Chapter 7: Haemoglobin and related variables

This chapter describes the position at the end of 2000 for all units from England and Wales on the Registry.

The Renal Association Standards document 1997 recommends that ***"a target haemoglobin concentration of 10g/dl should be achieved in 85% of patients after 3 months on dialysis."***

Summary

There is continuing evidence of improvement in the management of renal anaemia in centres submitting data to the Registry. In haemodialysis, 79% of patients had a haemoglobin > 10g/dl compared to 72% in 1999 and 69% in 1998. In peritoneal dialysis 86% of patients had a haemoglobin >10g/dl in 2000 compared to 80% in 1999 and 78% in 1998. An increasing proportion of centres achieved the Renal Association standard for both haemodialysis and peritoneal dialysis patients.

There is evidence of significantly different approaches to iron replacement in different centres.

There is evidence of different approaches to management of renal anaemia pre-dialysis, which will in part reflect availability of erythropoiesis stimulating treatments. In different centres, between 19% and 61% of patients started dialysis with a haemoglobin greater than 10g/dl.

Inclusion criteria

Patients were included in this analysis if they had been stable at the same centre, on the same modality of dialysis for 3 months. The last available haemoglobin from each patient in the last quarter of 2000 was used in the analysis. Centres with less than 50% completeness of data were not shown on the figures. In the figures, data completeness is indicated by the percentage missing figure below the code letter for the renal unit. No laboratory harmonisation is used for haemoglobin.

Haemoglobin achievement by dialysis units

The data for haemoglobin concentrations have been presented in a variety of ways. This has enabled comparison with the Renal Association Standard for haemoglobin achievement but also provides centres with their median haemoglobin. The spread of haemoglobin concentrations may indicate differences in the way that units manage renal anaemia and a number of different measures of spread have been included.

In both modalities a higher proportion of patients included in the 2000 data achieved the RA Standard haemoglobin of 10g/dl than in previous years, but it should be noted that in each year new centres have been added to the Registry. In haemodialysis 79% of patients had a haemoglobin >10g/dl compared to 72% in 1999 and 69% in 1998. In peritoneal dialysis 86% of patients had a haemoglobin >10g/dl in 2000 compared to 80% in 1999 and 78% in 1998.

5 of the 27 centres with sufficient data achieved the Standard of 85% of haemodialysis patients with haemoglobin >10g/dl (2 of 22 centres in 1999). 14 of the 27 centres had 95% confidence intervals that included 85% (5 of 22 in 1999).

19 of 27 centres achieved the Standard for peritoneal dialysis (9 of 22 in 1999) and all but 2 centres data had 95% confidence intervals that included the 85% standard.

These data provide increasing evidence that the RA Standard for haemoglobin is achievable. For the first time the percentage of patients with haemoglobin greater than 11.0g/dl is shown in this years report. 85% of patients with a haemoglobin greater than 11.0g/dl has been recommended as the standard in European centres. No centre achieved this standard for haemodialysis patients (range 40% to 75% ≥ 11g/dl) but 3 centres achieved the European standard for peritoneal dialysis (range 46% to 93% ≥ 11g/dl).

There were some differences between centres, e.g. in haemodialysis centres B5 and B6 both achieved the standard but in centre B5 there was a considerably higher proportion of patients with haemoglobin greater than 12g/dl and a median haemoglobin of 11.9g/dl compared to 11.3g/dl in B6. Whether this is a statistical quirk influenced by centre size or the result of a successful targeting strategy in B6 is uncertain. In peritoneal dialysis B6 had a broad spread.

Centre	% data return	Median Hb g/dl	90% range	Quartile range	% Hb ≥ 10 g/dl	Mean Hb g/dl	Standard deviation
A1	97	11.4	8.5 - 13.4	10.2 - 12.3	79	11.2	1.5
A2	99	10.9	7.6 - 13.5	9.6 - 12.0	68	10.7	1.8
A3	99	11.5	8.4 - 14.0	10.4 - 12.6	83	11.4	1.7
A4	98	10.7	7.7 - 13.4	9.9 - 11.7	72	10.8	1.5
A5	94	11.8	8.3 - 13.9	10.5 - 12.7	82	11.5	1.7
A6	98	11.8	9.4 - 14.2	10.7 - 12.8	85	11.8	1.6
A7	98	11.2	8.6 - 13.9	10.4 - 11.9	84	11.2	1.5
A8	93	11.8	8.5 - 14.0	10.9 - 12.7	90	11.7	1.5
A9	99	11.3	8.3 - 13.6	10.5 - 12.4	82	11.3	1.6
B1	95	10.6	8.1 - 12.8	9.9 - 11.4	74	10.6	1.4
B2	97	11.3	8.7 - 14.1	10.4 - 12.6	82	11.3	1.7
B3	97	11.1	8.8 - 13.9	10.3 - 12.0	80	11.1	1.4
B4	89	10.8	7.9 - 13.7	9.9 - 12.0	73	10.8	1.8
B5	100	11.9	9.3 - 14.7	11.0 - 12.8	91	11.9	1.6
B6	93	11.4	9.3 - 12.9	10.6 - 12.0	90	11.3	1.1
B7	87	11.0	8.7 - 13.2	10.0 - 11.8	77	10.9	1.4
B8	76	10.6	8.1 - 14.3	9.3 - 11.9	67	10.8	1.9
B9	95	11.1	8.1 - 14.0	10.0 - 12.1	76	11.2	1.8
C1	92	11.5	7.8 - 13.8	10.2 - 12.2	78	11.2	1.7
C3	78	11.0	8.1 - 13.2	9.9 - 12.0	74	10.9	1.6
C4	69	11.4	8.5 - 14.0	10.4 - 12.5	84	11.4	1.6
C5	91	11.0	8.0 - 15.0	10.0 - 12.0	88	11.4	1.8
C6	100	11.5	8.7 - 13.5	10.2 - 12.4	80	11.3	1.5
C7	89	10.8	8.0 - 13.2	9.9 - 11.8	73	10.8	1.6
C8	83	11.1	8.6 - 14.1	10.3 - 12.1	81	11.2	1.5
C9	94	10.4	8.2 - 13.5	9.5 - 11.7	64	10.6	1.7
D1	82	11.3	7.9 - 13.5	10.5 - 12.3	82	11.2	1.7
E&W	90	11.2	8.3 - 13.8	10.1 - 12.2	79	11.2	1.6

Table 7.1: Haemoglobin data for patients on haemodialysis

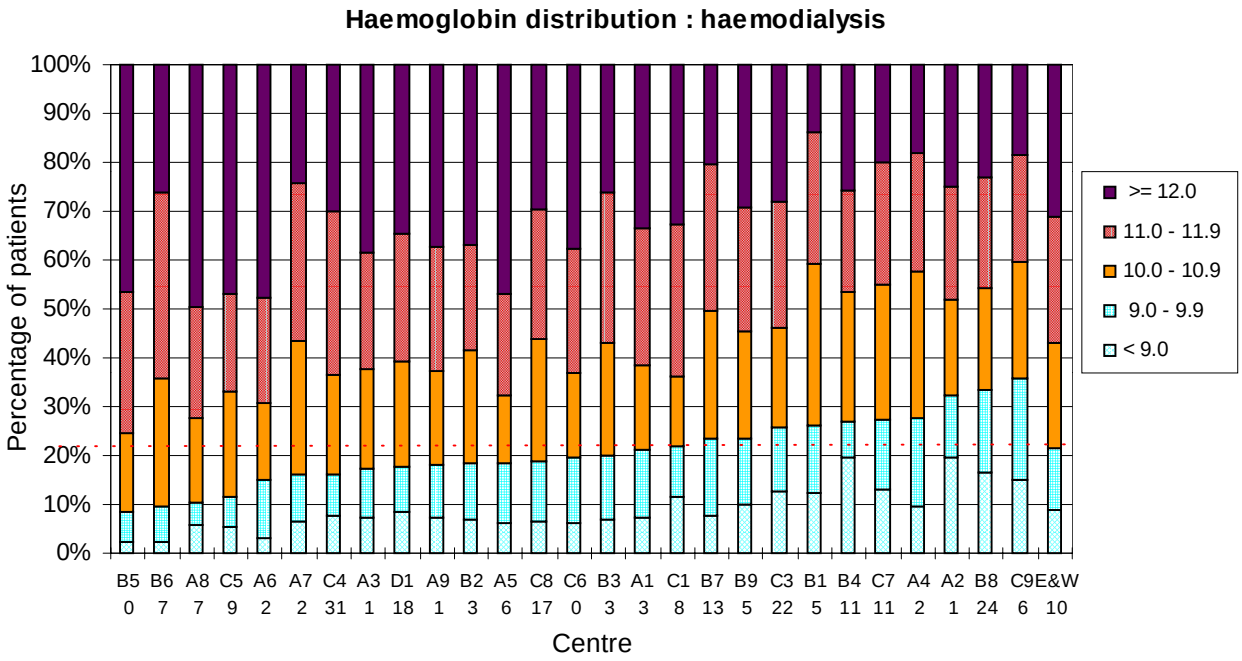


Figure 7.1: Haemoglobin in patients on HD by 1g/dl bands

Figure 7.1 shows the spread of data by 1g/dl bands. The centres are ordered by increasing percentage with a haemoglobin ≥ 10 g/dl, with centres to the left having the highest percentage

