UK Renal Registry 14th Annual Report: Chapter 8 Haemoglobin, Ferritin and Erythropoietin amongst UK Adult Dialysis Patients in 2010: national and centre-specific analyses

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Key Words
Anaemia · Chronic kidney disease · Dialysis · End stage renal disease · Epidemiology · Erythropoietin · Erythropoietin Stimulating Agent · European Best Practice Guidelines · Ferritin · Haemodialysis · Haemoglobin · NICE · Peritoneal dialysis · Renal Association

Summary

- In 2010, the median Hb of patients at the time of starting dialysis in the UK was 10.1 g/dl with 53.6% of patients having a Hb $\geqslant$10.0 g/dl.
- By dialysis modality, median Hb at dialysis start was 9.8 g/dl (IQR 9.0–10.8) for HD patients and 11.1 g/dl (IQR 10.1–12.0) for PD patients.
- The median Hb of prevalent patients on HD in the UK was 11.5 g/dl with an IQR of 10.5–12.3 g/dl.
- The median Hb of prevalent patients on PD in the UK was 11.6 g/dl with an IQR of 10.6–12.5 g/dl.
- In 2010, 52.7% of HD patients had Hb $\geqslant$10 and $\leqslant$12 g/dl and 54.3% of PD patients had Hb 10.5–12.5 g/dl.
- In 2010, 84.6% of HD and 87.2% of PD patients had Hb $\geqslant$10 g/dl.
- In England, Wales and Northern Ireland the median ferritin in HD patients was 444 µg/L (IQR 299–635) and 96% of HD patients had a ferritin $\geqslant$100 µg/L.
- In England, Wales and Northern Ireland the median ferritin in PD patients was 264 µg/L (IQR 148–426) with 86% of PD patients having a ferritin $\geqslant$100 µg/L.
- In 2010, the mean Erythropoietin Stimulating Agent (ESA) dose was higher for HD than PD patients (9,020 vs. 6,202 IU/week) in England, Wales and Northern Ireland.

Introduction

This chapter describes UK Renal Registry (UKRR) data relating to the management of anaemia in dialysis patients during 2010. 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 haemoglobin (Hb) of at least 10 g/dl within 6 months of being seen by a nephrologist, unless there is a specific reason why it was unachievable. At present the UKRR does not collect Hb measurements specifically from patients 6 months after meeting a nephrologist. However an indication of the attainment of this standard is given by the Hb of the incident patient population (i.e. the Hb at the start of dialysis). The achievement of these standards is mainly through the use of iron therapy (oral and intravenous) and Erythropoietin Stimulating Agents (ESAs).

The risks associated with low (<10 g/dl) and high (>13 g/dl) Hb are not necessarily equivalent. 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. In 2009, a new target Hb range for haemodialysis (HD) patients was recommended by the 5th edition of the Renal Association Guidelines for Haemodialysis patients [7]. This guidance specified that pre-HD Hb concentration should be maintained between 10 and 12 g/dl. As this chapter analyses 2010 data, HD patients have been compared against this revised target.

The 5th edition of the UK Renal Association's Anaemia in CKD guideline [8] was published at the end of 2010 and attempted to unify targets with those published in the 2010 update NICE guideline on anaemia management in CKD [9]. The target outcome Hb for RRT patients on ESA treatment in these guidelines is between 10 and 12 g/dl. Therefore next year's report will use this standard for peritoneal dialysis (PD) and transplant patients on ESA therapy. The KDIGO website [10] is a useful resource for comparison of international anaemia guidelines.

The analyses in this chapter examine how centres comply with the 10–12 g/dl range (HD patients), 10.5–12.5 g/dl range (PD patients) and the attainment of the minimum standard of Hb $\geqslant$ 10.0 g/dl.

The national and international recommendations for target iron status in CKD used in this chapter remain 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) of 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 not all 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 2010 were analysed. The UKRR extracted quarterly data electronically from renal centres in England, Wales and Northern Ireland; data from Scotland were provided by the Scottish Renal Registry. Patients receiving dialysis on 31st December 2010 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 2010 was used for analysis. Patients were analysed as a complete cohort and also divided by modality into groups.

For the incident patient analyses, data from the first quarter after starting dialysis were 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 was analysed at both centre and country level. As in previous years 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 inter-quartile ranges (IQR) were also calculated. These data are represented as caterpillar plots showing median values and quartile ranges.

The percentage achieving RA and other standards was 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 (CIs) shown.

Longitudinal analysis was performed to calculate overall changes in achievement of standards from 1998 to 2010.

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.

For the target Hb range in haemodialysis patients the standard specified by the 5th UK RA Clinical Practice Haemodialysis guideline [7] was used, which specifies:

Haemodialysis patients should have a pre-dialysis Hb concentration between 10 and 12 g/dl.

Data regarding ESAs were collected from all renal centres. Erythropoietin data from the last quarter of 2010 were used. Scotland was excluded from the analysis as data regarding ESA was not included in its return. 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 they are in part based upon the frequency distribution graph of centres' ESA use. The percentage of patients on ESAs is calculated from these data and incomplete data returns risk seriously impacting on any conclusions drawn.

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. In the future the UKRR hopes to collect and report CKD 5 data from patients who subsequently commence RRT and for those managed conservatively.

The percentage of data returned and outcome Hb are listed in table 8.1. Twelve centres are not included in this analysis due to either being small centres who submitted data on fewer than 20 patients and/or because data completeness was less than 50%.

The median Hb of patients at the time of starting dialysis in the UK was 10.1 g/dl with 53.6% of patients

Table 8.1. Haemoglobin data for new patients starting haemodialysis or peritoneal dialysis during 2010

Centre	% data return	N with data	Median Hb g/dl	90% range	Inter-quartile range	% Hb ⩾10 g/dl
Abrdn	75	33	10.0	7.7–11.6	9.2–11.2	52
Airdrie	89	48	9.9	7.7–12.8	8.6–11.0	46
Antrim	97	30	9.4	7.5–11.7	8.4–10.6	33
B Heart	100	93	9.5	7.5–12.3	8.8–11.0	44
B QEH	69	124	10.5	8.0–12.5	9.3–11.3	64
Bangor	96	25	11.3	9.4–13.1	9.9–12.1	72
Basldn	100	26	9.6	6.6–11.7	8.3–10.4	42
Belfast	82	49	10.0	7.8–12.0	8.9–10.6	51
Bradfd	96	53	9.8	7.7–12.6	9.2–11.3	47
Brightn	99	101	10.2	7.8–12.4	9.6–10.9	65
Bristol	99	141	9.6	7.5–12.3	8.7–10.7	44
Camb	95	75	10.3	7.5–13.0	9.5–11.4	63
Cardff	100	160	10.0	8.4–12.6	9.3–11.0	54
Carlis	100	20	10.8	8.6–13.2	9.5–12.2	70
Carsh	97	193	10.4	8.4–12.7	9.7–11.3	65
Chelms	100	41	10.9	8.4–12.7	9.6–11.6	71
Clwyd	100	13				
Colchr	62	16				
Covnt	91	96	10.4	7.6–12.9	9.4–11.3	63
D & Gall	30	3				
Derby	93	71	10.2	8.5–12.5	9.5–11.1	61
Derry	100	15				
Donc	100	43	9.4	7.1–12.6	8.4–11.4	42
Dorset	97	63	10.5	7.7–12.0	9.3–11.1	65
Dudley	97	37	9.5	8.1–12.3	8.6–10.2	32
Dundee	82	37	9.5	7.7–12.2	9.3–10.4	35
Dunfn[a]	19	8				
Edinb	79	48	10.8	7.7–12.9	9.5–11.4	65
Exeter	100	129	9.9	8.2–12.4	9.2–10.9	50
Glasgw	48	70				
Glouc	100	53	10.0	7.7–12.4	9.1–10.9	51
Hull	98	78	9.7	7.6–11.9	9.0–10.4	38
Inverns[a]	50	13				
Ipswi	89	25	9.7	7.8–11.8	8.9–10.4	40
Kent	100	115	9.8	7.6–12.3	8.9–10.8	45
Klmarnk	24	10				
L Barts	97	187	9.8	7.4–13.1	8.8–11.2	46
L Guys	82	91	9.6	7.6–11.5	8.6–10.4	34
L Kings	99	144	9.6	8.1–12.0	9.0–10.5	37
L Rfree	91	127	10.6	8.3–13.3	9.4–11.3	66
L St.G	96	65	9.7	7.7–12.4	9.1–10.9	45
L West	90	281	10.7	8.6–12.8	9.9–11.6	71
Leeds	100	96	9.6	7.2–11.8	8.7–10.6	36
Leic	100	207	9.8	7.5–12.2	8.9–10.8	43
Liv Ain	9	4				
Liv RI	96	77	10.7	8.0–13.3	9.7–11.9	68
M Hope	86	97	9.7	7.6–13.6	9.0–10.9	43
M RI	96	133	9.6	7.8–13.0	8.8–11.2	45
Middlbr	95	87	9.3	7.5–12.5	8.3–10.7	32
Newc	97	70	10.2	7.1–12.8	8.9–11.4	57
Newry	100	23	9.6	8.0–11.4	9.1–10.4	39
Norwch	96	75	10.2	7.8–13.0	9.0–11.4	57
Nottm	100	101	10.0	7.8–12.3	9.0–11.0	51
Oxford	100	132	10.1	7.6–12.3	9.3–11.0	52
Plymth	46	24				
Ports	99	125	10.5	8.5–13.6	9.6–11.6	66
Prestn	91	102	10.1	8.0–12.3	9.0–10.9	55
Redng	100	76	10.1	7.6–12.8	9.1–11.3	51
Sheff	100	109	10.5	7.8–13.1	9.6–11.4	66
Shrew	100	55	10.4	8.4–12.3	9.7–11.1	65
Stevng	100	104	10.0	8.0–12.6	9.1–10.9	51

Table 8.1. Continued

Centre	% data return	N with data	Median Hb g/dl	90% range	Inter-quartile range	% Hb ⩾10 g/dl
Sthend	100	27	10.3	8.0–12.4	9.1–11.6	56
Stoke	100	89	10.5	7.9–13.4	9.5–11.6	63
Sund	94	48	10.4	8.3–13.2	9.4–11.2	58
Swanse	99	122	10.4	8.2–12.6	9.4–11.3	64
Truro	100	39	10.2	8.0–13.6	9.2–11.6	59
Tyrone	91	10				
Ulster	100	19				
Wirral	90	46	10.2	8.0–12.9	9.4–10.8	54
Wolve	99	96	10.5	7.6–14.3	9.0–11.8	61
Wrexm	100	23	11.5	8.9–13.6	10.9–12.3	83
York	100	28	9.9	7.4–11.6	8.9–11.1	43
England	**94**	**4,535**	**10.1**	**7.7–12.7**	**9.1–11.1**	**54**
N Ireland	**92**	**146**	**9.7**	**7.6–11.7**	**8.9–10.6**	**43**
Scotland[a]	**57**	**270**	**9.9**	**7.5–12.6**	**8.7–11.2**	**49**
Wales	**99**	**343**	**10.3**	**8.4–12.9**	**9.4–11.3**	**61**
UK	**91**	**5,294**	**10.1**	**7.7–12.7**	**9.1–11.1**	**54**

Blank cells = centres excluded from analyses due to poor data completeness or low patient numbers
[a]A data extraction problem resulted in the UKRR not collecting all available data for these centres. The Scottish Renal Registry (www.srr.scot.nhs.uk <http://www.srr.scot.nhs.uk/>) record data completeness >90% for both centres and also for Scotland as a whole

having a Hb ⩾10.0 g/dl (vs. 10.2 g/dl and 55% for 2010 report). The variation between centres remained high (32–83%).

Median Hb of patients at dialysis start by modality was also examined (data not shown). Median Hb at dialysis start was 9.8 g/dl [inter-quartile range (IQR) 9.0–10.8 g/dl)] and 11.1 g/dl (IQR 10.1–12.0 g/dl) for HD and PD patients, respectively. When initiating dialysis, 47.0% of HD patients had a Hb ⩾10.0 g/dl, compared to 78.0% of PD patients.

The median starting Hb by centre is shown in figure 8.1 and the percentage starting with a Hb ⩾10.0 g/dl by centre is given in figure 8.2. The distribution of Hb in incident dialysis patients during 2010 is shown in figure 8.3.

Incident dialysis patients from 2009 were followed for one year and the median haemoglobin (and percentage with a Hb ⩾10.0 g/dl) of survivors at the end of each quarter was calculated (figures 8.4 and 8.5). Hb is higher in those surviving 3 months reflecting both the treatment administered and poor survival of sicker, more anaemic patients.

The annual distribution of Hb in incident dialysis patients is shown in figure 8.6. Since 2006 the proportion

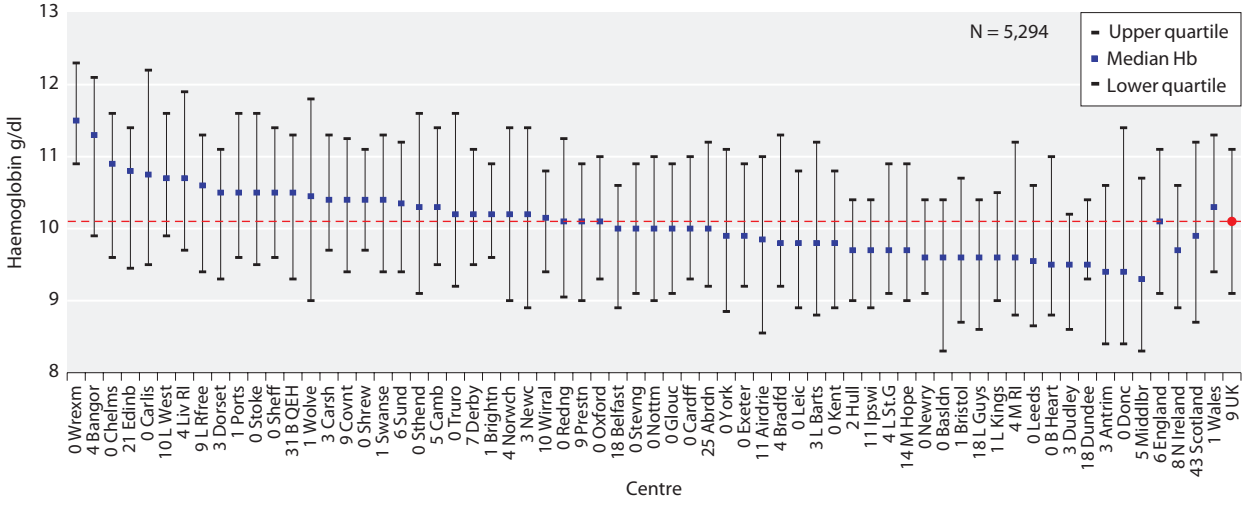

Fig. 8.1. Median haemoglobin for incident dialysis patients at start of dialysis treatment in 2010

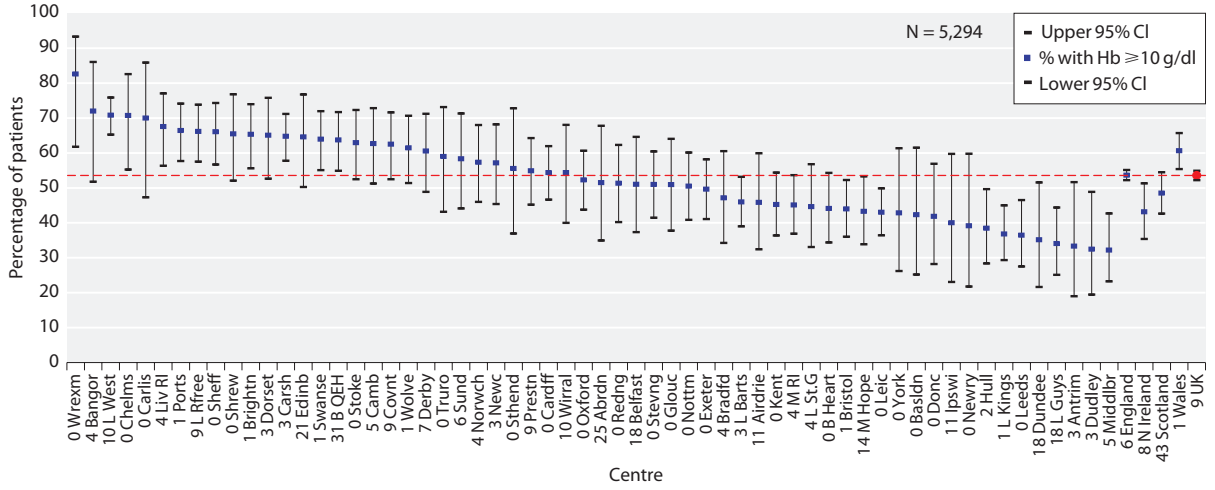

Fig. 8.2. Percentage of incident dialysis patients with Hb ⩾10 g/dl at start of dialysis treatment in 2010

of incident patients with Hb ⩾12 g/dl has fallen from 17.2% to 11.5%.

