

## **CHAPTER 6**

# **Management of Anaemia In Patients on Dialysis**

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## SECTION 6.1: TREATMENT FOR ANAEMIA IN PATIENTS ON DIALYSIS

The use of Erythropoiesis Stimulating Agents (ESAs) has been consistently  $\geq 90\%$  since 2010. Higher percentage (91%) of patients on haemodialysis received ESAs compared to 83% of patients on peritoneal dialysis. National scheme for ESA subsidy for patients in NGO centres has been introduced by the Ministry of Health since 2009. Despite the high use of ESAs, a significant percentage (12%) of patients still received blood transfusions. This is probably due to costs and administrative limitations (Table 6.1.1& 6.1.2).

Over the last 5 years, patients receiving oral and parenteral iron have remained at about 52% and 36% respectively. There is a greater need for use of parenteral iron especially in hemodialysis patients. (Table 6.1.1). In patients on peritoneal dialysis, the use of oral iron remained high at 65% with only 15% on parenteral iron. (Table 6.1.2)

Table 6.1.1: Treatment for anaemia, HD patients 2007-2016

Year	Number of patients	% on ESAs	% received blood transfusion	% on oral iron	% received parenteral iron
2007	12906	85	15	74	17
2008	15402	88	16	63	23
2009	17976	89	15	59	26
2010	19584	90	14	57	26
2011	22310	90	14	55	28
2012	25670	90	14	56	30
2013	29114	91	12	54	34
2014	32470	91	12	54	37
2015	35338	91	13	52	38
2016	38082	91	12	52	36

Table 6.1.2: Treatment for anaemia, PD patients 2007-2016

Year	Number of patients	% on ESAs	% received blood transfusion	% on oral iron	% received parenteral iron
2007	1806	74	16	80	12
2008	2084	77	16	77	12
2009	2212	76	16	74	14
2010	2360	78	16	73	12
2011	2551	78	18	72	11
2012	2876	80	18	69	11
2013	3260	80	17	70	14
2014	3727	82	18	71	20
2015	4333	81	15	67	16
2016	4702	83	13	65	15

In 2016, the percentage of patients on ESAs among HD centres varied. The variation in percentage of patients using ESAs among HD centres at the 5th centile and 95th centile has not changed for the last 5 years. This variation is less compared to what it was 10 years ago. The median usage of ESAs is at 93% for the last 6 years. A similar trend was observed in PD patients (Table 6.1.4).

Table 6.1.3: Variation in Erythropoiesis-Stimulating Agents (ESAs) utilization (% patients) among HD centres, 2007-2016

Year	Number of centres	Min	5 <sup>th</sup> centile	LQ	Median	UQ	95 <sup>th</sup> centile	Max
2007	310	0	60	83	89	95	100	100
2008	359	0	62	85	92	96	100	100
2009	404	0	70	86	92	97	100	100
2010	438	10	71	87	92	97	100	100
2011	497	0	73	88	93	97	100	100
2012	559	39	76	88	93	97	100	100
2013	611	31	77	88	93	97	100	100
2014	645	47	77	88	93	97	100	100
2015	670	0	78	88	93	97	100	100
2016	697	18	79	88	93	97	100	100

Figure 6.1.3: Variation in ESAs utilization (% patients) among HD centres, 2016

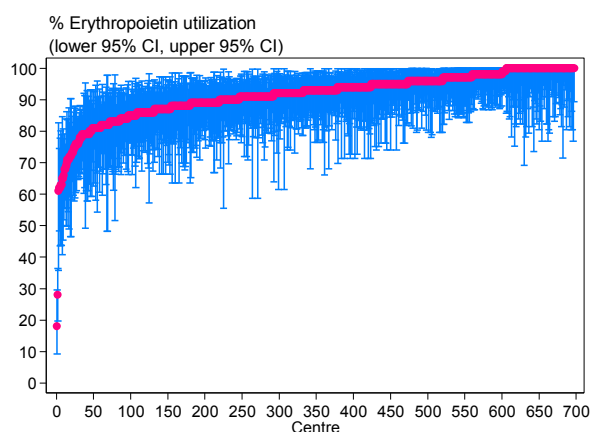


Figure 6.1.4: Variation in ESAs utilization (% patients) among PD centres, 2016

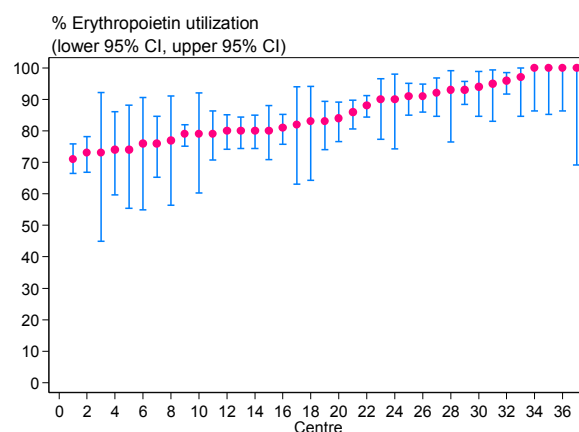


Table 6.1.4: Variation in ESAs utilization (% patients) among PD centres, 2007-2016

Year	Number of centres	Min	5 <sup>th</sup> centile	LQ	Median	UQ	95 <sup>th</sup> centile	Max
2007	24	0	41	65.5	77.5	90.5	97	97
2008	23	57	60	70	81	86	97	100
2009	23	30	56	73	83	87	98	100
2010	25	55	63	80	83	94	100	100
2011	26	44	72	79	87	93	100	100
2012	29	51	60	80	87	93	100	100
2013	28	60	63	81	86.5	94	100	100
2014	32	60	67	78	87	93.5	100	100
2015	35	65	70	75	85	92	100	100
2016	37	71	73	79	83	93	100	100

Since 2010, the median weekly dose of ESA for HD patients has remained stable at 5000 units. It is also noted that the minimum and maximum weekly ESA dose was at 2000 and 28000 units respectively. The median weekly ESA dose in PD patients was slightly less compared to HD patients at 4500 units per week. The minimum and maximum weekly ESA dose for PD patients was at 2000 units and 8000 units respectively. This variation is significantly less as compared to HD patients (Table 6.15 & 6.16).

Table 6.1.5: Variation in mean weekly ESAs dose (u/week) among HD centres, 2007-2016

Year	Number of centres	Mean	SD	Min	5 <sup>th</sup> centile	LQ	Median	UQ	95 <sup>th</sup> centile	Max
2007	299	5301	1874	2000	3133	4125	5100	6087	8500	17500
2008	360	4569	1115	1935	2955	3800	4462	5166	6655	8632
2009	402	4750	891	2444	3372	4141	4761	5231	6260	8154
2010	444	5079	1109	2182	3400	4391	4980	5721	7191	8240
2011	500	5088	1108	2000	3477	4342	5000	5714	7123	10115
2012	551	5196	1145	2000	3539	4364	5097	5913	7397	9191
2013	608	5348	1461	2250	3574	4391	5060	6003	7759	15600
2014	637	5298	1224	2182	3600	4403	5174	6000	7674	9561
2015	662	5486	1391	2000	3750	4500	5250	6242	8000	16613
2016	690	5403	1605	2258	3688	4466	5080	6056	7859	28000

