

# KIDNEY DIALYSIS FOUNDATION

## MEDICAL ANNUAL REPORT

2018

*Prepared by*

Dr Choong Hui Lin  
Medical Director

*With input from:*

Petra Chong  
Nurse Manager (Head, Clinical Services)

Ma MingJuan  
Nurse Clinician (SWWT), Clinical Services

Sunitha D/O Silvanathan

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## 1. INTRODUCTION

The Kidney Dialysis Foundation is now in its 24<sup>th</sup> 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 4<sup>th</sup> 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
2018		DV*KDF	FMC	RT

Legend:      ARC =            Asia Renal Care  
                   FMC =            Fresenius Medicare  
                   RT =             Renal Team  
                   RT\*DV=        Davita until Sep 2015, taken over by Renal Team  
                   \* Contract renewed  
                   DV\*KDF =      Davita until 24 Jan 2018, taken over by KDF

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

The Clinical Service team is lead by Ms Petra Chong (Acting Head, Clinical Services) and includes Ms Sunitha d/o Silvanathan (Nurse Clinician, Centre Manager), Ms Ma MingJuan (Nurse Clinician, Centre Manager) and Ms Angela Tang (Nurse Clinician, Centre Manager).

This report covers medical data collated at the end of 2018.

## 2. THE DIALYSIS CENTRES

The location and prevalent number of patients as of 31 Dec 2018 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

### Dialysis Stations and Patient number

All haemodialysis centres operate 3 shifts a day. Stations and patient numbers are shown below:

	Centre	No. of Regular + Isolation Stations	Total stations	Patient No
1	KDF-Bishan Centre	19 + 1 isolation	20	90
2	San Wang Wu Ti – KDF Centre	15 +1 isolation	16	75
3	KDF – Ghim Moh Centre	19 +1 isolation	20	88

The PD programme has been closed since January 2017 but 14 patients as of December 2018 are on the portable subsidy PD programme.

# HAEMODIALYSIS PROGRAMME

## 2018

### 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 Renal Team, 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 16 new entrants.

Thirty-Seven (37) patients exited the programme (0 transplant, 23 deaths, 14 patients transfer to other centres). In the prevalent population, average age was  $62.2 \pm 10.9$  years, the number of patients with chronic glomerulonephritis as the etiology of renal failure was 31.6%, diabetic nephropathy 43.9%.

All patients (100%) are using high flux dialysers. Average blood flow was  $285 \pm 36.5$  ml/min. 90.5% of patients dialyse 4 hours or more. 87.3% of patients use a native arteriovenous fistula. Dialysis adequacy as measured by single pool KT/V is  $>1.2$  in 99.8% of patients.

Mean hemoglobin was  $11.0 \pm 1.5$  g/dl. About 85.4% of all patients are on EPO. About 6.2 % of patients are considered Fe deficient.

There has been a drop in S Albumin of with only 31.6% of patients having Albumin $<40$  g/l compared with 39.3% the previous year.

Diabetes as a comorbidity was present in 50.2% of the population. This is an increase from last year (49.5%).

There was no significant changes in virology status. Hep B positivity was 5.5%, HCV 3.2%, Hep B and HCV 0.4%.

Less patients were registered on the National Transplant waiting list (6.3%), 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 physician staff comprised a pool of 13 nephrologists from both the restructured hospitals as well as the private sector. They are rostered to do rounds in the centre. New patients are screened by the Medical Director for suitability before entry into the dialysis programme. Routinely, dialysis patients are seen once every month.

The nephrologists include:

1. Dr Stephen Chew
2. A/Prof Lina Choong
3. Dr Grace Lee
4. Dr Pwee Hock Swee
5. Dr Tan Han Khim
6. Dr Tan Seng Hoe
7. Dr Yeoh Lee Ying
8. Dr Ng Tsun Gun
9. Dr Timothy Koh
10. Dr Manish Kaushik
11. Dr Sobhana Thangraju
12. Dr Htay Htay
13. Dr Wong Jiunn

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 Lai Li Cheng – Chinatown Medical Clinic
2. Dr Chong Foong Chong – Grace Clinic

\*Ghim Moh Centre:

1. Mobile doctor – 24hrs hotline

## NURSING

Ms Sunitha Silvanathan was the Acting Head of Clinical Services until 01<sup>st</sup> August 2018, when she stepped down. The Head of Clinical Services oversee a group of Nurse Clinicians - Ms Ma Ming Juan, Ms Tang Huie. Ms Petra Chong joined the team in Jan 2018 as Manager, Education, Audit and Compliance. She later took over as Acting Head of Clinical Services.

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

The Dialysis Providers were:

- Fresenius Medicare at San Wang Wu Ti (Kreta Ayer) Centre (contract renewed in Sep 2018 to end Aug 2021)
- Renal Team at Ghim Moh Centre (contract from Oct 2015 to end Sep 2020)
- Bishan Centre was managed directly by KDF from Jan 2018.

The Dialysis Providers are responsible for rostering of the nursing services. Staff numbers inclusive of the charge nurse as at 31 Dec 2018 is listed as follows:

Centre	Renal trained SN	SN	EN	DT	Total
Bishan	2	16	2	0	18
SWWT	0	12	2	0	14
Ghim Moh	2	13	2	0	15
<hr/>					
Grand total					47

## 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 5008S	Fresenius 4008S	Gambro AK96
Bishan	*21	0	0
Kreta Ayer	0	0	17
Ghim Moh	0	21	0

\*21 machines were replaced in July 2018 with F5008S, Fresenius Medical Care.



## WATER TREATMENT SYSTEMS

Provision of treated water is essential for safe hemodialysis therapy.

All centres use Reverse Osmosis Systems. Pretreatment to remove particles, some solutes, chlorine./chloramine comprises backwashable multimedia, activated carbon filters, regenerable water softener and pre cartridge filter before water enters the RO membranes to allow reverse osmosis to take place. 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	Baxter	2009
Kreta Ayer	Baxter	2012
Ghim Moh	Cantel	2007

The systems at Bishan, Ghim Moh and SWWT centres undergo auto-washing and flushing before going onto standby mode at the end of each dialysis day.

Daily monitoring of RO system pressure parameters and chloramine checks are carried out at the beginning of the day before priming and during mid shift. Chemical disinfection is done 6 monthly by the vendors for Ghim Moh centre and monthly by nurses for SWWT centre. In Bishan membrane disinfection is performed every month 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 of dialyser had been discontinued in all centres as at September 2018.

All centres practice single use of dialyser. Ghim Moh centre managed by Renal Team started single use in October 2015. Bishan centre converted from reuse to single use of dialyser in March 2018 and SWWT centre managed by Fresenius Medical Care started single use in September 2018.

## 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 Amanda Chew 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 Ivy Tan assisted Ms Vivienne Lim with the patient welfare matters.

The number of Medifund recipients were as follows:

<b>Year</b>	<b>No of Patients</b>	<b>% of pt</b>
2013	149	55.6
2014	86	33.2
2015	82	33.3
2016	125	51.9%
2017	150	54.5%
2018	135	53.4%

In addition to subsidies for dialysis, patients are also eligible for drug subsidies for Erythropoietin, intravenous One-Alpha, Venofer, 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 Nurse Clinician or designee and Nurse Managers 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. In accordance with MOH circular No. MH24:60/8, an 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 needy patients. 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 Jul 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 2018, we had 253 patients dialysing in 3 centres – 90 patients at Bishan Centre (BS), 75 at Kreta Ayer (SWWT) and 88 patients at Ghim Moh centre.