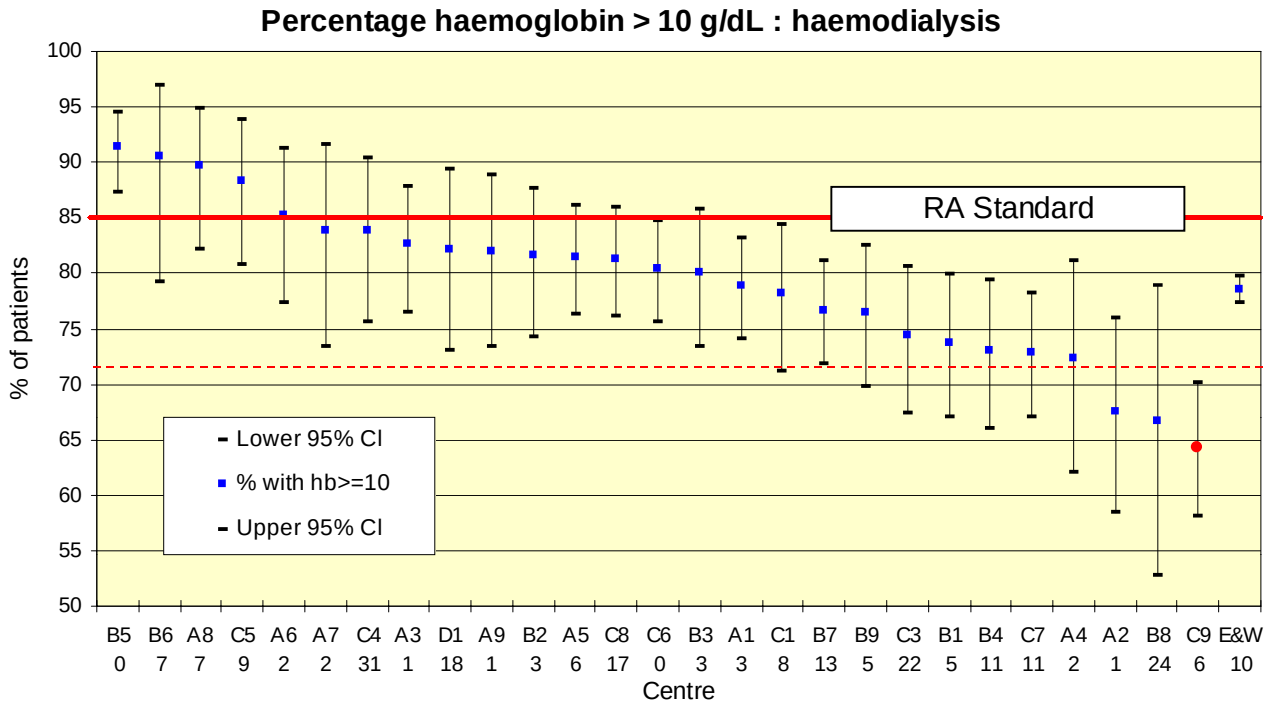


Figure 7.2: Percentage of HD patients by centre achieving the RA Standard

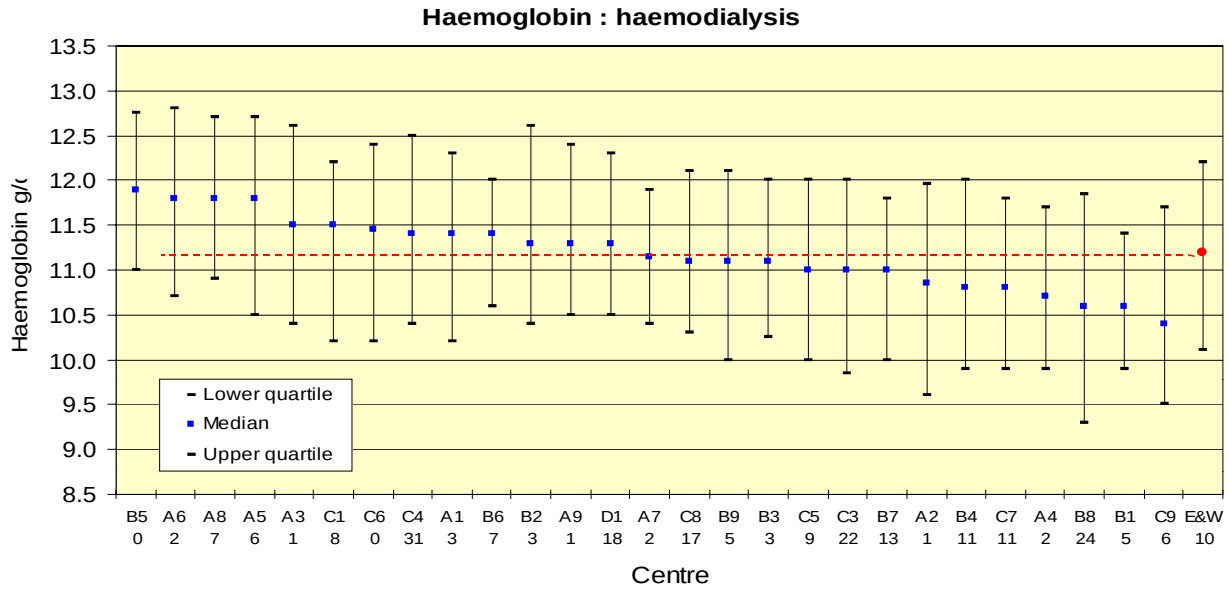


Figure 7.3: Haemoglobin median and quartile ranges for haemodialysis patients

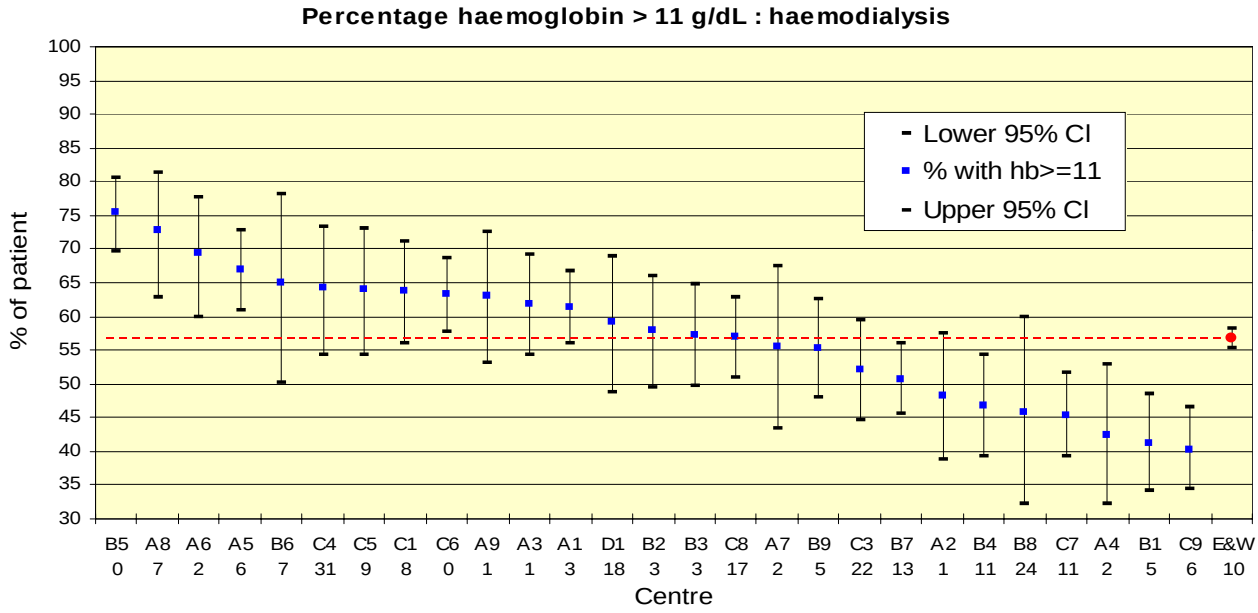


Figure 7.4: Percentage of HD patients by centre achieving the European Standard

Centre	% data return	Median Hb g/dl	90% range	Quartile range	% Hb ≥ 10 g/dl	Mean Hb g/dl	Standard deviation
A1	100	11.9	10.3 - 13.9	11.2 - 12.9	96	11.9	1.3
A2	100	11.3	9.0 - 14.0	10.6 - 12.6	83	11.4	1.5
A3	98	12.4	9.2 - 15.8	11.5 - 13.6	91	12.5	1.7
A4	100	11.6	9.2 - 13.9	10.8 - 12.6	88	11.6	1.4
A5	98	11.7	8.9 - 15.0	10.5 - 12.6	83	11.7	1.8
A6	96	11.9	9.4 - 15.9	11.2 - 13.1	94	12.2	1.8
A7	97	11.6	8.7 - 13.7	10.5 - 12.6	85	11.5	1.6
A8	100	11.4	9.5 - 14.4	10.5 - 12.9	92	11.6	1.6
A9	100	11.7	9.9 - 13.7	10.4 - 13.2	91	11.9	1.5
B1	98	11.0	8.6 - 14.1	9.7 - 12.1	69	11.0	1.8
B2	99	11.9	9.7 - 14.2	11.2 - 12.6	92	11.9	1.3
B3	94	11.3	8.9 - 13.7	10.4 - 12.6	87	11.4	1.5
B4	99	11.6	8.8 - 14.7	10.7 - 12.7	88	11.7	1.6
B5	100	12.0	8.5 - 15.0	11.6 - 13.3	90	12.1	1.7
B6	100	12.3	9.4 - 15.1	10.9 - 13.1	79	12.0	1.9
B7	100	10.9	7.9 - 14.1	9.9 - 12.3	73	11.0	1.8
B8	94	11.6	8.6 - 14.2	10.6 - 12.3	84	11.4	1.6
B9	99	12.0	9.3 - 14.6	10.8 - 12.8	86	11.9	1.7
C1	95	12.0	8.6 - 14.3	10.9 - 12.9	87	11.8	1.5
C3	96	11.8	9.7 - 13.3	10.6 - 12.8	91	11.6	1.3
C4	98	11.3	8.8 - 13.8	10.3 - 12.3	81	11.2	1.6
C5	100	12.0	10.0 - 14.0	11.0 - 13.0	100	12.1	1.3
C6	99	11.6	9.2 - 14.6	10.5 - 13.0	87	11.8	1.8
C7	90	11.5	9.1 - 14.1	10.6 - 12.3	85	11.4	1.5
C8	97	11.3	9.0 - 14.3	10.5 - 12.6	85	11.5	1.6
C9	96	11.4	8.8 - 13.9	10.4 - 12.6	82	11.4	1.6
D1	90	12.3	10.5 - 14.4	11.3 - 13.4	100	12.4	1.3
E&W	95	11.6	9.0 - 14.3	10.6 - 12.7	86	11.6	1.6

