



MINISTRY OF HEALTH
SINGAPORE

SINGAPORE RENAL REGISTRY REPORT NO. 9

TRENDS IN RENAL IN SINGAPORE 2010 / 2011

INTERIM

NATIONAL REGISTRY OF DISEASES OFFICE

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Foreword

The Singapore Renal Registry has been working very hard to put together data on kidney disease in Singapore in the past years. The data fulfil a very important function in providing insight and understanding of the trends and pattern of kidney disease in Singapore, particular chronic kidney failure, dialysis and renal transplantation.

This report would not have been possible without the support of many people and organisations, who have submitted, collected, analysed the data, prepared report and provided guidance. I am grateful to those who have worked hard and long on this report.

There have been many improvements made in this report. Trends on chronic kidney disease stage 5, mineral metabolism and nutrition have been added. I am confident that more improvements and refinements will be made with future reports.

I am sure that the report will be invaluable to those who are involved in the care of patients suffering from chronic kidney disease.

Assoc Prof Evan Lee
Chairman
Singapore Renal Registry

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MINISTRY OF HEALTH

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1 LIST OF PARTICIPATING CENTRES AND PREVALENT PATIENTS as of 31 DECEMBER 2010 and 2011

	2010			2011		
	HD	PD	TX^	HD	PD	TX^
Public Acute Hospitals and Affiliated Dialysis Centres						
Singapore General Hospital	9	271	814	8	322	834
Alexandra Hospital		12			14	
Tan Tock Seng Renal Centre	1	55	12	1	58	15
CHANGI GENERAL HOSPITAL		5		2	15	
KHOO TECK PUAT HOSPITAL		15			20	
National University Hospital		115	373	1	109	383
NUH Dialysis Centre	67				75	
NUH RENAL CENTRE	10				12	
SHAW NKF - NUH Children's Kidney Centre	5	26	33	3	26	35
sub-total	92	499	1232	102	564	1267
Voluntary Welfare Organisations						
Hong Leong - NKF Dialysis Centre (Aljunied Crescent)	103				103	
IFPAS - NKF Dialysis Centre (Serangoon)	100				99	
Japan Airline - NKF Dialysis Centre (Ang Mo Kio I)	98				107	
Kwan Im Thong Hood Cho Temple - NKF Dialysis Centre (Simei)	145				147	
Leong Hwa Chan Si Temple - NKF Dialysis Centre (Teck Whye)	103				105	
New Creation Church - NKF Dialysis Centre	83				83	
NKF Dialysis Centre (BLK 365 Woodlands II)	103				102	
NKF Hougang Punggol Dialysis Centre	79				89	
NTUC Income - NKF Dialysis Centre (Bukit Batok)	81				81	
NTUC/Singapore Pools - NKF Dialysis Centre (Tampines)	112				112	
Pei Hwa Foundation - NKF Dialysis Centre (Ang Mo Kio)	104				116	
SAF - NKF Dialysis Centre (Clementi)	114				112	
SAF - NKF Dialysis Centre (Hong Kah)	77				80	
Sakyadhita - NKF Dialysis Centre (Upper Boon Keng)	94				93	
Sheng Hong Temple - NKF Dialysis Centre (Jurong West)	103				103	
SIA - NKF Dialysis Centre (Toa Payoh)	74				76	
Singapore Buddhist Welfare Services - NKF Dialysis Centre (Hougang)	133				137	
Singapore Contractors Association NKF Dialysis Centre (Bukit Merah)	78				0	
Singapore Pools - NKF Dialysis Centre (Bedok)	84				83	
Tampines Chinese Temple - NKF Dialysis Centre (Pasir Ris)	72				75	
Tay Choon Hye - NKF Dialysis Centre (Kim Keat)	106				105	
Thong Teck Sian Tong Lian Sin SIA - NKF Dialysis Centre (Woodlands)	111				110	
Toa Payoh Seu Teck Sean Tong - NKF Dialysis Centre (Yishun)	68				68	
Western Digital - NKF Dialysis Centre (Ang Mo Kio)	133				150	
WOH HUP - NKF DIALYSIS CENTRE (GHIM MOH)	0				96	
KDF - Bishan Centre	95				88	
KDF - Ghim Moh Centre (HD)	45				41	
KDF - Ghim Moh Centre (PD)		70				55
KDF - Kreta Ayer (HD)	63				68	
Peoples' Dialysis Centre	93				93	
sub-total	2654	70	0	2722	55	0
Private Dialysis Centres/Clinics						
Advance Renal Therapy	21				26	
ARC Kidney Dialysis Centre (Clementi Ave 3) Pte Ltd	18				33	
ASIA KIDNEY DIALYSIS CENTRE (TP)	0				14	
ASIA KIDNEY DIALYSIS CENTRE (TPY)	0				12	
Asia Renal Care (Jurong) Pte Ltd	45				45	
Asia Renal Care (Katong) Pte Ltd	44				46	
Asia Renal Care (Kembangan) Pte Ltd	26				40	
Asia Renal Care (Mt Elizabeth) Pte Ltd	24	1			26	1
B.Braun Avitum Dialysis Centre	0				38	
Dialysis Centre - Youngberg Pte Ltd (Whampoa)	52				55	
Dialysis Centre - Youngberg Pte Ltd (Kovan)	66				55	
Dialysis Centre - Youngberg Pte Ltd (Serangoon)	47				42	
FHC Dialysis Centre PTE LTD	0				12	
Immanuel Dialysis Centre Pte Ltd (Ang Mo Kio)	34				36	
Immanuel Dialysis Centre Pte Ltd (Mt Alvernia)	32	1			31	1
Kidney Therapy Centre Pte Ltd (Marsiling Rd Blk136)	55				58	
Kidney Therapy Centre Pte Ltd (YISHUN Blk 236)	25				43	
Nephrocare GDI Pte Ltd	26	4			25	3
Nephrocare S & J Dialysis Centre (Boulevard)	37				36	
Nephrocare Singapore Dialysis	26				0	
Orthe Pte Ltd - (Bukit Batok)	43				48	
Orthe Pte Ltd - (Orchard Rd , Lucky Plaza)	9	1			9	1
Orthe Pte Ltd (Jurong West)	18				41	
Orthe Pte Ltd (Tampines Blk 107)	0				47	
RAFFLES DIALYSIS CENTRE	8				7	
Renal & Dialysis Clinic (S) Pte Ltd (Depot Road)	10				10	
Renal Health Pte Ltd	77				83	
RENAL LIFE DIALYSIS CENTRE PTE LTD (Blk 463 Jurong West)	1				10	
Renal Therapy Centre Pte Ltd - (Bedok Blk 744)	96				81	
Renal Therapy Centre Pte Ltd (Ang Mo Kio Blk422)	61				64	
Renal Therapy Centre Pte Ltd (Hougang BLK 620)	52				49	
Renal Therapy Centre Pte Ltd (Jurong East Blk 326)	47				49	
Renal Therapy Centre Pte Ltd (Toa Payoh Blk 92)	63				61	
Renal Therapy Services Pte Ltd (Ang Mo Kio Blk 443)	46				45	
Renal Therapy Services Pte Ltd (Bukit Merah Blk 161)	47				44	
Renal Therapy Services Pte Ltd (Jurong East Blk 104)	85				81	
Renal Therapy Services Pte Ltd (Yishun Ring Blk 236)	33				44	
Centre For Kidney Disease Pte Ltd (Lucky Plaza)			34			38
Grace Lee Renal And Medical Clinic Pte Ltd			10			12
Kidney & Medical Centre			2			4
Ku Kidney & Medical Centre			24			22
Raffles Hospital			2			3
Stephew Chew Centre for Kidney Disease and Hypertension			32			31
The Kidney Clinic Pte Ltd			0			1
The Singapore Clinic for Kidney Diseases			4			3
Wu Nephrology & Medical Clinic (Wu Medical Clinic Pte Ltd)			18			20
sub-total	1274	7	132	1446	6	136
Grand Total	4020	576	1364*	4270	625	1403*

^ TX refers to number of transplanted patients

2 INTRODUCTION

This report summarises the characteristics of dialysis and renal transplant (donor and recipient) patients among the resident population of Singapore (citizens and permanent residents).

2.1 Dialysis Programmes

In Singapore, both HD and PD are available for patients with end-stage renal failure. While the practice of PD is almost totally confined to the Public Acute Hospitals, HD is practised in different settings as detailed below:

1. Public Acute Hospitals where hospital-based centres provide total care dialysis;
2. Dialysis Centres run by Voluntary Welfare Organisations where free-standing centres provide total care for elderly patients and those unable to perform self-dialysis, as well as assisted care for the more able patients;
3. Private centres that provide total care dialysis in hospital-based as well as free-standing centres in the private sector.

2.2 Transplantation Programmes

Both living and deceased-donor renal transplants are performed in Singapore. Transplants from live donors are performed in both the public acute and private hospitals while deceased-donor transplants are only performed in Public Acute Hospitals. In addition, patients return for follow-up at hospitals in Singapore after having received a transplant overseas.

2.3 Method of Payment

The Ministry of Health provides subsidies to lower- and middle-income PD and HD patients. The subsidy framework for renal dialysis was recently enhanced and subsidy coverage extended to more middle income households. Government subsidies are also provided for selected immunosuppressive drugs for subsidised patients in our public healthcare institutions to help patients with drug cost after transplantation. In addition, patients can also use Medisave (a national medical savings scheme) and MediShield benefits (a low cost basic medical insurance scheme) to pay for their dialysis or immunosuppressive drugs after Government subsidies. Voluntary welfare organisations such as the National Kidney Foundation, Kidney Dialysis Foundation and Peoples' Dialysis Centre also provide charity assistance to dialysis patients who need further financial assistance.

3 DATA COLLECTION

3.1 Methods of Data Collection

Data was collected from all centres in Singapore providing care for end-stage renal failure patients through the following methods:

1. Annual audits on 31 December 2011. New patients are registered using Registry forms (Appendix I) while existing patients have their data reconfirmed and updated (e.g. change in dialysis modality, location, etc) in the central database. Cases were identified based on serum creatinine > 10 mg/dl or 880 µmol/L or on initiation of renal replacement therapy. From year 2007 onwards, the Singapore General Hospital, which contributed about 50% of new cases, started to provide a listing of patients with estimated glomerular filtration rate (eGFR) < 15 ml/min (corrected for BSA 1.73m²) to the registry to replace serum creatinine listing for case findings. Similarly, the National University Hospital, which contributed about 20% of new cases, started to provide listing of patients with eGFR < 15 ml/min (corrected for BSA 1.73m²) to the registry to replace serum creatinine listing for case findings from year 2009.
2. An event-driven basis where abbreviated forms are submitted to the Registry to register a patient's change in dialysis location, modality or death when the event occurs.
3. Submission of Registry forms was on a voluntary basis, until the introduction of the National Registry of Diseases Act in 2007. Data capture is estimated at 95% of all dialysis patients in Singapore.
4. New transplant cases are identified by matching the master lists from the transplant centres against existing data in the central database. The Registry Coordinators then extract relevant data from the case-notes in the Medical Record Office of the hospitals.

3.2 Database System

The Registry initially used the Microsoft Visual Foxpro™ Version 5.0 for data entry. The data was later migrated to Microsoft Access in 2000 and finally to a web-based application with Oracle database in 2006.

The web-based application is running on IBM pSeries Unix servers. The application was built with stringent validation rules and features to prevent unauthorised access, to protect patient confidentiality, to identify duplication of records and to detect missing or out-of-range values.

4 DATA CLEANING AND ANALYSIS

A snapshot of data for the years 2010-2011 was used to generate trends and check for obvious errors and inconsistency. Erroneous data items were identified, extracted and passed to the team of renal registry coordinators for verification and data cleaning.

The tables and figures in this monograph were generated based on data snapshot taken on 17th June 2013. Hence, numbers and estimates for a particular year would differ from the previous monographs due to updating of figures in the latest dataset. Dialysis modality at 90 days after initiation was used in the computation of incidence, prevalence and survival analysis. This methodology was first applied in the Second Report of the Singapore Renal Registry 1998. In most instances, STATA version 10.1 was used in data analysis.

In this report, we used mid-year population estimates of Singapore residents from the Department of Statistics (DOS), Singapore to calculate the rates. Age standardised rates (ASR) were derived by the direct method using the UICC "World" Population. (Doll R, Muir C, Waterhouse J (eds) Cancer Incidence in Five Continents Vol. 2, Geneva, UICC, 1970). All rates were expressed in per million population (pmp).

Deaths that occurred in the year were categorised according to the modality at the time of deaths.

Survival Analysis

The Kaplan-Meier method was used to calculate unadjusted survival probabilities. Deaths were defined as events for dialysis and transplanted patients. Survival was computed till death or till March 2013 for those who were alive.

Patients who switched modality and remained on the switched modality for at least 60 days had the survival experience attributed to the switched modality. Patients who remained on the switched modality for less than 60 days had their survival experience attributed to the original modality.

Patients on dialysis were censored if they received a kidney transplant.

For analysis of graft survival for renal transplants, graft loss as defined by return to dialysis or a preemptive renal transplant and death with a functioning graft were defined as events. Deaths from all causes were considered as events for calculations of patient survival.

Bio-clinical indicators

Bio-clinical (e.g. haemoglobin) values were reported from 2005 onwards when the registry started collecting these data items.

In this monograph, the numbers in tables and figures were rounded to one decimal place. In addition, the percentages may not add up to 100% due to rounding error.

5 SYNOPSIS 2010-2011

5.1 Dialysis

5.1.1 Stock and Flow (1999 – 2011)

Intake of new dialysis patients increased from 663 in 2005 to 904 in 2011. Prevalent dialysis patients increased from 3565 in 2005 to 4895 in 2011.

The number of renal transplants varied between 84 and 124 in the period 2005-2011. Patients with functioning transplant increased from 1112 in 2005 to 1403 in 2011.

5.1.2 Demographics

5.1.2.1 New Patients Diagnosed with CKD5

Of the CKD5 patients, the proportion of males was 53.4% in 2010 and 52.0% in 2011. The mean and median age was 64.2 years in 2010 and 65.4 years (median 65.9 years) in 2011; and the modal age group was 60-69 in both years.

Among the incident CKD5 patients, diabetic nephropathy (60.4% in 2010, 63.5% in 2011) was the most common cause of CKD5. Primary glomerulonephritis accounted for 15.1% in 2010 and 12.8% in 2011 while hypertension and renovascular disease accounted for 16.1% and 15.7% in 2010 and 2011 respectively.

5.1.2.2 New Patients on Dialysis

(1 January 2010 – 31 December 2010)

Of the 741 new CKD5 patients who survived 90 days after initiation of dialysis (Crude rate, CR 206.9 per million population (ppm); Age standardised rate, ASR 166.0 ppm), 55.2% were males (CR 219.8 ppm; ASR 166.1 ppm). 611 patients (CR 170.6 ppm; ASR 135.7 ppm) or 82.5% of those who survived 90 days after initiation of dialysis were on HD compared with 17.5% on PD. The mean age of patients surviving 90 days on dialysis was 61.3 years (median 61.5 years) with 55.6% aged 60 years and above.

(1 January 2011 – 31 December 2011)

Of the 904 new CKD5 patients who survived 90 days after initiation of dialysis (Crude rate, CR 248.2 per million population (ppm); Age standardised rate, ASR 192.6 ppm), 61.3% were males (CR 296.5 ppm; ASR 217.1 ppm). 741 patients (CR 203.4 ppm; ASR 157.2 ppm) or 82.0% of those who survived 90 days after initiation of dialysis were on HD

compared with 18.0% on PD. The mean age of patients surviving 90 days on dialysis was 60.9 years (median 61.2 years) with 55.0% aged 60 years and above.

5.1.2.3 Existing Patients on Dialysis

(As of 31 December 2010)

Of the 4596 prevalent patients on dialysis (CR 1218.5 pmp; ASR 896.4 pmp), 52.6% were males (CR 1299.8 pmp; ASR 981.4 pmp). There were 4020 patients (CR 1065.8 pmp; ASR 778.4 pmp, 87.5%) on hemodialysis and 576 patients (CR 152.7 pmp; ASR 118.0 pmp, 12.5%) on PD. The mean age was 60.4 years (median 60.9 years) with 52.9% aged 60 years and above.

(As of 31 December 2011)

Of the 4895 prevalent patients on dialysis (CR 1291.8 pmp; ASR 919.2 pmp), 54.5% were males (CR 1429.2 pmp; ASR 1045.0 pmp). There were 4270 patients (CR 1126.9 pmp; ASR 795.2 pmp, 87.2%) on hemodialysis and 625 patients (CR 164.9 pmp; ASR 124.0 pmp, 12.8%) on PD. The mean age was 60.7 years (median 61.2 years) with 53.9% aged 60 years and above.

5.1.3 Primary Renal Disease

New patients on dialysis in 2010: Diabetic nephropathy and primary glomerulonephritis were the commonest cause of CKD5 at 63.3% and 19.0% respectively. Only 37.6% (53/141) of primary glomerulonephritis cases were biopsy-proven of which IgA nephropathy was the commonest at 52.8% (28/53). Secondary glomerulonephritis and other autoimmune diseases accounted for 0.8% (6/741) of CKD5.

New patients on dialysis in 2011: Diabetic nephropathy and primary glomerulonephritis were the commonest cause of CKD5 at 61.6% and 17.6% respectively. Only 35.8% (57/159) of primary glomerulonephritis cases were biopsy-proven of which IgA nephropathy was the commonest at 31.6% (18/57). Secondary glomerulonephritis and other autoimmune diseases accounted for 1.0% (9/904) of CKD5.

Prevalent patients on dialysis in 2010: 32.5% (1495/4596) and 45.3% (2081/4596) of patients had primary glomerulonephritis (386/4596, 8.4% were biopsy proven) and diabetic nephropathy attributed as their cause of CKD5, respectively. Secondary glomerulonephritis and other autoimmune diseases accounted for 2.4% (112/4596) of CKD5. Of the biopsy-proven primary GN, IgA nephropathy accounted for 57.8% (223/386).

Prevalent patients on dialysis in 2011: 31.1% (1524/4895) and 46.6% (2283/4895) of patients had primary glomerulonephritis (412/4895, 8.4% were biopsy proven) and diabetic nephropathy attributed as their cause of CKD5, respectively. Secondary glomerulonephritis

and other autoimmune diseases accounted for 2.3% (114/4895) of CKD5. Of the biopsy-proven primary GN, IgA nephropathy accounted for 53.9% (222/412).

5.1.4 Co-morbid Conditions

In year 2010, prevalent dialysis patients had the following co-morbidities - diabetes mellitus (52.9%), ischaemic heart disease (44.7%), cerebrovascular disease (18.8%), peripheral vascular disease (13.8%). 3.9% of them had positive Hepatitis BsAg status.

In year 2011, prevalent dialysis patients had the following co-morbidities - diabetes mellitus (54.5%), ischaemic heart disease (45.7%), cerebrovascular disease (19.7%), peripheral vascular disease (15.1%). 4.0% of them had positive Hepatitis BsAg status.

5.1.5 Haemodialysis

In 2010, 611 incident patients survived 90 days on HD (CR 170.6 pmp; ASR 135.7 pmp). There were 4020 prevalent patients (CR 1065.8 pmp; ASR 778.4 pmp) on HD with mean age of 60.6 years. 53.0% of patients were aged 60 years and above. Majority of prevalent patients were dialysed in dialysis centres managed by voluntary welfare organisations (66.0%) followed by 31.7% in private dialysis centres and 2.3% in Public Acute Hospitals.

In 2011, 741 incident patients survived 90 days on HD (CR 203.4 pmp; ASR 157.2 pmp). There were 4270 prevalent patients (CR 1126.9 pmp; ASR 795.2 pmp) on HD with mean age of 60.9 years. 53.5% of patients were aged 60 years and above. Majority of prevalent patients were dialysed in dialysis centres managed by voluntary welfare organisations (63.7%) followed by 33.9% in private dialysis centres and 2.4% in Public Acute Hospitals.

5.1.6 Peritoneal Dialysis

In 2010, 130 incident patients who survived 90 days were on PD (CR 34.5 pmp; ASR 26.1 pmp). There were 576 prevalent patients (CR 152.7 pmp; ASR 118.0 pmp) on PD with mean age of 58.8 years. 52.7% were aged 60 years and above. Majority received treatment in Public Acute Hospitals (86.6%).

In 2011, 163 incident patients who survived 90 days were on PD (CR 43.0 pmp; ASR 31.1 pmp). There were 625 prevalent patients (CR 164.9 pmp; ASR 124.0 pmp) on PD with mean age of 59.5 years. 56.1% were aged 60 years and above. Majority received treatment in Public Acute Hospitals (90.2%).

5.1.7 Dialysis Deaths

In 2010, there were 560 deaths (CR 148.5 pmp; ASR 108.6 pmp) with a death rate of 10.7% (560/5221). The death rate for those on HD was at 9.6% and PD at 17.7%. Cardiac

events and infection were the commonest cause of death at 32.9% and 32.0% respectively; cerebrovascular death was at 3.6%.

In 2011, there were 663 deaths (CR 174.9 pmp; ASR 120.8 pmp) with a death rate of 11.8% (663/5634). The death rate for those on HD was at 11.4% and PD at 14.1%. Cardiac events and infection were the commonest cause of death at 35.7% and 32.3% respectively; cerebrovascular death was at 4.1%.

5.1.8 Survival Analysis

Patient survival for HD was 59.8% at 5 years for the period 1999-2011. The corresponding figures for PD was 35.3% at 5 years. The median survival was 6.7 years for HD patients and 3.5 years for PD patients.

5.2 Transplants

5.2.1 Demographics

5.2.1.1 New Transplant Patients

There were 61 (CR 16.2 pmp) new kidney transplant recipients in 2010. Of these, male recipients comprised 50.0%. In addition, 23 patients in 2010 (CR 6.1 pmp) received transplants overseas.

There were 67 (CR 17.7 pmp) new kidney transplant recipients in 2011. Of these, male recipients comprised 58.2%. In addition, 24 patients in 2011 (CR 6.3 pmp) received transplants overseas.

5.2.1.2 Prevalent Patients Transplanted

As of 31 December 2010

There were 1364 prevalent transplant patients (CR 361.6 pmp, ASR 265.1 pmp) in 2010. Of these, 53.9% were males. Mean age was 51.7 years. The prevalent transplant population was predominately Chinese (83.0%).

As of 31 December 2011

There were 1403 prevalent transplant patients (CR 370.3 pmp, ASR 266.4 pmp) in 2011. Of these, 53.3% were males. Mean age was 52.3 years. The prevalent transplant population was predominately Chinese (82.6%).

5.2.2 Primary Renal Disease

For the prevalent transplanted population, the commonest known primary renal disease was primary glomerulonephritis at 71.3% in 2010 and 71.0% in 2011. Diabetic nephropathy accounted for only 7.3% in 2010 and 2011 while autoimmune disease accounted for 4.1% in 2010 and 4.3% in 2011.

5.2.3 Co-morbid Conditions

Co-morbidities for prevalent transplanted patients in year 2010 included diabetes mellitus in 26.1%, ischaemic heart disease 15.4%, cerebrovascular disease 4.5% and peripheral vascular disease 1.8%. 3.2% had positive Hepatitis BsAg status.

Co-morbidities for prevalent transplanted patients in year 2011 included diabetes mellitus in 25.3%, ischaemic heart disease 15.4%, cerebrovascular disease 4.7% and peripheral vascular disease 1.9%. 3.5% had positive Hepatitis BsAg status.

5.2.4 Location where Transplant was Performed

Among prevalent patients in 2010, the transplants performed at the Singapore General Hospital constituted 49.0%, followed by transplants performed at overseas centres at 30.2% and those performed at the National University Hospital at 16.6%.

Among prevalent patients in 2011, the transplants performed at the Singapore General Hospital constituted 48.7%, followed by transplants performed at overseas centres at 29.7% and those performed at the National University Hospital at 16.9%.

5.2.5 Donor Type

Among prevalent patients in 2010, deceased-donor transplantation constituted the highest at 66.6% (592 local, 317 overseas). Live-donor transplant, either biologically or emotionally related was the next most common at 26.5% (357 local, 22 overseas), while unrelated live-donor transplant constituted 5.4%.

Among prevalent patients in 2011, deceased-donor transplantation constituted the highest at 65.7% (602 local, 320 overseas). Live-donor transplant, either biologically or emotionally related was the next most common at 28.9% (380 local, 25 overseas), while unrelated live-donor transplant constituted 5.2%.

5.2.6 Survival Analysis

Transplant patient survival was 97.7% at 1 year and 92.5% at 5 years for patients transplanted in the period 1999 to 2011. The corresponding 1 and 5-year graft survivals were 95.0% and 89.8% respectively.

6 STOCK AND FLOW

The number of new and prevalent dialysis patients has increased over the years (incidence 663, prevalence 3565 in 2005; incidence 904, prevalence 4895 in 2011). The number of renal transplants hovered between 84 in 2010 and 124 in 2006. Patients with functioning transplant have increased from 1112 to 1403 over the same period. See Table 6.1.

Table 6.1: STOCK AND FLOW OF RRT, 2005 – 2011

Stock and Flow of RRT 2005 - 2011	2005	2006	2007	2008	2009	2010	2011
New Dialysis patients	663	728	762	770	770	741	904
New Transplants	117	124	112	104	96	84	91
Dialysis deaths	546	557	643	592	603	560	663
Transplant deaths*	23	20	29	25	27	18	20
Dialysis as at 31st December	3565	3774	3943	4174	4382	4596	4895
Functioning transplants as at 31st December	1112	1181	1232	1277	1325	1364	1403

* Refers to all transplant deaths that occurred among all new and functioning transplants during a particular year

Figure 6.1: NEW DIALYSIS PATIENTS, 1999 – 2011

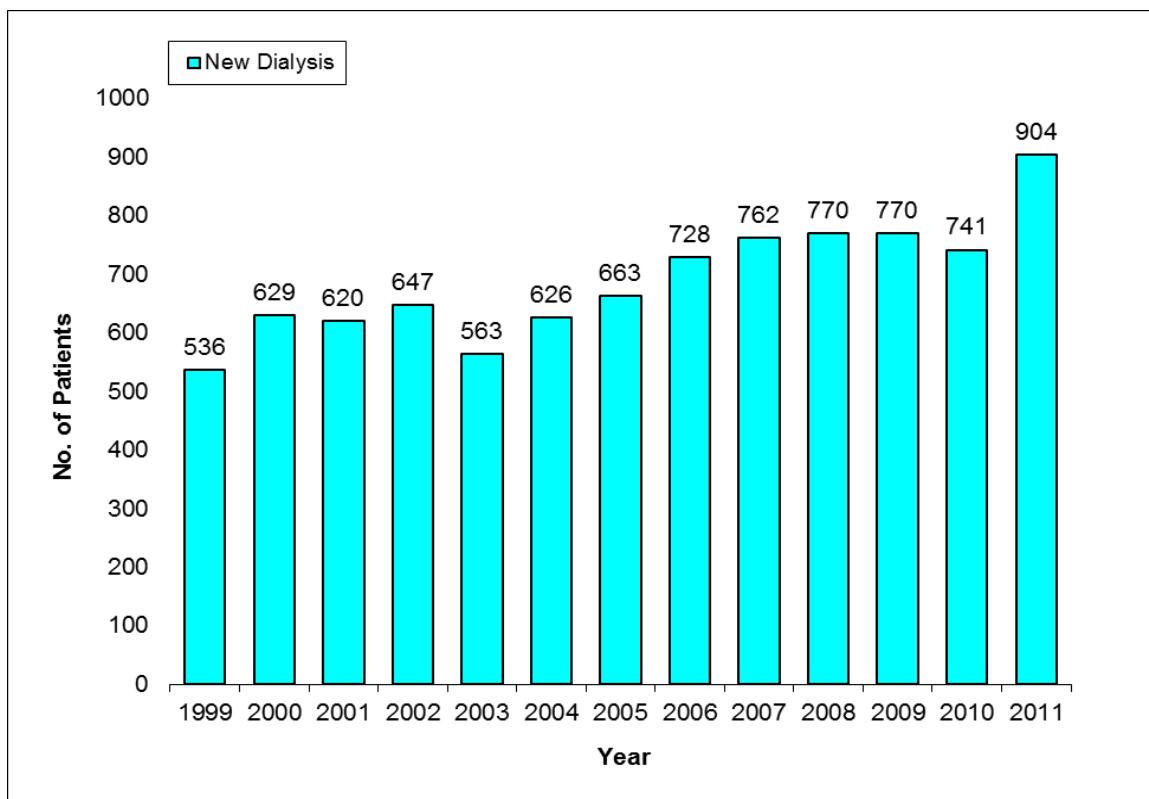


Figure 6.2: NEW TRANSPLANTS, 1999 – 2011

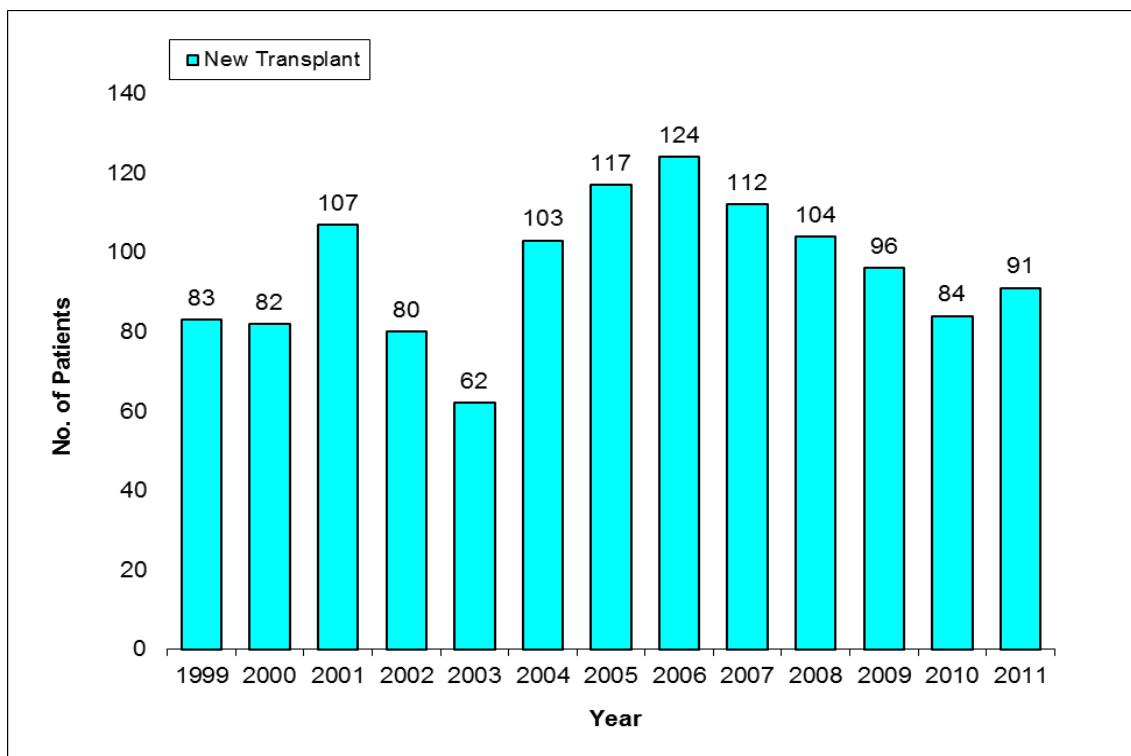


Figure 6.3: PREVALENT DIALYSIS PATIENTS AS AT 31ST DECEMBER, 1999 – 2011

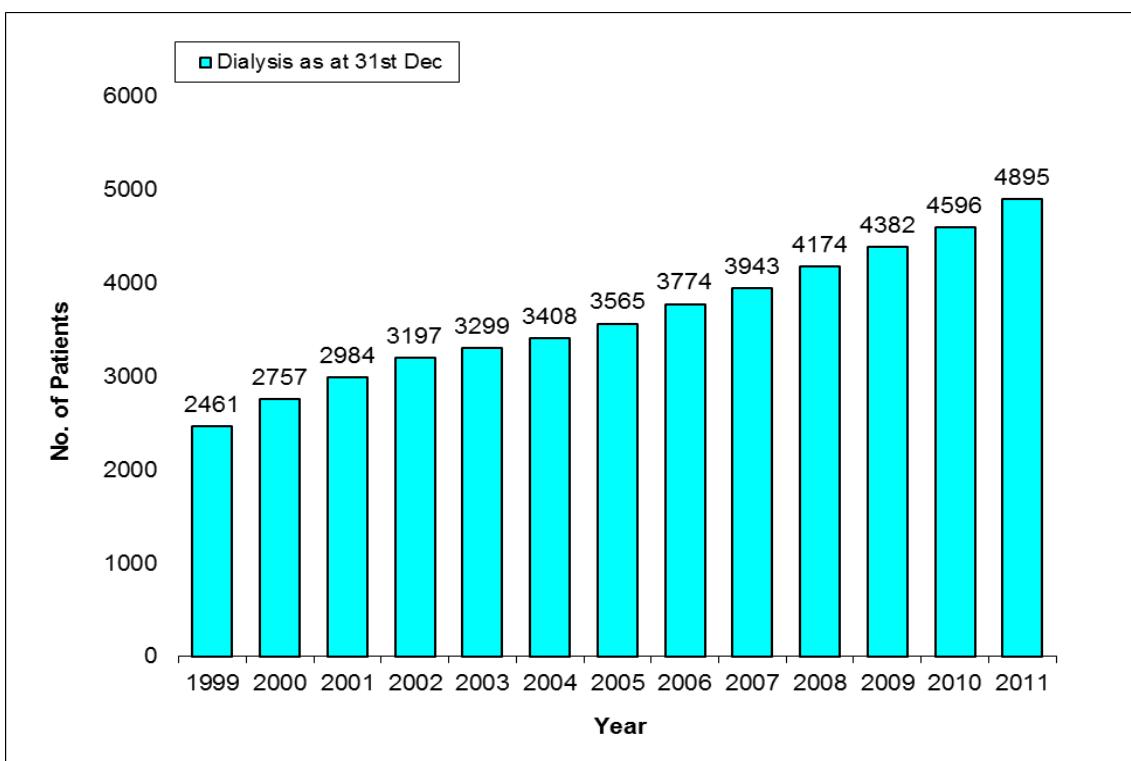
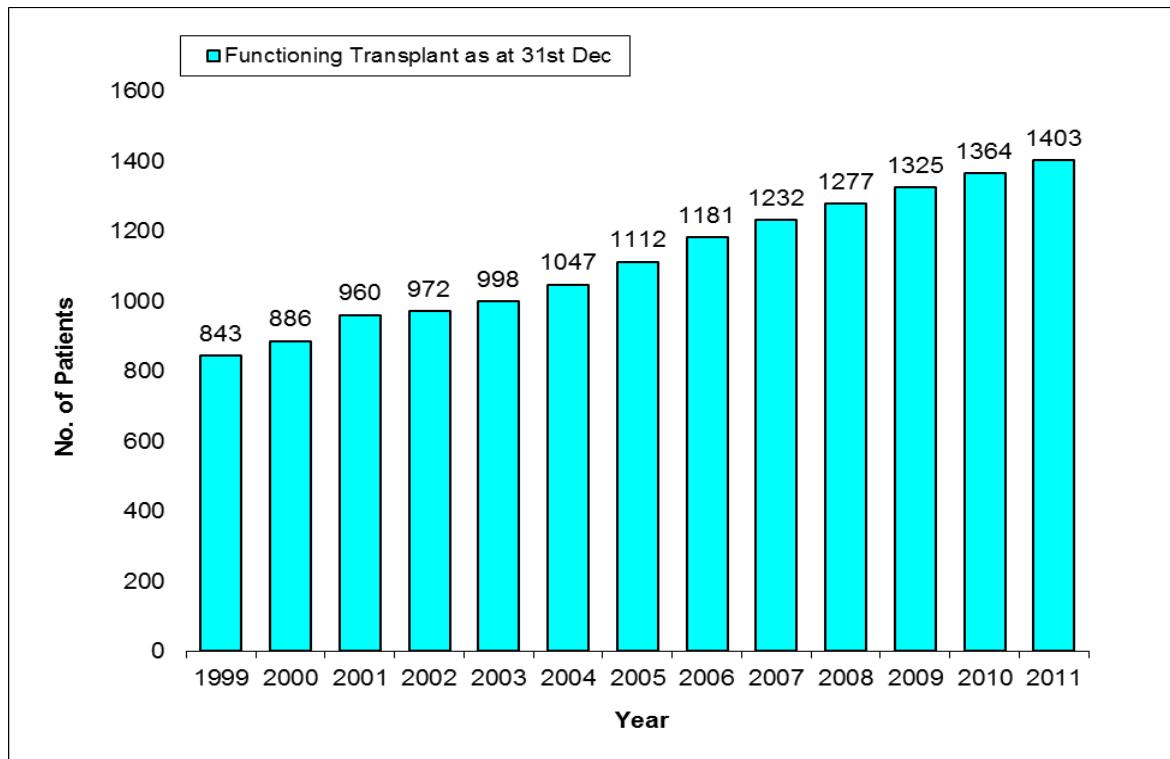


Figure 6.4: FUNCTIONING TRANSPLANT AS AT 31ST DECEMBER, 1999 – 2011



7 THE DIALYSIS POPULATION

7.1 Incidence and Prevalence

7.1.1 Introduction

This section reports the incidence and prevalence of Chronic Kidney Disease Stage 5 (CKD5) treated with dialysis. Incidence is defined as the number of new CKD5 patients treated with dialysis in a year while prevalence is defined as the total number of cases of CKD5 on dialysis at a specific time point, namely, 31 December of the year in this report. Incidence is a measure of development of renal disease in the population whereas prevalence describes the burden of renal disease in the population.

Table 7.1.1.1: INCIDENT AND PREVALENT CKD5 PATIENTS

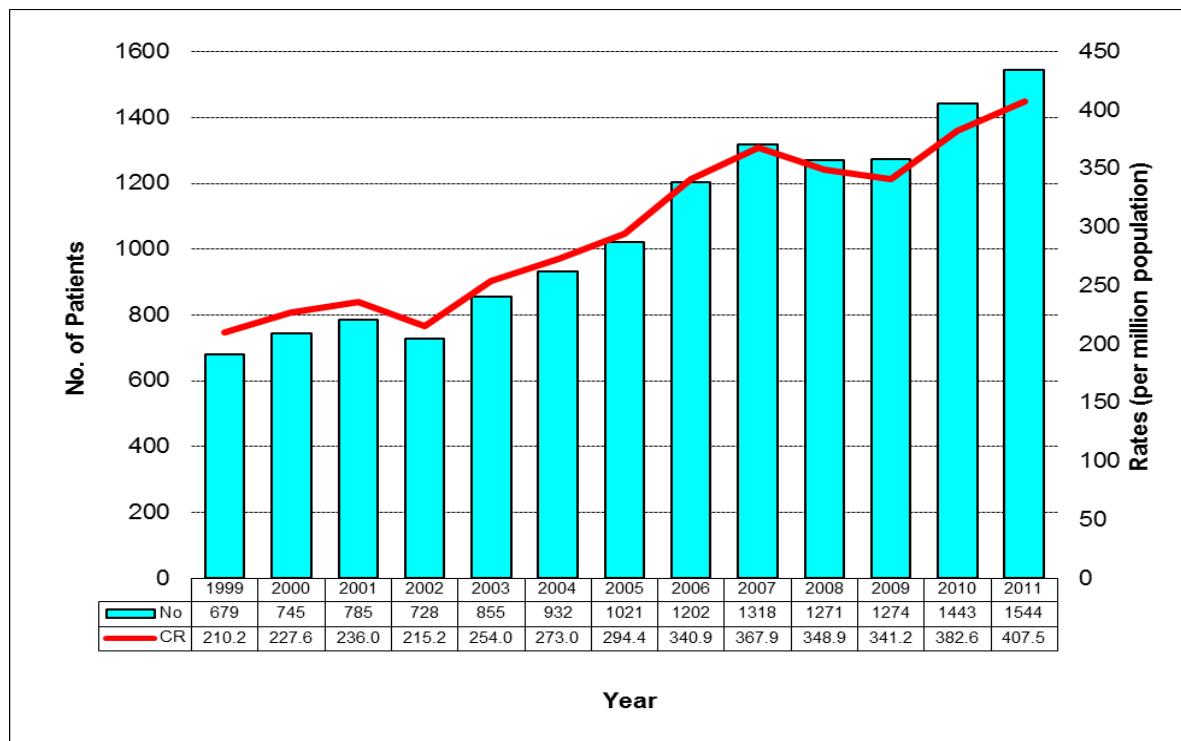
	2010			2011		
	No	CR*	ASR*	No	CR*	ASR*
New CKD5 patients	1443	382.6	273.1	1544	407.5	281.3
New patients ever started on dialysis	908	240.7	175.6	1049	276.8	197.1
- On Haemodialysis	833	220.9	160.7	965	254.7	181.0
- On Peritoneal Dialysis	75	19.9	14.9	84	22.2	16.2
New patients for preceding one year surviving 90 days	741	206.9	166.0	904	248.2	192.6
- On Haemodialysis	611	170.6	135.7	741	203.4	157.2
- On Peritoneal Dialysis	130	36.3	30.3	163	44.7	35.4
Prevalence of patients on Dialysis	4596	1218.5	896.4	4895	1291.8	919.2
- On Haemodialysis	4020	1065.8	778.4	4270	1126.9	795.2
- On Peritoneal Dialysis	576	152.7	118.0	625	164.9	124.0
Dialysis death for preceding one year	560	148.5	108.6	663	175.0	120.8
Transplanted in Singapore	61	16.2	-	67	17.7	-
Transplanted in Overseas	23	6.1	-	24	6.3	-
Transplanted death with functioning graft	18	4.8	-	18	4.8	-
Transplanted death with graft loss	0	0.0	-	2	0.5	-
Transplanted with graft loss	22	5.8	-	32	8.4	-
Prevalent Transplant Population	1364	361.6	265.1	1403	370.3	266.4

* per million residential population

^ Note that the ASRs were not computed, as the numbers were too small for meaningful analysis.

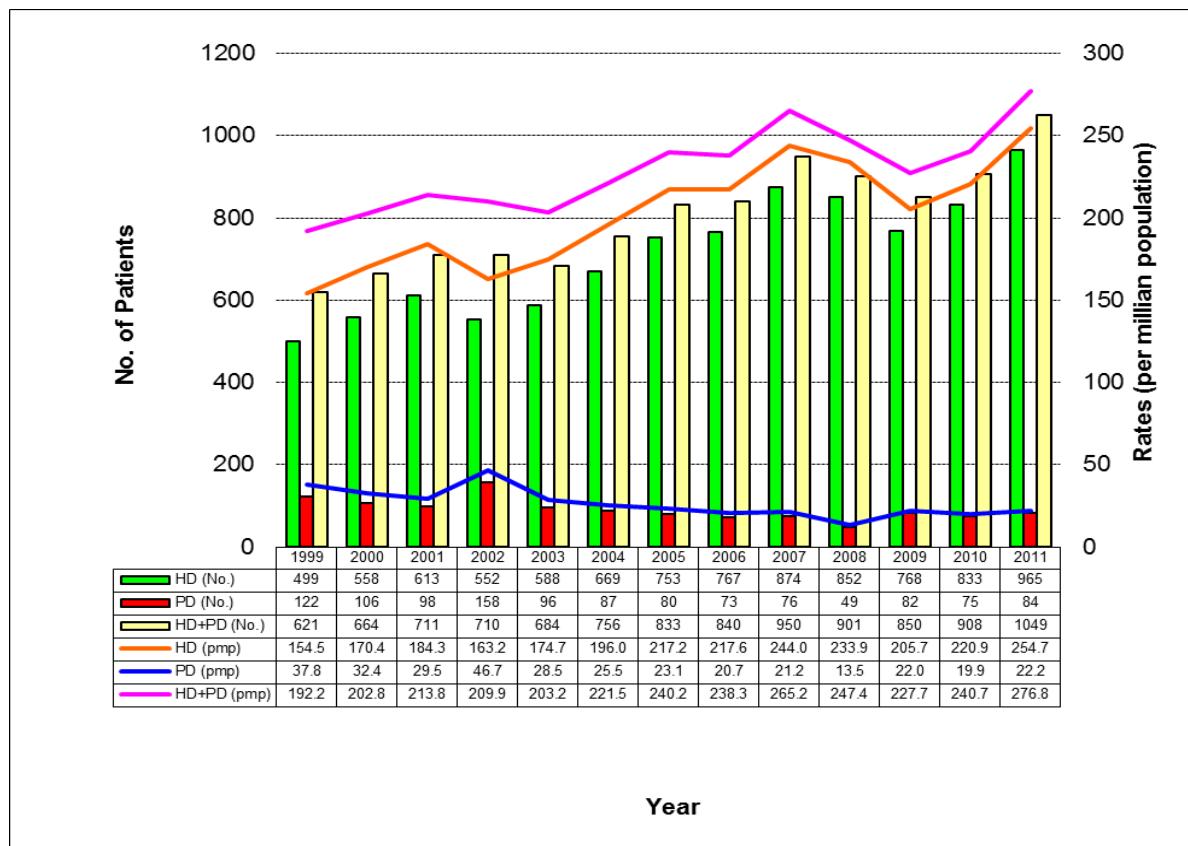
During the period of 1 January to 31 December in 2010, 1443 patients (CR 382.6 pmp; ASR 273.1 pmp) were diagnosed with CKD5 in 2010. See Figure 7.1.1.1. In the same year, 908 patients were started on dialysis. Of these, 741 patients (CR 206.9 pmp; ASR 166.0 pmp) survived 90 days after initiation in 2010.

During the period of 1 January to 31 December in 2011, 1544 patients (CR 407.5 pmp; ASR 281.3 pmp) were diagnosed with CKD5 in 2011. See Figure 7.1.1.1. In the same year, 1049 patients were started on dialysis. Of these, 904 patients (CR 248.2 pmp; ASR 192.6 pmp) survived 90 days after initiation in 2011. Patients, who were not started on dialysis, include CKD5 patients not needing dialysis as yet.

Figure 7.1.1.1: CRUDE RATES AND TOTAL FOR CKD5, 1999 – 2011

The time trend observed in patients initiating HD is different from that in patients initiating PD. See Figure 7.1.1.2.

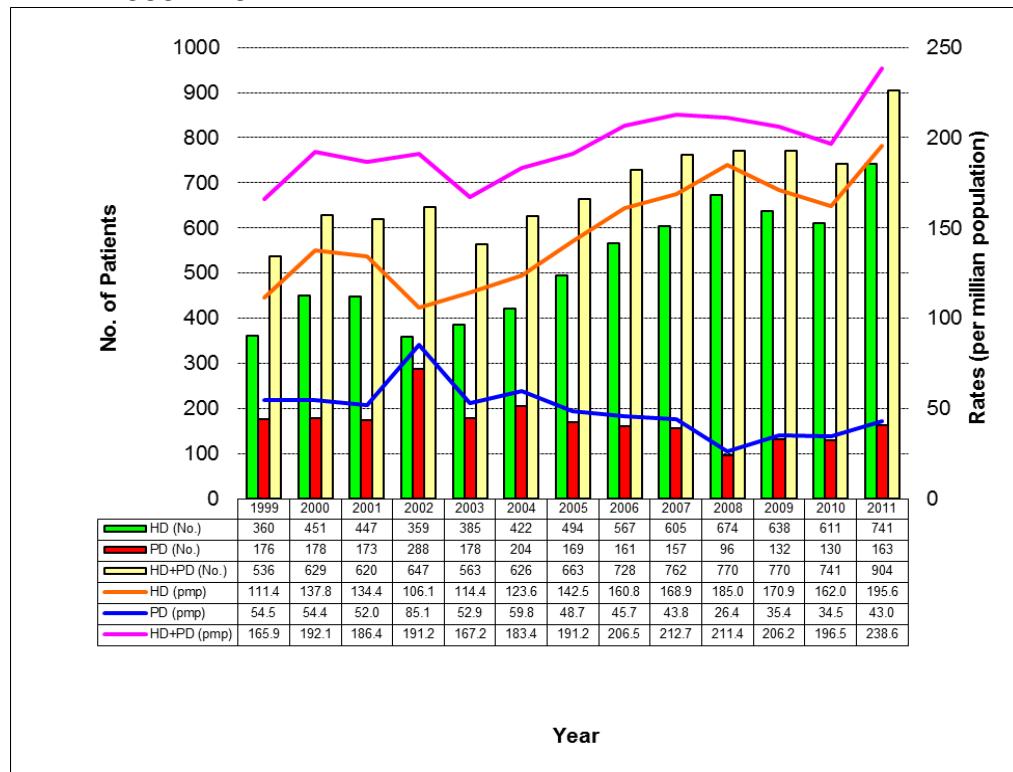
**Figure 7.1.1.2: CRUDE RATES AND TOTAL FOR EVER STARTED DIALYSIS,
1999 – 2011**



Subsequent information refers to the new patients who were still on dialysis 90 days after commencement.

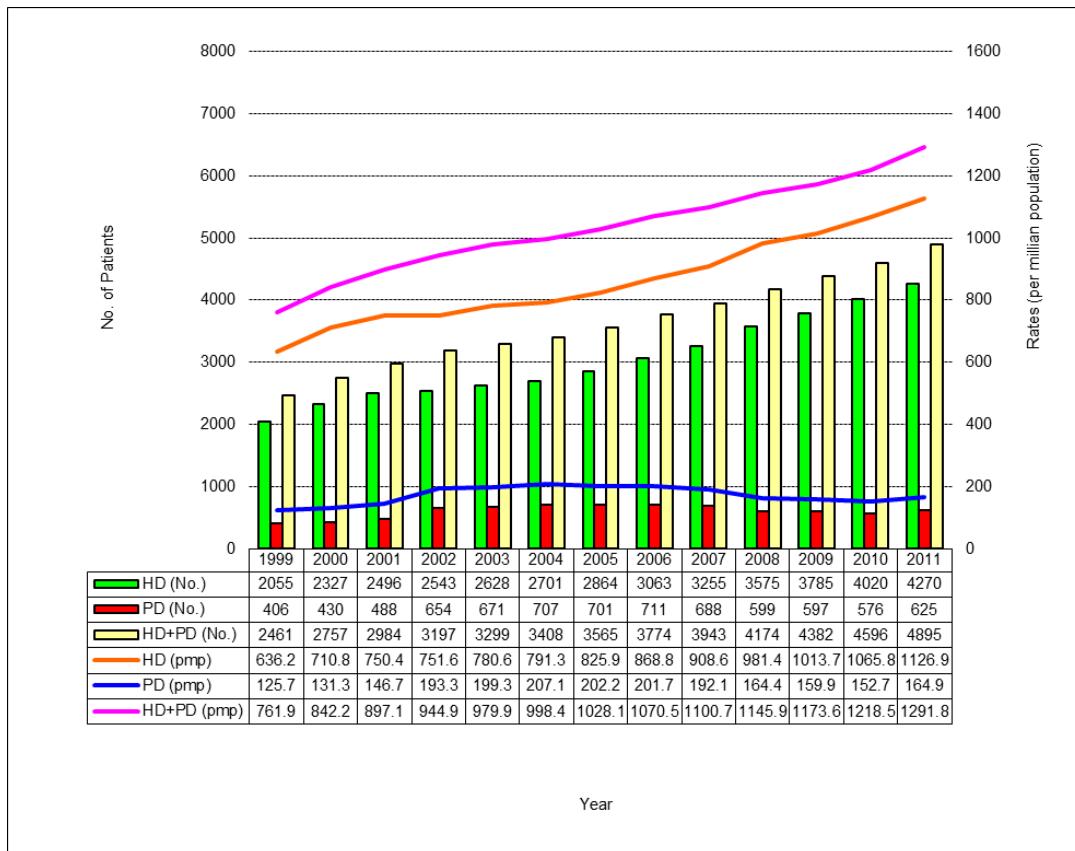
The number and rates of CKD5 patients who survived 90 days after initiation followed the trends for CKD5 patients initiated on dialysis. See Figure 7.1.1.3.

Figure 7.1.1.3: CRUDE RATES AND TOTAL FOR DEFINITIVE DIALYSIS, 1999 – 2011



There was an increasing number of prevalent patients in both dialysis modalities from 1999 to 2011. See Figure 7.1.1.4.

Figure 7.1.1.4: CRUDE RATES AND TOTAL FOR PREVALENT DIALYSIS PATIENTS, 1999 – 2011



7.1.2 Incident CKD5 Patients

7.1.2.1 Incident CKD5 Patients by Age Group and Gender

Of the CKD5 patients, the proportion of males was 53.4% in 2010 and 52.0% in 2011. The mean and median age was 64.2 years in 2010 and 65.4 years (median 65.9 years) in 2011; and the modal age group was 60-69 in both years. See Table 7.1.2.1.1.

