

KIDNEY DIALYSIS FOUNDATION

MEDICAL ANNUAL REPORT

2017

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1. INTRODUCTION

The Kidney Dialysis Foundation is now in its 21th 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 at Kreta Ayer 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
2017		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), Ms Sunitha d/o Silvanathan (Clinical Nurse) and Ms Ma MingJuan (Clinical Nurse) headed the paramedical team comprising Nursing, Patient Welfare and Dietetic Services.

This report covers medical data collated at the end of 2017.

2. THE DIALYSIS CENTRES

The location and prevalent number of patients as of 31 Dec 2017 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

The PD programme has been closed since January 2017

As of January 2017, the PD programme was converted to 'portable subsidy PD programme', whereby KDF will continue to apply for MOH subsidy to help the 26 patients purchase PD solutions and get reimbursement for them.

Dialysis Stations and Patient number

	Centre	No. of Regular + Isolation Stations	Total stations	Patient No
1	KDF-Bishan Centre	19 + 1 isolation	20	104
2	San Wang Wu Ti – KDF Centre	15 +1 isolation	16	82
3	KDF – Ghim Moh Centre	19 +1 isolation	20	89

All haemodialysis centres operate 3 shifts a day.

HAEMODIALYSIS PROGRAMME

2017

3. EXECUTIVE SUMMARY (HD) – Not Done

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 2017, there were 63 new entrants.

Twenty- Nine (29) patients exited the programme (5 transplant, 15 deaths, 1 transfers to KDF PD programme, 8 patients transfer to other centres). In the prevalent population, average age was 71.8 ± 11.0 years, the number of patients with chronic glomerulonephritis as the etiology of renal failure was 32.7%, diabetic nephropathy 44.0%.

All patients (100%) are using high flux dialysers. Average blood flow was 278 ± 39.3 ml/min. 90.5% of patients dialyse 4 hours or more. 74.5% of patients use a native arteriovenous fistula. Dialysis adequacy as measured by single pool KT/V is >1.2 in 93.0% of patients.

Mean hemoglobin was 20.9 ± 1.5 g/dl. About 92.4% of all patients are on EPO. About 11.4 % of patients are considered Fe deficient.

There has been a drop in S Albumin of with only 39.3% of patients having Albumin <40 g/l compared with 45.0% the previous year.

Diabetes as a comorbidity was present in 49.5% of the population. This is an increase from last year (46.6%).

There was no significant changes in virology status. Hep B positivity was 6.2%, HCV 4.5%, HepB and HCV 0.4%.

Less patients were registered on the National Transplant waiting list (5.5%), 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 Titus Lau (Step down wef April 2017)
4. Dr Grace Lee
5. Dr Pwee Hock Swee
6. Dr Tan Han Khim
7. Dr Tan Seng Hoe
8. Dr Yeoh Lee Ying
9. Dr Ng Tsun Gun
10. Dr Timothy Koh
11. Dr Manish Kaushik
12. Dr Sobhana T
13. Dr Kwek Jia Liang (Step down wef May 2017)
14. Dr Teo Su Hooi
15. 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. Dr Madeline Chew - MW Medical
2. Dr Lau Tzun Hon - MW Medical

NURSING

The overall standard of nursing is overseen by Ms Lay Kwee Chin (Nurse Manager) until 29th September 2017 when she resigned, together with Nurse Clinicians - Ms Sunitha Silvanathan, Ms Ma Ming Juan, Ms Florence Fan and Ms.Tang Huie (16th Oct 2017)

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 2017 is listed as follows:

Centre	Renal trained SN	SN	AN	DT	Total
Bishan	2	14	0	0	16
SWWT	0	11	2	0	13
Ghim Moh	0	10	2	0	12
<hr/>					
Grand total					42

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 – Hydrogen Peroxide 5-8%, acetic acid 1-5% and Peracetic acid <0.5% (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 and possession of the Renalin. The license 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 2017.

6 PATIENT CARE

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

Ms Vivienne Lim is the Welfare Executive in-charge. Consistent with its mission, KDF patients are heavily subsidised. Ms Lyn Loke and Ms Shalom assisted Ms Vivienne with the patient welfare matters.

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%
2017	150	54.5%

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

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 2017, we had 275 patients dialysing in 3 centres – 104 patients at Bishan Centre (BS), 82 at Kreta Ayer (SWWT) and 89 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	2017
New Cases	10	13	18	26	28	12	32	31	12	11	2	30
New Cases (interim)	3	3	3	7	7	15	31	31	13	10	16	31
Re-enter KDF	0	1	1	0	3	2	2	0	3	2	4	2
Total Entries	13	17	22	33	38	29	65	62	28	23	22	63
EXIT												
Transfer Out to non-KDF Programs	0	1	0	5	1	7	5	3	10	12	11	9
Transfer Out to KDF PD	3	2	2	1	2	3	7	3	4	1	2	0
Transplant	10	6	4	4	2	1	4	2*	2	1	0	5
Withdraw from Dialysis/Default	0	2	0	1	4	4	2	3	5	5	1	0
Deaths	11	2	9	8	8	20	13	18	16	17	13	15
Total Exits	24	13	15	19	17	35	31	29	37	36	27	29
Total No of Pt	161	165	172	186	207	201	235	268	259	246	241	275

* Cadaveric/Deceased Donor

Table 7A-2 –Mode of Dialysis

Interim HD		31
- Newly initiated subsequently permanent HD	22	
- Newly initiated awaiting PD	-	
- Newly initiated Bridge to Transplant	-	
- PD complications for temp HD	-	
- PD complications to permanent HD	2	
- Failed tx, back on HD	-	
- had been on dx, transferred from other VWO centre	-	
- Transfer from Private Centres	7	
Permanent HD [not via interim route]		32
- newly initiated	1	
- failed PD program, re-enter program	-	
- had been on HD, transferred to VWO from private	-	
Failed tx, back on HD	1	
- Re entry	1	
- Transfer from Private Centres	29	
TOTAL		63

Table 7A-3 – Source of Referral

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
SGH	14	18	16	25	22	52	53	25	22	19	39
NUH	1	2	11	8	3	6	8	1	1	3	6
TTSH	1	1	1	2	1	3	0	1	0	0	10
AH / KPTH	1	0	4	3	3	4	1	1	0	0	3
Private	0	1	1	0	0	0	0	0	0	0	0
NTFH	0	0	0	0	0	0	0	0	0	0	5
Total Entries	17	22	33	38	29	65	62	28	23	22	63

Note: NTFH started operations from 2017

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	2012		2013		2014		2015		2016		2017	
	n	%	n	%	n	%	n	%	n	%	n	%
Chronic GN	18	27.7	13	21.0	3	10.7	8	34.8	3	13.6	11	17.5
Diabetic nephropathy	27	41.5	37	59.7	16	57.1	13	56.5	15	68.2	38	60.3
Lupus nephritis	1	1.5	0	0	0	0	0	0	0	0	0	0
Obstructive uropathy	1	1.5	0	0	1	3.6	0	0	1	4.5	0	0
PCKD	2	3.1	0	0	0	0	0	0	0	0	0	0
TB kidney	1.5	0	0	0	0	0	0	0	0	0	0	0
Hypertension	2	3.1	3	4.8	2	7.1	0	0	2	9.1	4	6.3
Others	6	9.2	6	9.7	5	17.9	1	4.3	1	4.5	6	9.5
Unknown Etiology	6	9.2	3	4.8	1	3.6	1	4.3	0	0	4	6.3
Total	65	100	62	100	28	100	23	100	22	100	63	100

The majority of new cases were patients with diabetes mellitus (60.3%) and chronic GN (17.5%).