Figure 6.1.5: Variation in mean weekly ESAs dose (u/week) among HD centres, 2016

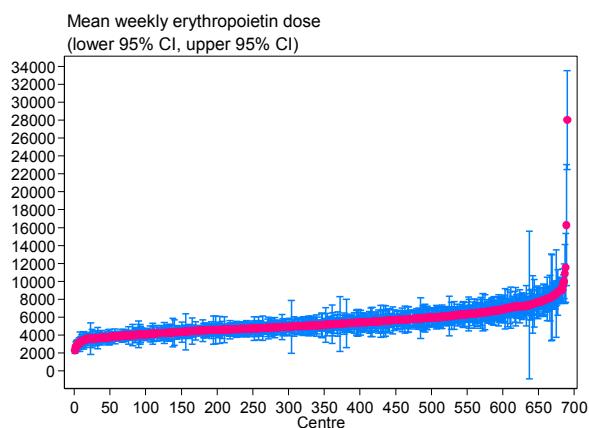


Figure 6.1.6: Variation in mean weekly ESAs dose (u/week) among PD centres, 2016

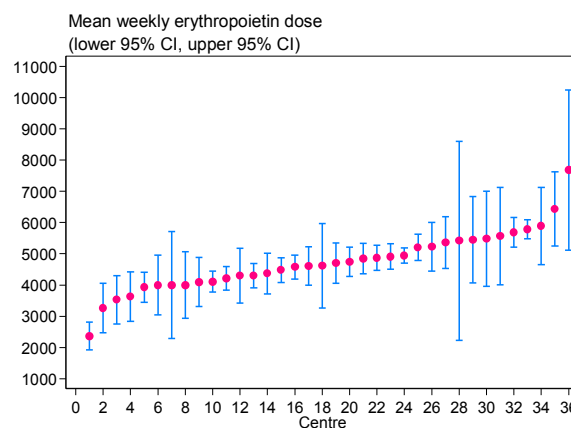


Table 6.1.6: Variation in mean weekly ESAs dose (u/week) among PD centres, 2007-2016

Year	Number of centres	Mean	SD	Min	5 <sup>th</sup> centile	LQ	Median	UQ	95 <sup>th</sup> centile	Max
2007	22	4968	1013	3250	3429	4151	5058	5702	6471	7044
2008	22	4551	968	2556	2952	3852	4539	5344	5997	6239
2009	23	4368	916	2364	2720	4036	4605	4800	5235	6518
2010	26	4366	943	2200	2800	4000	4254	4993	6066	6410
2011	28	4401	1119	1909	1955	4044	4556	5042	5540	7056
2012	29	4546	913	2500	2571	4171	4570	5026	6167	6208
2013	30	4495	904	2100	2615	4011	4557	5202	5530	6533
2014	31	4646	1087	1697	2518	3957	4483	5407	6500	6541
2015	34	4692	1179	2000	2775	4114	4457	5380	7143	8037
2016	36	4738	964	2364	3266	4102	4657	5387	6434	7680

The median requirement of blood transfusion in HD and PD centres was at 11% and 9% respectively. For the past 3 years, in HD, the variation in blood transfusion usage remained the same (0% to 30%). In contrast, the variation among PD centres has dropped (0% to 28%) (Table 6.1.7 & 6.1.8).

Table 6.1.7: Variation in use of blood transfusion (% patients) among HD centres, 2007-2016

Year	Number of centres	Min	5 <sup>th</sup> centile	LQ	Median	UQ	95 <sup>th</sup> centile	Max
2007	310	0	0	6	13	21	36	62
2008	359	0	0	6	14	23	38	94
2009	404	0	0	6	12	21	39	53
2010	438	0	0	5	11	20	36	73
2011	497	0	0	6	12	19	32	62
2012	559	0	0	6	12	19	37	73
2013	611	0	0	5	10	17	35	67
2014	645	0	0	5	10	18	31	63
2015	670	0	0	6	11	18	31	80
2016	697	0	0	5	11	17	30	79

Figure 6.1.7: Variation in use of blood transfusion (% patients) among HD centres, 2016

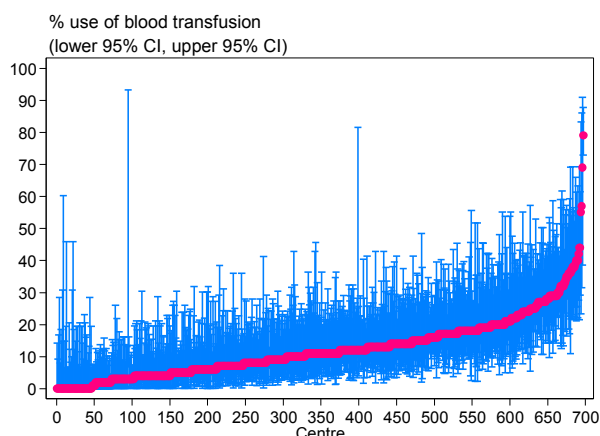


Figure 6.1.8: Variation in use of blood transfusion (% patients) among PD centres, 2016

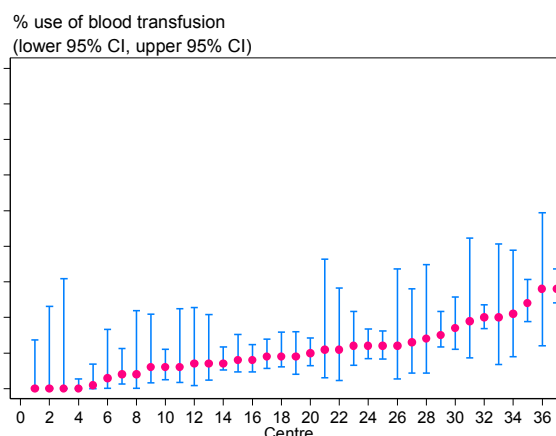


Table 6.1.8: Variation in use of blood transfusion (% patients) among PD centres, 2007-2016

Year	Number of centres	Min	5 <sup>th</sup> centile	LQ	Median	UQ	95 <sup>th</sup> centile	Max
2007	24	6	6	10.5	15.5	21.5	37	38
2008	23	2	3	7	14	24	29	35
2009	23	0	2	8	13	23	31	34
2010	25	0	1	9	14	24	31	35
2011	26	2	3	7	16	21	39	48
2012	29	0	0	7	15	21	39	40
2013	28	6	7	9	14	21.5	32	33
2014	32	0	0	8	12	20	38	44
2015	35	2	3	7	12	17	31	45
2016	37	0	0	6	9	14	28	28

## SECTION 6.2: IRON STATUS ON DIALYSIS

The median serum ferritin for HD and PD patients on ESAs was at 300ng/ml and 500ng/ml respectively. The target ferritin for HD and PD patients are  $\geq 200$ ng/ml and  $\geq 100$ ng/ml respectively. 66% of HD patients and 93% of PD patients achieved their target (Table 6.2.1 & 6.2.4).