### A. INTAKE AND EXITS

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

**Table 7A-1 – Patient Stock & Flow**

<b>ENTRY</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
New Cases	26	28	12	32	31	12	11	2	30	7
New Cases (interim)	7	7	15	31	31	13	10	16	31	7
Re-enter KDF	0	3	2	2	0	3	2	4	2	2
<b>Total Entries</b>	<b>33</b>	<b>38</b>	<b>29</b>	<b>65</b>	<b>62</b>	<b>28</b>	<b>23</b>	<b>22</b>	<b>63</b>	<b>16</b>
<b>EXIT</b>										
Transfer Out to non-KDF Programs	5	1	7	5	3	10	12	11	9	14
Transfer Out to KDF PD	1	2	3	7	3	4	1	2	0	0
Transplant	4	2	1	4	2*	2	1	0	6	0
Withdraw from Dialysis/Default	1	4	4	2	3	5	5	1	0	0
Deaths	8	8	20	13	18	16	17	13	15	23
<b>Total Exits</b>	<b>19</b>	<b>17</b>	<b>35</b>	<b>31</b>	<b>29</b>	<b>37</b>	<b>36</b>	<b>27</b>	<b>30</b>	<b>37</b>
<b>Total No of Pt</b>	<b>186</b>	<b>207</b>	<b>201</b>	<b>235</b>	<b>268</b>	<b>259</b>	<b>246</b>	<b>241</b>	<b>274</b>	<b>253</b>

\* Cadaveric/Deceased Donor

**Table 7A-2 –Mode of Dialysis**

Interim HD		8
- Newly initiated subsequently permanent HD	6	
- Newly initiated awaiting PD	-	
- Newly initiated Bridge to Transplant	-	
- PD complications for temp HD Ow Yeong How Keong	1	
- PD complications to permanent HD	-	
- Failed tx, back on HD	-	
- had been on dx, transferred from other WO centre	-	
- <b>Transfer from Private Centres</b>	1	
Permanent HD [not via interim route]		8
- newly initiated	-	
- failed PD program, re-enter program	1	
- had been on HD, transferred to VWO from private	7	
- Failed tx, back on HD	-	
- Re entry	1	
- <b>Transfer from Private Centres</b>	0	
TOTAL		16

**Table 7A-3 – Source of Referral**

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
SGH	16	25	22	52	53	25	22	19	39	5
NUH	11	8	3	6	8	1	1	3	6	1
TTSH	1	2	1	3	0	1	0	0	10	1
AH / KPTH	4	3	3	4	1	1	0	0	3	4
NTFH	0	0	0	0	0	0	0	0	5	4
CGH	0	0	0	0	0	0	0	0	0	1
Private	1	0	0	0	0	0	0	0	0	0
<b>Total Entries</b>	<b>33</b>	<b>38</b>	<b>29</b>	<b>65</b>	<b>62</b>	<b>28</b>	<b>23</b>	<b>22</b>	<b>63</b>	<b>16</b>

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	2014		2015		2016		2017		2018	
	n	%	n	%	n	%	n	%	n	%
<b>Chronic GN</b>	3	10.7	8	34.8	3	13.6	11	17.5	1	6.3
<b>Diabetic nephropathy</b>	16	57.1	13	56.5	15	68.2	38	60.3	10	62.5
<b>Lupus nephritis</b>	0	0	0	0	0	0	0	0	0	0
<b>Obstructive uropathy</b>	1	3.6	0	0	1	4.5	0	0	0	0
<b>PCKD</b>	0	0	0	0	0	0	0	0	0	0
<b>TB kidney</b>	0	0	0	0	0	0	0	0	0	0
<b>Hypertension</b>	2	7.1	0	0	2	9.1	4	6.3	2	12.5
<b>Others</b>	5	17.9	1	4.3	1	4.5	6	9.5	2	12.5
<b>Unknown Etiology</b>	1	3.6	1	4.3	0	0	4	6.3	1	12.5
<b>Total</b>	28	100	23	100	22	100	63	100	16	100

The majority of new cases were patients with diabetes mellitus (62.5%) and chronic GN (6.3%).

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

Etiology	2014		2015		2016		2017		2018	
	n	%	n	%	n	%	n	%	n	%
<b>Chronic GN</b>	92	35.5	92	37.4	88	36.5	90	32.7	80	31.6
<b>Diabetic nephropathy</b>	97	37.5	95	38.6	97	40.5	121	44.0	111	43.9
<b>Lupus nephritis</b>	9	3.5	8	3.3	7	2.9	5	1.8	6	2.4
<b>Obstructive uropathy</b>	3	1.2	3	1.2	4	1.7	4	1.5	4	1.6
<b>PCKD</b>	7	2.7	5	2.0	5	2.1	3	1.1	5	2.0
<b>TB kidney</b>	2	0.7	2	0.8	2	0.8	1	0.4	1	0.4
<b>Hypertension</b>	10	3.9	8	3.3	8	3.3	13	4.7	12	4.7
<b>VUR</b>	3	1.2	2	0.8	2	0.8	0	0	1	0.4
<b>Others</b>	18	6.9	16	6.5	15	6.2	21	7.6	12	4.7
<b>Unknown Etiology</b>	18	6.9	15	6.1	13	5.4	17	6.2	21	8.3
<b>Total</b>	259	100	246	100	241	100	275	100	253	100

There are more patients with diabetic nephropathy (43.9%) than chronic glomerulonephritis (31.6%)

## Gender

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

Gender	2014		2015		2016		2017		2018	
	n	%	n	%	n	%	n	%	n	%
<b>Males</b>	20	71.4	11	47.8	13	59.1	38	60.3	9	56
<b>Females</b>	8	28.6	12	52.2	9	40.9	25	39.7	7	44
<b>Total</b>	28	100	23	100	22	100	63	100	16	100

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

Gender	2014		2015		2016		2017		2018	
	n	%	n	%	n	%	n	%	n	%
<b>Males</b>	130	50.2	120	48.8	117	48.5	141	51.3	129	51
<b>Females</b>	129	49.8	126	51.2	124	51.5	134	48.7	124	49
<b>Total</b>	259	100	246	100	241	100	275	100	253	100

At the end of 2018, the ratio of male to female patients was 1:1.04

## Ethnic Distribution

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

Race	2014		2015		2016		2017		2018	
	n	%	n	%	n	%	n	%	n	%
<b>Chinese</b>	21	80.8	12	52.2	19	86.4	34	54	13	81
<b>Malay</b>	2	7.7	7	30.4	2	9.1	19	30.1	3	19
<b>Indian</b>	3	11.5	4	17.4	1	4.5	8	12.7	0	0
<b>Others</b>	0	0	0	0	0	0	2	3.2	0	0
<b>Total</b>	26	100	23	100	22	100	63	100	16	100

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

Race	2014		2015		2016		2017		2018	
	n	%	n	%	n	%	n	%	n	%
<b>Chinese</b>	180	69.5	169	68.7	166	68.9	182	66.2	170	67.2
<b>Malay</b>	59	22.8	55	22.4	55	22.8	70	25.5	63	24.9
<b>Indian</b>	20	7.7	22	8.9	20	8.3	20	7.2	19	7.5
<b>Others</b>	0	0	0	0	0	0	3	1.1	1	0.4
<b>Total</b>	259	100	246	100	241	100	275	100	253	100

The ethnic distribution of our prevalent patients was 67.2% Chinese, 24.9% Malays and 7.5% Indians.

### Age

The mean age at entry in 2018 was 62.1 ± 7.8 years (median, 62). Five (5) patients were above the age of 65 years

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

Year	2014	2015	2016	2017	2018
<b>Mean Age (years)</b>	59.1	58.0	62.8	61.4	62.1
<b>SD</b>	12.5	14.9	12.9	11.3	7.8
<b>Min</b>	30.6	29.0	33.0	31.2	49.2
<b>Max</b>	78.0	85.1	84.2	84.9	73.1

Average age of new patients with diabetic nephropathy (10 pts) was 60.2 years compared with 64.8 years in non-diabetics (3 pts).