Table 7.1.2.1.1a: INCIDENT CKD5 PATIENTS BY AGE GROUP AND GENDER, 2010

Age group	Male		Female		Both Genders	
	No	%	No	%	No	%
0-19	3	0.4	3	0.4	6	0.4
20-29	8	1.0	3	0.4	11	0.8
30-39	30	3.9	20	3.0	50	3.5
40-49	85	11.0	76	11.3	161	11.2
50-59	207	26.9	127	18.9	334	23.1
60-69	196	25.5	148	22.0	344	23.8
70-79	154	20.0	182	27.0	336	23.3
80+	87	11.3	114	16.9	201	13.9
All Age Groups	770	100	673	100	1443	100

Table 7.1.2.1.1b: INCIDENT CKD5 PATIENTS BY AGE GROUP AND GENDER, 2011

Age group	Male		Female		Both Genders	
	No	%	No	%	No	%
0-19	3	0.4	3	0.4	6	0.4
20-29	7	0.9	12	1.6	19	1.2
30-39	33	4.1	21	2.8	54	3.5
40-49	81	10.1	49	6.6	130	8.4
50-59	197	24.5	127	17.1	324	21.0
60-69	221	27.5	164	22.1	385	24.9
70-79	173	21.5	211	28.5	384	24.9
80+	88	11.0	154	20.8	242	15.7
All Age Groups	803	100	741	100	1544	100

7.1.2.2 Incident CKD5 Patients by Ethnic Group and Gender

The majority of patients were Chinese (70.1% in 2010, 69.4% in 2011) reflecting the racial distribution of the population (Table 7.1.2.2.1). The male to female ratio was about 1 to 0.9 in both years. There was a slight male predominance of males among the Chinese and Indians, while there were more female Malay CKD5 patients in both years.

Table 7.1.2.2.1a: INCIDENT CKD5 PATIENTS BY ETHNIC GROUP AND GENDER, 2010

Ethnic group	Male		Female		Both Genders	
	No	%	No	%	No	%
Chinese	559	72.6	453	67.3	1012	70.1
Malay	150	19.5	163	24.2	313	21.7
Indian	54	7.0	44	6.5	98	6.8
Others	7	0.9	13	1.9	20	1.4
All Ethnic Groups	770	100	673	100	1443	100

Table 7.1.2.2.1b: INCIDENT CKD5 PATIENTS BY ETHNIC GROUP AND GENDER, 2011

Ethnic group	Male		Female		Both Genders	
	No	%	No	%	No	%
Chinese	575	71.6	496	66.9	1071	69.4
Malay	149	18.6	185	25.0	334	21.6
Indian	68	8.5	46	6.2	114	7.4
Others	11	1.4	14	1.9	25	1.6
All Ethnic Groups	803	100	741	100	1544	100

7.1.2.3 Incident CKD5 Patients by Aetiology

Among the incident CKD5 patients, diabetic nephropathy (60.4% in 2010, 63.5% in 2011) was the most common cause of CKD5. Primary glomerulonephritis accounted for 15.1% in 2010 and 12.8% in 2011 while hypertension and renovascular disease accounted for 16.1% and 15.7% in 2010 and 2011 respectively (Table 7.1.2.3)

Table 7.1.2.3.1: INCIDENT CKD5 PATIENTS BY AETIOLOGY

Cause of CKD5	2010		2011	
	No	%	No	%
Diabetic Nephropathy (DN)	871	60.4	980	63.5
Primary Glomerulonephritis (GN)	218	15.1	197	12.8
Autoimmune Disease/GN with Systemic Manifestations	13	0.9	12	0.8
Hypertension and Renovascular Disease (HYP)	233	16.1	242	15.7
Polycystic Kidney Disease/Other Cystic Diseases	36	2.5	32	2.1
Vesicoureteric Reflux/Chronic Pyelonephritis	2	0.1	3	0.2
Obstruction	16	1.1	17	1.1
Stone Disease	7	0.5	1	0.1
Miscellaneous	42	2.9	52	3.4
Unknown	5	0.3	8	0.5
All Causes	1443	100	1544	100

In 2010, there were 6 patients with 0 co-morbidity, 134 patients with 1 co-morbidity, 202 with 2 co-morbidities and 399 patients with more than 2 co-morbidities. In 2011, there were 10 patients with 0 co-morbidity, 178 patients with 1 co-morbidity, 247 patients with 2 co-

morbidities and 469 patients with more than 2 co-morbidities. Diabetes Mellitus as a co-morbid condition occurred in 67.4% of CKD5 patients in 2010 and 70.9% in 2011. See Table 7.1.2.4.

Ischaemic heart disease was reported in 45.0% of patients in 2010 and 47.1% in 2011. Cerebrovascular Disease was reported at 27.6% in 2010 and 30.4% in 2011. Among the CKD5 patients, there were 11.2% current smokers in 2010 and 10.9% in 2011. Another 23.6% in 2010 and 21.2% in 2011 were former smokers. The smoking status was unknown in 4.3% of patients in 2010, 4.7% of patients in 2011.

7.1.2.4 Incident CKD5 Patients by Co-morbid Conditions

Table 7.1.2.4.1: INCIDENT CKD5 PATIENTS BY CO-MORBID CONDITIONS

Diabetic Mellitus	2010		2011	
	No	%	No	%
Yes	972	67.4	1094	70.9
No	471	32.6	448	29.0
Unknown	0	0.0	2	0.1
Total	1443	100	1544	100
<hr/>				
Ischaemic Heart Disease	2010		2011	
	No	%	No	%
Yes	649	45.0	727	47.1
No	792	54.9	815	52.8
Unknown	2	0.1	2	0.1
Total	1443	100	1544	100
<hr/>				
Cerebrovascular Disease	2010		2011	
	No	%	No	%
Yes	398	27.6	469	30.4
No	1045	72.4	1073	69.5
Unknown	0	0.0	2	0.1
Total	1443	100	1544	100
<hr/>				
Smoking	2010		2011	
	No	%	No	%
Current Smoker	162	11.2	169	10.9
Ex-Smoker	340	23.6	327	21.2
Non-Smoker/Never	879	60.9	975	63.1
Unknown	62	4.3	73	4.7
Total	1443	100	1544	100

7.1.2.5 Incident CKD5 Patients by Service Providers

About 96% of the new CKD5 patients was managed by the public acute hospitals, previously known as restructured hospitals. (Table 7.1.2.5)

Table 7.1.2.5.1: INCIDENT CKD5 PATIENTS BY SERVICE PROVIDERS

Service Provider	2010		2011	
	No	%	No	%
Public Acute Hospitals	1391	96.4	1485	96.2
Voluntary Welfare Organisations	0	0.0	0	0.0
Private Centres	52	3.6	59	3.8
All Providers	1443	100	1544	100

7.1.3 Incident Dialysis Patients

7.1.3.1 Incident Dialysis Patients by Age Group and Gender

Males comprised 55.2% in dialysis patients who survived 60 days after commencement of dialysis in 2010 while in 2010 this was 61.3% in 2011. Mean age was 61.3 years (median 61.5 years), modal age group was 60-69 years for 2010. The proportion of CKD5 patients aged 60 years and above at initiation of dialysis was 55.6%.

Corresponding figures for 2011 was mean age of 60.9 years (median 61.5 years); modal age group was 60-69 years, proportion of CKD5 patients aged 60 years and above at initiation of dialysis 55.0% (See Table 7.1.3.1.1).

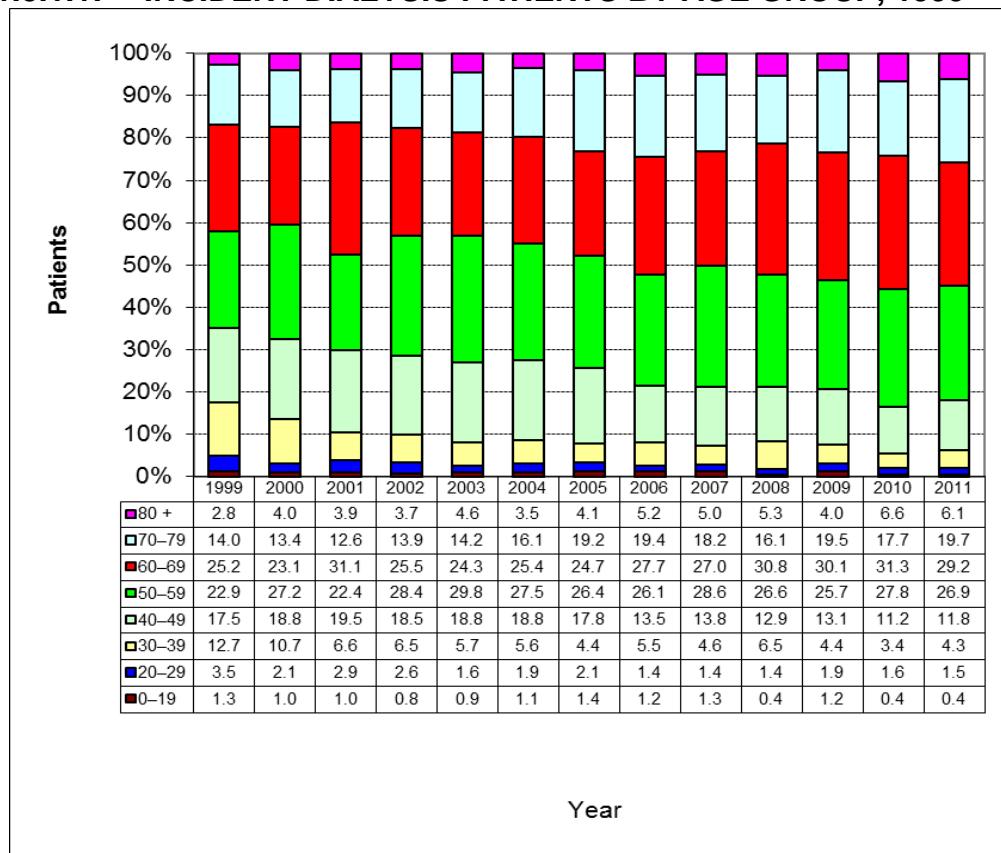
Table 7.1.3.1.1: INCIDENT DIALYSIS PATIENTS BY AGE GROUP AND GENDER

2010 AGE GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
0–19	1	0.2	2	0.6	3	0.4
20–29	6	1.5	6	1.8	12	1.6
30–39	15	3.7	10	3.0	25	3.4
40–49	39	9.5	44	13.3	83	11.2
50–59	126	30.8	80	24.1	206	27.8
60–69	133	32.5	99	29.8	232	31.3
70–79	61	14.9	70	21.1	131	17.7
80 +	28	6.8	21	6.3	49	6.6
All Age Groups	409	100	332	100	741	100

2011 AGE GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
0–19	1	0.2	3	0.9	4	0.4
20–29	9	1.6	5	1.4	14	1.5
30–39	27	4.9	12	3.4	39	4.3
40–49	73	13.2	34	9.7	107	11.8
50–59	149	26.9	94	26.9	243	26.9
60–69	166	30.0	98	28.0	264	29.2
70–79	102	18.4	76	21.7	178	19.7
80 +	27	4.9	28	8.0	55	6.1
All Age Groups	554	100	350	100	904	100

Figure 7.1.3.1.1 showed the trends in proportions of patients on dialysis from 1999 to 2011 by age group.

Figure 7.1.3.1.1: INCIDENT DIALYSIS PATIENTS BY AGE GROUP, 1999 – 2011



7.1.3.2 Incident Dialysis Patients by Age Group and Modality

With the exception of age group 0-19 years in 2011, there was a comparatively greater percentage of patients started on HD. See Table 7.1.3.2.1.

Table 7.1.3.2.1: INCIDENT DIALYSIS PATIENTS BY AGE GROUP AND MODALITY

2010 AGE GROUP	HD		PD	
	No	%	No	%
0-19	2	66.7	1	33.3
20-29	8	66.7	4	33.3
30-39	21	84.0	4	16.0
40-49	76	91.6	7	8.4
50-59	177	85.9	29	14.1
60-69	186	80.2	46	19.8
70-79	101	77.1	30	22.9
80 +	40	81.6	9	18.4
Total	611	82.5	130	17.5

2011 AGE GROUP	HD		PD	
	No	%	No	%
0–19	1	25.0	3	75.0
20–29	9	64.3	5	35.7
30–39	27	69.2	12	30.8
40–49	98	91.6	9	8.4
50–59	204	84.0	39	16.0
60–69	218	82.6	46	17.4
70–79	148	83.1	30	16.9
80 +	36	65.5	19	34.5
Total	741	82.0	163	18.0

7.1.3.3 Incident Dialysis Patients by Ethnic Group and Gender

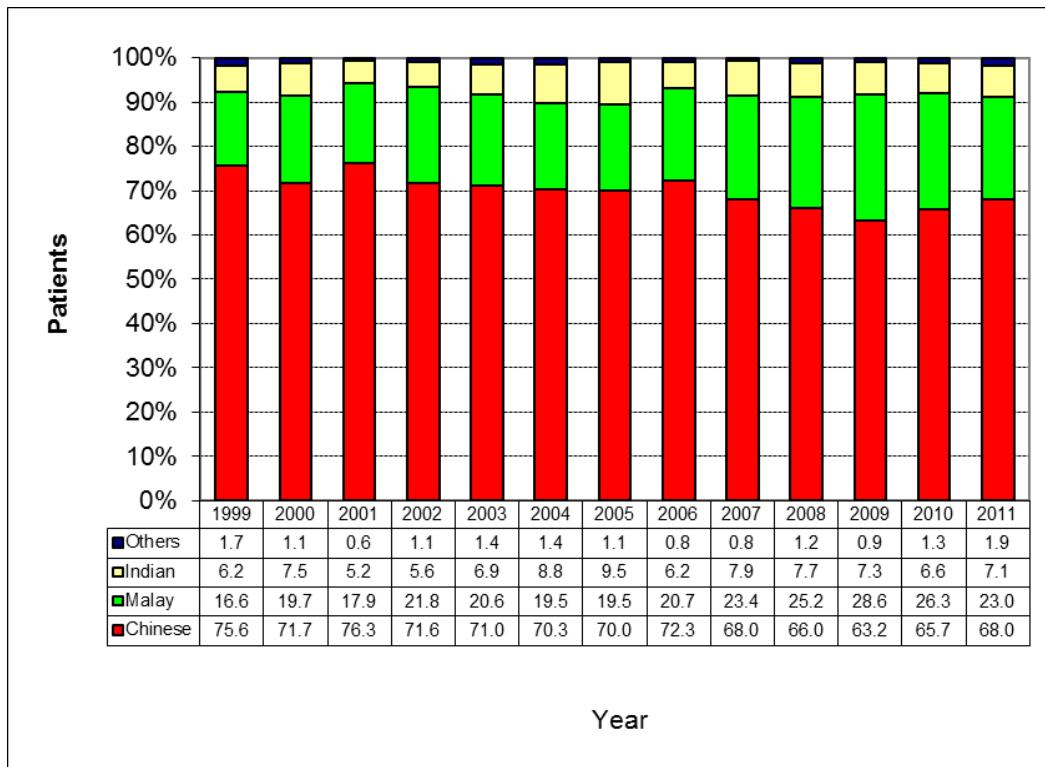
In both years, the racial composition is similar to the racial distribution of the population. There is a male predominance in Chinese but female predominance in Malay and other races.

Table 7.1.3.3.1: INCIDENT DIALYSIS PATIENTS BY ETHNIC GROUP AND GENDER

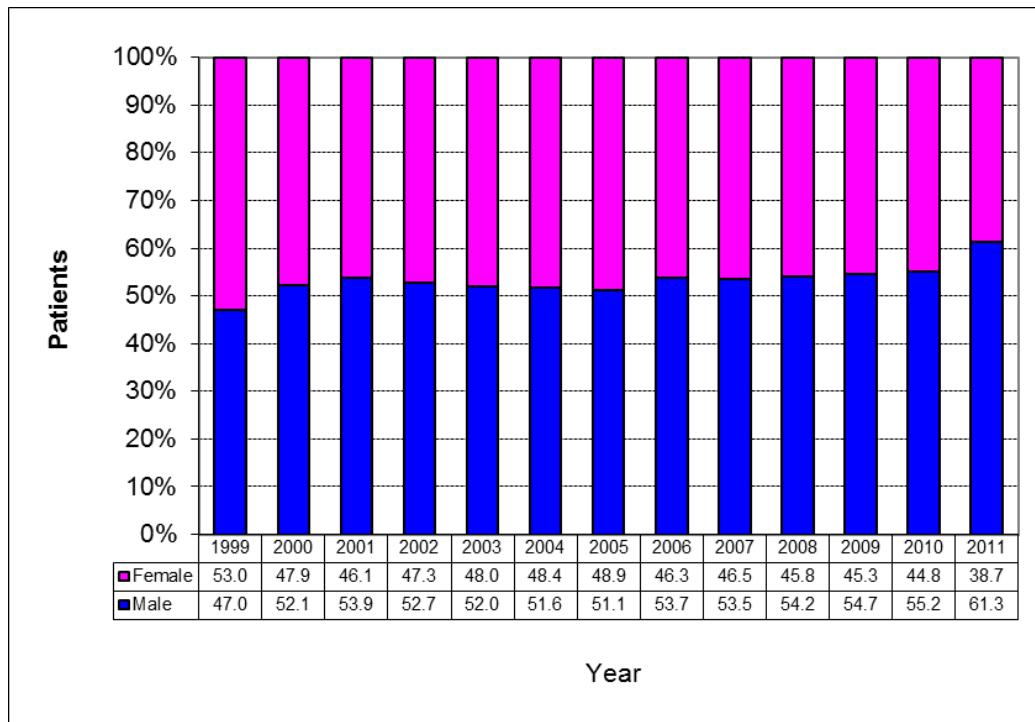
2010 ETHNIC GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
Chinese	294	71.9	193	58.1	487	65.7
Malay	85	20.8	110	33.1	195	26.3
Indian	25	6.1	24	7.2	49	6.6
Others	5	1.2	5	1.5	10	1.3
All Ethnic Groups	409	100	332	100	741	100

2011 ETHNIC GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
Chinese	396	71.5	219	62.6	615	68.0
Malay	107	19.3	101	28.9	208	23.0
Indian	43	7.8	21	6.0	64	7.1
Others	8	1.4	9	2.6	17	1.9
All Ethnic Groups	554	100	350	100	904	100

In the period 1999–2011, the proportion of Chinese dialysis patients was the highest among the different ethnic groups and maintained above 60% almost every year. See Figure 7.1.3.3.1.

Figure 7.1.3.3.1: INCIDENT DIALYSIS PATIENTS BY ETHNIC GROUP, 1999 – 2011

With the exception of year 1999, the proportion of male dialysis patients was greater than that for females for the period 1999 to 2011. See Figure 7.1.3.3.2.

Figure 7.1.3.3.2: INCIDENT DIALYSIS PATIENTS BY GENDER, 1999 – 2011

7.1.4 Prevalent Dialysis Patients

7.1.4.1 Prevalent Dialysis Patients by Age Group and Gender

There were 4596 prevalent dialysis patients (CR 1218.5 pmp; ASR 896.4 pmp) at the end of 2010 (Table 7.1.1.1). Of these, 52.6% (CR 1299.8 pmp; ASR 981.4 pmp) were males. The mean age was 60.4 years (median 60.9 years). The proportion aged 60 years and above was 52.9% (Table 7.1.4.1.1).

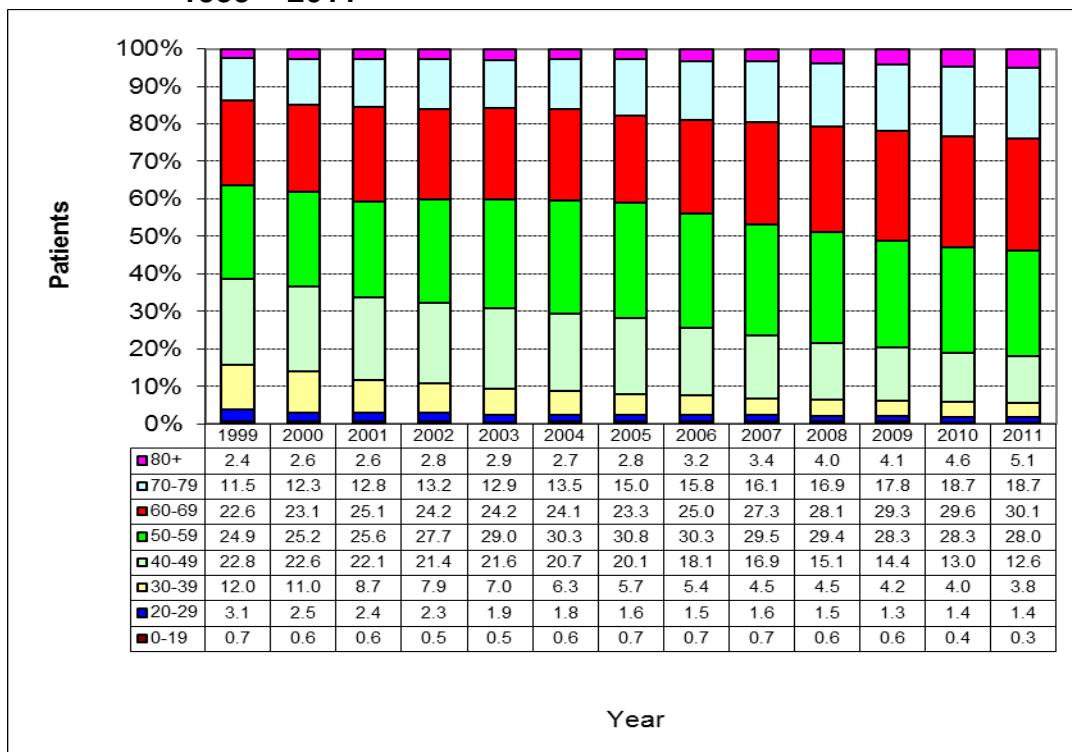
At the end of 2011, there were 4895 prevalent dialysis patients (CR 1291.8 pmp, ASR 919.2 pmp). 54.5% of them (CR 1429.2 pmp; ASR 1045.0 pmp) were males, mean age 60.7 years (median 61.2 years), proportion aged 60 years and above 53.9%.

Table 7.1.4.1.1: PREVALENT DIALYSIS PATIENTS BY AGE GROUP AND GENDER

2010 AGE GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
0–19	6	0.2	11	0.5	17	0.4
20–29	38	1.6	25	1.1	63	1.4
30–39	103	4.3	82	3.8	185	4.0
40–49	317	13.1	282	13.0	599	13.0
50–59	711	29.4	590	27.1	1301	28.3
60–69	737	30.5	622	28.6	1359	29.6
70–79	412	17.0	447	20.5	859	18.7
80 +	95	3.9	118	5.4	213	4.6
All Age Groups	2419	100	2177	100	4596	100

2011 AGE GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
0–19	7	0.3	10	0.4	17	0.3
20–29	43	1.6	24	1.1	67	1.4
30–39	107	4.0	78	3.5	185	3.8
40–49	343	12.8	273	12.3	616	12.6
50–59	763	28.6	609	27.4	1372	28.0
60–69	829	31.0	644	28.9	1473	30.1
70–79	457	17.1	459	20.6	916	18.7
80 +	121	4.5	128	5.8	249	5.1
All Age Groups	2670	100	2225	100	4895	100

The trends in age groups are shown in Figure 7.1.4.1.1. The proportion of patients in age groups 60 years and above increased while the remaining age groups decreased or remained constant. Notably, proportion of dialysis patients aged 60 years and above increased from 36.5% in 1999 to 53.9% in 2011.

Figure 7.1.4.1.1: PREVALENT DIALYSIS PATIENTS BY AGE GROUP, 1999 – 2011

7.1.4.2 Prevalent Dialysis Patients by Age Group and Modality

Among the middle-aged and elderly, the proportion of HD patients hovered between 85% and 90%. See Table 7.1.4.2.1.

Table 7.1.4.2.1: PREVALENT DIALYSIS PATIENTS BY AGE GROUP AND MODALITY

2010 AGE GROUP	HD		PD	
	No	%	No	%
0–19	2	11.8	15	88.2
20–29	39	61.9	24	38.1
30–39	164	88.6	21	11.4
40–49	537	89.6	62	10.4
50–59	1151	88.5	150	11.5
60–69	1189	87.5	170	12.5
70–79	746	86.8	113	13.2
80 +	192	90.1	21	9.9
Total	4020	87.5	576	12.5

2011 AGE GROUP	HD		PD	
	No	%	No	%
0–19	1	5.9	16	94.1
20–29	41	61.2	26	38.8
30–39	162	87.6	23	12.4
40–49	549	89.1	67	10.9
50–59	1230	89.7	142	10.3
60–69	1274	86.5	199	13.5
70–79	803	87.7	113	12.3
80 +	210	84.3	39	15.7
Total	4270	87.2	625	12.8

7.1.4.3 Prevalent Dialysis Patients by Ethnic Group and Gender

In both years, the racial composition is similar to the racial distribution of the population. There is a male predominance in Chinese and Indians but female predominance in Malay and other races.

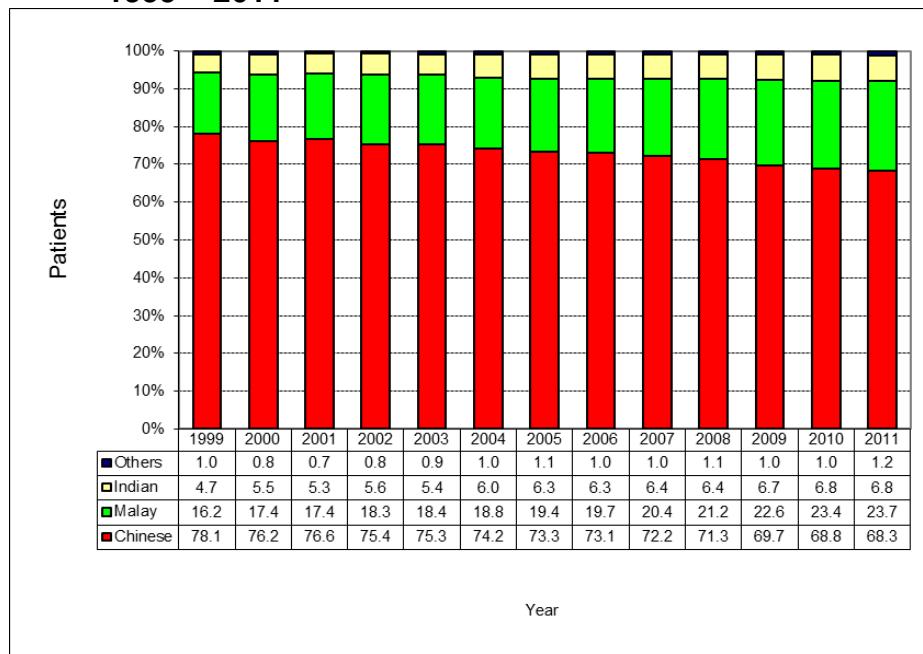
Table 7.1.4.3.1: PREVALENT DIALYSIS PATIENTS BY ETHNIC GROUP AND GENDER

2010 ETHNIC GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
Chinese	1736	71.8	1424	65.4	3160	68.8
Malay	485	20.0	591	27.1	1076	23.4
Indian	175	7.2	137	6.3	312	6.8
Others	23	1.0	25	1.1	48	1.0
All Ethnic Groups	2419	100	2177	100	4596	100

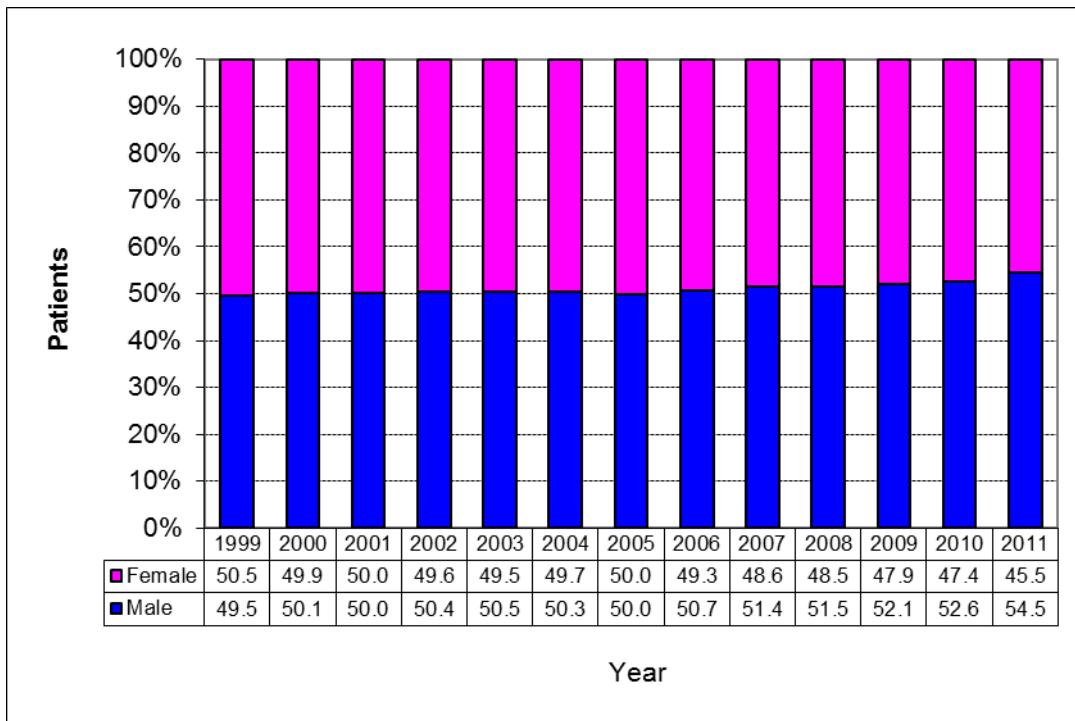
2011 ETHNIC GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
Chinese	1902	71.2	1442	64.8	3344	68.3
Malay	544	20.4	617	27.7	1161	23.7
Indian	197	7.4	135	6.1	332	6.8
Others	27	1.0	31	1.4	58	1.2
All Ethnic Groups	2670	100	2225	100	4895	100

As in incident dialysis patients, the racial composition is similar to the racial distribution of the population in both years. See Figure 7.1.4.3.1.

Figure 7.1.4.3.1: PREVALENT DIALYSIS PATIENTS BY ETHNIC GROUP, 1999 – 2011



The proportion of Chinese has been dropping from 78.1% in 1999 to 68.3% in 2011. During this time, the proportions of Indians (4.7 to 6.8%) and Malays (16.2 to 23.7%) have increased. In 1999 the proportion of prevalent dialysis was slightly higher in females, the trends reversed from year 2000 onwards. See Figure 7.1.4.3.2.

Figure 7.1.4.3.2: PREVALENT DIALYSIS PATIENTS BY GENDER, 1999 – 2011

7.1.5 Mortality

There were 560 dialysis deaths (CR 148.5 pmp; ASR 108.6 pmp) in 2010. Of these deaths, 434 of them (CR 115.1 pmp; ASR 83.8 pmp) were on HD and 126 (CR 33.4 pmp; ASR 24.9 pmp) were on PD programmes prior to their demise. Mortality is further discussed in Section 7.9.

In 2011, there were 663 dialysis deaths (CR 174.9 pmp; ASR 101.9 pmp) were on HD and 104 (CR 27.4 pmp; ASR 18.8 pmp) were on PD programmes prior to their demise.

7.2 Aetiology of Renal Failure

7.2.1 Incident Patients

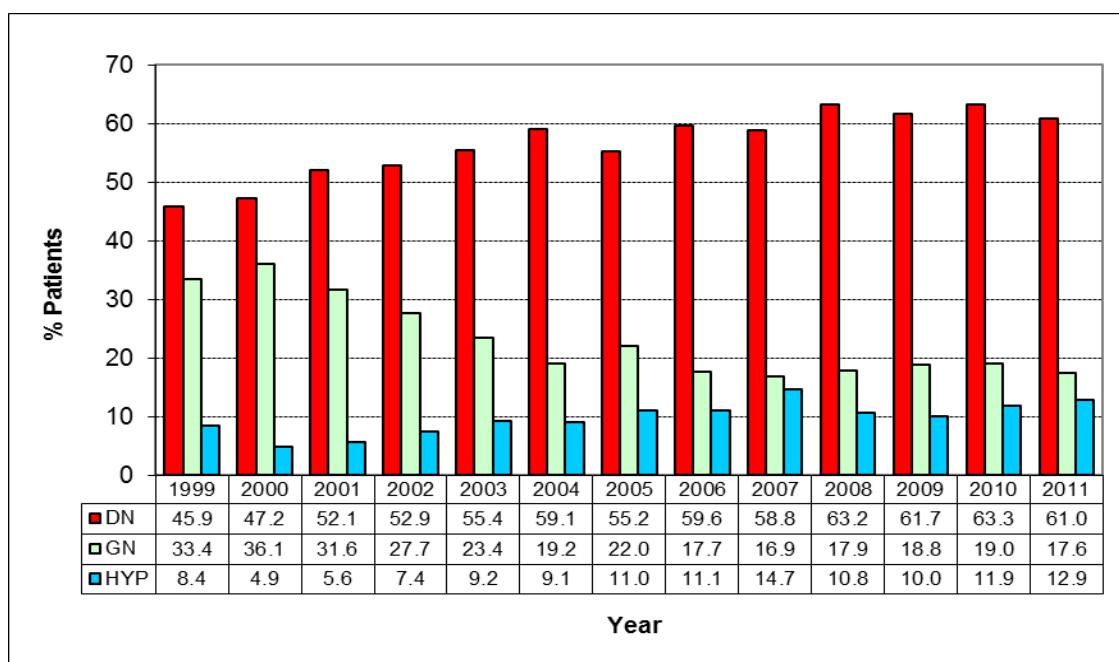
Among the 741 new patients, diabetic nephropathy (63.3%) was the most common cause of end-stage renal failure in 2010. Primary glomerulonephritis accounted for 19.0% of cases while hypertension and renovascular disease accounted for 11.9% (Table 7.2.1.1).

Among the 904 new patients, diabetic nephropathy (61.0%) was the most common cause of end-stage renal failure in 2011. Primary glomerulonephritis accounted for 17.6% of cases while hypertension and renovascular disease accounted for 12.9% (Table 7.2.1.1).

Table 7.2.1.1: INCIDENT DIALYSIS PATIENTS BY AETIOLOGY OF RENAL FAILURE

Cause of CKD5	2010		2011	
	No	%	No	%
Diabetic Nephropathy	469	63.3	551	61.0
Primary Glomerulonephritis (GN)	141	19.0	159	17.6
Autoimmune Disease/GN with Systemic Manifestations	6	0.8	9	1.0
Hypertension and Renovascular Disease	88	11.9	117	12.9
Polycystic Kidney Disease / Other Cystic Diseases	15	2.0	20	2.2
Vesicoureteric Reflex / Chronic Pyelonephritis	0	0.0	3	0.3
Obstruction	2	0.3	8	0.9
Stone Disease	1	0.1	2	0.2
Miscellaneous	17	2.3	28	3.1
Unknown	2	0.3	7	0.8
All Causes	741	100	904	100

Figure 7.2.1.1: INCIDENT DIALYSIS PATIENTS BY AETIOLOGY (DIABETIC NEPHROPATHY, PRIMARY GLOMERULONEPHRITIS AND HYPERTENSION/RENOVASCULAR DISEASE), 1999 – 2011



Among the 141 cases of primary glomerulonephritis in 2010, 37.6% (53/141) were biopsy-proven. Among the 159 cases of primary glomerulonephritis in 2011, 35.8% (57/159) were biopsy-proven. The remainder were presumptive based on evidence of small kidneys with smooth contour on ultrasound examination, proteinuria of >1 g/day, haematuria, and/or a history of "nephritis".

Causes of all biopsy-proven cases in both primary and secondary glomerulonephritis are shown in Table 7.2.1.2.

IgA Nephropathy was the most common biopsy-proven glomerulonephritis in 2010 (52.8% (28/53)).

Systemic Lupus Erythematosus comprised 83.3% of secondary glomerulonephritis in 2010 and 77.8% in 2011. It also made up 3.4% (5/147) of all glomerulonephritis (primary and secondary) in 2010 while 4.2% (7/168) in 2011.

Table 7.2.1.2: INCIDENT DIALYSIS PATIENTS BY GLOMERULONEPHRITIS

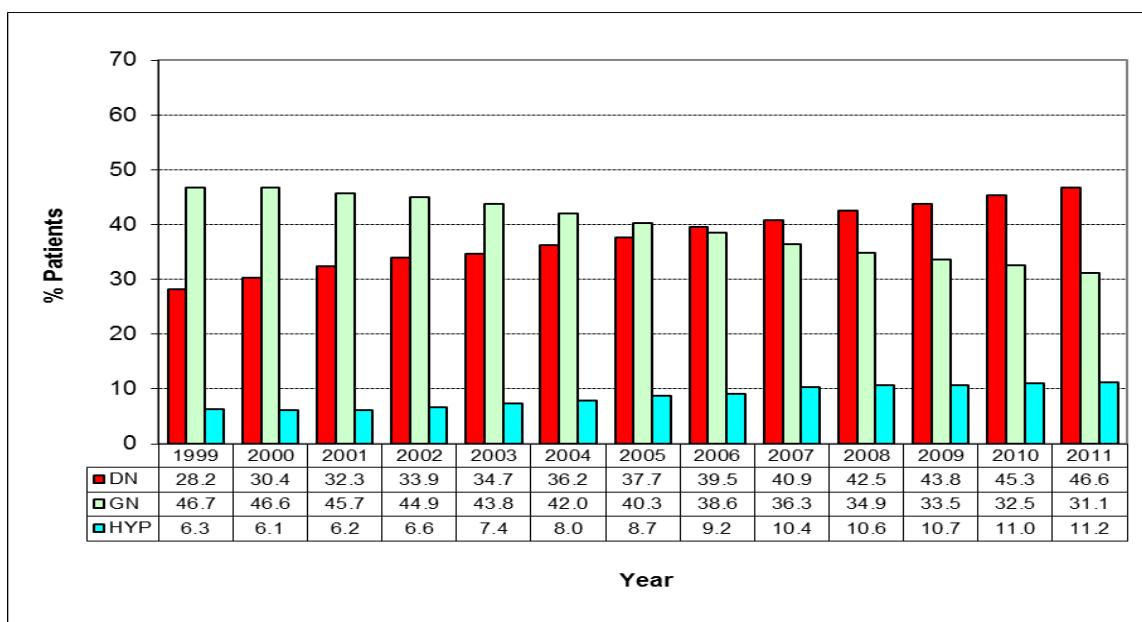
GLOMERULONEPHRITIS	2010		2011	
	No	%	No	%
Primary Glomerulonephritis (No Biopsy)				
Presumed Glomerulonephritis	88	62.4	102	64.2
Primary Glomerulonephritis (with Biopsy)				
Histology undefinable; advanced	2	1.4	1	0.6
Focal sclerosing Glomerulonephritis	18	12.8	28	17.6
IgA Nephropathy	28	19.9	18	11.3
Crescentric GN (otherwise not specified): RPGN	3	2.1	3	1.9
Membranous (epimembranous) Glomerulonephritis	1	0.7	4	2.5
Focal segmental proliferative (include focal necrosis)	0	0.0	1	0.6
GN: Minimal lesion	0	0.0	1	0.6
IgM Nephropathy	1	0.7	1	0.6
Sub-total Primary Glomerulonephritis (with Biopsy)	53	37.6	57	35.8
Total Primary Glomerulonephritis	141	100	159	100
Secondary Glomerulonephritis				
Systemic Lupus Erythematosus	5	83.3	7	77.8
Goodpastures (anti-GBM with lung involvement)	0	0.0	1	11.1
ANCA positive GN	1	16.7	0	0.0
HIV Nephropathy	0	0.0	1	11.1
Total Secondary Glomerulonephritis	6	100	9	100
All Glomerulonephritis	147	19.8	168	18.6
All Biopsy proven Glomerulonephritis	59	8.0	66	7.3
All CKD5	741		904	

7.2.2 Prevalent Patients

The commonest overall cause of CKD5 in the existing dialysis population in 2010 and 2011 was diabetic nephropathy with 45.3% and 46.6% respectively. Primary and secondary glomerulonephritis comprised 34.9% in 2010 while 33.4% in 2011.

Table 7.2.2.1: PREVALENT DIALYSIS PATIENTS BY AETIOLOGY OF RENAL FAILURE

Cause of CKD5	2010		2011	
	No	%	No	%
Diabetic Nephropathy	2081	45.3	2283	46.6
Primary Glomerulonephritis (GN)	1495	32.5	1524	31.1
Autoimmune Disease/GN with Systemic Manifestations	112	2.4	114	2.3
Hypertension and Renovascular Disease	507	11.0	548	11.2
Polycystic Kidney Disease / Other Cystic Diseases	131	2.9	144	2.9
Vesicoureteric Reflex / Chronic Pyelonephritis	25	0.5	27	0.6
Obstruction	39	0.8	41	0.8
Stone Disease	13	0.3	13	0.3
Miscellaneous	115	2.5	124	2.5
Unknown	78	1.7	77	1.6
All Causes	4596	100	4895	100

Figure 7.2.2.1: PREVALENT DIALYSIS PATIENTS BY AETIOLOGY (DIABETIC NEPHROPATHY, PRIMARY GLOMERULONEPHRITIS AND HYPERTENSION/RENOVASCULAR DISEASE), 1999 – 2011

There continues to be an increasing proportion of patients with diabetic nephropathy, and a decreasing proportion of patients with primary glomerulonephritis as the etiology.

Among the 1495 cases of primary glomerulonephritis in 2010, 1109 cases (74.2%) were not biopsy-proven. Among the 1524 cases of primary glomerulonephritis in 2011, 1112 cases (73.0%) were not biopsy-proven.

Causes of all biopsy-proven cases of both primary and secondary glomerulonephritis are shown in Table 7.2.2.2.

In 2010, IgA Nephropathy represented 57.8% (223/386) of biopsy-proven primary glomerulonephritis. 10.1% (39/386) of primary glomerulonephritis cases with biopsy were histologically undefinable or inconclusive. Systemic Lupus Erythematosus comprised 84.8% (95/112) of secondary glomerulonephritis. It also made up 5.9% (95/1607) of all glomerulonephritis.

In 2011, IgA Nephropathy represented 53.9% (222/412) of biopsy-proven primary glomerulonephritis. 9.0% (37/412) of primary glomerulonephritis cases with biopsy were histologically undefinable or inconclusive. Systemic Lupus Erythematosus comprised 83.3% (95/114) of secondary glomerulonephritis. It also made up 5.8% (95/1638) of all glomerulonephritis.

Table 7.2.2.2: PREVALENT DIALYSIS PATIENTS BY BIOPSY-PROVEN GLOMERULONEPHRITIS

GLOMERULONEPHRITIS	2010		2011	
	No	%	No	%
Primary Glomerulonephritis (No Biopsy)				
Presumed Glomerulonephritis	1109	74.2	1112	73.0
Primary Glomerulonephritis (with Biopsy)				
Histology undefinable; advanced	39	2.6	37	2.4
Focal sclerosing Glomerulonephritis	80	5.4	103	6.8
IgA Nephropathy	223	14.9	222	14.6
Mesangiocapillary/membranoproliferative Type I (DDD)	1	0.1	2	0.1
Membranous (epimembranous) Glomerulonephritis	13	0.9	15	1.0
Crescentic GN (otherwise not specified): RPGN	12	0.8	13	0.9
Mesangial proliferative (non IgA)	8	0.5	7	0.5
Mesangial proliferative no IMF	1	0.1	1	0.1
Focal segmental proliferative (include focal necrosis)	0	0.0	1	0.1
GN: Minimal lesion	1	0.1	2	0.1
IgM Nephropathy	7	0.5	8	0.5
Other Primary Glomerulonephritis	1	0.1	1	0.1
Sub-total Primary Glomerulonephritis (with Biopsy)	386	25.8	412	27
Total Primary Glomerulonephritis	1495	100	1524	100
Secondary Glomerulonephritis				
Henoch-Schonlein Glomerulonephritis	5	4.5	5	4.4
Goodpastures (anti-GBM with lung involvement)	5	4.5	6	5.3
Systemic Lupus Erythematosus	95	84.8	95	83.3
Wegener (extra renal granuloma proven)	2	1.8	2	1.8
ANCA positive GN	3	2.7	3	2.6
Scleroderma	1	0.9	1	0.9
HIV Nephropathy	0	0.0	1	0.9
HBsAG associated GN	1	0.9	1	0.9
Total Secondary Glomerulonephritis	112	100	114	100
All Glomerulonephritis	1607	35.0	1638	33.5
All Biopsy proven Glomerulonephritis	498	10.8	526	10.7
All CKD5	4596		4895	

Miscellaneous causes of renal failure for 2010, 2011 are listed in Table 7.2.2.3.

Table 7.2.2.3: PREVALENT DIALYSIS PATIENTS BY MISCELLANEOUS CAUSES OF RENAL FAILURE

Miscellaneous Cause of Renal Failure	2010		2011	
	No	%	No	%
Amyloid glomerulopathy	0	0.0	1	0.8
Drug induced glomerulopathy incl heroin	1	0.9	2	1.6
Alport's disease (classical)	4	3.5	4	3.2
Analgesic nephropathy	10	8.7	12	9.7
Drug-induced interstitial nephritis	2	1.7	1	0.8
Bladder neck obstruction (include prostatomegaly)	1	0.9	1	0.8
Congenital obstructive uropathy renal tract anomaly (unspecified)	2	1.7	3	2.4
Posterior urethral valves (obstructive nephropathy)	8	7.0	6	4.8
PUJ obstruction	2	1.7	1	0.8
Renal anomaly with spina bifida/myelomeningocele	1	0.9	1	0.8
Renal hypoplasia/dysplasia/agenesis	14	12.2	14	11.3
Neuropathic bladder (congenital or acquired)	11	9.6	9	7.3
Renal TB	3	2.6	3	2.4
Interstitial nephritis (otherwise unspecified)	2	1.7	3	2.4
Acute cortical necrosis (otherwise unspecified)	1	0.9	0	0.0
Renal cell carcinoma	7	6.1	6	4.8
Transitional cell carcinoma	1	0.9	1	0.8
Paraproteinemia (include multiple myeloma)	3	2.6	4	3.2
Diagnosis not listed (specify)	42	36.5	52	41.9
Total	115	100	124	100

7.3 MODALITY

7.3.1 Incident Patients

In 2010, 611 patients (CR 162.0 pmp; ASR 118.6 pmp) started on HD. In the same year, another 130 new patients (CR 34.5 pmp; ASR 26.1 pmp) started on PD (Table 7.3.1.1).

In 2011, 741 patients (CR 195.6 pmp; ASR 138.6 pmp) started on HD. In the same year, another 163 new patients (CR 43.0 pmp; ASR 31.1 pmp) started on PD (Table 7.3.1.1).

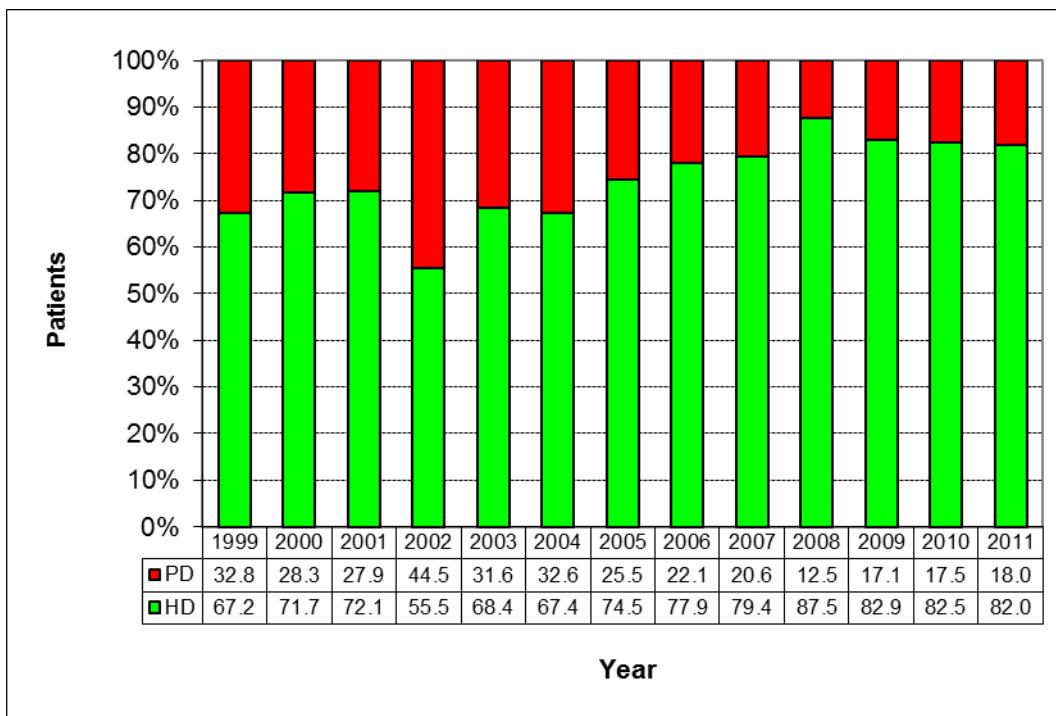
Table 7.3.1.1: INCIDENT DIALYSIS PATIENTS BY MODALITY

MODALITY	2010				2011			
	No	%	CR*	ASR*	No	%	CR*	ASR*
HD	611	82.5	162.0	118.6	741	82.0	195.6	138.6
PD	130	17.5	34.5	26.1	163	18.0	43.0	31.1
HD+PD	741	100	196.5	144.7	904	100	238.6	169.7

* per million residential population

Transiently in 2002 more new patients were started on PD; 44.5% compared with around 30% in other years.

Figure 7.3.1.1: INCIDENT DIALYSIS PATIENTS BY MODALITY, 1999 – 2011



The proportion of patients on HD aged 60 years and above was 53.4% and 65.4% for those on PD in 2010 (Table 7.3.1.2).

The proportion of patients on HD aged 60 years and above was 54.3% and 58.3% for those on PD in 2011 (Table 7.3.1.2).

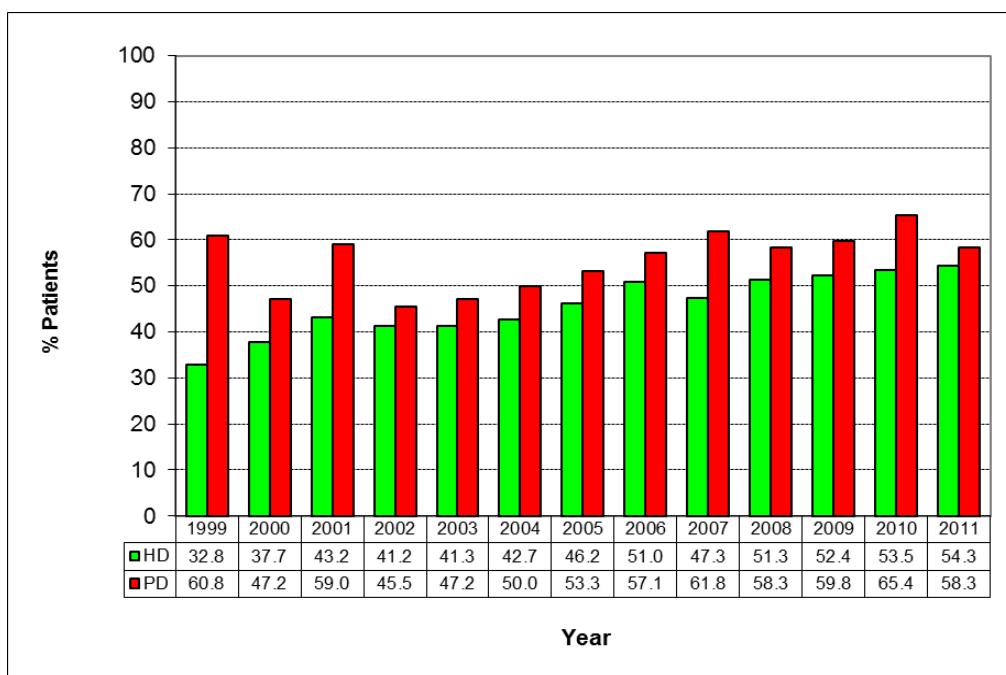
Table 7.3.1.2: INCIDENT DIALYSIS PATIENTS BY AGE GROUP AND MODALITY

2010 AGE GROUP	HD			PD			HD+PD		
	No	%	CR	No	%	CR	No	%	CR
0–19	2	0.3	2.2	1	0.8	1.1	3	0.4	3.3
20–29	8	1.3	15.4	4	3.1	7.7	12	1.6	23.1
30–39	21	3.4	33.9	4	3.1	6.5	25	3.4	40.4
40–49	76	12.4	120.0	7	5.4	11.1	83	11.2	131.1
50–59	177	29.0	320.8	29	22.3	52.6	206	27.8	373.3
60–69	186	30.4	613.5	46	35.4	151.7	232	31.3	765.2
70–79	101	16.5	640.5	30	23.1	190.2	131	17.7	830.7
80 +	40	6.5	578.0	9	6.9	130.1	49	6.6	708.1
All Age Groups	611	100	162.0	130	100	34.5	741	100	196.5

2011 AGE GROUP	HD			PD			HD+PD		
	No	%	CR	No	%	CR	No	%	CR
0–19	1	0.1	1.1	3	1.8	3.3	4	0.4	4.5
20–29	9	1.2	17.4	5	3.1	9.7	14	1.5	27.0
30–39	27	3.6	44.0	12	7.4	19.6	39	4.3	63.5
40–49	98	13.2	155.4	9	5.5	14.3	107	11.8	169.7
50–59	204	27.5	358.8	39	23.9	68.6	243	26.9	427.4
60–69	218	29.4	680.2	46	28.2	143.5	264	29.2	823.7
70–79	148	20.0	886.8	30	18.4	179.7	178	19.7	1066.5
80 +	36	4.9	491.8	19	11.7	259.6	55	6.1	751.4
All Age Groups	741	100	195.6	163	100	43.0	904	100	238.6

* per million residential population

The proportion of patients on HD aged 60 years and above increased from 32.8% in 1999 to 54.3% in 2011. However, patients aged 60 years and above on PD dropped from 60.8% in 1999 to 45.5% in 2002, before increasing to 58.3% in 2011. See Figure 7.3.1.2.

