Chapter 9
Anaemia Variables in UK Adult Dialysis Patients in 2008: national and centre-specific analyses

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Key Words
Anaemia · Chronic kidney disease · Dialysis · End stage renal disease · Epidemiology · Erythropoietin · Ferritin · Haemoglobin · Quality improvement · Renal Registry

Abstract
Background: The UK Renal Association (RA) and National Institute for Health and Clinical Excellence (NICE) have published Clinical Practice Guidelines which include recommendations for management of anaemia in established renal failure. ***Aims:*** To determine the extent to which the guidelines for anaemia management are met in the UK. ***Methods:*** Quarterly data (haemoglobin (Hb) and factors that influence Hb) extracts from renal centres in England, Wales, Northern Ireland (EWNI), and annual data from the Scottish Renal Registry for incident and prevalent renal replacement therapy (RRT) cohorts for 2008 were analysed by the UK Renal Registry (UKRR). ***Results:*** In the UK, in 2008 57% of patients commenced dialysis therapy with Hb $\geqslant$10.0 g/dl (median Hb 10.2 g/dl). For incident patients the Hb at 3 and 6 months of dialysis treatment was 11.4 and 11.7 g/dl respectively. The median Hb of haemodialysis (HD) patients was 11.6 g/dl with an interquartile range (IQR) of 10.6–12.5 g/dl. Of HD patients 85% had a Hb $\geqslant$10.0 g/dl. The median Hb of peritoneal dialysis (PD) patients in the UK was 11.7 g/dl (IQR 10.8–12.6 g/dl). Of UK PD patients 89% had a Hb $\geqslant$10.0 g/dl. The median ferritin in HD patients in EWNI was 436 μg/L (IQR 289–622) and 95% of HD patients had a ferritin $\geqslant$100 μg/L. The median ferritin in PD patients was 246 μg/L (IQR 141–399) with 84% of PD patients having a ferritin $\geqslant$100 μg/L. In EWNI the mean ESA dose was higher for HD than PD patients (9,166 vs. 6,302 IU/week). ***Conclusions:*** Last year for the first time a small fall (from 85.9% in 2006 to 85.6% in 2007) in the % of HD patients with a Hb of $\geqslant$10 g/dl which was thought to be related to the implementation of the new Hb Standard which has a target range of 10.5–12.5 g/dl was seen. This year attainment of Hb $\geqslant$10 g/dl in HD patients fell again slightly to 85.3%. In HD patients, 54% of patients had a Hb $\geqslant$10.5 and $\leqslant$12.5 g/dl compared with 53% in the 2008 Report.

Introduction

This chapter describes data reported to the UKRR relating to management of renal anaemia in dialysis patients during 2008. The chapter reports outcomes of submitted variables and analyses of these variables in the context of established guidelines and recommendations.

The renal National Service Framework (NSF) part one [1] and the RA minimum standards document 3rd edition [2] state that individuals with chronic kidney disease (CKD) should achieve a Hb 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 Hb specifically from patients 6 months after meeting a nephrologist. Some indication of the standard comes from the Hb of the incident patient population (i.e. the Hb at the start of dialysis).

The European Best Practice Guidelines (EBPG) [3] set a minimum target of 11 g/dl but suggest not to go higher than 12 g/dl in severe cardiovascular disease. The United States Kidney Disease Outcomes Quality Initiative (KDOQI) [4] guidelines set a target Hb range of 11–12 g/dl with a recommendation that the Hb target should not be greater than 13.0 g/dl. The NICE guidelines published in 2006 [5] and the 4th edition of the RA Clinical Practice Guidelines 2006 [6] recommended an outcome Hb 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 in consistently narrowing the distribution to between 11 and 12 g/dl. The 2008 UKRR Annual Report reported how the attempt to comply with both the 10.5–12.5 g/dl range and the minimum standard of Hb $\geqslant$10.0 g/dl impacted on performance against a combination of measures. The risks associated with low (<10 g/dl) and high (>13 g/dl) Hb are not necessarily equivalent.

National and international recommendations for target iron status in CKD remained unchanged from the 2006 UKRR Annual Report. The 2007 Renal Association (RA) Clinical Practice Guidelines Document, revised European Best Practice Guidelines (EBPGII), Dialysis Outcomes Quality Initiative (DOQI) guidelines and UK NICE anaemia guidelines all recommend a target serum ferritin greater than 100 μg/L and percentage transferrin saturation (TSAT) of more than 20% in patients with CKD. RA guidelines and EBPGII recommend hypochromic red cells (HRC) less than 10%. In addition, EBPGII recommends a target reticulocyte Hb content (CHr) greater than 29 pg/cell. KDOQI recommends a serum ferritin >200 μg/L for HD patients. The NICE guidelines suggest that a hypochromic red cell value >6% suggests ongoing iron deficiency.

To achieve adequate iron status across a patient population, RA guidelines 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 potential risk of 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 some 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.

Methods

The incident and prevalent RRT cohorts for 2008 were analysed. The UKRR extracted quarterly data electronically from renal centres in England, Wales and Northern Ireland, and quarterly data were sent in a single annual extract from the Scottish Renal Registry. Patients receiving dialysis on 31st December 2008 were included in the prevalent analysis if they had been on the same modality of dialysis in the same centre for 3 months. The last available measurement of Hb from each patient from the last two quarters of 2008 was used for analysis. Patients were analysed as a complete cohort and divided by modality into groups.

For the incident patient analyses, data from the first quarter after starting dialysis was used. Patients commencing RRT on PD or HD were included. Those receiving a pre-emptive transplant were excluded.

The last available ferritin measurement was taken from the last three quarters of the year and analysed for prevalent patients. Scotland is excluded from the analysis as data regarding ferritin is not included in its return.

The completeness of data items were analysed at both 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 were 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 RA and other standards was also calculated for Hb. The percentage of patients achieving serum ferritin $\geqslant 100\,\mu g/L$, $\geqslant 200\,\mu g/L$ and $\geqslant 800\,\mu g/L$ were also 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 2008.

The UK RA Clinical Practice [2, 6] and NICE [5] guidelines in operation at the time these data were collected were as follows:

Patients with CKD should achieve a Hb 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.

Patients with CKD treated with RRT should have a Hb of between 10.5 and 12.5 g/dl.

Patients with CKD should have a serum ferritin greater than 100 μg/L and percentage transferrin saturation (TSAT) of more than 20%.

Serum ferritin levels in patients with CKD should not exceed 800 μg/L.

Data regarding ESAs were collected from all renal centres. Centres were excluded if there was <90% completeness of ESA data. Centres reporting fewer than 70% of HD patients or fewer than 50% of PD patients treated with ESAs, were considered to have incomplete data and were also excluded from further analysis. It is recognised that these exclusion criteria are relatively arbitrary but are in part based upon the frequency distribution graph of centres' doses. The UK percentage of patients on ESAs is calculated from these data and incomplete data returns risk seriously impacting on any conclusions drawn. Scotland is excluded from the analysis as data regarding ESA is not included in its return.

Data are presented as weekly erythropoietin dose. Doses of darbepoietin were harmonised with erythropoietin data by multiplying by 200 and correcting for frequency of administration less than weekly. No adjustments were made with respect to route of administration.

The ESA data were collected electronically from renal IT systems but in contrast to laboratory linked variables the ESA dose required manual data entry. The reliability depended upon who entered the data, whether the entry was linked to the prescription or whether the prescriptions were provided by the primary care physician. In the latter case doses may not be as reliably updated as the link between data entry and prescription is indirect.

Results

Haemoglobin

Haemoglobin in incident dialysis patients

The Hb 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 for conservative care of established renal failure were by definition excluded from the dataset. Patients were similarly excluded if they received a pre-emptive transplant. The UKRR plans to collect and report CKD 5 data from patients who subsequently commence RRT as well as those managed conservatively.

The percentage of data returned and outcome Hb are listed in table 9.1. Eight of the nine renal centres excluded from inclusion in this analysis are relatively small centres which had submitted data on fewer than 20 patients.

The median Hb of patients at the time of starting dialysis in the UK was 10.2 g/dl with 57% of patients having a Hb $\geqslant 10.0$ g/dl (vs. 58% for 2008 report). The variation between centres remained high (29–84%).

There were six centres with noticeably lower median Hb for new patients compared with last year. For five of these (Basildon, Belfast, Kilmarnock, Wolverhampton and York) this year's 95% CI for the percentage with Hb >10 g/dl overlaps with the centre's 95% CI from last year. For the other centre (Middlesbrough) the lower confidence limit from 2007 is exactly the same as the upper limit from 2008.

The median starting Hb by centre is shown in figure 9.1 and the percentage starting with a Hb $\geqslant 10.0$ g/dl by centre is given in figure 9.2. The distribution of Hb in incident dialysis patients during 2008 is shown in figure 9.3. The median Hb and the percentage of incident dialysis patients in 2007 with Hb $\geqslant 10.0$ g/dl by time on dialysis are shown in figures 9.4 and 9.5.

The annual distribution (figure 9.6) of Hb in incident dialysis patients has remained relatively stable since 2002, although there has been a reduction in the proportion of patients with Hb $\geqslant 12.0$ g/dl in 2008.

Haemoglobin in prevalent haemodialysis patients

The compliance with data returns and Hb outcome for prevalent HD patients in the 72 UK renal centres are shown in table 9.2.

The median Hb of patients on HD in the UK was 11.6 g/dl with an IQR of 10.6–12.5 g/dl. In the UK, 85% of HD patients had a Hb $\geqslant 10.0$ g/dl. The median Hb by centre, compliance with the previous UK minimum standard of Hb $\geqslant 10.0$ g/dl and EBPG standard of Hb $\geqslant 11.0$ g/dl are shown in figures 9.7, 9.8 and 9.9 respectively. The distribution of Hb in HD patients by centre is shown in figure 9.10. The compliance with the NICE and RA Clinical Practice Guidelines recommended range of 10.5–12.5 g/dl is shown in figure 9.11. The majority of centres complied well with respect to both outcomes but it was possible to

Table 9.1. Haemoglobin data for new patients starting haemodialysis or peritoneal dialysis during 2008

Centre	% data return	Median Hb g/dl	90% range	Inter-quartile range	% Hb ⩾10 g/dl
Abrdn	100	10.1	8.4–11.9	9.4–10.9	56
Airdrie	84	10.2	8.7–11.9	9.4–11.1	56
Antrim	94	10.1	7.7–12.8	8.9–10.9	50
B Heart	96	10.1	7.4–12.7	9.1–11.3	53
B QEH	70	10.0	7.2–13.0	8.9–11.0	50
Bangor	97	9.7	7.5–12.0	8.8–10.7	43
Basldn	95	9.7	7.1–12.2	9.3–10.6	42
Belfast	85	9.4	7.1–11.7	8.0–10.9	43
Bradfd	98	10.1	7.5–13.2	9.2–11.0	59
Brightn	99	10.2	7.9–13.4	9.3–11.4	59
Bristol	99	10.0	7.2–13.0	9.0–11.1	52
Camb	82	10.3	8.2–13.0	9.6–11.3	60
Cardff	98	10.5	7.9–13.0	9.4–11.3	64
Carlis	100	10.6	8.8–14.3	9.6–11.4	67
Carsh	96	10.1	8.1–12.6	9.3–11.1	57
Chelms	100	10.9	8.9–13.6	9.7–11.5	68
Clwyd	77				
Colchr	81	11.2	9.0–13.5	10.3–12.3	84
Covnt	98	10.0	8.0–13.4	9.4–11.1	54
D & Gall	89				
Derby	96	10.6	8.6–13.2	9.5–11.7	65
Derry	100				
Donc	96	10.2	7.6–13.0	9.4–11.0	52
Dorset	91	10.8	8.6–12.6	9.6–11.8	66
Dudley	98	9.9	7.5–12.7	8.4–10.9	48
Dundee	54	10.1	8.3–13.6	9.1–11.2	54
Dunfn	28				
Edinb	84	10.5	7.5–12.8	9.4–11.4	58
Exeter	100	10.1	7.6–12.5	9.3–11.0	53
Glasgw	97	9.5	7.7–12.1	8.6–10.6	39
Glouc	100	10.2	8.1–12.6	9.4–11.3	57
Hull	87	9.9	7.1–12.6	8.7–10.9	49
Inverns	75				
Ipswi	95	10.0	8.8–12.4	9.4–10.7	51
Kent	99	10.1	7.9–12.2	9.0–11.0	52
Klmarnk	79	10.0	8.7–13.2	9.5–11.5	57
L Barts	99	10.0	7.1–13.2	8.7–11.4	50
L Guys	65	10.2	7.9–12.5	8.9–11.3	53
L Kings	93	9.9	8.2–11.9	9.1–11.0	47
L Rfree	93	10.1	7.8–12.9	9.1–11.2	52
L St.G	97	10.5	8.3–13.1	9.8–11.7	68
L West	44				
Leeds	100	10.3	8.0–13.2	9.1–11.1	57
Leic	99	10.1	8.2–12.8	9.2–11.1	54
Liv Ain	90	9.4	7.2–11.6	8.7–10.0	29
Liv RI	99	11.1	8.1–12.7	9.5–11.9	71
M Hope	75	10.2	7.3–13.8	8.9–11.4	53
M RI	94	10.4	7.9–13.2	9.2–11.6	60
Middlbr	99	9.1	6.3–12.2	8.3–10.7	33
Newc	98	10.3	7.2–13.3	9.1–11.8	58
Newry	95				
Norwch	96	10.2	7.4–12.3	9.2–11.3	56
Nottm	99	9.9	7.6–13.2	9.2–11.4	49
Oxford	100	10.5	7.8–12.8	9.1–11.3	60
Plymth	65	11.3	8.5–14.2	10.4–12.1	79
Ports	100	10.4	7.9–13.4	9.4–11.4	61
Prestn	95	10.0	7.5–12.9	8.8–11.1	52
Redng	100	9.9	7.9–12.4	9.0–10.8	49
Sheff	100	10.4	8.0–12.8	9.5–11.3	61
Shrew	95	10.5	7.9–13.1	9.7–11.5	69

Table 9.1. Continued

Centre	% data return	Median Hb g/dl	90% range	Inter-quartile range	% Hb ⩾10 g/dl
Stevng	99	10.6	8.2–13.9	9.4–11.6	64
Sthend	100	10.3	7.3–12.6	9.3–11.0	56
Stoke	100	10.3	7.8–13.3	9.0–11.6	59
Sund	100	10.6	8.4–12.2	9.3–11.5	61
Swanse	97	10.9	7.8–13.5	9.7–11.7	72
Truro	100	10.6	8.8–14.1	9.6–12.1	67
Tyrone	96	10.3	8.3–12.7	9.1–11.3	61
Ulster	100				
Wirral	83	10.2	8.6–13.4	9.3–11.1	61
Wolve	100	9.9	7.3–12.7	9.0–10.8	46
Wrexm	100				
York	93	9.7	6.6–14.7	8.6–10.7	44
England	**91**	**10.2**	**7.8–12.9**	**9.2–11.3**	**56**
N Ireland	**92**	**10.1**	**7.4–12.7**	**8.8–11.1**	**53**
Scotland	**82**	**10.0**	**8.0–12.7**	**9.1–11.1**	**52**
Wales	**97**	**10.6**	**7.8–13.0**	**9.4–11.5**	**65**
UK	**91**	**10.2**	**7.8–12.9**	**9.2–11.3**	**57**

Blank cells = centres excluded from analyses due to poor data completeness or low patient numbers

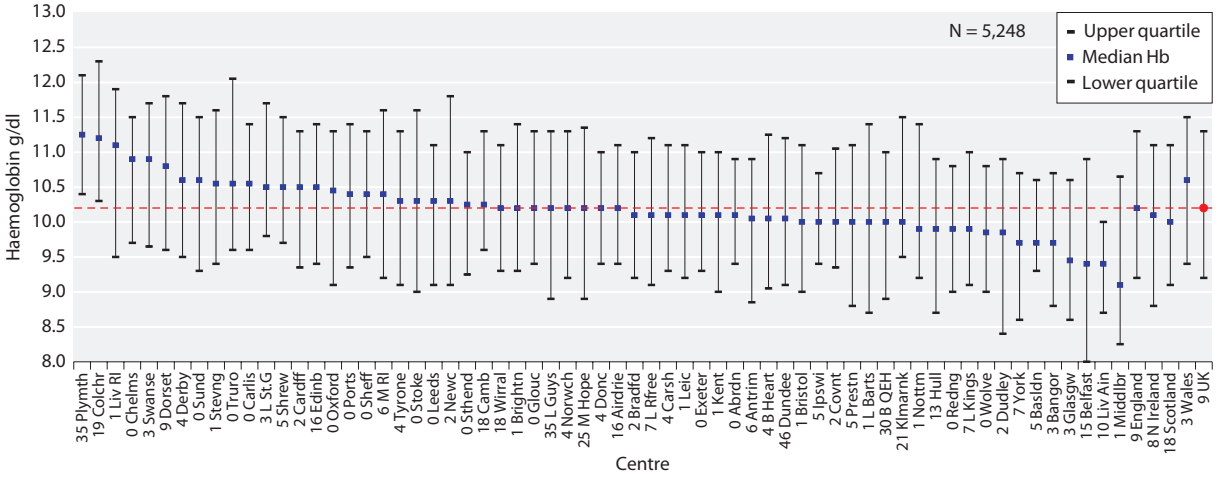

Fig. 9.1. Median haemoglobin for incident dialysis patients at start of dialysis treatment in 2008

