

## **CHAPTER 6**

# **Management of Anaemia In Dialysis Patients**

Philip N. Jeremiah  
Bee Boon Cheak

**SECTION 6.1: TREATMENT FOR ANAEMIA IN DIALYSIS**

From 1997 – 2006, there was an increasing percentage of patients on erythropoietin (EPO); there were more haemodialysis patients on EPO; 84% compared to 74% in CAPD. The percentage of patients requiring blood transfusion however has also increased.

There were a decreasing number of patients on oral iron, with correspondingly significant increase of patients on parenteral iron.

**Table 6.1.1:** Treatment for Anaemia, HD patients 1997-2006

Year	No. of subjects	% on Erythropoietin	% received blood transfusion	% on oral Iron	% received parenteral Iron
1997	1695	46	8	92	4
1998	2141	46	13	92	4
1999	2996	51	15	90	5
2000	4392	56	15	88	5
2001	5194	62	13	88	5
2002	6108	67	10	85	7
2003	7017	71	12	83	8
2004	8064	74	11	80	10
2005	9344	81	14	74	11
2006	11494	84	18	76	16

**Table 6.1.2:** Treatment for Anaemia, CAPD patients 1997-2006

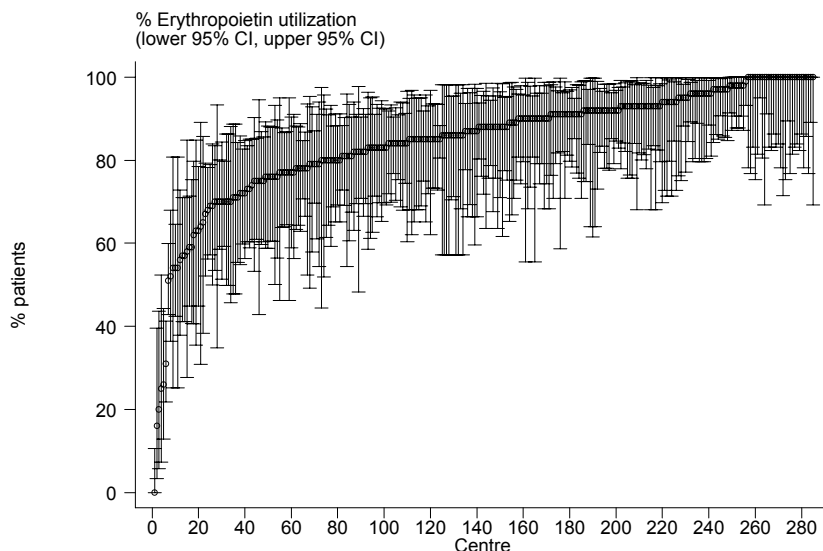
Year	No. of subjects	% on Erythropoietin	% received blood transfusion	% on oral Iron	% received parenteral Iron
1997	476	37	12	96	3
1998	541	44	16	96	3
1999	610	44	14	94	0
2000	662	46	11	92	4
2001	781	45	11	91	2
2002	891	49	11	93	2
2003	1230	53	14	87	4
2004	1312	63	15	85	7
2005	1390	72	12	87	8
2006	1550	74	16	83	13

In 2006, the percentage of patients on EPO among the HD centres varied significantly from 0% to 100%. The median usage of EPO was 88% compared to 45.5% 10 years ago.

**Table 6.1.3:** Variation in Erythropoietin utilization (% patients) among HD centres, 2006

Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	44	7	20	37.5	45.5	62.5	72	92
1998	50	0	4	33	49	57	78	86
1999	76	6	15	42	52	68	82	90
2000	109	0	20	45	56	69	90	100
2001	125	0	19	50	62	75	89	100
2002	156	14	25	55.5	68.5	78	92	100
2003	178	18	35	60	73	82	95	100
2004	207	7	35	65	77	86	96	100
2005	236	4	56	74	84	91	100	100
2006	285	0	58	79	88	93	100	100

**Figure 6.1.3:** Variation in Erythropoietin utilization (% patients) among HD centres, 2006

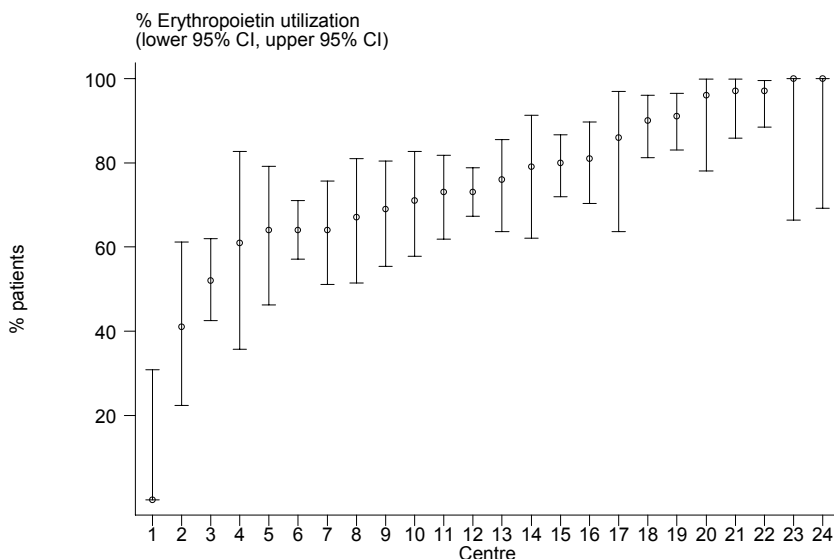


Surprisingly, in CAPD centres too, the variation in EPO utilization was from 0 to 100%. This was not so in 2005. The median usage of EPO was 74.5% in 2006

**Table 6.1.4:** Variation in Erythropoietin utilization (% patients) among CAPD centres, 2006

Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	7	19	19	21	41	49	53	53
1998	9	15	15	30	46	55	64	64
1999	10	22	22	32	40.5	54	79	79
2000	11	26	26	33	47	56	67	67
2001	12	25	25	33.5	46.5	56.5	84	84
2002	15	25	25	41	53	56	68	68
2003	19	26	26	38	51	73	92	92
2004	19	5	5	55	63	83	97	97
2005	21	42	56	59	67	81	97	100
2006	24	0	41	64	74.5	90.5	100	100

**Figure 6.1.4:** Variation in Erythropoietin utilization (%patients) among CAPD centres, 2006

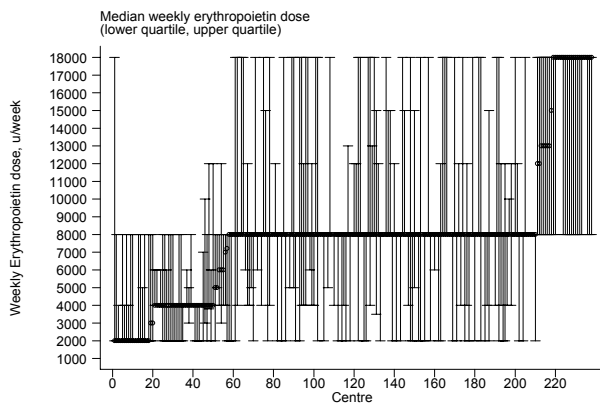


The median weekly EPO dose has increased significantly to 8000 units, in both haemodialysis and CAPD. In HD centres at the 5<sup>th</sup> and 95<sup>th</sup> centiles, 5% of centres have their weekly dose at 2000 units and 18,000 units respectively. (Table and Figure 6.1.5 and 6.1.6)

