

KIDNEY DIALYSIS FOUNDATION

ANNUAL REPORT

MEDICAL

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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 2008, there were 18 new entrants.

Fifteen patients exited the programme (4 transplants, 9 deaths, 2 transfers to PD programme). In the prevalent population, average age was 55.5 ± 9.7 years, the number of patients with chronic glomerulonephritis as the etiology of renal failure was 52.3%, diabetic nephropathy 23.3%. Overall first year survival of patients was 95.5% and five year survival 84.0%. 5 year survival in diabetics was 75.8% compared with 85.5% in non diabetics.

All patients are using high flux dialysers. Average blood flow was 273 ± 34 ml/min. 79.1% of patients dialyse 4 hours or more. 78.5% of patients use a native arteriovenous fistula. Dialysis adequacy as measured by single pool KT/V is >1.2 in 83.1% of patients.

Mean hemoglobin was 11.1 g/dl. About 84.9% of all patients are on EPO. About 9.9 % of patients are considered Fe deficient.

90.0% of patients have a S Albumin of <40 g/l. Hyperparathyroidism and hyperphosphatemia remains a problem. More patients are on intravenous Vitamin D.

Diabetes as a comorbidity was present in 28.5% of the population. 70.3% were on treatment for hypertension.

There was no significant changes in virology status. Hep B positivity was 6.4%, HCV 8.7%, HepB and HCV 1.2%.

Less patients were registered on the National Transplant waiting list (22.7%), 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).

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 Sang Wan 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 4th 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 14 doctors who are all practicing nephrologists from SGH, NUH, TTSH and the private sector.

Ms Theresa Soh (Manager of Patient Services, changed to Coordinator from May 08) headed the paramedical team comprising Nursing, Patient Welfare and Dietetic Services.

This report covers medical data collated at the end of 2008.

3. THE DIALYSIS CENTRES

The location and prevalent number of patients as of 31 Dec 2008 are listed below:

	Centre	Location	Patient No
1	KDF-Bishan Centre	Block 197, Bishan Street 13 #01-575/583	83
2	San Wang Wu Ti – KDF Centre	Block 333, Kreta Ayer Road #03-33	69
3	KDF – Ghim Moh Centre	Blk 6 Ghim Moh Road #01-188	20
	TOTAL	Haemodialysis patients	172

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 operates 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 and Isolation Station	Total
1	KDF-Bishan Centre	19 + 1	20
2	San Wang Wu Ti – KDF Centre	15 + 1	16
3	KDF – Ghim Moh Centre	10 + 1	11
	TOTAL		47

I. HAEMODIALYSIS PROGRAMME

4 STAFFING

MEDICAL

The medical staff comprises a pool of 14 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 Chan Choong Meng
2. Dr Stephen Chew
3. A/Prof Lina Choong
4. Dr Marjorie Foo
5. Dr Ho Chee Khun
6. Dr Terence Kee
7. Dr Titus Lau
8. Dr Grace Lee
9. Dr Pary Sivaraman (until from Mar 2008)
10. Dr Pwee Hock Swee
11. Dr Tan Han Khim
12. Dr Tan Seng Hoe
13. Dr Yeoh Lee Ying
14. Dr Ng Tsun Gun (from April 2008)
15. Prof A. Vathsala (until April 2008)

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 Joyce Lim joined the team in October 2007 as Nurse Clinician but resigned in May 2008 due to family commitments.

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 as at 31 Dec 2008 is listed as follows:

Centre	Renal trained	SN	AN	DT	Total
Bishan	1	8	4	4	17
SWWT	2	6	4	2	14
Ghim Moh	1	4	-	1	6
Grand total					37

Training & Education

The Patient Services Coordinator and Senior Executive together with the Senior Nursing Sisters is responsible for Training & Education for the Nursing staff. This is discussed in the Nursing report.

5 EQUIPMENT

DIALYSIS MACHINES

There are in total 48 dialysis machines.

These were located as follows:

	Baxter 1550	Baxter Tina	Fresenius 4008S
Bishan	0	11	10
Kreta Ayer	0	0	17
Ghim Moh	0	0	10

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.

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.

At the end of each dialysis day the system undergoes auto-washing and flushing before going onto standby mode.

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.

The chemical disinfectant used for RO disinfection as follows:

Bishan centre – Puristeril

SWWT centre – Hydrogen Peroxide 13%

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

Residual check 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. As the patient numbers in Ghim Moh centre was small. No hepatitis patients were catered for in that year.

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 expires in March 2010. Appropriate measures were taken to ensure that the service provider comply with the requirements. SPF conducts surprise check.

6 PATIENT CARE

Ms Theresa Soh (Coordinator of Patient Services) headed the paramedical team assisted by Ms Lay Kwee Chin (Senior Executive, Patient Services) and Ms Joyce Lim (Nurse Clinician till Jun 08).

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 Ms Lai Yi Shan, Lyvia by Asia Renalcare and Ms Liow Min Choo by Fresenius Medical Care.

PATIENT WELFARE

Ms Wong Mei Toon, Welfare Officer (joined in March 08) took over the administration and HD Welfare post from Ms Ruth Low, Social Worker (who resigned in March 08) while Ms Rena Lee was in charge of the PD patients.

Patients continue to receive subsidies for dialysis fees, erythropoietin and Calcijex on a case by case basis.

Seven (7) received civil service benefits.

Thirty-one (31) patients (18%) received Medifund subsidies from the restructured hospitals.

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.

Dialysate containing 1.8 mmol/L calcium and 11.1 mmol/L glucose was introduced in SWWT centre on 2nd December 2008 for diabetic and elderly patients.

7 THE PATIENT POPULATION

As at 31 December 2008, we had 172 patients dialysing in 3 centres – 83 patients at Bishan Centre (BS), 69 at Kreta Ayer (SWWT) and 20 patients at Ghim Moh centre.

A. INTAKE AND EXITS

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

Table 1 – Patient Stock & Flow

ENTRY	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
New Cases	32	51	25	18	27	16	10	5	18	5	10	13	18
New Cases (interim)									1	6	3	3	3
Transfers in from SDDU	28	43	1	0	0	0	0	0	0	0	0	0	0
Re-enter KDF	0	1	1	0	2	1	0	3	0	0	0	1	1
Total Entries	60	96	27	18	29	17	10	8	19	11	13	17	22
EXIT													
Transfer Out to non-KDF Programs	1	1	2	7	3	5	2	2	2	3	0	1	0
Transfer Out to KDF PD										5	3	2	2
Transplant	0	0	4	7	7	2	2	2	4	6	10	6	4*
Withdraw from Dialysis/Default	0	1	3	1	0	1	1	0	0	1	0	2	0
Deaths	2	8	3	2	9	4	5	4	6	5	11	2	9
Total Exits	3	10	12	17	19	11	10	8	12	20	24	13	15
Total No of Pt	57	143	158	159	169	174	174	174	181	172	161	165	172

* Cadaveric

Table 2 – Source of Referral

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
SDDU	28	43	1	0	0	0	0	0	0	0	0	0	0
SGH	26	45	26	17	25	15	6	5	19	8	10	14	18
NUH	5	2	0	1	4	2	3	3	0	0	2	1	2
TTSH										2	1	1	1
AH												1	0
Private	1	5	0	0	0	0	1	0	0	1	0	0	1
Total Entries	60	95	27	18	29	17	10	8	19	11	13	17	22

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

Twenty-two (22) patients were admitted to the programme in 2008: 1 after transplant graft failure (a previous patient of KDF); 3 for interim hemodialysis of which two were awaiting catheter re-insertion for peritoneal dialysis and one waiting to start PD program. The rest initiated dialysis only recently.

