KIDNEY DIALYSIS FOUNDATION

MEDICAL ANNUAL REPORT

2016

Prepared by

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1. INTRODUCTION

The Kidney Dialysis Foundation is now in its 20th year of operations having opened in 1996 with only one hemodialysis 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 this center was taken over from MOH. The second hemodialysis centre at Bishan commenced operations in November 1997 with 43 patients transferred from the former Tan Tock Seng Dialysis Centre. A third hemodialysis centre called the San Wang Wu Ti - KDF Centre started operations on 1 Sept 03. A peritoneal dialysis centre built to support peritoneal dialysis services started operations on 1 Jul 03.

The centre at AH stopped operations in April 2005 when the lease expired. KDF's 4th hemodialysis centre started operations in Ghim Moh on 16 July 2007. At the same time, the Peritoneal Dialysis Centre also shifted from Kreta Ayer to Ghim Moh.

Service Providers for the hemodialysis centres have been as follows:

	AH	**BS**	**KA**	**GM**
1996	ARC			
1997	ARC	ARC		
1998	ARC	ARC		
1999	ARC	ARC		
2000	ARC	ARC		
2001	FMC	ARC		
2002	FMC	ARC		
2003	FMC	ARC	FMC	
2004	FMC	ARC	FMC	
2005	FMC	ARC	FMC	
2006		ARC	FMC	
2007		ARC	FMC	ARC
2008		ARC	FMC	ARC
2009		ARC	FMC	ARC
2010		ARC	FMC	ARC
2011		DV *	FMC	ARC
2012		DV	FMC	DV *
2013		DV	FMC *	DV
2014		DV	FMC	DV
2015		DV	FMC	RT*DV
2016		DV *	FMC	RT

Legend: ARC = AsiaRenalCare
FMC = Fresenius Medicare
RT = Renal Team
RT*DV= Davita until Sep2015, taken over by Renal Team
* Contract renewed

Dialysis medical care is currently provided by a team of practicing nephrologists from SGH, NUH, TTSH, KTPH and the private sector.

Ms Lay Kwee Chin (Nurse Manager, Patient Services) and Ms Sunitha d/o Silvanathan (Clinical Nurse) headed the paramedical team comprising Nursing, Patient Welfare and Dietetic Services.

This report covers medical data collated at the end of 2016.

2. THE DIALYSIS CENTRES

The location and prevalent number of patients as of 31 Dec 2016 are listed below:

	Centre	Location
1	KDF-Bishan Centre	Block 197, Bishan Street 13 #01-575/583
2	San Wang Wu Ti – KDF Centre	Block 333, Kreta Ayer Road #03-33
3	KDF – Ghim Moh Centre	Blk 6 Ghim Moh Road #01-188
4	KDF Peritoneal Dialysis	Blk 6 Ghim Moh Road #01-188

Dialysis Stations and Patient number

	Centre	No. of Regular + Isolation Stations	Total stations	Patient No
1	KDF-Bishan Centre	19 + 1 isolation	20	93
2	San Wang Wu Ti – KDF Centre	15 +1 isolation	16	70
3	KDF – Ghim Moh Centre	19 +1 isolation	20	78
4	Peritoneal Dialysis Centre	Not applicable	Nil	25

All haemodialysis centres operate 3 shifts a day.

HAEMODIALYSIS PROGRAMME

2016

3. EXECUTIVE SUMMARY (HD)

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

Two dialysis providers, Fresenius Medical Care and DaVita Renal, 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 2015, there were 23 new entrants.

Thirty-six (36) patients exited the programme (1 transplant, 17 deaths, 1 transfers to PD programme, 12 to non-PD programmes, 4 withdrew from dialysis/terminated and 1 incarcerated). In the prevalent population, average age was 59.9 $\pm$ 10.8 years, the number of patients with chronic glomerulonephritis as the etiology of renal failure was 37.4%, diabetic nephropathy 38.6%.

All patients (100%) are using high flux dialysers. Average blood flow was 282 $\pm$ 36.9 ml/min. 93.1% of patients dialyse 4 hours or more. 80.1% of patients use a native arteriovenous fistula. Dialysis adequacy as measured by single pool KT/V is >1.2 in 96.3% of patients.

Mean hemoglobin was 11.0 $\pm$ 1.4 g/dl. About 86% of all patients are on EPO. About 7.3 % of patients are considered Fe deficient.

There has been significant improvement in S Albumin of with only 45.5% of patients having Albumin<40 g/l compared with 49.8% the previous year.

Diabetes as a comorbidity was present in 46.6% of the population.

There was no significant changes in virology status. Hep B positivity was 5.3%, HCV 6.9%, HepB and HCV 0.4%.

Less patients were registered on the National Transplant waiting list (9.2%), likely due to more patients having comorbidities in an aging population and a large influx of new patients.

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 Titus Lau
5. Dr Grace Lee
6. Dr Pwee Hock Swee
7. Dr Tan Han Khim
8. Dr Tan Seng Hoe
9. Dr Yeoh Lee Ying
10. Dr Ng Tsun Gun
11. Dr Adrian Liew (step down wef April 2016)
12. Dr Timothy Koh (with effect from May 2016)
13. Dr Manish Kaushik
14. Dr Sobhana T
15. Dr Kwek Jia Liang
16. Dr Teo Su Hooi (with effect from Oct 2016)
17. Dr Htay Htay

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

NURSING

The overall standard of nursing is overseen by Ms Lay Kwee Chin, Nurse Manager and Ms Sunitha Silvanathan, Clinical Nurse.

Routine audits are performed on the service provider to maintain standards.

The Dialysis Providers are:

- Fresenius Medicare at San Wang Wu Ti (Kreta Ayer) Centre (contract renewed in Aug 2013, to end Jul 2018)
- DaVita Renal at Bishan Centre (contract renewed from May 2016, to end April 2021)
- Renal Team at Ghim Moh Centre (contract from Oct 2015 to end Sep 2020)

The Dialysis Provider is responsible for rostering of the nursing services. Staff numbers inclusive of the charge nurse as at 31 Dec 2016 is listed as follows:

Centre	Renal trained SN	SN	AN	DT	Total
Bishan	3	13	1	0	17
SWWT	0	13	2	0	15
Ghim Moh	1	14	2	0	17
Grand total					49

Training & Education

The Nurse Manager and Clinical Nurse, together with the Centre Charge Nurses are responsible for Training & Education for the service provider nursing staff. This is discussed in the Nursing report.

5 EQUIPMENT

DIALYSIS MACHINES

There are in total 59 dialysis machines.

These were located as follows:

	Fresenius 4008S	Gambro AK96
Bishan	0	21
Kreta Ayer	0	17
Ghim Moh	*21	0

*14 machines were replaced November 2015 with F4008SNG, Fresenius Medical Care. 7 machines were replaced January 2016 with F4008SNG, Fresenius Medical Care.

WATER TREATMENT SYSTEMS

Water Treatment is essential for safe hemodialysis therapy.

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.

Centre	Vendor	Year Installed
Bishan	Gambro	2009
Kreta Ayer	Gambro	2012
Ghim Moh	Transmedic	2007

The systems at Ghim Moh and SWWT centres undergo auto-washing and flushing before going onto standby mode at the end of each dialysis day whereas in Bishan centre the RO system will perform daily integrated heat disinfection at the end of each day.

Daily monitoring of RO system pressure parameters and chloramine checks are carried out at the beginning of the day before priming and mid shift. Chemical disinfection is done 6 monthly by the vendors for Ghim Moh centre. In Bishan and SWWT centres membrane disinfection is performed every 2 months by the nurses.

The chemical disinfectant used for RO disinfection as follows:

Bishan and SWWT centres – Dialox
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 performed 2 monthly meeting local and international 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 7 Renatron machines in the two centres (four in Bishan and three in Kreta Ayer) linked to the Renalog Reprocessing Management (RM).