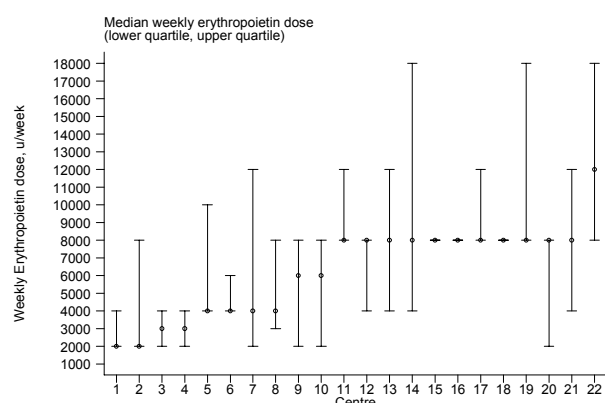
**Table 6.1.5:** Variation in median weekly Erythropoietin dose (u/week) among HD centres 2006

Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	30	2000	2000	4000	4000	4000	6000	8000
1998	34	2000	2000	4000	4000	4000	4000	4000
1999	51	2000	2000	2000	4000	4000	4000	4000
2000	78	2000	2000	2000	4000	4000	4000	6000
2001	93	2000	2000	2000	4000	4000	5000	8000
2002	116	2000	2000	4000	4000	4000	5000	6000
2003	137	2000	2000	4000	4000	4000	6000	8000
2004	171	2000	2000	4000	4000	4000	6000	8000
2005	197	2000	2000	4000	4000	8000	8000	18000
2006	238	2000	2000	8000	8000	8000	18000	18000

**Figure 6.1.5:** Variation in median weekly Erythropoietin dose (u/week) among HD centres 2006



**Figure 6.1.6:** Variation in median weekly Erythropoietin dose (u/week) among CAPD centres 2006



**Table 6.1.6:** Variation in median weekly Erythropoietin dose (u/week) among CAPD centres 2006

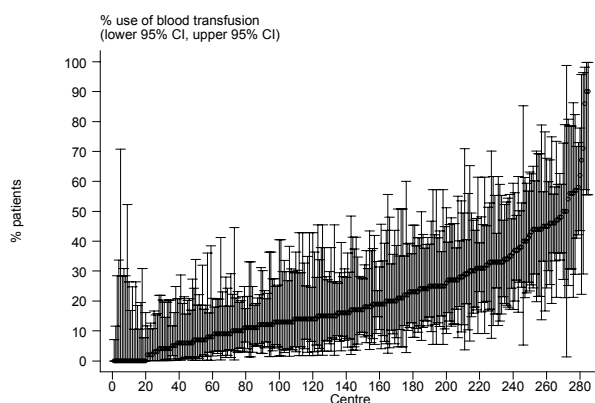
Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	6	4000	4000	4000	4000	4000	4000	4000
1998	6	3000	3000	4000	4000	4000	4000	4000
1999	7	2000	2000	2000	4000	4000	4000	4000
2000	9	2000	2000	4000	4000	4000	4000	4000
2001	11	2000	2000	4000	4000	4000	4000	4000
2002	12	2000	2000	3000	4000	4000	4000	4000
2003	14	2000	2000	4000	4000	4000	5000	5000
2004	13	2000	2000	4000	4000	4000	4000	4000
2005	20	2000	2000	3000	4000	4000	8000	8000
2006	22	2000	2000	4000	8000	8000	8000	12000

In HD and CAPD patients, the median requirement of blood transfusion has steadily increased over the last 2 years. (Table and Figure 6.1.7, 6.1.8)

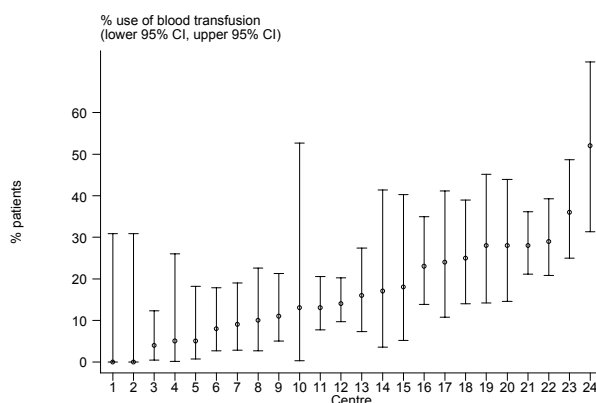
**Table 6.1.7:** Variation in use of blood transfusion (% patients) among HD centres, 2006

Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	44	0	0	0	6.5	13.5	37	71
1998	50	0	0	4	9	16	36	48
1999	76	0	0	4	10	21	41	56
2000	109	0	0	4	11	21	48	75
2001	125	0	0	5	12	20	38	50
2002	156	0	0	2.5	7	14	36	67
2003	178	0	0	3	9	19	36	63
2004	207	0	0	2	8	17	36	50
2005	236	0	0	5	11	20	40	78
2006	285	0	0	10	17	30	50	90

**Figure 6.1.7:** Variation in use of blood transfusion (% patients) among HD centres, 2006



**Figure 6.1.8:** Variation in use of blood transfusion (% patients) among CAPD centres, 2006



**Table 6.1.8:** Variation in use of blood transfusion (% patients) among CAPD centres, 2006

Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	7	1	1	4	6	29	47	47
1998	9	0	0	7	11	17	47	47
1999	10	0	0	0	6.5	23	47	47
2000	11	0	0	0	8	16	43	43
2001	12	0	0	0	3.5	15.5	38	38
2002	15	0	0	4	7	21	44	44
2003	19	0	0	3	13	21	59	59
2004	19	0	0	5	15	20	37	37
2005	21	0	0	4	10	17	41	43
2006	24	0	0	8.5	15	26.5	36	52

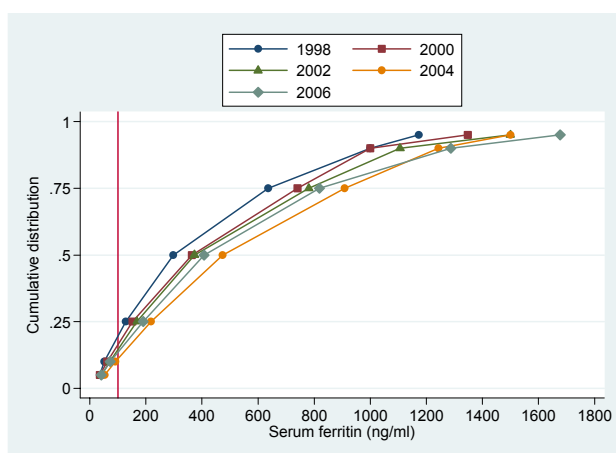
**SECTION 6.2: IRON STATUS ON DIALYSIS**

In HD and CAPD patients with or without EPO, the mean and median serum Ferritin was steadily increasing over the years except in 2006, when it decreased. This corresponded to an increase in the use of EPO. Up to 98% of patients have serum ferritin of 100 ng/ml. (Table and Figure 6.2.1 to 6.2.4)

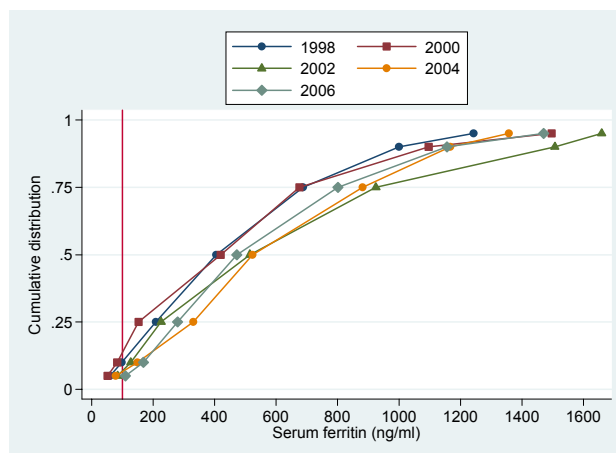
**Table 6.2.1:** Distribution of Serum Ferritin without Erythropoietin, HD patients 1997 –2006

