perempuan Zainab II, Kota Bharu	5	2	1	0	8	2	**18**
Hospital Seberang Jaya, Pulau Pinang	0	2	0	3	0	0	**5**
Hospital Selayang	0	0	3	0	0	0	**3**
Hospital Seremban	2	2	1	0	0	2	**7**
Hospital Sultanah Aminah, Johor Bahru	9	19	11	1	0	0	**40**
Hospital Sultan Ismail, Johor Bahru	0	0	0	2	73	1	**76**
Hospital Tengku Ampuan Afzan, Kuantan	0	1	2	0	0	0	**3**
Hospital Tengku Ampuan Rahimah, Klang	0	5	0	0	0	0	**5**
Hospital Pakar Sultanah Fatimah, Johor	0	0	0	0	2	0	**2**
Total	**26**	**59**	**74**	**29**	**86**	**8**	**282**
University Hospitals							
HUSM	39	23	30	3	20	14	**129**
HUKM	3	2	3	5	0	0	**13**
UMMC	9	3	0	0	0	1	**13**
Total	**51**	**28**	**33**	**8**	**20**	**15**	**155**
Private and other sectors							
Amin Dental Surgery, Johor Bahru	0	0	0	5	0	0	**5**
Antal Rastu Sdn Bhd	0	0	2	0	0	0	**2**
Borneo Indah Sdn. Bhd.	0	0	0	0	4	0	**4**
Chong Dental Surgery, Seri Kembangan Selangor	0	0	0	1	0	0	**1**
Hospital Fatimah, Ipoh	1	12	0	2	11	4	**30**
Pantai Medical Centre, Air Keroh	0	0	5	0	0	0	**5**
Mahkota Medical Centre, Melaka	0	2	1	0	0	0	**3**
Hospital Tawakal, KL	0	0	0	3	9	0	**12**
Hospital Tung Shin, Kuala Lumpur	0	2	0	0	0	0	**2**
Jasa Dental Surgery, Kuala Lumpur	5	0	0	0	0	0	**5**
Johnson & Johnson Medical	0	0	0	2	16	3	**21**
Kemajuan Abadi Sdn. Bhd.	0	5	0	2	0	0	**7**
Klinik Pergigian Chong, Tangkak, Johor	0	0	0	1	0	0	**1**
Kota Bahru Medical Centre, Kota Bharu	0	0	2	0	0	1	**3**
Lam Wah Ee Hospital, Pulau Pinang	0	0	3	0	0	0	**3**
Normah Medical Center, Kuching	0	0	0	3	3	0	**6**
Pantai Medical Center, Bangsar	0	0	0	1	0	0	**1**
Island Hospital, Pulau Pinang	0	0	0	0	1	0	**1**
Sentosa Medical Centre, Kuala Lumpur	0	1	0	0	0	0	**1**
Sri Kota Medical Centre, Klang	2	0	0	0	0	0	**2**
Stryker	2	4	6	12	20	9	**53**
Sunway Medical Centre, Selangor	0	0	1	0	0	0	**1**
Teo Orthopaedic, Kuala Lumpur	0	10	0	0	0	0	**10**
Zimmer	9	3	5	21	18	5	**61**
Kuching Specialist Hospital, Sarawak	0	0	0	0	1	0	**1**
Total	**19**	**39**	**25**	**53**	**83**	**22**	**241**
Grand Total	**96**	**126**	**132**	**90**	**189**	**45**	**678**

Table 7.1.3: Hospitals/Other Sectors Using Amniotic Membranes provided by USM Tissue Bank, 2004-2009

Recipients	No. of pieces						
	2004	**2005**	**2006**	**2007**	**2008**	**2009**	**Total**
Ministry of Health							
Hospital Miri, Sarawak	0	0	0	5	10	0	**15**
Hospital Kuala Lumpur	22	15	13	40	0	0	**90**
Hospital Sultanah Bahiyah, Alor Setar	0	0	2	7	0	0	**9**
Hospital Umum Sarawak, Kuching	6	10	0	6	1	0	**23**
Hospital Sultanah Nurzahirah, Kuala Terengganu	0	1	0	5	0	0	**6**
Hospital Melaka	5	5	10	0	5	0	**25**
Hospital Pakar Sultanah Fatimah, Johor	0	0	100	0	0	0	**100**
Hospital Pulau Pinang	0	0	0	3	0	0	**3**
Queen Elizabeth Hospital, Kota Kinabalu	0	0	4	1	0	0	**5**
Hospital Raja Perempuan Zainab II, Kota Bharu	0	5	0	2	1	0	**8**
Hospital Selayang	0	0	1	0	0	0	**1**
Hospital Sultanah Aminah, Johor Bahru	73	0	200	0	0	0	**273**
Hospital Sultan Ismail, Johor Bahru	0	0	0	50	0	0	**50**
Hospital Teluk Intan	0	0	1	4	0	0	**5**
Hospital Tengku Ampuan Afzan, Kuantan	6	6	7	0	0	0	**19**
Hospital Tengku Ampuan Rahimah, Klang	4	5	0	0	0	0	**9**
Hospital Kuala Krai	0	0	0	0	1	0	**1**
Hospital Sungai Buloh	0	0	0	21	40	0	**61**
Total	**116**	**47**	**338**	**144**	**58**	**0**	**703**
University Hospitals							
HUSM	1001	1	8	7	4	0	**1021**
HUKM	4	0	0	7	32	0	**43**
UMMC	5	0	6	0	5	0	**16**
IIUM	0	0	0	6	0	0	**6**
Total	**1010**	**1**	**14**	**20**	**41**	**0**	**1086**
Private and other sectors							
Gleneagles Medical Centre, Pulau Pinang	2	4	8	0	6	0	**20**
Hospita Mata Tun Hussein Onn	0	4	0	0	5	0	**9**
Hospital Tawakal, KL	0	0	4	0	0	0	**4**
ISEC Sdn. Bhd.	0	0	0	2	0	0	**2**
Klinik Iman, Seremban	0	1	0	0	0	0	**1**
Kuala Terengganu Specialist Center, Kuala Terengganu	0	0	0	3	0	0	**3**
Peter Kong Eye Clinic, Kota Kinabalu	0	0	0	0	2	0	**2**
Pusat Rawatan Islam Al-Zahirah, Bangi, Selangor	0	0	10	0	0	0	**10**
Puteri Specialist Hospital, Johor Bahru	0	5	0	5	0	0	**10**
Putra Medical Centre, Alor Setar	0	0	1	1	0	0	**2**
Sri Kota Medical Centre, Klang	0	2	4	0	2	0	**8**
CryoCord Sdn. Bhd.	0	0	0	0	1968	932	**2900**
Total	**2**	**16**	**27**	**11**	**1983**	**932**	**2971**
Grand Total	**1128**	**64**	**379**	**175**	**2082**	**932**	**4760**

7.2 Reporting Centre

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. The total number of reporting centres between 2004 and 2009 show a decreasing trend.

Table 7.2.1: Distribution of Reporting Centre, 2004-2009

Reporting centre	2004	2005	2006	2007	2008	2009	Total
Orthopaedics Department							
Department of Orthopaedics, HUSM	1	7	2	1	1	0	**12**
Institute of Orthopaedic & Traumatology, Hospital Kuala Lumpur	2	0	0	0	0	0	**2**
Department of Orthopaedics Surgery, UMMC	1	0	0	0	0	0	**1**
Department of Orthopaedics, Hospital Pulau Pinang	0	0	0	1	0	0	**1**
Department of Orthopaedics, Hospital Ipoh	0	1	0	0	0	0	**1**
Department of Orthopaedics, Hospital Raja Perempuan Zainab II	9	3	0	0	0	0	**12**
Department of Orthopaedics, Hospital Umum Sarawak	1	0	1	0	0	0	**2**
Department of Orthopaedics, Hospital Tengku Ampuan Afzan	0	0	0	1	0	0	**1**
Department of Orthopaedics, Hospital Sultanah Aminah	0	1	0	0	0	0	**1**
Wan Orthopaedic, Trauma & Sports Injury Centre (WOTSIC), Seremban Specialist Hospital	0	0	2	0	0	0	**2**
Department of Orthopaedics, Island Hospital, Pulau Pinang	0	1	0	0	0	0	**1**
Department of Orthopaedics, Normah Medical Specialist Centre, Kuching	0	1	0	0	0	0	**1**
Department of Orthopaedics, Hospital Fatimah, Ipoh	0	3	0	1	0	1	**5**
Department of Orthopaedics, Kota Bharu Medical Centre	0	0	2	0	0	0	**2**
Department of Orthopaedics, Pantai Medical Centre, Kuala Lumpur	0	0	0	1	0	0	**1**
Department of Orthopaedics, Gleneagles Medical Centre, Pulau Pinang	0	0	0	0	1	0	**1**
Department of Orthopaedics, Penang Adventis Hospital, Pulau Pinang	0	0	0	0	1	0	**1**
Spine Unit, HUSM	0	0	1	0	1	0	**2**
Total	**14**	**17**	**8**	**5**	**4**	**1**	**49**
Ophthalmology Department							
Department of Ophthalmology, Hospital Tengku Ampuan Rahimah, Klang	1	1	0	0	0	0	**2**
Department of Ophthalmology, Hospital Tengku Ampuan Afzan, Kuantan	1	1	0	0	0	0	**2**
Department of Ophthalmology, Hospital Teluk Intan	0	0	1	0	0	0	**1**
Department of Ophthalmology, Hospital Kuala Lumpur	0	0	23	20	15	10	**68**
Department of Ophthalmology, Hospital Sultanah Bahiyah, Alor Setar	0	0	1	0	0	0	**1**
Department of Ophthalmology, Hospital Sungai Buloh	0	0	0	9	0	5	**14**
Department of Ophthalmology, Hospital Umum Sarawak	0	0	0	0	1	0	**1**
Department of Ophthalmology, Sri Kota Medical Centre, Klang	0	1	0	0	0	0	**1**
Department of Ophthalmology, HUSM	0	0	1	2	2	0	**5**
Pusat Pakar Mata Centre For Sight	0	0	0	0	1	0	**1**
Total	**2**	**3**	**26**	**31**	**19**	**15**	**96**
Others							
Maxillofacial Surgery, HUSM	1	1	0	0	0	0	**2**
Timberland Medical Centre, Kuching	0	1	0	0	0	0	**1**
Sri Kota Medical Centre, Klang	0	0	1	0	0	0	**1**
Total	**1**	**2**	**1**	**0**	**0**	**0**	**4**
Grand Total	**17**	**22**	**35**	**36**	**23**	**16**	**149**

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 Number of Transplant by Gender, 2004-2009

Gender	2004		2005		2006		2007		2008		2009		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Male	9	53	10	45	27	77	21	58	10	43	12	75	**89**	**60**
Female	8	47	12	55	8	23	15	42	13	57	4	25	**60**	**40**
Total	**17**	**100**	**22**	**100**	**35**	**100**	**36**	**100**	**23**	**100**	**16**	**100**	**149**	**100**

Table 7.3.2: Distribution of Number of Transplant by Ethnic Group, 2004-2009

Race	2004		2005		2006		2007		2008		2009		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Malay	11	65	14	64	26	74	18	50	13	57	8	50	**90**	**60**
Chinese	3	18	5	23	7	20	12	33	6	26	0	0	**33**	**22**
Indian	1	6	1	5	1	3	4	11	1	4	3	19	**11**	**7**
Bumiputra Sabah	0	0	0	0	0	0	0	0	1	4	0	0	**1**	**1**
Bumiputra Sarawak	1	6	0	0	0	0	1	3	0	0	0	0	**2**	**1**
Others	1	6	2	9	1	3	1	3	2	9	5	31	**12**	**8**
Total	**17**	**100**	**22**	**100**	**35**	**100**	**36**	**100**	**23**	**100**	**16**	**100**	**149**	**100**

Table 7.3.3: Distribution of Number of Transplant by Age Group, 2004-2009

Age group	2004		2005		2006		2007		2008		2009		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0-9	0	0	1	5	4	11	5	14	4	17	4	25	**18**	**12**
10-11	1	6	6	27	2	6	1	3	5	22	1	6	**16**	**11**
20-39	9	53	6	27	16	46	8	22	6	26	6	38	**51**	**34**
40-59	5	29	3	14	8	23	11	31	5	22	4	25	**36**	**24**
≥60	2	12	5	23	5	14	10	28	3	13	1	6	**26**	**17**
Missing	0	0	1	5	0	0	1	3	0	0	0	0	**2**	**1**
Total	**17**	**100**	**22**	**100**	**35**	**100**	**36**	**100**	**23**	**100**	**16**	**100**	**149**	**100**
Mean	37		36		37		42		30		28		**36**	
SD	16		23		20		23		22		18		**21**	
Median	35		27		36		49		27		31		**33**	
Min	15		7		0		0		1		0		**0**	
Max	75		80		77		80		69		61		**80**	

Table 7.3.4: Distribution of Number of Transplant by Diagnosis Warranting Tissue Graft, 2004-2009

Diagnosis	**2004**		**2005**		**2006**		**2007**		**2008**		**2009**		**Total**	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Congenital deformity	1	6	0	0	1	3	1	3	1	4	0	0	**4**	**3**
Infection	0	0	0	0	3	8	3	8	4	17	0	0	**10**	**6**
Trauma	5	28	1	5	6	16	1	3	2	9	2	13	**17**	**11**
Degenerative disease	1	6	2	9	0	0	1	3	1	4	0	0	**5**	**3**
Tumour - benign	5	28	4	18	1	3	1	3	0	0	0	0	**11**	**7**
Tumour - malignant	0	0	6	27	1	3	0	0	0	0	1	6	**8**	**5**
Burn	0	0	1	5	2	5	0	0	0	0	0	0	**3**	**2**
Scald	0	0	0	0	1	3	0	0	0	0	0	0	**1**	**1**
Sports injury	0	0	1	5	0	0	1	3	0	0	0	0	**2**	**1**
Failed primary surgery	1	6	2	9	1	3	2	5	0	0	0	0	**6**	**4**
Ophtalmological disease	0	0	0	0	16	42	7	19	4	17	8	50	**35**	**23**
Others	5	28	3	14	6	16	20	54	11	48	5	31	**50**	**32**
Missing	0	0	2	9	0	0	0	0	0	0	0	0	**2**	**1**
Total	**18**	**100**	**22**	**100**	**38**	**100**	**37**	**100**	**23**	**100**	**16**	**100**	**154**	**100**

*1 case in 2004 and 2007 had 2 diagnoses; 3 cases in 2006 had 2 diagnoses.