B. DEMOGRAPHIC & PATIENT CHARACTERISTICS

Etiology of Renal Failure

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

Table 3 – Etiology of Renal Failure in New Patients

Etiology	2003		2004		2005		2006		2007		2008	
	n	%	n	%	n	%	n	%	n	%	n	%
Chronic glomerulonephritis	5	62.5	6	31.6	1	9.1	4	30.8	4	23.5	4	18.2
Diabetic nephropathy	0	0	7	36.8	6	54.5	6	46.2	9	52.9	13	59.1
Lupus nephritis	0	0	1	5.3	1	9.1	0	0	0	0	1	4.5
Obstructive uropathy	0	0	0	0	0	0	0	0	0	0	0	0
PCKD	0	0	1	5.3	1	9.1	0	0	0	0	1	4.5
TB kidney	1	12.5	0	0	0	0	0	0	0	0	0	0
Hypertension							2	15.4	1	5.9	1	4.5
Others	2	25.0	0	0	2	18.2	1	7.7	3	17.6	0	0
Unknown Etiology	0	0.0	4	21.1	0	0	0	0	0	0	2	9.1
Total	8	100.0	19	100.0	11	100.0	13	100	17	100	22	100

As in last year, the majority of new cases were patients with diabetes mellitus (59.1%).

Table 4 – Etiology of Renal Failure in Prevalent Patients

Etiology	2003		2004		2005		2006		2007		2008	
	n	%	n	%	n	%	n	%	N	%	n	%
Chr glomerulonephritis	105	60.3	103	56.6	100	58.4	96	59.6	93	56.4	90	52.3
Diabetic nephropathy	21	12.1	27	14.8	29	16.8	28	17.4	33	20.0	40	23.3
Lupus nephritis	10	5.7	10	5.5	10	5.8	9	5.6	8	4.8	9	5.2
Obstructive uropathy	1	0.6	1	0.5	1	0.6	0	0.0	0	0	0	0
PCKD	5	2.9	5	2.7	4	2.3	2	1.2	2	1.2	2	1.2
TB kidney	2	1.1	2	1.1	2	1.2	1	0.6	1	0.6	1	0.6
HT									3	1.3	4	2.3
VUR	5	2.9	5	2.7	3	1.7	2	1.2	2	1.2	2	1.2
Others	5	2.9	5	2.7	2	1.2	9	5.6	9	5.5	8	4.6
Unknown Etiology	20	11.5	24	13.2	21	12.1	14	8.7	14	8.5	16	9.3
Total	174	100	182	100	172	100	161	100	165	100	172	100

Majority of patients (52.3%) have chronic glomerulonephritis as the primary etiology of renal failure. Patients with diabetic nephropathy have increased to 23.3%.

Gender

Table 5 – Gender of New Patients

Gender	2003		2004		2005		2006		2007		2008	
	N	%	N	%	n	%	n	%	n	%	n	%
Males	4	50.0	4	21.1	6	54.5	4	30.8	11	64.7	14	63.6
Females	4	50.0	15	78.9	5	45.4	9	69.2	6	35.3	8	36.4
Total	8	100.0	19	100.0	11	100.0	13	100.0	17	100.0	22	100.0

Table 6 – Gender of Prevalent Patients

Gender	2003		2004		2005		2006		2007		2008	
	n	%	n	%	n	%	n	%	n	%	n	%
Males	89	51.1	88	48.4	83	48.0	72	44.7	79	47.9	82	47.7
Females	85	48.9	94	51.6	90	52.0	89	55.3	86	52.1	90	52.3
Total	174	100.0	182	100.0	173	100	161	100	165	100	172	100

At the end of 2008, the ratio of male to female patients was 82:90.

Ethnic Distribution

Table 7 – Ethnic Distribution of New Patients

Race	2002		2003		2004		2005		2006		2007		2008	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Chinese	9	90.0	4	50.0	17	89.5	10	90.9	10	76.9	13	76.5	16	72.7
Malay	1	10.0	4	50.0	1	5.3	1	9.1	1	7.7	4	23.5	5	22.7
Indian	0	0	0	0	1	5.3	0	0	2	15.4	0	0	1	4.5
Others	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	10	100.0	8	100.0	19	100.0	11	100.0	13	100	17	100	22	100

Table 8 – Ethnic Distribution of Prevalent Patients

Race	2002		2003		2004		2005		2006		2007		2008	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Chinese	139	79.9	137	78.7	144	79.1	133	77.5	126	78.30	126	76.4	133	77.3
Malay	24	13.8	27	15.5	27	14.8	28	16.2	23	14.3	27	16.4	30	17.4
Indian	11	6.3	10	5.7	11	6.0	11	6.4	12	7.4	12	7.3	9	5.2
Others	0	0.0	0	0.0	0	0	0	0	0	0	0	0	0	0
Total	174	100.0	174	100.0	182	100.0	172	100.0	161	100	165	100	172	100

The ethnic distribution of our prevalent patients was 77.0% Chinese, 17.4% Malays and 5.2% Indians.

Age

The mean age at entry in 2008 was 58.8 ± 12.4 years. Only 7 patients were above the age of 65 years

Table 9: Average age of entry into the Programme

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Mean Age (years)	43	47.9	37.3	42.3	42.1	43.1	43.4	41.5	46.6	52.7	62.6	56.6	58.8
SD	8.2	6.7	9.2	10.0	11	10.6	12.1	7.3	8.8	15.1	11.8	12.9	12.4
Min												26.9	33
Max												73.0	78

Table 10: Average age of Prevalent patients on the Programme

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Mean Age (years)	44.2	42.8	45.1	46.0	47.2	46.7	47.3	48.1	48.7	50.1	52.3	53.8	55.5
SD	7.7	8.2	8.5	8.7	9.5	9.3	9.4	9.3	9.3	9.3	10.0	9.9	9.7

Age of the prevalent dialysis population at the end of 2008 was 55.5 ± 9.7 years. The mean prevalent age continues to rise as the existing population ages with a low turnover with influx of elderly new patients.

COMORBIDITY

Table 11: Common Comorbidities in Incident patients

Year	2006		2007		2008	
	n	%	n	%	n	%
Diabetic	6	46.2	11	64.7	10	45.5
IHD n other cardiac disease	3	23.1	2	11.8	5	22.7
CVA	0	0	0	0	4	18
PVD	0	0	1	5.9	1	4.5

Table 12: Common Comorbidities in Prevalent patients

Year	2004		2005		2006		2007		2008	
	n	%	N	%	n	%	n	%	n	%
Diabetics		17.6	31	17.9	36	21.8	44	26.7	45	26.2
IHD n other cardiac dis			18	10.4	33	20.0	42	25.5	37	25.1
CVA					7	4.2	7	4.2	9	5.2
PVD					5	3.0	5	5	6	3.5

The proportion of diabetics in the prevalent dialysis population was stable at 26.2% compared with the previous year's 26.7%.

About a quarter of patients had cardiac problems.

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

HOSPITALIZATIONS

Hospitalizations during the period 1 January 2008 to 31 December 2008 were analyzed and expressed as days hospitalized per patient year of dialysis programme. There were 234 hospitalization episodes in 97 patients. Thus, 54.2% of the patients were ever admitted that year.

The admission rate was 1.5 episodes per patient year or 10.1 days per dialysis year. Access problems also accounted for 35.5% of admission days

Hospitalizations during the period 1 January 2008 to 31 December 2008 were analyzed and expressed as days hospitalized per patient year of dialysis programme. There were 248 hospitalization episodes in 108 patients. Thus, 57.4% of the patients were ever admitted that year.

The admission rate was lower than the previous year at 1.3 episodes per patient year or 9.8 days per dialysis year. Access problems accounted for lesser admission days (17.6%) compared with the previous year.