Table 6.2.1: Distribution of serum ferritin without ESAs, HD patients 2007-2016

Year	Number of patients	Mean	SD	Median	LQ	UQ	% Patients $\geq 100$ ng/ml	% Patients $\geq 200$ ng/ml
2007	1182	586.0	501.0	431.0	196.0	860.9	86	75
2008	1186	578.0	489.9	431.9	197.0	838.1	87	75
2009	1283	546.6	461.7	419.7	171.0	798.0	87	71
2010	1394	510.1	453.4	372.9	160.0	755.6	84	69
2011	1564	499.2	441.1	374.0	163.8	701.5	84	70
2012	1674	480.9	440.8	344.8	146.9	671.7	83	67
2013	1973	463.3	423.5	324.5	142.5	660.4	82	66
2014	2260	448.5	417.3	320.5	124.0	637.9	80	64
2015	2415	450.0	417.5	318.6	125.0	650.0	80	64
2016	2717	464.0	421.0	324.5	140.4	675.5	82	66

Figure 6.2.1: Cumulative Distribution of serum ferritin without ESAs, HD patients 2007-2016

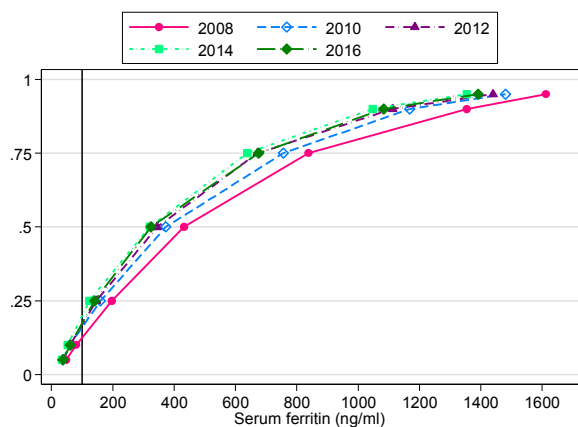


Figure 6.2.2: Distribution of serum ferritin without ESAs, PD patients 2007-2016

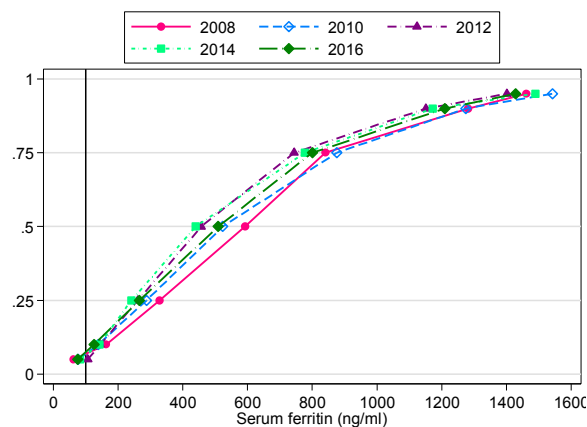


Table 6.2.2: Distribution of serum ferritin without ESAs, PD patients 2007-2016

Year	Number of patients	Mean	SD	Median	LQ	UQ	% Patients $\geq 100$ ng/ml	% Patients $\geq 200$ ng/ml
2007	305	636.9	396.6	582.3	342.8	841.9	96	87
2008	338	634.0	410.1	592.0	327.4	841.0	93	86
2009	364	621.6	401.1	553.0	322.5	861.8	95	86
2010	382	624.9	446.6	523.5	287.4	875.8	93	83
2011	435	604.7	407.4	500.0	316.9	806.8	95	88
2012	467	557.5	398.8	456.8	260.4	743.9	96	83
2013	486	587.6	407.3	487.9	298.3	767.5	95	83
2014	495	563.6	427.7	439.5	241.0	777.2	94	83
2015	617	565.0	424.4	452.5	256.1	778.5	92	81
2016	597	586.9	419.0	509.4	265.7	800.2	93	82

Table 6.2.3: Distribution of serum ferritin on ESAs, HD patients 2007-2016

Year	Number of patients	Mean	SD	Median	LQ	UQ	% Patients $\geq 100$ ng/ml	% Patients $\geq 200$ ng/ml
2007	8031	658.9	452.2	564.4	315.5	914.0	94	86
2008	9936	703.7	469.2	611.1	337.6	979.6	95	87
2009	12240	679.3	459.5	596.1	319.4	942.0	94	86
2010	13637	679.3	469.9	581.5	312.0	958.0	94	85
2011	15881	653.5	461.2	551.5	297.0	913.0	93	84
2012	18134	627.6	450.0	527.8	280.0	879.3	93	83
2013	20907	605.8	448.0	500.3	262.9	837.5	92	82
2014	24193	612.3	447.9	508.0	269.0	852.9	92	82
2015	26438	603.6	434.8	508.5	263.4	847.0	92	82
2016	28777	622.0	445.3	521.8	268.0	888.0	92	82

Figure 6.2.3: Cumulative distribution of serum ferritin on ESAs, HD patients 2007-2016

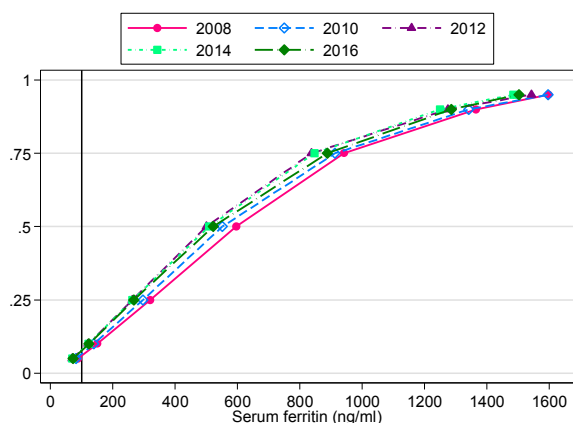


Figure 6.2.4: Cumulative distribution of serum ferritin on ESAs, PD patients 2007-2016

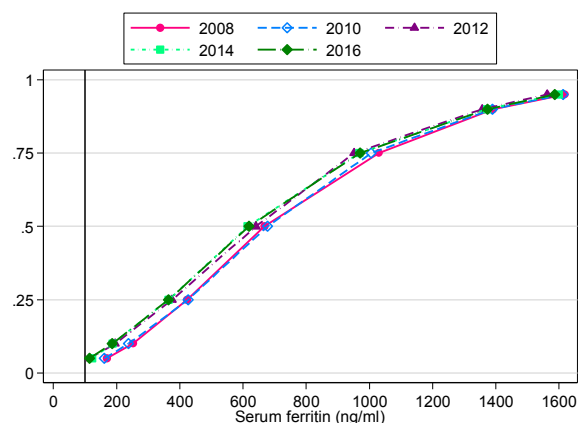


Table 6.2.4: Distribution of serum ferritin on ESAs, PD patients 2007-2016

Year	Number of patients	Mean	SD	Median	LQ	UQ	% Patients $\geq 100$ ng/ml	% Patients $\geq 200$ ng/ml
2007	1091	741.3	426.1	652.0	423.8	1015.0	98	94
2008	1310	758.4	445.4	668.6	422.4	1030.3	98	93
2009	1390	759.5	438.7	689.0	421.1	1017.5	98	93
2010	1554	753.3	438.0	677.1	426.3	1005.5	97	93
2011	1631	726.4	436.4	644.7	403.3	993.7	97	91
2012	1899	707.4	440.2	640.8	375.6	951.5	96	90
2013	2139	705.1	448.9	611.5	362.7	966.3	97	89
2014	2533	704.9	450.7	614.8	364.7	968.6	96	89
2015	2883	711.3	445.2	620.0	369.3	986.1	96	90
2016	3131	705.6	445.9	618.7	364.8	970.0	96	89

For the past 5 years, the median transferrin saturation for HD and PD patients on ESAs remained the same, at 28% and 34% respectively. The percentage of patients achieving transferrin saturation  $\geq 20\%$  for HD and PD patients was 81% and 89% respectively (Table 6.2.5 & 6.2.8).