Figure 7.3.1.2: INCIDENT PATIENTS AGED 60 YEARS AND ABOVE BY MODALITY, 1999 – 2011

In 2010, while the mean age of new patients on HD was 60.9 years (median 60.8 years), the mean age of new patients on PD was 63.1 years (median 65.5 years) (Table 7.3.1.3).

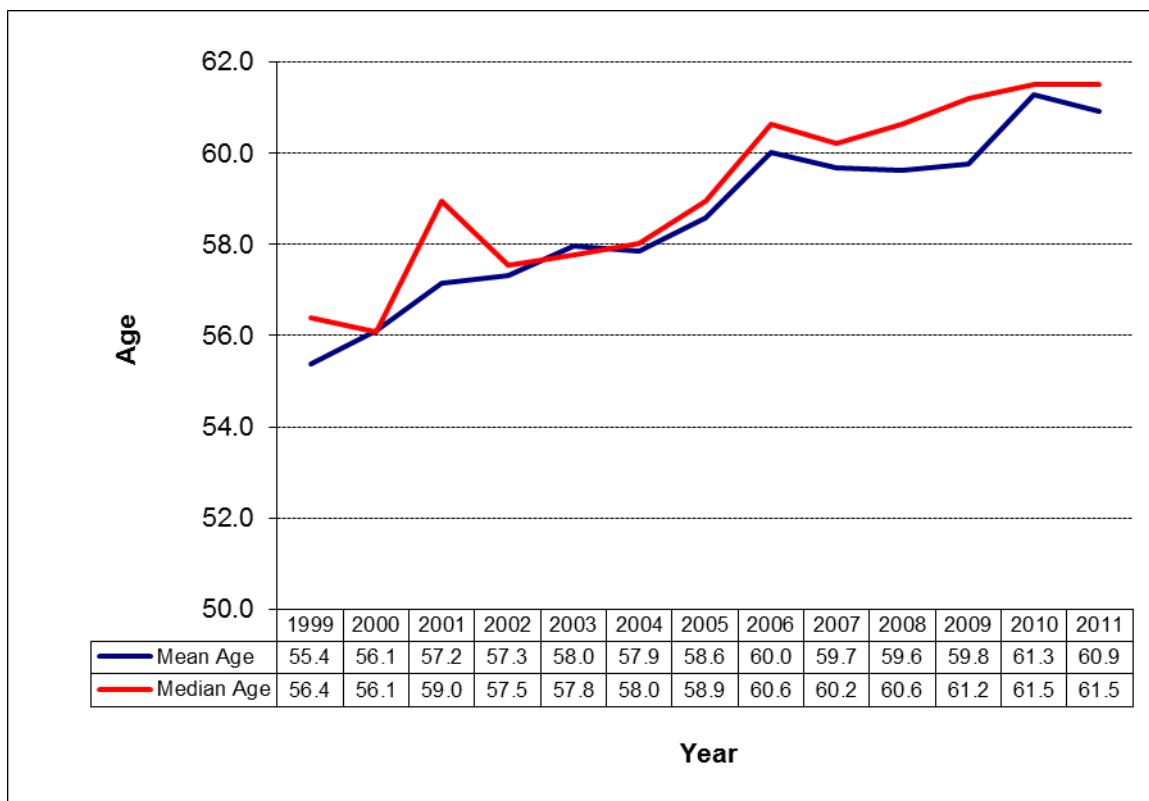
In 2011, while the mean age of new patients on HD was 60.9 years (median 61.5 years), the mean age of new patients on PD was 61.0 years (median 61.8 years) (Table 7.3.1.3).

Table 7.3.1.3: AGE OF INCIDENT PATIENTS BY MODALITY

MODALITY	2010			2011		
	Mean Age	Median Age	Std Dev	Mean Age	Median Age	Std Dev
HD	60.9	60.8	12.5	60.9	61.5	12.4
PD	63.1	65.5	13.4	61.0	61.8	15.8
HD+PD	61.3	61.5	12.7	60.9	61.5	13.1

The mean age of all incident patients on dialysis increased from 55.4 years old in 1999 to 60.9 years old in 2011. See Figure 7.3.1.3.

Figure 7.3.1.3: AGE OF INCIDENT DIALYSIS PATIENTS, 1999 – 2011



In 2010, almost two thirds (68.5%) of new patients who went on to PD had diabetic nephropathy. Fewer patients who went on to HD had diabetic nephropathy (62.2%). The proportion of patients with primary glomerulonephritis was higher in HD patients than PD patients (19.5% vs 16.9%). (Table 7.3.1.4)

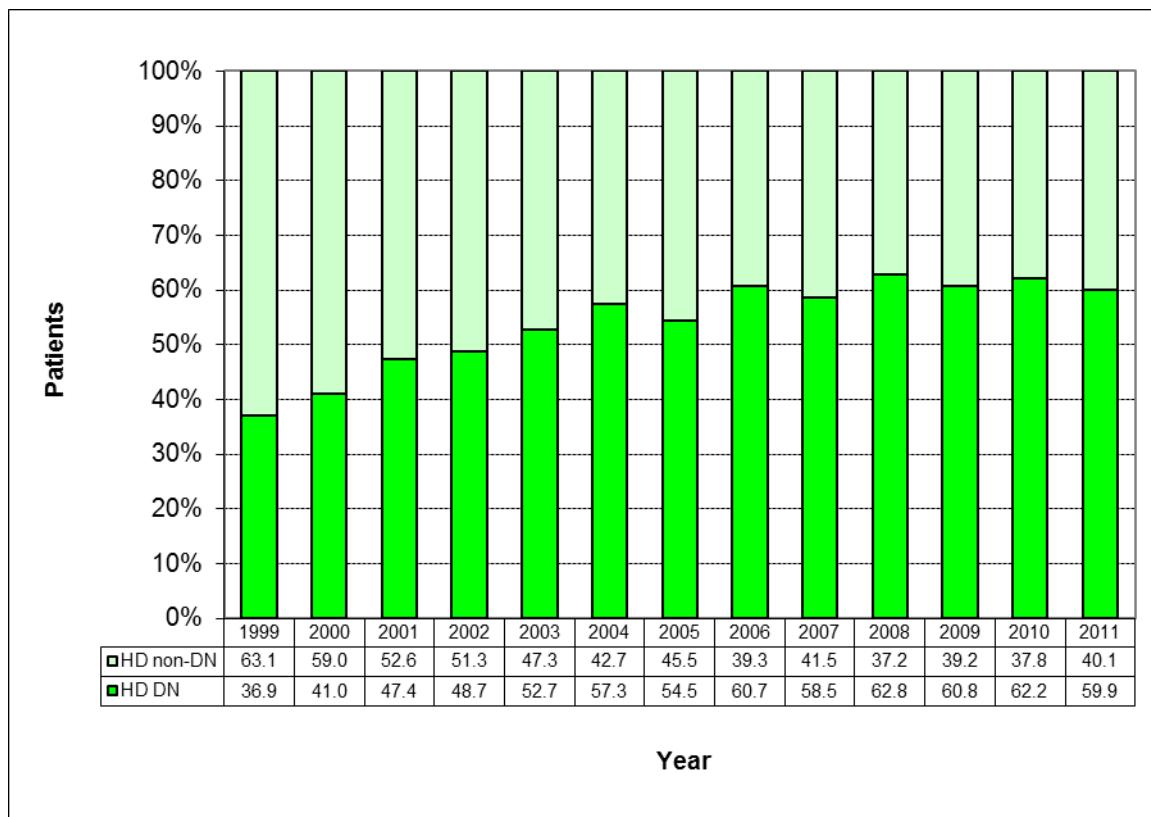
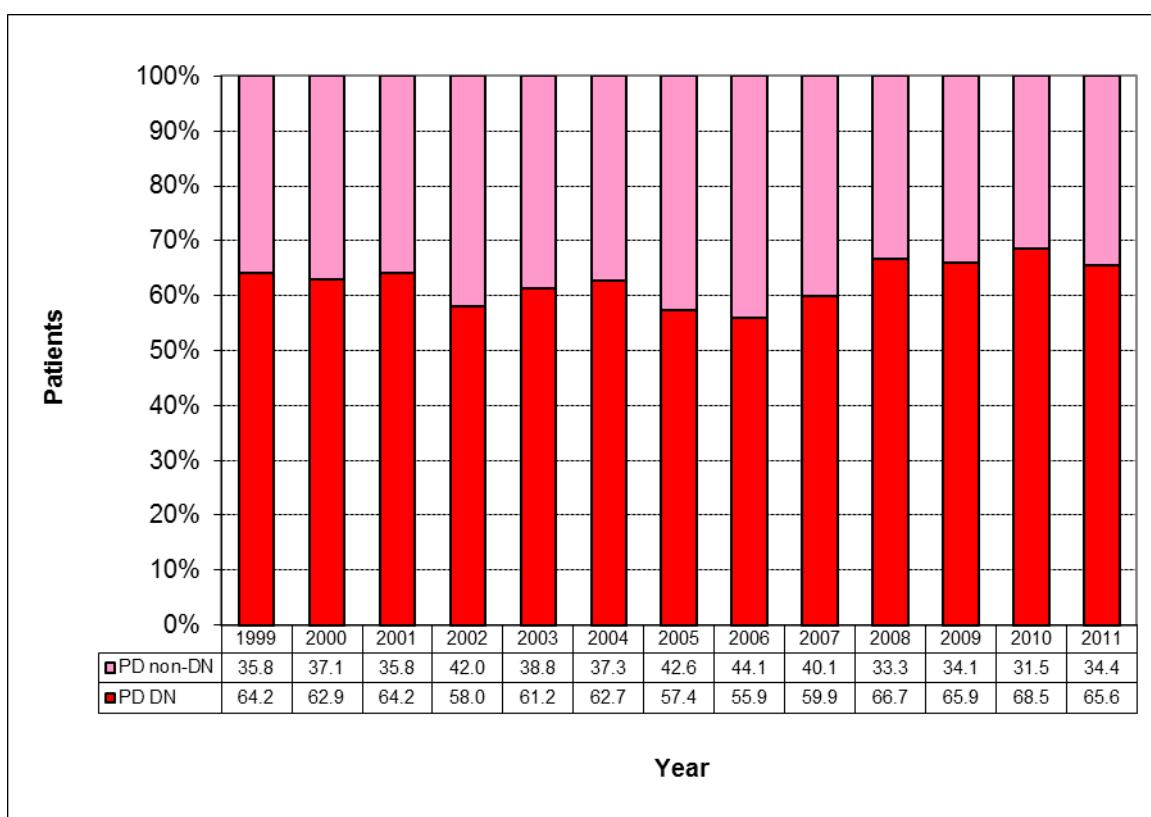
In 2011, almost two thirds (65.6%) of new patients who went on to PD had diabetic nephropathy. Fewer patients who went on to HD had diabetic nephropathy (59.9%). The

proportion of patients with primary glomerulonephritis was higher in HD patients than PD patients (17.8% vs 16.6%). (Table 7.3.1.4)

Table 7.3.1.4: INCIDENT DIALYSIS PATIENTS BY MODALITY AND AETIOLOGY OF RENAL FAILURE

Causes of CKD5	2010				2011			
	HD		PD		HD		PD	
	No	%	No	%	No	%	No	%
Diabetic Nephropathy	380	62.2	89	68.5	444	59.9	107	65.6
Primary Glomerulonephritis (GN)	119	19.5	22	16.9	132	17.8	27	16.6
Autoimmune Disease/GN with Systemic Manifestations	6	1.0	0	0.0	6	0.8	3	1.8
Hypertension and Renovascular Disease	75	12.3	13	10.0	102	13.8	15	9.2
Polycystic Kidney Disease / Other Cystic Diseases	14	2.3	1	0.8	18	2.4	2	1.2
Vesicoureteric Reflex / Chronic Pyelonephritis	0	0.0	0	0.0	3	0.4	0	0.0
Obstruction	2	0.3	0	0.0	6	0.8	2	1.2
Stone Disease	1	0.2	0	0.0	1	0.1	1	0.6
Miscellaneous	13	2.1	4	3.1	22	3.0	6	3.7
Unknown	1	0.2	1	0.8	7	0.9	0	0.0
All Causes	611	100	130	100	741	100	163	100

Diabetic nephropathy was the etiology of CKD5 in approximately two thirds of incident PD patients from 1999 to 2011. The proportion of incident HD patients with diabetic nephropathy increased from 36.9% to 59.9% from 1999 to 2011. See Figure 7.3.1.4.

Figure 7.3.1.4: INCIDENT DIALYSIS PATIENTS BY MODALITY AND AETIOLOGY, 1999 – 2011**(a) Haemodialysis****(b) Peritoneal Dialysis**

7.3.2 Prevalent Patients

There were 4596 patients (CR 1218.5 pmp; ASR 896.4 pmp) on dialysis as of 31 December 2010 of which 4020 (CR 1065.8 pmp; ASR 778.4 pmp) were on HD and 576 (CR 152.7 pmp; ASR 118.0 pmp) were on PD.

There were 4895 patients (CR 1291.8 pmp; ASR 919.2 pmp) on dialysis as of 31 December 2011 of which 4270 (CR 1126.9 pmp; ASR 795.2 pmp) were on HD and 625 (CR 164.9 pmp; ASR 124.0 pmp) were on PD.

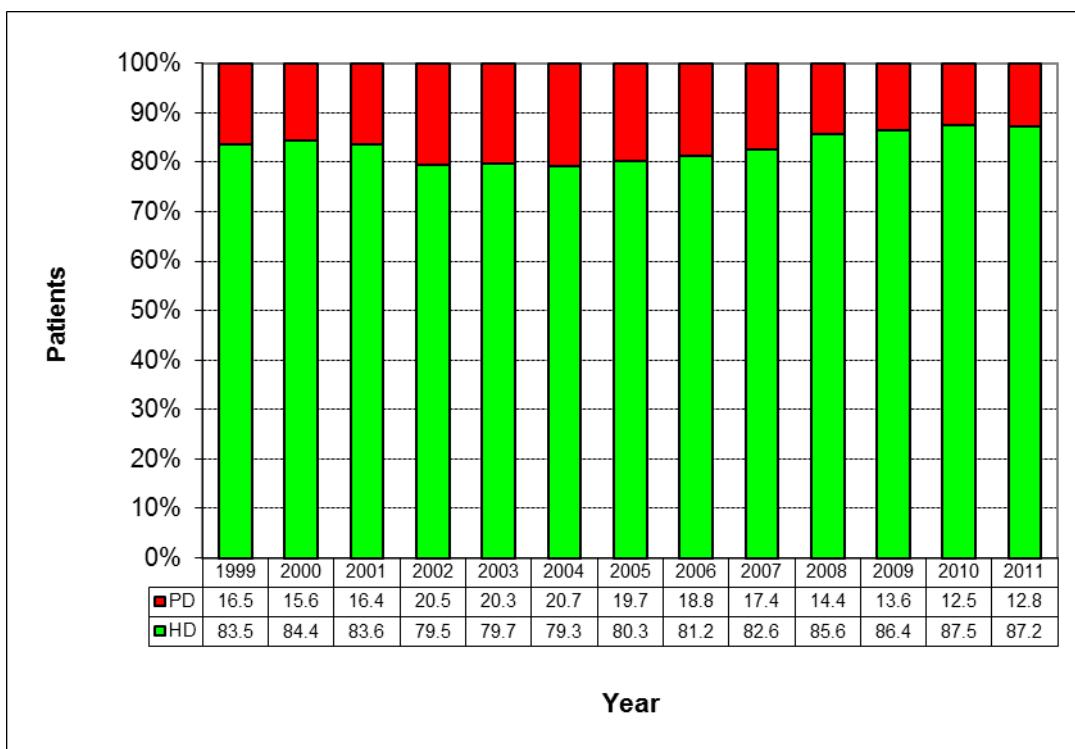
An increasing trend of prevalent patients was observed from 1999 till 2011. Prevalent PD patients formed 12.8% of the total dialysis population in 2011. See Table 7.3.2.1.

Table 7.3.2.1: PREVALENT DIALYSIS PATIENTS BY MODALITY

MODALITY	2010				2011			
	No	%	CR*	ASR*	No	%	CR*	ASR*
HD	4020	87.5	1065.8	778.4	4270	87.2	1126.9	795.2
PD	576	12.5	152.7	118.0	625	12.8	164.9	124.0
HD+PD	4596	100	1218.5	896.4	4895	100	1291.8	919.2

* per million residential population

Figure 7.3.2.1: PREVALENT DIALYSIS PATIENTS BY MODALITY, 1999 – 2011



The age distribution of the prevalent dialysis patients is shown in Table 7.3.2.2.

Table 7.3.2.2: PREVALENT DIALYSIS PATIENTS BY AGE GROUP AND MODALITY

2010 AGE GROUP	HD			PD			HD+PD		
	No	%	CR*	No	%	CR*	No	%	CR*
0–19	2	0.0	2.2	15	2.6	16.3	17	0.4	18.5
20–29	39	1.0	75.0	24	4.2	46.2	63	1.4	121.2
30–39	164	4.1	265.1	21	3.6	33.9	185	4.0	299.1
40–49	537	13.4	848.2	62	10.8	97.9	599	13.0	946.1
50–59	1151	28.6	2085.9	150	26.0	271.8	1301	28.3	2357.7
60–69	1189	29.6	3921.5	170	29.5	560.7	1359	29.6	4482.2
70–79	746	18.6	4730.5	113	19.6	716.6	859	18.7	5447.1
80 +	192	4.8	2774.6	21	3.6	303.5	213	4.6	3078.0
All Age Groups	4020	100	1065.8	576	100	152.7	4596	100	1218.5

2011 AGE GROUP	HD			PD			HD+PD		
	No	%	CR*	No	%	CR*	No	%	CR*
0–19	1	0.0	1.1	16	2.6	17.8	17	0.3	18.9
20–29	41	1.0	79.2	26	4.2	50.2	67	1.4	129.3
30–39	162	3.8	263.9	23	3.7	37.5	185	3.8	301.4
40–49	549	12.9	870.6	67	10.7	106.2	616	12.6	976.8
50–59	1230	28.8	2163.2	142	22.7	249.7	1372	28.0	2412.9
60–69	1274	29.8	3975.0	199	31.8	620.9	1473	30.1	4595.9
70–79	803	18.8	4811.3	113	18.1	677.1	916	18.7	5488.3
80 +	210	4.9	2868.9	39	6.2	532.8	249	5.1	3401.6
All Age Groups	4270	100	1126.9	625	100	164.9	4895	100	1291.8

* per million residential population

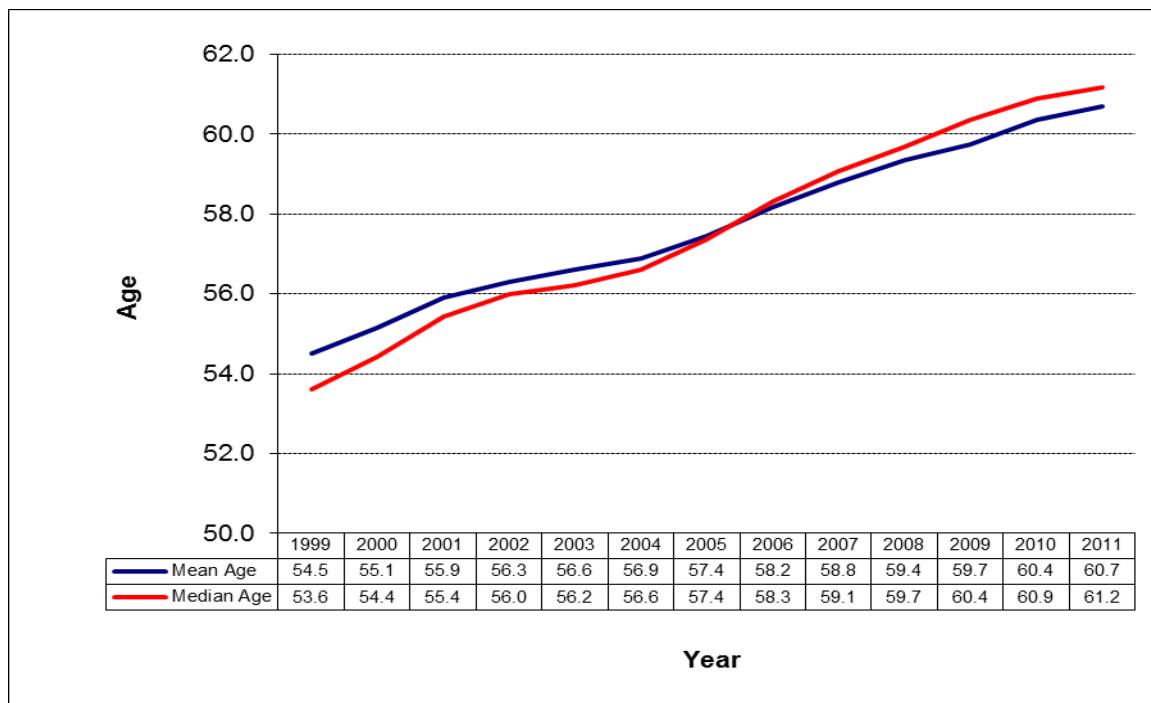
In 2010, the proportion of patients on HD aged 60 years and above was 53.0% compared with 52.7% for those on PD. See Table 7.3.2.2. The mean age of the patient on HD was 60.6 years (median 60.9 years) while the patient on PD was 58.8 years (median 61.2 years). See Table 7.3.2.3.

In 2011, the proportion of patients on HD aged 60 years and above was 53.5% compared with 56.1% for those on PD. See Table 7.3.2.2. The mean age of the patient on HD was 60.9 years (median 61.1 years) while the patient on PD was 59.5 years (median 62.1 years). See Table 7.3.2.3.

Table 7.3.2.3: AGE OF PREVALENT PATIENTS BY MODALITY

MODALITY	2010			2011		
	Mean Age	Median Age	Std Dev	Mean Age	Median Age	Std Dev
HD	60.6	60.9	12.2	60.9	61.1	12.0
PD	58.8	61.2	15.3	59.5	62.1	15.5
HD+PD	60.4	60.9	12.6	60.7	61.2	12.5

The mean age of all prevalent patients on dialysis increased from 54.5 years old in 1999 to 60.7 years old in 2011. See Figure 7.3.2.2.

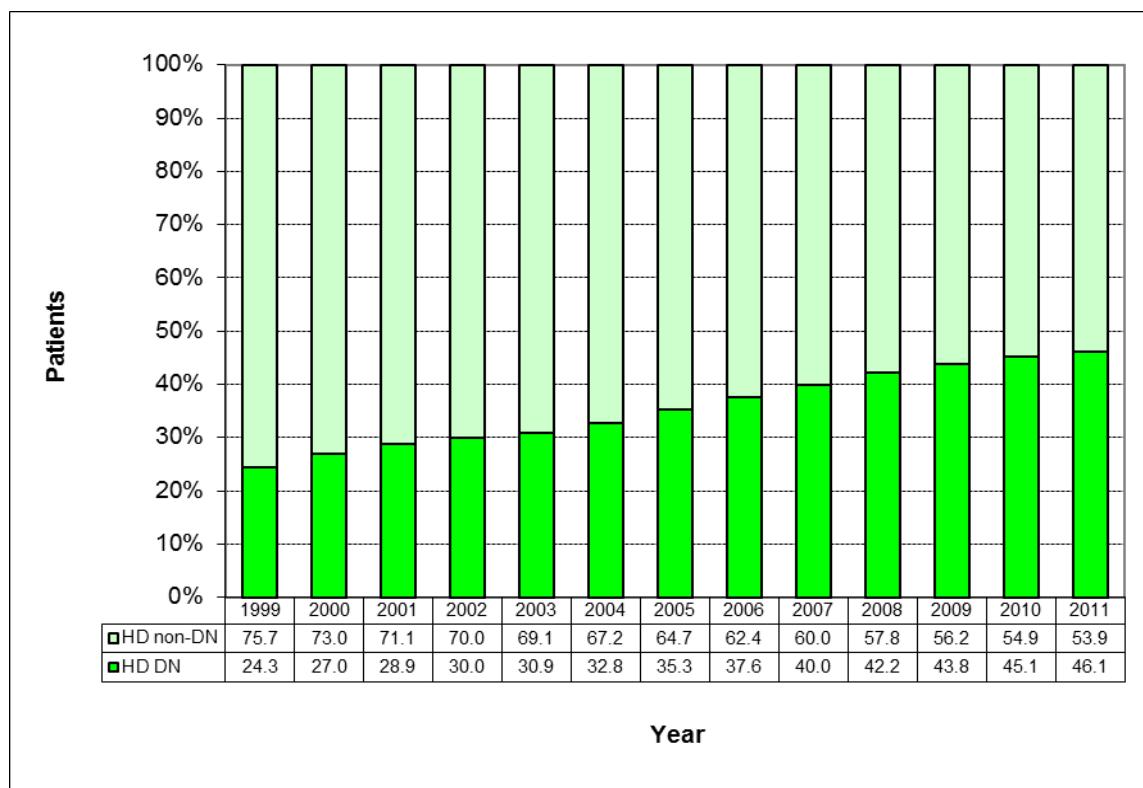
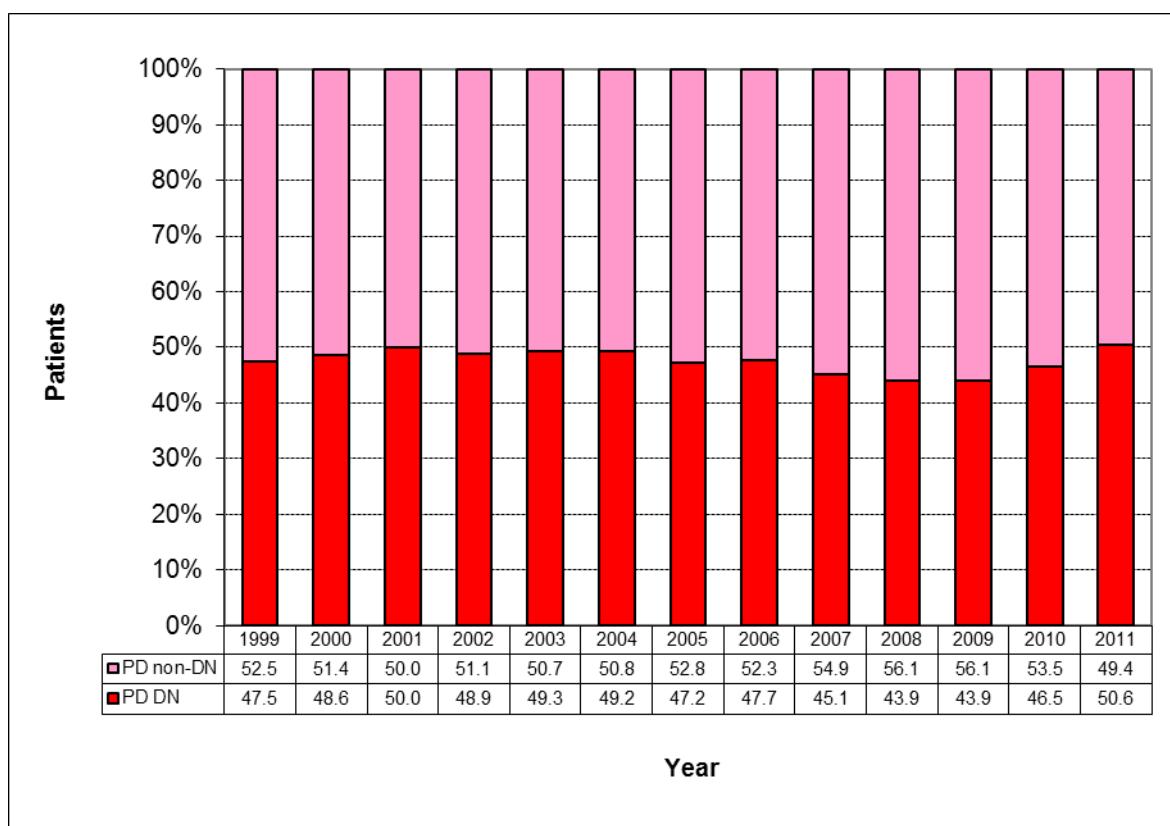
Figure 7.3.2.2: AGE OF PREVALENT DIALYSIS PATIENTS, 1999 – 2011

In 2010, 46.5% of the PD patients had diabetic nephropathy as the aetiology for renal failure compared to 45.1% of HD patients. While in 2011, 50.6% of the PD patients had diabetic nephropathy as the aetiology for renal failure compared to 46.1% of HD patients. Primary glomerulonephritis was the second most common aetiology in both HD and PD patients in 2010 and 2011. See Table 7.3.2.4.

Table 7.3.2.4: PREVALENT DIALYSIS PATIENTS BY MODALITY AND AETIOLOGY OF RENAL FAILURE

Causes of CKD5	2010				2011			
	HD		PD		HD		PD	
	No	%	No	%	No	%	No	%
Diabetic Nephropathy	1813	45.1	268	46.5	1967	46.1	316	50.6
Primary Glomerulonephritis (GN)	1341	33.4	154	26.7	1367	32.0	157	25.1
Autoimmune Disease/GN with Systemic Manifestations	82	2.0	30	5.2	83	1.9	31	5.0
Hypertension and Renovascular Disease	437	10.9	70	12.2	480	11.2	68	10.9
Polycystic Kidney Disease / Other Cystic Diseases	116	2.9	15	2.6	131	3.1	13	2.1
Vesicoureteric Reflex / Chronic Pyelonephritis	21	0.5	4	0.7	22	0.5	5	0.8
Obstruction	37	0.9	2	0.3	38	0.9	3	0.5
Stone Disease	12	0.3	1	0.2	11	0.3	2	0.3
Miscellaneous	92	2.3	23	4.0	102	2.4	22	3.5
Unknown	69	1.7	9	1.6	69	1.6	8	1.3
All Causes	4020	100	576	100	4270	100	625	100

Diabetic nephropathy, as a cause of CKD5, is rising among prevalent HD patients while the proportion appears to be stable in prevalent PD patients. See Figure 7.3.2.3.

Figure 7.3.2.3: PREVALENT DIALYSIS PATIENTS BY MODALITY AND AETIOLOGY, 1999 – 2011**(a) Haemodialysis****(b) Peritoneal Dialysis**

7.4 Service Provider

7.4.1 Incident Patients

In 2010, a substantial proportion of new dialysis patients went to the private centres (57.8%). Smaller proportion was dialysed in programmes at the Public Acute Hospitals (PAH), previously known as Restructured Hospitals (20.1%). The remainder went to centres run by voluntary welfare organisations (VWOs) (Table 7.4.1.1).

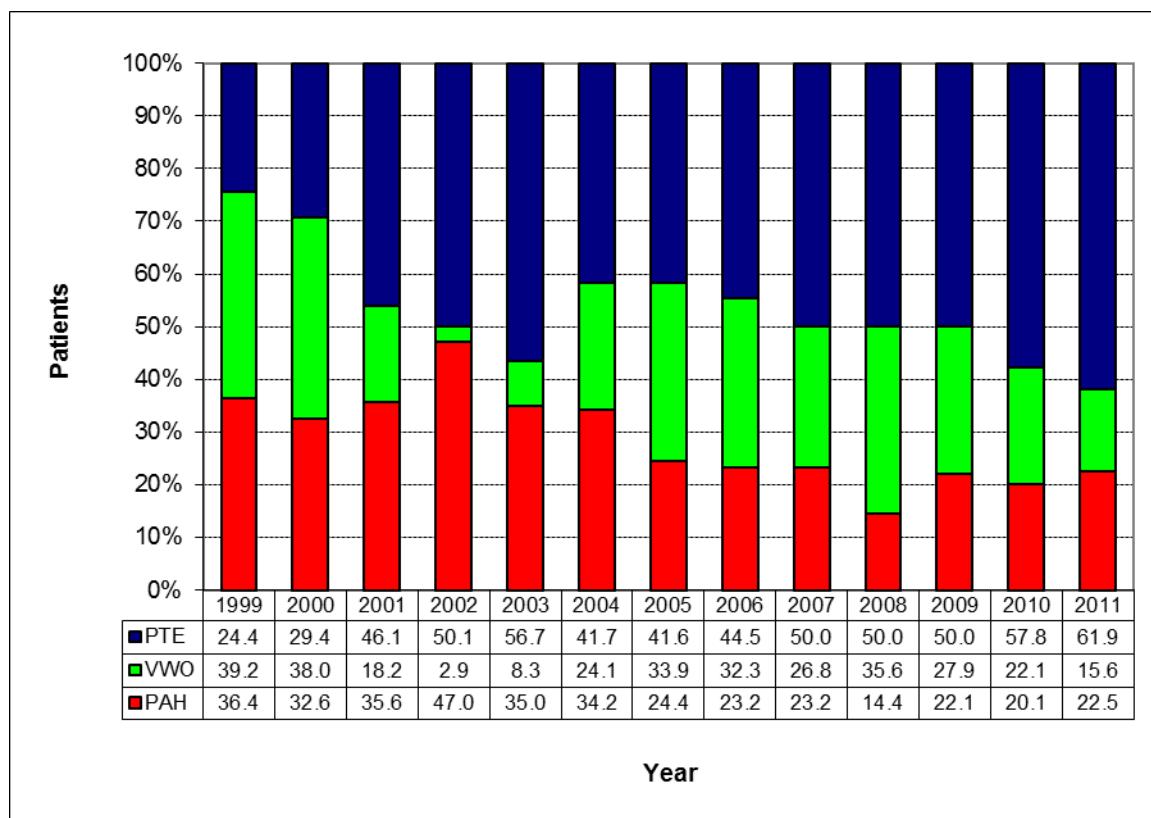
In 2011, 61.9% of new dialysis patients went to the private centres. And 22.5% was dialysed in programmes at the Public Acute Hospitals. The remainder went to centres run by voluntary welfare organisations (VWOs) (Table 7.4.1.1).

Table 7.4.1.1: INCIDENT DIALYSIS PATIENTS BY SERVICE PROVIDER

SERVICE PROVIDER	2010		2011	
	No	%	No	%
Public Acute Hospitals	149	20.1	203	22.5
Voluntary Welfare Organisations	164	22.1	141	15.6
Private Centres	428	57.8	560	61.9
All Providers	741	100	904	100

Except for the years 2001 to 2003, between 15%-35% of incident patients were dialysed at centres managed by voluntary welfare organisations (VWOs). See Figure 7.4.1.1.

Figure 7.4.1.1: INCIDENT DIALYSIS PATIENTS BY SERVICE PROVIDER, 1999 – 2011



The age distribution of incident patients by service provider is shown in Table 7.4.1.2. The proportion of new patients aged 60 years and above was highest in the Public Acute Hospitals in 2010 (63.1%) and in 2011 (57.6%).

Table 7.4.1.2: INCIDENCE AND DISTRIBUTION OF DIALYSIS PATIENTS BY SERVICE PROVIDER AND AGE GROUP

2010 AGE GROUP	PAH		VWO		PTE		ALL	
	No	%	No	%	No	%	No	%
0–19	2	1.3	0	0.0	1	0.2	3	0.4
20–29	4	2.7	3	1.8	5	1.2	12	1.6
30–39	4	2.7	7	4.3	14	3.3	25	3.4
40–49	11	7.4	16	9.8	56	13.1	83	11.2
50–59	34	22.8	59	36.0	113	26.4	206	27.8
60–69	50	33.6	59	36.0	123	28.7	232	31.3
70–79	36	24.2	16	9.8	79	18.5	131	17.7
80 +	8	5.4	4	2.4	37	8.6	49	6.6
All Age Groups	149	100	164	100	428	100	741	100

2011 AGE GROUP	PAH		VWO		PTE		ALL	
	No	%	No	%	No	%	No	%
0–19	4	2.0	0	0.0	0	0.0	4	0.4
20–29	5	2.5	5	3.5	4	0.7	14	1.5
30–39	12	5.9	3	2.1	24	4.3	39	4.3
40–49	11	5.4	18	12.8	78	13.9	107	11.8
50–59	54	26.6	48	34.0	141	25.2	243	26.9
60–69	60	29.6	45	31.9	159	28.4	264	29.2
70–79	36	17.7	17	12.1	125	22.3	178	19.7
80 +	21	10.3	5	3.5	29	5.2	55	6.1
All Age Groups	203	100	141	100	560	100	904	100

The mean age of the patients dialysing with the VWO centres was 59.1 years in 2010 and 59.2 in 2011. Patients in Public Acute Hospitals and private centres were older. See Table 7.4.1.3.

Table 7.4.1.3: AGE OF INCIDENT DIALYSIS PATIENTS BY SERVICE PROVIDER

SERVICE PROVIDER	2010			2011		
	Mean Age	Median Age	Std Dev*	Mean Age	Median Age	Std Dev
Public Acute Hospitals	62.6	65.3	13.6	61.1	61.9	15.1
Voluntary Welfare Organisations	59.1	59.3	11.0	59.2	59.8	12.1
Private Centres	61.7	61.5	12.9	61.3	61.6	12.5
All Providers	61.3	61.5	12.7	60.9	61.5	13.1

* Std Dev stands for Standard Deviation

Public Acute Hospitals did not provide much chronic outpatient HD facilities and cared for only a small proportion of new outpatient HD patients 3.8% (23/611) in 2010 and 5.7% (42/741) in 2011. Thus, majority of HD patients (96.2% in 2010; 94.3% in 2011) was dialysed in VWOs and private centres. Majority of incident PD patients were cared for by

the Public Acute Hospitals; 96.9% (126/130) in 2010 and 98.8% (161/163) in 2011. See Table 7.4.1.4.

Table 7.4.1.4: INCIDENT DIALYSIS PATIENTS BY SERVICE PROVIDER AND MODALITY

2010 SERVICE PROVIDER	HD		PD		HD+PD	
	No	%	No	%	No	%
Public Acute Hospitals	23	3.8	126	96.9	149	20.1
Voluntary Welfare Organisations	163	26.7	1	0.8	164	22.1
Private Centres	425	69.6	3	2.3	428	57.8
All Providers	611	100	130	100	741	100

2011 SERVICE PROVIDER	HD		PD		HD+PD	
	No	%	No	%	No	%
Public Acute Hospitals	42	5.7	161	98.8	203	22.5
Voluntary Welfare Organisations	141	19.0	0	0.0	141	15.6
Private Centres	558	75.3	2	1.2	560	61.9
All Providers	741	100	163	100	904	100

The mean age of incident patients is shown in Table 7.4.1.5 below.

Table 7.4.1.5: AGE OF INCIDENT DIALYSIS PATIENTS BY SERVICE PROVIDER AND MODALITY

MODALITY	2010				2011			
	PAH	VWO	PTE	All	PAH	VWO	PTE	All
HD	Mean	61.6	59.0	61.6	60.9	62.2	59.2	61.2
	Median	63.1	59.1	61.4	60.8	63.1	59.8	61.6
	Std. Deviation	14.9	11.0	12.9	12.5	12.3	12.1	12.5
PD	Mean	62.8	68.1	74.7	63.1	60.8	-	76.8
	Median	65.4	68.1	80.7	65.5	61.7	-	76.8
	Std. Deviation	13.4	0.0	11.6	13.4	15.8	-	19.4
HD+PD	Mean	62.6	59.1	61.7	61.3	61.1	59.2	61.3
	Median	65.3	59.3	61.5	61.5	61.9	59.8	61.6
	Std. Deviation	13.6	11.0	12.9	12.7	15.1	12.1	12.5

7.4.2 Prevalent Patients

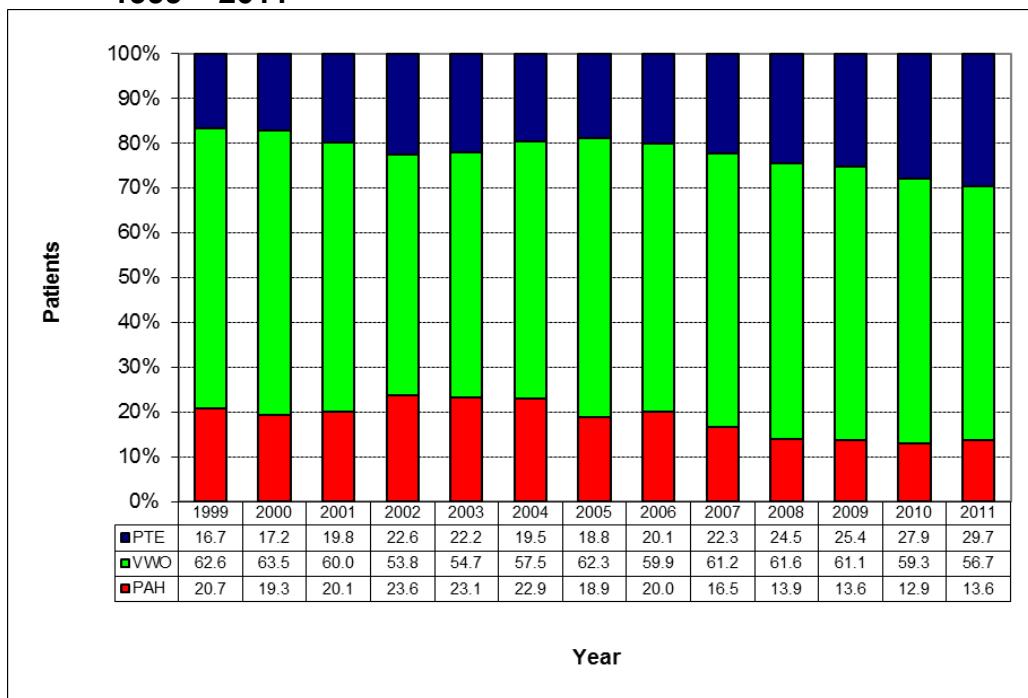
Most of the prevalent dialysis patients were dialysed in centres runs by VWOs (59.3% in 2010; 56.7% in 2011). The Public Acute Hospitals dialysed 12.9% of all prevalent dialysis patients in 2010 and 13.6% in 2011. The remainder went to private dialysis centres. See Table 7.4.2.1.

This pattern is different from that of the new patients and is probably related to the practice of dialysing temporarily in a private centre while awaiting assessment and permanent placement for dialysis in a VWO centre.

Table 7.4.2.1: PREVALENT DIALYSIS PATIENTS BY SERVICE PROVIDER

SERVICE PROVIDER	2010		2011	
	No	%	No	%
Public Acute Hospitals	591	12.9	666	13.6
Voluntary Welfare Organisations	2724	59.3	2777	56.7
Private Centres	1281	27.9	1452	29.7
All Providers	4596	100	4895	100

There was a decreasing trend in the number of prevalent patients on dialysis managed by the Public Acute Hospitals. See Figure 7.4.2.1.

Figure 7.4.2.1: PREVALENT DIALYSIS PATIENTS BY SERVICE PROVIDER, 1999 – 2011

The age distribution of prevalent patients by service provider is shown in Table 7.4.2.2. In 2009, the proportion of patients aged 60 years and above was highest in private centres (62.2% in 2010; 61.7% in 2011) and lowest in VWO centres (47.8% in 2010; 48.7% in 2011).

Table 7.4.2.2: DIALYSIS PATIENTS BY SERVICE PROVIDER AND AGE GROUP

2010 AGE GROUP	PAH		VWO		PTE		ALL	
	No	%	No	%	No	%	No	%
0–19	17	2.9	0	0.0	0	0.0	17	0.4
20–29	27	4.6	30	1.1	6	0.5	63	1.4
30–39	19	3.2	119	4.4	47	3.7	185	4.0
40–49	58	9.8	407	14.9	134	10.5	599	13.0
50–59	137	23.2	867	31.8	297	23.2	1301	28.3
60–69	185	31.3	803	29.5	371	29.0	1359	29.6
70–79	121	20.5	430	15.8	308	24.0	859	18.7
80 +	27	4.6	68	2.5	118	9.2	213	4.6
All Age Groups	591	100	2724	100	1281	100	4596	100

2011 AGE GROUP	PAH		VWO		PTE		ALL	
	No	%	No	%	No	%	No	%
0–19	17	2.6	0	0.0	0	0.0	17	0.3
20–29	28	4.2	31	1.1	8	0.6	67	1.4
30–39	24	3.6	105	3.8	56	3.9	185	3.8
40–49	65	9.8	401	14.4	150	10.3	616	12.6
50–59	143	21.5	887	31.9	342	23.6	1372	28.0
60–69	219	32.9	836	30.1	418	28.8	1473	30.1
70–79	126	18.9	441	15.9	349	24.0	916	18.7
80 +	44	6.6	76	2.7	129	8.9	249	5.1
All Age Groups	666	100	2777	100	1452	100	4895	100

The mean age of the prevalent patients dialysing with the VWO centres was 59.1 years in 2010 and 59.5 in 2011. Patients in private sector were the oldest (mean age 63.5 in 2010; 63.4 in 2011). See Table 7.4.2.3.

Table 7.4.2.3: AGE OF PREVALENT DIALYSIS PATIENTS BY SERVICE PROVIDER

SERVICE PROVIDER	2010			2011		
	Mean Age	Median Age	Std Dev	Mean Age	Median Age	Std Dev
Public Acute Hospitals	59.3	62.1	15.8	59.9	62.9	15.6
Voluntary Welfare Organisations	59.1	59.2	11.5	59.5	59.6	11.3
Private Centres	63.5	63.7	12.8	63.4	64.0	12.7
All Providers	60.4	60.9	12.6	60.7	61.2	12.5

As in the new patients, the majority of the patients in a programme in the Public Acute Hospitals did PD (84.4% in 2010; 84.7% in 2011). Almost all VWOs and private centres offered only HD in both years. See Table 7.4.2.4.

Table 7.4.2.4: PREVALENT DIALYSIS PATIENTS BY SERVICE PROVIDER AND MODALITY

2010 SERVICE PROVIDER	HD		PD		HD+PD	
	No	%	No	%	No	%
Public Acute Hospitals	92	15.6	499	84.4	591	12.9
Voluntary Welfare Organisations	2654	97.4	70	2.6	2724	59.3
Private Centres	1274	99.5	7	0.5	1281	27.9
All Providers	4020	87.5	576	12.5	4596	100

2011 SERVICE PROVIDER	HD		PD		HD+PD	
	No	%	No	%	No	%
Public Acute Hospitals	102	15.3	564	84.7	666	13.6
Voluntary Welfare Organisations	2722	98.0	55	2.0	2777	56.7
Private Centres	1446	99.6	6	0.4	1452	29.7
All Providers	4270	87.2	625	12.8	4895	100

Private sector dialysis patients tended to be older with mean age of overall patients in year 2010 and 2011. See Table 7.4.2.5.

Table 7.4.2.5: AGE OF PREVALENT DIALYSIS PATIENTS BY SERVICE PROVIDER AND MODALITY

MODALITY		2010				2011			
		PAH	VWO	PTE	All	PAH	VWO	PTE	All
HD	Mean	60.5	59.2	63.5	60.6	61.6	59.5	63.4	60.9
	Median	61.8	59.4	63.7	60.9	63.1	59.7	64.0	61.1
	Std. Deviation	15.6	11.5	12.9	12.2	14.1	11.3	12.7	12.0
PD	Mean	59.1	55.8	70.6	58.8	59.6	57.0	69.9	59.5
	Median	62.2	55.1	65.8	61.2	62.8	55.6	65.2	62.1
	Std. Deviation	15.8	10.5	10.2	15.3	15.9	10.7	10.0	15.5
HD+PD	Mean	59.3	59.1	63.5	60.4	59.9	59.5	63.4	60.7
	Median	62.1	59.2	63.7	60.9	62.9	59.6	64.0	61.2
	Std. Deviation	15.8	11.5	12.8	12.6	15.6	11.3	12.7	12.5

7.5 Co-morbid Conditions

Diabetes Mellitus is reported as a co-morbid condition, even if the cause of renal failure was not due to diabetic nephropathy

7.5.1 Incident Patients

Diabetes Mellitus as a co-morbid condition occurred in 69.9% of patients newly started on dialysis in 2010 and 67.3% in 2011. See Table 7.5.1.1.

Ischaemic Heart Disease was reported in 47.6% of patients in 2010 and 48.5% in 2011, Cerebrovascular Disease in 24.4% in 2010 and 25.1% in 2011, Peripheral Vascular Disease in 16.7% in 2010 and 16.2% in 2011.

In the above conditions, the status was not stated in 0.1% of cases.

Smoking: There were 10.3% of patients who were current smokers in 2010. Another 23.3% were former smokers. The status was unknown in 3.2% of patients. In 2011, there were 12.5% of current smokers, and 25.1% of former smokers.

Hepatitis B Surface Antigen and anti-HCV status: In 2010, 3.6% of the patients were serologically positive for Hepatitis B Surface Antigen (HepBsAg), while in 2011 the number decreased to 3.4%. Smaller percentages were positive for anti-HCV antibody (1.2% in 2010; 1.5% in 2011). More of the PD patients did not have HepBsAg and anti-HCV antibody test results within the last 6 months.

Table 7.5.1.1: INCIDENT DIALYSIS PATIENTS BY CO-MORBID CONDITIONS

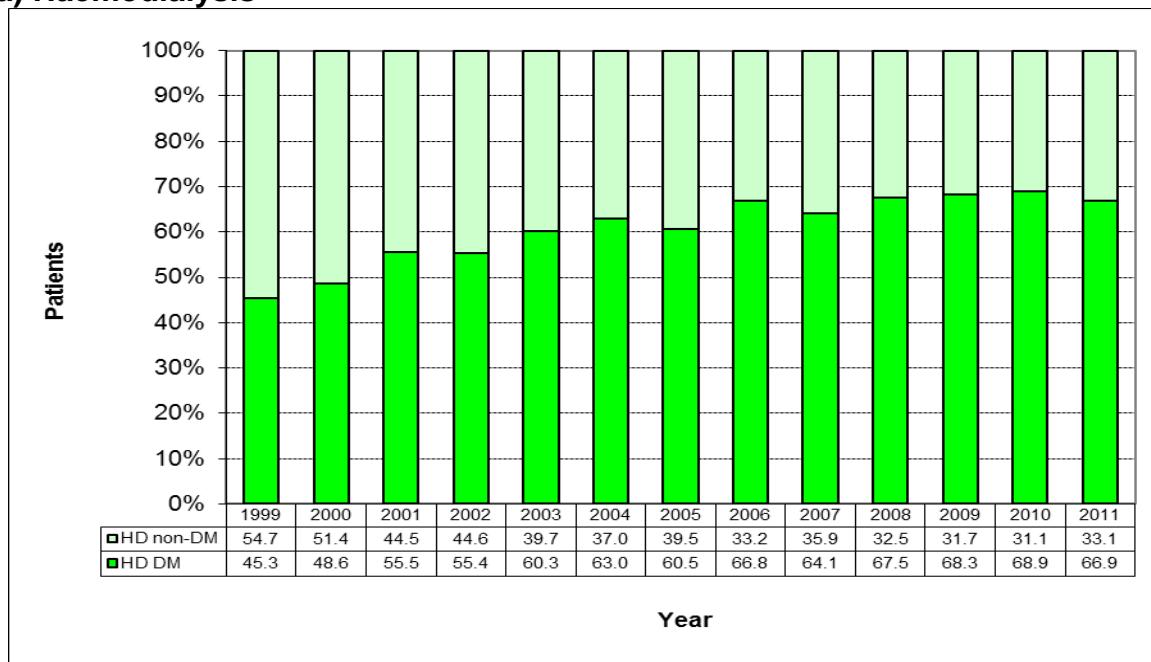
Diabetes Mellitus	2010						2011					
	HD		PD		HD+PD		HD		PD		HD+PD	
	No	%										
Yes	421	68.9	97	74.6	518	69.9	496	66.9	112	68.7	608	67.3
No	190	31.1	33	25.4	223	30.1	243	32.8	51	31.3	294	32.5
Unknown	0	0.0	0	0.0	0	0.0	2	0.3	0	0.0	2	0.2
Total	611	100	130	100	741	100	741	100	163	100	904	100
Ischaemic Heart Disease	2010						2011					
	HD		PD		HD+PD		HD		PD		HD+PD	
	No	%										
Yes	283	46.3	70	53.8	353	47.6	355	47.9	83	50.9	438	48.5
No	328	53.7	60	46.2	388	52.4	382	51.6	80	49.1	462	51.1
Unknown	0	0.0	0	0.0	0	0.0	4	0.5	0	0.0	4	0.4
Total	611	100	130	100	741	100	741	100	163	100	904	100
Chronic Obstructive Airway Disease	2010						2011					
	HD		PD		HD+PD		HD		PD		HD+PD	
	No	%										
Yes	0	0.0	1	0.8	1	0.1	1	0.1	0	0.0	1	0.1
No	62	10.1	17	13.1	79	10.7	21	2.8	8	4.9	29	3.2
Unknown	549	89.9	112	86.2	661	89.2	719	97.0	155	95.1	874	96.7
Total	611	100	130	100	741	100	741	100	163	100	904	100
Cerebrovascular Disease	2010						2011					
	HD		PD		HD+PD		HD		PD		HD+PD	
	No	%										
Yes	140	22.9	41	31.5	181	24.4	179	24.2	48	29.4	227	25.1
No	471	77.1	89	68.5	560	75.6	560	75.6	115	70.6	675	74.7
Unknown	0	0.0	0	0.0	0	0.0	2	0.3	0	0.0	2	0.2
Total	611	100	130	100	741	100	741	100	163	100	904	100
Peripheral Vascular Disease	2010						2011					
	HD		PD		HD+PD		HD		PD		HD+PD	
	No	%										
Yes	99	16.2	25	19.2	124	16.7	120	16.2	26	16.0	146	16.2
No	512	83.8	105	80.8	617	83.3	618	83.4	137	84.0	755	83.5
Unknown	0	0.0	0	0.0	0	0.0	3	0.4	0	0.0	3	0.3
Total	611	100	130	100	741	100	741	100	163	100	904	100
Smoking	2010						2011					
	HD		PD		HD+PD		HD		PD		HD+PD	
	No	%										
Current Smoker	65	10.6	11	8.5	76	10.3	102	13.8	11	6.7	113	12.5
Ex-Smoker	147	24.1	26	20.0	173	23.3	190	25.6	37	22.7	227	25.1
Non-Smoker	379	62.0	89	68.5	468	63.2	424	57.2	114	69.9	538	59.5
Unknown	20	3.3	4	3.1	24	3.2	25	3.4	1	0.6	26	2.9
Total	611	100	130	100	741	100	741	100	163	100	904	100
Hepatitis BsAg Status	2010						2011					
	HD		PD		HD+PD		HD		PD		HD+PD	
	No	%										
Positive	25	4.1	2	1.5	27	3.6	25	3.4	6	3.7	31	3.4
Negative	582	95.3	117	90.0	699	94.3	708	95.5	139	85.3	847	93.7
Unknown	4	0.7	11	8.5	15	2.0	8	1.1	18	11.0	26	2.9
Total	611	100	130	100	741	100	741	100	163	100	904	100
Anti-HCV Status	2010						2011					
	HD		PD		HD+PD		HD		PD		HD+PD	
	No	%										
Positive	6	1.0	3	2.3	9	1.2	13	1.8	1	0.6	14	1.5
Negative	601	98.4	116	89.2	717	96.8	719	97.0	142	87.1	861	95.2
Unknown	4	0.7	11	8.5	15	2.0	9	1.2	20	12.3	29	3.2
Total	611	100	130	100	741	100	741	100	163	100	904	100

Patients on PD had a higher proportion of patients with diabetes mellitus, ischaemic heart disease and cerebrovascular disease as well as peripheral vascular disease compared with patients on HD. See Table 7.5.1.1.

