

## Chapter 7: Haemoglobin and related variables

This chapter describes the position at the end of 1999 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

- Of the 22 renal units in England and Wales with adequate data returns, the Renal Association standard for haemoglobin in dialysis patients of 85% with haemoglobin of at least 10 g/dl was achieved by 2 units for haemodialysis patients, and 9 for peritoneal dialysis patients.
- Overall haemoglobin levels improved with 72% of haemodialysis patients and 80% of peritoneal dialysis patients in England and Wales achieving a haemoglobin of 10g/dl or more. This improvement was reflected by an improvement in the performance of most individual renal units.
- Serum ferritin concentrations were above 100mcg/l in 88% of haemodialysis patients in renal units in England & Wales (unit range 67-100%), and 80% of peritoneal dialysis patients.(unit range 63% -93%). It appears that the most efficient use of erythropoietin therapy is not being obtained in many units.
- Erythropoietin is given to 86% (range between renal units of 79% to 97%) of haemodialysis patients and 63% (36% to 88%) of peritoneal dialysis patients.
- An haemoglobin  $\geq 10$ g/dl was obtained without the use of erythropoietin in between 2% and 16% of haemodialysis patients in different renal units, and between 12% and 45% of peritoneal dialysis patients. The factors determining this variation are not clear. There was no clear relationship of haemoglobin of erythropoietin usage to age, but women had lower haemoglobin concentrations and were more likely to be on erythropoietin than men.

The management plans being used in different units with varying degrees of success are not influencing the spread of haemoglobin concentrations within the unit. Thus there is no evidence of successful targeting of a particular haemoglobin concentration. The maintenance of a broad spread of haemoglobin concentrations, even as haemoglobin concentrations on average are rising, is contributed to by the demonstrated variability of individual's haemoglobin concentrations.

## ***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 1999 was used in the analysis.

Data from centres were only included for statistical analysis if there was more than 75% data completeness. 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 units 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. The data for haemodialysis and peritoneal dialysis patients is presented in figures 1- 6 and tables 1 and 2.

A higher proportion of patients on peritoneal dialysis than on haemodialysis achieved the Renal Association Standard. In 1999 80% of peritoneal dialysis patients and 72% of haemodialysis patients in England and Wales had haemoglobin of 10g/dl or more (78% and 69% respectively in 1998).

Two centres achieved the Standard for patients on haemodialysis and in an additional three centres the 95% C.I. also included the 85% achievement Standard. This is unchanged compared to 1998.

Nine centres achieved the haemoglobin Standard for patients on peritoneal dialysis with an additional six centres having a 95% C.I which includes the Standard. In 1998 for patients on peritoneal dialysis, five centres achieved the Standard.

<b>Centre</b>	<b>% data return</b>	<b>Median Hb g/dl</b>	<b>90% range</b>	<b>Quartile range</b>	<b>% Hb ≥ 10 g/dl</b>	<b>Mean Hb g/dl</b>	<b>Standard deviation</b>
A	100	11.4	8.9-13.2	10.5-12.2	87	11.2	1.2
B	94	10.9	7.8-13.6	9.7-12.2	68	10.8	1.8
C	97	10.6	8.1-12.9	9.4-11.5	64	10.5	1.6
D	84	10.4	7.4-13.1	9.3-11.6	60	10.3	1.8
F	98	11.6	9.2-13.8	10.6-12.4	88	11.4	1.4
G	92	10.9	8.5-13.7	9.9-12.1	72	11.0	1.7
H	99	10.4	7.6-13.3	9.2-11.4	60	10.4	1.7
I	99	11.0	7.7-13.3	10.2-12.0	78	10.9	1.6
J	100	11.2	8.3-13.7	9.9-12.1	74	11.0	1.7
K	97	10.4	8.4-12.6	9.6-11.2	66	10.5	1.3
L	88	11.0	8.1-13.6	9.9-11.9	74	10.9	1.7
M	83	10.8	8.4-13.7	9.6-12.1	69	10.8	1.6
N	100	11.0	8.6-13.4	10.1-12.1	76	11.0	1.5
<b>Centre</b>	<b>% data</b>	<b>Median</b>	<b>90%</b>	<b>Quartile</b>	<b>% Hb ≥</b>	<b>Mean</b>	<b>Standard</b>

	return	Hb g/dl	range	range	10 g/dl	Hb g/dl	deviation
O	100	11.3	8.7-13.5	10.3-12.3	82	11.2	1.5
P	100	10.9	8.8-15.0	9.8-12.2	73	11.1	1.7
Q	99	11.4	8.5-13.9	10.0-12.4	77	11.2	1.7
R	98	10.8	8.4-14.0	9.9-11.9	73	10.9	1.7
T	96	11.0	8.4-13.7	10.0-12.1	75	11.0	1.6
U	82	10.6	8.2-13.0	9.6-11.6	72	10.6	1.4
V	100	11.5	8.7-14.1	10.5-12.3	84	11.5	1.5
W	99	10.1	8.0-12.3	8.8-11.0	56	10.0	1.4
X	100	10.7	8.6-13.2	9.7-11.8	68	10.7	1.4
<b>E&amp;W</b>	<b>94</b>	<b>10.9</b>	<b>8.3-13.6</b>	<b>9.8-12.0</b>	<b>73</b>	<b>10.9</b>	<b>1.6</b>
<b>Scot.</b>	<b>94</b>	<b>11.0</b>	<b>7.8-13.5</b>	<b>9.7-12.1</b>	<b>70</b>	<b>10.8</b>	<b>1.7</b>

Table 7.1 Haemoglobin data for patients on haemodialysis

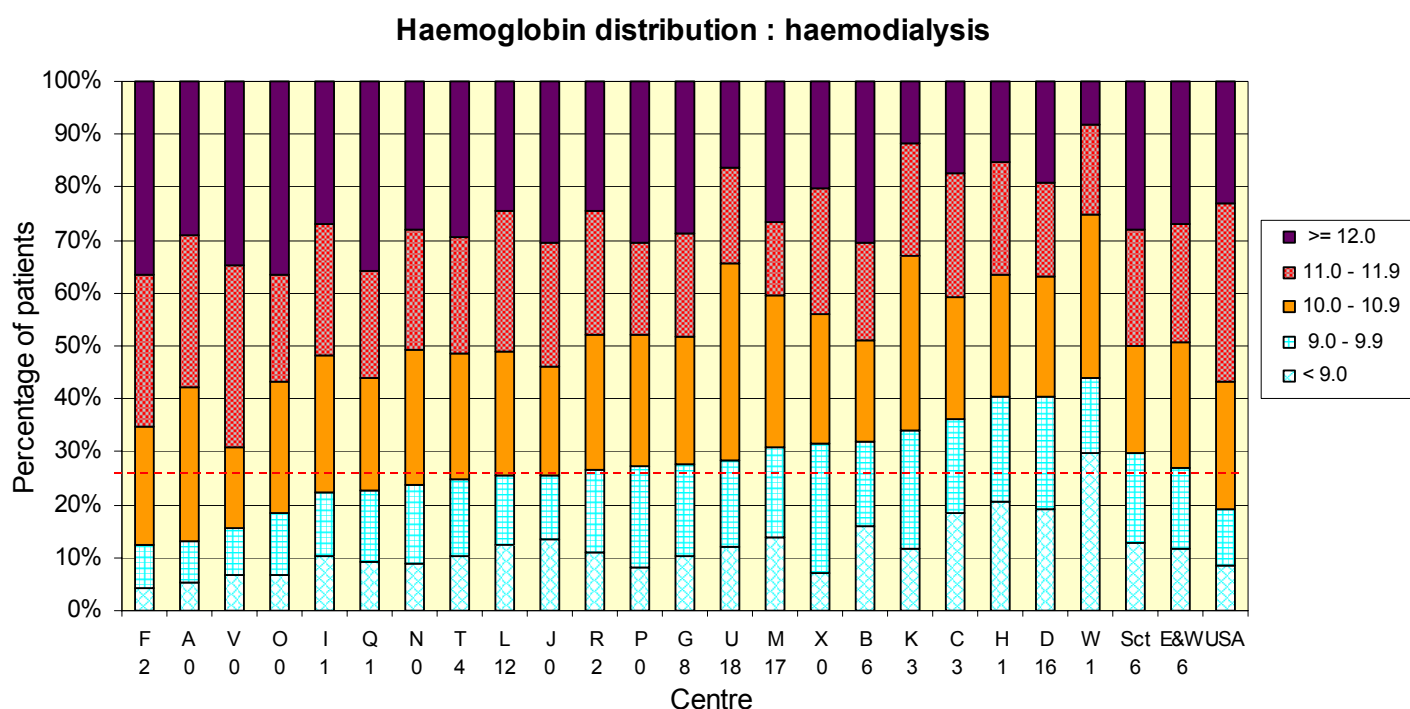


Figure 7.1 Haemoglobin patients on HD by 1g/dl bands

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

### Percentage haemoglobin > 10 g/dL : haemodialysis

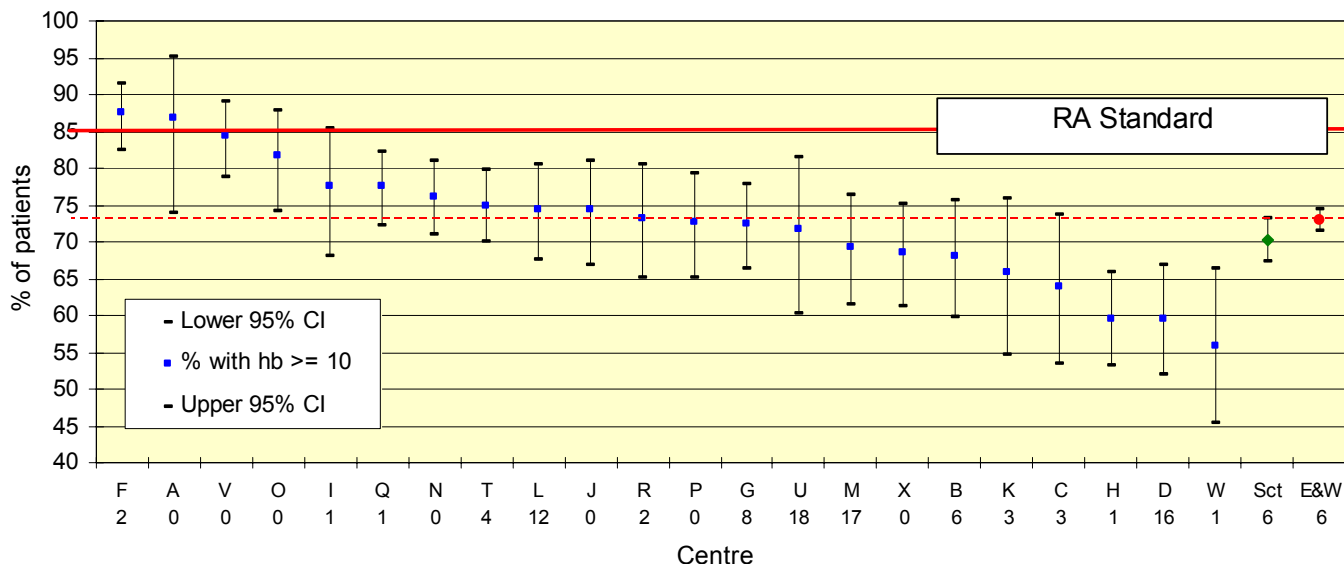


Figure 7.2 Percentage of HD patients by centre achieving the RA Standard

### Haemoglobin : haemodialysis

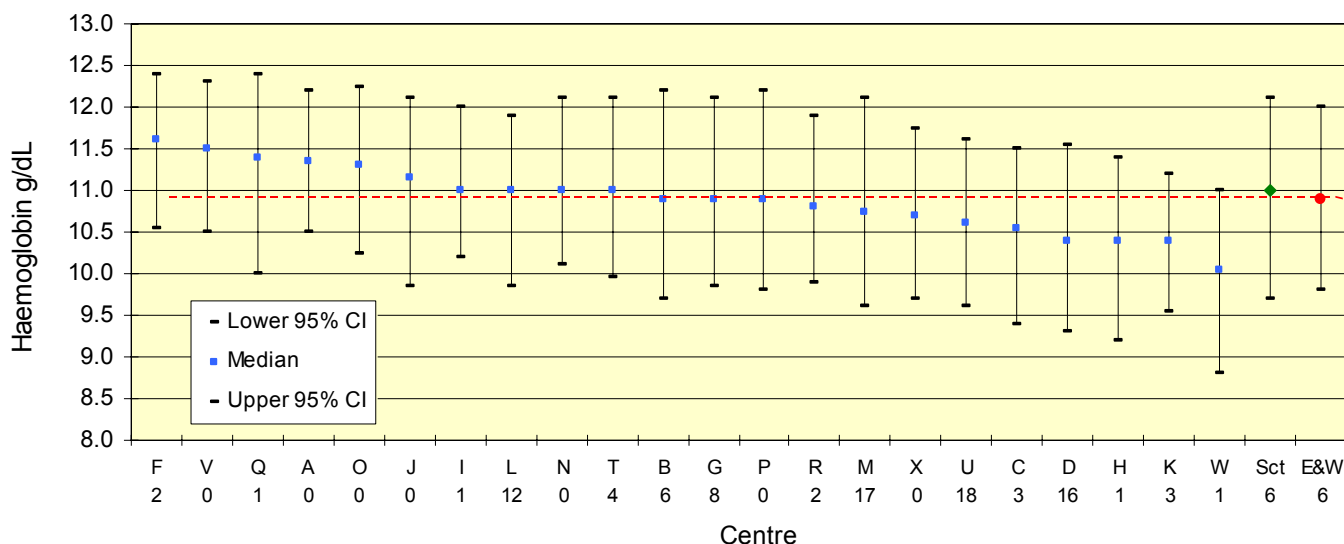


Figure 7.3 Haemoglobin median and quartile range for haemodialysis patients

Centre	% data return	Median Hb g/dl	90% range	Quartile range	% Hb ≥ 10 g/dl	Mean Hb g/dl	Standard deviation
A	100	12.1	10.1-15.4	11.0-13.5	95	12.3	1.6
B	94	11.4	8.8-13.2	9.9-12.1	74	11.0	1.4
C	100	12.0	9.0-15.1	11.4-13.3	88	12.1	1.7
D	100	11.5	9.4-14.3	10.4-12.6	84	11.6	1.6
F	99	11.8	9.5-14.8	11.0-13.0	95	12.0	1.6
G	97	11.3	8.8-13.8	10.2-12.2	79	11.2	1.6
H	100	10.9	8.2-13.2	9.7-11.7	71	10.8	1.4
J	100	12.1	9.1-14.3	10.4-13.1	84	11.8	1.9
K	99	11.3	9.2-13.6	10.5-12.3	86	11.4	1.4
L	97	10.8	7.3-14.4	9.7-12.4	69	11.0	2.2
M	99	11.6	8.0-15.0	10.6-12.7	80	11.6	1.9
N	100	11.8	9.6-14.1	10.6-12.4	88	11.6	1.4
O	99	11.6	9.5-14.5	10.9-12.7	87	11.8	1.6
P	97	11.5	9.1-14.1	10.7-12.4	87	11.6	1.4