Year	No of subjects	Mean	Std Dev	Median	LQ	UQ	% Patients ≤100 ng/ml
1997	280	493.1	349.3	435.5	162.5	850.5	86
1998	224	430.8	383.2	297.5	128.4	636.5	80
1999	337	517.9	424.3	402.8	162.8	809.5	86
2000	571	487.5	416.8	363.2	152.5	741	83
2001	758	537.6	453.9	383.5	172	828	87
2002	803	519.5	447.3	373	168.5	781	85
2003	916	551.6	434.2	456.7	190	827.7	87
2004	1044	590.1	463.4	473	218	908.5	89
2005	1012	616.5	498.4	482.5	224.5	901	90
2006	1127	562.7	488.7	407	190	819.5	87

**Figure 6.2.1:** Cumulative distribution of Serum Ferritin without Erythropoietin, HD patients 1997-2006



**Figure 6.2.2:** Cumulative distribution of Serum Ferritin without Erythropoietin, CAPD patients 1997-2006



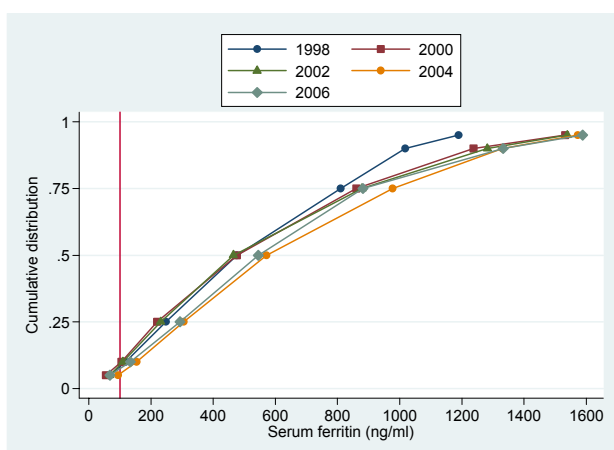
**Table 6.2.2:** Distribution of Serum Ferritin without Erythropoietin, CAPD patients 1997–2006

Year	No of subjects	Mean	Std Dev	Median	LQ	UQ	% Patients ≤100 ng/ml
1997	133	469	333.5	392	198	718	88
1998	92	492.4	368.3	405	208.2	687.5	87
1999	124	553.7	400.1	499.3	255.3	686.8	94
2000	144	505.9	433.8	420	152.3	675.5	88
2001	223	543.8	417.5	440	216.9	754	91
2002	236	634.8	491.2	514.9	226	924.6	93
2003	329	602.5	429.2	503.7	269	834	93
2004	303	608.4	385.7	522.7	330	882	94
2005	225	651.4	397.8	609	324	913.3	96
2006	262	582.4	407.1	471.7	279.1	801	95

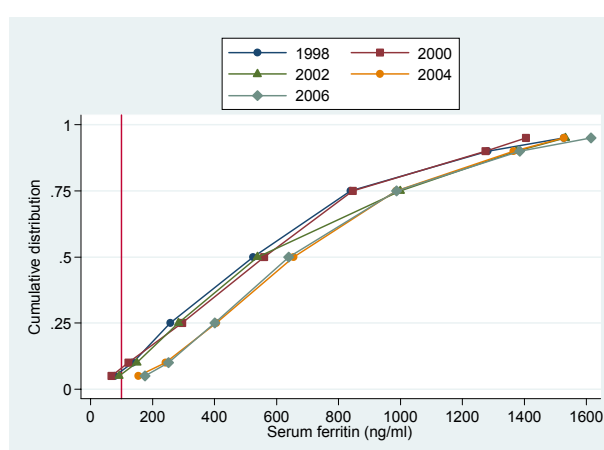
**Table 6.2.3:** Distribution of Serum Ferritin on Erythropoietin, HD patients 1997 – 2006

Year	No of subjects	Mean	Std Dev	Median	LQ	UQ	% Patients $\leq 100$ ng/ml
1997	471	543.3	347	495.5	219	973	90
1998	328	549.9	382.4	476.5	248	809.8	91
1999	586	560.4	418.6	453	225	829	93
2000	1174	588.3	456.6	475.5	219	860	91
2001	1637	597.5	444.2	491	236	894.2	91
2002	2224	593.1	459.3	464.8	231.3	878.2	91
2003	3134	640.8	428.1	562.8	298	931	94
2004	3902	669.9	460.5	571	306	977	94
2005	5114	683.2	471	599.8	316	972.5	93
2006	6714	641.6	459.3	545	293.8	882	93

**Figure 6.2.3:** Cumulative distribution of Serum Ferritin on Erythropoietin, HD patients 1997-2006



**Figure 6.2.4:** Cumulative distribution of Serum Ferritin on Erythropoietin, CAPD patients 1997-2006



**Table 6.2.4:** Distribution of Serum Ferritin on Erythropoietin, CAPD patients 1997 – 2006

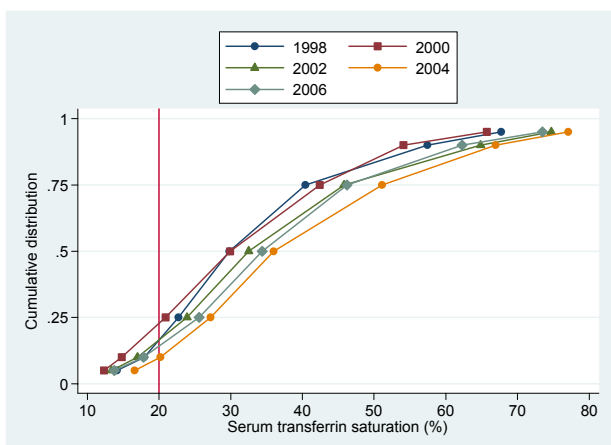
Year	No of subjects	Mean	Std Dev	Median	LQ	UQ	% Patients $\leq 100$ ng/ml
1997	129	550.8	323.7	496	256	862	93
1998	135	611.2	438.3	524.7	257	839.5	93
1999	136	604.8	436.3	540.6	264.6	870.1	93
2000	180	608.2	416.7	560	295.2	846.3	92
2001	261	645.9	449.2	557.5	275.7	885.4	93
2002	345	666.8	462.4	538.5	284	999.5	94
2003	517	689.9	459.9	589	304	993.2	96
2004	540	728.8	427.2	655.6	406.3	986.7	98
2005	767	732.9	433.6	659	403.6	997.5	97
2006	888	730.5	434.4	639.6	401.3	986.9	98

The median transferrin saturation has remained the same over the last 10 years, with the mean and median always greater than 30%. Up to 95% of all patients have transferrin saturation greater than 20% (Table and Figure 6.2.5 to 6.2.8)

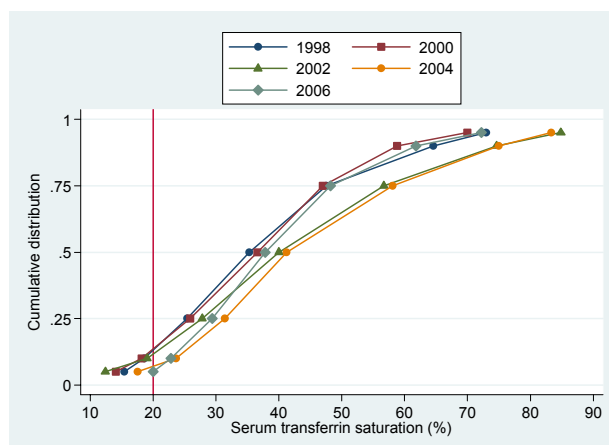
**Table 6.2.5:** Distribution of transferrin saturation without Erythropoietin, HD patients 1997 –2006

Year	No of subjects	Mean	Std Dev	Median	LQ	UQ	% Patients $\leq 20\%$
1997	723	34.1	16.6	29.8	22.7	40.4	84
1998	599	33.3	16.2	29.5	22.1	41.7	82
1999	654	32.9	16.3	29.9	20.9	42.4	78
2000	800	32.7	16.9	28.6	20.9	41.4	78
2001	836	36.9	18.5	32.5	23.9	45.8	84
2002	811	36.5	18.9	32	22.9	45.7	83
2003	921	40.3	18.6	36	27.2	51.1	91
2004	1031	41.2	18.1	37.5	28.5	50.1	92
2005	1110	37.7	17.7	34.4	25.6	46.2	87
2006	1116	36.2	16.8	33	24.6	44.1	87