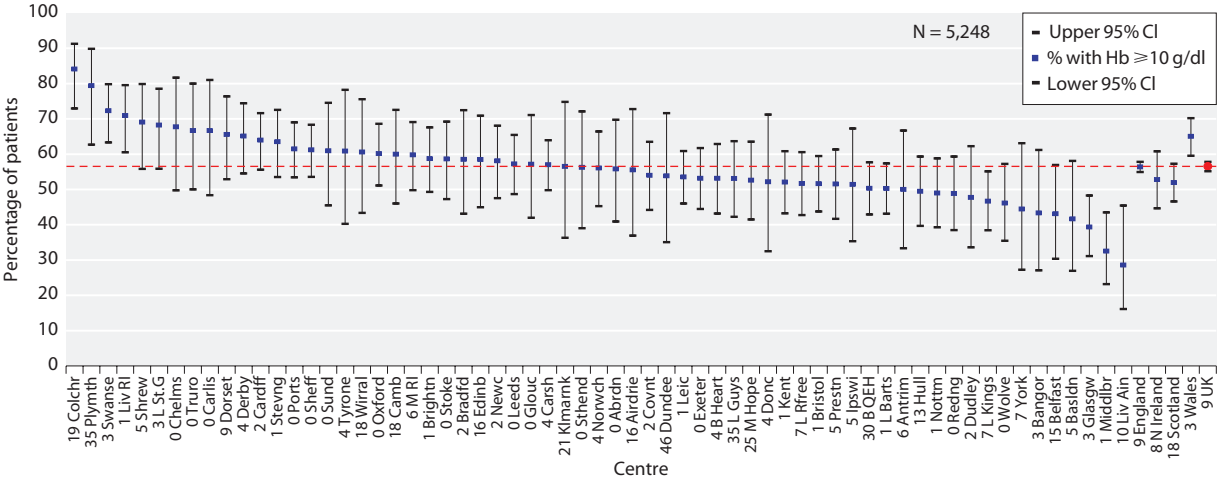

Fig. 9.2. Percentage of incident dialysis patients with Hb ⩾10 g/dl at start of dialysis treatment in 2008

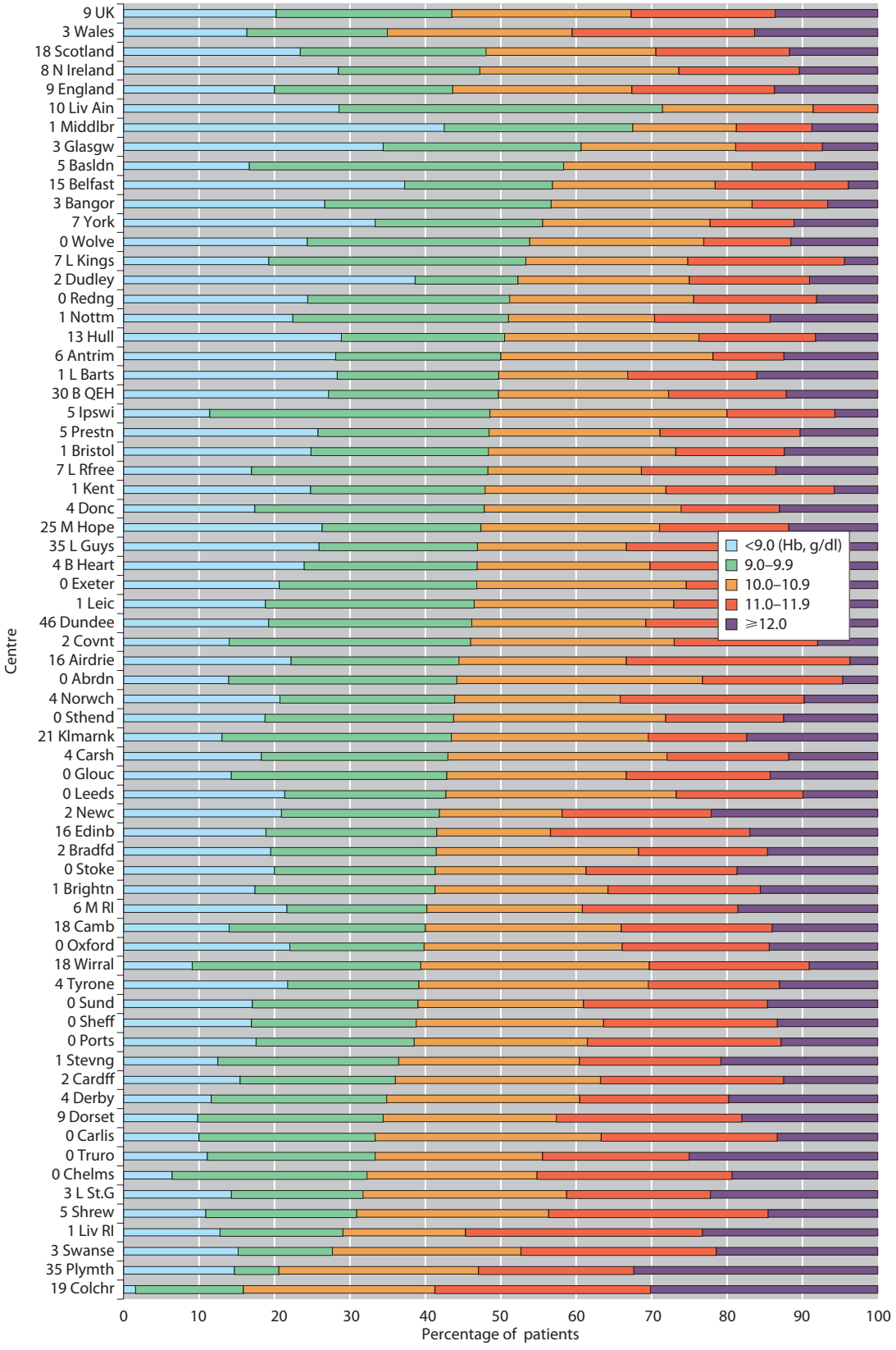

Fig. 9.3. Distribution of haemoglobin in incident dialysis patients at start of dialysis treatment in 2008

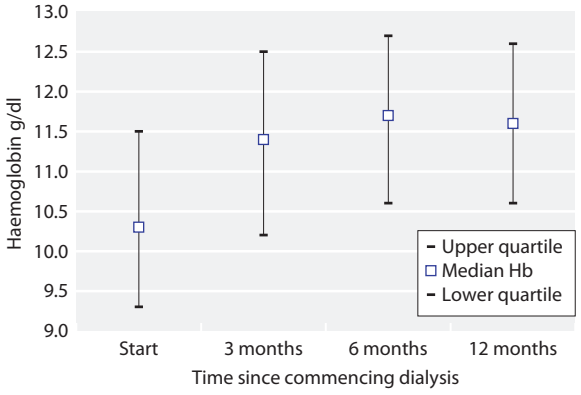

Fig. 9.4. Median haemoglobin, by time on dialysis, for incident dialysis patients in 2007

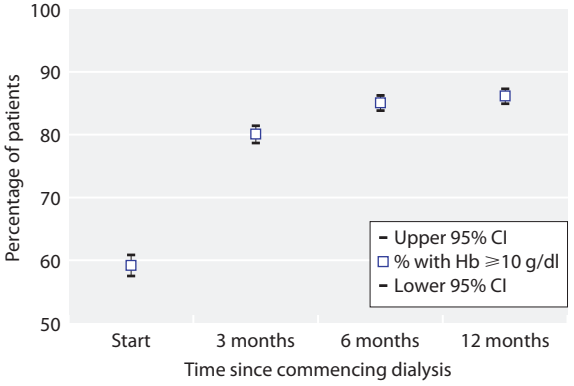

Fig. 9.5. Percentage of incident dialysis patients in 2007 with Hb ⩾10 g/dl, by time on dialysis

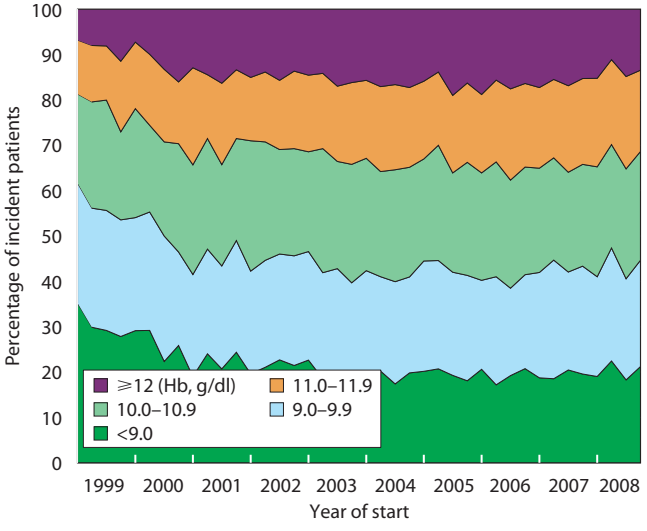

Fig. 9.6. Distribution of haemoglobin in incident dialysis patients by year of start

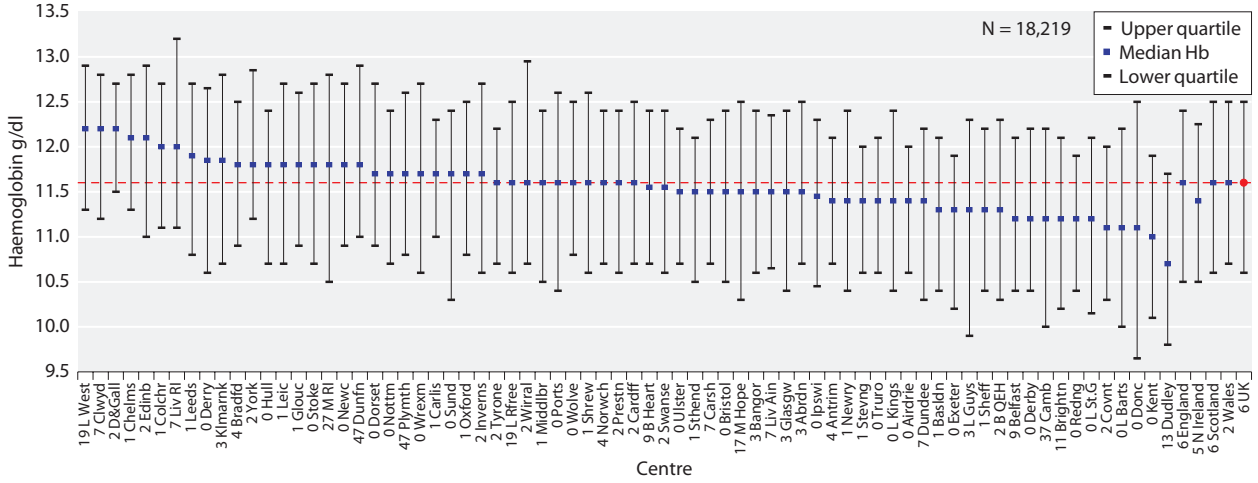

Fig. 9.7. Median haemoglobin in patients treated with HD

Table 9.2. Haemoglobin data for prevalent HD patients

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	11.5	9.5–13.7	10.7–12.5	11.6	1.3	91	65
Airdrie	100	11.4	9.5–13.0	10.6–12.0	11.3	1.1	89	70
Antrim	96	11.4	8.7–13.9	10.7–12.1	11.3	1.5	84	63
B Heart	91	11.6	8.7–14.0	10.7–12.4	11.5	1.5	86	69
B QEH	98	11.3	8.2–13.7	10.3–12.3	11.2	1.6	80	58
Bangor	97	11.5	8.7–14.3	10.6–12.4	11.5	1.8	87	62
Basldn	99	11.3	8.9–13.4	10.4–12.1	11.3	1.4	86	64
Belfast	91	11.2	8.7–13.7	10.4–12.1	11.2	1.5	82	61
Bradfd	96	11.8	9.7–14.0	10.9–12.5	11.8	1.3	92	73
Brightn	89	11.2	8.7–13.5	10.2–12.1	11.2	1.5	80	56
Bristol	100	11.5	8.7–13.9	10.5–12.4	11.5	1.5	85	66
Camb	63	11.2	8.9–13.5	10.0–12.2	11.1	1.5	77	56
Cardff	98	11.6	9.0–14.0	10.7–12.5	11.6	1.5	86	67
Carlis	99	11.7	9.5–13.3	11.0–12.3	11.6	1.1	91	76
Carsh	93	11.5	9.2–13.4	10.7–12.3	11.5	1.3	89	67
Chelms	99	12.1	9.1–13.8	11.3–12.8	12.0	1.4	91	84
Clwyd	93	12.2	10.0–13.4	11.2–12.8	12.0	1.1	95	83
Colchr	99	12.0	9.3–14.0	11.1–12.7	11.9	1.4	90	77
Covnt	98	11.1	8.9–13.6	10.3–12.0	11.2	1.4	83	54
D & Gall	98	12.2	9.4–14.0	11.5–12.7	12.0	1.4	91	83
Derby	100	11.2	9.1–13.9	10.4–12.2	11.4	1.5	85	60
Derry	100	11.9	9.7–13.3	10.6–12.7	11.6	1.2	87	65
Donc	100	11.1	8.3–13.9	9.7–12.5	11.1	1.8	72	51
Dorset	100	11.7	9.3–13.9	10.9–12.7	11.7	1.4	89	74
Dudley	87	10.7	8.2–14.0	9.8–11.7	10.8	1.7	69	41
Dundee	93	11.4	8.6–13.8	10.3–12.2	11.3	1.5	81	61
Dunfn	53	11.8	9.2–14.8	11.0–12.9	12.0	1.5	91	79
Edinb	98	12.1	9.1–14.2	11.0–12.9	11.9	1.6	88	76
Exeter	100	11.3	8.8–13.0	10.2–11.9	11.1	1.2	79	60
Glasgw	97	11.5	9.0–13.8	10.4–12.4	11.4	1.5	83	63
Glouc	99	11.8	8.9–14.0	10.9–12.6	11.7	1.5	89	73
Hull	100	11.8	9.0–13.8	10.7–12.4	11.6	1.5	88	70
Inverns	98	11.7	9.3–14.4	10.6–12.7	11.7	1.6	90	66
Ipswi	100	11.5	9.4–13.2	10.5–12.3	11.3	1.2	86	60
Kent	100	11.0	8.7–13.3	10.1–11.9	11.0	1.4	77	52
Klmarnk	97	11.9	9.1–14.3	10.7–12.8	11.7	1.5	86	72
L Barts	100	11.1	8.0–13.5	10.0–12.2	11.0	1.7	75	54
L Guys	97	11.3	8.3–13.7	9.9–12.3	11.1	1.6	74	56
L Kings	100	11.4	8.8–13.4	10.4–12.4	11.3	1.4	82	63
L Rfree	81	11.6	8.6–13.9	10.6–12.5	11.5	1.6	85	67
L St.G	100	11.2	9.0–13.1	10.2–12.1	11.2	1.4	82	57
L West	81	12.2	9.9–13.9	11.3–12.9	12.1	1.2	95	82
Leeds	99	11.9	8.9–14.1	10.8–12.7	11.8	1.5	88	72
Leic	99	11.8	8.8–14.1	10.7–12.7	11.7	1.6	86	72
Liv Ain	93	11.5	9.1–13.6	10.7–12.4	11.4	1.4	86	68
Liv RI	93	12.0	9.4–14.5	11.1–13.2	12.0	1.6	93	77
M Hope	83	11.5	8.7–13.7	10.3–12.5	11.4	1.6	83	61
M RI	73	11.8	8.6–14.4	10.5–12.8	11.8	1.8	85	71
Middlbr	99	11.6	8.8–13.7	10.5–12.4	11.5	1.5	87	66

Table 9.2. 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
Newc	100	11.8	9.1–14.2	10.9–12.7	11.7	1.5	87	74
Newry	99	11.4	8.6–13.6	10.4–12.4	11.3	1.5	79	62
Norwch	96	11.6	9.3–13.5	10.7–12.4	11.5	1.3	89	69
Nottm	100	11.7	9.1–13.7	10.7–12.4	11.5	1.4	86	70
Oxford	99	11.7	9.1–13.8	10.8–12.5	11.6	1.5	87	68
Plymth	53	11.7	9.5–14.4	10.8–12.6	11.8	1.4	93	71
Ports	100	11.6	8.7–13.9	10.4–12.6	11.5	1.6	83	66
Prestn	98	11.6	9.1–13.7	10.6–12.4	11.5	1.5	88	66
Redng	100	11.2	8.8–13.2	10.4–11.9	11.2	1.3	83	59
Sheff	99	11.3	9.0–13.5	10.4–12.2	11.3	1.4	83	62
Shrew	99	11.6	9.2–13.5	10.6–12.6	11.5	1.3	89	67
Stevng	99	11.4	9.1–13.2	10.6–12.0	11.3	1.2	87	64
Sthend	99	11.5	9.2–12.9	10.5–12.1	11.3	1.2	87	64
Stoke	100	11.8	9.0–13.6	10.7–12.7	11.6	1.5	86	69
Sund	100	11.7	8.5–13.4	10.3–12.4	11.4	1.5	81	67
Swanse	98	11.6	8.9–13.6	10.6–12.4	11.4	1.4	88	66
Truro	100	11.4	9.4–13.2	10.6–12.1	11.4	1.2	89	68
Tyrone	98	11.6	9.6–13.5	10.7–12.2	11.4	1.2	88	66
Ulster	100	11.5	9.8–13.6	10.7–12.2	11.5	1.2	92	65
Wirral	98	11.6	8.8–14.2	10.7–13.0	11.7	1.6	88	69
Wolve	100	11.6	8.9–14.1	10.8–12.5	11.6	1.5	89	71
Wrexm	100	11.7	9.5–13.7	10.6–12.7	11.6	1.4	90	66
York	98	11.8	9.9–13.9	11.2–12.9	11.9	1.3	93	80
England	**94**	**11.6**	**8.9–13.8**	**10.5–12.4**	**11.5**	**1.5**	**85**	**66**
N Ireland	**95**	**11.4**	**8.8–13.6**	**10.5–12.3**	**11.3**	**1.4**	**84**	**63**
Scotland	**94**	**11.6**	**9.1–13.9**	**10.6–12.5**	**11.6**	**1.5**	**86**	**68**
Wales	**98**	**11.6**	**9.0–13.8**	**10.7–12.5**	**11.5**	**1.5**	**88**	**67**
UK	**94**	**11.6**	**8.9–13.8**	**10.6–12.5**	**11.5**	**1.5**	**85**	**66**