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

Year	2014	2015	2016	2017	2018
<b>Mean Age (years)</b>	59.5	59.9	60.7	61.6	62.2
<b>SD</b>	10.6	10.8	10.9	11.0	10.9
<b>Min</b>	31.4	29.3	30.3	31.3	32.3
<b>Max</b>	89.0	86.0	86.0	87.0	88.0

Age of the prevalent dialysis population at the end of 2018 was 62.2 ± 10.9 years (median 63.4). 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	2014		2015		2016		2017		2018	
	n	%	n	%	n	%	n	%	n	%
<b>Diabetic</b>	8	30.8	14	60.9	14	63.6	42	66.7	15	93.6
<b>IHD n oth cardiac dis</b>	7	26.9	9	39.1	8	36.4	17	27	7	43.6
<b>CVA</b>	2	7.7	1	4.3	2	9.1	1	1.6	4	25
<b>PVD</b>	0	0	3	13.0	2	9.1	0	0	2	12.5

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

Year	2014		2015		2016		2017		2018	
	n	%	n	%	n	%	n	%	n	%
<b>Diabeti cs</b>	110	42.5	115	46.6	106	43.9	136	49.5	127	50.2
<b>IHD n oth cardiac</b>	77	29.7	60	24.4	67	27.8	91	33.1	83	32.8
<b>CVA</b>	14	5.4	13	5.3	10	4.1	23	8.36	19	7.5
<b>PVD</b>	11	4.2	12	4.9	14	5.8	19	6.9	16	6.3

The proportion of diabetics in the prevalent dialysis population has increased to 50.2%.

The proportion of patients with cardiac problems has decreased to 32.8%.



## HOSPITALIZATIONS

Hospitalizations during the period 1 January 2018 to 31 December 2018 were analyzed and expressed as episodes and days hospitalized per patient year of dialysis programme. There were 599 hospitalization episodes in 204 patients. Thus, 70.3% of the patients were ever admitted that year.

**Table 7B-11 – Admission Rates**

	2014		2015		2016		2017		2018	
	No	%	No	%	No	%	No	%	No	%
No of Patients admitted in ref year	209/294	71.1	199/282	70.6	184/268	68.7	199/304	65.5	204/290	70.3
- Diab pt adm / all diab	117/126	92.9	117/122	95.9	96/111	86.5	110/151	72.8	129/152	84.9
- Non-diab pt adm / all non-diab	92/168	54.8	82/160	51.3	88/157	56.1	89/153	58.2	75/138	54.3

RATES/YR	2014	<i>Per yr</i>	2015	<i>Per yr</i>	2016	<i>Per yr</i>	2017	<i>Per year</i>	2018	<i>Per year</i>
Admission episodes	618	2.3	556	2.0	512	2.1	635	2.3	599	2.1
• diabetic	358	3.1	335	2.5	262	2.7	375	2.8	385	2.5
• non-diab	260	1.7	221	1.5	250	1.7	260	1.9	214	1.6
Admission days	5766	21.7	5272	20.4	4298	17.6	4387	17.7	5095	18.9
• diabetic	3432	29.7	3326	28.2	2160	22.4	3106	25.3	3555	28.1
• non-diab	2334	15.5	1946	13.6	2138	14.5	1281	10.3	1540	13.4

The admission rate was 2.1 episodes per patient year. Days admitted per dialysis year reduced to 18.9. Not unexpectedly, diabetics had higher number of days (28.1) admitted compared with non-diabetics (13.4).

## DEATHS AND WITHDRAWALS

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

- 1 patient to Myanmar).
- 1 patient to KTPH PD programme
- 13 patients transferred to other centres (6 to NKF; 6 to high dependency dialysis)

There were 23 deaths –

- 7 from cardiac causes
- 6 from pneumonia
- 2 from Cancer
- 1 from respiratory arrest
- 1 E coli bacteraemia secondary to infective endocarditis
- 1 from septicemia
- 2 died at home
- 1 died in nursing home
- 2 unknown cause

**Table 7B-13 – Deaths and Withdrawals**

	2011	2012	2013	2014	2015	2016	2017	2018
Transfers								
- PD	3	7	3	4	1	3	1	1
- Other	7	5	3 (1 hi-dep)	10 (5 hi-dep)	12 (9 hi-dep)	10 (3 hi-dep)	8	13 (6 hi-dep)
Transplants	1	4	2	2	1	0	5	0
Withdrawals	4	2	2	5	5	1	0	0
Deaths	20	13	18	16	17	13	15	23
<b>Total</b>	<b>35</b>	<b>31</b>	<b>28</b>	<b>37</b>	<b>36</b>	<b>27</b>	<b>29</b>	<b>37</b>

## D. DIALYSIS PARAMETERS

All patients used high flux dialyzers.

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

	2013		2014		2015		2016		2017		2018	
	n	%	n	%	n	%	n	%	n	%	n	%
F6	6	2	1	0.4	0	0	0	0	1	0.4	0	0
HF50	19	7	17	6.6	14	5.7	7	2.9	5	1.8	0	0
HF60	66	25	62	23.9	63	25.6	33	13.7	33	12	0	0
HF80	51	19	56	21.6	54	22.0	21	8.7	34	12.4	0	0
HF100	24	9	24	9.3	24	9.8	14	5.8	15	5.5	0	0
PolyFlux6L	0	0	1	0.4	0	0	0	0	0	0	0	0
F70S	0	0	23	8.9	0	0	0	0	0	0	0	0
PolyFlux14*	46	17	24	9.3	41	16.7	76	31.5	77	28	31	12.3
PolyFlux17*	43	16	39	15.1	37	15	61	25.3	80	29	43	17.0
PolyFlux21*	13	5	12	4.6	13	5.3	29	12.1	30	10.9	14	5.5
FX50	0	0	0	0	0	0	0	0	0	0	4	1.6
FX60	0	0	0	0	0	0	0	0	0	0	49	19.4
FX80	0	0	0	0	0	0	0	0	0	0	71	28.1
FX100	0	0	0	0	0	0	0	0	0	0	40	15.8
Xevonta H23											1	0.4
<b>TOTAL</b>	<b>268</b>	<b>100</b>	<b>259</b>	<b>100</b>	<b>246</b>	<b>100</b>	<b>241</b>	<b>100</b>	<b>275</b>	<b>100</b>	<b>253</b>	<b>199</b>