Table 13: Hospitalization Days

Hospitalization	2007	2008
Days per pt year	10.2	9.75
• % due to access*	35.4	24.0
• % due to infection +	10.7	4.9
Episodes per pt year	1.5	1.3

* including infections of the access

+ excluding access related infections

Table 14: Admission Rates for Diabetics

RATES/YR	2007	<i>Rates/yr</i>	2008	<i>Rates/yr</i>
Admission days	1628	10.2	1833	9.75
• diabetic	909	25.9	870	16.7
• non-diabetic	719	5.7	963	7.1
Admission episodes	234	1.5	248	1.3
• diabetic	93	2.7	111	2.1
• non-diabetic	141	1.1	137	1.0

Admission episodes in both diabetics and non-diabetics were lower in 2008 compared with 2007. However, admission days for non-diabetics increased while that for diabetics fell.

DEATHS AND WITHDRAWALS

15 patients left the programme.

One patient was on interim haemodialysis and transferred to PD programme while the other patient failed HD and changed to PD programme.

4 patients were transplanted. All were cadaveric (deceased donor) transplants.

There were 9 deaths - 2 from IHD, 2 from cardiac causes, 1 from septicaemia, 1 – multiple myeloma, 2 – ESRD and 1 – diabetes mellitus.

C. SURVIVAL

Patient survival was analysed by the Kaplan Meier method. There were a total of 343 entries (including re-entries) into the programme.

Overall first year survival was 95.6% and 5 year survival 84.2%.

Table 15 – Survival of entire program as analysed in years 1996 - 2008

Yr of analysis	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1 yr	89%	91%	95%	94.4%	94.9%	94.8%	94.9%	95.2%	95.4%	95.5%	96.0%	95.6%
2 yr	NA	88%	92%	90.6%	91.5%	91.6%	91.9%	92.3%	93.0%	92.9%	93.1%	92.4%
3 yr	NA	NA	91%	88.6%	89.7%	90.0%	89.8%	90.4%	91.3%	91.2%	91.5%	90.5%
4 yr	NA	NA	NA	88.6%	88.9%	87.2%	87.9%	87.6%	88.3%	87.8%	88.2%	87.4%
5 yr	NA	NA	NA	NA	83.4%	82.5%	83.0%	83.3%	84.5%	84.3%	84.7%	84.2%
10 yr	NA	NA	NA	NA	NA	NA	NA	NA	NA	63.8%	68.5%	68.7%

Fig 1: Overall Patient Survival

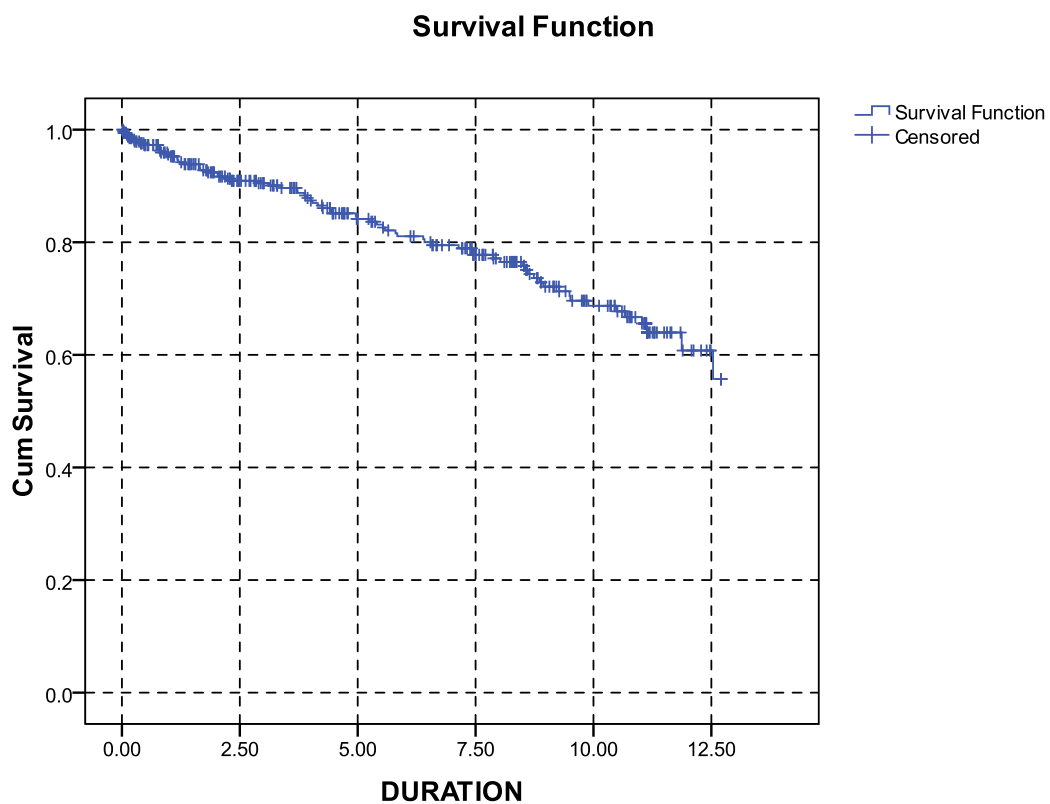
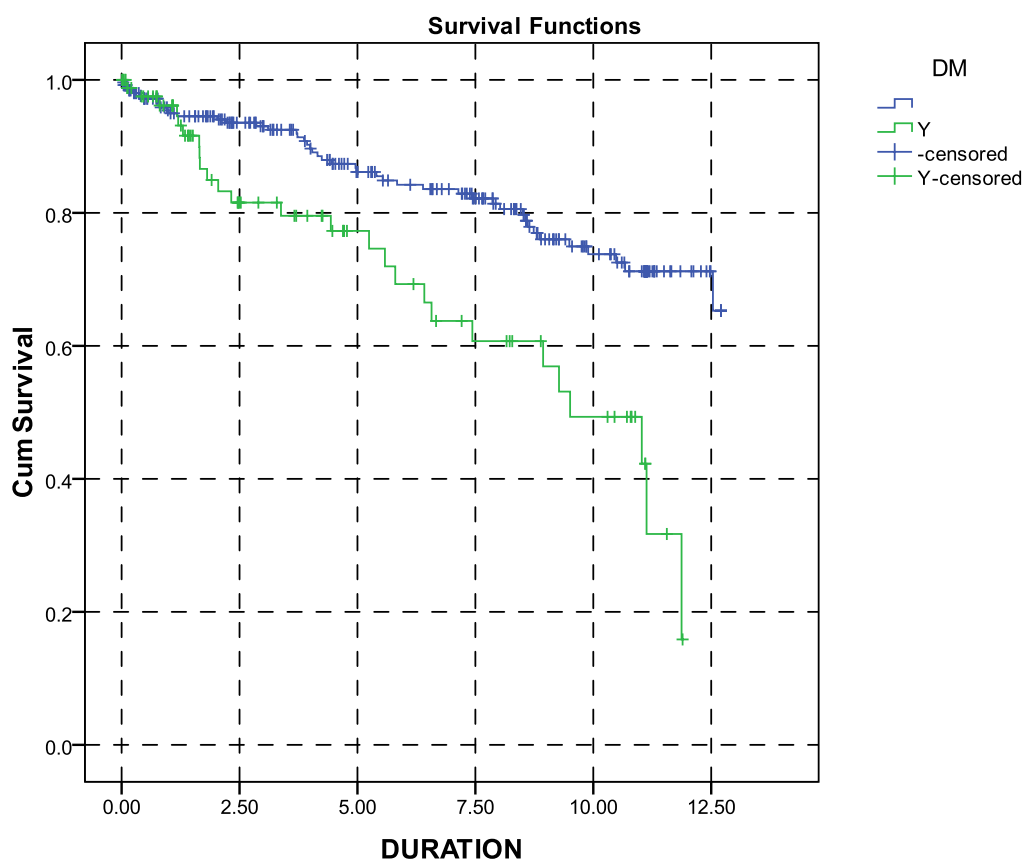


Table 16 - Survival Difference between Diabetics and Non diabetics 1996- 2008

	2007	2008
Non-DM		
1 yr	96.2%	95.4%
5 yr	86.8%	86.2%
10 yr	74.4%	73.8%
DM		
1 yr	95.4%	96.1%
5 yr	76.2%	84.9%
10 yr	41.2%	49.3%

As expected, diabetics have worse survival than non diabetics.