**Figure 6.2.5:** Cumulative distribution of transferrin saturation without Erythropoietin, HD patients 1997-2006



**Figure 6.2.6:** Cumulative distribution of transferrin saturation without Erythropoietin, CAPD patients 1997-2006



**Table 6.2.6:** Distribution of transferrin saturation without Erythropoietin, CAPD patients 1997–2006

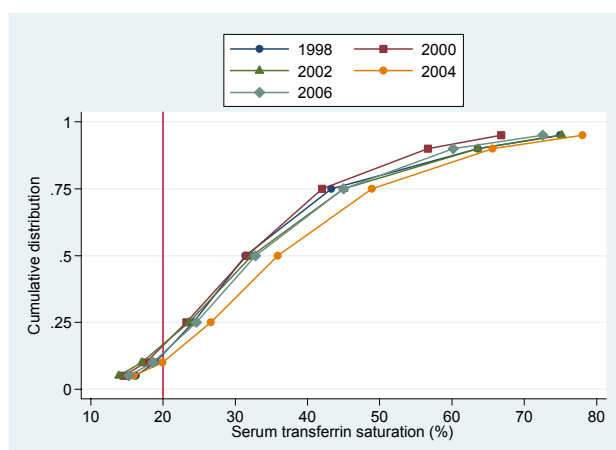
Year	No of subjects	Mean	Std Dev	Median	LQ	UQ	% Patients $\leq 20\%$
1997	246	38.7	17.9	35.3	25.4	47.6	88
1998	184	37.7	15.7	37.3	25.6	47	85
1999	194	37.7	16.2	36.6	25.9	47	88
2000	237	37.9	18.5	34.2	25	48	86
2001	279	43.2	20.8	40	27.8	56.7	89
2002	332	42.7	19.1	38.1	28.3	54.5	92
2003	397	45.2	19.7	41.2	31.4	58.1	93
2004	379	44.5	18.2	41.6	30.9	55.5	98
2005	287	40.6	16.2	37.8	29.4	48.2	95
2006	298	40.5	17.3	38	27.3	46.8	95



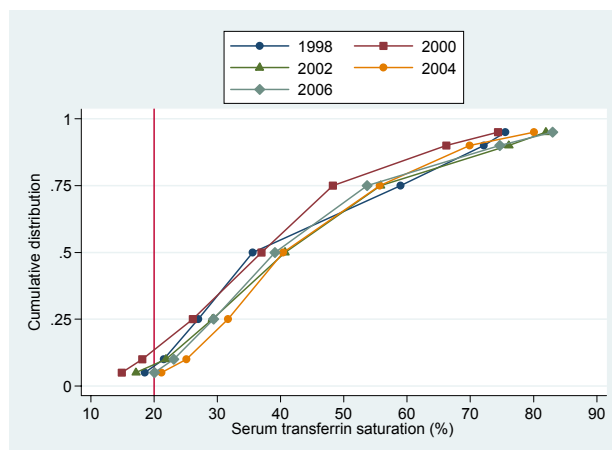
**Table 6.2.7:** Distribution of transferrin saturation on Erythropoietin, HD patients 1997 – 2006

Year	No of subjects	Mean	Std Dev	Median	LQ	UQ	% Patients ≤20%
1997	636	35.9	17.3	31.4	24.2	43.3	87
1998	549	34.9	15.5	32	24.4	42.5	86
1999	703	34.5	16	31.6	23.2	42	85
2000	1247	34.9	16.7	30.4	23	44	84
2001	1634	36.2	17.9	32.3	23.6	45	84
2002	1995	34.6	17.6	30.6	22.2	43.6	81
2003	2642	39.6	18.4	35.9	26.6	48.9	90
2004	3269	39.6	17	36.1	27.8	48.1	93
2005	4804	36.6	17.3	32.8	24.6	45	87
2006	6393	35.2	16.4	31.7	24.1	42.1	87

**Figure 6.2.7:** Cumulative distribution of transferrin saturation on Erythropoietin, HD patients 1997-2006



**Figure 6.2.8:** Cumulative distribution of transferrin saturation on Erythropoietin, CAPD patients 1997-2006



**Table 6.2.8:** Distribution of transferrin saturation on Erythropoietin, CAPD patients 1997 – 2006

Year	No of subjects	Mean	Std Dev	Median	LQ	UQ	% Patients ≤20%
1997	147	42.2	19.7	35.6	27	59	91
1998	111	39.4	13.8	38.5	28.8	47.4	94
1999	137	38.9	17	37	26.1	48.3	86
2000	238	38.9	18.7	36	24.5	51.1	86
2001	292	44.1	19.6	40.7	29.2	55.8	94
2002	363	43.6	18.6	39.7	30	54.3	94
2003	460	44.6	17.8	40.4	31.7	55.7	96
2004	697	44.7	18.7	40.8	30.8	54.5	96
2005	820	43.5	19.3	39.1	29.4	53.7	95
2006	916	41.7	17.5	38	29.3	50.8	95

From 1997 to 2005, the median for both ferritin and transferrin saturation for all HD centres had increased, except in 2006 when it reduced. There was a wide variation in median ferritin level between HD centres in 2006, ranging from 236 to more than 800 ng/ml. At the median, more than 90% of patients on EPO have serum ferritin levels greater 100 ng/ml and 89% have transferrin saturation greater than 20%. (Table and Figure 6.2.9)

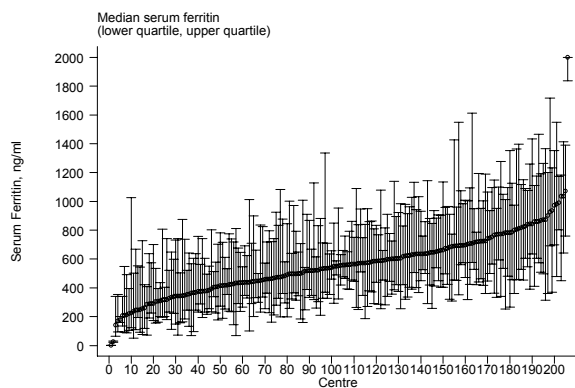
A similar trend, but with higher level of ferritin and transferrin saturation was seen in the CAPD centres. (Table and Figure 6.2.10)

**Table 6.2.9:** Variation in iron status outcomes among HD centres 2006

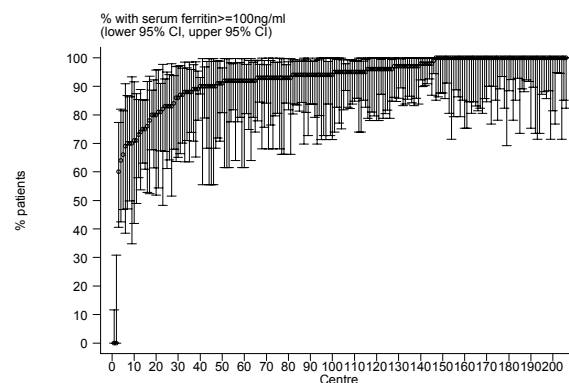
a) Median serum ferritin among patients on erythropoietin

Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	21	220.5	291.5	414.5	495.5	623.5	792	809.3
1998	13	205	205	432	468.5	560.3	722.8	722.8
1999	22	189.5	202	355.5	419	569	898.8	949.5
2000	41	154	229	387.5	548.3	683.8	813.5	1232
2001	52	217	238.3	393.3	510.4	661.3	883.3	1191.3
2002	71	106.6	192	364.5	475	611.6	875.3	1070.8
2003	98	138	303.8	458.5	542.5	708.5	997	1742.8
2004	123	112	327	463.1	566	735	1001.5	2000
2005	167	1.6	249	458.3	617.5	727.5	965.8	2000
2006	206	1.5	236	417	553.6	688.8	872.6	2000