Table 7.2: Haemoglobin data for patients on peritoneal dialysis

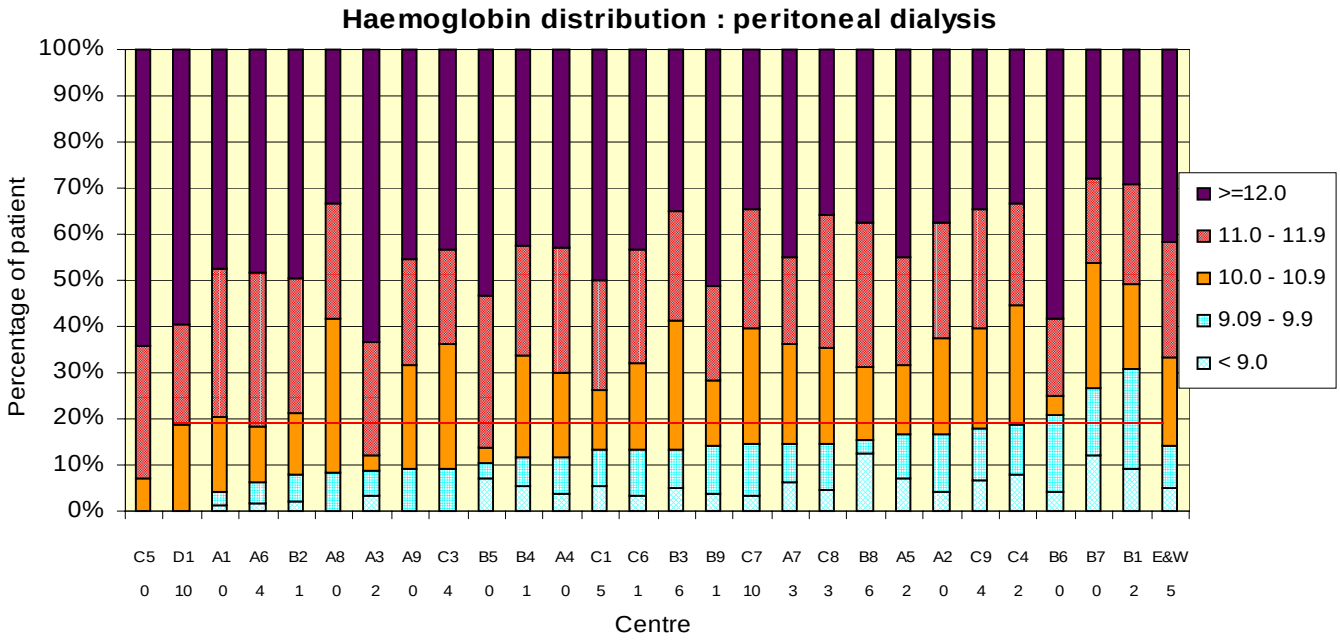


Figure 7.5: Distribution of haemoglobin for patients on PD by 1g/dl bands

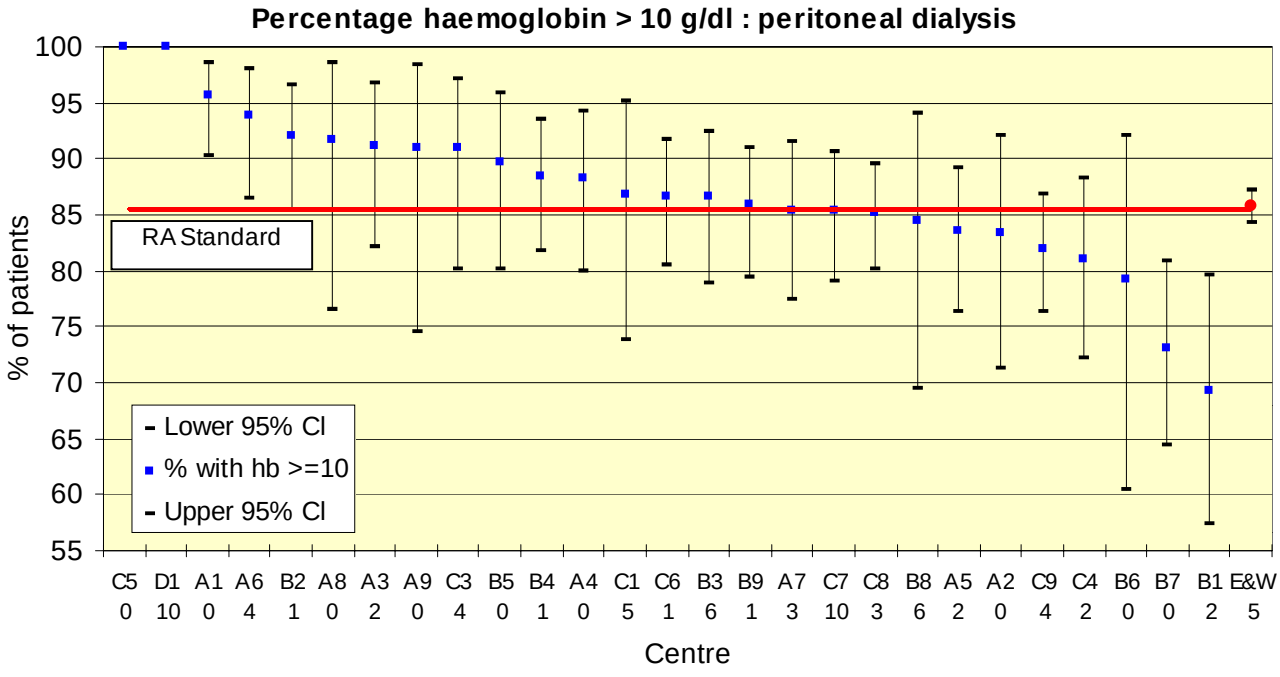


Figure 7.6: Percentage of PD patients by centre achieving the RA Standard

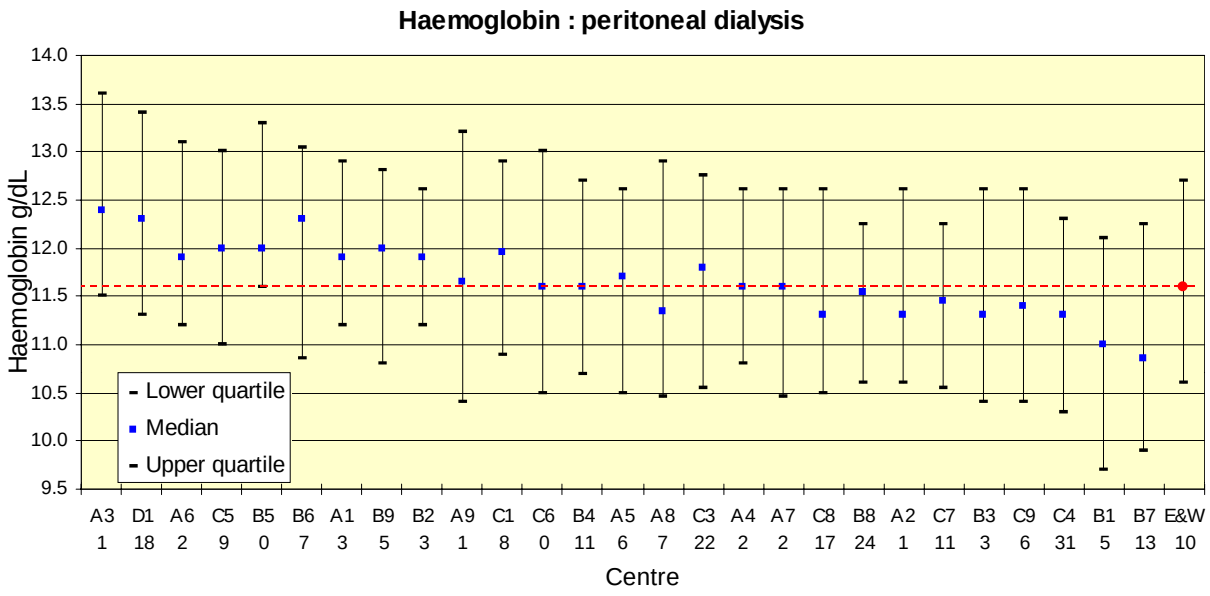


Figure 7.7: Percentage of PD patients by centre achieving a haemoglobin of at least 11.0 g/dl

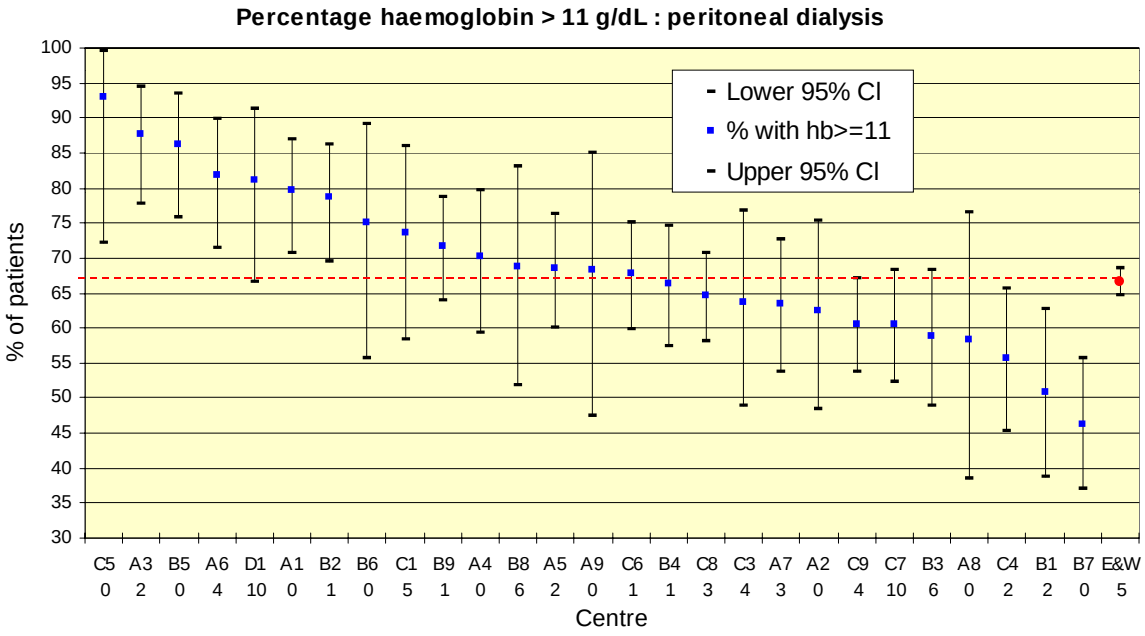


Figure 7.8: Haemoglobin median and quartile ranges for peritoneal dialysis patients

Factors influencing haemoglobin

Erythropoietin prescription and iron stores influence haemoglobin concentration. Other influences are less certain. Erythropoietin data are not available in this years report.

Haemoglobin and serum ferritin

Centres use different variables as measures of iron stores: serum ferritin is most commonly used. For this report, serum ferritin levels have been analysed and are shown in tables 7.3 and 7.4. As with haemoglobin the distribution of serum ferritin concentrations is represented by the inter-quartile and 90% ranges. The percentage with serum ferritin over 100 mcg/l and 200mcg/l can be compared between units using the 95% confidence intervals shown in figures 9-12.