Table 6.2.5: Distribution of transferrin saturation without ESAs, HD patients, 2007-2016

Year	Number of patients	Mean	SD	Median	LQ	UQ	% Patients $\geq 20$
2007	1206	36.1	16.5	32.5	25.0	43.7	87
2008	1211	34.3	15.5	31.8	23.7	41.4	85
2009	1283	34.3	15.9	31.3	24.0	40.8	85
2010	1449	33.5	15.6	30.4	22.7	40.5	83
2011	1568	32.4	14.7	29.8	22.9	38.4	85
2012	1859	32.4	14.5	29.9	22.8	38.7	83
2013	2118	31.2	14.0	28.9	22.0	37.3	81
2014	2391	31.1	13.4	28.9	22.4	37.5	82
2015	2571	30.8	13.4	28.6	21.9	37.0	81
2016	2936	30.7	13.4	28.6	21.8	36.9	81

Figure 6.2.5: Cumulative distribution of transferrin saturation without ESAs, HD patients 2007-2016

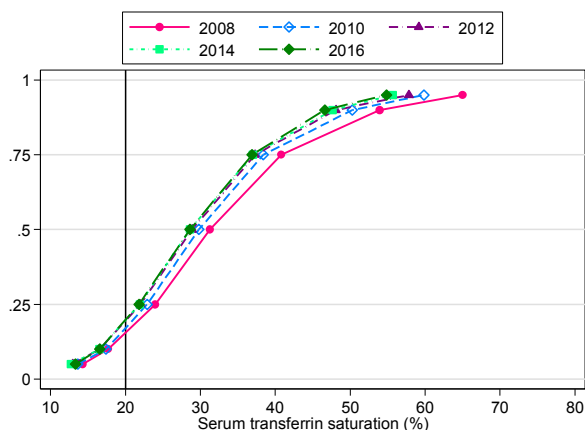


Figure 6.2.6: Cumulative distribution of transferrin saturation without ESAs, PD patients 2007-2016

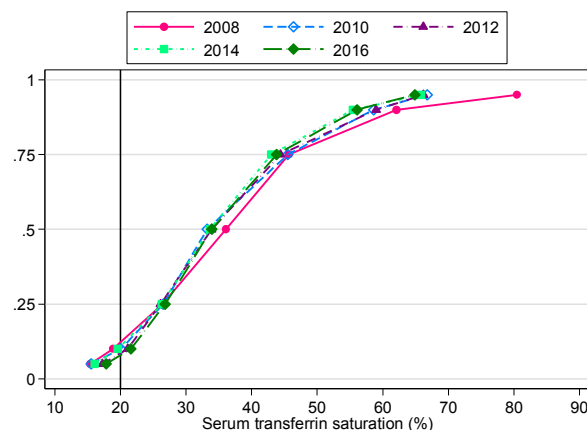




Table 6.2.6: Distribution of transferrin saturation without ESAs, PD patients, 2007-2016

Year	Number of patients	Mean	SD	Median	LQ	UQ	% Patients $\geq 20\%$
2007	299	40.5	17.4	37.9	27.3	47.3	95
2008	348	40.3	17.9	36.6	27.5	48.2	92
2009	349	38.2	17.8	34.3	26.2	44.4	91
2010	439	38.4	18.2	36.1	26.4	45.7	87
2011	441	38.3	17.8	35.1	25.9	45.3	89
2012	424	36.8	15.8	33.2	26.5	45.5	90
2013	498	35.6	15.7	33.8	24.9	43.9	85
2014	462	37.3	15.7	33.9	26.1	44.4	91
2015	542	36.3	16.0	34.5	24.5	43.9	87
2016	669	36.2	15.5	33.6	26.3	43.0	89

Table 6.2.7: Distribution of transferrin saturation on ESAs, HD patients, 2007-2016

Year	Number of patients	Mean	SD	Median	LQ	UQ	% Patients $\geq 20\%$
2007	7603	34.7	15.4	31.6	24.4	41.5	88
2008	9536	34.7	15.4	31.5	24.0	41.6	87
2009	11853	34.0	15.4	30.9	23.8	40.5	86
2010	13802	34.0	15.0	30.9	24.1	40.2	87
2011	16222	32.6	14.3	29.7	23.1	38.7	85
2012	18971	31.7	13.5	29.2	22.9	37.5	85
2013	21987	31.0	13.0	28.7	22.6	36.8	84
2014	24992	31.2	12.9	28.9	22.7	36.9	84
2015	27851	30.4	12.6	28.2	22.2	35.8	83
2016	31044	30.3	12.5	28.1	22.1	35.8	83

Figure 6.2.7: Cumulative distribution of transferrin saturation on ESAs, HD patients 2007-2016

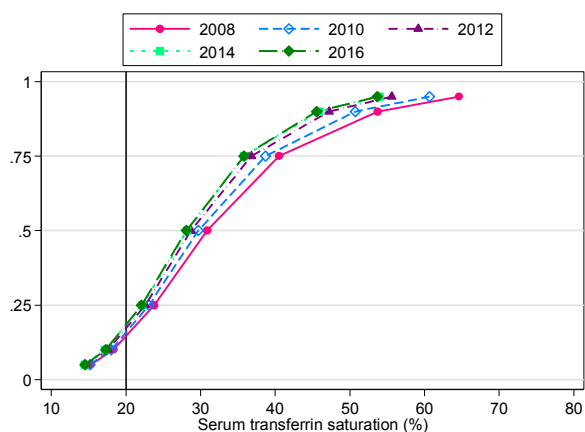


Figure 6.2.8: Cumulative distribution of transferrin saturation on ESAs, PD patients 2007-2016

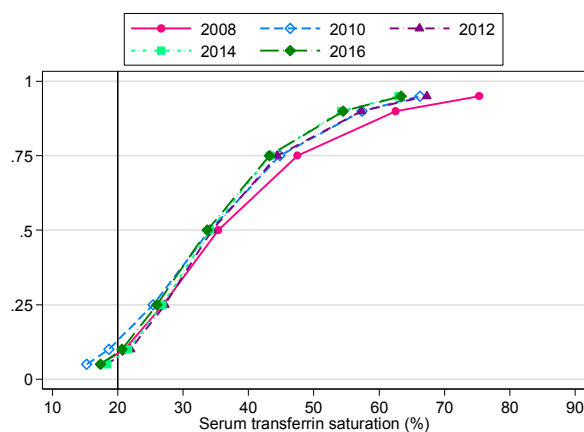


Table 6.2.8: Distribution of transferrin saturation on ESAs, PD patients, 2007-2016

Year	Number of patients	Mean	SD	Median	LQ	UQ	% Patients $\geq 20\%$
2007	1080	39.3	17.6	35.3	26.9	47.3	92
2008	1265	38.6	17.9	34.4	26.2	47.1	91
2009	1550	39.1	17.3	35.4	26.9	47.5	92
2010	1628	38.9	17.5	35.5	26.7	47.3	91
2011	1673	36.5	15.5	34.1	25.4	44.8	88
2012	1932	36.2	14.5	34.0	26.6	43.8	90
2013	1995	37.4	14.7	34.4	27.2	44.4	93
2014	2483	36.5	14.7	33.9	26.5	43.0	93
2015	2965	36.3	13.8	34.1	26.8	43.3	93
2016	3269	36.0	14.4	33.7	26.0	43.2	91

There was a wide variation in ferritin levels ranging from 110 to 1250 ng/ml between HD centres in 2016. A similar trend was seen in the PD centres (Table 6.2.9 & 6.2.10)

Table 6.2.9(a): Variation in Medium serum ferritin among patients on ESAs, HD centres, 2007-2016

Year	Number of centres	Min	5 <sup>th</sup> centile	LQ	Median	UQ	95 <sup>th</sup> centile	Max
2007	237	78.3	236.0	428.5	560.7	682.0	881.0	1457.0
2008	274	82.4	277.0	481.4	592.8	719.5	934.7	2000.0
2009	331	113.1	283.6	444.0	592.0	714.0	894.0	1530.5
2010	365	35.5	248.0	435.3	558.0	733.8	981.8	1177.4
2011	427	25.0	251.6	409.5	539.0	683.0	915.0	1210.5
2012	488	10.1	246.7	383.0	512.2	663.7	869.5	1365.5
2013	530	107.9	231.3	375.5	502.1	624.3	853.2	1240.8
2014	587	30.0	231.4	366.5	497.8	647.5	928.4	1265.5
2015	615	63.7	204.5	369.0	500.3	663.8	884.0	1250.0
2016	651	111.0	230.0	377.0	517.5	688.4	960.0	1246.0