Centre	% data return	Median Hb g/dl	90% range	Quartile range	% Hb ≥ 10 g/dl	Mean Hb g/dl	Standard deviation
Q	99	11.6	8.2-14.2	10.6-12.7	81	11.5	1.9
R	98	11.4	8.8-13.4	10.6-12.1	84	11.3	1.3
T	99	10.7	8.0-13.8	9.6-12.4	68	10.8	1.9
U	93	11.6	9.7-13.3	10.8-12.1	88	11.5	1.1
V	98	12.1	9.2-14.6	11.3-12.9	93	12.1	1.6
W	98	10.3	7.1-12.9	9.2-11.3	59	10.3	1.6
X	98	10.7	8.5-13.7	9.8-11.9	67	10.9	1.7
<b>E&amp;W</b>	<b>95</b>	<b>11.4</b>	<b>8.6-14.1</b>	<b>10.3-12.4</b>	<b>80</b>	<b>11.3</b>	<b>1.7</b>
<b>Scot</b>	<b>90</b>	<b>11.2</b>	<b>8.5-14.1</b>	<b>10.1-12.4</b>	<b>77</b>	<b>11.2</b>	<b>1.8</b>

Table 7.2 Haemoglobin data for patients on peritoneal dialysis

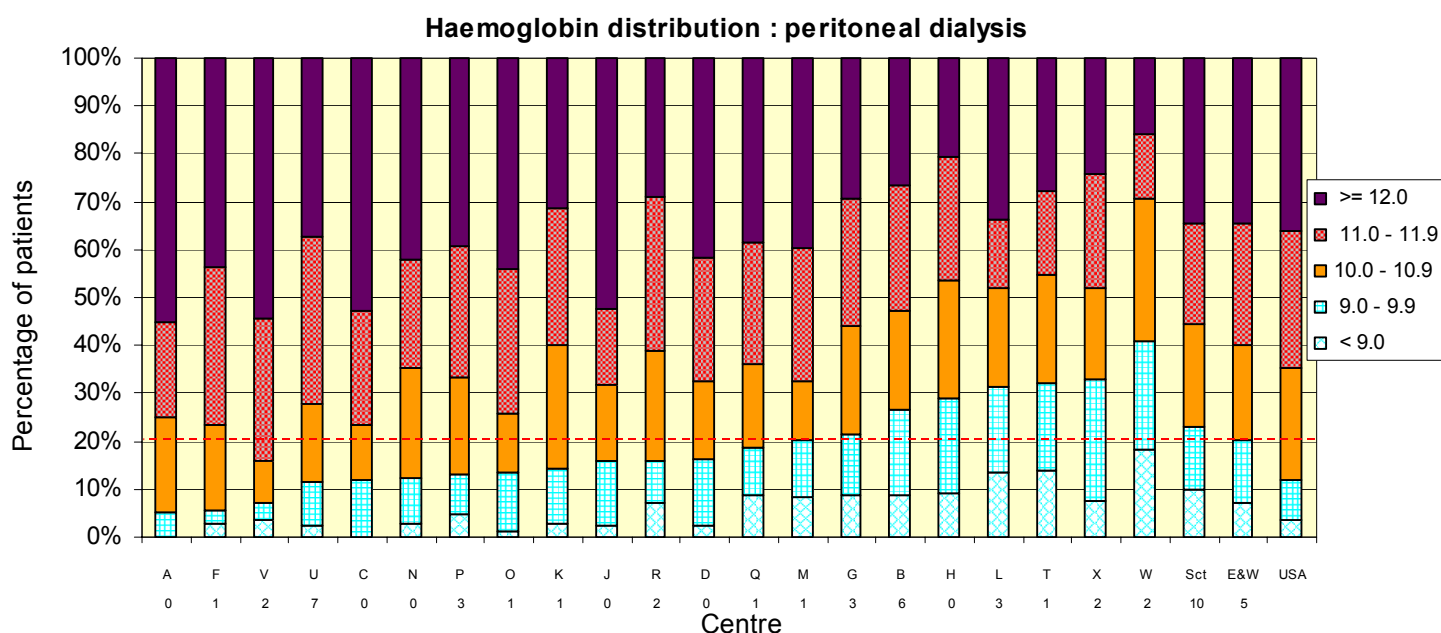


Figure 7.4 Distribution of haemoglobin for patients on PD by 1g/dl bands

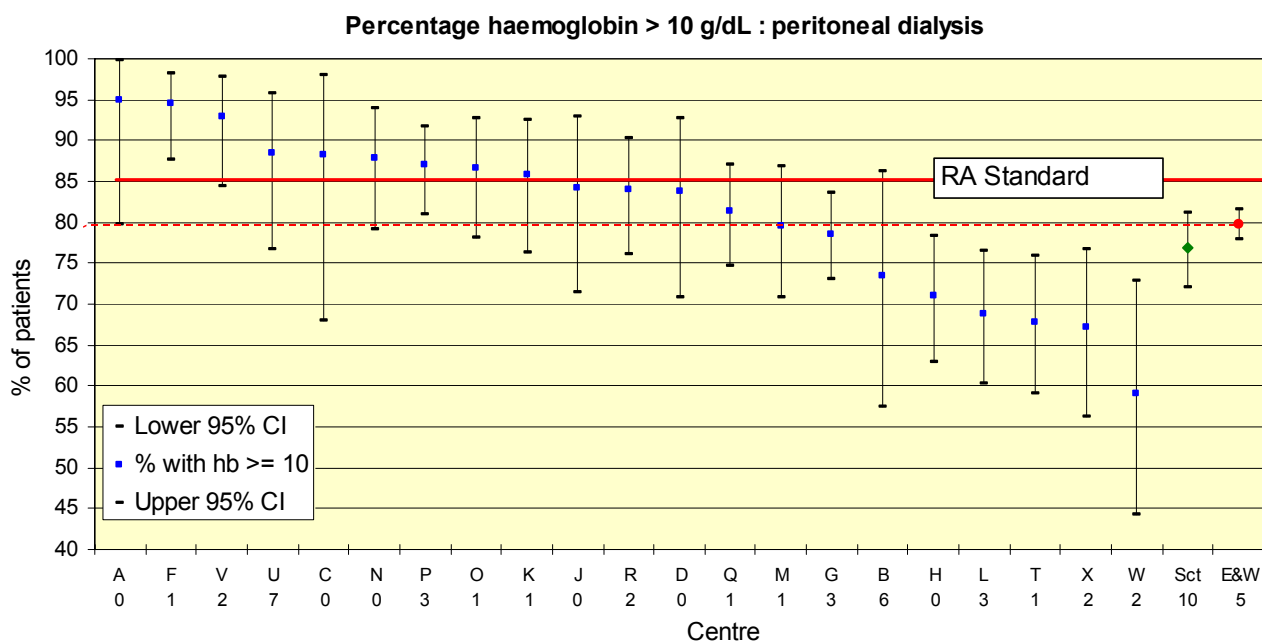
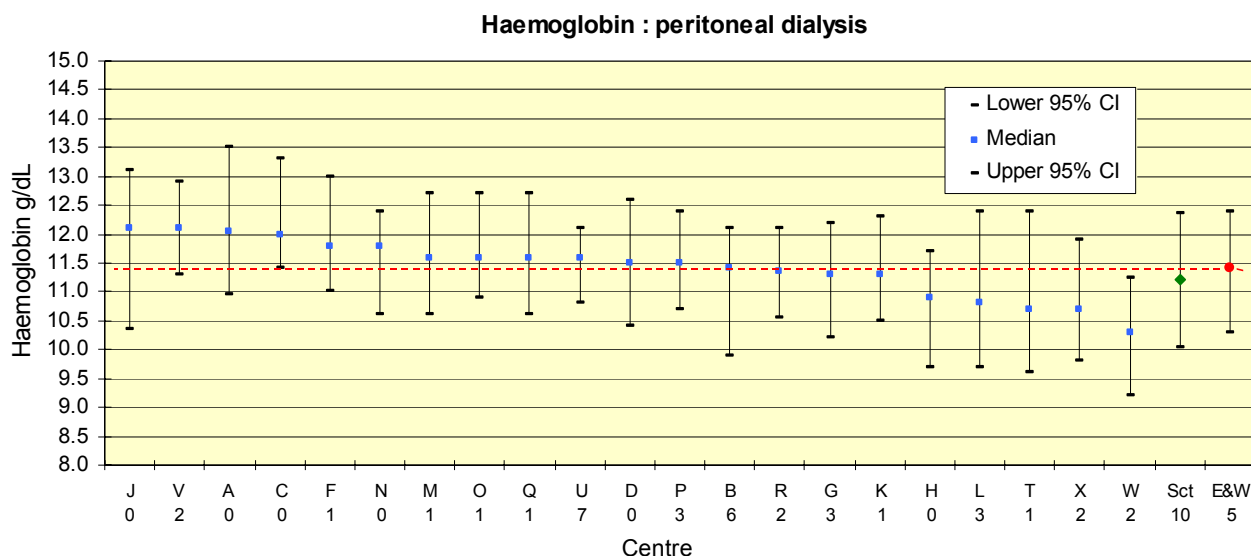


Figure 7.5 Percentage of PD patients by centre achieving the RA Standard



**Figure 7.6 Median haemoglobin on peritoneal dialysis**

### ***Factors influencing haemoglobin***

Erythropoietin prescription and iron stores influence haemoglobin concentration and data on these variables are presented in this report. Other influences are less certain.