Centre	% data return	Median ferritin	90% range	Quartile range	**% ferritin ≥ 100µg/l**
A1	100	287	45 - 947	159 - 447	84
A2	100	247	43 - 833	138 - 404	85
A3	99	433	124 - 980	310 - 642	97
A4	100	268	70 - 877	147 - 435	91
A5	94	461	66 - 1069	264 - 698	93
A6	98	400	105 - 740	294 - 532	96
A7	100	622	118 - 1096	372 - 929	97
A8	93	468	252 - 887	405 - 565	99
A9	100	341	164 - 597	253 - 404	99
B1	95	380	161 - 748	267 - 486	97
B2	99	242	97 - 1327	164 - 350	95
B3	98	312	95 - 922	195 - 461	94
B4	80	344	64 - 964	182 - 568	91
B5	100	496	179 - 826	413 - 621	98
B6	96	447	120 - 763	304 - 571	98
B7	100	566	91 - 1287	308 - 764	95
B8	76	301	77 - 1675	159 - 460	85
B9	88	349	112 - 906	222 - 530	97
C1	89	330	88 - 1213	169 - 508	93
C2	2	*	*	*	*
C3	84	153	30 - 566	83 - 242	68
C4	60	809	142 - 1219	559 - 994	98
C5	95	358	63 - 1190	224 - 541	93
C6	99	334	52 - 867	198 - 532	90
C7	89	525	116 - 1308	302 - 719	96
C8	97	288	51 - 858	161 - 469	88
C9	89	500	90 - 1306	271 - 778	93
D1	84	282	115 - 804	210 - 426	97
E&W	92	377	72 - 1038	215 - 586	92