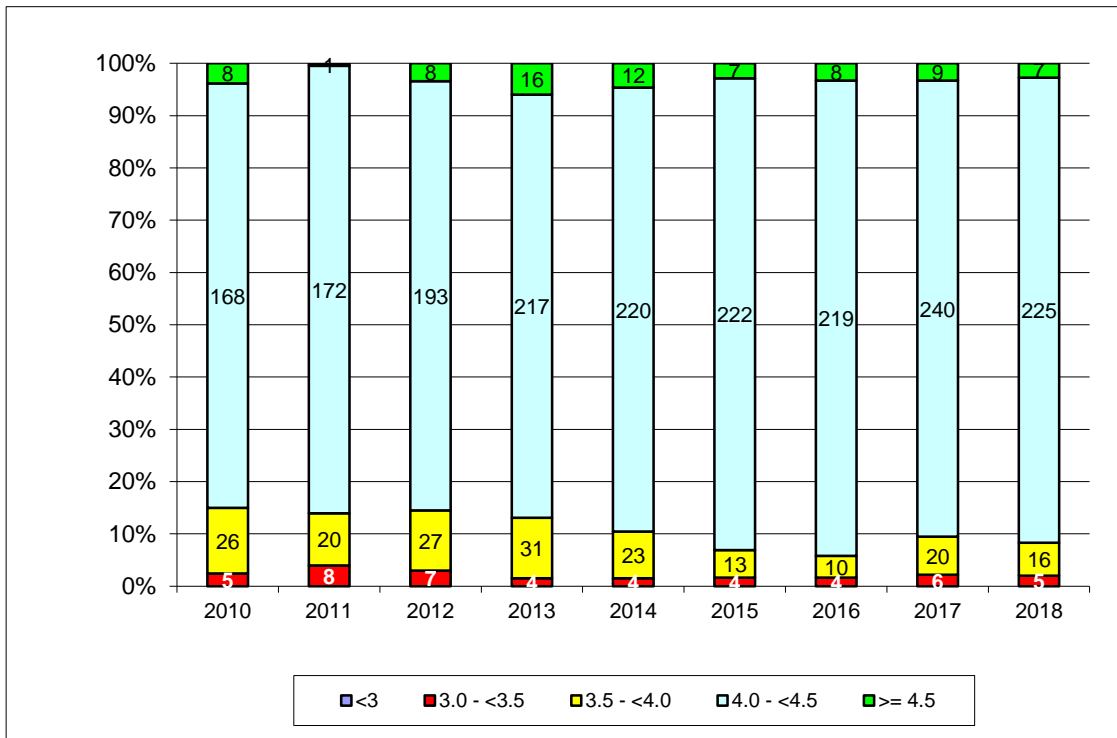
Note: \* The name of polyflux high flux dialyzers were changed to Polyflux14H, Polyflux17H and Polyflux21H respectively. \*All centres discontinued using HF high flux dialyzer. It was replaced by FX series dialyzer.

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

ml/min	2010	2011	2012	2013	2014	2015	2016	2017	2018
<b>Mean</b>	267	267	267	270	276	282	279	278	285
<b>Std Dev</b>	31	34	33.4	33.9	35.2	36.9	38.1	39.3	36.5
<b>Min</b>	150	180	200	180	200	200	200	200	200
<b>Max</b>	360	360	360	360	400	400	400	400	400

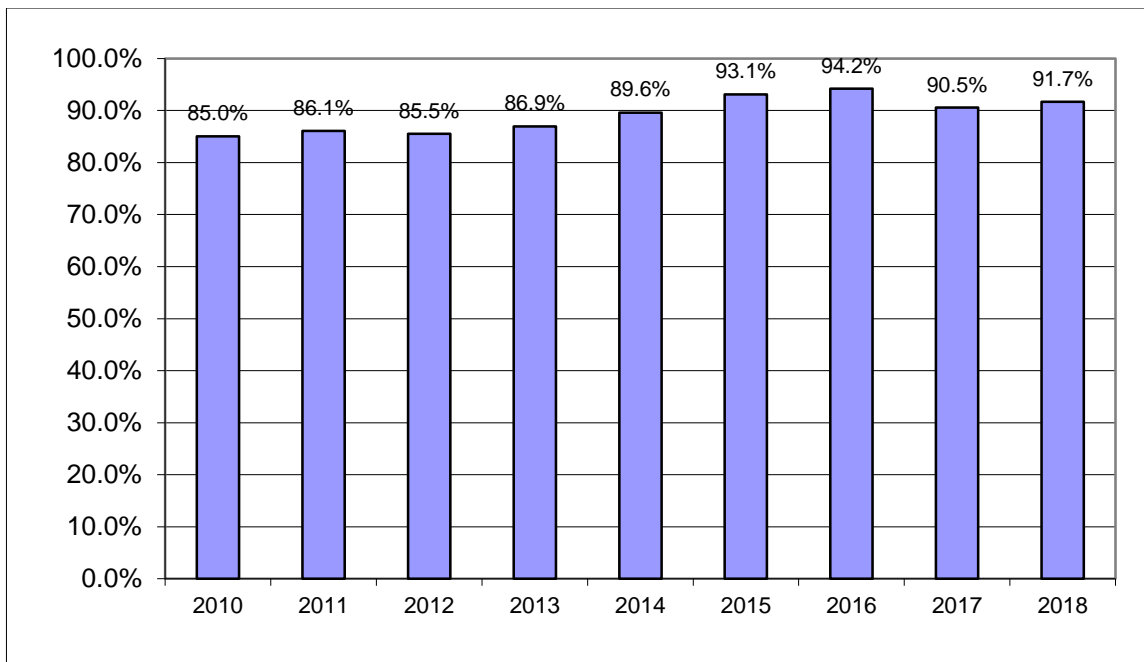
Blood flow is set at a minimum of 200 ml/min and averaged  $285 \pm 36.5$  ml/min, median 280 ml/min (range 200 -400).

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



91.7% [232/253] patients dialyze for 4 hours or more as compared to the previous year (90.5%). Decreased numbers of less than 4 hrs.