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

Etiology	2012		2013		2014		2015		2016		2017	
	n	%	n	%	n	%	n	%	n	%	n	%
Chronic GN	96	41.4	97	36.2	92	35.5	92	37.4	88	36.5	90	32.7
Diabetic nephropathy	69	29.7	98	36.6	97	37.5	95	38.6	97	40.5	121	44.0
Lupus nephritis	9	3.9	9	3.4	9	3.5	8	3.3	7	2.9	5	1.8
Obstructive Uropathy	2	0.9	2	0.8	3	1.2	3	1.2	4	1.7	4	1.5
PCKD	8	3.4	10	3.7	7	2.7	5	2.0	5	2.1	3	1.1
TB kidney	2	0.9	2	0.8	2	0.7	2	0.8	2	0.8	1	0.4
HT	7	3.0	10	3.7	10	3.9	8	3.3	8	3.3	13	4.7
VUR	3	1.3	3	1.1	3	1.2	2	0.8	2	0.8	0	0
Others	17	7.3	18	6.7	18	6.9	16	6.5	15	6.2	21	7.6
Unknown Etiology	22	9.4	21	7.8	18	6.9	15	6.1	13	5.4	17	6.2
Total	232	100	268	100	259	100	246	100	241	100	275	100

There are now more patients with diabetic nephropathy (44.0%) than chronic glomerulonephritis (32.7%)

Gender

Table 7B-3 – Gender of New Patients

Gender	2011		2012		2013		2014		2015		2016		2017	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Males	18	62.1	28	43	37	59.7	20	71.4	11	47.8	13	59.1	38	60.3
Females	11	37.9	37	57	25	40.3	8	28.6	12	52.2	9	40.9	25	39.7
Total	29	100	65	100	62	100	28	100	23	100	22	100	63	100

Table 7B-4 – Gender of Prevalent Patients

Gender	2011		2012		2013		2014		2015		2016		2017	
	n	%	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	141	51.3
Females	105	52.4	123	52.3	135	50.4	129	49.8	126	51.2	124	51.5	134	48.7
Total	201	100	235	100	268	100	259	100	246	100	241	100	275	100

At the end of 2017, the ratio of male to female patients was 1.1:1

Ethnic Distribution

Table 7B-5 – Ethnic Distribution of New Patients

Race	2011		2012		2013		2014		2015		2016		2017	
	n	%	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	34	54
Malay	8	27.6	18	27.7	17	27.4	2	7.7	7	30.4	2	9.1	19	30.1
Indian	1	3.4	9	13.8	6	9.7	3	11.5	4	17.4	1	4.5	8	12.7
Others	0	0	1	1.5	0	0	0	0	0	0	0	0	2	3.2
Total	29	100	65	100	62	100	26	100	23	100	22	100	63	100

Table 7B-6 – Ethnic Distribution of Prevalent Patients

Race	2012		2013		2014		2015		2016		2017	
	n	%	n	%	n	%	n	%	n	%	n	%
Chinese	163	69.4	184	68.7	180	69.5	169	68.7	166	68.9	182	66.2
Malay	54	23	61	22.8	59	22.8	55	22.4	55	22.8	70	25.5
Indian	17	7.2	22	8.2	20	7.7	22	8.9	20	8.3	20	7.2
Others	1	0.4	0	0	0	0	0	0	0	0	3	1.1
Total	235	100	268	100	259	100	246	100	241	100	275	100

The ethnic distribution of our prevalent patients was 66.2% Chinese, 25.5% Malays and 7.2% Indians.

Age

The mean age at entry in 2017 was 61.4 ± 11.3 years (median, 62.9). Twenty Eight (28) 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	2017
Mean Age (years)	56.7	56.9	56.5	56.1	59.1	58.0	62.8	61.4
SD	10.4	12.5	12.5	9.3	12.5	14.9	12.9	11.3
Min	34.5	32.7	23.5	30.7	30.6	29.0	33.0	31.2
Max	81.9	78.9	80.2	74.1	78.0	85.1	84.2	84.9

Average age of new patients with diabetic nephropathy (42 pts) was 60.1 years compared with 60.1 years in non-diabetics (21 pts).

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

Year	2010	2011	2012	2013	2014	2015	2016	2017
Mean Age (years)	57.4	57.7	58.7	58.7	59.5	59.9	60.7	61.6
SD	10.3	10.8	10.8	10.5	10.6	10.8	10.9	11.0
Min		28.0	29.0	30.0	31.4	29.3	30.3	31.3
Max		86.0	87.0	88.0	89.0	86.0	86.0	87.0

Age of the prevalent dialysis population at the end of 2017 was 61.6 ± 11.0 years (median 62.7). 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		2017	
	n	%	n	%	n	%	n	%	n	%	n	%
Diabetic	31	47.7	35	59.3	8	30.8	14	60.9	14	63.6	42	66.7
IHD n oth cardiac dis	21	32.3	20	33.9	7	26.9	9	39.1	8	36.4	17	27
CVA	1	1.5	1	1.7	2	7.7	1	4.3	2	9.1	1	1.6
PVD	6	9.2	7	11.9	0	0	3	13.0	2	9.1	0	0

Table 7B-10 – Common Comorbidities in Prevalent patients

Year	2012		2013		2014		2015		2016		2017	
	n	%	n	%	n	%	n	%	n	%	n	%
Diabetics	81	34.5	107	39.9	110	42.5	115	46.6	106	43.9	136	49.5
IHD n oth cardiac	46	19.6	71	26.5	77	29.7	60	24.4	67	27.8	91	33.1
CVA	11	4.7	12	4.5	14	5.4	13	5.3	10	4.1	23	8.36
PVD	11	4.7	15	5.6	11	4.2	12	4.9	14	5.8	19	6.9

The proportion of diabetics in the prevalent dialysis population has increased to 49.5%.

The proportion of patients with cardiac problems has increased to 33.1%.

HOSPITALIZATIONS

Hospitalizations during the period 1 January 2017 to 31 December 2017 were analyzed and expressed as episodes and days hospitalized per patient year of dialysis programme. There were 635 hospitalization episodes in 199 patients. Thus, 65.5% of the patients were ever admitted that year.