### ***Haemoglobin and serum ferritin***

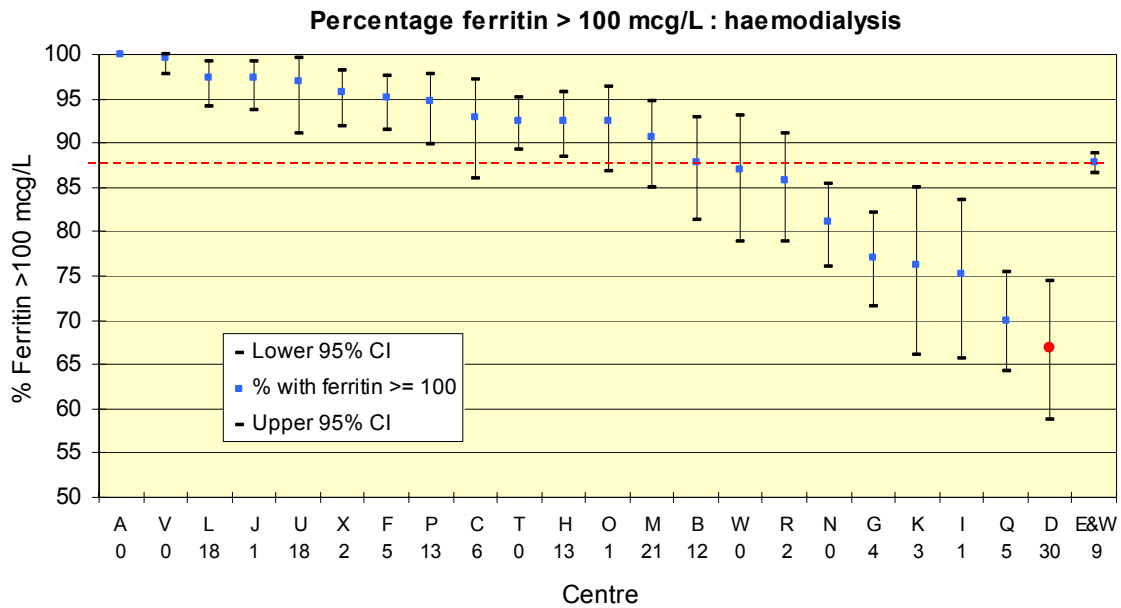
Centres use different variables as measures of iron stores: serum ferritin is most commonly used. For this report, serum ferritin levels have been analysed and are shown in tables 7.3 and 7.4. As with haemoglobin the distribution of serum ferritin concentrations is represented by the inter-quartile and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

Centre	% data return	Median ferritin	90% range	Quartile range	% ferritin $\geq$ 100 $\mu$ g/l
A	100	496	191-1273	371-688	100
B	88	340	62-1367	181-702	88
C	94	420	75-1790	263-709	93
D	70	132	27-652	73-253	67
E	22	*	*	*	*
F	95	483	102-1337	288-732	95
G	96	182	43-957	106-310	77
H	87	286	94-801	204-436	93
I	99	157	32-493	103-257	75
J	99	411	125-990	283-558	97
K	97	211	23-929	105-342	76
L	82	713	173-1798	422-1133	97
M	79	321	73-813	180-503	91
N	100	222	36-682	122-382	81
O	99	239	66-1000	165-335	92
P	87	345	92-861	200-497	95
Q	95	158	25-782	84-267	70
R	98	244	57-1012	158-388	86
T	100	484	63-1144	320-756	93

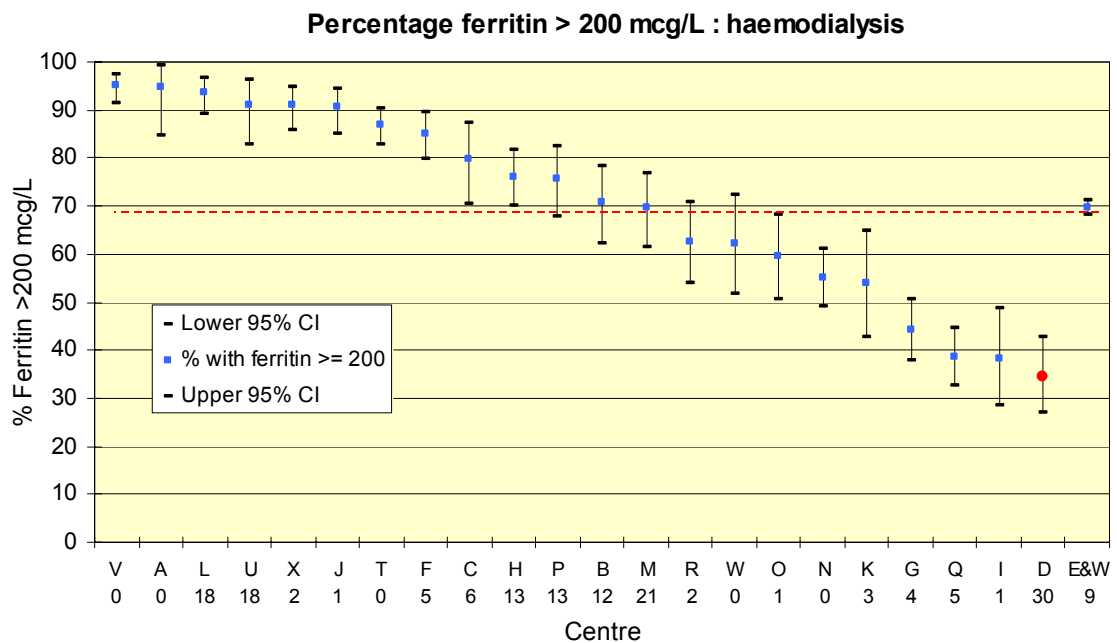
Centre	% data return	Median ferritin	90% range	Quartile range	% ferritin $\geq$ 100 $\mu$ g/l
U	82	403	157-849	298-561	97
V	100	517	186-891	411-647	99
W	100	236	56-831	151-409	87
X	98	407	127-832	321-554	96
E & W	91	316	55-1094	171-535	88

\* insufficient data

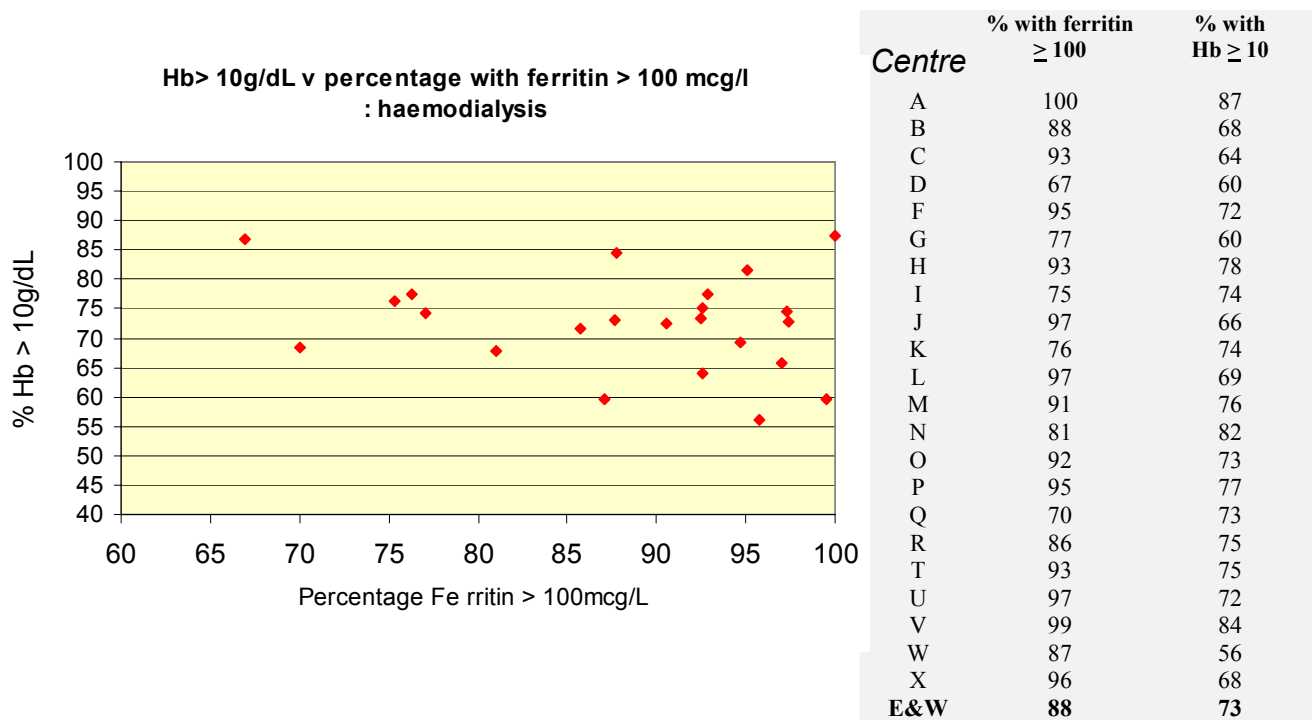
**Table 7.3 Serum Ferritin concentration in haemodialysis patients**



**Figure 7.7 Percentage of HD patients with serum ferritin > 100 mcg/l.**



**Figure 7.8 Percentage serum ferritin > 200 mcg/l on HD**

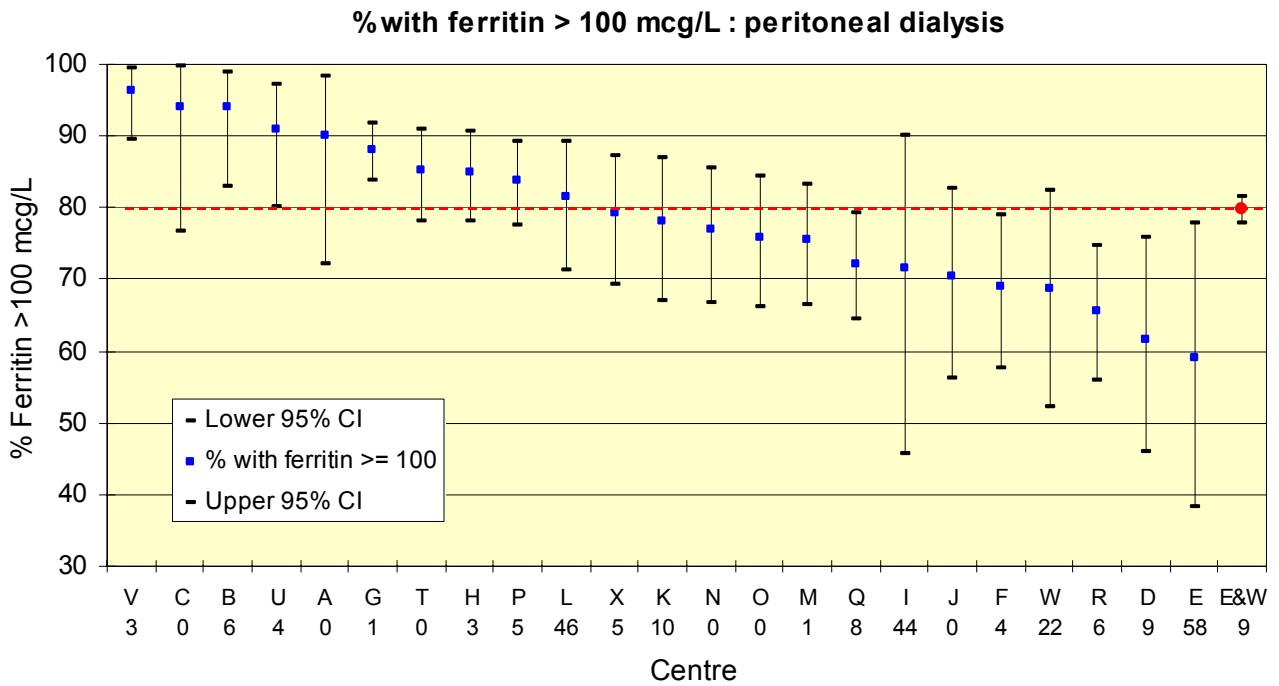


**Figure 7.9 Haemoglobin > 10 g/dl vs. serum ferritin > 100 mcg/l on haemodialysis**

Centre	% data return	Median ferritin µg/l	90% range	Quartile range	% ferritin > 100µg/l
A	100	508	14-1043	426-636	90
B	94	434	93-1226	243-669	94
C	100	515	61-1472	362-825	94
D	91	136	21-403	77-222	62
E	42	*	*	*	*
F	96	138	29-516	85-323	69
G	99	263	48-1101	156-462	88
H	97	177	46-836	122-323	85
I	56	192	51-538	99-246	71
J	100	188	21-478	65-335	70
K	90	208	37-793	111-372	78
L	54	312	47-1251	141-506	81
M	99	186	37-678	100-370	76
N	100	193	42-483	114-292	77
O	100	211	26-749	103-344	76
P	95	269	61-795	162-422	84
Q	92	174	31-718	94-304	72
R	94	152	22-521	69-242	66
T	100	305	54-1085	158-432	85
U	96	282	37-606	137-389	91
V	97	326	118-806	215-510	96
W	78	160	25-643	89-254	69
X	95	222	38-1129	110-360	79
<b>E &amp; W</b>	<b>91</b>	<b>226</b>	<b>37-817</b>	<b>117-392</b>	<b>80</b>

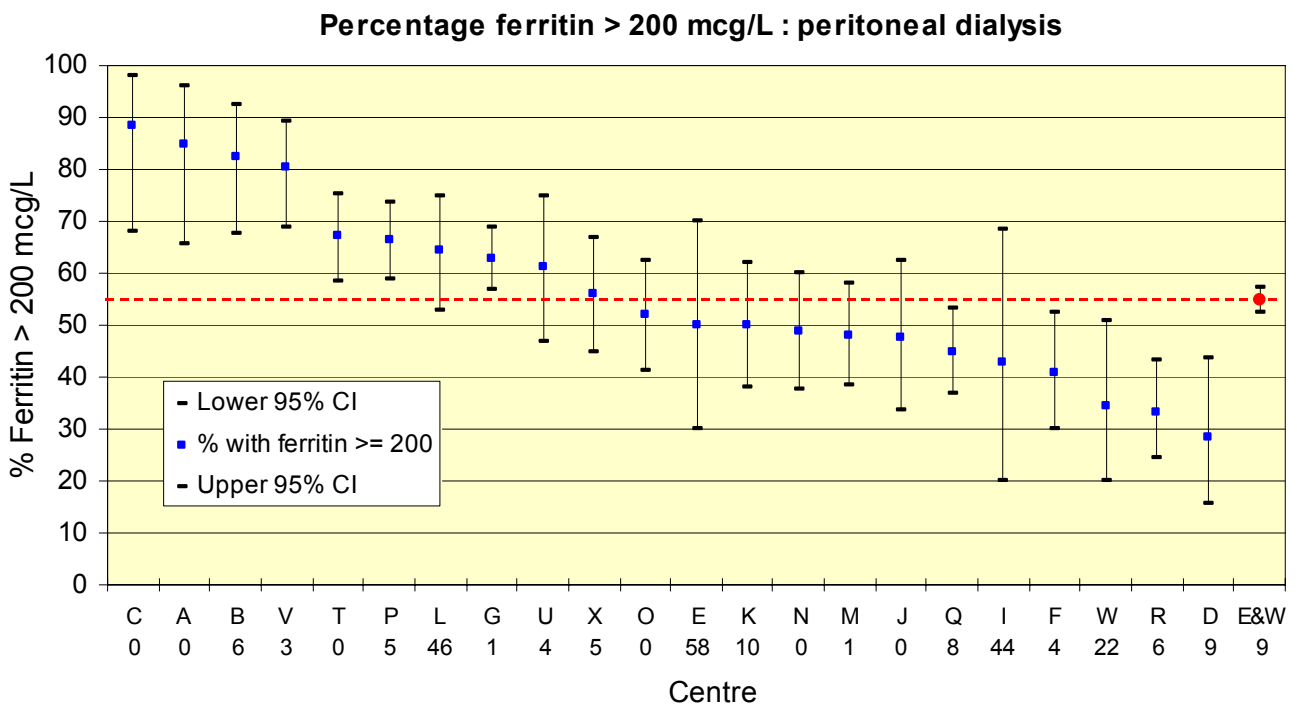
**Table 7.4 Ferritin concentrations in peritoneal dialysis patients**