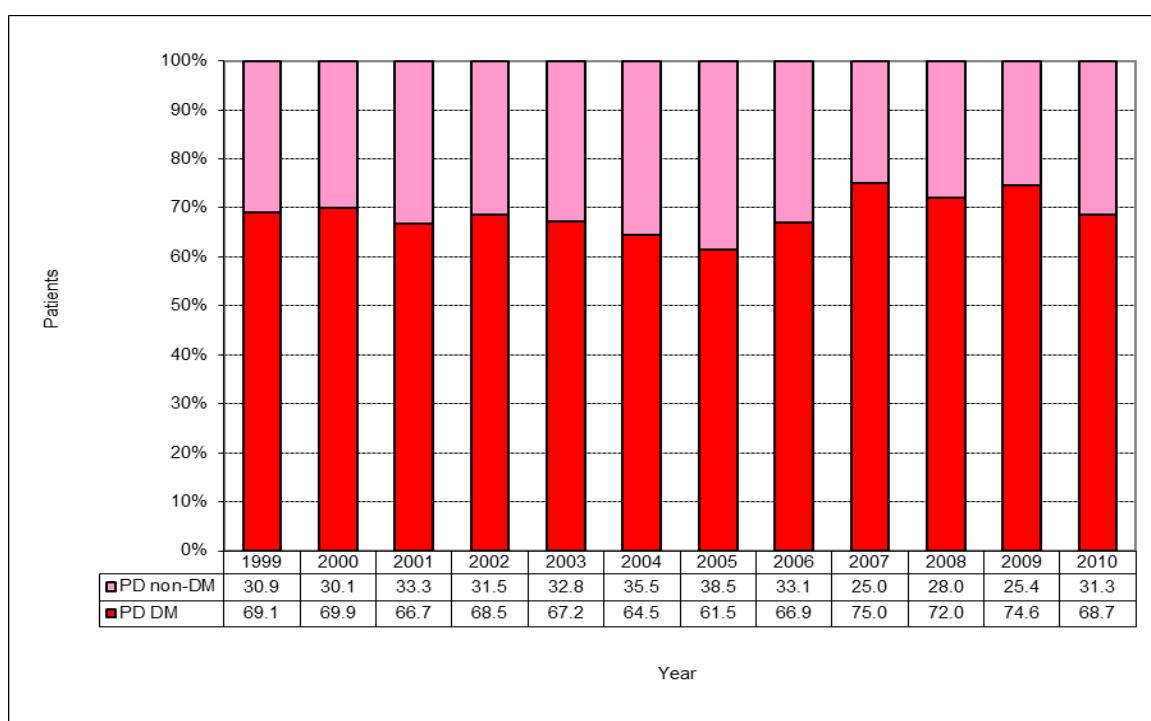
The proportion of incident patients on HD with diabetes as co-morbidity has increased over the years (45.3% in 1999, 66.9% in 2011) while that for PD fluctuated from 61.5% to 75.0% for the period 1999 to 2011. See Figure 7.5.1.1.

Figure 7.5.1.1: INCIDENT DIALYSIS PATIENTS BY MODALITY AND DIABETES MELLITUS, 1999 – 2011

(a) Haemodialysis



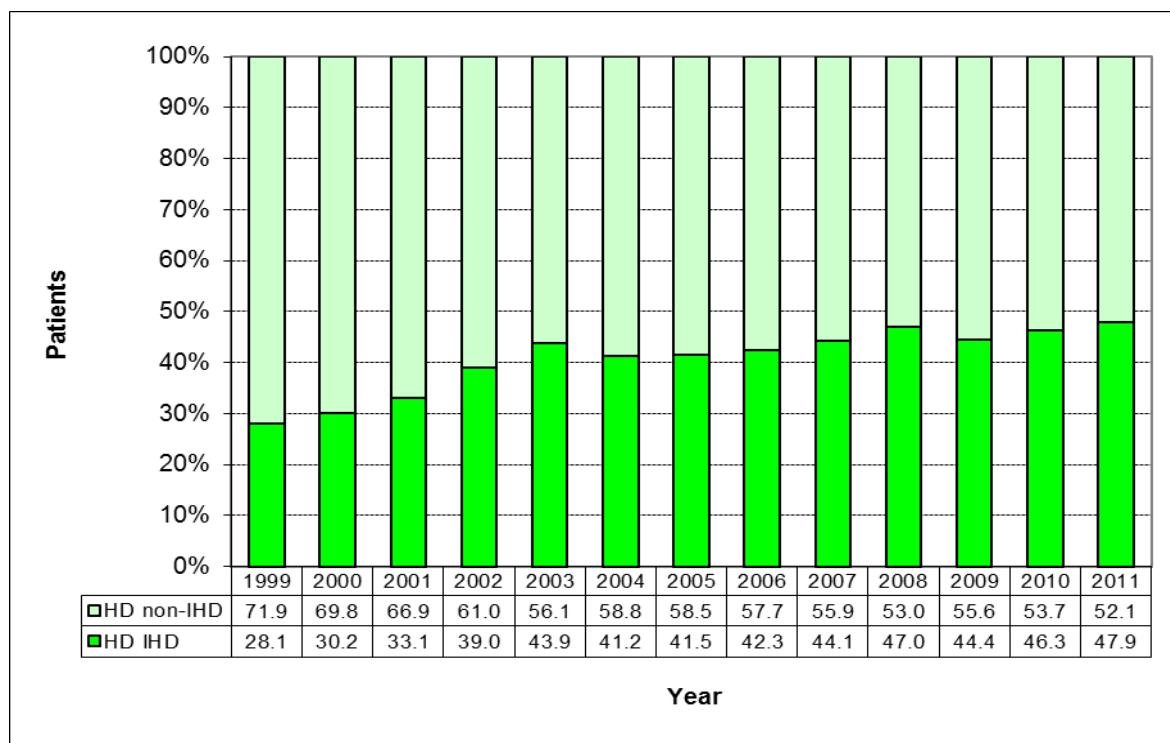
(b) Peritoneal Dialysis



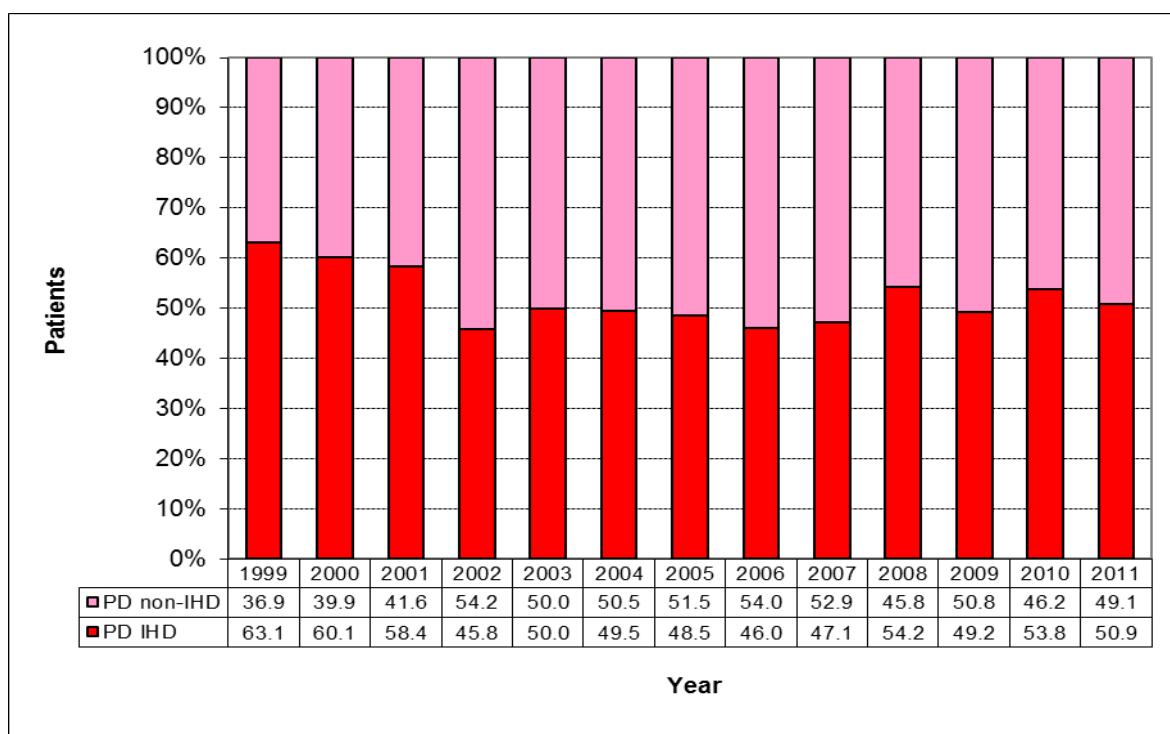
The proportion of incident dialysis patients having ischaemic heart disease as co-morbidity was rising for HD (28.1% in 1999, 47.9% in 2011). There was a decrease in the proportion of PD patients having ischaemic heart disease as co-morbidity from 1999 to 2002 but the proportion has risen with little variation around 50%. See Figure 7.5.1.2.

Figure 7.5.1.2: INCIDENT DIALYSIS PATIENTS BY MODALITY AND ISCHAEMIC HEART DISEASE, 1999 – 2011

(a) Haemodialysis



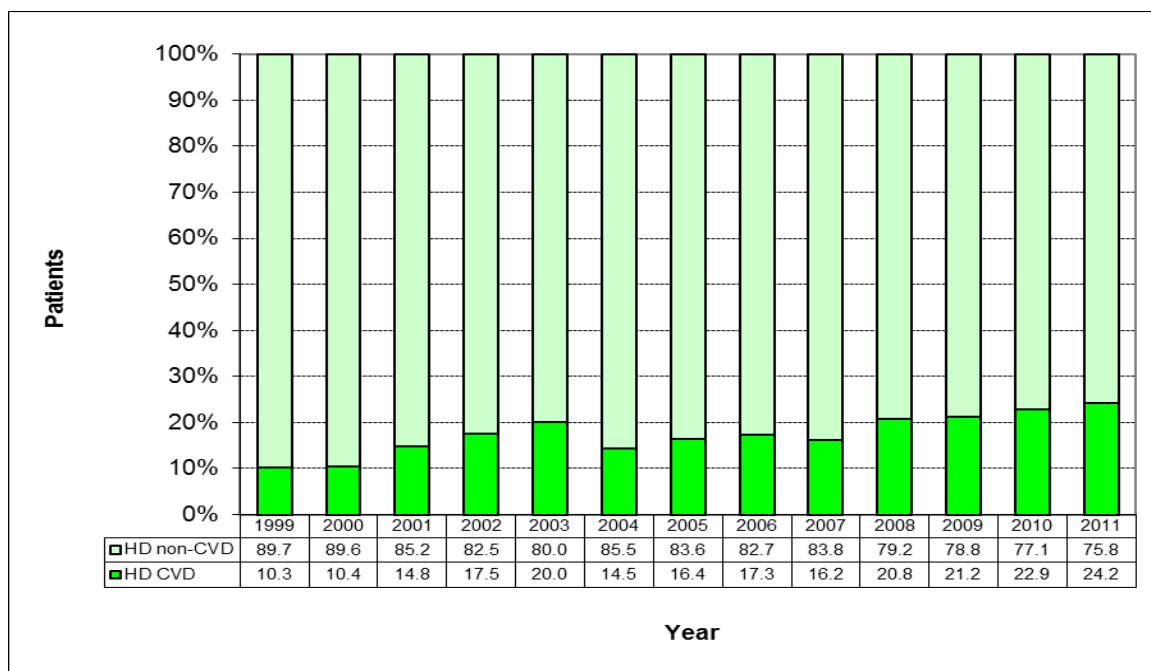
(b) Peritoneal Dialysis



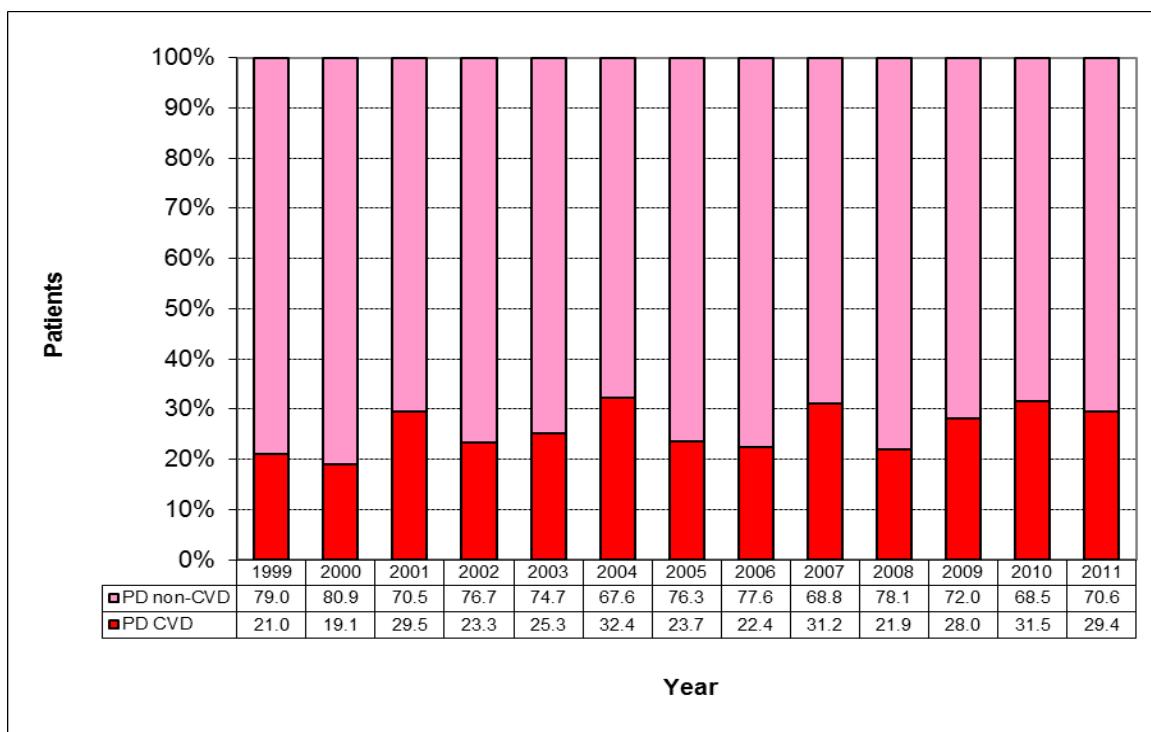
The proportion of incident dialysis patients having cerebrovascular disease as co-morbidity fluctuated between 10% and 24% for HD; and between 19% and 33% for PD. See Figure 7.5.1.3.

Figure 7.5.1.3: INCIDENT DIALYSIS PATIENTS BY MODALITY AND CEREBROVASCULAR DISEASE, 1999 – 2011

(a) Haemodialysis



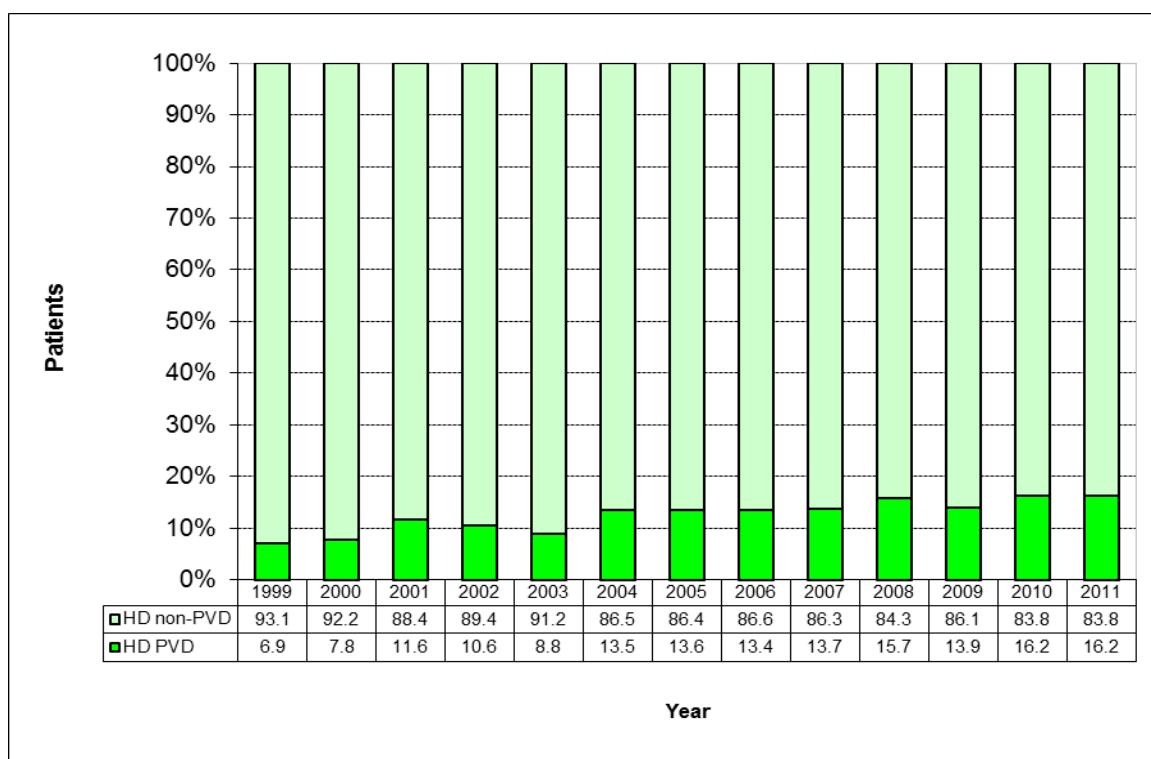
(b) Peritoneal Dialysis



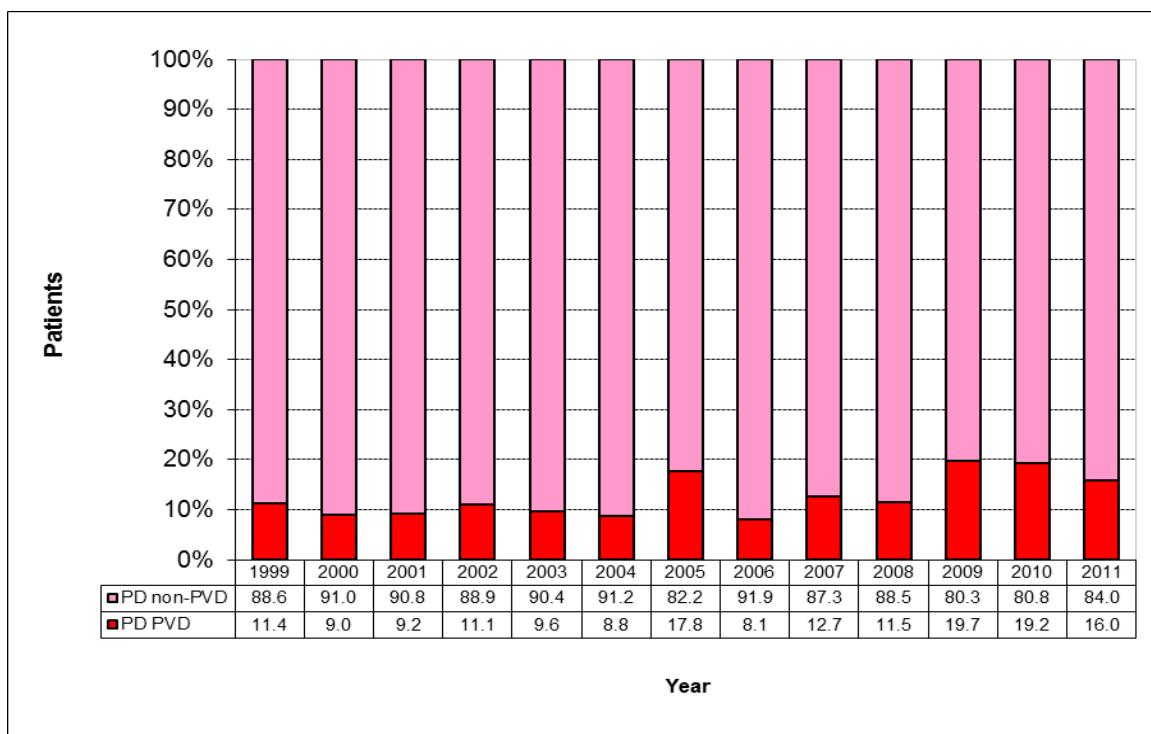
Peripheral vascular disease as co-morbidity increased from 6.9% in 1999 to 16.2% in 2011 for incident HD patients while that for PD was between 8.1% and 19.7% for the same period. See Figure 7.5.1.4.

Figure 7.5.1.4: INCIDENT DIALYSIS PATIENTS BY MODALITY AND PERIPHERAL VASCULAR DISEASE, 1999 – 2011

(a) Haemodialysis



(b) Peritoneal Dialysis



7.5.2 Prevalent Patients

Diabetes Mellitus was present in 52.9% of prevalent patients in 2010 and 54.5% in 2011.

Ischaemic heart disease was present in 44.7% in 2010 and 45.7% in 2011, cerebrovascular disease 18.8% of prevalent patients in 2010 and 19.7% in 2011. See Table 7.5.2.1.

Smoking: There were 9.0% of patients who were current smokers in 2010 and 9.7% in 2011. Former smokers were 22.5% in 2010 and 23.1% in 2011.

Hepatitis B surface antigen and anti-HCV status: In 2010, 3.9% of patients were serologically positive for Hepatitis B Surface Antigen. 3.8% of patients were positive for anti-HCV antibody. While in 2011, 4.0% of patients were serologically positive for Hepatitis B Surface Antigen. 4.2% of patients were positive for anti-HCV antibody.

Table 7.5.2.1: PREVALENT DIALYSIS PATIENTS BY CO-MORBID CONDITIONS

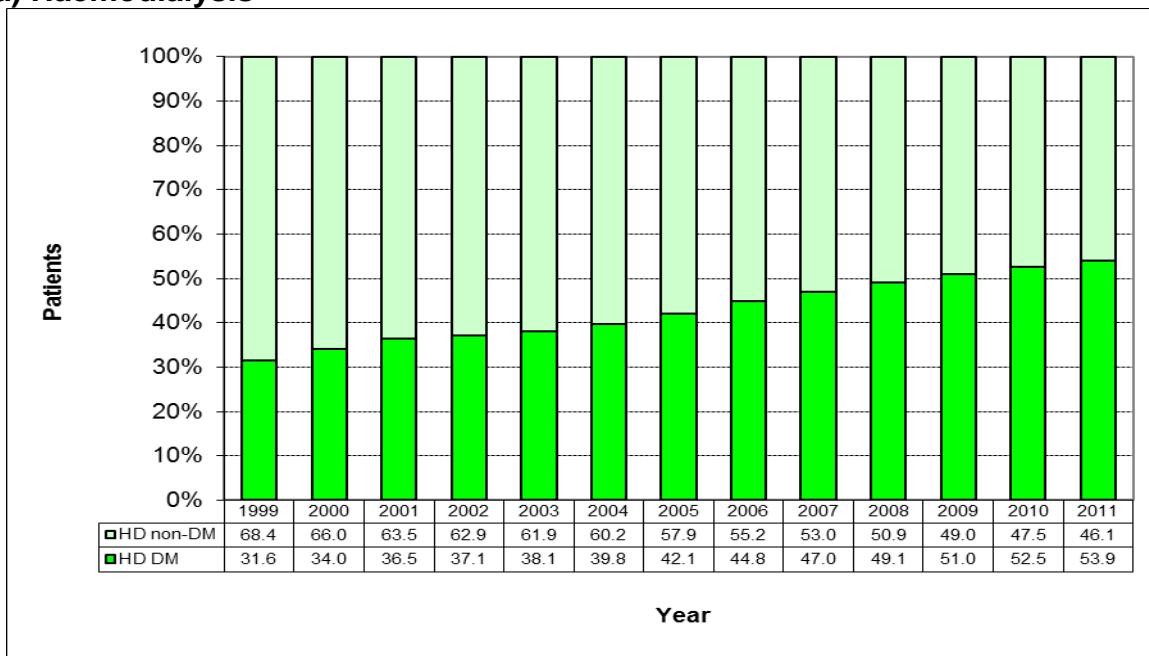
Diabetes Mellitus	2010						2011					
	HD		PD		HD+PD		HD		PD		HD+PD	
	No	%	No	%	No	%	No	%	No	%	No	%
Yes	2112	52.5	321	55.7	2433	52.9	2303	53.9	366	58.6	2669	54.5
No	1908	47.5	255	44.3	2163	47.1	1966	46.0	259	41.4	2225	45.5
Unknown	0	0.0	0	0.0	0	0.0	1	0.0	0	0.0	1	0.0
Total	4020	100	576	100	4596	100	4270	100	625	100	4895	100
Ischaemic Heart Disease	2010						2011					
	HD		PD		HD+PD		HD		PD		HD+PD	
	No	%	No	%	No	%	No	%	No	%	No	%
Yes	1809	45.0	244	42.4	2053	44.7	1954	45.8	285	45.6	2239	45.7
No	2211	55.0	332	57.6	2543	55.3	2314	54.2	339	54.2	2653	54.2
Unknown	0	0.0	0	0.0	0	0.0	2	0.0	1	0.2	3	0.1
Total	4020	100	576	100	4596	100	4270	100	625	100	4895	100
Chronic Obstructive Airway Disease	2010						2011					
	HD		PD		HD+PD		HD		PD		HD+PD	
	No	%	No	%	No	%	No	%	No	%	No	%
Yes	140	3.5	15	2.6	155	3.4	118	2.8	12	1.9	130	2.7
No	3295	82.0	430	74.7	3725	81.0	2992	70.1	348	55.7	3340	68.2
Unknown	585	14.6	131	22.7	716	15.6	1160	27.2	265	42.4	1425	29.1
Total	4020	100	576	100	4596	100	4270	100	625	100	4895	100
Cerebrovascular Disease	2010						2011					
	HD		PD		HD+PD		HD		PD		HD+PD	
	No	%	No	%	No	%	No	%	No	%	No	%
Yes	736	18.3	130	22.6	866	18.8	817	19.1	147	23.5	964	19.7
No	3284	81.7	446	77.4	3730	81.2	3452	80.8	478	76.5	3930	80.3
Unknown	0	0.0	0	0.0	0	0.0	1	0.0	0	0.0	1	0.0
Total	4020	100	576	100	4596	100	4270	100	625	100	4895	100
Peripheral Vascular Disease	2010						2011					
	HD		PD		HD+PD		HD		PD		HD+PD	
	No	%	No	%	No	%	No	%	No	%	No	%
Yes	564	14.0	69	12.0	633	13.8	653	15.3	86	13.8	739	15.1
No	3456	86.0	507	88.0	3963	86.2	3615	84.7	539	86.2	4154	84.9
Unknown	0	0.0	0	0.0	0	0.0	2	0.0	0	0.0	2	0.0
Total	4020	100	576	100	4596	100	4270	100	625	100	4895	100
Smoking	2010						2011					
	HD		PD		HD+PD		HD		PD		HD+PD	
	No	%	No	%	No	%	No	%	No	%	No	%
Current Smoker	374	9.3	40	6.9	414	9.0	434	10.2	43	6.9	477	9.7
Ex-Smoker	929	23.1	103	17.9	1032	22.5	1010	23.7	121	19.4	1131	23.1
Non-Smoker	2687	66.8	425	73.8	3112	67.7	2782	65.2	456	73.0	3238	66.1
Unknown	30	0.7	8	1.4	38	0.8	44	1.0	5	0.8	49	1.0
Total	4020	100	576	100	4596	100	4270	100	625	100	4895	100
Hepatitis B S AG Status	2010						2011					
	HD		PD		HD+PD		HD		PD		HD+PD	
	No	%	No	%	No	%	No	%	No	%	No	%
Positive	165	4.1	14	2.4	179	3.9	180	4.2	14	2.2	194	4.0
Negative	3852	95.8	543	94.3	4395	95.6	4087	95.7	579	92.6	4666	95.3
Unknown	3	0.1	19	3.3	22	0.5	3	0.1	32	5.1	35	0.7
Total	4020	100	576	100	4596	100	4270	100	625	100	4895	100
Anti-HCV Status	2010						2011					
	HD		PD		HD+PD		HD		PD		HD+PD	
	No	%	No	%	No	%	No	%	No	%	No	%
Positive	168	4.2	7	1.2	175	3.8	197	4.6	7	1.1	204	4.2
Negative	3848	95.7	549	95.3	4397	95.7	4068	95.3	583	93.3	4651	95.0
Unknown	4	0.1	20	3.5	24	0.5	5	0.1	35	5.6	40	0.8
Total	4020	100	576	100	4596	100	4270	100	625	100	4895	100

Patients with diabetes mellitus were higher in proportion among those on PD as compared with HD (55.7% vs 52.5% in 2010; 58.6% vs 53.9% in 2011) and cerebrovascular disease (22.6% vs 18.3% in 2010; 23.5% vs 19.1% in 2011).

An increasing proportion of HD patients, 31.6% in 1999 compared to 53.9% in 2011, have diabetes whereas the proportion for PD patients has been stable. See Figure 7.5.2.1. Similar trends have been noted for ischaemic heart disease as a co-morbid condition. See Figure 7.5.2.2

Figure 7.5.2.1: PREVALENT DIALYSIS PATIENTS BY MODALITY AND DIABETES MELLITUS, 1999 – 2011

(a) Haemodialysis



(b) Peritoneal Dialysis

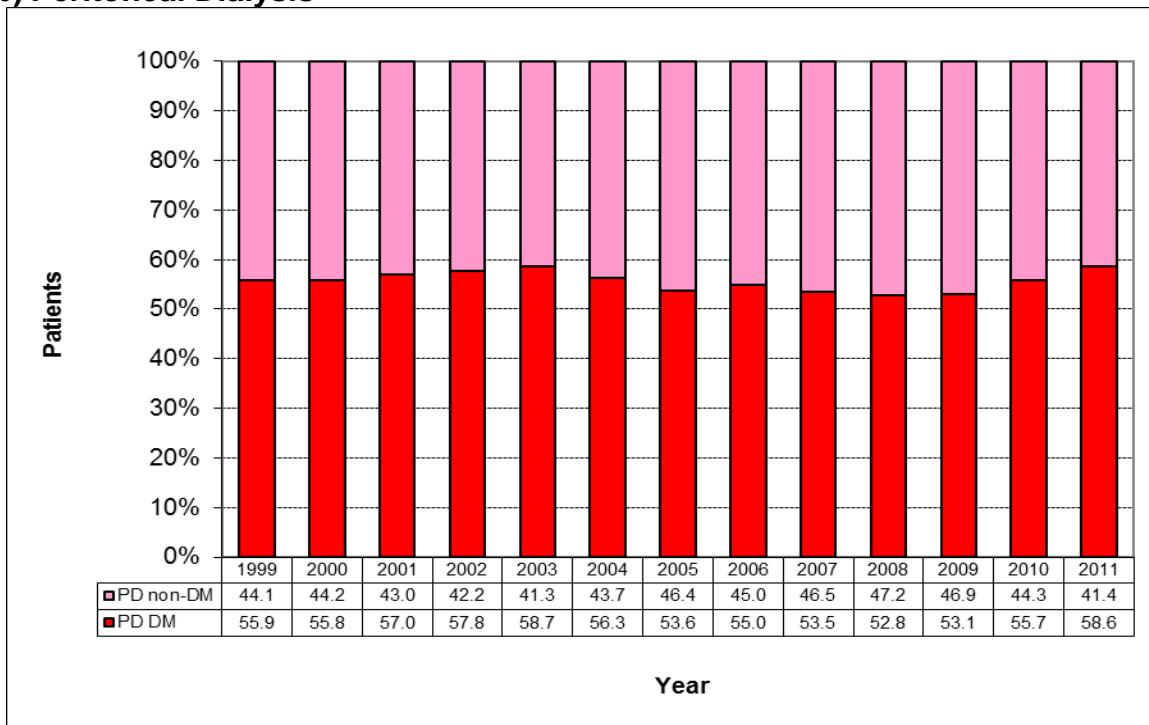
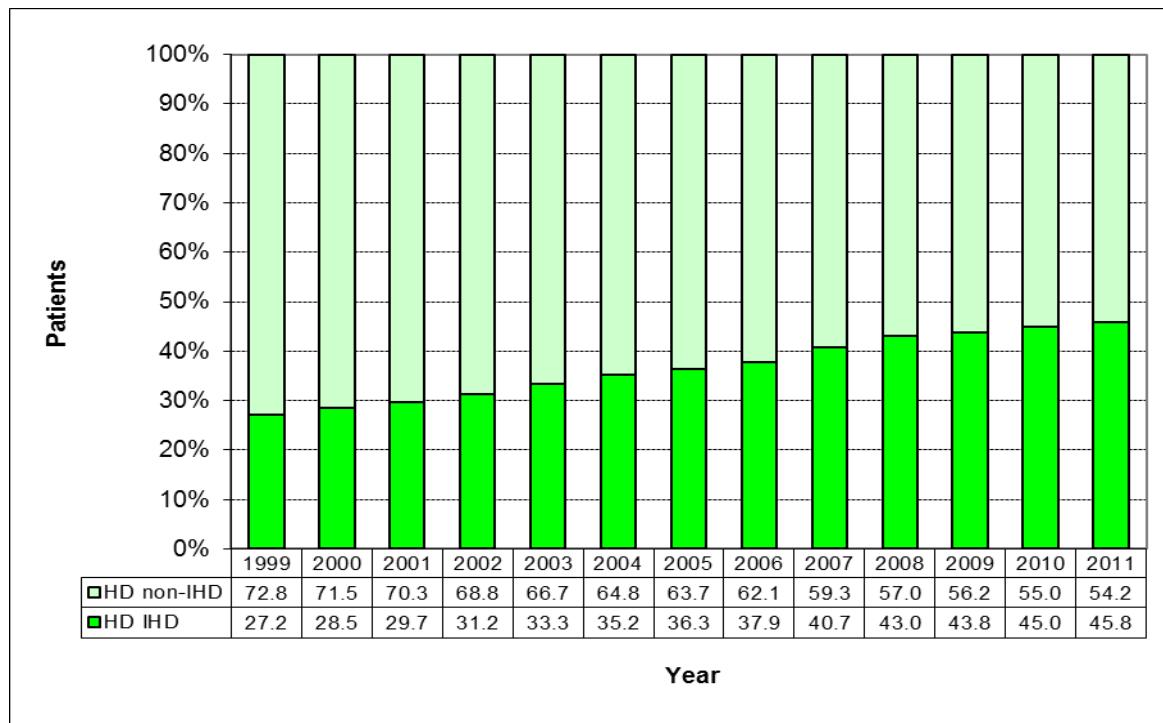
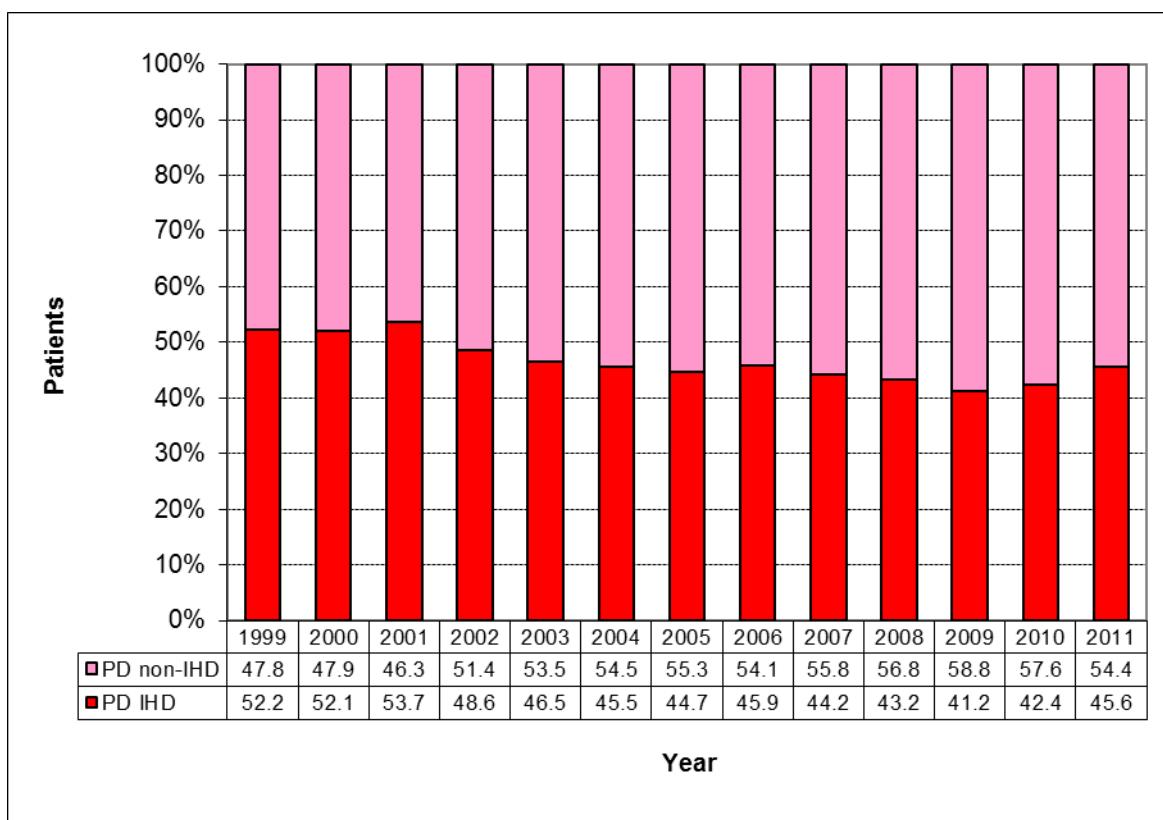


Figure 7.5.2.2: PREVALENT DIALYSIS PATIENTS BY MODALITY AND ISCHAEMIC HEART DISEASE, 1999 – 2011

(a) Haemodialysis



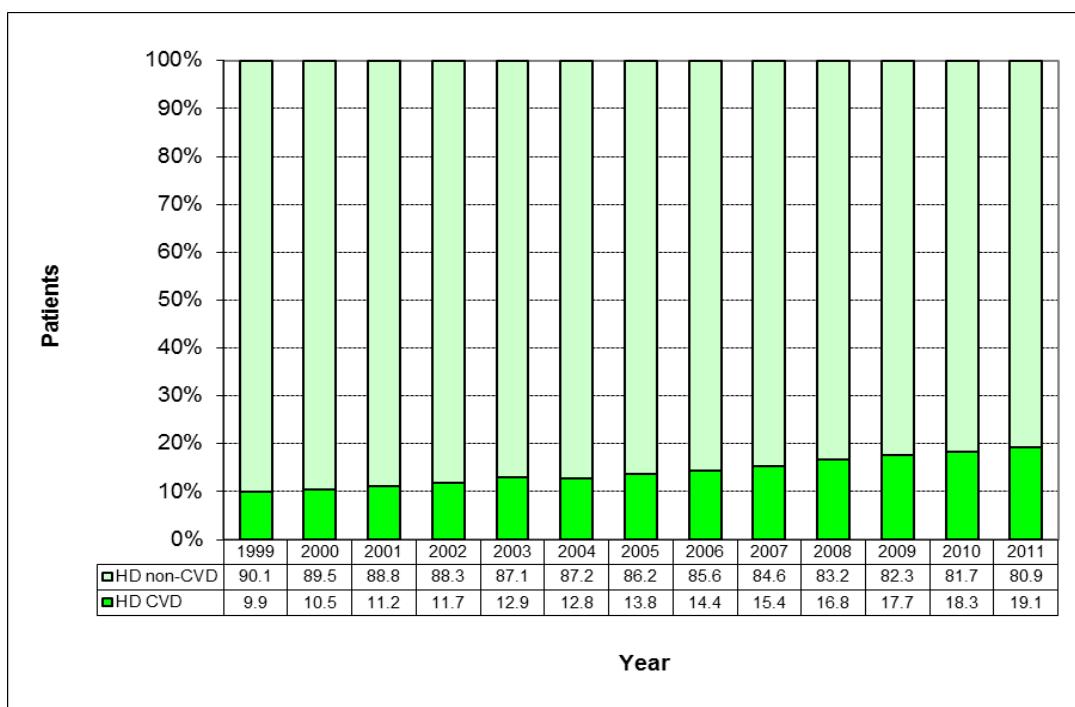
(b) Peritoneal Dialysis



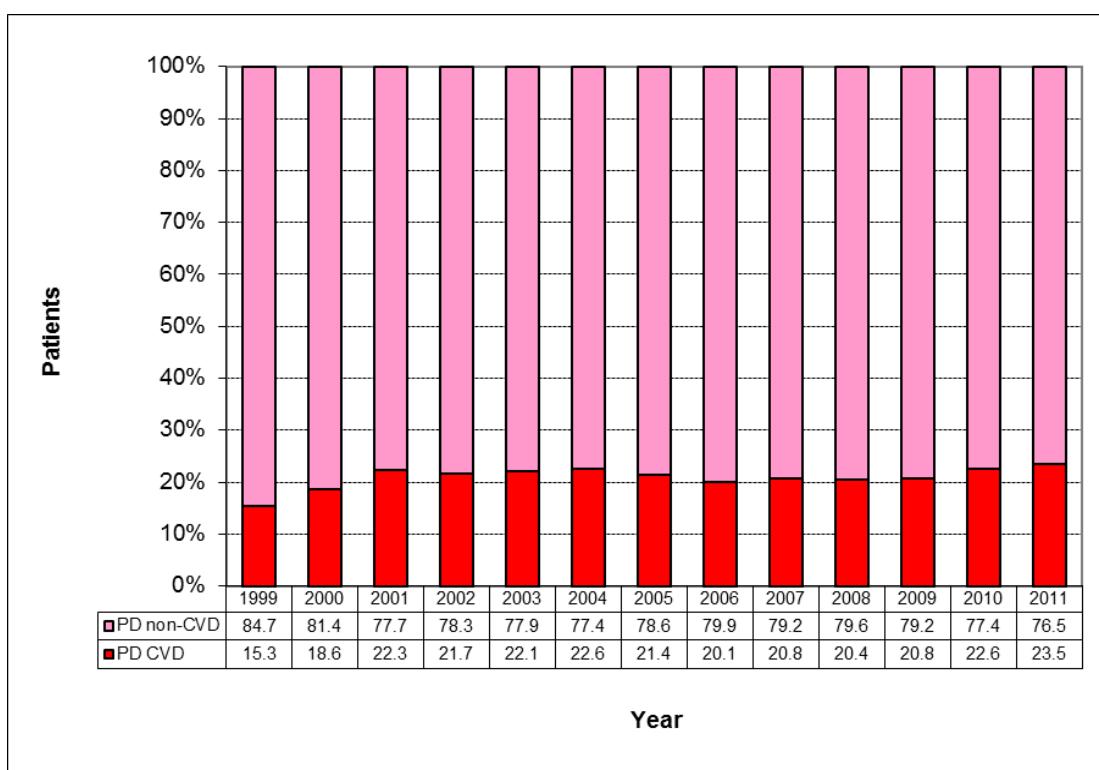
There was a similar rising trend in the prevalent HD patients for cerebrovascular disease as co-morbid condition (9.9% in 1999 to 19.1% in 2011). The proportion for patients on PD increased from 15.3% to 22.3% in 2001, before hovering between 20-23% in the period 2002-2011. See Figure 7.5.2.3.

Figure 7.5.2.3: PREVALENT DIALYSIS PATIENTS BY MODALITY, CEREBROVASCULAR DISEASE, 1999 – 2011

(a) Haemodialysis



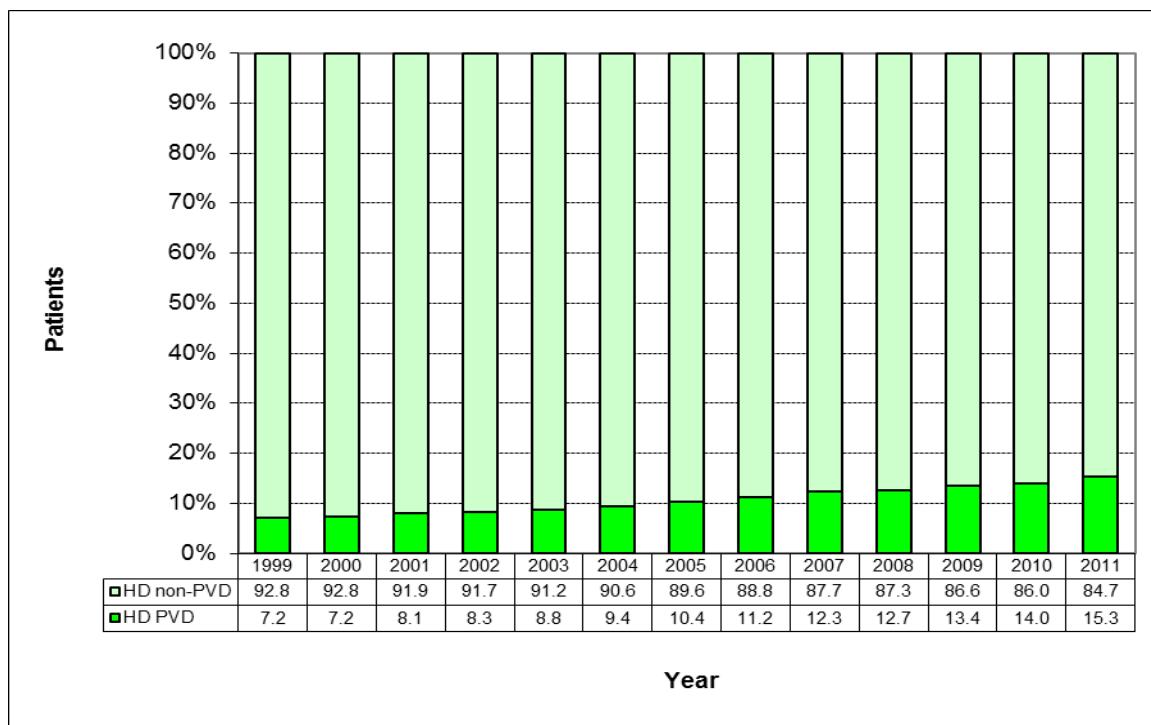
(b) Peritoneal Dialysis



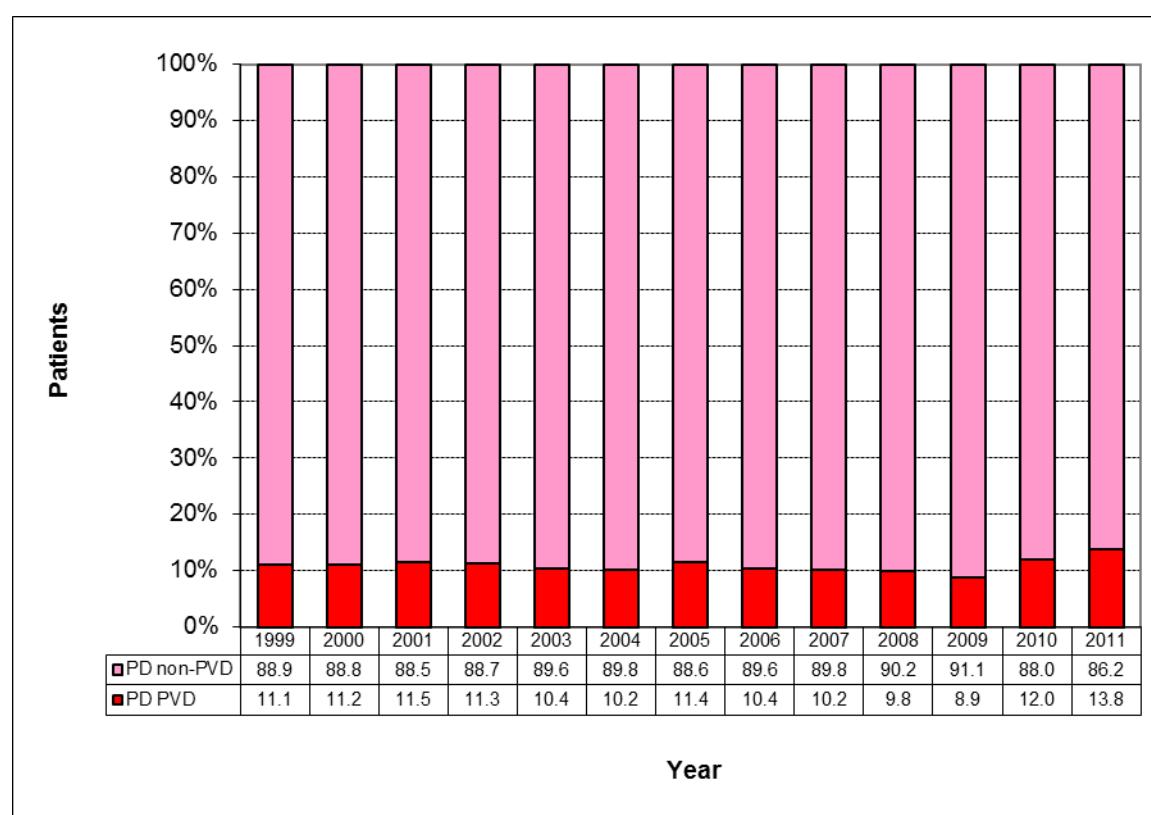
The proportion of prevalent patients having peripheral vascular disease as co-morbid condition was small for the period 1999-2011 (7%-15% for HD, 9%-13% for PD). See Figure 7.5.2.4.

Figure 7.5.2.4: PREVALENT DIALYSIS PATIENTS BY MODALITY AND PERIPHERAL VASCULAR DISEASE, 1999 – 2011

(a) Haemodialysis



(b) Peritoneal Dialysis



7.6 Social Aspects

7.6.1 Educational Level

7.6.1.1 Incident Patients

The incident dialysis patients who have had no formal education were 16.5% in 2010 and 11.5% in 2011. See Table 7.6.1.1.1.