Fig 2: Patient Survival – Diabetic vs Non Diabetic



D. DIALYSIS PARAMETERS

All patients are on high flux dialyzers, majority being made up of 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, dialyzers used by HepB positive patients are not reused. Ghim Moh does not cater for hepatitis positive patients for the time being.

Table 17: Types of Dialyzers used

	2003		2003		2004		2005		2006		2007		2008	
	N	%	N	%	n	%	n	%	n	%	n	%	n	%
F6	2	1.2	0	0			2	1.20	1	0.6	1	0.6	3	1.7
F7	1	0.6	1	0.6	0	0	0		0	0	0	0	0	0
HF50	14	8.1	17	9.8	10	5.5	10	5.8	13	7.9	13	7.9	13	7.6
HF60	96	55.5	92	53.2	54	29.7	44	25.4	42	25.5	38	23.0	41	23.8
HF80	49	28.3	47	27.2	30	16.5	18	10.4	14	8.5	10	6.1	10	5.8
HF100	2	1.2	7	4	7	3.8	7	4.0	7	4.2	8	4.8	8	4.7
PolyFlux6L											1	0.6	1	0.6
PolyFlux11					7	3.8			1	0.6			0	0
PolyFlux14					39	21.4	48	27.7	47	28.5	54	32.7	55	32
PolyFlux17					23	12.6	26	15.0	24	14.5	25	15.2	25	14.5
PolyFlux21	7	5.2	9	5.2	11	6.0	17	9.8	15	9.1	14	8.5	15	8.7
FB210U					1	0.6	1	0.6	1	0.6	1	0.6	1	0.6
TOTAL	171	100	173	100	182	100	173	100	165	100	165	100	172	100

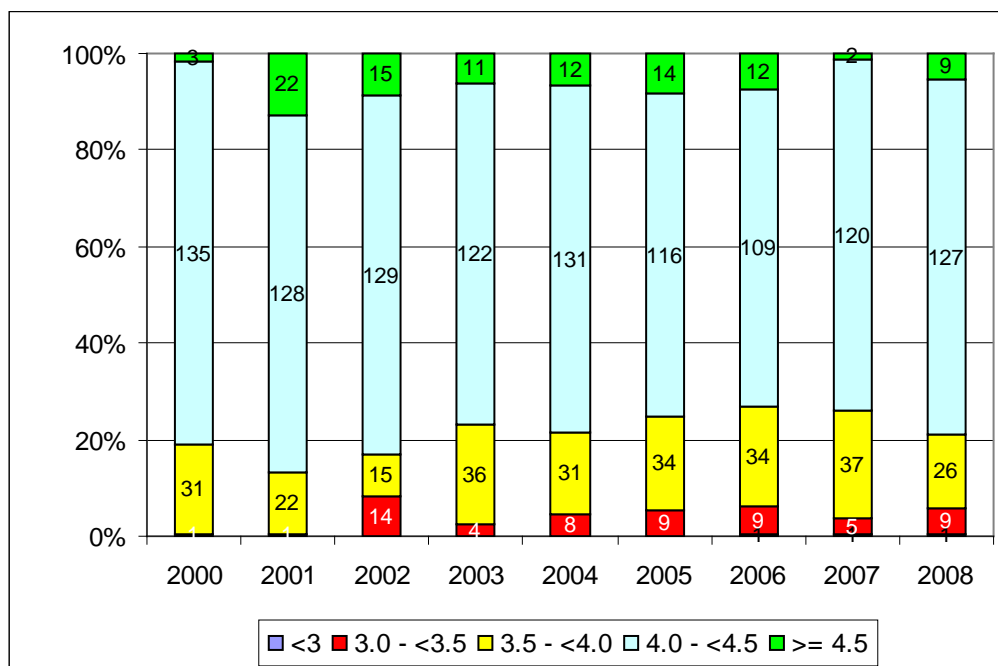
Only 2.3 % (4 patients) were on low flux dialyzers.

Table 18: Average Blood flow Used (ml/min)

ml/min	2000	2001	2002	2003	2004	2005	2006	2007	2008
Mean	264	274	281	280	278	276	274	272	273
Std Dev	29	30	33	35	33	36	34	36	34
Min	133	200	200	208	208	180	180	180	150
Max	323	350	353	364	364	400	400	360	360

Blood flow is set at a minimum of 200 ml/min averaging 273 ± 34 ml/min range (150 - 360).

Figure 3: Dialysis Time Per Session



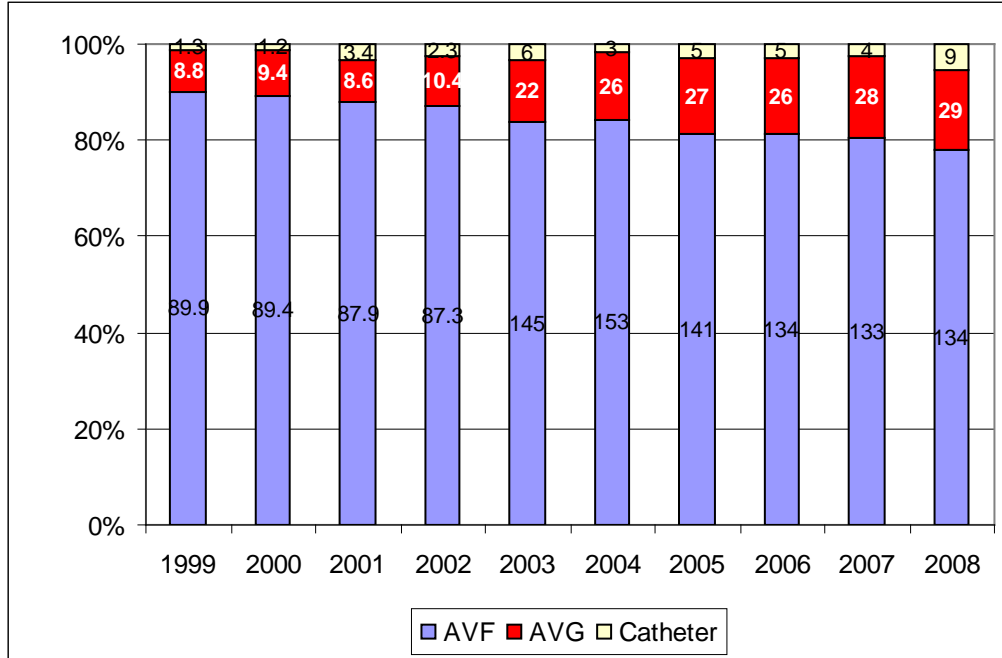
Most patients (79.1%) dialyze for 4 hours or more.

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 does not accept any hepatitis positive patients.

E. VASCULAR ACCESS

Fig 4: Vascular Access



Twenty nine patients or 16.3% (29/172) were using grafts for vascular access, approximately the same proportion as last year. This is compared to 8.8% in 1999. Nine patients were on temporary catheters (5.2%). The rest were using AV fistulae (78.5%).

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 1254 ± 649 ml/min (median 1140 ml/min). The average flow for AVG's was 966 ± 453 ml/min (median 970 ml/min). There is zero recirculation.

