



**Singapore Renal Registry
Annual Registry Report
1999 - 2013
(*Preliminary*)**

**National Registry of Diseases Office
(NRDO)**

Acknowledgement

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Glossary

ASR	<i>Age-Standardised Rate</i>
BSA	<i>Body Surface Area</i>
CKD5	<i>Chronic Kidney Disease Stage 5</i>
CR	<i>Crude Rate</i>
DN	<i>Diabetic Nephropathy</i>
eGFR	<i>Estimated glomerular filtration rate</i>
ESRD	<i>End Stage Renal Disease</i>
GN	<i>Primary glomerulonephritis</i>
HD	<i>Haemodialysis</i>
PD	<i>Peritoneal Dialysis</i>
PMP	<i>Per million population</i>

RENAL REGISTRY REPORT FOR THE YEAR 1999-2013

Executive Summary

The age-standardised incidence rates of Chronic Kidney Disease Stage 5 (CKD5) patients on definitive dialysis increased from 153.8 per million population (pmp) in 1999 to 170.4 pmp in 2013

Haemodialysis (HD) remained the main dialysis modality among incident (67.2% in 1999; 82.3% in 2013) and prevalent (83.5% in 1999; 87.7% in 2013) CKD5 patients on dialysis. Although majority of the incident and prevalent CKD5 patients was Chinese, the proportion of incident (16.6% in 1999; 24.4% in 2013) and prevalent (16.2% in 1999; 24.3% in 2013) CKD5 patients had increased among the Malays over the same period.

Diabetic nephropathy (DN) remained the main cause of CKD5 for incident (64.8% of HD, 63.0% of Peritoneal Dialysis (PD) in 2013) and prevalent (49.6% of HD, 50.5% of PD in 2013) patients.

The age-standardised incidence rates of renal transplants increased from 20.4 per million population (pmp) in 1999 to 27.0 pmp in 2006 but dropped to 16.9 pmp in 2013.

Most transplant recipients were Chinese. The number of Malays who had received transplants was highest in 2008 (19.2%) but dropped to 16.7% in 2013.

Overall, primary glomerulonephritis remained the single main cause for CKD5 among incident (63.1% in 2013) and prevalent (70.5% in 2013) renal transplants.

1. INTRODUCTION

Chronic Kidney Diseases Stage 5 (CKD5) is the stage of kidney failure when either

- a) the GFR (corrected to the BSA of 1.73m^2) is less than 15 ml/min or
- b) when the patient has started renal replacement therapy

CKD 5 includes patients who are approaching End-stage Renal Disease (ESRD) and patients who have ESRD. In some registries e.g, USRDS and the Malaysian Renal Registry, only data on those surviving 90 days is captured. However, this does not reflect accurately the burden of kidney failure in the nation and may underestimate the workload of healthcare professionals, especially the nephrologists, who manage this group of patients. As such, in 1999, the Registry started capturing data of cases classified as having CKD5 i.e. patients initiating on renal replacement therapy and all patients with serum creatinine $> 10\text{ mg/dl}$ or $880\text{ }\mu\text{mol/L}$, instead of just those surviving beyond 90 days after initiation of dialysis.

In 2007, the Singapore General Hospital, which contributes about 50% of the new CKD5 cases, started to provide the Registry with listing of patients with estimated glomerular filtration rate (eGFR) $< 15\text{ ml/min}$ (corrected for BSA 1.73m^2). This was followed by the National University Hospital in 2009, and the remaining public hospitals in year 2010. Majority of the patients (75%) reside in the public sector.

This report provides the epidemiological trends on CKD5 patients on dialysis and renal transplantation for the period 1999 – 2013. During this period the number of Singapore residents above 50 years old has increased disproportionately over the last 10 years.¹ The increase has an impact on the age-specific rates, and hence the age-standardised rates.

The 2013 figures in this report are preliminary.

2. METHODOLOGY

Incidence (New cases) of CKD5 on definitive dialysis: 90-day rule

Only patients who survived 90 days after the start of dialysis (effectively 91 days with respect to the first date of dialysis) were counted in the incidence of CKD5 patients on definitive dialysis.

¹ Population Trends 2011. Singapore Department of Statistics. Accessed 9 July 2012.

Prevalence (Existing Number) of CKD5

To report the prevalent population at the end of a particular year, all surviving CKD5 cases up till 31 December of that year were included for analysis. They must have survived 90 days after first initiation; that is all patients who died before 90 days after first initiation were excluded from analysis.

Incidence (New cases) of renal transplantation

The incidence of renal transplantation referred to the occurrence of the transplantation in the reporting year. Data was obtained from the National Organ Transplant Unit, MOH.

Population estimates and age standardisation

Crude rates are rates which have not been age-standardised; and are derived from the number of CKD5 cases divided by the number of Singapore residents multiplied by 1 million.

Age-standardisation of rates are intended to eliminate the effect of age on the results. For example, as the population in Singapore is now older than the population 20 years ago, it follows that the CKD5 incidence is expected to be higher than that of 20 years ago because the risk of CKD5 increases with age. Hence, age-standardisation aims to remove the age effect by computing the rate based on a reference age population.

