Chapter 8: Management of Anaemia in Dialysis Patients

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Summary

- In the UK, 40% of patients commenced dialysis therapy with a Hb <10.0 g/dl. The median Hb at commencement of dialysis therapy was 10.4 g/dl. 80% and 86% of incident patients had a Hb ⩾10.0 g/dl by 3 and 6 months after commencement of dialysis treatment respectively.

- The median Hb of patients treated with haemodialysis (HD) in the UK was 11.8 g/dl with an inter-quartile range (IQR) of 10.7–12.8 g/dl. Of HD patients, 86% had a Hb ⩾10.0 g/dl. The median Hb of patients treated with peritoneal dialysis (PD) in the UK was 12.0 g/dl with an IQR of 11.0–12.9 g/dl. 90% of PD patients in the UK had a Hb ⩾10.0 g/dl.

- The median serum ferritin in UK HD patients was 418 μg/L (IQR 268–605) whilst 95% of UK HD patients had a ferritin ⩾100 μg/L. The median ferritin in UK PD patients was 250 μg/L (IQR 145–424) with 85% of UK PD patients having a ferritin ⩾100 μg/L.

- A higher proportion of HD patients required erythropoeisis stimulating agent (ESA) therapy than PD patients (93% vs 79%). The mean ESA dose was higher for HD than PD patients (9,223 vs 5,969 IU/week).

Introduction

This chapter describes data reported to the Renal Registry (UKRR) relating to management of renal anaemia during 2006. The chapter reports outcomes of submitted variables and analyses of these variables in the context of established guidelines and recommendations. More recently introduced NICE guidelines are also quoted to place current outcomes into context with future expectations.

Methods

This chapter analyses the incident and prevalent RRT cohorts for 2006. The Registry extracts quarterly data electronically from renal centres in England, Wales and Northern Ireland, data is sent annually from the Scottish Renal Registry. Patients treated with dialysis during the last quarter of 2006 were included in the analysis if they had been on the same modality of dialysis in the same centre for 3 months. The last available measurement of haemoglobin from each patient from the last two quarters of 2006 was used for analysis. Scottish renal centres only submit haemoglobin data for the final quarter of the year and therefore any patients commencing dialysis in the first three quarters of the year do not have a haemoglobin result at the start of dialysis. This has resulted in only one Scottish renal centre providing data for 20 or more incident dialysis patients. No summary statistics have been calculated for Scotland or Scottish renal centres because of this data incompleteness. Scottish patients with incident haemoglobin data are included in overall UK summary statistics.

The last available ferritin measurement was taken from the last three quarters of the year. For incident patients, data from their first quarter on dialysis was used. Patients commencing RRT on PD or HD were included. Those receiving a pre-emptive transplant were excluded. Patients were analysed as a complete cohort and divided by modality into groups. Analyses were also done on a combined dialysis group.

The completeness of data items were analysed at centre and country level. All patients were included in analyses but centres with less than 50% completeness were excluded from the caterpillar and funnel plots showing centre performance. Centres providing relevant data from less than 20 patients were also excluded from the plots. The number preceding the centre name in each figure indicates the percentage of missing data for that centre.

The data were analysed to calculate summary statistics. These are maximum, minimum and average (mean and median) values. Standard deviations and quartile ranges were also found. These data are represented as caterpillar plots showing median values and quartile ranges.

The percentage achieving Renal Association and other standards was also calculated for haemoglobin. The percentage of patients achieving serum ferritin $\geqslant 100\,\mu g/L$ and $\geqslant 200\,\mu g/L$ have also been calculated. These are represented as caterpillar plots with 95% confidence intervals shown. For the percentage achieving standards, chi-squared values have also been calculated to identify significant variability between centres and between nations.

Longitudinal analysis has also been done to calculate overall changes in achievement of standards from 1998 to 2006.

Data regarding ESAs were collected from all centres. Centres were excluded if fewer than 90% of patients were on the ESA file. Centres with fewer than 80% of HD patients or fewer than 65% of PD patients on ESAs were considered to have incomplete data and were also excluded from further analysis.

Results

Haemoglobin

The NSF part one[1] and the Renal Association minimum standards document 3rd edition[2] state that individuals with CKD should achieve a haemoglobin of at least 10 g/dl within 6 months of being seen by a nephrologist, unless there is a specific reason why it could not be achieved. The UKRR does not collect a specific haemoglobin measurement from patients 6 months after meeting a nephrologist. Some indication of compliance with the standard comes from the haemoglobin of the incident patient population (i.e. Hb at the start of RRT).

The European Best Practice Guidelines (EBPG)[3] set a minimum target of 11 g/dl for all patients and United States (KDOQI)[4] guidelines set a target haemoglobin range of 11–12 g/dl. The NICE guidelines published in 2006[5] recommend a target haemoglobin of between 10.5 and 12.5 g/dl (with ESA dose changes considered at 11 and 12 g/dl) which allows for the difficulty of narrowing the distribution to between 11 and 12 g/dl. However, it should be recognised that much of the data collection for 2006 pre-dates the publication of these NICE guidelines and that care should be taken to avoid improving compliance with the 10.5–12.5 g/dl desired outcome range at the expense of the patients having a Hb <10.0 g/dl. The NICE guidelines highlight the benefit of increasing Hb up to 11 g/dl suggesting consideration of dose changes at 11 and 12 g/dl. The risks associated with low (<10 g/dl) and high haemoglobin (>13 g/dl) are not necessarily equivalent.

Haemoglobin in incident dialysis patients

The haemoglobin level at the time of starting RRT gives the only indication of concordance with current anaemia management recommendations in the pre-dialysis (CKD 5 – not yet on dialysis) group. Patients not receiving dialysis (conservative care) were by definition excluded from the current dataset. In the future the Registry plans to collect CKD stage 5 data from patients who subsequently commence RRT as well as those managed conservatively.

The percentage of data returned and outcome haemoglobin are listed in Table 8.1.

The current starting median haemoglobin in the UK was 10.4 g/dl with 60% of patients starting dialysis with a Hb $\geqslant 10$ g/dl. Thus, 40% of patients commenced dialysis therapy with a Hb <10.0 g/dl. There remained a wide range of compliance between centres, from 30 to 82%. The wide range of starting Hb may reflect different practices in referral to nephrologists or differences in funding for pre-dialysis ESA therapy.

The median starting Hb is shown in Figure 8.1 and the percentage starting with a Hb $\geqslant 10.0$ g/dl by centre is given in Figure 8.2. The distribution of haemoglobin in incident dialysis patients is shown in Figure 8.3. The median haemoglobin and the percentage of incident dialysis patients in 2005 with Hb $\geqslant 10$ g/dl, by time on dialysis are shown in Figures 8.4 and 8.5.

The change that has occurred in the haemoglobin of incident dialysis patients since 1997 is

Table 8.1: Haemoglobin data for new patients starting haemodialysis or peritoneal dialysis

Centre	% data return	Median Hb g/dl	90% range	Inter-quartile range	% Hb ⩾10 g/dl
Antrim	55				
B Heart	94	10.0	7.6–12.6	9.0–11.3	53
B QEH	84	10.0	7.4–12.4	8.8–11.0	50
Bangor	93	11.0	9.2–13.6	9.5–11.6	72
Basldn	93	9.3	7.4–12.4	8.5–10.4	30
Belfast	83	10.1	7.5–12.6	8.8–11.1	53
Bradfd	98	10.5	8.5–12.8	9.2–12.1	58
Brightn	76	10.0	7.3–12.9	8.9–11.1	51
Bristol	100	10.4	7.9–13.2	9.5–11.3	62
Camb	73	10.0	7.8–12.4	9.1–11.0	53
Cardff	98	10.7	7.8–13.5	9.3–12.1	64
Carlis	100	10.1	7.8–12.4	9.3–11.3	56
Carsh	96	10.3	8.1–13.2	9.4–11.5	61
Chelms	91	10.7	8.6–12.9	9.9–11.3	68
Chestr	20				
Clwyd	93				
Covnt	94	10.3	7.8–12.4	9.4–11.1	60
Derby	82	9.8	7.8–12.2	8.6–10.8	43
Derry	100				
Dorset	100	10.2	8.3–14.3	9.6–12.0	63
Dudley	95	9.8	8.3–12.3	9.0–10.8	45
Exeter	100	10.1	7.8–12.8	8.9–11.3	54
Glouc	100	10.5	7.7–12.9	9.6–11.5	63
Hull	97	10.5	7.7–12.5	9.4–11.3	63
Ipswi	95	10.4	7.4–14.2	9.3–11.8	67
L Barts	24				
L Guys	72	10.5	7.6–13.0	9.3–11.9	65
L Kings	97	10.1	7.7–13.1	9.0–11.2	54
L Rfree	96	10.6	7.7–13.6	9.3–11.5	64
L West	99	11.2	8.5–13.9	10.2–12.1	81
Leeds	99	10.6	8.1–13.4	9.6–11.7	66
Leic	100	9.8	7.7–12.9	8.9–10.9	48
Liv Ain	88	10.4	8.5–13.3	9.0–11.2	57
Liv RI	96	11.1	7.9–13.9	9.7–12.1	70
ManWst	98	10.8	8.0–13.8	9.6–11.9	67
Middlbr	99	10.4	7.8–13.1	8.9–11.3	56
Newc	98	10.8	6.7–13.2	8.9–11.9	62
Newry	92				
Norwch	94	10.4	7.6–13.2	9.2–11.6	61
Nottm	99	10.3	8.3–12.3	9.5–11.6	61
Oxford	99	10.8	8.4–13.0	9.8–11.7	72
Plymth	71	10.5	7.5–13.0	10.0–11.5	76
Ports	100	10.4	7.9–13.5	9.3–11.8	62
Prestn	92	9.6	7.4–11.8	8.7–10.7	44
Redng	100	10.6	8.1–13.6	9.4–11.5	64
Sheff	100	10.2	8.1–13.1	9.4–11.6	56
Shrew	100	10.8	8.3–13.5	9.8–11.7	71
Stevng	94	10.1	7.9–13.1	8.8–11.0	53
Sthend	100	10.2	7.4–13.2	9.6–11.0	53
Sund	100	10.6	8.4–14.5	9.8–11.9	65
Swanse	99	10.3	8.2–13.0	9.1–11.3	55
Truro	100	10.9	8.5–13.7	10.2–11.9	82

Table 8.1: (continued)

Centre	% data return	Median Hb g/dl	90% range	Inter-quartile range	% Hb ⩾10 g/dl
Tyrone	87	10.1	7.4–11.9	9.1–11.2	62
Ulster	100				
Wirral	63	10.9	8.3–14.1	9.4–13.3	59
Wolve	99	10.5	7.9–13.4	9.2–11.8	61
Wrexm	32				
York	98	10.4	7.9–13.8	9.4–11.7	67
England	**92**	**10.3**	**7.9–13.2**	**9.3–11.5**	**60**
N Ireland	**80**	**10.5**	**7.5–12.6**	**9.1–11.3**	**61**
Wales	**93**	**10.6**	**8.1–13.4**	**9.3–11.8**	**63**
Eng, NI, Wales	**91**	**10.4**	**7.8–13.2**	**9.3–11.5**	**60**

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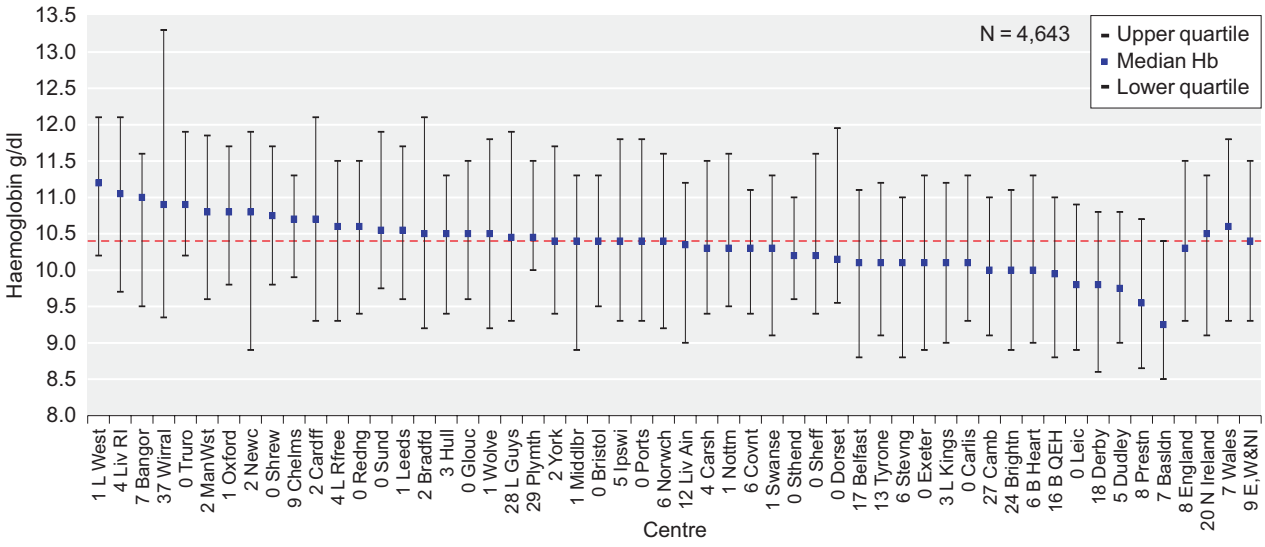

Figure 8.1: Median haemoglobin for incident dialysis patients at start of dialysis treatment

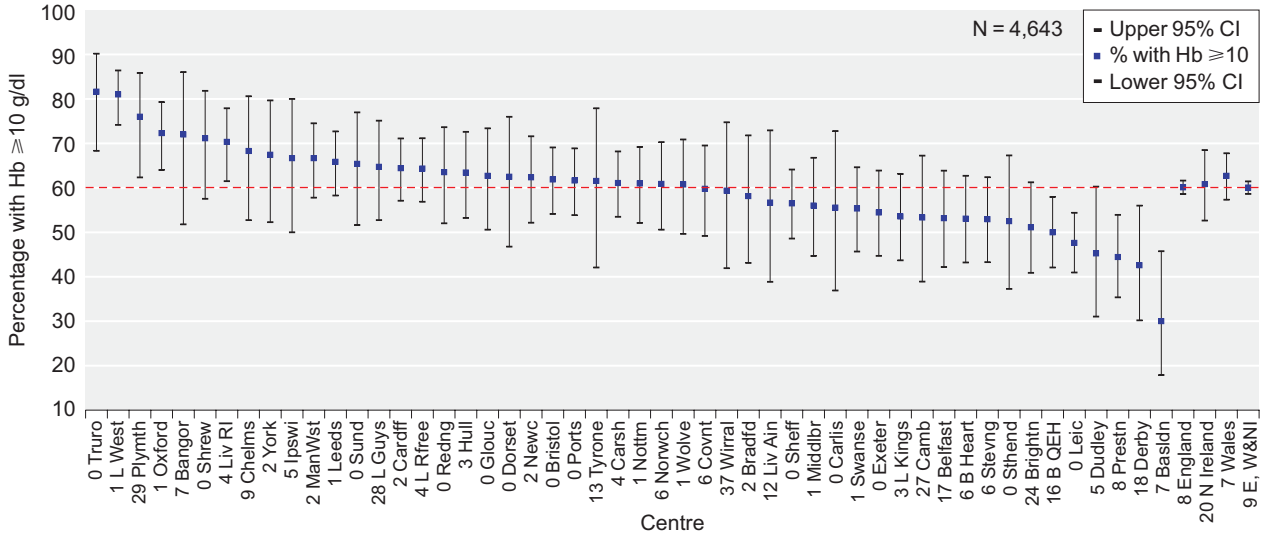

Figure 8.2: Percentage of incident dialysis patients with Hb ⩾10 g/dl at start of dialysis treatment

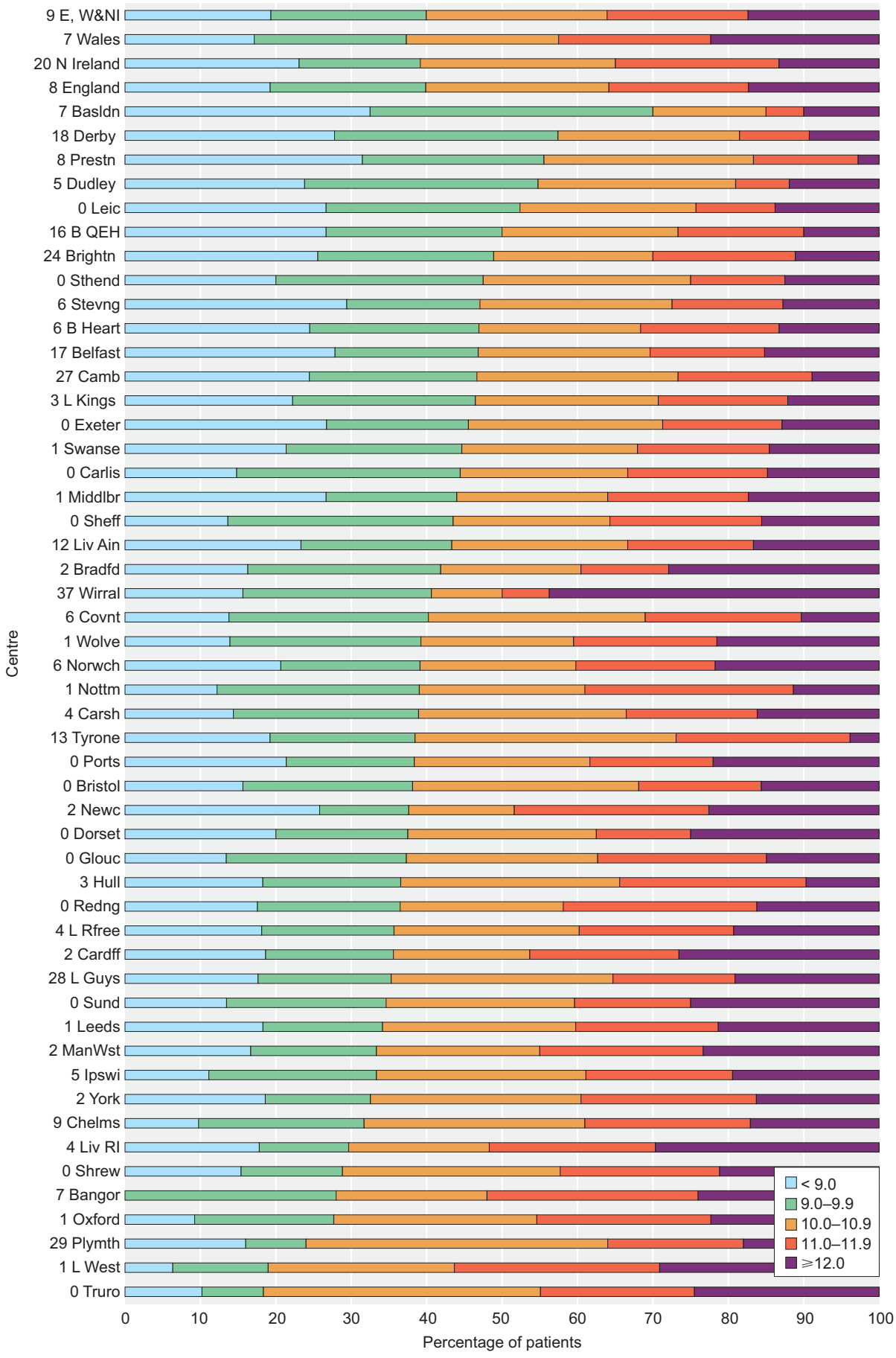

Figure 8.3: Distribution of haemoglobin in incident dialysis patients at start of dialysis treatment