Any 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:

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

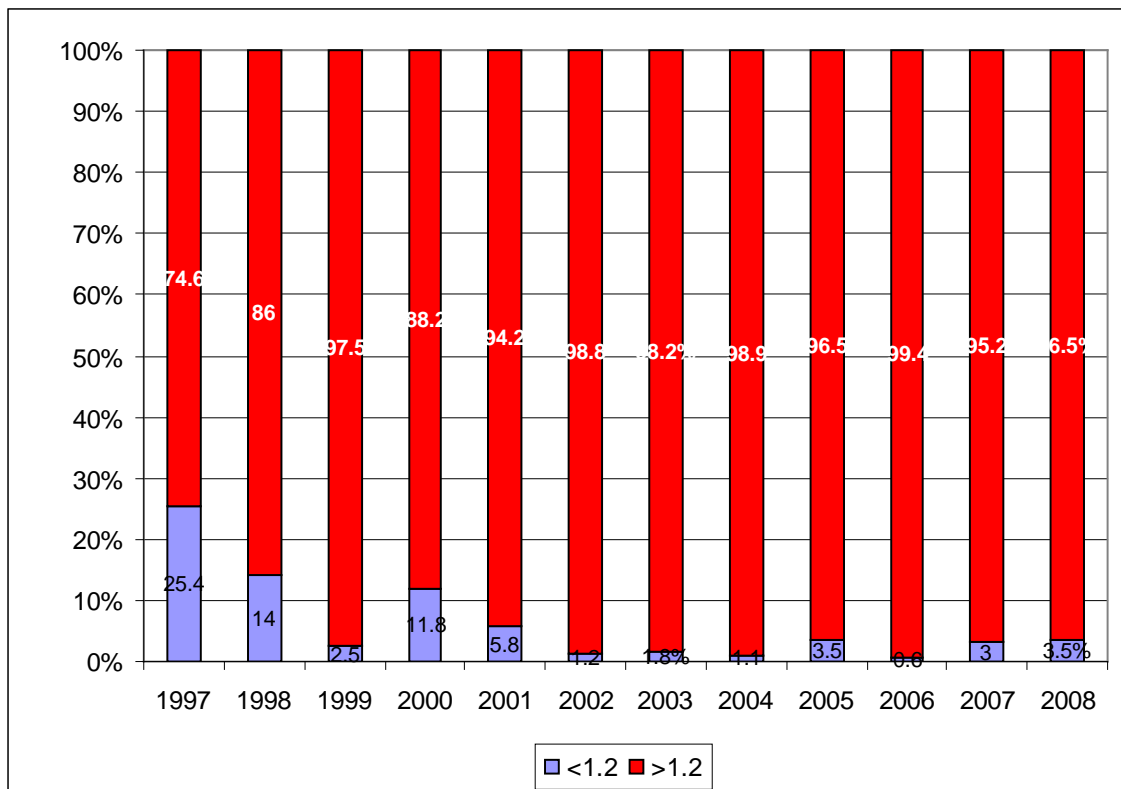
where R = post/pre urea
 UF = ultrafiltration in litres
 W = post dialysis weight

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

Our patients weighed $57. \pm 14.1$ kg (range 29.2 – 102.4 kg). Median 54.6

The proportion of patients with KT/V of 1.2 or greater in November / December 2008 was 96.5%.

Fig 5: Percentage with KT/V index > 1.2



G. ANAEMIA

The mean Hb was calculated to be 11.1 ± 1.6 g/dl (range 5.6 – 15.4). This has been stable over the past few years. The percentage of patients with a haemoglobin count of less than 10 g/dl was 23.3% same as last year.

Fig: 6: Average Hemoglobin

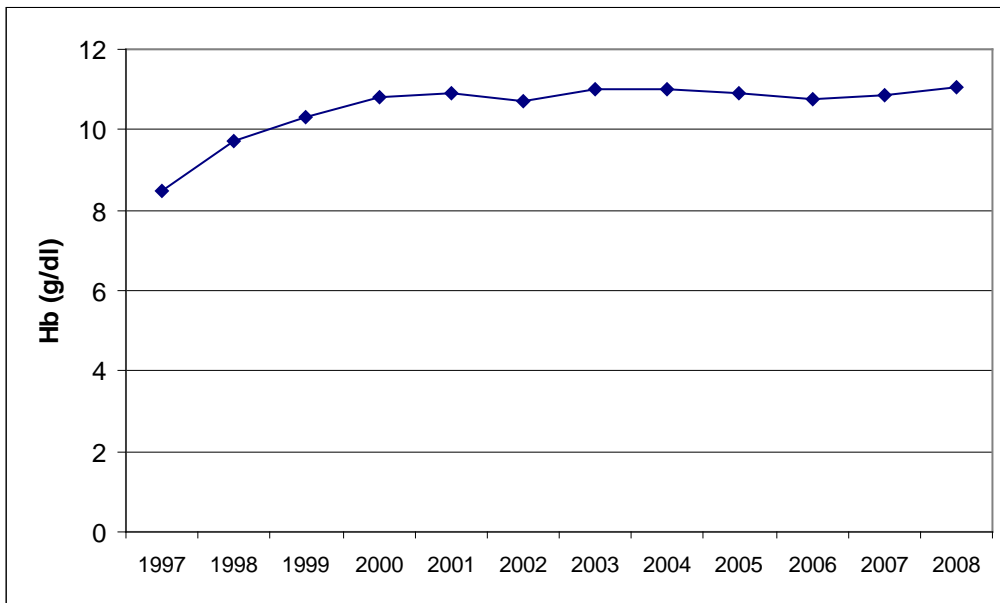
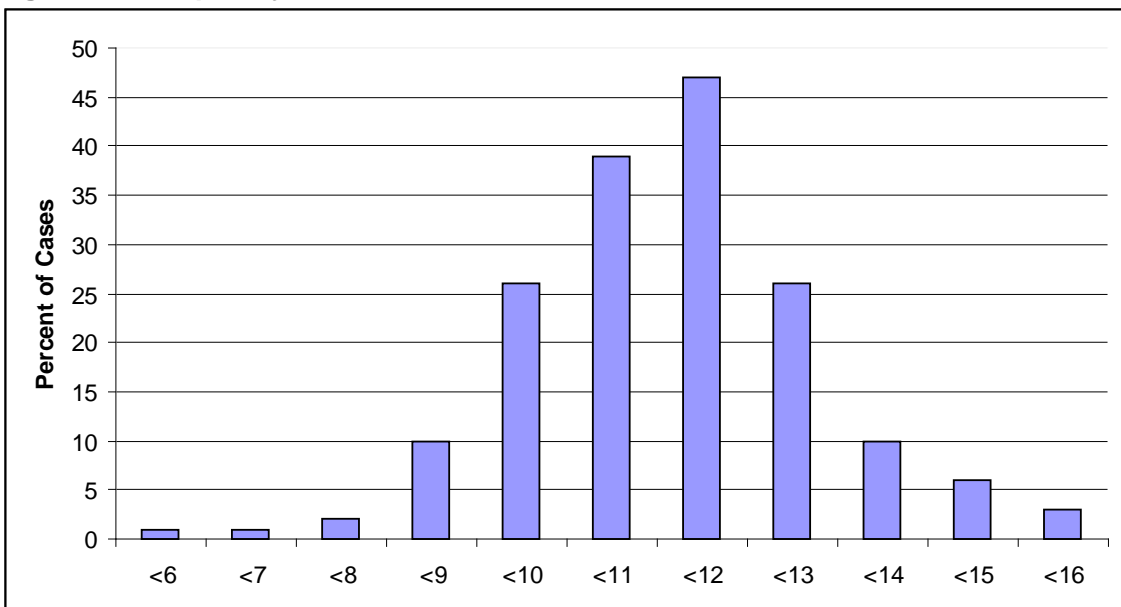


Fig: 7: Hb Frequency



ERYTHROPOIETIN

Patients are advised to start erythropoietin when their Hb falls below 10 g/dl. Target Hb while on erythropoietin is 12 g/dl. More patients (146, 84.9%) were on erythropoietin as compared to last year 138 patients, although the percentage is about the same (84.7%).