**Figure 6.2.9(a):** Variation in median serum ferritin among patients on erythropoietin, HD centres 2006



**Figure 6.2.9(b):** Variation in proportion of patients on erythropoietin with serum ferritin ≥100 ng/ml, HD centres 2006



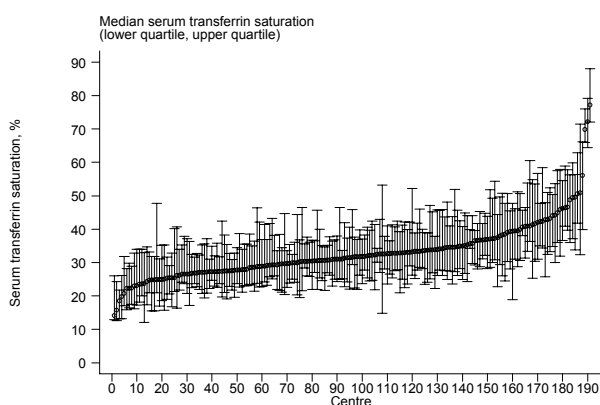
(b) Proportion of patients on erythropoietin with serum ferritin ≥100 ng/ml

Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	21	73	77	87	91	93	100	100
1998	13	75	75	90	91	95	100	100
1999	22	73	76	92	96	100	100	100
2000	41	70	73	88	94	97	100	100
2001	52	71	73	86.5	93	97	100	100
2002	71	55	73	88	93	97	100	100
2003	98	60	75	91	95	100	100	100
2004	123	52	84	92	96	100	100	100
2005	167	7	79	90	95	100	100	100
2006	206	0	71	92	95	100	100	100

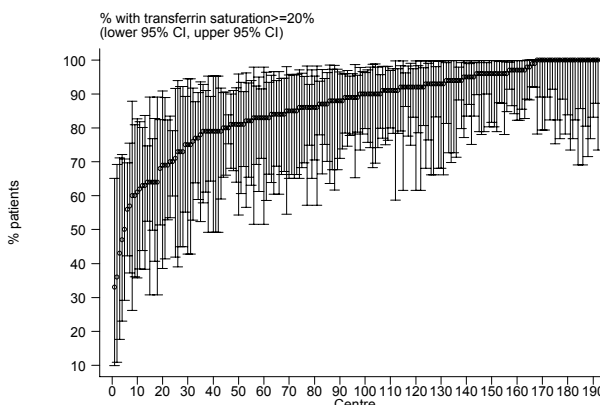
(c) Median transferrin saturation among patients on erythropoietin

Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Cen- tile	Max
1997	26	22.6	25.7	29.3	32	37.1	68.5	69.2
1998	22	22.8	24.1	27.8	32.3	35.6	44.4	51.9
1999	26	16.4	20.7	26.9	31.8	34	41.8	44.8
2000	42	16	23.2	27.6	31.5	37.2	44.1	57.5
2001	54	21	22.5	27.1	31.3	37	48.1	76.6
2002	61	14.7	21	25.3	29.8	36	47.5	59.7
2003	91	19.2	24.2	30.9	34.7	41.6	57.3	70.7
2004	114	22.7	27.2	32.7	36.6	41.1	52.7	67.6
2005	150	15.2	23.6	29.1	32.1	37.1	49.5	71.7
2006	191	14.1	23	27.5	31.6	35.7	46.6	77.2

**Figure 6.2.9(c):** Variation in median transferrin saturation among patients on erythropoietin, HD centres 2006



**Figure 6.2.9(d):** Variation in proportion of patients on erythropoietin with transferrin saturation  $\geq 20\%$ , HD centres 2006



(d) Proportion of patients on erythropoietin with transferrin saturation  $\geq 20\%$

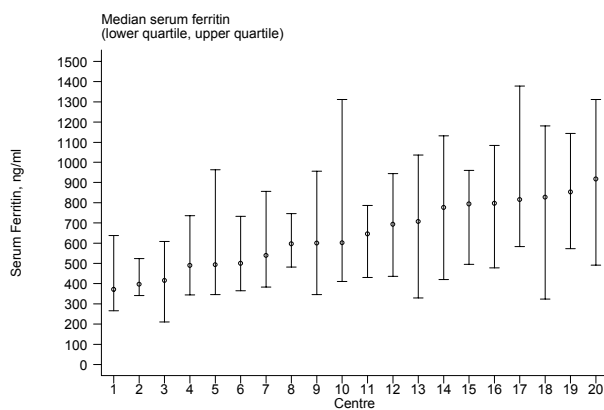
Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	26	69	75	82	90	93	100	100
1998	22	57	64	78	88	97	100	100
1999	26	30	57	83	87	94	100	100
2000	42	20	60	77	86	94	100	100
2001	54	53	59	74	87.5	94	100	100
2002	61	33	56	70	82	92	100	100
2003	91	47	69	85	92	100	100	100
2004	114	57	71	91	94	100	100	100
2005	151	29	69	83	91	95	100	100
2006	192	33	61	81	89	96	100	100

**Table 6.2.10:** Variation in iron status outcomes among CAPD centres 2006

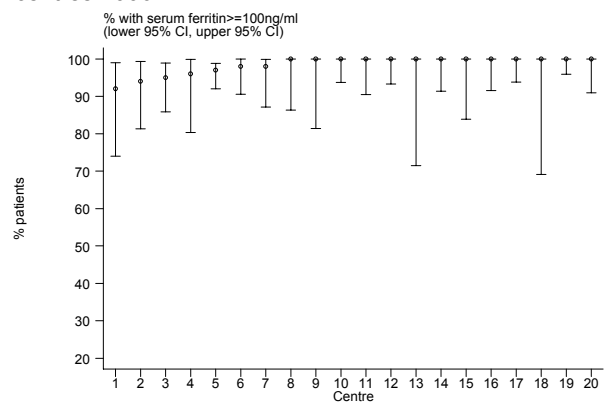
a) Median serum ferritin among patients on erythropoietin

Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	4	377.5	377.5	404.8	457.3	530	577.5	577.5
1998	4	418.4	418.4	468.7	534.3	606.3	663	663
1999	5	302.8	302.8	320.4	470	495.6	719.5	719.5
2000	6	335	335	437.3	653.8	745	773	773
2001	9	275.7	275.7	508	581	623	908	908
2002	10	372.2	372.2	437.4	475.6	618	826.5	826.5
2003	12	307.6	307.6	441	508.5	708.3	963.6	963.6
2004	14	312.4	312.4	518	608.3	701.3	1011	1011
2005	18	358.1	358.1	538.2	696.5	807.9	873.8	873.8
2006	20	371	384.1	496.9	623.8	795	885.5	917.6

**Figure 6.2.10(a):** Variation in median serum ferritin among patients on erythropoietin, CAPD centres 2006



**Figure 6.2.10(b):** Variation in proportion of patients on erythropoietin with serum ferritin  $\geq 100$  ng/ml, CAPD centres 2006



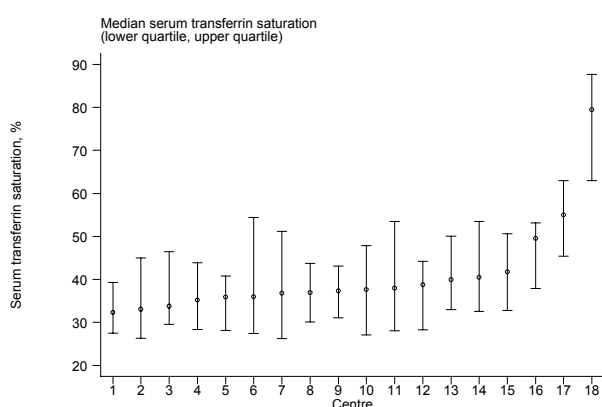
(b) Proportion of patients on erythropoietin with serum ferritin  $\geq 100$  ng/ml

Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	4	84	84	88.5	93.5	97	100	100
1998	4	83	83	89	97.5	100	100	100
1999	5	84	84	92	95	100	100	100
2000	6	87	87	88	92.5	100	100	100
2001	9	80	80	84	95	100	100	100
2002	10	91	91	92	95	100	100	100
2003	12	86	86	95.5	96	98	100	100
2004	14	90	90	94	99.5	100	100	100
2005	18	85	85	94	97.5	100	100	100
2006	20	92	93	97.5	100	100	100	100

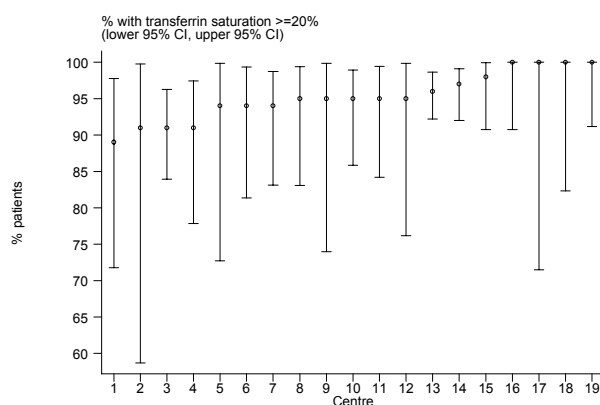
(c) Median transferrin saturation among patients on erythropoietin

Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	6	26.7	26.7	27.6	33.6	42.5	70.5	70.5
1998	4	34.2	34.2	35.5	37	41.6	46.2	46.2
1999	6	24	24	27.2	33.6	39.4	42.4	42.4
2000	6	23.1	23.1	26.5	36.3	37.6	52.5	52.5
2001	8	28.4	28.4	31.3	35.9	47.5	79.8	79.8
2002	9	30.5	30.5	36.5	38	40.3	61	61
2003	13	31.9	31.9	35.7	41.9	47.5	64	64
2004	17	29.1	29.1	36.1	40.8	42.8	82.3	82.3
2005	19	31.1	31.1	35.6	38.8	46.2	74.9	74.9
2006	18	32.3	32.3	35.9	37.5	40.5	79.5	79.5

**Figure 6.2.10(c):** Variation in median transferrin saturation among patients on erythropoietin, CAPD centres 2006



**Figure 6.2.10(d):** Variation in proportion of patients on erythropoietin with transferrin saturation  $\geq 20\%$ , CAPD centres 2006



(d) Proportion of patients on erythropoietin with transferrin saturation  $\geq 20\%$

Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	6	70	70	88	90.5	100	100	100
1998	4	81	81	88	95.5	96.5	97	97
1999	6	53	53	84	87.5	94	100	100
2000	6	68	68	74	90	100	100	100
2001	8	85	85	92	93.5	95.5	97	97
2002	9	78	78	92	92	98	100	100
2003	13	90	90	95	96	100	100	100
2004	17	88	88	95	97	100	100	100
2005	19	89	89	94	97	100	100	100
2006	19	89	89	94	95	98	100	100

**SECTION 6.3: HAEMOGLOBIN OUTCOMES ON DIALYSIS**

The mean and median haemoglobin(Hb) concentrations in all dialysis patients with or without EPO were steadily increasing; in 2006 the mean and median haemoglobin ranged from 10 to 10.9g/dl. The percentage of patients with Hb >10 or >11 g/dl was also steadily increasing for patients not on EPO. However the percentage of patients on EPO, with haemoglobin >10 or >11 g/dl were essentially static.

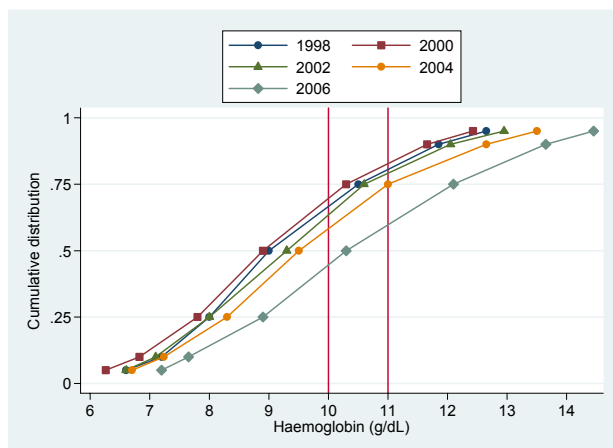
For dialysis patients without EPO the percentage of patients with the Hb >10 g/dl ranged from 59% to 70%; whereas the percentage of patient with Hb >11 gm/dl ranged from 42% to 46%.

For dialysis patients on EPO the percentage of patients with the Hb >10 g/dl was at 50%; whereas the percentage of patient with Hb >11 g/dl was around 27%. (Table and Figure 6.3.1 – 6.3.4)

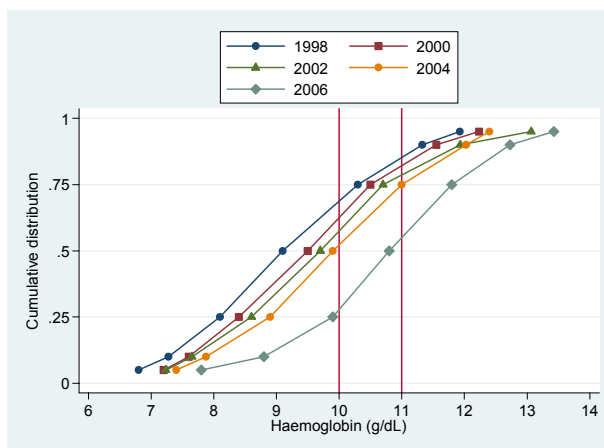
**Table 6.3.1:** Distribution of Haemoglobin Concentration without Erythropoietin, HD patients 1997 – 2006

Year	No. of subjects	Mean	Std Dev	Median	LQ	UQ	% Patients ≤ 10 g/dL	% Patients >10 g/dL	% Patients ≤ 11 g/dL	% Patients >11 g/dL
1997	896	9.3	1.9	9	8	10.5	69	31	82	18
1998	1119	9.1	1.9	8.9	7.8	10.3	71	29	83	17
1999	1400	9.1	1.9	8.9	7.8	10.3	70	30	85	15
2000	1754	9.4	2.1	9.1	7.9	10.6	67	33	80	20
2001	1809	9.4	1.9	9.3	8	10.6	64	36	81	19
2002	1795	9.6	2.1	9.4	8.1	10.9	62	38	76	24
2003	1802	9.7	2.1	9.5	8.3	11	60	40	75	25
2004	1927	10.1	2.2	9.9	8.6	11.5	53	47	68	32
2005	1672	10.5	2.3	10.3	8.9	12.1	46	54	62	38
2006	1697	10.6	2.2	10.5	9	12.1	41	59	58	42

**Figure 6.3.1:** Cumulative distribution of haemoglobin Concentration without Erythropoietin, HD patients 1997-2006



**Figure 6.3.2:** Cumulative distribution of haemoglobin concentration without Erythropoietin, CAPD patients 1997-2006



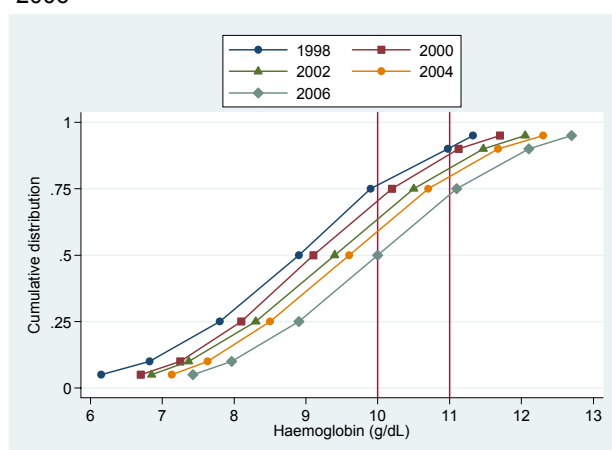
**Table 6.3.2:** Distribution of Haemoglobin Concentration without Erythropoietin, CAPD patients 1997– 2006