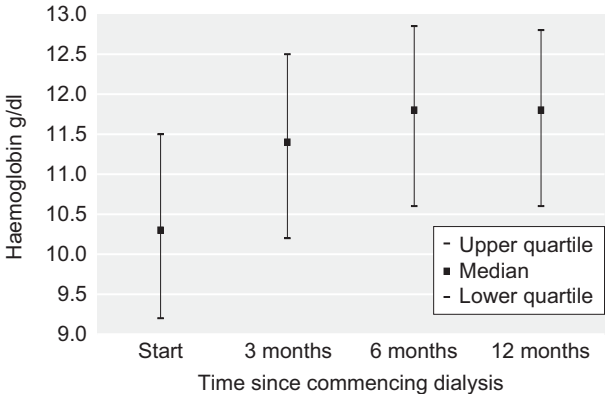

Figure 8.4: Median haemoglobin, by time on dialysis, for incident dialysis patients in 2005

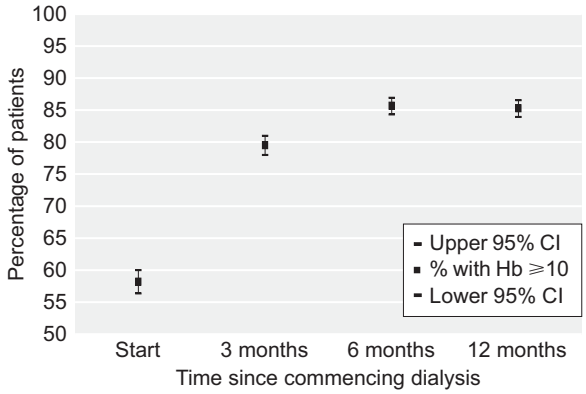

Figure 8.5: Percentage of incident dialysis patients in 2005 with Hb ⩾10 g/dl, by time on dialysis

shown in Figure 8.6. This shows an increase in the Hb for incident patients and probably represents the increased availability of renal anaemia therapy for pre-dialysis patients in the UK.

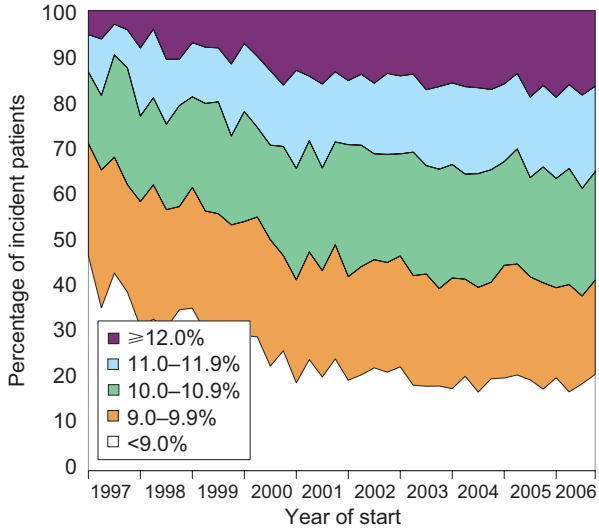

Figure 8.6: Distribution of haemoglobin in incident dialysis patients by year of start

Haemoglobin in prevalent haemodialysis patients

The compliance with data returns and haemoglobin outcome for prevalent HD patients are shown in Table 8.2.

The median Hb of patients on HD in the UK was 11.8 g/dl with an IQR of 10.7–12.8 g/dl. In the UK, 86% of HD patients had a Hb ⩾10.0 g/dl. The median haemoglobin for HD patients by centre, compliance with the UK minimum standard Hb ⩾10 g/dl and EBPG standard of Hb ⩾11 g/dl are shown in Figures 8.7, 8.8 and 8.9 respectively. The distribution of Hb in HD patients by centre is shown in Figure 8.10. The

Table 8.2: Haemoglobin data for prevalent patients on haemodialysis

Centre	% data return	Median Hb g/dl	90% range	Inter-quartile range	Mean Hb g/dl	Standard deviation	% with Hb ⩾10 g/dl	% with Hb ⩾11 g/dl
Abrdn	98	11.9	9.1–14.0	10.6–12.7	11.7	1.4	88	68
Airdrie	99	12.4	9.4–14.1	11.3–13.2	12.2	1.5	91	78
Antrim	97	12.2	10.6–14.1	11.5–13.0	12.2	1.1	99	85
B Heart	92	11.7	9.0–13.7	10.3–12.7	11.4	1.6	81	64
B QEH	97	12.1	8.3–14.5	10.8–13.1	11.9	1.9	83	73
Bangor	97	11.7	9.7–14.1	10.6–12.5	11.6	1.3	90	69
Basldn	98	11.3	8.2–13.2	10.2–12.1	11.1	1.5	76	60
Belfast	95	11.8	9.4–13.8	10.6–12.7	11.7	1.5	89	68
Bradfd	100	12.2	9.3–14.6	11.1–13.2	12.1	1.6	89	77
Brightn	73	11.0	8.3–13.3	9.7–12.1	10.9	1.5	70	52
Bristol	100	11.7	8.9–14.2	10.7–12.8	11.7	1.6	86	71
Camb	66	11.4	8.8–13.5	10.2–12.4	11.3	1.5	78	61
Cardff	98	12.0	9.4–14.6	10.8–12.8	11.9	1.6	89	72
Carlis	95	12.0	9.3–14.3	11.0–13.1	11.9	1.6	87	75
Carsh	84	11.5	8.8–13.7	10.3–12.4	11.4	1.5	83	63
Chelms	98	11.7	9.6–13.7	11.0–12.4	11.6	1.3	90	75
Chestr	81	12.9	9.9–15.4	12.2–13.9	12.9	1.5	94	91

Table 8.2: (continued)

Centre	% data return	Median Hb g/dl	90% range	Inter-quartile range	Mean Hb g/dl	Standard deviation	% with Hb ⩾10 g/dl	% with Hb ⩾11 g/dl
Clwyd	92	12.2	9.8–14.3	11.1–13.1	12.2	1.4	95	80
Covnt	98	11.3	9.1–13.8	10.3–12.5	11.4	1.5	82	58
D&Gall	96	12.3	10.6–13.9	11.4–13.3	12.3	1.3	96	89
Derby	99	11.3	8.7–13.6	10.3–12.3	11.3	1.6	80	62
Derry	39							
Dorset	98	11.6	9.3–14.0	10.5–12.5	11.6	1.5	86	63
Dudley	85	11.2	8.2–14.1	10.1–12.1	11.1	1.7	77	55
Dundee	98	12.0	9.4–14.3	10.8–13.0	11.9	1.5	87	75
Dunfn	98	12.1	8.8–15.2	10.8–13.3	12.0	1.8	86	74
Edinb	98	12.4	9.9–14.3	11.5–13.1	12.3	1.3	95	85
Exeter	99	11.3	9.1–13.2	10.6–12.2	11.3	1.3	84	61
Glasgw	98	11.8	8.8–14.3	10.6–12.8	11.7	1.7	85	69
Glouc	100	11.8	8.8–14.0	10.8–12.8	11.7	1.6	87	72
Hull	99	11.6	8.8–14.0	10.8–12.4	11.5	1.4	86	70
Inverns	100	12.1	9.6–14.7	11.1–13.1	12.2	1.6	93	79
Ipswi	100	11.5	8.9–13.1	10.5–12.3	11.4	1.3	86	67
Klmarnk	99	11.8	9.2–13.8	10.7–12.8	11.7	1.5	89	69
L Barts	100	11.2	7.9–13.8	9.8–12.4	11.1	1.8	74	55
L Guys	88	11.7	8.9–13.7	10.6–12.6	11.6	1.5	85	68
L Kings	100	11.7	8.8–14.0	10.5–12.7	11.6	1.7	84	69
L Rfree	87	12.2	8.7–14.2	11.0–13.1	12.0	1.7	88	76
L West	99	12.2	9.7–14.2	11.3–13.1	12.1	1.4	93	82
Leeds	99	12.3	9.4–15.0	11.1–13.3	12.2	1.7	90	79
Leic	99	12.1	8.7–14.4	11.0–13.2	11.9	1.7	86	75
Liv Ain	97	11.7	9.1–14.4	10.6–12.8	11.6	1.6	88	61
Liv RI	97	12.7	9.3–15.1	11.4–13.8	12.5	1.7	92	80
ManWst	81	11.7	8.7–14.4	10.3–12.8	11.6	1.9	81	67
Middlbr	99	11.9	9.0–14.4	10.6–13.0	11.9	1.7	85	71
Newc	100	12.3	9.3–14.3	11.3–13.0	12.1	1.5	91	79
Newry	99	11.6	9.2–14.1	10.5–12.3	11.5	1.5	86	71
Norwch	96	11.7	9.1–13.8	10.8–12.6	11.7	1.4	89	72
Nottm	99	11.7	9.1–13.8	10.7–12.5	11.6	1.5	88	68
Oxford	99	12.1	8.9–14.4	11.0–12.9	11.9	1.6	87	75
Plymth	93	11.5	8.8–13.6	10.5–12.4	11.4	1.5	84	64
Ports	99	11.6	9.0–14.2	10.4–12.8	11.6	1.6	84	63
Prestn	97	11.6	8.6–14.2	10.5–12.5	11.5	1.6	85	65
Redng	100	11.8	9.4–14.3	11.0–12.7	11.9	1.5	89	76
Sheff	99	11.7	9.3–13.8	10.8–12.6	11.7	1.4	88	71
Shrew	100	12.0	10.0–14.0	11.0–13.0	12.0	1.3	96	77
Stevng	83	11.4	9.1–13.4	10.6–12.2	11.3	1.3	84	63
Sthend	99	11.2	8.5–13.1	10.4–12.1	11.1	1.3	83	58
Sund	97	11.7	9.5–13.7	10.8–12.5	11.6	1.4	89	71
Swanse	99	11.8	9.3–14.2	11.1–12.8	11.9	1.4	92	78
Truro	99	11.6	9.6–13.4	10.9–12.5	11.6	1.1	92	73
Tyrone	96	12.1	9.3–14.2	11.0–12.8	11.9	1.5	86	75
Ulster	100	11.5	9.3–13.1	10.8–12.4	11.5	1.3	84	73
Wirral	95	11.9	8.7–14.5	10.6–12.8	11.7	1.7	84	68
Wolve	99	12.6	9.7–15.2	11.7–13.7	12.6	1.6	92	83
Wrexm	2							
York	99	12.6	9.4–14.7	11.6–13.4	12.5	1.6	94	86
England	**95**	**11.8**	**8.9–14.2**	**10.7–12.8**	**11.7**	**1.6**	**86**	**70**
N Ireland	**94**	**11.8**	**9.4–14.0**	**10.8–12.7**	**11.8**	**1.4**	**89**	**73**
Scotland	**98**	**12.0**	**9.1–14.3**	**10.9–13.0**	**11.9**	**1.6**	**88**	**74**
Wales	**88**	**11.9**	**9.5–14.4**	**10.9–12.8**	**11.9**	**1.5**	**91**	**74**
UK	**95**	**11.8**	**9.0–14.2**	**10.7–12.8**	**11.8**	**1.6**	**86**	**71**

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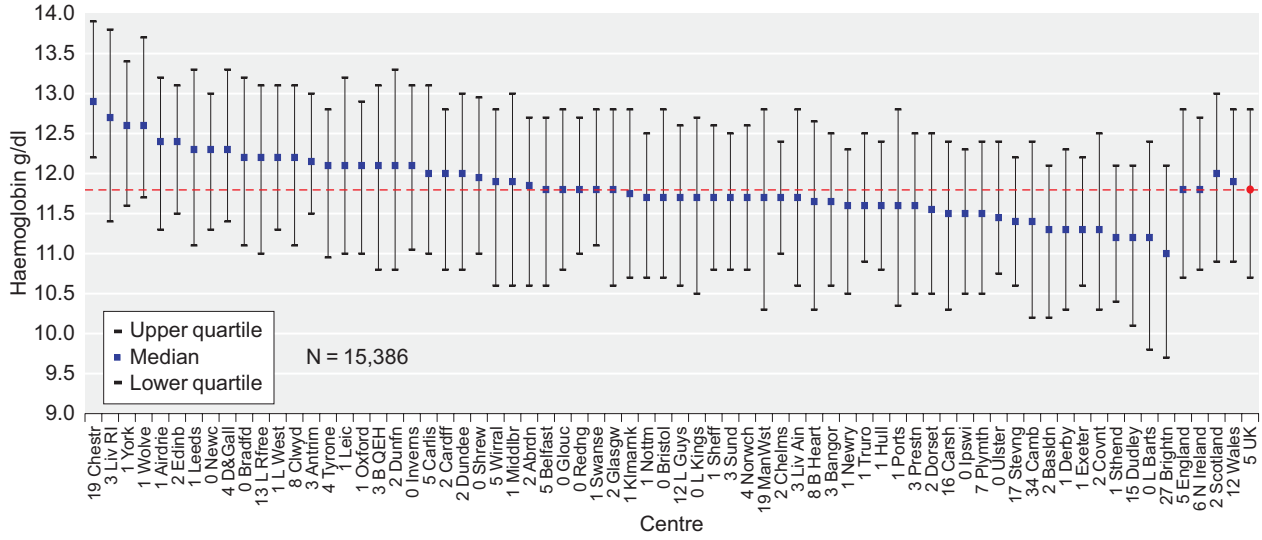