Table 7B-11 – Admission Rates

	2012		2013		2014		2015		2016		2017	
	No	%	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	199/304	65.5
- 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	110/151	72.8
- Non-diab pt adm / all non-diab	100/154	64.9	113/167	67.7	92/168	54.8	82/160	51.3	88/157	56.1	89/153	58.2

RATES/YR	2012	<i>Per yr</i>	2013	<i>Per yr</i>	2014	<i>Per yr</i>	2015	<i>Per yr</i>	2016	<i>Per yr</i>	2017	<i>Per year</i>
Admission episodes	521	2.4	627	2.1	618	2.3	556	2.0	512	2.1	635	2.3
• diabetic	239	2.9	294	2.7	358	3.1	335	2.5	262	2.7	375	2.8
• non-diab	282	2.1	333	2.3	260	1.7	221	1.5	250	1.7	260	1.9
Admission days	3928	17.8	5384	20.9	5766	21.7	5272	20.4	4298	17.6	4387	17.7
• diabetic	2084	25.1	2378	21.8	3432	29.7	3326	28.2	2160	22.4	3106	25.3
• non-diab	1844	13.4	3006	20.3	2334	15.5	1946	13.6	2138	14.5	1281	10.3

The admission rate was 2.3 episodes per patient year. Days admitted per dialysis year reduced to 17.7. Not unexpectedly, diabetics had higher number of days (25.3) admitted compared with non-diabetics (10.3).

DEATHS AND WITHDRAWALS

A total of 9 patients left the programme. Reasons were as follows:

- 1 patient to NKF PD programme
- 8 patients transferred to other centres (1 to NKF;7 to high dependency dialysis)

There were 15 deaths –

- 5 from cardiac causes
- 3 from pneumonia
- 1 from limb ischemia
- 2 from Cancer
- 1 from intracranial haemorrhage
- 1 from Cranio-cerebral injuries
- 1 from Sepsis secondary to right AKA wound infection
- 1 died at home

Table 7B-13 – Deaths and Withdrawals

	2011	2012	2013	2014	2015	2016	2017
Transfers							
- PD	3	7	3	4	1	3	1
- Other	7	5 (hi- dep)	3 (1 hi- dep)	10 (5 hi- dep)	12 (9 hi- dep)	10 (3 hi dep)	8
Transplants	1	4	2	2	1	0	5
Withdrawals	4	2	2	5	5	1	0
Deaths	20	13	18	16	17	13	15
Total	35	31	28	37	36	27	29

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		2017	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
F6	2	1	0	0	6	2	1	0.4	0	0	0	0	1	0.4
HF50	21	10	22	9.4	19	7	17	6.6	14	5.7	7	2.9	5	1.8
HF60	49	24	60	25.5	66	25	62	23.9	63	25.6	33	13.7	33	12
HF80	32	16	36	15.3	51	19	56	21.6	54	22.0	21	8.7	34	12.4
HF100	12	6	14	6	24	9	24	9.3	24	9.8	14	5.8	15	5.5
PolyFlux6L	0	0	3	1.3	0	0	1	0.4	0	0	0	0	0	0
F70S	0	0	0	0	0	0	23	8.9	0	0	0	0	0	0
PolyFlux14*	45	22	56	23.8	46	17	24	9.3	41	16.7	76	31.5	77	28
PolyFlux17*	30	15	33	14	43	16	39	15.1	37	15	61	25.3	80	29
PolyFlux21*	10	5	11	4.7	13	5	12	4.6	13	5.3	29	12.1	30	10.9
TOTAL	201	100	235	100	268	100	259	100	246	100	241	100	275	100

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

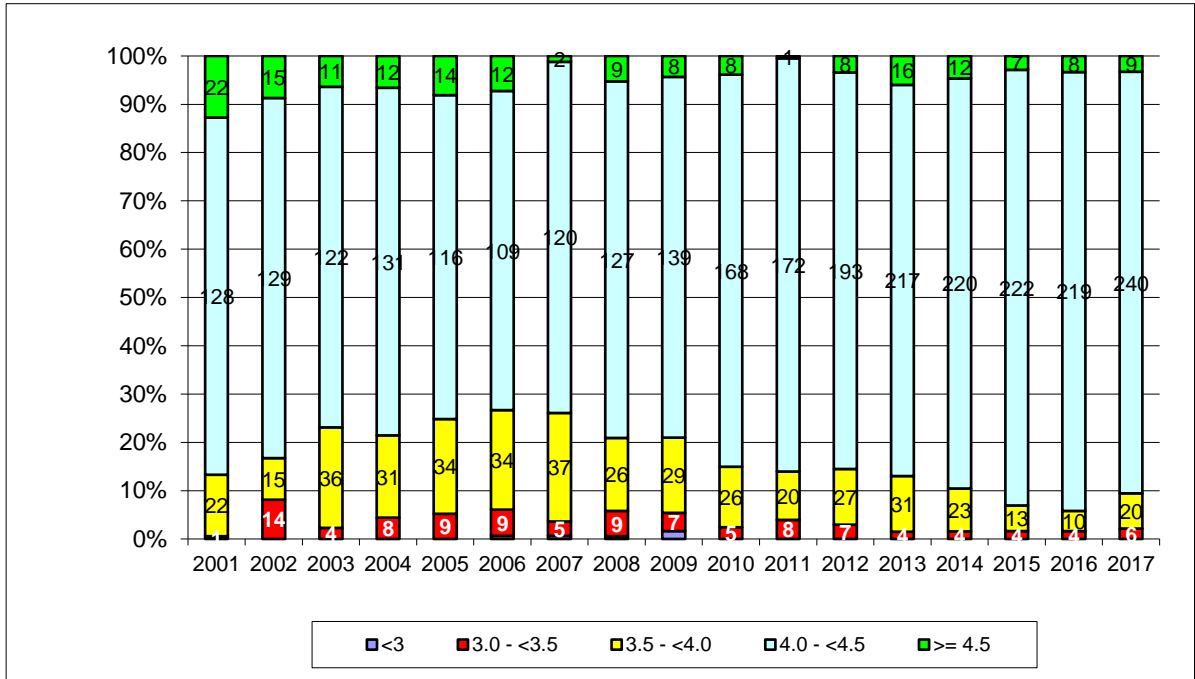
All were using high flux dialyzers.

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

ml/min	2010	2011	2012	2013	2014	2015	2016	2017
Mean	267	267	267	270	276	282	279	278
Std Dev	31	34	33.4	33.9	35.2	36.9	38.1	39.3
Min	150	180	200	180	200	200	200	200
Max	360	360	360	360	400	400	400	400