Ghim Moh centre managed by Renal Team started single use in Oct 2015, the two Renatron machines, one was transferred to Bishan centre for use and one was put away.

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 renewed every 2 years.

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

Purchase of renalin requires an NEA licence which was renewed in 2016.

6 PATIENT CARE

Ms Lay Kwee Chin (Nurse Manager) and Ms Sunitha (Clinical Nurse) together oversee 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 Ms Lim Chi Lee by DaVita, Lee Sze Mien by Renal Team and Ms Liow Min Choo by Fresenius Medical Care.

PATIENT WELFARE

Mr Jeffrey Loy was the Welfare Executive in charge of SWWT and PD till October 2016. Mr Justin Lim took over in October 2016. Ms Viviene Lim continued to be in charge of Bishan and Ghim Moh patients since 28 Jul 2015.

Consistent with its mission, KDF patients are heavily subsidised.

The number of Medifund recipients were as follows:

Year	No of Patients	% of HD pt
2011		40.3
2012	105	44.7
2013	149	55.6
2014	86	33.2
2015	82	33.3
2016	125	51.9%

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

* As of 23 Aug 2016, IV Calcijex was switched to IV One Alpha.

One (1) patient has civil service benefits.

DIALYSIS REVIEWS

Apart from the rounds which are carried out on a monthly basis by the doctors, problem cases are reviewed at Patient Services meetings by the Senior Nurse Clinician, Clinical Nurse or designee and Staff Nurse in charge of the patient with the Medical Director.

REPORTING OF INCIDENTS AND ADVERSE OUTCOMES

As mandated by MOH mortality statistics were provided to MOH on prescribed on their format since December 2011. This format was stopped in 2014. According to MOH circular No. MH24:60/8 internal Quality Assurance Committee comprising Medical Director, KDF General Manager, and Service Provider Manager and nursing personnel was set up to review adverse events and mortality and morbidity cases regularly. These meetings are held once every 2 months with the providers.

A process of incident reporting of adverse events is in place. Immediate action if required will be carried out by Dialysis Provider and reported to KDF Administration within 24 hours.

7 THE PATIENT POPULATION

KDF haemodialysis centres provide long term low dependency dialysis to the needy. Application requires both a social assessment as well as a medical assessment.

Aside from the provision of long term hemodialysis, KDF also provides:

A) An interim haemodialysis scheme started in May 2009 for patients temporarily requiring hemodialysis at a cheaper rate while awaiting permanent placement, PD patients temporarily on hemodialysis and bridging to transplantation.

B) Subsidies for KDF patients turning high dependency and considered unsuitable for low dependency dialysis. This was started in Dec 2009 to enable the patients to continue dialysis in a private sector where physician care/advice could be rendered more quickly.

As at 31 December 2016, we had 241 patients dialysing in 3 centres – 93 patients at Bishan Centre (BS), 70 at Kreta Ayer (SWWT) and 78 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

ENTRY	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
New Cases	10	13	18	26	28	12	32	31	12	11	2
New Cases (interim)	3	3	3	7	7	15	31	31	13	10	16
Re-enter KDF	0	1	1	0	3	2	2	0	3	2	4
Total Entries	**13**	**17**	**22**	**33**	**38**	**29**	**65**	**62**	**28**	**23**	**22**
EXIT											
Transfer Out to non-KDF Programs	0	1	0	5	1	7	5	3	10	12	11
Transfer Out to KDF PD	3	2	2	1	2	3	7	3	4	1	2
Transplant	10	6	4	4	2	1	4	2*	2	1	0
Withdraw from Dialysis/Default	0	2	0	1	4	4	2	3	5	5	1
Deaths	11	2	9	8	8	20	13	18	16	17	13
Total Exits	**24**	**13**	**15**	**19**	**17**	**35**	**31**	**29**	**37**	**36**	**27**
Total No of Pt	**161**	**165**	**172**	**186**	**207**	**201**	**235**	**268**	**259**	**246**	**241**

* Cadaveric/Deceased Donor

Table 7A-2 –Mode of Dialysis

Interim HD		17
- Newly initiated subsequently permanent HD	12	
- Newly initiated awaiting PD	0	
- Newly initiated Bridge to Transplant	0	
- PD complications for temp HD	2	
- PD complications to permanent HD	2	
- Failed tx, back on HD	0	
- had been on dx, transferred from other VWO centre	1	
Permanent HD [not via interim route]		5
- newly initiated	2	
- failed PD program, re-enter program	0	
- had been on HD, transferred to VWO from private	0	
- failed tx, back on HD	0	
- Re enrty	3	
TOTAL		22

Table 7A-3 – Source of Referral

	2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
SGH	14	18	16	25	22	52	53	25	22	19
NUH	1	2	11	8	3	6	8	1	1	3
TTSH	1	1	1	2	1	3	0	1	0	0
AH / KPTH	1	0	4	3	3	4	1	1	0	0
Private	0	1	1	0	0	0	0	0	0	0
Total Entries	**17**	**22**	**33**	**38**	**29**	**65**	**62**	**28**	**23**	**22**

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

	2012		2013		2014		2015		2016	
Etiology	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Chronic GN	18	*27.7*	13	*21.0*	*3*	10.7	*8*	34.8	3	13.6
Diabetic nephropathy	*27*	*41.5*	37	*59.7*	*16*	57.1	*13*	56.5	15	68.2
Lupus nephritis	1	*1.5*	0	*0*	*0*	0	*0*	0	0	0
Obstructive uropathy	1	*1.5*	0	*0*	*1*	3.6	*0*	0	1	4.5
PCKD	2	*3.1*	0	*0*	*0*	0	*0*	0	0	0
TB kidney	*1.5*	0	*0*	*0*	*0*	0	*0*	0	0	0
Hypertension	2	*3.1*	3	*4.8*	*2*	7.1	*0*	0	2	9.1
Others	6	*9.2*	6	*9.7*	*5*	17.9	*1*	4.3	1	4.5
Unknown Etiology	6	*9.2*	3	*4.8*	*1*	3.6	*1*	4.3	0	0
Total	65	*100*	62	*100*	*28*	100	*23*	100	22	100

The majority of new cases were patients with diabetes mellitus (68.2%) and chronic GN (13.6%).

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

	2012		2013		2014		2015		2016	
Etiology	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Chronic GN	96	*41.4*	97	*36.2*	92	*35.5*	92	*37.4*	88	*36.5*
Diabetic nephropathy	69	*29.7*	98	*36.6*	97	*37.5*	95	*38.6*	97	*40.5*
Lupus nephritis	9	*3.9*	9	*3.4*	9	*3.5*	8	*3.3*	7	*2.9*
Obstructive uropathy	2	*0.9*	2	*0.8*	3	*1.2*	3	*1.2*	4	*1.7*
PCKD	8	*3.4*	10	*3.7*	7	*2.7*	5	*2.0*	5	*2.1*
TB kidney	2	*0.9*	2	*0.8*	2	*0.7*	2	*0.8*	2	*0.8*
HT	7	*3.0*	10	*3.7*	10	*3.9*	8	*3.3*	8	*3.3*
VUR	3	*1.3*	3	*1.1*	3	*1.2*	2	*0.8*	2	*0.8*
Others	17	*7.3*	18	*6.7*	18	*6.9*	16	*6.5*	15	*6.2*
Unknown Etiology	22	*9.4*	21	*7.8*	18	*6.9*	15	*6.1*	13	*5.4*
Total	232	*100*	268	*100*	259	*100*	*246*	*100*	*241*	*100*

There are now more patients with diabetic nephropathy (40.5%) than chronic glomerulonephritis (36.5%)

Gender

Table 7B-3 – Gender of New Patients

	2011		2012		2013		2014		2015		2016	
Gender	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Males	18	*62.1*	28	*43*	37	*59.7*	*20*	*71.4*	*11*	*47.8*	13	*59.1*
Females	11	*37.9*	37	*57*	25	*40.3*	*8*	*28.6*	*12*	*52.2*	9	*40.9*
Total	29	*100*	65	*100*	62	*100*	*28*	*100*	*23*	*100*	*22*	*100*

Table 7B-4 – Gender of Prevalent Patients

	2011		2012		2013		2014		2015		2016	
Gender	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Males	96	*47.5*	112	*47.7*	133	*49.6*	*130*	*50.2*	*120*	*48.8*	117	*48.5*
Females	105	*52.4*	123	*52.3*	135	*50.4*	*129*	*49.8*	*126*	*51.2*	124	*51.5*
Total	201	*100*	235	*100*	268	*100*	*259*	*100*	*246*	*100*	241	*100*

At the end of 2016, the ratio of male to female patients was 1:1.06.