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 Number of Transplantation according to Tissue Provider, 2004-2009

Name of Tissue Bank	2004		2005		2006		2007		2008		2009		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
USM Tissue Bank	13	76	18	82	31	89	34	94	23	100	13	81	**132**	**89**
Bone Bank, UMMC	1	6	0	0	0	0	0	0	0	0	0	0	**1**	**1**
Bone Bank, Hospital Kuala Lumpur	3	18	0	0	0	0	0	0	0	0	0	0	**3**	**2**
Eucara Pharmaceutical (P) Ltd., India	0	0	0	0	2	6	0	0	0	0	0	0	**2**	**1**
Osteo Tech Inc., USA	0	0	1	5	0	0	0	0	0	0	0	0	**1**	**1**
Amniocord	0	0	0	0	0	0	0	0	0	0	1	6	**1**	**1**
Missing	0	0	3	14	2	6	2	6	0	0	2	13	**9**	**6**
Total	**17**	**100**	**22**	**100**	**35**	**100**	**36**	**100**	**23**	**100**	**16**	**100**	**149**	**100**

Table 7.4.2: Distribution of Number of Transplantation by Origin of Tissue Graft, 2004-2009

Origin of Tissue Graft	2004		2005		2006		2007		2008		2009		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Local	17	100	15	68	31	89	34	94	22	96	15	94	**134**	**90**
Imported	0	0	3	14	2	6	0	0	0	0	0	0	**5**	**3**
Missing	0	0	4	18	2	6	2	6	1	4	1	6	**10**	**7**
Total	**17**	**100**	**22**	**100**	**35**	**100**	**36**	**100**	**23**	**100**	**16**	**100**	**149**	**100**

Table 7.4.3: Distribution of Number of Transplantation by Tissue Graft Types, 2004-2009

Tissue graft types	2004		2005		2006		2007		2008		2009		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Deep frozen tissues	9	53	15	68	5	14	5	14	3	13	1	6	**38**	**26**
Freeze dried (Lyophilised)	6	35	2	9	3	9	0	0	1	4	0	0	**12**	**8**
Others	2	12	3	14	26	74	31	86	19	83	15	94	**96**	**64**
Missing	0	0	2	9	1	3	0	0	0	0	0	0	**3**	**2**
Total	**17**	**100**	**22**	**100**	**35**	**100**	**36**	**100**	**23**	**100**	**16**	**100**	**149**	**100**

Table 7.4.3(a): Distribution of Tissue Graft Types (breakdowns), 2004-2009

Tissue graft types (breakdowns)	2004		2005		2006		2007		2008		2009		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Femur	3	11	3	6	0	0	0	0	2	8	0	0	**8**	**4**
Femoral head	2	7	12	26	5	11	7	18	2	8	3	17	**31**	**15**
Humerus	0	0	1	2	0	0	0	0	0	0	0	0	**1**	**0**
Tibia	1	4	1	2	1	2	0	0	0	0	0	0	**3**	**1**
Radius	2	7	5	11	0	0	0	0	0	0	0	0	**7**	**3**
Patella	1	4	1	2	2	4	0	0	0	0	0	0	**4**	**2**
Other tendon fascia cartilage	0	0	1	2	0	0	1	3	0	0	0	0	**2**	**1**
Skin	0	0	0	0	0	0	0	0	1	4	0	0	**1**	**0**
Air-dried Amnion	1	4	1	2	0	0	0	0	1	4	0	0	**3**	**1**
Glycerolized Amnion	0	0	2	4	26	57	31	79	18	75	15	83	**92**	**46**
Glycerol Cryopreserved Amnion	1	4	0	0	0	0	0	0	0	0	0	0	**1**	**0**
Cancellous	15	56	19	40	2	4	0	0	0	0	0	0	**36**	**18**
Cortical	0	0	0	0	6	13	0	0	0	0	0	0	**6**	**3**
Cortical cancellous	1	4	1	2	0	0	0	0	0	0	0	0	**2**	**1**
Bone granule	0	0	0	0	1	2	0	0	0	0	0	0	**1**	**0**
Bone powder	0	0	0	0	3	7	0	0	0	0	0	0	**3**	**1**
Total	**27**	**100**	**47**	**100**	**46**	**100**	**39**	**100**	**24**	**100**	**18**	**100**	**201**	**100**

Table 7.4.4: Distribution of Graft Sterilization Types, 2004-2009

Graft sterilization types	2004		2005		2006		2007		2008		2009		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Irradiation	16	94	15	68	30	86	27	75	19	83	10	63	**117**	**79**
Peracetic Acid-Ethanol	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**
Ethylene Oxide	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**
Others	0	0	0	0	1	3	0	0	0	0	0	0	**1**	**1**
Missing	1	6	7	32	4	11	9	25	4	17	6	38	**31**	**21**
Total	**17**	**100**	**22**	**100**	**35**	**100**	**36**	**100**	**23**	**100**	**16**	**100**	**149**	**100**

Table 7.4.5: Distribution of Mode of Transport Storage to Recipient Hospital during Transportation, 2004-2009

Mode of transport storage to recipient hospital	2004		2005		2006		2007		2008		2009		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
By flight and/or land vehicle	1	6	2	9	2	6	3	8	1	4	1	6	**10**	**7**
By courier service	2	12	3	14	22	63	23	64	17	74	10	63	**77**	**52**
By hand directly from bank	4	24	7	32	1	3	0	0	0	0	0	0	**12**	**8**
Dry ice box	5	29	3	14	0	0	0	0	0	0	0	0	**8**	**5**
Sterile package	0	0	0	0	2	6	0	0	0	0	0	0	**2**	**1**
Missing	5	29	7	32	8	23	10	28	5	22	5	31	**40**	**27**
Total	**17**	**100**	**22**	**100**	**35**	**100**	**36**	**100**	**23**	**100**	**16**	**100**	**149**	**100**

Table 7.4.6: Distribution of Temperature of Storage during Transportation, 2004-2009

Temperature of storage during transportation (ºC)	**2004**		**2005**		**2006**		**2007**		**2008**		**2009**		**Total**	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
-80 to -50	2	12	0	0	0	0	0	0	1	4	0	0	**3**	**2**
-49 to 0	6	35	10	45	2	6	2	6	1	4	0	0	**21**	**14**
Room temperature	3	18	4	18	27	77	22	61	17	74	11	69	**84**	**56**
Others	0	0	1	5	0	0	0	0	0	0	0	0	**1**	**1**
Missing	6	35	7	32	6	17	12	33	4	17	5	31	**40**	**27**
Total	**17**	**100**	**22**	**100**	**35**	**100**	**36**	**100**	**23**	**100**	**16**	**100**	**149**	**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), presence of pre operative infection at implant site (Table 7.5.3), presence of infection of pre implanted grafts (Table 7.5.4) and the usage of antibiotics (Tables 7.5.5 and 7.5.6).

Table 7.5.1: Distribution of Mode of Storage in Recipient Hospital, 2004-2009

Mode of storage in recipient hospital	2004		2005		2006		2007		2008		2009		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Refrigerator	0	0	1	5	25	71	28	78	18	78	13	81	**85**	**57**
Deep Freezer -20 ºC	0	0	3	14	2	6	3	8	0	0	0	0	**8**	**5**
Deep Freezer -40 ºC	1	6	2	9	0	0	0	0	1	4	1	6	**5**	**3**
Deep Freezer -80 ºC	3	18	5	23	1	3	1	3	1	4	0	0	**11**	**7**
Liquid Nitrogen	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**
Glycerol	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**
Room Temperature	0	0	0	0	2	6	0	0	2	9	0	0	**4**	**3**
Others	12	71	6	27	1	3	0	0	0	0	0	0	**19**	**13**
Not Available	1	6	0	0	0	0	0	0	0	0	0	0	**1**	**1**
Missing	0	0	5	23	4	11	4	11	1	4	2	13	**16**	**11**
Total	**17**	**100**	**22**	**100**	**35**	**100**	**36**	**100**	**23**	**100**	**16**	**100**	**149**	**100**

Table 7.5.2: Distribution of Additional Tissue Usage (Composite Graft), 2004-2009

Additional Tissue Used	2004		2005		2006		2007		2008		2009		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Yes	**9**	**53**	**7**	**32**	**1**	**3**	**2**	**6**	**2**	**9**	**0**	**0**	**21**	**14**
• Autografts	7	41	3	14	0	0	0	0	2	9	0	0	**12**	**8**
• Allografts	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**
• Xenografts	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**
• Aloprosthesis	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**
• Others	1	6	1	5	0	0	0	0	0	0	0	0	**2**	**1**
• Missing	1	6	3	14	1	3	2	6	0	0	0	0	**7**	**5**
No	**6**	**35**	**12**	**55**	**32**	**91**	**33**	**92**	**20**	**87**	**16**	**100**	**119**	**80**
Not Available	**2**	**12**	**1**	**5**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**2**
Missing	**0**	**0**	**2**	**9**	**2**	**6**	**1**	**3**	**1**	**4**	**0**	**0**	**6**	**4**
Total	**17**	**100**	**22**	**100**	**35**	**100**	**36**	**100**	**23**	**100**	**16**	**100**	**149**	**100**

Table 7.5.3: Distribution of Presence of Pre Operative Infection at Implant Site, 2004-2009

Presence of pre operative infection at implant site	2004		2005		2006		2007		2008		2009		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Yes	0	0	0	0	4	11	9	25	3	13	0	0	**16**	**11**
No	15	88	21	95	31	89	27	75	20	87	16	100	**130**	**87**
Not Available	2	12	0	0	0	0	0	0	0	0	0	0	**2**	**1**
Missing	0	0	1	5	0	0	0	0	0	0	0	0	**1**	**1**
Total	**17**	**100**	**22**	**100**	**35**	**100**	**36**	**100**	**23**	**100**	**16**	**100**	**149**	**100**

Table 7.5.4: Distribution of Pre Implant Graft Cultural Swab, 2004-2009

Pre implant graft cultural swab	2004		2005		2006		2007		2008		2009		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Yes	**0**	**0**	**1**	**5**	**0**	**0**	**1**	**3**	**0**	**0**	**0**	**0**	**2**	**1**
• Cytomegalovirus	0	0	1	5	0	0	0	0	0	0	0	0	**1**	**1**
• Proteus	0	0	0	0	0	0	1	3	0	0	0	0	**1**	**1**
No	**15**	**88**	**16**	**73**	**17**	**49**	**22**	**61**	**19**	**83**	**9**	**56**	**98**	**66**
Not available	**2**	**12**	**0**	**0**	**6**	**17**	**5**	**14**	**1**	**4**	**3**	**19**	**17**	**11**
Missing	**0**	**0**	**5**	**23**	**12**	**34**	**8**	**22**	**3**	**13**	**4**	**25**	**32**	**21**
Total	**17**	**100**	**22**	**100**	**35**	**100**	**36**	**100**	**23**	**100**	**16**	**100**	**149**	**100**

Table 7.5.5: Distribution of Grafts Soaked in Antibiotics Prior to Transplantation, 2004-2009

Grafts soaked in antibiotics prior to transplantation	2004		2005		2006		2007		2008		2009		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Yes	7	41	16	73	6	17	6	17	1	4	1	6	37	25
• Ceftriazone	4	24	9	41	3	9	0	0	0	0	0	0	16	11
• Gentamicin	3	18	4	18	3	9	4	11	1	4	1	6	16	11
• Povidone iodine, Ceftriazone	0	0	1	5	0	0	0	0	0	0	0	0	1	1
• Ceftriazone and Gentamicin	0	0	0	0	0	0	1	3	0	0	0	0	1	1
• Vancomycin, Postome iodine	0	0	1	5	0	0	0	0	0	0	0	0	1	1
• Missing	0	0	1	5	0	0	1	3	0	0	0	0	2	1
No	**8**	**47**	**5**	**23**	**28**	**80**	**28**	**78**	**22**	**96**	**15**	**94**	**106**	**71**
Not available	**2**	**12**	**0**	**0**	**1**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**2**
Missing	**0**	**0**	**1**	**5**	**0**	**0**	**2**	**6**	**0**	**0**	**0**	**0**	**3**	**2**
Total	**17**	**100**	**22**	**100**	**35**	**100**	**36**	**100**	**23**	**100**	**16**	**100**	**149**	**100**

Table 7.5.6: Distribution of Number of Transplant by Systemic Antibiotics Given Prior to Transplantation, 2004-2009

Systemic antibiotics given prioir to transplantation	**2004**		**2005**		**2006**		**2007**		**2008**		**2009**		**Total**	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Yes	**12**	**71**	**17**	**77**	**9**	**26**	**10**	**28**	**4**	**17**	**2**	**13**	**54**	**36**
• Cefeperazone	2	12	2	9	0	0	0	0	1	4	0	0	**5**	**3**
• Ceftriazone/ Imipenam	2	12	2	9	3	9	3	8	0	0	0	0	**10**	**7**
• Cefuroxine	7	41	7	32	4	11	2	6	1	4	0	0	**21**	**14**
• Ciproflaxacin	0	0	2	9	0	0	2	6	1	4	1	6	**6**	**4**
• Chloramphenicol	0	0	0	0	1	3	0	0	0	0	0	0	**1**	**1**
• Gentamicin	0	0	0	0	0	0	0	0	1	4	0	0	**1**	**1**
• Metronidazole	1	6	1	5	0	0	0	0	0	0	0	0	**2**	**1**
• Ceftazidime	0	0	0	0	1	3	0	0	0	0	0	0	**1**	**1**
• T. Augmentin	0	0	0	0	0	0	1	3	0	0	0	0	**1**	**1**
• T.Flurariazole	0	0	0	0	0	0	2	6	0	0	0	0	**2**	**1**
• Ampicillin / Sulbactam	0	0	2	9	0	0	0	0	0	0	0	0	**2**	**1**
• Vancomycin	0	0	0	0	0	0	0	0	0	0	1	6	**1**	**1**
• Missing	0	0	1	5	0	0	0	0	0	0	0	0	**1**	**1**
No	**4**	**24**	**3**	**14**	**26**	**74**	**26**	**72**	**18**	**78**	**14**	**88**	**91**	**61**
Not Available	**1**	**6**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**
Missing	**0**	**0**	**2**	**9**	**0**	**0**	**0**	**0**	**1**	**4**	**0**	**0**	**3**	**2**
Total	**17**	**100**	**22**	**100**	**35**	**100**	**36**	**100**	**23**	**100**	**16**	**100**	**149**	**100**

CHAPTER 8

CADAVERIC ORGAN AND TISSUE DONATION

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CADAVERIC ORGAN AND TISSUE DONATION

There was an increase in the number of potential cadaveric donors referred to the National Transplant Procurement Unit (NTPMU) nationwide from 112 the previous year to 143 in 2009. The number of actual donors was 39 for the year, which translated to a conversion rate of 27% and a donation rate of 1.38 per million population (Table 8.1), the highest recorded in Malaysia so far in a calendar year. Of these 18 (46%) were brain dead donors who donated organs and tissues which were procured in the operating theatre, while another 21 were tissue donations after cardiac death (Table 8.3, Table 8.11). In total 126 organs and tissues were procured, comprising 50 corneas, 1 heart, 36 kidneys, 7 livers, 20 pairs of heart valves, 9 sets of long bones and 3 skin donations.

The number of donations throughout the year did not conform to any particular trend (Table 8.3). There were 6 paediatric donors (age 0 – 9 years) and 7 teenage donors which together constitute 33% of the total number of donors (Table 8.4). Another 18% (7/39) were in their twenties which means that 51% of donors were under the age of thirty. The mean age was 28.8 years, age range 25 days – 68 years. Male donors outnumber female three to one (Table 8.5).

Two thirds of donors were Chinese, 26% Indian and 8% Malay by ethnicity (Table 8.6), 59% were Buddhist by religion (Table 8.7). 100% of donors were Malaysian (Table 8.8). Majority of the donors came from the Selangor (36%) followed by Johor (15%), Federal Territory of Kuala Lumpur (13%) and Penang (13%) (Table 8.9). Only three out of the 39 actual donors (8%) had pledged to donate before and carried the donor card (Table 8.10).