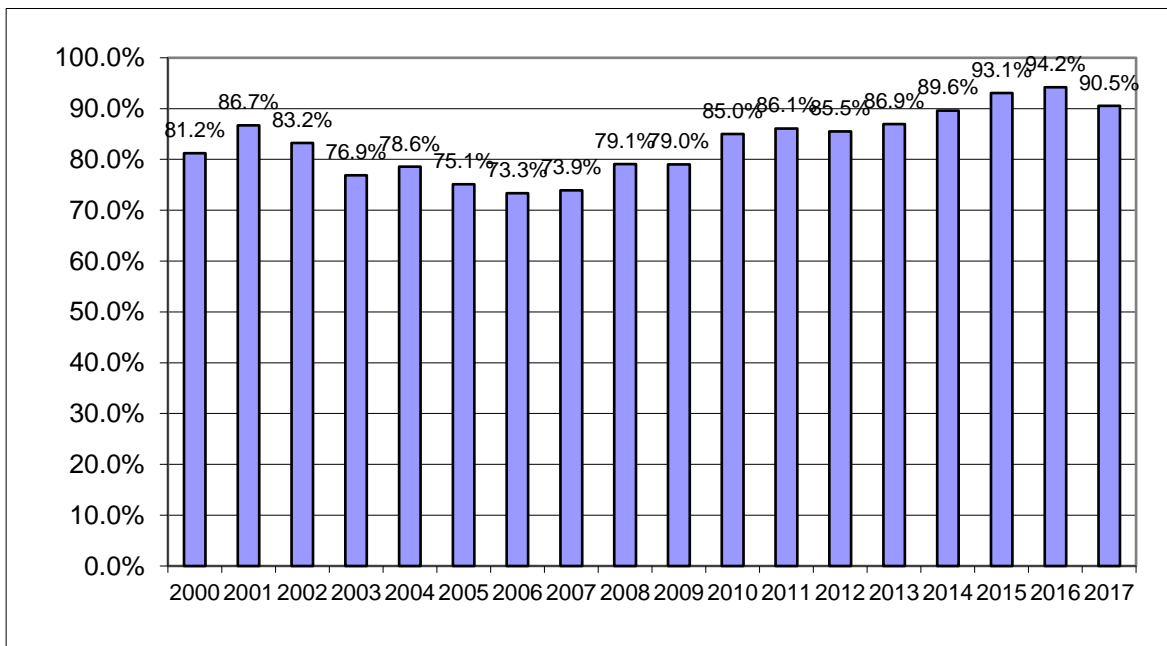
Blood flow is set at a minimum of 200 ml/min and averaged 278 ± 39.3 ml/min, median 250 ml/min (range 200 -400).

Fig 7D-1: Dialysis Time Per Session



90.5% [249/275] patients dialyze for 4 hours or more as compared to the previous year (88.0%). Increased numbers of less than 4 hrs.

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



DIALYZER REUSE

Ghim Moh Centre practices single use. The other two 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.

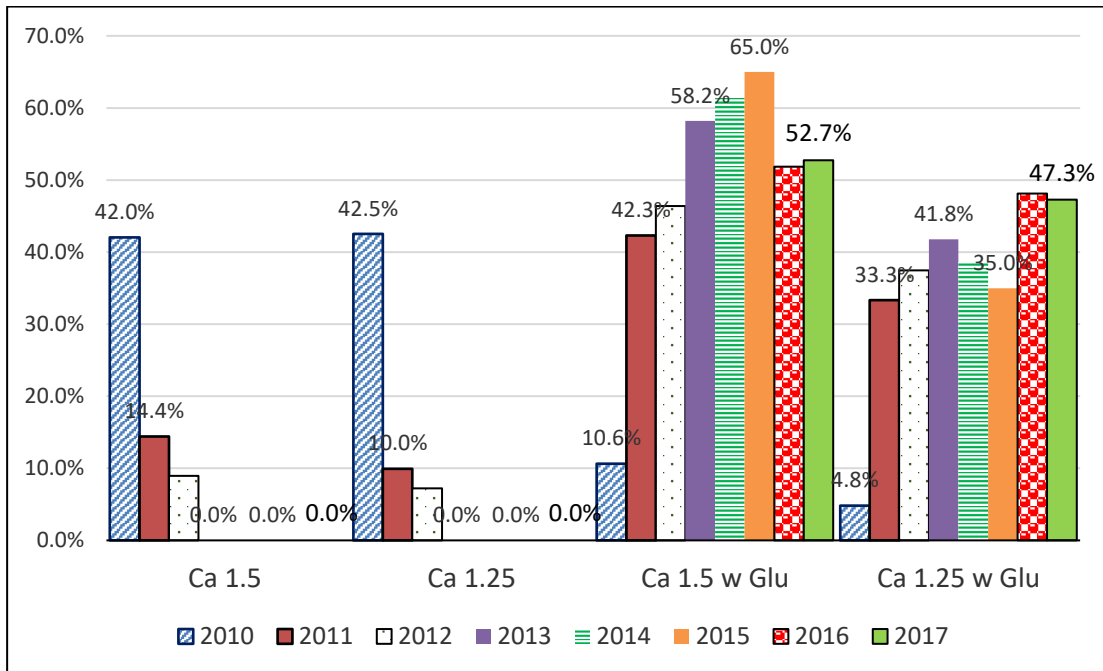
DIALYSATE

Dialysate available contains

- potassium value of 2.0 mmol/L
- calcium of 1.5 mmol/L and 1.2 mmol/L
- glucose of 11 mmol/L

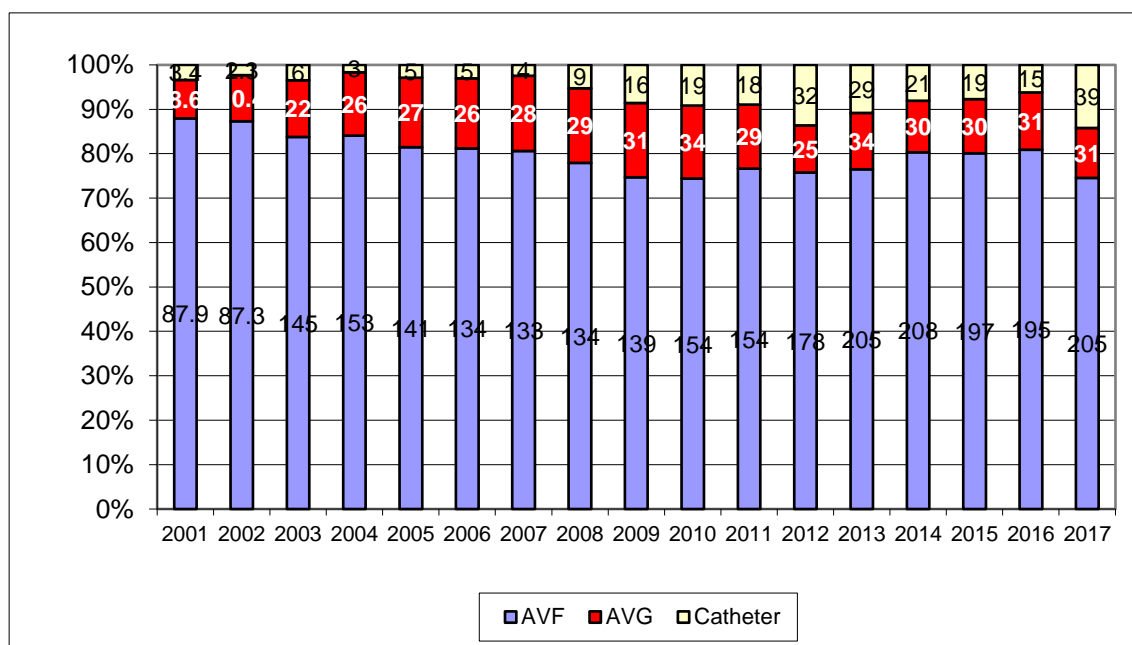
Dialysate containing 1.5 mmol/L calcium and 11 mmol/L glucose was first introduced in SWWT centre on 2nd December 2008 for diabetic and elderly patients. All patients in Bishan centre were provided with dialysate with glucose with either calcium 1.5 or 1.2 mmol/L from July 2011. With effect from September 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



There is a sudden increase in the number of patient using temporary catheters (14.2 % (39/275) due to the increased number of new patients for the near. This caused a corresponding drop in patients using AV fistulae 74.5 % (205/275) compared with the previous year (80.0%). Thirty-one patients or 11.3% (31/275) were using grafts.