Figure 8.7: Median haemoglobin: HD

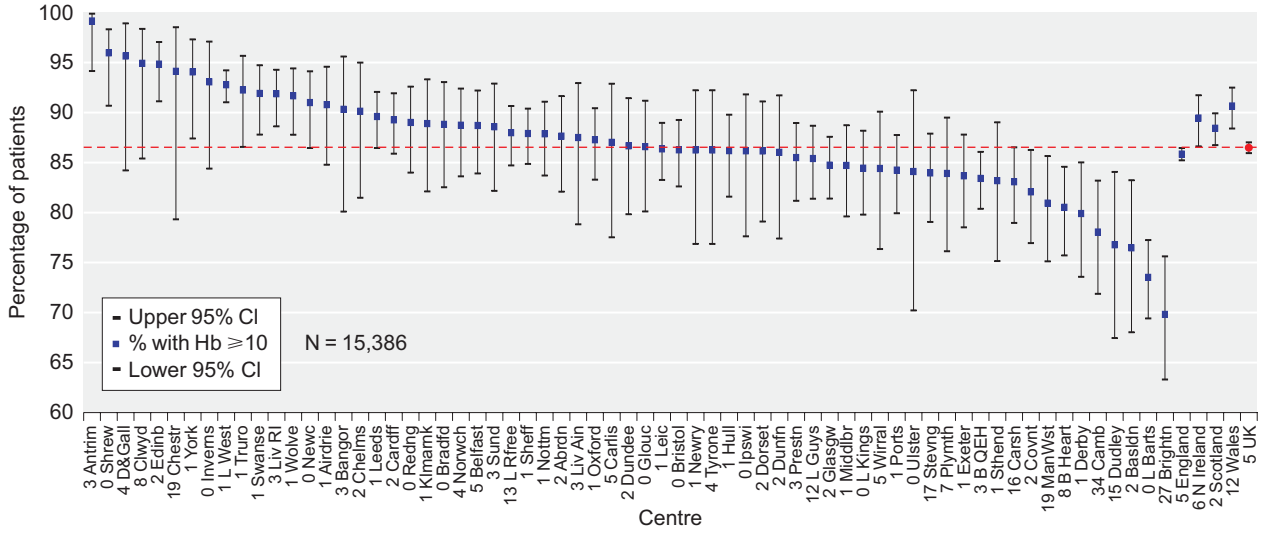

Figure 8.8: Percentage of HD patients with Hb ⩾10 g/dl

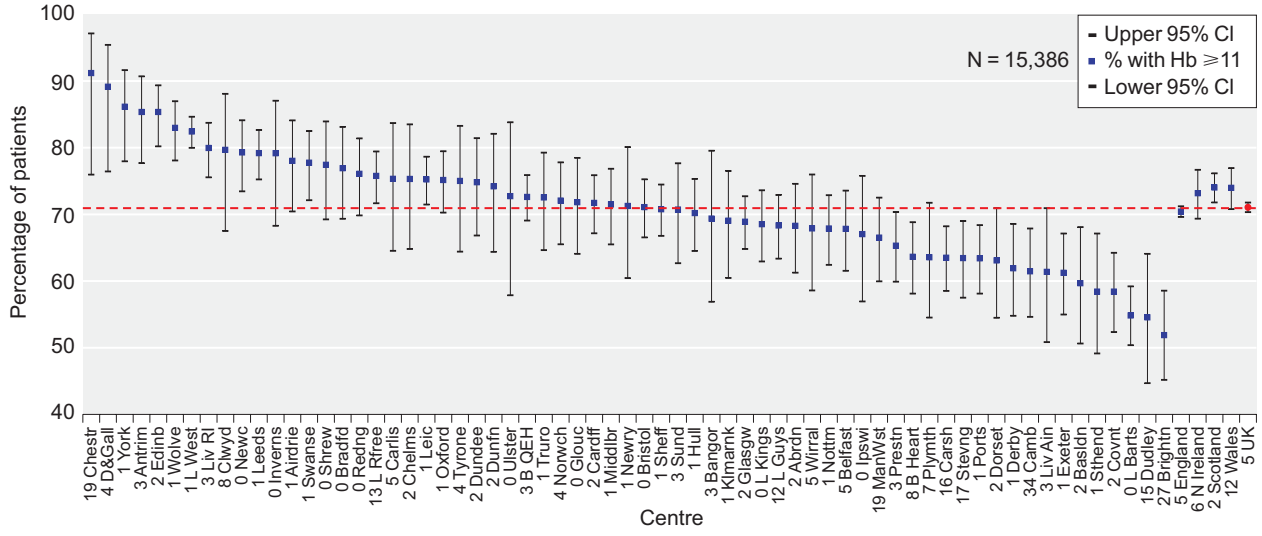

Figure 8.9: Percentage of HD patients with Hb ⩾11 g/dl

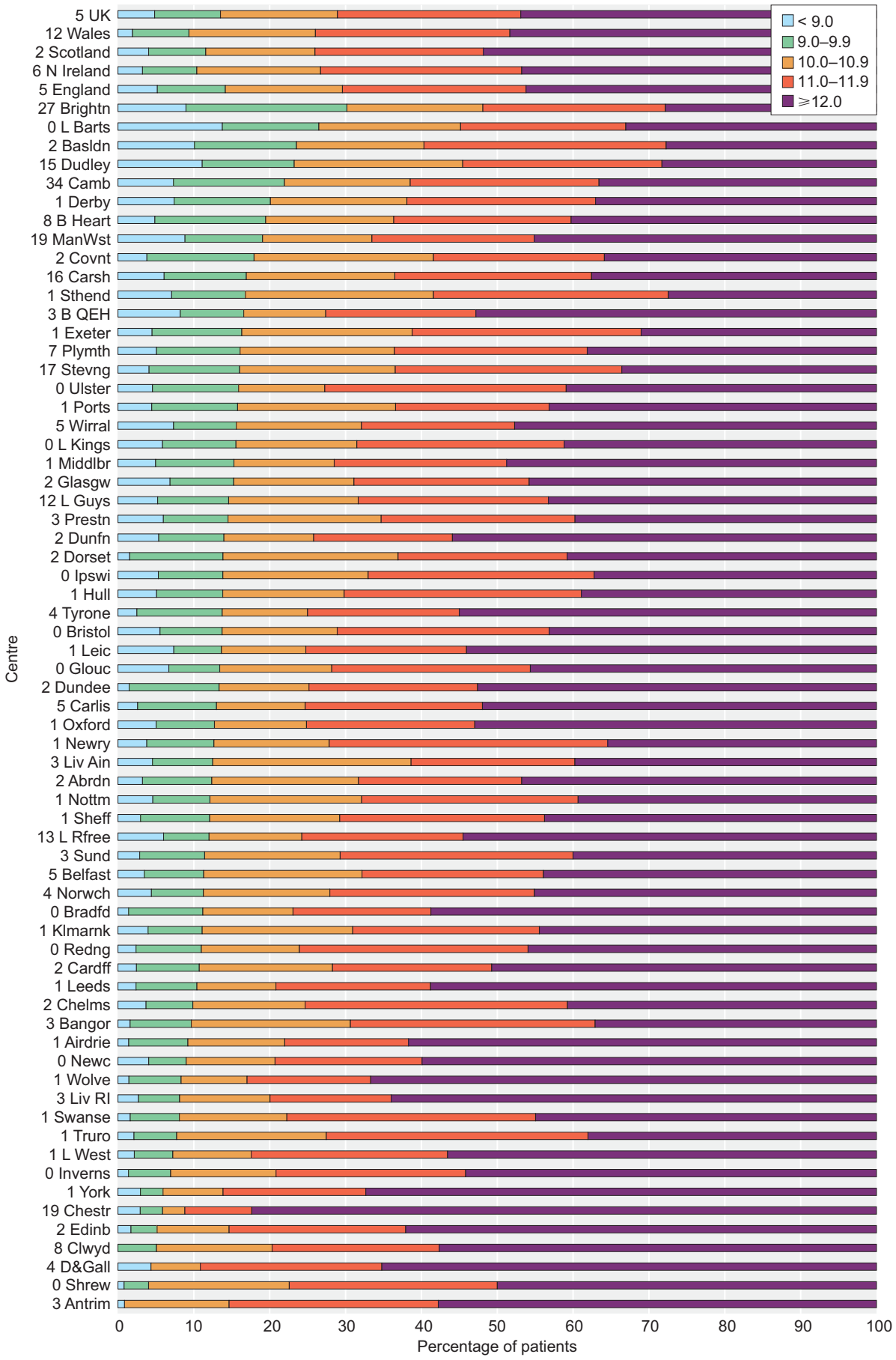

Figure 8.10: Distribution of haemoglobin in patients on HD

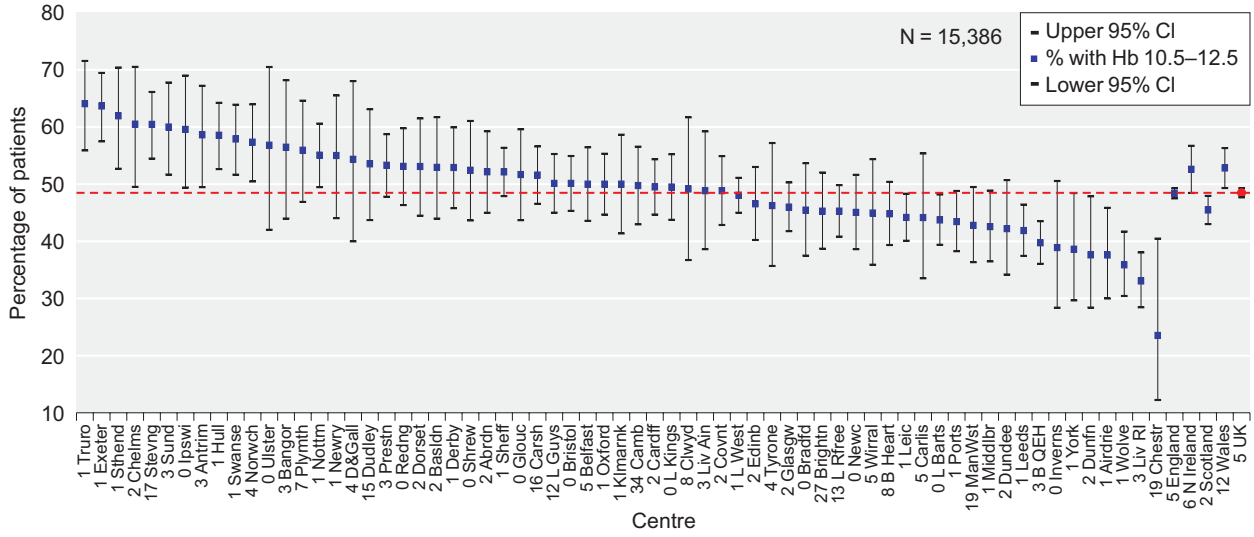

Figure 8.11: Percentage of HD patients with Hb ⩾10.5 and ⩽12.5 g/dl

compliance with the NICE recommended range of 10.5–12.5 g/dl is shown in Figure 8.11. At this point it is worth highlighting that although centres can comply well with respect to both outcomes it is also possible to fall within 2 to 3 SDs of the mean in the funnel plot for percentage of patients with Hb ⩾10.5 and ⩽12.5 g/dl (Figure 8.12) and yet have a poor compliance with percentage Hb ⩾10 g/dl (Figure 8.13). The examples of the London Barts and Brighton centres, demonstrate that compliance with one standard (i.e. % Hb 10.5–12.5 g/dl) can be achieved without compliance with another standard (% Hb ⩾10 g/dl). Figures 8.12 and 8.13 should be used in conjunction with Table 8.3 to identify centres.

Haemoglobin in prevalent peritoneal dialysis patients

In the UK, 90% of patients on PD had a Hb ⩾10.0 g/dl (Table 8.4). The median Hb of patients on PD in the UK was 12.0 g/dl with an IQR of 11.0–12.9 g/dl (Table 8.4). The median haemoglobin by centre, compliance with the UK minimum standard Hb ⩾10 g/dl and EBPG standard of Hb ⩾11 g/dl are shown in

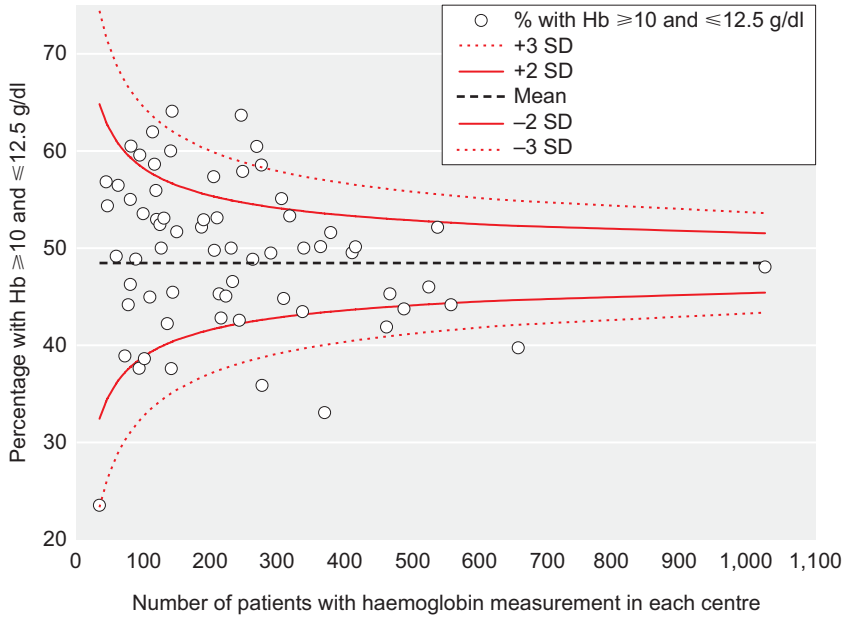

Figure 8.12: Funnel plot for percentage of HD patients with Hb ⩾10.5 and ⩽12.5 g/dl

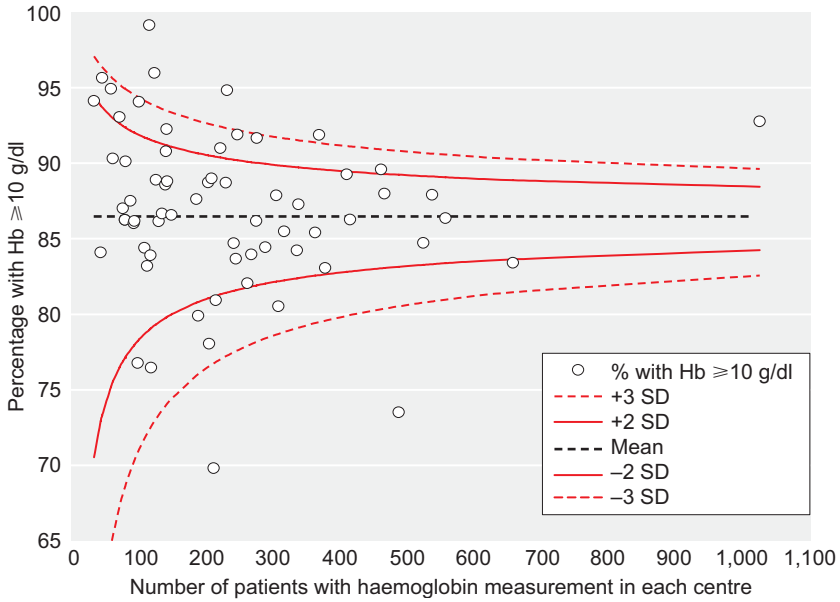

Figure 8.13: Funnel plot for percentage of HD patients with Hb ⩾10 g/dl

Table 8.3: Percentage of HD patients achieving Hb ⩾10 g/dl and Hb 10.5–12.5 g/dl

Centre	No pts with Hb	% with Hb ⩾10 g/dl	% Hb 10.5–12.5 g/dl	Centre	No pts with Hb	% with Hb ⩾10 g/dl	% Hb 10.5–12.5 g/dl
Chestr	34	94	24	Redng	209	89	53
Ulster	44	84	57	Brightn	212	70	45
D&Gall	46	96	54	ManWst	215	81	43
Clwyd	59	95	49	Newc	222	91	45
Bangor	62	90	56	Belfast	230	89	50
Inverns	72	93	39	Edinb	232	95	47
Carlis	77	87	44	Middlbr	242	85	43
Newry	80	86	55	Exeter	245	84	64
Tyrone	80	86	46	Swanse	247	92	58
Chelms	81	90	60	Covnt	262	82	49
Liv Ain	88	88	49	Stevng	268	84	60
Dunfn	93	86	38	Hull	275	86	59
Ipswi	94	86	60	Wolve	276	92	36
Dudley	99	77	54	L Kings	289	84	49
York	101	94	39	Nottm	305	88	55
Wirral	109	84	45	B Heart	308	81	45
Sthend	113	83	62	Prestn	317	85	53
Antrim	116	99	59	Ports	336	84	43
Plymth	118	84	56	Oxford	338	87	50
Basldn	119	76	53	L Guys	363	85	50
Shrew	124	96	52	Liv RI	369	92	33
Klmarnk	126	89	50	Carsh	378	83	52
Dorset	130	86	53	Cardff	410	89	50
Dundee	135	87	42	Bristol	415	86	50
Sund	140	89	60	Leeds	461	90	42
Airdrie	141	91	38	L Rfree	466	88	45
Truro	142	92	64	L Barts	487	74	44
Bradfd	143	89	45	Glasgw	524	85	46
Glouc	149	87	52	Sheff	537	88	52
Abrdn	186	88	52	Leic	557	86	44
Derby	189	80	53	B QEH	657	83	40
Norwch	204	89	57	L West	1,024	93	48
Camb	205	78	50				

Table 8.4: Haemoglobin data for prevalent patients on peritoneal dialysis

Centre	% data return	Median Hb g/dl	90% range	Inter-quartile range	Mean Hb g/dl	Standard deviation	% with Hb ⩾10 g/dl	% with Hb ⩾11 g/dl
Abrdn	97	12.3	9.7–14.3	11.6–12.6	12.2	1.5	90	86
Airdrie	100	12.0	9.4–13.4	10.8–12.8	11.8	1.3	88	75
Antrim	92	12.8	10.8–14.3	11.4–13.3	12.6	1.3	100	91
B Heart	95	12.0	10.0–14.4	11.4–12.9	12.2	1.4	97	83
B QEH	94	11.3	7.5–13.6	10.8–12.2	11.2	1.7	85	66
Bangor	100	12.3	9.6–15.6	11.6–13.2	12.3	1.6	88	82
Basldn	100	11.7	9.6–14.4	11.1–12.6	11.7	1.5	86	79
Belfast	95	11.9	8.9–14.5	11.0–12.9	11.9	1.6	93	76
Bradfd	100	11.7	9.1–14.1	10.9–12.7	11.7	1.7	86	74
Brightn	99	11.9	9.2–14.6	10.7–13.4	12.0	1.7	87	73
Bristol	100	12.1	9.9–14.1	11.0–12.9	12.0	1.3	94	76
Camb	100	12.1	10.0–14.7	11.0–12.7	12.0	1.4	97	80
Cardff	100	12.2	9.3–14.7	11.0–13.0	12.1	1.7	91	77
Carlis	100							
Carsh	98	11.8	9.3–14.3	10.9–12.8	11.8	1.5	90	74
Chelms	100	12.1	9.4–14.6	11.5–12.8	12.1	1.4	93	87
Chestr	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Clwyd	88							
Covnt	100	11.9	9.3–13.8	10.9–12.6	11.7	1.3	91	72
D&Gall	100							
Derby	97	11.8	9.6–13.5	11.0–12.5	11.7	1.2	90	77
Derry	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Dorset	100	12.6	9.2–14.8	11.2–13.7	12.4	1.7	88	79
Dudley	100	12.3	9.2–14.5	11.0–13.4	12.1	1.6	88	78
Dundee	100	12.1	10.7–13.5	11.1–12.8	12.0	1.1	95	86
Dunfn	100	11.9	8.9–14.3	11.3–12.6	11.8	1.5	88	84
Edinb	98	11.9	9.6–13.6	10.9–12.8	11.8	1.4	91	74
Exeter	100	11.8	9.3–13.7	10.9–12.7	11.7	1.3	85	74
Glasgw	98	11.8	9.4–14.3	10.7–12.6	11.8	1.4	91	72
Glouc	100	11.8	9.5–13.9	10.8–12.4	11.6	1.4	91	72
Hull	93	11.7	9.0–14.2	10.8–13.0	11.7	1.8	86	75
Inverns	24							
Ipswi	96	12.2	10.9–14.3	11.4–13.5	12.4	1.2	98	92
Klmarnk	95	12.0	9.7–14.5	10.7–13.3	11.9	1.7	90	68
L Barts	86	12.4	8.7–15.2	11.1–13.6	12.2	2.0	88	78
L Guys	99	11.9	9.6–13.6	11.2–12.8	11.8	1.3	89	77
L Kings	99	12.7	9.9–14.9	11.9–13.6	12.6	1.6	94	90
L Rfree	94	11.3	8.8–14.6	10.5–12.4	11.5	1.7	84	64
L West	97	11.6	9.0–14.3	11.1–12.6	11.7	1.4	90	77
Leeds	98	12.1	9.9–14.9	11.3–13.3	12.3	1.7	94	85
Leic	97	11.8	8.8–14.0	10.6–12.6	11.6	1.6	85	69
Liv Ain	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Liv RI	92	12.4	10.0–14.4	11.6–13.4	12.4	1.4	95	87
ManWst	89	12.0	8.6–14.4	10.7–12.8	11.8	1.7	87	67
Middlbr	96	12.4	9.8–14.7	11.2–13.1	12.2	1.6	93	81
Newc	98	12.0	9.3–15.1	11.0–13.4	12.1	1.9	87	75
Newry	86							
Norwch	98	12.3	10.6–14.6	11.8–13.1	12.5	1.4	98	93
Nottm	100	11.6	9.1–14.5	10.7–12.5	11.7	1.5	89	69

Table 8.4: (continued)

Centre	% data return	Median Hb g/dl	90% range	Inter-quartile range	Mean Hb g/dl	Standard deviation	% with Hb ⩾10 g/dl	% with Hb ⩾11 g/dl
Oxford	100	12.1	9.3–14.5	10.9–12.9	11.9	1.7	90	75
Plymth	92	11.9	9.0–14.2	11.0–12.7	11.8	1.5	85	76
Ports	100	12.1	9.0–14.8	10.9–13.3	12.0	1.7	92	73
Prestn	99	11.8	9.1–14.8	10.8–12.8	11.8	1.6	88	69
Redng	100	12.4	9.7–15.9	11.6–13.6	12.6	1.8	95	85
Sheff	100	11.9	9.1–14.7	10.7–13.1	11.9	1.7	86	72
Shrew	100	12.2	10.1–14.6	11.6–13.3	12.3	1.3	97	85
Stevng	98	12.1	9.9–14.2	11.0–12.8	11.9	1.3	93	75
Sthend	94							
Sund	100							
Swanse	97	11.8	9.3–13.9	10.8–12.4	11.7	1.4	89	71
Truro	100	11.9	9.9–13.9	11.2–12.8	11.9	1.1	94	84
Tyrone	86							
Ulster	100							
Wirral	55							
Wolve	98	12.5	10.1–15.1	11.3–13.8	12.5	1.7	96	80
Wrexm	0							
York	95	12.3	8.5–15.6	11.7–13.7	12.4	2.5	90	86
England	**96**	**12.0**	**9.2–14.5**	**11.0–13.0**	**11.9**	**1.6**	**90**	**76**
N Ireland	**92**	**12.1**	**9.8–14.5**	**11.1–13.1**	**12.1**	**1.5**	**95**	**84**
Scotland	**91**	**11.9**	**9.4–14.3**	**11.0–12.8**	**11.9**	**1.4**	**91**	**76**
Wales	**87**	**12.1**	**9.3–14.5**	**11.0–12.9**	**12.0**	**1.6**	**90**	**75**
UK	**95**	**12.0**	**9.3–14.5**	**11.0–12.9**	**11.9**	**1.6**	**90**	**76**

Blank cells – insufficient data for analysis.
n/a – not applicable.

