

# **KIDNEY DIALYSIS FOUNDATION**

## **ANNUAL REPORT**

### **MEDICAL**

**2010**

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## 1. EXECUTIVE SUMMARY

The Kidney Dialysis Foundation runs 3 dialysis centres at Bishan from 1997, Kreta Ayer Road – San Wang Wu Ti centre from Sep 2003 and Ghim Moh 2007.

Two dialysis providers, Asia Renalcare and Fresenius, have been contracted to provide dialysis care. Medical care is provided by private sector as well as public sector nephrologists. Majority of the patients originate from SGH. In 2010, there were 28 new entrants.

Seventeen (17) patients exited the programme (2 transplants, 8 deaths, 3 transfers to PD programme, 4 to non-PD programmes). In the prevalent population, average age was  $57.4 \pm 10.3$  years, the number of patients with chronic glomerulonephritis as the etiology of renal failure was 44.9%, diabetic nephropathy 30.0%. Overall first year survival of patients was 96.1% and five year survival 85.1%. 5 year survival in diabetics was similar in the first year (non-DM vs DM 96.8% vs 96.6%), 5 years 87% vs 80.3% and 10 years 71.8% vs 52.6%.

Almost all patients (99%) are using high flux dialysers. Average blood flow was  $267 \pm 31$  ml/min. 85.0% of patients dialyse 4 hours or more. 74% of patients use a native arteriovenous fistula. Dialysis adequacy as measured by single pool KT/V is  $>1.2$  in 92% of patients.

Mean hemoglobin was  $11.1 \pm 1.5$ g/dl. About 85% of all patients are on EPO. About 11.1 % of patients are considered Fe deficient.

88.4% of patients have a S Albumin of  $<40$  g/l. Hyperparathyroidism and hyper-phosphatemia remains a problem. More patients are on intravenous Vitamin D.

Diabetes as a comorbidity was present in 37.7% of the population. 77.8% were on treatment for hypertension.

There was no significant changes in virology status. Hep B positivity was 6.3%, HCV 7.7%, HepB and HCV 1 %.

Less patients were registered on the National Transplant waiting list (13%), likely due to more patients having comorbidities in an aging population.

## 2. INTRODUCTION

The Kidney Dialysis Foundation started operations in 1996 with only one centre at Alexandra Hospital. This was a centre originally managed jointly by the Renal Department at the SGH providing medical cover and nursing staff from Alexandra Hospital under the Ministry of Health (MOH). On 17 April 96 when the center was taken over from MOH, the care of twenty-eight (28) patients was transferred to the KDF. Bishan Dialysis Centre commenced operation on November/December 1997 with forty- three (43) patients from the former Tan Tock Seng Dialysis Centre.

Originally Renalcare Holdings Pte Ltd provided the dialysis service by contract. They also won the first tender to supply haemodialysis services in 1997 for a period of three years. In 2000, the tender was opened with an option to quote for three and 5 years. After much deliberation, the tender for Alexandra Hospital Centre was awarded to Fresenius Medicare and Bishan Centre to Asia Renal Care (the company which had absorbed Renalcare Holdings). Asia Renal Care was absorbed by Fresenius Medical Care on 1<sup>st</sup> July 2010. Thus all three centres came under one management.

KDF started operations in its third centre called the San Wang Wu Ti - KDF Centre on 1 Sept 03. It was built from funds donated from San Wang Wu Ti Religious Society. The idea was first mooted in 2000. Numerous site visits were made to assess suitability as the location was an old HDB block with many physical constraints. Tenders were called in the second half of 2001. Fresenius Medical Care was awarded the tender for supply of dialysis machines and Baxter Healthcare the dialysis chairs. A local company, Memiontec Pte Ltd, was awarded the tender for the RO water treatment system. Renovation works were started in October 2002 after all the necessary approvals were obtained. Fresenius Nephrocare was awarded the tender as dialysis provider. Eight patients were subsequently transferred from Alexandra Hospital Centre.

KDF's first Peritoneal Dialysis Centre is also located at the Kreta Ayer Centre and was renovated with generous donations from the Khoo Foundation and Singapore Pools Pte Ltd. The Khoo Foundation also continues to contribute to the deficit funding of the Centre. The PD Centre obtained its license on 7 May 2003 but because of the SARS outbreak, it only became operational on 1 July 2003. The dialysis service is contracted out to a dialysis provider and the current provider is Baxter Healthcare Pte Ltd.

In January 2005, KDF was informed of the decision by Alexandra Hospital that the lease for the premises on which the dialysis centre was situated will not be renewed. The last day of operation was on 25 April 2005.

KDF's 4<sup>th</sup> dialysis centre started operations in Ghim Moh on 16 July 2007. The Peritoneal Dialysis Centre also shifted from Kreta Ayer to Ghim Moh.

Dialysis medical care is provided by a team of 15 doctors who are all practicing nephrologists from SGH, NUH, TTSH, KTPH and the private sector.

Ms Theresa Soh (Coordinator Patient Services) together with Ms Lay Kwee Chin headed the paramedical team comprising Nursing, Patient Welfare and Dietetic Services.

This report covers medical data collated at the end of 2010.

### 3. THE DIALYSIS CENTRES

The location and prevalent number of patients as of 31 Dec 2010 are listed below:

	Centre	Location	Patient No
1	KDF-Bishan Centre	Block 197, Bishan Street 13 #01-575/583	95
2	San Wang Wu Ti – KDF Centre	Block 333, Kreta Ayer Road #03-33	67
3	KDF – Ghim Moh Centre	Blk 6 Ghim Moh Road #01-188	45
	TOTAL	Haemodialysis patients	207

The new Ghim Moh Centre started operations from 16 July 2007 with a total no of 14 patients. Ten (10) patients were transferred from SWWT centre and 3 from Bishan centre and 1 new patient from Alexandra Hospital. The centre operated 2 shifts inclusive of Public Holidays as the patient number was low.

The other haemodialysis centres operate 3 shifts a day.

#### Dialysis Station

	Centre	No. of Regular + Isolation Station	Total
1	KDF-Bishan Centre	19 + 1	20
2	San Wang Wu Ti – KDF Centre	12 + 1	13
3	KDF – Ghim Moh Centre	18+ 1	19
	TOTAL		52

### I. HAEMODIALYSIS PROGRAMME

#### 4 STAFFING

##### MEDICAL

The medical staff comprised a pool of 15 nephrologists from both the restructured hospitals as well as the private sector. They are rostered to do rounds in the centre as well as screen new patients for medical suitability for entry into the dialysis programme if there has been no assessment performed at the restructured hospitals. Routinely, dialysis patients are seen once every month.

The nephrologists include:

1. Dr Stephen Chew
2. A/Prof Lina Choong
3. Dr Marjorie Foo
4. Dr Ho Chee Khun
5. Dr Titus Lau
6. Dr Grace Lee
7. Dr Pwee Hock Swee
8. Dr Tan Han Khim
9. Dr Tan Seng Hoe
10. Dr Yeoh Lee Ying
11. Dr Ng Tsun Gun
12. Dr Adrian Liew
13. Dr Yang Wen Shin
14. Dr Jason Choo
15. Dr Roger Tan (joined in Sept 10)

Urgent medical cover was arranged as follows:

Bishan Centre:

1. Dr Goh Ming Kiong – Lifeline Medical Group
2. Dr Woo Kim Fatt – Agape Clinic

Kreta Ayer Centre:

1. Dr Chua Thiam Eng – Cambridge Clinic
2. Dr Lai Li Cheng – Chinatown Clinic
3. Dr Chong Foong Chong – Grace Clinic

Ghim Moh Centre:

1. Mobile doctor – 24hrs hotline: 62500625
2. Dr Lim Chin Wei – Family Clinic

## NURSING

The overall standard of nursing is overseen by Ms Theresa Soh as Patient Services Coordinator and Ms Lay Kwee Chin (Senior Executive Patient Services,) Ms Tay See Inn (Nurse Clinician).

Routine audits are performed on the provider to maintain standards. The Dialysis Providers are:

- Fresenius Medicare at San Wang Wu Ti (Kreta Ayer) Centre (contract is renewed in Sep 2008, to end in Aug 2013)
- Asia Renalcare Pte Ltd at Bishan Centre (contract renewed in 2006, to end in Feb 2011) and Ghim Moh Centre (contract to end in May 2012)

The Dialysis Provider is responsible for rostering of the nursing services. Staff numbers inclusive of the charge nurse as at 31 Dec 2010 is listed as follows:

Centre	Renal trained SN	SN	AN	DT	Total
Bishan	2	8	6	1	17
SWWT	2	7	5	0	14
Ghim Moh	1	7	3	1	12
Grand total					43

## Training & Education

The Patient Services Coordinator and Nurse Clinician together with the Nursing Officers are responsible for Training & Education for the Nursing staff. This is discussed in the Nursing report.

## 5 EQUIPMENT

### DIALYSIS MACHINES

There are in total 54 dialysis machines.

These were located as follows:

	Baxter 1550	Baxter Tina	Fresenius 4008S	Gambro AK96
Bishan	0	0	5	16
Kreta Ayer	0	0	14	0
Ghim Moh	0	0	19	0

The stations in SWWT centre were decreased from 15+1 (normal + isolation) to 12+1 as the patient census was low. Three Fresenius 4008S were transferred to Ghim Moh Centre, making a total of 19 machines there.

### WATER TREATMENT SYSTEMS

The water treatment system in Bishan Centre is serviced by Waterman Pte Ltd, SWWT Centre by Memiontec Pte Ltd while that in Ghim Moh Centre is by Transmedic Pte Ltd. The water treatment system in Bishan Centre was replaced by Gambro WRO

All centres use the Reverse Osmosis System. Pretreatment comprises of backwashable multimedia, activated carbon filter, regenerable water softener and pre cartridge filter before entering the RO membranes via high pressure pumps to allow reverse osmosis to take place. This removes most of the dissolved solids from the feed water. The product water then passes through 0.2 micron filter to be distributed to the dialysis stations. The distribution piping is a closed loop system.

For Ghim Moh and SWWT centres the system undergoes auto-washing and flushing before going onto standby mode at the end of each dialysis day whereas for Bishan centre the RO system will perform daily intergrated heat disinfection at the end of the day.

Daily monitoring of RO system pressure parameters and performing the chloramine check at the beginning of the day before priming. Chemical disinfection is done 6 monthly by the vendors for Ghim Moh and SWWT centres and the nurses in Bishan centre will perform the membrane disinfection 2 monthly.

The chemical disinfectant used for RO disinfection as follows:

Bishan centre – Dialox

SWWT centre – Hydrogen Peroxide 13%

Ghim Moh centre – Hydrogen Peroxide 22% and Peroxyacetic Acid 4.5%

Residual checks are conducted after disinfection to ensure that the system is clear of chemical before patient use. RO water and dialysate cultures for LAL and total microbial count samples are done 2 monthly, meet AAMI standards.