* insufficient data

Table 7.3: Serum Ferritin concentration in haemodialysis patients

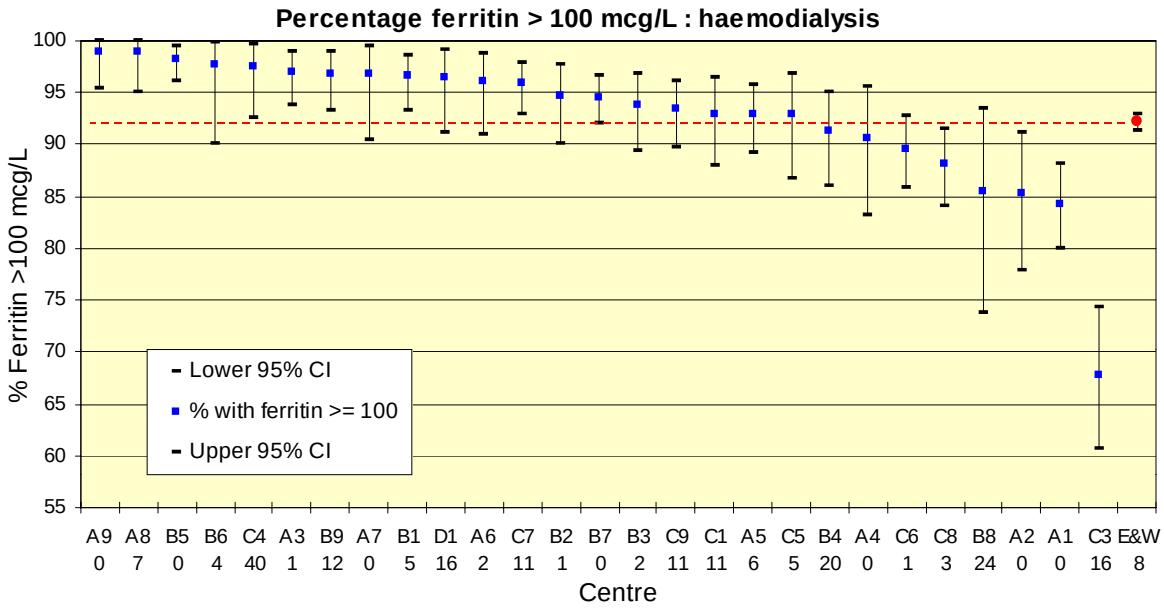


Figure 7.9: Percentage of HD patients with serum ferritin > 100 mcg/dl

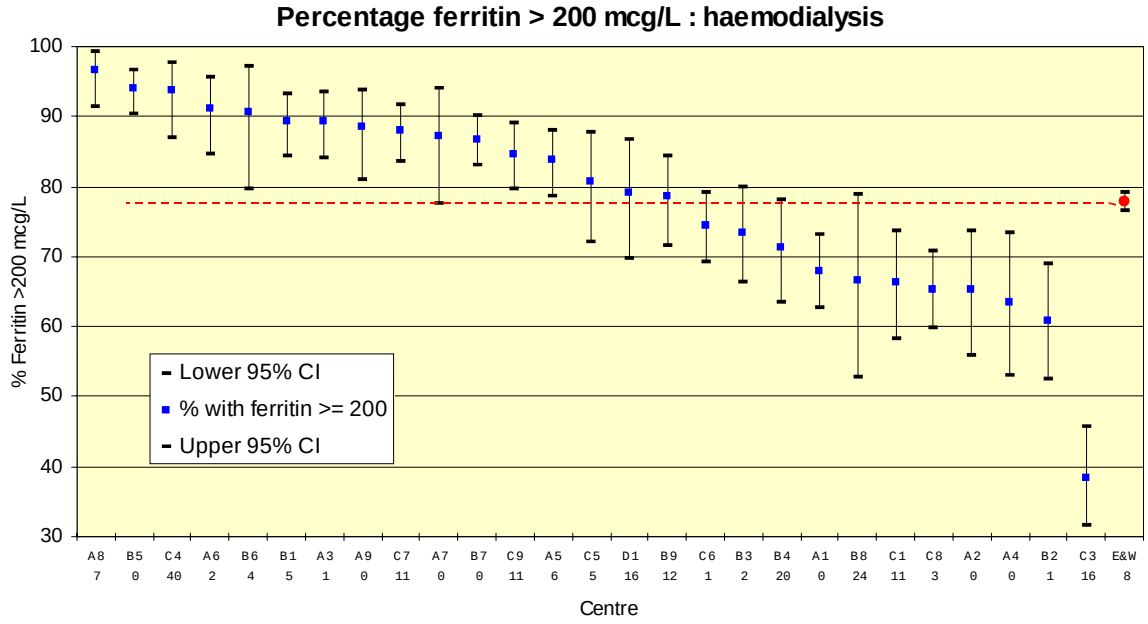
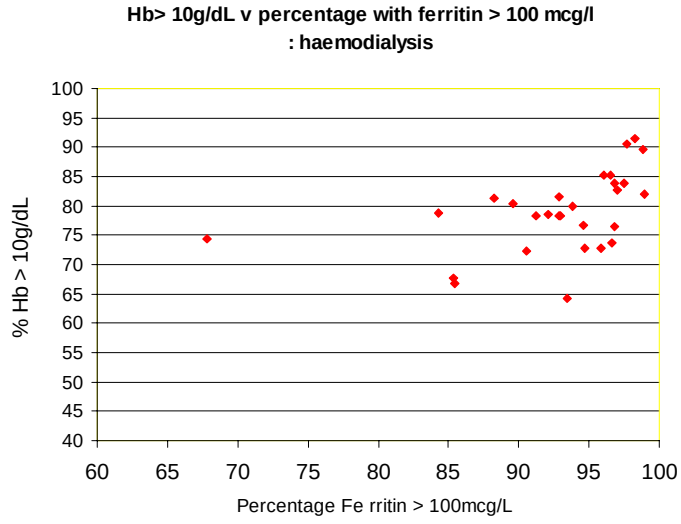


Figure 7.10: Percentage of HD patients with serum ferritin > 200 mcg/dl

Centre	% data return	Median ferritin µg/l	90% range	Quartile range	% ferritin > 100µg/l
A1	100	213	46 - 720	128 - 325	84
A2	94	184	28 - 896	105 - 268	76
A3	100	97	17 - 660	64 - 232	47
A4	90	220	43 - 747	128 - 356	83
A5	94	202	27 - 791	107 - 374	77
A6	96	340	46 - 830	205 - 453	91
A7	99	272	65 - 857	189 - 427	92
A8	100	271	67 - 687	168 -481	88
A9	100	214	28 - 620	122 - 436	77
B1	98	309	91 - 850	170 - 521	92
B2	100	277	30 - 878	164 - 408	83
B3	93	153	27 - 599	78.5 - 271	68
B4	98	230	49 - 788	137 - 383	84
B5	100	281	121 - 783	192 - 439	98
B6	100	420	247 - 951	372 -511	100
B7	100	342	62 - 1292	197 - 383	90
B8	85	195	19 - 522	111 - 344	79
B9	94	290	77 - 1205	181 - 458	92
C1	95	281	32 - 1248	153 - 614	87
C3	98	192	60 - 546	116 - 285	87
C4	97	216	49 - 1089	135 - 442	84
C5	93	283	51 - 722	137 - 450	77
C6	96	194	23 - 790	94 - 317	74
C7	90	233	49 - 675	130 - 368	84
C8	96	334	97 - 1068	197 - 489	95
C9	85	147	35 - 885	92 - 391	71
D1	98	276	33 - 737	141 - 369	83
E&W	**93**	**237**	**43 - 850**	**134 - 410**	**83**

* insufficient data

Table 7.4: Serum Ferritin concentration in peritoneal dialysis patients



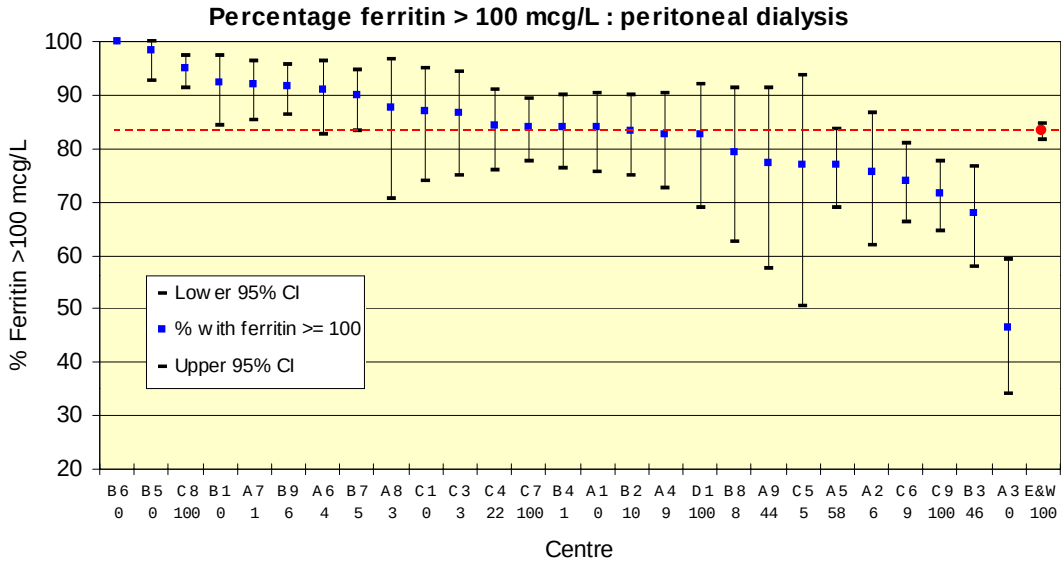


Figure 7.11: Percentage of PD patients with serum ferritin > 100 mcg/dl

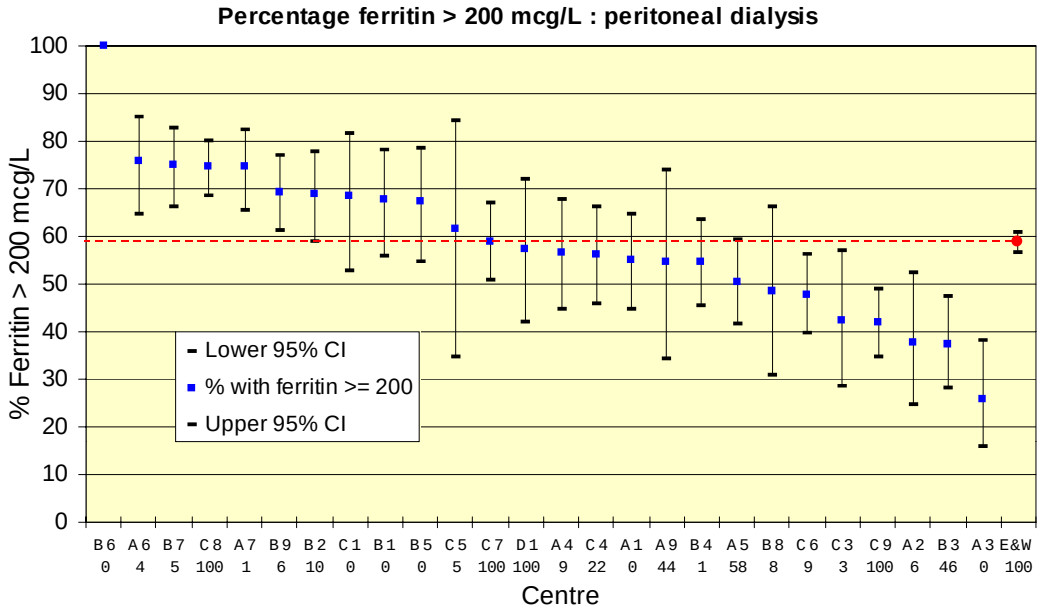


Figure 7.12: Percentage of PD patients with serum ferritin > 200 mcg/dl

Most centres had ferritin levels greater than 100 mcg/L in a high proportion of patients. The proportion with this ferritin level was higher in haemodialysis than peritoneal dialysis patients. This could reflect a greater difficulty in giving intravenous iron to peritoneal dialysis patients or could indicate that peritoneal dialysis patients achieve acceptable levels of haemoglobin with a lesser iron requirement.