In this report, we used the mid-year population estimates from the Department of Statistics (DOS), Singapore to calculate the rates. Segi World Population was used for direct standardisation to calculate age standardised rates. Both crude and age-standardised rates were expressed in per million population (pmp).

The data presented in this report refers only to Singapore residents i.e. citizens and permanent residents. The data reported here represents the 1999 – 2013 statistics as they stood on 17 June 2014. The figures in this report were rounded to one decimal place.

3. FINDINGS

3.1 Incidence of CKD5

3.1.1 CKD5 Incidence

In the period from 1999 to 2013, the annual number of new CKD5 patients increased from 679 in 1999 to 1587 in 2011. The number was projected to increase to 1642 in 2013. The corresponding age-standardised incidence rates increased from 193.4 per million population (pmp) in 1999 to 294.7 pmp in 2007 (Table 3.1.1.1), thereafter the rates fluctuated around 270 pmp

The figures encompassed all cases diagnosed by physicians to have CKD5, regardless of whether they were started on renal replacement therapy.

Table 3.1.1.1: CKD5 Incidence, 1999 – 2013

Year	No.	CR*	ASR*
1999	679	210.2	193.4
2000	744	227.3	208.2
2001	786	236.3	211.5
2002	728	215.2	188.3
2003	855	254.0	220.5
2004	932	273.0	229.6
2005	1022	294.7	246.0
2006	1203	341.2	283.2
2007	1319	368.2	294.7
2008	1271	348.9	268.8
2009	1274	341.2	255.8
2010	1446	383.4	273.5
2011	1587	418.8	288.7
2012	1499	392.6	263.9
2013	1642 [^]		

* Crude rates (CR) and age-standardised rates (ASR) are expressed as per 1,000,000 residential populations (DOS) and ASR are standardised to World Standard Million.

[^] Projected number, as more cases are expected to be registered in the next few months

3.1.2 Incidence of CKD5 Patients on Definitive Dialysis

The number of new cases of CKD5 patients on definitive dialysis increased from 536 in 1999 to 975 in 2013. The age-standardised incidence rates increased from 153.8 per million population (pmp) in 1999 to 170.4 pmp in 2013 (Table 3.1.2.1).

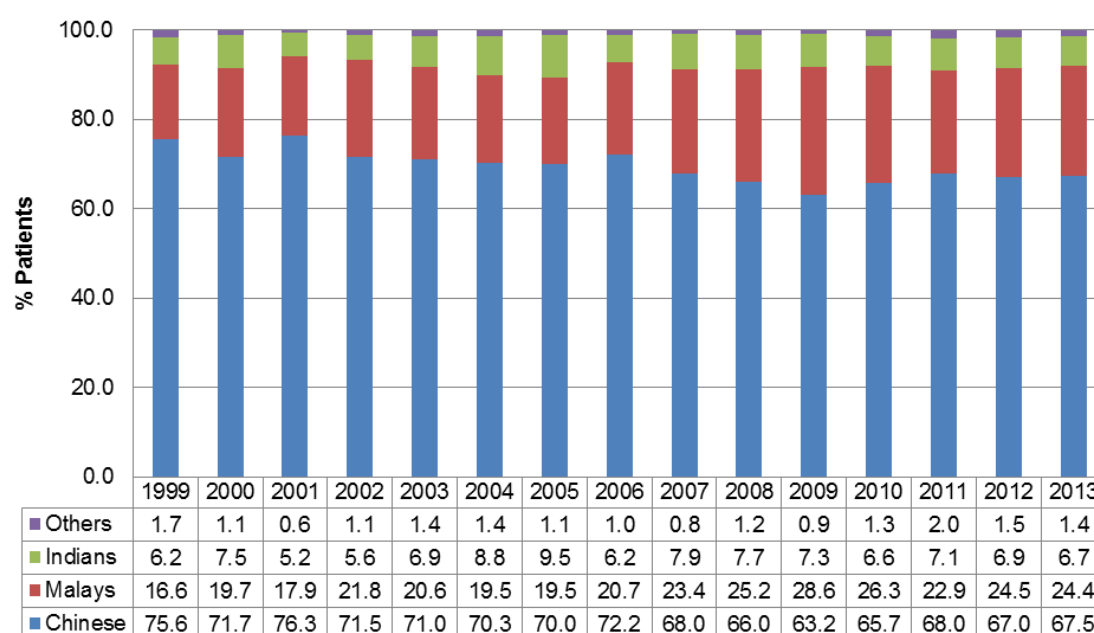
Table 3.1.2.1: Incidence of CKD5 Patients on Definitive Dialysis, 1999 – 2013

Year	No	CR*	ASR*
1999	536	165.9	153.8
2000	629	192.1	171.9
2001	619	186.1	168.2
2002	646	190.9	166.6
2003	563	167.2	143.4
2004	626	183.4	154.6
2005	663	191.2	159.5
2006	729	206.8	170.9
2007	762	212.7	169.5
2008	770	211.4	164.4
2009	770	206.2	159.2
2010	741	196.5	144.7
2011	903	238.3	169.6
2012	921	241.2	169.3
2013	975	253.6	170.4

* Crude rates (CR) and age-standardised rates (ASR) are expressed as per 1,000,000 residential populations (DOS) and ASR are standardised to World Standard Million.