#### REUSE EQUIPMENT

Reuse is practiced using the Renatron Reprocessing machines. Dialysers from hepatitis positive patients are not mixed with those from serologically negative patients during washing.

There are in total 8 Renatron machines in the three centres (three each in Bishan and Kreta Ayer, two in Ghim Moh) linked to the Renalog Reprocessing Management (RM).

The Renalog RM dialyzer reprocessing management software is a Windows-based system that provides capabilities to analyze and manage automatic and manual dialyzer reuse operations. Renalog RM is able to provide different standard or specific reports that can be printed, viewed and exported to editable file formats.

Renalin 100 Cold Sterilant (containing Hydrogen Peroxide 20%) was classified as an explosive precursor since 1 Dec 07. In order to comply with the requirements of the Arms and Explosives Act, each of the centres has applied for a licence from the Singapore Police Force (SPF) for storage of the Renalin. The licence is due to expire in March 2012.

Appropriate measures were taken to ensure that the service provider comply with the requirements. SPF conducts surprise checks.



## **6 PATIENT CARE**

Ms Theresa Soh (Coordinator of Patient Services) together with Ms Lay Kwee Chin (Senior Executive, Patient Services) headed the paramedical team.

### **DIETETICS**

Dietetic counseling was provided for under the contract with the dialysis providers. Patients are seen at least once in 3 months at the centre. The dieticians assigned were Mr Nelson Chin by Asia Renalcare and Ms Liow Min Choo by Fresenius Medical Care.

### **PATIENT WELFARE**

Ms Rena Lee, Welfare Officer resigned in October 2010 and was replaced by Ms Sandy Lim.

Patients continue to receive subsidies for dialysis fees, Erythropoietin and Calcijex, Venofer and Lanthanum Carbonate on a case by case basis.

Eight (8) patients received civil service benefits.

Ninety-five (95) patients (45.9%) received Medifund subsidies from the restructured hospitals compared with 32.3% the previous year

In addition to routine dialysis, KDF provides interim haemodialysis for CAPD and bridging to transplantation. Portable funding for KDF patients turning high dependency was started for a former PD patient. Another scheme providing interim dialysis for needy patients waiting for other programs is to be started in 2009

### **DIALYSIS REVIEWS**

Apart from the rounds which are carried out on a monthly basis by the doctors, Patient Services Coordinator or designee and Staff Nurse in charge of the patient will review problem cases with the Medical Director.

## 7 THE PATIENT POPULATION

As at 31 December 2010, we had 207 patients dialysing in 3 centres – 95 patients at Bishan Centre (BS), 67 at Kreta Ayer (SWWT) and 45 patients at Ghim Moh centre.

### A. INTAKE AND EXITS

The following table shows the intake and exit of patients by year.

**Table 7A-1 – Patient Stock & Flow**

<b>ENTRY</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>
New Cases	27	16	10	5	18	5	10	13	18	26	28
New Cases (interim)					1	6	3	3	3	7	7
Transfers in from SDDU	0	0	0	0	0	0	0	0	0	0	0
Re-enter KDF	2	1	0	3	0	0	0	1	1	0	3
<b>Total Entries</b>	<b>29</b>	<b>17</b>	<b>10</b>	<b>8</b>	<b>19</b>	<b>11</b>	<b>13</b>	<b>17</b>	<b>22</b>	<b>33</b>	<b>38</b>
<b>EXIT</b>											
Transfer Out to non-KDF Programs	3	5	2	2	2	3	0	1	0	5	1
Transfer Out to KDF PD						5	3	2	2	1	2
Transplant	7	2	2	2	4	6	10	6	4*	4*	2*
Withdraw from Dialysis/Default	0	1	1	0	0	1	0	2	0	1	4
Deaths	9	4	5	4	6	5	11	2	9	8	8
<b>Total Exits</b>	<b>19</b>	<b>11</b>	<b>10</b>	<b>8</b>	<b>12</b>	<b>20</b>	<b>24</b>	<b>13</b>	<b>15</b>	<b>19</b>	<b>17</b>
<b>Total No of Pt</b>	<b>169</b>	<b>174</b>	<b>174</b>	<b>174</b>	<b>181</b>	<b>172</b>	<b>161</b>	<b>165</b>	<b>172</b>	<b>186</b>	<b>207</b>

\* Cadaveric

**Table 7A-2 – Source of Referral**

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
SDDU	0	0	0	0	0	0	0	0	0	0	0
SGH	25	15	6	5	19	8	10	14	18	16	25
NUH	4	2	3	3	0	0	2	1	2	11	8
TTSH						2	1	1	1	1	2
AH								1	0	4	3
Private	0	0	1	0	0	1	0	0	1	1	0
<b>Total Entries</b>	<b>29</b>	<b>17</b>	<b>10</b>	<b>8</b>	<b>19</b>	<b>11</b>	<b>13</b>	<b>17</b>	<b>22</b>	<b>33</b>	<b>38</b>

We supported patients on interim haemodialysis while awaiting living related transplant as well as patients waiting to enter the KDF Peritoneal Dialysis program as long as they were suitable for satellite dialysis

Thirty-eight (38) patients were admitted to the programme in 2010: 7 for interim hemodialysis of which five were converted to permanent HD and two were awaiting catheter re-insertion for peritoneal dialysis, two re-entered after failed transplant and one after being released from prison. The rest were newly initiated on dialysis.

## **B. DEMOGRAPHIC & PATIENT CHARACTERISTICS**

### **Etiology of Renal Failure**

The etiology of renal failure in new and prevalent patients was as follows:

**Table 7B-1 – Etiology of Renal Failure in New Patients**

Etiology	2005		2006		2007		2008		2009		2010	
	n	%	n	%	n	%	n	%	n	%	n	%
<b>Chronic glomerulonephritis</b>	1	9.1	4	30.8	4	23.5	4	18.2	6	18.1	14	36.8
<b>Diabetic nephropathy</b>	6	54.5	6	46.2	9	52.9	13	59.1	20	60.6	14	36.8
<b>Lupus nephritis</b>	1	9.1	0	0	0	0	1	4.5	1	3.1	0	0
<b>Obstructive uropathy</b>	0	0	0	0	0	0	0	0	0	0	1	2.6
<b>PCKD</b>	1	9.1	0	0	0	0	1	4.5	1	3.1	2	5.3
<b>TB kidney</b>	0	0	0	0	0	0	0	0	0	0	0	0
<b>Hypertension</b>			2	15.4	1	5.9	1	4.5	0	0	1	2.6
<b>Others</b>	2	18.2	1	7.7	3	17.6	0	0	0	0	4	10.6
<b>Unknown Etiology</b>	0	0	0	0	0	0	2	9.1	5	15.1	2	5.3
<b>Total</b>	<b>11</b>	<b>100.0</b>	<b>13</b>	<b>100</b>	<b>17</b>	<b>100</b>	<b>22</b>	<b>100</b>	<b>33</b>	<b>100</b>	<b>38</b>	<b>100</b>

As in last year, the majority of new cases were patients with diabetes mellitus and chronic GN (36.8% each).

**Table 7B-2 – Etiology of Renal Failure in Prevalent Patients**

Etiology	2005		2006		2007		2008		2009		2010	
	n	%	n	%	n	%	n	%	n	%	n	%
Chr glomerulonephritis	100	58.4	96	59.6	93	56.4	90	52.3	86	46.2	93	44.9
Diabetic nephropathy	29	16.8	28	17.4	33	20.0	40	23.3	53	28.5	62	30.0
Lupus nephritis	10	5.8	9	5.6	8	4.8	9	5.2	10	5.4	10	4.8
Obstructive uropathy	1	0.6	0	0.0	0	0	0	0	0	0	2	1.0
PCKD	4	2.3	2	1.2	2	1.2	2	1.2	3	1.6	5	2.4
TB kidney	2	1.2	1	0.6	1	0.6	1	0.6	1	0.5	0	0
HT					3	1.3	4	2.3	4	2.2	4	1.9
VUR	3	1.7	2	1.2	2	1.2	2	1.2	2	1.1	2	1.0
Others	2	1.2	9	5.6	9	5.5	8	4.6	9	4.8	10	4.8
Unknown Etiology	21	12.1	14	8.7	14	8.5	16	9.3	18	9.7	19	9.2
<b>Total</b>	<b>172</b>	<b>100</b>	<b>161</b>	<b>100</b>	<b>165</b>	<b>100</b>	<b>172</b>	<b>100</b>	<b>186</b>	<b>100</b>	<b>207</b>	<b>100</b>

Majority of patients (44.9%) have chronic glomerulonephritis as the primary etiology of renal failure. Patients with diabetic nephropathy have increased to 30.0%.

#### Gender

**Table 7B-3 – Gender of New Patients**

Gender	2005		2006		2007		2008		2009		2010	
	n	%	n	%	n	%	n	%	n	%	n	%
Males	6	54.5	4	30.8	11	64.7	14	63.6	16	48.5	21	55.3
Females	5	45.4	9	69.2	6	35.3	8	36.4	17	51.5	17	44.7
<b>Total</b>	<b>11</b>	<b>100.0</b>	<b>13</b>	<b>100.0</b>	<b>17</b>	<b>100.0</b>	<b>22</b>	<b>100.0</b>	<b>33</b>	<b>100</b>	<b>38</b>	<b>100</b>

**Table 7B-4 – Gender of Prevalent Patients**

Gender	2005		2006		2007		2008		2009		2010	
	n	%	n	%	n	%	n	%	n	%	n	%
Males	83	48.0	72	44.7	79	47.9	82	47.7	87	46.8	96	46.4
Females	90	52.0	89	55.3	86	52.1	90	52.3	99	53.2	111	53.6
<b>Total</b>	<b>173</b>	<b>100</b>	<b>161</b>	<b>100</b>	<b>165</b>	<b>100</b>	<b>172</b>	<b>100</b>	<b>186</b>	<b>100</b>	<b>207</b>	<b>100</b>

At the end of 2010, the ratio of male to female patients was 96:111.