**Figure 7.10 Percentage serum ferritin > 100 mcg/l on peritoneal dialysis**

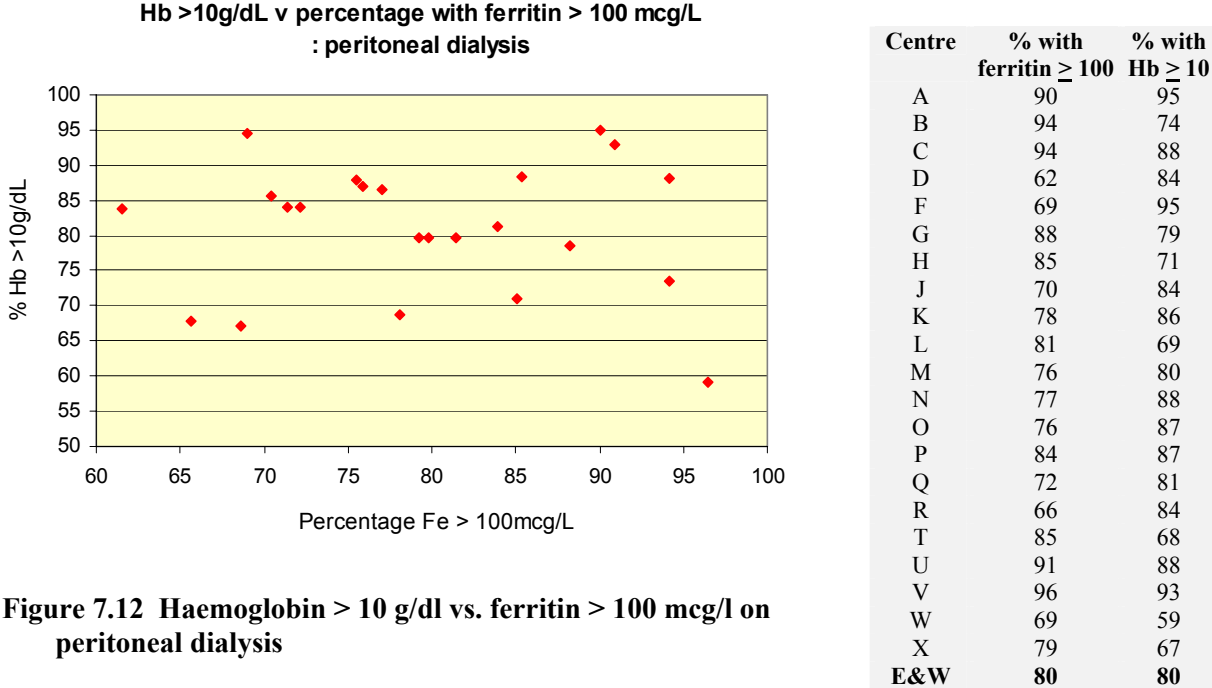
The numbers under each centre on the graph show the percentage of missing ferritin data over 9 months, for that unit. Error bars represent 95% confidence intervals.



**Figure 7.11 Percentage serum ferritin > 200 mcg/l on peritoneal dialysis**

The numbers under each centre on the graph show the percentage of missing ferritin data over 9 months, for that unit. Error bars represent 95% confidence intervals.

There was no clear correlation between the percentage of patients with serum ferritin over 100 mcg/l and achievement of the Real Association Standard for haemoglobin in either haemodialysis or peritoneal dialysis patients (figures 7. 9 and 7.12).



**Figure 7.12 Haemoglobin > 10 g/dl vs. ferritin > 100 mcg/l on peritoneal dialysis**

**Haemoglobin and erythropoietin**

Many centres do not record prescription of erythropoietin on their IT systems or do so only partially. Partial recording has been identified during the analysis, confirmed with the centre and excluded from the analysis. Most centres only record whether an individual was prescribed erythropoietin and failure to record is assumed to mean that erythropoietin has not been prescribed. This year 9 centres submitted data on erythropoietin prescribing compared to 8 in last year’s report. The rates of prescription of erythropoietin are shown in tables 7.5 and 7.6.

If centres work to a minimum haemoglobin of 10g/dl then it might be presumed that patients with a haemoglobin less than this level should be prescribed erythropoietin. Rates of erythropoietin prescription to patients with haemoglobin less than 10g/dl may be useful in determining whether there are specific groups to which there is a relative reluctance to prescribe erythropoietin. For example there are some centres that have lower rates of erythropoietin prescribing for patients on peritoneal dialysis with haemoglobin less than 10g/dl than for haemodialysis patients.

Some patients on dialysis maintain adequate haemoglobin concentrations without the need for erythropoietin prescription. This is reported in tables 7.5 and 7.6 as the percentage of patients with a haemoglobin over 10g/dl but not requiring erythropoietin. This measure might be indicative of whether the overall management in a centre (excluding erythropoietin prescription) is conducive to high haemoglobin and may help explain some of the differences between units. For example centre C uses relatively high doses of erythropoietin in a high proportion of patients and has good serum levels of ferritin but still only achieves 64% of haemodialysis patients with a haemoglobin over 10g/dl. Only 2% of patients in centre C have

a haemoglobin over 10g/dl without the need for erythropoietin. As expected a higher percentage of peritoneal dialysis patients maintain adequate haemoglobin without erythropoietin than haemodialysis patients.

Centre	% on epo	Mean weekly dose for pats on epo	Median dose for pats on epo	Hb < 10g/dl % on epo	Hb ≥10 g/dl % not on epo
B	86	5920	6000	93	8
C	97	7470	8000	100	2
G	84	6720	6000	88	11
J	93	8690	8000	97	7
K	85	6000	4000	77	5
N	87	6870	6000	97	12
R	84	6880	6000	91	13
T	79	5600	6000	80	16
W	89	7660	8000	89	6
<b>E &amp; W</b>	<b>86</b>	<b>6750</b>	<b>6000</b>	<b>90</b>	<b>10</b>

**Table 7.5 Erythropoietin prescribing in haemodialysis patients**

Centre	% on epo	Mean weekly dose for pats on epo	Median dose for pats on epo	Hb < 10g/dl % on epo	Hb ≥10 g/dl % not on epo
B	61	4910	6000	78	29
C	88	3670	4000	100	12
G	77	4550	4000	74	18
J	75	4520	4000	100	25
K	62	4410	4000	90	36
N	58	4400	4000	100	42
R	64	5170	4000	75	31
T	36	4770	4000	43	45
W	49	4320	4000	67	39
<b>E &amp; W</b>	<b>63</b>	<b>4600</b>	<b>4000</b>	<b>70</b>	<b>30</b>

**Table 7.6 Erythropoietin prescribing in peritoneal dialysis patients and weekly dose**

### ***Erythropoietin and time on renal replacement therapy***

Table 7.7 shows that with increasing time on peritoneal dialysis there is an increase in proportion treated with erythropoietin but in haemodialysis patients there is little change in erythropoietin prescription with time.

Time on treatment	< 1year	1-2 years	2-3 years	3-5 years	5-10 years	>10 years
<b>Haemodialysis % patients</b>	82 (200)	92 (261)	85 (159)	89 (219)	84 (218)	80 (185)
<b>Peritoneal dialysis %</b>	49 (98)	67 (126)	60 (57)	68 (84)	73 (66)	79 (31)

Brackets indicate total numbers

**Table 7.7 Percentage of patients prescribed erythropoietin against time on RRT**

## Age and anaemia management

Data on erythropoietin prescribing and age was available from 1500 haemodialysis and 744 peritoneal dialysis patients.

### Haemodialysis

Age group (years)	18-34	35-44	45-54	55-64	65-74	75+
% on epo	89 (121)	83 (151)	83 (203)	83 (262)	89 (320)	88 (229)
% Hb >10 no epo	7 (9)	12 (22)	14 (34)	14 (44)	7 (26)	7 (17)
% Hb <10 on epo	95 (36)	86 (43)	90 (70)	93 (79)	89 (82)	87 (59)

Brackets indicate total numbers.

**Table 7.8 Erythropoietin prescription by age in haemodialysis patients**

No definite trends in use of erythropoietin prescription with age are evident although the data may indicate less use of erythropoietin in middle ages compared with both the young and elderly. This data is consistent with that reported for 1998. There is also a suggestion from the data that there are fewer patients with adequate haemoglobin without the need for erythropoietin among the young and elderly compared to the middle aged although the number of patients is small.

### Peritoneal dialysis

Age group (years)	18-34	35-44	45-54	55-64	65-74	75+
% on epo	58 (36)	73 (66)	70 (94)	55(102)	61 (112)	67 (59)
% Hb>10 no epo	26 (16)	17 (15)	29 (38)	35 (64)	35 (64)	29 (25)
% Hb<10 on epo	44 (7)	76 (28)	89 (25)	59 (23)	67 (16)	86 (12)

Brackets indicate total numbers

**Table 7.9 Erythropoietin prescription by age in peritoneal dialysis patients**

It is difficult to draw conclusions from the data on erythropoietin prescribing in peritoneal dialysis because of the relatively small number of patients. The apparent low levels of erythropoietin prescribing in the young even when the haemoglobin is less than 10g/dl was not seen in the data from 1998 and is of uncertain significance.

## Erythropoietin prescription and gender

### Haemodialysis

The 1999 and 1998 Registry reports demonstrated that as in the normal population females on dialysis had lower haemoglobin than males. The data presented in table 7.10 confirms that fewer females have haemoglobin  $\geq 10$ g/dl without erythropoietin than males. Females are prescribed erythropoietin appropriately as demonstrated by a higher proportion of females than males prescribed erythropoietin in the population as a whole. Amongst haemodialysis

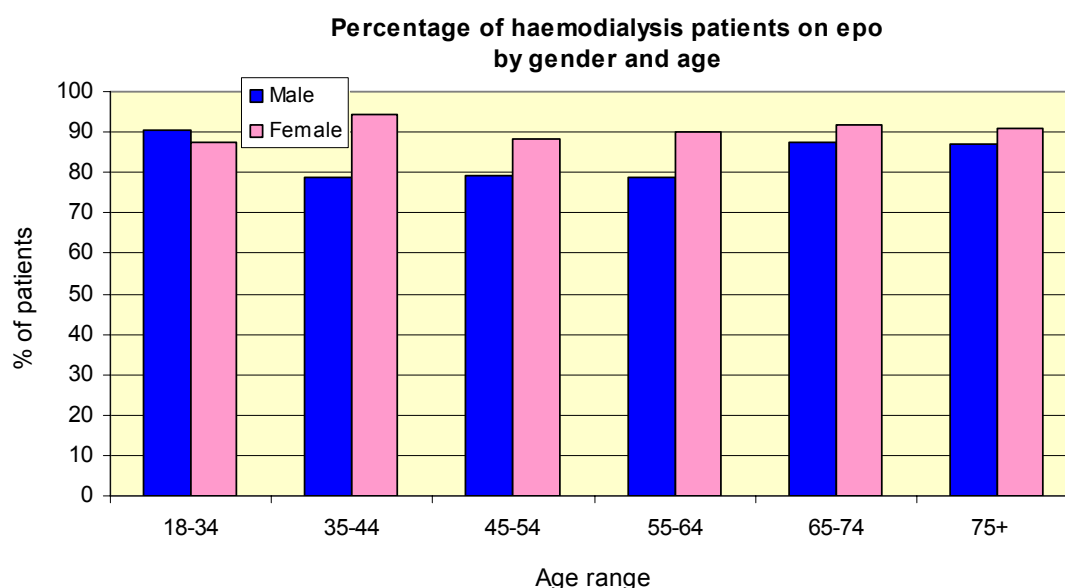
patients with a haemoglobin < 10g/dl, a higher proportion of males did not receive erythropoietin than females.

Gender	mean Hb g/dl	Standard deviation	% on epo	% Hb < 10 g/dl on epo	% Hb>10g/dl without epo
Male	11.0	1.64	83 (801)	87 (211)	13 (120)
Female	10.8	1.58	90 (485)	93 (158)	6 (32)

Numbers in brackets are the total number of patients

**Table 7.10 Haemoglobin and gender in HD patients**

In 1999 the mean haemoglobin has risen from the 1998 figure of 10.9 g/dl for males and 10.6 g/dl for females. Similar to last year, the mean haemoglobin of men on haemodialysis was significantly higher than women, (Chi squared, p=0.004).