Ethnic Distribution

Table 7B-5 – Ethnic Distribution of New Patients

	2011		2012		2013		2014		2015		2016	
Race	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Chinese	20	*67.0*	37	*56.9*	39	*62.9*	*21*	*80.8*	*12*	*52.2*	19	*86.4*
Malay	8	*27.6*	18	*27.7*	17	*27.4*	*2*	*7.7*	*7*	*30.4*	2	*9.1*
Indian	1	*3.4*	9	*13.8*	6	*9.7*	*3*	*11.5*	*4*	*17.4*	1	*4.5*
Others	0	*0*	1	*1.5*	0	*0*	*0*	*0*	*0*	*0*	0	*0*
Total	29	*100*	65	*100*	62	*100*	*26*	*100*	*23*	*100*	*22*	*100*

Table 7B-6 – Ethnic Distribution of Prevalent Patients

	2012		2013		2014		2015		2016	
Race	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Chinese	163	*69.4*	184	*68.7*	*180*	*69.5*	*169*	*68.7*	166	*68.9*
Malay	54	*23*	61	*22.8*	*59*	*22.8*	*55*	*22.4*	55	*22.8*
Indian	17	*7.2*	22	*8.2*	*20*	*7.7*	*22*	*8.9*	20	*8.3*
Others	1	*0.4*	0	*0*	*0*	*0*	*0*	*0*	0	*0*
Total	235	*100*	268	*100*	*259*	*100*	*246*	*100*	241	*100*

The ethnic distribution of our prevalent patients was 68.9% Chinese, 22.8% Malays and 8.3% Indians.

Age

The mean age at entry in 2016 was 62.8 $\pm$ 12.9 years (median, 63.4). Eight (8) patients were above the age of 65 years

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

Year	2010	2011	2012	2013	2014	2015	2016
Mean Age (years)	56.7	56.9	56.5	56.1	59.1	58.0	62.8
SD	10.4	12.5	12.5	9.3	12.5	14.9	12.9
Min	34.5	32.7	23.5	30.7	30.6	29.0	33.0
Max	81.9	78.9	80.2	74.1	78.0	85.1	84.2

Average age of new patients with diabetic nephropathy was 68.3 years compared with 55.0 years in non-diabetics.

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

Year	2010	2011	2012	2013	2014	2015	2016
Mean Age (years)	57.4	57.7	58.7	58.7	59.5	59.9	60.7
SD	10.3	10.8	10.8	10.5	10.6	10.8	10.9
Min		28.0	29.0	30.0	31.4	29.3	30.3
Max		86.0	87.0	88.0	89.0	86.0	86.0

Age of the prevalent dialysis population at the end of 2016 was 60.7 $\pm$ 10.9 years (median 61.6). 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	2012		2013		2014		2015		2016	
	n	%	n	%	n	%	n	%	n	%
Diabetic	31	47.7	35	59.3	8	30.8	14	60.9	14	63.6
IHD n oth cardiac dis	21	32.3	20	33.9	7	26.9	9	39.1	8	36.4
CVA	1	1.5	1	1.7	2	7.7	1	4.3	2	9.1
PVD	6	9.2	7	11.9	0	0	3	13.0	2	9.1

Table 7B-10 – Common Comorbidities in Prevalent patients

Year	2012		2013		2014		2015		2016	
	n	%	n	%	n	%	n	%	n	%
Diabetics	81	34.5	107	39.9	110	42.5	115	46.6	106	43.9
IHD n oth cardiac	46	19.6	71	26.5	77	29.7	60	24.4	67	27.8
CVA	11	4.7	12	4.5	14	5.4	13	5.3	10	4.1
PVD	11	4.7	15	5.6	11	4.2	12	4.9	14	5.8

The proportion of diabetics in the prevalent dialysis population has decreased to 43.9%.

The proportion of patients with cardiac problems has increased 27.8%.

HOSPITALIZATIONS

Hospitalizations during the period 1 January 2016 to 31 December 2016 were analyzed and expressed as episodes and days hospitalized per patient year of dialysis programme. There were 512 hospitalization episodes in 184 patients. Thus, 68.7% of the patients were ever admitted that year.

Table 7B-11 – Admission Rates

	2012		2013		2014		2015		2016	
	No	%	No	%	No	%	No	%	No	**%**
No of Patients admitted in ref year	180/266	67.7	212/296	71.6	209/294	71.1	199/282	70.6	184/268	68.7
- Diab pt adm / all diab	80/99	80.8	99/129	76.7	117/126	92.9	117/122	95.9	96/111	86.5
- Non-diab pt adm / all	100/154	64.9	113/167	67.7	92/168	54.8	82/160	51.3	88/157	56.1

RATES/YR	2012	*Per yr*	2013	*Per yr*	2014	*Per yr*	2015	*Per yr*	2016	*Per yr*
Admission episodes	521	2.4	627	2.1	618	2.3	556	2.0	512	2.1
• diabetic	239	2.9	294	2.7	358	3.1	335	2.5	262	2.7
• non-diabc	282	2.1	333	2.3	260	1.7	221	1.5	250	1.7
Admission days	3928	17.8	5384	20.9	5766	21.7	5272	20.4	4298	17.6
• diabetic	2084	25.1	2378	21.8	3432	29.7	3326	28.2	2160	22.4
• non-diab	1844	13.4	3006	20.3	2334	15.5	1946	13.6	2138	14.5

The admission rate was 2.1 episodes per patient year. Days admitted per dialysis year reduced to 17.6. Not unexpectedly, diabetics had higher number of days (22.4) admitted compared with non-diabetics (14.5).

Access problems accounted for 19.8% of admission days (19.0% in diabetics, 20.5% in non-diabetics.

DEATHS AND WITHDRAWALS

A total of 14 patients left the programme. Reasons were as follows:

- 2 patients were on interim haemodialysis and transferred to PD programme
- 1 patient to NKF PD programme
- 1 patient terminated from dialysis treatment to private centre
- 9 patients transferred to other centres (6 to NKF; 3 to high dependency dialysis.

One temporarily dialyzed at a private centre subsidized by KDF while undergoing rehabilitation in a community hospital. He is expected to return to KDF.

There were 13 deaths –

- 5 from cardiac
- 3 from pneumonia
- 1 from hepato-biliary condition
- 1 from CVA
- 1 from intracranial haemorrhage
- 2 died at home

Table 7B-13 – Deaths and Withdrawals

	2011	2012	2013	2014	2015	2016
Transfers						
- PD	3	7	3	4	1	3
- Other	7	5 (hi-dep)	3 (1 hi-dep)	10 (5 hi-dep)	12 (9 hi-dep)	10 (3 hi dep)
Transplants	1	4	2	2	1	0
Withdrawals	4	2	2	5	5	1
Deaths	20	13	18	16	17	13
Total	**35**	**31**	**28**	**37**	**36**	**27**

D. DIALYSIS PARAMETERS

We aim to put all patients are on high flux dialyzers.