## Ethnic Distribution

**Table 7B-5 – Ethnic Distribution of New Patients**

Race	2005		2006		2007		2008		2009		2010	
	n	%	n	%	n	%	n	%	n	%	n	%
Chinese	10	90.9	10	76.9	13	76.5	16	72.7	18	54.6	27	71.0
Malay	1	9.1	1	7.7	4	23.5	5	22.7	11	33.3	6	15.8
Indian	0	0	2	15.4	0	0	1	4.5	4	12.1	5	13.2
Others	0	0	0	0	0	0	0	0	0	0	0	0
<b>Total</b>	<b>11</b>	<b>100.0</b>	<b>13</b>	<b>100</b>	<b>17</b>	<b>100</b>	<b>22</b>	<b>100</b>	<b>33</b>	<b>100</b>	<b>38</b>	<b>100</b>

**Table 7B-6 – Ethnic Distribution of Prevalent Patients**

Race	2005		2006		2007		2008		2009		2010	
	n	%	n	%	n	%	n	%	n	%	n	%
Chinese	133	77.5	126	78.30	126	76.4	138	77.3	138	74.2	153	73.9
Malay	28	16.2	23	14.3	27	16.4	36	17.4	36	19.4	38	18.4
Indian	11	6.4	12	7.4	12	7.3	12	5.2	12	6.4	16	7.7
Others	0	0	0	0	0	0	0	0	0	0	0	0
<b>Total</b>	<b>172</b>	<b>100.0</b>	<b>161</b>	<b>100</b>	<b>165</b>	<b>100</b>	<b>172</b>	<b>100</b>	<b>186</b>	<b>100</b>	<b>207</b>	<b>100</b>

The ethnic distribution of our prevalent patients was 73.9% Chinese, 18.4% Malays and 7.7% Indians.

## Age

The mean age at entry in 2010 was 56.7 ± 10.4 years (median, 55.8). Seven (7) patients were above the age of 65 years

**Table 7B-7 -- Average age of entry into the Programme**

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Mean Age (years)	42.1	43.1	43.4	41.5	46.6	52.7	62.6	56.6	58.8	56.6	56.7
SD	11	10.6	12.1	7.3	8.8	15.1	11.8	12.9	12.4	12.5	10.4
Min								26.9	33	26	34.5
Max								73.0	78	76	81.9

Average age of new patients with diabetic nephropathy was 59.4 years compared with 53.4 years in non-diabetics.

**Table 7B-8 -- Average age of Prevalent patients on the Programme**

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
<b>Mean Age (years)</b>	47.2	46.7	47.3	48.1	48.7	50.1	52.3	53.8	55.5	56.2	57.4
<b>SD</b>	9.5	9.3	9.4	9.3	9.3	9.3	10.0	9.9	9.7	10.3	10.3

Age of the prevalent dialysis population at the end of 2010 was 57.4 ± 10.3 years (median 57.5). The mean prevalent age continues to rise as the existing population ages with a low turnover with influx of elderly new patients.

## COMORBIDITY

**Table 7B-9 -- Common Comorbidities in Incident patients**

Year	2006		2007		2008		2009		2010	
	n	%	n	%	n	%	n	%	n	%
<b>Diabetic</b>	6	46.2	11	64.7	10	45.5	22	71	20	52.6
<b>IHD n other cardiac disease</b>	3	23.1	2	11.8	5	22.7	15	48.4	22	57..9
<b>CVA</b>	0	0	0	0	4	18	7	22.6	4	10.5
<b>PVD</b>	0	0	1	5.9	1	4.5	5	16.1	4	10.5

**Table 7B-10 -- Common Comorbidities in Prevalent patients**

Year	2005		2006		2007		2008		2009		2010	
	n	%	n	%	n	%	n	%	n	%	n	%
<b>Diabetics</b>	31	17.9	36	21.8	44	26.7	45	26.2	65	34.9	69	33.3
<b>IHD n other cardiac dis</b>	18	10.4	33	20.0	42	25.5	37	25.1	59	31.7	57	27.5
<b>CVA</b>			7	4.2	7	4.2	9	5.2	15	8.1	14	6.8
<b>PVD</b>			5	3.0	5	5	6	3.5	7	3.8	11	5.3

The proportion of diabetics in the prevalent dialysis population was 33.3%

The proportion of patients with cardiac problems has decreased from 31.7% to 27.5%.

This probably reflects the older population coming on to dialysis together with the aging prevalent patients.

## HOSPITALIZATIONS

Hospitalizations during the period 1 January 2010 to 31 December 2010 were analyzed and expressed as episodes and days hospitalized per patient year of dialysis programme. There were 272 hospitalization episodes in 130 patients. Thus, 63.4% of the patients were ever admitted that year.

**Table 7B-11 Admission Rates**

	2008		2009		2010	
	No	%	No	%	No	%
No of Patients admitted in ref year	108	57.4%	134	63.4%	141/224	62.9%
- Diab pt adm / all diab			51	70.8%	69/85	81.2%
- Non-diab pt adm / all			83	59.4%	72/139	51.8%

RATES/YR	2007	Per yr	2008	Per yr	2009	Per yr	2010	Per yr
Admission episodes	234	1.5	248	1.3	272	1.5	466	2.4
• diabetic	93	2.7	111	2.1	165	2.84	266	3.6
• non-diabetic	141	1.1	137	1.0	107	0.87	200	1.6
Admission days	1628	10.2	1833	9.75	2207	13.9	2581	13.0
• diabetic	909	25.9	870	16.7	1148	20.5	1394	18.8
• non-diabetic	719	5.7	963	7.1	1059	10.9	1187	9.6

The admission rate was 2.4 episodes per patient year. This was much higher than the previous year but the days admitted per dialysis year fell from 13.9 to 13.0. Not unexpectedly, diabetics had about double the number of days admitted compared with non-diabetics.

Access problems accounted for 33.8% of admission days (51.8% in diabetics, 26.3% in non-diabetics).

**Table 7B-12: Hospitalization Days**

Hospitalization	2007	2008	2009	2010
Days per pt year	10.2	9.75	13.9	13.4
• % due to access*	35.4	24.0	28.1	33.8
• % due to infection +	10.7	4.9	15.9	20.0

\* including infections of the access

+ excluding access related infections

## DEATHS AND WITHDRAWALS

A total of 17 patients left the programme. Causes were as follows:

2 patients was on interim haemodialysis and transferred to PD programme while one other patient failed HD and changed to PD programme. One patient was incarcerated.

2 patients had cadaveric (deceased donor) transplants and

3 patients withdrew dialysis treatment.

There were 8 deaths – 1 from heart failure, 2 from cardiac causes, 3 from pneumonia, 1 from multi organ failure and 1 from brain stem haemorrhage.

**Table 7B-14: Deaths and Withdrawals**

	2008	2009	2010
Transfers			
- PD	2	2	3
- Other	-	4 (high dep)	1
Transplants	4	4	2
Withdrawals	-	1	1
Deaths	9	8	8
<b>Total</b>	<b>15</b>	<b>19</b>	<b>17</b>



### C. SURVIVAL

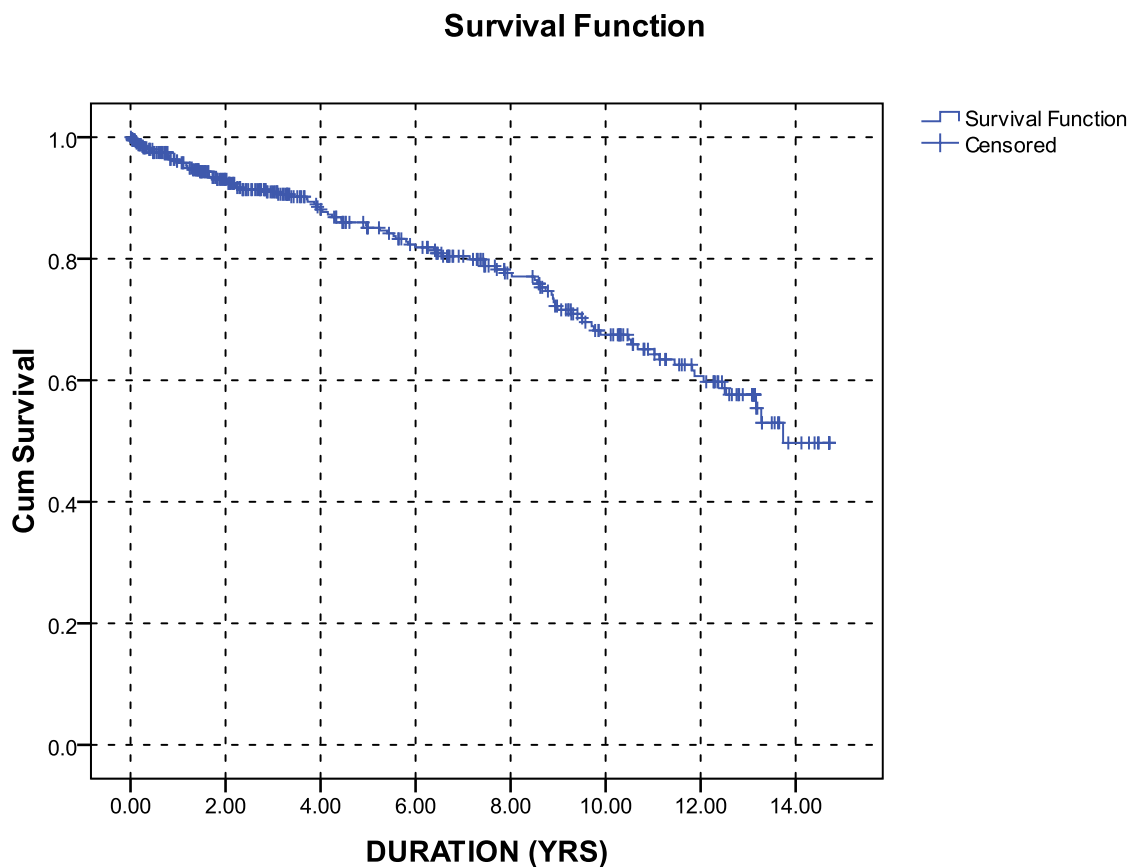
Patient survival was analysed by the Kaplan Meier method. There were a total of 418 entries (including re-entries) into the programme.

Overall first year survival was 96.1% and 5 year survival 85.1%.