Haemoglobin in prevalent haemodialysis patients

Compliance with data returns and Hb outcome for prevalent HD patients in the 72 UK renal centres are shown in table 8.2.

The median Hb of patients on HD in the UK was 11.5 g/dl with an IQR of 10.5–12.3 g/dl. In the UK, 85% of HD patients had a Hb ⩾10.0 g/dl. These UK averages are very similar to the values published in the last few UKRR reports. The median Hb by centre, compliance with the previous UK minimum standard of Hb ⩾10.0 g/dl and EBPG standard of Hb ⩾11.0 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 compliance with the new RA Clinical Practice Guidelines [7] recommended range of 10.0–12.0 g/dl is shown in figure 8.11. In 2010, 52.7% of prevalent HD patients had a Hb within this target range. The majority of centres complied well with respect to both the minimum and target range Hb standards but it was possible to fall within 2–3 SDs of the mean in the funnel plot (figure 8.12) for a percentage of patients with Hb ⩾10 and ⩽12 g/dl and yet have a poor compliance with percentage of Hb ⩾10.0 g/dl (figure 8.13). This demonstrates that compliance with one standard (Hb ⩾10 and ⩽12 g/dl) can be achieved without compliance with another standard (Hb ⩾10.0 g/dl). Table 8.2 can be used in conjunction with figures 8.12 and 8.13 to identify centres.

Haemoglobin in prevalent peritoneal dialysis patients

In the UK 87% of patients on PD had a Hb ⩾10.0 g/dl (table 8.3). The median Hb of patients on PD in the UK was 11.6 g/dl with an IQR of 10.6–12.5 g/dl. These UK averages are very similar to the values published in the last few UKRR reports. The median Hb by centre, compliance with the UK minimum standard Hb ⩾10.0 g/dl and EBPG Hb ⩾11.0 g/dl are shown in figures 8.14, 8.15 and 8.16 respectively. The compliance with RA and NICE [5, 6] recommended range Hb ⩾10.5 and ⩽12.5 g/dl is shown in figure 8.17. In 2010, 54.3% of prevalent PD patients had a Hb within the target range. The distribution of Hb in PD patients by centre is shown in figure 8.18. The funnel plot for percentage Hb ⩾10.0 g/dl is shown in figure 8.19. Table 8.3 can be used to identify centres in the funnel plot.

Relationship between Hb in incident and prevalent dialysis patients in 2010

The relationship between the percentage of new and prevalent dialysis (HD and PD) patients with a Hb ⩾10.0 g/dl is shown in figure 8.20. As expected, all centres have a higher percentage of prevalent patients achieving a Hb ⩾10.0 g/dl than incident patients. Overall in the UK, 85.0% of prevalent patients, compared to 53.6% of incident patients, had a Hb ⩾10.0 g/dl in 2010.

Correlation between median haemoglobin and compliance with clinical guidelines

Rose-Day plots (figures 8.21 to 8.24) are used to

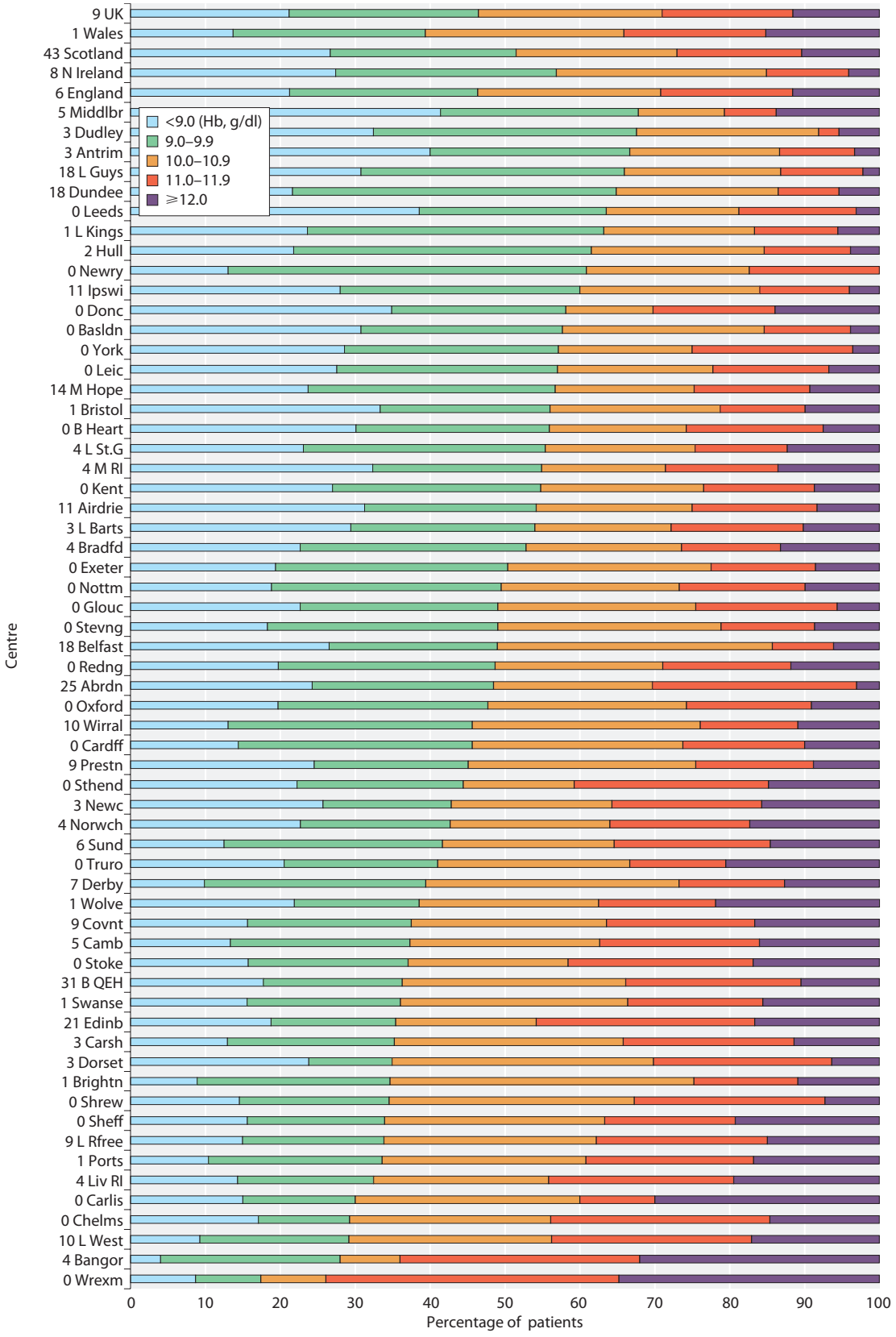

Fig. 8.3. Distribution of haemoglobin in incident dialysis patients at start of dialysis treatment in 2010

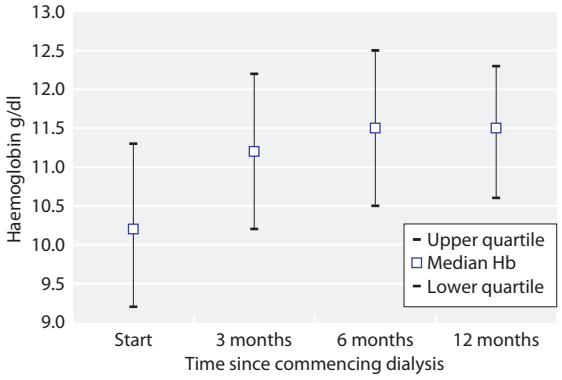

Fig. 8.4. Median haemoglobin, by time on dialysis, for incident dialysis patients in 2009

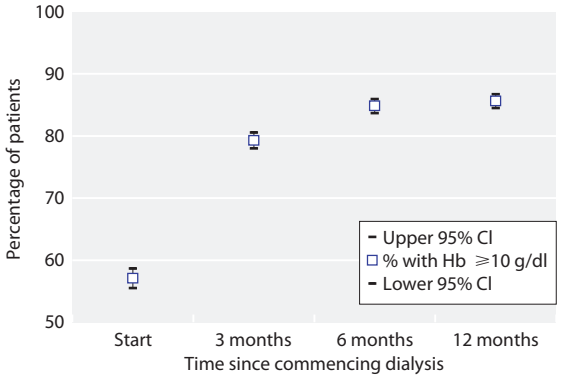

Fig. 8.5. Percentage of incident dialysis patients in 2009 with Hb ⩾10 g/dl, by time on dialysis

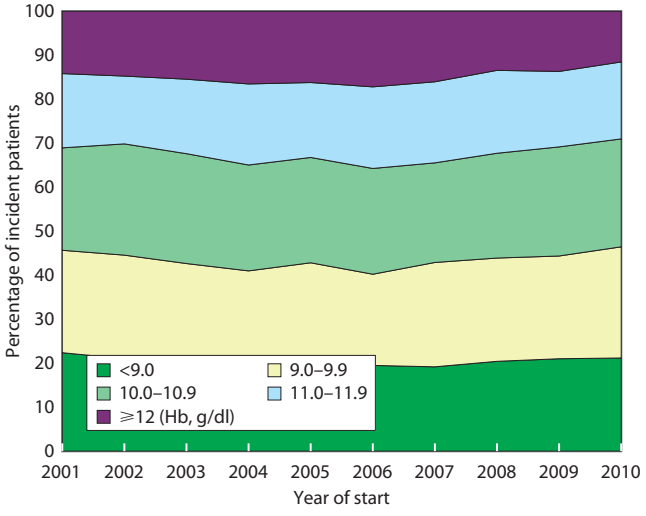

Fig. 8.6. Distribution of haemoglobin in incident dialysis patients by year of start

Table 8.2. Haemoglobin data for prevalent HD patients in 2010

Centre	% data return	N with data	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	% with Hb 10–12 g/dl
Abrdn	98	187	11.1	9.1–13.2	10.2–12.1	11.1	1.3	79	58	53
Airdrie	99	171	11.3	8.6–12.9	10.6–12.1	11.1	1.3	84	60	56
Antrim	100	123	11.4	8.9–13.0	10.6–12.1	11.2	1.3	87	66	62
B Heart	99	391	11.3	8.4–13.1	10.2–12.3	11.2	1.5	79	61	48
B QEH	89	731	11.4	8.7–13.5	10.4–12.2	11.3	1.5	81	62	52
Bangor	99	81	12.0	10.1–13.8	11.1–12.6	11.9	1.1	96	78	47
Basldn	98	129	11.3	8.6–13.1	10.0–12.0	11.0	1.5	76	58	51
Belfast	98	213	11.2	8.4–13.6	10.3–12.0	11.1	1.5	79	62	55
Bradfd	98	161	11.6	8.9–14.0	10.7–12.4	11.5	1.5	88	65	52
Brightn	98	317	11.3	9.2–13.2	10.4–12.1	11.3	1.3	84	62	57
Bristol	100	430	11.6	8.9–13.4	10.7–12.5	11.5	1.5	85	71	51
Camb	99	317	11.5	9.2–13.3	10.8–12.3	11.5	1.3	90	70	61
Cardff	100	452	11.4	8.8–13.6	10.4–12.3	11.3	1.4	83	61	53
Carlis	98	51	11.5	9.6–13.8	10.6–12.1	11.4	1.1	92	65	67
Carsh	97	663	11.4	9.2–13.4	10.6–12.1	11.4	1.3	86	63	59
Chelms	100	112	11.4	9.4–13.1	10.8–12.1	11.4	1.1	90	72	64
Clwyd	97	59	11.6	9.8–13.9	11.0–12.4	11.7	1.3	95	80	56
Colchr	97	96	11.6	9.8–13.3	11.0–12.3	11.7	1.0	93	76	54
Covnt	100	331	11.4	8.5–13.5	10.2–12.3	11.2	1.5	77	62	47
D & Gall	88	45	11.0	9.0–13.0	10.5–12.0	11.3	1.2	89	58	69