Injury from motor vehicle accident was the most common cause of death, accounting for 44% of the brain death and 43% of the cardiac death. Another 33% of brain dead donors and 29% of post-cardiac death tissue donors died from medical conditions (Table 8.12). In 2009, the most common blood group among the 18 organ donors was group O rhesus positive (50%), followed by A positive (33%), B positive (11%) and AB (5%) (Table 8.13). When considered in totality since 1997, blood group O positive remained the most common group (42%) followed by B positive and A positive.

Most of the donations (77%) took place in Ministry of Health hospitals with 4 (10%) from University hospitals and 3 (8%) from private hospitals (Table 8.14a). Forty-six percent of the donors were found in the ICU, but there were also 9 direct referrals for tissue donation from the mortuary with 7 from the ward and 4 from emergency department (“brought in dead” BID) (Table 8.14b).

Organ donors were sent to the operating theatre for procurement of organs (18/18) while tissues were mainly procured in the mortuary (17/21) (Table 8.14c). For the organ donors all were on inotropic support before procurement with the commonest drug being dopamine (7/18) (Table 8.15).

Table 8.1: Number of Donations by Year, 1997-2009

Number of procurement by year N=252													
Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Number of donors	5	7	4	13	24	30	25	16	13	25	25	26	39
Rate of procurement (per million population)	0.23	0.32	0.18	0.55	1	1.22	1	0.63	0.5	0.94	0.92	0.94	1.38

Figure 8.1: Number of Donations by Year, 1997-2009

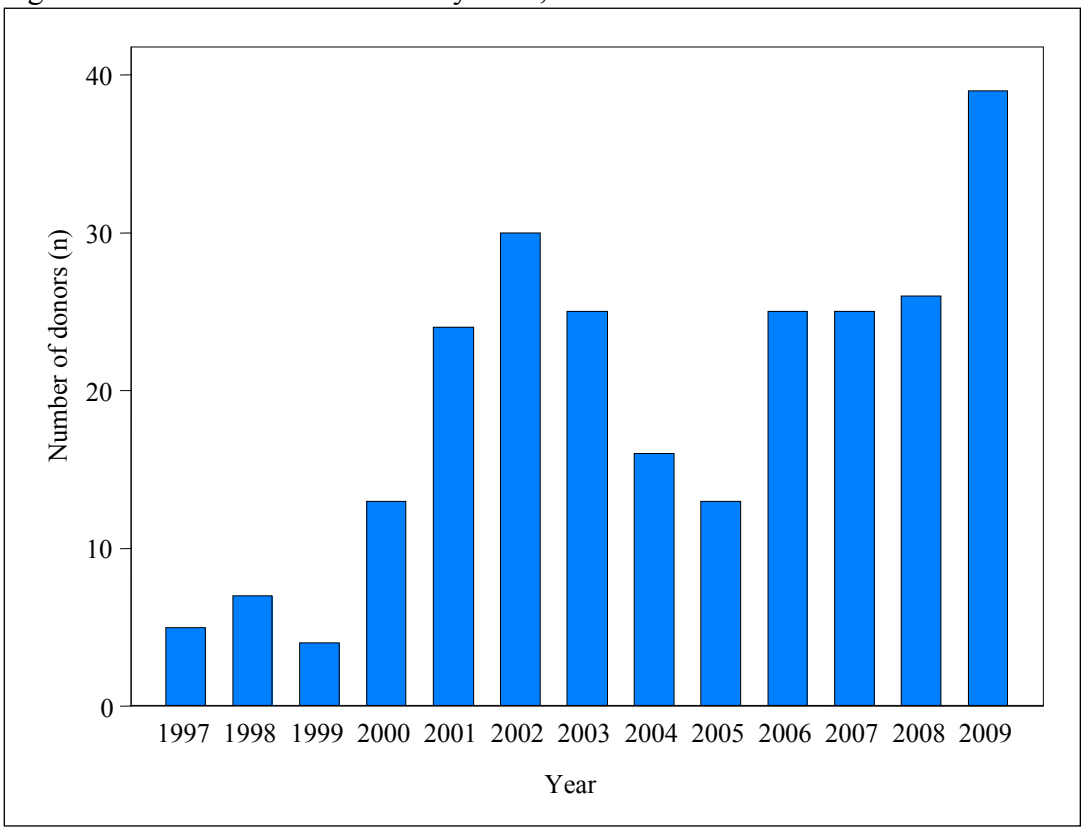


Table 8.2: Number of Organs procured by Year, 1997-2009

Number of procurement by year N=252													
Organs procured	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Cornea	4	10	6	18	32	48	40	20	22	38	32	40	50
Heart	1	3	2	3	4	0	2	0	1	1	3	0	1
Liver	0	0	2	2	1	2	1	3	3	6	5	5	7
Kidney	8	10	6	22	38	26	16	18	8	26	28	26	36
Heart valve	0	1	2	8	10	10	10	10	6	16	8	12	20
Bone	0	1	0	3	2	6	4	5	2	5	5	4	9
Skin	0	0	0	2	2	2	0	1	0	3	0	0	3
Lung	0	0	0	0	0	0	0	0	1	1	2	0	0

Table 8.3: Potential Donor Referrals and Actual Donations by Month, 2009

Month	Potential Donor Referrals	Actual donors	
		Brain Death Donors (BD)	Cardiac Death Tissue Donors (CD)
	No.	No.	No.
January	15	1	2
February	9	1	0
March	8	0	2
April	10	0	2
May	15	3	3
June	10	1	2
July	11	0	3
August	12	2	2
September	10	4	0
October	12	3	2
November	12	0	2
December	19	3	1
TOTAL	**143**	**18**	**21**

Figure 8.3: Potential Donor Referrals and Actual Donations by Month, 2009

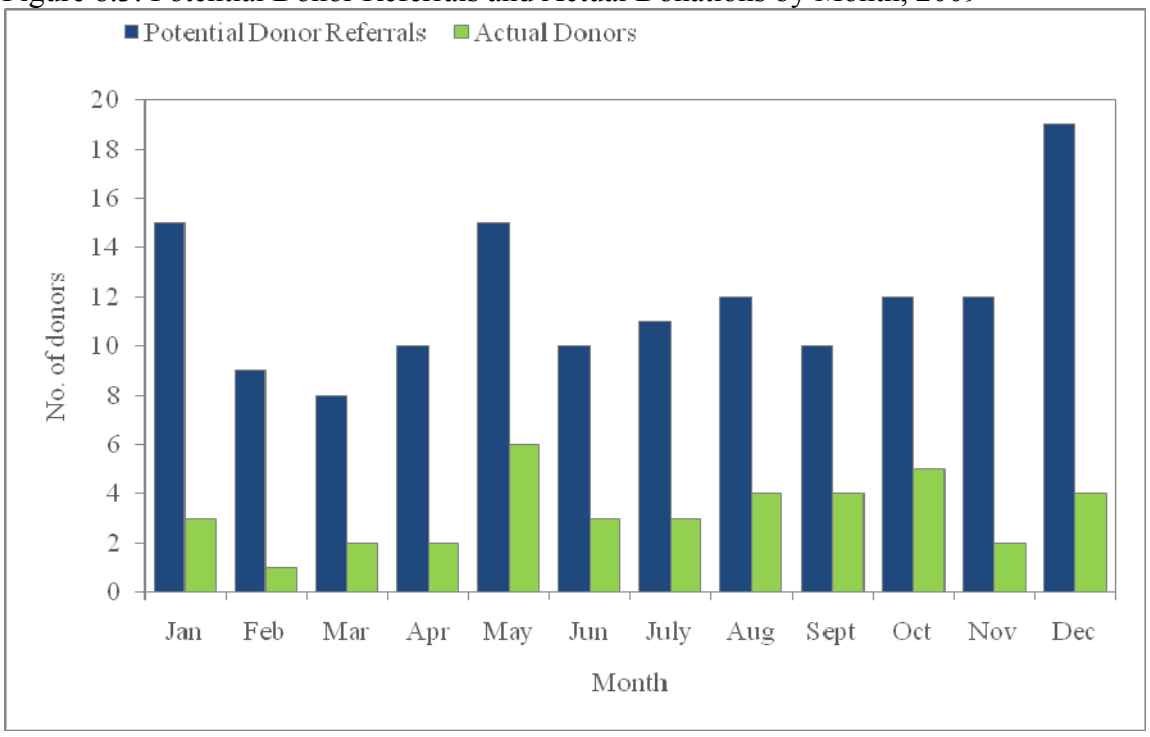
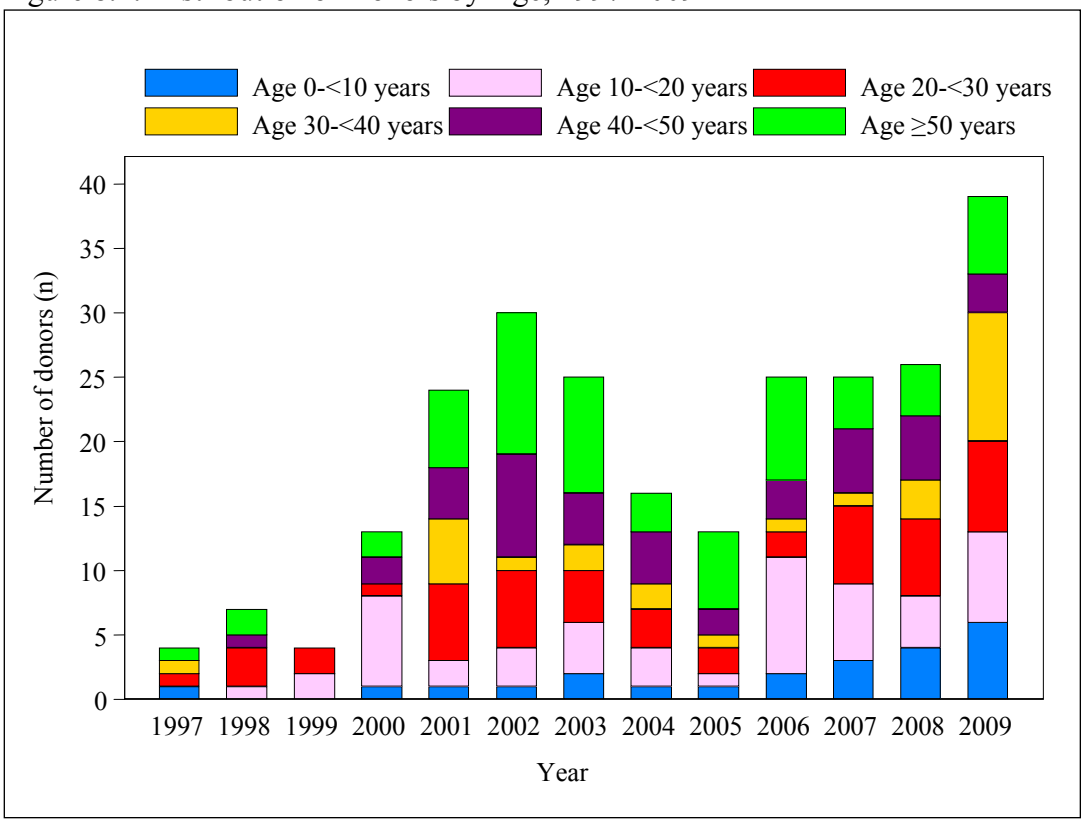


Table 8.4: Distribution of Donors by Age, 1997-2009

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		2008 N=26		2009 N=39		Total N=252	
	No.	%	No.	%	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	0	0	2	5	3	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	4	15	4	10	20	8
10-19	0	0	1	14	2	50	7	54	2	8	3	10	4	16	3	19	1	8	9	36	6	24	4	15	7	18	49	19
20-29	1	20	3	43	2	50	1	8	6	25	6	20	4	16	3	19	2	15	2	8	6	24	6	23	7	18	49	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	3	12	10	26	27	11
40-49	0	0	1	14	0	0	2	15	4	17	8	27	4	16	4	25	2	15	3	12	5	20	5	19	3	8	41	16
50-59	1	20	2	29	0	0	1	8	4	17	7	23	3	12	3	19	1	8	2	8	2	8	2	8	5	13	33	13
60-69	0	0	0	0	0	0	1	8	2	8	0	0	3	12	0	0	3	23	4	16	2	8	1	4	1	3	17	7
70-79	0	0	0	0	0	0	0	0	0	0	4	13	3	12	0	0	1	8	2	8	0	0	1	4	0	0	11	4
80-89	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	8	0	0	0	0	0	0	0	0	1	0
No data	1	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Total	5		7		4		13		24		30		25		16		13		25		25		26		39		252	
Mean	27.25		34.43		20.50		25.23		36.83		42.37		39.36		32.50		46.38		35.64		29.60		30.75		28.79		34.17	
SD	21.06		17.12		4.43		18.71		15.71		19.61		22.26		15.57		24.78		23.42		18.75		19.06		16.75		19.72	
Median	28.00		25.00		21.00		17.00		37.00		46.00		40.00		31.50		48.00		23.00		23.00		27.00		29		32	
Minimum	2		16		15		5		8		4		<1*		8		3		3		1**		2		<1*		<1*	
Maximum	51		57		25		60		66		79		77		55		81***		77		68		71		68		81***	

* The youngest tissue donor was 25-days-old donated heart valves in 2009 and 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 8.4: Distribution of Donors by Age, 1997-2009



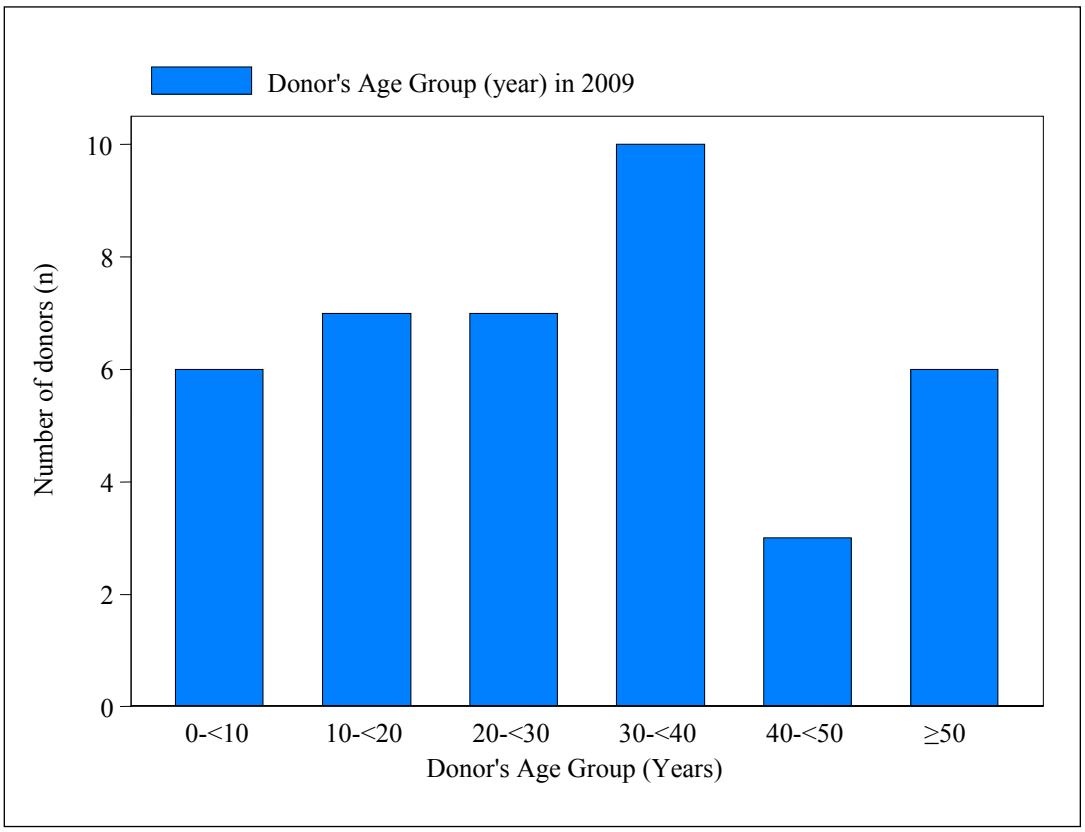


Table 8.5: Distribution of Donors by Gender, 1997-2009

Donor's gender	1997 N=5		1998 N=7		1999 N=4		2000 N=13		2001 N=24		2002 N=30		2003 N=25	
	No.	%	No.	%	No.	No.	%	No.	%	%	No.	%	No.	%
Male	3	60	7	100	3	75	11	85	20	83	27	90	21	84
Female	2	40	0	0	1	25	2	15	4	17	3	10	4	16