**Figure 7.13 Percentage of haemodialysis patients on epo by age and gender**

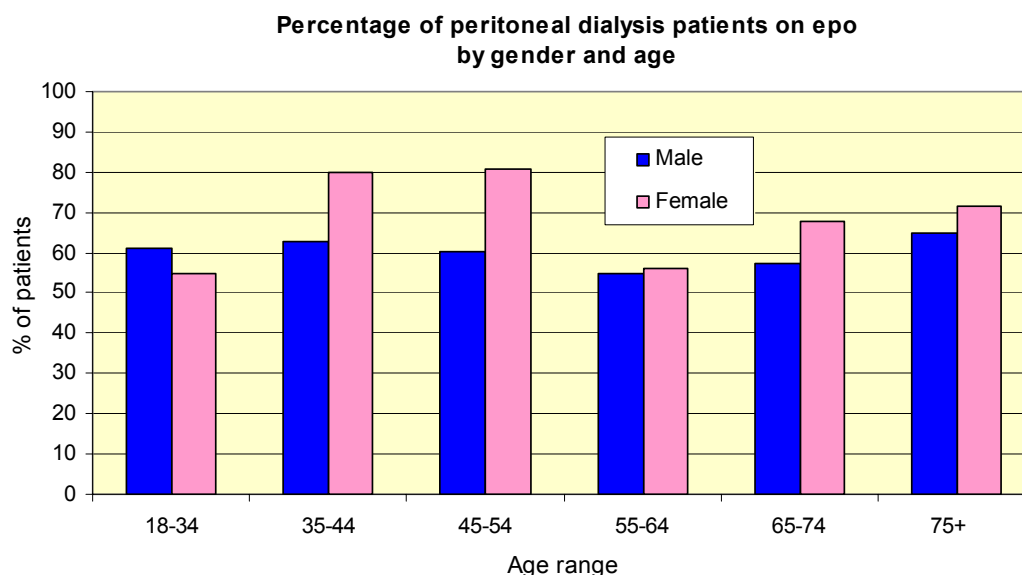
### **Peritoneal dialysis**

Gender	mean Hb g/dl	Standard deviation	% on epo	Hb < 10 g/dl % on epo	% Hb>10g/dl without epo
Male	11.5	1.70	59 (257)	64 (48)	35 (151)
Female	11.1	1.69	69 (212)	76 (63)	24 (71)

Numbers in brackets are the total number of patients

**Table 7.11 Haemoglobin and gender in peritoneal dialysis patients**

In 1999 the mean haemoglobin has risen from the 1998 figure of 11.2 g/dl for males and 10.8 g/dl for females. Similar to last year, the mean haemoglobin of men on peritoneal dialysis was significantly higher (chi squared p=0.001).

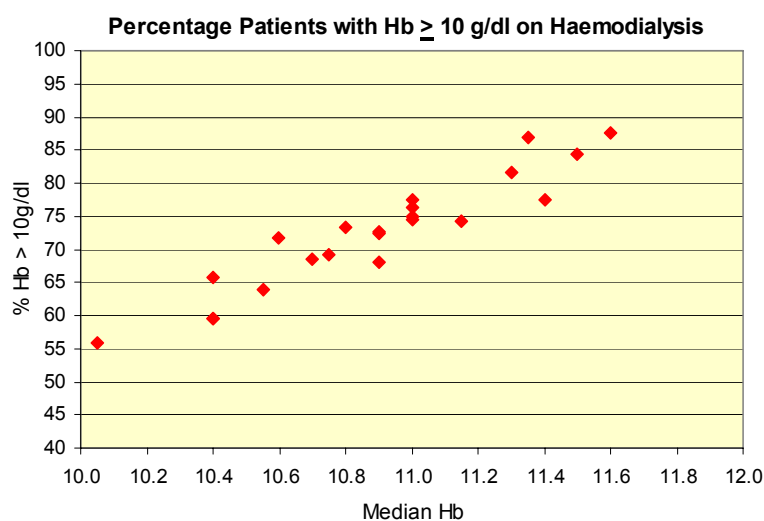


**Figure 7.14** Percentage of peritoneal dialysis patients on epo by age

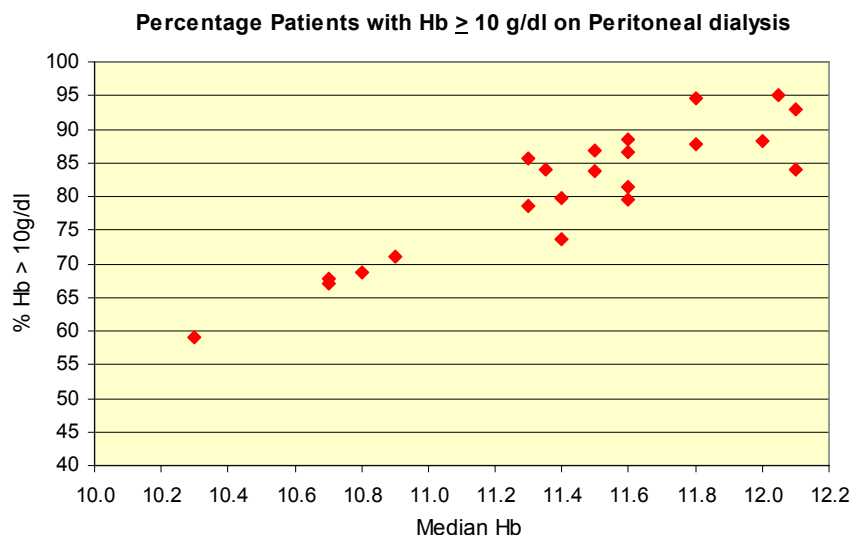
### ***Compliance with Renal Association standards and median haemoglobin***

As in previous reports figure 7.15 demonstrates a linear relationship between median haemoglobin and percentage achievement of the Renal Association recommended level of 10g/dl. There is no evidence that the spread of data in units with higher achievement of the recommended level is different from that with lower levels. The data show that in current practice units which have a high achievement of the Renal Association haemoglobin standard have proportionately high median haemoglobins. There is no evidence that they have successful targeting strategies.

A similar relationship is shown by the Healthcare Finance Administration data from USA where an average haemoglobin of 11.1g/dl was achieved across all the renal networks in October 1998 with 78% of patients having a haemoglobin above 10g/dl.



**Figure 7.15** Percent Hb above 10g/dl and median Hb in individual centres (HD)



**Figure 7.16 Percent Hb above 10g/dl and median Hb in individual centres (PD)**

### ***Changes in Haemoglobin over Time***

The Renal Registry collects individual patient data which allows analysis of changes over time within centres as a whole and also longitudinal changes over time for individual patients.

#### ***Data selection***

At the end of each quarter of the calendar year the Registry collects the most recent haemoglobin for each patient.

For the analysis relating to the start of dialysis, data used are the haemoglobin recorded for a new patient during the quarter in which renal replacement therapy by dialysis started. The measurement is thus made within 1 to 90 days of starting dialysis.

For all other data points there had been no change of treatment modality in the previous 3 months and there had been no transfer between centres in the previous 3 months. Data from centres are shown if there was more than 50% completeness, though centres were only included in the statistical analysis if there was greater than 75% completeness.

### ***Haemoglobin at start of dialysis***

<b>Centre</b>	<b>% data return</b>	<b>Median Hb g/dl</b>	<b>90% range</b>	<b>Quartile range</b>	<b>%Hb &gt; 10g/dL</b>
A	96	11.0	9.5-12.8	10.7-11.9	84
B	96	8.7	6.3-11.3	7.5-9.7	15
C	91	9.4	7.4-12.2	8.7-10.4	38
D	86	9.5	7.0-12.4	7.9-10.5	36
E	27				
F	93	9.9	6.7-13.6	8.8-11.2	49
G	93	10.2	8.3-12.8	9.5-11.3	59
H	98	9.3	7.6-11.7	8.7-10.2	33
I	95	9.5	6.6-13.0	8.6-10.2	37

J	91	10.0	6.8-13.7	9.1-10.9	50
K	100	10.1	8.3-13.0	9.3-11.7	56
L	100	9.5	7.1-12.6	8.7-10.7	39
M	97	9.4	6.9-13.2	8.2-10.7	36
N	96	9.9	7.9-12.9	9.1-11.1	48
O	100	9.8	7.6-11.8	9.1-10.8	49
P	98	9.9	7.9-12.0	8.9-10.8	49
Q	97	10.2	7.6-13.0	9.1-11.4	56
R	82	9.9	8.0-12.4	9.2-11.1	49
T	90	9.3	7.2-11.8	8.4-10.2	31
U	71	9.5	7.0-12.6	8.4-10.2	36
V	100	9.8	7.3-12.3	9.0-10.7	41
W	98	9.1	7.0-11.9	8.3-10.2	29
X	94	9.4	7.3-11.9	8.3-10.5	34
Sct	61	9.5	7.1-12.3	8.6-10.5	39
E&W	92	9.7	7.2-12.4	8.7-10.8	43