Figure 6.2.9(a): Variation in medium serum ferritin among patients on ESAs, HD centres 2016

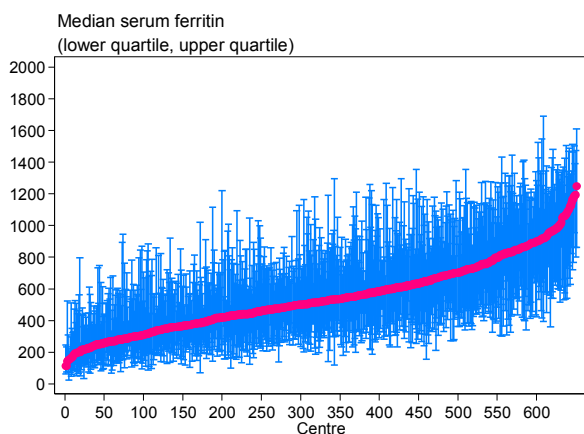


Figure 6.2.9(b): Variation in proportion of patients on ESAs with serum ferritin  $\geq 100$  ng/ml, HD centres 2016

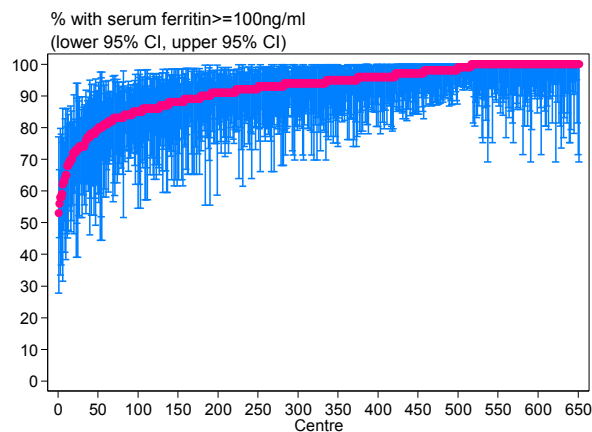


Table 6.2.9(b): Proportion of patients on ESAs with serum ferritin  $\geq 100$  ng/ml, HD centres, 2007-2016

Year	Number of centres	Min	5 <sup>th</sup> centile	LQ	Median	UQ	95 <sup>th</sup> centile	Max
2007	237	41	78	92	96	100	100	100
2008	274	36	82	92	96	100	100	100
2009	331	53	81	90	95	100	100	100
2010	365	0	79	90	96	100	100	100
2011	427	0	77	89	95	100	100	100
2012	488	10	76	88	95	100	100	100
2013	530	63	75	88	94	98	100	100
2014	587	45	73	88	94	98	100	100
2015	615	33	74	88	94	98	100	100
2016	651	53	74	89	94	98	100	100

Table 6.2.9(c): Median transferrin saturation among patients on ESAs, HD centres, 2007-2016

Year	Number of centres	Min	5 <sup>th</sup> centile	LQ	Median	UQ	95 <sup>th</sup> centile	Max
2007	217	16.3	21.8	27.9	31.2	35.5	43.3	78.1
2008	262	14.8	22.9	27.8	31.2	34.8	46.5	76.8
2009	305	16.3	22.0	27.3	30.4	34.1	42.9	81.9
2010	348	16.1	22.6	27.6	30.8	34.0	40.9	77.8
2011	419	15.3	22.4	26.5	29.4	32.7	39.3	61.8
2012	479	12.6	22.9	26.0	28.8	31.9	37.6	46.6
2013	530	14.6	22.1	25.4	28.3	31.5	36.3	70.6
2014	581	17.8	21.8	25.6	28.5	31.8	36.8	70.8
2015	614	13.9	21.5	25.2	28.1	31.1	35.4	59.5
2016	661	16.8	21.5	25.2	28.1	30.7	35.8	51.4

Figure 6.2.9(c): Variation in median transferrin saturation among patients on ESAs HD centres 2016

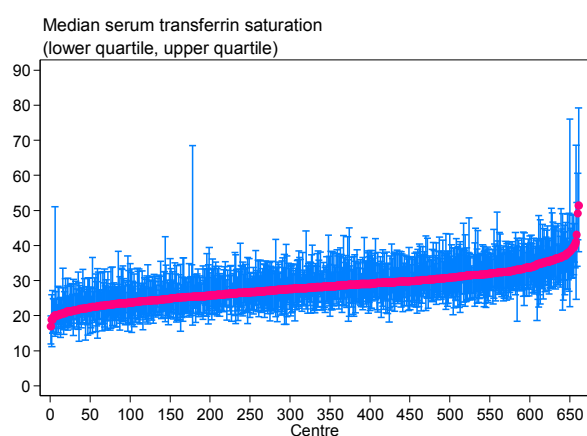


Figure 6.2.9(d): Variation in proportion of patients on ESAs with transferrin saturation  $\geq 20\%$ , HD centres 2016

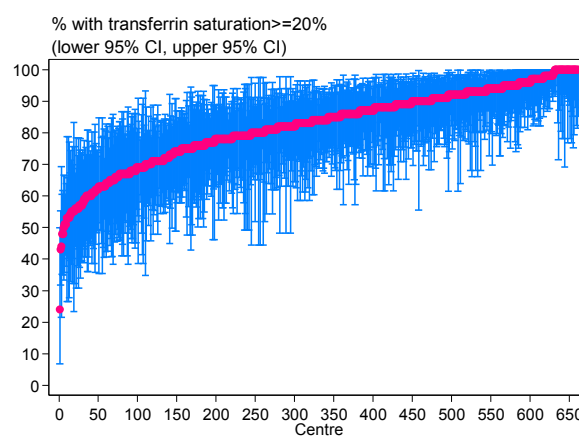


Table 6.2.9(d): Proportion of patients on ESAs with transferrin saturation  $\geq 20\%$ , HD centres, 2007-2016

Year	Number of centres	Min	5 <sup>th</sup> centile	LQ	Median	UQ	95 <sup>th</sup> centile	Max
2007	217	29	60	82	90	96	100	100
2008	262	17	64	80	89	95	100	100
2009	308	29	58	80	88	94	100	100
2010	349	26	64	81	89	94	100	100
2011	422	16	64	79	87	93	100	100
2012	484	23	60	78	86	94	100	100
2013	534	29	62	76	86	93	100	100
2014	586	29	60	77	86	94	100	100
2015	619	26	58	75	85	92	99	100
2016	32	59	64	85.5	92	95.5	100	100

Table 6.2.10(a): Variation in medium serum ferritin among patients on ESAs, PD centres, 2007-2016

Year	Number of centres	Min	5 <sup>th</sup> centile	LQ	Median	UQ	95 <sup>th</sup> centile	Max
2007	21	280.3	290.3	589.6	652.0	716.1	874.0	1048.6
2008	21	211.3	381.3	520.5	655.5	697.0	953.3	958.9
2009	21	280.0	332.1	545.0	676.6	797.6	951.0	1158.0
2010	24	260.4	272.3	509.8	659.8	760.3	827.5	973.3
2011	25	209.4	309.0	525.8	637.3	781.5	822.3	923.8
2012	26	133.7	205.7	519.5	659.7	735.9	870.5	965.5
2013	27	189.5	318.0	501.7	607.9	724.7	917.6	991.7
2014	29	160.1	339.7	499.8	588.8	704.3	1004.2	1021.0
2015	33	155.6	354.8	482.5	605.4	683.0	890.3	961.9
2016	33	204.5	266.6	504.8	554.0	664.5	897.6	1047.2