Table 8.2. Continued

Centre	% data return	N with data	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	% with Hb 10–12 g/dl
Derby	100	202	11.8	9.3–13.6	10.9–12.5	11.7	1.3	89	73	47
Derry	100	53	11.4	8.6–13.2	10.1–12.1	11.1	1.4	81	62	53
Donc	100	130	11.4	8.8–13.6	10.2–12.1	11.2	1.4	79	58	52
Dorset	100	226	11.7	9.1–14.1	10.8–12.6	11.7	1.5	89	73	52
Dudley	99	142	11.3	8.6–13.5	10.4–12.0	11.2	1.6	80	59	56
Dundee	100	160	11.9	9.1–13.7	11.1–12.4	11.7	1.5	89	77	46
Dunfn[a]	32	40								
Edinb	100	257	11.8	9.0–13.6	10.9–12.5	11.7	1.4	89	74	49
Exeter	100	322	11.3	8.6–13.0	10.3–12.1	11.1	1.4	82	58	56
Glasgw	91	536	11.4	8.6–14.0	10.4–12.3	11.3	1.6	82	63	51
Glouc	100	177	11.4	8.3–13.2	10.6–12.2	11.2	1.4	82	65	55
Hull	99	309	11.6	9.2–13.9	10.7–12.4	11.5	1.4	87	68	53
Inverns[a]	2	2								
Ipswi	100	106	11.5	9.6–13.3	10.9–12.1	11.5	1.2	91	73	63
Kent	99	329	11.5	8.8–13.6	10.6–12.2	11.4	1.4	88	67	56
Klmarnk	89	129	11.7	9.0–14.0	10.8–12.6	11.8	1.4	88	72	47
L Barts	99	743	11.2	8.6–13.3	10.2–12.0	11.0	1.4	78	55	54
L Guys	88	466	11.2	8.3–13.5	10.0–12.1	11.0	1.6	76	56	50
L Kings	100	390	11.0	9.0–13.0	10.1–11.8	11.0	1.3	81	52	60
L Rfree	88	565	11.5	8.8–13.6	10.5–12.4	11.4	1.5	85	64	49
L St.G	99	263	11.1	8.3–12.9	9.7–11.9	10.9	1.4	71	54	52
L West	99	1,233	11.9	9.5–13.6	11.1–12.7	11.8	1.3	92	77	47
Leeds	100	437	11.6	8.9–13.7	10.9–12.4	11.5	1.4	88	73	54
Leic	100	730	11.5	8.8–13.5	10.4–12.4	11.4	1.4	83	63	50
Liv Ain	10	13								
Liv RI	99	362	11.8	9.0–14.4	10.7–12.7	11.7	1.6	87	69	48
M Hope	77	258	11.3	8.0–13.7	10.2–12.3	11.2	1.6	78	60	48
M RI	89	391	11.5	9.1–13.7	10.6–12.4	11.5	1.4	84	66	49
Middlbr	99	260	11.4	8.1–13.8	10.5–12.4	11.3	1.7	79	66	46
Newc	99	245	11.5	8.8–14.2	10.4–12.8	11.5	1.7	82	64	44
Newry	99	99	11.6	9.0–13.0	10.8–12.2	11.4	1.2	91	71	59
Norwch	99	296	11.7	9.3–13.9	10.8–12.4	11.6	1.4	88	72	51
Nottm	100	385	11.5	8.6–13.1	10.7–12.2	11.3	1.3	86	68	56
Oxford	100	352	11.6	8.9–13.8	10.4–12.4	11.4	1.5	85	63	49
Plymth	51	63	11.7	9.7–13.6	10.8–12.7	11.6	1.4	87	70	56
Ports	100	444	12.0	9.3–14.1	10.9–12.9	11.9	1.5	89	74	42
Prestn	98	456	11.3	8.9–13.3	10.3–12.1	11.2	1.4	83	58	57
Redng	100	243	11.5	8.8–13.4	10.5–12.3	11.4	1.4	88	67	57
Sheff	100	565	11.3	8.7–13.3	10.4–12.2	11.2	1.4	82	60	54
Shrew	100	186	11.6	9.4–13.4	11.0–12.4	11.6	1.1	91	76	56
Stevng	100	360	11.3	9.5–13.1	10.6–12.1	11.3	1.2	89	63	63
Sthend	100	119	11.2	8.3–12.6	10.2–11.9	10.9	1.3	77	57	60
Stoke	100	278	11.8	9.1–13.4	10.8–12.3	11.5	1.3	88	71	49
Sund	99	163	11.6	9.1–13.4	10.8–12.4	11.5	1.3	87	70	51
Swanse	100	323	11.7	9.5–13.3	10.8–12.3	11.5	1.2	89	73	57
Truro	100	140	11.5	9.6–13.3	10.7–12.1	11.4	1.1	89	66	64
Tyrone	98	88	11.5	9.6–13.0	10.6–12.2	11.4	1.2	91	67	59
Ulster	100	86	11.0	9.2–12.8	10.4–11.7	11.0	1.3	84	51	67
Wirral	73	126	11.3	8.6–13.4	10.4–12.3	11.2	1.5	83	57	52
Wolve	100	285	11.4	8.8–14.1	10.4–12.5	11.4	1.6	85	63	52
Wrexm	100	72	11.5	9.0–13.9	10.6–12.3	11.4	1.4	88	64	50
York	96	134	11.3	9.0–13.7	10.2–12.1	11.3	1.5	82	60	54
England	**96**	**16,623**	**11.5**	**8.9–13.6**	**10.5–12.3**	**11.4**	**1.4**	**84**	**65**	**52**
N Ireland	**99**	**662**	**11.3**	**8.9–13.2**	**10.5–12.1**	**11.2**	**1.3**	**85**	**63**	**59**
Scotland[a]	**86**	**1,527**	**11.6**	**8.9–13.6**	**10.6–12.4**	**11.4**	**1.5**	**85**	**67**	**53**
Wales	**100**	**987**	**11.6**	**9.1–13.6**	**10.6–12.3**	**11.5**	**1.4**	**87**	**68**	**54**
UK	**95**	**19,799**	**11.5**	**8.9–13.6**	**10.5–12.3**	**11.4**	**1.4**	**85**	**65**	**53**

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

[a]A data extraction problem resulted in the UKRR not collecting all available data for these centres. The Scottish Renal Registry (www.srr.scot.nhs.uk <http://www.srr.scot.nhs.uk/>) record data completeness >90% for both centres and also for Scotland as a whole

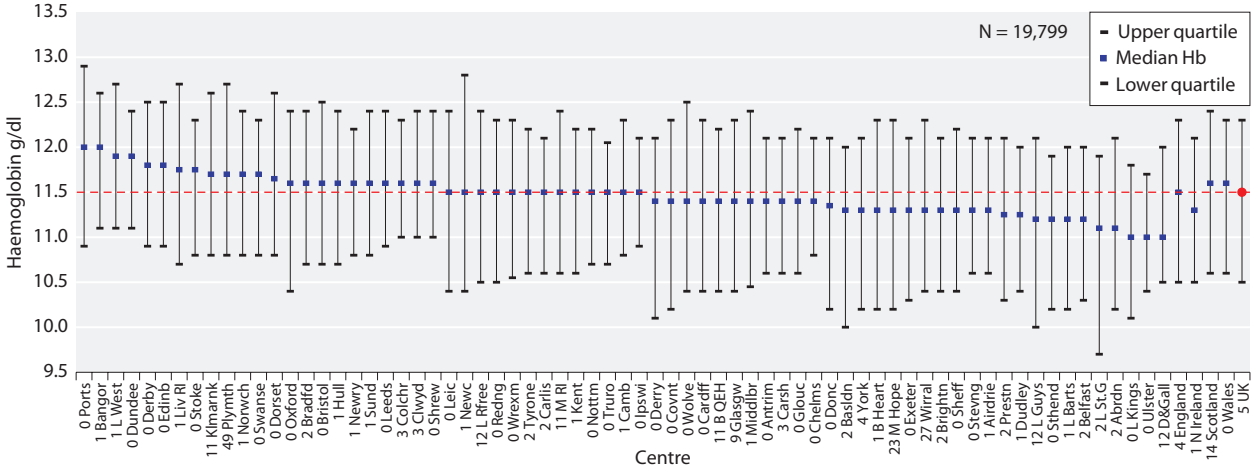

Fig. 8.7. Median haemoglobin in patients treated with HD by centre in 2010

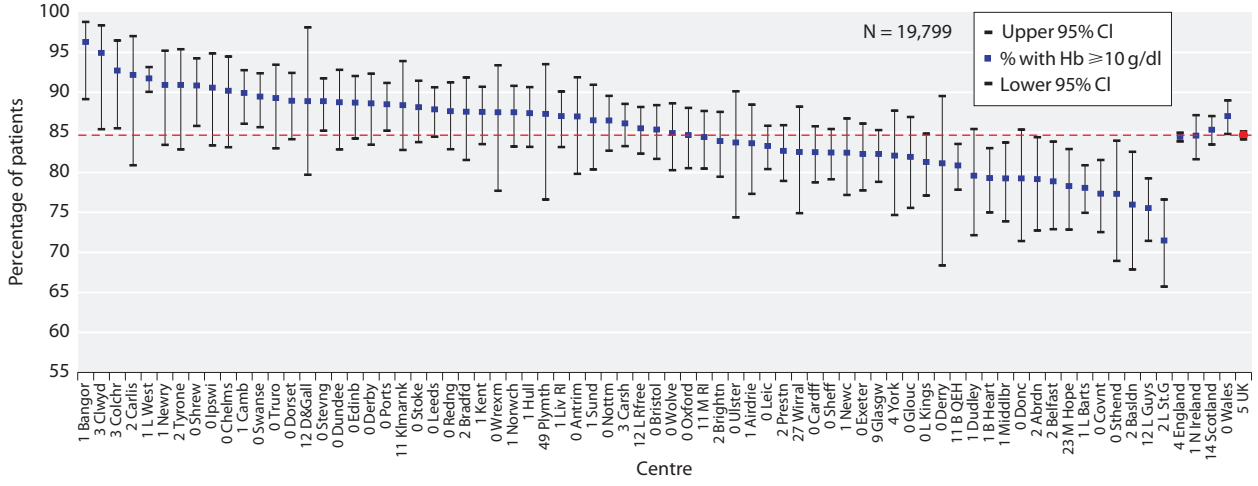

Fig. 8.8. Percentage of HD patients with Hb ⩾10 g/dl by centre in 2010

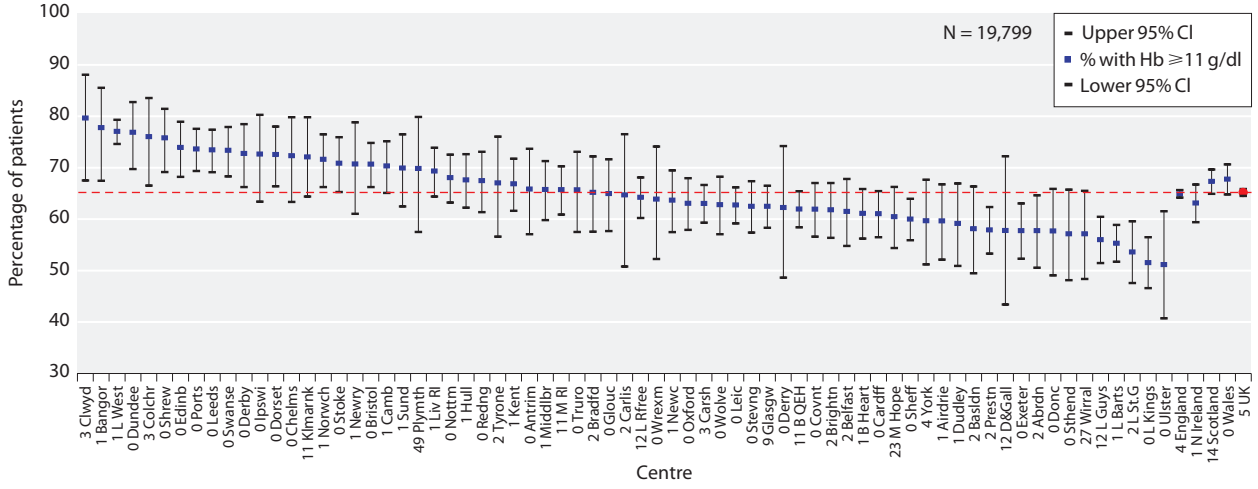

Fig. 8.9. Percentage of HD patients with Hb ⩾11 g/dl by centre in 2010

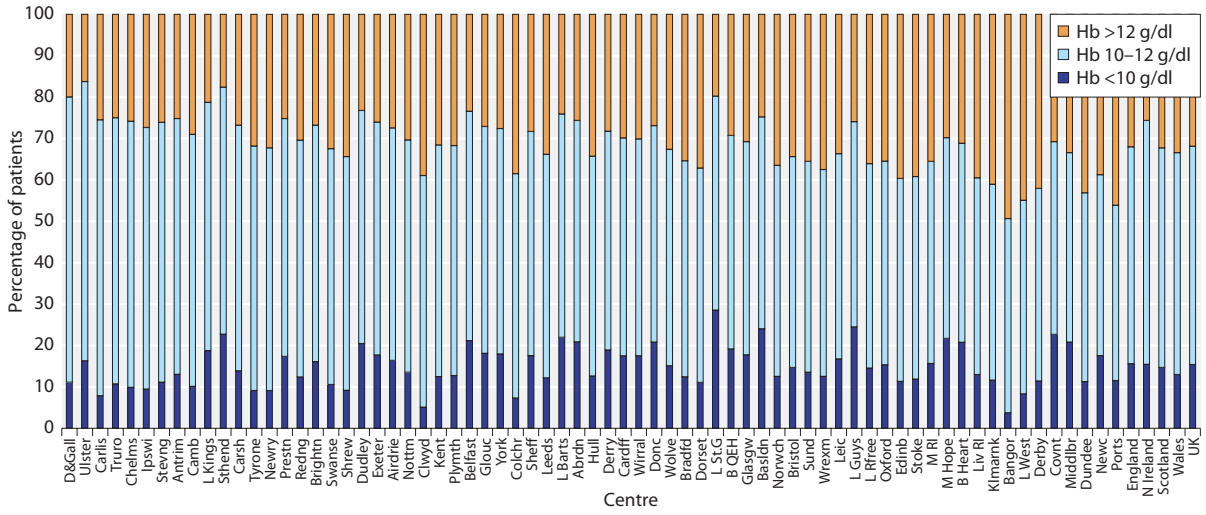

Fig. 8.10. Distribution of haemoglobin in patients treated with HD by centre in 2010

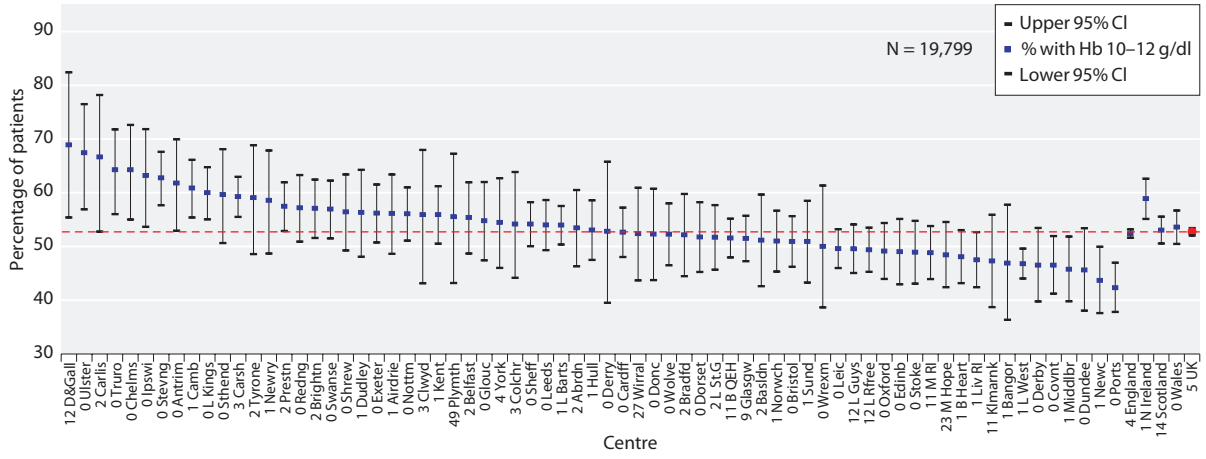

Fig. 8.11. Percentage of HD patients with Hb $\geqslant$10 and $\leqslant$12 g/dl by centre in 2010

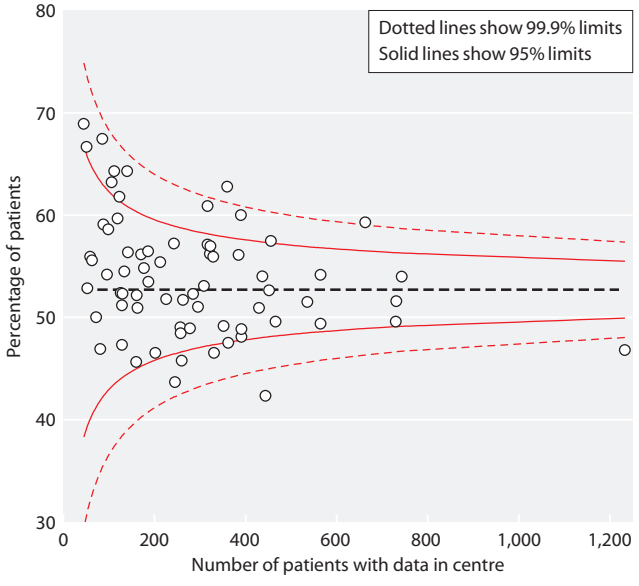

Fig. 8.12. Funnel plot of percentage of HD patients with Hb $\geqslant$10 and $\leqslant$12 g/dl by centre in 2010