Donor's gender	2004 N=16		2005 N=13		2006 N=25		2007 N=25		2008 N=26		2009 N=39		Total N=252	
	No.	%	No.	No.	%	No.	No.	No.	No.	%	No.	%	No.	%
Male	12	75	8	62	19	76	20	80	18	69	26	67	195	77
Female	4	25	5	38	6	24	5	20	8	31	13	33	57	23

Figure 8.5: Distribution of Donors by Gender, 1997-2009

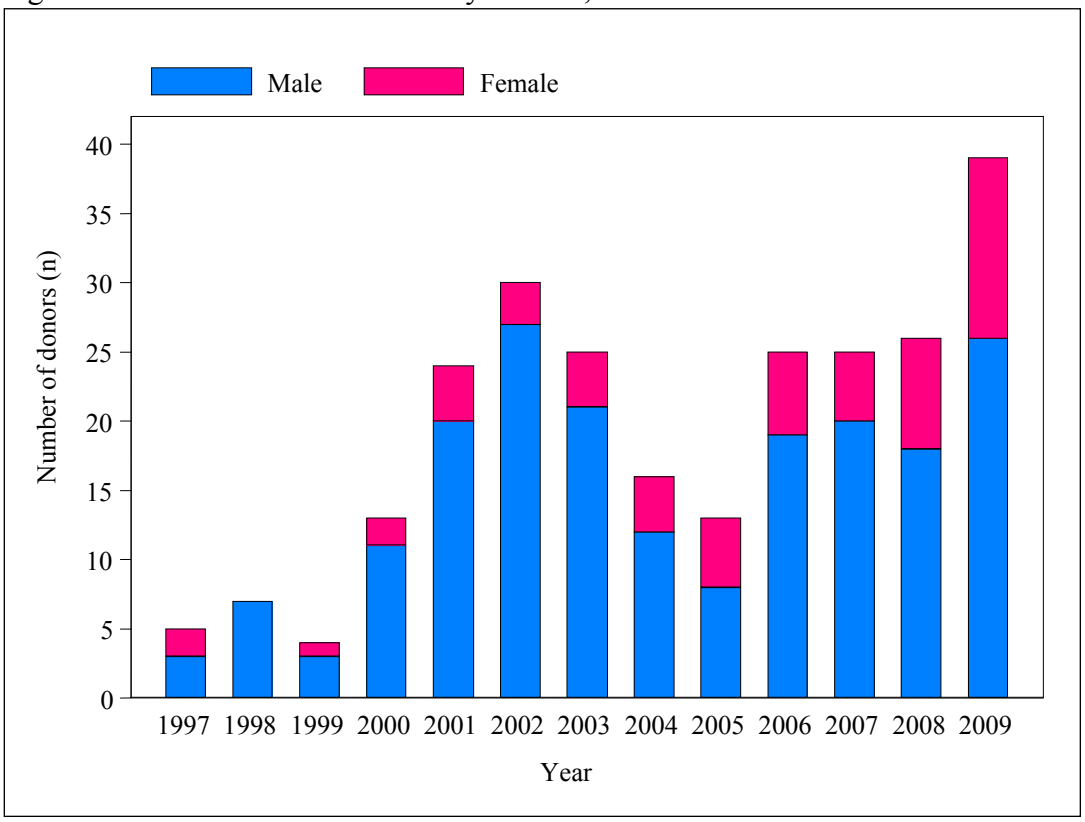


Table 8.6: Distribution of Donors by Ethnic Group, 1997-2009

Donor's ethnic group	1997 N=5		1998 N=7		1999 N=4		2000 N=13		2001 N=24		2002 N=30		2003 N=25	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Malay	1	20	0	0	0	0	2	15	1	4	0	0	0	0
Chinese	3	60	4	57	4	100	7	54	17	71	13	43	14	56
Indian	1	20	3	43	0	0	3	23	4	17	15	50	9	36
Others	0	0	0	0	0	0	1	8	2	8	2	7	2	8

Donor's ethnic group	2004 N=16		2005 N=13		2006 N=25		2007 N=25		2008 N=26		2009 N=39		Total N=252	
	No.	No.	%	No.	No.	No.	No.	%	No.	%	No.	%	No.	%
Malay	1	6	1	8	1	4	5	20	0	0	3	8	15	6
Chinese	14	88	5	38	12	48	14	56	17	65	26	66	150	60
Indian	1	6	7	54	11	44	3	12	6	23	10	26	73	29
Others	0	0	0	0	1	4	3	12	3	12	0	0	14	6

Figure 8.6: Distribution of Donors by Ethnic Group, 1997-2009

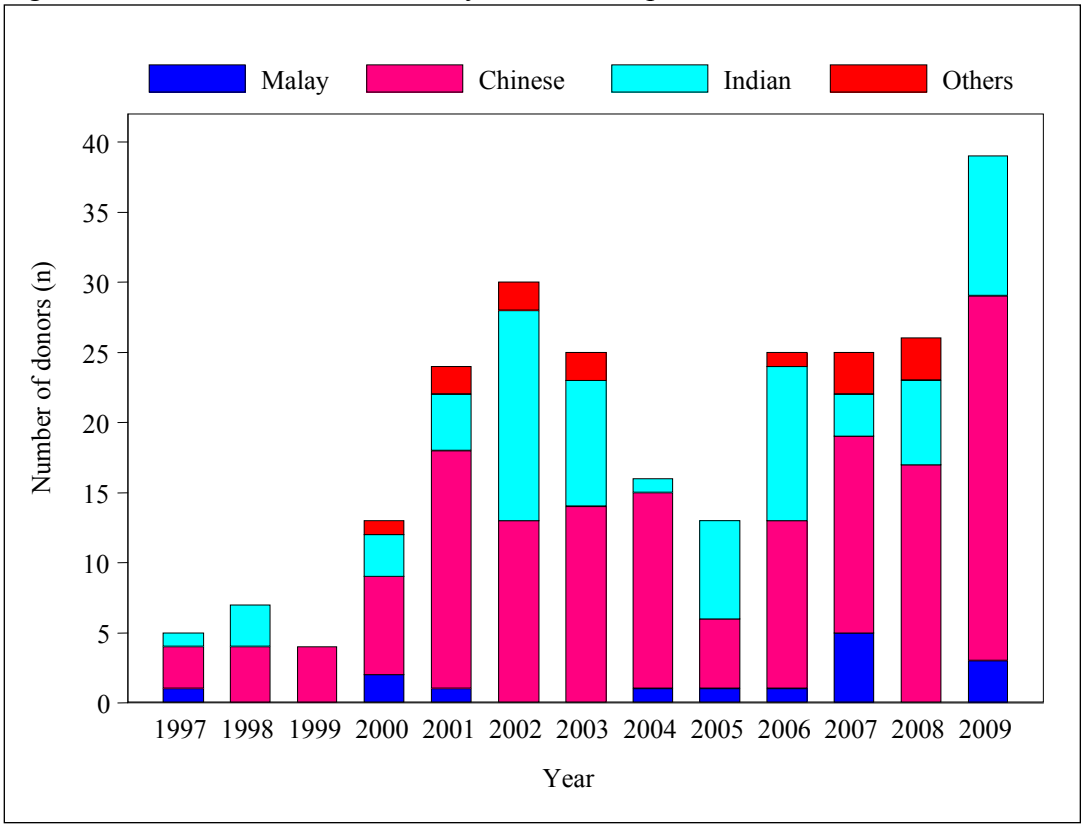


Table 8.7: Distribution of Donors by Religion, 1997-2009

Donor's religion	1997 N=5		1998 N=7		1999 N=4		2000 N=13		2001 N=24		2002 N=30		2003 N=25	
	No.	%	No.	%	No.	No.	%	No.	%	%	No.	%	No.	%
Islam	1	20	0	0	0	0	2	15	1	4	0	0	1	4
Buddhism	3	60	3	43	0	0	0	0	1	4	5	17	14	56
Hinduism	1	20	3	43	0	0	3	23	3	13	13	43	8	32
Christianity	0	0	0	0	0	0	1	8	0	0	1	3	0	0
Others	0	0	0	0	0	0	0	0	0	0	0	0	2	8
Unknown	0	0	1	14	4	100	7	54	19	79	11	37	0	0

Donor's religion	2004 N=16		2005 N=13		2006 N=25		2007 N=25		2008 N=26		2009 N=39		Total N=252	
	No.	%	No.	No.	%	No.	No.	%	No.	%	No.	%	No.	%
Islam	2	13	1	8	2	8	5	20	0	0	3	8	18	7
Buddhism	14	88	5	38	12	48	13	52	16	62	23	59	109	43
Hinduism	0	0	5	38	10	40	2	8	6	23	9	23	63	25
Christianity	0	0	0	0	0	0	4	16	3	12	4	10	13	5
Others	0	0	2	15	0	0	1	4	0	0	0	0	5	2
Unknown	0	0	0	0	1	4	0	0	1	4	0	0	44	17

Figure 8.7: Distribution of Donors by Religion, 1997-2009

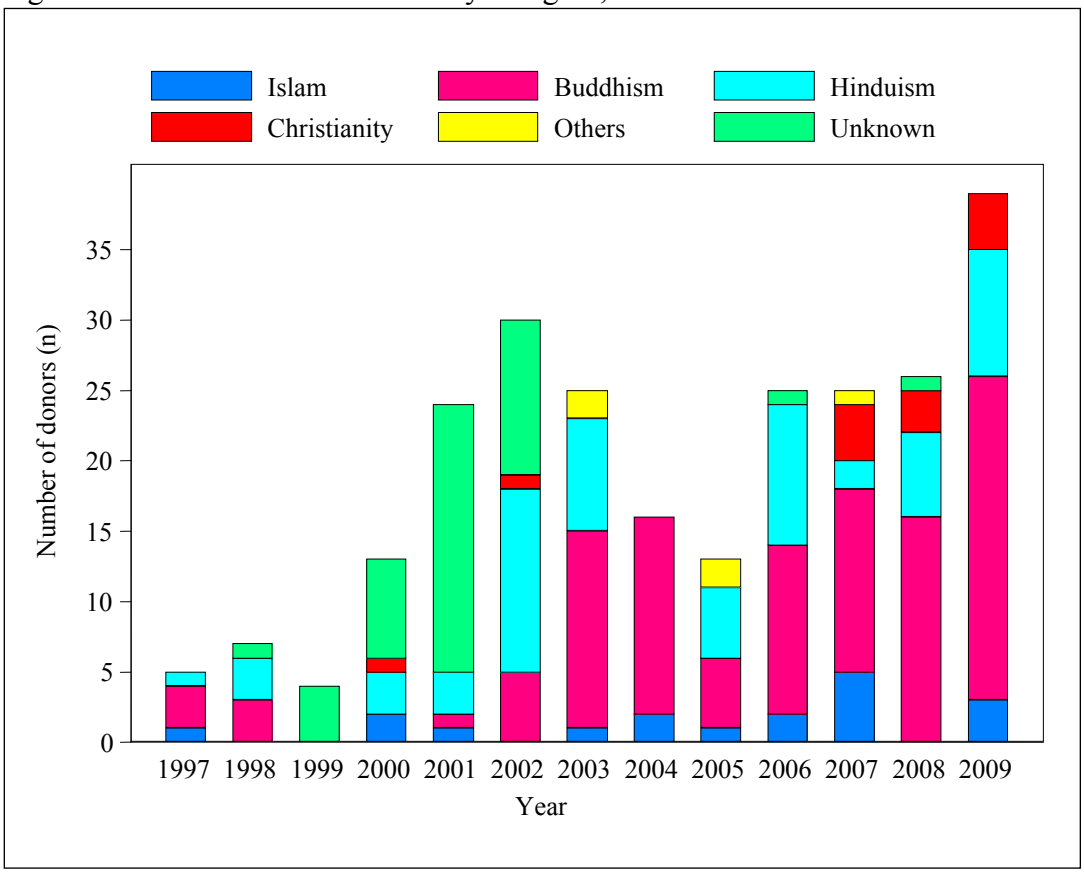


Table 8.8: Distribution of Donors by Nationality, 1997-2009

Donor's nationality	1997 N=5		1998 N=7		1999 N=4		2000 N=13		2001 N=24		2002 N=30		2003 N=25	
	No.	%	No.	%	No.	No.	%	No.	%	%	No.	%	No.	%
Malaysian	5	100	7	100	4	100	13	100	21	88	29	97	24	96
Non-Malaysian	0	0	0	0	0	0	0	0	3	13	1	3	1	4

Donor's nationality	2004 N=16		2005 N=13		2006 N=25		2007 N=25		2008 N=26		2009 N=39		Total N=252	
	No.	%	No.	No.	%	No.	No.	%	No.	%	No.	%	No.	%
Malaysian	16	100	13	100	24	96	24	96	24	92	39	100	243	96
Non-Malaysian	0	0	0	0	1	4	1	4	2	8	0	0	9	4