Figure 6.2.10(a): Variation in medium serum ferritin among patients on ESAs, PD centres 2016

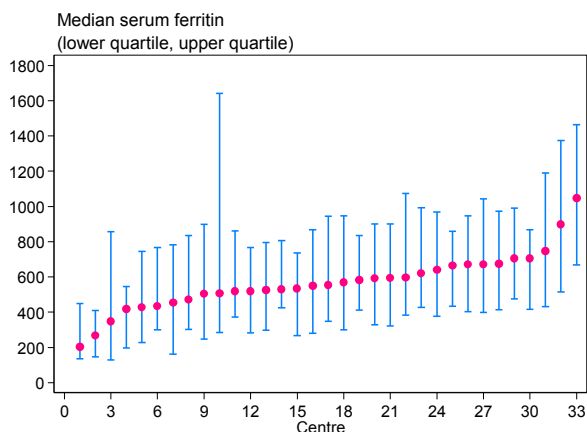


Figure 6.2.10(b): Variation in proportion of patients on ESAs with serum ferritin  $\geq 100\text{ng/ml}$ , PD centres 2016

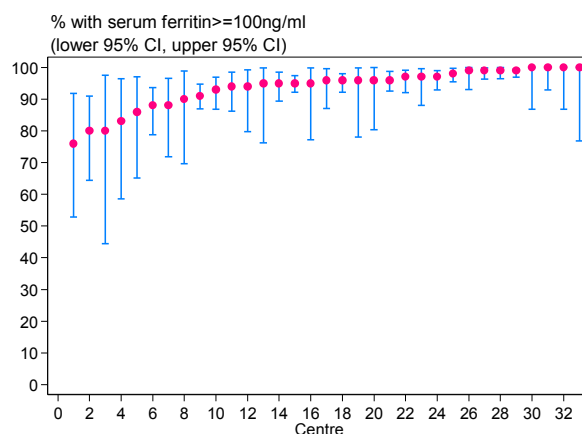


Table 6.2.10(b): Proportion of patients on ESAs with serum ferritin  $\geq 100$  ng/ml, PD centres, 2007-2016

Year	Number of centres	Min	5 <sup>th</sup> centile	LQ	Median	UQ	95 <sup>th</sup> centile	Max
2007	21	84	93	98	99	100	100	100
2008	21	83	87	93	98	100	100	100
2009	21	84	86	95	98	100	100	100
2010	24	82	87	94.5	98	99.5	100	100
2011	25	82	83	92	98	100	100	100
2012	26	67	83	91	97	99	100	100
2013	27	79	88	93	98	99	100	100
2014	29	78	83	91	95	98	100	100
2015	33	75	85	93	96	99	100	100
2016	33	76	80	91	96	98	100	100

Table 6.2.10(c): Median transferrin saturation among patients on ESAs, PD centres, 2007-2016

Year	Number of centres	Min	5 <sup>th</sup> centile	LQ	Median	UQ	95 <sup>th</sup> centile	Max
2007	19	25.5	25.5	29.6	37.7	46.5	83.4	83.4
2008	19	25.4	25.4	31.6	34.5	42.5	81.2	81.2
2009	21	24.9	28.4	32.5	37.4	39.2	55.9	84.7
2010	23	23.5	24.8	31.9	35.8	42.6	54.2	78.5
2011	23	22.6	23.6	32.3	34.1	37.6	48.6	60.3
2012	25	25.1	26.6	30.5	33.9	36.2	45.2	45.7
2013	23	27.7	29.8	31.4	34.6	37.3	42.1	55.1
2014	26	27.4	27.8	30.6	32.4	37.5	40.2	49.4
2015	31	27.8	28.3	30.3	34.8	37.4	39.0	43.0
2016	32	21.8	24.2	30.2	32.9	36.9	43.7	44.7

Figure 6.2.10(c): Variation in median transferrin saturation among patients on ESAs, PD centres 2016

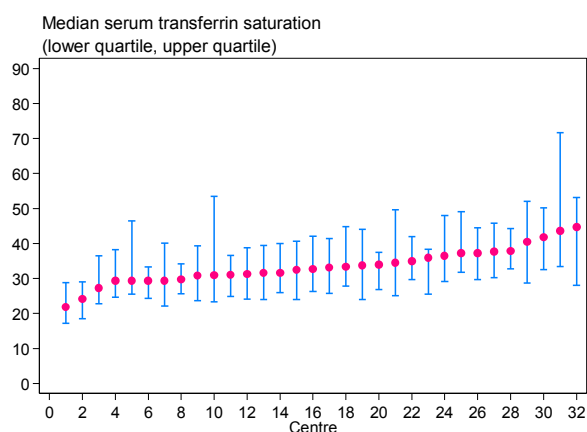


Figure 6.2.10(d): Variation in proportion of patients on ESAs with transferrin saturation  $\geq 20\%$ , PD centres 2016

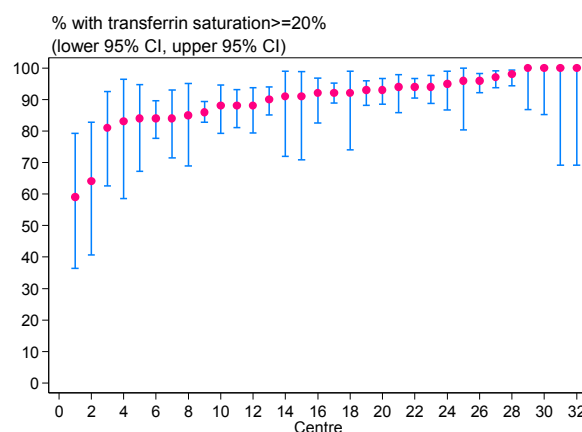


Table 6.2.10(d): Proportion of patients on ESAs with transferrin saturation  $\geq 20\%$ , PD centres, 2007-2016

Year	Number of centres	Min	5 <sup>th</sup> centile	LQ	Median	UQ	95 <sup>th</sup> centile	Max
2007	19	72	72	89	95	98	100	100
2008	19	65	65	92	95	96	100	100
2009	21	70	81	91	95	97	100	100
2010	23	69	72	90	95	100	100	100
2011	23	60	65	85	94	98	100	100
2012	25	63	71	86	94	97	100	100
2013	23	78	83	89	94	98	100	100
2014	26	81	82	89	94	96	100	100
2015	31	71	81	90	95	98	100	100
2016	32	59	64	85.5	92	95.5	100	100

### SECTION 6.3: HAEMOGLOBIN OUTCOMES ON DIALYSIS

The median haemoglobin in HD and PD patients on ESA was 10.3 and 10.2g/dl respectively. (Table 6.3.5 (a) & 6.3.6(a)). Median haemoglobin in HD patients without ESA was 11.8g/dl and 11.4g/dl for PD patient. (Table 6.3.1 & 6.3.2).