F. DIALYSIS ADEQUACY- Updated for 2017

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:

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

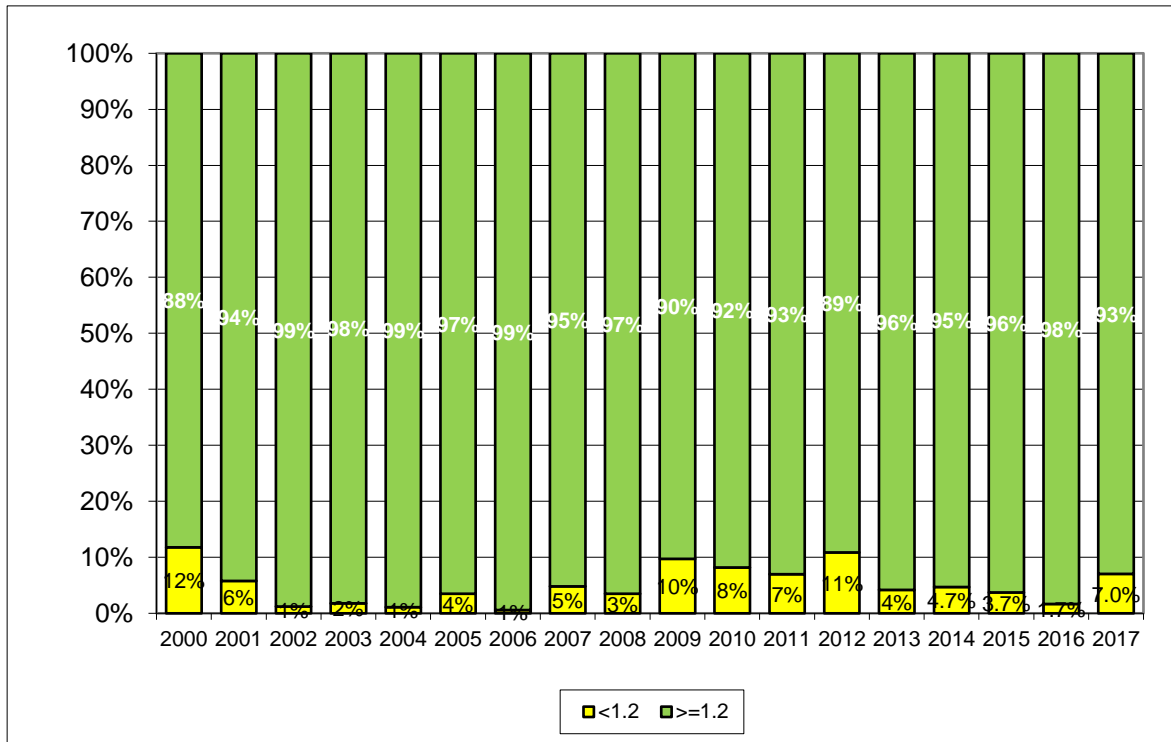
where R = post/pre urea
 UF = ultrafiltration in litres
 W = post dialysis weight

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

Our patients weighed 62.1 ± 16.1 kg (median 60.3 kg, range 34.4 – 122.4 kg).

The proportion of patients with KT/V of 1.2 or greater in November / December 2017 was 93.0% (251/270). A number of patients had newly joined and not yet evaluated.

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



The proportion of patients with low KT/V is now 7.0% (19/270).

G. ANAEMIA

The mean Hb was calculated to be 11.1 ± 2.8 g/dl (range 7.6 – 15.2 g/dl). 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