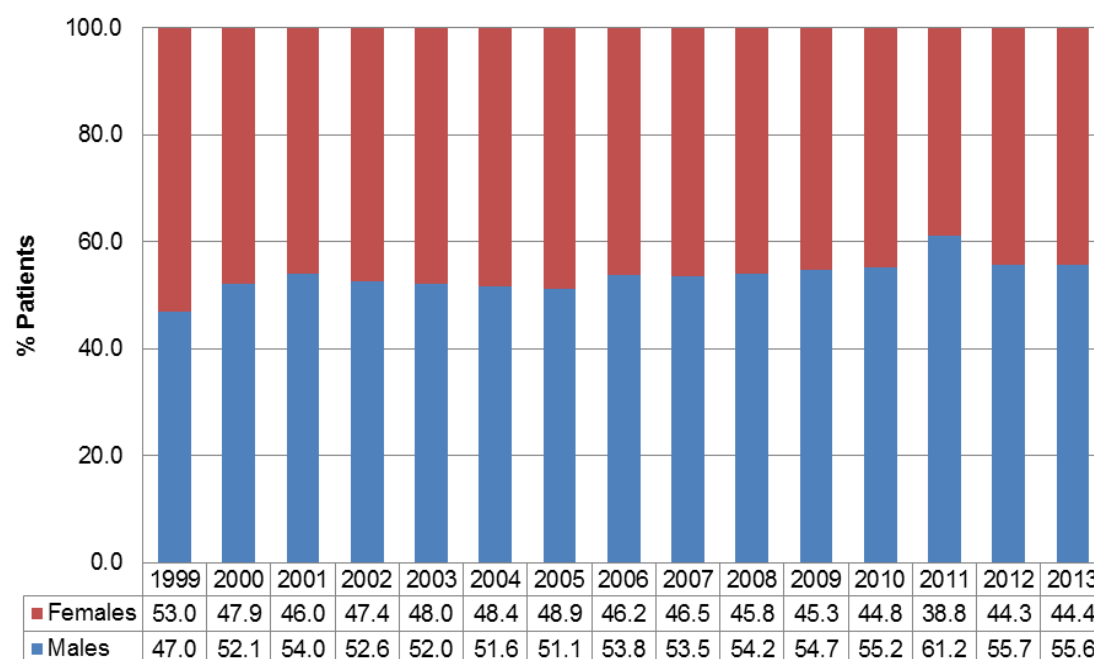
Although more than 60% of the dialysis patients were Chinese, the proportion of Chinese among the new CKD5 patients on dialysis decreased from 75.6% in 1999 to 67.5% in 2013 (Figure 3.1.2.1). There was an increase in the proportion of CKD5 among the Malay population. The increase in proportion of CKD5 among the Malay population corresponded to the increase in proportion of diabetics among the Malay population (11.3% in 1998 and 16.6% in 2010; NHS1998 and NHS2010).

Figure 3.1.2.1: Incidence of Patients on Dialysis by Ethnic Group, 1999 – 2013



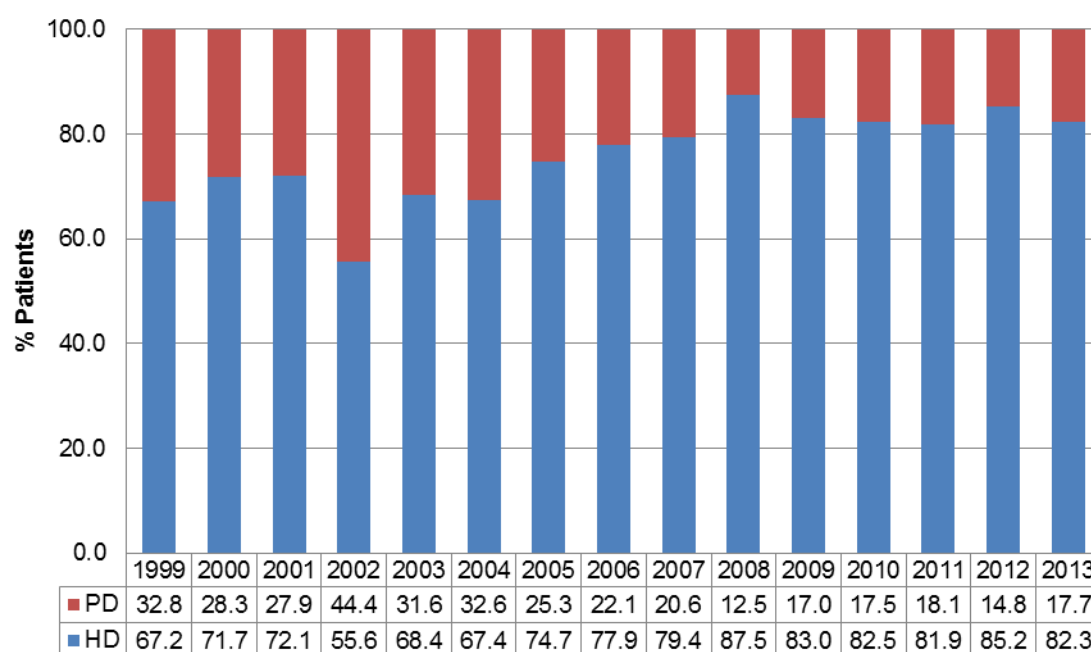
Generally there was a higher proportion of male patients on dialysis than females, except in year 1999 (Figure 3.1.2.2).