Table 7D-1: Types of Dialyzers used

	2011		2012		2013		2014		2015		2016	
	n	***%***	**n**	***%***	**n**	***%***	**n**	***%***	**n**	**%**	**n**	**%**
F6	2	*1*	0	*0*	6	*2*	*1*	*0.4*	0	*0*	0	*0*
HF50	21	*10*	22	*9.4*	19	*7*	*17*	*6.6*	14	*5.7*	7	*2.9*
HF60	49	*24*	60	*25.5*	66	*25*	*62*	*23.9*	63	*25.6*	33	*13.7*
HF80	32	*16*	36	*15.3*	51	*19*	*56*	*21.6*	54	*22.0*	21	*8.7*
HF100	12	*6*	14	*6*	24	*9*	*24*	*9.3*	24	*9.8*	14	*5.8*
PolyFlux6L	0	*0*	3	*1.3*	0	*0*	*1*	*0.4*	0	*0*	0	*0*
F70S	0	*0*	0	*0*	0	*0*	*23*	*8.9*	0	*0*	0	*0*
PolyFlux14*	45	*22*	56	*23.8*	46	*17*	*24*	*9.3*	41	*16.7*	76	*31.5*
PolyFlux17*	30	*15*	33	*14*	43	*16*	*39*	*15.1*	37	*15*	61	*25.3*
PolyFlux21*	10	*5*	11	*4.7*	13	*5*	*12*	*4.6*	13	*5.3*	29	*12.1*
TOTAL	201	*100*	235	*100*	268	*100*	*259*	*100*	246	*100*	241	*100*

Note: * The name of polyflux high flux dialyzers were changed to Polyflux14H, Polyflux17H and Polyflux21H respectively.

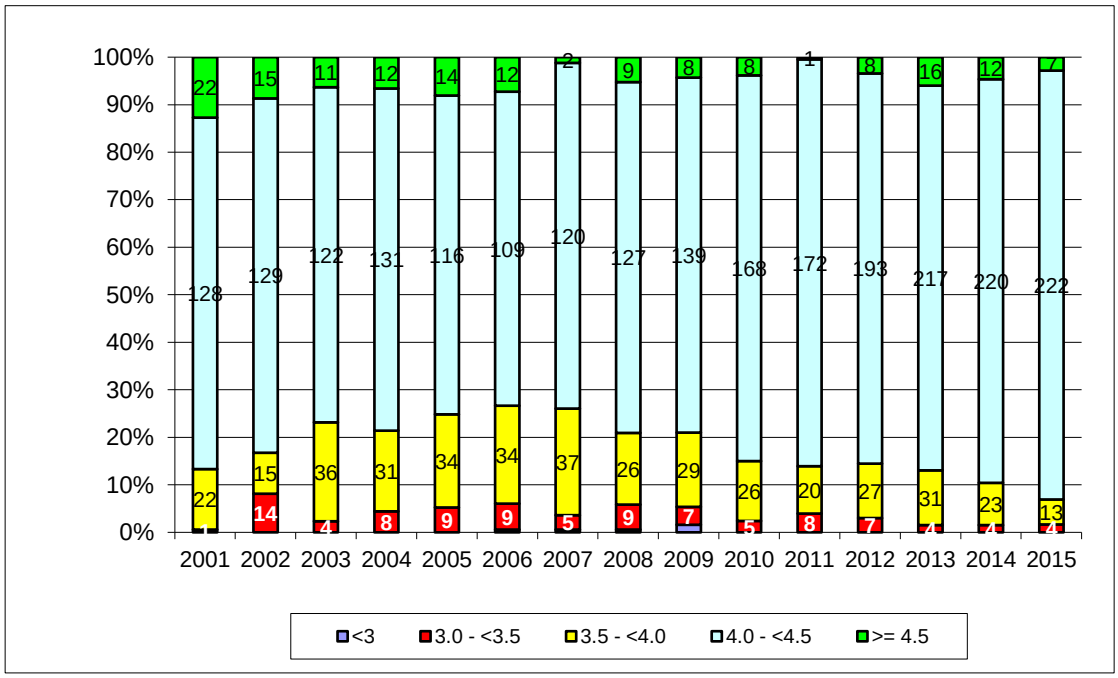
All were using high flux dialyzers.

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

ml/min	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Mean	267	267	267	270	276	282	279
Std Dev	31	34	33.4	33.9	35.2	36.9	38.1
Min	150	180	200	180	200	200	200
Max	360	360	360	360	400	400	400

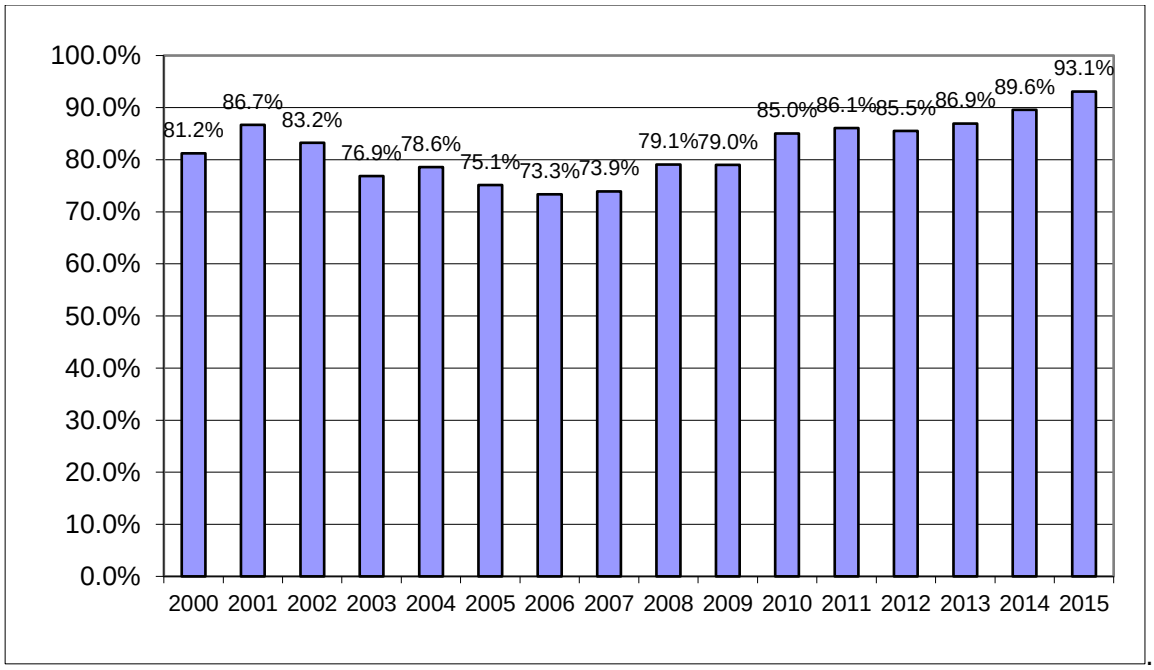
Blood flow is set at a minimum of 200 ml/min and averaged 279 $\pm$ 38.1 ml/min, median 280 mml/min (range 200 -400).

Fig 7D-1: Dialysis Time Per Session



88.0% [212/241] patients dialyze for 4 hours or more as compared to the previous year (93.1%). Increased numbers of less than 4 hrs.

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



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DIALYZER REUSE

All centres use the Renatron System. Maximum reuse is 15 times. The following is the practice for virology positive cases

HIV positive cases: There are no HIV positive cases

Hep B positive cases: No reuse is practiced for Hep B positive cases in all centres.

HCV positive cases: Bishan and SWWT centres reuse HCV positive dialysers while Ghim Moh centre practices single use wef Oct 2015.