**Table 7C-1– Survival of entire program as analysed in years 1996 - 2010**

<b>Yr of analysis</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>
1 yr	94.4%	94.9%	94.8%	94.9%	95.2%	95.4%	95.5%	96.0%	95.6%	95.7%	96.1%
2 yr	90.6%	91.5%	91.6%	91.9%	92.3%	93.0%	92.9%	93.1%	92.4%	92.8%	93.1%
3 yr	88.6%	89.7%	90.0%	89.8%	90.4%	91.3%	91.2%	91.5%	90.5%	90.9%	91.0%
4 yr	88.6%	88.9%	87.2%	87.9%	87.6%	88.3%	87.8%	88.2%	87.4%	87.9%	88.1%
5 yr	NA	83.4%	82.5%	83.0%	83.3%	84.5%	84.3%	84.7%	84.2%	84.4%	85.1%
10 yr	NA	NA	NA	NA	NA	NA	63.8%	68.5%	68.7%	70.1%	67.5%

**Fig 7C-1: Overall Patient Survival**

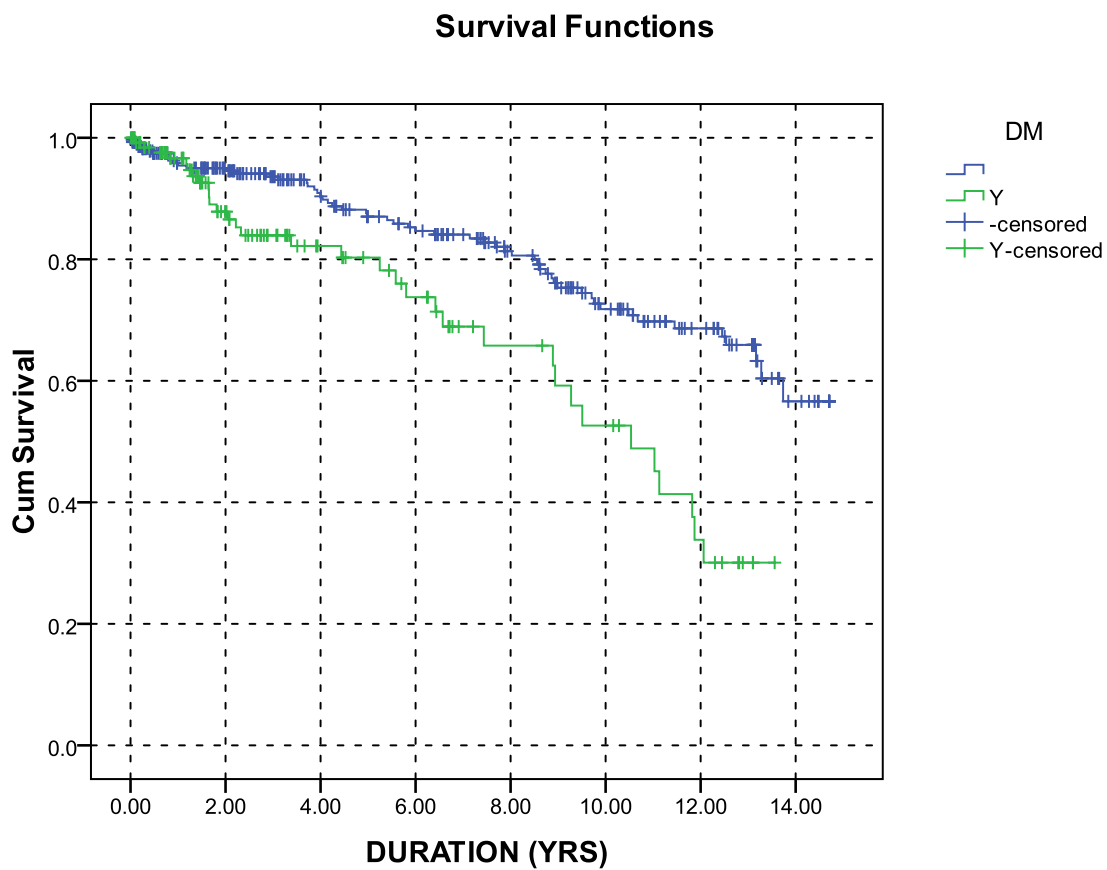


**Table 7C-2 - Survival Difference between Diabetics and Non diabetics 1996- 2010**

	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>
<b>Non-DM</b>				
1 yr	96.2%	95.4%	95.6%	96.8%
5 yr	86.8%	86.2%	86.0%	87.0%
10 yr	74.4%	73.8%	74.6%	71.8%
<b>DM</b>				
1 yr	95.4%	96.1%	95.9%	96.6%
5 yr	76.2%	84.9%	79.7%	80.3%
10 yr	41.2%	49.3%	53.2%	52.6%

As expected, diabetics have worse survival than non diabetics.

Fig 7C-2: Patient Survival – Diabetic vs Non Diabetic



## D. DIALYSIS PARAMETERS

All patients are on high flux dialyzers, majority using Fresenius Polysulfone membrane unless a larger dialyzer size is required. Maximum reuse is 15 times. There are separate reuse facilities for Hepatitis B and HCV positive dialyzers in Bishan while in SWWT and Ghim Moh, dialyzers used by HepB positive patients are not reused.

**Table 7D-1 : Types of Dialyzers used**

	2005		2006		2007		2008		2009		2010	
	n	%	n	%	n	%	n	%	n	%	n	%
F6	2	1.20	1	0.6	1	0.6	3	1.7	2	1	1	0.5
F7	0		0	0	0	0	0	0	0	0	0	0
HF50	10	5.8	13	7.9	13	7.9	13	7.6	17	9	19	9.2
HF60	44	25.4	42	25.5	38	23.0	41	23.8	40	22	37	17.9
HF80	18	10.4	14	8.5	10	6.1	10	5.8	9	5	15	7.2
HF100	7	4.0	7	4.2	8	4.8	8	4.7	9	5	8	3.9
PolyFlux6L					1	0.6	1	0.6	0	0	0	0
PolyFlux11			1	0.6			0	0	0	0	0	0
PolyFlux14	48	27.7	47	28.5	54	32.7	55	32	65	35	77	37.2
PolyFlux17	26	15.0	24	14.5	25	15.2	25	14.5	30	16	34	16.4
PolyFlux21	17	9.8	15	9.1	14	8.5	15	8.7	14	8	16	7.7
FB210U	1	0.6	1	0.6	1	0.6	1	0.6	0	0	0	0
TOTAL	173	100	165	100	165	100	172	100	186	100	207	100

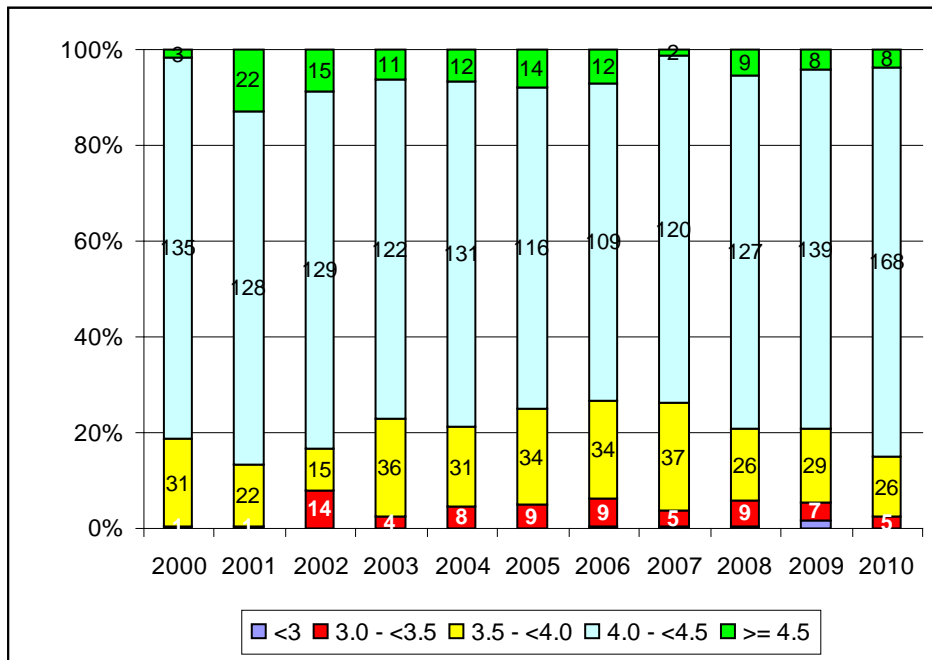
Only 1 patient (0.5 %) was on a low flux dialyzer.

**Table 7D-2: Average Blood flow Used (ml/min)**

ml/min	2005	2006	2007	2008	2009	2010
Mean	276	274	272	273	270	267
Std Dev	36	34	36	34	35	31
Min	180	180	180	150	150	150
Max	400	400	360	360	360	360

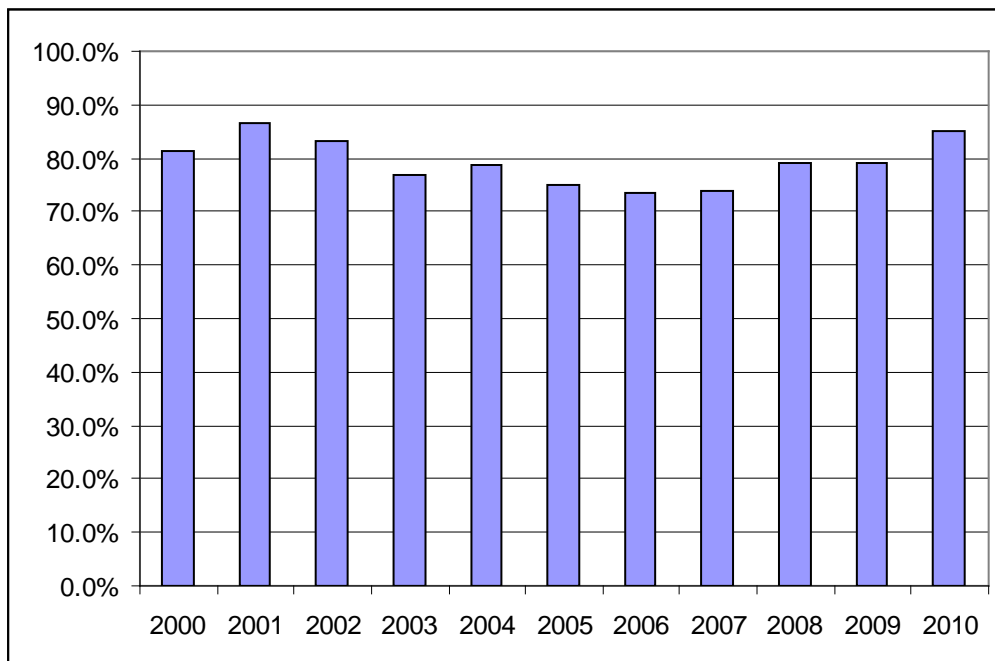
Blood flow is set at a minimum of 200 ml/min and averaged  $267 \pm 31$  ml/min (range 150 -360).

**Fig 7D-1: Dialysis Time Per Session**



Most patients (85.0%) dialyze for 4 hours or more as compared to the previous year (79%).

**Fig 7D-2: Percentage of patients Dialyzing 4 hours or more per session**



## DIALYZER REUSE

Maximum reuse is 15 times. All centres use the Renatron System. There are separate reuse facilities for washing of dialyzers used by Hepatitis B and HCV positive patients in Bishan. SWWT centre started accepting hepatitis positive patients when AH centre closed down but without reuse of dialyzers for Hepatitis B positive patients. Ghim Moh centre started accepting Hepatitis B positive but without reuse of dialyzers.