Figure 8.8: Distribution of Donors by Nationality, 1997-2009

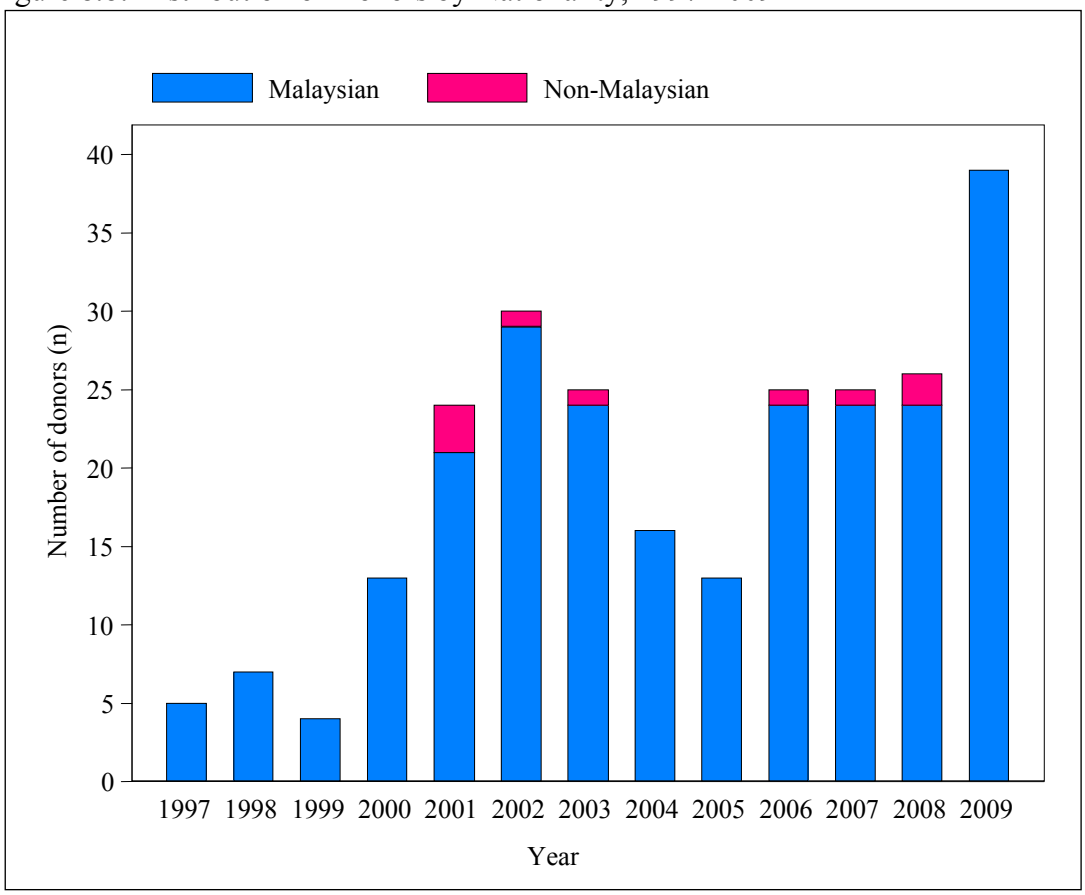


Table 8.9: Distribution of Donors by State, 1997-2009

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

Donor's state of residence*	2004 N=16		2005 N=13		2006 N=25		2007 N=25		2008 N=26		2009 N=39		Total N=252	
	No.	%	No.	No.	%	No.	No.	%	No.	%	No.	%	No.	%
Johor	1	6	1	8	1	4	5	20	3	12	6	15	25	10
Malacca	0	0	1	8	2	8	1	4	0	0	1	3	10	4
Negeri Sembilan	0	0	1	8	2	8	1	4	2	8	3	8	16	6
Selangor	6	38	7	54	2	8	6	24	3	12	14	36	59	23
WP Kuala Lumpur	3	19	2	15	6	24	3	12	8	31	5	13	38	15
WP Putrajaya	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Perak	2	13	1	8	4	16	2	8	3	12	4	10	27	11
Kedah	1	6	0	0	1	4	2	8	1	4	0	0	11	4
Perlis	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulau Pinang	2	13	0	0	4	16	2	8	2	8	5	13	23	9
Pahang	0	0	0	0	1	4	1	4	2	8	1	3	13	5
Terengganu	0	0	0	0	0	0	1	4	0	0	0	0	2	1
Kelantan	0	0	0	0	1	4	0	0	0	0	0	0	2	1
Sabah	1	6	0	0	0	0	0	0	2	8	0	0	7	3
Sarawak	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Others**	0	0	0	0	1	4	1	4	0	0	0	0	3	1
Unknown	0	0	0	0	0	0	0	0	0	0	0	0	15	6

Table 8.10: Donor's Pledged Status, 1997-2009

Donor's pledged status	1997 N=5		1998 N=7		1999 N=4		2000 N=13		2001 N=24		2002 N=30		2003 N=25	
	No.	%	No.	%	No.	No.	%	No.	%	%	No.	%	No.	%
Pledged donors	0	0	0	0	0	0	0	0	0	0	5	17	6	24
Non-pledged donors	5	100	7	100	4	100	13	100	24	100	25	83	19	76

Donor's pledged status	2004 N=16		2005 N=13		2006 N=25		2007 N=25		2008 N=26		2009 N=39		Total N=252	
	No.	%	No.	No.	%	No.	No.	%	No.	%	No.	%	No.	%
Pledged donors	2	13	3	23	1	4	6	24	2	8	3	8	28	11
Non-pledged donors	14	88	10	77	24	96	19	76	24	92	36	92	224	89

Figure 8.10: Donor's Pledged Status, 1997-2009

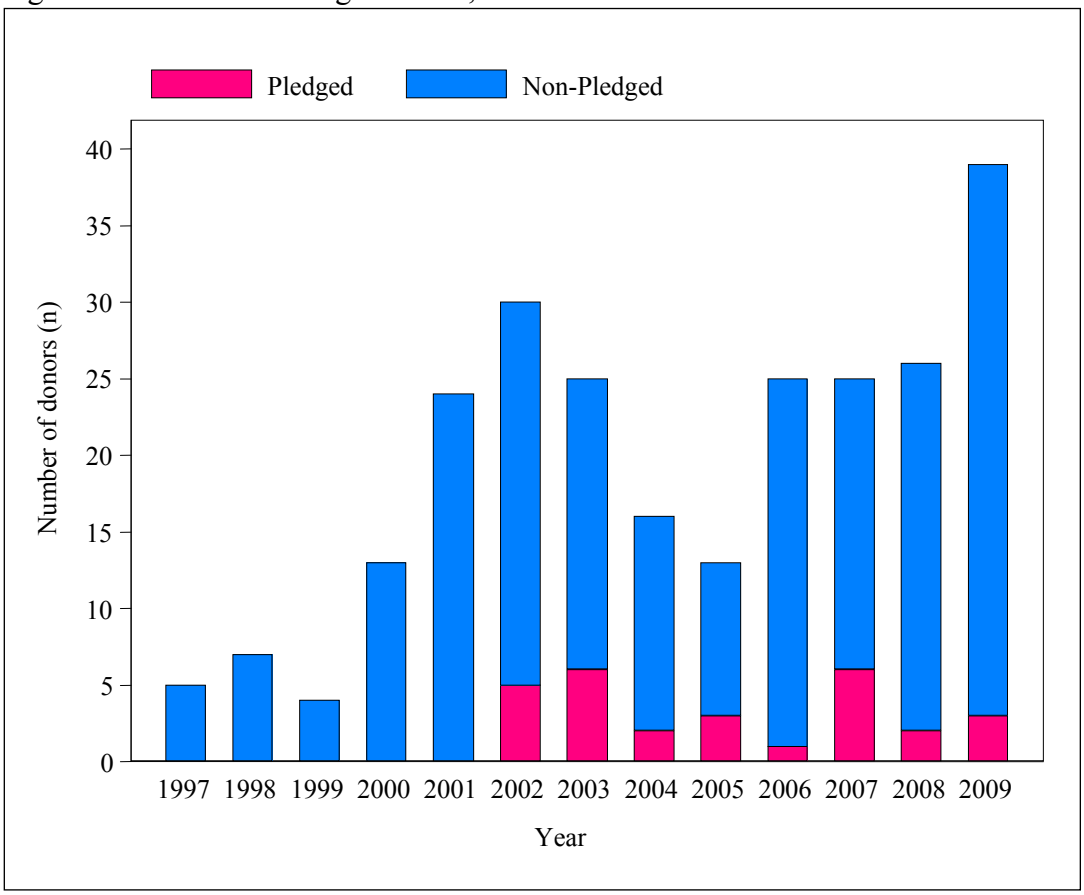


Table 8.11: Distribution of Donors by Type, 1997-2009

Type of donors	1997 N=5		1998 N=7		1999 N=4		2000 N=13		2001 N=24		2002 N=30		2003 N=25	
	No.	%	No.	%	No.	No.	%	No.	%	%	No.	%	No.	%
BD (Brain Death donor)	4	80	6	86	4	100	11	85	20	83	17	57	8	32
CD (tissue donors after Cardiac Death)*	1	20	1	14	0	0	2	15	4	17	13	43	17	68

Type of donors	2004 N=16		2005 N=13		2006 N=25		2007 N=25		2008 N=26		2009 N=39		Total N=252	
	No.	%	No.	No.	%	No.	No.	%	No.	%	No.	%	No.	%
BD (Brain Death donor)	10	63	5	38	14	56	15	60	14	54	18	46	146	58
CD (tissue donors after Cardiac Death)*	6	38	8	62	11	44	10	40	12	46	21	54	106	42

Figure 8.11: Distribution of Donors by Type, 1997-2009

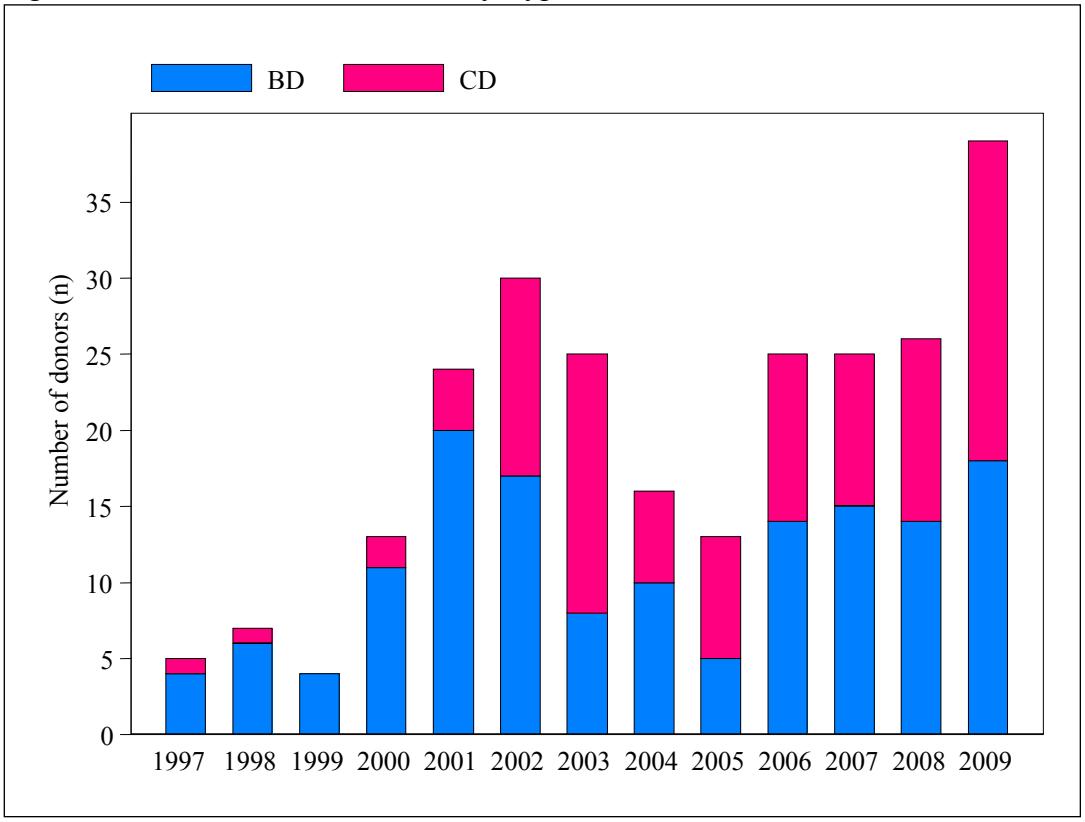


Table 8.12: Distribution of Donors by Cause of Death, 1997-2009

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	13	65	1	25	10	59	7	54
Injury from fall	0	0	0	0	0	0	0	0	0	0	0	0	1	9	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	2	12	0	0
Spontaneous AVM/ Anuerysm 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
Asphyxia	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 Tumor	1	25	0	0	0	0	0	0	0	0	0	0	1	9	0	0	0	0	0	0	0	0	0	0
Stroke	0	0	0	0	0	0	1	100	0	0	0	0	1	9	0	0	0	0	1	25	1	6	0	0
Died at home	0	0	1	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drowning	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medical Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	38
Unknown	0	0	0	0	0	0	0	0	1	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Others	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	1	25	0	0	1	8
Suicidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Causes of death	2003 N=25				2004 N=16				2005 N=13				2006 N=25				2007 N=25				2008 N=26				2009 N=39				Total N=252			
	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=14		Cardiac death tissue donors N=12		Brain dead donors N=18		Cardiac death tissue donors N=21		Brain dead donors N=146		Cardiac death tissue donors N=106	
	No.	%	No.	%	No.	%	No.	%	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	3	21	2	17	8	44	9	43	73	50	34	32
Injury from fall	1	13	0	0	2	20	0	0	0	0	0	0	1	7	1	9	1	7	2	20	1	7	1	8	1	6	1	5	9	6	5	5
Injury from assault	0	0	0	0	1	10	1	17	1	20	0	0	1	7	1	9	1	7	0	0	0	0	2	17	0	0	0	0	6	4	4	4
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	7	0	0	0	0	0	0	2	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	1	7	0	0	0	0	1	5	14	10	5	5
Spontaneous AVM/Anuerysm intracranial bleed	0	0	1	6	3	30	0	0	0	0	0	0	0	0	0	0	2	13	0	0	1	7	1	8	2	11	0	0	12	8	2	2
Asphyxia	0	0	1	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
Brain Tumor	0	0	0	0	0	0	0	0	0	0	0	0	2	14	0	0	0	0	0	0	2	14	0	0	1	6	1	5	7	5	1	1
Stroke	1	13	0	0	0	0	0	0	1	20	0	0	0	0	2	18	0	0	0	0	0	0	0	0	0	0	0	0	4	3	4	4
Died at home	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Drowning	0	0	1	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	0	0	2	2
Medical Conditions	0	0	7	41	1	10	0	0	1	20	3	38	2	14	5	45	0	0	4	40	4	29	6	50	6	33	6	29	14	10	36	34
Unknown	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	7	0	0	0	0	1	5	2	1	1	1
Others	0	0	3	18	0	0	0	0	0	0	3	38	0	0	0	0	1	7	0	0	0	0	0	0	0	0	1	5	2	1	9	8
Suicidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1

Table 8.13: Distribution of Organ Donors by Blood Group, 1997-2009

Blood group	No. (%)						
	1997 N=4	1998 N=6	1999 N=4	2000 N=11	2001 N=20	2002 N=15	2003 N=7
A positive	1 (25)	2 (33)	0 (0)	1 (9)	5 (25)	4 (27)	4 (57)
B positive	0 (0)	1 (17)	1 (25)	5 (45)	4 (20)	4 (27)	2 (29)
AB positive	1 (25)	1 (17)	0 (0)	0 (0)	1 (5)	0 (0)	0 (0)
O positive	2 (50)	2 (33)	3 (75)	5 (45)	10 (50)	7 (47)	1 (14)
A negative	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Unknown	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