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



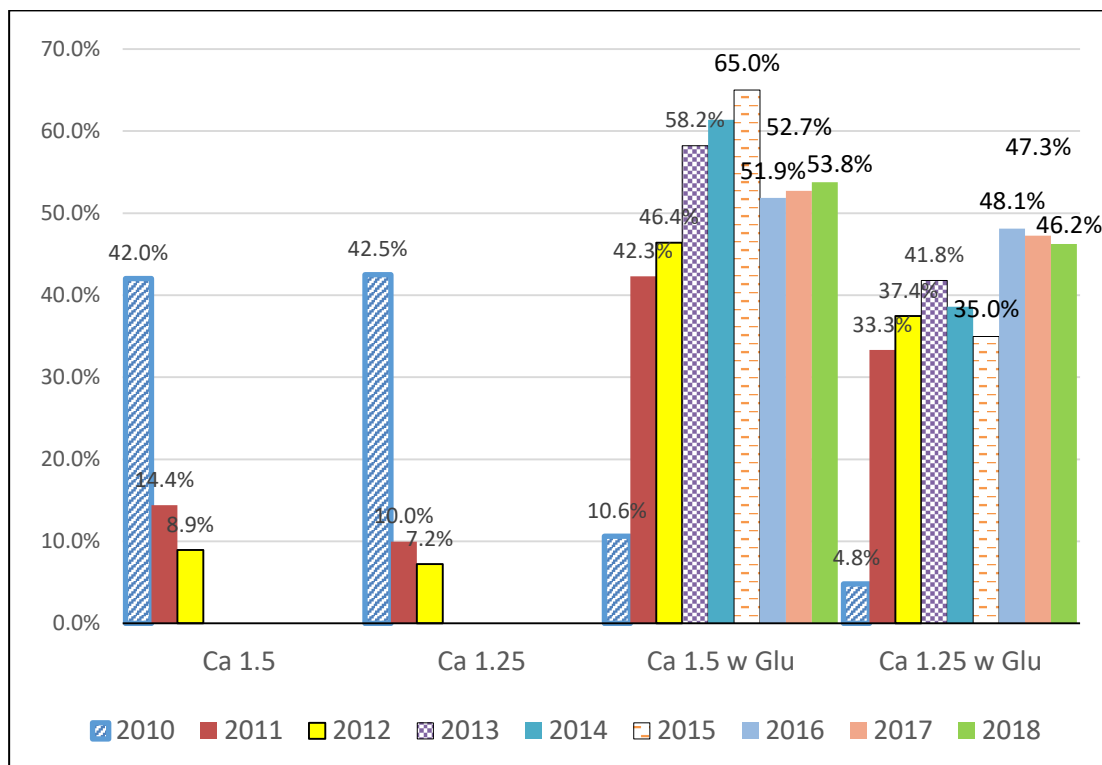
## DIALYSATE

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

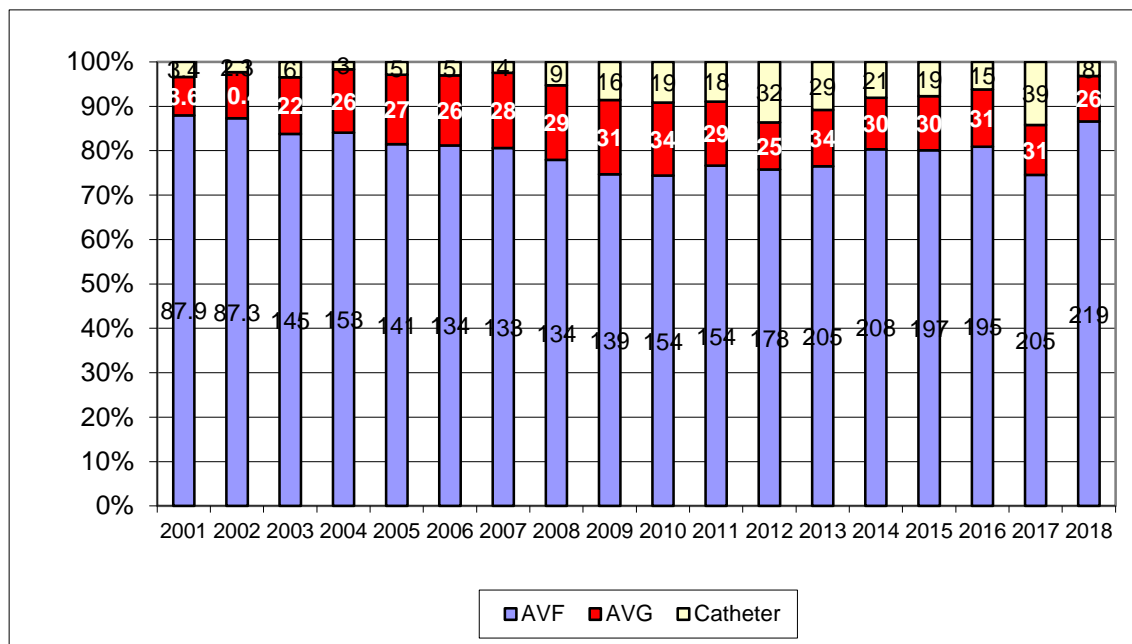
Dialysate containing 1.5 mmol/L calcium and 11 mmol/L glucose was first introduced in SWWT centre on 2<sup>nd</sup> December 2008 for diabetic and elderly patients. All patients in Bishan centre were provided with dialysate with glucose with either calcium 1.5 or 1.25 mmol/L from July 2011. With effect 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



There is a decrease in the number of patient using temporary catheters 3.2 % (8/253) compared with the previous year (14.2%). Two hundreds and nineteen patients or 86.6% (219/253) were using AV fistula and 10.3% (26/253) using grafts.

## 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:

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

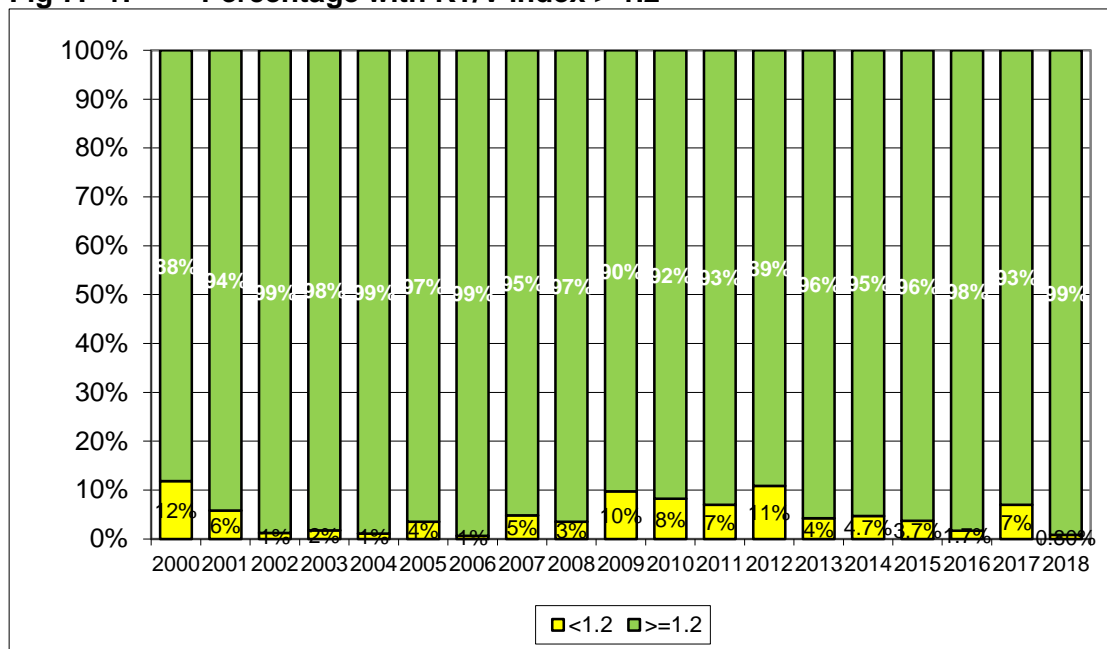
where R = post/pre urea  
 UF = ultrafiltration in litres  
 W = post dialysis weight

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

Our patients weighed  $63.2 \pm 16.7$  kg (median 60.9 kg, range 34.4 – 125.0 kg).

The proportion of patients with KT/V of 1.2 or greater in November / December 2018 was 99.8% (251/253).

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

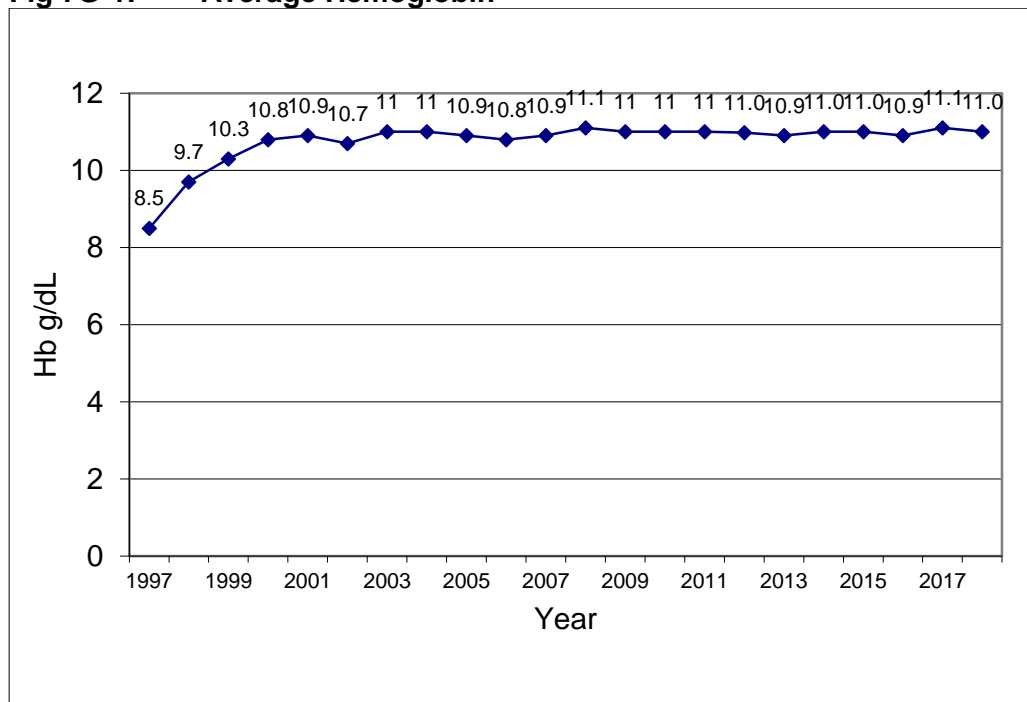


The proportion of patients with low KT/V is now 0.8% (2/253).