Year	No. of subjects	Mean	Std Dev	Median	LQ	UQ	% Patients ≤ 10 g/dL	% Patients >10 g/dL	% Patients ≤ 11 g/dL	% Patients >11 g/dL
1997	297	9.2	1.6	9.1	8.1	10.3	72	28	86	14
1998	301	9.3	1.8	9.2	8.1	10.3	68	32	84	16
1999	336	9.5	1.6	9.5	8.4	10.5	66	34	84	16
2000	342	9.8	1.7	9.7	8.7	10.9	58	42	79	21
2001	405	9.8	1.8	9.7	8.6	10.7	59	41	78	22
2002	434	10	1.8	9.9	8.8	11	54	46	76	24
2003	542	10	1.7	9.9	8.9	11	52	48	76	24
2004	481	10.4	1.6	10.3	9.4	11.4	42	58	67	33
2005	375	10.8	1.6	10.8	9.9	11.8	28	72	60	40
2006	385	10.9	1.6	10.9	10	11.8	25	75	54	46

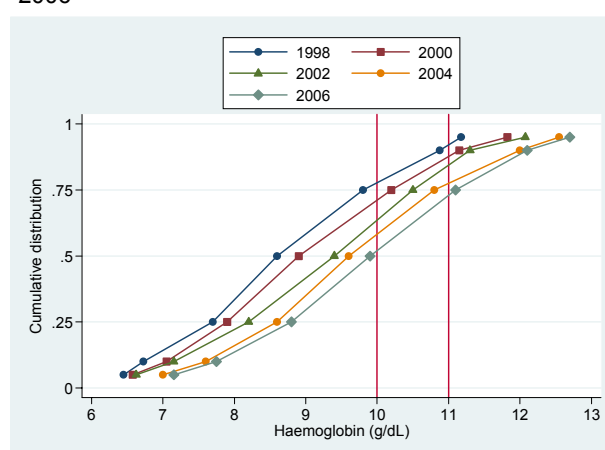
**Table 6.3.3:** Distribution of Haemoglobin Concentration on Erythropoietin, HD patients 1997 – 2006

Year	No. of subjects	Mean	Std Dev	Median	LQ	UQ	% Patients ≤ 10 g/dL	% Patients >10 g/dL	% Patients ≤ 11 g/dL	% Patients >11 g/dL
1997	773	8.9	1.6	8.9	7.8	9.9	76	24	90	10
1998	971	9.1	1.6	9.1	7.9	10.2	71	29	88	12
1999	1503	9.2	1.5	9.1	8.1	10.2	71	29	89	11
2000	2332	9.4	1.7	9.4	8.3	10.5	65	35	85	15
2001	3049	9.4	1.6	9.4	8.3	10.5	65	35	85	15
2002	3859	9.5	1.7	9.5	8.4	10.7	62	38	81	19
2003	4782	9.6	1.6	9.6	8.5	10.7	61	39	81	19
2004	5804	9.8	1.6	9.9	8.8	10.9	54	46	77	23
2005	7213	10	1.6	10	8.9	11.1	50	50	73	27
2006	9311	10.1	1.6	10	9	11.1	50	50	73	27

**Figure 6.3.3:** Cumulative distribution of Haemoglobin Concentration on Erythropoietin, HD patients 1997-2006



**Figure 6.3.4:** Cumulative distribution of Haemoglobin Concentration on Erythropoietin, CAPD patients 1997-2006



**Table 6.3.4:** Distribution of Haemoglobin Concentration on Erythropoietin, CAPD patients 1997 – 2006

Year	No. of subjects	Mean	Std Dev	Median	LQ	UQ	% Patients ≤ 10 g/dL	% Patients >10 g/dL	% Patients ≤ 11 g/dL	% Patients >11 g/dL
1997	175	8.8	1.5	8.6	7.7	9.8	79	21	94	6
1998	238	9	1.6	8.8	8	10.1	74	26	88	12
1999	262	9	1.6	8.9	7.9	10.2	73	27	89	11
2000	299	9.4	1.7	9.2	8.1	10.6	65	35	82	18
2001	345	9.3	1.6	9.4	8.2	10.5	65	35	86	14
2002	432	9.4	1.6	9.3	8.4	10.4	69	31	83	17
2003	639	9.7	1.7	9.6	8.6	10.8	59	41	78	22
2004	798	9.8	1.7	9.8	8.6	11	54	46	76	24
2005	970	9.9	1.7	9.9	8.8	11.1	53	47	73	27
2006	1119	10	1.6	10.1	9	11.1	50	50	74	26

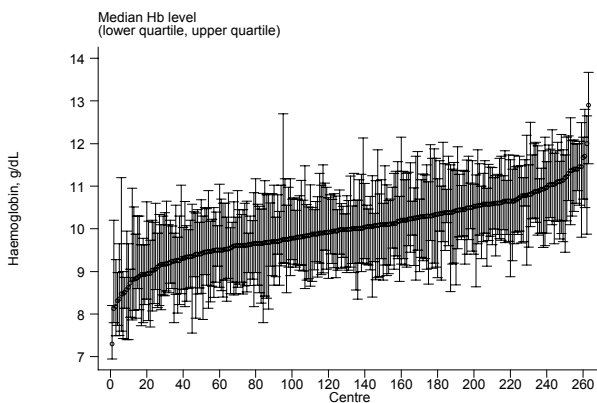
In 2006, for HD patients on EPO, the median Hb in HD centres ranged 7.3 to 12.9 g/dl with the median at 10 g/dl. Similar trend was noted in the CAPD centres with lesser variation.

In 2006 for HD patients on EPO, the proportion of patients with Hb >10 g /dl varied between 0 to 89%, with median at 50%. Similarly for patients with Hb > 11g/dl, the range was from 0 to 80% with the median at 24%. This wide variation was not seen in the CAPD patients.

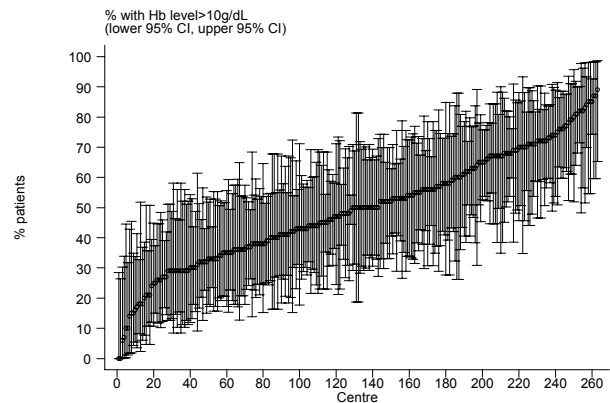
**Table 6.3.5:** Variation in Haemoglobin outcomes among HD centres 2006  
(a) Median haemoglobin level among patients on erythropoietin

Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	30	7.8	7.9	8.5	8.9	9.3	10.4	10.6
1998	34	7.6	7.6	8.5	9	9.4	10.2	10.5
1999	51	7.8	8.1	8.6	9	9.6	10.2	10.4
2000	76	7.8	8.2	8.8	9.2	9.8	10.5	14.6
2001	92	8.1	8.4	8.9	9.5	9.9	10.6	12.2
2002	114	8.2	8.5	9	9.4	10.1	10.8	11.4
2003	142	7.8	8.5	9.1	9.6	10	10.7	11.6
2004	179	7.8	8.6	9.2	9.7	10.3	11	11.2
2005	209	8.4	8.8	9.5	10	10.5	11.2	12.2
2006	263	7.3	8.8	9.6	10	10.5	11.2	12.9