Figure 3.1.2.2: Incidence of Patients on Dialysis by Gender, 1999 – 2013



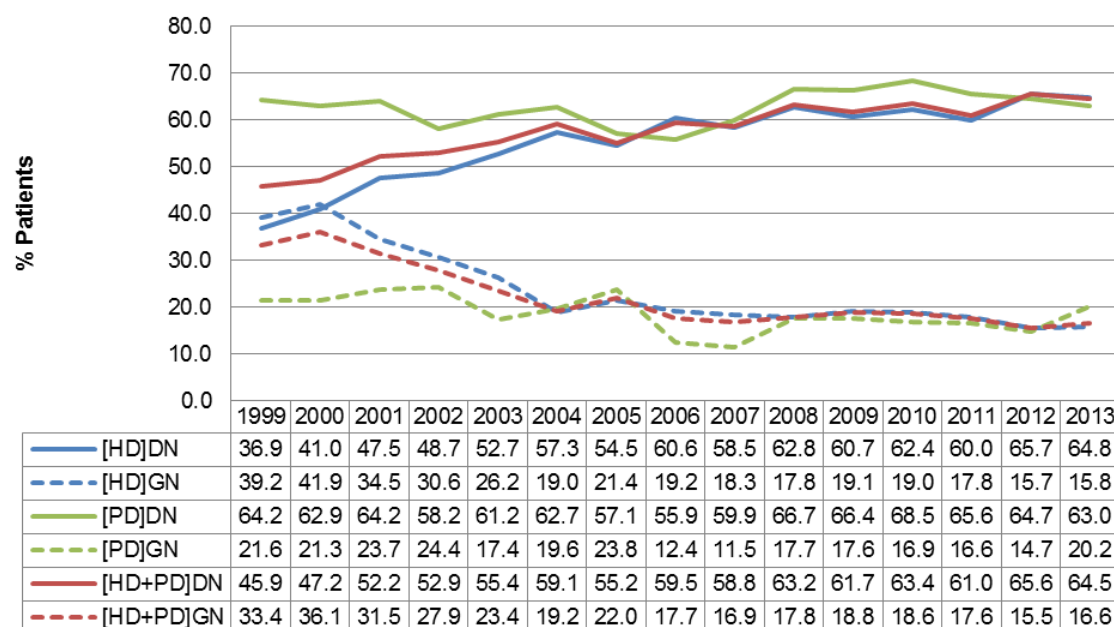
From Figure 3.1.2.3, there was a slight increasing trend for haemodialysis as a renal replacement therapy option of choice for incident patients at 90 days after initiation of dialysis since 2002.

Figure 3.1.2.3: Incidence of Patients on Dialysis by Mode of Dialysis, 1999 – 2013



Diabetic nephropathy (DN) was the commonest cause of CKD5 for haemodialysis and peritoneal dialysis patients. DN as an aetiology of CKD5 accounted for more than 50% of CKD5 cases in general (Figure 3.1.2.4).

Figure 3.1.2.4: Incidence of Patients on Dialysis by Mode of Dialysis and Etiology, 1999 – 2013



3.2 Prevalent Dialysis Population

As at the end of 2013, there were a total of 5521 prevalent patients on dialysis. The age-standardised prevalence rates increased from 690.2 pmp in 1999 to 961.3 pmp in 2013 (Table 3.2.1).

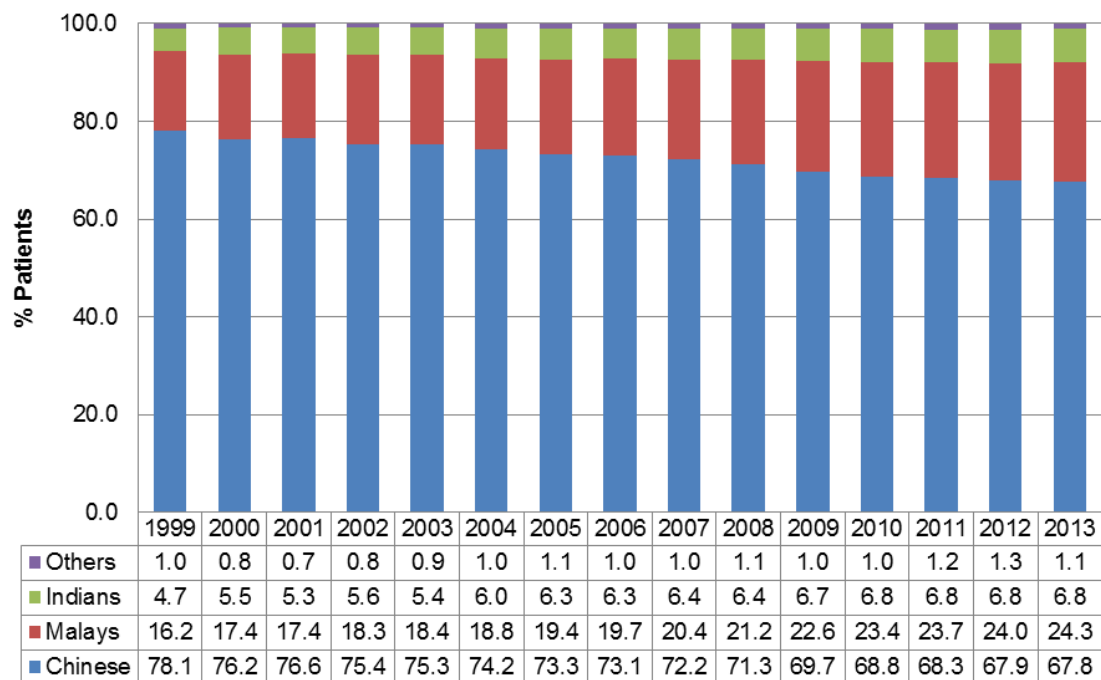
Table 3.2.1: Prevalence of Dialysis Patients, 1999 – 2013