Table 7.6.1.1.1: INCIDENT DIALYSIS PATIENTS BY EDUCATIONAL LEVEL

EDUCATIONAL LEVEL	2010		2011	
	No	%	No	%
No formal education	122	16.5	104	11.5
Low primary	189	25.5	243	26.9
PSLE Certificate	187	25.2	183	20.2
GCE N level passes	7	0.9	6	0.7
GCE O level passes	165	22.3	253	28.0
GCE A level passes	10	1.3	11	1.2
Diploma	18	2.4	25	2.8
University and above	35	4.7	45	5.0
Unknown/Others	8	1.1	34	3.8
All Educational Levels	741	100	904	100

7.6.1.2 Prevalent Patients

The prevalent dialysis patients who have had no formal education were 19.3% in 2010 and 16.5% in 2011. See Table 7.6.1.2.1.

Table 7.6.1.2.1: PREVALENT DIALYSIS PATIENTS BY EDUCATIONAL LEVEL

EDUCATIONAL LEVEL	2010		2011	
	No	%	No	%
No formal education	888	19.3	809	16.5
Low primary	1080	23.5	1172	23.9
PSLE Certificate	1092	23.8	1142	23.3
GCE N level passes	94	2.0	100	2.0
GCE O level passes	968	21.1	1131	23.1
GCE A level passes	112	2.4	114	2.3
Diploma	148	3.2	157	3.2
University and above	169	3.7	197	4.0
Unknown/Others	45	1.0	73	1.5
All Educational Levels	4596	100	4895	100

7.7 Haemodialysis

7.7.1 Incidence and Prevalence

During 2010, there were 611 new HD (HD) patients (CR 170.6 pmp; ASR 135.7 pmp) who started on HD and 56 were transplanted. During 2011, there were 741 new HD (HD) patients (CR 203.4 pmp; ASR 157.2 pmp) who started on HD and 56 were transplanted.

There were 424 deaths in 2010 and 559 in 2011 among HD patients.

The prevalent HD population numbered 4020 patients (CR 1065.8 pmp; ASR 778.4 pmp) in 2010, while 4270 patients (CR 1126.9 pmp; ASR 795.2 pmp) in 2011. See Table 7.7.1.1.

Table 7.7.1.1: INCIDENT AND PREVALENT HD PATIENTS

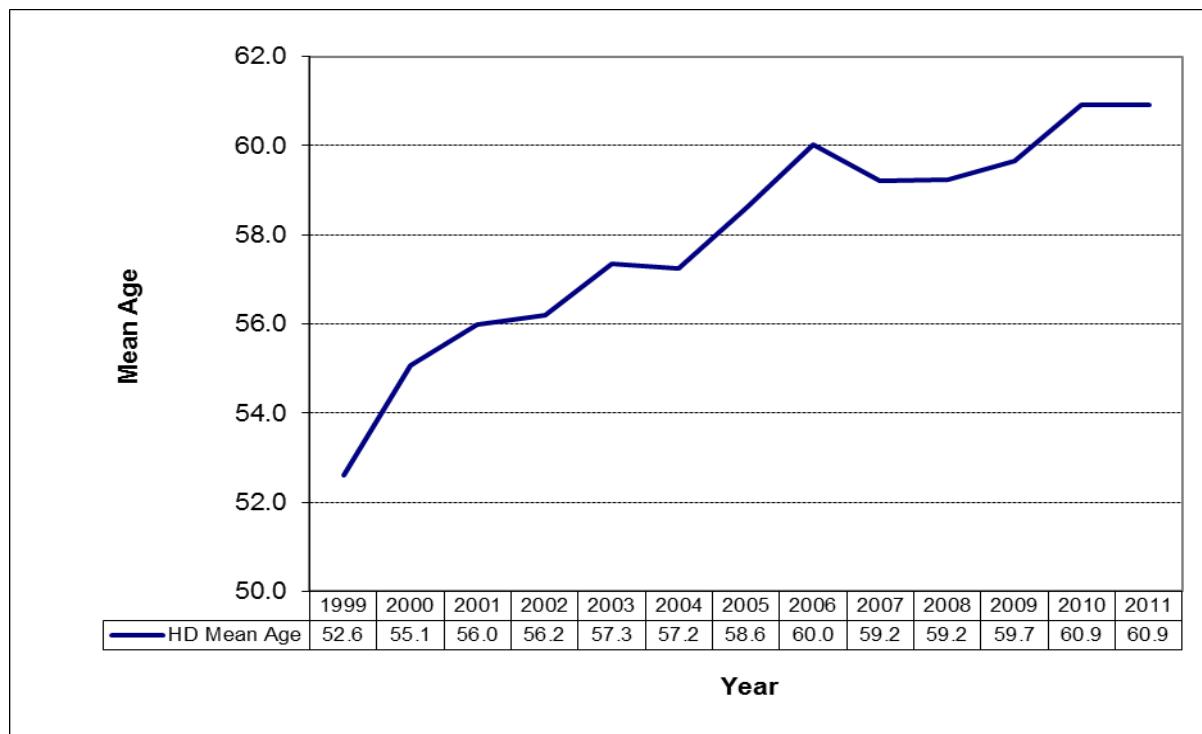
	2010				2011			
	New Patients	Transplanted	Dialysis Deaths for preceding one year	Prevalent Dialysis Population	New Patients	Transplanted	Dialysis Deaths for preceding one year	Prevalent Dialysis Population
Number	611	56	424	4020	741	68	559	4270
CR*	170.6	14.8	115.1	1065.8	203.4	17.9	147.5	1126.9
ASR*	135.7	-	83.8	778.4	157.2		102.0	795.2

* per million residential population

7.7.2 Incidence

Within the incident HD population, 57.4% in 2010 and 63.6% in 2011 were male. The mean age was 60.9 years (median 60.8 years) in 2010 and 60.9 years (median 61.5 years) in 2011. In 2010, 53.4% of patients were age 60 years and above while in 2011 it was 54.3%. See Table 7.7.2.1.

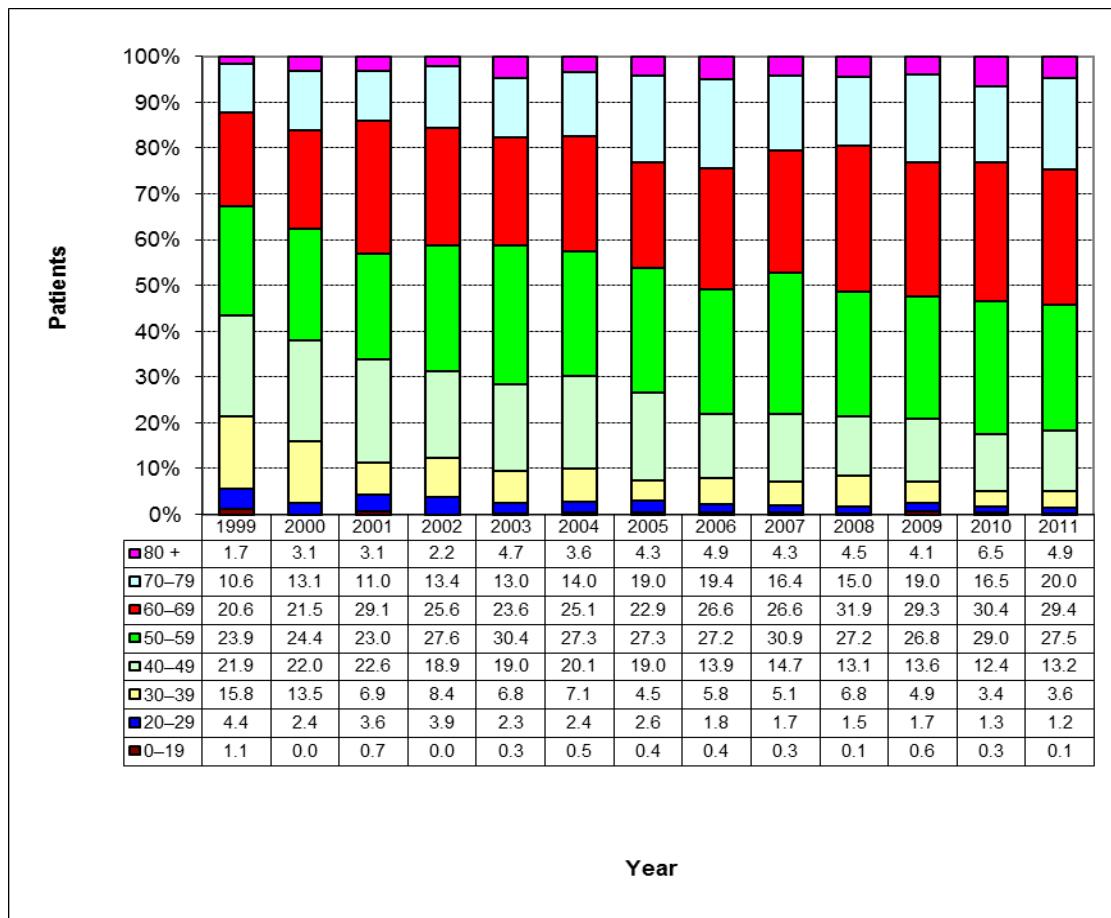
The mean age for incident HD patients increased from 52.6 years old in 1999 to 60.9 years old in 2011. See Figure 7.7.2.1.

Figure 7.7.2.1: MEAN AGE OF INCIDENT HD PATIENTS, 1999 – 2011**Table 7.7.2.1: INCIDENT HD PATIENTS BY AGE GROUP AND GENDER**

2010 AGE GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
0–19	1	0.3	1	0.4	2	0.3
20–29	3	0.9	5	1.9	8	1.3
30–39	13	3.7	8	3.1	21	3.4
40–49	36	10.3	40	15.4	76	12.4
50–59	108	30.8	69	26.5	177	29.0
60–69	114	32.5	72	27.7	186	30.4
70–79	52	14.8	49	18.8	101	16.5
80 +	24	6.8	16	6.2	40	6.5
All Age Groups	351	100	260	100	611	100

2011 AGE GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
0–19	0	0.0	1	0.4	1	0.1
20–29	7	1.5	2	0.7	9	1.2
30–39	20	4.2	7	2.6	27	3.6
40–49	68	14.4	30	11.1	98	13.2
50–59	126	26.8	78	28.9	204	27.5
60–69	145	30.8	73	27.0	218	29.4
70–79	84	17.8	64	23.7	148	20.0
80 +	21	4.5	15	5.6	36	4.9
All Age Groups	471	100	270	100	741	100

More than half of the new HD patients were of age 50-69 years. See Figure 7.7.2.2.

Figure 7.7.2.2: INCIDENT HD PATIENTS BY AGE GROUP, 1999 – 2011

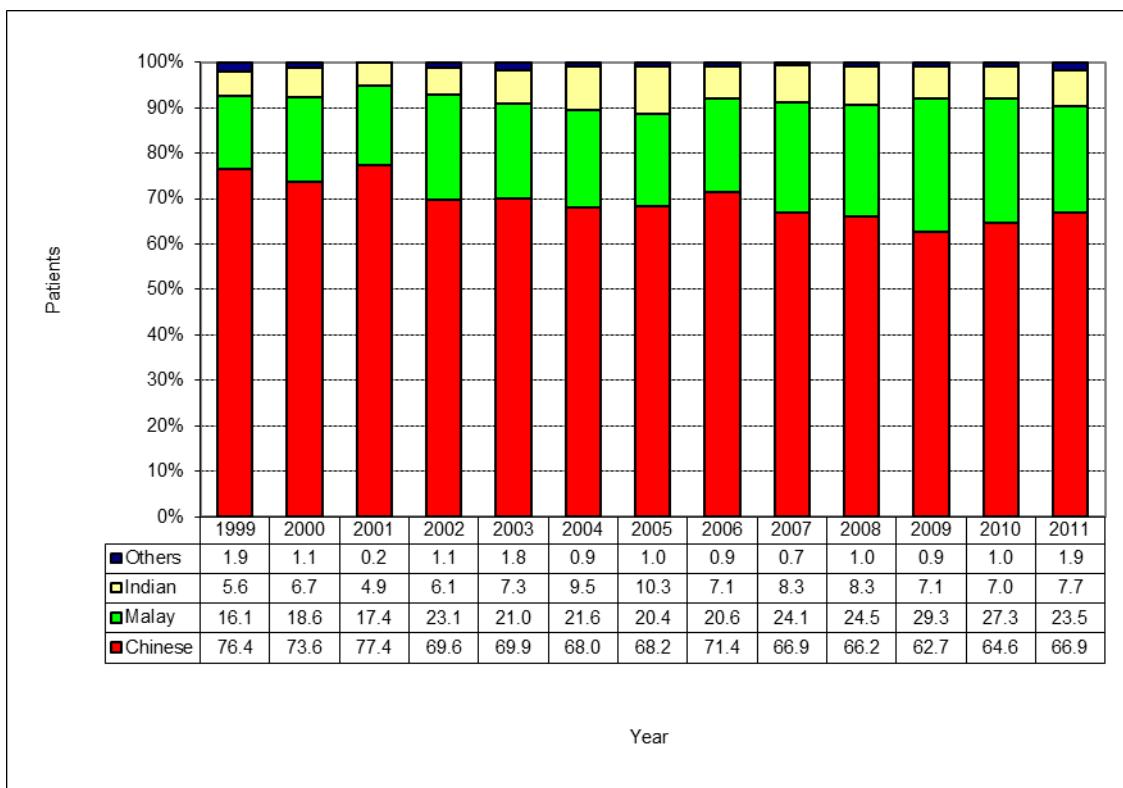
The proportion of Malays in new HD patients was slightly higher than the ethnic distribution in the country. See Table 7.7.2.2.

Table 7.7.2.2: INCIDENT HD PATIENTS BY ETHNIC GROUP AND GENDER

2010 ETHNIC GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
Chinese	251	71.5	144	55.4	395	64.6
Malay	75	21.4	92	35.4	167	27.3
Indian	22	6.3	21	8.1	43	7.0
Others	3	0.9	3	1.2	6	1.0
All Ethnic Groups	351	100	260	100	611	100

2011 ETHNIC GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
Chinese	335	71.1	161	59.6	496	66.9
Malay	89	18.9	85	31.5	174	23.5
Indian	41	8.7	16	5.9	57	7.7
Others	6	1.3	8	3.0	14	1.9
All Ethnic Groups	471	100	270	100	741	100

As in the general population, the majority of new HD patients are Chinese. See Figure 7.7.2.3.

Figure 7.7.2.3: INCIDENT HD PATIENTS BY ETHNIC GROUP, 1999 – 2011

Male incident HD patients outnumbered females in the period 2000-2011. See Table 7.7.2.3.

Table 7.7.2.3: INCIDENT HD PATIENTS BY GENDER, 1999 – 2011

YEAR	Male		Female	
	No	%	No	%
1999	174	48.3	186	51.7
2000	227	50.3	224	49.7
2001	260	58.2	187	41.8
2002	203	56.5	156	43.5
2003	206	53.5	179	46.5
2004	226	53.6	196	46.4
2005	261	52.8	233	47.2
2006	309	54.5	258	45.5
2007	330	54.5	275	45.5
2008	379	56.2	295	43.8
2009	357	56.0	281	44.0
2010	351	57.4	260	42.6
2011	471	63.6	270	36.4

7.7.3 Prevalence

In 2010, there were 4020 prevalent patients (CR 1065.8 pmp; ASR 778.4 pmp) on HD as of 31 December 2010. While in 2011, there were 4270 prevalent patients (CR 1126.9 pmp; ASR 795.2 pmp) on HD as of 31 December 2011.

Males made up 54.1% in 2010 and 55.9% in 2011. The mean age of all HD patients was 60.6 years (median 60.9 years) in 2010 and 60.9 (median 61.1 years) in 2011. 53.0% were aged 60 years or above in 2010 and 53.5% in 2011. See Table 7.7.3.1.

The mean age for prevalent HD patients has increased from a mean of 53.7 years old in 1999 to 60.9 years old in 2011. See Figure 7.7.3.1.

Figure 7.7.3.1: AGE OF PREVALENT HD PATIENTS, 1999 – 2011

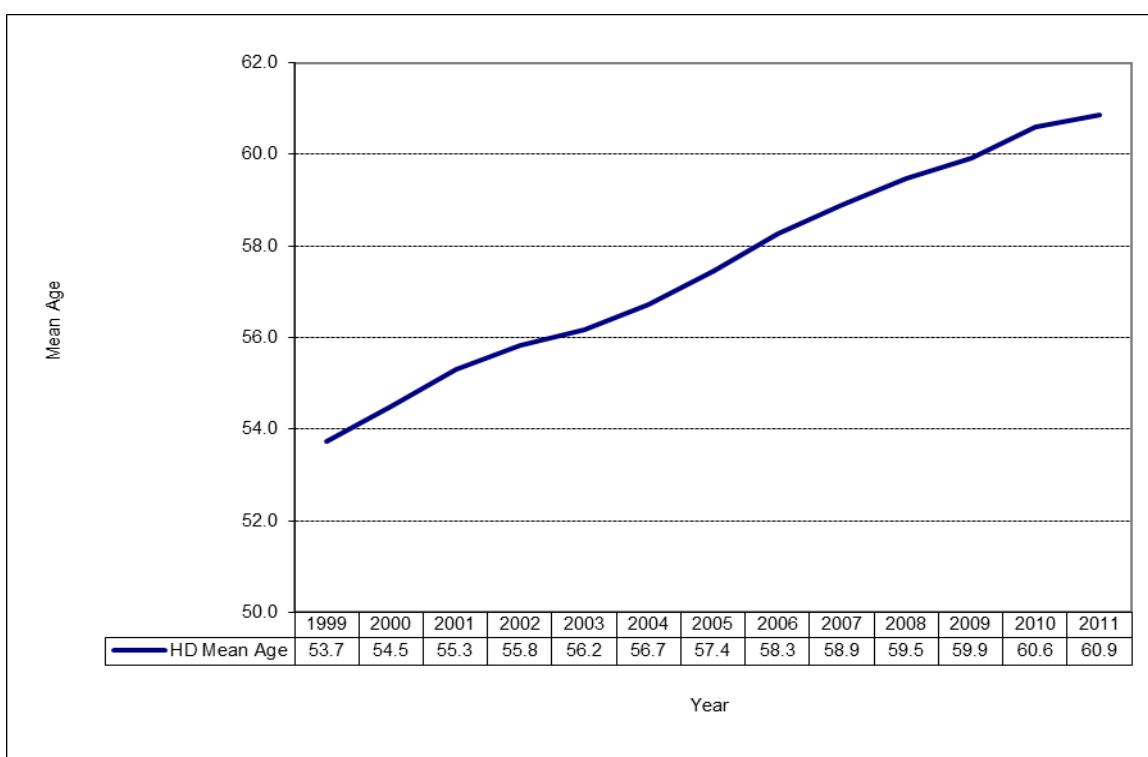


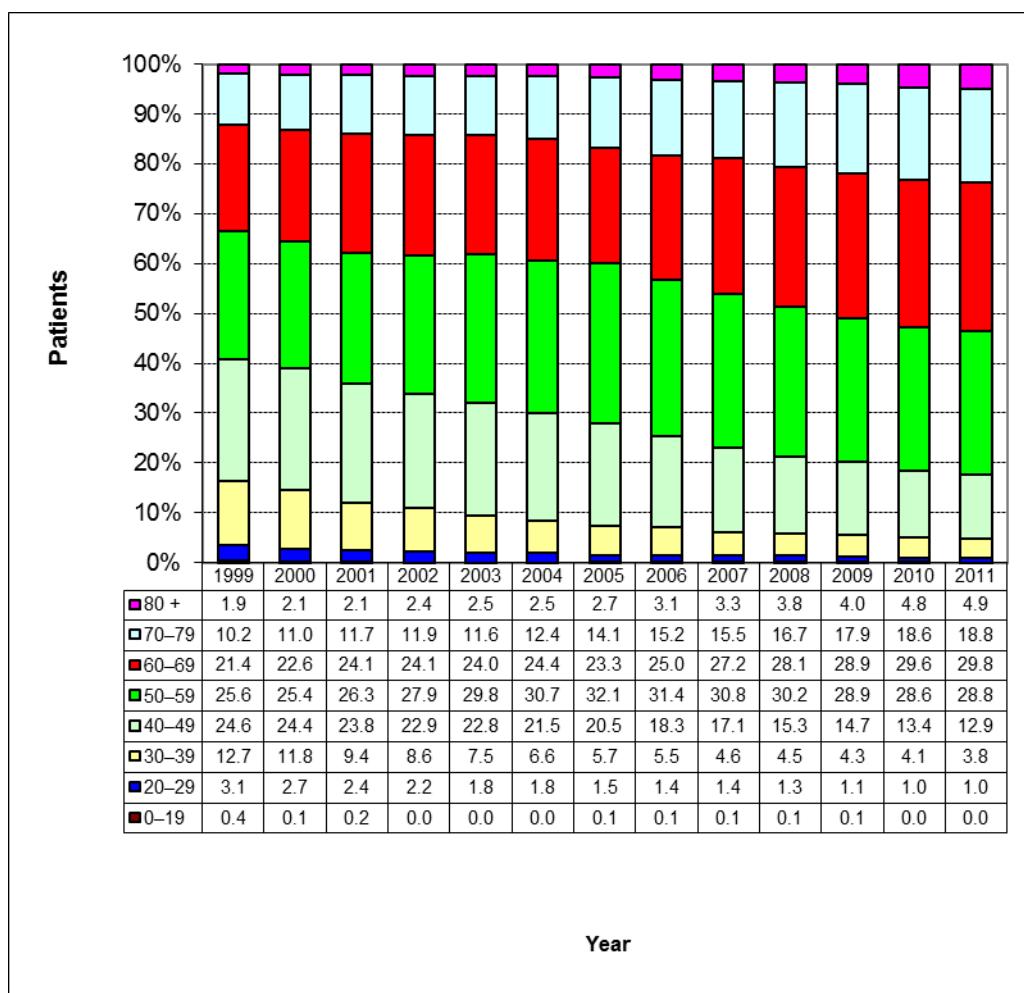
Table 7.7.3.1: PREVALENT HD PATIENTS BY AGE GROUP AND GENDER

2010 AGE GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
0–19	0	0.0	2	0.1	2	0.0
20–29	23	1.1	16	0.9	39	1.0
30–39	97	4.5	67	3.6	164	4.1
40–49	301	13.8	236	12.8	537	13.4
50–59	640	29.4	511	27.7	1151	28.6
60–69	657	30.2	532	28.8	1189	29.6
70–79	369	17.0	377	20.4	746	18.6
80 +	88	4.0	104	5.6	192	4.8
All Age Groups	2175	100	1845	100	4020	100

2011 AGE GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
0–19	0	0.0	1	0.1	1	0.0
20–29	27	1.1	14	0.7	41	1.0
30–39	99	4.1	63	3.3	162	3.8
40–49	319	13.4	230	12.2	549	12.9
50–59	695	29.1	535	28.4	1230	28.8
60–69	727	30.5	547	29.0	1274	29.8
70–79	410	17.2	393	20.9	803	18.8
80 +	109	4.6	101	5.4	210	4.9
All Age Groups	2386	100	1884	100	4270	100

The proportion of existing HD patients were highest in age groups 50-59 and 60-69 while the younger age groups showed a decreasing trend. See Figure 7.7.3.2.

Figure 7.7.3.2: PREVALENT HD PATIENTS BY AGE GROUP, 1999 – 2011



In 2010, the ethnic composition was as follows: Chinese 68.5%, Malay 23.7%, Indian 6.9% and 0.9% other races. See Table 7.7.3.2.

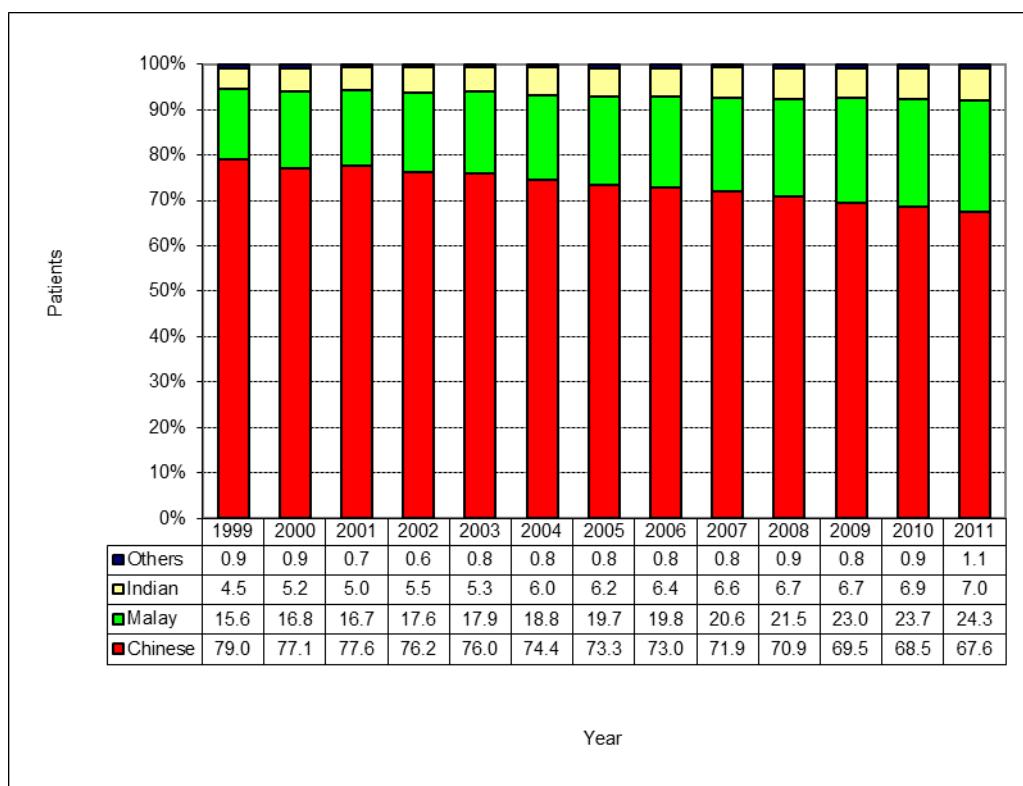
In 2011, the ethnic composition was as follows: Chinese 67.6%, Malay 24.3%, Indian 7.0% and 1.1% other races. See Table 7.7.3.2.

Table 7.7.3.2: PREVALENT HD PATIENTS BY ETHNIC GROUP AND GENDER

2010 ETHNIC GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
Chinese	1563	71.9	1191	64.6	2754	68.5
Malay	434	20.0	518	28.1	952	23.7
Indian	159	7.3	120	6.5	279	6.9
Others	19	0.9	16	0.9	35	0.9
All Ethnic Groups	2175	100	1845	100	4020	100

2011 ETHNIC GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
Chinese	1695	71.0	1190	63.2	2885	67.6
Malay	486	20.4	553	29.4	1039	24.3
Indian	183	7.7	118	6.3	301	7.0
Others	22	0.9	23	1.2	45	1.1
All Ethnic Groups	2386	100	1884	100	4270	100

The number of existing Chinese patients on HD declined from 79.0% in 1999 to 67.6% in 2011, while the Indians and Malays have increased. See Figure 7.7.3.3.

Figure 7.7.3.3: PREVALENT HD PATIENTS BY ETHNIC GROUP, 1999 – 2011

The proportion of existing male HD patients was consistently higher than that for females for 1999-2011. See Table 7.7.3.3.

Table 7.7.3.3: PREVALENT HD PATIENTS BY GENDER, 1999 – 2011

YEAR	Male		Female	
	No	%	No	%
1999	1050	51.1	1005	48.9
2000	1179	50.7	1148	49.3
2001	1274	51.0	1222	49.0
2002	1315	51.7	1228	48.3
2003	1356	51.6	1272	48.4
2004	1389	51.4	1312	48.6
2005	1463	51.1	1401	48.9
2006	1589	51.9	1474	48.1
2007	1713	52.6	1542	47.4
2008	1884	52.7	1691	47.3
2009	2021	53.4	1764	46.6
2010	2175	54.1	1845	45.9
2011	2386	55.9	1884	44.1

7.7.4 Aetiology of Renal Failure

Diabetic nephropathy was the aetiology of renal failure in 62.2% of incident HD patients in 2010 and 59.9% in 2011. Primary glomerulonephritis was the aetiology of renal failure in 19.5% of incident HD patients in 2010 and 17.8% in 2011.

Diabetic nephropathy was the leading cause of renal failure in prevalent HD patients (45.1% in 2010; 46.1% in 2011) followed by primary glomerulonephritis (33.4% in 2010; 32.0% in 2011). See Table 7.7.4.1.

Table 7.7.4.1: INCIDENT AND PREVALENT HD PATIENTS BY AETIOLOGY OF RENAL FAILURE

Causes of CKD5	2010				2011			
	Incident		Prevalent		Incident		Prevalent	
	No	%	No	%	No	%	No	%
Diabetic Nephropathy	380	62.2	1813	45.1	444	59.9	1967	46.1
Primary Glomerulonephritis (GN)	119	19.5	1341	33.4	132	17.8	1367	32.0
Autoimmune Disease/GN with Systemic Manifestations	6	1.0	82	2.0	6	0.8	83	1.9
Hypertension and Renovascular Disease	75	12.3	437	10.9	102	13.8	480	11.2
Polycystic Kidney Disease / Other Cystic Diseases	14	2.3	116	2.9	18	2.4	131	3.1
Vesicoureteric Reflex / Chronic Pyelonephritis	0	0.0	21	0.5	3	0.4	22	0.5
Obstruction	2	0.3	37	0.9	6	0.8	38	0.9
Stone Disease	1	0.2	12	0.3	1	0.1	11	0.3
Miscellaneous	13	2.1	92	2.3	22	3.0	102	2.4
Unknown	1	0.2	69	1.7	7	0.9	69	1.6
All Causes of CKD5	611	100	4020	100	741	100	4270	100

Figure 7.3.1.4(a) showed the 12-year trend (1999-2011) of diabetic nephropathy among HD patients.

7.7.5 Service Provider

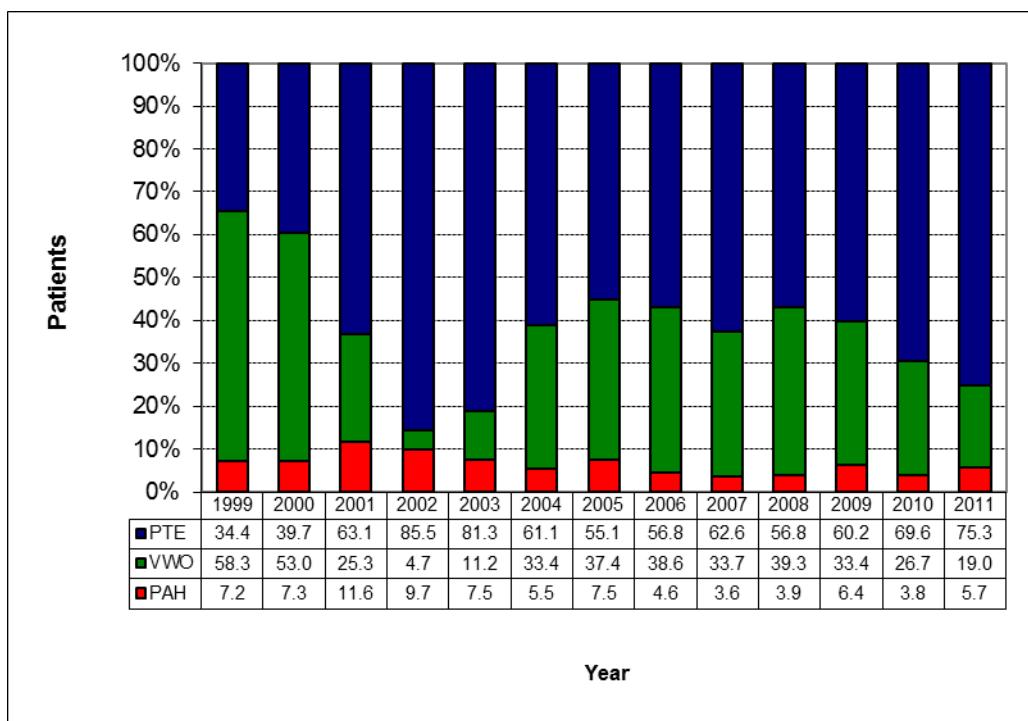
While the majority of new HD patients (69.6% in 2010; 75.3% in 2011) were dialysed in private dialysis centres, most prevalent HD patients (66.0% in 2010; 63.7% in 2011) were dialysed in centres run by voluntary welfare organisations (VWO). This probably reflects the patients' long term choice for subsidised dialysis. See Table 7.7.5.1.

Table 7.7.5.1: INCIDENT AND PREVALENT HD PATIENTS BY SERVICE PROVIDER

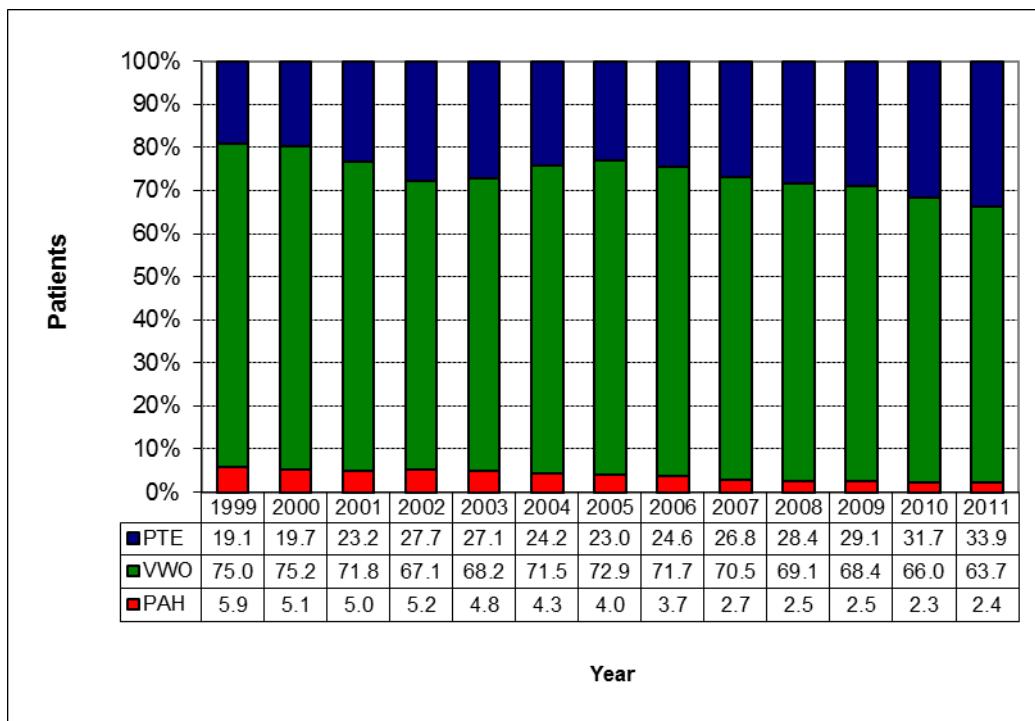
SERVICE PROVIDER	2010				2011			
	New	%	Prevalent	%	New	%	Prevalent	%
PAH	23	3.8	92	2.3	42	5.7	102	2.4
VWO	163	26.7	2654	66.0	141	19.0	2722	63.7
PTE	425	69.6	1274	31.7	558	75.3	1446	33.9
All Providers	611	100	4020	100	741	100	4270	100

The percentage of new HD patients dialysed in private centres increased from 34.4% in 1999 to 85.5% in 2002 and fluctuated from 55.0% to 75.3% subsequently. Intake of new HD patients to voluntary welfare organisations (VWO) was lowest in 2002, subsequently it stabilised from 33.4% to 39.3%. See Figure 7.7.5.1.

Figure 7.7.5.1: INCIDENT HD PATIENTS BY SERVICE PROVIDER, 1999 – 2011



In the period 1999-2011, more than two-thirds of the prevalent HD patients were dialysed at centres run by VWOs. See Figure 7.7.5.2. The proportion has been dropping from 2005.

Figure 7.7.5.2: PREVALENT HD PATIENTS BY SERVICE PROVIDER, 1999 – 2011

7.7.6 Dialysis Treatment

The majority of prevalent HD patients (2010: 96.5%; 2011: 97.3%) were dialysed three times a week. More patients in the VWO centres (2010: 99.8%; 2011: 99.9%) and Public Acute Hospitals (2010: 94.6%; 2011: 97.1%) dialysed three times a week. See Table 7.7.6.1.

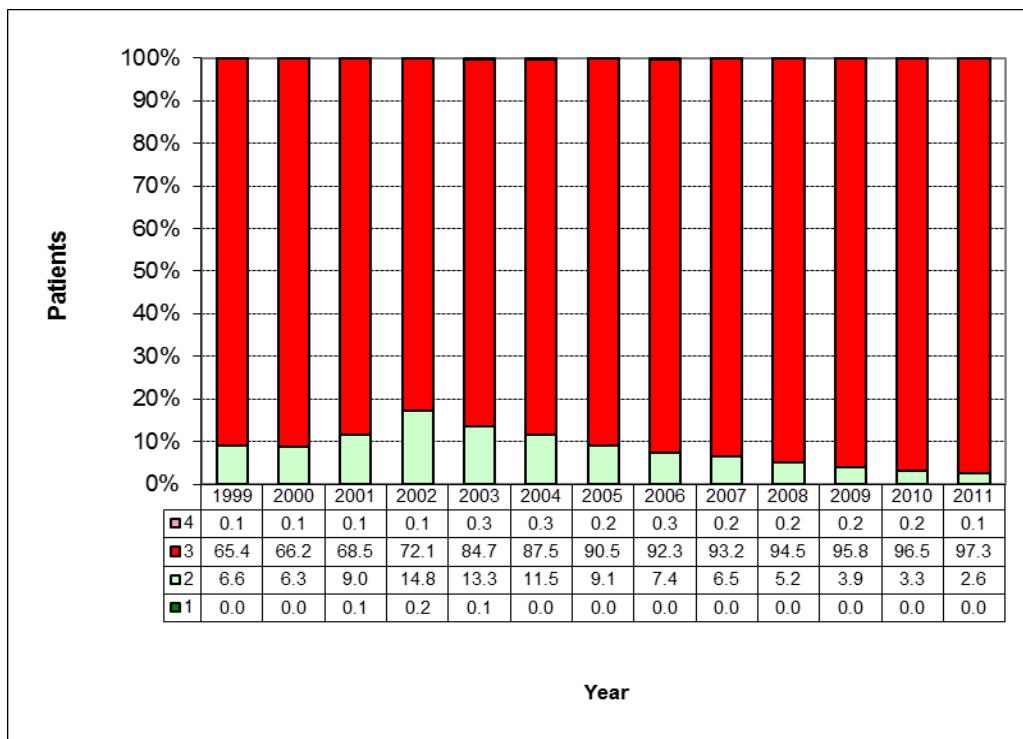
Table 7.7.6.1: PREVALENT HD PATIENTS BY FREQUENCY OF HD AND SERVICE PROVIDER

2010 SESSION PER WEEK	PAH		VWO		PTE		ALL	
	No	%	No	%	No	%	No	%
1	0	0.0	0	0.0	1	0.1	1	0.0
2	3	3.3	2	0.1	127	10.0	132	3.3
3	87	94.6	2650	99.8	1143	89.7	3880	96.5
4	2	2.2	2	0.1	3	0.2	7	0.2
5	0	0.0	0	0.0	0	0.0	0	0.0
6	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
All Patients	92	100	2654	100	1274	100	4020	100

2011 SESSION PER WEEK	PAH		VWO		PTE		ALL	
	No	%	No	%	No	%	No	%
1	0	0.0	0	0.0	1	0.1	1	0.0
2	2	2.0	2	0.1	107	7.4	111	2.6
3	99	97.1	2719	99.9	1336	92.4	4154	97.3
4	1	1.0	1	0.0	2	0.1	4	0.1
5	0	0.0	0	0.0	0	0.0	0	0.0
6	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
All Patients	102	100	2722	100	1446	100	4270	100

The number of patients dialysing 3 times per week is increasing. See Figure 7.7.6.1.

Figure 7.7.6.1: PREVALENT HD PATIENTS BY FREQUENCY OF HD, 1999 – 2011



Of all the patients dialysing three times a week, majority of them (2010: 78.3%; 2011: 80.8%) dialysed between 3.5 to 4.0 hours. More patients in the private centres dialysed 3.5 hours or longer. See Table 7.7.6.2.

Table 7.7.6.2: PREVALENT PATIENTS DIALYSING THREE TIMES A WEEK BY NUMBER OF HOURS PER SESSION AND SERVICE PROVIDER

2010 NUMBER OF HOURS PER SESSION	PAH		VWO		PTE		ALL	
	No	%	No	%	No	%	No	%
<=3.0	3	3.4	4	0.2	3	0.3	10	0.3
>3.0-3.5	13	14.9	98	3.7	10	0.9	121	3.1
>3.5-4.0	68	78.2	1854	70.0	1116	97.6	3038	78.3
>4.0-4.5	3	3.4	626	23.6	14	1.2	643	16.6
>4.5	0	0.0	68	2.6	0	0.0	68	1.8
Unknown	0	0.0	0	0.0	0	0.0	0	0.0
All Patients	87	100	2650	100	1143	100	3880	100

2011 NUMBER OF HOURS PER SESSION	PAH		VWO		PTE		ALL	
	No	%	No	%	No	%	No	%
<=3.0	4	4.0	5	0.2	3	0.2	12	0.3
>3.0-3.5	13	13.1	84	3.1	11	0.8	108	2.6
>3.5-4.0	77	77.8	1969	72.4	1309	98.0	3355	80.8
>4.0-4.5	5	5.1	599	22.0	13	1.0	617	14.9
>4.5	0	0.0	62	2.3	0	0.0	62	1.5
Unknown	0	0.0	0	0.0	0	0.0	0	0.0
All Patients	99	100	2719	100	1336	100	4154	100

7.8 Peritoneal Dialysis

7.8.1 Incidence and Prevalence

During 2010, there were 130 new PD patients who survived 90 days after starting on PD (CR 34.5 pmp; ASR 26.1 pmp). 9 patients were transplanted. There were 126 deaths.

During 2011, there were 163 new PD patients who survived 90 days after starting on PD (CR 43.0 pmp; ASR 31.1 pmp). 8 patients were transplanted. There were 104 deaths.

The prevalent PD population numbered 576 patients (CR 152.7 pmp; ASR 118.0 pmp) in 2010 and 625 patients (CR 164.9 pmp; ASR 124.0 pmp) in 2011. See Table 7.8.1.1. This comprised 12.5% of the prevalent dialysis population in 2010 and 12.7% in 2011. See Figure 7.3.2.1.

Table 7.8.1.1: INCIDENT AND PREVALENT PD PATIENTS

	2010				2011			
	New Patients	Transplanted	Dialysis Deaths for preceding one year	Prevalent Dialysis Population	New Patients	Transplanted	Dialysis Deaths for preceding one year	Prevalent Dialysis Population
Number	130	9	126	576	163	8	104	625
CR*	34.5	2.4	33.4	152.7	43.0	2.1	27.4	164.9
ASR*	26.1	-	24.9	118.0	31.1	-	18.8	124.0

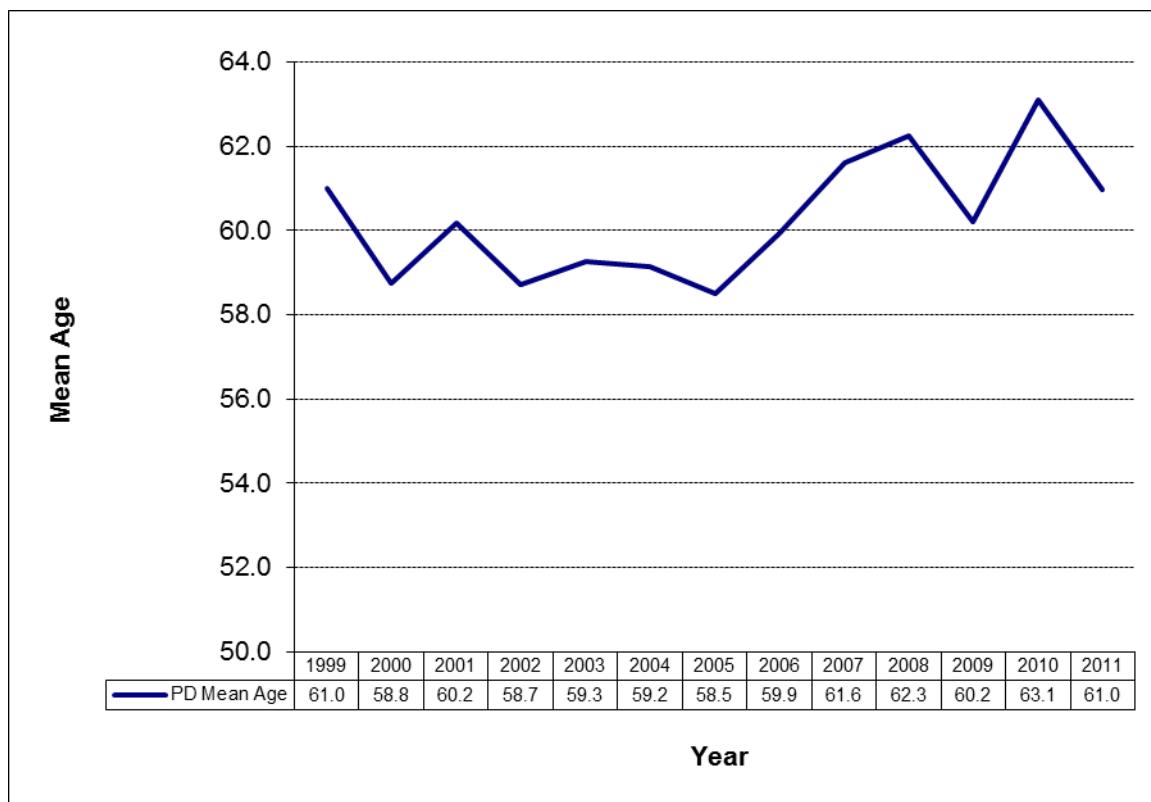
* per million residential population

7.8.1.1 Incidence

Of the new patients in 2010, 44.6% (58/130) were male, unlike the higher proportion in HD patients. The mean age was 63.1 years (median 65.5 years), similar to the HD patients. Most patients were aged 60 years and above. See Table 7.8.1.1.1.

Of the new patients in 2011, 50.9% (83/163) were male. The mean age was 61.0 years (median 61.8 years).

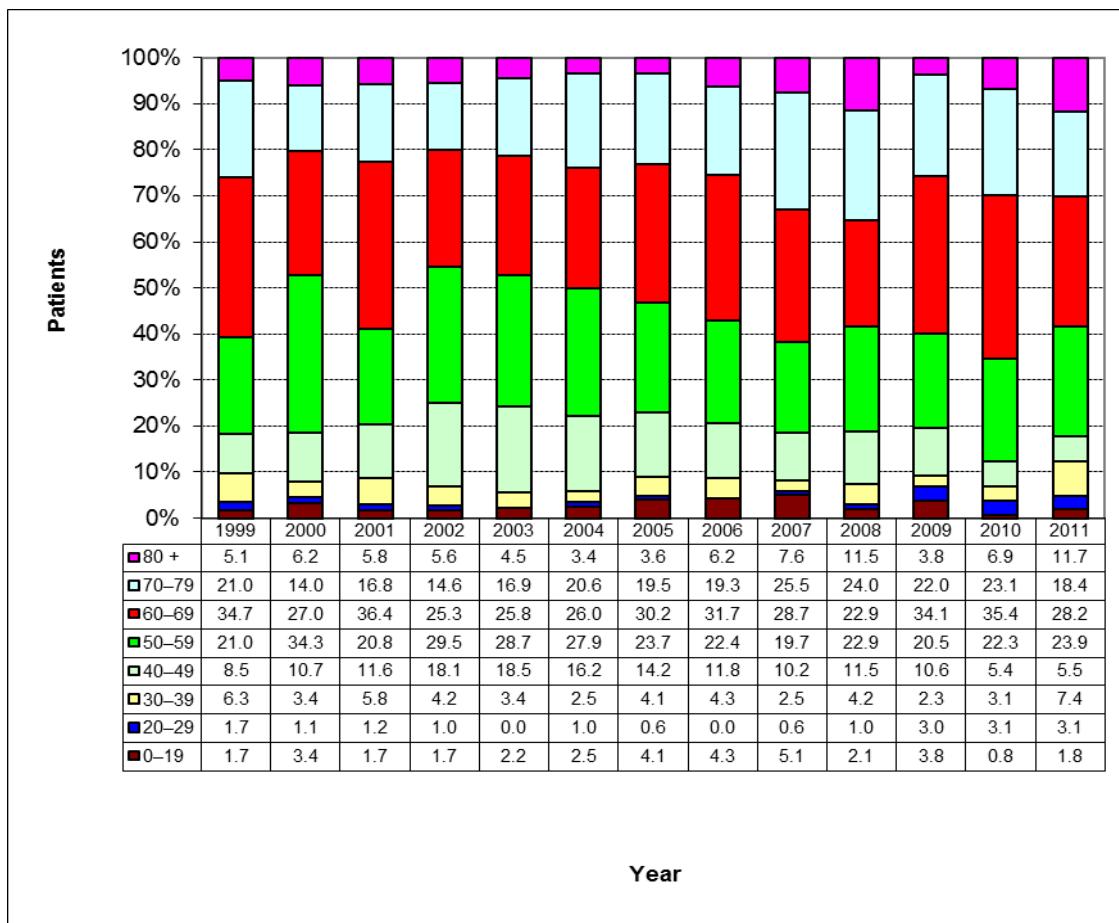
Figure 7.8.1.1.1 shows the trend of the mean age of incident PD patients.

Figure 7.8.1.1.1: AGE OF INCIDENT PD PATIENTS, 1999 – 2011**Table 7.8.1.1.1: INCIDENT PD PATIENTS BY AGE GROUP AND GENDER**

2010 AGE GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
0–19	0	0.0	1	1.4	1	0.8
20–29	3	5.2	1	1.4	4	3.1
30–39	2	3.4	2	2.8	4	3.1
40–49	3	5.2	4	5.6	7	5.4
50–59	18	31.0	11	15.3	29	22.3
60–69	19	32.8	27	37.5	46	35.4
70–79	9	15.5	21	29.2	30	23.1
80 +	4	6.9	5	6.9	9	6.9
All Age Groups	58	100	72	100	130	100

2011 AGE GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
0–19	1	1.2	2	2.5	3	1.8
20–29	2	2.4	3	3.8	5	3.1
30–39	7	8.4	5	6.3	12	7.4
40–49	5	6.0	4	5.0	9	5.5
50–59	23	27.7	16	20.0	39	23.9
60–69	21	25.3	25	31.3	46	28.2
70–79	18	21.7	12	15.0	30	18.4
80 +	6	7.2	13	16.3	19	11.7
All Age Groups	83	100	80	100	163	100

Age groups 50-59 and 60-69 had the largest number of new PD patients for 1999-2011.
See Figure 7.8.1.1.2.

Figure 7.8.1.1.2: INCIDENT PD PATIENTS BY AGE GROUP, 1999 – 2011

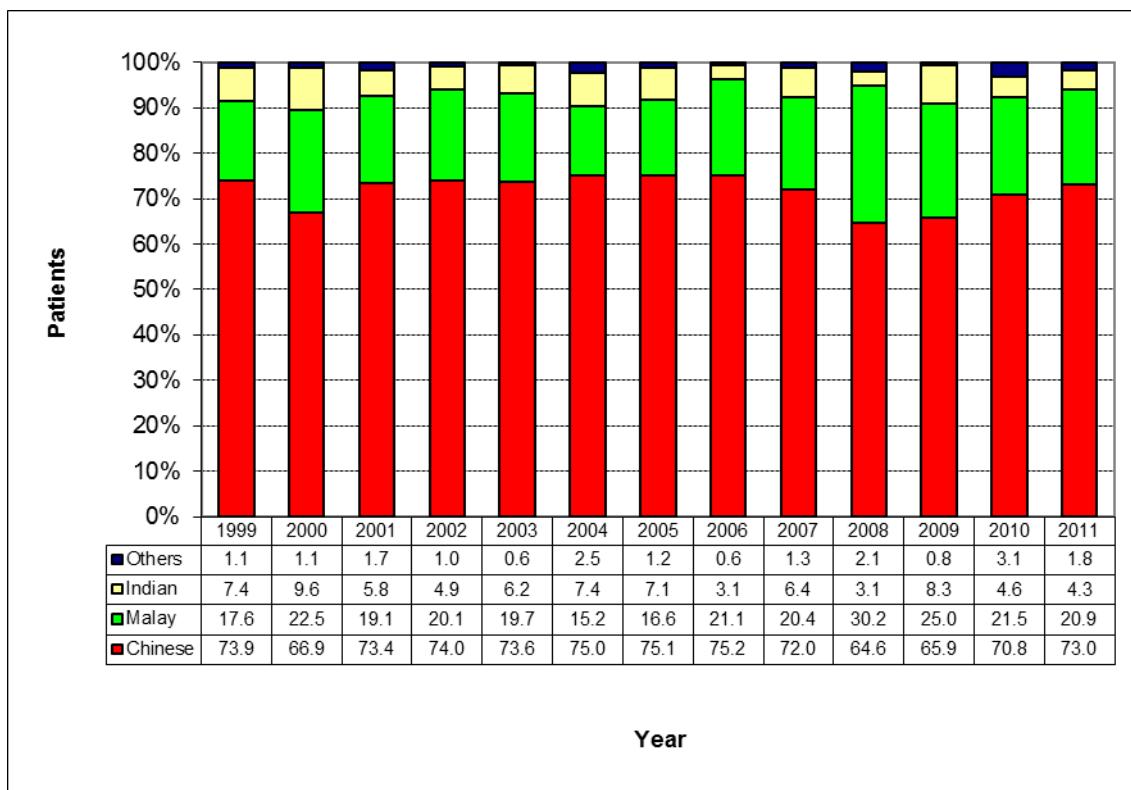
In the incident PD population, the majority were Chinese (2010: 70.8%; 2011: 73.0%). The proportion of Malays was higher than the general population (2010: 21.5%; 2011: 20.9%). See Table 7.8.1.1.2.