Blood group	No. (%)						
	2004 N=10	2005 N=5	2006 N=14	2007 N=15	2008 N=13	2009 N=18	Total N=142
A positive	2 (20)	1 (20)	4 (29)	6 (40)	4 (31)	6 (33)	40 (28)
B positive	4 (40)	2 (40)	5 (36)	3 (20)	2 (15)	2 (11)	35 (25)
AB positive	0 (0)	0 (0)	2 (14)	0 (0)	0 (0)	1 (6)	6 (4)
O positive	4 (40)	2 (40)	3 (21)	5 (33)	6 (46)	9 (50)	59 (42)
A negative	0 (0)	0 (0)	0 (0)	1 (7)	1 (8)	0 (0)	2 (1)
Unknown	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

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

Figure 8.13a: Distribution of Organ Donors by Blood Group, 1997-2009

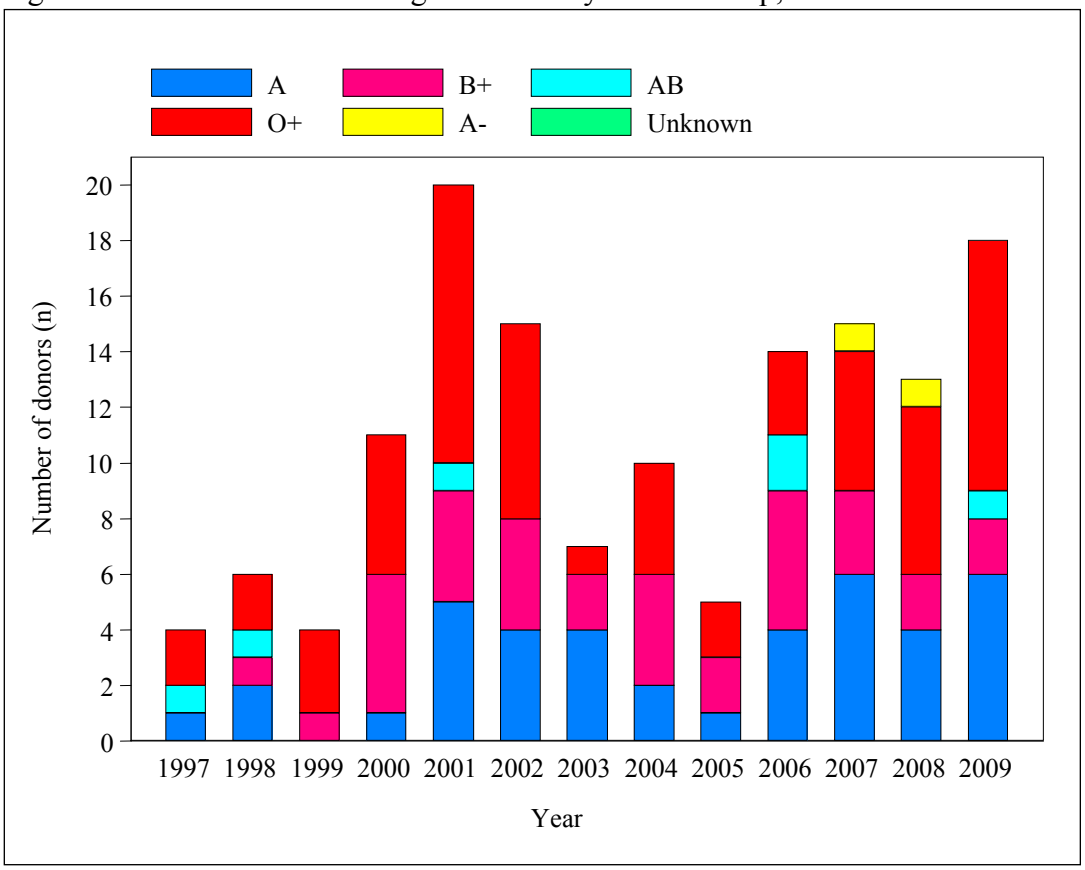


Figure 8.13b: Distribution of Organ Donors by Blood Group Type (pie chart), 1997-2009

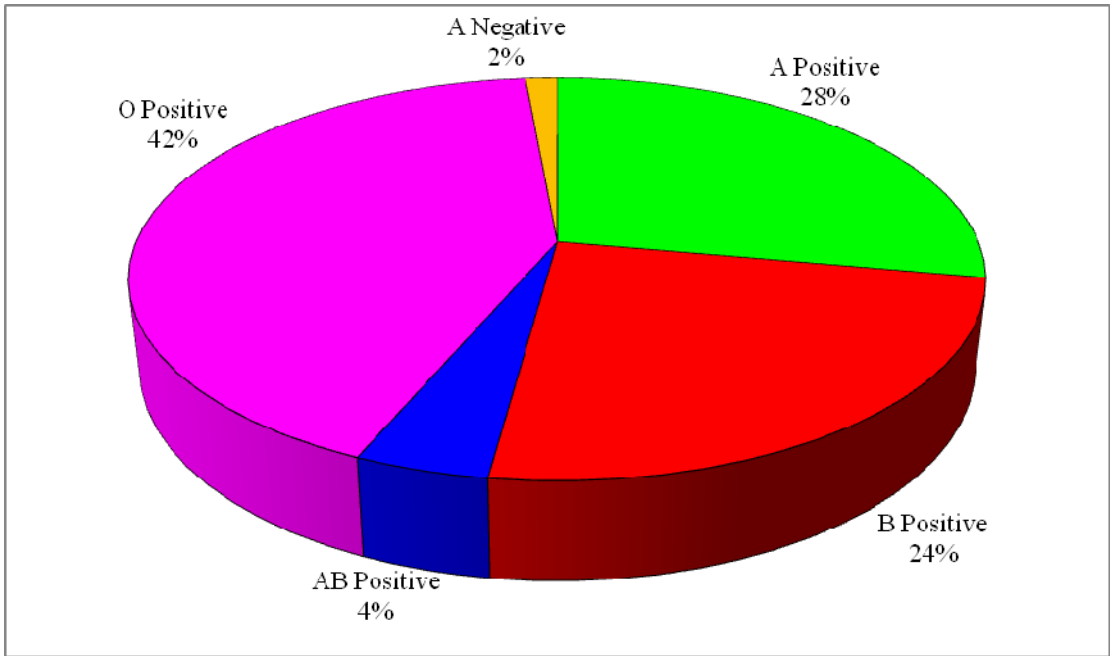


Figure 8.13c: Distribution of Organ Donors by Blood Group Type (pie chart), 2009

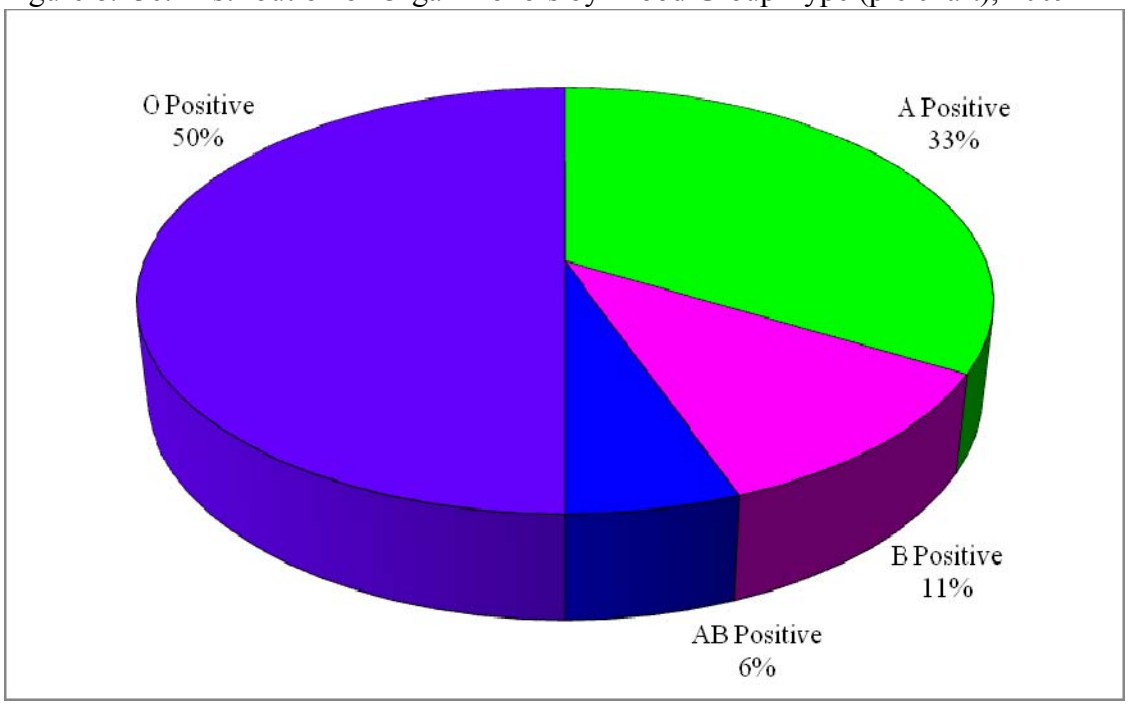


Table 8.14a: Distribution of Donors by Institution of Origin, 1997-2009

Donors' Institution of Origin	1997 N=5		1998 N=7		1999 N=4		2000 N=13		2001 N=24		2002 N=30		2003 N=25	
	No.	%	No.	%	No.	No.	%	No.	%	%	No.	%	No.	%
MOH state/general hospitals	2	40	5	71	1	25	10	77	16	67	19	63	15	60
MOH district hospitals	0	0	0	0	0	0	2	15	0	0	3	10	4	16
University hospitals	1	20	1	14	0	0	0	0	6	25	3	10	3	12
Private hospitals	1	20	1	14	3	75	1	8	2	8	4	13	3	12
Home	1	20	0	0	0	0	0	0	0	0	1	3	0	0

Donors' Institution of Origin	2004 N=16		2005 N=13		2006 N=25		2007 N=25		2008 N=26		2009 N=39		Total N=252	
	No.	%	No.	No.	%	No.	No.	%	No.	%	No.	%	No.	%
MOH state/general hospitals	12	75	8	62	20	80	18	72	15	58	30	77	171	68
MOH district hospitals	2	13	0	0	0	0	3	12	0	0	2	5	16	6
University hospitals	1	6	1	8	3	12	2	8	3	12	4	10	28	11
Private hospitals	1	6	4	31	2	8	2	8	6	23	3	8	33	13
Home	0	0	0	0	0	0	0	0	2	8	0	0	4	2

Figure 8.14a: Distribution of Donors by Institution of Origin, 1997-2009

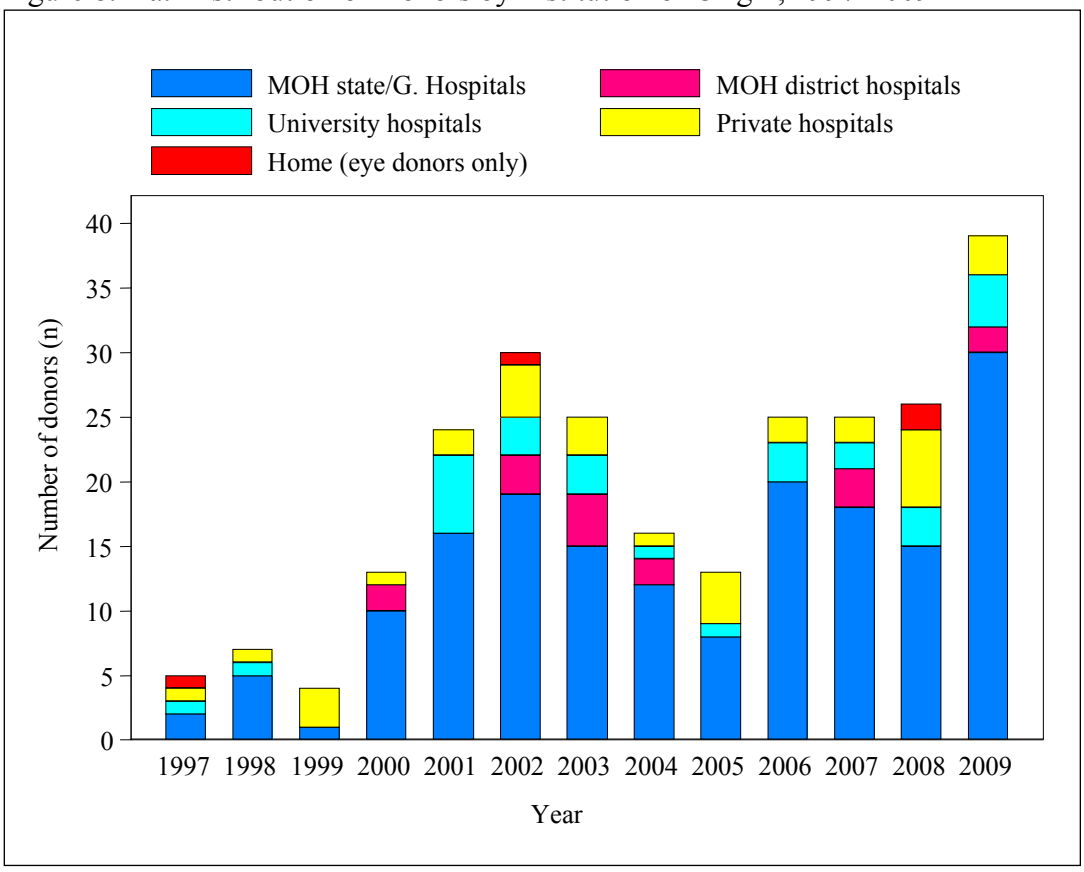


Table 8.14b: Distribution of Donors by Referral Site, 1997-2009

Donor Referral Site	1997 N=5		1998 N=7		1999 N=4		2000 N=13		2001 N=24		2002 N=30		2003 N=25	
	No.	%	No.	%	No.	No.	%	No.	%	%	No.	%	No.	%
ICU	1	20	0	0	0	0	1	8	14	58	16	53	13	52
Ward	0	0	0	0	0	0	0	0	0	0	1	3	3	12
Emergency department	0	0	0	0	0	0	0	0	3	13	4	13	1	4
Mortuary	0	0	0	0	0	0	0	0	0	0	3	10	6	24
Home	0	0	0	0	0	0	0	0	0	0	1	3	0	0
Data not available	4	80	7	100	4	100	12	92	7	29	5	17	2	8

Donor Referral Site	2004 N=16		2005 N=13		2006 N=25		2007 N=25		2008 N=26		2009 N=39		Total N=252	
	No.	%	No.	No.	%	No.	No.	%	No.	%	No.	%	No.	%
ICU	12	75	8	62	16	64	17	68	17	65	18	46	133	53
Ward	1	6	3	23	3	12	1	4	3	12	7	18	22	9
Emergency department	0	0	0	0	3	12	1	4	1	4	4	10	17	7
Mortuary	3	19	1	8	3	12	5	20	4	15	9	23	34	13
Home	0	0	0	0	0	0	0	0	1	4	0	0	2	1
Data not available	0	0	1	8	0	0	1	4	0	0	1	3	44	17