Figures 8.14, 8.15 and 8.16 respectively. The compliance with the NICE recommended range of 10.5–12.5 g/dl is shown in Figure 8.17. The distribution of Hb in PD patients by centre is shown in Figure 8.18. The funnel plot for % Hb ⩾10 g/dl is shown in Figure 8.19. Figure 8.19 should be used in conjunction with Table 8.5 to identify centres.

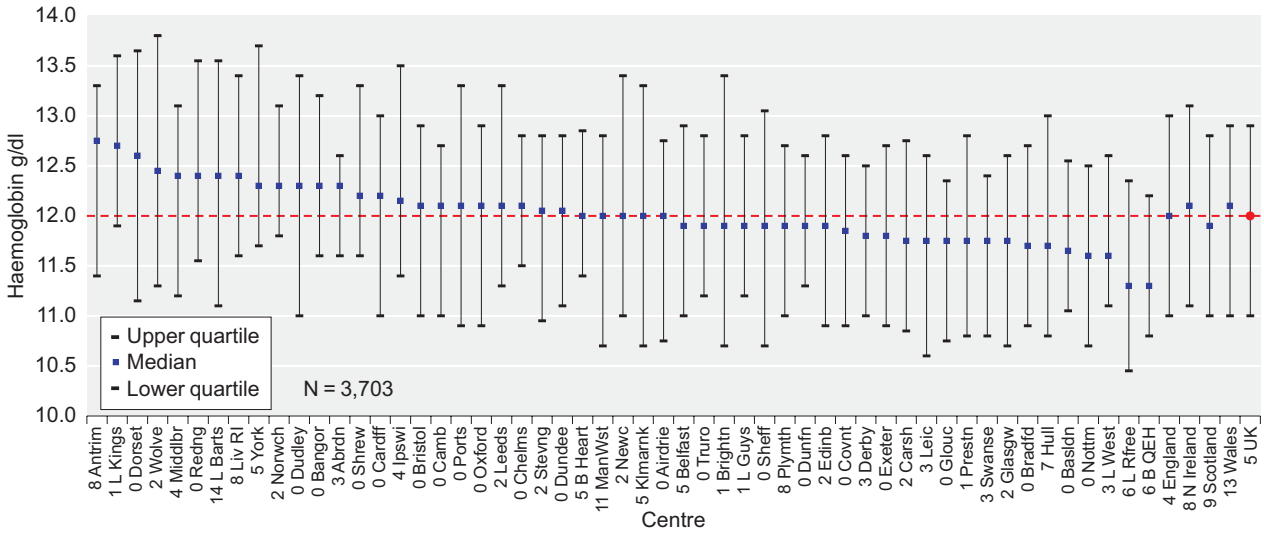

Figure 8.14: Median haemoglobin: PD

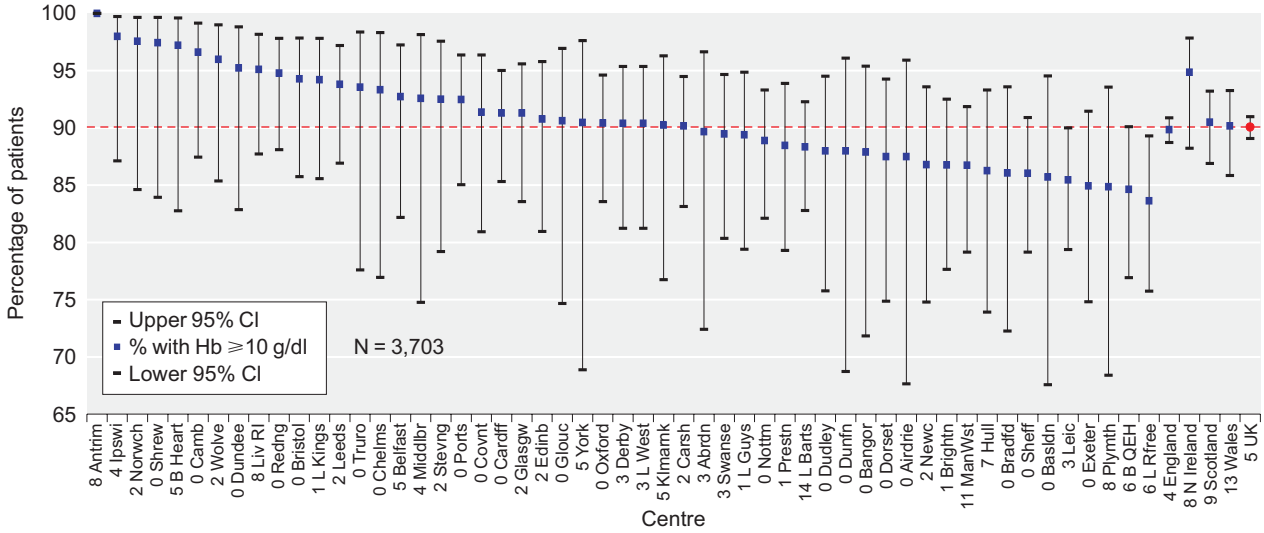

Figure 8.15: Percentage of PD patients with Hb ⩾10 g/dl

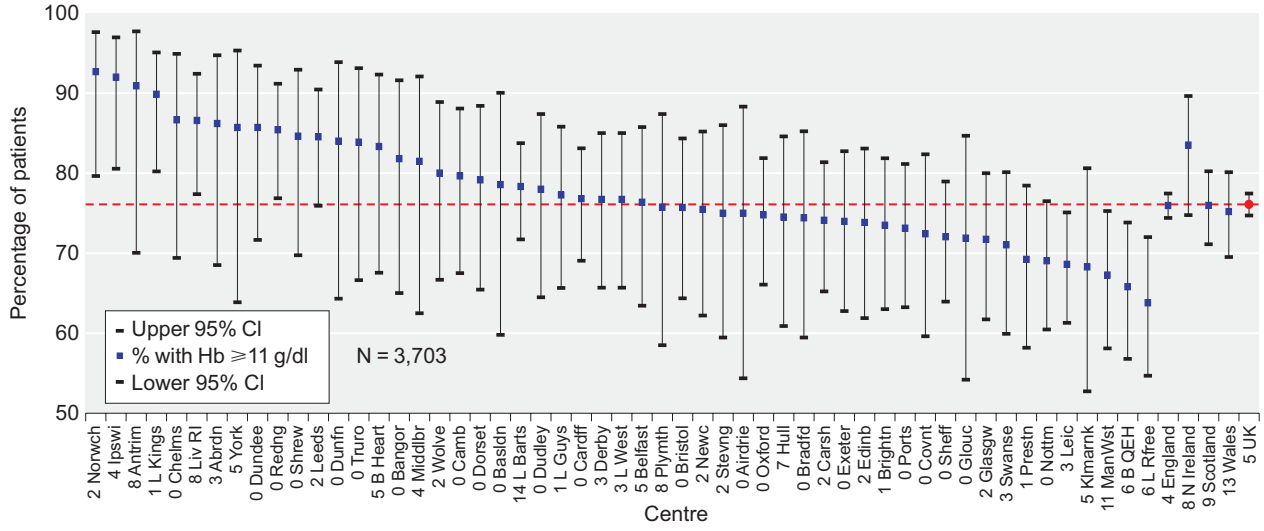

Figure 8.16: Percentage of PD patients with Hb ⩾11 g/dl

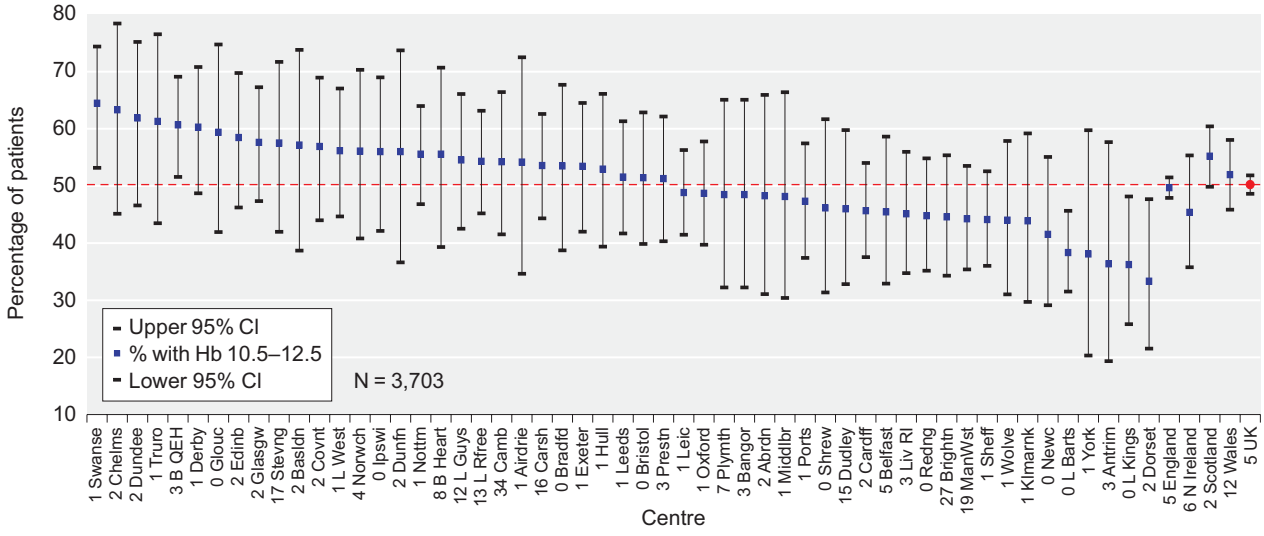

Figure 8.17: Percentage of PD patients with Hb ⩾10.5 and ⩽12.5 g/dl

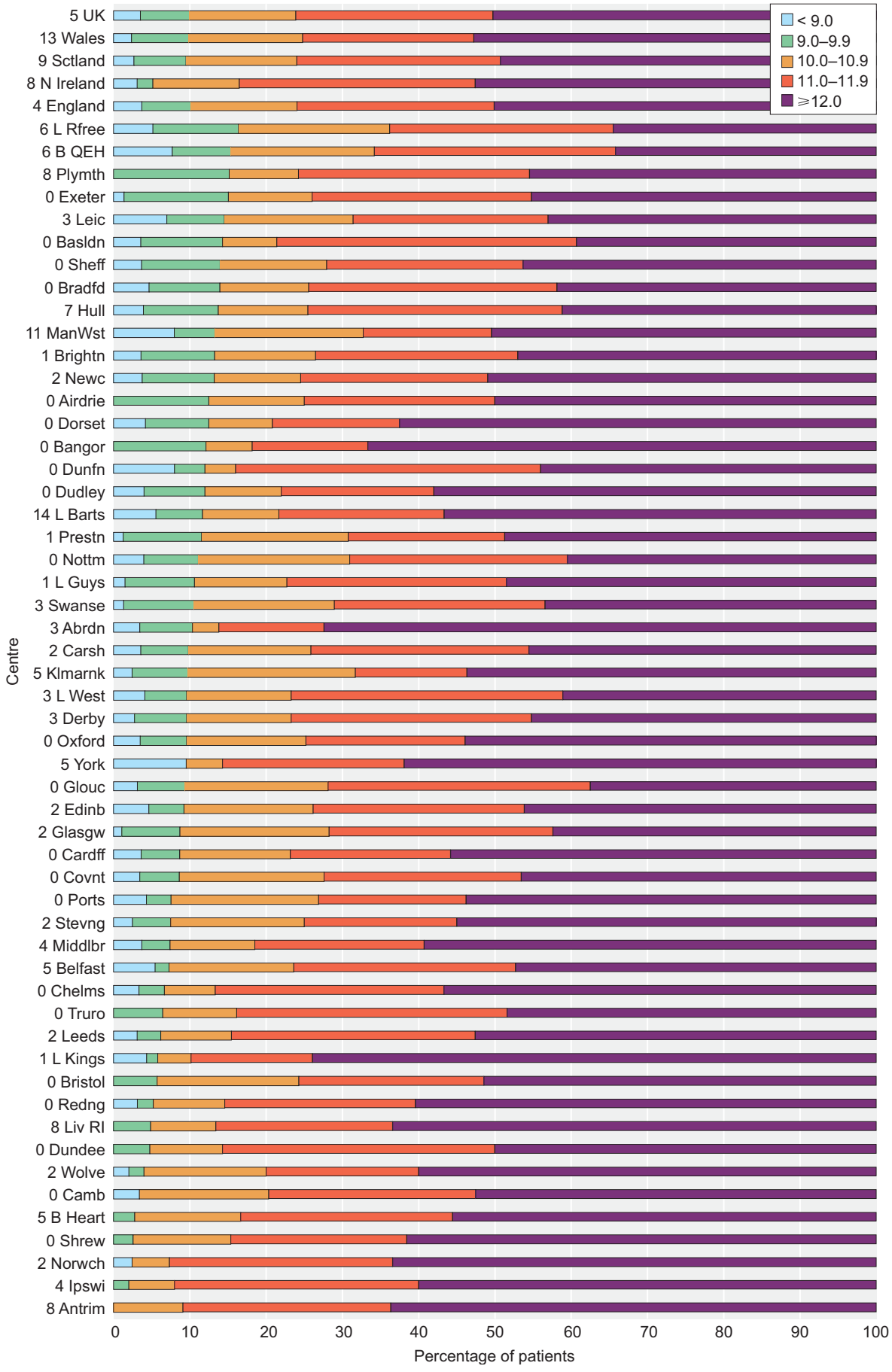

Figure 8.18: Distribution of haemoglobin in patients on PD

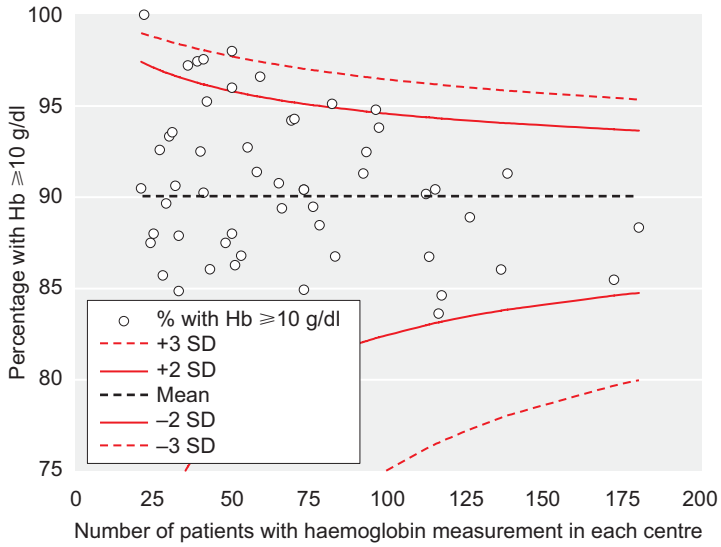

Figure 8.19: Funnel plot for percentage of PD patients with Hb ⩾10 g/dl

Table 8.5: Percentage of PD patients achieving Hb ⩾10 g/dl

Centre	No pts with Hb	% with Hb ⩾10 g/dl	Centre	No pts with Hb	% with Hb ⩾10 g/dl
York	21	90	Camb	59	97
Antrim	22	100	Edinb	65	91
Airdrie	24	88	L Guys	66	89
Dunfn	25	88	L Kings	69	94
Middlbr	27	93	Bristol	70	94
Basldn	28	86	Derby	73	90
Abrdn	29	90	Exeter	73	85
Chelms	30	93	L West	73	90
Truro	31	94	Swanse	76	89
Glouc	32	91	Prestn	78	88
Bangor	33	88	Liv RI	82	95
Plymth	33	85	Brightn	83	87
B Heart	36	97	Glasgw	92	91
Shrew	39	97	Ports	93	92
Stevng	40	93	Redng	96	95
Klmarnk	41	90	Leeds	97	94
Norwch	41	98	Carsh	112	90
Dundee	42	95	ManWst	113	87
Bradfd	43	86	Oxford	115	90
Dorset	48	88	L Rfree	116	84
Dudley	50	88	B QEH	117	85
Ipswi	50	98	Nottm	126	89
Wolve	50	96	Sheff	136	86
Hull	51	86	Cardff	138	91
Newc	53	87	Leic	172	85
Belfast	55	93	L Barts	180	88
Covnt	58	91			

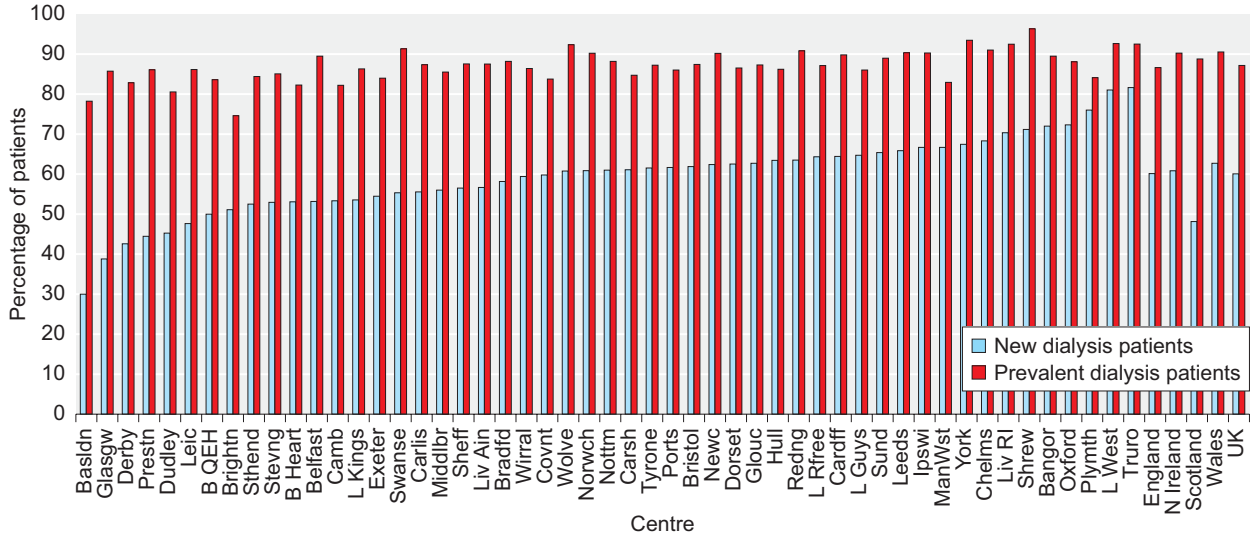

Figure 8.20: Percentage of new and prevalent dialysis patients with Hb ⩾10 g/dl

Relationship between Hb in incident and prevalent dialysis patients in 2006

The relationship between the percentage of new and prevalent dialysis (HD and PD combined) patients who have had a Hb ⩾10 g/dl is demonstrated in Figure 8.20.