Table 7.8.1.1.2: INCIDENT PD PATIENTS BY ETHNIC GROUP AND GENDER

2010 ETHNIC GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
Chinese	43	74.1	49	68.1	92	70.8
Malay	10	17.2	18	25.0	28	21.5
Indian	3	5.2	3	4.2	6	4.6
Others	2	3.4	2	2.8	4	3.1
All Ethnic Groups	58	100	72	100	130	100

2011 ETHNIC GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
Chinese	61	73.5	58	72.5	119	73.0
Malay	18	21.7	16	20.0	34	20.9
Indian	2	2.4	5	6.3	7	4.3
Others	2	2.4	1	1.3	3	1.8
All Ethnic Groups	83	100	80	100	163	100

As in HD patients, the highest proportion in PD patients was Chinese. See Figure 7.8.1.1.3.

Figure 7.8.1.1.3: INCIDENT PD PATIENTS BY ETHNIC GROUP, 1999 – 2011

Females outnumbered males among the incident PD patients in the period 1999-2011 except for the years 2000, 2006 and 2011. See Table 7.8.1.1.3.

Table 7.8.1.1.3: INCIDENT PD PATIENTS BY GENDER, 1999 – 2011

YEAR	Male		Female	
	No	%	No	%
1999	78	44.3	98	55.7
2000	101	56.7	77	43.3
2001	74	42.8	99	57.2
2002	138	47.9	150	52.1
2003	87	48.9	91	51.1
2004	97	47.5	107	52.5
2005	78	46.2	91	53.8
2006	82	50.9	79	49.1
2007	78	49.7	79	50.3
2008	38	39.6	58	60.4
2009	64	48.5	68	51.5
2010	58	44.6	72	55.4
2011	83	50.9	80	49.1

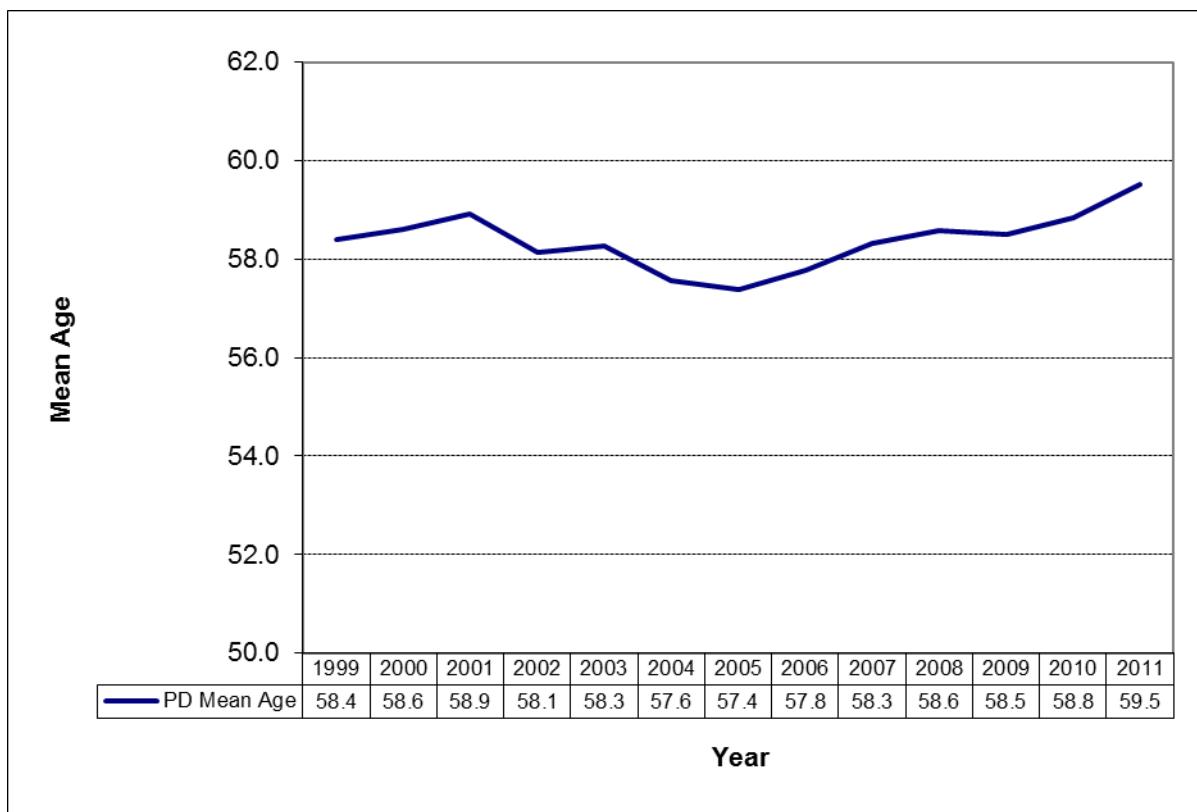
7.8.1.2 Prevalence

There were 576 prevalent patients (CR 152.7 pmp; ASR 118.0 pmp) on PD as of 31 December 2010. Of these, 42.4% (244 patients) were males. The mean age was 58.8 years (median 61.2 years).

There were 625 prevalent patients (CR 164.9 pmp; ASR 124.0 pmp) on PD as of 31 December 2011. Of these, 45.4% (284 patients) were males. The mean age was 59.5 years (median 62.1 years).

The mean age for prevalent PD patients ranged from 57.4 years old to 59.5 years old in the period 1999-2011. See Figure 7.8.1.2.1.

Figure 7.8.1.2.1: AGE OF PREVALENT PD PATIENTS, 1999 – 2011



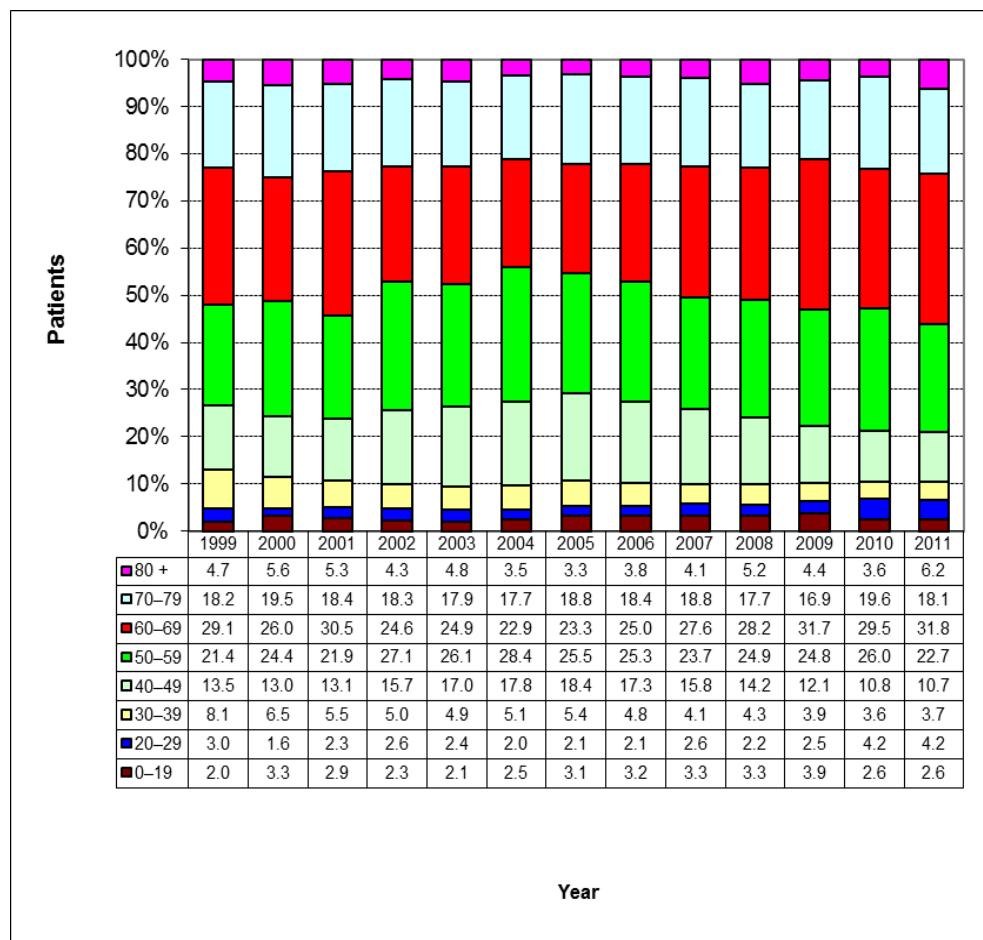
About half of the prevalent PD patients were aged 60 years or above. These patients were older than the prevalent HD patients. See Table 7.8.1.2.2.

Table 7.8.1.2.2: PREVALENT PD PATIENTS BY AGE GROUP AND GENDER

2010 AGE GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
0–19	6	2.5	9	2.7	15	2.6
20–29	15	6.1	9	2.7	24	4.2
30–39	6	2.5	15	4.5	21	3.6
40–49	16	6.6	46	13.9	62	10.8
50–59	71	29.1	79	23.8	150	26.0
60–69	80	32.8	90	27.1	170	29.5
70–79	43	17.6	70	21.1	113	19.6
80 +	7	2.9	14	4.2	21	3.6
All Age Groups	244	100	332	100	576	100

2011 AGE GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
0–19	7	2.5	9	2.6	16	2.6
20–29	16	5.6	10	2.9	26	4.2
30–39	8	2.8	15	4.4	23	3.7
40–49	24	8.5	43	12.6	67	10.7
50–59	68	23.9	74	21.7	142	22.7
60–69	102	35.9	97	28.4	199	31.8
70–79	47	16.5	66	19.4	113	18.1
80 +	12	4.2	27	7.9	39	6.2
All Age Groups	284	100	341	100	625	100

As with incident peritoneal patients, age groups 60-69 years have the highest proportion of existing PD patients. See Figure 7.8.1.2.2.

Figure 7.8.1.2.2: PREVALENT PD PATIENTS BY AGE GROUP, 1999 – 2011

The majority of the patients were Chinese (70.5%). Malays comprised 21.5%; Indian 5.7%, and other races 2.3% in 2010. See Table 7.8.1.2.3.

The majority of the patients were Chinese (73.4%). Malays comprised 19.5%; Indian 5.0%, and other races 2.1% in 2011. See Table 7.8.1.2.3.

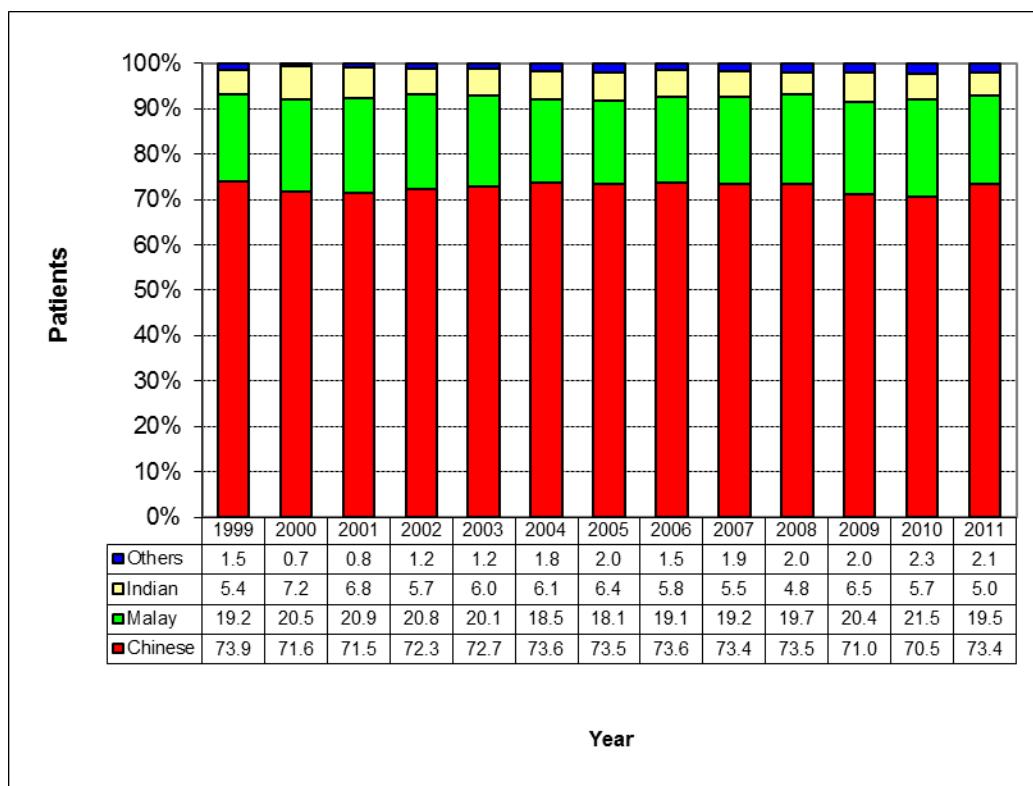
Table 7.8.1.2.3: PREVALENT PD PATIENTS BY ETHNIC GROUP AND GENDER

2010 ETHNIC GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
Chinese	173	70.9	233	70.2	406	70.5
Malay	51	20.9	73	22.0	124	21.5
Indian	16	6.6	17	5.1	33	5.7
Others	4	1.6	9	2.7	13	2.3
All Ethnic Groups	244	100	332	100	576	100

2011 ETHNIC GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
Chinese	207	72.9	252	73.9	459	73.4
Malay	58	20.4	64	18.8	122	19.5
Indian	14	4.9	17	5.0	31	5.0
Others	5	1.8	8	2.3	13	2.1
All Ethnic Groups	284	100	341	100	625	100

For the period 1999-2011, more than 70% of existing peritoneal patients were Chinese. See Figure 7.8.1.2.3.

Figure 7.8.1.2.3: PREVALENT PD PATIENTS BY ETHNIC GROUP, 1999 – 2011



The proportion of existing female PD patients was consistently higher than the male patients for 1999-2011. See Table 7.8.1.2.4.

Table 7.8.1.2.4: PREVALENT PD PATIENTS BY GENDER, 1999 – 2011

YEAR	Male		Female	
	No	%	No	%
1999	167	41.1	239	58.9
2000	201	46.7	229	53.3
2001	219	44.9	269	55.1
2002	296	45.3	358	54.7
2003	310	46.2	361	53.8
2004	325	46.0	382	54.0
2005	318	45.4	383	54.6
2006	326	45.9	385	54.1
2007	314	45.6	374	54.4
2008	264	44.1	335	55.9
2009	261	43.7	336	56.3
2010	244	42.4	332	57.6
2011	284	45.4	341	54.6

7.8.2 Aetiology of Renal Failure

In 2010, the majority of new patients going onto PD were patients with diabetic nephropathy (68.5%). Diabetic nephropathy in the prevalent population, however, accounted for 46.5%. This probably reflects the lower survival rate of patients with diabetic nephropathy. Patients with primary glomerulonephritis comprised only 16.9% of the new patients but formed 26.7% of the prevalent PD patients. See Table 7.8.2.1.

In 2011, the majority of new patients going onto PD were patients with diabetic nephropathy (65.6%). Diabetic nephropathy in the prevalent population, however, accounted for 50.6%. Patients with primary glomerulonephritis comprised only 16.6% of the new patients but formed 25.1% of the prevalent PD patients.

Table 7.8.2.1: INCIDENT AND PREVALENT PD PATIENTS BY AETIOLOGY OF RENAL FAILURE

Causes of CKD5	2010				2011			
	Incident		Prevalent		Incident		Prevalent	
	No.	%	No.	%	No.	%	No.	%
Diabetic Nephropathy	89	68.5	268	46.5	107	65.6	316	50.6
Primary Glomerulonephritis (GN)	22	16.9	154	26.7	27	16.6	157	25.1
Autoimmune Disease/GN with Systemic Manifestations	0	0.0	30	5.2	3	1.8	31	5.0
Hypertension and Renovascular Disease	13	10.0	70	12.2	15	9.2	68	10.9
Polycystic Kidney Disease / Other Cystic Diseases	1	0.8	15	2.6	2	1.2	13	2.1
Vesicoureteric Reflex / Chronic Pyelonephritis	0	0.0	4	0.7	0	0.0	5	0.8
Obstruction	0	0.0	2	0.3	2	1.2	3	0.5
Stone Disease	0	0.0	1	0.2	1	0.6	2	0.3
Miscellaneous	4	3.1	23	4.0	6	3.7	22	3.5
Unknown	1	0.8	9	1.6	0	0.0	8	1.3
All Causes of CKD5	130	100	576	100	163	100	625	100

Figure 7.3.1.4(b) showed the 12-year trend (1999-2011) of diabetic nephropathy among PD patients.

7.8.3 Service Provider

The majority of new PD patients dialysed with the Public Acute Hospitals (2010: 96.9%; 2011: 98.8%) while the remaining were with voluntary welfare organisations (2010: 0.8%). The distribution of prevalent patients was similar with Public Acute Hospitals caring for the majority (2010: 86.6%; 2011: 90.2%). See Table 7.8.3.1.

Table 7.8.3.1: INCIDENT AND PREVALENT PD PATIENTS BY SERVICE PROVIDER

SERVICE PROVIDER	2010				2011			
	New	%	Prevalent	%	New	%	Prevalent	%
PAH	126	96.9	499	86.6	161	98.8	564	90.2
VWO	1	0.8	70	12.2	0	0.0	55	8.8
PTE	3	2.3	7	1.2	2	1.2	6	1.0
All Providers	130	100	576	100	163	100	625	100

Twelve year trends from 1999 to 2011 for incident and prevalent patients on PD by service provider are shown below. See Figures 7.8.3.1 and 7.8.3.2.

Figure 7.8.3.1: INCIDENT PD PATIENTS BY SERVICE PROVIDER, 1999 – 2011

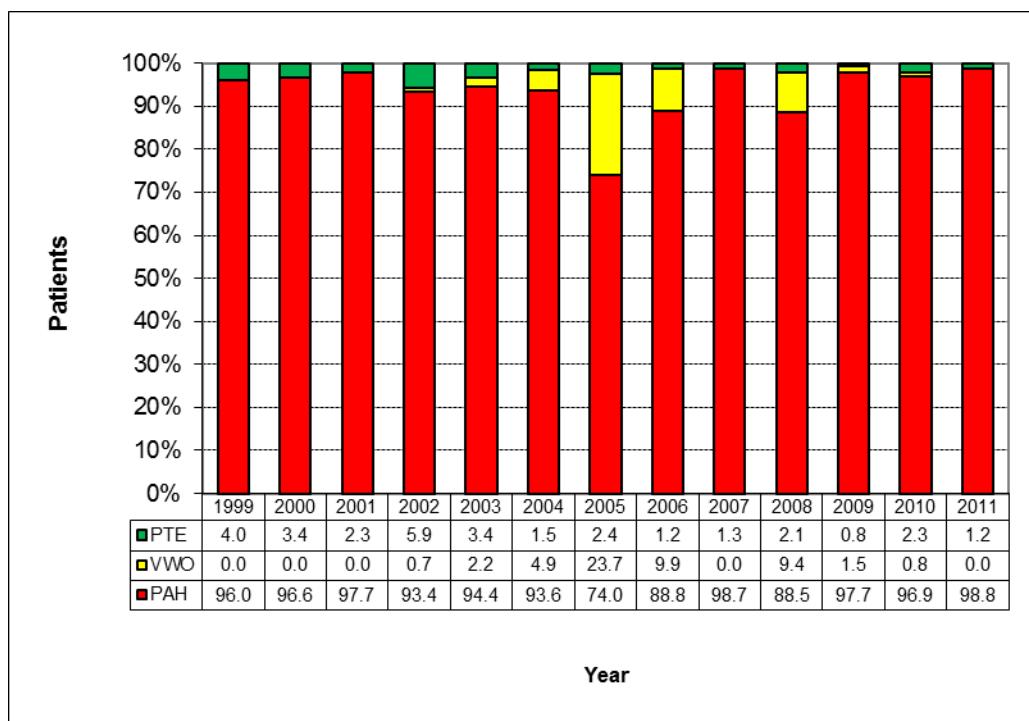
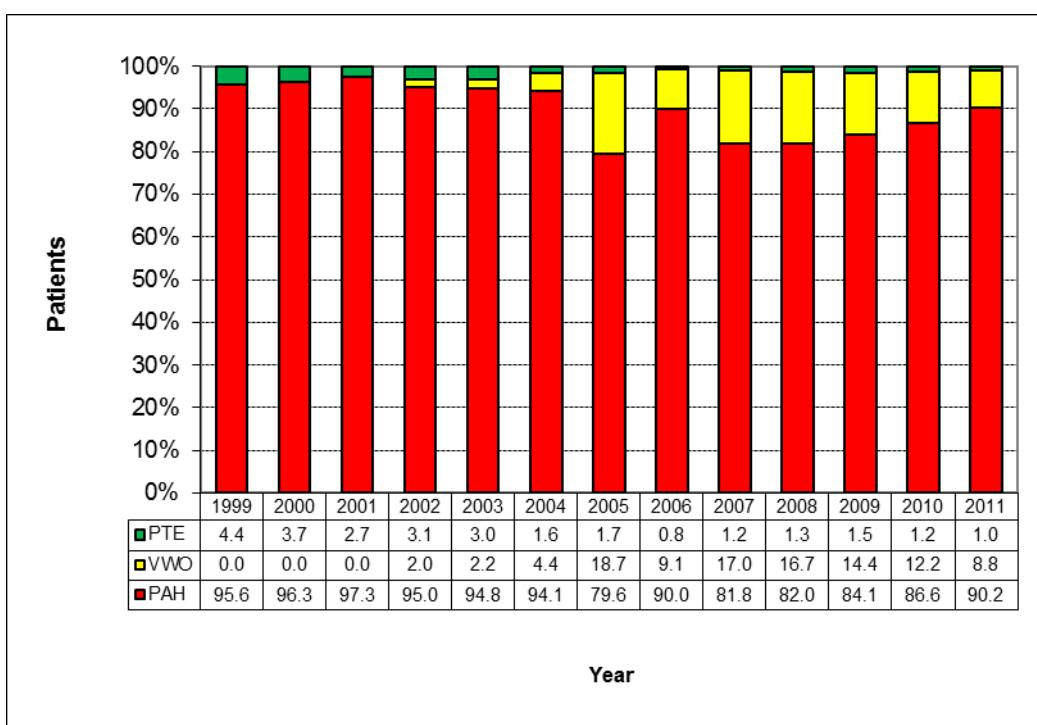


Figure 7.8.3.2: PREVALENT PD PATIENTS BY SERVICE PROVIDER, 1999 – 2011



In all years except 2008 to 2011, majority of the incident PD patients were on Continuous Ambulatory Peritoneal Dialysis (CAPD). However there was an increasing proportion of

incident and prevalent patients on Automated Peritoneal Dialysis (APD) over the years. See Figures 7.8.3.3 and 7.8.3.4.

Figure 7.8.3.3: INCIDENT CAPD VS APD PATIENTS, 1999 – 2011

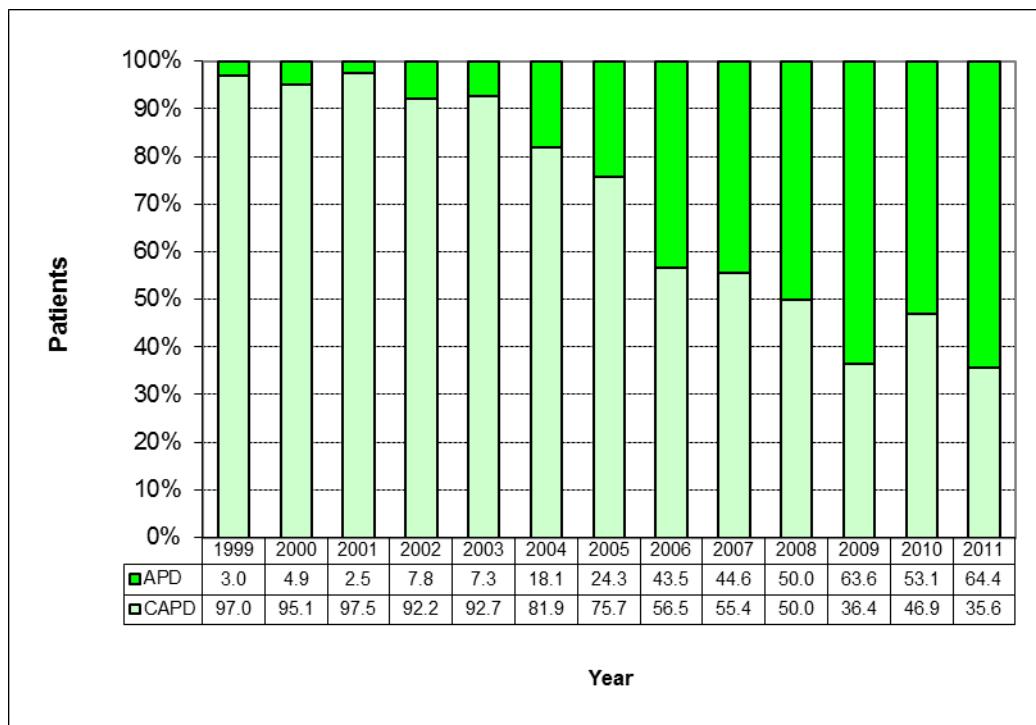
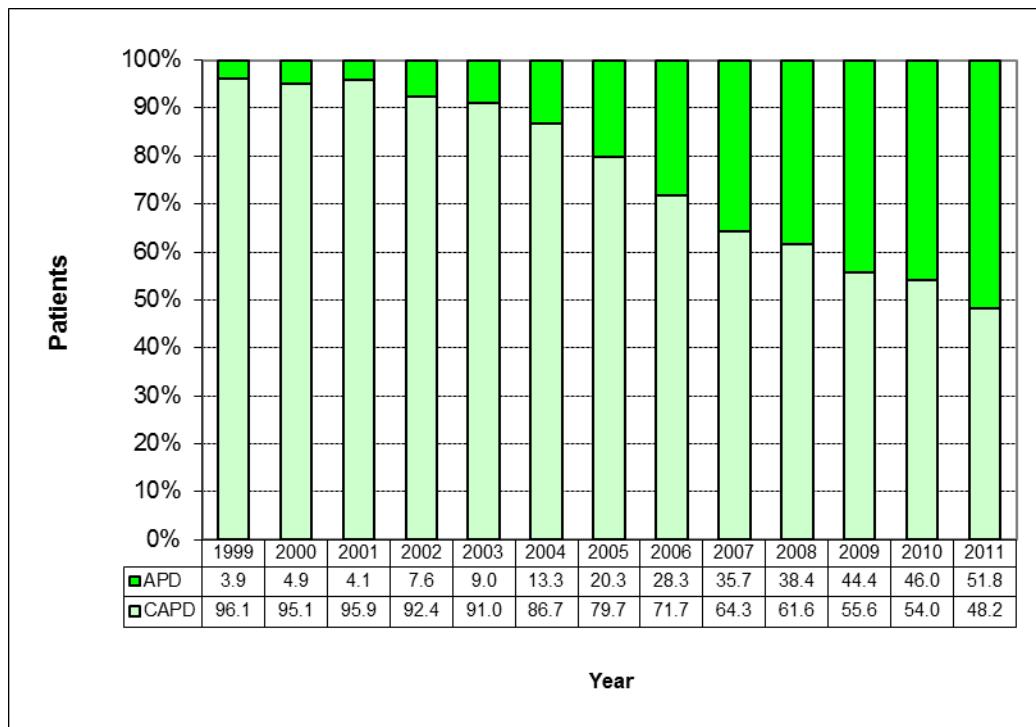


Figure 7.8.3.4: PREVALENT CAPD VS APD PATIENTS, 1999 – 2011



7.9 Mortality

7.9.1 Demographics

There were 560 deaths amongst dialysis patients in 2010 and 663 deaths in 2011. The death rate, reported as a proportion of all treated patients within the year, was 10.7% in 2010 and 11.8% in 2011. See Table 7.9.1.1.

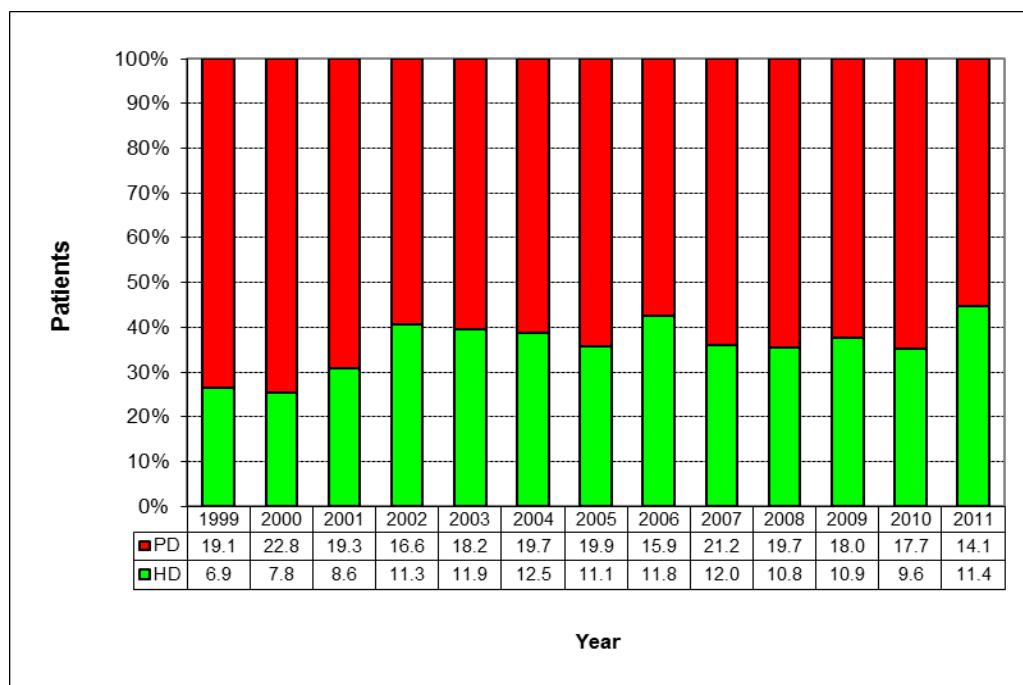
The death rate was higher in PD patients (2010: 17.7%; 2011: 14.1%) compared with HD patients (2010: 9.6%; 2011: 11.4%). Many factors contribute to the higher death rate in PD patients. These include their older age and more co-morbid conditions including diabetes mellitus and ischaemic heart disease. See Table 7.9.1.2.

Table 7.9.1.1: DEMOGRAPHICS

MODALITY	2010		2011	
	No	%	No	%
HD	434	9.6	559	11.4
PD	126	17.7	104	14.1
HD+PD	560	10.7	663	11.8

The death rate was consistently higher in PD patients than HD patients for the period 1999 to 2011 but the gap narrowed from 2002. See Figure 7.9.1.1.

Figure 7.9.1.1: DIALYSIS DEATH BY MODALITY, 1999 – 2011



The proportion of deaths above aged 60 was 74.3% in 2010 and 75.9% in 2011. Majority of the deaths amongst dialysis patients occurred in the age group 60 to 69 years old for both genders. See Table 7.9.1.2.

Table 7.9.1.2: DIALYSIS DEATHS BY AGE GROUP AND GENDER

2010 AGE GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
0–19	0	0.0	1	0.4	1	0.2
20–29	2	0.7	1	0.4	3	0.5
30–39	2	0.7	1	0.4	3	0.5
40–49	13	4.4	12	4.6	25	4.5
50–59	69	23.2	43	16.4	112	20.0
60–69	108	36.2	84	32.1	192	34.3
70–79	72	24.2	81	30.9	153	27.3
80 +	32	10.7	39	14.9	71	12.7
All Age Groups	298	100	262	100	560	100

2011 AGE GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
0–19	0	0.0	0	0.0	0	0.0
20–29	1	0.3	1	0.3	2	0.3
30–39	5	1.4	5	1.6	10	1.5
40–49	15	4.2	17	5.5	32	4.8
50–59	73	20.7	43	13.9	116	17.5
60–69	113	32.0	83	26.8	196	29.6
70–79	102	28.9	107	34.5	209	31.5
80 +	44	12.5	54	17.4	98	14.8
All Age Groups	353	100	310	100	663	100

The deaths in the different ethnic groups are shown in Table 7.9.1.3.

Table 7.9.1.3: DIALYSIS DEATHS BY ETHNIC GROUP AND GENDER

2010 ETHNIC GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
Chinese	210	70.5	185	70.6	395	70.5
Malay	63	21.1	60	22.9	123	22.0
Indian	22	7.4	16	6.1	38	6.8
Others	3	1.0	1	0.4	4	0.7
All Ethnic Groups	298	100	262	100	560	100

2011 ETHNIC GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
Chinese	260	73.7	208	67.1	468	70.6
Malay	64	18.1	78	25.2	142	21.4
Indian	23	6.5	21	6.8	44	6.6
Others	6	1.7	3	1.0	9	1.4
All Ethnic Groups	353	100	310	100	663	100

While majority of the deaths amongst dialysis patients occurred in the age group 60 to 69 years old for HD patients and for PD patients in 2010, most of the deaths occurred in the age group 70 to 79 years old in 2011. See Table 7.9.1.4.

Table 7.9.1.4: DIALYSIS DEATHS BY AGE GROUP AND MODALITY

2010 AGE GROUP	HD		PD		HD+PD	
	No	%	No	%	No	%
0–19	0	0.0	1	0.8	1	0.2
20–29	3	0.7	0	0.0	3	0.5
30–39	3	0.7	0	0.0	3	0.5
40–49	19	4.4	6	4.8	25	4.5
50–59	90	20.7	22	17.5	112	20.0
60–69	144	33.2	48	38.1	192	34.3
70–79	119	27.4	34	27.0	153	27.3
80 +	56	12.9	15	11.9	71	12.7
All Age Groups	434	100	126	100	560	100

2011 AGE GROUP	HD		PD		HD+PD	
	No	%	No	%	No	%
0–19	0	0.0	0	0.0	0	0.0
20–29	2	0.4	0	0.0	2	0.3
30–39	7	1.3	3	2.9	10	1.5
40–49	28	5.0	4	3.8	32	4.8
50–59	92	16.5	24	23.1	116	17.5
60–69	168	30.1	28	26.9	196	29.6
70–79	176	31.5	33	31.7	209	31.5
80 +	86	15.4	12	11.5	98	14.8
All Age Groups	559	100	104	100	663	100

The mean age of death was also similar in both modalities (HD: 67.2 years in 2010 and 68.1 years in 2011; PD: 67.4 years in 2010 and 66.7 years in 2011). Chinese appeared to have a later age at death compared with the Malays or Indians. See Table 7.9.1.5.

Table 7.9.1.5: AGE OF DIALYSIS DEATH BY ETHNIC GROUP

Modality		2010					2011				
		Chinese	Malay	Indian	Others	All	Chinese	Malay	Indian	Others	All
HD	Mean	68.7	63.6	64.4	68.9	67.2	69.8	63.4	62.8	73.9	68.1
	Median	67.9	64.2	61.6	58.8	66.6	70.6	64.5	60.8	74.2	69.1
	Std. Dev*	11.2	12.0	10.7	20.2	11.6	11.2	12.2	9.7	11.4	11.7
PD	Mean	67.6	67.1	63.0	84.1	67.4	69.8	60.6	59.9	83.8	66.7
	Median	68.5	68.3	61.2	84.1	68.1	72.5	60.9	57.9	83.1	68.2
	Std. Dev	12.0	8.8	9.2	0.0	11.3	10.5	10.3	11.4	5.0	11.7
HD+PD	Mean	68.4	64.3	64.1	72.7	67.2	69.8	62.8	62.1	77.2	67.9
	Median	68.1	65.6	61.4	71.5	67.1	70.8	63.7	60.5	79.2	69.0
	Std. Dev	11.4	11.5	10.4	18.2	11.5	11.1	11.9	10.1	10.6	11.7

* Std. Dev stands for Standard Deviation

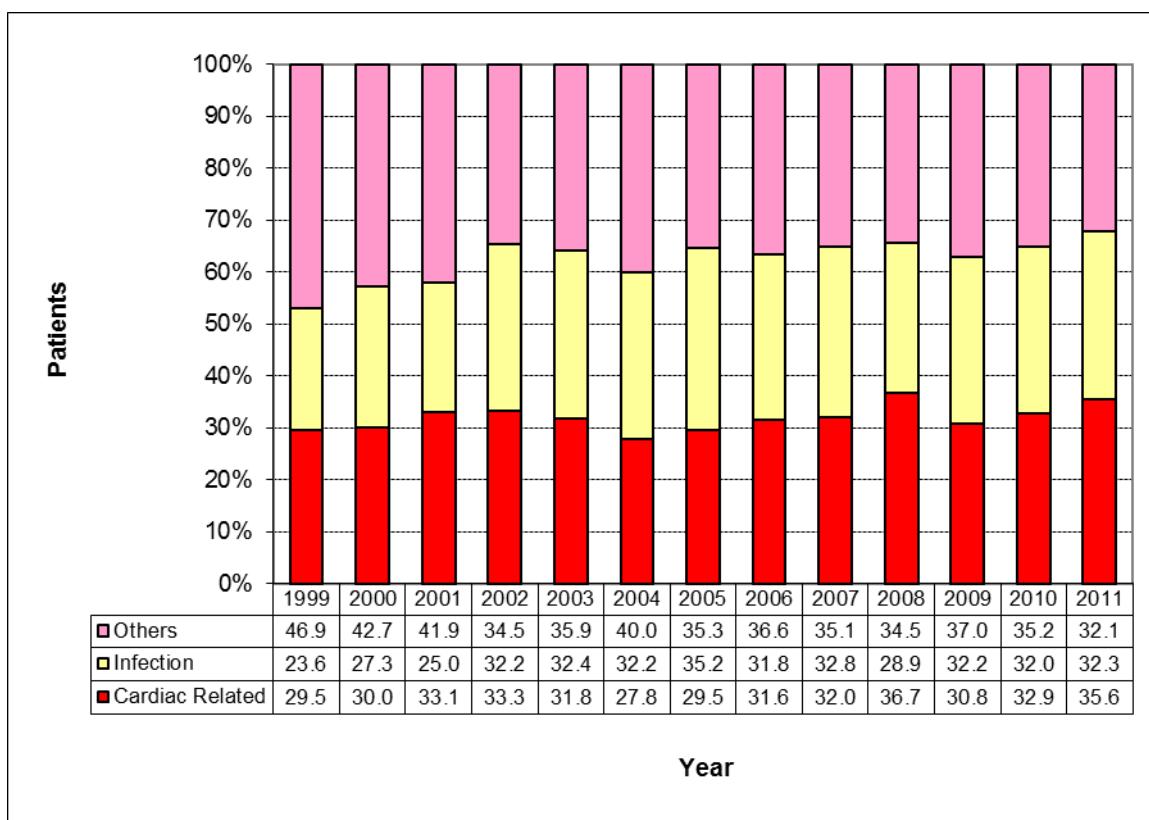
7.9.2 Cause of Death

Cardiac events (AMI, APO and other cardiac causes) accounted for 32.9% of deaths in 2010 and 35.7% in 2011. Infections accounted for 32.0% in 2010 and 32.3% in 2011. See Table 7.9.2.1.

Table 7.9.2.1: CAUSES OF DEATH IN DIALYSIS PATIENTS

Cause of Death	2010		2011	
	No	%	No	%
Acute Myocardial Infarct (AMI)	77	13.8	112	16.9
Acute Pulmonary Oedema (APO)	0	0.0	1	0.2
Other Cardiac	107	19.1	123	18.6
Cerebrovascular Accident (CVA)	20	3.6	27	4.1
Infections	179	32.0	214	32.3
Liver Failure	1	0.2	0	0.0
Other Haemorrhage	10	1.8	7	1.1
Malignancy	32	5.7	31	4.7
Withdraw dialysis	0	0.0	0	0.0
Uremia	97	17.3	124	18.7
Accidental/Homicide	2	0.4	0	0.0
Other Social	0	0.0	0	0.0
Died at Home	21	3.8	5	0.8
Hyperkalemia (cardiac standstill)	0	0.0	0	0.0
Bleeding from the Gastro-intestinal Tract (BGIT)	5	0.9	3	0.5
Other	9	1.6	13	2.0
Unknown	0	0.0	3	0.5
Total	560	100	663	100

Cardiac events and infection accounted for high proportion of deaths. See Figure 7.9.2.1.

Figure 7.9.2.1: DIALYSIS DEATH BY INFECTION AND CARDIAC RELATED CAUSES, 1999 – 2011

Note: "Cardiac Related" deaths include Acute Myocardial Infarct, Acute Pulmonary Oedema and Other Cardiac causes.

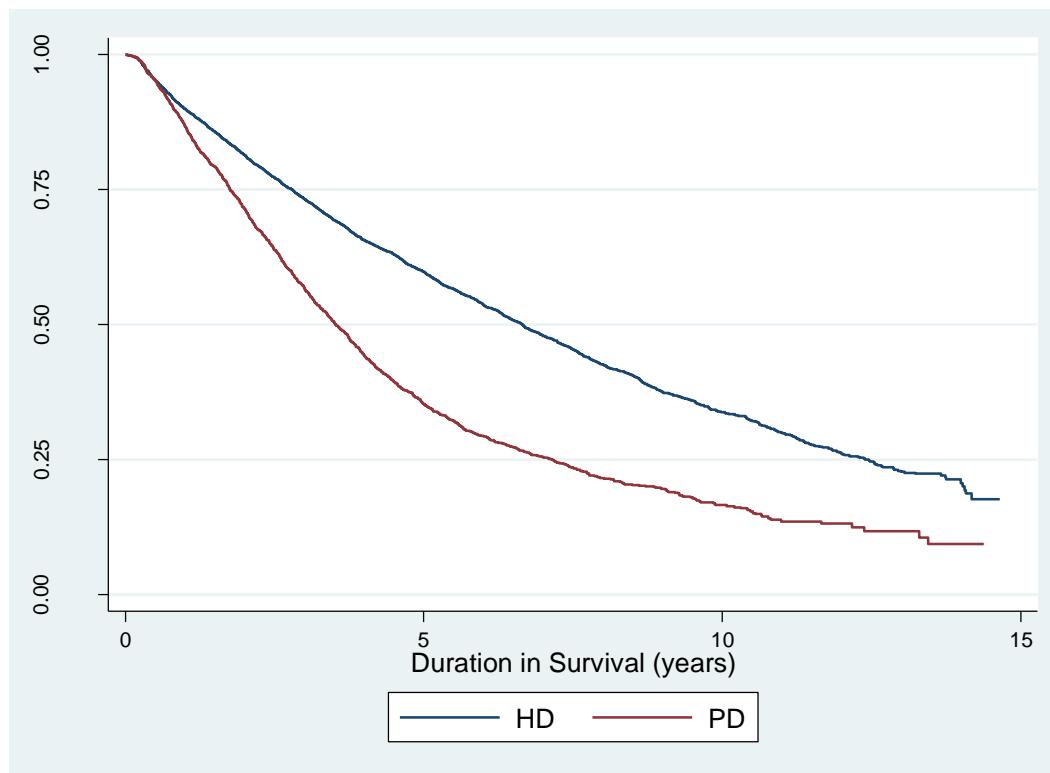
7.9.3 Survival Analysis for Dialysis Patients

The 1 and 5-year survival for patients who survived 90 days after initiation on dialysis was 89.1% and 53.4% respectively. There is a significant difference in survival between the patients on HD and PD ($p<0.001$). The 1-year survival for patients who survived 90 days after initiation on HD in the period 1999-2011 was 89.9% and that for PD was 86.8%. See Table 7.9.3.1. The median survival was 6.7 years for HD patients and 3.5 years for PD patients.

Table 7.9.3.1: SURVIVAL BY MODALITY, 1999 – 2011

SURVIVAL BY YEAR	1999-2011	
	HD	PD
1 year in % (95% C.I.)	89.9 (89.2-90.6)	86.8 (85.3-88.2)
5 year in % (95% C.I.)	59.8 (58.5-61.1)	35.3 (33.1-37.5)

Figure 7.9.3.1: SURVIVAL BY MODALITY, 1999 – 2011



There was no significant difference in the 1- and 5- year survival between female and male patients on PD ($p=0.83$); and also between female and male patients on HD ($p=0.49$). See Table 7.9.3.2.

Table 7.9.3.2: SURVIVAL BY GENDER AND MODALITY, 1999 – 2011

1999 - 2011	Male		Female	
	PD	HD	PD	HD
1 year survival in % (95% C.I.)	86.5 (84.3 – 88.4)	90.0 (89.0 - 90.9)	87.1 (85.0 – 88.9)	89.9 (88.7 – 90.9)
5 year survival in % (95% C.I.)	35.1 (31.9 – 38.2)	59.5 (57.7 – 61.2)	35.5 (32.5 - 38.5)	60.1 (58.2 - 62.0)

As expected, patients aged below 60 years have better survival than patients aged 60 and above for both PD and HD ($p<0.001$). See Table 7.9.3.3.

Table 7.9.3.3: SURVIVAL BY AGE GROUPS AND MODALITY, 1999 – 2011

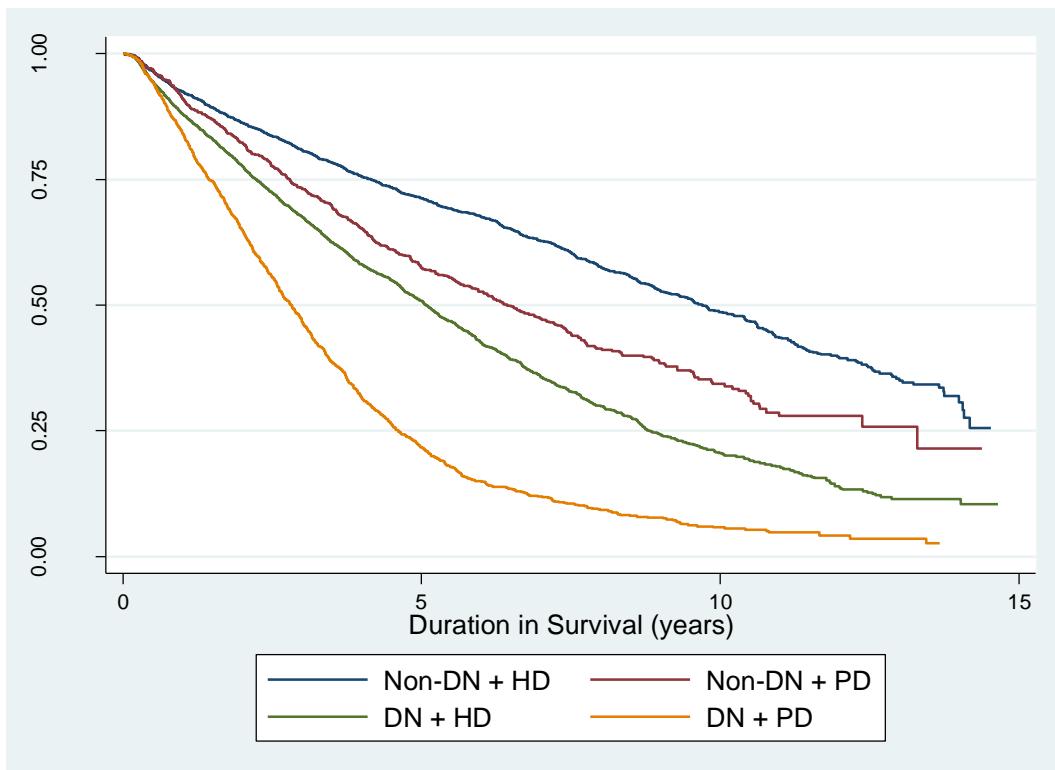
1999 - 2011	Age < 60		Age \geq 60	
	PD	HD	PD	HD
1 year survival in % (95% C.I.)	90.5 (88.5 – 92.1)	93.0 (92.1 – 93.8)	83.8 (81.5 - 85.7)	86.6 (85.3 - 87.7)
5 year survival in % (95% C.I.)	51.5 (48.0 – 54.7)	71.1 (69.4 - 72.7)	21.6 (19.1 – 24.3)	47.4 (45.4 – 49.3)

Similarly, non-diabetic patients have better survival as compared to diabetics ($p<0.001$). There was bigger gap in survival probabilities between HD and PD among the diabetics as compared to non-diabetics. See Table 7.9.3.4 and Figure 7.9.3.2.

Table 7.9.3.4: SURVIVAL BY DIABETES STATUS (PRIMARY CAUSE) AND MODALITY, 1999 – 2011

1999-2011	DN		Non-DN		DN	Non-DN
	PD	HD	PD	HD	HD+PD	HD+PD
1 year survival in % (95% C.I.)	84.2 (82.1 – 86.0)	88.0 (86.9 - 89.0)	91.1 (88.9 – 92.9)	92.4 (91.4 - 93.4)	87.0 (86.0 - 87.9)	92.1 (91.2 - 93.0)
5 year survival in % (95% C.I.)	21.8 (19.4 – 24.2)	50.8 (49.0 - 52.6)	57.4 (53.6 - 60.9)	71.2 (69.4 – 73.0)	42.7 (41.2 – 44.2)	68.0 (66.3 - 69.6)

Figure 7.9.3.2: SURVIVAL BY DIABETES STATUS (PRIMARY CAUSE) AND MODALITY, 1999-2011



8 THE TRANSPLANT POPULATION

8.1 Incidence and Prevalence

In 2010, 61 (CR 16.2 pmp) renal transplants were performed in Singapore. In addition, 23 patients received transplants overseas in 2010, bringing the total of newly transplanted patients to 84 in 2010. See Table 8.1.1. In 2011, 67 (CR 17.7 pmp) renal transplants were performed in Singapore. In addition, 24 patients received transplants overseas in 2011, bringing the total of newly transplanted patients to 91 in 2011. See Table 8.1.1.

The prevalent renal transplant population at the end of 2009 was 1318 (CR 353.0 pmp). There were 18 deaths in 2010. In addition, there were 23 (CR 6.1 pmp) transplant patients who returned to dialysis in 2010. After taking into account the patient deaths and graft losses, there were 1364 (CR 361.6 pmp; ASR 265.1 pmp) prevalent renal transplant patients at the end of 2010 respectively.

There were 20 deaths in 2011. In addition, there were 32 (CR 8.4 pmp) transplant patients who returned to dialysis in 2011. After taking into account the patient deaths and graft losses, there were 1403 (CR 370.3 pmp; ASR 266.4 pmp) prevalent renal transplant patients at the end of 2011 respectively.

In comparison to international statistics*, the prevalent transplant populations in Singapore in 2009 was higher than that of New Zealand (325/pmp), Australia (361/pmp), Denmark (363/pmp), but lower than France (509/pmp), Hong Kong (458/pmp), Norway (591/pmp), Spain (495/pmp), Sweden (497/pmp) and USA (562/pmp).

* The paragraph above is with reference to: United States Renal Data System (USRDS), 2011 Annual Data Report. All rates were unadjusted.