Figure 8.14b: Distribution of Donors by Referral Site, 1997-2009

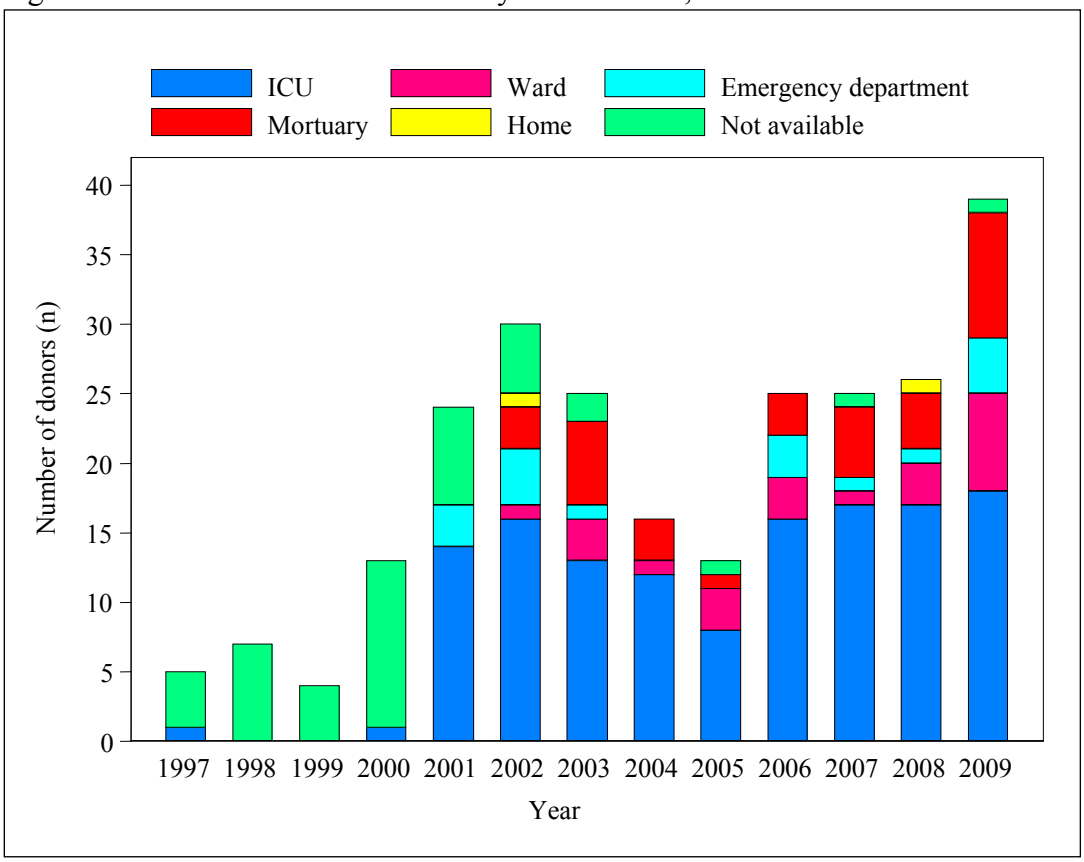


Table 8.14c: Distribution of Donors by Procurement Site, 1997-2009

Donor Procurement Site	1997 N=5		1998 N=7		1999 N=4		2000 N=13		2001 N=24		2002 N=30		2003 N=25	
	No.	%	No.	%	No.	No.	%	No.	%	%	No.	%	No.	%
Operation theatre	4	80	6	86	4	100	11	85	21	88	13	43	8	32
Mortuary	0	0	1	14	0	0	2	15	3	13	17	57	17	68
Ward	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Home	1	20	0	0	0	0	0	0	0	0	0	0	0	0
ICU Isolation Room	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A & E	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Donor Procurement Site	2004 N=16		2005 N=13		2006 N=25		2007 N=25		2008 N=26		2009 N=39		Total N=252	
	No.	%	No.	No.	%	No.	No.	%	No.	%	No.	%	No.	%
Operation theatre	9	56	5	38	13	52	14	56	15	58	18	46	141	56
Mortuary	7	44	8	62	12	48	11	44	10	38	17	44	105	42
Ward	0	0	0	0	0	0	0	0	0	0	1	3	1	0
Home	0	0	0	0	0	0	0	0	1	4	0	0	2	1
ICU Isolation Room	0	0	0	0	0	0	0	0	0	0	2	5	2	1
A & E	0	0	0	0	0	0	0	0	0	0	1	3	1	0

Figure 8.14c: Distribution of Donors by Procurement Site, 1997-2009

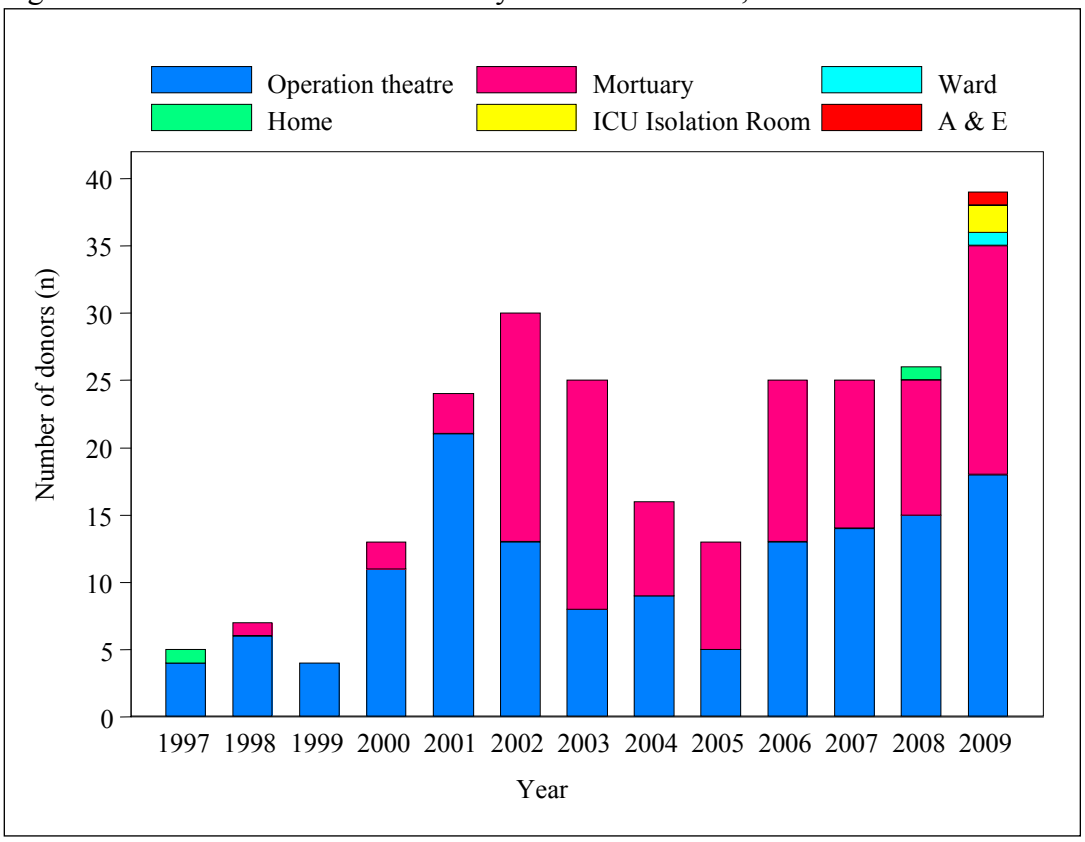


Table 8.15: Distribution of Donors by Inotrope, 2009

Inotrope	**No.**	**%**
Dopamine	7	39
Dopamine/Noradrenaline	5	28
Dopamine/Adrenaline	2	11
Dopamine/Dobutamine/Adrenaline	0	0
Dopamine/Dobutamine/Adrenaline/Noradrenaline	1	6
Noradrenaline	1	6
Noradrenaline/Vasopressin	1	6
Missing	1	6
Total	18	100

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 Microsoft SQL Server.

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. 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.

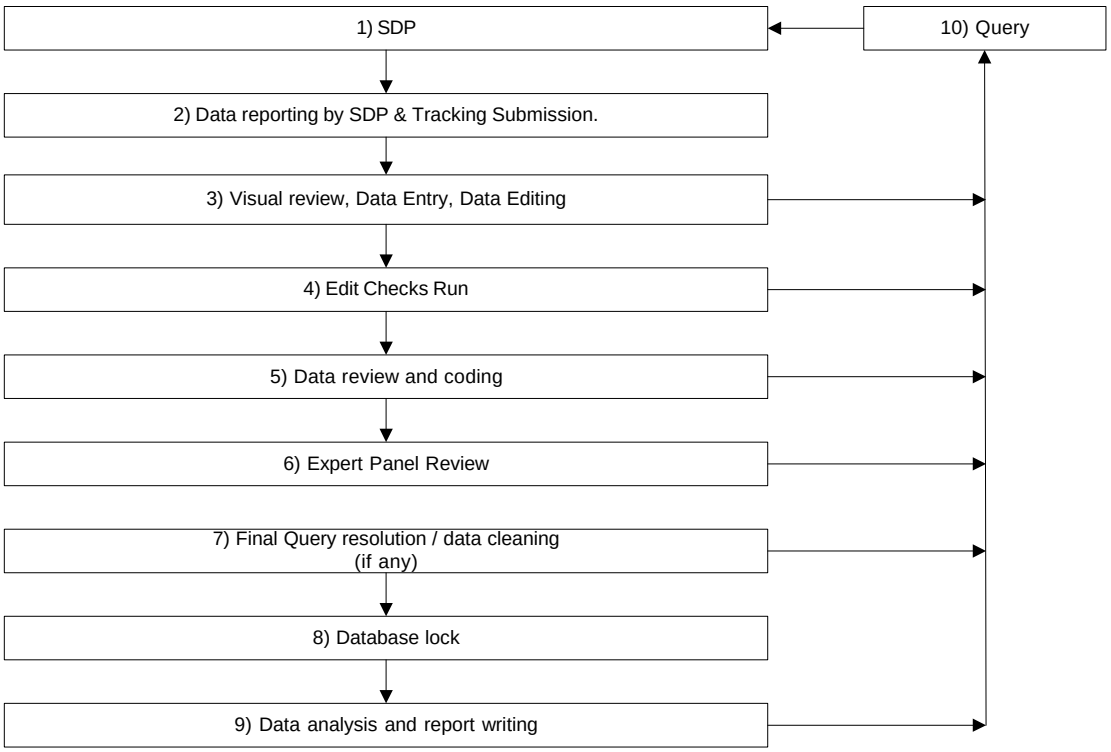
Data sources

SDPs or Source Data Providers of the National Transplant Registry comprise of centres for various transplanted organs throughout Malaysia. NTR then obtains the data for analysis from NRR. Blood and marrow transplant, heart and lung transplant, bone and tissue transplant, cornea transplant and liver transplant SDPs submit data via eNTR web application. Kidney transplant SDPs submit Case Report Forms (CRFs) to National Renal Registry (NRR).

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 Web Application 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 eNTR.

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

For cornea transplant, NTR collects data via Cornea Transplant Notification Form and Cornea Transplant Outcome Form through web application eNTR.

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 eNTR.

For liver transplant, NTR collects data via Liver Transplant Notification Form through web application eNTR.

For kidney transplant, NTR obtains data from NRR which collects data via Renal Transplant Notification Form and Renal Transplant Outcome Form. For annual survey purposes, NRR also collects data via Renal Transplant Annual Return Form and Renal Transplant Annual Quality of Life and Rehabilitation Assessment Form.

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.

Data download functionality is also provided in the web application to enable authorised users to download their own centre's data in comma separated value (CSV) format, MS Excel format and ASCII Text format.

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.

There are also reports on tracking of submission available to the registry manager for each of the organ transplant data.

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 module in eNTR. Data with problems was sent to SDP as queries.

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 NTR Steering Committee 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

A & E	Accident and Emergency
AIIRB	Angiotensin II Receptor Blocker
ACE	Angiotensin Converting Enzyme
ADPKD	Autosomal Dominant Polycystic Kidney Disease
AG	Antigen
ALL	Acute Lymphocytic Leukaemia
ALP	Alkaline Phosphatase
ALT	Alanine Transferase
AML	Acute Myelogenous Leukaemia
APSH	Ampang Puteri Specialist Hospital
ARDS	Adult Respiratory Distress Syndrome
ASCII	American Standard Code for Information Interchange
ATG	Anti-thymocyte globulin
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
CAD	Coronary Artery Disease
CAPD	Continuous Ambulatory Peritoneal Dialysis
CD	Cardiac Death
CDA	Congenital Dyserythropoeitic Anaemia
CF	Counting Fingers
CI	Confidence Interval
CKD	Chronic Kidney Disease
CMV	Cytomegalovirus
CR	Complete Remission
CRF	Case Report Form
CSV	Comma separated value
DFS	Disease-free Survival
DIVC	Disseminated Intra-Vascular Coagulation
DM	Diabetes Mellitus
FK506	Tacrolimus
GCT	Germ Cell Tumour
GFR	Glomerular Filtration Rate
GI	Gastointestinal
GMC	Gleneagles Medical Centre
GN	Glomerulonephritis
GS	Gentamicin and Streptomycin
GVHD	Graft Versus Host Disease
HA	Hospital Ampang
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
HM	Hand Movement
HPP	Hospital Pulau Pinang
HPT	Hypertension
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
IIUM	International Islamic University Malaysia
IJN	Institut Jantung Negara
IL2R	Interleukin 2 Receptor
IOL	Intraocular Lens
ISEC	International Specialist Eye Centre
JNC	Joint National Committee
KLA	HKL, Adult
KLP	HKL, Paediatric
KPJ	Kumpulan Perubatan Johor
LDL	Low Density Lipoprotein
LQ	Lower Quartile
LWE	Lam Wah Ee Hospital
Max	Maximum
MDS	Myelodysplastic Syndrome
Min	Minimum
MK	McCarey and Kaufman
mm	millimetres
MMF	Mycophenolate Mofetil
MOH	Ministry of Health, Malaysia
MS	Microsoft
MST	Malaysian Society of Transplantation
MVA	Motor Vehicle Accident
N	Number
NCEP	National Cholesterol Education Program
NET	Neuroectodermal Tumour
NHL	Non-Hodgkin's Lymphoma
NPL	No Perception of Light
NTPMU	National Transplant Procurement and Management Unit
NTR	National Transplant Registry
Paeds	Paediatrics
PBSC	Peripheral Blood Stem Cells
PJ	Petaling Jaya
PK	Penetrating Keratoplasty

PL	Perception of Light
pmp	per million population
QoL	Quality of Life
RMS	Rhabdomyosarcoma
SD	Standard Deviation
SDP	Source Data Provider
SE	Standard Error
SJA	Sime Darby Medical Centre, Subang Jaya (Adult)
SJP	Sime Darby Medical Centre, Subang Jaya (Paediatric)
SLE	Systemic Lupus Erythematosus
SOP	Standard Operating Procedure
SQL	Structured Query Language
TKI	Tyrosine Kinase Inhibitor
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
VA	Visual Acuity
VAD	Venticular Assist Device
VOD	Veno-Occlusive Disease
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
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Selangor Darul Ehsan
Tel : (03)56391212
Fax : (03)56391209

Sime Darby Medical Centre Subang Jaya
Paediatrics BMT Unit
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Fax : (03)56306209

Blood and Marrow Transplant Services

UNIVERSITY

Hospital Universiti Kebangsaan Malaysia
Maybank BMT Centre
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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