Table 7.12 Haemoglobin at start of dialysis

Median Haemoglobin and range : At start of ESRF

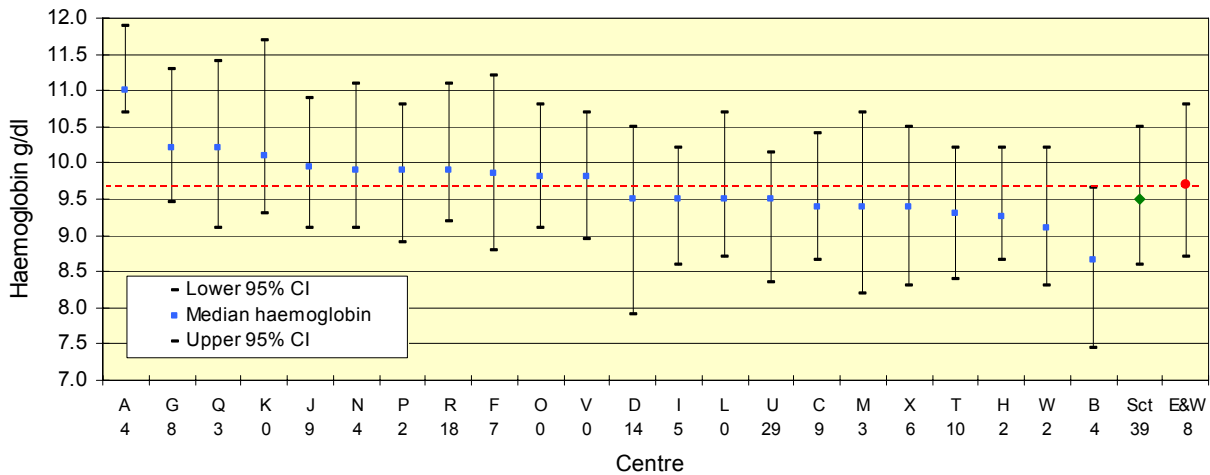


Figure 7.17 Median haemoglobin and 90% range at start of dialysis treatment

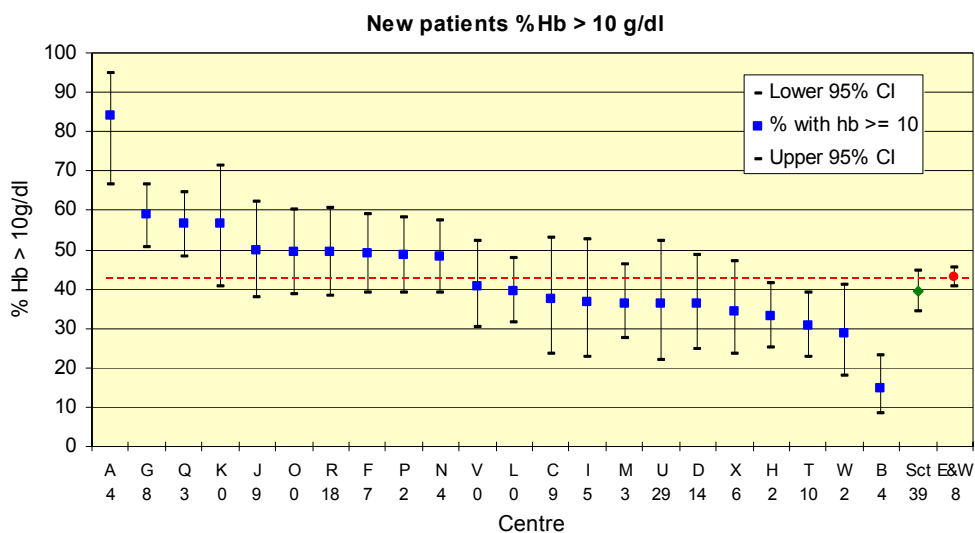
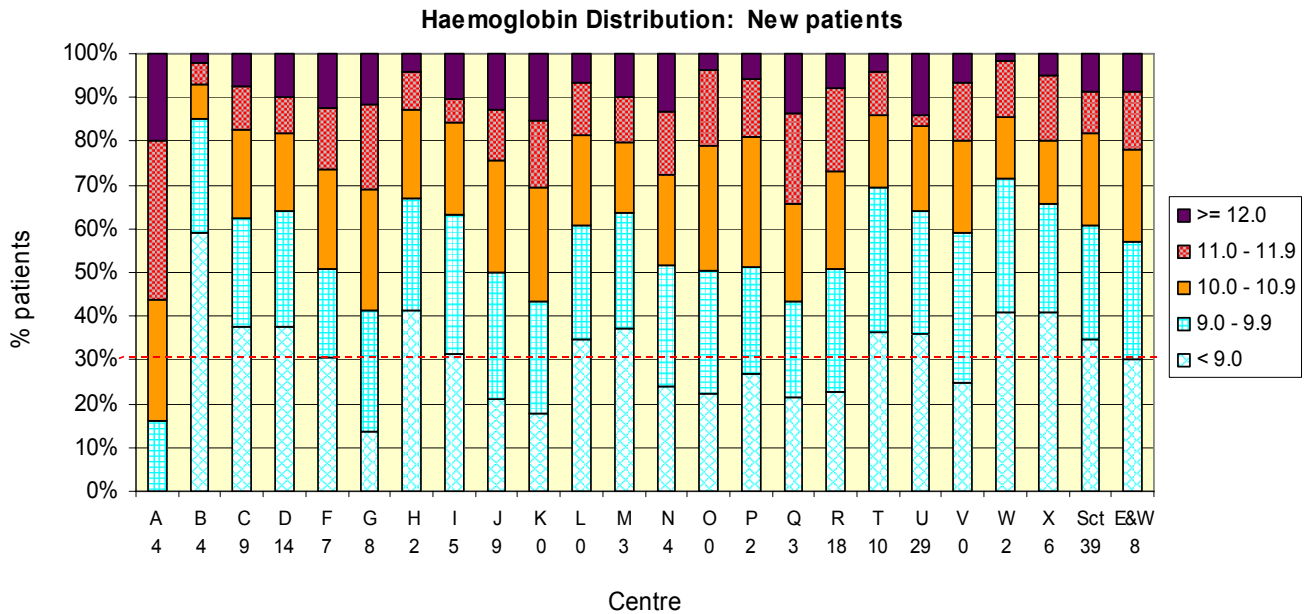
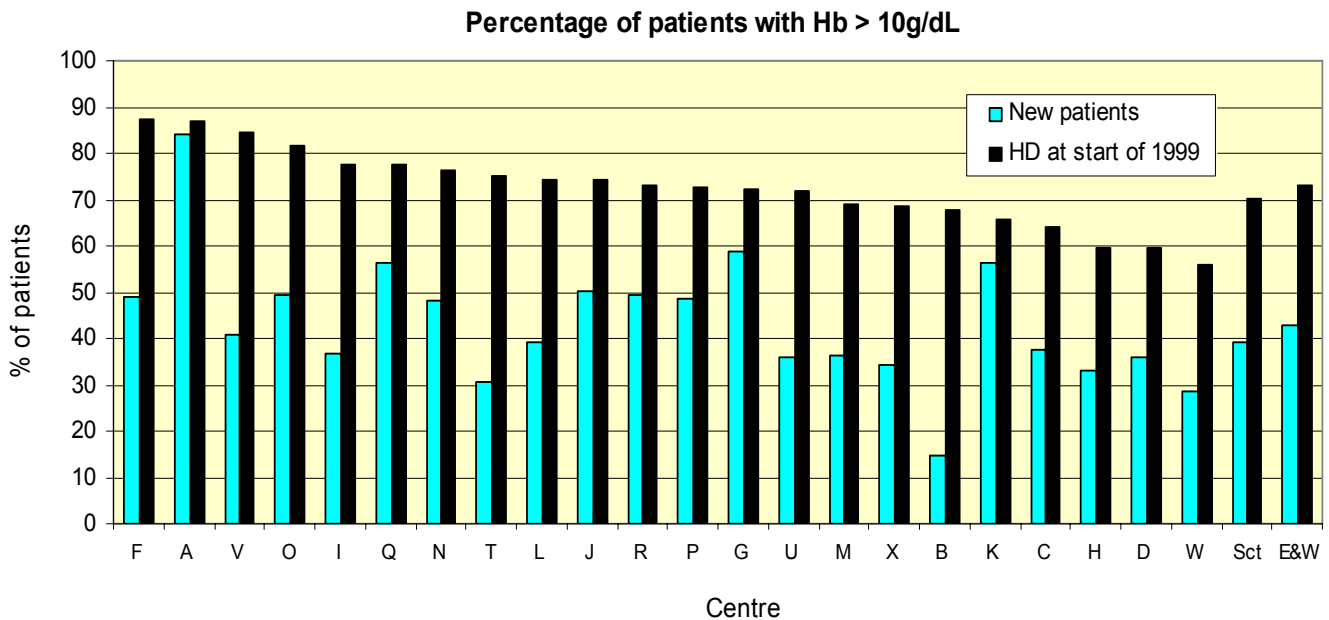


Figure 7.18 Percentage haemoglobin  $\geq 10$ g/dl for new patients





**Figure 7.19** Haemoglobin distribution at start of dialysis



**Figure 7.20** Percentage with haemoglobin > 10g/dL: new and prevalent patients

### **Changes in haemoglobin of prevalent patients 1998-1999**

This data relates to all patients alive on dialysis at selected time points. Data over 2 years is available from centres which sent returns to the Registry in 1998. The data for England and Wales are summarised in table 7.13

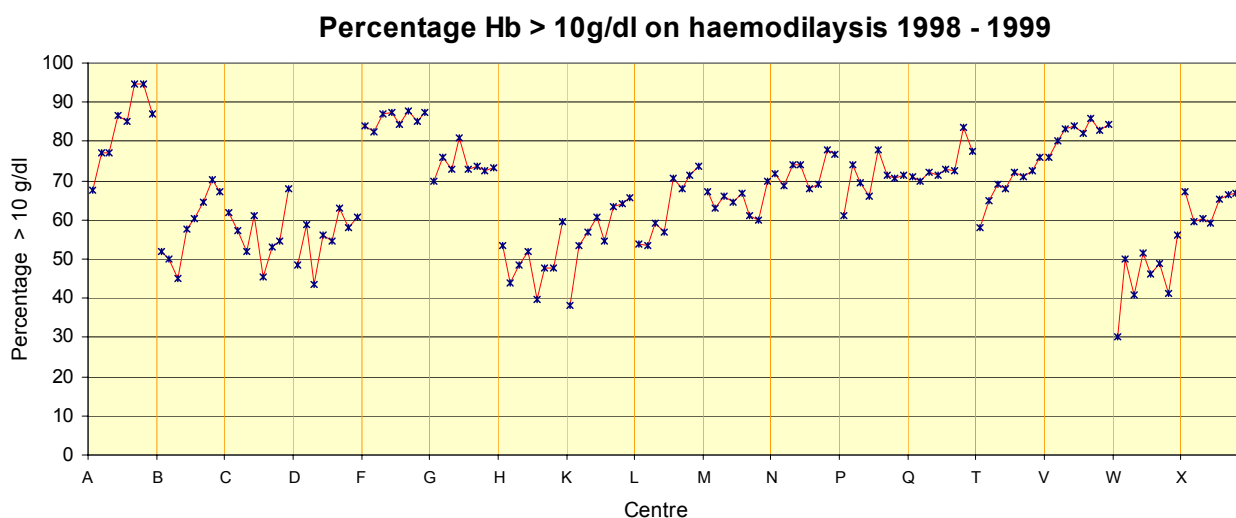
	Mean	SD	Median	90% Range	Quartile Range	%Hb $\geq 10\text{g/dl}$
<b>Haemodialysis</b>						
Qtr 1 1998	10.6	1.8	10.5	7.7-13.5	9.4-11.7	64
Qtr 1 1999	10.7	1.7	10.7	7.9-13.6	9.6-11.8	67
Qtr 4 1999	10.9	1.6	10.9	8.3-13.6	9.8-12.0	73
<b>Peritoneal dialysis</b>						
Qtr 1 1998	10.9	1.7	10.9	8.1-13.7	9.8-12.0	71
Qtr 1 1999	11.1	1.7	11.0	8.3-13.9	10.0-12.1	76
Qtr 4 1999	11.3	1.7	11.3	8.5-14.0	10.2-12.4	79

**Table 7.13** Change in Hb for all centres in 1st qtr. of 1998, 1999 and 4th qtr. of 1999

For the haemodialysis and peritoneal dialysis populations there has been continued increase in mean haemoglobin, median haemoglobin and percent with haemoglobin greater than 10g/dl. Similar increases were shown between 1997 and 1998 in last years report. 1997 data has not been included in this years report because relatively few (8) centres returned data to the Registry for 1997.

### Haemodialysis

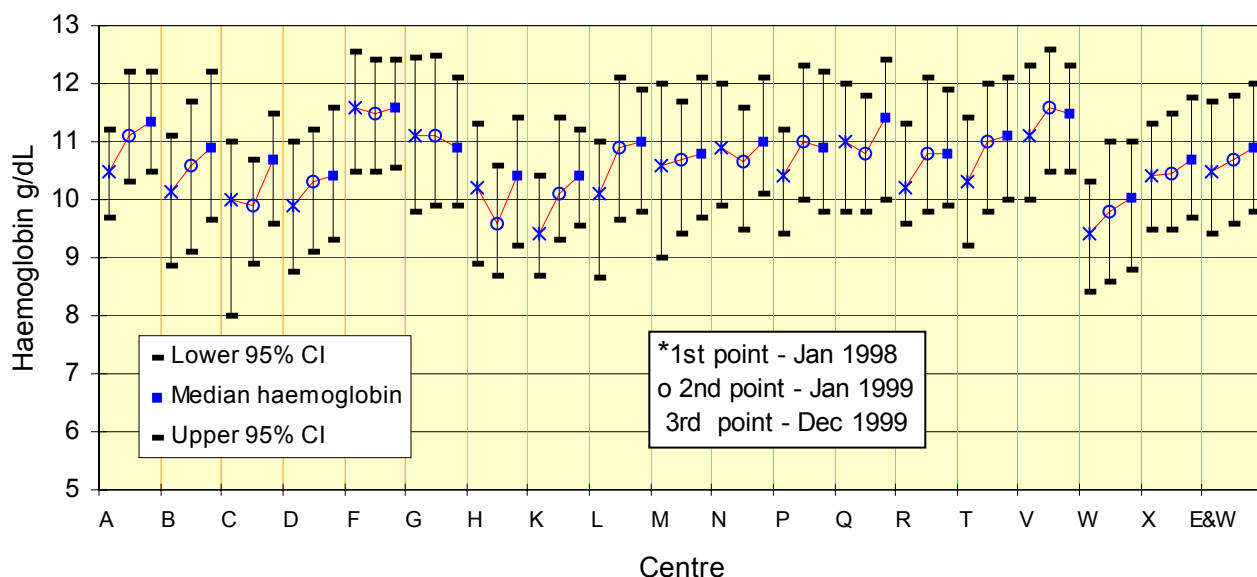
Figure 7.21 shows the percentage haemoglobin greater than 10g/dl for haemodialysis patients in each quarterly return from those centres that returned data in 1998 and 1999.



**Figure 7.21** Hb  $\geq 10$  g/dl from 1997 to end 1998, on haemodialysis

In every centre the percent with haemoglobin greater than or equal to 10g/dl was higher in the last quarter of 1999 than in the first quarter of 1998. Some centres showed large increases whereas in other centres the results were more stable though still below the Renal Association standard.

**Median haemoglobin from start 1998 to end of 1999 by centre :  
haemodialysis:**



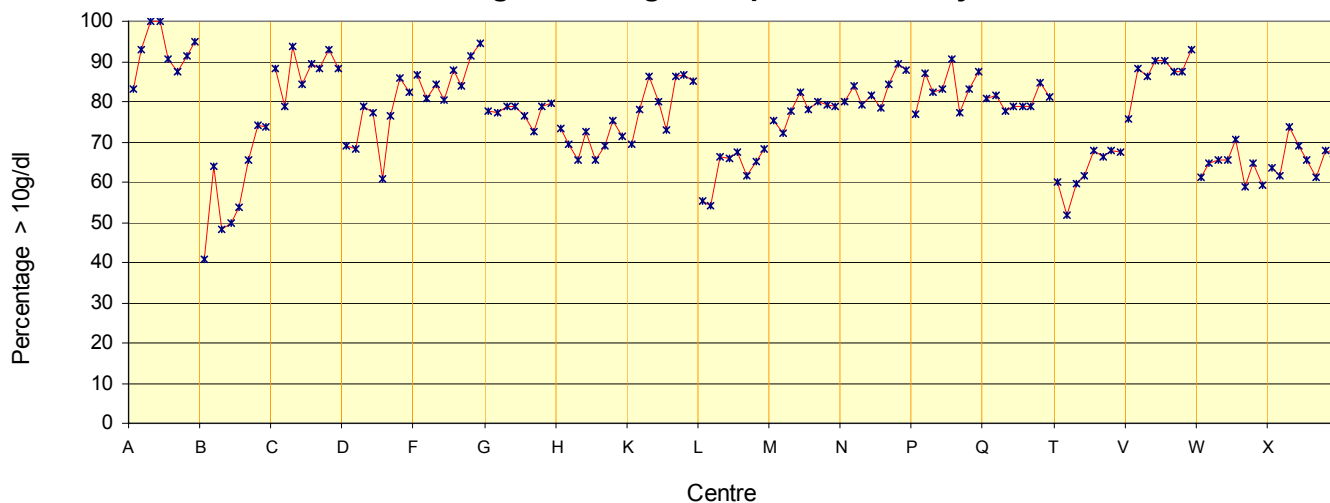
**Figure 7.22 Median haemoglobin 1997-1998 on haemodialysis**

Data presented for each centre are, in sequence, from the end of 1<sup>st</sup> quarter 1997, 1<sup>st</sup> quarter 1998 and the 4<sup>th</sup> quarter 1998

Median haemoglobin increased for haemodialysis patients in all but 2 centres from the first quarter of 1998 to the last quarter of 1999. Centre F had a stable median and centre G a small fall in median haemoglobin, in both these centres there was a small increase in percent greater than or equal to 10g/dl.