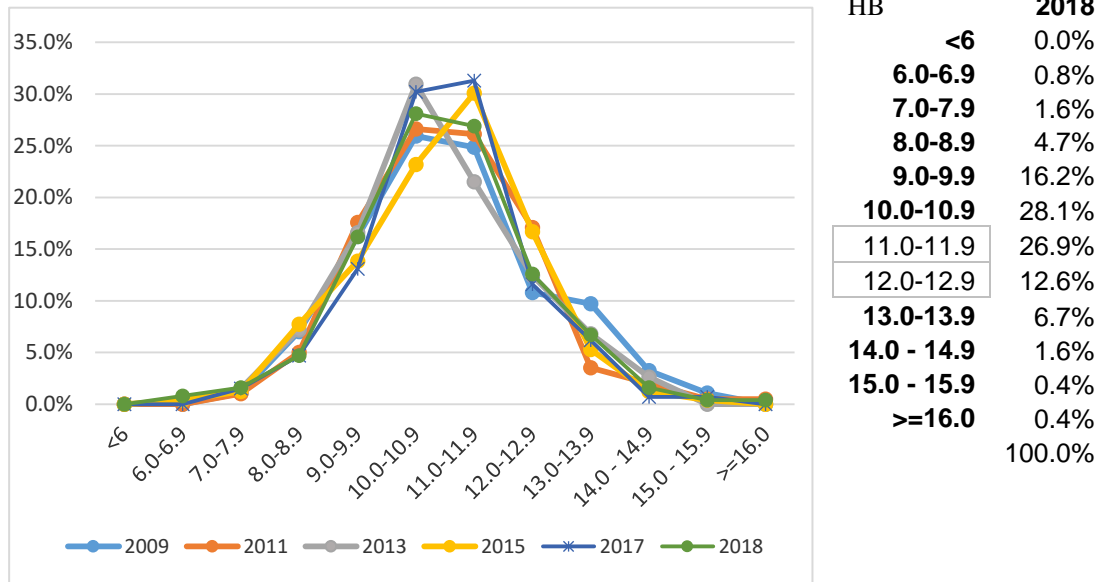
**G. ANAEMIA**

The mean Hb was calculated to be  $11.0 \pm 1.5$  g/dl (range 6.3 – 16.7 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 23.3% (59/253) slightly higher than last year (19.3%).

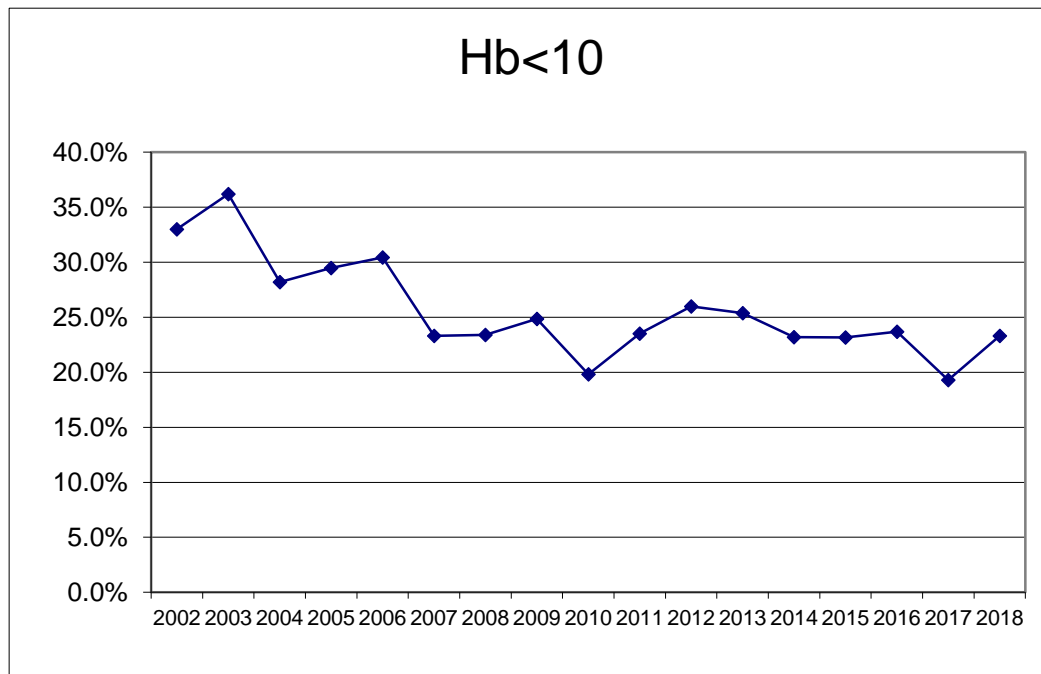
**Fig 7G-1: Average Hemoglobin**



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



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

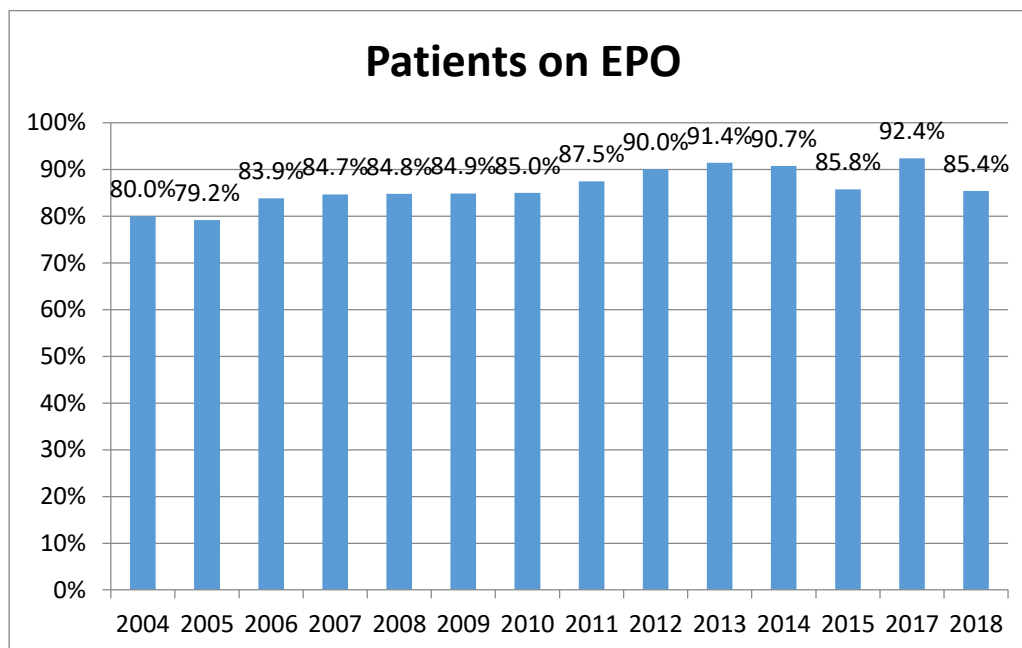




## ERYTHROPOIESIS STIMULATING AGENTS

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 to 23.3% when compared to previous year (19.3%). The proportion of patients on ESA is around 85.4%.