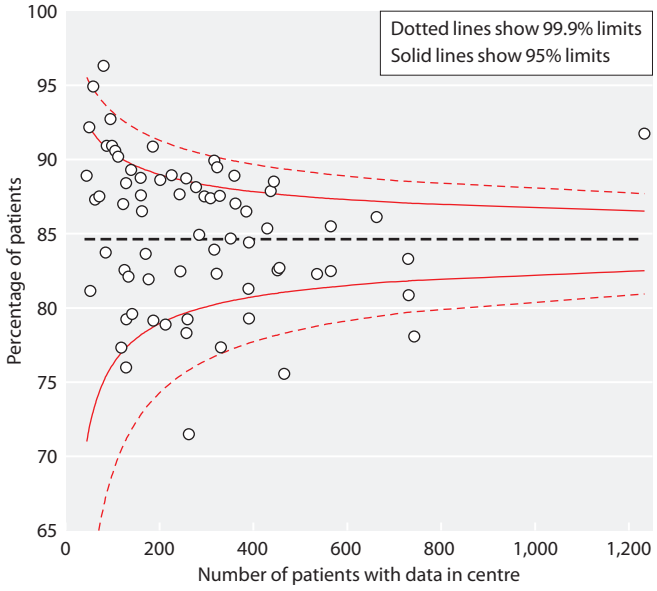

Fig. 8.13. Funnel plot of percentage of HD patients with Hb ⩾10 g/dl by centre in 2010

Table 8.3. Haemoglobin data for prevalent PD patients in 2010

Centre	% data return	N with data	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	% with Hb 10.5–12.5 g/dl
Abrdn	96	27	11.4	9.6–13.0	10.6–12.2	11.5	1.1	93	70	67
Airdrie	100	11								
Antrim	100	11								
B Heart	100	36	11.7	8.9–14.4	11.1–12.6	11.7	1.5	86	75	58
B QEH	90	126	11.6	9.4–14.0	10.6–12.6	11.6	1.5	87	66	51
Bangor	100	23	11.9	10.8–13.8	11.4–12.9	12.2	1.1	100	87	61
Basldn	100	24	11.2	9.6–15.1	10.4–12.3	11.6	1.8	88	58	50
Belfast	96	24	11.6	8.9–12.9	10.5–12.1	11.4	1.5	88	67	54
Bradfd	100	33	10.9	7.5–14.4	9.8–12.8	11.2	2.0	73	48	33
Brightn	100	75	11.8	9.7–13.7	11.0–12.5	11.7	1.2	91	76	59
Bristol	100	56	12.0	9.1–14.2	11.3–13.2	12.0	1.5	88	84	54
Camb	100	31	11.8	8.9–14.0	11.2–12.6	11.7	1.6	87	77	61
Cardff	100	87	11.7	9.4–14.0	10.6–12.6	11.6	1.5	85	66	51
Carlis	100	12								
Carsh	94	87	11.0	9.0–14.4	10.3–12.4	11.4	1.6	79	53	49
Chelms	100	32	12.8	10.4–15.5	11.5–13.4	12.6	1.7	97	78	41
Clwyd	80	4								
Colchr	n/a	n/a								
Covnt	97	70	11.1	9.2–14.3	10.4–12.6	11.3	1.6	84	54	47
D & Gall	100	6								
Derby	99	88	11.6	9.3–14.1	10.7–12.8	11.7	1.6	88	73	50
Derry	100	2								
Donc	100	23	11.6	8.8–12.9	10.6–12.2	11.4	1.4	83	70	65
Dorset	100	51	11.9	10.0–14.0	11.0–12.7	12.0	1.3	96	80	53
Dudley	97	56	12.0	9.8–13.6	10.9–12.8	11.8	1.3	91	71	55
Dundee	95	19								
Dunfn	100	26	12.2	9.8–13.6	10.8–12.8	11.9	1.7	92	73	54
Edinb	98	47	11.2	9.6–14.5	10.5–12.2	11.5	1.5	87	62	57
Exeter	100	69	11.6	9.6–13.4	10.8–12.4	11.6	1.3	90	74	61
Glasgw	83	39	11.1	9.7–13.0	10.3–11.8	11.1	0.9	90	51	56
Glouc	100	39	11.0	8.9–13.9	10.2–12.3	11.2	1.5	79	54	54

Table 8.3. Continued

Centre	% data return	N with data	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	% with Hb 10.5–12.5 g/dl
Hull	100	62	11.4	9.2–14.0	10.6–12.5	11.6	1.7	89	65	53
Inverns	0	0								
Ipswi	97	34	11.1	8.8–14.9	10.6–12.5	11.5	1.7	88	59	53
Kent	100	67	11.7	8.7–13.5	10.5–12.4	11.4	1.5	85	69	58
Klmarnk	80	32	11.7	10.0–14.0	10.8–12.2	11.7	1.1	97	75	66
L Barts	98	169	11.5	8.7–14.2	10.5–12.8	11.6	1.6	86	65	49
L Guys	98	42	11.1	9.1–13.3	10.0–11.7	11.1	1.3	79	52	57
L Kings	100	84	11.5	9.6–13.4	10.7–12.3	11.4	1.5	86	69	61
L Rfree	98	62	11.4	9.7–13.7	10.6–12.3	11.5	1.4	89	65	58
L St.G	98	53	11.5	8.3–13.5	10.6–12.2	11.4	1.6	83	64	64
L West	100	31	11.2	9.4–12.4	10.3–11.8	11.1	0.9	87	58	71
Leeds	99	83	11.3	9.5–13.1	10.5–12.3	11.4	1.3	88	61	60
Leic	99	140	11.5	8.6–13.9	10.3–12.2	11.3	1.6	84	59	54
Liv Ain	0	0								
Liv RI	99	77	11.7	8.9–14.2	11.0–12.8	11.8	1.4	91	77	53
M Hope	73	80	11.3	8.7–13.6	10.3–12.3	11.3	1.5	79	63	49
M RI	100	75	11.6	8.7–14.4	10.6–12.6	11.5	1.7	85	65	55
Middlbr	94	17								
Newc	100	45	11.3	8.3–12.8	10.3–12.1	11.1	1.5	78	60	60
Newry	100	8								
Norwch	100	46	12.3	9.9–14.9	11.1–13.1	12.3	1.6	93	78	46
Nottm	100	78	11.6	9.0–13.5	10.5–12.2	11.4	1.3	85	65	62
Oxford	100	101	11.6	9.3–13.8	10.8–12.6	11.6	1.5	91	71	54
Plymth	84	36	12.2	9.6–14.5	11.3–13.5	12.3	1.5	94	81	50
Ports	100	91	12.1	8.9–14.1	11.0–12.9	11.9	1.5	89	77	49
Prestn	100	60	11.8	9.6–14.1	10.9–12.6	11.7	1.4	90	73	55
Redng	99	77	11.5	8.6–14.1	10.9–12.0	11.5	1.5	92	70	66
Sheff	100	60	11.6	9.2–14.1	10.5–12.6	11.6	1.5	87	67	52
Shrew	94	17								
Stevng	100	28	11.4	7.4–13.8	9.7–12.9	11.1	1.9	71	64	39
Sthend	100	18								
Stoke	100	65	11.7	9.6–14.1	10.7–12.9	11.9	1.5	89	71	49
Sund	100	29	12.0	8.9–14.9	10.4–13.2	12.0	2.3	76	66	31
Swanse	100	45	12.2	10.2–13.6	11.6–12.7	12.1	1.1	98	89	60
Truro	100	26	11.8	9.4–12.9	10.6–12.3	11.4	1.1	92	69	69
Tyrone	71	5								
Ulster	100	2								
Wirral	54	19								
Wolve	100	62	11.5	9.2–13.8	10.2–12.4	11.5	1.5	84	58	47
Wrexm	95	19								
York	100	17								
England	**97**	**2,859**	**11.6**	**9.0–14.1**	**10.6–12.5**	**11.6**	**1.5**	**87**	**67**	**54**
N Ireland	**95**	**52**	**11.8**	**9.0–14.7**	**11.0–12.4**	**11.7**	**1.4**	**92**	**79**	**62**
Scotland	**84**	**207**	**11.4**	**9.7–14.0**	**10.6–12.3**	**11.6**	**1.3**	**91**	**68**	**58**
Wales	**99**	**178**	**11.9**	**9.6–14.3**	**11.1–12.8**	**12.0**	**1.4**	**92**	**78**	**54**
UK	**96**	**3,296**	**11.6**	**9.1–14.1**	**10.6–12.5**	**11.6**	**1.5**	**87**	**68**	**54**

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

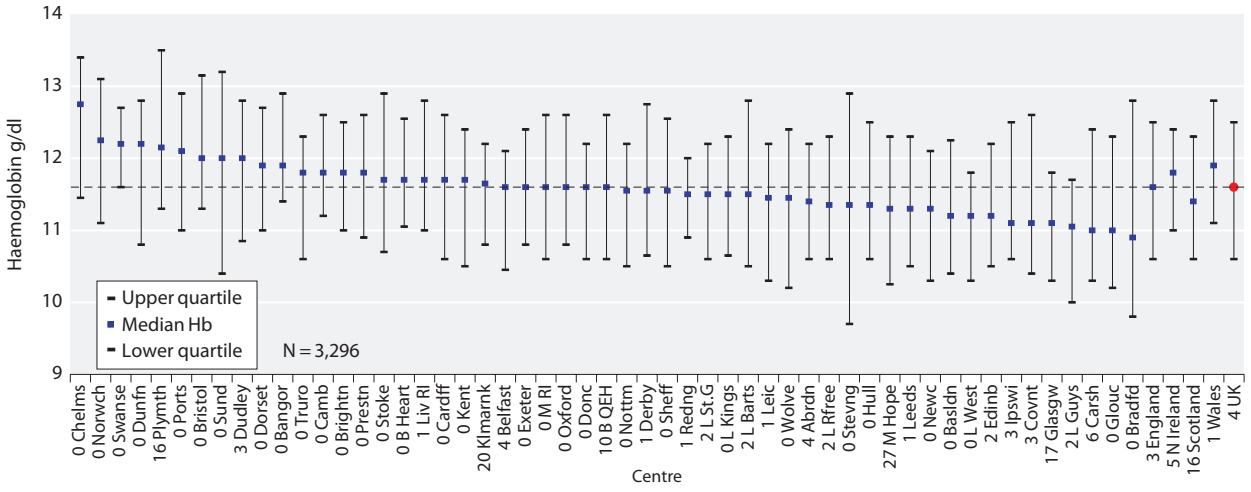

Fig. 8.14. Median haemoglobin in patients treated with PD by centre in 2010

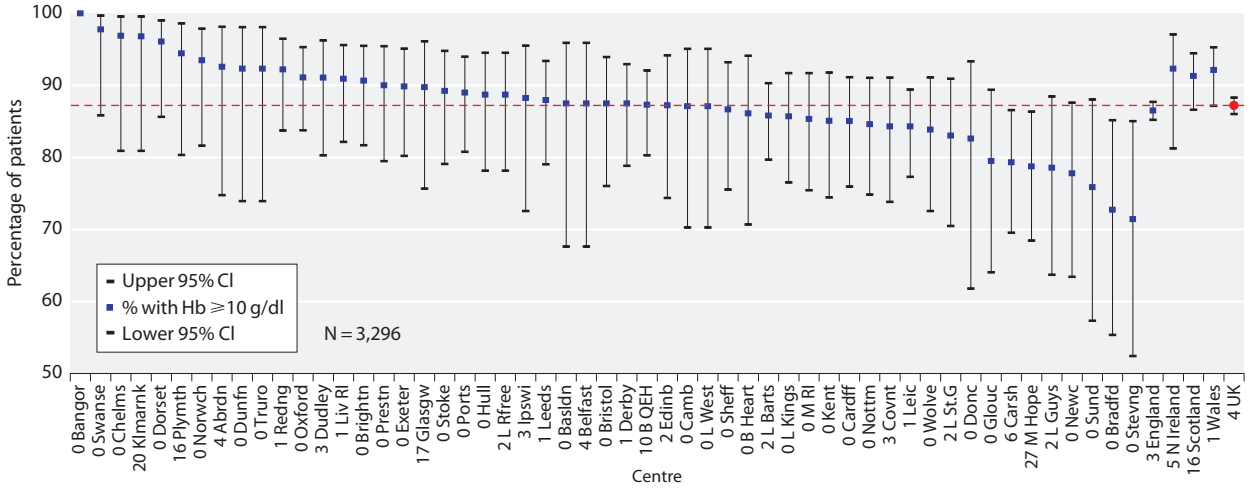

Fig. 8.15. Percentage of PD patients with Hb ⩾10 g/dl by centre in 2010

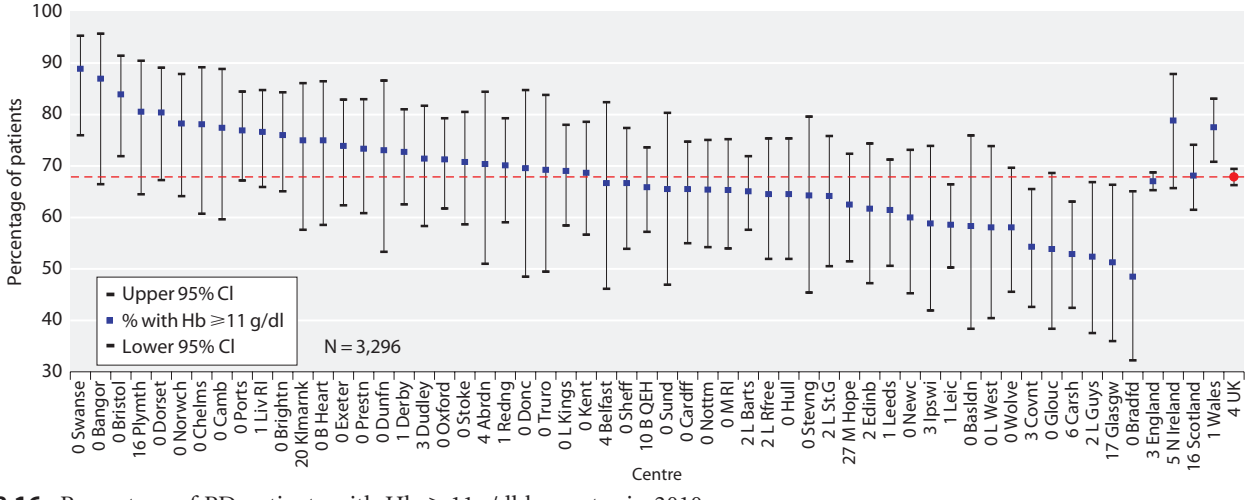

Fig. 8.16. Percentage of PD patients with Hb ⩾11 g/dl by centre in 2010

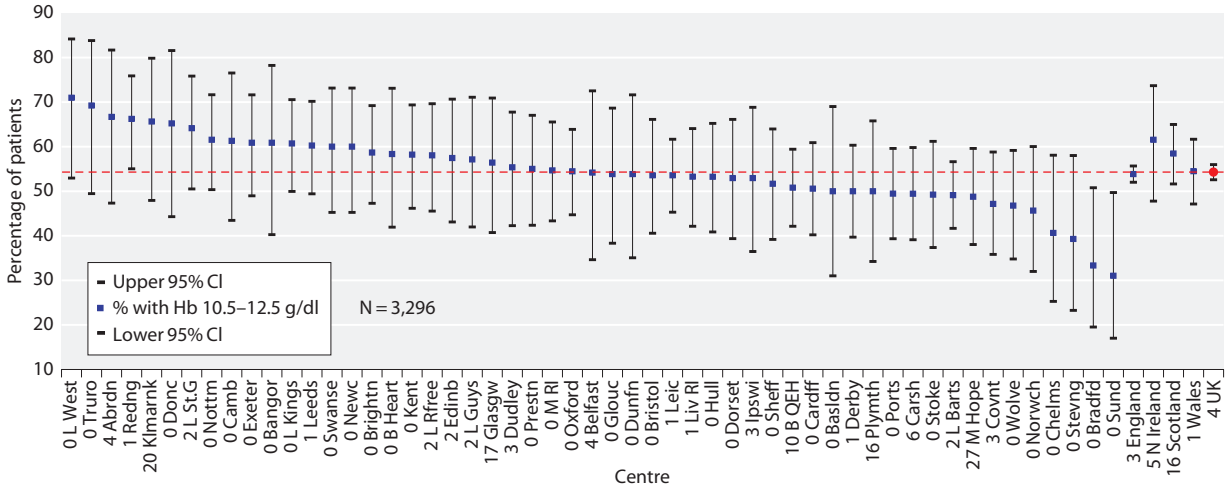

Fig. 8.17. Percentage of PD patients with Hb $\geqslant$10.5 and $\leqslant$12.5 g/dl by centre in 2010