Correlation between median haemoglobin and compliance with clinical guidelines

The use of Rose-Day plots has now become well established in demonstrating the relationship between the population mean (and standard deviation) and the compliance with minimum standards. The plots for Hb ⩾10 g/dl and Hb ⩾11 g/dl for HD and PD populations are given in Figures 8.21 to 8.24.

The compliance with the minimum standards over time between 1997 and 2006 are shown in Figure 8.25 for prevalent patients and in Figure 8.26 for incident and prevalent patients between 1998 and 2006.

Changes in haemoglobin by length of time on renal replacement therapy over time

The median Hb of patients treated with HD increased during the first year of treatment (Figure 8.27) but did not do so in patients

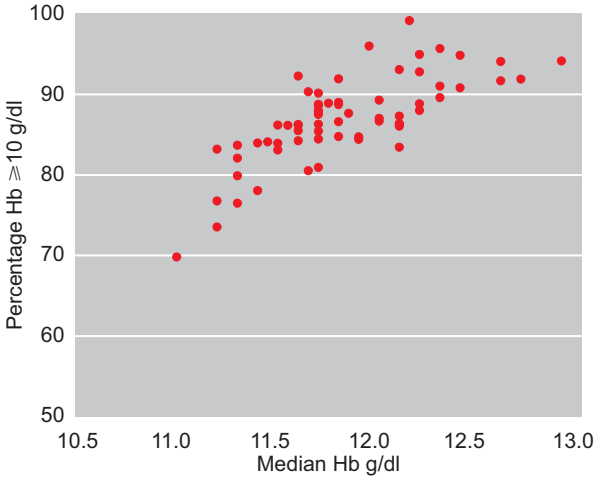

Figure 8.21: Percentage of patients with Hb ⩾10 g/dl plotted against median haemoglobin: HD

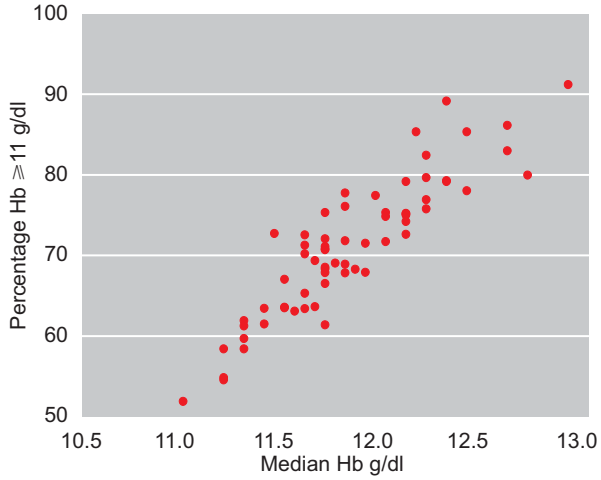

Figure 8.22: Percentage of patients with Hb ⩾11 g/dl plotted against median haemoglobin: HD

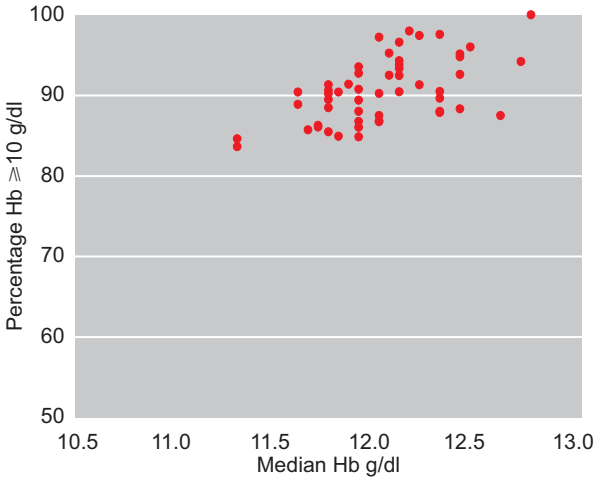

Figure 8.23: Percentage of patients with Hb ⩾10 g/dl plotted against median haemoglobin: PD

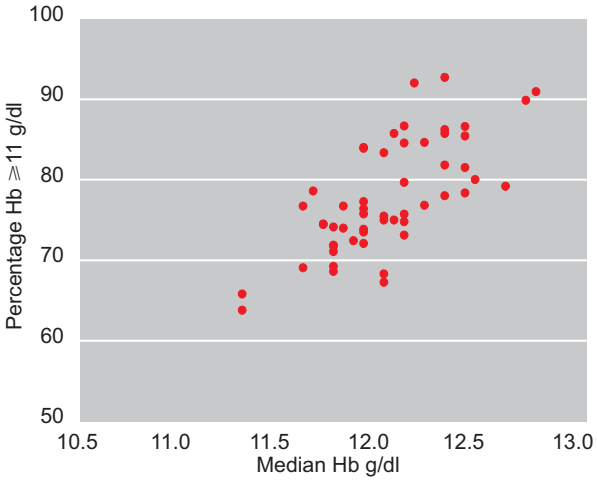

Figure 8.24: Percentage of patients with Hb ⩾11 g/dl plotted against median haemoglobin: PD

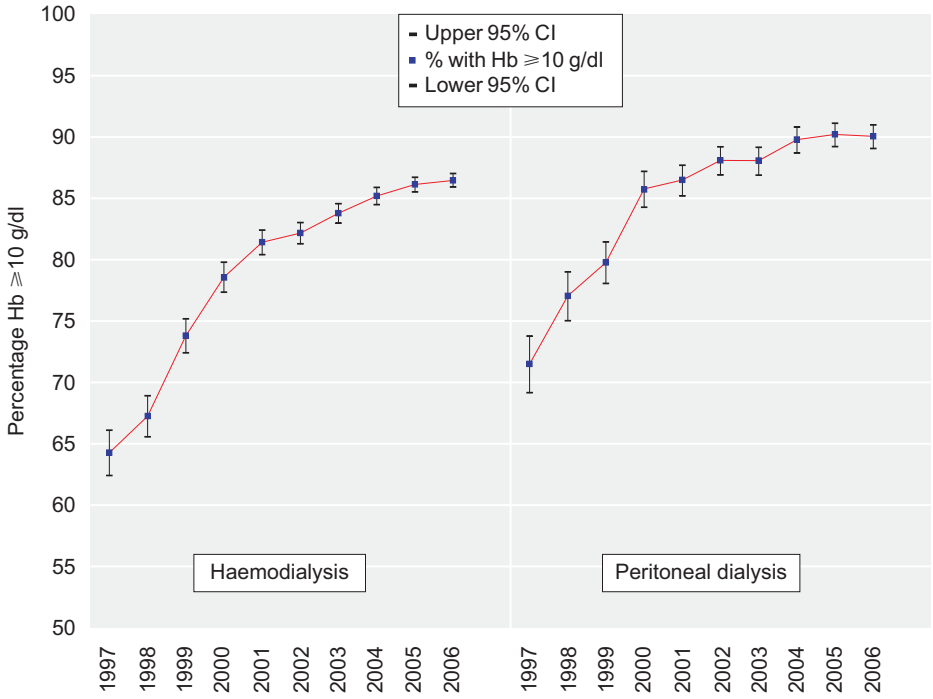

Figure 8.25: Percentage of prevalent HD and PD patients with Hb ⩾10 g/dl: 1997–2006

treated with PD (Figure 8.28). The median Hb (11.3 g/dl) of HD patients (Figure 8.27) during the 6 months after starting dialysis treatment during 2006 was higher than in previous years. By contrast Hb during the 6 months after starting treatment in PD patients (Figure 8.28) had remained stable (12.1 g/dl) for the last 6 years and was higher than in HD patients.

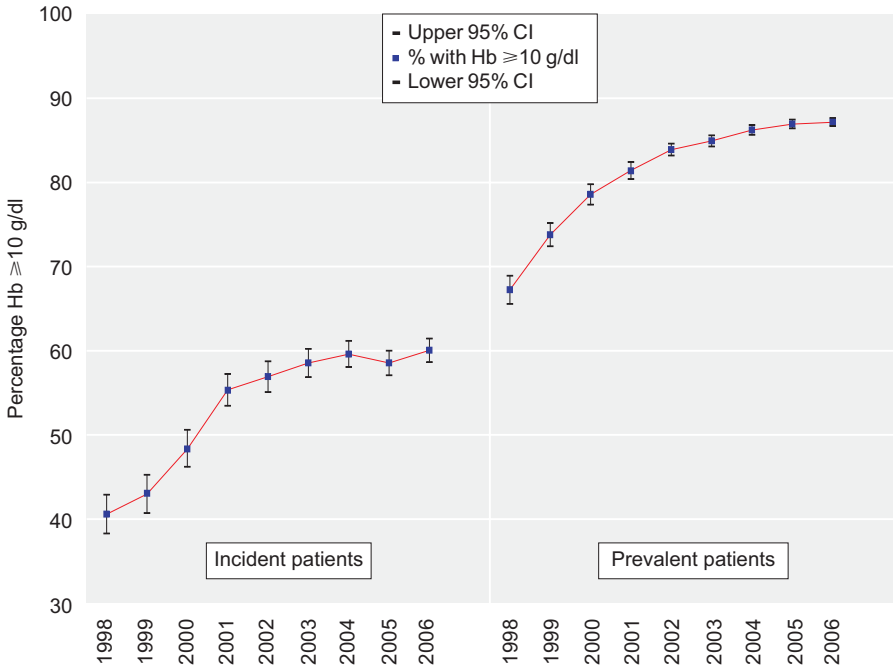

Figure 8.26: Percentage of incident and prevalent dialysis patients with Hb ⩾10 g/dl: 1998–2006

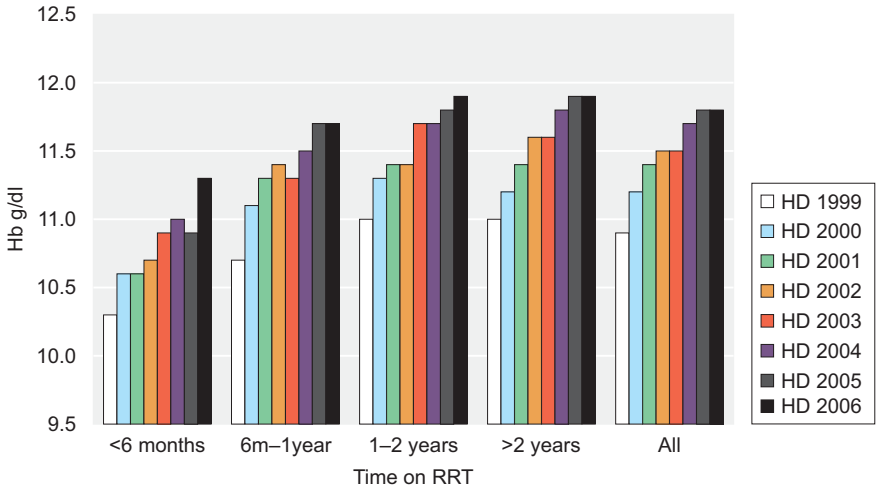

Figure 8.27: Median haemoglobin by length of time on RRT: HD

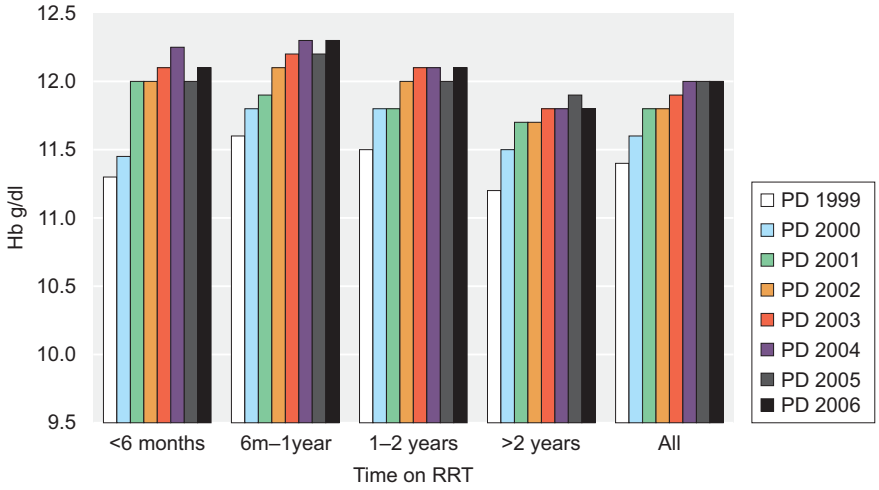

Figure 8.28: Median haemoglobin by length of time on RRT: PD

Factors affecting haemoglobin

National and international recommendations for target iron status in chronic kidney disease remained unchanged from previous reports. The 2007 Renal Association standards document (SDIV)[6], revised European Best Practice Guidelines (EBPGII)[3], Dialysis Outcomes Quality Initiatives (DOQI)[4] guidelines and UK NICE[5] anaemia guidelines all recommend:

a target serum ferritin greater than 100 μg/L and percentage transferrin saturation (TSAT) more than 20% in patients with chronic kidney disease

SDIV and EBPGII recommend:

less than 10% hypochromic red cells (HRC) (evidence level B)

in addition, EBPGII adds:

a target reticulocyte Hb content (CHr) greater than 29 pg/cell (evidence level B)

KDOQI recommends:

Ferritin >200 μg/L for HD patients

The NICE guidelines suggest:

a hypochromic red cells value >6% suggests ongoing iron deficiency (HRC)

To achieve adequate iron status across a patient population, SDIV and EBPGII advocate population target medians for ferritin of 200–500 μg/L, for TSAT of 30–40%, for hypochromic red cells of <2.5% and CHr of 35 pg/cell. EBPGII comments that: a serum ferritin target for the treatment population of 200–500 μg/L ensures that 85–90% of patients attain a serum ferritin of 100 μg/L.

All guidelines advise that:

serum ferritin levels should not exceed 800 μg/L since the risk of iron toxicity increases without conferring additional benefit. The KDOQI and NICE guidelines advise against intravenous iron administration to patients with a ferritin >500 μg/L.

Serum ferritin has several disadvantages as an index of iron status. It measures storage iron rather than available iron; behaves as an acute phase reactant and is therefore increased in inflammatory states, malignancy and liver disease; and may not accurately reflect iron stores if measured within a week of the administration of intravenous iron. Of the alternative measures of iron status available, HRC and CHr are generally considered superior to TSAT. Both however require specialised analysers to which few UK renal centres have easy access. Since TSAT is measured infrequently in many centres and most UK centres continue to use serum ferritin for routine iron management, ferritin remains the chosen index of iron status for this report.

Serum ferritin

Completeness of serum ferritin returns for HD and PD

The completeness of serum ferritin returns to the Registry is shown in Table 8.6. Not all sites used serum ferritin as the sole indicator of iron status. Completeness of data for serum ferritin returned from England and Wales improved again compared with last year's report. For Scotland, lack of an automated biochemistry link into the IT renal system is thought to account for a very low rate of return. A '0%' compliance for ferritin data in Scotland persists. In other cases of missing data, renal centres may need to address organisational processes in addition to dealing with automatic download facilities to ensure that serum ferritin is checked.

Serum ferritin in prevalent dialysis patients

Percentage returns, serum ferritin concentrations and interquartile ranges are presented in Tables 8.7 and 8.8 for HD and PD respectively. The percentage of patients with a ferritin ⩾800 μg/L by centre for HD and PD patients is shown in Table 8.9.

The median and IQR for serum ferritin for HD and PD patients, by centre is given in Figures 8.29 and 8.30 respectively. The percentage of patients with a serum ferritin ⩾100 μg/L, ⩾200 μg/L and ⩾800 μg/L are shown in Figures 8.31, 8.32 and 8.33 for HD and Figures 8.34, 8.35 and 8.36 for PD respectively.