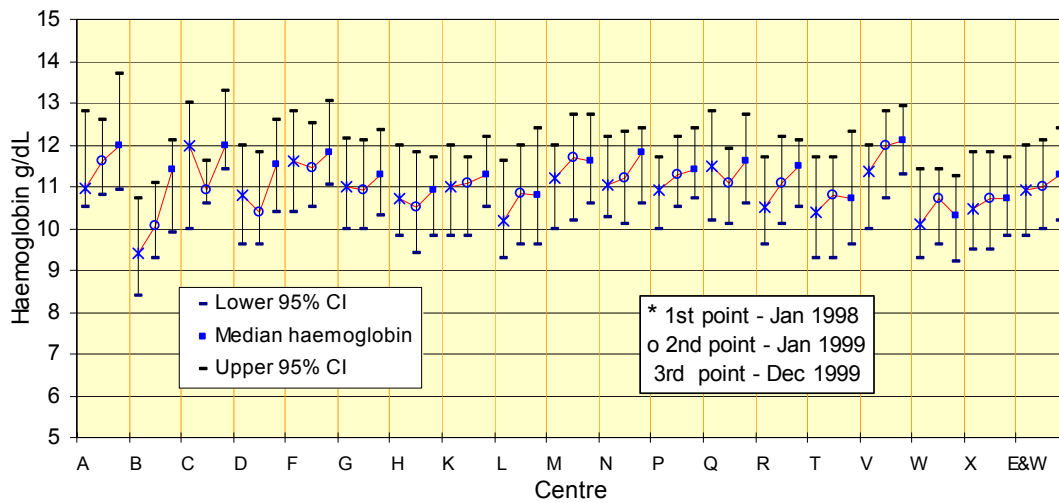
**Peritoneal dialysis**

**Percentage Hb > 10g/dl on peritoneal dialysis 1998-1999**



**Figure 7.23 Percentage with Hb ≥ 10g/dl 1998 to end 1999, on Peritoneal dialysis**

**Median haemoglobin from start 1998 to end of 1999 by centre :  
peritoneal dialysis**



**Figure 7.24 Median haemoglobin 1998- 1999 on peritoneal dialysis**

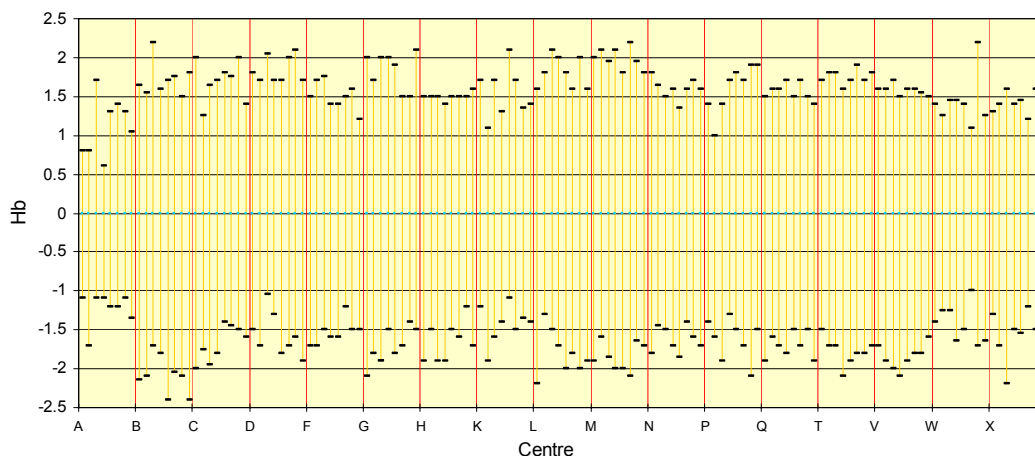
Data presented for each centre are, in sequence, from the end of 1<sup>st</sup> quarter 1997, 1<sup>st</sup> quarter 1998 and the 4<sup>th</sup> quarter 1998

In 15 out of 17 centres there was an increase in the percentage of peritoneal dialysis patients with haemoglobin greater than or equal to 10g/dl between the first quarter of 1998 and the last quarter of 1999. This resulted in an increase for England and Wales from 76 to 79% over this time period. Median haemoglobins are shown in the figure below and demonstrate modest increases in most centres

Figures 7.25 and 7.26 show the inter-quantile range between the 15<sup>th</sup> and 85<sup>th</sup> percentiles at each quarter of 1998 and 1999 for haemodialysis and peritoneal dialysis. This range has been chosen as a measure of the spread of data to exclude outliers. There is no clear trend to narrowing of the inter-quantile range suggesting that centres are not successfully targeting particular haemoglobin levels.

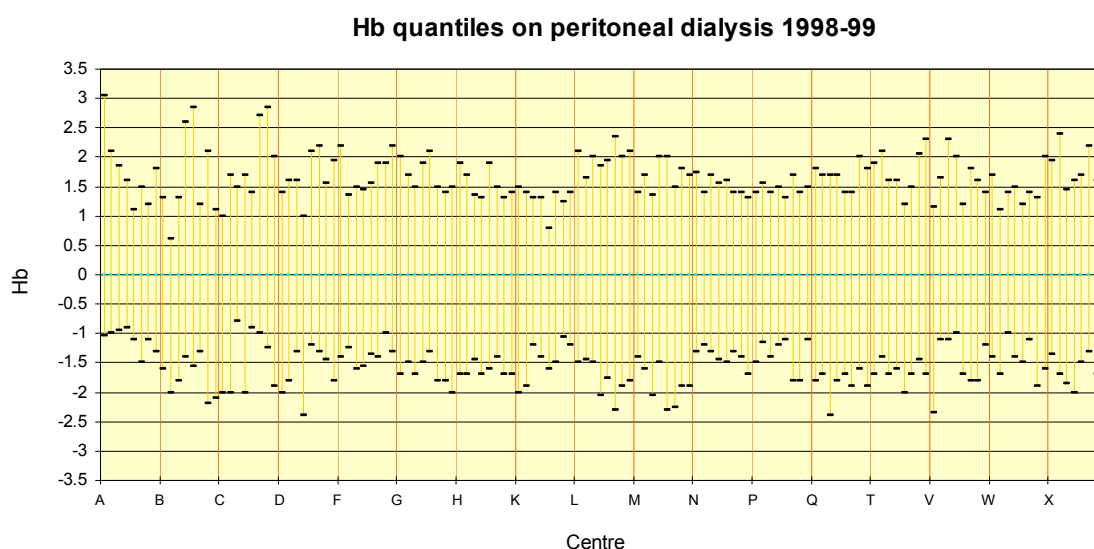
**Figure 7.25 15 to 85% quantiles for median Hb on HD at each quarter from 1st 1998 to 4th**

**Hb quantiles on haemodialysis 1998 - 1999**



**1999.**

Median value is normalised to zero to allow comparison of quantiles at each quarter.



**Figure 7.26 15 to 85% quantiles for median Hb on PD at each quarter from 1st 1998 to 4th 1999.**

Median value is normalised to zero to allow comparison of quantiles at each quarter

### ***Change in haemoglobin achieved through 1999***

Four units that returned data in 1999 had not done so in 1998 and were not included in the above analysis. To include those units in data on changes over time the following analysis compares data from the first quarter of 1999 with the fourth quarter of 1999 for those 22 centres that submitted sufficient data in 1999.

The data are summarised in table 7.14.

	Mean	SD	Median	90% Range	Quartile Range	% $\geq 10\text{g/dl}$
<b>Haemodialysis</b>						
Qtr 1 1999	10.7	1.7	10.7	8.0-13.6	9.6-11.9	68
Qtr 4 1999	10.9	1.6	10.9	8.3-13.6	9.9-12.1	73
<b>Peritoneal dialysis</b>						
Qtr 1 1999	11.1	1.7	11.1	8.4-14.0	10.1-12.1	79
Qtr 4 1999	11.3	1.7	11.4	8.6-14.0	10.3-12.4	82

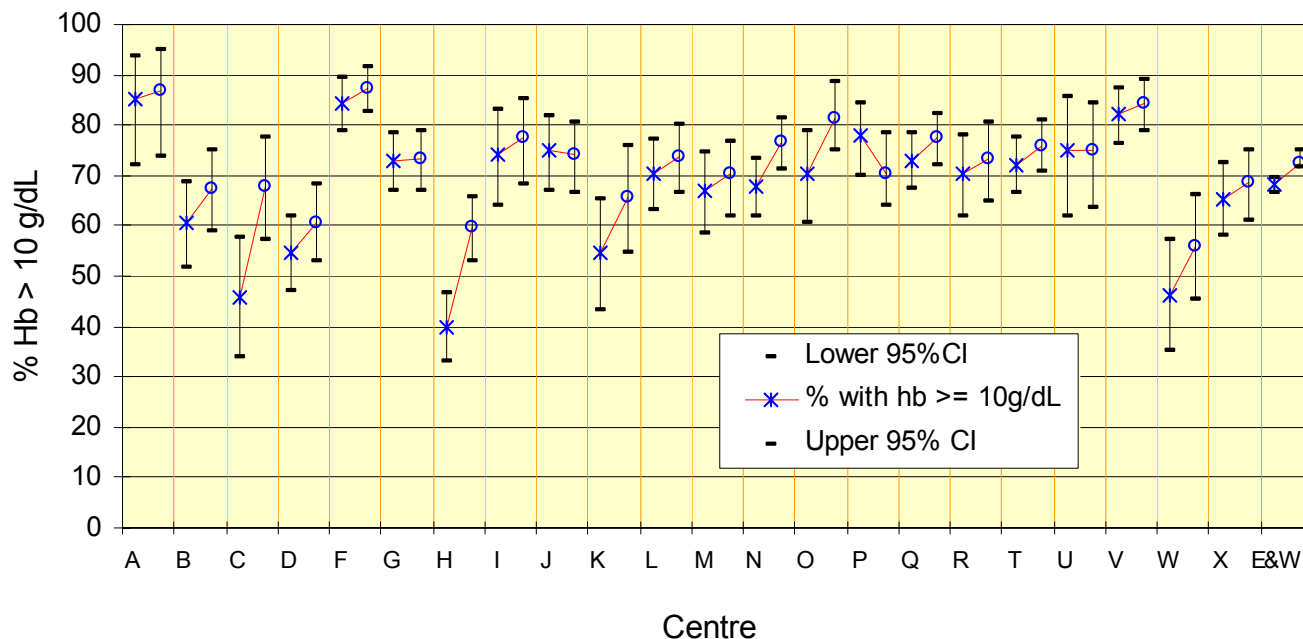
**Table 7.14 Change in Hb for all centres returning data in 1<sup>st</sup> and 4<sup>th</sup> quarter of 1998.**

### ***Haemodialysis***

During 1998 18 of 22 centres recorded an increase in the percentage of haemodialysis patients with haemoglobin of 10g/dl or more between the 1<sup>st</sup> and 4<sup>th</sup> quarters. In 16 of 22 centres there was an increase in median haemoglobin.