**Figure 6.3.5(a):** Variation in median haemoglobin level among patients on Erythropoietin, HD centres 2006



**Figure 6.3.5(b):** Variation in proportion of patients on erythropoietin with haemoglobin level > 10 g/dL, HD centres 2006



(b) Proportion of patients on erythropoietin with haemoglobin level > 10 g/dL

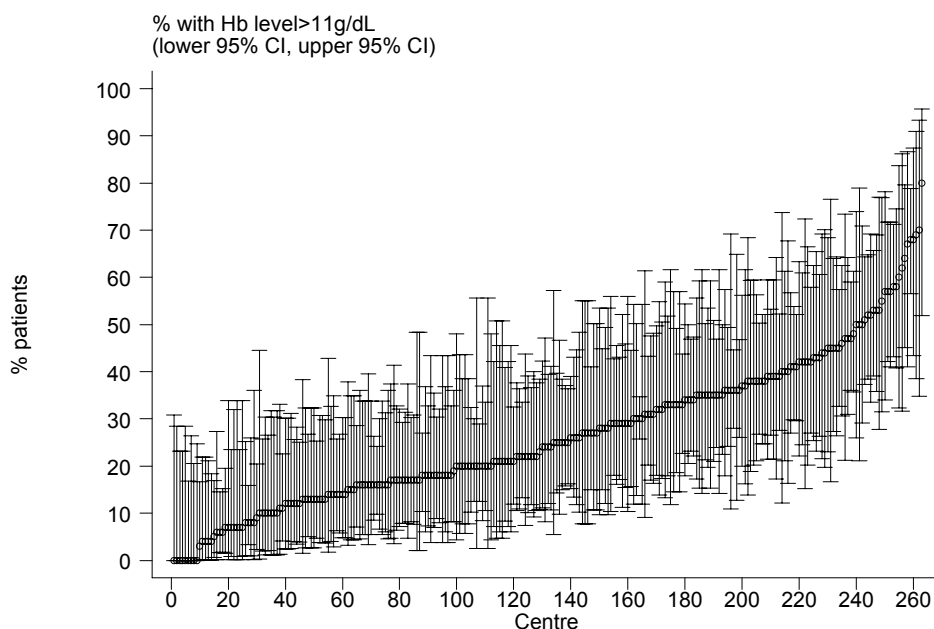
Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	30	0	0	13	21	29	60	82
1998	34	0	0	13	27.5	38	57	71
1999	51	0	5	15	26	38	58	61
2000	76	0	5	20	30.5	43.5	64	97
2001	92	5	12	23.5	33	46	67	100
2002	114	8	15	27	36	50	69	86
2003	142	0	12	27	36	50	68	100
2004	179	8	17	31	41	58	73	86
2005	209	0	20	35	50	63	81	100
2006	263	0	18	36	50	65	80	89



(c) Proportion of patients on erythropoietin with haemoglobin level > 11 g/dL

Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	30	0	0	0	7	14	21	33
1998	34	0	0	0	7	17	27	38
1999	51	0	0	0	8	16	29	39
2000	76	0	0	6.5	12.5	20	31	92
2001	92	0	0	8	13	24.5	38	60
2002	114	0	5	12	18	28	46	71
2003	142	0	0	8	15	27	44	61
2004	179	0	0	11	19	29	48	56
2005	209	0	4	14	24	36	54	75
2006	263	0	4	16	24	36	57	80

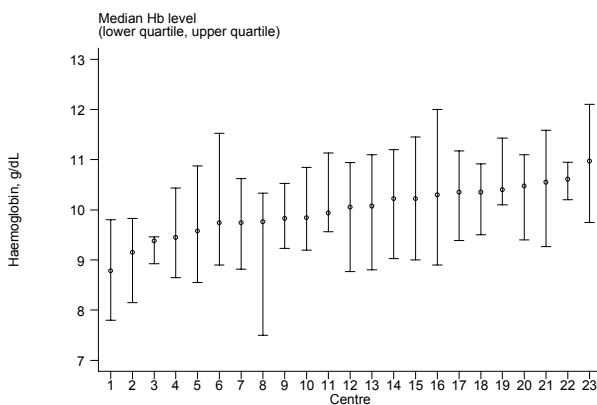
**Figure 6.3.5(c): Variation** in proportion of patients on erythropoietin with haemoglobin level > 11 g/dL, HD centres 2006



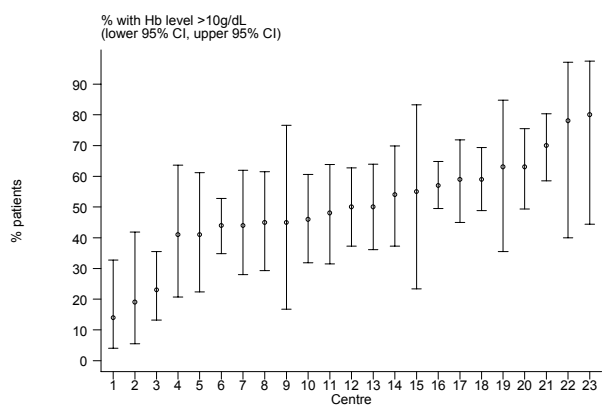
**Table 6.3.6:** Variation in Haemoglobin outcomes among CAPD centres 2006  
(a) Median haemoglobin level among patients on erythropoietin

Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	6	7.8	7.8	7.8	8.7	9	9.5	9.5
1998	6	7.9	7.9	8.4	8.9	9.3	9.5	9.5
1999	7	8.1	8.1	8.4	8.7	9.3	9.5	9.5
2000	9	8.2	8.2	8.9	9	9.3	10.3	10.3
2001	11	8.9	8.9	9.2	9.4	9.6	9.7	9.7
2002	12	8.8	8.8	9.1	9.3	9.5	9.9	9.9
2003	16	8.4	8.4	9.3	9.5	9.9	11.2	11.2
2004	17	8.4	8.4	9.2	9.6	10.1	11.2	11.2
2005	20	9	9.1	9.4	9.8	10.4	11	11.1
2006	23	8.8	9.1	9.7	10.1	10.4	10.6	11

**Figure 6.3.6(a):** Variation in median haemoglobin level among patients on Erythropoietin, CAPD centres 2006



**Figure 6.3.6(b):** Variation in proportion of patients on erythropoietin with haemoglobin level > 10 g/dL, CAPD centres 2006



(b) Proportion of patients on erythropoietin with haemoglobin level > 10 g/dL

Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	6	0	0	10	19	31	38	38
1998	6	19	19	19	25.5	29	40	40
1999	7	13	13	20	25	36	40	40
2000	9	19	19	30	36	38	55	55
2001	11	24	24	31	38	42	47	47
2002	12	15	15	25.5	31.5	36.5	48	48
2003	16	0	0	27	35	48.5	75	75
2004	17	13	13	39	44	52	72	72
2005	20	21	24.5	35.5	47	57.5	70	76
2006	23	14	19	44	50	59	78	80

(c) Proportion of patients on erythropoietin with haemoglobin level > 11 g/dL

Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	6	0	0	0	5.5	8	10	10
1998	6	8	8	8	11	13	16	16
1999	7	0	0	8	9	13	16	16
2000	9	13	13	17	18	20	24	24
2001	11	7	7	10	16	20	23	23
2002	12	11	11	13	16.5	22	27	27
2003	16	0	0	10.5	16.5	22.5	52	52
2004	17	0	0	13	19	29	54	54
2005	20	7	8.5	18.5	28.5	36	55.5	60
2006	23	7	7	14	23	35	44	49

**Figure 6.3.6(c):** Variation in proportion of patients on erythropoietin with haemoglobin level > 11 g/dL, CAPD centres 2006