Table 8.6: Completeness of serum ferritin returns

Centre	HD %	PD %	Centre	HD %	PD %
Abrdn	1	0	L Kings	100	100
Airdrie	0	0	L Rfree	86	98
Antrim	97	100	L West	100	96
B Heart	92	95	Leeds	99	98
B QEH	97	92	Leic	87	93
Bangor	97	97	Liv Ain	91	n/a
Basldn	99	100	Liv RI	95	98
Belfast	94	95	ManWst	57	88
Bradfd	99	100	Middlbr	96	89
Brightn	63	92	Newc	100	100
Bristol	100	100	Newry	99	86
Camb	77	100	Norwch	97	98
Cardff	96	98	Nottm	99	100
Carlis	95	100	Oxford	97	98
Carsh	84	96	Plymth	97	92
Chelms	99	97	Ports	97	88
Chestr	7	n/a	Prestn	100	100
Clwyd	92	88	Redng	94	88
Covnt	97	97	Sheff	99	100
D&Gall	0	0	Shrew	98	97
Derby	90	61	Stevng	100	88
Derry	100	n/a	Sthend	98	94
Dorset	100	98	Sund	97	100
Dudley	74	96	Swanse	99	97
Dundee	0	0	Truro	98	100
Dunfn	1	0	Tyrone	51	100
Edinb	0	0	Ulster	100	100
Exeter	98	100	Wirral	95	55
Glasgw	0	0	Wolve	99	100
Glouc	99	97	Wrexm	2	0
Hull	99	87	York	99	100
Inverns	0	0	**England**	**93**	**92**
Ipswi	99	88	**N Ireland**	**90**	**95**
Klmarnk	0	0	**Scotland**	**0**	**0**
L Barts	94	51	**Wales**	**88**	**86**
L Guys	90	99	**UK**	**84**	**83**

n/a – not applicable.

Table 8.7: Serum ferritin in HD patients

Centre	% data return	Median ferritin	90% range	Inter-quartile range	% ferritin ⩾100 µg/L
Antrim	97	465	119–976	297–606	97.4
B Heart	92	195	23–524	107–303	77.5
B QEH	97	349	156–687	266–437	97.9
Bangor	97	445	142–976	288–568	100.0
Basldn	99	298	71–480	195–375	89.2
Belfast	94	516	170–1,061	335–723	99.1
Bradfd	99	491	159–888	350–655	97.2
Brightn	63	384	140–1,137	267–565	96.2
Bristol	100	417	103–852	286–557	95.2
Camb	77	335	60–720	229–489	92.9
Cardff	96	473	142–1,166	321–675	97.0

Table 8.7: (continued)

Centre	% data return	Median ferritin	90% range	Inter-quartile range	% ferritin ⩾100 µg/L
Carlis	95	370	186–773	308–497	98.7
Carsh	84	339	58–870	236–466	91.8
Chelms	99	575	315–1,078	452–791	100.0
Chestr	7				
Clwyd	92	363	162–686	266–464	100.0
Covnt	97	294	72–977	192–470	91.6
Derby	90	288	70–914	178–475	89.5
Derry	100	591	43–1,270	381–925	91.3
Dorset	100	413	96–844	293–570	93.9
Dudley	74	327	61–845	155–458	80.2
Exeter	98	280	98–591	199–384	94.3
Glouc	99	363	51–914	222–595	89.8
Hull	99	384	148–786	281–505	98.2
Ipswi	99	420	66–1,136	218–608	91.4
L Barts	94	408	137–904	275–552	97.2
L Guys	90	409	98–892	254–567	94.9
L Kings	100	452	141–1,180	295–662	95.8
L Rfree	86	379	63–1,203	200–582	90.2
L West	100	555	241–1,267	389–780	98.1
Leeds	99	500	145–873	379–626	97.0
Leic	87	321	63–1,019	193–493	89.4
Liv Ain	91	441	85–1,230	193–725	94.0
Liv RI	95	581	117–1,619	335–934	95.8
ManWst	57	610	174–1,769	411–947	96.1
Middlbr	96	336	58–1,308	183–695	87.6
Newc	100	469	200–989	326–639	98.2
Newry	99	450	166–1,182	292–618	100.0
Norwch	97	573	169–1,139	381–750	98.1
Nottm	99	554	277–1,009	448–664	99.0
Oxford	97	288	83–692	204–406	92.8
Plymth	97	449	129–1,255	284–630	96.8
Ports	97	252	70–742	169–368	90.3
Prestn	100	724	177–1,821	471–976	96.6
Redng	94	553	221–1,247	435–691	99.0
Sheff	99	465	101–1,017	302–632	95.3
Shrew	98	210	63–628	133–334	83.6
Stevng	100	403	119–848	257–563	96.9
Sthend	98	298	77–797	238–388	92.9
Sund	97	520	258–1,032	380–667	99.3
Swanse	99	391	112–825	259–563	97.2
Truro	98	440	187–733	333–563	97.9
Tyrone	51	570	164–1,440	301–819	97.6
Ulster	100	457	204–1,124	311–651	100.0
Wirral	95	644	348–1,683	501–835	100.0
Wolve	99	493	189–964	389–617	98.6
Wrexm	2				
York	99	603	326–965	486–706	98.0
England	**93**	**415**	**96–1,069**	**265–601**	**94.6**
N Ireland	**90**	**493**	**155–1,154**	**317–684**	**98.5**
Wales	**88**	**434**	**129–976**	**298–608**	**97.5**
Eng, NI & Wales	**84**	**418**	**99–1,070**	**268–605**	**94.9**

Blank cells – insufficient data for analysis.

Table 8.8: Serum ferritin in PD patients

Centre	% data return	Median ferritin	90% range	Inter-quartile range	% ferritin ⩾100 µg/L
Antrim	100	183	18–498	136–376	83.3
B Heart	95	198	27–1,567	87–352	72.2
B QEH	92	199	31–676	106–339	79.8
Bangor	97	399	45–1,140	270–569	90.6
Basldn	100	192	49–600	123–325	82.1
Belfast	95	254	46–1,218	125–536	78.2
Bradfd	100	331	53–776	139–504	81.4
Brightn	92	349	65–1,449	205–535	89.6
Bristol	100	237	56–675	124–385	80.0
Camb	100	220	47–699	146–350	89.8
Cardff	98	215	48–824	146–373	88.9
Carlis	100				
Carsh	96	169	33–590	85–279	72.7
Chelms	97	241	67–725	169–527	82.8
Chestr	n/a	n/a	n/a	n/a	n/a
Clwyd	88				
Covnt	97	217	53–1,171	134–371	80.4
Derby	61	274	56–726	203–423	89.1
Derry	n/a	n/a	n/a	n/a	n/a
Dorset	98	248	42–579	206–378	87.2
Dudley	96	184	28–675	126–367	81.3
Exeter	100	172	54–352	115–241	80.8
Glouc	97	217	40–763	141–303	83.9
Hull	87	301	45–732	212–423	93.8
Ipswi	88	229	43–687	86–379	73.9
L Barts	51	282	84–1,194	182–467	90.7
L Guys	99	224	72–791	157–317	86.4
L Kings	100	192	59–548	128–327	81.4
L Rfree	98	313	36–987	188–520	90.0
L West	96	240	107–981	179–378	95.8
Leeds	98	282	47–717	161–439	88.7
Leic	93	244	39–933	143–431	84.2
Liv Ain	n/a	n/a	n/a	n/a	n/a
Liv RI	98	235	68–888	162–428	92.0
ManWst	88	270	44–917	155–443	84.8
Middlbr	89	284	90–827	136–451	88.0
Newc	100	300	62–1,123	179–433	87.0
Newry	86				
Norwch	98	526	118–993	359–768	95.1
Nottm	100	299	88–749	214–460	94.4
Oxford	98	181	34–895	104–345	75.2
Plymth	92	261	25–1,567	140–473	84.9
Ports	88	224	43–606	123–351	81.7
Prestn	100	234	36–941	111–382	76.0
Redng	88	449	66–972	285–624	94.1
Sheff	100	274	49–706	182–422	88.2
Shrew	97	266	45–741	120–400	86.8
Stevng	88	151	44–765	109–224	80.6
Sthend	94				
Sund	100				
Swanse	97	248	35–707	156–438	85.5
Truro	100	196	115–556	135–308	96.8

Table 8.8: (continued)

Centre	% data return	Median ferritin	90% range	Inter-quartile range	% ferritin ⩾100 µg/L
Tyrone	100				
Ulster	100				
Wirral	55				
Wolve	100	213	42–756	103–383	78.4
Wrexm	0				
York	100	322	87–1,071	190–411	86.4
England	**92**	**251**	**49–834**	**145–424**	**85.4**
N Ireland	**95**	**245**	**46–965**	**133–455**	**82.0**
Wales	**86**	**241**	**45–755**	**153–419**	**86.8**
Eng, NI & Wales	**83**	**250**	**48–834**	**145–424**	**85.4**

Blank cells – insufficient data for analysis.
n/a – not applicable.

Table 8.9: Percentage of patients with serum ferritin ⩾800 µg/L

	HD		PD	
Centre	% ferritin ⩾800 µg/L	95% CI	% ferritin ⩾800 µg/L	95% CI
Antrim	11.2	6.6–18.4	0.0	n/a
B Heart	1.0	0.3–3.0	5.6	1.4–19.7
B QEH	2.6	1.6–4.1	3.5	1.3–9.0
Bangor	12.9	6.6–23.7	6.3	1.6–21.8
Basldn	0.8	0.1–5.7	3.6	0.5–21.4
Belfast	17.1	12.8–22.6	12.7	6.2–24.4
Bradfd	11.3	7.0–17.6	4.7	1.2–16.8
Brightn	8.2	5.0–13.1	10.4	5.3–19.4
Bristol	7.2	5.1–10.2	1.4	0.2–9.5
Camb	3.3	1.7–6.5	1.7	0.2–11.1
Cardff	15.4	12.2–19.3	5.9	3.0–11.4
Carlis	3.9	1.3–11.4		
Carsh	6.9	4.7–9.9	0.9	0.1–6.2
Chelms	22.0	14.3–32.2	3.5	0.5–20.8
Chestr			n/a	n/a
Clwyd	0.0	n/a		
Covnt	7.7	5.0–11.6	3.6	0.9–13.2
Derby	7.0	4.0–11.9	2.2	0.3–13.9
Derry	34.8	18.4–55.7	n/a	n/a
Dorset	6.8	3.6–12.6	2.1	0.3–13.6
Dudley	5.8	2.4–13.2	4.2	1.0–15.2
Exeter	3.3	1.7–6.4	0.0	n/a
Glouc	10.2	6.3–16.2	0.0	n/a
Hull	4.4	2.5–7.6	2.1	0.3–13.4
Ipswi	10.8	5.9–18.8	0.0	n/a
L Barts	6.6	4.6–9.2	5.6	2.5–11.8
L Guys	9.4	6.8–12.8	3.0	0.8–11.3
L Kings	14.6	11.0–19.2	1.4	0.2–9.5
L Rfree	12.9	10.1–16.3	10.0	5.8–16.8
L West	22.6	20.1–25.2	8.3	3.8–17.3
Leeds	8.2	6.1–11.1	2.1	0.5–7.9

Table 8.9: (continued)

Centre	HD		PD	
	% ferritin ⩾800 µg/L	95% CI	% ferritin ⩾800 µg/L	95% CI
Leic	9.6	7.3–12.5	6.1	3.3–10.9
Liv Ain	16.9	10.3–26.5	n/a	n/a
Liv RI	32.2	27.6–37.2	5.8	2.4–13.1
ManWst	33.6	26.5–41.4	5.4	2.4–11.4
Middlbr	20.5	15.8–26.2	8.0	2.0–26.9
Newc	11.3	7.7–16.1	5.6	1.8–15.9
Newry	17.5	10.7–27.4		
Norwch	19.0	14.2–25.0	24.4	13.7–39.7
Nottm	14.8	11.2–19.2	4.8	2.2–10.2
Oxford	3.6	2.1–6.2	6.2	3.0–12.4
Plymth	17.1	11.4–24.8	12.1	4.6–28.2
Ports	4.2	2.5–7.0	4.9	1.8–12.3
Prestn	42.0	36.8–47.5	8.9	4.3–17.4
Redng	14.7	10.4–20.3	10.7	5.7–19.3
Sheff	11.4	8.9–14.3	3.7	1.5–8.5
Shrew	3.3	1.2–8.4	2.6	0.4–16.5
Stevng	8.0	5.5–11.5	2.8	0.4–17.3
Sthend	3.6	1.4–9.1		
Sund	15.1	10.1–22.1		
Swanse	5.7	3.4–9.3	2.6	0.7–9.9
Truro	3.6	1.5–8.2	0.0	n/a
Tyrone	28.6	17.0–43.9		
Ulster	13.6	6.3–27.2		
Wirral	28.4	20.8–37.6		
Wolve	10.9	7.7–15.1	3.9	1.0–14.4
Wrexm				
York	13.9	8.4–22.1	9.1	2.3–30.0
England	**11.9**	**11.3–12.5**	**5.3**	**4.5–6.2**
N Ireland	**17.3**	**14.3–20.7**	**8.0**	**4.1–15.2**
Wales	**10.9**	**8.9–13.3**	**4.8**	**2.8–8.3**
Eng, NI & Wales	**12.0**	**11.5–12.6**	**5.4**	**4.6–6.2**

Blank cells – insufficient data for analysis.
n/a – not applicable.