Year	No	CR*	ASR*
1999	2461	761.9	690.2
2000	2757	842.2	746.1
2001	2983	896.8	786.4
2002	3196	944.6	811.9
2003	3299	979.9	833.1
2004	3408	998.4	827.9
2005	3565	1028.1	837.6
2006	3774	1070.5	863.7
2007	3943	1100.7	870.2
2008	4174	1145.9	884.1
2009	4382	1173.6	891.1
2010	4596	1218.5	896.4
2011	4895	1291.8	919.2
2012	5244	1373.6	948.7
2013	5521	1436.1	961.3

* Crude rates (CR) and age-standardised rates (ASR) are expressed as per 1,000,000 residential populations (DOS) and ASR are standardised to World Standard Million.

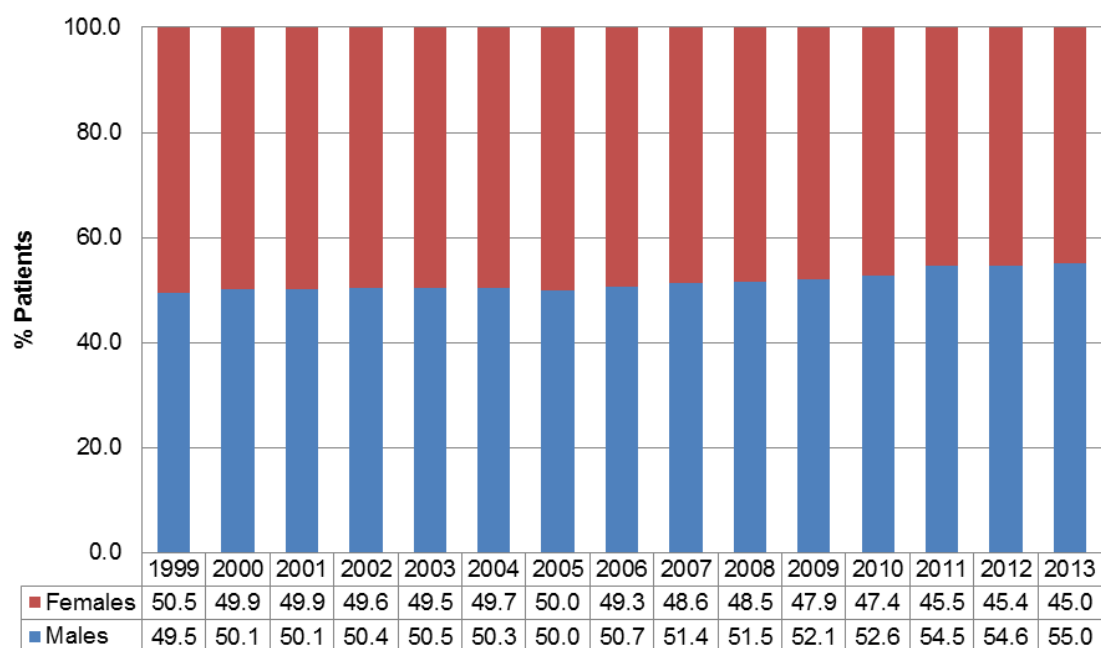
Similar to trends in the incident dialysis patients, the percentage of Chinese prevalent dialysis patients decreased from 78.1% in 1999 to 67.8% in 2013, while the percentage of Malay and Indian patients increased from 16.2% to 24.3% and 4.7% to 6.8% respectively over the same period (Figure 3.2.1).