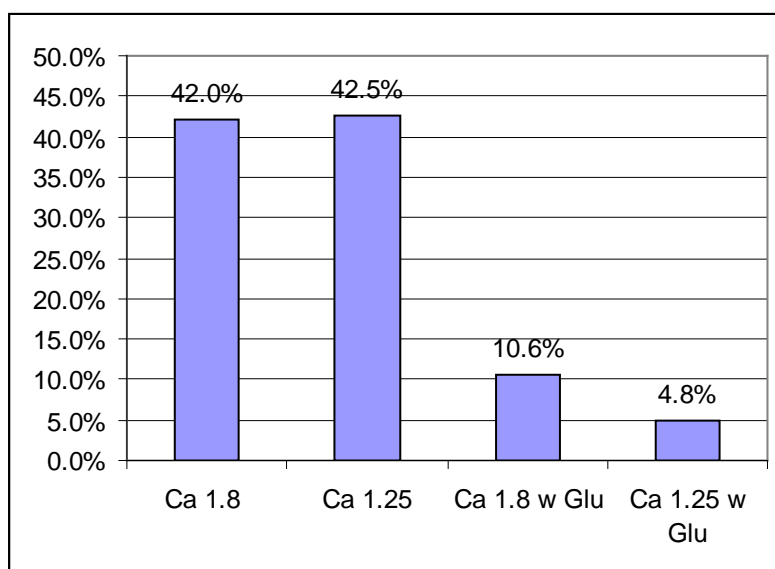
## DIALYSATE

Dialysate available contains

- potassium value of 2.0 mmol/L
- calcium of 1.5 mmol/L and 1.2 mmol/L
- glucose of 10 mmol/L in SWWT centre for diabetic and elderly patients

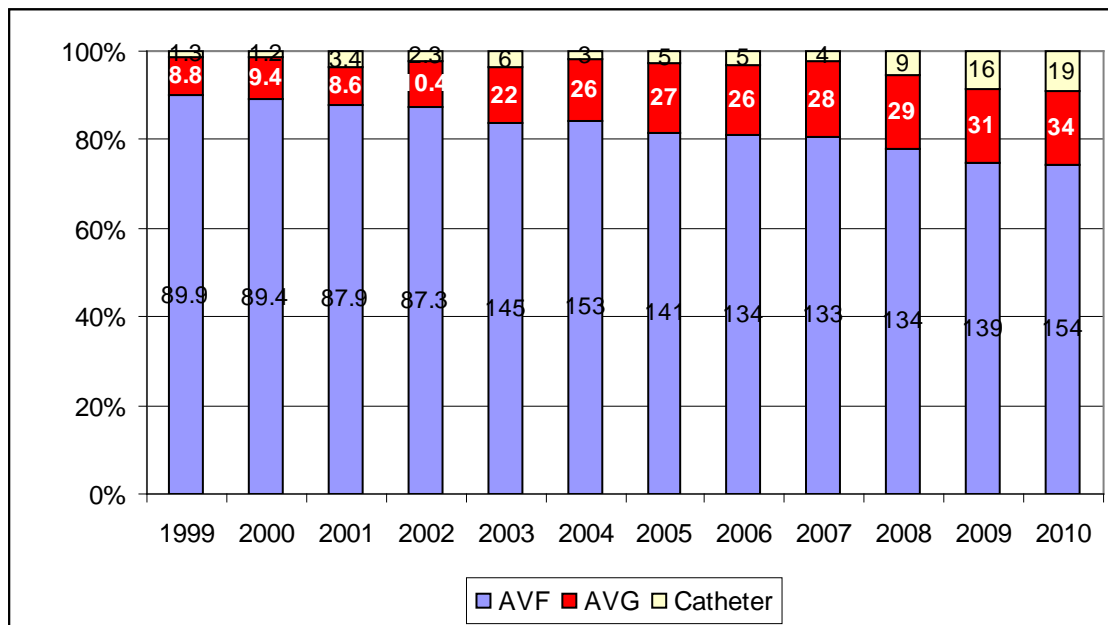
Dialysate containing 1.5 mmol/L calcium and 10 mmol/L glucose was introduced in SWWT centre on 2<sup>nd</sup> December 2008 for diabetic and elderly patients.

**Fig 7D-3 Dialysate Calcium and Glucose**



## E. VASCULAR ACCESS

Fig 7E-1: Vascular Access



Thirty four patients or 16% (34/207) were using grafts for vascular access, approximately the same proportion as last year. This is compared to 8.8% in 1999. Nineteen patients were on temporary catheters (9%). The rest were using AV fistulae (74%).

We continue to use the Transonic machine for monitoring the access flows and recirculation in the vascular access. This performed every 6 months unless the flows are below 600 ml/min. The average flow for AVF's was  $1185 \pm 638$  ml/min (median 1060 ml/min). The average flow for AVG's was  $1001 \pm 365$  ml/min (median 910 ml/min). There were no patients with recirculation.

Any patient who had recirculation above 5% or persistently low access flow with reduction of 25% over the past 3 months was referred back to the surgeon.

## F. DIALYSIS ADEQUACY

This assessment is performed every 2 months using a pre and post blood urea performed on a midweek dialysis session to calculate the single pool KT/V as follows:

$$KT/V = -\ln(R - 0.03) + (4 - 3.5 \times R) \times UF/W$$

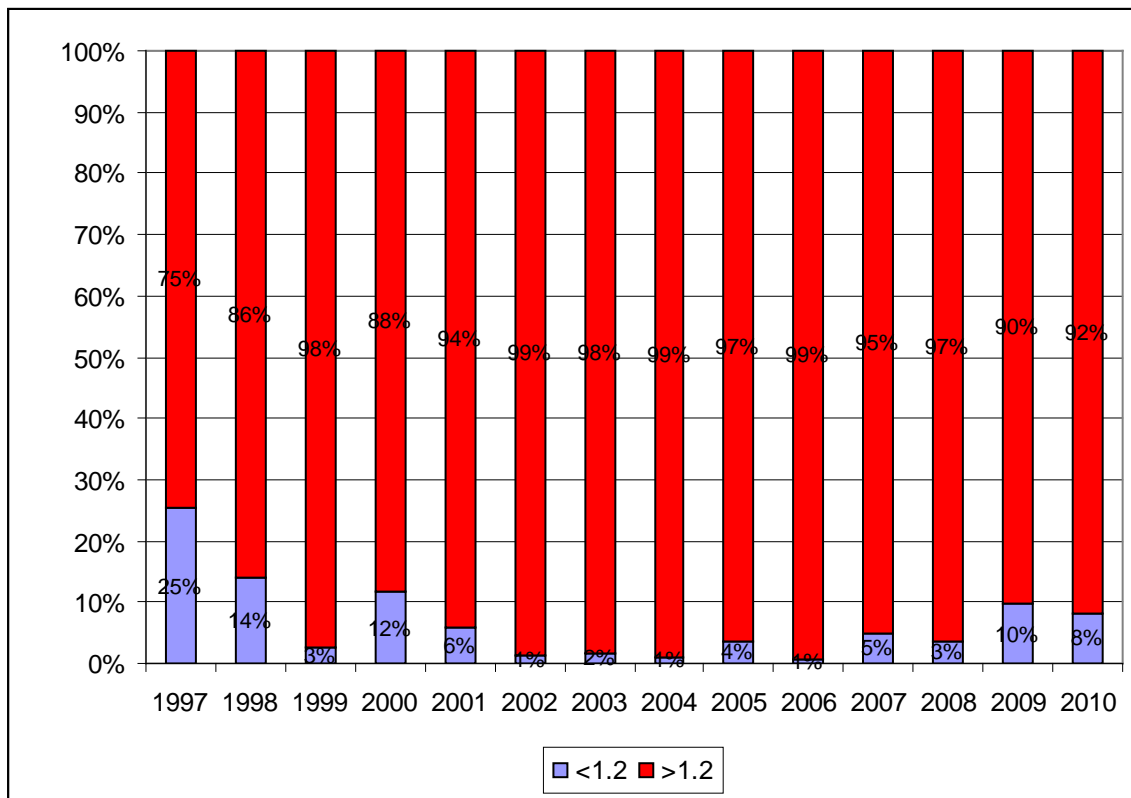
where R = post/pre urea  
 UF = ultrafiltration in litres  
 W = post dialysis weight

The formula used is that adapted from "Handbook of Dialysis" Ed JT Daugirdas & TS Ing.

Our patients weighed  $59.0 \pm 14.2$  kg (median 56.8 kg, range 33.7 – 114.3 kg).

The proportion of patients with KT/V of 1.2 or greater in November / December 2010 was 92%.

**Fig 7F-1: Percentage with KT/V index > 1.2**

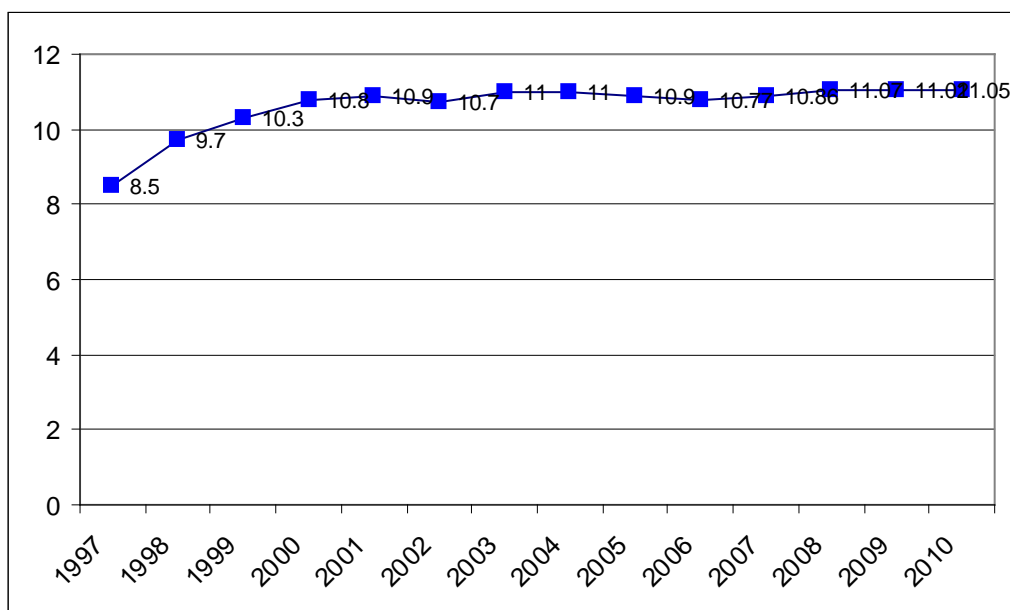




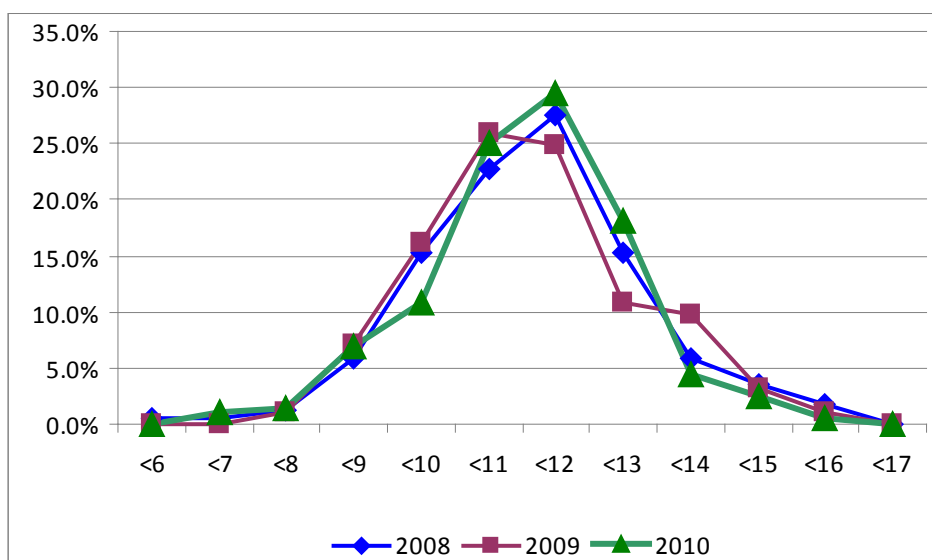
## G. ANAEMIA

The mean Hb was calculated to be  $11.1 \pm 1.5$  g/dl (range 6.6 – 15.5). This has been stable over the past few years. The percentage of patients with a haemoglobin count of less than 10 g/dl was 20% lower than last year (24%).