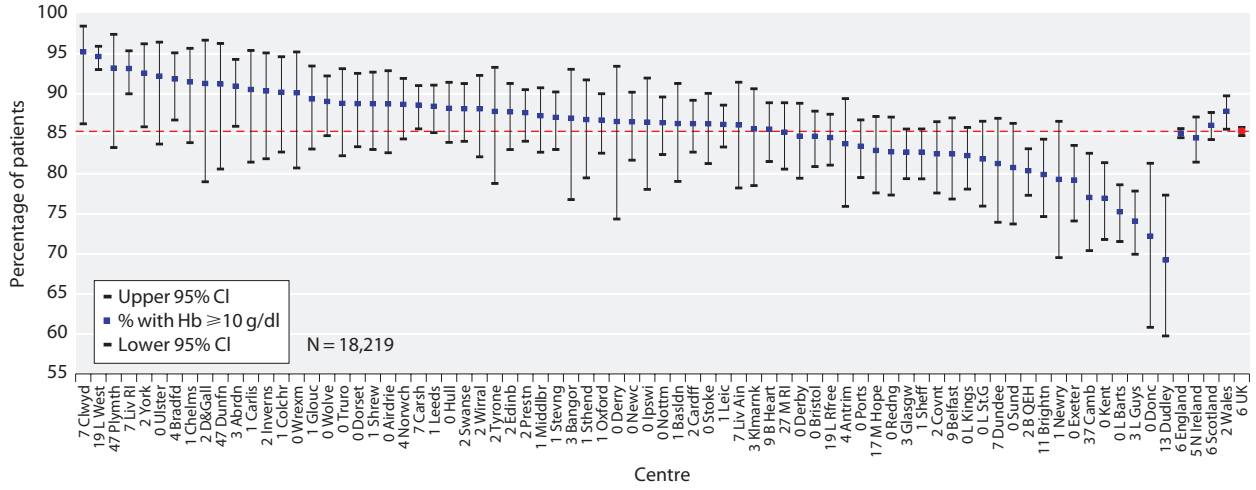

Fig. 9.8. Percentage of HD patients with Hb ⩾10 g/dl

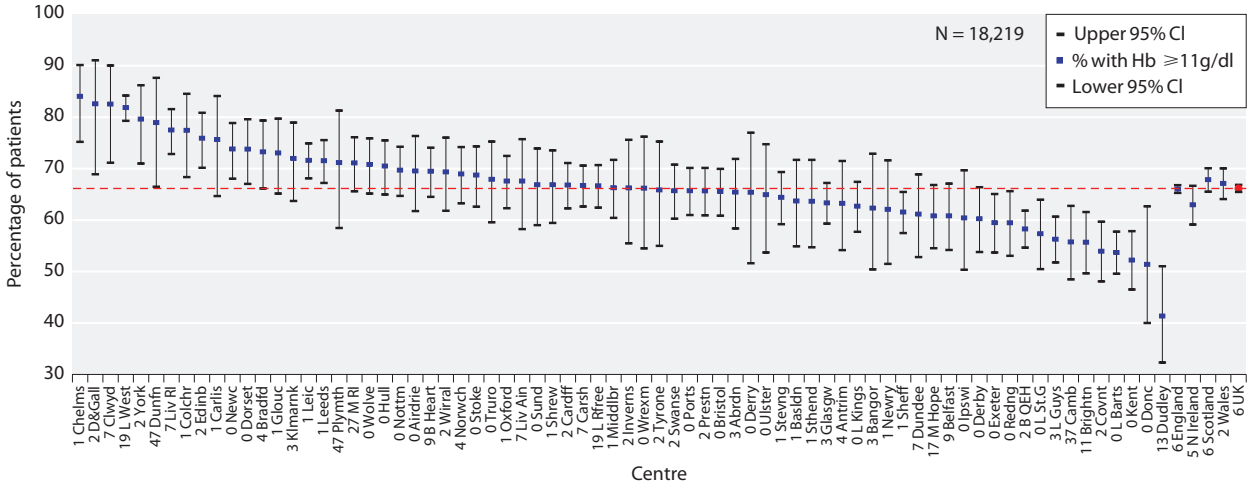

Fig. 9.9. Percentage of HD patients with Hb ⩾11 g/dl

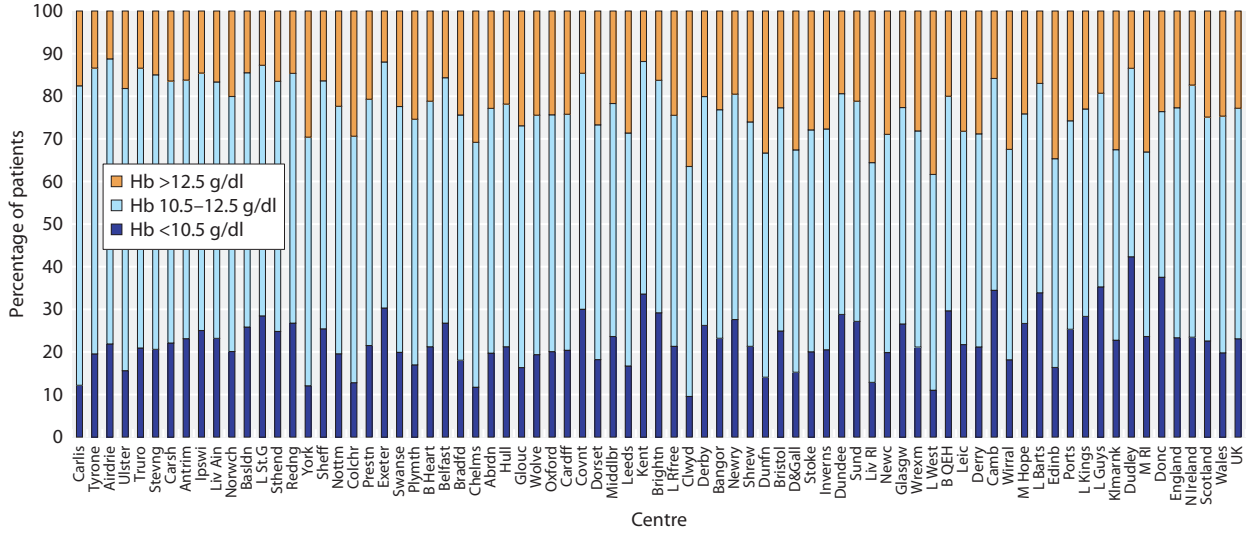

Fig. 9.10. Distribution of haemoglobin in patients treated with HD

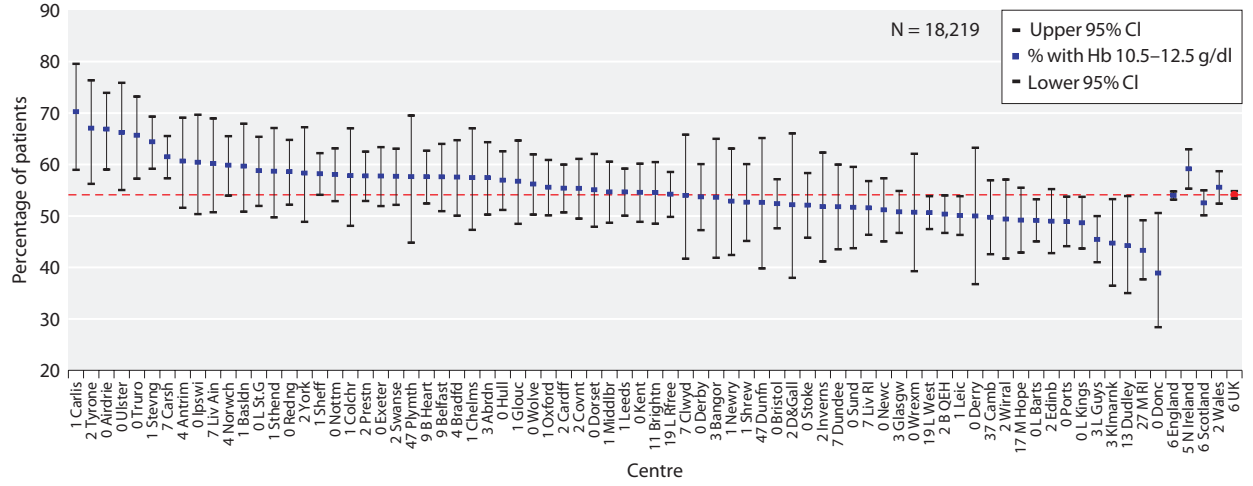

Fig. 9.11. Percentage of HD patients with Hb ⩾10.5 and ⩽12.5 g/dl

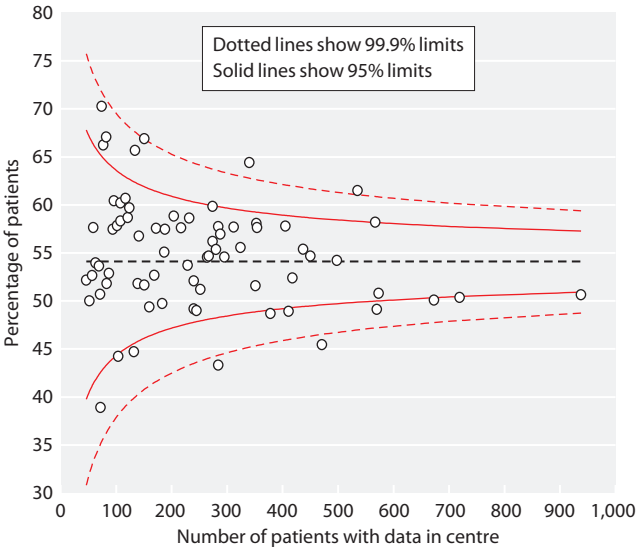

Fig. 9.12. Funnel plot of percentage of HD patients with Hb $\geqslant$10.5 and $\leqslant$12.5 g/dl

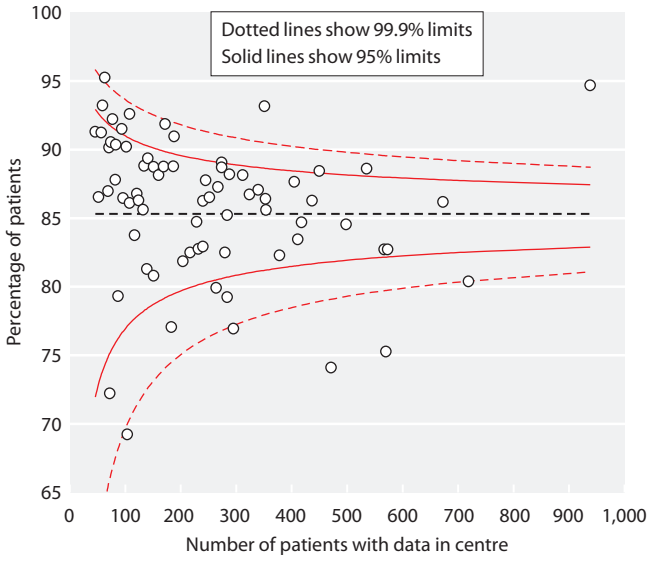

Fig. 9.13. Funnel plot of percentage of HD patients with Hb $\geqslant$10 g/dl

fall within 2–3 SDs of the mean in the funnel plot (figure 9.12) for a percentage of patients with Hb $\geqslant$10.5 and $\leqslant$12.5 g/dl and yet have a poor compliance with percentage of Hb $\geqslant$10.0 g/dl (figure 9.13). This demonstrates that compliance with one standard (Hb $\geqslant$10.5 and $\leqslant$12.5 g/dl) can be achieved without compliance with another standard (Hb $\geqslant$10.0 g/dl). Figures 9.12 and 9.13 should be used in conjunction with table 9.3 to identify centres.

Haemoglobin in prevalent peritoneal dialysis patients

In the UK 89% of patients on PD had a Hb $\geqslant$10.0 g/dl (table 9.4). The median Hb of patients on PD in the UK was 11.7 g/dl with an IQR of 10.8–12.6 g/dl. The median Hb by centre, compliance with the UK minimum standard Hb $\geqslant$10.0 g/dl and EBPG Hb $\geqslant$11.0 g/dl are shown in figures 9.14, 9.15 and 9.16 respectively. The compliance with recommended range Hb $\geqslant$10.5 and $\leqslant$12.5 g/dl (NICE & RA) is shown in figure 9.17. The distribution of Hb in PD patients by centre is shown in figure 9.18. The funnel plot for percentage Hb $\geqslant$10.0 g/dl is shown in figure 9.19 which can be used in conjunction with table 9.5 to identify centres.

Table 9.3. Percentage of HD patients achieving Hb ⩾10 g/dl and Hb 10.5–12.5 g/dl

Centre	N with Hb	% with Hb ⩾10 g/dl	% Hb 10.5–12.5 g/dl	Centre	N with Hb	% with Hb ⩾10 g/dl	% Hb 10.5–12.5 g/dl
D & Gall	46	91	52	Derby	229	85	54
Derry	52	87	50	Redng	232	83	59
Dunfn	57	91	53	M Hope	240	83	49
Plymth	59	93	58	Stoke	240	86	52
Clwyd	63	95	54	Edinb	245	88	49
Bangor	69	87	54	Newc	252	87	51
Wrexm	71	90	51	Brightn	264	80	55
Donc	72	72	39	Middlbr	267	87	55
Carlis	74	91	70	Norwch	274	89	60
Ulster	77	92	66	Wolve	274	89	56
Tyrone	82	88	67	Covnt	280	83	55
Inverns	83	90	52	Exeter	284	79	58
Newry	87	79	53	M RI	284	85	**43**
Chelms	94	91	57	Hull	288	88	57
Ipswi	96	86	60	Kent	295	**77**	55
Colchr	102	90	58	Swanse	312	88	58
Dudley	104	**69**	44	Oxford	324	87	56
Liv Ain	108	86	60	Stevng	340	87	64
York	108	93	58	Liv RI	351	93	52
Antrim	117	84	61	Nottm	353	86	58
Sthend	121	87	59	B Heart	354	86	58
Basldn	124	86	60	L Kings	378	82	49
Klmarnk	132	86	45	Prestn	405	88	58
Truro	134	89	66	Ports	411	83	49
Dundee	139	81	52	Bristol	418	85	52
Glouc	141	89	57	Cardff	437	86	55
Airdrie	151	89	67	Leeds	450	88	55
Sund	151	81	52	L Guys	471	**74**	**45**
Wirral	160	88	49	L Rfree	498	85	54
Shrew	169	89	53	Carsh	535	89	62
Bradfd	172	92	58	Sheff	567	83	58
Camb	183	77	50	L Barts	570	**75**	49
Dorset	187	89	55	Glasgw	573	83	51
Abrdn	188	91	57	Leic	673	86	50
L St.G	204	82	59	B QEH	719	80	50
Belfast	217	82	58	L West	938	95	51

Entries in bold text lie below the lower 99.9% confidence limit in the funnel plot

Table 9.4. Haemoglobin data for prevalent PD patients

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	94	12.2	10.3–14.6	11.1–13.1	12.1	1.4	97	84
Airdrie	100							
Antrim	88							
B Heart	100	11.5	9.8–14.3	10.9–12.2	11.5	1.2	89	68
B QEH	86	11.6	8.6–14.2	10.5–12.7	11.6	1.6	87	69
Bangor	100	11.9	10.1–13.7	11.4–12.4	11.9	1.1	97	83
Basldn	100	11.3	9.3–14.7	10.6–12.5	11.5	1.5	87	57
Belfast	98	11.4	7.7–13.5	10.8–12.5	11.3	1.7	84	67
Bradfd	100	11.6	8.9–13.5	10.4–12.2	11.4	1.4	81	66
Brightn	100	12.1	9.9–14.2	11.1–13.1	12.1	1.4	95	79
Bristol	100	12.2	8.7–14.8	11.0–13.3	12.1	1.7	90	76
Camb	100	12.1	10.2–13.9	11.0–12.6	11.9	1.2	98	78
Cardff	100	11.8	9.8–14.5	10.9–12.9	12.0	1.6	93	73
Carlis	100							
Carsh	96	11.4	8.8–14.2	10.6–12.2	11.5	1.4	86	67
Chelms	100	11.9	9.0–13.7	11.1–13.0	12.0	1.3	95	82
Clwyd	80							
Colchr	n/a							
Covnt	96	11.8	9.8–14.5	10.8–12.8	11.8	1.4	93	68
D & Gall	100							
Derby	100	11.5	9.7–14.6	10.7–12.7	11.7	1.5	89	65
Derry	100							
Donc	97	11.7	9.7–13.7	11.2–12.6	11.8	1.3	89	81
Dorset	98	12.2	9.3–13.8	11.1–12.8	12.0	1.3	94	80
Dudley	98	12.2	9.2–14.6	10.8–13.4	12.1	1.8	85	72
Dundee	100	12.6	10.8–15.2	12.1–13.5	12.9	1.4	100	91
Dunfn	96	12.0	10.7–14.0	11.5–12.5	12.1	1.0	100	88
Edinb	97	11.3	8.5–13.8	10.2–12.6	11.4	1.6	83	63
Exeter	100	11.6	9.5–13.4	10.9–12.4	11.6	1.4	90	75
Glasgw	97	11.7	9.2–13.9	10.9–12.7	11.7	1.3	90	75
Glouc	100	11.4	9.3–12.7	10.7–11.9	11.4	1.0	94	73
Hull	99	11.7	9.2–15.7	10.9–12.9	11.9	1.8	92	73
Inverns	4							
Ipswi	98	11.5	8.5–13.1	10.9–12.5	11.4	1.4	88	69
Kent	99	11.5	9.1–13.2	10.7–12.2	11.4	1.3	85	66
Klmarnk	98	11.4	8.9–13.7	10.6–12.1	11.3	1.5	79	72
L Barts	100	11.8	8.5–14.0	10.9–12.7	11.7	1.7	86	72
L Guys	98	11.6	9.4–13.7	10.9–12.1	11.6	1.3	92	73
L Kings	100	11.7	9.1–13.1	10.9–12.2	11.5	1.1	90	74
L Rfree	71	11.1	8.6–13.3	10.3–12.0	11.1	1.4	83	55
L St.G	98	11.8	9.1–14.1	11.1–12.5	11.8	1.6	92	78
L West	100	11.7	9.6–13.4	10.8–12.6	11.7	1.3	90	74
Leeds	99	12.0	9.3–14.2	11.1–13.0	12.0	1.7	91	81
Leic	99	11.3	8.1–14.5	10.4–12.6	11.4	1.8	83	62
Liv Ain	50							
Liv RI	87	11.8	9.6–14.3	10.8–12.7	11.8	1.4	87	72
M Hope	97	11.4	8.4–14.8	10.0–12.3	11.3	1.9	76	58
M RI	100	11.5	8.3–14.1	10.3–12.4	11.4	1.7	82	66
Middlbr	91	11.8	9.0–13.2	11.0–12.1	11.5	1.2	85	75