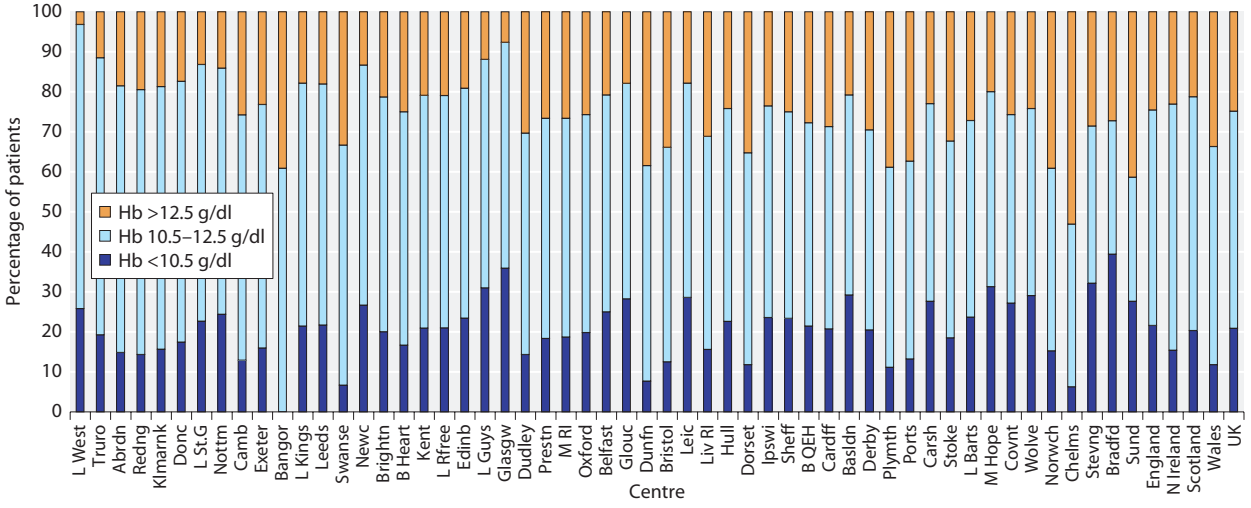

Fig. 8.18. Distribution of haemoglobin in patients treated with PD by centre in 2010

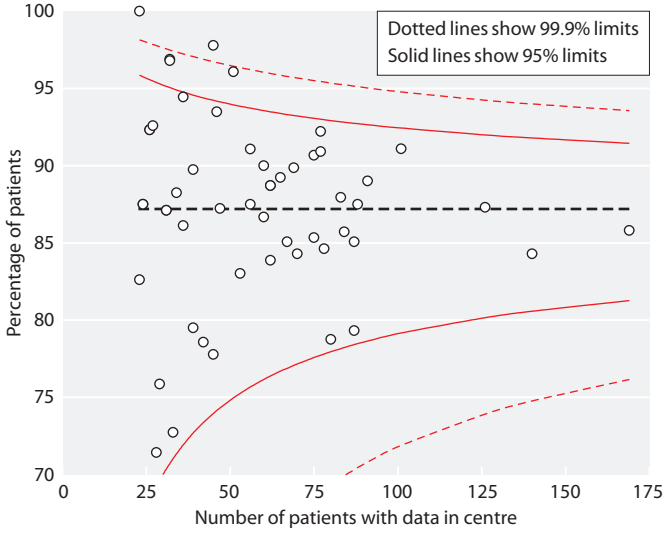

Fig. 8.19. Funnel plot of percentage of PD patients with Hb $\geqslant$10 g/dl by centre in 2010

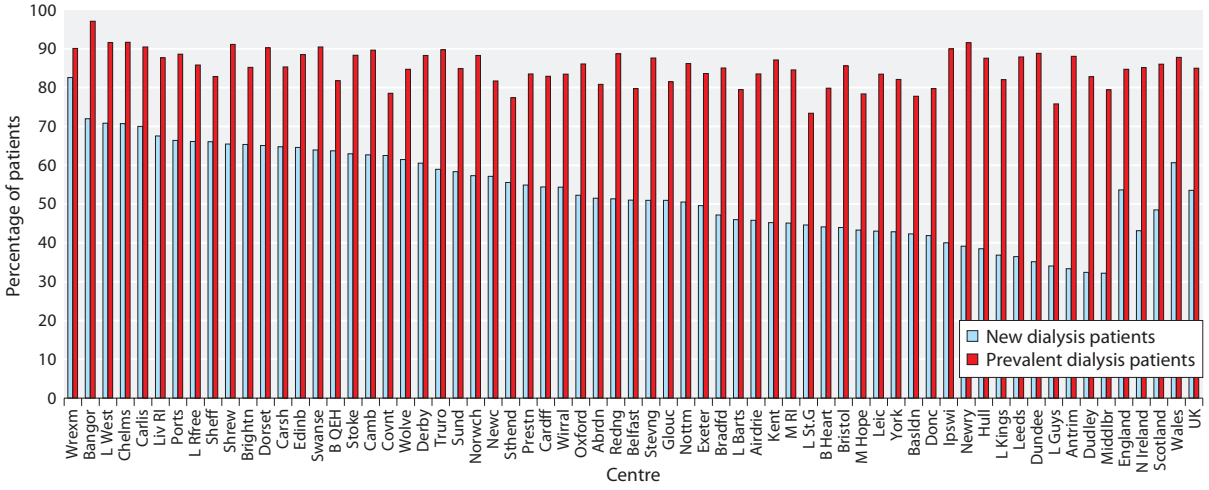

Fig. 8.20. Percentage of new and prevalent dialysis patients with Hb ⩾10 g/dl by centre in 2010

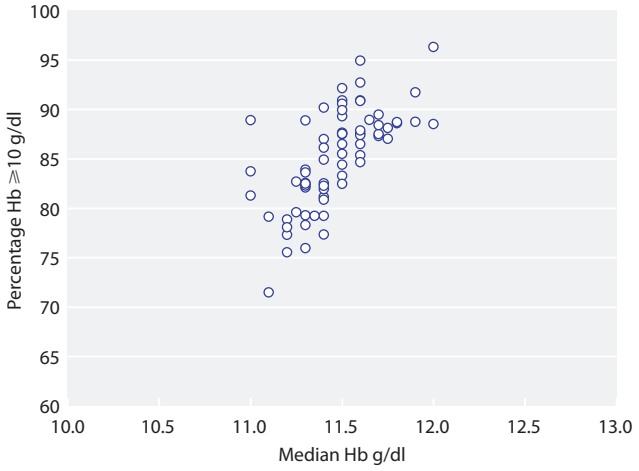

Fig. 8.21. Percentage of HD patients with Hb ⩾10 g/dl plotted against median haemoglobin by centre in 2010

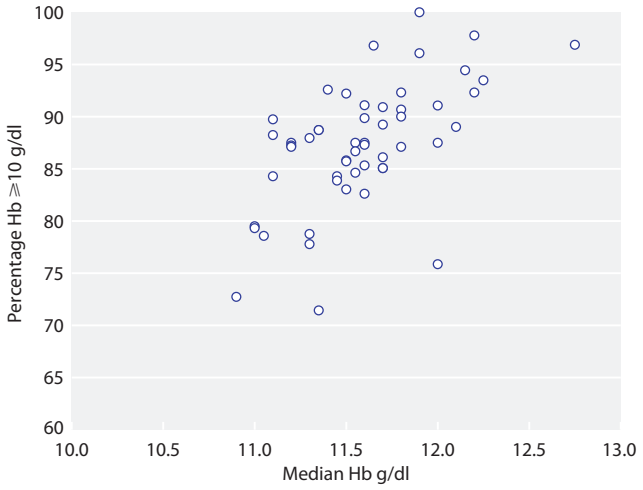

Fig. 8.23. Percentage of PD patients with Hb ⩾10 g/dl plotted against median haemoglobin by centre in 2010

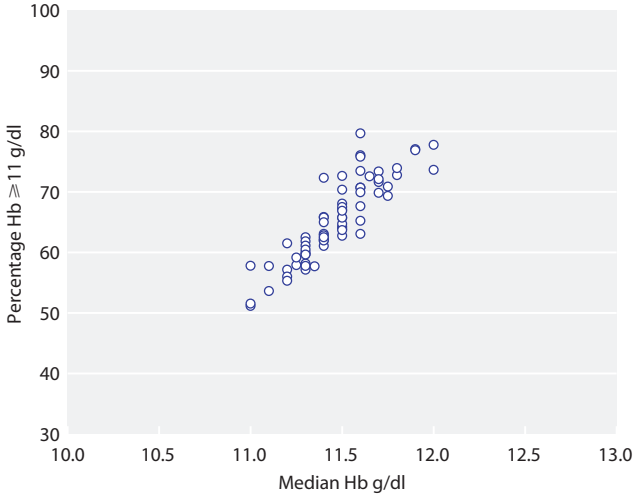

Fig. 8.22. Percentage of HD patients with Hb ⩾11 g/dl plotted against median haemoglobin by centre in 2010

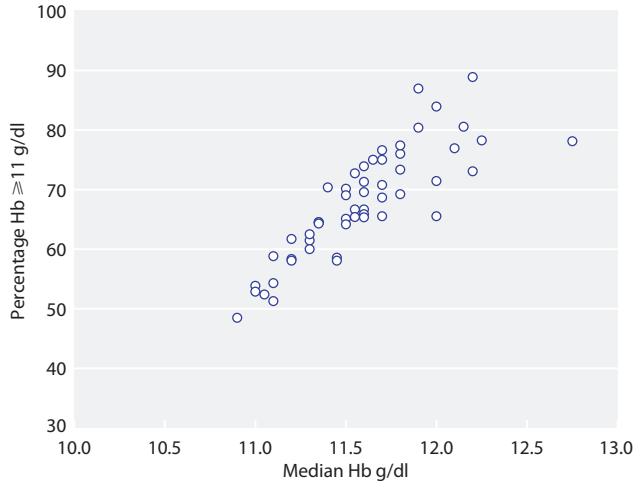

Fig. 8.24. Percentage of PD patients with Hb ⩾11 g/dl plotted against median haemoglobin by centre in 2010

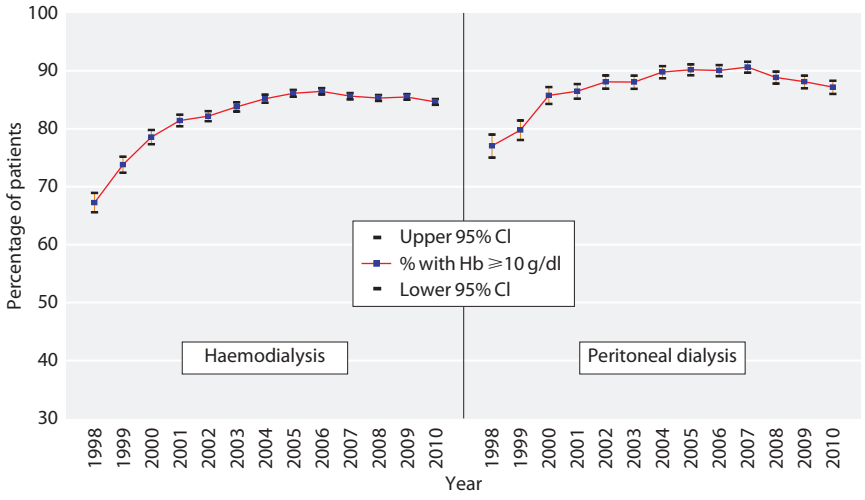

Fig. 8.25. Percentage of prevalent HD and PD patients (1998–2010) with Hb ⩾10 g/dl

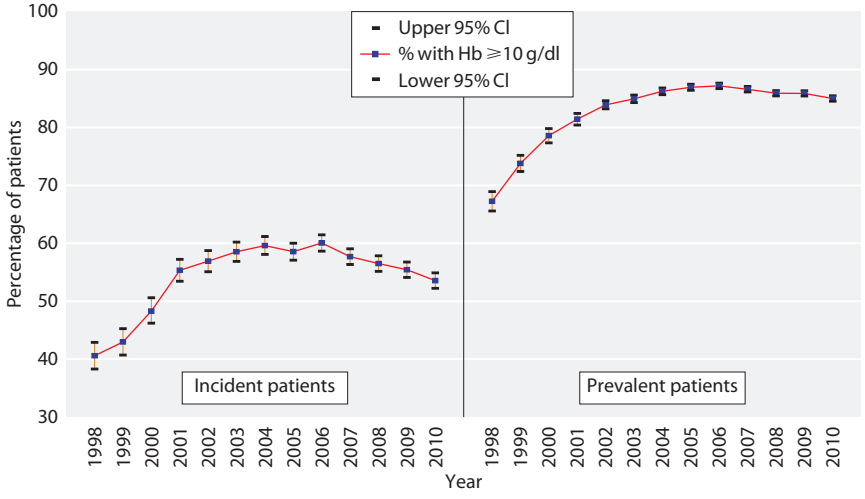

Fig. 8.26. Percentage of incident and prevalent dialysis patients (1998–2010) with Hb ⩾10 g/dl

show the relationship between a centre's median Hb and their compliance with minimum standards for Hb ⩾10.0 g/dl and ⩾ 11.0 g/dl in HD and PD populations. Compliance with minimum standards by year (1998 to 2010) is shown in figure 8.25 for prevalent patients (by treatment modality) and in figure 8.26 for incident and prevalent patients (all dialysis patients).

Median haemoglobin and length of survival on RRT

Median Hb of cohorts of patients who had survived different lengths of time on RRT were analysed in both HD and PD patients (figures 8.27 and 8.28).