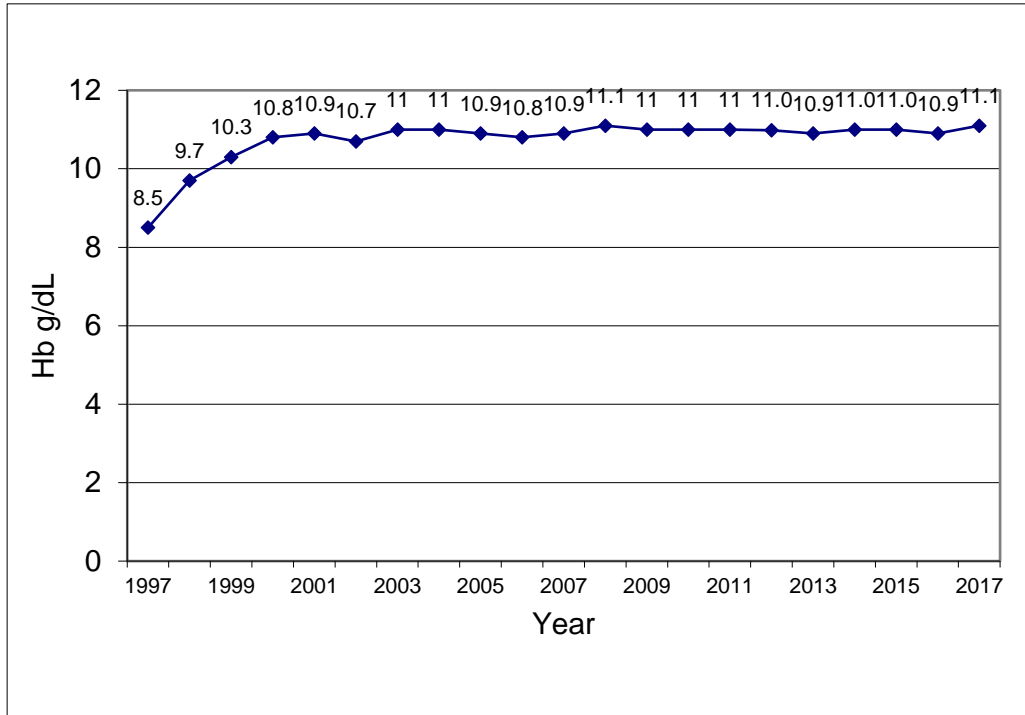


Fig 7G-2: Hb Frequency

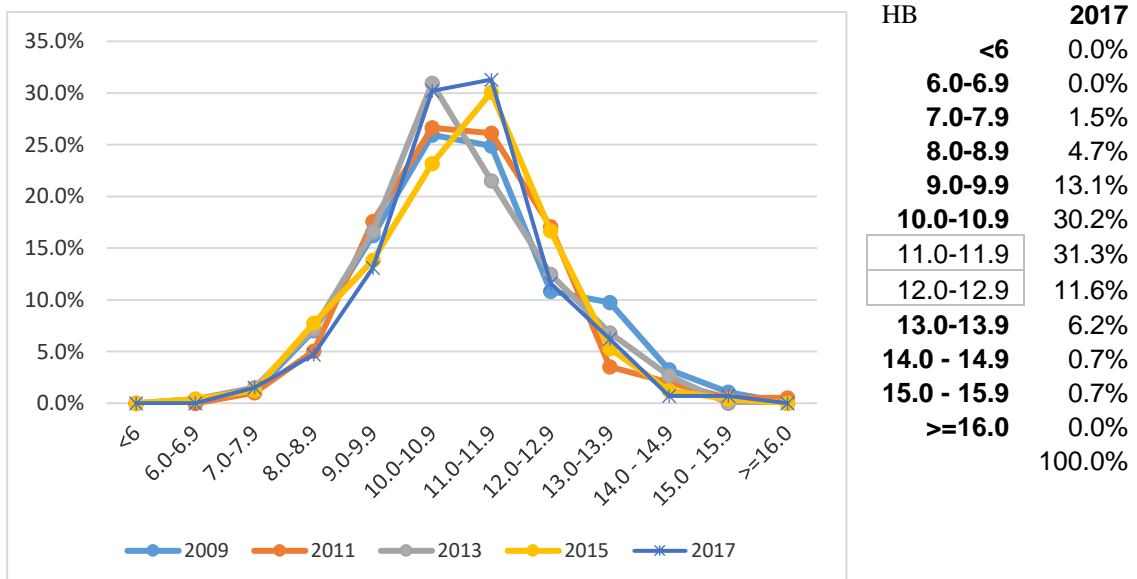
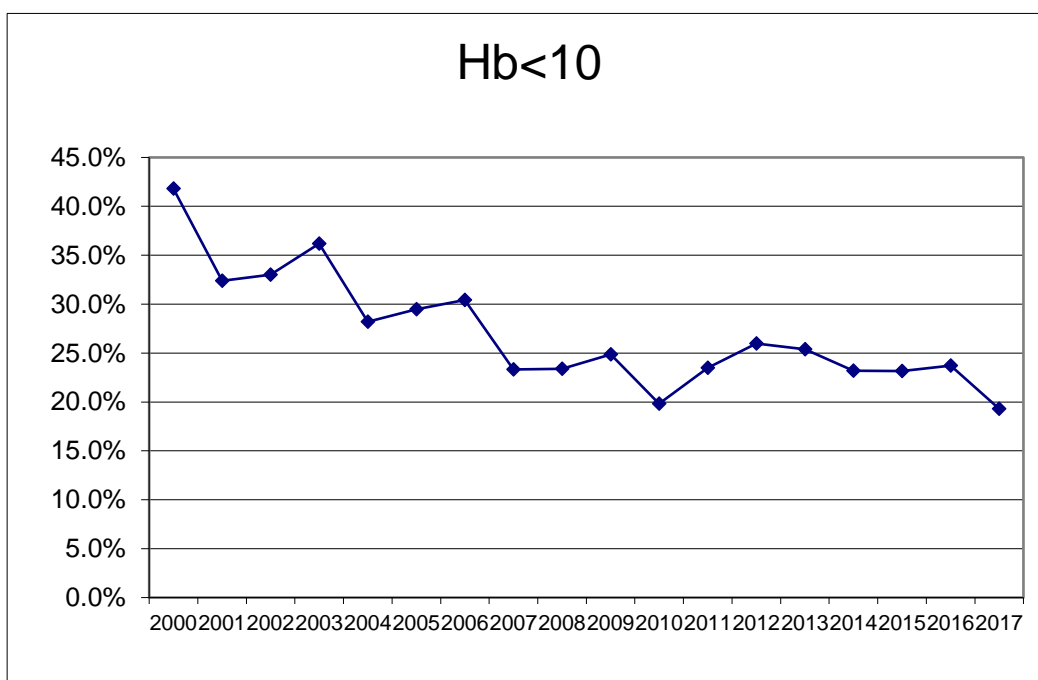


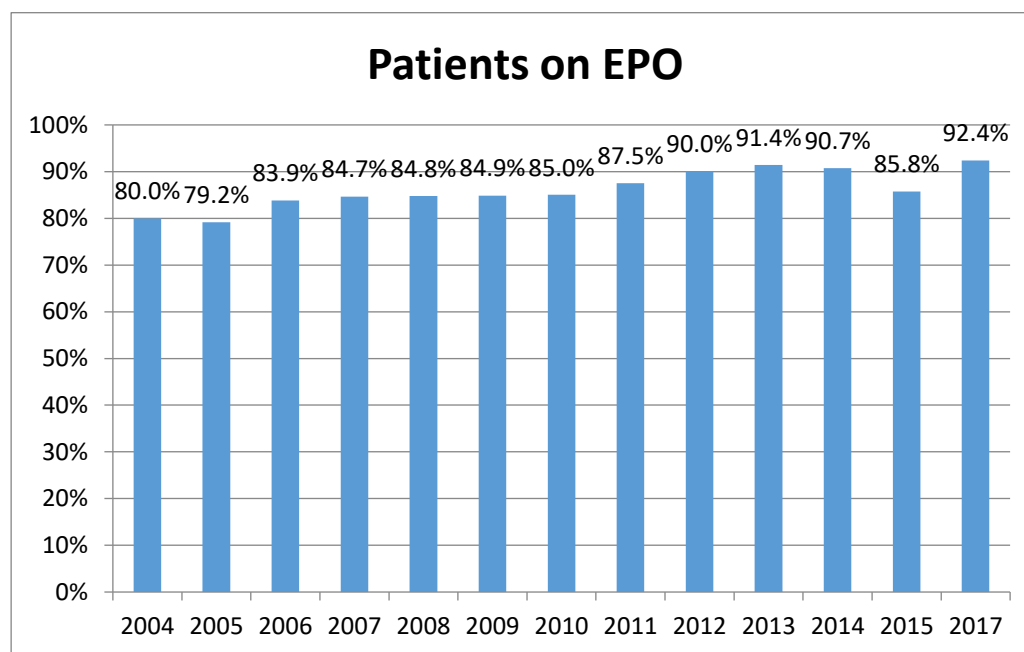
Fig 7G-3: Hb <10



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 decreased to 19.3% when compared to previous year (23.2%). The proportion of patients on ESA is around 92.4%.