Policies on iron treatment differ between centres and in individual centres may differ between haemodialysis and peritoneal dialysis. Centre C3 is a low outlier for ferritin in haemodialysis but has above average proportion with ferritin ≥ 100 mcg/dl in peritoneal dialysis. Centre A3 is a low outlier in peritoneal dialysis patients but has 97% of haemodialysis patients with ferritin ≥ 100 mcg/dl.

Centre C4 has 98% of haemodialysis patients with ferritin ≥ 100 mcg/dl but a median ferritin of 809 mcg/dl compared to Centre A9 which has 99% with ferritin ≥ 100 mcg/dl but a median of 341 mcg/dl.

As in previous years there is no direct relationship demonstrated between serum ferritin levels and the achievement of the Renal Association Standard for haemoglobin.

Haemoglobin at start of dialysis

The haemoglobin concentration in the first quarter in which a patient starts dialysis will reflect the pre-dialysis management in those patients already under medical review within a centre but will also be affected by the proportion of patients presenting late for renal replacement therapy.

Centre	% data return	Median Hb g/dl	90% range	Quartile range	%Hb > 10g/dL
A1	99	9.9	7.3-12.5	8.6-10.9	49
A2	98	9.6	7.5-12.3	8.6-10.4	38
A3	96	10.2	7.8-12.9	9.3-11.7	61
A4	100	10.4	8.6-12.1	9.6-11.1	55
A5	99	10.4	8.2-13.2	9.3-11.3	59
A6	78	9.8	7.0-13.6	8.8-11.0	49
A7	98	10.1	8.2-12.8	9.2-11.2	53
A8	80	10.4	7.9-12.5	8.9-10.9	66
A9	92	9.7	7.1-11.9	8.6-10.8	39
B1	98	9.4	7.1-11.6	8.7-10.4	37
B2	94	10.1	8.3-12.0	9.3-10.8	55
B3	83	9.8	7.8-12.9	8.9-11.1	49
B4	91	9.8	6.9-12.7	8.6-11.2	48
B5	98	10.5	8.0-13.0	9.1-11.7	59
B6	100	9.9	8.6-13.4	9.2-11.1	48
B7	90	9.5	7.5-12.1	8.6-10.5	38
B8	42	9.3	5.1-10.7	8.2-10.2	36
B9	90	10.1	7.3-13.1	8.9-11.1	55
C1	98	8.8	6.7-11.9	7.7-9.6	19
C3	82	9.5	7.2-12.2	8.3-10.7	38
C4	82	9.5	7.4-11.7	8.9-10.4	38
C5	85	9.0	7.0-12.1	9.0-11.0	41
C6	95	10.4	7.7-13.6	9.2-11.6	59
C7	96	9.4	7.4-11.7	8.5-10.4	32
C8	90	10.4	8.0-13.2	9.3-11.5	60
C9	39	*	*	*	*
D1	76	10.1	7.9-13.0	9.5-11.4	52
E&W	86	9.9	7.4-12.7	8.9-11.0	48