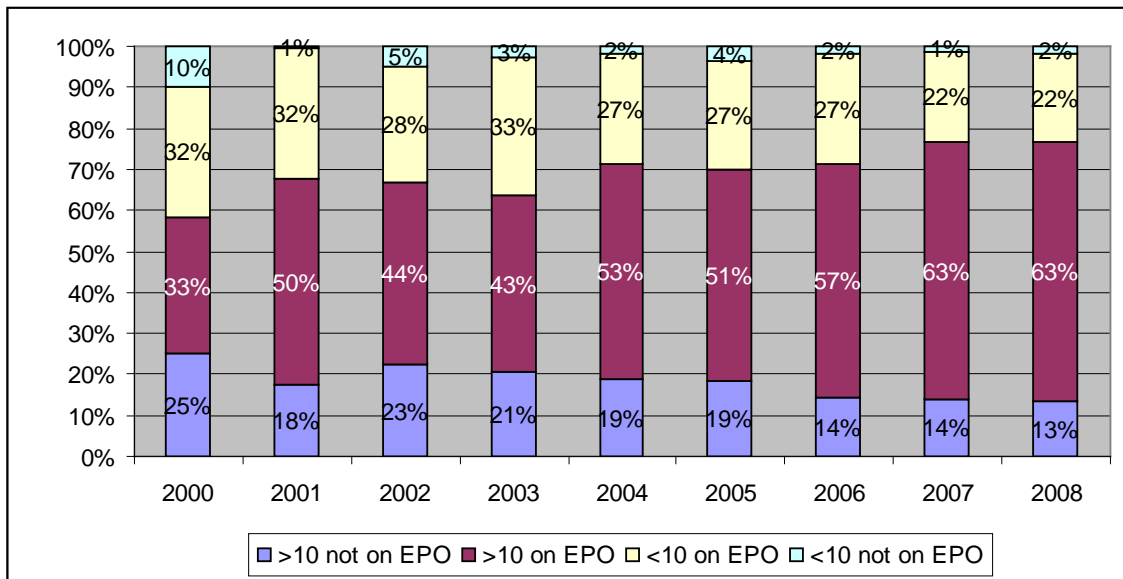
The cost of erythropoietin is Medishield claimable if the patient is eligible. In addition, patients are also eligible to apply for the Foundation's subsidy programme. There is no cap on the erythropoietin subsidy

Patients who were on EPO used on the average 88.8 ± 67.9 units/kg body weight per week lower than last year's figure of 97.2 units/kg body weight per week. 84% of patients were on EPO.

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.

26 patients (15.1%) were not on EPO. They had a mean Hb of 12.6 g/dl (range 8 – 15.4). Only 3 patients with Hb below 10 g/dl were not on EPO.

Fig 8: Use of Erythropoietin



IRON STATUS

Table 19 : Transferrin Saturation

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Mean (%)	NA	37.4	37.3	40.3	39.0	37.4	36.2	39.2	33.5	37.9
SD	NA	16.2	16.3	15.9	13.9	14.8	16	16.9	16.3	18.2
% pats w TFSat <20%	15.1	8.8	9.2	7.5	6.5	6.6	9.2	6.7	19.6%	9.9%
Average HB when TFSat<20% (g/dl)	9.5	10.7	10.5	10.4	10.2	11.2	10.6	10.5	10.7	11.4
% pats w TFSat >20%	84.9	91.2	90.8	92.5	93.5	93.4	90.8	93.3	80.4	90.1
Average HB when TFSat>20% (g/dl)	10.4	10.8	11.0	10.7	11.0	11	10.9	10.8	10.9	11

As at the end of 2008, mean transferrin saturation was 37.9 ± 18.2 % (range 6.9 – 122.7). The proportion of patients with transferrin saturation of less than 20% was 9.9%, lower than the previous year. Only 11.8% (2/17) 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 11.4 g/dl for those whose TF Sat was <20%

More patients (30) used intravenous iron (Venofer) in 2008 to replenish iron stores (as compared to 19 in 2007) while a similar number (23 patients) used it for maintenance. A subsidy scheme for Venofer was available since April 2005.

BLOOD TRANSFUSION

A total of 18 patients received 48 units of blood during admissions to hospital.

H. NUTRITION

Mean S Albumin was 33.9 ± 3.8 g/l. The number of patients with Serum albumin less than 40 g/dl was 90%.

Table 20: Normalised Protein Catabolic Rate and S Albumin

	2000	2001	2002	2003	2004	2005	2006	2007	2008
NPCR (g/kgBW)									
• Mean \pm SD	1.12 ± 0.23	1.14 ± 0.24	1.13 ± 0.23	1.14 ± 0.23	1.13 ± 0.23	1.12 ± 0.21	1.13 ± 0.22	1.14 ± 0.24	1.07 ± 0.23
• % < 1.2	62.9	63.6	63.6	62.6	63.5	68.2	63.6	63.6	75
S Albumin (g/l)									
• Mean \pm SD	37.5 ± 3.6	35.7 ± 3.5	36.9 ± 3.1	36.9 ± 3.1	36.9 ± 3.5	37.5 ± 3.4	36.8 ± 3.1	34.3 ± 3.4	33.9 ± 3.8
• % <40	73.5	87.9	81.5	80.6	81.8	72.3	77.6	95.7	90.0
• % <35	14.1	31.6	19.7	22.9	21.0	16.8	24.2	59.1	50.0

I. RENAL BONE DISEASE

Table 21 Serum Calcium levels

	1999	2000	2001	2002	2003	2004	2005	2006	2007*	2008
Mean S Calcium (mmol/L)	2.59	2.59	2.53	2.54	2.56	2.48	2.44	2.38	2.44	2.46
SD	0.2	0.2	0.21	0.21	0.19	0.23	0.25	0.22	0.21	0.20
Min								1.26	1.79	2.01
Max								2.88	3.04	3.06

* S Calcium corrected for S Albumin reported from this year

The mean corrected serum calcium value was 2.46 ± 0.2 mmol/l. Low calcium dialysate is currently in use for more than half of the patients (92/172, 53.5%).

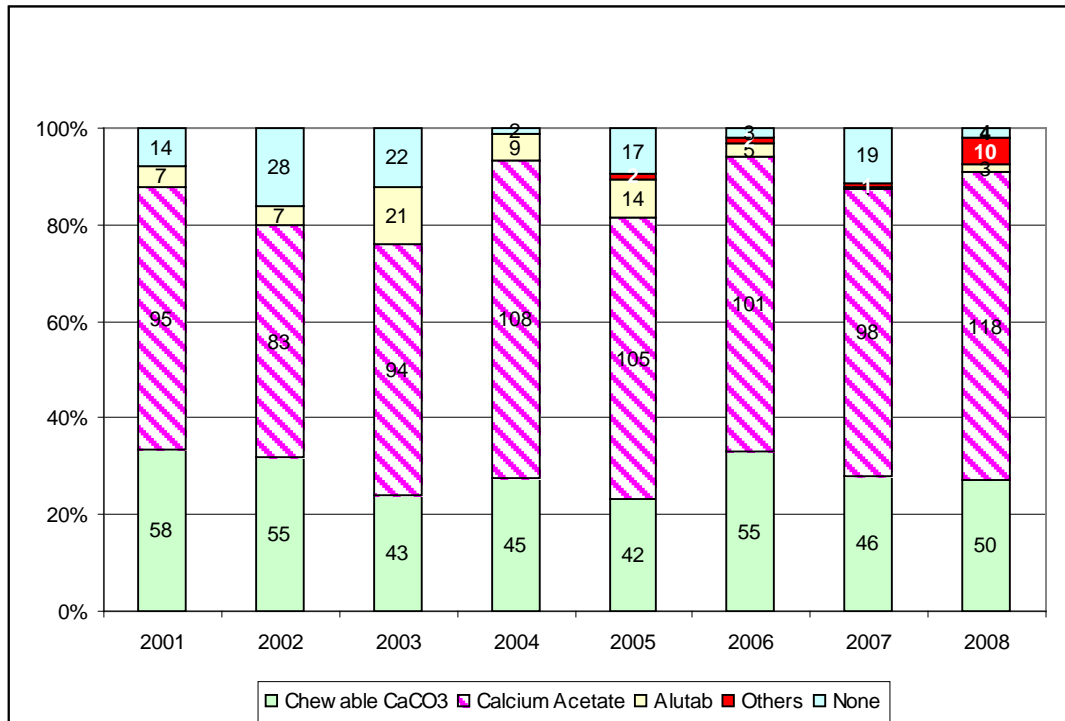
Table 22 Serum Phosphate levels

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Mean S PO4 (mmol/L)	1.81	1.84	1.83	1.85	1.92	1.89	1.88	1.75	1.79	1.55
SD	0.6	0.53	0.52	0.47	0.53	0.49	0.51	0.44	0.52	0.38
% with S PO4>2.0 mmol/l	NA	36.4	37.9	31.8	42.4	38.1	41.6	29.1	31.7	11
Min						0.4	0.38	0.49	0.66	0.62
Max						3.3	3.63	3.37	3.65	2.55