Fig 7G-4: Proportion of Patients on ESA



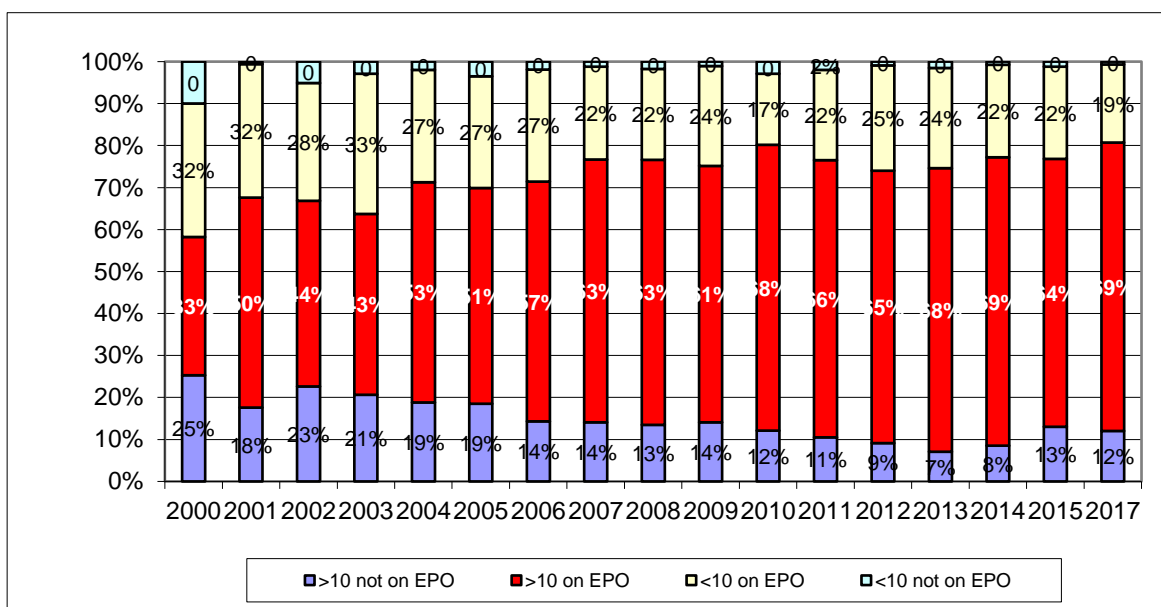
The cost of erythropoietin is Medishield claimable if the patient is eligible. In addition, patients are also eligible to apply for the Foundation's subsidy programme. There is no cap on the erythropoietin subsidy.

Patients who were on EPO used on the average 97.3 ± 63.3 units/kg/wk (median 82.4) in 2017

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.

Twenty -One (21) patients (7.6%) were not on EPO. They had a mean Hb of 12.6 g/dl (range 10.8 – 14.3).

Fig 7G-5: Use of Erythropoietin



	2017	NO. OF PTS
>10 not on EPO	12.0%	33
>10 on EPO	68.7%	189
<10 on EPO	18.6%	51
<10 not on EPO	0.7%	2

Two patients with Hb<10g/dl not using EPO. The proportion of patients with HB > 10 g/dl not requiring EPO was 12%.

IRON STATUS

Table 7G-1: Transferrin Saturation – Need to recalculate (will resend again)

	2010	2011	2012	2013	2014	2015	2016	2017
Mean (%)	34.2	34.6	32.8	33.4	34.8	36.3	36.0	33.2
SD	15	15	15	15.3	16	16.5	14.7	13.8
% pats w TFSat <20%	11.1%	10.4%	13.6%	15.3%	12%	11.4%	7%	11.4
Average HB when TFSat<20% (g/dl)	10.4	10.8	11.2	10.5	10.4	10.3	10.1	10.3
% pats w TFSat <30%					43.4	40.7	36.9	48.4
Average HB when TFSat<30% (g/dl)					10.8	10.7	10.6	10.7
% pats w TFSat >=20%	87.9	88.6	83.8	84.0	88.0	88.6	90	88.6
% pats w TFSat >= 30%					56.6	59.3	62	51.6
Average HB when TFSat>=20% (g/dl)	11	11	11	11	11.1	11	10.9	10.9

As at the end of 2017, mean transferrin saturation was 33.2 ± 13.7 % (range 8.2 – 97.8). The proportion of patients with transferrin saturation of less than 20% was 11.4%, higher than the previous year (7%). 38.7% (12/31) 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 10.4 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	2017
Mean	525	543	597	626	725	859	773	854
SD	392	356	454	467	521	649	434	572
% pats w Ferritin < 200	14.5%	15.4%	16.4%	14.6%	6.6%	7.3%	4%	10.6%

Using S Ferritin of 200 mg/ml, 10.6% are iron deficient

H. NUTRITION

Substantial improvement in mean S Albumin has been seen in the last few years as a result of supplemental protein powder provided at a much reduced price. The number of patients with Serum albumin less than 40 g/dl was 39.3%. Much improved when compared to last year (45%).

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

	2009	2010	2011	2012	2013	2014	2015	2016	2017
NPCR (g/kgBW)									
• Mean \pm SD	1.09 \pm 0.26	1.06 \pm 0.26	1.05 \pm 0.24	1.01 \pm 0.24	1.07 \pm 0.24	1.07 \pm 0.25	1.1 \pm 0.2	1.09 \pm 0.24	1.06 \pm 0.25
• % < 1.2	71	73.9	78.4	79.6	72	71.8	70.7	67.6	75.6
S Albumin (g/l)									
• Mean \pm SD	33.9 \pm 3.4	34.5 \pm 3.4	35 \pm 3.2	34.1 \pm 3.5	38.8 \pm 3.6	39.9 \pm 3.8	39.5 \pm 3.1	39.4 \pm 3.1	40.0 \pm 3.0
• % <40	90.3	88.4	93.5	95.7	54.1	49.8	45.5	45	39.3
• % <35	51.1	48.8	49.3	49.8	15.7	8.5	9.8	7	5.5

Supplemental feeds were provided upon the advice of the centre's dieticians to patients at a highly subsidized price from September 2011. A total 19 patients are on Beneprotein.

BENEPROTIEN 2017

	Patients	Quantity	Total Cost	Subsidy	Subsidy \div Cost
Bishan	8	50	780.92	511.24	65.47%
Kreta Ayer	7	39	606.46	508.73	83.89%
Ghim Moh	3	18	276.62	230.07	83.17%
PD	1	2	61.40	40.00	65.15%
	19	109	1,725.40	1,290.04	74.77%

2017:

19 of 275 (6.9%) patients used Beneprotein.

19 of 19 patients (100%) received subsidy from KDF.

In 2016:

28 of 241 (11.6%) patients used Beneprotein.

27 of the 28 patients (96.4%) who used Beneprotein was subsidized by KDF.

I. MINERAL METAB

Table 7I-1: Serum Calcium levels

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Mean S Calcium (mmol/L)	2.46	2.46	2.3	2.37	2.39	2.26	2.29	2.32	2.27	2.26
SD	0.20	0.21	0.23	0.18	0.20	0.22	0.18	0.2	0.2	0.18
Min	2.01	1.73	1.68	1.86	1.71	1.79	1.85	1.76	1.83	1.75
Max	3.06	3.2	3.79	2.92	3.3	3.93	2.93	3.34	3.8	2.68

* S Calcium corrected for S Albumin reported from 2007

The mean corrected serum calcium value was 2.26 ± 0.18 mmol/l. Low calcium dialysate is currently in use for 47.3% of the patients (130/275).

Table 7I-2: Serum Phosphate levels

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Mean S PO ₄ (mmol/L)	1.55	1.65	1.54	1.5	1.57	1.52	1.49	1.5	1.49	1.56
SD	0.38	0.47	0.47	0.42	0.44	0.43	0.41	0.4	0.4	0.44
% with S PO ₄ >2.0 mmol/l	11	11.8	18.4	11	14.0	11.6	7.7	11.0	11.2	14.1
% with S PO ₄ >1.78 mmol/l (KDOQI)			30.0	24.0	28.0	23.5	25.1	22.8	19.9	27.3
Min	0.62	0.7	0.42	0.57	0.56	0.37	0.45	0.54	0.25	0.5
Max	2.55	3.25	3.12	2.57	3.3	2.92	2.85	2.98	2.97	3.54

Mean S Phosphate was 1.56 ± 0.44 mmol/l. The patients having values above 2.0 mmol/l was 14.1 % as compared to 11.2% the previous year.