Table 9.4. 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
Newc	98	11.3	9.1–13.0	10.6–12.5	11.3	1.4	84	66
Newry	100							
Norwch	93	12.0	9.9–15.5	11.3–13.2	12.3	1.7	95	85
Nottm	99	11.4	9.3–14.0	10.5–12.2	11.4	1.5	88	63
Oxford	100	11.8	9.3–14.0	10.9–12.8	11.8	1.5	91	74
Plymth	93	12.3	10.6–14.3	11.2–13.0	12.2	1.3	95	83
Ports	99	12.1	8.6–14.0	10.9–12.9	11.8	1.6	89	73
Prestn	100	11.3	8.8–13.7	10.6–12.4	11.4	1.4	84	71
Redng	100	11.6	9.2–13.8	10.8–12.5	11.6	1.4	88	68
Sheff	100	11.9	8.5–13.7	10.9–12.6	11.7	1.5	92	72
Shrew	94	11.8	9.1–13.9	11.2–12.8	11.8	1.4	90	83
Stevng	97	11.7	9.8–15.0	10.9–12.8	11.9	1.4	92	75
Sthend	93							
Stoke	100	11.5	9.4–14.3	10.8–12.6	11.6	1.5	92	69
Sund	100	12.0	11.0–14.6	11.6–13.5	12.4	1.2	100	95
Swanse	98	12.1	9.4–14.9	11.3–12.9	12.1	1.4	95	81
Truro	100	12.2	10.1–13.6	11.1–12.5	12.0	1.0	96	88
Tyrone	100							
Ulster	100							
Wirral	74	12.4	9.5–14.0	11.8–13.3	12.2	1.6	88	80
Wolve	100	11.8	9.3–14.2	10.7–12.9	11.8	1.5	91	70
Wrexm	95	11.6	8.2–13.9	11.2–12.5	11.6	1.7	90	81
York	100							
England	**97**	**11.7**	**9.1–14.1**	**10.8–12.6**	**11.7**	**1.5**	**88**	**71**
N Ireland	**97**	**12.0**	**8.2–13.6**	**10.9–12.5**	**11.6**	**1.6**	**90**	**72**
Scotland	**88**	**11.9**	**9.3–14.1**	**11.0–12.7**	**11.8**	**1.5**	**90**	**76**
Wales	**98**	**11.9**	**9.8–14.4**	**11.1–12.8**	**12.0**	**1.5**	**94**	**78**
UK	**96**	**11.7**	**9.1–14.1**	**10.8–12.6**	**11.7**	**1.5**	**89**	**72**

Blank cells = centres excluded from analyses due to poor data completeness or low patient numbers
n/a = not applicable

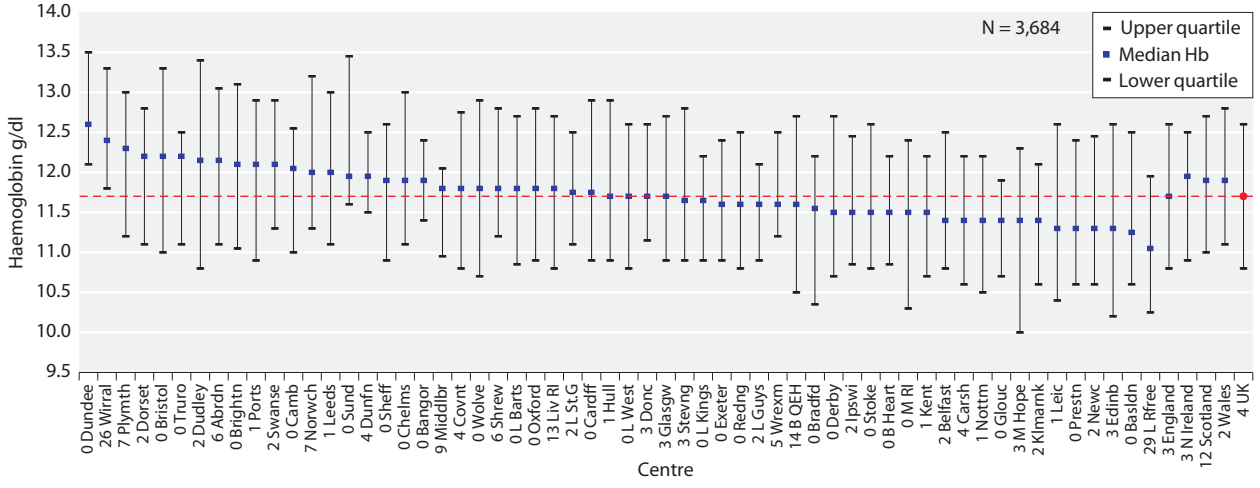

Fig. 9.14. Median haemoglobin in patients treated with PD

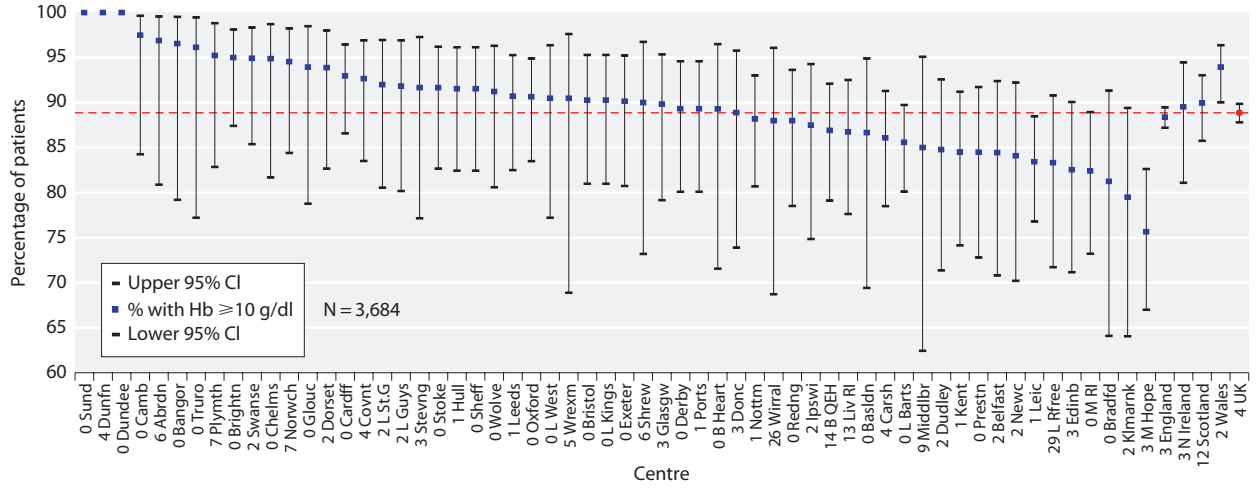

Fig. 9.15. Percentage of PD patients with Hb ⩾10 g/dl

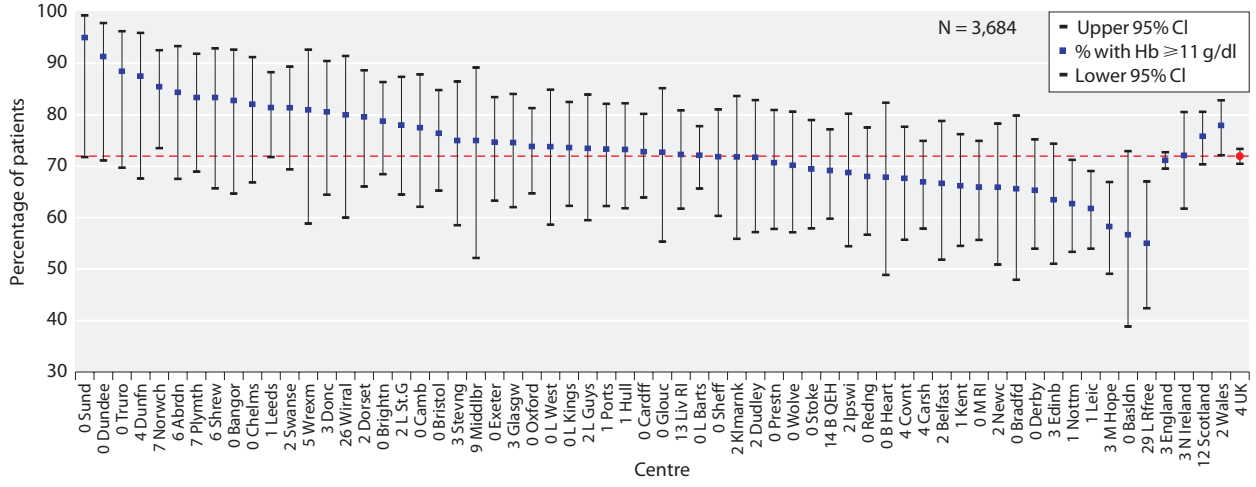

Fig. 9.16. Percentage of PD patients with Hb ⩾11 g/dl

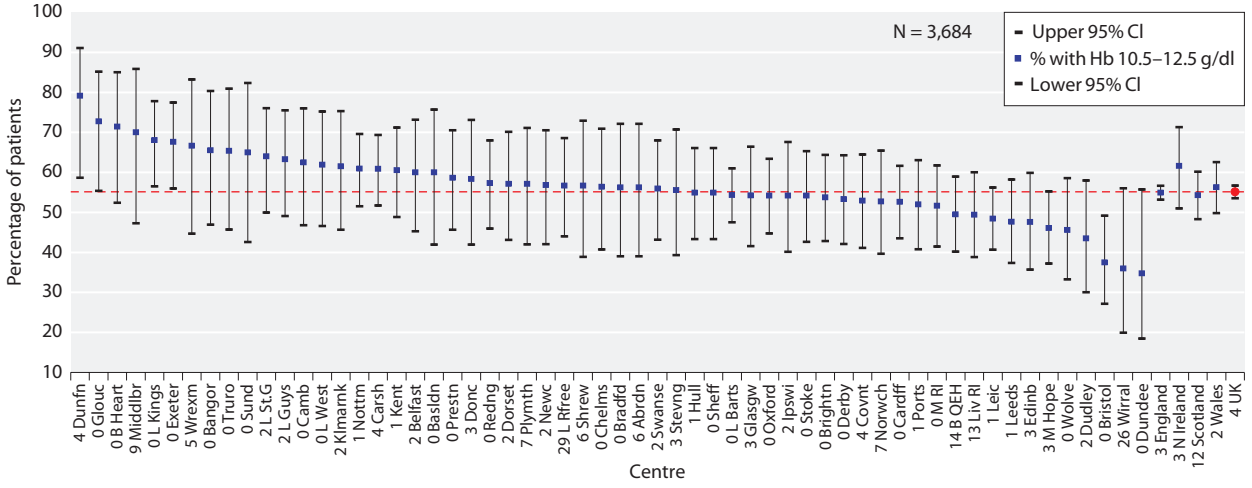

Fig. 9.17. Percentage of PD patients with Hb ⩾10.5 and ⩽12.5 g/dl

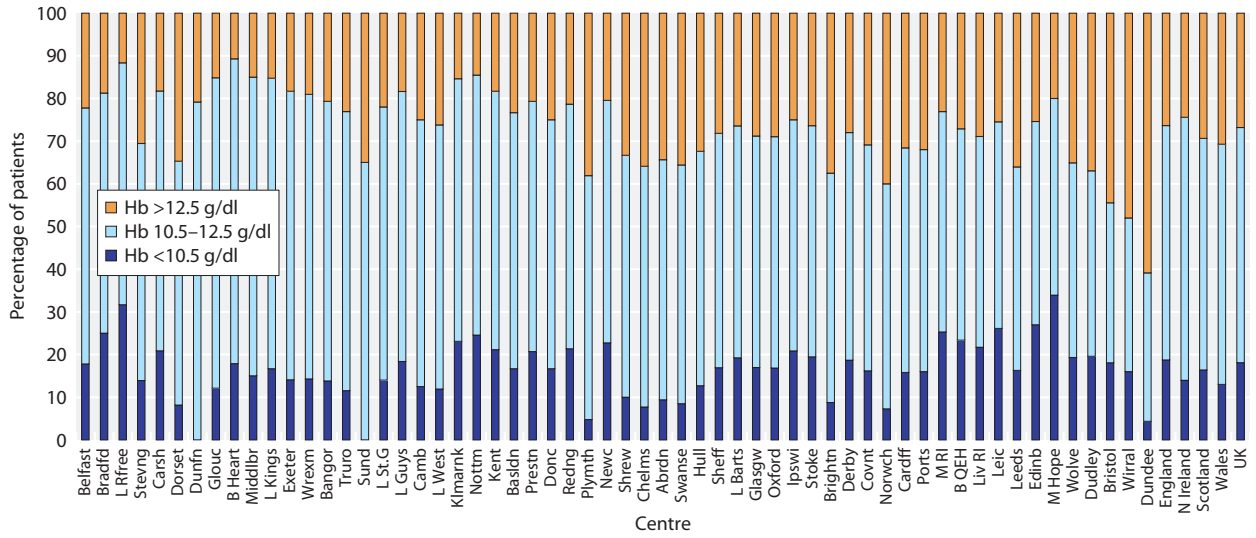

Fig. 9.18. Distribution of haemoglobin in patients treated with PD

Relationship between Hb in incident and prevalent dialysis patients in 2008

The relationship between the percentage of new and prevalent dialysis (HD and PD) patients with a Hb $\geqslant$10.0 g/dl is demonstrated in figure 9.20.

Correlation between median haemoglobin and compliance with clinical guidelines

The use of Rose-Day plots demonstrated the relationship between the population median and the compliance with minimum standards. The plots for Hb $\geqslant$10.0 g/dl and $\geqslant$11.0 g/dl for HD and PD populations are given in figures 9.21 to 9.24. The compliance with minimum standards over time between 1998 and 2008 are shown in figure 9.25 for prevalent patients (by treatment modality) and in figure 9.26 for incident and prevalent patients.

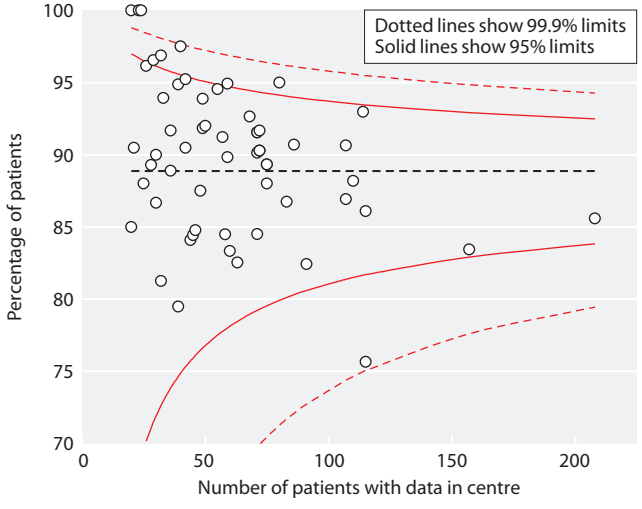

Fig. 9.19. Funnel plot of percentage of PD patients with Hb $\geqslant$10 g/dl

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 9.27) but did not do so in patients treated with PD (figure 9.28). The Hb in PD patients had been stable for some years and remained higher than in HD patients up to 2 years into dialysis therapy.

Factors affecting haemoglobin

Ferritin

Completeness of ferritin returns for patients treated with HD and PD

The completeness of serum ferritin returns to the UKRR is shown in table 9.6. Not all centres used serum ferritin as the sole indicator of iron status. Completeness of data for serum ferritin returned for England, Wales and Northern Ireland improved by comparison with the previous year. Renal centres may still need to address organisational processes in dealing with automatic download facilities to ensure that serum ferritin is checked, or alternatively that a declaration is made that alternative measures of iron status are being utilised.