Table 6.3.1: Distribution of haemoglobin concentration without ESAs, HD patients 2007-2016

Year	Number of patients	Mean	SD	Median	LQ	UQ	% Patients <10g/dL	% Patients 10-<12g/dL	% Patients $\geq 12$ g/dL
2007	1756	10.8	2.2	10.7	9.1	12.4	40	29	31
2008	1751	10.8	2.3	10.8	9.1	12.6	39	29	32
2009	1848	11.2	2.3	11.3	9.4	12.9	33	29	38
2010	1884	11.2	2.2	11.4	9.6	12.9	30	30	40
2011	2074	11.2	2.2	11.4	9.6	12.8	31	30	39
2012	2285	11.4	2.2	11.7	9.9	13.0	26	31	43
2013	2560	11.4	2.2	11.7	10.0	13.0	26	30	44
2014	2815	11.5	2.1	11.8	10.2	13.0	24	30	46
2015	2982	11.5	2.1	11.8	10.1	12.9	24	31	45
2016	3290	11.5	2.1	11.8	10.0	12.9	25	29	46

Figure 6.3.1: Cumulative distribution of haemoglobin concentration without ESAs, HD patients 2007-2016

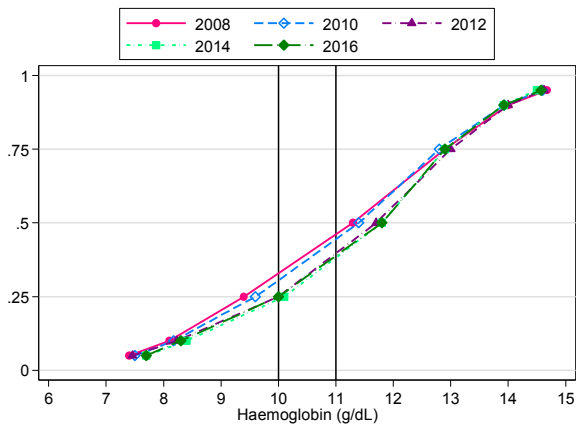


Figure 6.3.2: Cumulative distribution of haemoglobin concentration without ESAs, PD patients 2007-2016

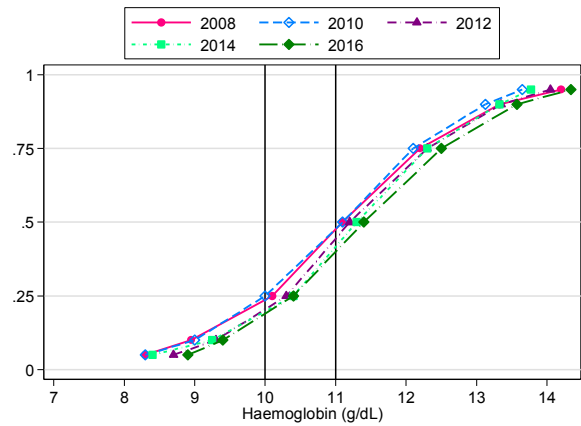


Table 6.3.2: Distribution of haemoglobin concentration without ESAs, PD patients 2007-2016

Year	Number of patients	Mean	SD	Median	LQ	UQ	% Patients <10g/dL	% Patients 10-<12g/dL	% Patients ≥12g/dL
2007	436	11.1	1.6	11.0	10.2	12.1	22	51	27
2008	450	11.1	1.7	11.1	10.2	12.1	21	51	28
2009	488	11.1	1.8	11.1	10.1	12.2	25	47	28
2010	495	11.1	1.7	11.1	9.9	12.2	27	46	27
2011	547	11.1	1.6	11.1	10.0	12.1	25	48	27
2012	565	11.2	1.7	11.1	10.1	12.3	25	46	29
2013	609	11.3	1.6	11.2	10.3	12.3	19	49	32
2014	642	11.1	1.7	11.1	10.1	12.1	25	48	27
2015	776	11.3	1.6	11.3	10.4	12.3	19	51	30
2016	780	11.5	1.7	11.4	10.4	12.5	17	48	35

Figure 6.3.3(a): Cumulative distribution of haemoglobin concentration on ESAs, diabetes HD patients 2007-2016

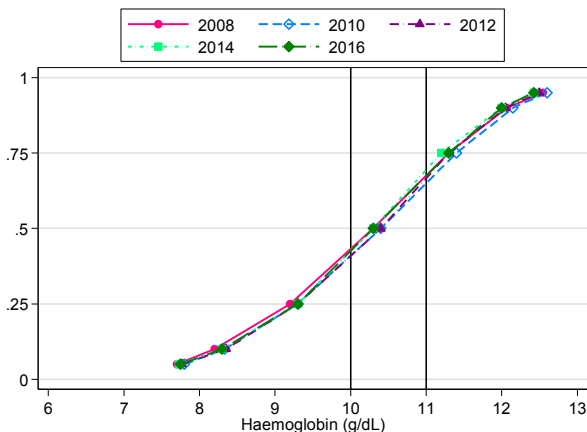


Figure 6.3.3(b): Cumulative distribution of haemoglobin concentration on ESAs, non-diabetes HD patients 2007-2016

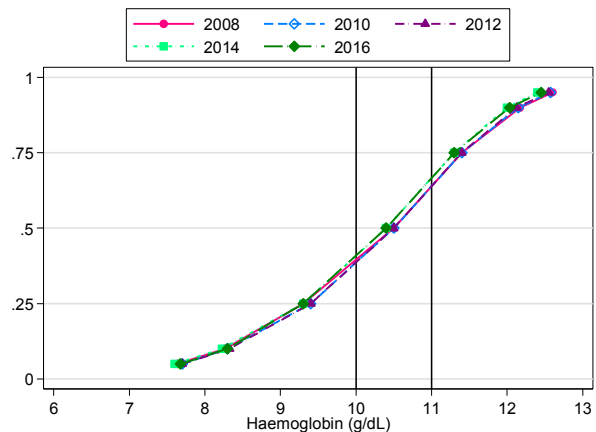


Figure 6.3.4(a): Cumulative distribution of haemoglobin concentration on ESAs, diabetes PD patients 2007-2016

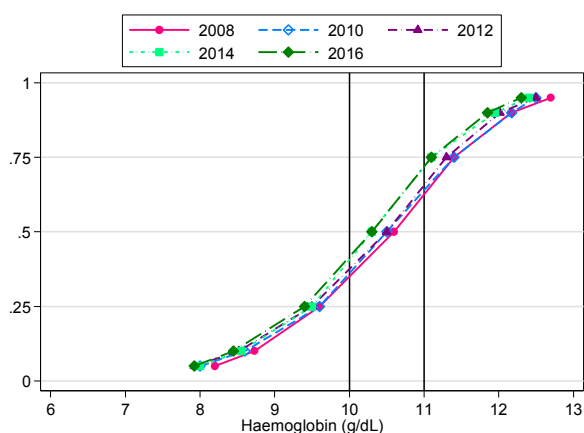
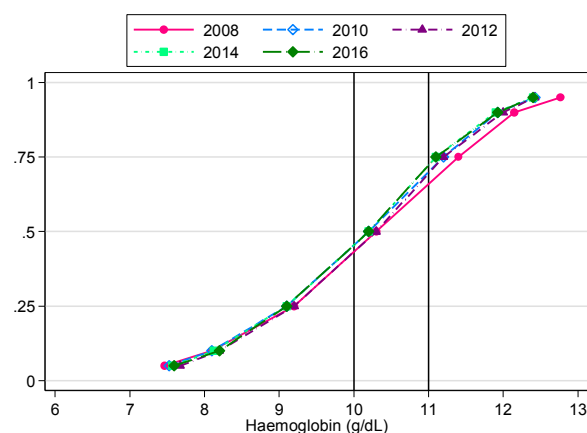


Figure 6.3.4(b): Cumulative distribution of haemoglobin concentration on ESAs, non-diabetes PD patients 2007-2016



In 2016, for HD patients on ESAs, the Hb ranged 7.9 to 12.2gm/dl with the median at 10.3 gm/dl. For PD patients, the median hemoglobin was similar at 10.2g/dl, with a lesser variation among PD centres compared to HD centres.