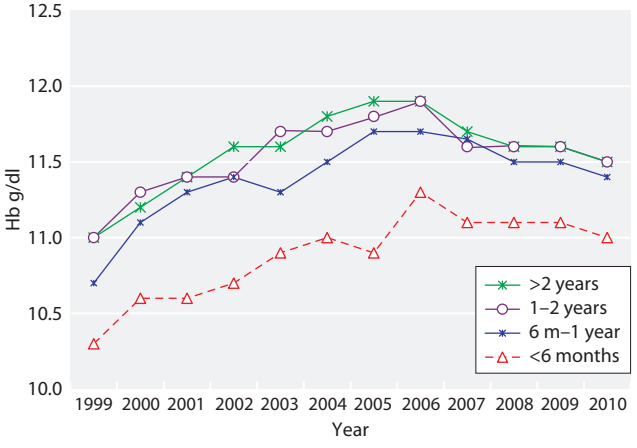

Fig. 8.27. Median haemoglobin plotted by length of time on RRT (HD patients)

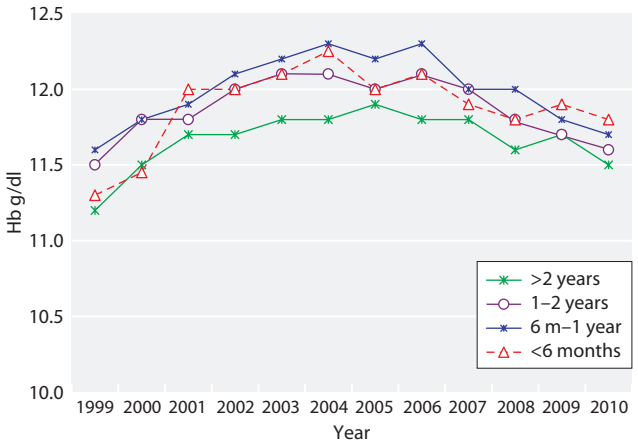

Fig. 8.28. Median haemoglobin plotted by length of time on RRT (PD patients)

Factors affecting haemoglobin

Ferritin

Ferritin in prevalent dialysis patients

Percentage returns and summary statistics for serum ferritin are shown for the 63 renal centres in England, Northern Ireland and Wales in tables 8.4 and 8.5 for HD and PD patients respectively.

The median and IQR for serum ferritin for HD and PD patients is given, by centre, in figures 8.29 and 8.30 respectively. The percentage of patients with serum ferritin $\geqslant 100$ µg/L, $\geqslant 200$ µg/L and $\geqslant 800$ 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.

All centres achieved greater than 90% compliance with a serum ferritin $\geqslant 100$ µg/L for HD patients. The PD population had a lower median ferritin value (264 µg/L, IQR 148–426 vs. 444 µg/L, IQR 299–635 for HD). In 2010, 31 centres reported less than 90% of PD patients compliant with serum ferritin $\geqslant 100$ µg/L.

Changes in ferritin 2001–2010

The compliance with guidelines for ferritin in the HD populations has been 95% or above since 2007. In the PD population the compliance has fluctuated over the last few years, and was 85.9% in 2010. The serial values are shown in figure 8.37. The difference between the compliance in HD and PD was probably because more PD patients achieve adequate Hb without any iron or ESA therapy. The median serum ferritin outcome over time is shown in figure 8.38.

Ferritin and length of time on renal replacement therapy

In HD (but not PD) patients, the median serum ferritin was greatest in those who had survived longest (figures 8.39 and 8.40).

Erythropoiesis stimulating agents in prevalent dialysis patients

Patients treated and dose variation – ESA prescription and modality

Treatment of renal anaemia with ESAs has offered a major way to improve quality of life for dialysis patients. These agents are relatively expensive and thus approaches to achieving normal haemoglobin levels

Table 8.4. Ferritin in HD patients in 2010

Centre	% data return	N with data	Median ferritin	90% range	Inter-quartile range	% ferritin $\geqslant 100$ µg/L	% ferritin $\geqslant 800$ µg/L
Antrim	100	123	411	135–982	287–629	98	11
B Heart	95	375	310	65–747	204–446	92	2
B QEH	90	738	378	141–673	303–462	97	2
Bangor	100	82	553	207–961	399–716	98	11
Basldn	97	128	339	103–605	270–405	95	2
Belfast	97	211	534	123–1136	326–795	97	24
Bradfd	96	158	672	254–1260	462–878	99	32
Brightn	93	300	441	171–805	305–586	98	5
Bristol	100	429	604	123–1232	431–801	97	25
Camb	72	230	298	96–703	190–411	95	4
Cardff	99	448	266	87–682	171–386	93	2
Carlis	100	52	498	245–2557	391–724	100	21
Carsh	97	661	350	96–784	257–468	95	5
Chelms	98	110	464	239–823	380–561	100	7

Table 8.4. Continued

Centre	% data return	N with data	Median ferritin	90% range	Inter-quartile range	% ferritin ⩾100 µg/L	% ferritin ⩾800 µg/L
Clwyd	97	59	479	196–1180	311–568	98	8
Colchr	97	96	716	338–1401	585–920	100	35
Covnt	99	329	352	102–775	219–479	96	5
Derby	100	201	356	130–754	233–477	96	4
Derry	100	53	494	38–1656	297–807	91	26
Donc	100	130	467	248–925	356–614	100	12
Dorset	98	221	539	256–998	428–679	98	13
Dudley	97	140	343	39–824	219–463	90	5
Exeter	100	321	284	109–721	206–373	96	4
Glouc	99	175	487	110–1012	306–672	96	14
Hull	97	304	417	202–734	306–541	99	4
Ipswi	71	75	622	115–1176	422–797	96	24
Kent	98	324	377	77–1125	215–604	92	12
L Barts	98	734	481	149–1078	331–671	98	14
L Guys	80	426	578	200–1696	398–846	99	29
L Kings	99	385	604	203–1341	425–835	99	28
L Rfree	85	548	435	82–1348	251–737	93	21
L St.G	98	261	420	150–1041	308–575	97	11
L West	89	1104	525	253–1203	404–680	99	17
Leeds	100	437	511	106–1202	377–687	96	16
Leic	100	730	350	102–732	253–470	95	4
Liv Ain	2	3					
Liv RI	98	361	553	153–1409	338–822	98	27
M Hope	19	65					
M RI	87	382	376	107–816	251–510	96	6
Middlbr	97	255	674	124–1871	341–1068	96	40
Newc	100	246	688	157–1732	433–996	98	41
Newry	99	99	621	90–1058	383–775	95	22
Norwch	97	291	535	83–1275	345–753	94	20
Nottm	100	385	530	227–872	422–621	99	9
Oxford	99	348	301	91–741	195–420	94	4
Plymth	98	122	668	215–1876	465–1125	99	41
Ports	99	441	315	82–733	210–435	93	4
Prestn	99	461	540	89–1423	339–824	94	28
Redng	100	242	517	200–1075	391–684	98	17
Sheff	100	565	480	156–917	350–613	97	10
Shrew	98	183	404	83–952	249–649	95	12
Stevng	99	358	445	156–943	301–610	98	10
Sthend	100	119	322	174–612	263–407	98	3
Stoke	99	276	697	230–1587	491–894	100	34
Sund	99	163	583	202–1935	408–812	99	26
Swanse	100	322	337	65–760	203–497	90	4
Truro	100	140	466	234–1022	355–573	99	8
Tyrone	97	87	829	263–1763	550–1130	99	52
Ulster	100	86	585	279–1055	467–717	100	15
Wirral	66	114	601	266–1167	471–768	99	23
Wolve	100	285	512	145–1082	409–649	97	14
Wrexm	61	44	423	177–869	278–562	100	9
York	94	131	508	99–823	411–607	95	5
England	**93**	**16,058**	**448**	**125–1133**	**305–638**	**97**	**14**
N Ireland	**99**	**659**	**553**	**136–1305**	**350–783**	**97**	**24**
Wales	**96**	**955**	**321**	**85–778**	**203–492**	**93**	**4**
E, W & NI	**93**	**17,672**	**444**	**121–1127**	**299–635**	**96**	**14**

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

Table 8.5. Ferritin in PD patients in 2010

Centre	% data return	N with data	Median ferritin	90% range	Inter-quartile range	% ferritin ⩾100 μg/L	% ferritin ⩾800 μg/L
Antrim	100	11					
B Heart	97	35	210	35–1682	129–395	86	6
B QEH	84	117	158	32–655	78–236	68	3
Bangor	100	23	151	14–459	61–344	61	4
Basldn	100	24	164	50–385	86–282	63	0
Belfast	96	24	261	64–1423	136–381	88	13
Bradfd	97	32	280	31–998	122–453	88	6
Brightn	83	62	371	127–853	234–499	98	6
Bristol	96	54	380	60–1065	213–623	91	7
Camb	100	31	267	34–783	195–464	87	3
Cardff	100	87	119	23–293	68–192	56	2
Carlis	100	12					
Carsh	97	90	195	47–646	130–345	87	3
Chelms	100	32	122	19–481	54–225	63	0
Clwyd	60	3					
Colchr	n/a	n/a					
Covnt	89	64	245	56–658	143–359	84	3
Derby	99	88	323	108–774	207–450	97	3
Derry	100	2					
Donc	96	22	172	63–358	123–285	82	0
Dorset	98	50	259	113–725	169–333	98	2
Dudley	81	47	133	18–509	77–235	64	0
Exeter	100	69	206	33–558	114–280	77	1
Glouc	100	39	230	49–793	136–418	87	3
Hull	94	58	343	99–947	228–445	95	5
Ipswi	94	33	264	35–783	101–349	76	3
Kent	97	65	288	82–763	161–419	88	3
L Barts	93	161	285	93–1038	193–473	94	7
L Guys	95	41	207	70–723	117–306	80	2
L Kings	100	84	240	52–801	120–312	82	6
L Rfree	98	62	355	129–953	220–632	97	16
L St.G	98	53	299	106–1616	230–469	96	6
L West	97	30	280	116–1216	179–421	100	7
Leeds	100	84	363	118–761	244–501	96	5
Leic	99	140	358	83–938	258–475	94	8
Liv Ain	0	0					
Liv RI	97	76	320	68–1272	199–487	92	8
M Hope	2	2					
M RI	97	73	175	41–440	110–230	78	0
Middlbr	94	17					
Newc	100	45	457	92–1322	331–864	93	27
Newry	100	8					
Norwch	98	45	158	43–862	82–408	64	9
Nottm	100	78	283	66–1189	183–410	88	10
Oxford	97	98	205	75–671	136–328	85	3
Plymth	98	42	352	37–970	126–519	79	10
Ports	98	89	260	72–773	169–411	90	3
Prestn	100	60	230	37–915	131–516	80	8
Redng	99	77	404	73–720	269–566	94	3
Sheff	100	60	330	61–871	142–578	83	8
Shrew	94	17					
Stevng	89	25	270	65–955	118–366	80	8
Sthend	100	18					
Stoke	97	63	438	76–1133	288–757	94	21
Sund	97	28	565	32–1753	218–1166	89	32

Table 8.5. Ferritin in PD patients in 2010

Centre	% data return	N with data	Median ferritin	90% range	Inter-quartile range	% ferritin ⩾100 µg/L	% ferritin ⩾800 µg/L
Swanse	100	45	203	58–673	135–300	87	2
Truro	96	25	283	122–742	212–475	96	4
Tyrone	100	7					
Ulster	100	2					
Wirral	46	16					
Wolve	100	62	224	30–721	112–453	79	3
Wrexm	20	4					
York	100	17					
England	**92**	**2,712**	**271**	**54–879**	**157–441**	**87**	**6**
N Ireland	**98**	**54**	**235**	**37–1423**	**121–387**	**83**	**7**
Wales	**90**	**162**	**149**	**24–556**	**77–250**	**67**	**2**
E, W & NI	**92**	**2,928**	**264**	**50–871**	**148–426**	**86**	**6**