Mean S Phosphate was 1.55 ± 0.38 mmol/l. There was a significant decrease in patients having values above 2.0 mmol/l (11%) compared to last year 31.7%.

Fig 9: Phosphate binders in use

Majority of patients (68.6%) are on calcium acetate. Non calcium non-aluminum binders (Lanthanum and Renagel) are now available to selected patients. They are costly and probably out of reach of most patients. Patients may still be on calcium supplementation with regular calcium carbonate (non chewable formulation).



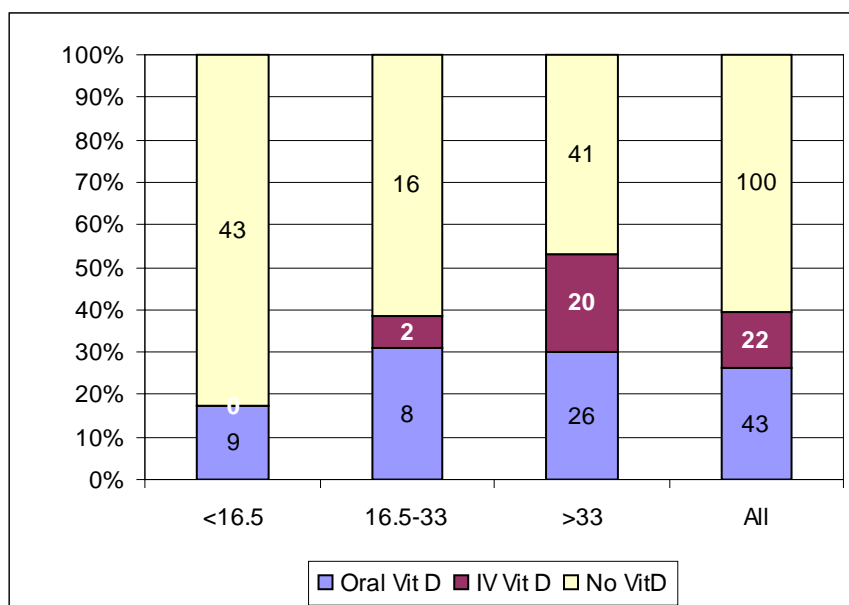
The KDOQI guidelines of 2003 (AJKD Vol 42 October 2003 Suppl 3) recommends treatment for patients on dialysis (CKD Stage 5) when iPTH exceed 33 pmol/l should be treated with Vit D analogs to main the PTH at 16.5-33 pmol/l.

Table 23: PTH levels

	2003	%	2004	%	2005	%	2006	%	2007	%	2008	%
<16.5	67	39.4	51	30.6	46	26.7	52	32.3	54	32.9	52	31.3
16.5-33	24	14.1	26	15.6	37	21.5	31	19.3	24	14.6	27	16.3
>33.0	79	46.4	90	53.8	89	51.7	78	48.4	86	52.4	87	52.4
Total	170	100	167	100	172	100	161	100	164	100	166	100

Majority (52.4%) 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 10: Parathyroid Hormone levels and Vit D Treatment



In the group with low PTH (<16.5 pmol/l) which constitutes 31.3% (52 patients) of all cases, only 5.4% (9) were on oral Vit D and none on iv Vit D.

K/DOQI now aims for a PTH level of 16.5 – 33 pmol/l. Only 15.8% of all patients had PTH values in this range. Only 27.7% (46/88) 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. Paricalcitol may be useful in these cases.

A total of 39 patients had parathyroidectomy bringing the prevalent rate to 22.7% (39/172).

J. DIABETICS

The prevalent number of diabetic patients was 49 (28.5%). This is not surprising as diabetic nephropathy is the etiology of ESRD in more than half of all new cases.

K. HYPERTENSION

70.3% have recorded high blood pressures or have their blood pressures controlled with anti-hypertensive agents.

Table 24 : Use of Antihypertensive Agents by number of Drugs

	2003	2004	2005	2006	2007	2008
None	42.5%	30.8%	38.7%	31.7%	37.0%	29.7%
1 Drug	30.5%	29.1%	28.3%	31.9%	31.5%	28.5%
2 Drugs	18.4%	17.6%	22.0%	20.7%	23.0%	27.3%
3 Drugs	8.0%	7.7%	8.7%	13.4%	6.1%	9.9%
4 drugs	0.6%	3.8%	2.3%	1.2%	2.4%	4.7%
	100.0%	100.0	100.0%	100%	100%	100%

About 30% of the patients were not on antihypertensives and another 29% on one drug only.

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

Table 25 : Use of Antihypertensive Agents by Drug Type

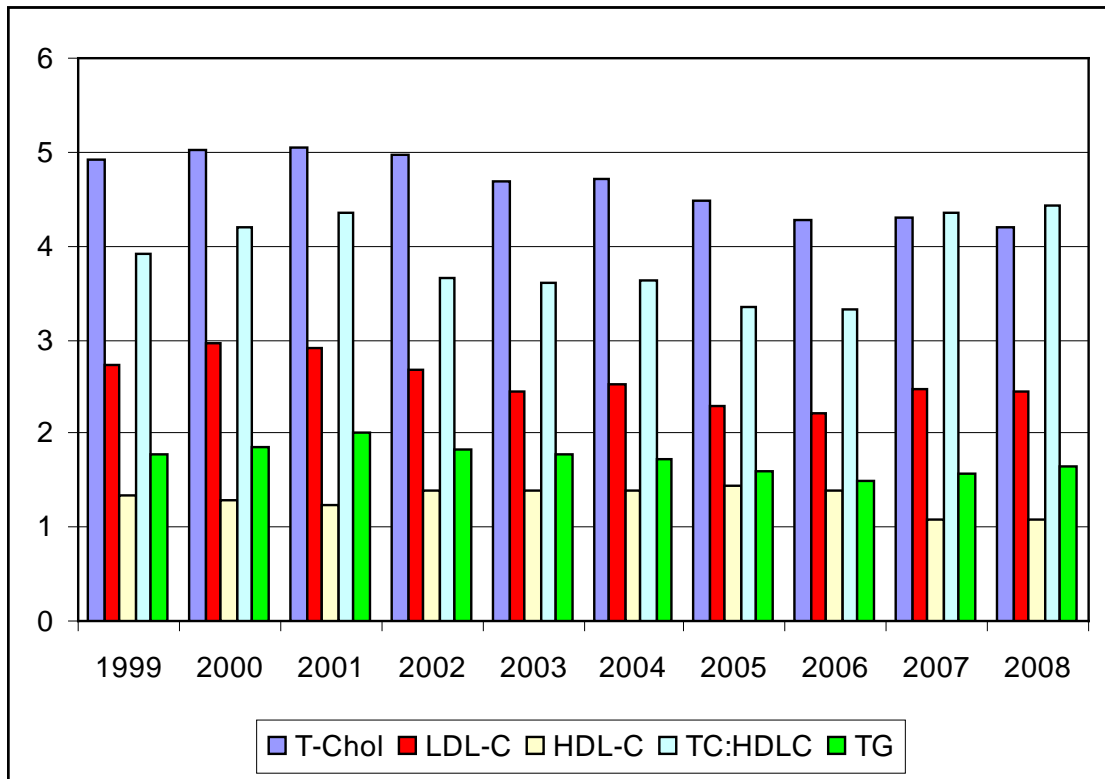
	2002	2003	2004	2005	2006	2007	2008
None	41.2%	41.6%	42.5%	38.7%	31.7%	37.0%	29.7%
Beta blockers			31.6%	43.9%	44.7%	38.8%	43.6%
Calcium channel Blockers			29.3%	31.2%	36.4%	33.3%	43.6%
ACEI / ARB			25.3%	26.0%	30.8%	26.7%	33.7%
Others			7.7%	5.8%	3.6%	4.8%	4.7%
Total			100.0%	100.0%	100%	100%	100%

These are not mutually exclusive.