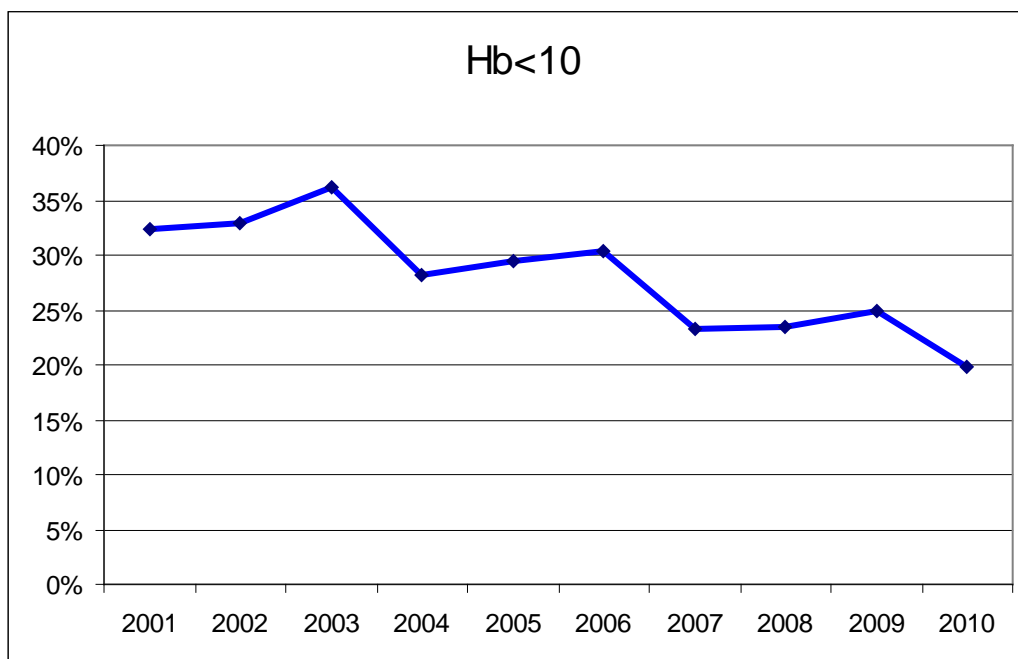
**Fig 7G-1: Average Hemoglobin**



**Fig 7G-2: Hb Frequency**



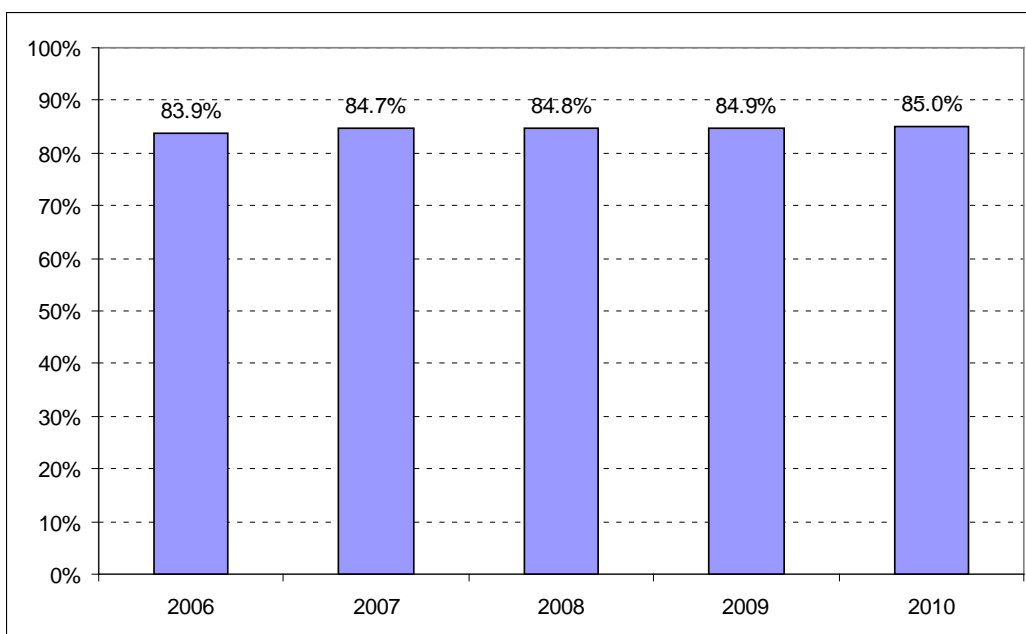
**Fig 7G-3: Hb <10**



**ERYTHROPOIESIS STIMULATING AGENTS**

Patients are advised to start erythropoietin when their Hb falls below 10 g/dl. Target Hb while on erythropoietin is 11-12 g/dl. The proportion of patients with Hb < 10 g/dl continues to fall with 85% (176/207) of patients on erythropoietin

**Fig 7G-4: Proportion of Patients on ESA**



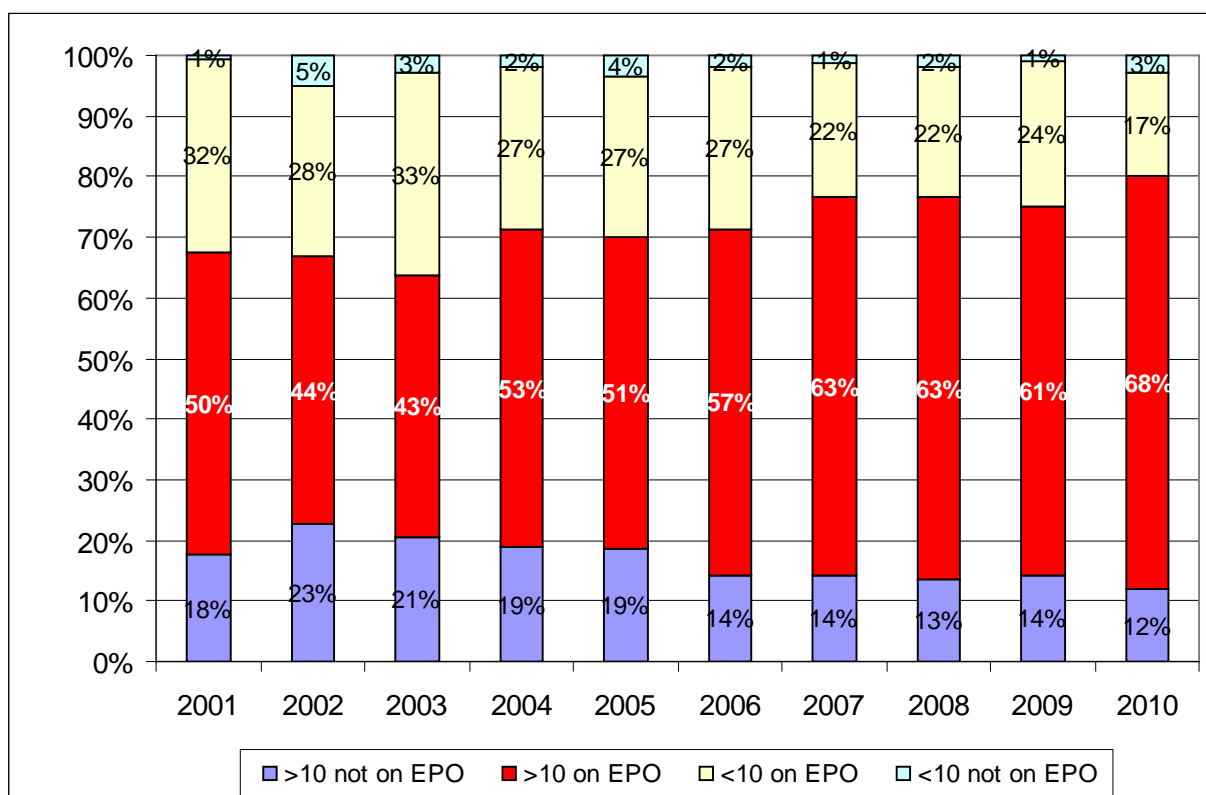
The cost of erythropoietin is Medishield claimable if the patient is eligible. In addition, patients are also eligible to apply for the Foundation's subsidy programme. There is no cap on the erythropoietin subsidy

Patients who were on EPO used on the average  $123 \pm 75$  units/kg/wk (median 110.7 units/kg/wk) higher than last year's figure of 113.4 units/kg/wk.

Because of the possibility of pure red cell aplasia from erythropoietin administration, all erythropoietin is now administered by the intravenous route. SWWT-Kreta Ayer and Ghim Moh Centres use Eprex while Bishan uses Recormon.

Twenty-five (25) patients (15.0%) were not on EPO. They had a mean Hb of 12.6 g/dl (range 7.2 – 15.5). Only 6 patients (2.9%) with Hb below 10 g/dl were not on EPO.

**Fig 7G-5: Use of Erythropoietin**



## IRON STATUS

**Table 7G-1 : Transferrin Saturation**

	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>
Mean (%)	36.2	39.2	33.5	37.9	36.7	34.2
SD	16	16.9	16.3	18.2	17	15
% pats w TFSat <20%	9.2	6.7	19.6%	9.9%	10.8%	11.1%
Average HB when TFSat<20% (g/dl)	10.6	10.5	10.7	11.4	10.9	10.4
% pats w TFSat >20%	90.8	93.3	80.4	90.1	88.7	87.9
Average HB when TFSat>20% (g/dl)	10.9	10.8	10.9	11	11	11

As at the end of 2010, mean transferrin saturation was  $34.2 \pm 15\%$  (range 6.7 – 100.0). The proportion of patients with transferrin saturation of less than 20% was 11.1%, higher than the previous year. 43.5% (10/23) in this iron deficient group had a Hb of less than 10 g/dl. The average Hb of patients with transferrin saturation greater or equal to 20% was 11 g/dl compared with 10.4 g/dl for those whose TF Sat was <20%

More patients (84) used intravenous iron (Venofer) in 2010. Fifty three (53) used Venofer to replenish iron stores (as compared to 44 in 2009) while 55 patients used it for maintenance. A subsidy scheme for Venofer has been available since April 2005.