Table 9.5. Percentage of PD patients achieving Hb ⩾10 g/dl

Centre	N with Hb	% with Hb ⩾10 g/dl	Centre	N with Hb	% with Hb ⩾10 g/dl
Middlbr	20	85	Wolve	57	91
Sund	20	100	Prestn	58	84
Wrexm	21	90	Glasgw	59	90
Dundee	23	100	Swanse	59	95
Dunfn	24	100	L Rfree	60	83
Wirral	25	88	Edinb	63	83
Truro	26	96	Covnt	68	93
B Heart	28	89	Exeter	71	90
Bangor	29	97	Hull	71	92
Basldn	30	87	Kent	71	85
Shrew	30	90	Sheff	71	92
Abrdn	32	97	Bristol	72	90
Bradfd	32	81	L Kings	72	90
Glouc	33	94	Stoke	72	92
Donc	36	89	Derby	75	89
Stevng	36	92	Ports	75	89
Chelms	39	95	Redng	75	88
Klmarnk	39	79	Brightn	80	95
Camb	40	98	Liv RI	83	87
L West	42	90	Leeds	86	91
Plymth	42	95	M RI	91	82
Newc	44	84	B QEH	107	87
Belfast	45	84	Oxford	107	91
Dudley	46	85	Nottm	110	88
Ipswi	48	88	Cardff	114	93
Dorset	49	94	Carsh	115	86
L Guys	49	92	M Hope	115	76
L St.G	50	92	Leic	157	83
Norwch	55	95	L Barts	208	86

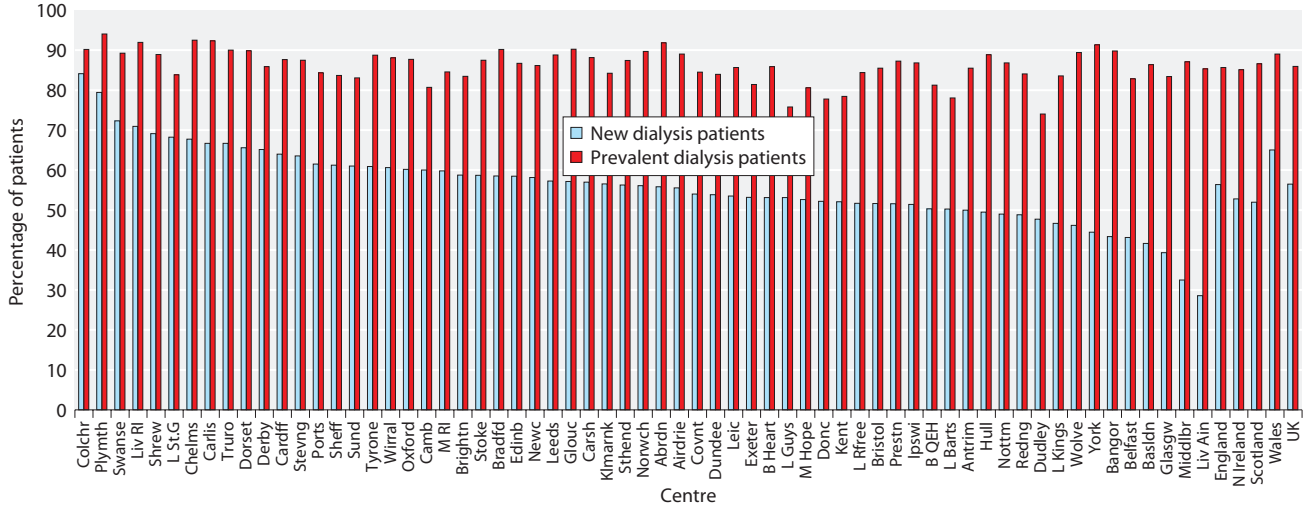

Fig. 9.20. Percentage of new and prevalent dialysis patients with Hb ⩾10 g/dl

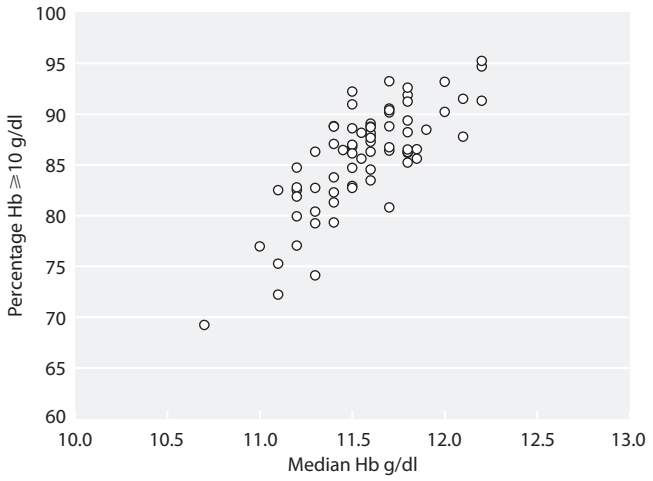

Fig. 9.21. Percentage of HD patients with Hb ⩾10 g/dl plotted against median haemoglobin

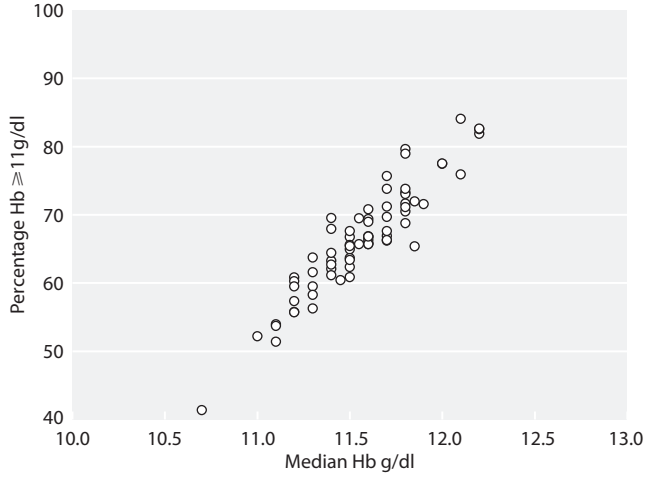

Fig. 9.22. Percentage of HD patients with Hb ⩾11 g/dl plotted against median haemoglobin

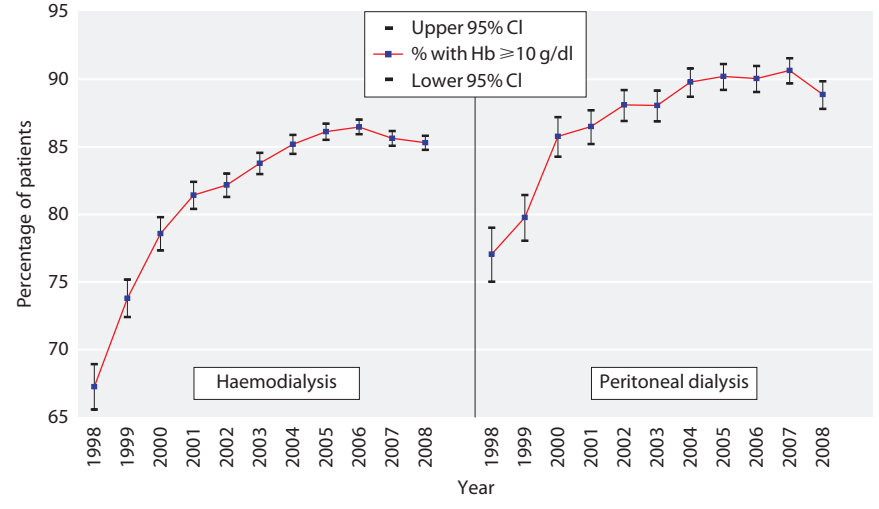

Fig. 9.25. Percentage of prevalent HD and PD patients (1998–2008) with Hb ⩾10 g/dl

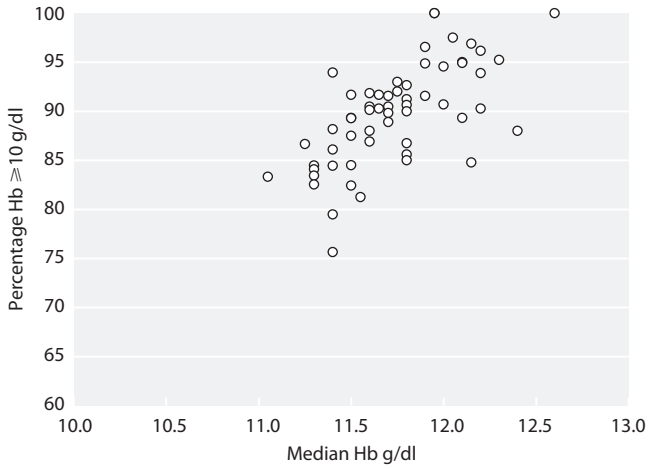

Fig. 9.23. Percentage of PD patients with Hb ⩾10 g/dl plotted against median haemoglobin

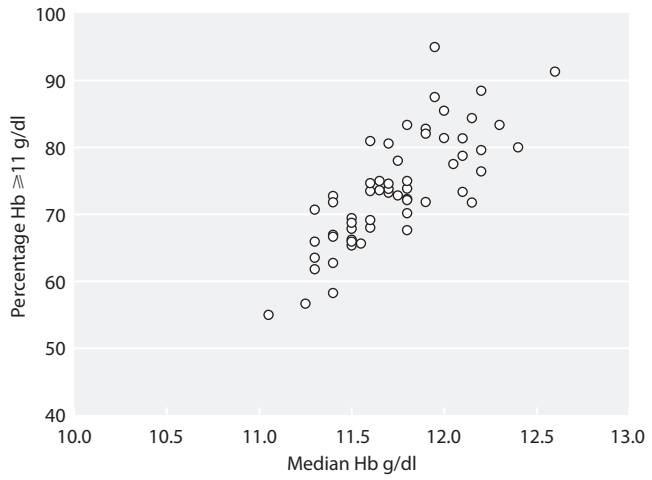

Fig. 9.24. Percentage of PD patients with Hb ⩾11 g/dl plotted against median haemoglobin

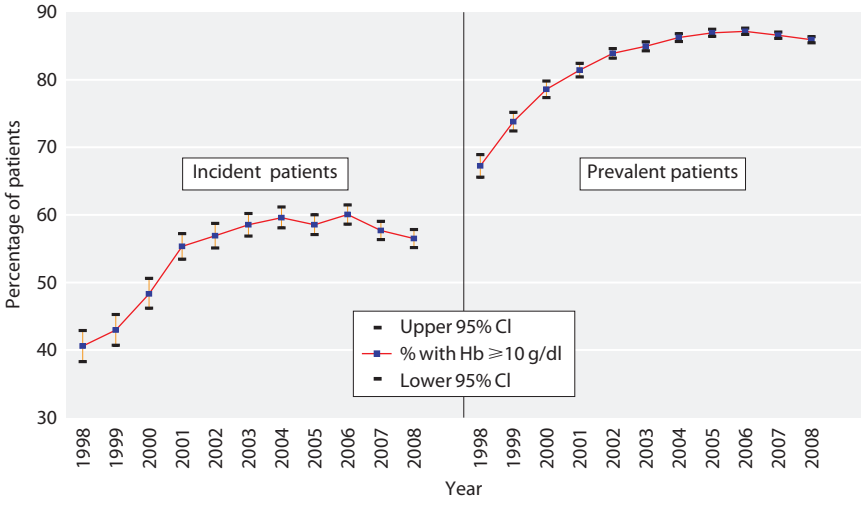

Fig. 9.26. Percentage of incident and prevalent dialysis patients (1998–2008) with Hb ⩾10 g/dl

Ferritin in prevalent dialysis patients

Percentage returns, serum ferritin concentrations and IQR are presented in tables 9.7 and 9.8 for HD and PD patients respectively. The percentage of patients with a ferritin ⩾800 µg/L by centre for HD and PD patients is shown in table 9.9.

The median and IQR for serum ferritin for HD and PD patients by centre is given in figures 9.29 and 9.30 respectively. The percentage of patients with a serum ferritin ⩾100 µg/L, ⩾200 µg/L and ⩾800 µg/L are shown in figures 9.31, 9.32 and 9.33 for HD and figures 9.34, 9.35 and 9.36 for PD respectively.

All centres achieved greater than 75% compliance with a serum of ferritin ⩾100 µg/L for HD patients and all but 6 centres achieved >90% compliance. The PD population had a lower median ferritin value (246 µg/L, IQR 141–399 vs. 436 µg/L, IQR 289–622 for HD). Thirty-five centres report less than 90% of PD patients compliant with serum ferritin ⩾100 µg/L. These results are comparable to last year's.

Changes in ferritin 2001–2008

The compliance with guidelines for ferritin in the HD populations at approximately 95% has remained stable over the last 6 years having reached a peak 5 years ago. In the PD population the compliance has decreased every year for the last 5 years but still remains at 84%. The serial values are shown in figure 9.37. The difference

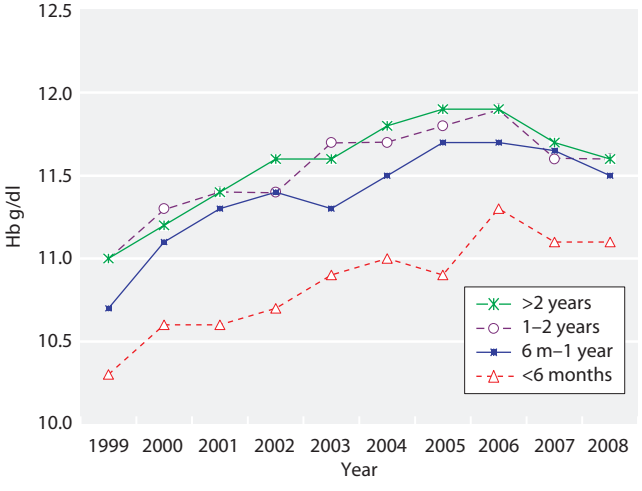

Fig. 9.27. Median haemoglobin plotted by length of time on RRT (HD patients)

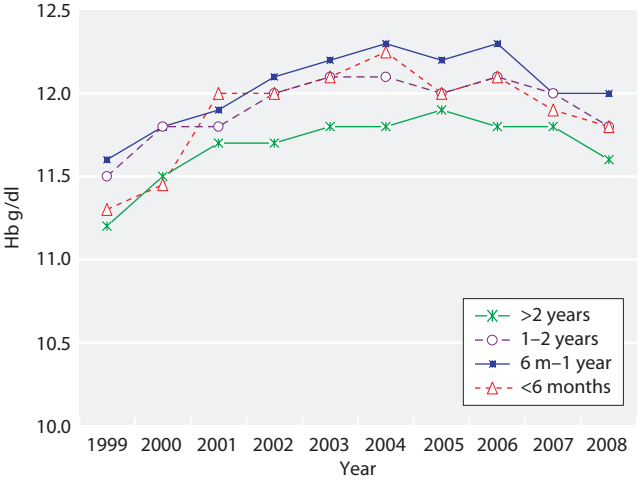

Fig. 9.28. Median haemoglobin plotted by length of time on RRT (PD patients)

Table 9.6. Completeness of ferritin returns

Centre	HD %	PD %	Centre	HD %	PD %
Abrdn	0	0	L Kings	100	99
Airdrie	1	0	L St.G	99	98
Antrim	91	88	L Rfree	81	95
B Heart	93	93	L West	79	98
B QEH	97	84	Leeds	98	99
Bangor	97	97	Leic	98	97
Basldn	99	100	Liv Ain	94	50
Belfast	95	98	Liv RI	94	91
Bradfd	91	100	M Hope	0	0
Brightn	92	99	M RI	68	99
Bristol	99	93	Middlbr	96	86
Camb	86	100	Newc	99	96
Cardff	96	97	Newry	67	100
Carlis	99	100	Norwch	97	93
Carsh	96	98	Nottm	100	100
Chelms	100	100	Oxford	98	96
Clwyd	93	90	Plymth	96	87
Colchr	98	n/a	Ports	98	91
Covnt	97	87	Prestn	99	95
D & Gall	0	0	Redng	99	100
Derby	99	100	Sheff	99	100
Derry	100	100	Shrew	100	100
Donc	100	84	Stevng	98	92
Dorset	99	92	Sthend	98	93
Dudley	78	94	Stoke	100	100
Dundee	0	0	Sund	100	85
Dunfn	0	0	Swanse	98	98
Edinb	0	0	Truro	99	96
Exeter	99	99	Tyrone	54	100
Glasgw	0	0	Ulster	99	100
Glouc	99	97	Wirral	63	74
Hull	98	96	Wolve	100	100
Inverns	0	0	Wrexm	79	23
Ipswi	100	90	York	95	100
Kent	100	97	**England**	**93**	**92**
Klmarnk	0	0	**N Ireland**	**86**	**97**
L Barts	100	100	**Scotland**	**0**	**0**
L Guys	96	96	**Wales**	**95**	**90**
			UK	**84**	**87**

Table 9.7. Ferritin in HD patients

Centre	% data return	Median ferritin	90% range	Inter-quartile range	% ferritin ⩾ 100 μg/L
Antrim	91	454	189–1142	303–724	98.2
B Heart	93	325	66–727	196–460	91.1
B QEH	97	384	165–760	293–480	97.8
Bangor	97	402	154–793	292–533	100.0
Basldn	99	345	91–611	283–441	94.4
Belfast	95	505	100–1280	312–756	95.2
Bradfd	91	460	122–947	336–678	96.9
Brightn	92	457	172–923	354–608	97.4
Bristol	99	337	65–876	205–502	92.3
Camb	86	267	48–703	172–394	88.8
Cardff	96	443	114–964	293–615	95.1
Carlis	99	468	201–1152	346–666	98.7
Carsh	96	357	63–738	248–463	92.4
Chelms	100	661	336–1014	549–779	100.0
Clwyd	93	427	182–941	313–600	100.0
Covnt	97	334	59–1024	186–516	89.2
Derby	99	452	116–955	302–640	96.0
Derry	100	550	78–1006	308–840	94.2
Donc	100	451	120–898	274–606	97.2
Dorset	99	454	188–853	333–630	98.9
Dudley	78	326	28–1028	191–508	86.2
Exeter	99	301	132–637	214–408	97.2
Glouc	99	473	180–1051	319–661	96.5
Hull	98	433	190–898	321–562	99.7
Ipswi	100	404	88–1013	276–554	94.8
L Barts	100	433	140–929	310–592	96.7
L Guys	96	426	89–917	287–605	94.7
L Kings	100	468	134–1103	307–699	98.4
L Rfree	81	415	29–1200	227–663	87.1
L West	79	570	249–1110	415–747	97.6
Leeds	98	465	125–813	342–563	96.2
Leic	98	360	60–810	226–496	91.5
Liv Ain	94	541	129–1201	353–715	98.2
Liv RI	94	614	125–1491	381–827	96.9
M Hope	0				
M RI	68	401	125–964	266–563	96.2
Middlbr	96	477	99–1588	310–843	94.6
Newc	99	521	175–1094	382–703	98.4
Newry	67	746	101–1288	482–960	96.6
Norwch	97	573	113–1254	346–810	95.7
Nottm	100	557	286–1029	460–670	99.2
Oxford	98	328	87–823	224–467	92.5
Plymth	96	466	178–1226	310–723	99.1
Ports	98	196	28–520	102–299	75.5
Prestn	99	589	175–1541	380–891	97.3
Redng	99	506	226–1045	376–664	99.6
Sheff	99	487	153–924	346–624	96.8
Shrew	100	246	36–678	158–373	80.6
Stevng	98	518	168–915	362–690	99.1
Sthend	98	320	132–559	230–394	96.7
Stoke	100	856	239–1853	581–1262	98.8

Table 9.7. Continued

Centre	% data return	Median ferritin	90% range	Inter-quartile range	% ferritin ⩾100 µg/L
Sund	100	542	226–1099	346–713	98.0
Swanse	98	438	114–937	272–602	95.5
Truro	99	467	198–911	327–599	98.5
Tyrone	54	816	360–1703	533–1010	100.0
Ulster	99	548	162–1314	368–703	100.0
Wirral	63	694	295–1497	507–937	99.0
Wolve	100	476	165–906	379–607	97.5
Wrexm	79	366	179–841	270–491	100.0
York	95	506	123–920	401–616	95.2
England	**93**	**433**	**100–1081**	**287–617**	**94.9**
N Ireland	**86**	**545**	**150–1276**	**335–806**	**96.8**
Wales	**95**	**434**	**133–932**	**289–599**	**96.2**
E, W & NI	**93**	**436**	**102–1079**	**289–622**	**95.0**