L. HYPERLIPIDEMIA

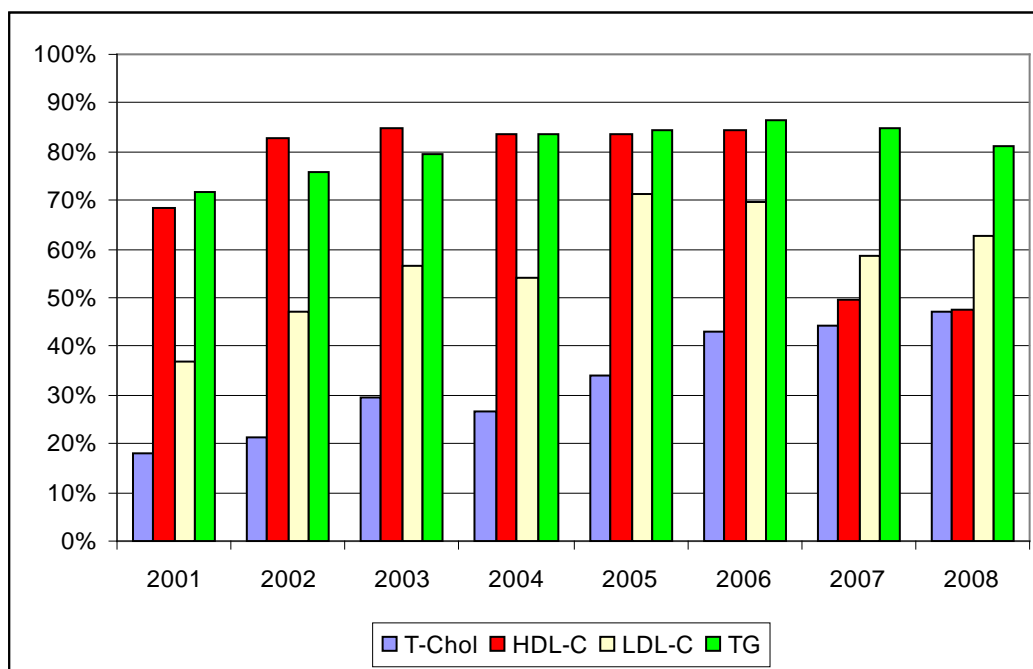
Mean total cholesterol and LDL-Cholesterol was lower than last year while total cholesterol/HDL-cholesterol ratio and triglyceride levels increased.

Figure 11: Lipids



The percentage of patients achieving MOH targets for TG (<2.3 mmol/l) remains quite high 84.8%. However, those for the rest are only around 50% - cholesterol (<4.1 mmol/l) 44.2%, HDL-cholesterol (\geq 1.0 mmol/l) 49.7%, LDL cholesterol (<2.6 mmol/l) 58.5% though the target for total cholesterol seems to be rising.

Fig 12: Percentage of patients achieving target levels as recommended by MOH guidelines 2002



The proportion of patients drug therapy has increased to 67.1%. Majority was on one drug only 61%. HMG-CoA reductase inhibitors were the most commonly used drug (60.0%),

M. HEPATITIS SEROPOSITIVITY

6.4% are hepatitis B carriers, 8.7% are anti-HCV positive for Hepatitis C antibody. Four patients had received interferon treatment and both patients' HCV PCR was negative. Two patients (1.2%) are both anti-HCV and HepBsAg positive.

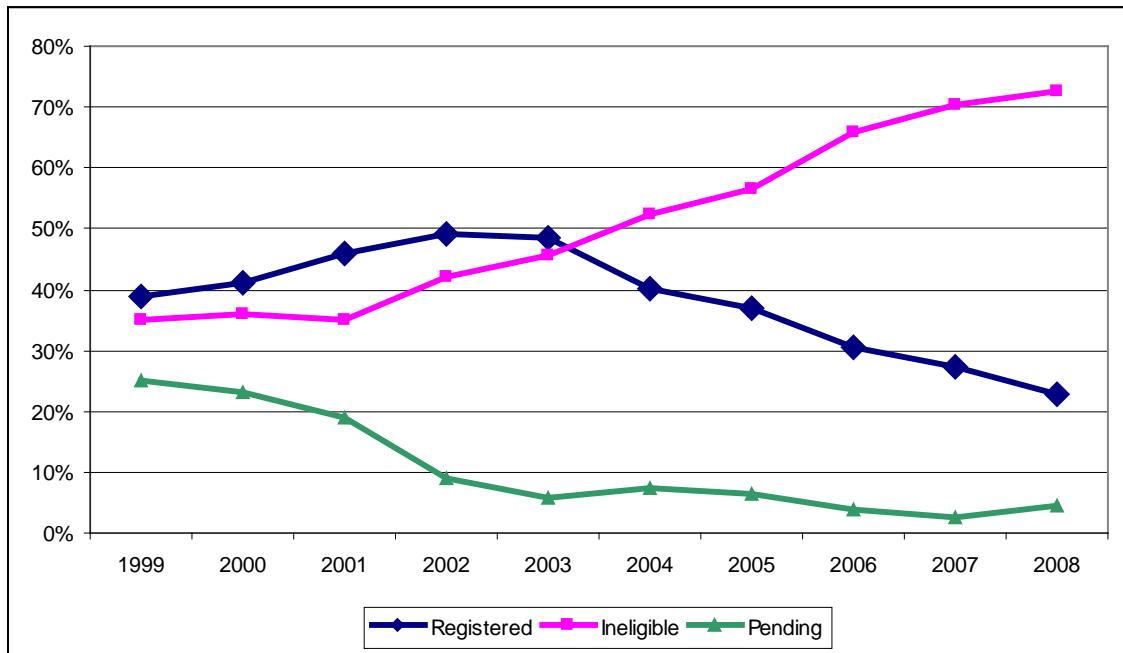
Table 26: Hepatitis Rates

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
HepB	9.8%	6.7%	6.9%	5.8%	5.7%	5.7%	7.5%	5.5%	5.2%	6.2%	6.7%	6.4%
HCV	9.8%	10.1%	9.4%	9.4%	9.7%	9.2%	11.5%	10.9%	9.8%	10.6%	9.1%	8.7%
HepB & HCV	1.4%	2%	1.9%	1.20%	1.1%	1.1%	1.7%	1.6%	1.7%	1.2%	1.2%	1.2%

N. TRANSPLANT WAITING LIST

Only 39 patients (22.7%) are on the waiting list. Only 8 patients have not been assessed. The number of ineligible patients grow as KDF takes in more patients with comorbidities since admission criteria was relaxed.

Figure 13: Proportion of patients on the Transplant Waiting List



8. CONCLUSION

Patient demographics has been changing. The typical new dialysis patient has generally more comorbidities. Meanwhile, patients taken on the program are growing older and manifesting increasing complications of the ESRD state.

Challenges for the future continues 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