**Table 7G-2: Ferritin**

	<b>2008</b>	<b>2009</b>	<b>2010</b>
Mean	580	547	525
SD	573	333	392
% pats w Ferritin < 200	17.5%	10.3%	14.5%

Using S Ferritin, 14.5% are iron deficient

## BLOOD TRANSFUSION

A total of 13 patients received 23 units of blood during admissions to hospital.

## H. NUTRITION

Mean S Albumin was  $34.5 \pm 3.41$  g/l. The number of patients with Serum albumin less than 40 g/dl was 88.4%.

**Table 7H-1 : Normalised Protein Catabolic Rate and S Albumin**

	2003	2004	2005	2006	2007	2008	2009	2010
NPCR (g/kgBW)								
• Mean $\pm$ SD	1.14 $\pm$ 0.23	1.13 $\pm$ 0.23	1.12 $\pm$ 0.21	1.13 $\pm$ 0.22	1.14 $\pm$ 0.24	1.07 $\pm$ 0.23	1.09 $\pm$ 0.26	1.06 $\pm$ 0.26
• % < 1.2	62.6	63.5	68.2	63.6	63.6	75	71	74
S Albumin (g/l)								
• Mean $\pm$ SD	36.9 $\pm$ 3.1	36.9 $\pm$ 3.5	37.5 $\pm$ 3.4	36.8 $\pm$ 3.1	34.3 $\pm$ 3.4	33.9 $\pm$ 3.8	33.9 $\pm$ 3.4	34.5 $\pm$ 3.4
• % <40	80.6	81.8	72.3	77.6	95.7	90.0	90.3	88.4
• % <35	22.9	21.0	16.8	24.2	59.1	50.0	51.1	48.8

## I. MINERAL METAB

**Table 7I-1 : Serum Calcium levels**

	2005	2006	2007*	2008	2009	2010
Mean S Calcium (mmol/L)	2.44	2.38	2.44	2.46	2.46	2.3
SD	0.25	0.22	0.21	0.20	0.21	0.23
Min		1.26	1.79	2.01	1.73	1.68
Max		2.88	3.04	3.06	3.2	3.79

\* S Calcium corrected for S Albumin reported from this year

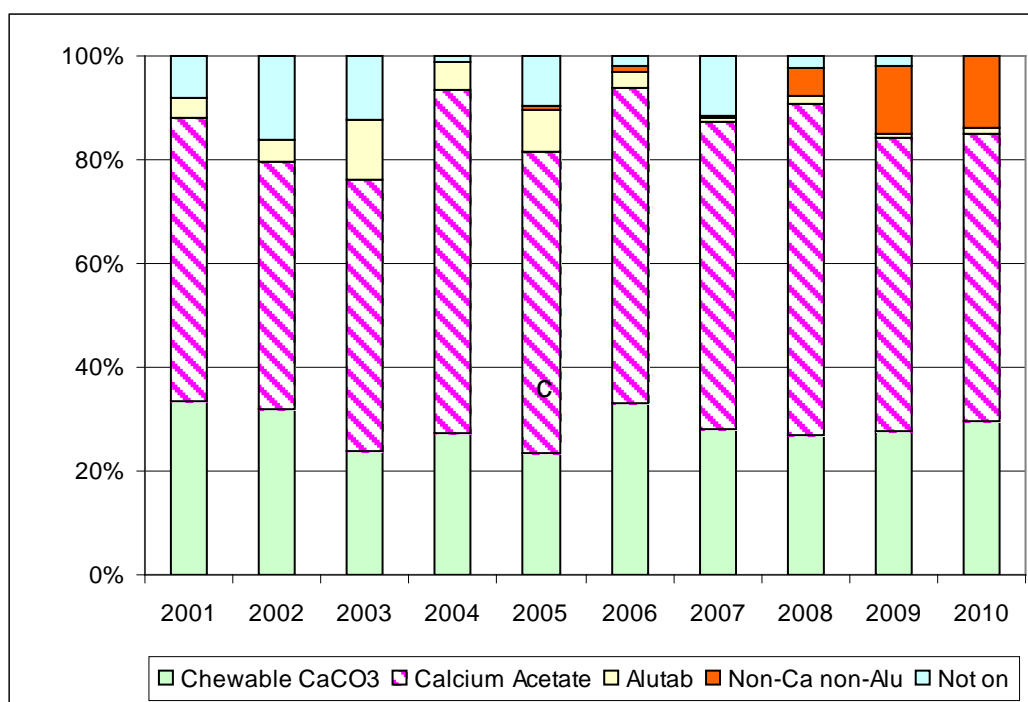
The mean corrected serum calcium value was  $2.3 \pm 0.23$  mmol/l. Low calcium dialysate is currently in use for almost half of the patients (97/207, 46.8%)

**Table 7I-2 : Serum Phosphate levels**

	2005	2006	2007	2008	2009	2010
Mean S PO4 (mmol/L)	1.88	1.75	1.79	1.55	1.65	1.54
SD	0.51	0.44	0.52	0.38	0.47	0.47
% with S PO4 > 2.0 mmol/l	41.6	29.1	31.7	11	11.8	18.4
% with S PO4 > 1.78 mmol/l (KDOQI)						29.95
Min	0.38	0.49	0.66	0.62	0.7	0.42
Max	3.63	3.37	3.65	2.55	3.25	3.12

Mean S Phosphate was  $1.54 \pm 0.47$  mmol/l. The patients having values above 2.0 mmol/l was 18.4% as compared to 11.8% the previous year

**Fig 7I-1 : Phosphate binders in use**



Majority of patients are on calcium-based phosphate binders of which 63.3% are on calcium acetate.

Non calcium non-aluminum binders (Lanthanum and Sevelamar use has increased to 15.9%. KDF provides a subsidy for these expensive phosphate binders. Aluminium use has dropped significantly.

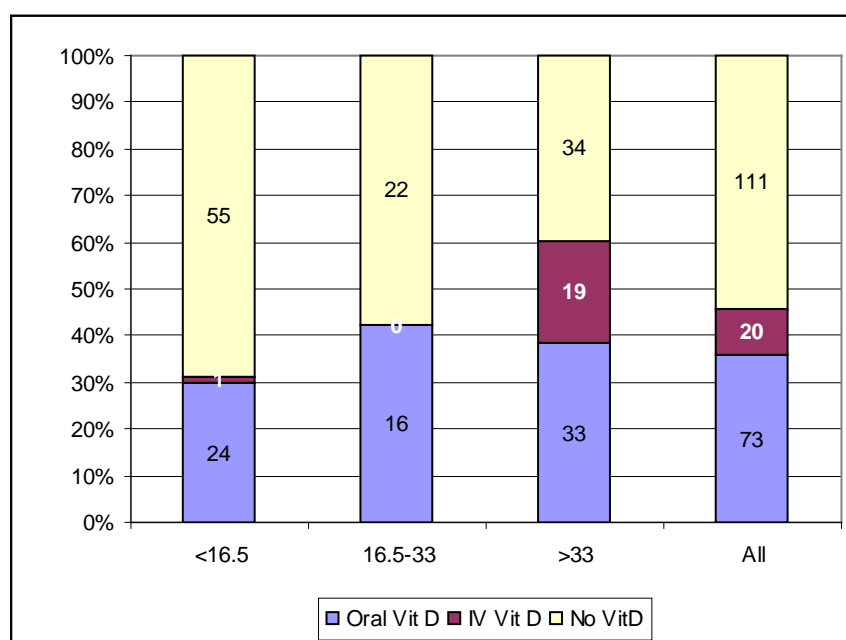
The KDOQI guidelines of 2003 (AJKD Vol 42 October 2003 Suppl 3) recommends treatment for patients on dialysis (CKD Stage 5) when iPTH exceed 33 pmol/l should be treated with Vit D analogs to main the PTH at 16.5-33 pmol/l.

**Table 7I-3: PTH levels**

	2006	%	2007	%	2008	%	2009	%	2010	%
<b>&lt;16.5</b>	52	32.3	54	32.9	52	31.3	71	38.4	80	39.2
<b>16.5-33</b>	31	19.3	24	14.6	27	16.3	31	16.8	38	18.6
<b>&gt;33.0</b>	78	48.4	86	52.4	87	52.4	83	44.9	86	42.2
<b>Total</b>	161	100	164	100	166	100	185	100	204	100

Majority (42%) of the patients have intact parathyroid hormone levels elevated beyond 33 pmol/l. Hyperparathyroid bone disease is still a significant problem in the dialysis population.

**Fig 7I-2 : Parathyroid Hormone levels and Vit D Treatment**



In the group with low PTH (<16.5 pmol/l) which constitutes 39% (80 patients) of all cases, only 11.6% (24) were on oral Vit D and 0.5%(1) on iv Vit D.

K/DOQI now aims for a PTH level of 16.5 – 33 pmol/l. Only 18% of all patients had PTH values in this range. 60% (82/86) of patients with PTH>33 pmol/l being treated with Vit D. A subsidy scheme for Calcijex was started in April 2005. Hyperphosphatemia and hypercalcemia often preclude them from treatment. One patient is on Paricalcitol.

A total of 42 patients had parathyroidectomy bringing the prevalent rate to 20.3% (42/207).

## J. DIABETICS

The prevalent number of diabetic patients was 78 (37.7%) This is not surprising as diabetic nephropathy is the etiology of ESRD in more than half of all new cases.

## K. HYPERTENSION

77.8% (106/207) have recorded high blood pressures or have their blood pressures controlled with anti-hypertensive agents.

**Table 7K-1 : Use of Antihypertensive Agents by number of Drugs**

	2005	2006	2007	2008	2009	2010
None	38.7%	31.7%	37.0%	29.7%	27.4%	22%
1 Drug	28.3%	31.9%	31.5%	28.5%	28.5%	33%
2 Drugs	22.0%	20.7%	23.0%	27.3%	26.3%	27%
3 Drugs	8.7%	13.4%	6.1%	9.9%	14%	14%
4 drugs	2.3%	1.2%	2.4%	4.7%	3.8%	4%
	100.0%	100%	100%	100%	100%	100%

About 22% of the patients were not on antihypertensives and another 33% on one drug only.

Calcium channel blockers, beta blockers and ACEI/ARB were the most common types of antihypertensives used.