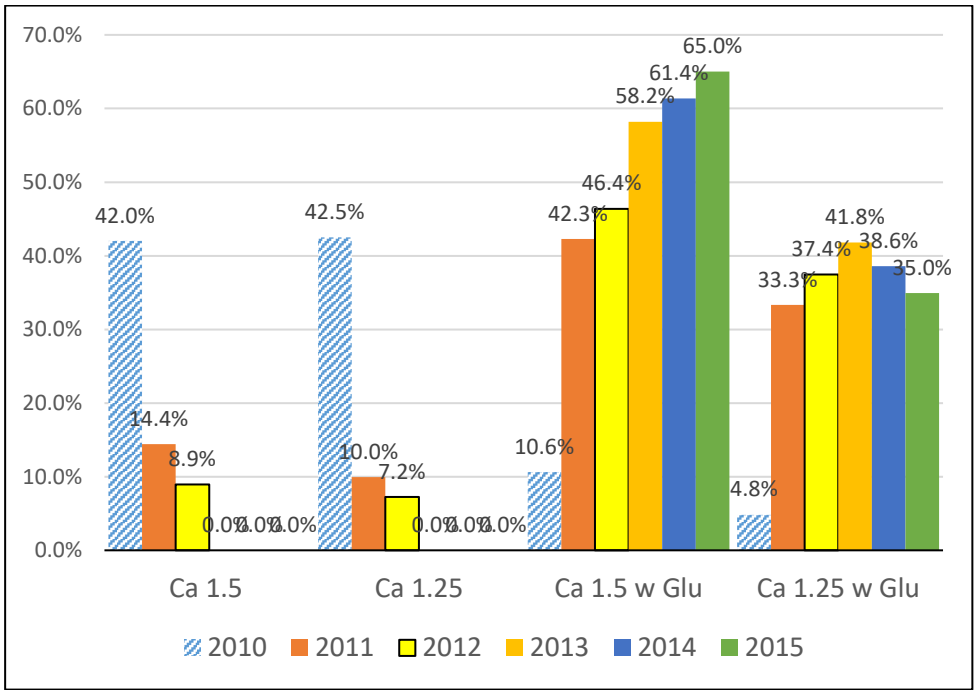
DIALYSATE

Dialysate available contains

- potassium value of 2.0 mmol/L
- calcium of 1.5 mmol/L and 1.25 mmol/L
- glucose of 11 mmol/L

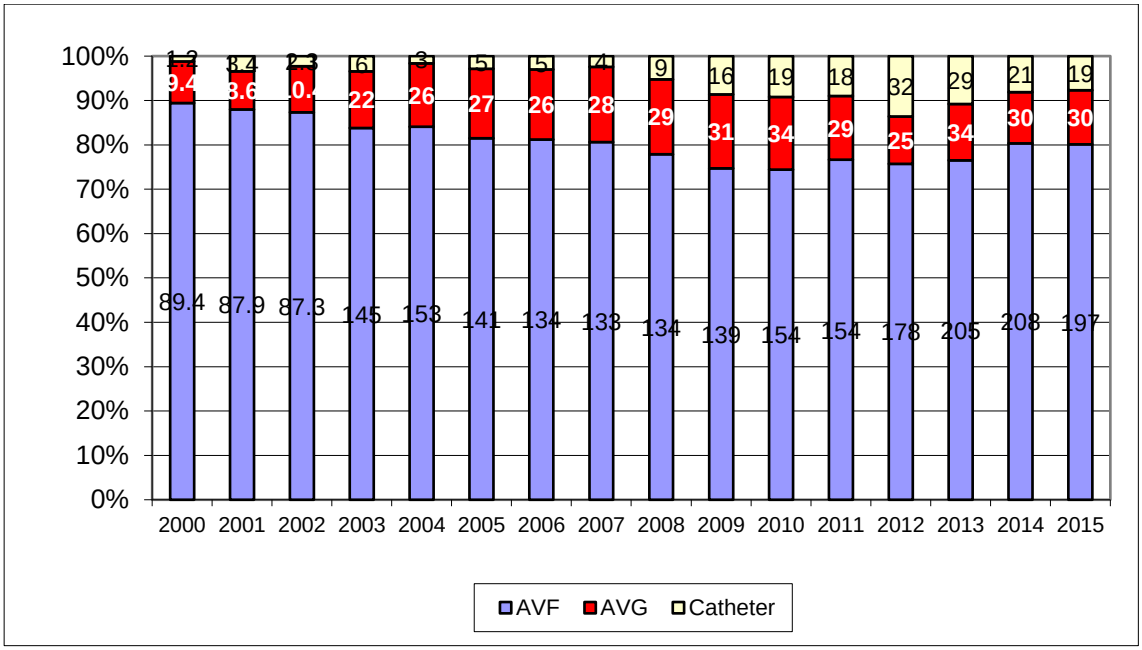
Dialysate containing 1.5 mmol/L calcium and 11 mmol/L glucose was first introduced in SWWT centre on 2nd December 2008 for diabetic and elderly patients. All patients in Bishan centre were provided with dialysate with glucose with either calcium 1.5 or 1.25 mmol/L from July 2011. With effect from September 2013, all patients in SWWT centre were also provided with glucose containing dialysate. By the end of 2013, non-glucose containing dialysate had been phased out.

Fig 7D-3: Dialysate Calcium and Glucose



E. VASCULAR ACCESS

Fig 7E-1: Vascular Access



About the same proportion of patients (80.9%, 195/241), were using AV fistulae compared with the previous year (80.1%). Thirty-one patients or 12.9% (31/241) were using grafts and 6.2% (15/241) on temporary catheters.

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:

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

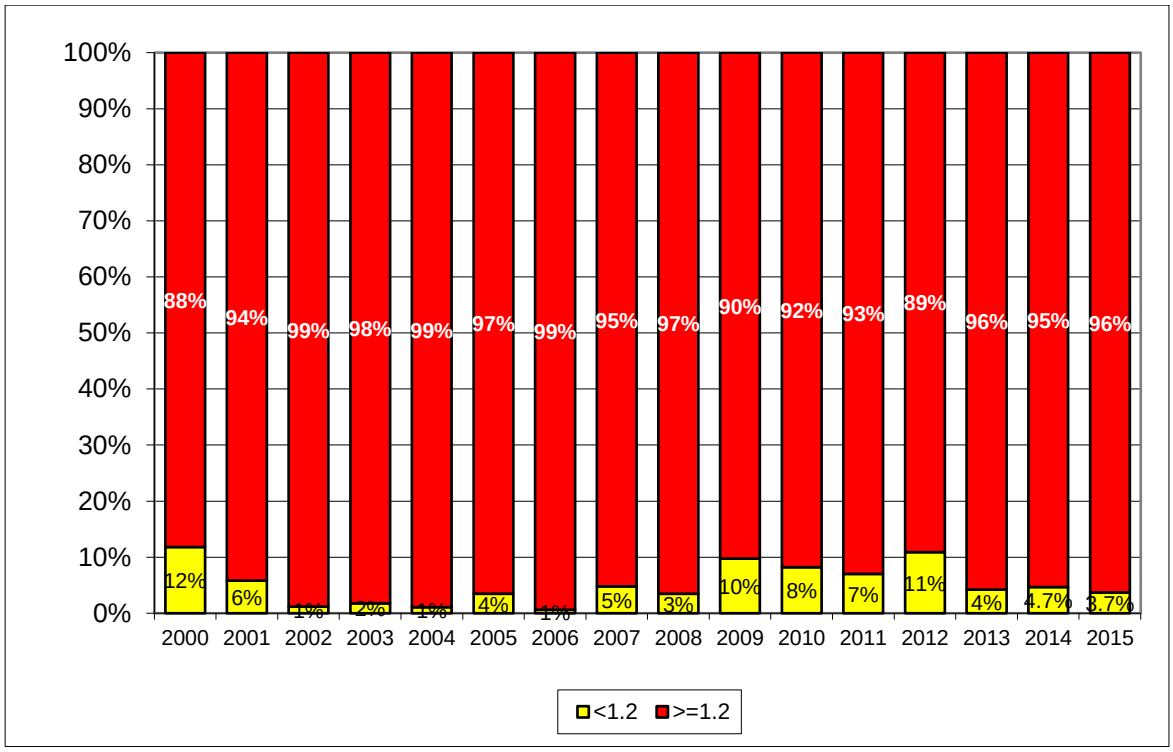
where R = post/pre urea
UF = ultrafiltration in litres
W = post dialysis weight

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

Our patients weighed 61.7 $\pm$ 15.9 kg (median 60.7 kg, range 20.6 – 123.8 kg).