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Department of Orthopaedics
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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

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Fax : (09)7653370

Hospital Universiti Sains Malaysia
Orthopaedics Department
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Kelantan Darul Naim
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International Islamic University Malaysia
Department of Orthopaedics,
Traumatology and Rehabilitation
Kulliyah of Medicine
Jalan Hospital
25100 Kuantan
Pahang Darul Makmur
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University of Malaya Medical Centre
Department of Orthopaedics Surgery
Jalan Universiti
59100 Kuala Lumpur
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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
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Bone Bank, University of Malaya
Medical Centre
Department of Orthopaedics Surgery
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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
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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
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Hospital Kuala Lipis
Ophthalmology Department
27200 Kuala Lipis
Pahang Darul Makmur
Tel : (09)3123333 Ext : 114
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Hospital Kuala Lumpur
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50586 Kuala Lumpur
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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
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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
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Hospital Putrajaya
Ophthalmology Department
Pusat Pentadbiran Kerajaan
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62250 Putra Jaya
Selangor Darul Ehsan
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Hospital Queen Elizabeth
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88586 Kota Kinabalu
Sabah
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Hospital Raja Perempuan Zainab II
Ophthalmology Department
Jalan Hospital
15586 Kota Bharu
Kelantan Darul Naim
Tel : (09)7485533 Ext : 2254
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Hospital Selayang
Ophthalmology Department
Lebuhraya Selayang-Kepong
Batu Caves
68100 Bandar Baru Selayang
Selangor Darul Ehsan
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Hospital Sibu
Ophthalmology Department
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Sarawak
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Fax : (084)337354

Hospital Sultan Ismail
Ophthalmology Department
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81100 Johor Bahru
Johor Darul Takzim
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Fax : (07)3565034

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

Cornea Transplant Services

MOH

Hospital Sultanah Bahiyah
Ophthalmology Department
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Kedah Darul Aman
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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
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91007 Tawau
Sabah
Tel : (089)773533 Ext : 179
Fax : (089)768626

Hospital Teluk Intan
Ophthalmology Department
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Perak Darul Ridzuan
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Ophthalmology Department
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Hospital Tengku Ampuan Rahimah
Ophthalmology Department
Jalan Langat
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Selangor Darul Ehsan
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Hospital Tuanku Ja'afar
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Cornea Transplant Services

MOH

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Fax : (082)419495

ARMED FORCES

94 Hospital Angkatan Tentera Kem
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Ophthalmology Department
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Melaka
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PRIVATE

International Specialist Eye Centre
Level 8, Centrepoint South,
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Lingkaran Syed Putra
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Tel : (03)22848989
Fax : (03)22844330

Gleneagles Intan Medical Centre
Hope Eye Centre
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Fax : (03)42576112

Gleneagles Medical Centre
Ophthalmology Department
Pulau Pinang Clinic Sdn Bhd
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Hospital Pantai Indah
Ophthalmology Department
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Pandan Indah
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Tel : (03)42892947

Cornea Transplant Services

PRIVATE

K. C. Yeo Eye Specialist Centre
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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
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80350 Johor Bahru
Johor Darul Takzim
(07)2233377
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Sri Kota Medical Centre
Ophthalmology Department
Jalan Mohet
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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
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Tan Eye Specialist Centre
Sunway Medical Centre
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Bandar Sunway
46150 Petaling Jaya
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Tel : (03)74919191 Ext : 1602
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Tun Hussein Onn National Eye
Hospital
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46200 Petaling Jaya
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Fax : (03)79576128

Cornea Transplant Services

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Hospital Universiti Sains Malaysia
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Fax : (09)7653370

University of Malaya Medical Centre
Ophthalmology Department
Faculty of Medicine
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Fax : (03) 79535635

Heart and Lung Transplant Services

MOH

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

Institute Jantung Negara
Cardiothoracic Department
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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
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Fax : (03)2692 8418

Kidney Transplant Services

MOH

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Renal Transplant Clinic
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Johor Darul Takzim
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Tel 2 : (07)4340654
Fax : (07)4322544

Hospital Bintulu
Renal Transplant Clinic
c/o Haemodialysis Unit
Jalan Nyabau
97000 Bintulu
Sarawak
Tel 1 : (086)255899
Tel 2 : (086)311416
Fax : (086)255866

Hospital Duchess of Kent
Renal Transplant Clinic
c/o Haemodialysis Unit
KM3.2, Jalan Utara
90007 Sandakan
Sabah
Tel 1 : (089)212111 Ext : 5190
Tel 2 : (089)212739
Fax : (089)213607

Hospital Dungun
Renal Transplant Clinic
c/o Haemodialysis Unit
23000 Dungun
Terengganu Darul Iman
Tel : (09)8483333 Ext : 261
Fax : (09)8484160

Hospital Kemaman
Renal Transplant Clinic
c/o Haemodialysis Unit
24000 Kemaman
Terengganu Darul Iman
Tel : (09)8593333 Ext : 2012
Fax : (09)8595512

Hospital Kluang
Renal Transplant Clinic
c/o Haemodialysis Unit
Jalan Hospital
88000 Kluang
Johor Darul Takzim
Tel 1 : (07)7723333 Ext : 266 / 313
Tel 2 : (07)7723334
Fax : (07)7734498

Hospital Kuala Lumpur (Paed Tx Unit)
Nephrology Clinic (Renal Transplant)
Department of Nephrology
Jalan Pahang
50586 Kuala Lumpur
Tel : (03)26921044 Ext : 6021
Fax : (03)26948187

Hospital Kuala Lumpur
Nephrology Clinic (Renal Transplant)
Department of Nephrology
Jalan Pahang
50586 Kuala Lumpur
Tel 1 : (03)26155555 Ext : 5910
Tel 2 : (03)26157561
Fax : (03)26938953

Kidney Transplant Services

MOH

Hospital Labuan
Renal Transplant Clinic
c/o Haemodialysis Unit
87020 Labuan
Sabah
Tel 1 : (087)423919 Ext : 274
Tel 2 : (087)410761
Fax : (087)423928

Hospital Likas
Renal Transplant Clinic
c/o Haemodialysis Unit
88996 Kota Kinabalu
Sabah
Tel : (088)522600 Ext : 723 / 714
Fax : (088)438512

Hospital Melaka
Renal Transplant Clinic
c/o Haemodialysis Unit
Tingkat Bawah, Blok D
Jalan Pringgit
70060 Melaka
Tel 1 : (06)2822344
Tel 2 : (06)2707648
Fax : (06)2837500

Hospital Mersing
Renal Transplant Clinic
c/o Haemodialysis Unit
Jalan Ismail
86800 Mersing
Johor Darul Takzim
Tel 1 : (07)7993333 Ext : 126
Tel 2 : (07)7991415
Fax : (07)7994200

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 1 : (07)6873333 Ext : 202
Tel 2 : (07)6874533
Fax : (07)6874533

Hospital Pulau Pinang
Renal Transplant Clinic
c/o Haemodialysis Unit
Jalan Residensi
10990 Georgetown
Pulau Pinang
Tel : (04)2225333 Ext : 397
Fax : (04)2281737

Kidney Transplant Services

MOH

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 1 : (09)7485533
Tel 2 : (09)7502801
Fax : (09)7486951

Hospital Raja Permaisuri Bainun
Nephrology Clinic
Jalan Hospital
30990 Ipoh
Perak Darul Ridzuan
Tel : (05)5222372
Fax : (05)2531541

Hospital Segamat
Renal Transplant Clinic
c/o Haemodialysis Unit
83500 Segamat
Johor Darul Takzim
Tel 1 : (07)9433333 Ext : 147
Tel 2 : (07)9433334
Fax : (07)9434641

Hospital Selayang
Renal Transplant Clinic
c/o Ward 7B
Lebuhraya Selayang-Kepong
68100 Batu Caves
Selangor Darul Ehsan
Tel 1 : (03)61203233 Ext : 7007/7011
Tel 2 : (03)61380409
Fax : (03)61377097

Hospital Serdang
Renal Transplant Clinic
c/o Haemodialysis Unit
Jalan Puchong
43000 Kajang
Selangor Darul Ehsan
Tel 1 : (03)89475555 Ext : 1256
Tel 2 : (03)89475282
Fax : (03)89455317

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

Hospital Sultan Haji Ahmad Shah
Renal Transplant Clinic
c/o Haemodialysis Unit
Jalan Maran
28000 Temerloh
Pahang Darul Makmur
Tel : (09)2955333 Ext : 1570

Kidney Transplant Services

MOH

Hospital Sultan Ismail Pandan
Renal Transplant Clinic (Paed)
c/o Paediatrics Ward (Wad 8C & D)
Jalan Persiaran Mutiara Emas Utama
Taman Mount Austin
81100 Johor Bahru
Johor Darul Takzim
Tel : (07)3565000 Ext : 2013/8306
Fax : (07)3565088

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 : 3508/3509
Fax : (07)3565034

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

Hospital Sultanah Bahiyah
Renal Transplant Clinic
c/o Haemodialysis Unit
06550 Alor Setar
Kedah Darul Aman
Tel : (04)7303333 Ext : 201/202
Fax : (04)7341737

Hospital Sultanah Nur Zahirah
Renal Transplant Clinic
c/o Haemodialysis 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 1 : (05)8083333 Ext : 8173
Tel 2 : (05)8408173
Fax : (05)8053121

Hospital Tawau
Renal Transplant Clinic
c/o Haemodialysis Unit
91007 Tawau
Sabah
Tel 1 : (089)773183
Tel 2 : (089)773533
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

Kidney Transplant Services

MOH

Hospital Tengku Ampuan Rahimah
Renal Transplant Clinic
c/o Haemodialysis Unit
Jalan Langat
41200 Klang
Selangor Darul Ehsan
Tel 1 : (03)33723333 Ext : 1411/1256
Tel 2 : (03)33757200
Fax : (03)33729089

Hospital Tuanku Ja'afar
Renal Transplant Clinic
c/o Haemodialysis Unit
Jalan Rasah
70300 Seremban
Negeri Sembilan Darul Khusus
Tel 1 : (06)7684000 Ext : 4125
Tel 2 : (06)7604743
Fax : (06)7684711

Hospital Umum Sarawak
Renal Transplant Clinic
c/o Haemodialysis Unit
Jalan Tun Ahmad Zaidi Adruce
93590 Kuching
Sarawak
Tel 1 : (082)276757
Tel 2 : (082)276528
Fax : (082)276734

PRIVATE

Assunta Hospital
Kidney Unit
Jalan Templer
46990 Petaling Jaya
Selangor Darul Ehsan
Tel 1 : (03)77823433 Ext : 254
Tel 2 : (03)76216696
Fax : (03)77814933

C. S. Loo Kidney & Medical Specialist Centre
Perak Community Specialist Hospital
227, Jalan Kampar
30250 Ipoh
Perak Darul Ridzuan
Tel 1 : (05)2458918
Tel 2 : (05)2545594
Fax : (05)2554288

Damai Medical & Heart Clinic
Renal Transplant Clinic
c/o Haemodialysis Centre
49-N, Jalan Ong Kim Wee
75300 Melaka
Melaka
Tel 1 : (06)2841204 Ext : 210/211
Tel 2 : (06)2844805
Fax : (06)2844805

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

Kidney Transplant Services

PRIVATE

Klinik Dr Choo & Liew
9-0, Lorong Lintas Plaza 1
Lintas Plaza, Jalan Lintas
88380 Kota Kinabalu
Sabah
Tel : (088)238292
Fax : (088)237292

KPJ Ampang Puteri Specialist Hospital
Renal Transplant Clinic
Suite 1-7, First Floor
No.1, Jalan Mamanda 9
Tmn Dato'Ahmad Razali
68000 Ampang
Selangor Darul Ehsan
Tel : (03)42722500 Ext : 1250
Fax : (03)42702443

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

Normah Medical Specialist Centre
Renal Transplant Clinic
c/o Haemodialysis Centre
P.O. Box 3298
93764 Kuching
Sarawak
Tel 1 : (082)440055 Ext : 260
Tel 2 : (082)443785
Fax : (082)443787

Pantai Hospital Penang
Renal Transplant Clinic
c/o Haemodialysis Centre
No. 82, Jalan Tengah, Bayan Baru
11900 Bayan Lepas
Pulau Pinang
Tel : (04)6433888 Ext : 155
Fax : (04)6432888

Prince Court Medical Centre
Renal Transplant Clinic
c/o Renal Dialysis Unit
Level 3
39, Jalan Kia Peng
50450 Kuala Lumpur
Wilayah Persekutuan
Tel : (03)21600147 Ext : 2977
Fax : (03)31600930

Renal Care, Ipoh Specialist Hospital
Renal Transplant Clinic
c/o Renal Care
Ipoh Specialist Hospital
26, Jalan Raja Dihilir (Tambun)
30350 Ipoh
Perak Darul Ridzuan
Tel 1 : (05)2418777 Ext : 275/276
Tel 2 : (05)2413128
Fax : (05)2541388

Sabah Medical Centre
Renal Transplant Clinic
c/o Haemodialysis Centre
Kingfisher Park, Kuala Inanam
88840 Kota Kinabalu
Sabah
Tel : (088)424333
Fax : (088)272622

Kidney Transplant Services

PRIVATE

Sime Darby Medical Centre Subang Jaya
Renal Transplant Clinic
c/o Clinic Dr Prasad
1, Jalan SS 12/1A
47500 Subang Jaya
Selangor Darul Ehsan
Tel : (03)56301212 Ext : 469
Fax : (03)56396188

Simon Wong Medical & Kidney Clinic
Timberland Medical Centre
Lot 5160, Ground Floor
Lorong 2, 2 1/2 miles Rock Road
93250 Kuching
Sarawak
Tel 1 : (082)241242
Tel 2 : (082)234466
Fax : (082)254242

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

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
Renal Transplant Clinic
c/o Haemodialysis Unit
Suite A1-28, First Floor
No 5, Jln Lagoon Selatan
Bandar Sunway
46150 Petaling Jaya
Selangor Darul Ehsan
Tel 1 : (03)74919191 Ext : 7784
Tel 2 : (03)74911135
Fax : (03)74918181

Tan Medical Renal Clinic
Healthcare Dialysis Centre
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
Melaka
Tel 1 : (06)2818222 Ext : 3309
Tel 2 : (06)2813333
Fax : (06)2810560

Kidney Transplant Services

UNIVERSITY

Pusat Perubatan Universiti Kebangsaan Malaysia
Renal Transplant Clinic (Medical 3)
Jalan Tenteram
Bandar Tun Razak, Cheras
56300 Kuala lumpur
Wilayah Persekutuan
Tel 1 : (03)91455555 Ext : 7318
Tel 2 : (03)91703831
Fax : (03)91735316

Universiti Sains Malaysia Hospital
Renal Transplant Clinic
c/o Haemodialysis Unit
16150 Kubang Kerian
Kelantan Darul Naim
Tel 1 : (09)7673328
Tel 2 : (09)7673329
Fax : (09)7652198

University of Malaya Medical Centre
Renal Transplant Clinic
c/o Ward 8TE Dialysis Unit
Jalan Universiti
59100 Kuala Lumpur
Wilayah Persekutuan
Tel 1 : (03)79494422 Ext : 2282/3093
Tel 2 : (03)79492282
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