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

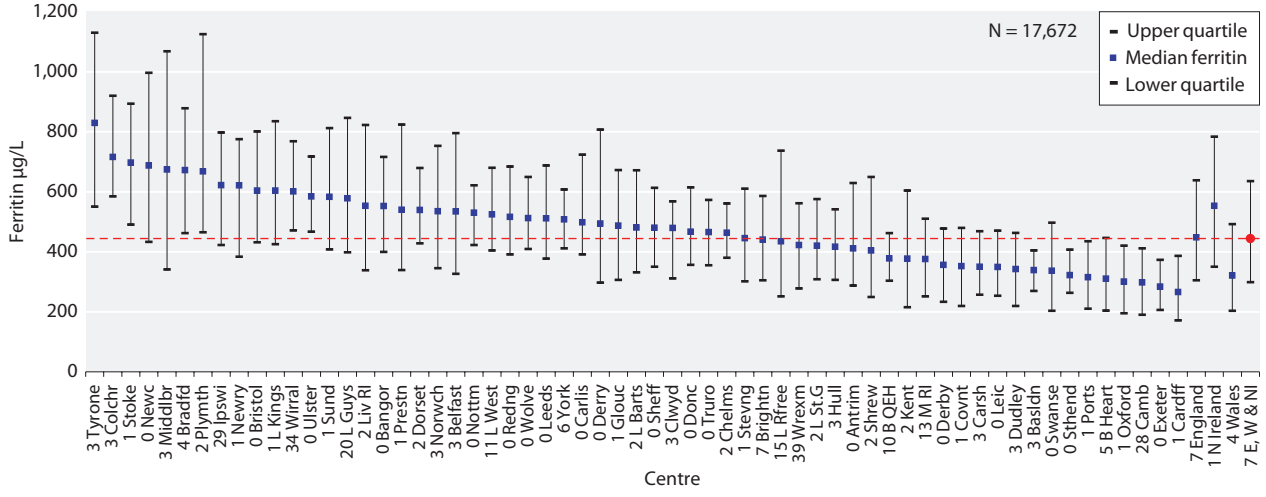

Fig. 8.29. Median ferritin in patients treated with HD by centre in 2010

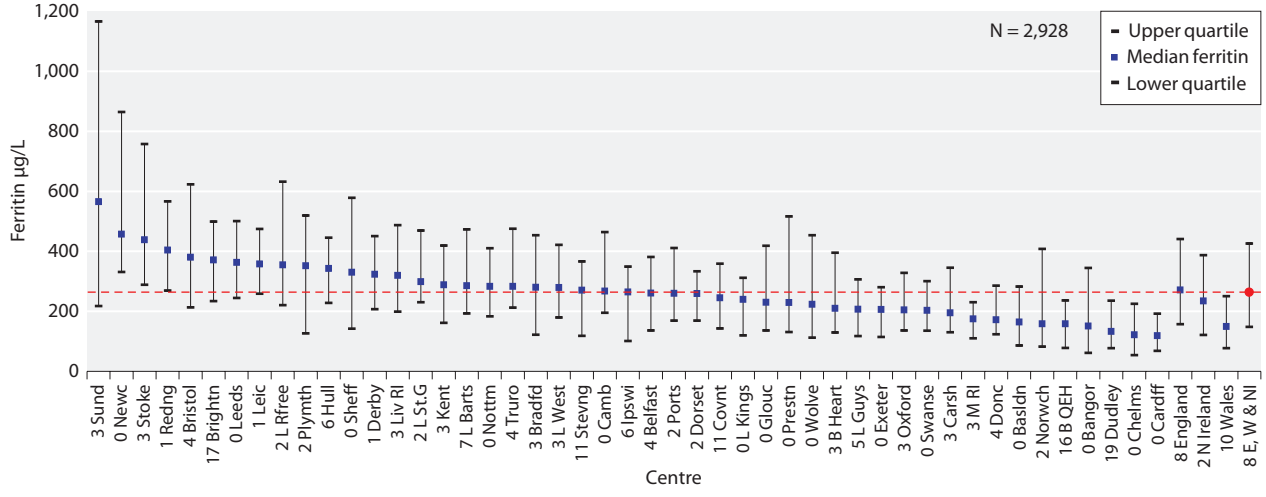

Fig. 8.30. Median ferritin in patients treated with PD by centre in 2010

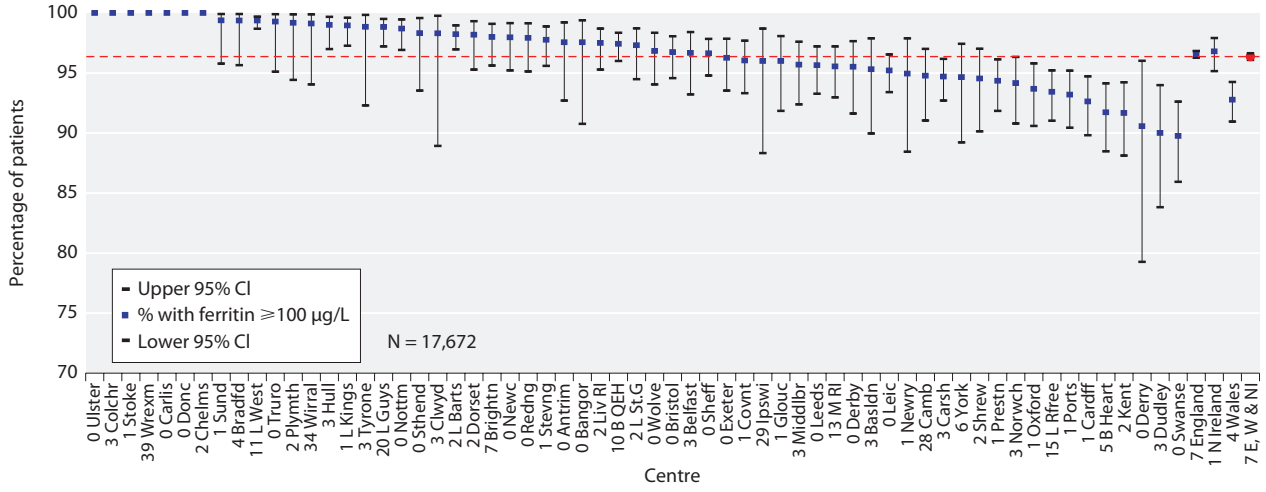

Fig. 8.31. Percentage of HD patients with ferritin ⩾100 µg/L by centre in 2010

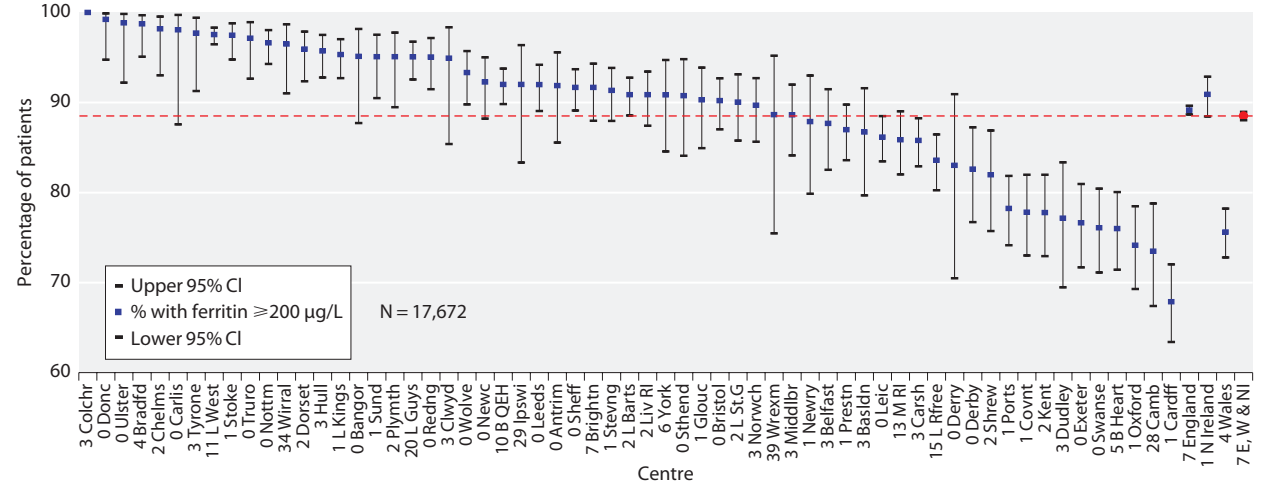

Fig. 8.32. Percentage of HD patients with ferritin ⩾200 µg/L by centre in 2010

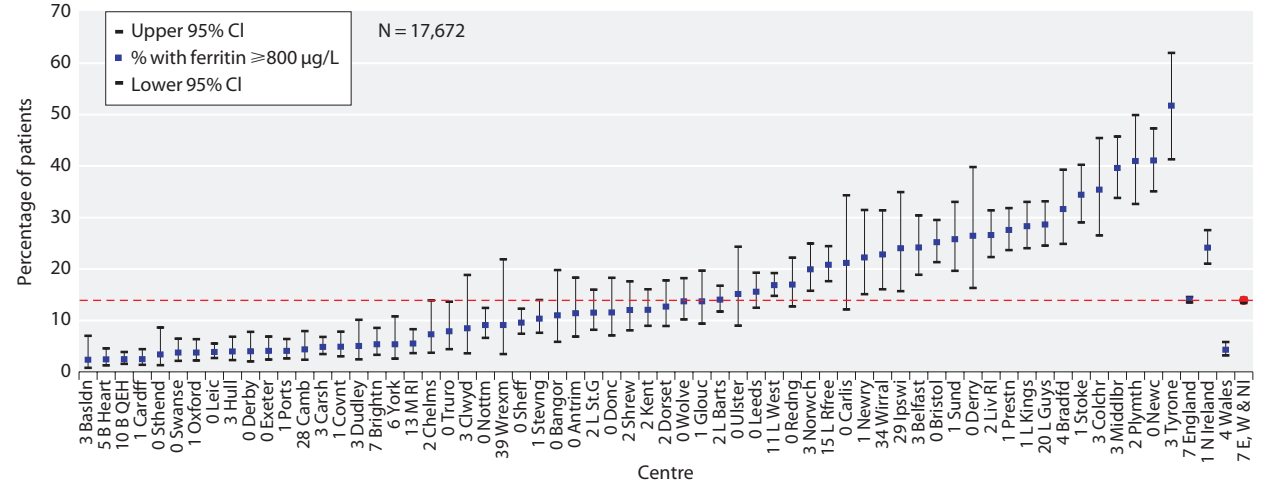

Fig. 8.33. Percentage of HD patients with ferritin ⩾800 µg/L by centre in 2010

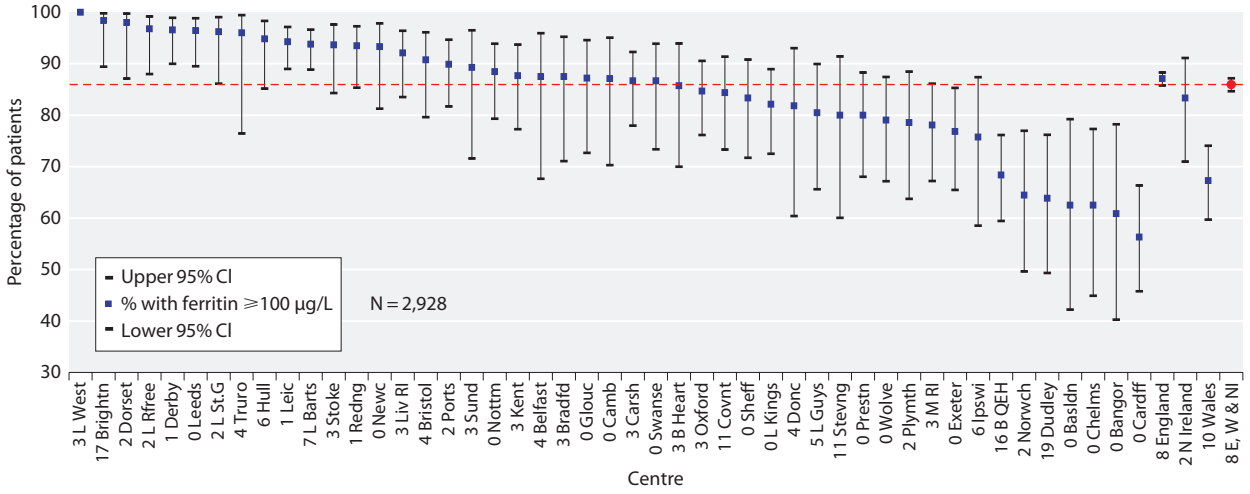

Fig. 8.34. Percentage of PD patients with ferritin ⩾100 µg/L by centre in 2010

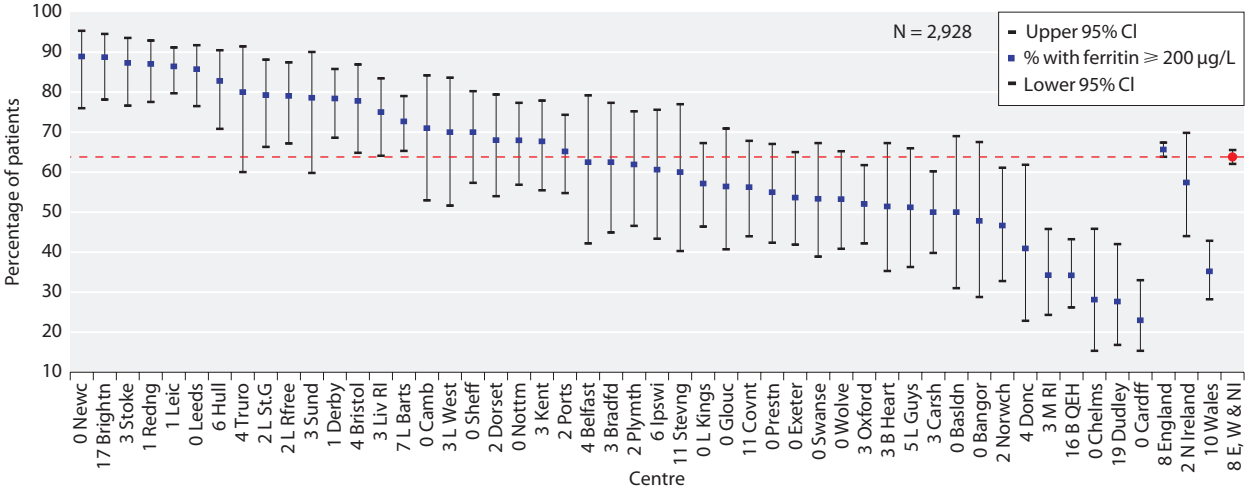

Fig. 8.35. Percentage of PD patients with ferritin ⩾200 µg/L by centre in 2010

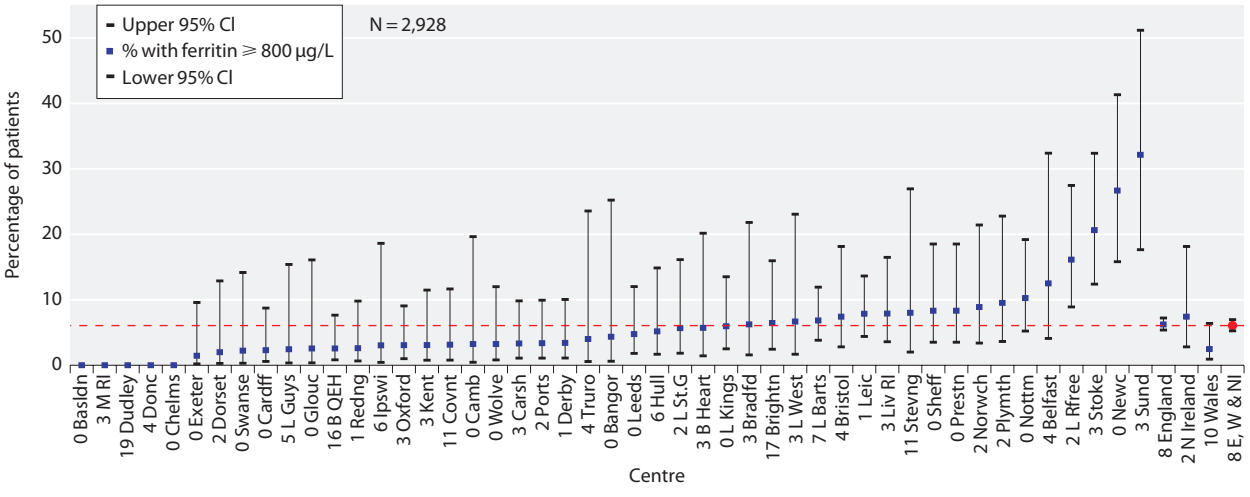

Fig. 8.36. Percentage of PD patients with ferritin ⩾800 µg/L by centre in 2010

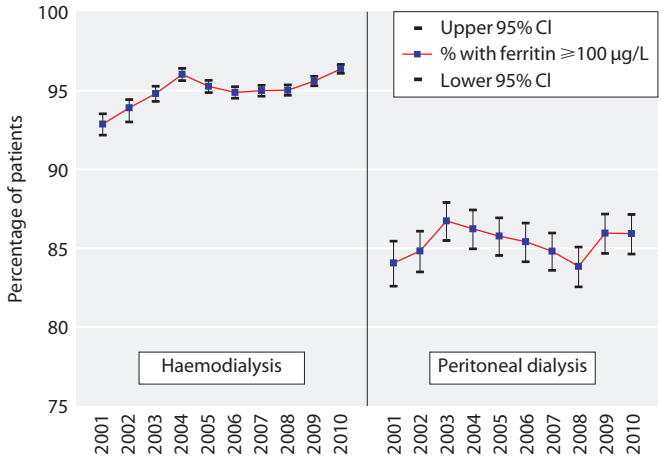

Fig. 8.37. Percentage of patients with ferritin ⩾100 µg/L (2001–2010)

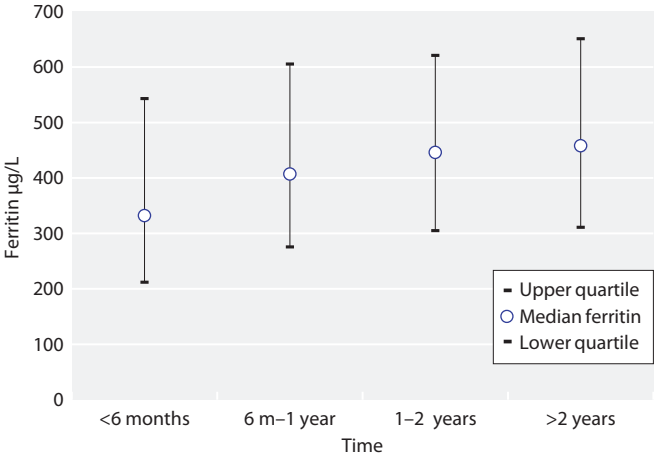

Fig. 8.39. Median ferritin by length of time on RRT in patients treated with HD in 2010

with the lowest possible doses are desirable. Furthermore, recent studies such as the CREATE and CHOIR studies suggest that driving the haemoglobin levels above 13 g/dl and/or high doses of ESAs per se may be associated with an excess of cardiovascular risk compared to the comparator groups in these and other studies [11, 12]. Table 8.6 shows the percentage of patients treated and the dose of ESA given in HD patients. Equivalent data for PD patients are shown in table 8.7. As shown in previous reports there is substantial variation in the average doses of ESA prescription used in UK dialysis units. The median dose for prevalent HD patients varied from 4,000 to 12,000 IU/week. In PD patients, in whom target haemoglobin can be achieved with substantially less agent, the median dose varied from 3,000–8,000 IU/week. The mean doses for 2010 prevalent patients in England, Wales and Northern Ireland were 9,020 IU/week for HD and 6,202 IU/week for PD patients.