The proportion of patients with KT/V of 1.2 or greater in November / December 2016 was 97.9%.

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



The proportion of patients with low KT/V is now 2.1%.

G. ANAEMIA

The mean Hb was calculated to be 10.9 ± 1.5 g/dl (range 5.7 – 15.9). This has been stable over the past few years. The percentage of patients with a haemoglobin count of less than 10 g/dl was 24% slightly higher than last year (23.2%).

Fig 7G-1: Average Hemoglobin

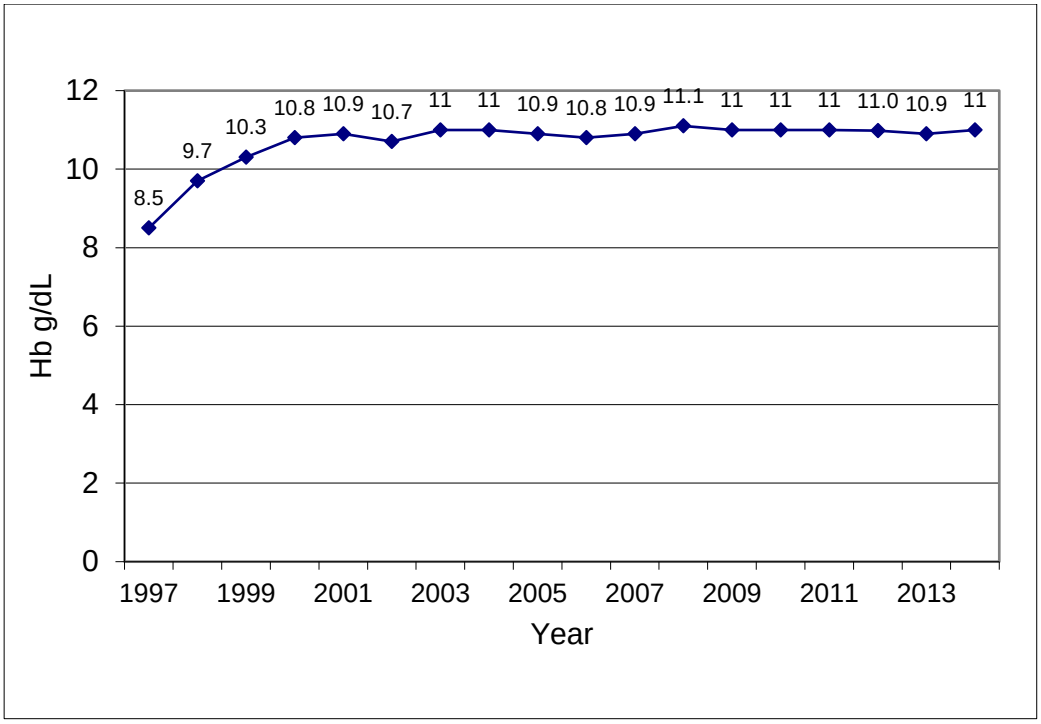


Fig 7G-2: Hb Frequency

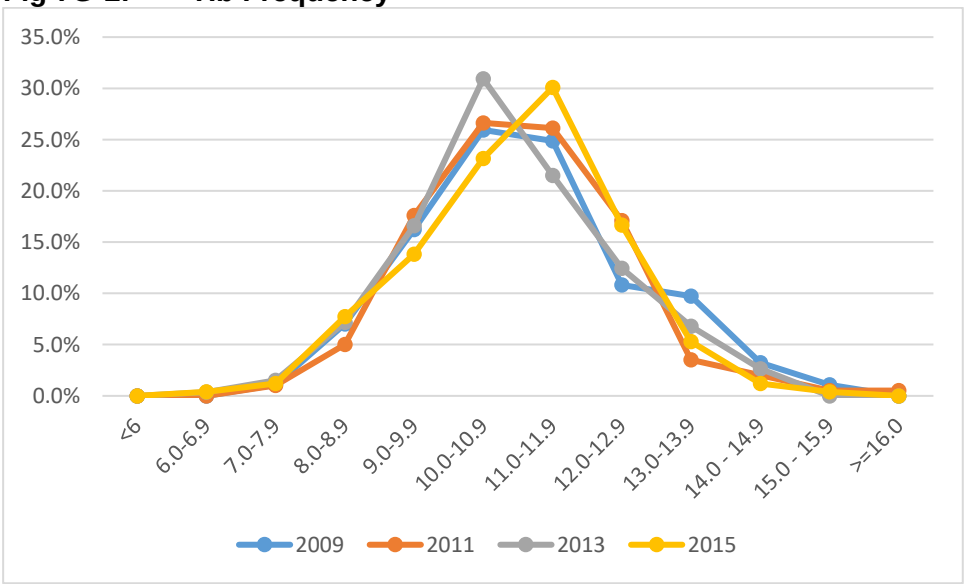
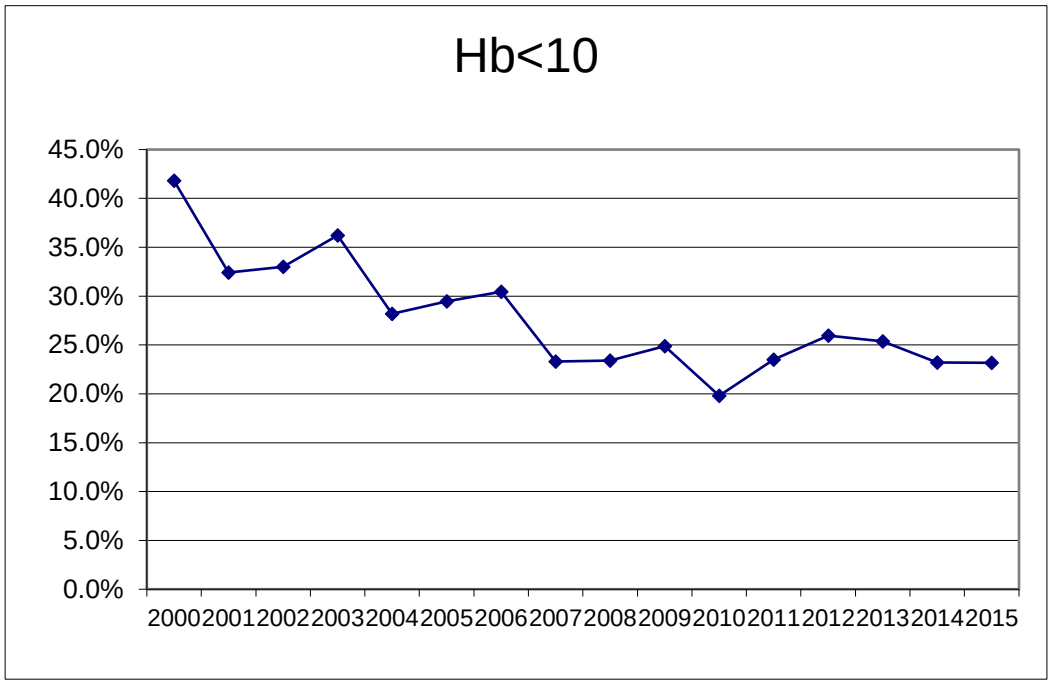