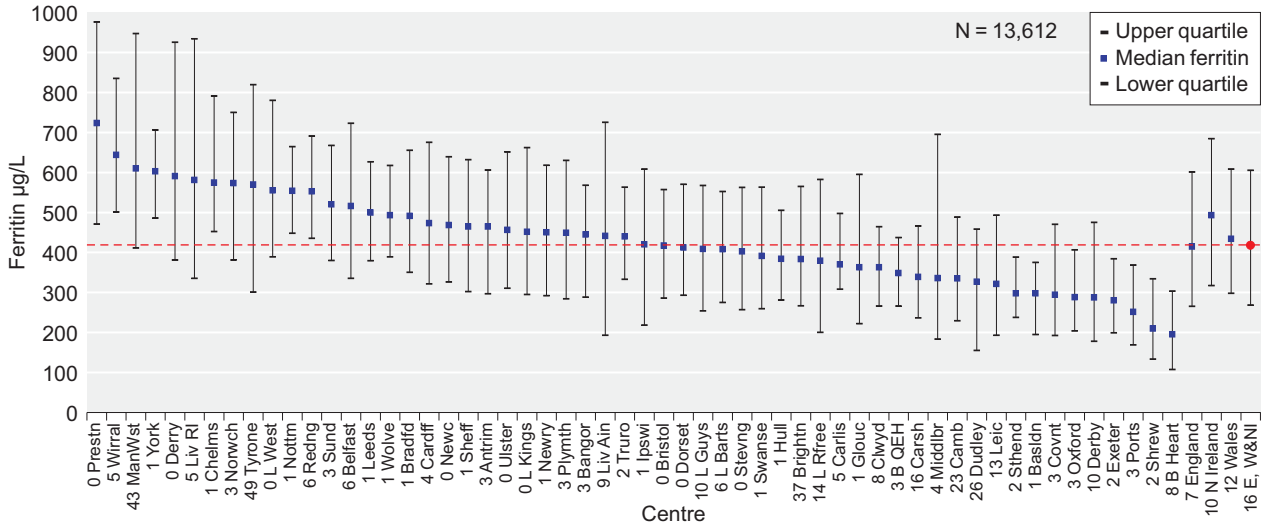

Figure 8.29: Median serum ferritin: HD

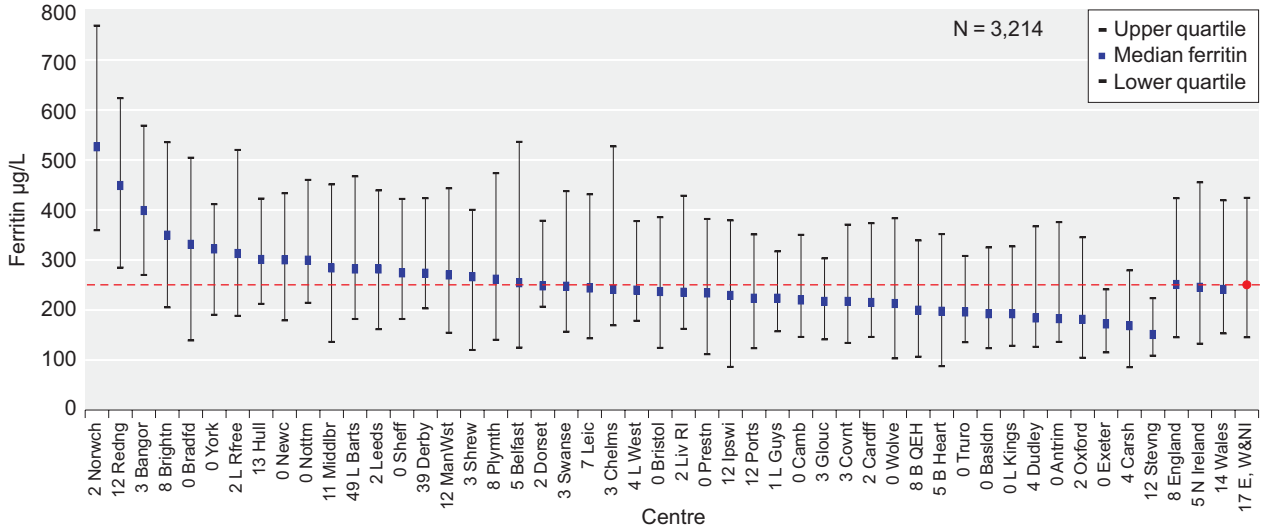

Figure 8.30: Median serum ferritin: PD

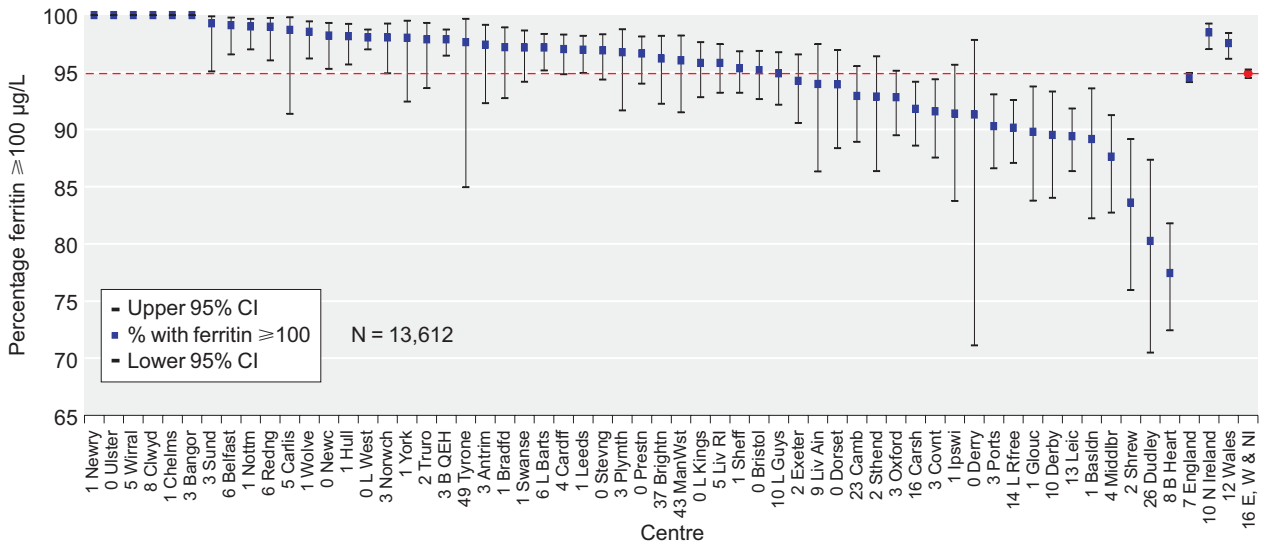

Figure 8.31: Percentage of HD patients with serum ferritin ⩾100 µg/L

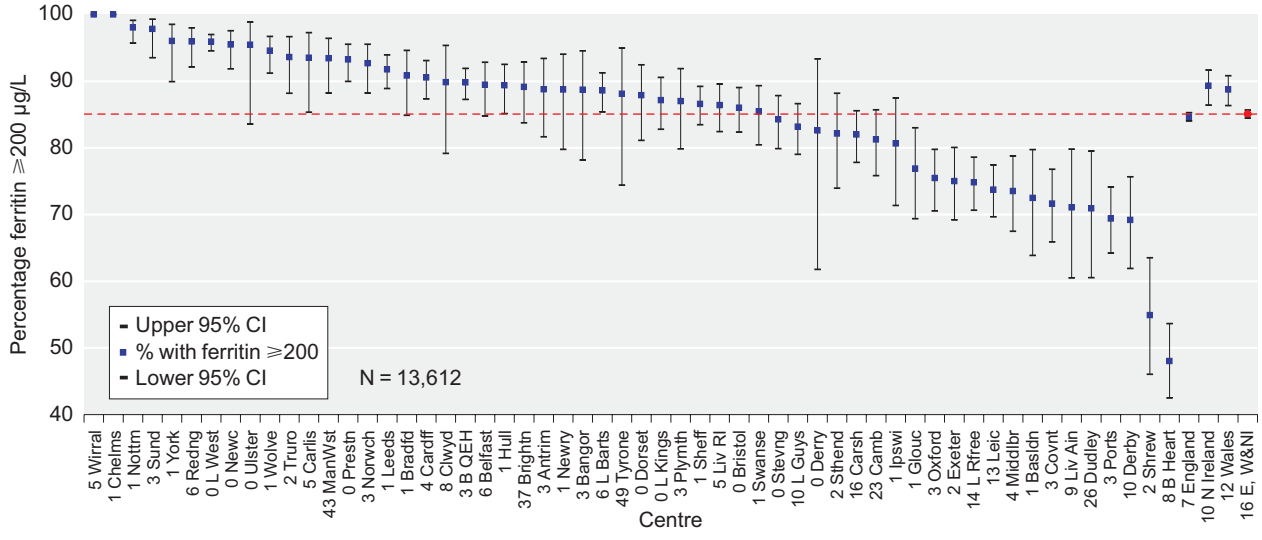

Figure 8.32: Percentage of HD patients with serum ferritin ⩾200 µg/L

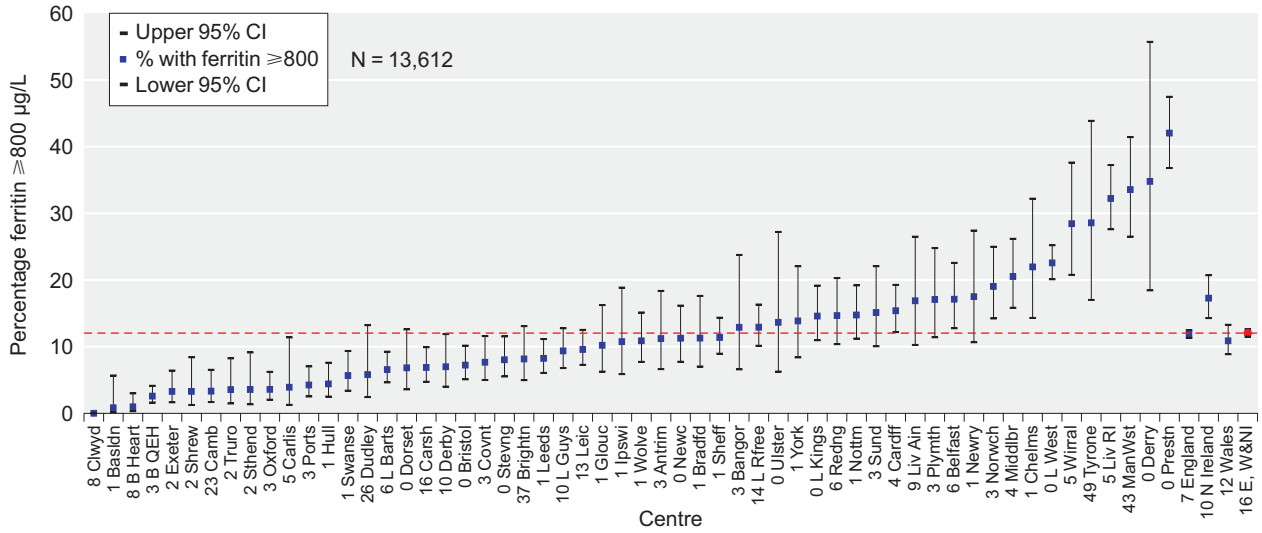

Figure 8.33: Percentage of HD patients with serum ferritin ⩾800 µg/L

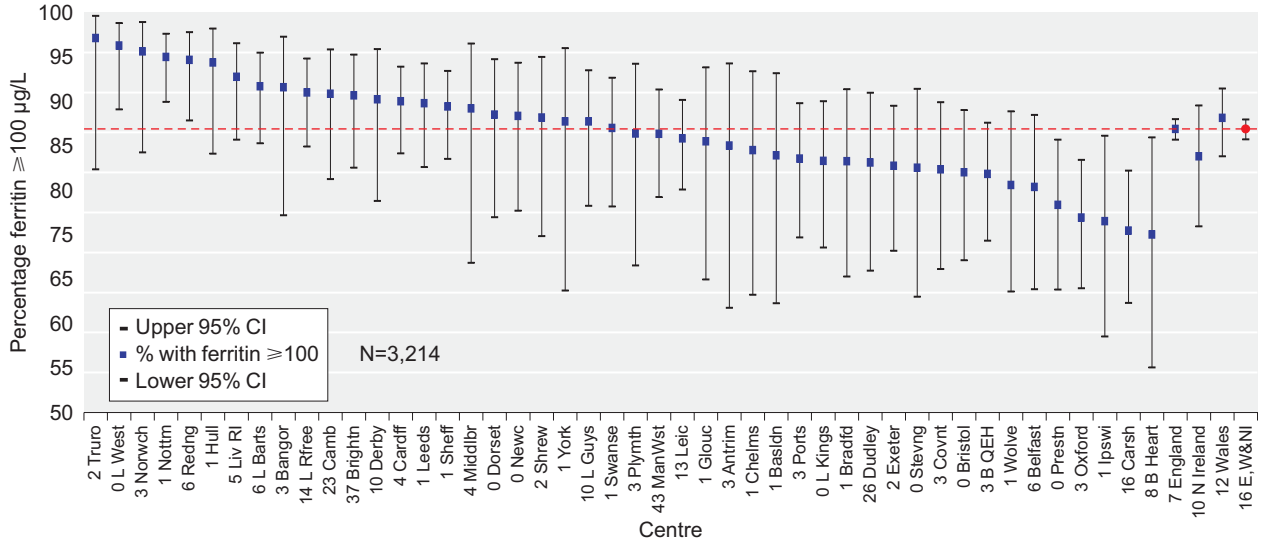

Figure 8.34: Percentage of PD patients with serum ferritin ⩾100 µg/L

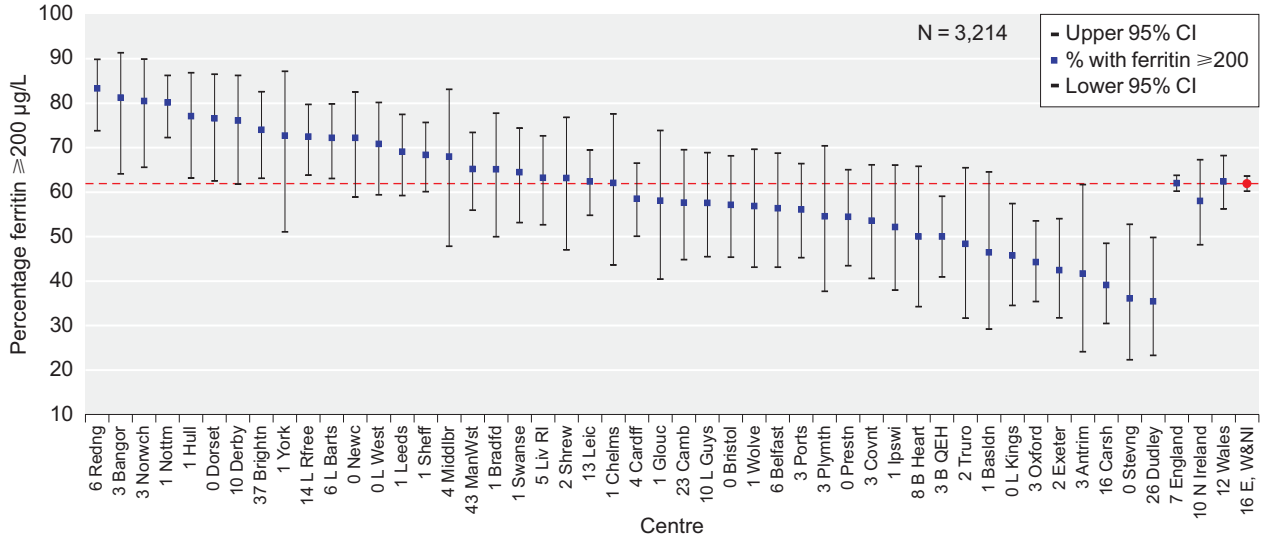

Figure 8.35: Percentage of PD patients with serum ferritin ⩾200 µg/L

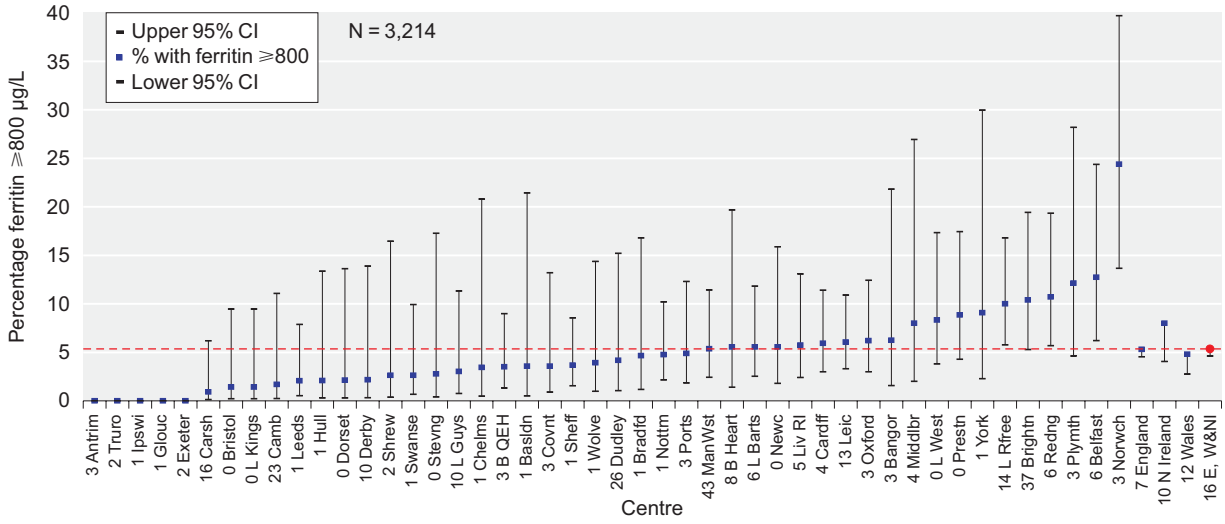

Figure 8.36: Percentage of PD patients with serum ferritin ⩾800 µg/L

All centres achieved greater than 75% compliance with a serum ferritin over 100 µg/L for HD. The PD population had a lower median ferritin value (250 µg/L, IQR 145–424) vs HD (418 µg/L, IQR 268–605) but all centres had median values for PD greater than 100 µg/L and 43/46 centres had a 25th centile for ferritin greater than 100 µg/L.

Changes in serum ferritin 1999–2006

During the last 4 years compliance with guidelines for serum ferritin ⩾100 µg/L has been stable at ~95% and ~85% for HD and PD patients respectively. The serial values are shown in Figure 8.37. The difference between compliance in HD and PD patients probably reflects the higher Hb outcomes for PD patients with lower ESA requirements which resulted in a lower requirement to supplement with intravenous iron. The median serum ferritin outcome over time is shown in Figure 8.38.

Serum ferritin and length of time on renal replacement therapy

The median ferritin outcome achieved appeared to increase and then plateau early for HD patients whereas there was a slower increase over time for PD patients. It would appear

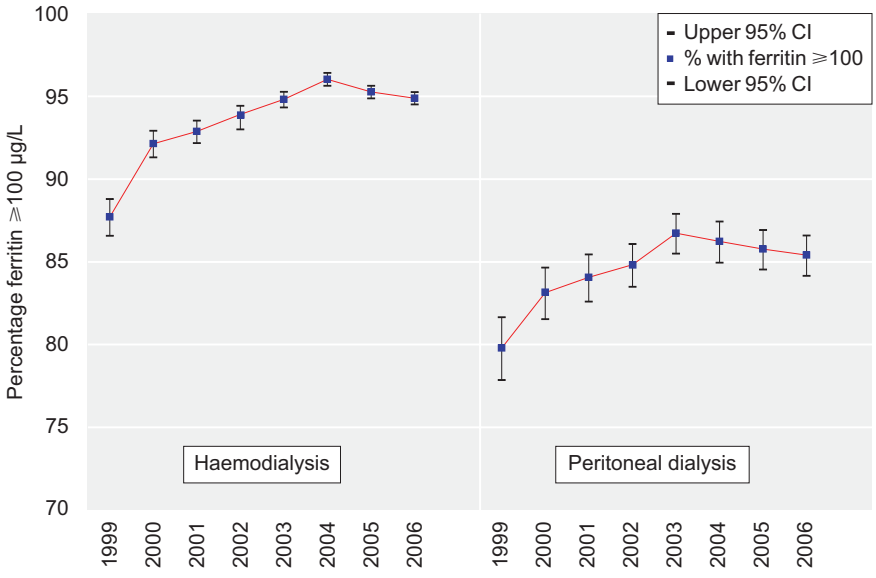

Figure 8.37: Change in achievement of serum ferritin ⩾100 µg/L: 1999–2006

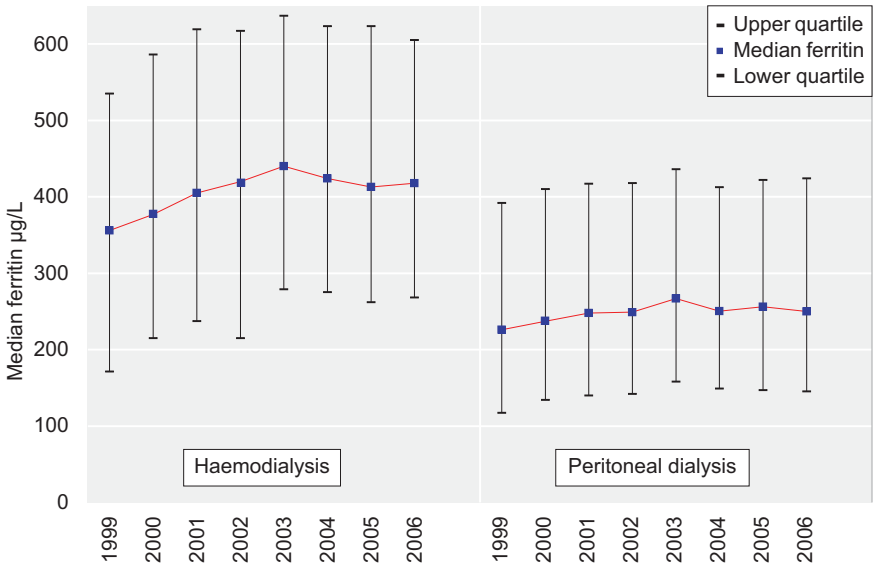

Figure 8.38: Change in median serum ferritin: 1999–2006

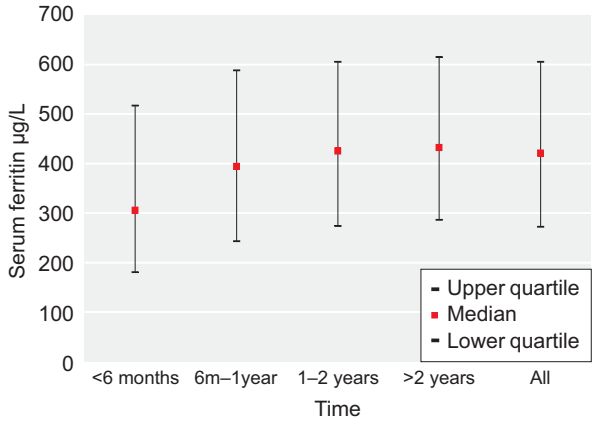

Figure 8.39: Median serum ferritin by length of time on RRT: HD

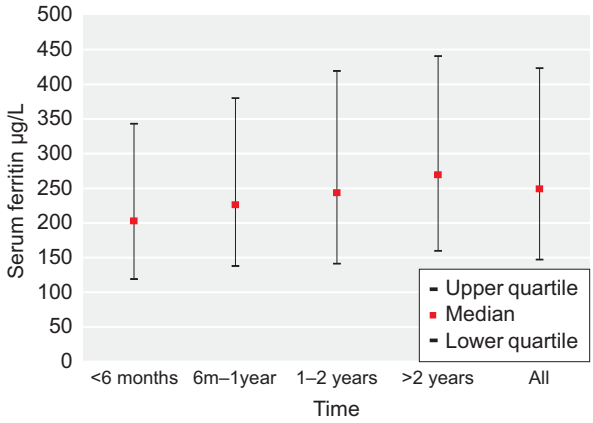

Figure 8.40: Median serum ferritin by length of time on RRT: PD

there was a tendency to supplement PD patients with iron later in their dialysis careers. Outcomes by length of time on dialysis for HD and PD patients are shown in Figures 8.39 and 8.40 respectively.