Table 7.5: Haemoglobin at start of dialysis

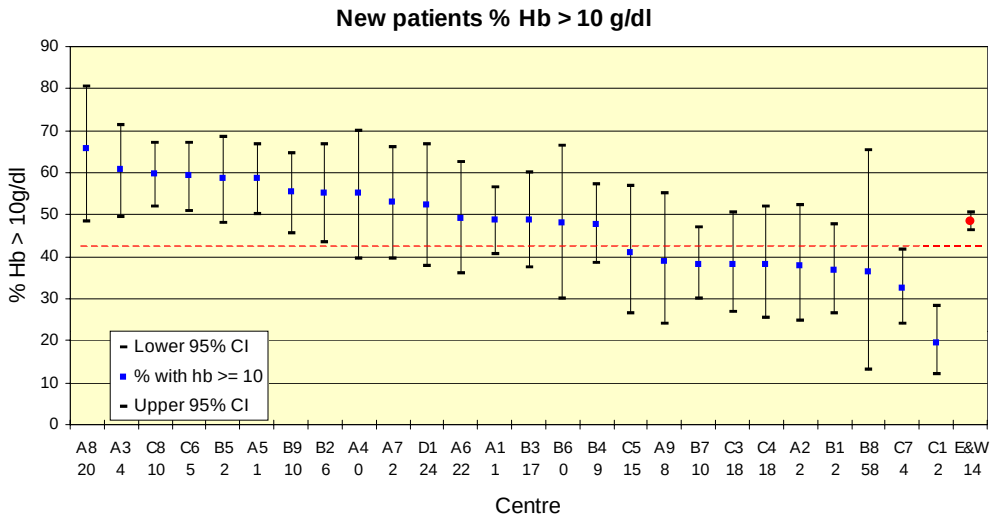


Figure 7.13: Percentage haemoglobin ≥10g/dl for new patients

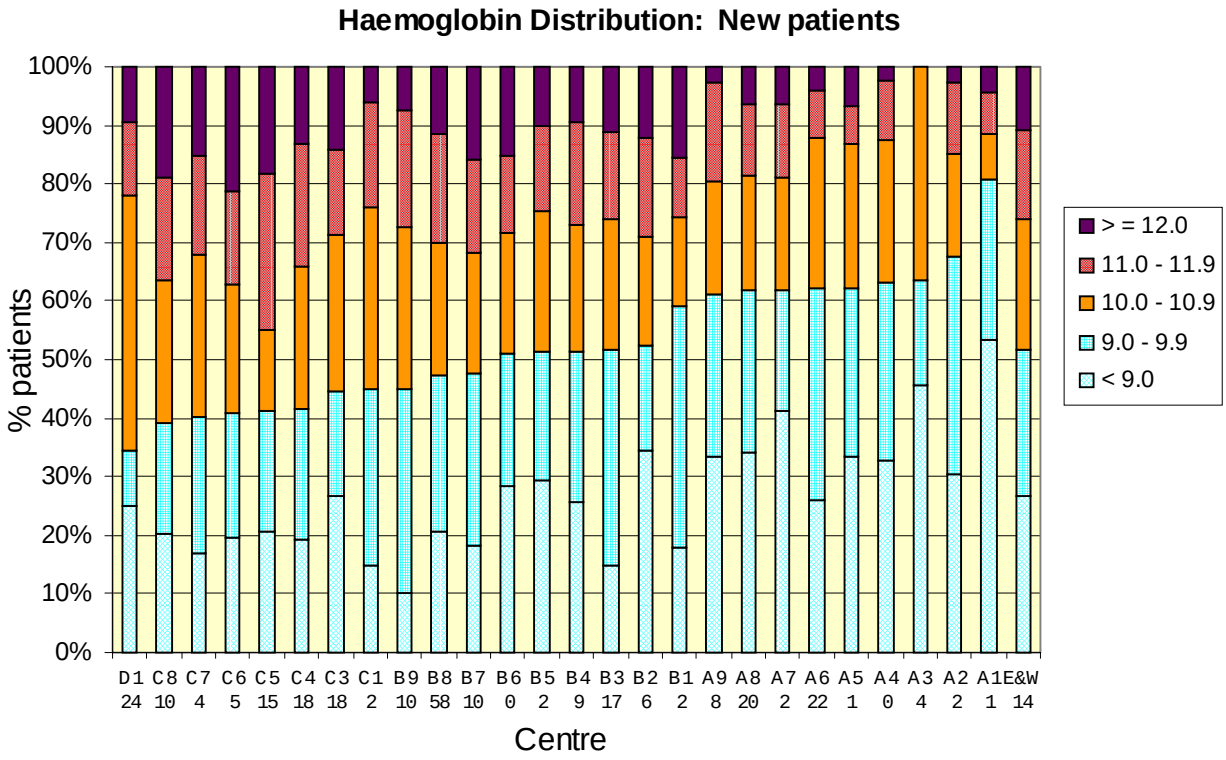


Figure 7.14: Haemoglobin distribution at start of dialysis

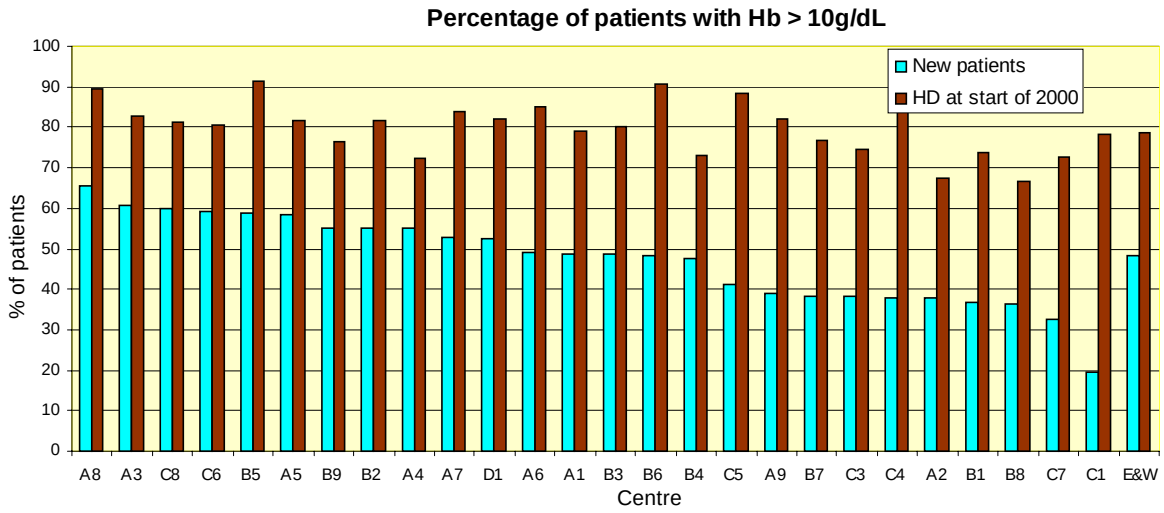


Figure 7.15: Percentage with haemoglobin > 10g/dl: new and prevalent patients

A significant proportion of new patients are very anaemic with haemoglobin < 9g/dl which may reflect patients presenting late with uraemia. The large variation in new patients haemoglobin between centres and the lack of relationship between haemoglobin of new patients and haemoglobin of established patients probably reflects differing policies on use of erythropoiesis stimulating treatments in pre-dialysis patients. Current standards for anaemia management in renal failure do not apply pre-dialysis.

Change in Haemoglobin Achievement 1999 -2000

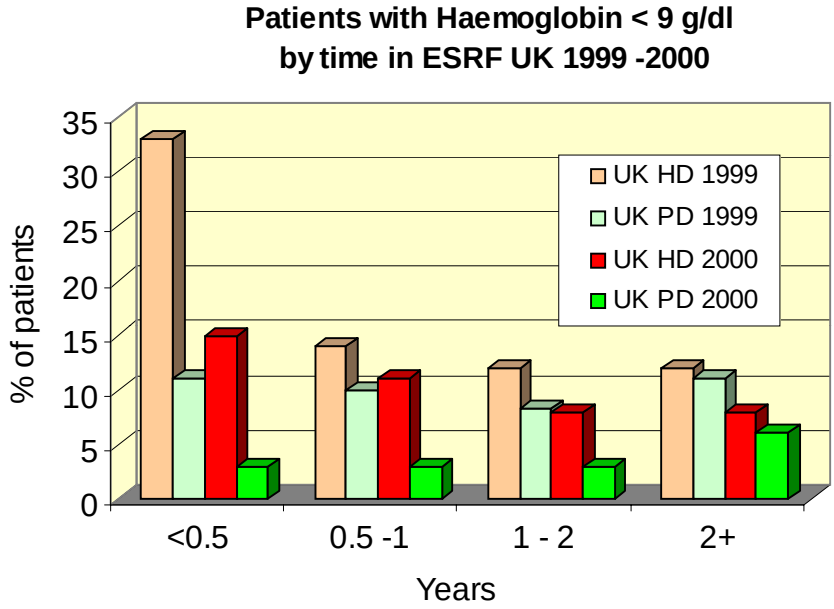


Figure 7.16: Haemoglobin < 9 g/dl in 1st 2 years since of RRT

Figure 7.16 shows that since 1999 fewer patients are starting renal replacement therapy severely anaemic with a haemoglobin of less than 9 g/dl. For patients both on haemodialysis and peritoneal dialysis this proportion has more than halved. These results for 2000 are now similar to those achieved in the 1999 US data.

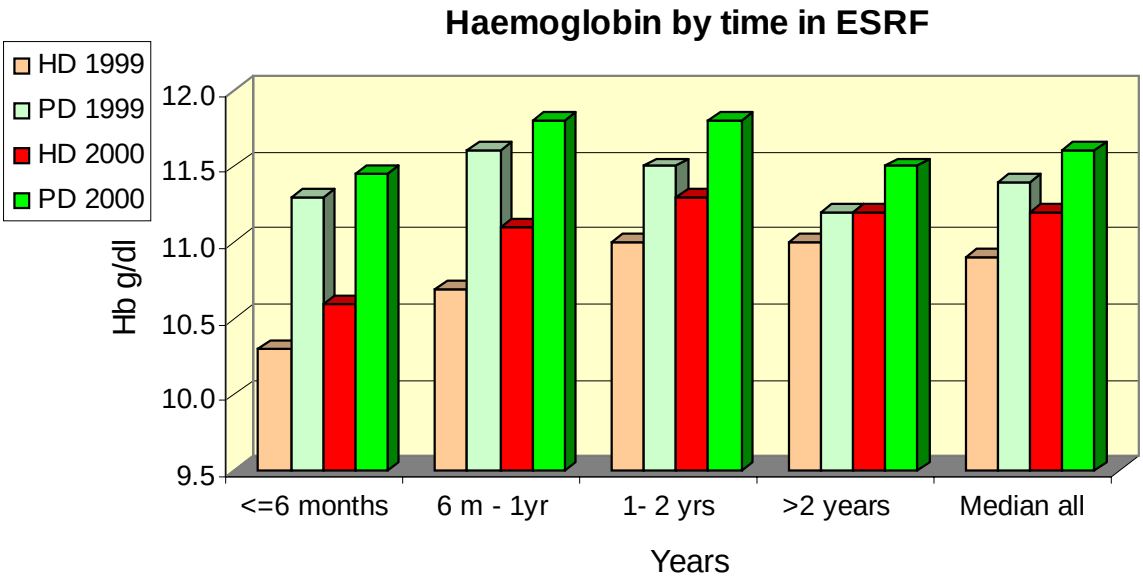


Figure 7.17: Median haemoglobin by time on RRT

In 2000 there has been a marked rise in median haemoglobins for patients on both dialysis modalities, across all time points. There is now no fall in haemoglobin for patients on PD after 1- 2 years, although the fall in haemoglobin still occurs for those on PD > 2years, although to a lesser extent. As shown last year, a median haemoglobin of 11.5g dl should indicate that > 85% of patients have a haemoglobin above 10 g/dl and achieve the Renal Associations standard.

Figures 7.18 show the improvement for patients on haemodialysis across all centres with 2 years of data. Two of the newer centres A6 and C9 with no data for 1999 show no improvement in the year 2000.

Figure 7.19 is a similar graph for patients on peritoneal dialysis. Centre B6 is the only centre to show a drop in achieving the standard over this time period.