Blank cells = centres excluded from analyses due to poor data completeness or low patient numbers

Table 9.8. Ferritin in PD patients

Centre	% data return	Median ferritin	90% range	Inter-quartile range	% ferritin ⩾100 µg/L
Antrim	88				
B Heart	93	183	70–751	122–320	84.6
B QEH	84	162	38–803	92–280	73.3
Bangor	97	254	19–592	158–334	82.1
Basldn	100	170	38–605	116–405	83.3
Belfast	98	263	34–845	150–512	80.0
Bradfd	100	216	52–920	152–484	84.4
Brightn	99	295	77–880	171–400	92.4
Bristol	93	181	18–671	99–308	73.1
Camb	100	243	46–712	158–327	87.5
Cardff	97	105	27–492	47–193	53.2
Carlis	100				
Carsh	98	209	44–545	126–300	82.2
Chelms	100	203	48–795	147–349	89.7
Clwyd	90				
Colchr	n/a				
Covnt	87	204	78–753	119–350	82.3
Derby	100	345	67–796	226–482	94.7
Derry	100				
Donc	84	175	53–645	77–354	67.7
Dorset	92	255	34–467	160–365	87.0
Dudley	94	180	33–480	74–313	68.2
Exeter	99	205	53–789	159–304	85.7
Glouc	97	292	115–705	216–360	96.9
Hull	96	357	36–852	229–496	89.9
Ipswi	90	217	56–704	134–365	84.1
Kent	97	280	53–956	165–395	88.6

Table 9.8. Continued

Centre	% data return	Median ferritin	90% range	Inter-quartile range	% ferritin ⩾100 µg/L
L Barts	100	278	65–899	161–466	91.4
L Guys	96	142	29–783	87–254	70.8
L Kings	99	210	41–593	128–279	85.9
L Rfree	95	302	25–1034	161–473	83.8
L St.G	98	282	106–976	181–473	96.0
L West	98	249	98–976	185–367	92.7
Leeds	99	259	72–714	173–418	89.5
Leic	97	257	38–882	166–390	85.7
Liv Ain	50				
Liv RI	91	274	88–964	124–528	88.4
M Hope	0				
M RI	99	137	24–500	82–211	63.3
Middlbr	86				
Newc	96	350	155–1043	260–453	100.0
Newry	100				
Norwch	93	296	29–1051	115–503	78.2
Nottm	100	265	70–707	156–396	91.0
Oxford	96	236	38–713	154–351	85.4
Plymth	87	203	20–515	82–318	69.2
Ports	91	220	38–728	109–397	76.8
Prestn	95	292	39–635	158–456	87.3
Redng	100	337	64–802	218–531	90.7
Sheff	100	231	59–1090	150–392	85.9
Shrew	100	319	59–1039	225–408	90.6
Stevng	92	212	21–825	107–430	76.5
Sthend	93				
Stoke	100	520	65–1442	289–749	91.7
Sund	85				
Swanse	98	240	21–730	144–458	84.8
Truro	96	280	113–492	228–388	100.0
Tyrone	100				
Ulster	100				
Wirral	74	587	257–1386	428–884	100.0
Wolve	100	264	41–774	107–406	77.2
Wrexm	23				
York	100				
England	**92**	**251**	**44–826**	**149–405**	**85.2**
N Ireland	**97**	**259**	**45–864**	**115–492**	**77.9**
Wales	**90**	**157**	**21–705**	**74–269**	**67.0**
E, W & NI	**92**	**246**	**41–816**	**141–399**	**83.9**

Blank cells = centres excluded from analyses due to poor data completeness or low patient numbers
n/a = not applicable

Table 9.9. Percentage of patients with ferritin ⩾800 µg/L

	HD		PD	
Centre	% ferritin ⩾800 µg/L	95% CI	% ferritin ⩾800 µg/L	95% CI
Antrim	18.0	11.9–26.3		
B Heart	3.6	2.1–6.1	3.9	0.5–22.8
B QEH	3.9	2.7–5.6	5.7	2.6–12.1
Bangor	4.4	1.4–12.6	0.0	
Basldn	1.6	0.4–6.2	3.3	0.5–20.2
Belfast	21.6	16.7–27.4	6.7	2.2–18.7
Bradfd	11.7	7.6–17.6	6.3	1.6–21.8
Brightn	8.5	5.7–12.4	7.6	3.5–15.9
Bristol	6.3	4.3–9.0	0.0	
Camb	3.2	1.6–6.3	2.5	0.4–15.7
Cardff	9.8	7.3–13.0	1.8	0.5–6.9
Carlis	16.2	9.5–26.4		
Carsh	3.3	2.1–5.1	3.4	1.3–8.7
Chelms	23.2	15.8–32.7	2.6	0.4–16.1
Clwyd	9.5	4.3–19.6		
Colchr	26.7	19.0–36.2	n/a	n/a
Covnt	8.7	5.9–12.6	4.8	1.6–14.0
Derby	11.0	7.6–15.8	4.0	1.3–11.7
Derry	28.9	18.2–42.5		
Donc	11.1	5.7–20.7	0.0	
Dorset	7.6	4.5–12.4	0.0	
Dudley	7.5	3.6–14.8	0.0	
Exeter	2.8	1.4–5.6	4.3	1.4–12.5
Glouc	17.7	12.3–24.9	3.1	0.4–19.1
Hull	6.7	4.3–10.3	8.7	4.0–18.0
Ipswi	8.3	4.2–15.8	4.6	1.1–16.4
Kent	9.9	6.9–13.8	5.7	2.2–14.3
L Barts	8.4	6.4–11.0	6.3	3.7–10.5
L Guys	9.4	7.1–12.4	4.2	1.0–15.2
L Kings	16.9	13.5–21.1	1.4	0.2–9.3
L Rfree	16.7	13.7–20.2	7.5	3.4–15.7
L St.G	5.0	2.7–9.0	8.0	3.0–19.5
L West	18.8	16.4–21.5	9.8	3.7–23.3
Leeds	5.6	3.8–8.1	2.3	0.6–8.8
Leic	5.1	3.7–7.0	6.5	3.5–11.7
Liv Ain	17.4	11.4–25.7		
Liv RI	26.4	22.0–31.2	8.1	3.9–16.1
M Hope				
M RI	7.6	4.9–11.4	0.0	
Middlbr	28.4	23.2–34.1		
Newc	18.0	13.7–23.3	9.3	3.5–22.3
Newry	44.1	32.0–56.9		
Norwch	26.4	21.5–31.9	12.7	6.2–24.4
Nottm	13.9	10.7–17.9	2.7	0.9–8.0
Oxford	5.0	3.1–8.0	3.9	1.5–9.9
Plymth	18.5	12.3–27.0	2.6	0.4–16.1
Ports	2.5	1.3–4.5	2.9	0.7–10.9
Prestn	31.5	27.2–36.1	0.0	
Redng	13.4	9.6–18.5	5.3	2.0–13.4
Sheff	9.5	7.4–12.2	7.0	3.0–15.8
Shrew	2.4	0.9–6.1	9.4	3.1–25.4
Stevng	11.6	8.6–15.5	5.9	1.5–20.7
Sthend	0.8	0.1–5.7		
Stoke	54.6	48.2–60.8	23.6	15.2–34.8
Sund	15.9	10.9–22.6		

Table 9.9. Continued

Centre	HD		PD	
	% ferritin ⩾ 800 µg/L	95% CI	% ferritin ⩾ 800 µg/L	95% CI
Swanse	8.7	6.0–12.3	3.4	0.9–12.6
Truro	7.5	4.1–13.4	4.0	0.6–23.6
Tyrone	51.1	36.8–65.2		
Ulster	15.8	9.2–25.8		
Wirral	37.3	28.4–47.0	32.0	16.9–52.2
Wolve	9.5	6.5–13.6	3.5	0.9–13.0
Wrexm	5.4	1.7–15.3		
York	7.7	3.9–14.6		
England	**11.9**	**11.4–12.5**	**5.4**	**4.6–6.3**
N Ireland	**25.4**	**22.0–29.2**	**7.0**	**3.2–14.7**
Wales	**8.7**	**7.1–10.7**	**1.9**	**0.7–4.9**
E, W & NI	**12.2**	**11.7–12.7**	**5.2**	**4.5–6.0**

Blank cells = centres excluded from analyses due to poor data completeness or low patient numbers
n/a = not applicable
Where percentage = 0.0, the confidence intervals have not been calculated