Erythropoiesis stimulating agents

Data regarding ESAs were collected from all centres. Centres were excluded if fewer than 90% of patients were on the ESA file. Centres with fewer than 80% of HD patients or fewer than 65% of PD patients on ESAs were considered to have incomplete data and were also excluded from further analysis.

Work continues to establish more comprehensive ESA returns. Data are presented as total weekly erythropoietin dose. Doses of darbepoietin were harmonised with erythropoietin data by multiplying by 200 and correcting for any frequency of administration less than weekly. No adjustments were made with regard to route of administration.

In a similar way to the rest of the Registry data the ESA data was collected from renal IT systems, although as previously, in contrast to the automated laboratory links, this relied on manual data entry. The reliability of these data depended on who was entering the data (doctor, ESA nurse or data clerk), whether the renal

centre was prescribing the ESA directly (within the renal centre budget) or whether ESAs were prescribed by the GP (i.e. from the PCT budget). In the latter case, the data in the renal IT system may not always have been updated with that from the GP letter or the GP may decline to prescribe ESAs at the higher dose advised by the nephrologist.

Patients treated and dose variation – ESA prescription and modality

ESA data including percentage treated and dose for HD patients are shown in Table 8.10. Equivalent data for PD patients are shown in Table 8.11.

Table 8.10: ESA prescribing in HD patients

Centre	% on ESA	Mean weekly dose for pts on ESA	Median weekly dose for pts on ESA	% with Hb <10 g/dl for pts on ESA	% with Hb ⩾10 g/dl and not on ESA
Antrim	96	8,868	8,000	100	4
B Heart	89	10,177	9,000	93	8
Bangor	92	9,322	6,000	83	5
Basldn	94	9,588	8,500	100	5
Belfast	92	7,752	6,000	100	5
Bradfd	96	6,410	6,000	100	4
Bristol	94	10,123	8,000	96	6
Chelms	98	10,370	8,000	100	2
Derry	100	6,174	6,000	100	0
Dorset	96	12,921	12,000	89	2
Dudley	85	7,186	6,000	70	11
Exeter	92	8,581	6,000	98	7
Glouc	96	11,007	9,000	100	4
Ipswi	95	10,765	9,000	100	5
Leeds	93	7,499	6,000	100	6
Leic	93	9,060	8,000	99	6
Liv Ain	89	8,048	6,000	91	7
Liv RI	94	9,058	8,000	87	4
Middlbr	88	7,208	6,000	92	10
Newry	96	8,159	6,000	100	4
Norwch	95	9,455	8,000	96	1
Oxford	91	10,150	8,000	88	7
Plymth	92	9,887	9,000	100	5
Redng	90			96	10
Sheff	92	11,277	10,000	97	8
Shrew	95	10,132	8,000	100	5
Sthend	96	9,761	8,000	100	4
Sund	91	8,058	6,000	100	7
Swanse	89	9,063	8,000	85	9
Truro	97	7,022	4,000	100	1
Tyrone	94	9,052	8,000	100	4
Ulster	100	8,795	7,000	100	0
Wolve	94	9,593	8,000	100	6
York	97	7,879	6,000	100	3
England	**93**	**9,334**	**8,000**	**95**	**6**
N Ireland	**95**	**8,234**	**6,000**	**100**	**4**
Wales	**90**	**9,117**	**8,000**	**85**	**8**
Eng, NI & Wales	**93**	**9,223**	**8,000**	**95**	**6**

Blank cells – insufficient data for analysis.

Table 8.11: ESA prescribing in PD patients

Centre	% on ESA	Mean weekly dose for pts on ESA	Median weekly dose for pts on ESA	% with Hb <10 g/dl for pts on ESA	% with Hb ⩾10 g/dl and not on ESA
Antrim	83	3,788	3,000		18
B Heart	71	5,778	6,000	100	25
Bangor	79	5,923	6,000	100	21
Belfast	69	4,231	4,000	100	29
Bradfd	77	5,917	4,500	100	23
Bristol	77	5,148	4,000	100	23
Camb	80	6,289	5,000	100	20
Cardff	86			100	14
Carlis	70	8,000	8,000	100	30
Chelms	87	5,715	5,500	100	13
Clwyd	75	7,000	5,000	100	14
Dorset	83	5,763	4,500	83	15
Dudley	88	5,747	5,500	100	12
Exeter	82	4,982	4,000	100	18
Glouc	78	7,740	4,000	100	22
Ipswi	80	5,502	4,000	100	20
Leeds	70	5,970	4,000	83	28
Leic	73	5,210	4,000	96	26
Liv RI	89	5,537	4,000	100	9
Middlbr	68	5,526	4,000	100	30
Norwch	69	4,316	3,000	100	29
Oxford	94	6,172	6,000	91	5
Plymth	86	5,484	4,000	100	15
Sheff	77	8,943	6,000	100	23
Shrew	82	7,690	8,000	100	18
Sthend	69	6,545	8,000	100	27
Sund	71	4,000	2,000	100	29
Swanse	78	7,967	6,000	88	18
Truro	94	4,094	4,000	100	6
Tyrone	71	2,600	2,000		33
Ulster	100	6,500	6,500		0
Wolve	69	5,514	4,000	100	32
York	82	4,667	4,000	100	14
England	**79**	**5,969**	**4,000**	**97**	**20**
N Ireland	**74**	**4,042**	**3,000**	**100**	**26**
Wales	**82**	**7,333**	**6,000**	**96**	**16**
Eng, NI & Wales	**79**	**5,969**	**4,000**	**97**	**20**

Blank cells – insufficient data for analysis.

Age and ESA provision

Patients on PD continued to maintain Hb without recourse to ESA to a greater degree than HD patients (Figure 8.41).

The percentage of dialysis patients receiving ESA by age and modality is given in Figure 8.42.

Figure 8.43 gives data on the percentage of patients who were anaemic with Hb <10.0 g/dl who were receiving an ESA. This shows that 95% of HD patients and 97% of PD patients with a Hb <10 g/dl were being treated with an ESA. If patients have been declared unresponsive to an ESA then they may be anaemic and no longer on treatment with an ESA. Alternatively they were anaemic but were still not receiving ESA for whatever reason.

ESA prescription and gender

Provision of ESA by age and gender for HD and PD patients are shown in Figures 8.44 and 8.45.

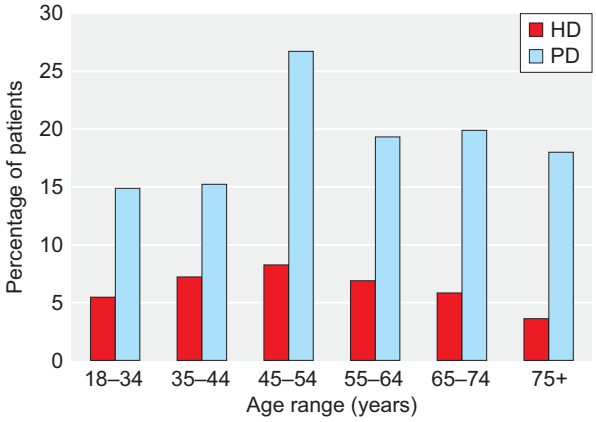

Figure 8.41: Percentage of patients who are not on ESA and have Hb $\geqslant$10 g/dl, by age group and modality

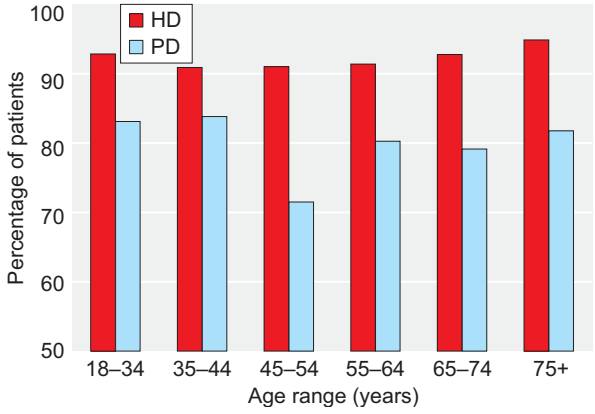

Figure 8.42: Percentage of dialysis patients on ESA, by age group and modality

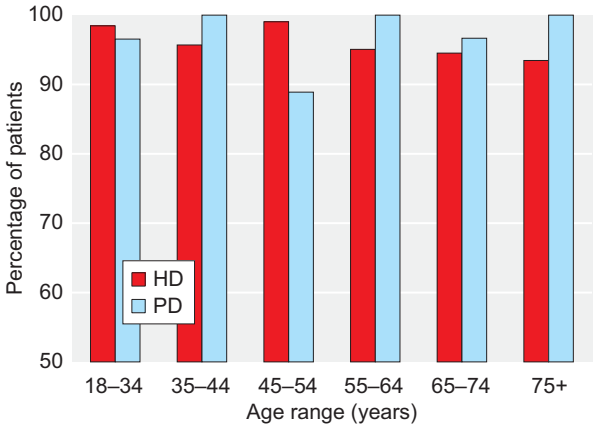

Figure 8.43: Percentage of patients with Hb <10 g/dl who are on ESA, by age group and modality

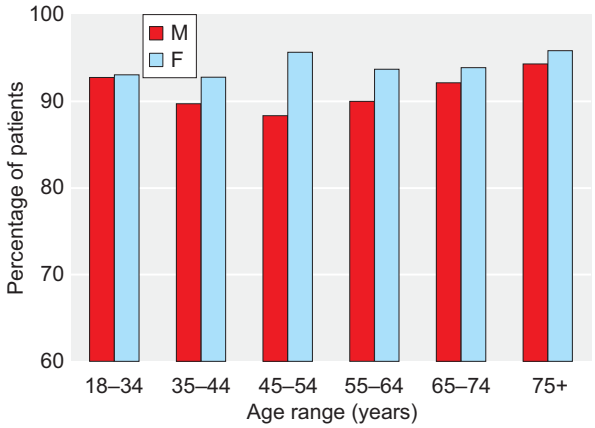

Figure 8.44: Provision of ESA by age and gender: HD

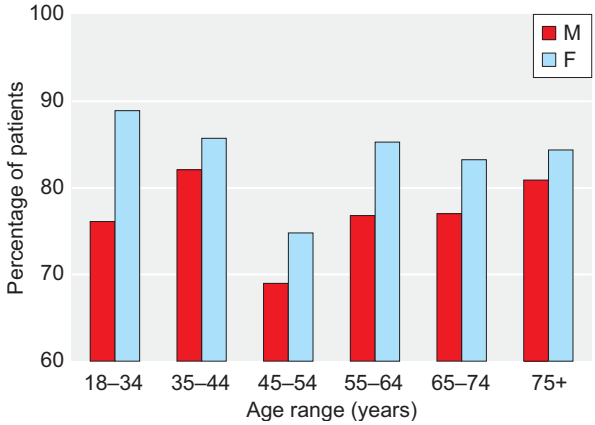

Figure 8.45: Provision of ESA by age and gender: PD

ESAs and time on renal replacement therapy

The percentage of PD patients requiring an ESA began to converge with that of the HD population after year 5 of therapy (Figure 8.46).

ESA dose and success with guideline compliance

There appeared to be no clear relationship between ESA dose and median Hb outcome in HD patients (Figure 8.47). This was similar for the PD population (chart not shown). This may be because of the wide spectrum of ESAs, routes and frequency of administration and

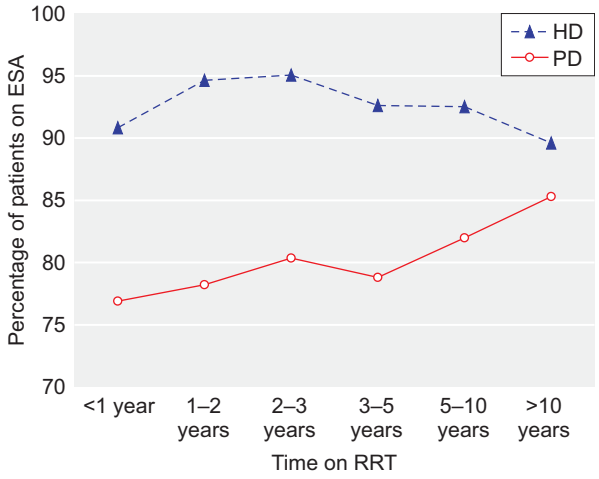

Figure 8.46: Percentage of patients on ESA by time on RRT

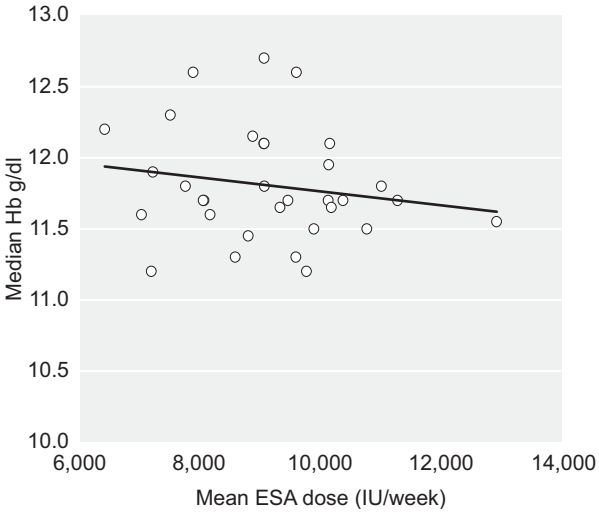

Figure 8.47: Median haemoglobin versus mean ESA dose in haemodialysis patients

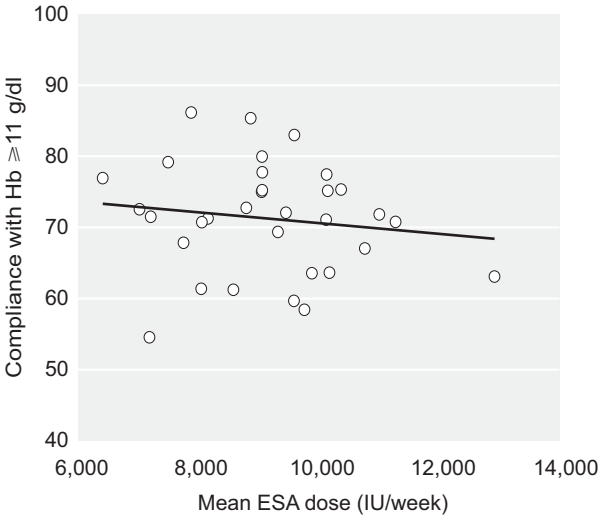

Figure 8.48: Compliance with European Best Practice Guidelines versus mean ESA dose in haemodialysis patients

wide range of documented iron supplementation outcomes. The same was true for compliance with the EBPG minimum standard for Hb by ESA dose in HD (Figure 8.48) and PD populations.

Conclusion

Haemoglobin outcomes for patients on HD and PD in the UK were compliant with Renal Association minimum standards. Haemoglobin outcomes reside below the EBPG that declares all patients should achieve a haemoglobin $\geqslant 11.0$ g/dl. Recently published NICE guidance however suggests that higher outcomes are not cost effective. The presentation of funnel plots for compliance with Hb $\geqslant 10$ g/dl and Hb between 10.5–12.5 (Figures 8.12 and 8.13) may enable centres to plan their desired future Hb outcome in light of the NICE guidance. Caution should be maintained however, that improvement in this specific measure is not at the expense of maintaining Hb $\geqslant 10.0$ g/dl. Use of the 10.5–12.5 compliance alone would infer equivalent risk of Hb >12.5 g/dl as for Hb <10.5 g/dl. The NICE guidance limiting upper Hb was primarily a health economic decision and not on the grounds of safety. The evidence for improving Hb to $\geqslant 10.0$ g/dl remains unchanged.

Ferritin outcome appeared to have reached a steady state in the UK dialysis population and the percentage of patients with serum ferritin greater than 100 µg/L seen in this year's report showed that the provision of intravenous iron for UK dialysis patients was maintained.

Haemoglobin outcome did not show a clear relationship with prescribed ESA dose amongst the dataset submitted to the UKRR. However ESA type, frequency of administration and route of administration may all affect the dose requirements in addition to other variables that can affect erythropoietic response.

Overall, the data demonstrate that UK renal centres continued to accord a high priority to the management of factors influencing haemoglobin. Local priorities in the treatment of renal anaemia may need to continue to be adjusted in line with NICE guidance in conjunction with previously established measures of compliance with Hb $\geqslant 10.0$ g/dl.

References

1. Department of Health. The National Service Framework for Renal Services. Part One: Dialysis and Transplantation. London: Department of Health, 2004:1–50.
2. Renal Association. Treatment of adults and children with renal failure: standards and audit measures. 3rd Edition. London: Royal College of Physicians of London and the Renal Association, 2002.
3. Revised European Best Practice Guidelines for the Management of Anaemia in Patients with Chronic Renal Failure. *Nephrol Dial Transplant* 2004;19, Supplement 2:ii1–ii47.
4. NKF-K/DOQI Clinical Practice Guidelines for Anemia of Chronic Kidney Disease: update 2000. *Am J Kidney Dis* 2001;37(1 Suppl 1):S182–238.
5. National Collaborating Centre for Chronic Conditions. Anaemia management in chronic kidney disease: national clinical guideline for management in adults and children. London: Royal College of Physicians, 2006.
6. Renal Association Clinical Practice Guidelines 4th Edition. 2007. www.renal.org/guidelines