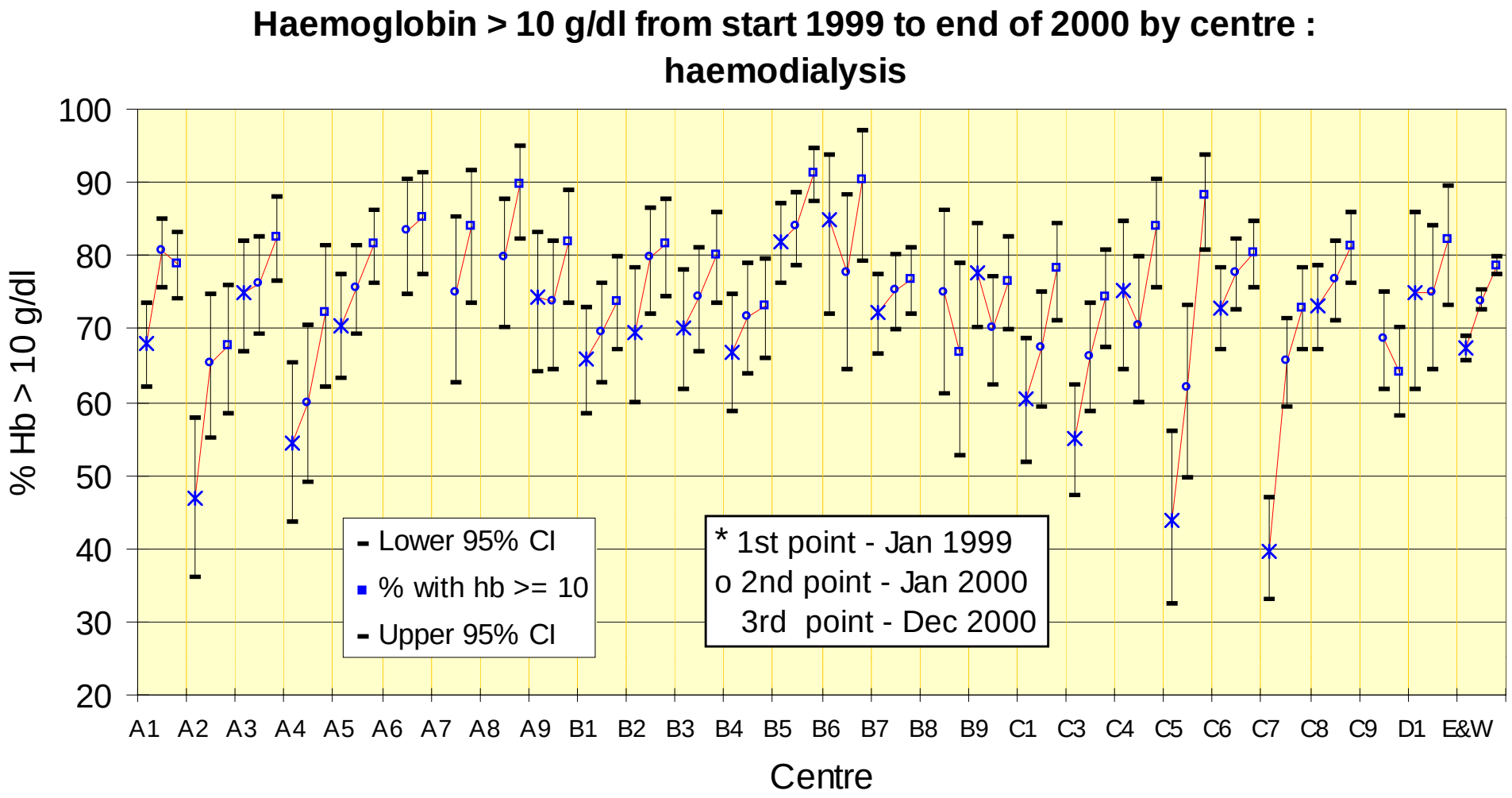


Figure 7.18: Change in haemoglobin 1999 –2000 haemodialysis

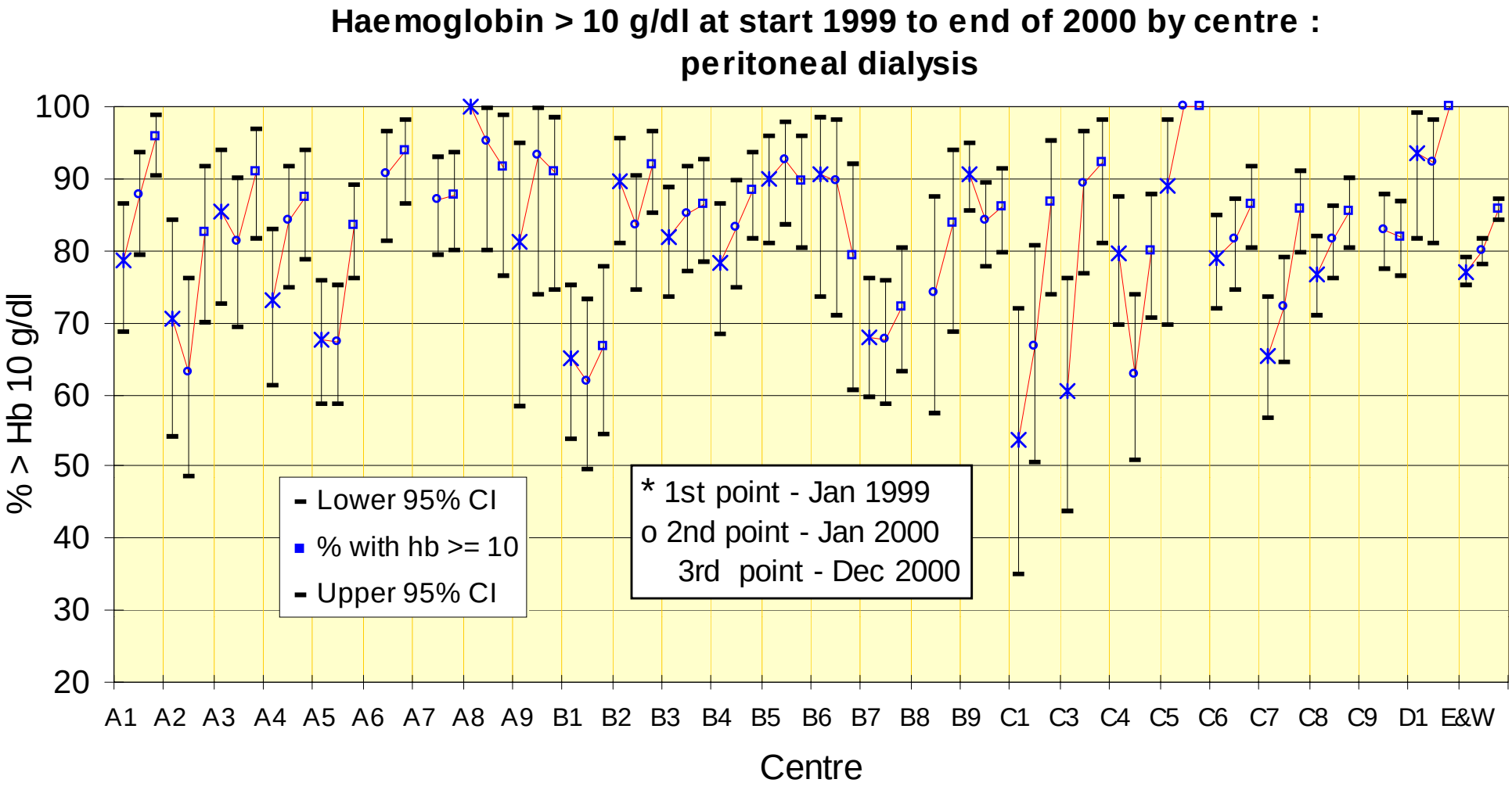


Figure 7.19: Change in haemoglobin 1999 –2000 peritoneal dialysis

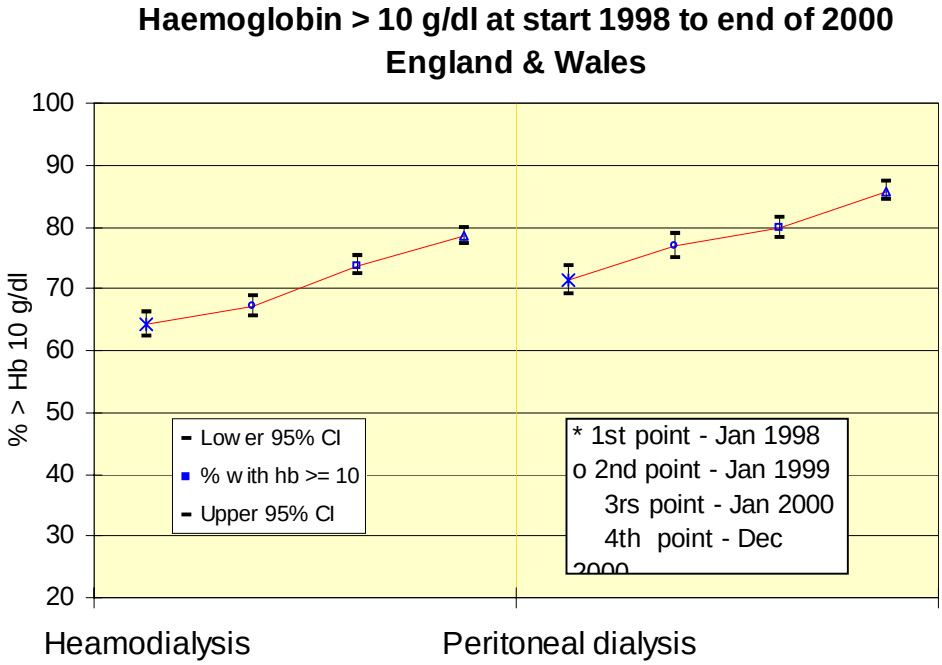


Figure 7.20: Improvement in E&W of achieving the Hb standard 1998-2000

The US data for October 2000, from the ESRD Clinical Performance Measures project showed that 91% of patients had a haemoglobin ≥10 g/dl and 74% achieved a haemoglobin ≥11 g/dl. Median haemoglobin in the US was 11.7 g/dl, which is consistent with the Registry prediction a median haemoglobin of 11.5g/dl is required to achieve 85% of patients above 10g/dl.

Conclusion

There is continuing evidence of improvement in the management of renal anaemia in centres submitting data to the Renal Registry. For peritoneal dialysis 86% of all patients whose data had been submitted to the Registry had a haemoglobin ≥10 g/dl. An increasing proportion of centres achieved the Renal Association standard for both haemodialysis and peritoneal dialysis patients.

There is evidence of significantly different approaches to iron replacement in different centres.

There is evidence of different approaches to management of renal anaemia pre-dialysis which will in part reflect availability of erythropoiesis stimulating treatments.