Table 8.1.1: INCIDENT AND PREVALENT TRANSPLANT PATIENTS

	2010					
	Incident Population		Outcome Post Transplant			Prevalent Population
	Transplanted in Singapore	Transplanted Overseas	Death with Functioning Graft	Death and Graft Failure	Return to Dialysis	Year End Prevalence
Number	61	23	18	0	23	1364
CR*	16.2	6.1	4.8	0.0	6.1	361.6
ASR*	-	-	-	-	-	265.1

	2011					
	Incident Population		Outcome Post Transplant			Prevalent Population
	Transplanted in Singapore	Transplanted Overseas	Death with Functioning Graft	Death and Graft Failure	Return to Dialysis	Year End Prevalence
Number	67	24	18	2	32	1403
CR*	17.7	6.3	4.8	0.5	8.4	370.3
ASR*	-	-	-	-	-	266.4

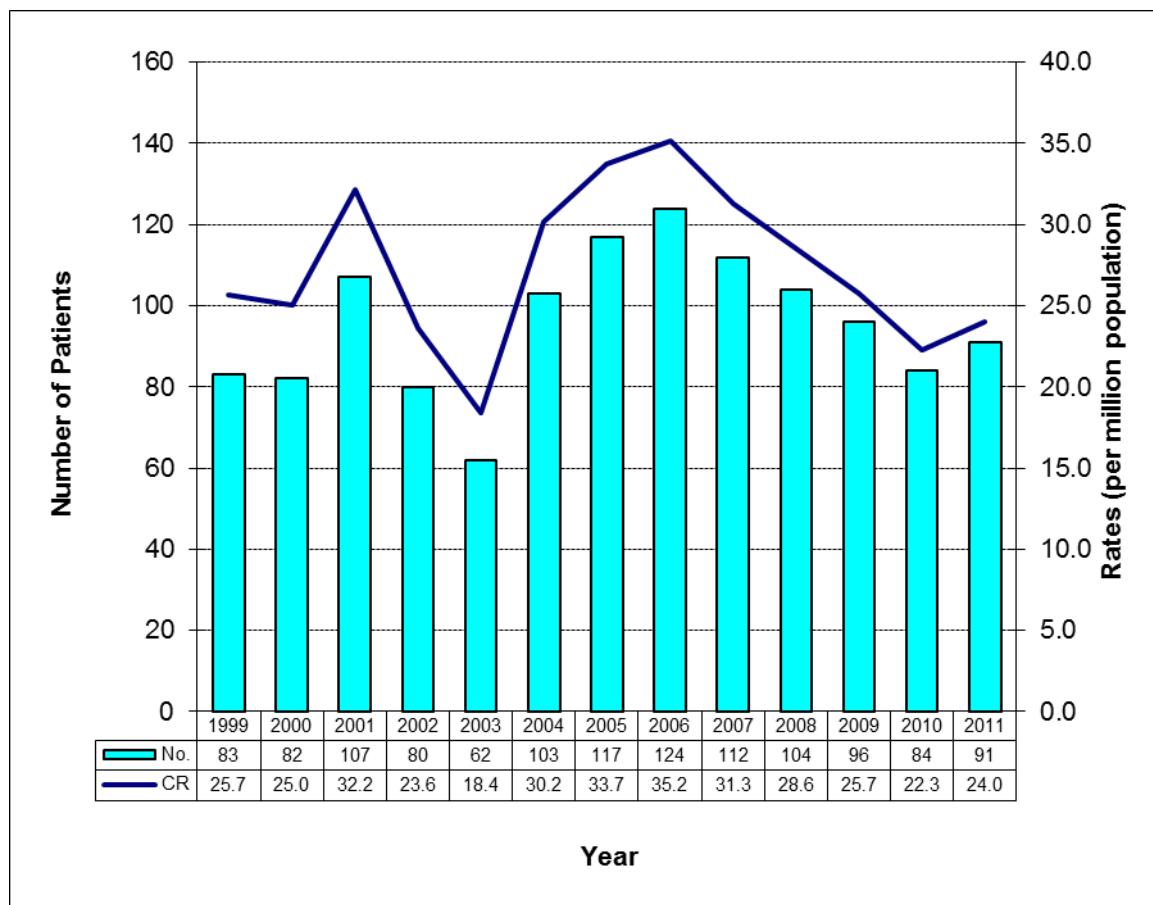
* per million residential population.

∞ includes 3 cases who returned to Singapore for follow-up

¤ excludes 1 case with re-transplant in 2008 and follow-up in 2009; as well as 4 cases who went overseas for follow-up

The number of incident transplant patients was at its lowest in 2003 over the period of analysis between 1999 to 2011 likely due to the SARS epidemic in Singapore that prevented delivery of some elective medical services. The corresponding crude rates for incident transplant patients increased from 25.7 pmp in 1999 to 35.2 pmp in 2006 with a notable drop to 18.4 pmp in 2003 and stable from 2009-2011. See Figure 8.1.1.

Figure 8.1.1: CRUDE RATE AND TOTAL NUMBER OF INCIDENT TRANSPLANT PATIENTS, 1999 – 2011

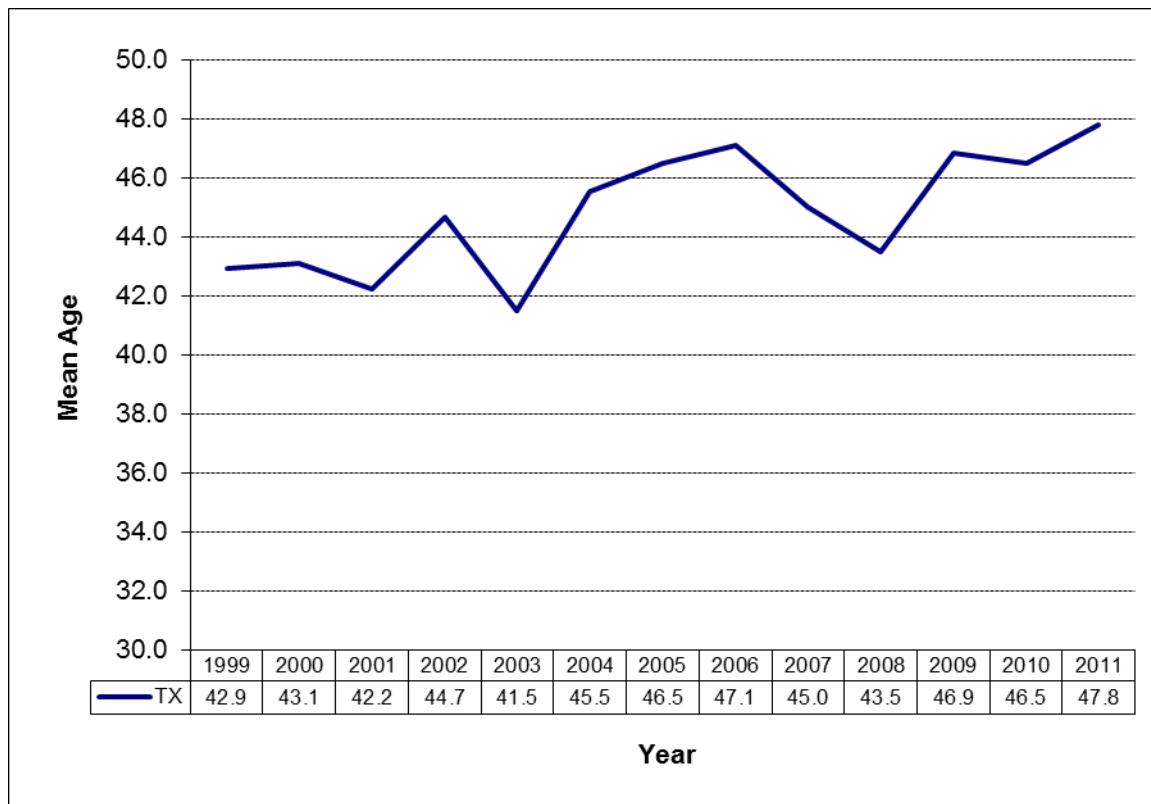


In 2010, 50.0% of incident transplant patients were males. While in 2011, 58.2% were males. The mean age of incident transplant patients was 46.5 years in 2010 and 47.8 in

2011. The mean age for male and female incident transplants were 48.5 and 44.4 years respectively in 2010 and 49.0 and 46.1 years respectively in 2011.

Of note was the increasing age for all incident transplant patients: the mean age increased from about 42.9 years old in 1999 to 47.8 years old in 2011. See Figure 8.1.2.

Figure 8.1.2: AGE OF INCIDENT TRANSPLANT PATIENTS, 1999 – 2011



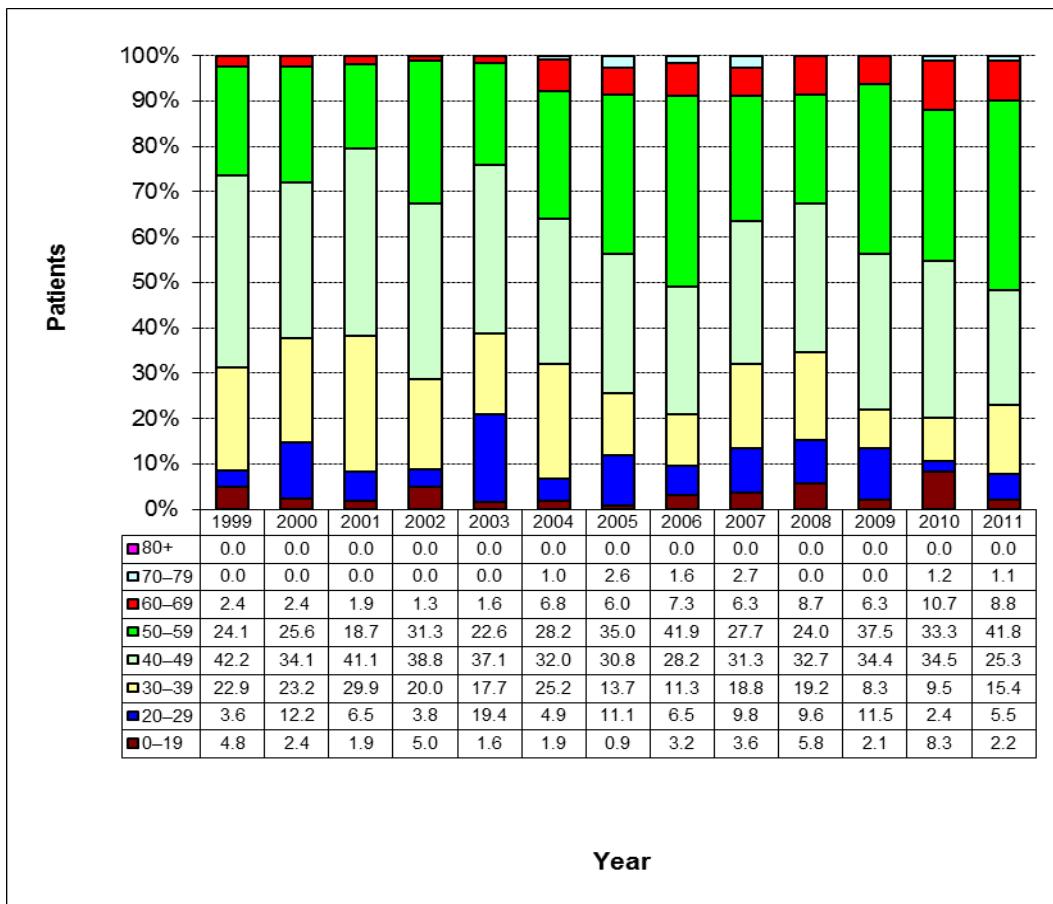
8.1.1 Incident Transplant Patients by Age Group and Gender

Among all incident patients who received transplants in 2010 and 2011, the majority were of the age group 40 to 59 years. See Tables 8.1.1.1. The increasing age of incident transplant patients in the period 1999-2011 is also evident in Figure 8.1.1.1. Notably, in 2006, more than 50% of incident transplant patients were older than age 49.

Table 8.1.1.1: INCIDENT TRANSPLANT PATIENTS BY AGE GROUP AND GENDER

2010 AGE GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
0–19	3	7.1	4	9.5	7	8.3
20–29	0	0.0	2	4.8	2	2.4
30–39	3	7.1	5	11.9	8	9.5
40–49	16	38.1	13	31.0	29	34.5
50–59	12	28.6	16	38.1	28	33.3
60–69	7	16.7	2	4.8	9	10.7
70–79	1	2.4	0	0.0	1	1.2
80 +	0	0.0	0	0.0	0	0.0
All Age Groups	42	100	42	100	84	100

2011 AGE GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
0–19	0	0.0	2	5.3	2	2.2
20–29	2	3.8	3	7.9	5	5.5
30–39	10	18.9	4	10.5	14	15.4
40–49	15	28.3	8	21.1	23	25.3
50–59	20	37.7	18	47.4	38	41.8
60–69	5	9.4	3	7.9	8	8.8
70–79	1	1.9	0	0.0	1	1.1
80 +	0	0.0	0	0.0	0	0.0
All Age Groups	53	100	38	100	91	100

Figure 8.1.1.1: INCIDENT TRANSPLANT PATIENTS BY AGE GROUP, 1999 – 2011

8.1.2 Incident Transplant Patients by Ethnic Group and Gender

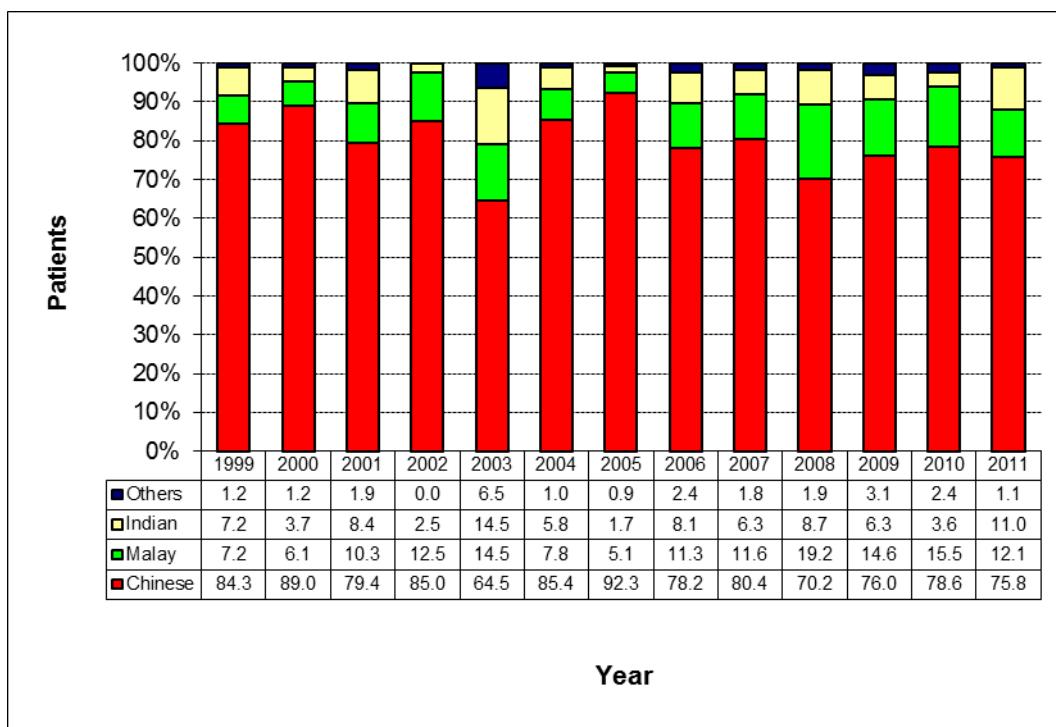
In 2010, 78.6% of incident transplant patients were Chinese. While in 2011, 75.8% were Chinese. The percentage of Malay incident transplant was 15.5% in 2010 and 12.1% in 2011. See Table 8.1.2.1.

Table 8.1.2.1: INCIDENT TRANSPLANT PATIENTS BY ETHNIC GROUP AND GENDER

2010 ETHNIC GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
Chinese	34	81.0	32	76.2	66	78.6
Malay	7	16.7	6	14.3	13	15.5
Indian	1	2.4	2	4.8	3	3.6
Others	0	0.0	2	4.8	2	2.4
All Ethnic Groups	42	100	42	100	84	100

2011 ETHNIC GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
Chinese	41	77.4	28	73.7	69	75.8
Malay	5	9.4	6	15.8	11	12.1
Indian	6	11.3	4	10.5	10	11.0
Others	1	1.9	0	0.0	1	1.1
All Ethnic Groups	53	100	38	100	91	100

Likewise, in the period 1999-2011, among incident transplant patients, the proportion of Chinese was the highest among the different ethnic groups for both genders and was above 60% every year. The proportion of incident transplant patients, by ethnicity, is shown in Figure 8.1.2.1.

Figure 8.1.2.1: INCIDENT TRANSPLANT PATIENTS BY ETHNIC GROUP, 1999 – 2011

The number of males among incident transplants outnumbered that of females except for years 2002 and 2004. See Table 8.1.2.2.

Table 8.1.2.2: INCIDENT TRANSPLANT PATIENTS BY GENDER, 1999 – 2011

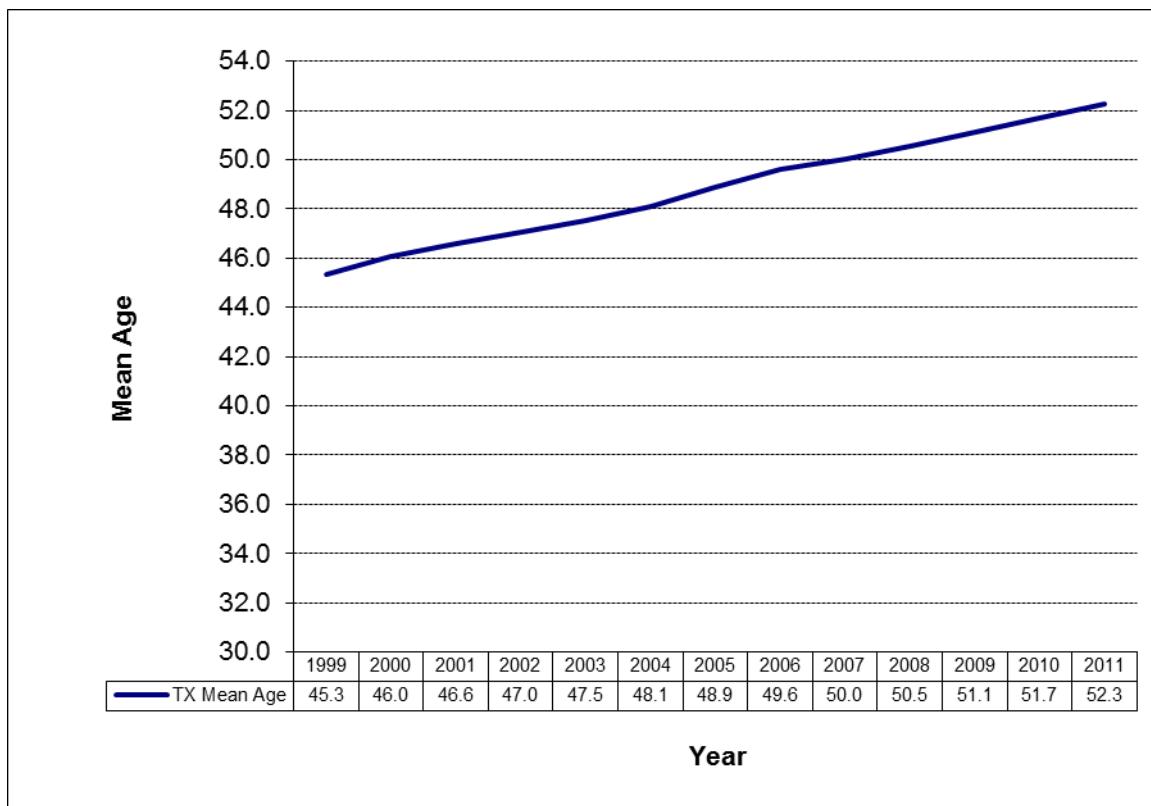
YEAR	Male		Female		Both Genders	
	No	%	No	%	No	%
1999	44	53.0	39	47.0	83	100.0
2000	43	52.4	39	47.6	82	100.0
2001	71	66.4	36	33.6	107	100.0
2002	37	46.3	43	53.8	80	100.0
2003	40	64.5	22	35.5	62	100.0
2004	51	49.5	52	50.5	103	100.0
2005	67	57.3	50	42.7	117	100.0
2006	65	52.4	59	47.6	124	100.0
2007	58	51.8	54	48.2	112	100.0
2008	60	57.7	44	42.3	104	100.0
2009	51	53.1	45	46.9	96	100.0
2010	42	50.0	42	50.0	84	100.0
2011	53	58.2	38	41.8	91	100.0

8.1.3 Prevalent Transplant Patients by Age Group and Gender

Among prevalent patients, 53.9% were males in 2010 and 53.3% in 2011. Their mean age was 51.7 years (median 53.0 years) in 2010 and 52.3 years (median 53.6 years) in 2011.

Expectedly, the mean age for prevalent transplant patients increased from about 45.3 years in 1999 to about 52.3 years in 2011. See Figure 8.1.3.1.

Figure 8.1.3.1: AGE OF PREVALENT TRANSPLANT PATIENTS, 1999 – 2011



The age distribution of prevalent transplant patients is shown in Tables 8.1.3.1, majority were of the age group 50 to 59 years.

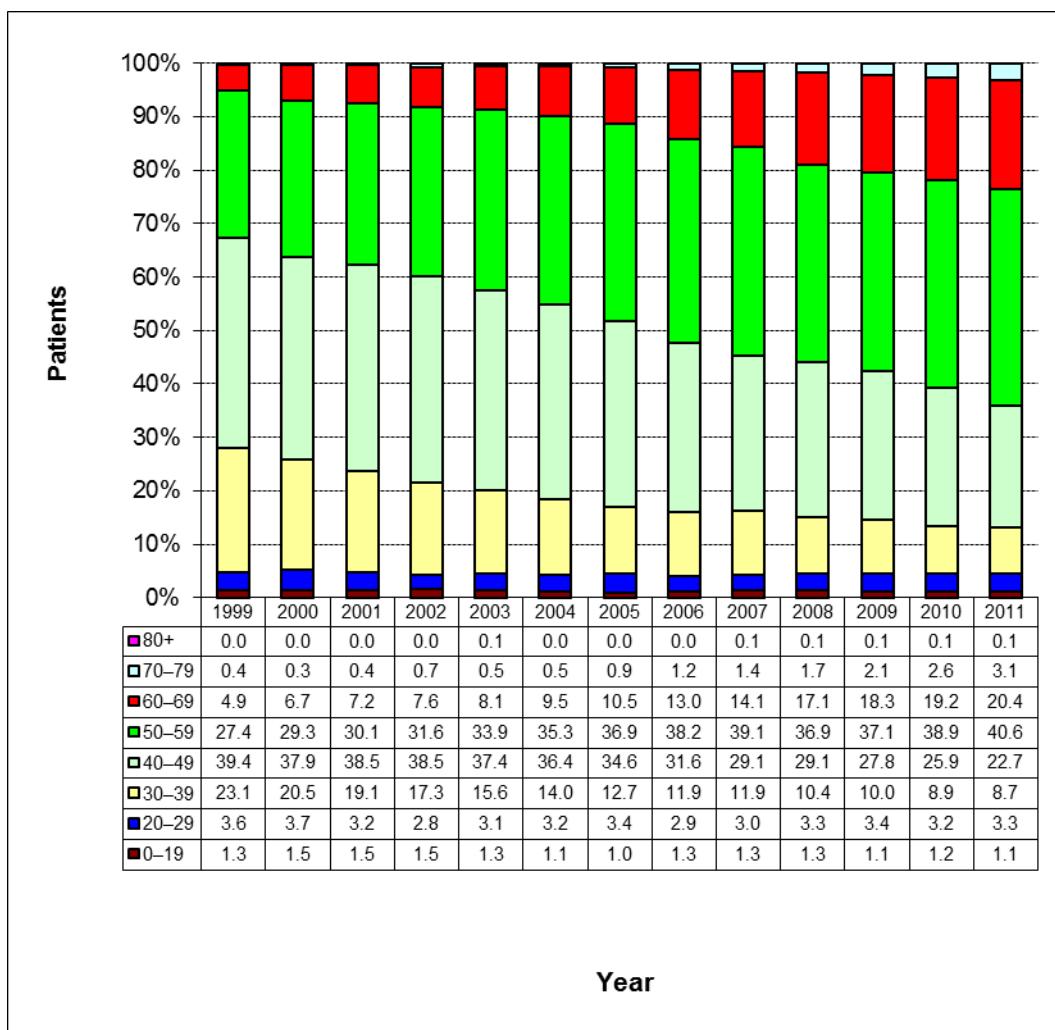
Table 8.1.3.1: PREVALENT TRANSPLANT PATIENTS BY AGE GROUP AND GENDER

2010 AGE GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
0–19	10	1.4	7	1.1	17	1.2
20–29	17	2.3	26	4.1	43	3.2
30–39	63	8.6	58	9.2	121	8.9
40–49	185	25.2	168	26.7	353	25.9
50–59	276	37.6	255	40.5	531	38.9
60–69	162	22.0	100	15.9	262	19.2
70–79	22	3.0	13	2.1	35	2.6
80 +	0	0.0	2	0.3	2	0.1
All Age Groups	735	100	629	100	1364	100

2011 AGE GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
0–19	8	1.1	8	1.2	16	1.1
20–29	18	2.4	28	4.3	46	3.3
30–39	65	8.7	57	8.7	122	8.7
40–49	165	22.1	154	23.5	319	22.7
50–59	294	39.3	275	42.0	569	40.6
60–69	169	22.6	117	17.9	286	20.4
70–79	29	3.9	14	2.1	43	3.1
80 +	0	0.0	2	0.3	2	0.1
All Age Groups	748	100	655	100	1403	100

Trends in age groups are shown in Figure 8.1.3.2. Of note is the increasing age of prevalent transplant patients.

Figure 8.1.3.2: PREVALENT TRANSPLANT PATIENTS BY AGE GROUP, 1999 – 2011



8.1.4 Prevalent Transplant Patients by Ethnic Group and Gender

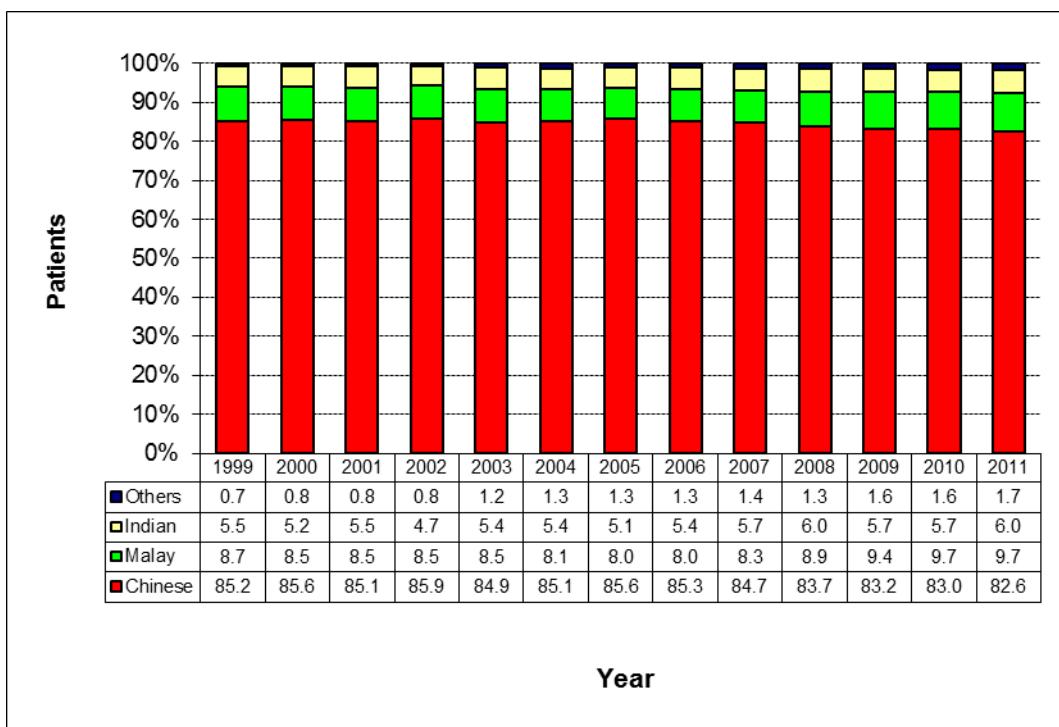
Among prevalent transplant patients in 2010 and 2011, the majority were Chinese. See Table 8.1.4.1.

Table 8.1.4.1: PREVALENT TRANSPLANT PATIENTS BY ETHNIC GROUP AND GENDER

2010 ETHNIC GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
Chinese	609	82.9	523	83.1	1132	83.0
Malay	67	9.1	65	10.3	132	9.7
Indian	47	6.4	31	4.9	78	5.7
Others	12	1.6	10	1.6	22	1.6
All Ethnic Groups	735	100	629	100	1364	100

2011 ETHNIC GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
Chinese	619	82.8	540	82.4	1159	82.6
Malay	67	9.0	69	10.5	136	9.7
Indian	50	6.7	34	5.2	84	6.0
Others	12	1.6	12	1.8	24	1.7
All Ethnic Groups	748	100	655	100	1403	100

Throughout the period 1999-2011, Chinese comprised the highest proportion of prevalent transplant patients groups for both genders and were above 80%.

Figure 8.1.4.1: PREVALENT TRANSPLANT PATIENTS BY ETHNIC GROUP, 1999 – 2011

Males comprised 53.4% and 53.3% of prevalent transplant patients in 1999 and 2011 respectively. See Table 8.1.4.2.

Table 8.1.4.2: PREVALENT TRANSPLANT PATIENTS BY GENDER, 1999 – 2011

YEAR	Male		Female	
	No	%	No	%
1999	450	53.4	393	46.6
2000	479	54.1	407	45.9
2001	530	55.2	430	44.8
2002	530	54.5	442	45.5
2003	551	55.2	447	44.8
2004	575	54.9	472	45.1
2005	611	54.9	501	45.1
2006	647	54.8	534	45.2
2007	668	54.2	564	45.8
2008	698	54.7	579	45.3
2009	719	54.3	606	45.7
2010	735	53.9	629	46.1
2011	748	53.3	655	46.7

8.2 Aetiology of Renal Failure among Renal Transplants

Most incident renal transplant patients had glomerulonephritis (64.3% in 2010 and 62.6% in 2011) as the underlying aetiology of renal failure. Patients with underlying diabetic nephropathy among incident transplants were 11.9% in 2010 and 9.9% in 2011. The corresponding figure for hypertension and renovascular disease was 6.0% in 2010 and 8.8% in 2011. See Table 8.2.1.

Likewise, of the prevalent transplant population, the majority (71.3% in 2010 and 71.0 in 2011) had primary glomerulonephritis as the aetiology of renal failure while patients with diabetic nephropathy comprising only 7.3% in 2010 and 2011. The corresponding figure for hypertension and renovascular disease was 5.9% in 2010 and 6.1% in 2011. See Table 8.2.1. This was in sharp contrast to the dialysis population where the vast majority of patients had underlying diabetic nephropathy as the aetiology of renal failure. See Tables 7.2.1.1 and 7.2.2.1. Among incident transplant patients, the proportion of diabetic nephropathy as aetiology of renal failure increased from 4.8% in 1999, increased to 9.9% in 2011. Similarly, an increasing proportion of diabetic nephropathy as aetiology of renal failure was observed among prevalent transplant patients. See Figure 8.2.1 and Figure 8.2.2.

Table 8.2.1: AETIOLOGY OF RENAL FAILURE AMONG INCIDENT AND PREVALENT TRANSPLANT PATIENTS

AETIOLOGY OF RENAL FAILURE	2010				2011			
	Incident		Prevalent		Incident		Prevalent	
	No	%	No	%	No	%	No	%
Diabetic Nephropathy	10	11.9	99	7.3	9	9.9	102	7.3
Primary Glomerulonephritis (GN)	54	64.3	972	71.3	57	62.6	996	71.0
Autoimmune Disease/GN with Systemic Manifestations	4	4.8	56	4.1	4	4.4	60	4.3
Hypertension and Renovascular Disease	5	6.0	80	5.9	8	8.8	86	6.1
Polycystic Kidney Disease / Other Cystic Diseases	6	7.1	57	4.2	4	4.4	56	4.0
Vesicoureteric Reflex / Chronic Pyelonephritis	2	2.4	20	1.5	1	1.1	21	1.5
Obstruction	1	1.2	4	0.3	0	0.0	4	0.3
Stone Disease	0	0.0	3	0.2	0	0.0	3	0.2
Miscellaneous	1	1.2	33	2.4	8	8.8	38	2.7
Unknown	1	1.2	40	2.9	0	0.0	37	2.6
All Aetiology	84	100	1364	100	91	100	1403	100

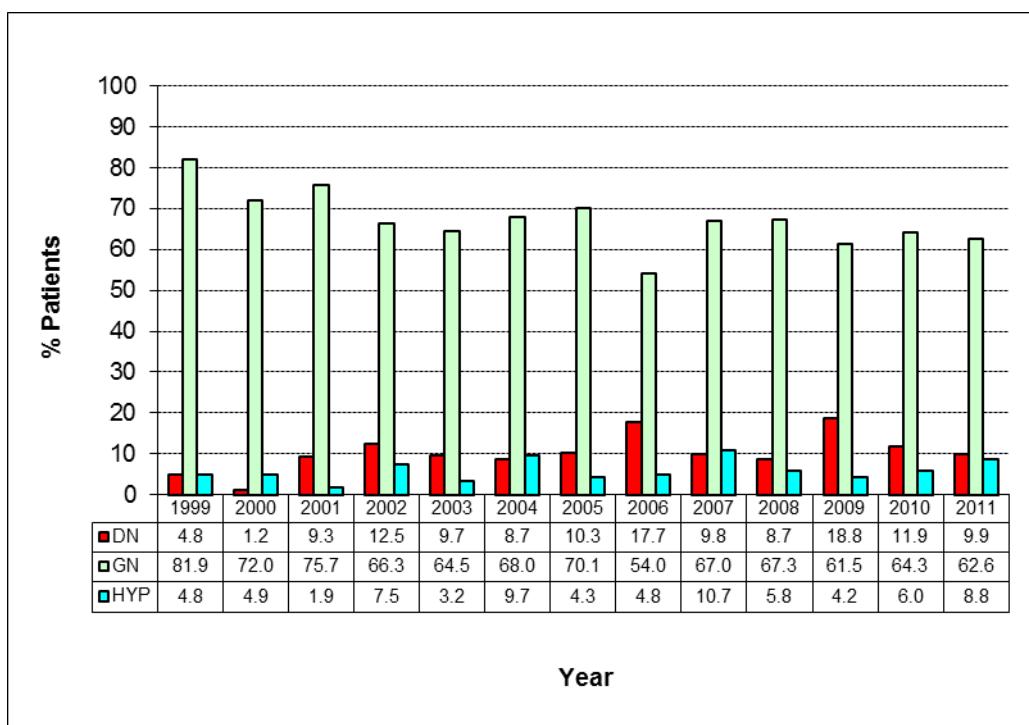
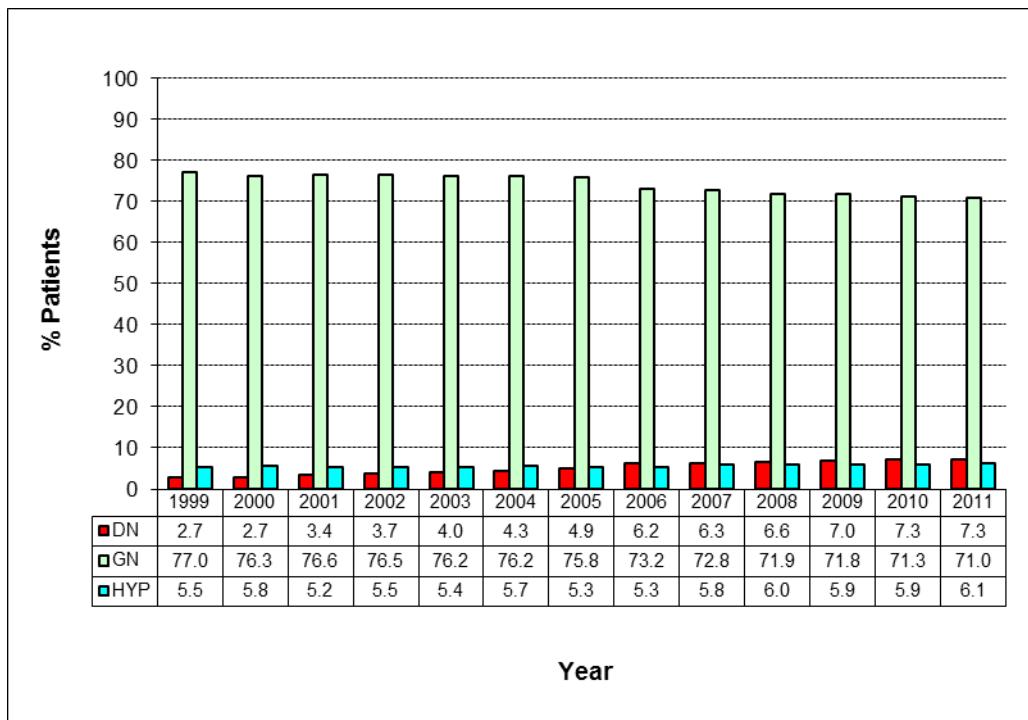
Figure 8.2.1: DIABETIC NEPHROPATHY, GLOMERULONEPHRITIS AND HYPERTENSION/RENOVASCULAR DISEASE AS AETIOLOGY OF RENAL FAILURE AMONG INCIDENT TRANSPLANT PATIENTS, 1999 – 2011

Figure 8.2.2: DIABETIC NEPHROPATHY, GLOMERULONEPHRITIS AND HYPERTENSION/RENOVASCULAR DISEASE AS AETIOLOGY OF RENAL FAILURE AMONG PREVALENT TRANSPLANT PATIENTS, 1999 – 2011



8.3 Co-morbid Conditions

Diabetes Mellitus was reported in 20.2% of newly transplanted patients in 2010 and 20.9% in 2011. See Table 8.3.1 and Figure 8.3.1.

Ischaemic Heart Disease was reported in 15.5% of patients in 2010 and 16.5% in 2011, Cerebrovascular Disease in 3.6% in 2010 and 4.4% in 2011, Peripheral Vascular Disease in 1.2% in 2010 and 3.3% in 2011.

There were 8.3% of patients who were current smokers in 2010 and 8.8% in 2011. Former smokers were 14.3% in 2010 and 12.1% in 2011.

In 2010, there were 2.4% of incident transplant patients who were serologically positive for Hepatitis B Surface Antigen while 2.2% were positive in 2011. Only 2.2% of incident transplant patients who were with Anti-HCV positive. A small proportion of patients had unknown Hepatitis B Surface Antigen status and Anti-HCV status.

An increase in the proportion of incident patients with co-morbidities was observed over the period from 1999 – 2011. See Figure 8.3.1.

Table 8.3.1: CO-MORBID CONDITIONS AMONG INCIDENT TRANSPLANT PATIENTS

Diabetes Mellitus	2010		2011	
	No	%	No	%
Yes	17	20.2	19	20.9
No	67	79.8	72	79.1
Unknown	0	0.0	0	0.0
Total	84	100	91	100

Ischaemic Heart Disease	2010		2011	
	No	%	No	%
Yes	13	15.5	15	16.5
No	71	84.5	76	83.5
Unknown	0	0.0	0	0.0
Total	84	100	91	100

Cerebrovascular Disease	2010		2011	
	No	%	No	%
Yes	3	3.6	4	4.4
No	81	96.4	87	95.6
Unknown	0	0.0	0	0.0
Total	84	100	91	100

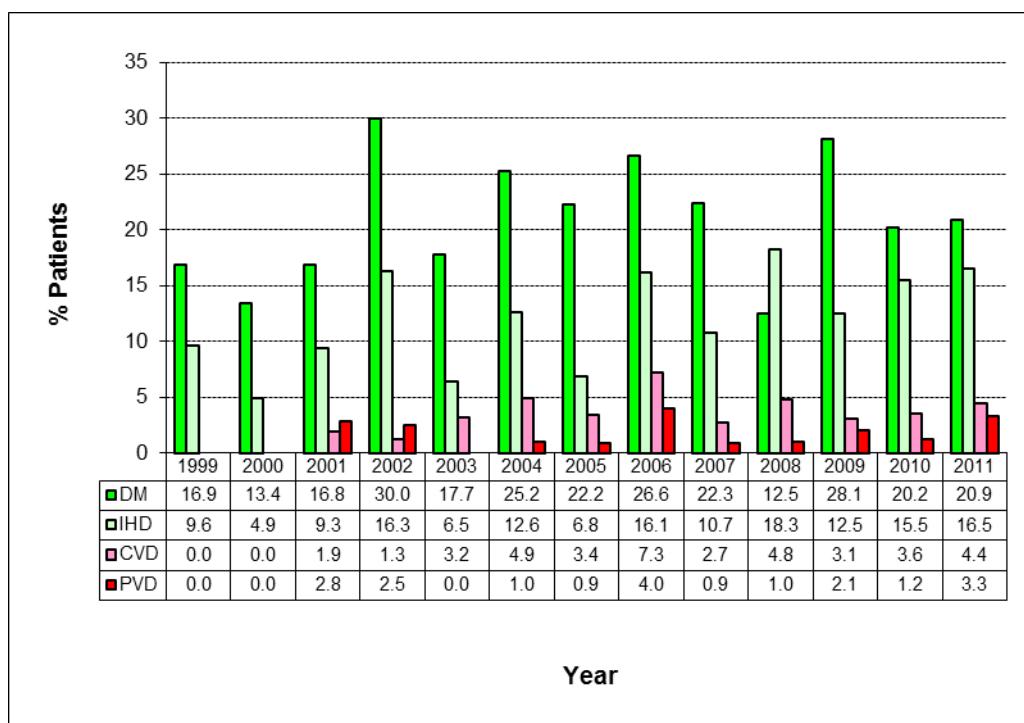
Peripheral Vascular Disease	2010		2011	
	No	%	No	%
Yes	1	1.2	3	3.3
No	83	98.8	88	96.7
Unknown	0	0.0	0	0.0
Total	84	100	91	100

Smoking	2010		2011	
	No	%	No	%
Current Smoker	7	8.3	8	8.8
Ex-Smoker	12	14.3	11	12.1
Non-Smoker	63	75.0	69	75.8
Unknown	2	2.4	3	3.3
Total	84	100	91	100

Hepatitis B S AG Status	2010		2011	
	No	%	No	%
Positive	2	2.4	2	2.2
Negative	78	92.9	88	96.7
Unknown	4	4.8	1	1.1
Total	84	100	91	100

Anti-HCV Status	2010		2011	
	No	%	No	%
Positive	0	0.0	2	2.2
Negative	78	92.9	88	96.7
Unknown	6	7.1	1	1.1
Total	84	100	91	100

Figure 8.3.1: CO-MORBID CONDITIONS AMONG INCIDENT TRANSPLANT PATIENTS, 1999 – 2011



The list of co-morbidities affecting prevalent transplant patients is shown in Table 8.3.2. About one quarter (26.1% in 2010 and 25.3% in 2011) had diabetes mellitus. The higher incidence of diabetes as co-morbidity among prevalent transplant patients may be related to immunosuppressive therapy used post-transplant as only a small proportion had underlying diabetic nephropathy. Other co-morbidities included ischaemic heart disease, cerebrovascular disease, peripheral vascular disease, currently smoking, Hepatitis B antigen positivity and Anti-HCV positivity. Expectedly, the proportion of prevalent transplant patients with co-morbidities increased over the evaluation period. See Table 8.3.2 and Figure 8.3.2. The proportion of prevalent transplant patients with these co-morbidities was lower than that of for prevalent dialysis patients. See Table 7.5.2.1.

Table 8.3.2: CO-MORBID CONDITIONS AMONG PREVALENT TRANSPLANT PATIENTS

Diabetes Mellitus	2010		2011	
	No	%	No	%
Yes	356	26.1	355	25.3
No	1008	73.9	1048	74.7
Unknown	0	0.0	0	0.0
Total	1364	100	1403	100

Ischaemic Heart Disease	2010		2011	
	No	%	No	%
Yes	210	15.4	216	15.4
No	1154	84.6	1187	84.6
Unknown	0	0.0	0	0.0
Total	1364	100	1403	100

Cerebrovascular Disease	2010		2011	
	No	%	No	%
Yes	62	4.5	66	4.7
No	1302	95.5	1337	95.3
Unknown	0	0.0	0	0.0
Total	1364	100	1403	100

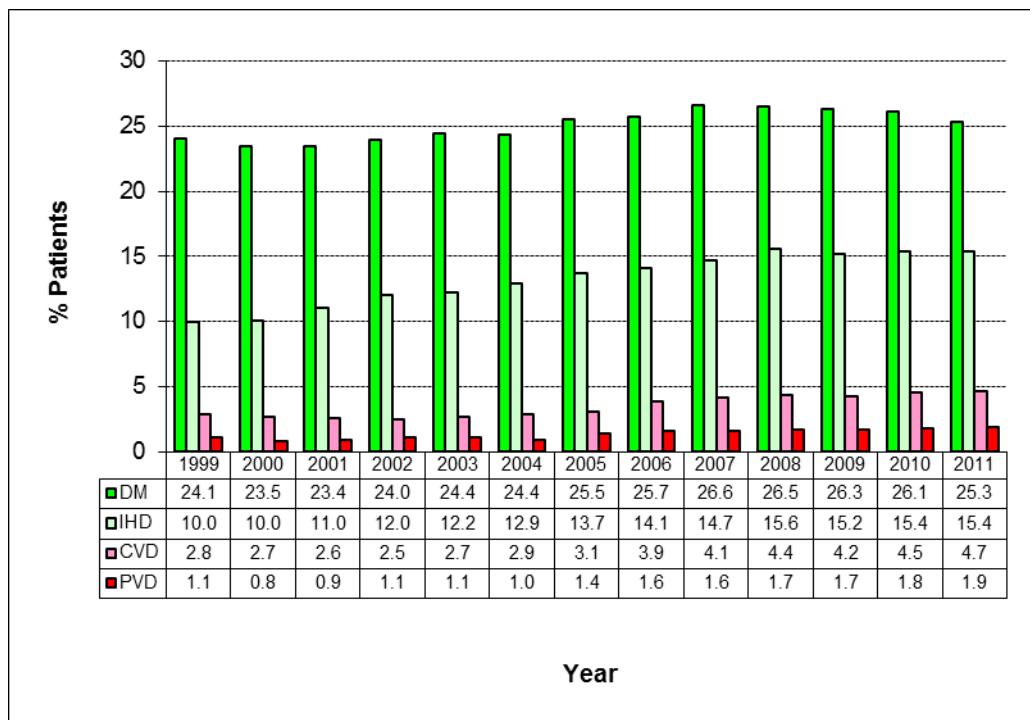
Peripheral Vascular Disease	2010		2011	
	No	%	No	%
Yes	25	1.8	27	1.9
No	1339	98.2	1376	98.1
Unknown	0	0.0	0	0.0
Total	1364	100	1403	100

Smoking	2010		2011	
	No	%	No	%
Current Smoker	46	3.4	49	3.5
Ex-Smoker	196	14.4	196	14.0
Non-Smoker	1099	80.6	1132	80.7
Unknown	23	1.7	26	1.9
Total	1364	100	1403	100

Hepatitis B S AG Status	2010		2011	
	No	%	No	%
Positive	44	3.2	49	3.5
Negative	1303	95.5	1342	95.7
Unknown	17	1.2	12	0.9
Total	1364	100	1403	100

Anti-HCV Status	2010		2011	
	No	%	No	%
Positive	63	4.6	62	4.4
Negative	1265	92.7	1312	93.5
Unknown	36	2.6	29	2.1
Total	1364	100	1403	100

Figure 8.3.2: CO-MORBID CONDITIONS AMONG PREVALENT TRANSPLANT PATIENTS, 1999 – 2011

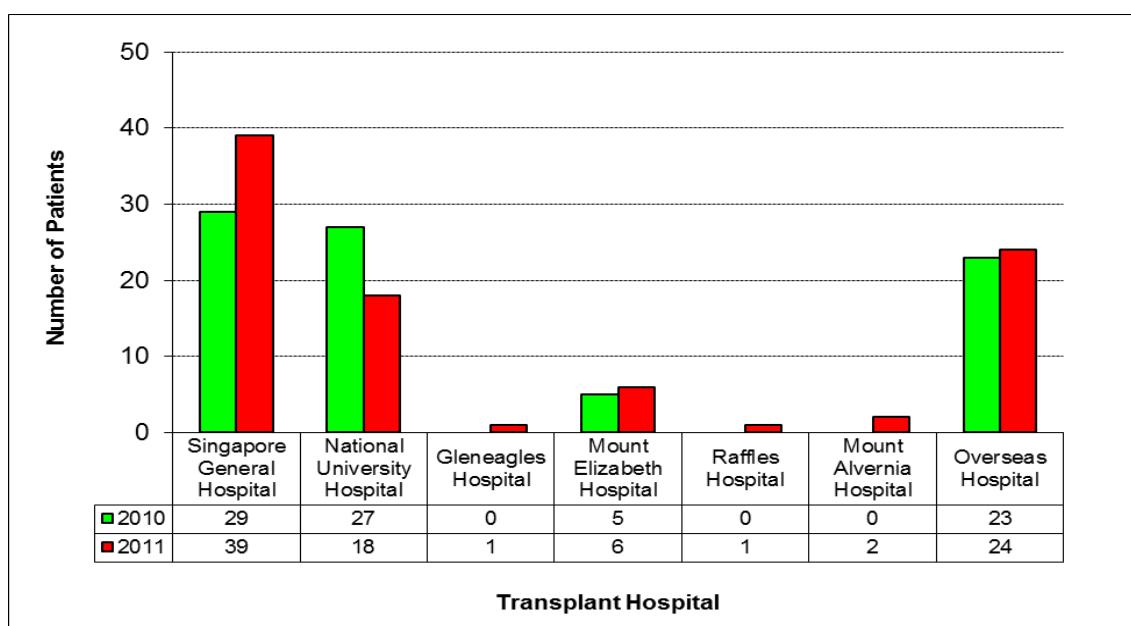


8.4 Location where Transplant was Performed

8.4.1 Incident Transplant Patients

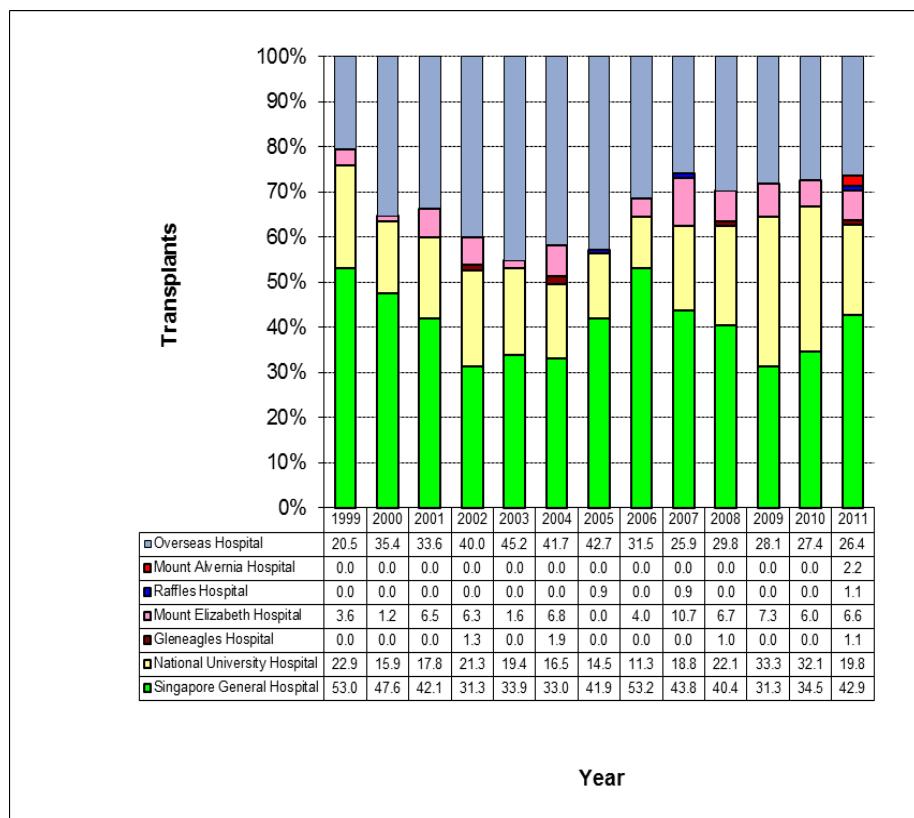
Among incident patients, the majority was performed locally, primarily at the Singapore General Hospital (34.5% in 2010 and 42.8% in 2011). However, about 27% of the transplants were performed at overseas centres in 2010 and 2011. See Figure 8.4.1.1.

Figure 8.4.1.1: INCIDENT TRANSPLANTS BY TRANSPLANT HOSPITAL



The proportion of incident transplants that were performed at Singapore General Hospital and overseas hospitals decreased in 2009 then increased in 2011 whereas the reverse was noted for transplants from the National University Hospital. The twelve-year-trend is seen in Figure 8.4.1.2.