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



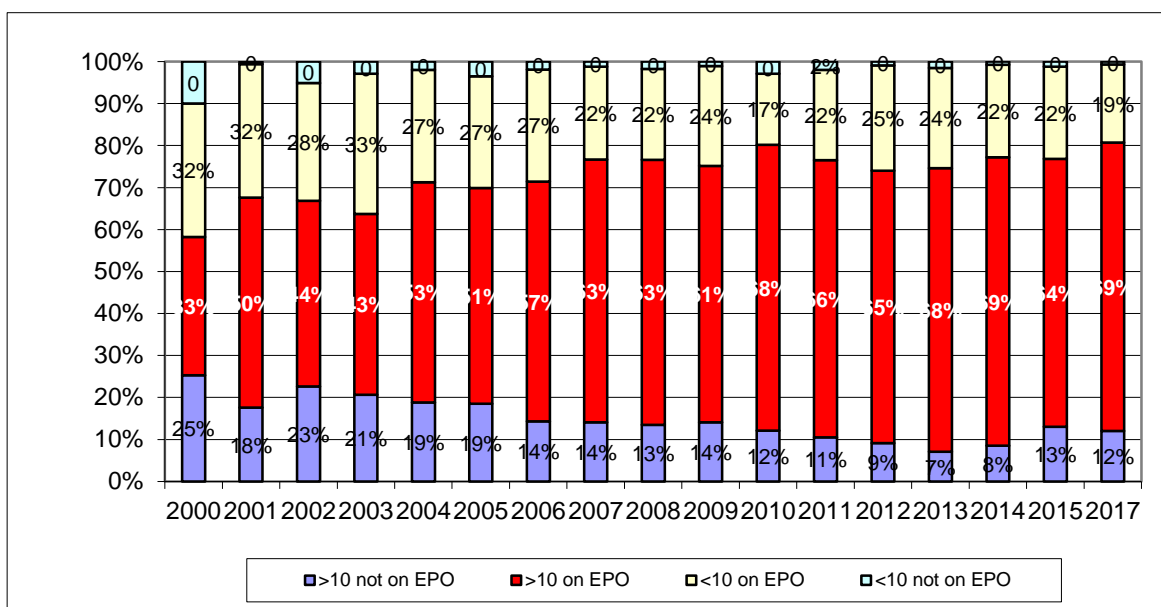
The cost of erythropoietin is Medishield claimable if the patient is eligible. In addition, patients are also eligible to apply for the Foundation's subsidy programme. There is no cap on the erythropoietin subsidy.

Patients who were on EPO used on the average  $76.9 \pm 68.0$  units/kg/wk (median 62.6) in 2018.

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-seven (37) patients (14.6%) were not on EPO. They had a mean Hb of 12.9 g/dl (range 9.8 – 16.7).

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



	2018	NO. OF PTS
≥10 not on EPO	14.2%	36
≥10 on EPO	62.5%	158
<10 on EPO	22.9%	58
<10 not on EPO	0.4%	1
	100.0%	253

One patients with Hb<10g/dl was not using EPO. The proportion of patients with HB > 10 g/dl not requiring EPO was 14.2%.

## IRON STATUS

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

	2011	2012	2013	2014	2015	2016	2017	2018
Mean (%)	34.6	32.8	33.4	34.8	36.3	36.0	33.2	36.0
SD	15	15	15.3	16	16.5	14.7	13.8	15.7
% pats w TFSat <20%	10.4%	13.6%	15.3%	12%	11.4%	7%	11.4%	6.3%
Average HB when TFSat<20% (g/dl)	10.8	11.2	10.5	10.4	10.3	10.1	10.3	10.1
% pats w TFSat <30%				43.4	40.7	36.9	48.4	39.5
Average HB when TFSat<30% (g/dl)				10.8	10.7	10.6	10.7	10.7
% pats w TFSat >=20%	88.6	83.8	84.0	88.0	88.6	90	88.6	93.7
% pats w TFSat >= 30%				56.6	59.3	62	51.6	60.5
Average HB when TFSat>=20% (g/dl)	11	11	11	11.1	11	10.9	10.9	11.0

As at the end of 2018, mean transferrin saturation was  $36.0 \pm 15.7$  % (range 12.0 – 104.3). The proportion of patients with transferrin saturation of less than 20% was 6.3%, higher than the previous year (11.4%). 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 11.0 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**

	2011	2012	2013	2014	2015	2016	2017	2018
Mean	543	597	626	725	859	773	854	829
SD	356	454	467	521	649	434	572	861
% pats w Ferritin < 200	15.4%	16.4%	14.6%	6.6%	7.3%	4%	10.6%	9.1%

Using S Ferritin of 200 mg/ml, 9.1% 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 very reduced price. The number of patients with Serum albumin less than 40 g/dl was 31.6%. Much improved when compared to last year (39.3%).

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

	2011	2012	2013	2014	2015	2016	2017	2018
NPCR (g/kgBW)								
• Mean $\pm$ SD	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	1.07 $\pm$ 0.25
• % < 1.2	78.4	79.6	72	71.8	70.7	67.6	75.6	73.9
S Albumin (g/l)								
• Mean $\pm$ SD	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	40.3 $\pm$ 3.4
• % <40	93.5	95.7	54.1	49.8	45.5	45	39.3	31.6
• % <35	49.3	49.8	15.7	8.5	9.8	7	5.5	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 2018

	Patients	Quantity	Total Cost	Subsidy	Subsidy $\div$ Cost
Bishan	8	88	1,412.40	938.93	66.48%
Kreta Ayer	8	31	497.55	487.00	97.88%
Ghim Moh	3	19	304.95	118.77	38.95%
	<b>19</b>	<b>138</b>	<b>2,214.90</b>	<b>1,554.70</b>	<b>70.19%</b>

	2016	2017	2018
% pts on Beneprotein	6.9%	11.6%	7.5%
% pts subsidised for Beneprotein	100%	96.4%	100%

2018:

9 of 253 (7.5%) patients used Beneprotein.

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

In additional, 1 PD patient who was under KDF portable subsidy bought 4 tin of Beneprotein in 2018. Total cost of the PD patient was \$64.20. KDF subsidized \$38.52. Subsidy rate was 60% for this patient.

## I. MINERAL METAB

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

	2011	2012	2013	2014	2015	2016	2017	2018
Mean S Calcium (mmol/L)	2.37	2.39	2.26	2.29	2.32	2.27	2.26	2.25
SD	0.18	0.20	0.22	0.18	0.2	0.2	0.18	0.17
Min	1.86	1.71	1.79	1.85	1.76	1.83	1.75	1.82
Max	2.92	3.3	3.93	2.93	3.34	3.8	2.68	2.76

\* S Calcium corrected for S Albumin reported from 2007

The mean corrected serum calcium value was  $2.25 \pm 0.17$  mmol/l. Low calcium dialysate is currently in use for 46.2% of the patients (117/253).

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

	2011	2012	2013	2014	2015	2016	2017	2018
Mean S PO4 (mmol/L)	1.5	1.57	1.52	1.49	1.5	1.49	1.56	1.47
SD	0.42	0.44	0.43	0.41	0.4	0.4	0.44	0.41
% with S PO4 >2.0 mmol/l	11	14.0	11.6	7.7	11.0	11.2	14.1	11.1
% with S PO4 >1.78 mmol/l (KDOQI)	24.0	28.0	23.5	25.1	22.8	19.9	27.3	20.6
Min	0.57	0.56	0.37	0.45	0.54	0.25	0.5	0.43
Max	2.57	3.3	2.92	2.85	2.98	2.97	3.54	2.78

Mean S Phosphate was  $1.47 \pm 0.41$  mmol/l. The patients having values above 2.0 mmol/l was 11.1 % as compared to 14.1% the previous year.