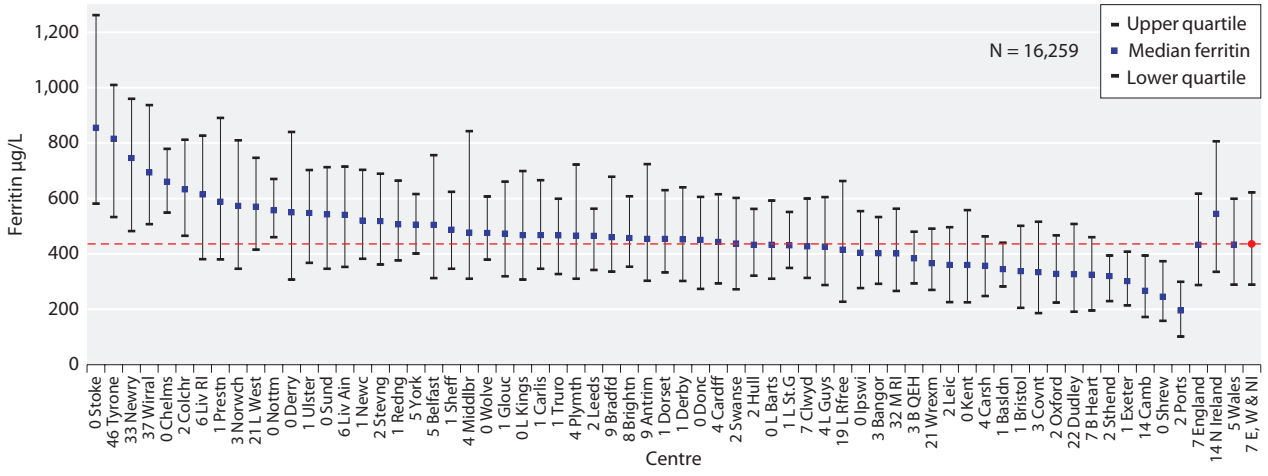

Fig. 9.29. Median ferritin in patients treated with HD

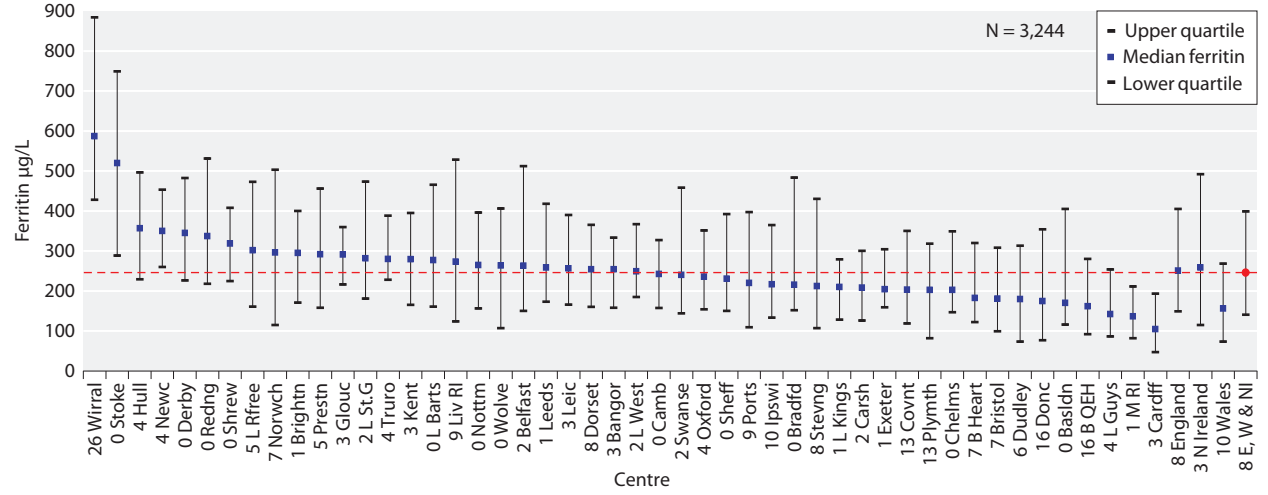

Fig. 9.30. Median ferritin in patients treated with PD

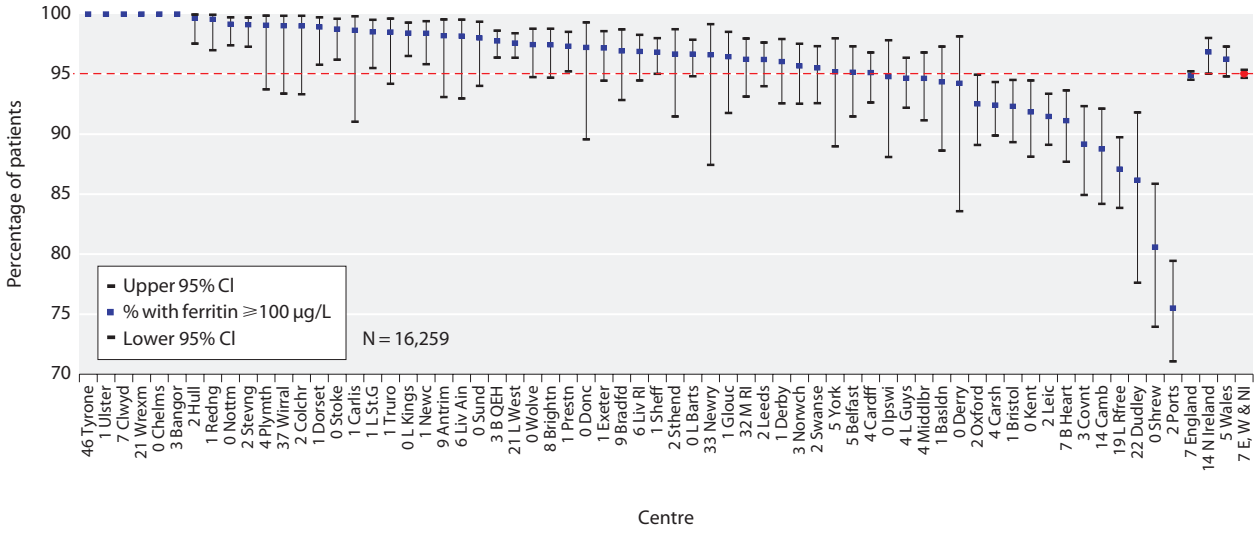

Fig. 9.31. Percentage of HD patients with ferritin ⩾100 µg/L

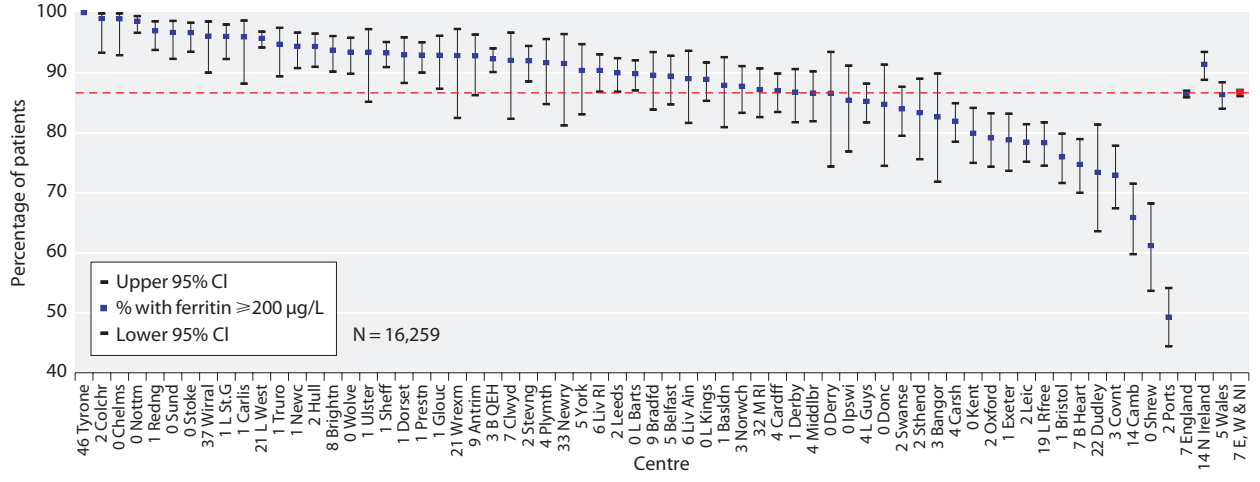

Fig. 9.32. Percentage of HD patients with ferritin ⩾200 µg/L

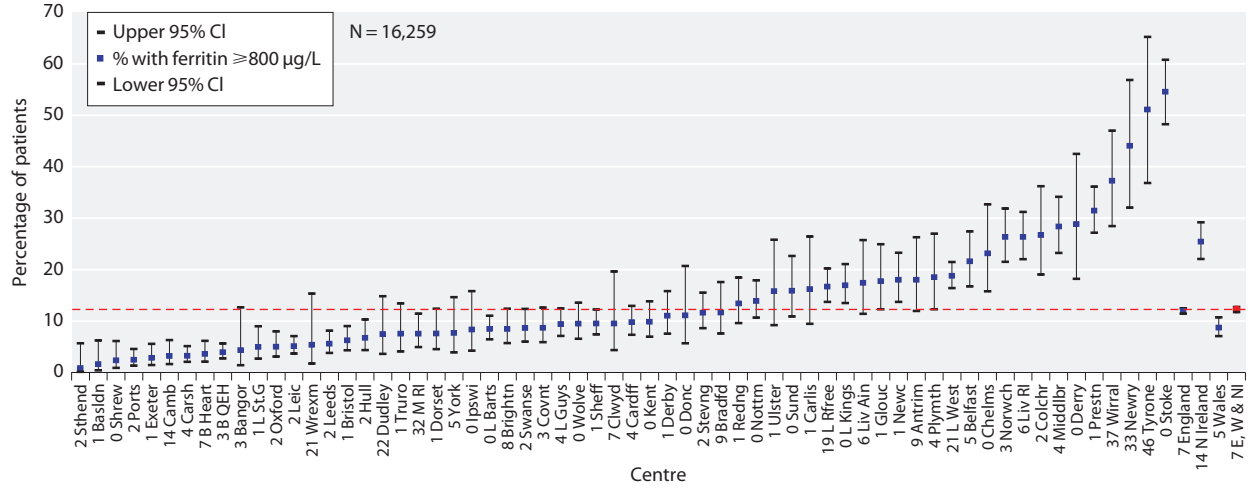

Fig. 9.33. Percentage of HD patients with ferritin ⩾800 µg/L

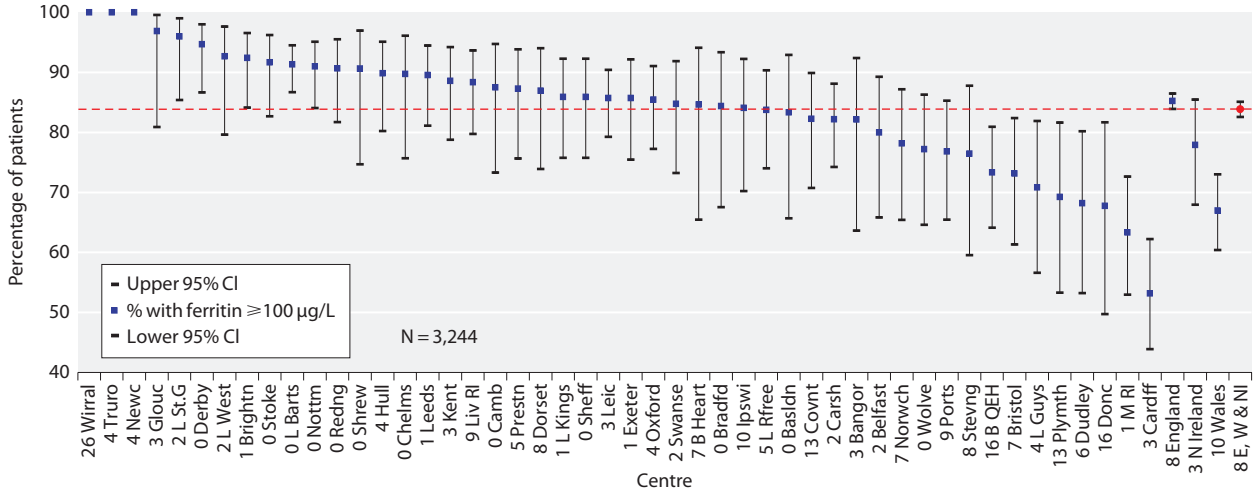

Fig. 9.34. Percentage of PD patients with ferritin ⩾100 µg/L

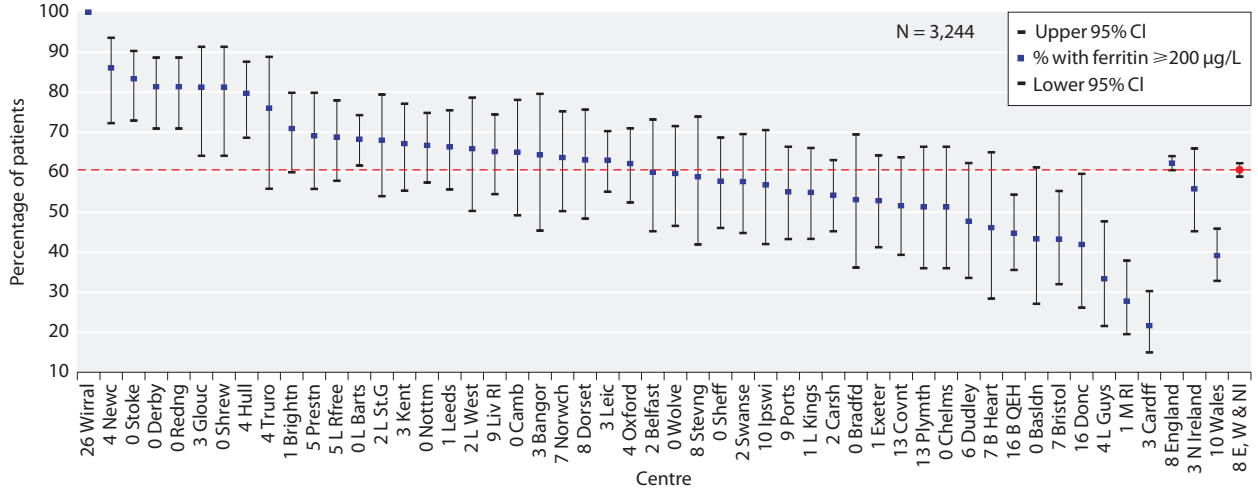

Fig. 9.35. Percentage of PD patients with ferritin ⩾200 µg/L

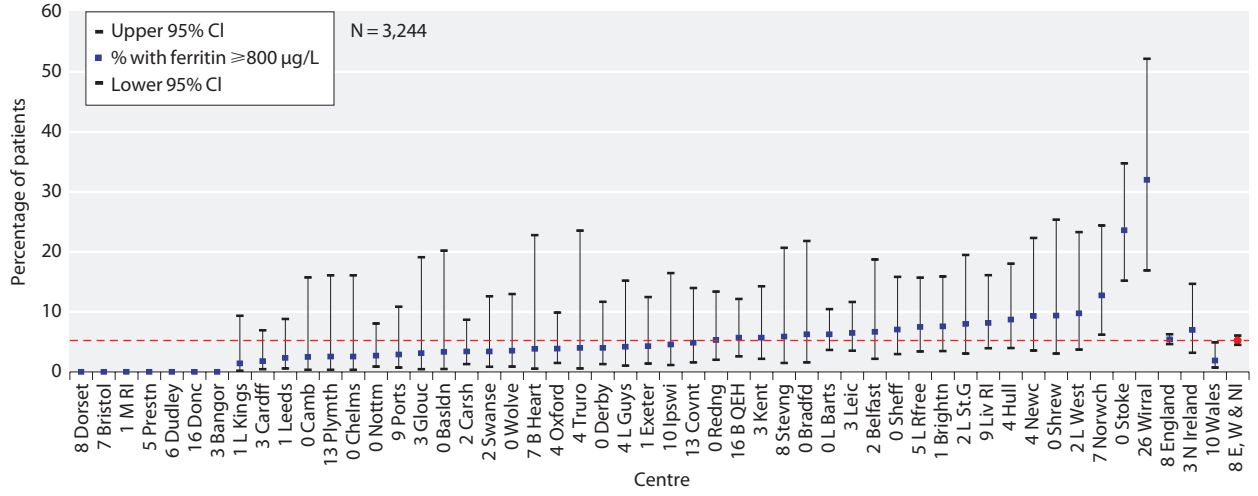

Fig. 9.36. Percentage of PD patients with ferritin ⩾800 µg/L

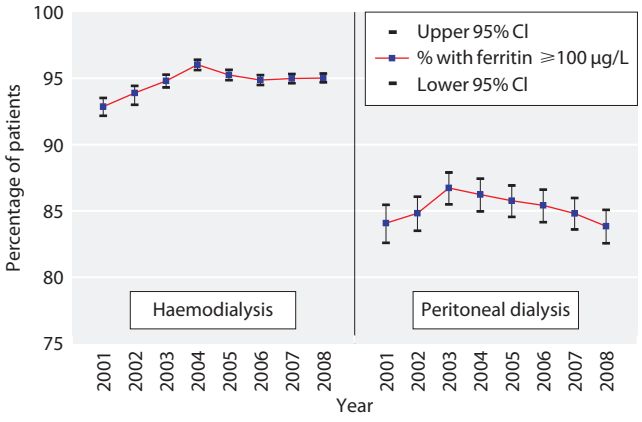

Fig. 9.37. Percentage of patients with ferritin ⩾100 µg/L (2001–2008)

between the compliance in HD and PD was probably because of the lower requirement for ESA to achieve target Hb levels in the PD population. There was therefore a lower requirement for intravenous iron supplementation. The median serum ferritin outcome over time is shown in figure 9.38.

Ferritin and length of time on renal replacement therapy

The median serum ferritin for patients grouped on the basis of length of time since starting dialysis treatment increased in HD and PD (figures 9.39 and 9.40).

Erythropoiesis stimulating agents

Patients treated and dose variation – ESA prescription and modality

Table 9.10 shows the percentage of patients treated and the dose of ESA given in HD patients. Equivalent data for PD patients are shown in table 9.11.

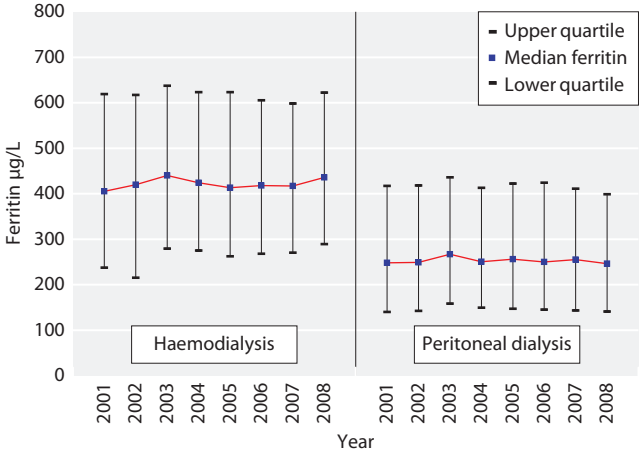

Fig. 9.38. Median ferritin (2001–2008)

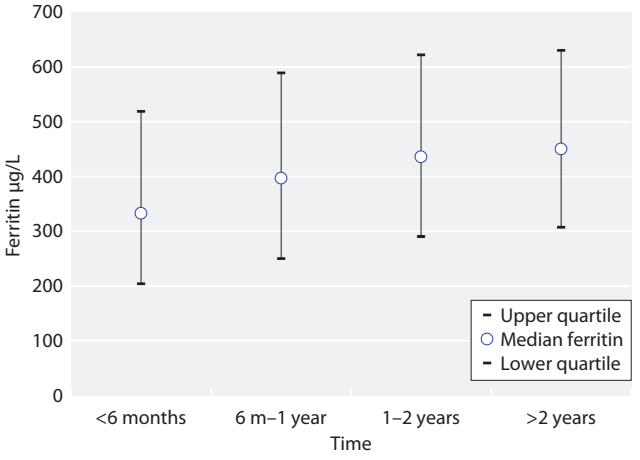

Fig. 9.39. Median ferritin by length of time on RRT in patients treated with HD

Age and ESA prescription

The proportion of patients on an ESA was higher for HD than PD and this discrepancy was evident across the age bands. The percentage of the whole cohort which maintained a Hb ⩾10 g/dl without requiring ESA (by age band and modality) is shown in figure 9.41.

The percentage of dialysis patients receiving ESA at all Hb levels is given in figure 9.42.

Figure 9.43 gives data on the percentage of anaemic patients (Hb <10.0 g/dl) receiving an ESA. Of the minority with Hb <10 g/dl and not on an ESA, some may have been declared unresponsive to ESA therapy and no longer be on treatment, some may have just become anaemic and not yet started therapy and others may have been on ESA but not have had it recorded.

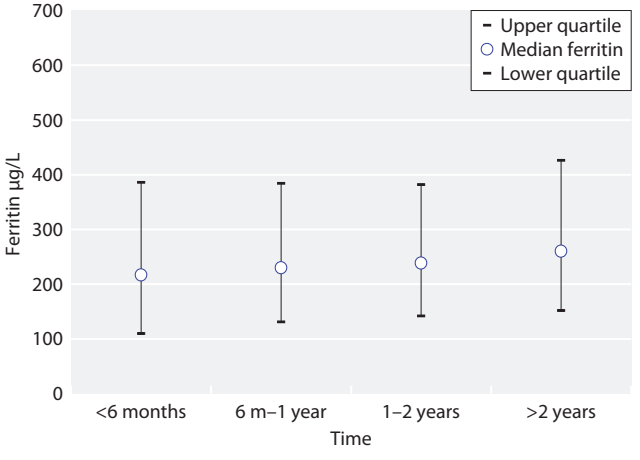

Fig. 9.40. Median ferritin by length of time on RRT in patients treated with PD

Table 9.10. ESA prescribing in HD patients

Centre	% on ESA	Mean weekly dose for pts on ESA (IU/week)	Median weekly dose for pts on ESA (IU/week)	% with Hb <10 g/dl who are on ESA	% with Hb ⩾10 g/dl and not on ESA
Antrim	96	9,179	6,000	100	4
B Heart	79	8,979	8,000	92	19
Bangor	80	9,228	8,000	89	17
Basldn	91	9,544	8,000	100	8
Belfast	91	7,951	6,000	100	6
Bradfd	86	7,724	6,000	100	10
Bristol	94	9,893	8,000	95	5
Chelms	98	10,011	8,000	100	2
Covnt	91	11,946	10,000	96	8
Derry	96	8,710	6,000	100	4
Donc	94	9,890	6,000	100	6
Dorset	90	11,974	12,000	100	10
Dudley	76	6,842	6,000	75	19
Exeter	95	9,245	8,000	100	4
Glouc	93	6,357	4,500	100	6
Ipswi	95	9,095	8,000	92	4
Kent	85	9,496	8,000	94	14
Leeds	93	7,419	6,000	100	6
Leic	96	8,494	6,000	99	3
Liv RI	90	9,141	8,000	96	4
Middlbr	80	6,138	6,000	82	16
Newry	91	6,438	6,000	100	9
Norwch	93	8,955	8,000	97	6
Oxford	95	10,781	8,000	95	4
Prestn	86			94	12
Redng	92			98	7
Sheff	90	10,879	8,000	98	9
Shrew	90	9,305	8,000	100	10
Sthend	95	11,810	10,000	100	5
Swanse	75	8,761	8,000	70	20
Truro	99	7,970	6,000	100	1
Tyrone	96	10,025	9,000	90	2
Ulster	99	7,776	6,000	100	1
Wrexm	94	8,897	8,000	100	6
York	92	9,898	6,000	75	5
England	**91**	**9,283**	**8,000**	**96**	**8**
N Ireland	**94**	**8,297**	**6,000**	**99**	**5**
Wales	**79**	**8,859**	**8,000**	**77**	**17**
E, W & NI	**90**	**9,166**	**8,000**	**95**	**8**

Blank cells denote centres excluded from analyses due to missing dosage data

Table 9.11. ESA prescribing in PD patients

Centre	% on ESA	Mean weekly dose for pts on ESA (IU/week)	Median weekly dose for pts on ESA (IU/week)	% with Hb <10 g/dl who are on ESA	% with Hb ⩾10 g/dl and not on ESA
Antrim*	63				
B Heart	68	5,368	4,000	100	32
Bangor	79	4,122	3,000	100	21
Basldn	60	7,278	3,500	100	40
Belfast	72	5,485	4,000	86	24
Bradfd	81	11,967	10,000	100	19
Bristol	69	6,077	4,000	100	31
Camb	85	6,735	4,000	100	15
Cardff**	75			100	25
Chelms	90	5,714	5,000	100	10
Covnt	80	7,982	6,000	80	19
Derry*	60				
Donc	73	5,704	4,000	100	28
Dorset	88	6,000	4,000	100	10
Dudley	81	5,706	4,000	100	17
Exeter	85	4,779	4,000	86	14
Glouc	82	6,315	4,000	100	18
Ipswi	82	6,235	4,000	83	15
Kent	56	3,764	3,000	45	37
Leeds	72	7,613	4,000	88	26
Leic	79	5,115	4,000	96	20
Liv RI	83	9,206	8,000	91	10
Norwch	58	3,765	2,600	67	40
Oxford	91	6,816	4,000	80	7
Plymth	78	5,543	4,000	50	17
Prestn**	76			78	21
Redng**	79			100	21
Sheff	63	7,289	6,000	100	37
Shrew	75	4,727	4,000	100	20
Sthend*	67				
Swanse	65	6,568	6,000	67	32
Truro	92	4,000	4,000	100	8
Tyrone*	57				
Ulster*	100				
York*	74				
England	**77**	**6,353**	**4,000**	**89**	**21**
N Ireland	**70**	**5,956**	**4,000**	**89**	**26**
Wales	**72**	**5,734**	**6,000**	**92**	**27**
E, W & NI	**76**	**6,302**	**4,000**	**89**	**22**

Blank cells denote centres excluded from analyses due to low patient numbers or missing dosage data
* Low patient numbers
** Missing dosage data

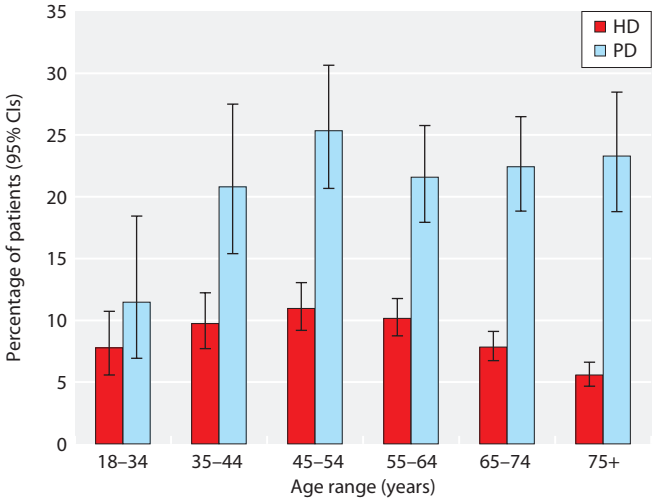

Fig. 9.41. Percentage of whole cohort who are not on ESA and have Hb $\geqslant$10 g/dl, by age group and treatment modality

ESA prescription and gender

Provision of ESA by age and gender for HD and PD patients is shown in figures 9.44 and 9.45.

ESAs and time on renal replacement therapy

The percentage of patients on ESA by time on RRT and treatment modality is shown in figure 9.46. This is a cross-sectional analysis at the final quarter of 2008. Patients who had previously changed RRT modality were still included in this analysis.