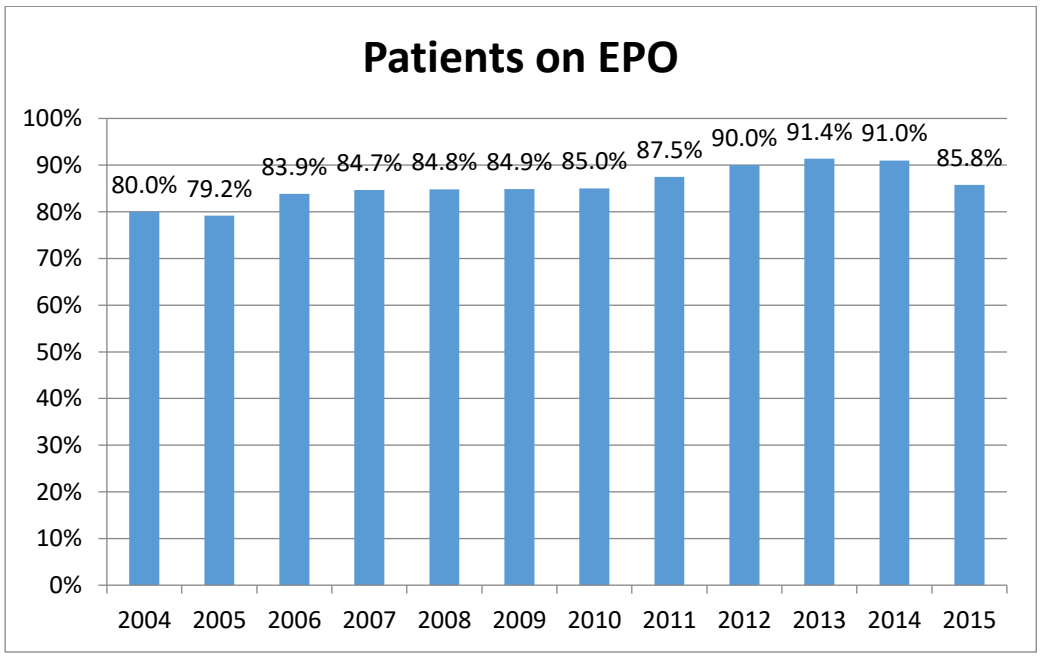
Fig 7G-3: Hb <10



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 has increased 23.2%. The proportion of patients on ESA is around 85.8%.

Fig 7G-4: Proportion of Patients on ESA



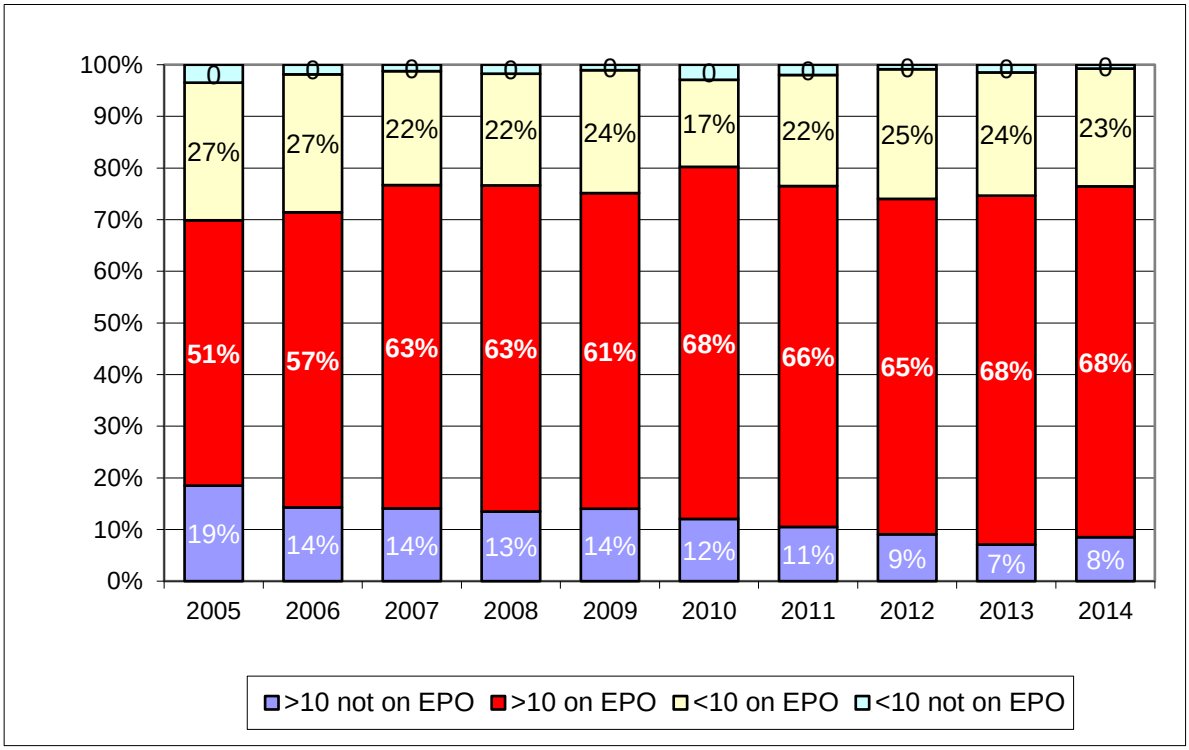
The cost of erythropoietin is Medishield claimable if the patient is eligible. In addition, patients are also eligible to apply for the Foundation's subsidy programme. There is no cap on the erythropoietin subsidy.

Patients who were on EPO used on the average 97.7 ± 209.7 units/kg/wk (median 90.9) in 2015

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 used Eprex until Dec 2013 when there was changed to Recormon after a tender exercise. Bishan centre continued to use Recormon.

Thirty-five (35) patients (14.2%) were not on EPO. They had a mean Hb of 12.1 g/dl (range 9.5 – 15.3). Only 3 patients (1.2%) with Hb below 10 g/dl were not on EPO.

Fig 7G-5: Use of Erythropoietin



Of note is the reduced proportion of patients with Hb<10g/dl not using EPO compared with 10 years ago. The proportion of patients with Hb>10 g/dl not requiring EPO was 8%.

IRON STATUS

Table 7G-1 : Transferrin Saturation

	2010	2011	2012	2013	2014	2015	2016
Mean (%)	34.2	34.6	32.8	33.4	34.8	36.3	36.0
SD	15	15	15	15.3	16	16.5	14.7
% pats w TFSat <20%	11.1%	10.4%	13.6%	15.3%	12%	11.4%	7%
Average HB when TFSat<20% (g/dl)	10.4	10.8	11.2	10.5	10.4	10.3	10.1
% pats w TFSat <30%					43.4	40.7	36.9
Average HB when TFSat<30% (g/dl)					10.8	10.7	10.6
% pats w TFSat >20%	87.9	88.6	83.8	84.0	88.0	88.6	90
% pats w TFSat >= 30%					56.6	59.3	62
Average HB when TFSat>20% (g/dl)	11	11	11	11	11.1	11	10.9

As at the end of 2016, mean transferrin saturation was 36.0 $\pm$ 14.7 % (range 10.0 – 104.0). The proportion of patients with transferrin saturation of less than 20% was 7%, lower than the previous year. 50% (8/16) 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 10.9 g/dl compared with 10.1 g/dl for those whose TF Sat was <20% .

The KDIGO guidelines of 2012 suggested target iron levels TSat >30% and S Ferritin >500 ng/mL if ESA dose reduction is aimed at.

Table 7G-2: Ferritin

	2010	2011	2012	2013	2014	2015	2016
Mean	525	543	597	626	725	859	773
SD	392	356	454	467	521	649	434
% pats w Ferritin < 200	14.5%	15.4%	16.4%	14.6%	6.6%	7.3%	4%

Using S Ferritin of 200 mg/ml, 4% are iron deficient

H. NUTRITION

Substantial improvement in mean S Albumin has been seen in the last 2 years 38.8 [2013] and 39.9 ± 3.8 g/l [2014] as a result of supplemental protein powder provided at a very reduced price. Remained the same 39.5±3.1 (2015). The number of patients with Serum albumin less than 40 g/dl was 45%. Much improvement as compared to last year (49.5%).