Table 6.3.5(a): Variation in median haemoglobin level among patients on ESAs, HD centres 2007-2016

Year	Number of centres	Min	5 <sup>th</sup> centile	LQ	Median	UQ	95 <sup>th</sup> centile	Max
2007	296	8.6	9.0	9.7	10.2	10.6	11.3	12.6
2008	348	8.0	8.9	9.8	10.2	10.7	11.4	12.6
2009	389	8.2	9.0	9.8	10.3	10.9	11.4	12.3
2010	425	7.9	9.1	9.9	10.4	10.9	11.4	12.1
2011	483	8.2	9.1	9.9	10.4	10.9	11.4	11.9
2012	545	7.9	9.0	9.8	10.4	10.8	11.3	11.9
2013	593	8.3	9.1	10.0	10.4	10.8	11.3	11.8
2014	640	8.5	9.2	10.0	10.4	10.7	11.2	11.7
2015	664	8.2	9.3	9.9	10.3	10.7	11.1	11.9
2016	692	7.9	9.3	9.9	10.3	10.8	11.3	12.2



Figure 6.3.5(a): Variation in median haemoglobin level among patients on ESAs, HD centres 2016

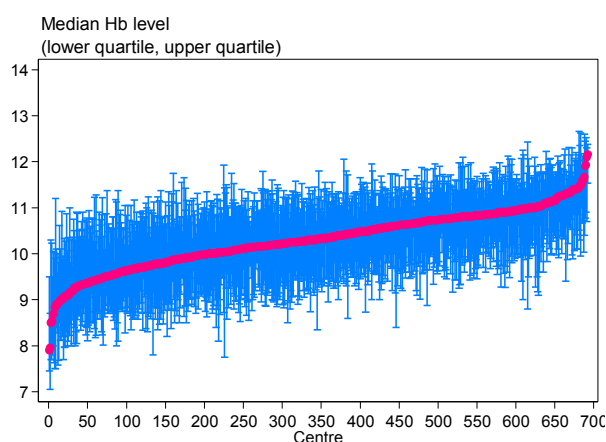


Figure 6.3.5(b): Variation in proportion of patients on ESAs with haemoglobin level > 10g/dL, HD centres 2016

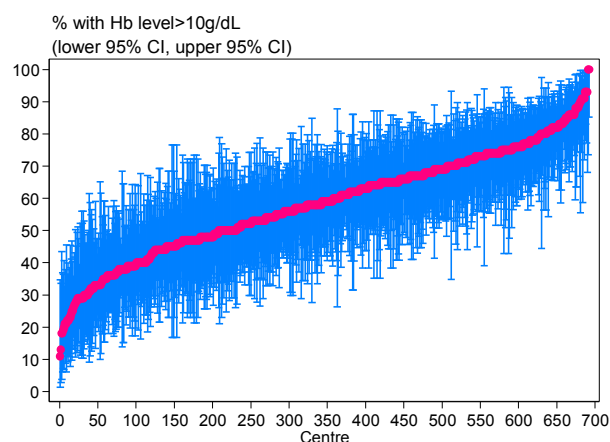


Table 6.3.5(b): Proportion of patients on ESAs with haemoglobin level > 10g/dL, HD centres, 2007-2016

Year	Number of centres	Min	5 <sup>th</sup> centile	LQ	Median	UQ	95 <sup>th</sup> centile	Max
2007	296	10	23	43	55	68	86	100
2008	348	0	26	43.5	56	69	84	100
2009	389	6	26	44	59	70	88	100
2010	425	0	27	46	62	73	88	100
2011	483	0	29	47	60	71	88	100
2012	545	0	25	46	60	70	84	100
2013	593	5	28	48	60	71	86	96
2014	640	8	28	49	59.5	70	83	94
2015	664	7	31	48	58	69	82	97
2016	692	11	30	47	59	70.5	83	100

Table 6.3.6(a): Variation in Median haemoglobin level among patients on ESAs, PD centres, 2007-2016

Year	Number of centres	Min	5 <sup>th</sup> centile	LQ	Median	UQ	95 <sup>th</sup> centile	Max
2007	22	9.5	9.6	10.1	10.3	10.9	11.1	11.3
2008	22	9.2	9.6	10.2	10.4	10.8	11.1	11.2
2009	22	9.5	9.6	9.9	10.5	10.7	10.7	11.0
2010	25	9.3	9.5	10.2	10.5	10.8	11.2	11.3
2011	26	9.0	9.1	10.0	10.4	10.6	10.9	11.0
2012	27	9.4	9.5	9.7	10.4	10.6	11.1	11.2
2013	28	9.3	9.6	9.9	10.3	10.5	10.9	11.3
2014	31	8.9	8.9	9.8	10.1	10.4	10.7	10.7
2015	35	8.8	9.1	9.8	10.1	10.5	10.8	10.9
2016	37	9.0	9.1	9.8	10.2	10.4	10.8	10.9

Figure 6.3.6(a): Variation in median haemoglobin level among patients on ESAs, PD centres 2016

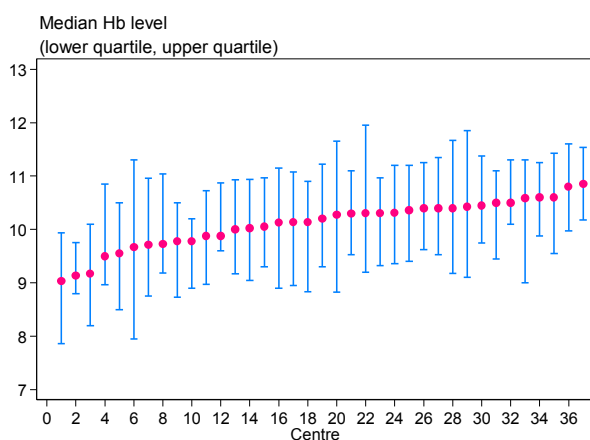


Figure 6.3.6(b): Variation in proportion of patients on ESAs with haemoglobin level >10g/dL, PD centres, 2016

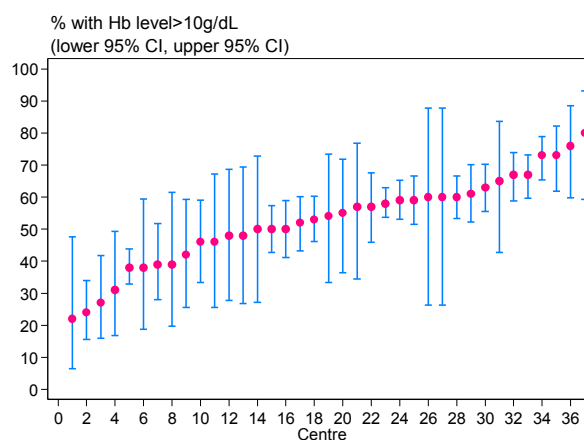


Table 6.3.6(b): Proportion of patients on ESAs with haemoglobin level >10g/dL, PD centres, 2007-2016

Year	Number of centres	Min	5 <sup>th</sup> centile	LQ	Median	UQ	95 <sup>th</sup> centile	Max
2007	22	36	38	51	59.5	63	72	73
2008	22	31	38	53	60.0	66	78	90
2009	22	35	37	48	60.5	66	75	77
2010	25	33	36	53	59.0	65	77	79
2011	26	18	23	48	59.5	68	77	81
2012	27	36	38	45	61.0	68	81	85
2013	28	28	40	46	58.5	63	71	82
2014	31	18	25	42	51.0	62	70	71
2015	35	24	33	41	53.0	65	78	81
2016	37	22	24	46	54.0	60	76	80