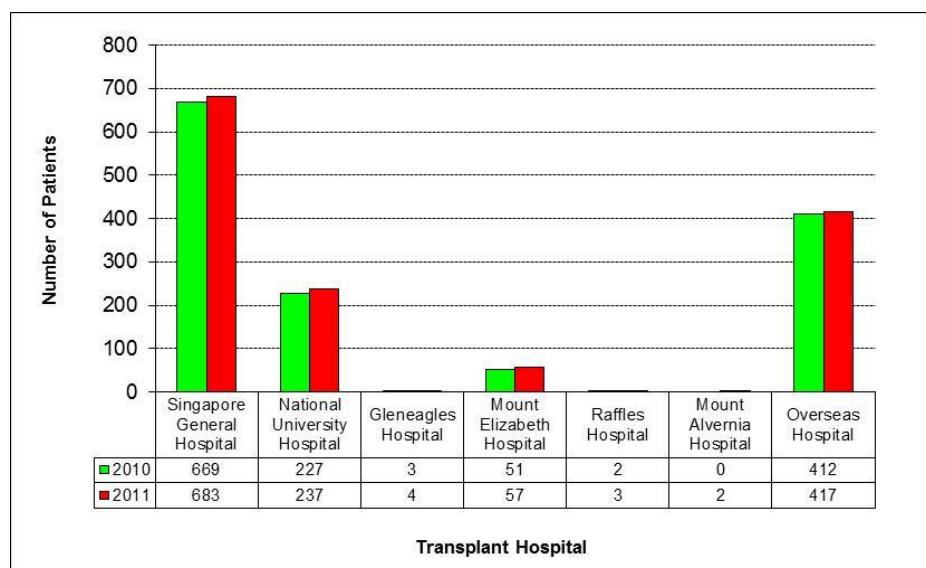
Figure 8.4.1.2: INCIDENT TRANSPLANTS BY TRANSPLANT HOSPITAL, 1999 – 2011



8.4.2 Prevalent Transplant Patients

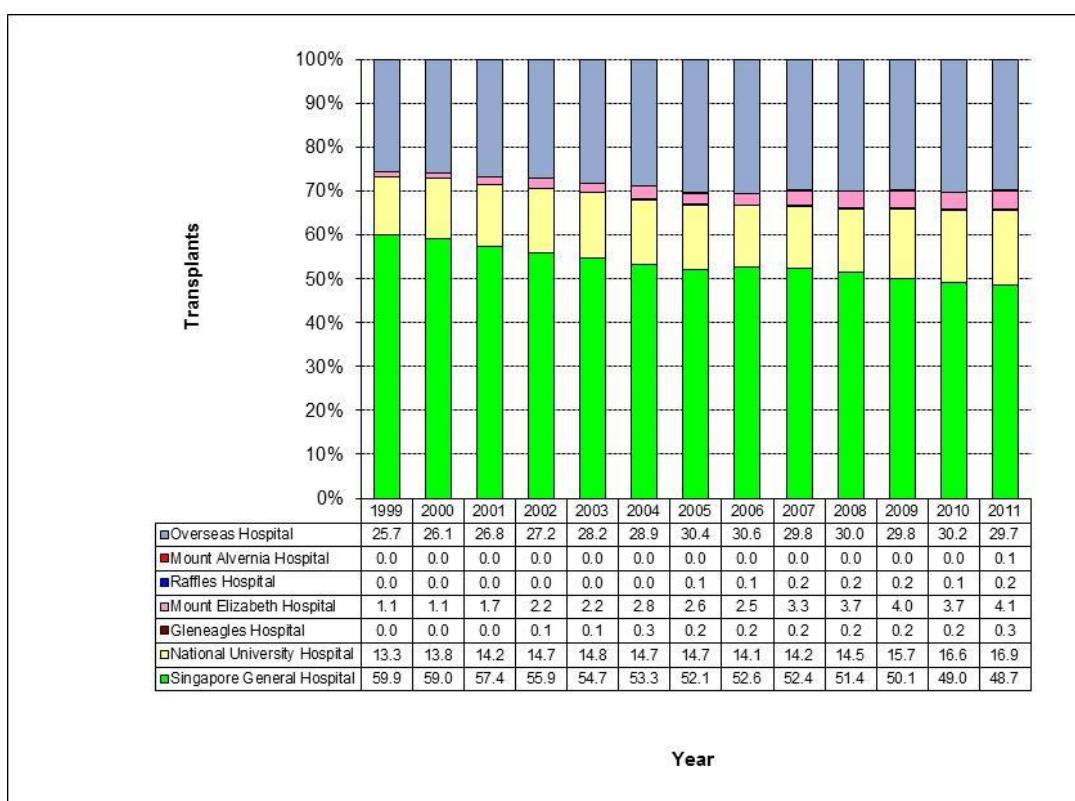
Among the prevalent transplant population, the majority had been performed at the Singapore General Hospital (49.0% in 2010 and 48.7% in 2011). See Figure 8.4.2.1.

Figure 8.4.2.1: PREVALENT TRANSPLANTS BY TRANSPLANT HOSPITAL



For the period 1999 to 2011, the majority of transplants had been performed at the Singapore General Hospital among the prevalent transplant patients. See Figure 8.4.2.2.

Figure 8.4.2.2: PREVALENT TRANSPLANTS BY TRANSPLANT HOSPITAL, 1999 – 2011



8.5 Donor Type and Source

Among incident patients transplanted locally, 54 (64.3%) in 2010 had received deceased-donor renal transplants. At the end of year 2010, 909 of 1364 prevalent patients (66.6%) had received deceased-donor transplants. See Table 8.5.1 and Table 8.5.3.

Among incident patients transplanted locally, 51 (56.0%) in 2011 had received deceased-donor renal transplants. At the end of year 2011, 922 of 1403 prevalent patients (65.7%) had received deceased-donor transplants. See Table 8.5.1 and Table 8.5.3.

Table 8.5.1: INCIDENT TRANSPLANTS BY DONOR TYPE AND TRANSPLANT HOSPITAL

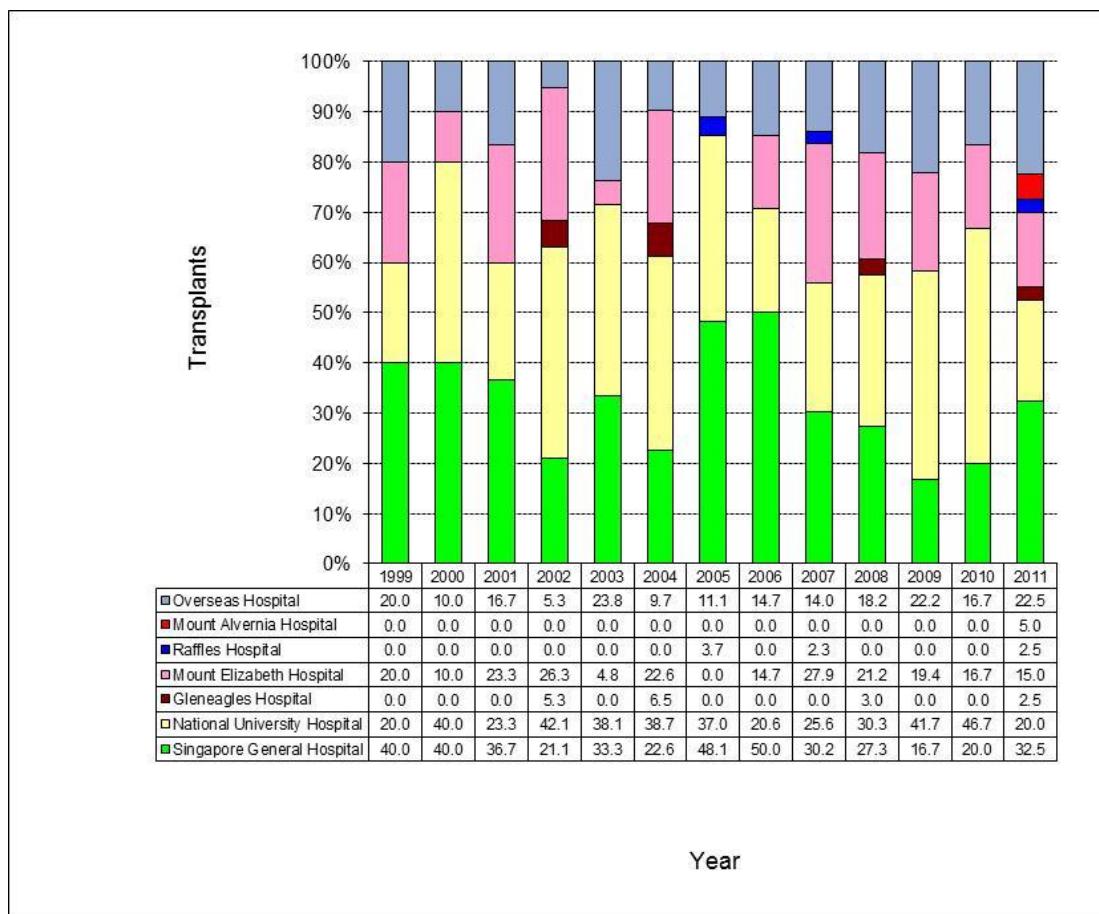
2010 HOSPITAL	Living-Donor		Deceased-Donor		All Donors	
	No	%	No	%	No	%
Singapore General Hospital	6	20.0	23	42.6	29	34.5
National University Hospital	14	46.7	13	24.1	27	32.1
Mount Elizabeth Hospital	5	16.7	0	0.0	5	6.0
Overseas Hospital	5	16.7	18	33.3	23	27.4
All Transplant Hospitals	30	100	54	100	84	100

2011 HOSPITAL	Living-Donor		Deceased-Donor		All Donors	
	No	%	No	%	No	%
Singapore General Hospital	13	32.5	26	51.0	39	42.9
National University Hospital	8	20.0	10	19.6	18	19.8
Gleneagles Hospital	1	2.5	0	0.0	1	1.1
Mount Elizabeth Hospital	6	15.0	0	0.0	6	6.6
Raffles Hospital	1	2.5	0	0.0	1	1.1
Mount Alvernia Hospital	2	5.0	0	0.0	2	2.2
Overseas Hospital	9	22.5	15	29.4	24	26.4
All Transplant Hospitals	40	100	51	100	91	100

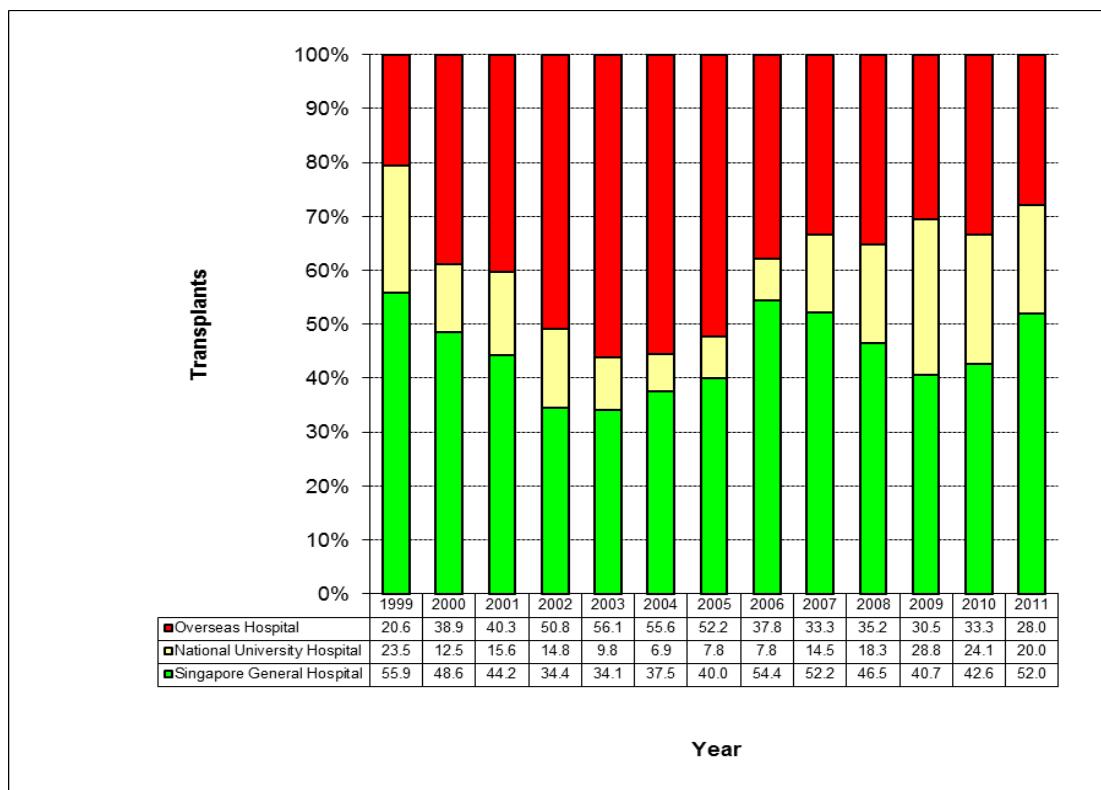
[†] There were 2 transplants whereby the donor type could not be ascertained, and hence excluded in the count.

Majority of the incident living-donor transplant were performed at Singapore General Hospital and National University Hospital in the twelve-year period. See Figure 8.5.1.

Figure 8.5.1: INCIDENT LIVING-DONOR TRANSPLANTS BY TRANSPLANT HOSPITAL, 1999 – 2011



Among incident deceased-donor transplants, the numbers performed at overseas hospitals increased for the period 1999-2003 then started to decline thereafter. See Figure 8.5.2.

Figure 8.5.2: INCIDENT DECEASED-DONOR TRANSPLANTS BY TRANSPLANT HOSPITAL, 1999 – 2011

Among incident living-donor transplants, the majority was biologically related (40% in 2010; 52.5% in 2011). See Table 8.5.2.

Table 8.5.2: INCIDENT LIVING-DONOR TRANSPLANTS BY DONOR RELATIONSHIP AND TRANSPLANT HOSPITAL

2010 HOSPITAL	Biologically Related		Emotionally Related		Neither		All Living Donors	
	No	%	No	%	No	%	No	%
Singapore General Hospital	3	25.0	3	18.8	0	0.0	6	20.0
National University Hospital	8	66.7	6	37.5	0	0.0	14	46.7
Mount Elizabeth Hospital	1	8.3	4	25.0	0	0.0	5	16.7
Overseas Hospital	0	0.0	3	18.8	2	100.0	5	16.7
All Transplant Hospitals	12	100	16	100	2	100	30	100

2011 HOSPITAL	Biologically Related		Emotionally Related		Neither		All Living Donors	
	No	%	No	%	No	%	No	%
Singapore General Hospital	7	33.3	5	41.7	1	14.3	13	32.5
National University Hospital	4	19.0	4	33.3	0	0.0	8	20.0
Gleneagles Hospital	1	4.8	0	0.0	0	0.0	1	2.5
Mount Elizabeth Hospital	4	19.0	2	16.7	0	0.0	6	15.0
Raffles Hospital	0	0.0	1	8.3	0	0.0	1	2.5
Mount Alvernia Hospital	2	9.5	0	0.0	0	0.0	2	5.0
Overseas Hospital	3	14.3	0	0.0	6	85.7	9	22.5
All Transplant Hospitals	21	100	12	100	7	100	40	100

Among prevalent patients, the majority of the transplants had been performed at the Singapore General Hospital (669 in 2010 and 683 in 2011). Of note, approximately one third of prevalent patients (412 in 2010 and 417 in 2011) have received renal transplantation at overseas hospitals. See Table 8.5.3.

Table 8.5.3: PREVALENT TRANSPLANTS BY DONOR TYPE AND TRANSPLANT HOSPITAL

2010 HOSPITAL	Living-Donor		Deceased-Donor		All Donors	
	No	%	No	%	No	%
Singapore General Hospital	197	43.5	472	51.9	669	49.0
National University Hospital	107	23.6	120	13.2	227	16.6
Gleneagles Hospital	3	0.7	0	0.0	3	0.2
Mount Elizabeth Hospital	51	11.3	0	0.0	51	3.7
Raffles Hospital	2	0.4	0	0.0	2	0.1
Overseas Hospital	93	20.5	317	34.9	412	30.2
All Transplant Hospitals	453	100	909	100	1364	100

note: 2 overseas cases with missing donor status

2011 HOSPITAL	Living-Donor		Deceased-Donor		All Donors	
	No	%	No	%	No	%
Singapore General Hospital	204	42.7	479	52.0	683	48.7
National University Hospital	114	23.8	123	13.3	237	16.9
Gleneagles Hospital	4	0.8	0	0.0	4	0.3
Mount Elizabeth Hospital	57	11.9	0	0.0	57	4.1
Raffles Hospital	3	0.6	0	0.0	3	0.2
Mount Alvernia Hospital	2	0.4	0	0.0	2	0.1
Overseas Hospital	94	19.7	320	34.7	417	29.7
All Transplant Hospitals	478	100	922	100	1403	100

note: 3 overseas cases with missing donor status

Majority of the living and deceased-donor prevalent transplants had undergone transplantation at the Singapore General Hospital for the period 1999 to 2011. Of the prevalent living-donor transplants, 19.7% of them sought transplants overseas in 2011. Although there had been no significant trends in numbers of incident living-donor transplants from overseas hospitals (See Figure 8.5.1), there was a definite trend to decreasing numbers of prevalent living-donor transplants from overseas hospitals in the evaluation period suggesting reduced survival in the latter. See Figure 8.5.3. In contrast, an increasingly larger proportion of prevalent decreased-donor transplants were from overseas hospitals. See Figure 8.5.4.

Figure 8.5.3: PREVALENT LIVING-DONOR TRANSPLANTS BY TRANSPLANT HOSPITAL, 1999 – 2011

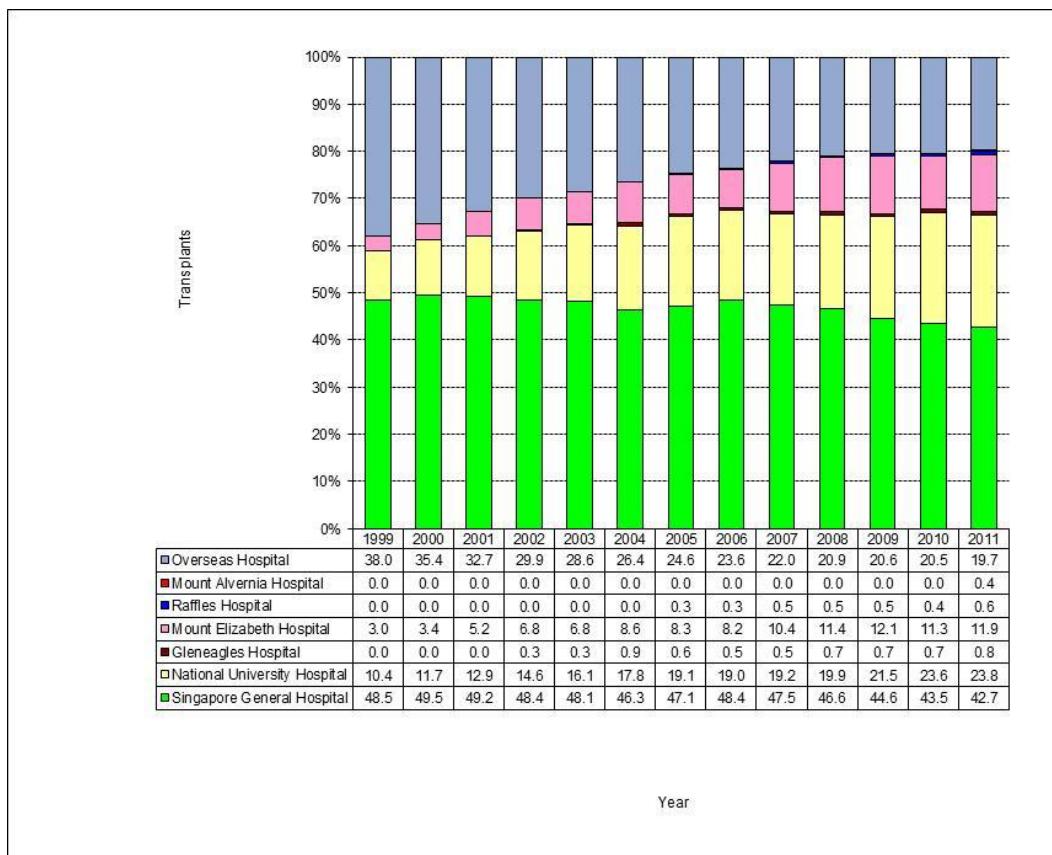
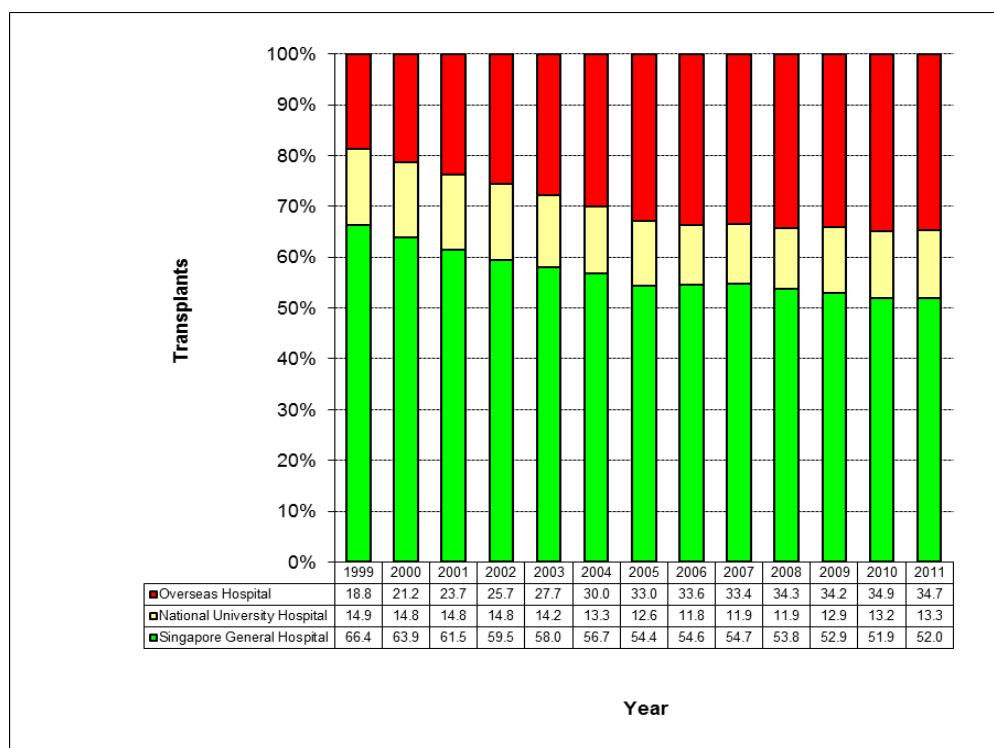


Figure 8.5.4: PREVALENT DECEASED-DONOR TRANSPLANTS BY TRANSPLANT HOSPITAL, 1999 – 2011



While living-related transplants, either biologically-related or emotionally-related, were performed at local hospitals, the majority of unrelated (i.e. neither biologically nor emotionally related) living-donor transplants had been performed at overseas hospitals. See Table 8.5.4.

Table 8.5.4: PREVALENT LIVING-DONOR TRANSPLANTS BY DONOR SOURCE AND TRANSPLANT HOSPITAL

2010 HOSPITAL	Biologically Related		Emotionally Related		Neither		All Living Donors	
	No	%	No	%	No	%	No	%
Singapore General Hospital	156	57.8	41	37.6	0	0.0	197	43.5
National University Hospital	70	25.9	37	33.9	0	0.0	107	23.6
Gleneagles Hospital	2	0.7	1	0.9	0	0.0	3	0.7
Mount Elizabeth Hospital	25	9.3	23	21.1	3	4.1	51	11.3
Raffles Hospital	1	0.4	1	0.9	0	0.0	2	0.4
Overseas Hospital	16	5.9	6	5.5	71	95.9	93	20.5
All Transplant Hospitals	270	100	109	100	74	100	453	100

2011 HOSPITAL	Biologically Related		Emotionally Related		Neither		All Living Donors	
	No	%	No	%	No	%	No	%
Singapore General Hospital	157	55.3	46	38.0	1	1.4	204	42.7
National University Hospital	74	26.1	40	33.1	0	0.0	114	23.8
Gleneagles Hospital	3	1.1	1	0.8	0	0.0	4	0.8
Mount Elizabeth Hospital	29	10.2	25	20.7	3	4.1	57	11.9
Raffles Hospital	1	0.4	2	1.7	0	0.0	3	0.6
Mount Alvernia Hospital	2	0.7	0	0.0	0	0.0	2	0.4
Overseas Hospital	18	6.3	7	5.8	69	94.5	94	19.7
All Transplant Hospitals	284	100	121	100	73	100	478	100

8.6 Graft and Patient Outcomes

8.6.1 Demographics for Transplant Deaths

There were 18 deaths amongst transplant patients in 2010 and 20 deaths in 2011. See Table 8.6.1.1. The death rate, defined as the proportion of transplant deaths among all those with a functioning graft for a particular year, was 3.2% in 2010 and 3.0% in 2011. Mortality among renal transplants was lower than that for dialysis patients. See Table 7.9.1.1.

Majority of the deaths amongst transplant patients occurred in the age group 60 to 69 years for both genders. See Table 8.6.1.1.

Table 8.6.1.1: TRANSPLANT DEATHS BY AGE GROUP AND GENDER

2010 AGE GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
0–19	0	0.0	0	0.0	0	0.0
20–29	0	0.0	0	0.0	0	0.0
30–39	0	0.0	0	0.0	0	0.0
40–49	1	8.3	2	33.3	3	16.7
50–59	4	33.3	0	0.0	4	22.2
60–69	5	41.7	2	33.3	7	38.9
70–79	2	16.7	2	33.3	4	22.2
80 +	0	0.0	0	0.0	0	0.0
All Age Groups	12	100	6	100	18	100

2011 AGE GROUP	Male		Female		Both Genders	
	No	%	No	%	No	%
0–19	0	0.0	0	0.0	0	0.0
20–29	0	0.0	0	0.0	0	0.0
30–39	0	0.0	1	50.0	1	5.0
40–49	2	11.1	0	0.0	2	10.0
50–59	2	11.1	1	50.0	3	15.0
60–69	13	72.2	0	0.0	13	65.0
70–79	1	5.6	0	0.0	1	5.0
80 +	0	0.0	0	0.0	0	0.0
All Age Groups	18	100	2	100	20	100

The mean age at death for transplant patients was 61.7 years in 2010 and 61.2 in 2011.

The deaths in different ethnic groups for transplant patients are shown in Table 8.6.1.2.

Table 8.6.1.2: TRANSPLANT DEATHS BY ETHNIC GROUP AND GENDER

2010	Male		Female		Both Genders	
	No	%	No	%	No	%
Chinese	12	100.0	4	66.7	16	88.9
Malay	0	0.0	1	16.7	1	5.6
Indian	0	0.0	1	16.7	1	5.6
Others	0	0.0	0	0.0	0	0.0
All Ethnic Groups	12	100	6	100	18	100

2011	Male		Female		Both Genders	
	No	%	No	%	No	%
Chinese	15	83.3	1	50.0	16	80.0
Malay	1	5.6	0	0.0	1	5.0
Indian	2	11.1	1	50.0	3	15.0
Others	0	0.0	0	0.0	0	0.0
All Ethnic Groups	18	100	2	100	20	100

8.6.2 Causes of Death

Infection accounted for 55.6% of deaths in 2010 and 25.0% in 2011, while cardiac events (AMI and other cardiac causes) accounted for 11.1% of deaths in 2010 and 35.0% in 2011. See Table 8.6.2.1.

Table 8.6.2.1: CAUSES OF DEATH IN TRANSPLANT PATIENTS

Cause of Death	2010		2011	
	No	%	No	%
Acute Myocardial Infarct (AMI)	2	11.1	4	20.0
Other Cardiac	0	0.0	3	15.0
Cerebrovascular Accident (CVA)	2	11.1	1	5.0
Infections	10	55.6	5	25.0
Liver Failure	0	0.0	0	0.0
Other Haemorrhage	0	0.0	1	5.0
Malignancy	3	16.7	4	20.0
Withdraw dialysis	0	0.0	0	0.0
Uremia	1	5.6	2	10.0
Total	18	100	20	100

8.6.3 Causes of Graft Failure

There were 23 graft failures among the transplant patients in 2010 and 34 in 2011. The greatest proportion of graft failure was due to chronic rejection (69.6% in 2010; 58.8% in 2011), followed by chronic allograft nephropathy (17.4% in 2010; 20.6% in 2011). See Table 8.6.3.1.

Table 8.6.3.1: CAUSES OF GRAFT FAILURE IN TRANSPLANT PATIENTS

	2010		2011	
	No	%	No	%
Chronic Rejection	16	69.6	20	58.8
Recurrent disease	0	0.0	1	2.9
Acute rejection	1	4.3	5	14.7
Graft thrombosis	0	0.0	1	2.9
Chronic allograft nephropathy	4	17.4	7	20.6
Infection	2	8.7	0	0.0
All Causes of Graft Failure	23	100	34	100

8.6.4 Survival Analysis

The chances of surviving 1 year and 5 years with a functioning graft for transplanted patients were 97.7% and 92.5% respectively. The corresponding 1 and 5-year graft survivals were 95.0% and 89.8% respectively. See Table 8.6.4.1.

Table 8.6.4.1: GRAFT AND PATIENT SURVIVAL, 1999 – 2011

YEAR OF TRANSPLANT 1999-2011	SURVIVAL			
	1 YEAR (%)	95% C.I.	5 YEAR (%)	95% C.I.
Graft	95.0	93.6 – 96.1	89.8	87.9 - 91.4
Patient	97.7	96.7 - 98.4	92.5	90.8 – 93.9

Graft and patient survival of renal transplants for living vs. deceased-donor transplants were shown in Table 8.6.4.2 and Figure 8.6.4.1; local living-donor transplants generally had better graft and patient survival than local deceased-donor transplants.

**Table 8.6.4.2: GRAFT AND PATIENT SURVIVAL BY TYPE OF RENAL TRANSPLANT,
1999 – 2011**

YEAR OF TRANSPLANT 1999-2011	SURVIVAL			
	1 YEAR (%)	95% C.I.	5 YEAR (%)	95% C.I.
Graft				
Local living-donor	97.6	94.6 - 98.9	94.7	90.9 - 97.0
Local deceased-donor	91.1	88.0 - 93.4	85.2	81.4 - 88.3
Patient				
Local living-donor	98.0	95.6 - 99.1	94.8	91.3 – 96.9
Local deceased-donor	91.9	89.2 – 93.9	85.7	82.2 – 88.5

Figure 8.6.4.1: GRAFT SURVIVAL BY TYPE OF RENAL TRANSPLANT, 1999 – 2011

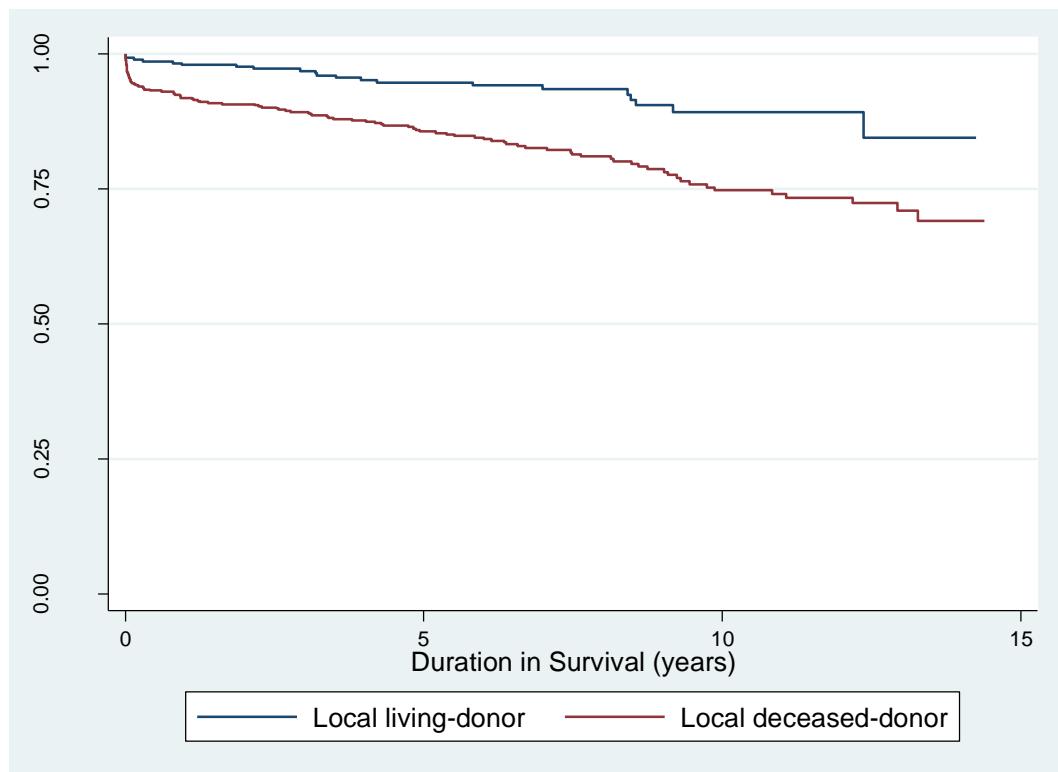
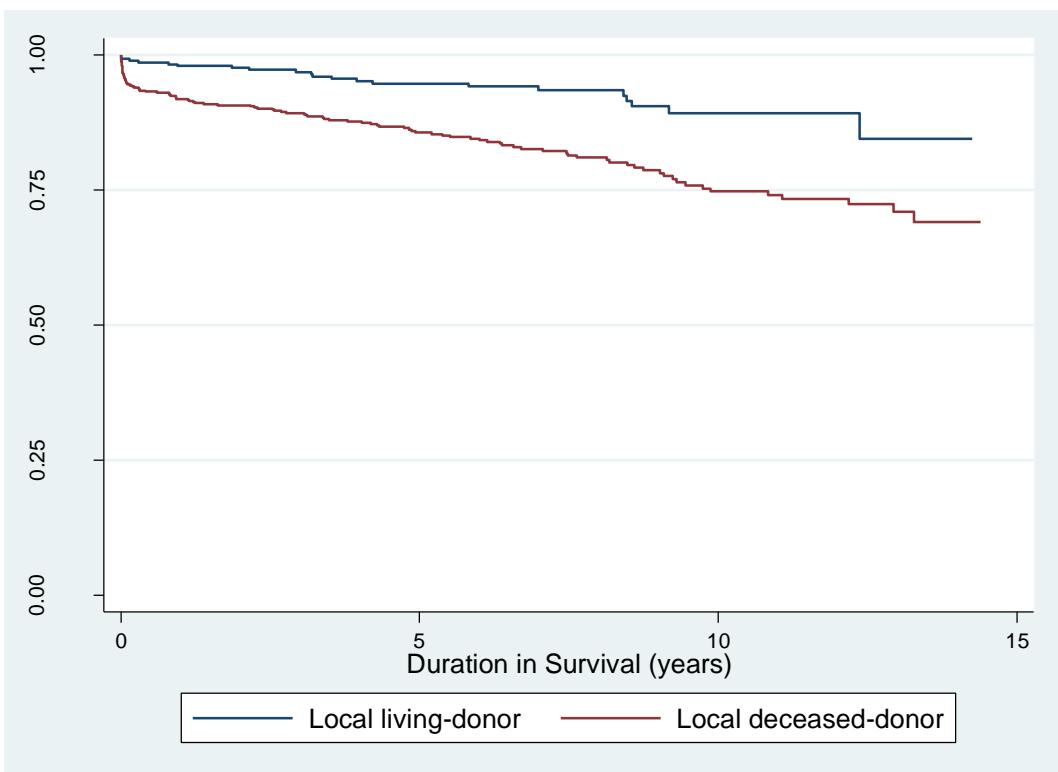


Figure 8.6.4.2: PATIENT SURVIVAL BY TYPE OF RENAL TRANSPLANT, 1999 – 2011



In a separate analysis, survival for locally performed transplants was compared with that for overseas transplants. As patients who had undergone transplant overseas but had lost their transplants or died at the overseas transplant centres would not have been registered as transplants in the Registry database, only transplants functioning beyond 30 days were included and deaths or graft losses before 30 days were censored from the analysis. See Table 8.6.4.3; Figure 8.6.4.3 and Figure 8.6.4.4. Local living-donor transplants had the best graft survival probability as compared to overseas living-donor, local deceased-donor or overseas deceased-donor transplants.

Table 8.6.4.3: CENSORED GRAFT AND PATIENT SURVIVAL BY TYPE OF RENAL TRANSPLANT, 1999 – 2011

YEAR OF TRANSPLANT 1999-2011	SURVIVAL			
	1 YEAR (%)	95% C.I.	5 YEAR (%)	95% C.I.
Graft				
Local living-donor	98.8	96.7 - 99.5	95.6	92.4 - 97.5
Overseas living-donor	98.4	89.3 - 99.8	90.2	77.6 – 95.9
Local deceased-donor	96.5	94.5 - 97.8	90.0	86.8 - 92.4
Overseas deceased-donor	98.8	96.9 - 99.6	94.0	90.7 – 96.1
Patient				
Local living-donor	98.8	96.7 - 99.6	95.6	92.4 – 97.5
Overseas living-donor	100	-	95.7	83.2 - 98.9
Local deceased-donor	97.7	95.9 - 98.7	91.3	88.3 - 93.6
Overseas deceased-donor	98.8	96.9 - 99.6	94.0	90.7 – 96.1

Figure 8.6.4.3: CENSORED GRAFT SURVIVAL BY TYPE OF RENAL TRANSPLANT, 1999 – 2011

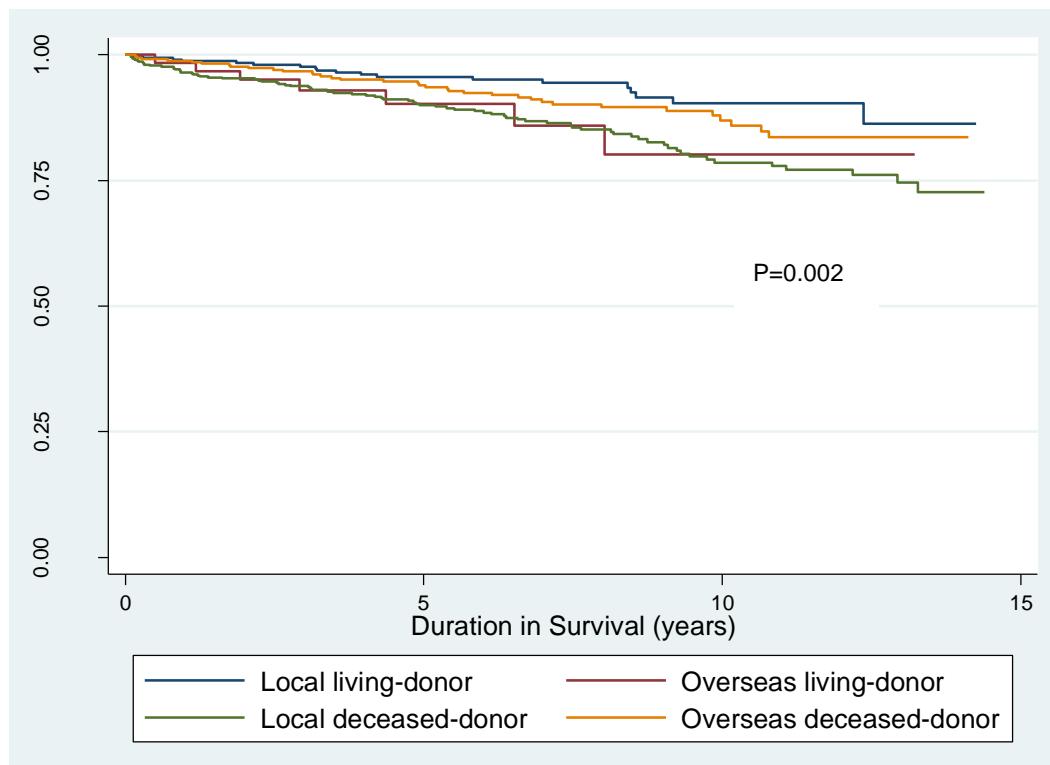
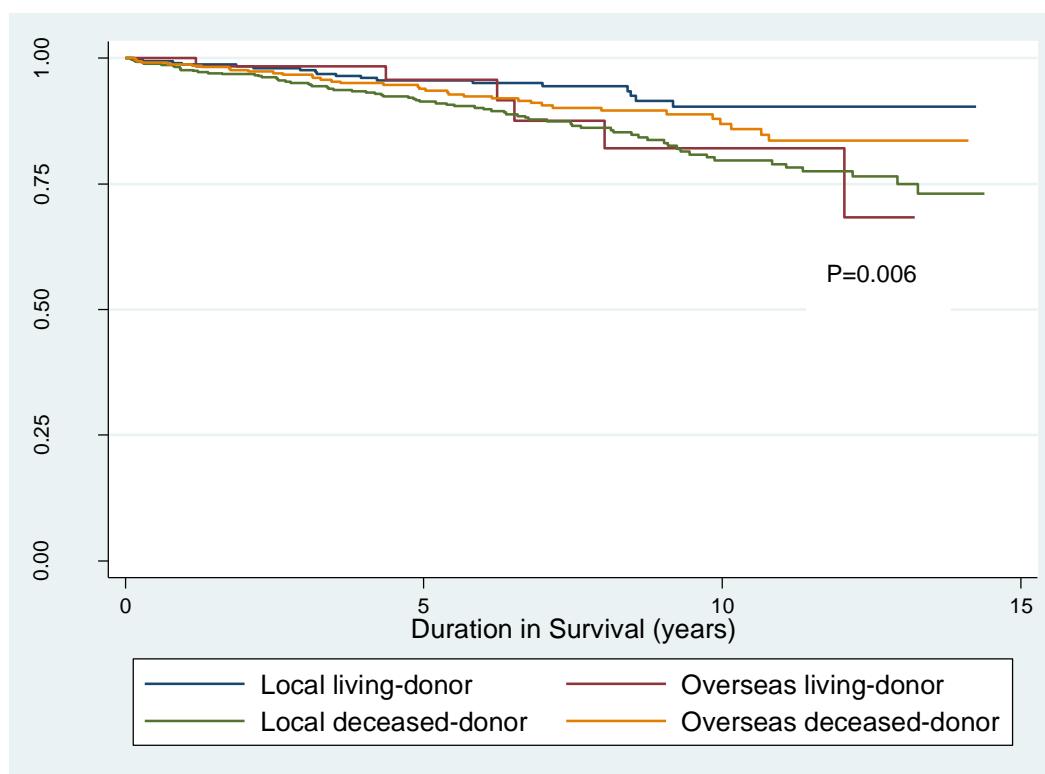


Figure 8.6.4.4: CENSORED PATIENT SURVIVAL BY TYPE OF RENAL TRANSPLANT, 1999 – 2011

Although graft and patient survival was comparable at 1 year, patient survival was poorer at 5 years for patients with diabetic nephropathy. See Table 8.6.4.5.

Table 8.6.4.5: GRAFT AND PATIENT SURVIVAL BY AETIOLOGY OF RENAL FAILURE AMONG RENAL TRANSPLANTS, 1999 – 2011

YEAR OF TRANSPLANT 1999-2011	GRAFT SURVIVAL			
	1 YEAR (%)	95% C.I.	5 YEAR (%)	95% C.I.
Diabetic Nephropathy	97.6	92.8 – 99.2	83.0	74.2 – 89.0
Non-Diabetic Nephropathy	94.7	93.2 – 95.9	90.5	88.5 – 92.2

P=0.06

YEAR OF TRANSPLANT 1999-2011	PATIENT SURVIVAL			
	1 YEAR (%)	95% C.I.	5 YEAR (%)	95% C.I.
Diabetic Nephropathy	97.6	92.8 – 99.2	83.0	74.2 – 89.0
Non-Diabetic Nephropathy	97.7	96.6 – 98.4	93.6	91.8 – 94.9

P=0.003

There were no significant differences in graft and patient survivals between genders. Chinese had the best graft and patient survivals among the three ethnic groups. See Table 8.6.4.6 and 8.6.4.7. As expected, patients aged below 60 years had significantly better graft and patient survival than those over age 60. See Table 8.6.4.8.

Table 8.6.4.6: GRAFT AND PATIENT SURVIVAL BY GENDER, 1999 – 2011

YEAR OF TRANSPLANT 1999-2009	GRAFT SURVIVAL			
	1 YEAR (%)	95% C.I.	5 YEAR (%)	95% C.I.
Males	95.0	93.0 – 96.4	90.1	87.4 – 92.2
Females	95.1	92.9 – 96.6	89.5	86.4 – 91.9

P=0.11

YEAR OF TRANSPLANT 1999-2009	PATIENT SURVIVAL			
	1 YEAR (%)	95% C.I.	5 YEAR (%)	95% C.I.
Males	97.6	96.1 – 98.5	92.8	90.5 – 94.6
Females	97.8	96.2 – 98.7	92.2	89.3 – 94.2

P=0.11

Table 8.6.4.7: GRAFT AND PATIENT SURVIVAL BY ETHNIC GROUP, 1999 – 2011

YEAR OF TRANSPLANT 1999-2009	GRAFT SURVIVAL			
	1 YEAR (%)	95% C.I.	5 YEAR (%)	95% C.I.
Chinese	95.8	94.4 - 96.9	91.0	88.9 - 92.7
Malay	90.5	84.2 – 94.4	85.4	78.0 – 90.5
Indian	92.7	84.4 - 96.6	82.6	71.9 – 89.6

P=0.29

YEAR OF TRANSPLANT 1999-2011	PATIENT SURVIVAL			
	1 YEAR (%)	95% C.I.	5 YEAR (%)	95% C.I.
Chinese	97.7	96.6 - 98.5	92.9	91.0 - 94.4
Malay	97.1	92.4 - 98.9	92.0	85.6 - 95.7
Indian	97.6	90.6 - 99.4	89.0	79.1 – 94.4

P=0.94

Table 8.6.4.8: GRAFT AND PATIENT SURVIVAL BY AGE GROUP, 1999 – 2011

YEAR OF TRANSPLANT 1999-2011	GRAFT SURVIVAL			
	1 YEAR (%)	95% C.I.	5 YEAR (%)	95% C.I.
< 60	95.0	93.6 – 96.2	90.2	88.2 – 91.8
≥ 60	94.9	86.9 – 98.0	83.6	72.1 – 90.7

P=0.01

YEAR OF TRANSPLANT 1999-2011	PATIENT SURVIVAL			
	1 YEAR (%)	95% C.I.	5 YEAR (%)	95% C.I.
< 60	97.9	96.8 - 98.6	93.1	91.3 – 94.5
≥ 60	94.9	86.9 – 98.0	83.6	72.1 – 90.7

P<0.001

9 APPENDICES

9.1 APPENDIX I

9.1.1 SRR Form

CONFIDENTIAL

SINGAPORE RENAL REGISTRY

National Registry of Diseases Office

Health Promotion Board

Level 5, 3 Second Hospital Avenue

Singapore 168937

Tel: (65) 6435 3078 / 3061 / 3077 or E-mail: hpb_servicenrdo@hpb.gov.sg

SRR No.

Registry use

E-Notification: www.hpp.moh.gov.sg

1. TREATING HEALTHCARE INSTITUTION

Current Centre: _____

<input type="text"/>	<input type="text"/>	<input type="text"/>
----------------------	----------------------	----------------------

Date treatment started at current centre: _____ (ddmm/yyyy)

2. PARTICULARS OF PATIENT

Name*: _____

NRIC/ Passport No/FIN/Hospital Registration No*:

<input type="text"/>							
----------------------	----------------------	----------------------	----------------------	----------------------	----------------------	----------------------	----------------------

Gender*: Male Female

Date of Birth*:

<input type="text"/>							
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(ddmm/yyyy)

Religion: Buddhist Christian Muslim Hindu Sikh
 Taoist Free thinker Missing Others, specify: _____

Highest Educational Level:

<input type="checkbox"/> Not available	<input type="checkbox"/> Pre-school	<input type="checkbox"/> ITE	<input type="checkbox"/> GCE A Level / IB
<input type="checkbox"/> No Formal Education	<input type="checkbox"/> Low Primary	<input type="checkbox"/> GCE N Level	<input type="checkbox"/> Diploma
<input type="checkbox"/> Special School	<input type="checkbox"/> PSLE / Secondary	<input type="checkbox"/> GCE O Level	<input type="checkbox"/> University and above

3. CO-MORBID CONDITIONS

Smoking status:	<input type="checkbox"/> Never	<input type="checkbox"/> Ex-smoker	<input type="checkbox"/> Current smoker	<input type="checkbox"/> Missing
Date of Diagnosis (ddmmmyy)				
Diabetes Mellitus	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Missing	_____
Hypertension	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Missing	_____
Cerebrovascular disease	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Missing	_____
Ischemic Heart Disease	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Missing	_____
Peripheral Vascular Disease	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Missing	_____
Malignancy	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Missing	_____
If Yes, state diagnosis: _____				

*Mandatory data items

YEAR-END FOLLOW-UP TREATMENT FORMSRR No.

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Date of test (ddmmyyyy)

HepB sAg Positive Negative Equivocal Missing _____Anti-Hep.BsAb ≥10 IU/ml <10 IU/ml Missing _____Anti-HCV Positive Negative Equivocal Missing _____HCV-RNA Positive Negative Not done Missing _____**4. CURRENT STATUS OF PATIENT**

<input type="checkbox"/> Living	<input type="checkbox"/> Deceased	Date of Death: (ddmmyyyy)	<table border="1" style="display: inline-table; vertical-align: middle;"><tr><td> </td><td> </td></tr></table>												

Place of Death: _____	Cause of death: _____
-----------------------	-----------------------

5. REHABILITATION STATUS AND QUALITY OF LIFE

Limitation/Preclusion from Transplant: _____	<table border="1" style="display: inline-table; vertical-align: middle;"><tr><td> </td><td> </td><td> </td><td> </td></tr></table>				

6. NUTRITIONLast Serum Albumin level: _____ g/L Date: _____ (dd/mm/yyyy) MissingLaboratory method: BCG BCP Missing**7. ANAEMIA**Last Hb level: _____ g/dl Date: _____ (dd/mm/yyyy) MissingT SAT(Transferrin saturation): _____ % Date: _____ (dd/mm/yyyy) MissingSerum Ferritin level: _____ ng/ml Date: _____ (dd/mm/yyyy) MissingESA (Erythropoietin stimulating agent): Yes No MissingType/dosage of ESA: EPO _____ u/week EBMPG (e.g. Micera) _____ mcg/month
 Darbepoetin _____ mcg/month**8. MINERAL METABOLISM**Serum Calcium level: _____ mmol/L Date: _____ (dd/mm/yyyy) MissingCorrected Calcium level: _____ mmol/L Date: _____ (dd/mm/yyyy) MissingSerum Phosphate level: _____ mmol/L Date: _____ (dd/mm/yyyy) MissingSerum iPTH level: _____ pmol/L Date: _____ (dd/mm/yyyy) Missing

*Mandatory data items

YEAR-END FOLLOW-UP TREATMENT FORMSRR No.

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9. HAEMODIALYSIS (HD) DATA**a. Dialysis Prescription**

Frequency of HD sessions: _____ per week Duration of each dialysis session: _____ mins

b. Vascular AccessCurrent Vascular Access: AVF AVG Non-tunneled catheter Tunneled catheter**c. Adequacy (Monitoring of dialysis dose)**Last URR: _____ % Date: _____ (dd/mm/yyyy) MissingLast Kt/V: _____ % Date: _____ (dd/mm/yyyy) Missing

For calculation of URR

Pre-Urea: _____ mmol/l Post-Urea: _____ mmol/l

10. PERITONEAL DIALYSIS (PD) DATA**a. Adequacy of PD**Last Weekly Total Kt/V: _____ % Date: _____ (dd/mm/yyyy) MissingResidual Creatinine Clearance (rCCT) at last
Total Creatinine Clearance (TCCT) measurement : _____ L/week Date: _____ (dd/mm/yyyy) Missing**b. PD Outcome**Ever had Peritonitis: Yes No Date of 1st episode: _____ (dd/mm/yyyy)**c. Technique Survival** (To be filled only when modality change from PD to HD permanently)Date of permanent transfer from PD to HD:

--	--	--	--	--	--	--	--

 (ddmmyyyy)

Cause of permanent transfer from PD to HD: _____

11. TRANSPLANT DATA (To be filled only if patient has received kidney transplantation)**a. Graft status**Graft Functioning: Yes No

If yes,

Current Serum Creatinine level : _____ umol/L / mg/dl Date: _____ (dd/mm/yyyy) MissingHeight: _____ (M) Date: _____ (dd/mm/yyyy) MissingWeight: _____ (Kg) Date: _____ (dd/mm/yyyy) MissingCorrected GFR(computed): _____ ml/min/1.73m²eGFR: _____ ml/min/1.73m² Date: _____ (dd/mm/yyyy) Missing

YEAR-END FOLLOW-UP TREATMENT FORM

SRR No.

--	--	--	--	--	--	--	--	--	--	--	--

Graft not functioning,

Date of graft loss: _____ (dd/mm/yyyy)

Missing

Cause of graft loss:

- Acute Rejection
- Hyper acute Rejection
- Chronic Rejection
- Primary non-function
- Recurrent disease
- Chronic allograft Nephropathy
- Graft thrombosis
- Ureteric obstruction
- Infection
- Other Surgical complication
- Non-compliance
- Unknown
- Others, specify: _____

12. DETAILS OF NOTIFYING HEALTHCARE INSTITUTION

Name of Notifying Healthcare Institution (including department)*: _____

Name of Person who provide the information: _____

Date of Notification: _____ (dd/mm/yyyy)

*Mandatory data items

--- END OF REPORT ---