Figure 3.2.1: Prevalence of Patients on Dialysis by Ethnic Group, 1999 – 2013



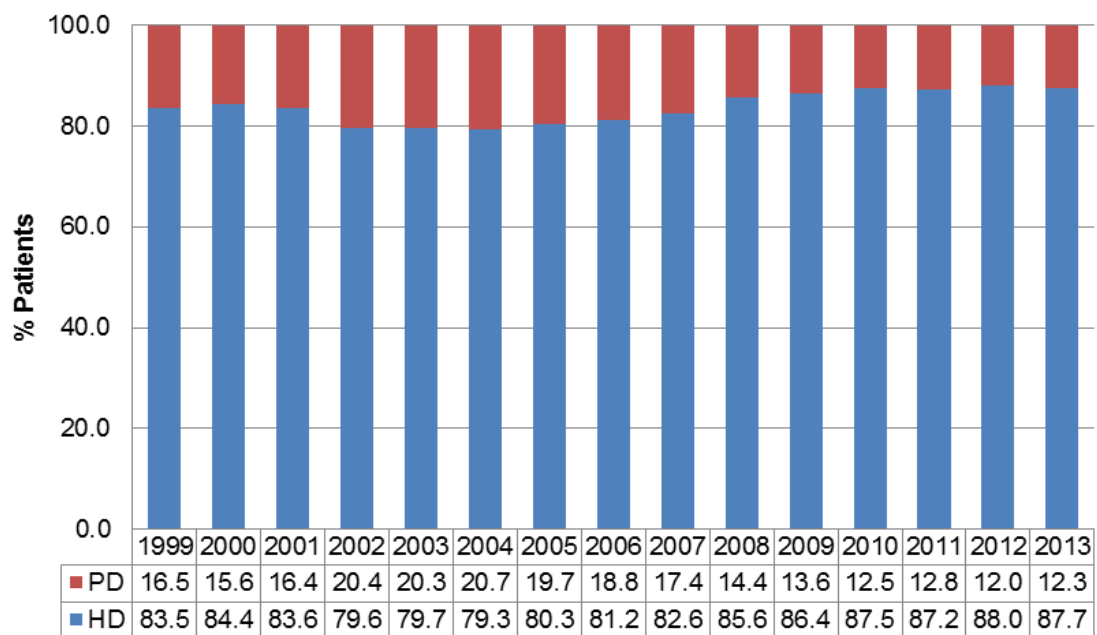
Males outnumbered females slightly among prevalent dialysis population, except in the year 1999 (Figure 3.2.2).

Figure 3.2.2: Prevalence of Patients on Dialysis by Gender, 1999 – 2013



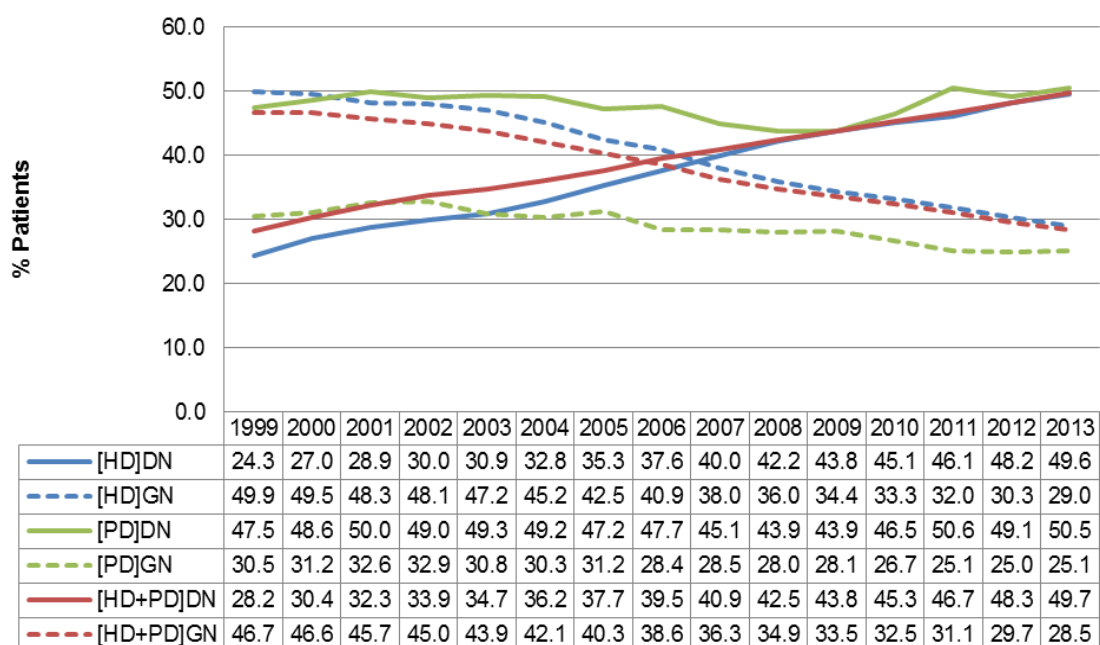
The proportion of prevalent dialysis patients on peritoneal dialysis has been decreasing from a high of 20.7% in 2004 to 12.3% in 2013 (Figure 3.2.3).

Figure 3.2.3: Prevalence of Patients on Dialysis by Mode of Dialysis, 1999 – 2013



Diabetic Nephropathy (DN) increased from 24.3% in 1999 to 49.6% in 2013 among prevalent patients on HD as the main cause of CKD5. Among prevalent patients on PD, DN contributed a large proportion of prevalent patients on PD for the period 1999 – 2013, which hovered at 43.9% - 50.6% (Figure 3.2.4).