**Table 7K-2: Use of Antihypertensive Agents by Drug Type**

	2005	2006	2007	2008	2009	2010
None	38.7%	31.7%	37.0%	29.7%	27.4%	22.2%
Beta blockers	43.9%	44.7%	38.8%	43.6%	47.3%	50.2%
Calcium channel Blockers	31.2%	36.4%	33.3%	43.6%	43%	45.9%
ACEI / ARB	26.0%	30.8%	26.7%	33.7%	37.6%	36.2%
Others	5.8%	3.6%	4.8%	4.7%	13.4%	5.8%

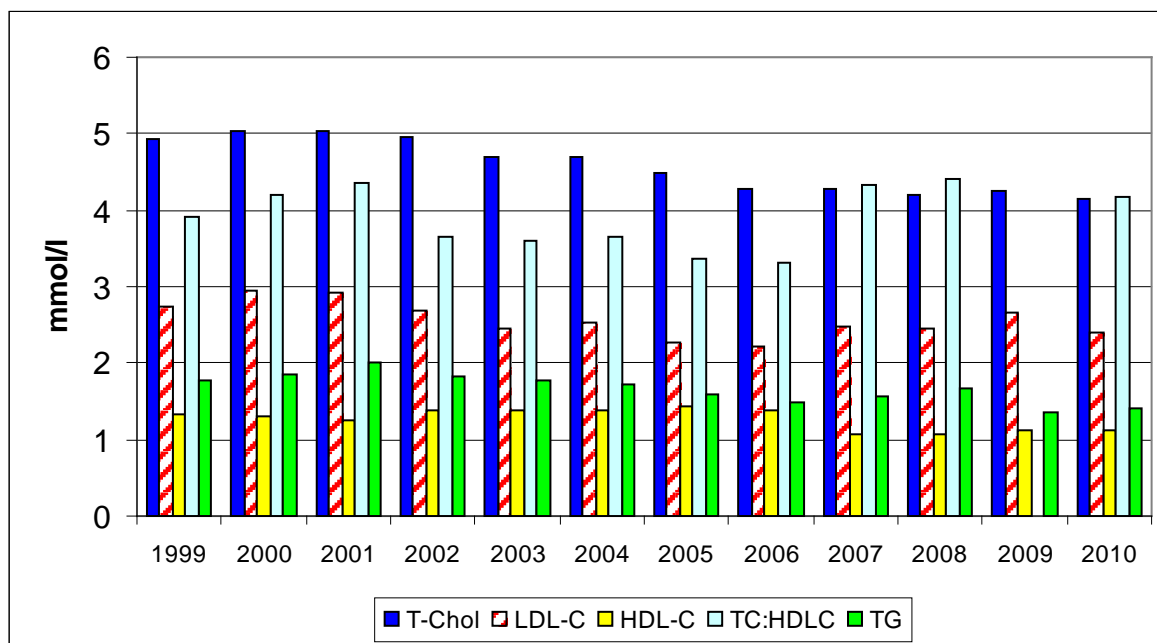
These are not mutually exclusive.



## L. HYPERLIPIDEMIA

Mean total cholesterol and LDL-Cholesterol was lower than last year while total cholesterol/HDL-cholesterol ratio and triglyceride levels increased marginally.

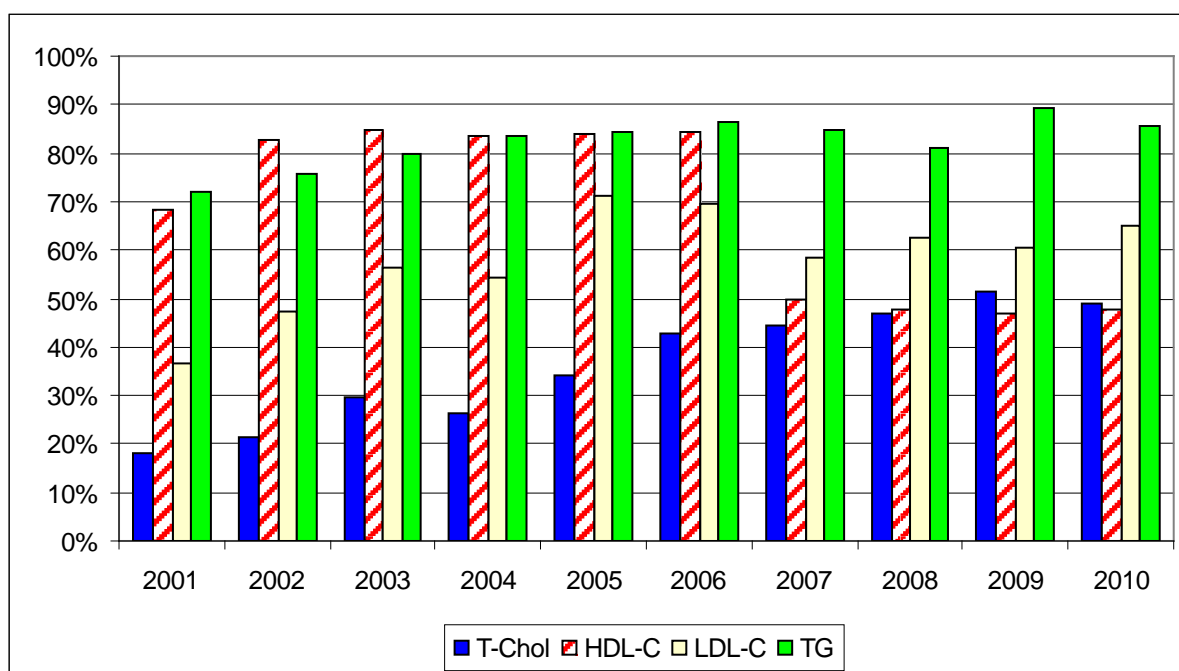
Fig 7L-1: Lipids



MOH 2/2006 guidelines for high risk groups were used to assess the proportion of patients with optimized levels:

- cholesterol (<4.1 mmol/l)
- HDL-cholesterol ( $\geq 1.0$  mmol/l)
- LDL cholesterol (<2.6 mmol/l)
- TG (<2.3 mmol/l)

**Fig 7L-2: Percentage of patients achieving target levels as recommended by MOH guidelines 2006**



The percentage of patients achieving MOH targets for TG (<2.3 mmol/l) remains quite high 85.9%. However, for LDL cholesterol (<2.6 mmol/l) it was 65.2%. Only around 50% of the patients achieved the other targets – total cholesterol (<4.1 mmol/l) 49.3% and HDL-cholesterol ( $\geq 1.0$  mmol/l) 47.8%,

The proportion of patients on drug therapy has increased to 71.0% (147/207). Majority (64.3%) was on only one drug. HMG-CoA reductase inhibitors were the most commonly used drug (69.6%),

### M. HEPATITIS SEROPOSITIVITY

6.3% are hepatitis B carriers, 7.7% are anti-HCV positive for Hepatitis C antibody. Four patients (1.9%) had received interferon treatment and both patients' HCV PCR was negative. Two patients (1.0%) are both anti-HCV and HepBsAg positive.

**Table 7M-1 : Hepatitis Rates**

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
HepB	5.8%	5.7%	5.7%	7.5%	5.5%	5.2%	6.2%	6.7%	6.4%	6.5%	6.3%
HCV	9.4%	9.7%	9.2%	11.5%	10.9%	9.8%	10.6%	9.1%	8.7%	8%	7.7%
HepB & HCV	1.20%	1.1%	1.1%	1.7%	1.6%	1.7%	1.2%	1.2%	1.2%	1%	1%

## VACCINATION

### Hepatitis B

Thirty-eight (18%) non immune patients with Hepatitis B antibody <10 were vaccinated and 19 (9%) patients were advised to be vaccinated. Financial assistance was extended to 4 needy patients.

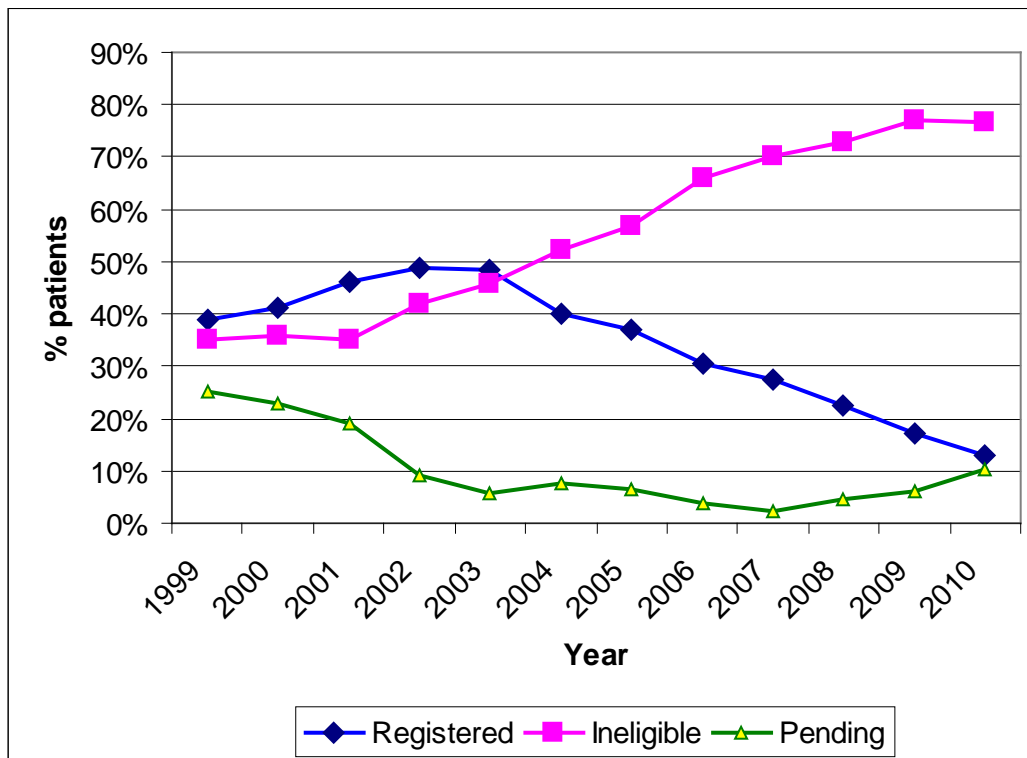
### Influenza vaccination

118 (57%) patients received influenza (Fluarix) vaccination.

## N. TRANSPLANT WAITING LIST

Only 27 patients (13%) are on the waiting list. More patients (21) have not been assessed with the larger influx of new cases this year. The number of ineligible patients grow as KDF takes in more patients with comorbidities since admission criteria was relaxed.

**Fig 7N-1: Proportion of patients on the Transplant Waiting List**



## **8. CONCLUSION**

In recent years, the typical new dialysis patient has diabetes and more comorbidities. Prevalent patients are growing older manifesting increasing complications of the ESRD state.

Challenges for the future continue to increase as we aim to maintain the same life expectancy and quality of life.

We would like to thank all those who participated in the care of the patients,

A/PROF CHOONG HUI LIN  
MEDICAL DIRECTOR