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

	2014	%	2015	%	2016	%	2017	%	2018	%
<16.5	82	32.3	65	26.6	62	25.9	63	23.3	65	25.7
16.5-33	58	22.8	69	28.3	38	15.9	57	21.1	53	29.0
>33.0	114	44.9	110	45.1	139	58.2	150	55.6	135	53.3
<b>Total</b>	254	100	244	100	239	100	270	100	253	100

53.3% (135) patients have intact parathyroid hormone levels elevated beyond 33 pmol/l. Hyperparathyroid bone disease is still a significant problem in the dialysis population. Parathyroidectomy has been performed in 46 patients.

## J. DIABETICS

The prevalent number of diabetic patients was 127 (50.2%) This is not surprising as diabetic nephropathy is the etiology of ESRD in more than half of all new cases.

## K. HYPERTENSION

79.1% (200/253) have recorded high blood pressures or have their blood pressures controlled with anti-hypertensive agents.

## M. HEPATITIS SEROPOSITIVITY

5.5% are hepatitis B carriers, 3.2% 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.

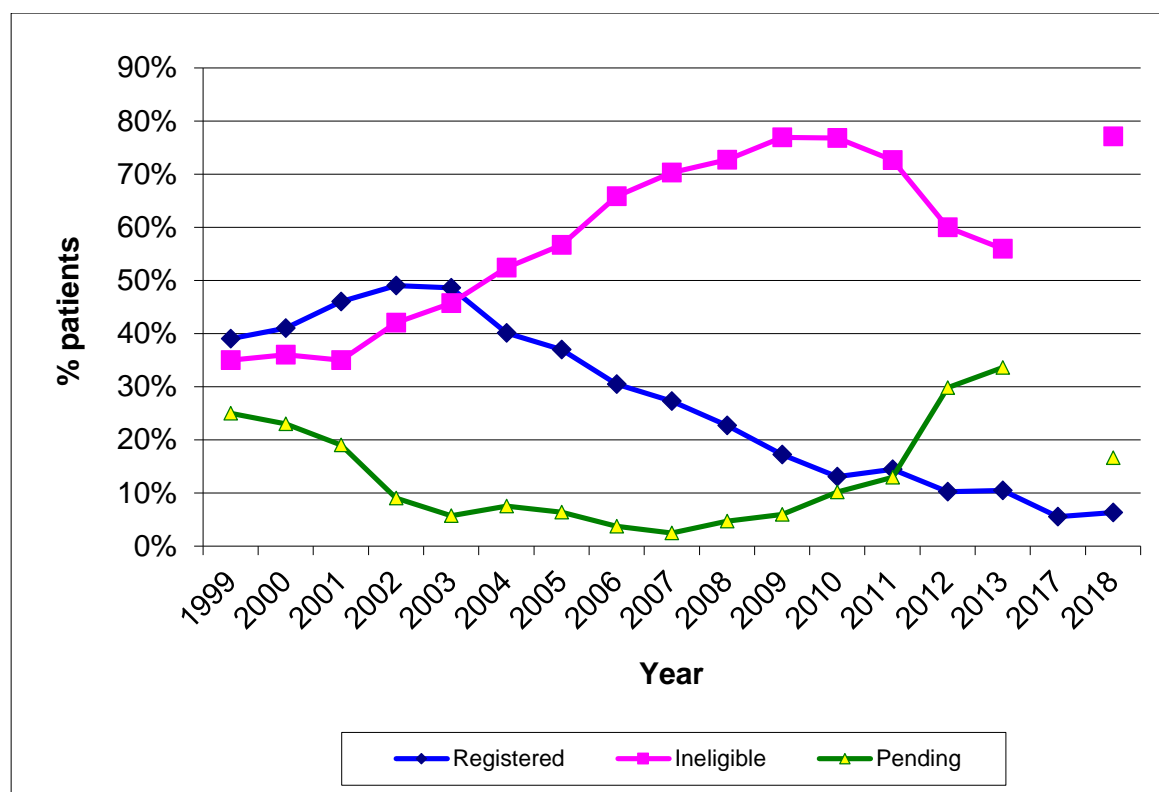
**Table 7M-1: Hepatitis Rates**

	2011	2012	2013	2014	2015	2016	2017	2018
HepB only	4.5%	6.4%	6.0%	5.4%	5.3%	4.1%	6.2%	5.5%
HCV only	4.9%	8.5%	7.1%	6.2%	6.9%	5.4%	4.5%	3.2%
HCV Treated	1.9%	1.7%	1.7%	1.2%	1.2%	1.2%	1.2%	1.2%
HepB & HCV	1%	0.9%	0.7%	0.8%	0.4%	0.4%	0.4%	0.4%

	n	%
All patients	253	100%
HepBsAg		
Pos	15	5.9%
Neg	238	94.1%
- number with HepBsAb>100	119	47.0%
- number with HepBsAb<100	119	47.0%
- HepBcore (total) Ab		
- not tested	58	22.9%
- Neg	45	17.8%
- Pos	16	6.3%
HBVDNA Pos	2	

## N. TRANSPLANT WAITING LIST

Only 16 patients (6.3%) are on the waiting list in 2018. Many new patients have not been assessed. The number of ineligible patients is expected to be high as KDF takes in more patients with comorbidities since admission criteria was relaxed.



## VACCINATIONS

### Pneumococcal Vaccines

#### Prevenar 13 – One time dose

Centre	2017		2018	
	N	%	N	%
Bishan	53/104	63.5	58/90	64.4
SWWT	57/82	69.5	43/75	43.0
Ghim Moh	58/89	65.2	56/88	63.6
<b>Total</b>	181/ 275	65.8	157/253	62.1%

A total of 62.1% of patients had received Prevenar 13.

#### Pneumovax 23 – To be given every 5 years

Centre	2017		2018	
	N	%	N	%
Bishan	65/104	62.5	56/90	62.2
SWWT	54/82	65.9	42/75	56.0
Ghim Moh	63/89	70.8	59/88	67.0
<b>Total</b>	182 /246	66.2	157/253	62.1

A total of 62.1% 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		2018	
	N	%	N	%	N	%	N	%
Bishan	67	70.5	76	81	78	75	70	77.8
SWWT	52	73.2	65	95.5	59	72	65	86.7
Ghim Moh	61	76.3	72	92	71	79.8	78	88.6
<b>Total</b>	180/246	73.2%	213/241	88.4%	208/275	75.6%	213/253	84.2

Flu vaccination is given yearly. In 2018, Flu vaccination was fully subsidised for all the patients who had given their consent for receiving the vaccination.

Fluarix Tetra (Quadrivalent) purchased from GlaxoSmith Pte Ltd (GSK) was given to 194 (76.7%) patients in October 2018.

Influvac (Trivalent) purchase from Abbott was given to 19 (7.5%) patients who are on Warfarin in October 2018.

There is an increase in the number of patients 84.2% (213/253) who received flu vaccination compared with the previous year (75.6%).

## Hepatitis B: Negative-Patient stats/ Vaccination / Booster

Centre	2017				2018			
	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	24	23.07	6	14	10	11.1	3	5
SWWT	9	10.9	4	5	8	10.7	2	3
Ghim Moh	24	27	12	1	11	12.5	2	2
Total:	57	22.1	22	20	29	11.5	7	10

## **8. CONCLUSION**

The number of new patients this year is lesser 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