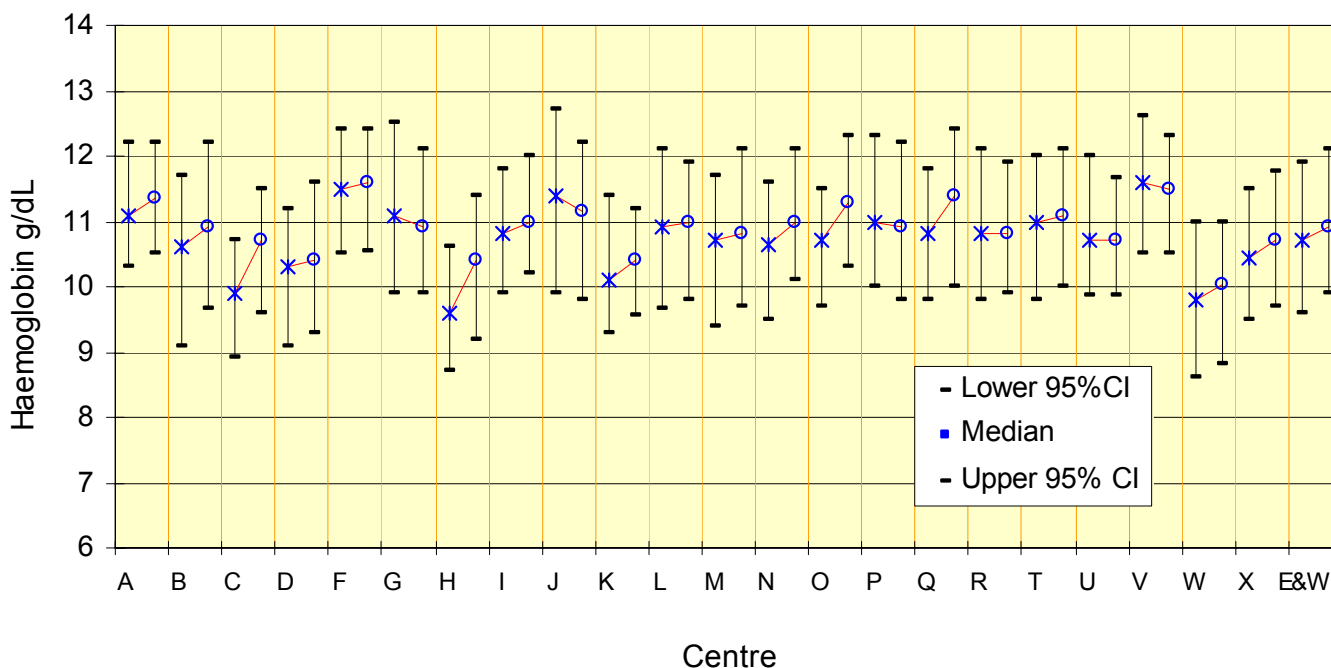
In peritoneal dialysis patients 16 of 22 centres recorded an increase in the percentage of patients with haemoglobin of 10g/dl or more between the 1<sup>st</sup> and 4<sup>th</sup> quarters of 1998. In 15 of 22 there was an increase in median haemoglobin.

**Haemoglobin > 10 g/dL at start and end of 1999 by centre : haemodialysis**



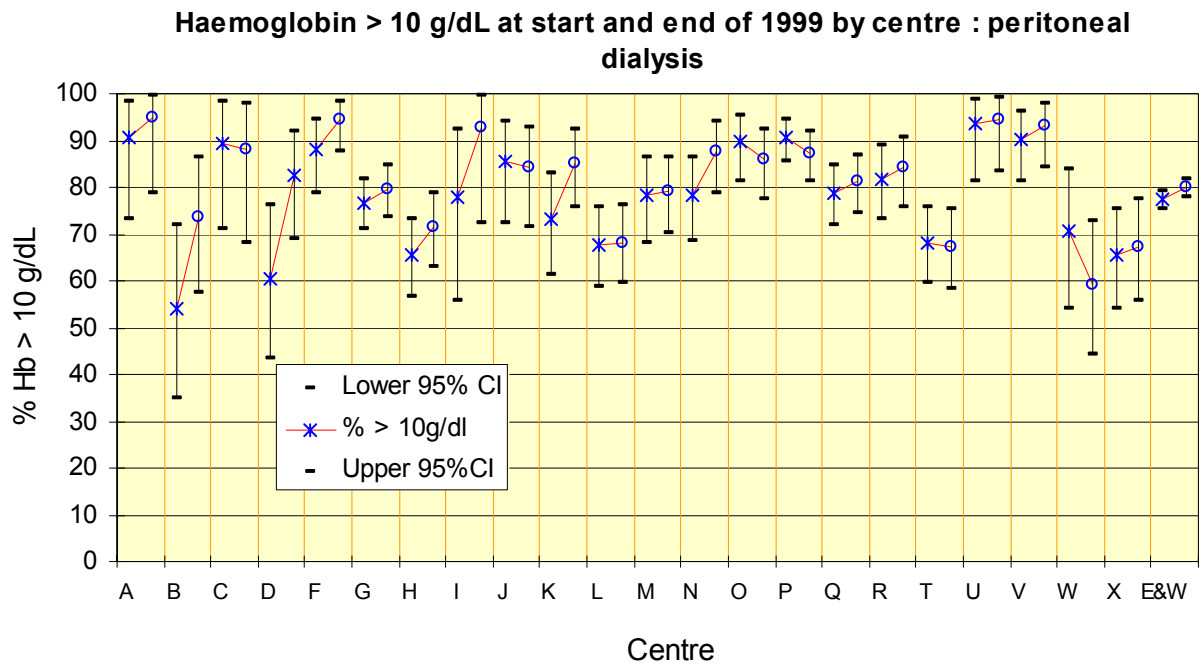
**Figure 7.27 Hb > 10g/dl at start and end of 1999, on Haemodialysis**  
Data from each centre are from the end of the first and fourth quarters of 1999

**Median haemoglobin at start and end of 1999 by centre : haemodialysis**

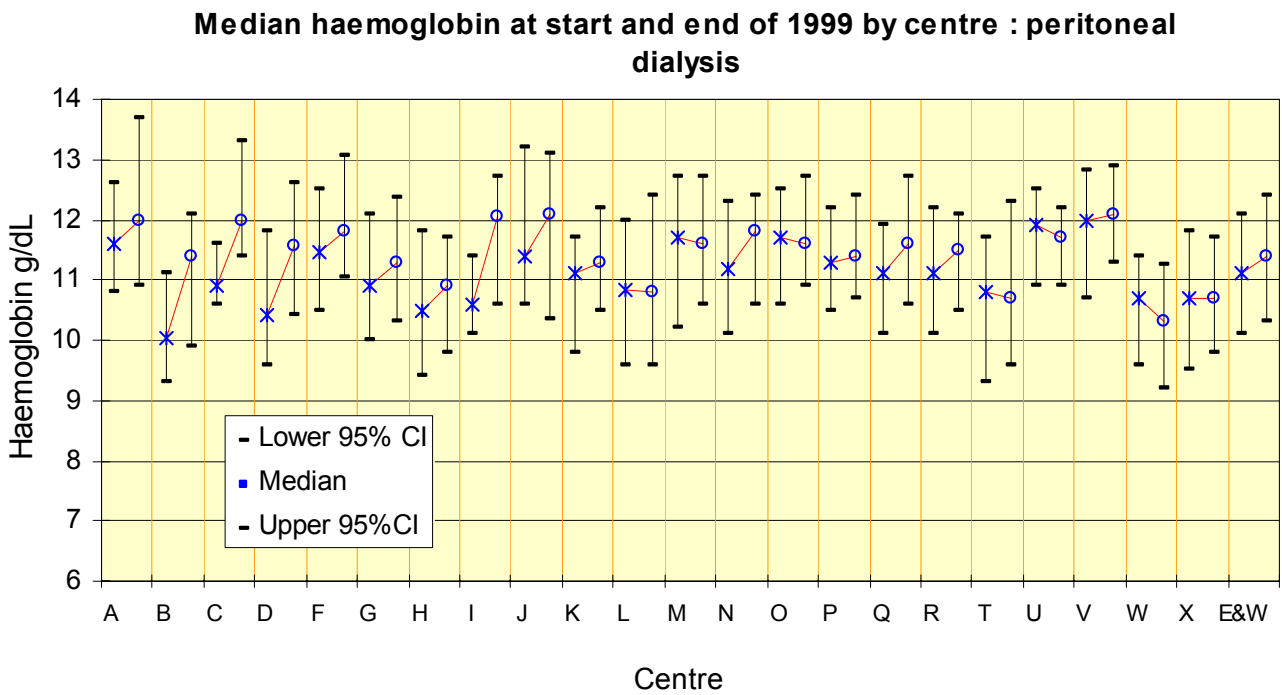


**Figure 7.28 Median Haemoglobin, Haemodialysis, start and end of 1999**  
Data from each centre are from the end of the first and fourth quarters of 1999

**Peritoneal dialysis**



**Figure 7.29 Hb > 10g/dl at start and end of 1999, on Peritoneal Dialysis**  
 Data from each centre are from the end of the first and fourth quarters of 1999



**Figure 7.30 Peritoneal Dialysis results at start and end of 1999**  
 Data from each centre are from the end of the first and fourth quarters of 1999

## Analysis of changes in haemoglobin of individuals during 1999

The data presented above could be interpreted as showing populations with relatively stable haemoglobin concentrations albeit in the context of an increasing trend. The collection of individual patient data by the Registry provides an opportunity to examine the variability of individuals haemoglobin concentration which may be important in devising management strategies to improve compliance with the Renal Association standards. Figure y.15 shows the haemoglobin distributions for all patients on the Registry in the first quarter of 1999. The haemoglobin bands for the 4<sup>th</sup> quarter of 1999 are further subdivided to indicate the haemoglobin that the same individuals had in the 1<sup>st</sup> quarter and also those patients that had started dialysis during the year. A complex picture emerges. Individuals within each band at the beginning of 1999 are distributed through every band at the end of the year. The populations within each band at start and end of the year are therefore quite different and great variability of individuals haemoglobin concentrations is demonstrated.

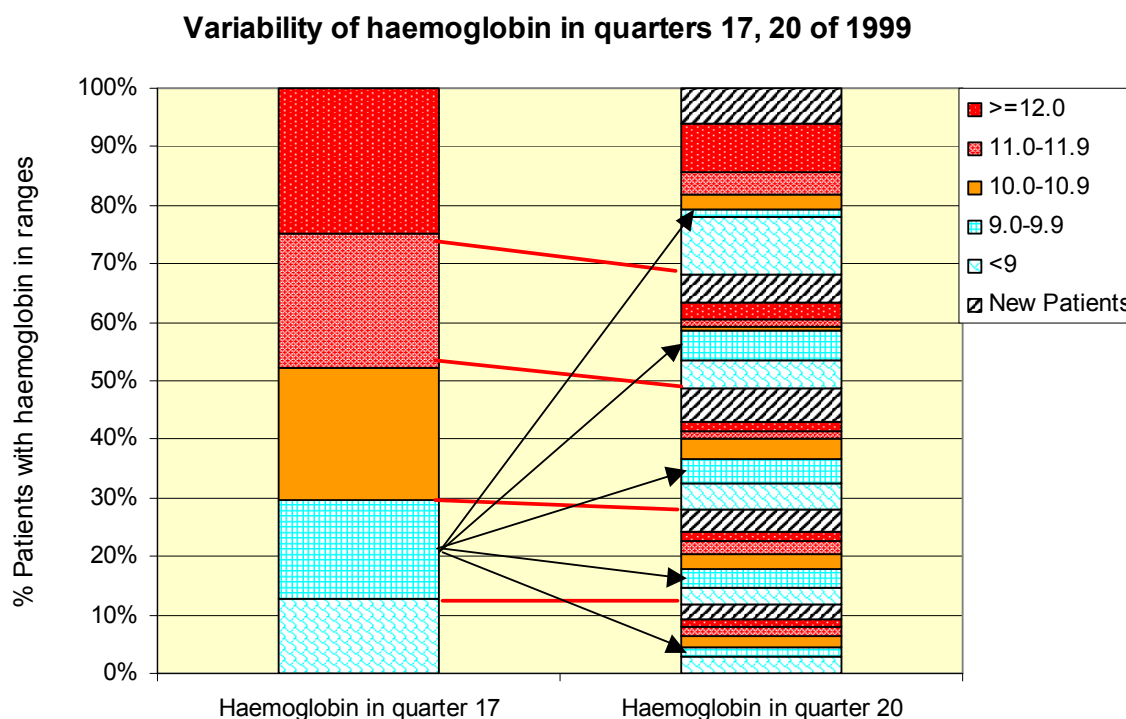


Figure 7.31 Change of haemoglobin in individuals from 1st to 4th quarters of 1999

## Conclusion

The previously reported improvements in achievement of the Renal Association standards for management of anaemia were continued in the data returned in 1999. There remain wide variations between centres in the haemoglobin levels recorded for their patients. There is further evidence that to achieve more than 85% of patients with haemoglobin at least 10g/dl requires a median haemoglobin for the centre as a whole above 11g/dl. The two centres that



achieved the Renal Association standard for haemoglobin in haemodialysis had median haemoglobins of 11.4 g/dl and 11.6 g/dl.

Iron stores as judged by serum ferritin were well maintained in most centres but there remain significant numbers of patients with ferritin less than 100µg/l. Some of these will have well maintained haemoglobin levels without requiring erythropoietin and will therefore be considered to have adequate iron stores. In others there may be an opportunity to increase haemoglobin levels and use of erythropoietin more efficiently by increasing iron stores.

It is difficult to adequately interpret data on haemoglobin concentrations without detailed information on erythropoietin prescribing. It is hoped that centres will increase their efforts to make this data available to the Registry.

There remains wide variation between centres in the haemoglobin concentration of patients on starting dialysis presumably reflecting differences in use of erythropoietin in pre-dialysis patients although differences in late referral rates may also contribute. In the great majority of centres there is increasing achievement of the Renal Association Standard haemoglobin level and increase in the centre median haemoglobin. There is no evidence that the management plans that are being used to bring about these improvements are reducing the spread of data. There is therefore no evidence of successful targeting of a particular haemoglobin concentration. The maintenance of a broad spread of haemoglobin concentrations even as haemoglobin concentrations on average are rising is contributed to by the demonstrated variability of individuals' haemoglobin concentrations. Some of this variability maybe slow in onset allowing time for intervention but other factors such as intercurrent illness may cause an unpredictable and rapid fall of haemoglobin concentration that cannot be prevented. These influences are likely to impact upon a centre's ability to obtain the Renal Association standards for haemoglobin.