Figure 3.2.4: Prevalence of Patients on Dialysis by Mode of Dialysis and Etiology, 1999 – 2013



3.3 Incidence of Renal Transplantation

The annual number of new renal transplants increased from 83 in 1999 to 125 in 2006 but dropped to 84 in 2013. The corresponding age-standardised incidence rates increased from 20.4 per million population (pmp) in 1999 to 27.0 pmp in 2006 but dropped to 16.9 pmp in 2013 (Table 3.3.1).

Over the past 15 years, about 70% of the transplants for Singapore residents were done locally. About 60% of the local transplants came from deceased donors, and 40% from living donors.

Table 3.3.1: Incidence of Renal Transplantation, 1999 – 2013

Year	No	CR*	ASR*
1999	83	25.7	20.4
2000	83	25.4	20.5
2001	107	32.2	24.2
2002	81	23.9	18.4
2003	62	18.4	14.8
2004 [†]	103	30.2	22.9
2005	117	33.7	26.1
2006	125	35.5	27.0
2007	112	31.3	24.5
2008 [†]	104	28.6	23.0
2009	96	25.7	19.6
2010	84	22.3	17.5
2011	92	24.3	17.7
2012	62	16.2	13.4
2013	84	21.8	16.9

* Crude rates (CR) and age-standardised rates (ASR) are expressed as per 1,000,000 residential populations (DOS) and ASR are standardised to World Standard Million.

[†] (a) The Human Organ Transplant Act (HOTA) was established in 1987 to allow for transplantation of cadaveric kidneys removed from those who died in a hospital as a result of an accident and had chosen not to opt out of donating their organs prior to their deaths.[1]

(b) HOTA was amended in January 2004 to allow (i) transplantation of liver, heart and cornea, (ii) organ donation from donors with non-accidental causes of death and (iii) organ donation from living (both related and unrelated) organ donors.1

(c) HOTA was amended in August 2008 to include Muslim organ donors.[2]

(d) HOTA was amended in March 2009 to remove the upper age limit for potential deceased donors.

Males constituted a higher percentage of incident renal transplants for all years (48.1% to 66.4%) except in 2002 and 2004 (Table 3.3.2).

[1] Shum E, Chern A. Amendment of The Human Organ Transplant Act. Ann Acad Med Singapore. 2006; 35 428 - 32

[2] Ministry of Health. 10 February 2009. "Dental Care, HOTA, Infection Control and Cloning".

Website: <http://www.moh.gov.sg/mohcorp/speeches.aspx?id=20980>. Accessed on: 22 July 2010

Table 3.3.2: Incidence of Renal Transplant Patients by Gender, 1999 – 2013

Year	Male		Female	
	No	%	No	%
1999	44	53.0	39	47.0
2000	43	51.8	40	48.2
2001	71	66.4	36	33.6
2002	39	48.1	42	51.9
2003	40	64.5	22	35.5
2004	51	49.5	52	50.5
2005	67	57.3	50	42.7
2006	66	52.8	59	47.2
2007	58	51.8	54	48.2
2008	60	57.7	44	42.3
2009	51	53.1	45	46.9
2010	42	50.0	42	50.0
2011	53	57.6	39	42.4
2012	31	50.0	31	50.0
2013	49	58.3	35	41.7

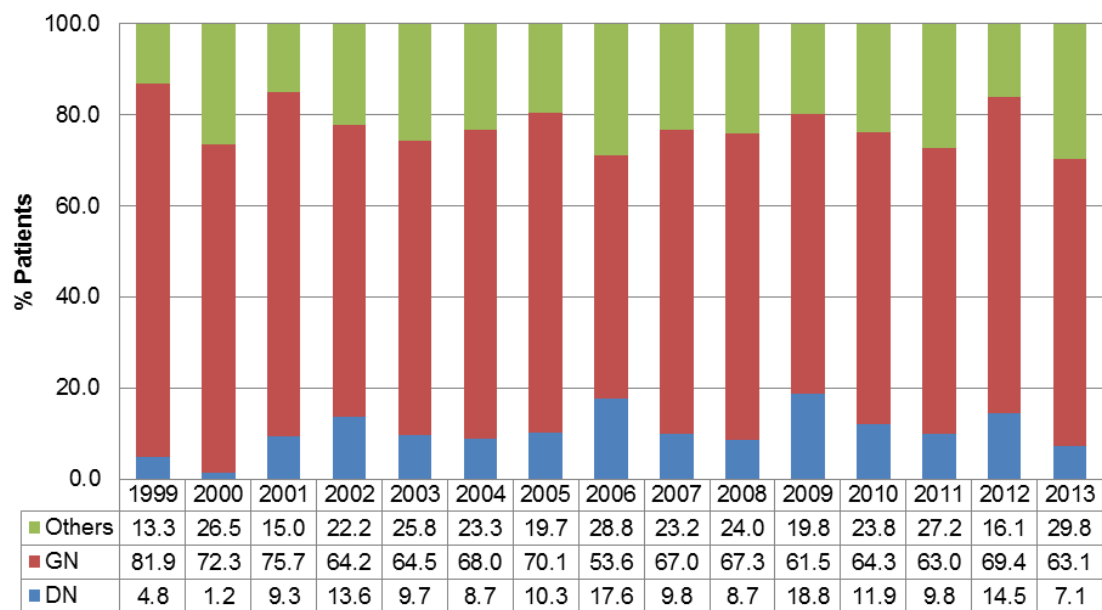
Most transplant recipients were Chinese. 2008 recorded the highest number ever of Malay patients receiving renal transplants (19.2%).