ESA dose and success with guideline compliance

There appears to be no direct relationship between ESA dose and median Hb in HD patients (figure 9.47)

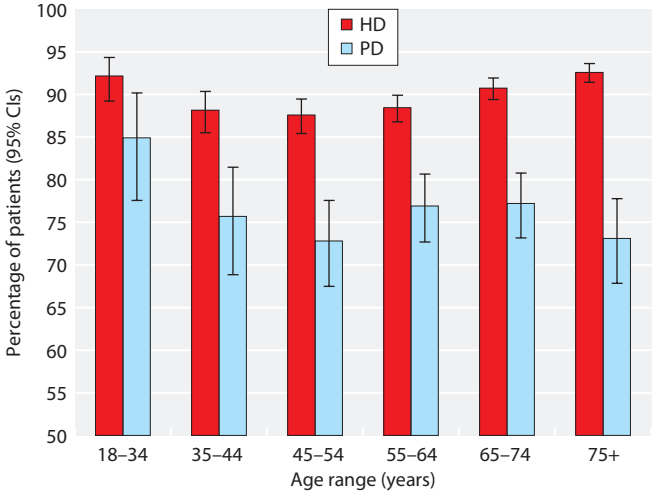

Fig. 9.42. Percentage of dialysis patients on ESA, by age group and treatment modality

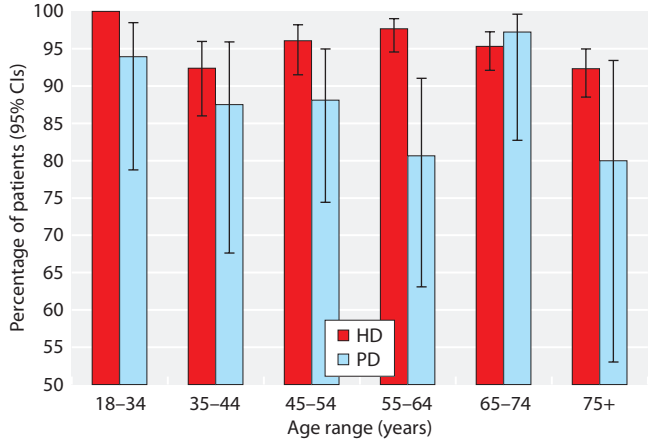

Fig. 9.43. Percentage of patients with Hb <10 g/dl who are on ESA, by age group and treatment modality

or in patients treated with PD (chart not shown). This may be because of the wide spectrum of ESAs available, the frequency and route of administration and the differing policies for iron supplementation. The same was true for compliance with the EPBG minimum standard for Hb in HD patients (figure 9.48). Figure 9.49 shows the frequency distribution of weekly ESA dose by treatment modality.

It is known that not all patients treated with dialysis who have a Hb above the new RA guideline ceiling of 12.5 g/dl are receiving ESA. As a result, it has been suggested that it may be inappropriate to include these patients within the group not meeting this RA target

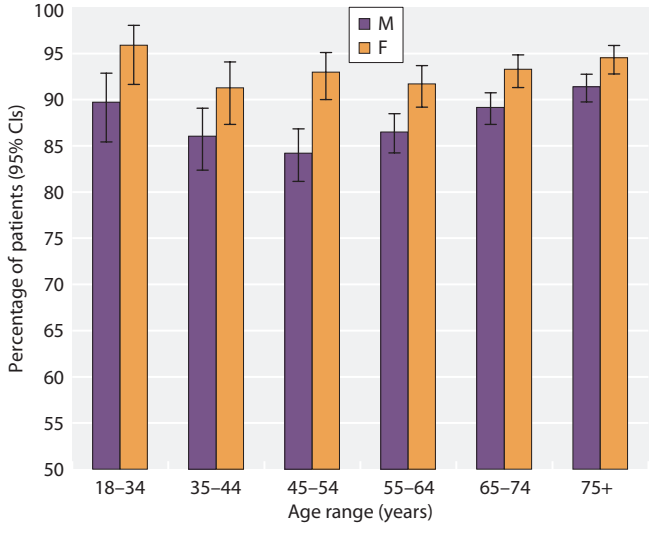

Fig. 9.44. Prescription of ESA by age and gender in patients treated with HD

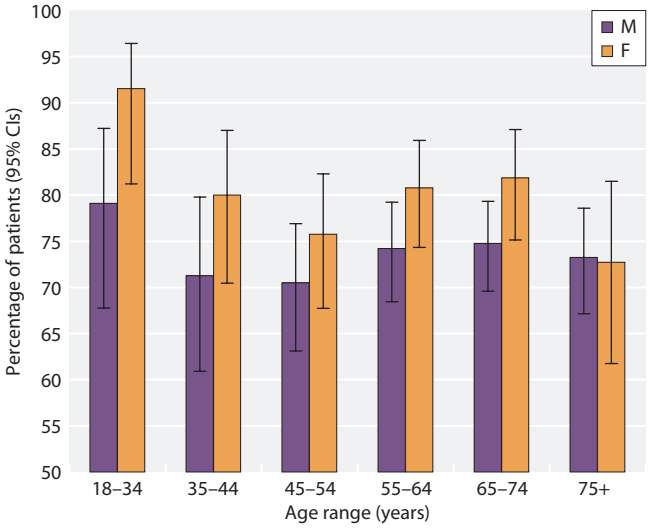

Fig. 9.45. Prescription of ESA by age and gender in patients treated with PD

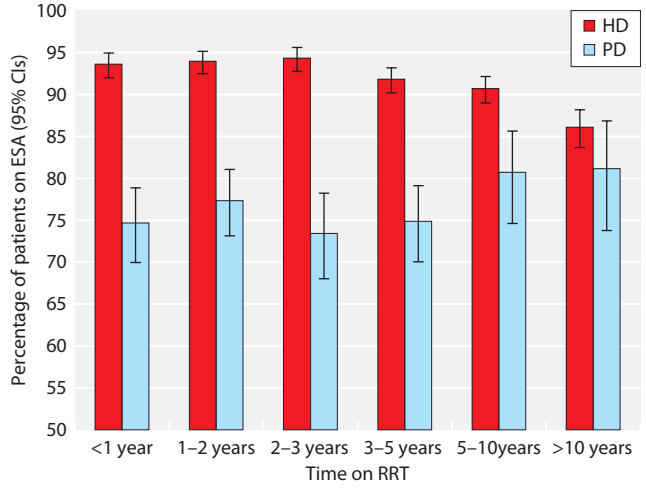

Fig. 9.46. Percentage of patients on ESA by time on RRT

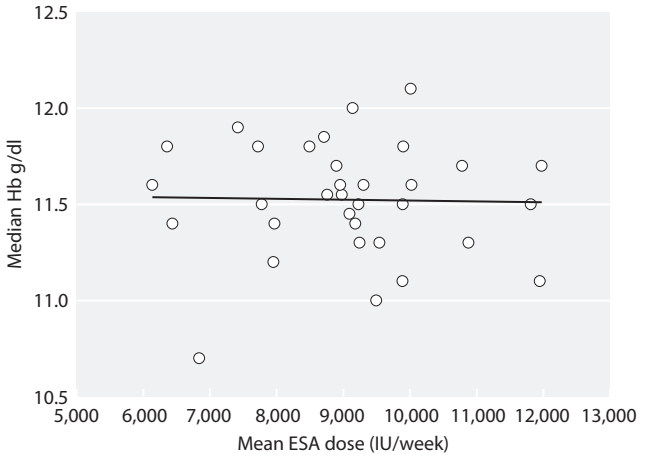

Fig. 9.47. Median Hb versus mean ESA dose in patients treated with HD

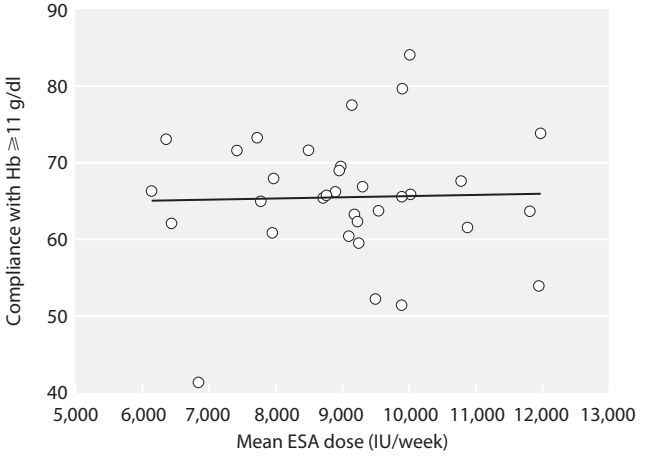

Fig. 9.48. Compliance with European Best Practice Guidelines versus mean ESA dose in patients treated with HD

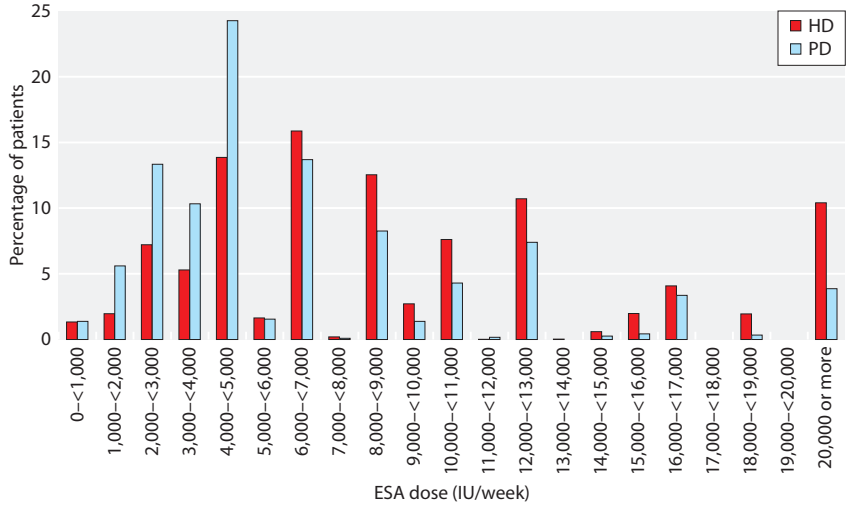

Fig. 9.49. Frequency distribution of weekly ESA dose

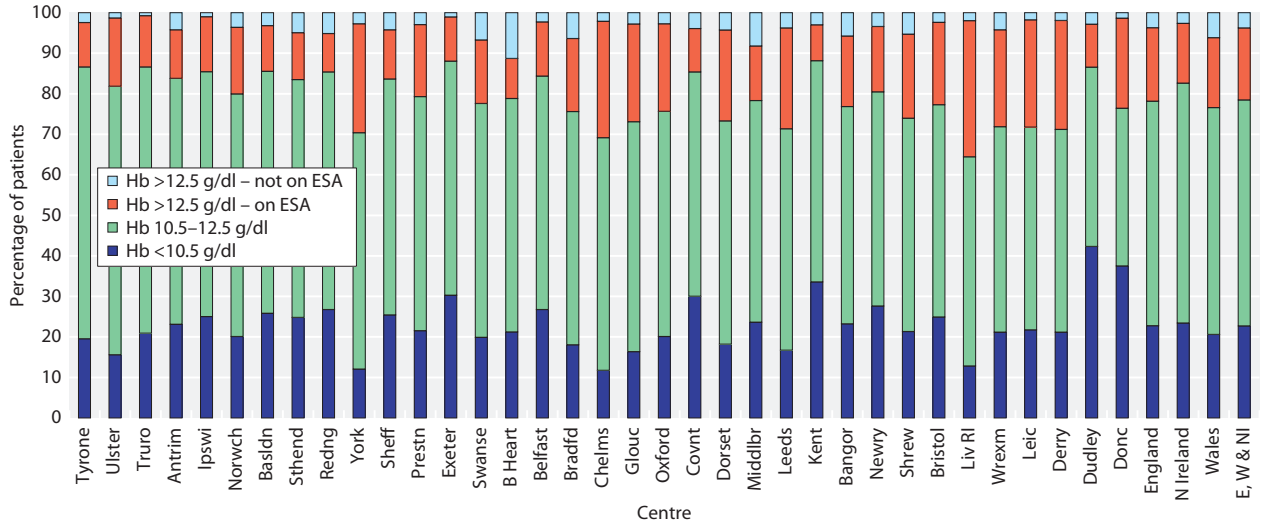

Fig. 9.50. Distribution of haemoglobin in patients treated with HD and the proportion of patients with Hb >12.5 receiving ESA

for two reasons: firstly, the high Hb remains outside the control of the clinician, and secondly, the recent trials suggesting that it may be detrimental to achieve a high Hb in renal patients were based only upon patients treated with ESAs [7, 8].

Figures 9.50 and 9.51 show the percentages of HD and PD patients in each centre whose Hb lies above, within or below the RA guidelines of 10.5–12.5 g/dl. These charts also show the proportion of patients with a Hb above 12.5 g/dl who are receiving, or are not receiving ESAs. These analyses are restricted to the centres with acceptable ESA returns as stipulated above. These figures show that 21.6% of HD patients have a Hb above the RA ceiling of 12.5 g/dl, but 3.8% are not receiving ESA. Patients on PD are more likely to have a high Hb without the use of ESA (28.1% with Hb >12.5, with 11.6% not on ESAs).

Discussion

Haemoglobin outcomes for patients on HD and PD in the UK were largely compliant with the RA minimum standard of Hb ⩾10.0 g/dl (85% and 89% respectively). Achieving compliance whilst also attempting compliance

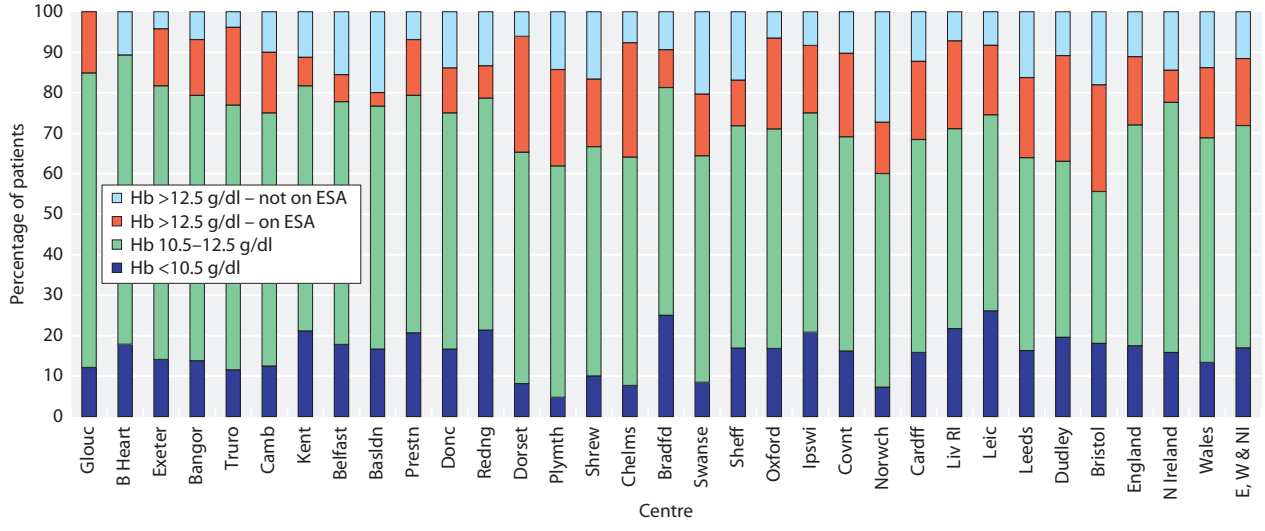

Fig. 9.51. Distribution of haemoglobin in patients treated with PD and the proportion of patients with Hb >12.5 receiving ESA

with the NICE guidelines published in 2006 and the 4th edition of the RA Clinical Practice Guidelines 2006 [6] recommended outcome Hb of between 10.5 and 12.5 g/dl requires careful positioning of the median outcome Hb for each centre. It also requires a reduction in the standard deviation of Hb to reach compliance levels higher than ~60% even if the median Hb falls on 11.5 g/dl.

Of 47 centres achieving >85% compliance with Hb ⩾10.0 g/dl in HD patients, only 9 centres achieved ⩾60% compliance with Hb between 10.5–12.5 g/dl. The presentation of funnel plots for compliance with Hb ⩾10.0 g/dl and Hb between 10.5–12.5 g/dl (figures 9.12 and 9.13) may enable centres to continue adjusting their desired Hb outcome in light of the NICE guidelines.

Narrowing the population Hb distribution would appear to be important if centres wish to achieve compliance with Hb >10 g/dl whilst avoiding higher Hb outcomes i.e. >12.5 g/dl [7–9]. Seven of the 10 units achieving the greatest compliance with Hb between 10.5 and 12.5 g/dl had the lowest standard deviations for Hb (1.1 to 1.2 g/dl) in HD patients. If centres consistently achieve these narrow distributions and the critical behaviour(s) by which they achieve these outcomes were identified, other centres could attempt to copy their behaviour.

In last year's report the need to avoid improving compliance with the NICE guidelines at the expense of the Hb ⩾10.0 g/dl minimum standard was highlighted. This year's report confirms maintained UK compliance with more than 85% Hb ⩾10.0 g/dl for dialysis patients. The use of a target Hb between 10.5–12.5 g/dl alone would infer equivalent risk of Hb >12.5/dl as for <10.5 g/dl. The NICE guidance [5] on limiting upper Hb was primarily a health economic decision and at the time not given on the grounds of safety. However recent studies highlight the lack of benefit and possible harm related to higher Hb outcomes. The evidence for improving Hb ⩾10 g/dl remains unchanged.

Compliance with advice regarding iron stores as reflected by ferritin has remained stable in the UK and the percentage of patients with serum ferritin greater than 100 μg/L showed that the provision of iron to UK dialysis patients has been maintained.

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

Overall the data demonstrated that UK renal centres continued to give a high priority to the management of factors influencing Hb. Adjustments seem to have been made in many centres in accordance with the NICE guidelines since the last report was published. Sixty centres achieved ⩾50% compliance with Hb between 10.5–12.5 g/dl for HD patients compared with 51 centres in last year's report and 35 in the report prior to that. The overall UK compliance with this range has also improved from 48% to 53% to 54% over the same period. Further improvements require us to learn from the positive deviants!

Conflict of interest: none

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