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

	2009	2010	2011	2012	2013	2014	2015	2016
NPCR (g/kgBW)								
• Mean ± SD	1.09 ± 0.26	1.06 ± 0.26	1.05 ± 0.24	1.01 ± 0.24	1.07 ± 0.24	1.07 ± 0.25	1.1 ± 0.2	1.09 ± 0.24
• % < 1.2	71	73.9	78.4	79.6	72	71.8	70.7	67.6
S Albumin (g/l)								
• Mean ± SD	33.9 ± 3.4	34.5 ± 3.4	35 ± 3.2	34.1 ± 3.5	38.8 ± 3.6	39.9 ± 3.8	39.5 ± 3.1	39.4 ± 3.1
• % <40	90.3	88.4	93.5	95.7	54.1	49.8	45.5	45
• % <35	51.1	48.8	49.3	49.8	15.7	8.5	9.8	7

Supplemental feeds were provided upon the advice of the centre's dieticians to patients at a highly subsidized price from September 2011. A total 31 patients are on Beneprotein.

I. MINERAL METAB

Table 7I-1 : Serum Calcium levels

	2008	2009	2010	2011	2012	2013	2014	2015	2016
Mean S Calcium (mmol/L)	2.46	2.46	2.3	2.37	2.39	2.26	2.29	2.32	2.27
SD	0.20	0.21	0.23	0.18	0.20	0.22	0.18	0.2	0.2
Min	2.01	1.73	1.68	1.86	1.71	1.79	1.85	1.76	1.83
Max	3.06	3.2	3.79	2.92	3.3	3.93	2.93	3.34	3.8

* S Calcium corrected for S Albumin reported from 2007

The mean corrected serum calcium value was 2.27 ± 0.2 mmol/l. Low calcium dialysate is currently in use for 35.0% of the patients (86/246).

Table 7I-2: Serum Phosphate levels

	2008	2009	2010	2011	2012	2013	2014	2015	2016
Mean S PO4 (mmol/L)	1.55	1.65	1.54	1.5	1.57	1.52	1.49	1.5	1.49
SD	0.38	0.47	0.47	0.42	0.44	0.43	0.41	0.4	0.4
% with S PO4>2.0 mmol/l	11	11.8	18.4	11	14.0	11.6	7.7	11.0	11.2
% with S PO4 >1.78 mmol/l (KDOQI)			30.0	24.0	28.0	23.5	25.1	22.8	19.9
Min	0.62	0.7	0.42	0.57	0.56	0.37	0.45	0.54	0.25
Max	2.55	3.25	3.12	2.57	3.3	2.92	2.85	2.98	2.97

Mean S Phosphate was 1.49 $\pm$ 0.4 mmol/l. The patients having values above 2.0 mmol/l was 11.2% as compared to 11% the previous year.

Table 7I-3 : PTH levels

	2011	%	2012	%	2013	%	2014	%	2015	%	2016	%
<16.5	77	*38.9*	87	*38.8*	90	*34.9*	82	*32.3*	65	*26.6*	62	*25.9*
16.5-33	45	*22.1*	47	*21.0*	61	*23.6*	58	*22.8*	69	*28.3*	38	*15.9*
>33.0	76	*38.4*	90	*40.2*	107	*41.4*	114	*44.9*	110	*45.1*	139	*58.2*
Total	198	*100*	224	*100*	258	*100*	254	*100*	244	*100*	239	*100*

58.2% (139) patients have intact parathyroid hormone levels elevated beyond 33 pmol/l. Hyperparathyroid bone disease is still a significant problem in the dialysis population.

J. DIABETICS

The prevalent number of diabetic patients was 106 (43.9%) This is not surprising as diabetic nephropathy is the etiology of ESRD in more than half of all new cases.

K. HYPERTENSION

67.2% (162/241) have recorded high blood pressures or have their blood pressures controlled with anti-hypertensive agents.

M. HEPATITIS SEROPOSITIVITY

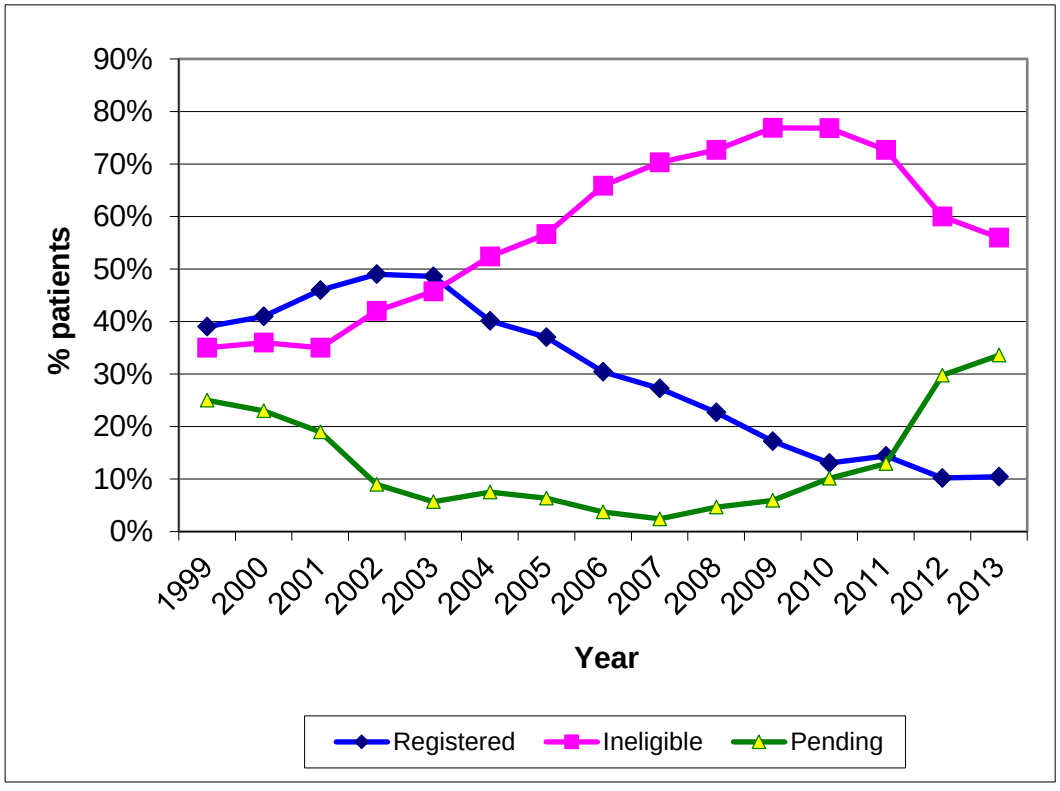
4.1% are hepatitis B carriers, 5.4% are anti-HCV positive for Hepatitis C antibody. Three patients (1.2%) had received interferon treatment and HCV PCR was tested negative. One patient (0.4%) is both anti-HCV and HepBsAg positive.

Table 7M-1 : Hepatitis Rates

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
HepB only	5.2%	6.2%	6.7%	6.4%	6.5%	6.3%	4.5%	6.4%	6.0%	5.4%	5.3%	4.1% (10)
HCV only	9.8%	10.6%	9.1%	8.7%	8%	7.7%	4.9%	8.5%	7.1%	6.2%	6.9%	5.4% (13)
HCV Treated	No data	No data	2.4%	2.3%	2.2%	1.9%	1.9%	1.7%	1.7%	1.2%	1.2%	1.2% (3)
HepB & HCV	1.7%	1.2%	1.2%	1.2%	1%	1%	1%	0.9%	0.7%	0.8%	0.4%	0.4% (1)

N. TRANSPLANT WAITING LIST

Only 23 patients (9.2%) are on the waiting list. More patients (145) 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.



8. CONCLUSION

The number of new patients this year is similar to the previous year. Patients are getting older and there are more challenges with multiple comorbidities.

While we have lesser episodes of hospitalization rates, each episode is longer. Admission days among the diabetics is twice that of the non-diabetic and it remains a challenge to manage these patients who not only require medical care but are in the lower socioeconomic strata.

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

A/PROF CHOONG HUI LIN
MEDICAL DIRECTOR