Table 7I-3 : PTH levels

	2012	%	2013	%	2014	%	2015	%	2016	%	2017	%
<16.5	87	38.8	90	34.9	82	32.3	65	26.6	62	25.9	63	23.3
16.5-33	47	21.0	61	23.6	58	22.8	69	28.3	38	15.9	57	21.1
>33.0	90	40.2	107	41.4	114	44.9	110	45.1	139	58.2	150	55.6
Total	224	100	258	100	254	100	244	100	239	100	270	100

55.6% (150) 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 136 (49.5%) This is not surprising as diabetic nephropathy is the etiology of ESRD in more than half of all new cases.

K. HYPERTENSION

83.2% (229/275) have recorded high blood pressures or have their blood pressures controlled with anti-hypertensive agents.

M. HEPATITIS SEROPOSITIVITY

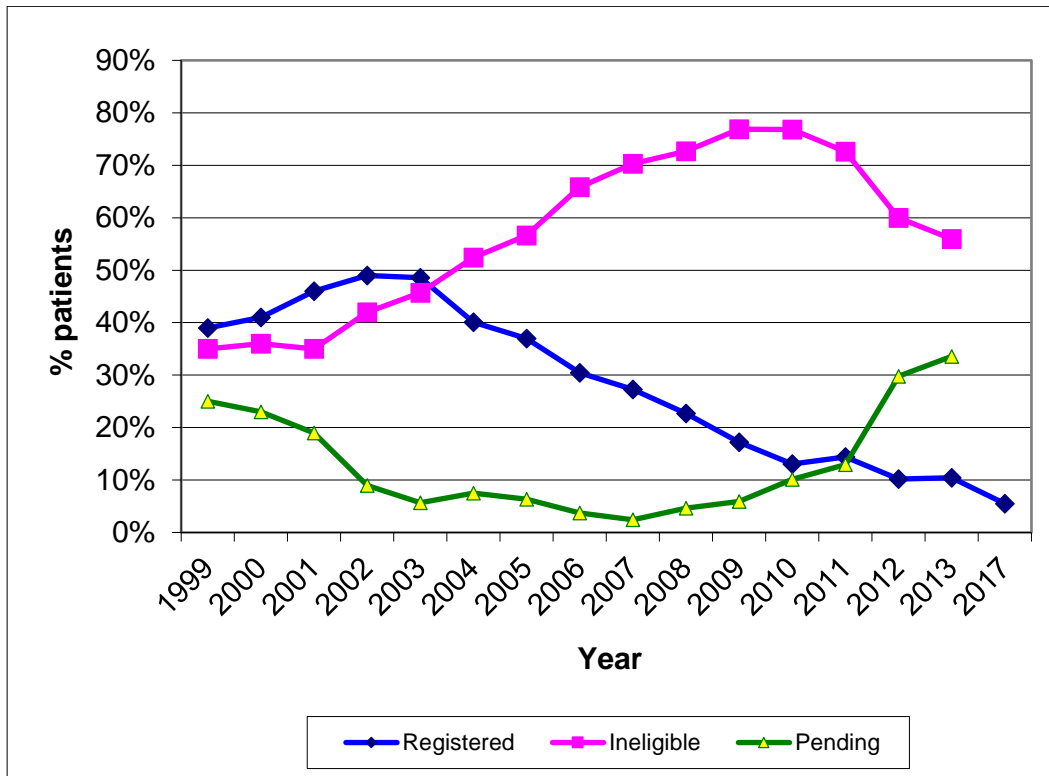
4.1% are hepatitis B carriers, 5.4% are anti-HCV positive for Hepatitis C antibody. Three patients (1.2%) had received interferon treatment and HCV PCR was tested negative. One patient (0.4%) is both anti-HCV and HepBsAg positive.

Table 7M-1: Hepatitis Rates

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
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)	6.2% (17)
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)	4.5% (12)
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)	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)	0.4% (1)

N. TRANSPLANT WAITING LIST

Only 15 patients (5.5%) are on the waiting list in 2017. Many patients 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.



VACCINATIONS

Pneumococcal Vaccines

Prevenar 13 – One time dose

	Up to Dec 2017	
Centre	N	%
Bishan centre	66/104	63.5
SWWT centre	57/82	69.5
Ghim Moh centre	58/89	65.2
Total	181/ 275	65.8

A total of 65.8% of patients had received Prevenar 13.

Pneumovax 23 – To be given every 5 years

	Up to Dec 2017	
Centre	N	%
Bishan centre	65/104	62.5
SWWT centre	54/82	65.9
Ghim Moh centre	63/89	70.8
Total	182 /246	66.2

A total of 66.2% of patients had received Pneumovax 23.

In 2015, Pneumococcal vaccination was provided fully subsidised to patients who consented.

According to the Advisory Committee on Immunization Practice (ACIP) recommendation, Prevenar 13 was given as first dose follow by Pneumovax 23 after an interval.

Prevenar 13 was purchased from Pfizer and Pneumovax 23 from MSD Pharma.

Pneumococcal vaccination was administered in 2015 & beginning of 2016 to the existing patients. Currently patients continue to receive the pneumococcal vaccines from restructured hospitals or polyclinics with reimbursement scheme.

Flu Vaccination

Centre	2015		2016		2017	
	N	%	N	%	N	%
Bishan centre	67	70.5	76	81	78	75%
SWWT centre	52	73.2	65	95.50%	59	72 %
Ghim Moh centre	61	76.3	72	92	71	79.8 %
Total	180/246	73.2%	213/241	88.4%	208/275	75.6%

Flu vaccination is given yearly. In 2017, Flu vaccination was fully subsidised for all the patients who had given their consent for receiving the vaccination.

Fluarix Tetra purchased from GlaxoSmith Pte Ltd (GSK) was given to 208 (75.6%) patients in October 2017.

There is a drop in the number from 2016 because there were 28 new intakes in 2017 between October to December 2017 (nearly half of the total new intakes for 2017). The order for flu vaccinations was done before August 2017.

Hepatitis B : Negative-Patient stats/ Vaccination / Booster

Centre	2016				2017			
	Negative Patients with hepbsAb < 10		Hep B vac	Hep B Booster	Negative Patients with hepbsAb < 10		Hep B vac	Hep B Booster
	N	%	N	N	N	%	N	N
Bishan centre	13	(13/87 x 100) 14.94%	4	5	24	(24/104 x 100) 23.07%	6	14
SWWT centre	8	(8/66 x 100) 12.12%	2	4	9	(9/82 x100) 10.9%	4	5
Ghim Moh centre	6	(6/75 x100) 8%	4	2	24	(24/ 89 x 100) 27%	12	1
Total:	27	(27 /228 x 100) 11.8%	10		57	(57/258 x 100) 22.1%	22	20

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