Table 3.3.3: Incidence of Renal Transplant Patients by Ethnic Group, 1999 – 2013

Year	Chinese		Malay		Indian		Others	
	No	%	No	%	No	%	No	%
1999	70	84.3	6	7.2	6	7.2	1	1.2
2000	74	89.2	5	6.0	3	3.6	1	1.2
2001	85	79.4	11	10.3	9	8.4	2	1.9
2002	69	85.2	10	12.3	2	2.5	0	0.0
2003	40	64.5	9	14.5	9	14.5	4	6.5
2004	88	85.4	8	7.8	6	5.8	1	1.0
2005	108	92.3	6	5.1	2	1.7	1	0.9
2006	97	77.6	14	11.2	10	8.0	4	3.2
2007	90	80.4	13	11.6	7	6.3	2	1.8
2008	73	70.2	20	19.2	9	8.7	2	1.9
2009	73	76.0	14	14.6	6	6.3	3	3.1
2010	66	78.6	13	15.5	3	3.6	2	2.4
2011	70	76.1	11	12.0	10	10.9	1	1.1
2012	46	74.2	6	9.7	8	12.9	2	3.2
2013	62	73.8	14	16.7	5	6.0	3	3.6

For the period 1999-2013, the percentage of incident renal transplants with Diabetic Nephropathy (DN) as the aetiology of renal failure ranged from 1.2% to 18.8% (Figure 3.3.1).

Figure 3.3.1: Incidence of Renal Transplant Patients by Aetiology, 1999 – 2013



3.4 Prevalence of Renal Transplantation

There were 1434 prevalent renal transplants at the end of 2013. The age-standardised prevalence rates increased from 206.3 pmp in 1999 to 261.0 pmp in 2013 (Table 3.4.1).

Table 3.4.1: Prevalence of Renal Transplantation, 1999 – 2013

Year	No	CR*	ASR*
1999	843	261.0	206.3
2000	887	270.9	214.8
2001	961	288.9	226.4
2002	974	287.9	222.9
2003	1000	297.0	227.4
2004	1049	307.3	232.7
2005	1114	321.3	241.6
2006	1184	335.8	252.2
2007	1235	344.8	256.6
2008	1280	351.4	262.4
2009	1328	355.7	264.1
2010	1367	362.4	265.6
2011	1407	371.3	267.1
2012	1407	368.5	261.8
2013	1434	373.0	261.0

* Crude rates (CR) and age-standardised rates (ASR) are expressed as per 1,000,000 residential populations (DOS) and ASR are standardised to World Standard Million.

Overall, there were more males than females with prevalent renal transplants (Table 3.4.2).

Table 3.4.2: Prevalence of Renal Transplant Patients by Gender, 1999 – 2013

Year	Male		Female	
	No	%	No	%
1999	450	53.4	393	46.6
2000	479	54.0	408	46.0
2001	530	55.2	431	44.8
2002	532	54.6	442	45.4
2003	553	55.3	447	44.7
2004	577	55.0	472	45.0
2005	613	55.0	501	45.0
2006	650	54.9	534	45.1
2007	671	54.3	564	45.7
2008	701	54.8	579	45.2
2009	722	54.4	606	45.6
2010	738	54.0	629	46.0
2011	752	53.4	655	46.6
2012	747	53.1	660	46.9
2013	759	52.9	675	47.1

Among the three ethnic groups, Chinese comprised the highest proportion of transplant recipients. The proportion of Malay transplant recipients has been increasing slightly over the years (Table 3.4.3).

Table 3.4.3: Prevalence of Renal Transplant Patients by Ethnic Group, 1999 – 2013

Year	Chinese		Malay		Indian		Others	
	No	%	No	%	No	%	No	%
1999	718	85.2	73	8.7	46	5.5	6	0.7
2000	759	85.6	75	8.6	46	5.2	7	0.8
2001	818	85.1	82	8.5	53	5.5	8	0.8
2002	837	85.9	83	8.5	46	4.7	8	0.8
2003	849	84.9	85	8.5	54	5.4	12	1.2
2004	893	85.1	85	8.1	57	5.4	14	1.3
2005	954	85.6	89	8.0	57	5.1	14	1.3
2006	1009	85.2	95	8.0	64	5.4	16	1.4
2007	1045	84.6	102	8.3	70	5.7	18	1.5
2008	1071	83.7	114	8.9	77	6.0	18	1.4
2009	1105	83.2	125	9.4	76	5.7	22	1.7
2010	1134	83.0	132	9.7	78	5.7	23	1.7
2011	1163	82.7	136	9.7	83	5.9	25	1.8
2012	1159	82.4	135	9.6	87	6.2	26	1.8
2013	1175	81.9	145	10.1	86	6.0	28	2.0