ESA prescription: age and modality associations

The proportion of patients on an ESA was higher for HD (91%) than PD (74%) and this difference was present and similar across all age bands (figure 8.41). The percentage of the whole cohort which maintained

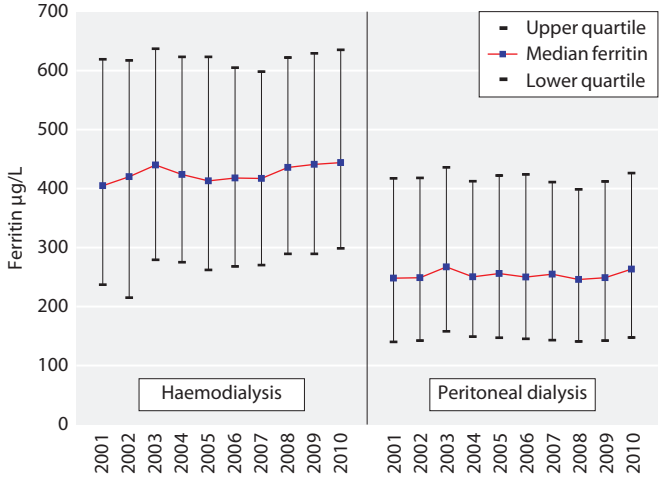

Fig. 8.38. Median ferritin of prevalent patients (2001–2010)

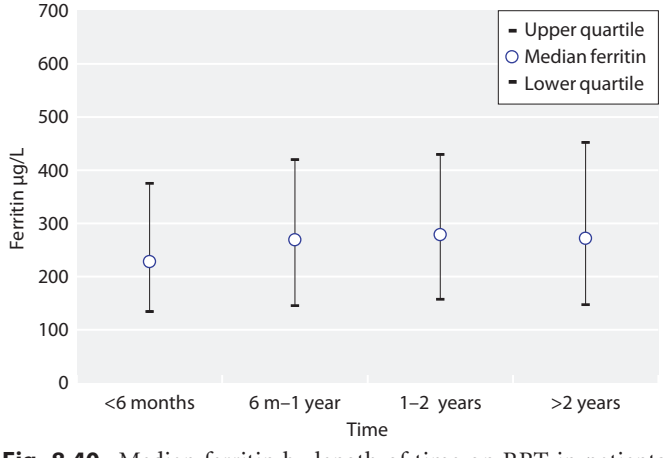

Fig. 8.40. Median ferritin by length of time on RRT in patients treated with PD in 2010

Table 8.6. ESA prescribing in HD patients in 2010

Centre	N in ESA data file	% on ESA	N on ESA	% with dose data	Mean weekly dose for pts on ESA (IU/week)	Median weekly dose for pts on ESA (IU/week)	% with Hb ⩾10 g/dl and not on ESA
Antrim	123	94	116	100	9,129	8,000	6
B Heart	396	83	330	100	10,297	9,000	15
Basldn	132	91	120	100	8,988	8,000	7
Belfast	217	90	196	100	7,849	6,000	8
Bradfd	165	95	157	99	7,401	6,000	3
Bristol	430	95	407	100	10,062	8,000	5
Chelms	112	100	112	100	12,339	9,000	0
Covnt	332	90	298	100	12,939	12,000	8
Derry	53	92	49	100	10,265	9,000	6
Donc	130	92	120	100	9,475	8,000	7
Exeter	322	96	309	100	8,894	8,000	4
Glouc	173	100	173	0			0
Ipswi	106	89	94	89	8,560	8,000	9
Kent	332	91	301	100	9,616	9,000	8
Leeds	437	92	404	98	5,538	4,000	7
Leic	732	98	719	100	8,054	6,000	2
Liv RI	367	93	340	100	9,156	8,000	6
Middlbr	263	78	206	100	6,461	6,000	17
Newc	247	89	220	100	9,966	7,600	9
Newry	100	95	95	100	6,202	4,000	5
Norwch	299	92	276	100	9,201	8,000	7
Nottm	385	93	358	87	10,806	9,000	6
Oxford	352	90	317	100	11,565	8,000	10
Prestn	467	86	401	9			11
Redng	243	93	226	0			6
Sheff	565	88	495	99	9,408	8,000	12
Shrew	186	91	170	100	8,341	8,000	8
Sthend	119	87	104	100	11,519	10,000	12
Truro	140	100	140	94	7,180	5,538	0
Tyrone	90	93	84	100	9,333	8,000	5
Ulster	86	94	81	100	5,953	6,000	6
Wolve	285	86	246	100	7,407	6,000	13
Wrexm	72	97	70	100	7,557	6,000	1
York	140	78	109	100	6,573	4,000	18
England	**7,857**	**91**	**7,152**	**88**	**9,138**	**8,000**	**8**
N Ireland	**669**	**93**	**621**	**100**	**7,980**	**6,000**	**6**
Wales	**72**	**97**	**70**	**100**	**7,557**	**6,000**	**1**
E, W & NI	**8,598**	**91**	**7,843**	**89**	**9,020**	**8,000**	**8**

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

a Hb ⩾10 g/dl without requiring ESA (by age band and modality) is shown in figure 8.42.

Figure 8.43 shows the percentage of anaemic patients (Hb <10.0 g/dl) receiving an ESA. A minority of patients had a Hb <10 g/dl and appeared to not be receiving ESA therapy. There are several potential explanations for this including some patients being declared unresponsive to ESA therapy and therefore no longer being on treatment, some individuals may have just become anaemic and not yet started therapy, others may have been on ESA treatment but not had it recorded and other patients may have decided not to use ESA because of a history of malignancy.

ESA prescription and gender

Provision of ESA by age and gender for HD and PD patients is shown in figures 8.44 and 8.45. For both modalities across all age ranges, a higher percentage of females were on ESA treatment. In HD patients, 94% of females were receiving ESA therapy compared to 89% of males. In PD patients, 77% of females compared to 72% of males were on ESA treatment.

Table 8.7. ESA prescribing in PD patients in 2010

Centre	N in ESA data file	% on ESA	N on ESA	% with dose data	Mean weekly dose for pts on ESA (IU/week)	Median weekly dose for pts on ESA (IU/week)	% with Hb ⩾10 g/dl and not on ESA
Antrim	11						
B Heart	36	75	27	100	7,156	4,000	25
Bangor	23	61	14				39
Basldn	24	50	12	100	6,083	5,000	46
Belfast	25	64	16	100	5,500	4,500	33
Bradfd	33	85	28	89	6,400	4,000	15
Bristol	56	75	42	100	5,401	4,000	25
Camb	31	68	21	100	8,210	5,600	29
Carlis	12						
Chelms	32	84	27	100	4,963	4,000	16
Covnt	72	75	54	100	9,622	8,000	23
Derry	2						
Donc	23	83	19	100	5,368	4,000	17
Dorset	51	84	43	100	6,418	4,000	14
Exeter	69	78	54	100	5,172	4,000	19
Glouc	36	100	36	0			0
Ipswi	35	86	30	97	4,977	5,000	9
Leeds	84	88	74	99	4,945	4,000	11
Leic	141	84	118	100	4,638	4,000	16
Liv RI	78	78	61	100	9,997	8,000	21
Middlbr	18						
Norwch	46	57	26	100	3,954	4,000	39
Nottm	78	69	54	0			29
Oxford	101	74	75	100	9,027	8,000	22
Plymth	43	63	27	100	6,148	6,000	33
Prestn	60	57	34	0			37
Redng	78	73	57	0			23
Sheff	60	65	39	100	6,551	4,000	35
Shrew	18						
Sthend	18						
Swanse	45	60	27	0			40
Truro	26	100	26	85	3,902	3,000	
Tyrone	7						
Ulster	2						
Wolve	62	66	41	100	4,817	3,000	31
York	17						
England	**1,438**	**75**	**1,081**	**82**	**6,318**	**4,000**	**23**
N Ireland	**47**	**66**	**31**	**100**	**5,226**	**3,000**	**32**
Wales	**68**	**60**	**41**				**40**
E, W & NI	**1,553**	**74**	**1,153**	**81**	**6,202**	**4,000**	**24**

Blank cells denote centres excluded from analyses due to low patient numbers or very incomplete dosage data

ESAs and time on renal replacement therapy

The percentage of patients on ESA by time on RRT and dialysis modality is shown in figure 8.46. This is a cross-sectional analysis at the final quarter of 2010. Patients who had previously changed RRT modality were still included in this analysis. The proportion of PD patients requiring ESA rises with duration of RRT from 73% after 1 year of PD, to 78% after 10 or more years. This almost certainly reflects the loss of residual renal function. For at least the first 10 years on RRT, a greater percentage of HD patients are receiving ESA treatment than patients on PD at any given time point.

ESA dose and success with guideline compliance

There is no significant relationship between centres' mean ESA dose and median Hb for HD patients (figure 8.47) or compliance with the EPBG minimum

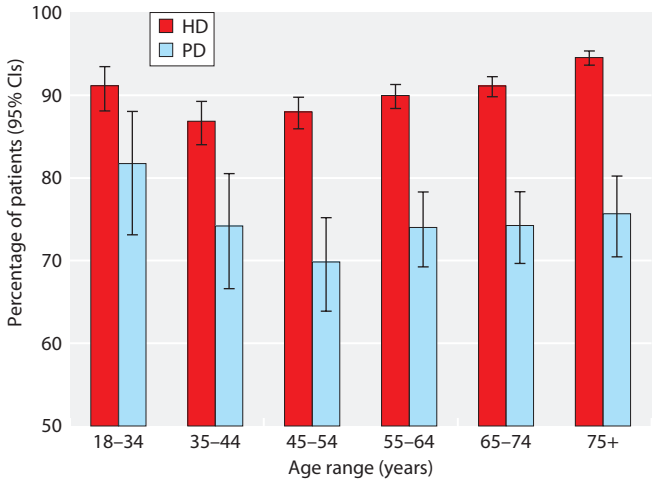

Fig. 8.41. Percentage of dialysis patients on ESA, by age group and treatment modality (2010)

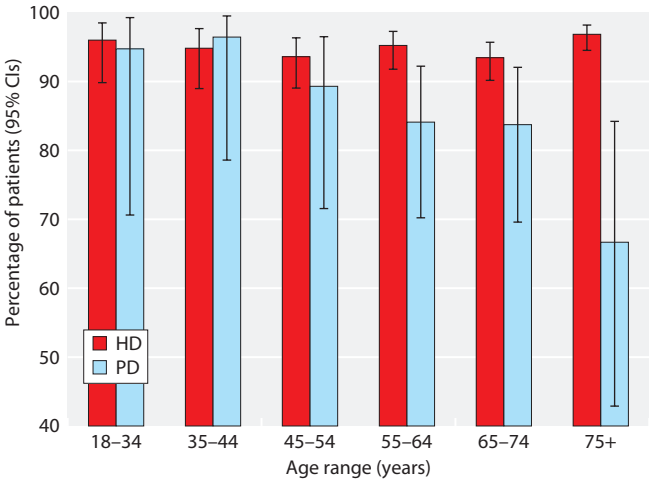

Fig. 8.43. Percentage of patients with Hb <10 g/dl who are on ESA, by age group and treatment modality (2010)

standard for Hb in HD patients (figure 8.48). This is not surprising as the most anaemic patients and those least responsive to ESAs are those given the biggest doses. Figure 8.49 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 12 g/dl (HD) or 12.5g/dl (PD) are receiving ESA. It has been suggested that it may be inappropriate to include those patients not receiving ESA within the group not meeting this RA target. There are 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 [11, 12].

Figures 8.50 and 8.51 show the percentages of HD and PD patients in each centre whose Hb lies above, within or below the RA guidelines of 10–12 g/dl (HD) or 10.5–12.5 g/dl (PD). These charts also show the proportion of patients with a Hb above the upper limit who were receiving, or were not receiving ESAs. These analyses are restricted to the centres with acceptable ESA returns as stipulated above. These figures show that 31.1% of HD patients had a Hb >12 g/dl. Most of these patients (84.8%) were on ESAs. Over a quarter (25.2%) of PD patients had a Hb >12.5 g/dl, but only 52.8% of these were on ESAs.

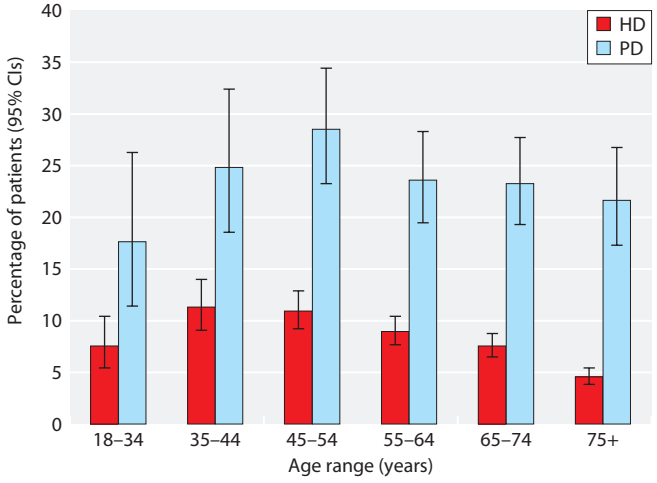

Fig. 8.42. Percentage of whole cohort (2010) who are not on ESA and have Hb ⩾10 g/dl, by age group and treatment modality

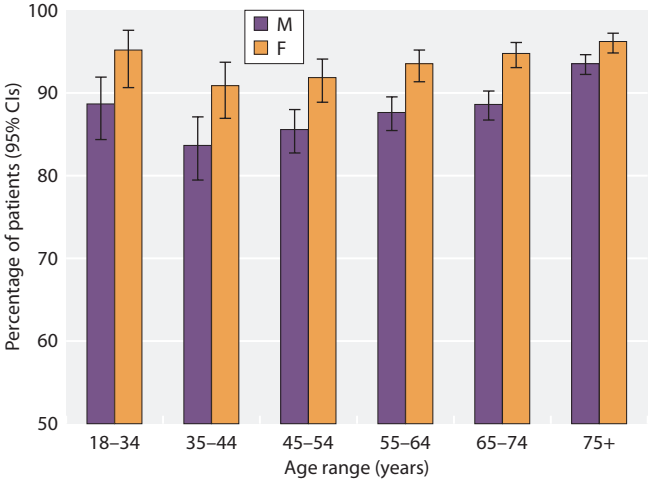

Fig. 8.44. Prescription of ESA by age and gender in patients treated with HD (2010)

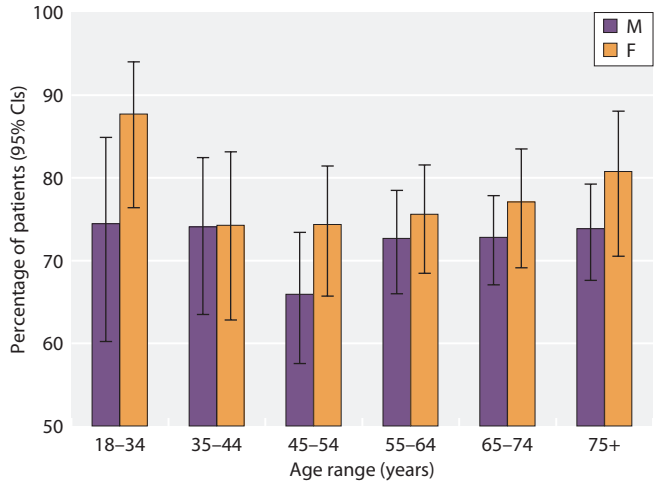

Fig. 8.45. Prescription of ESA by age and gender in patients treated with PD (2010)

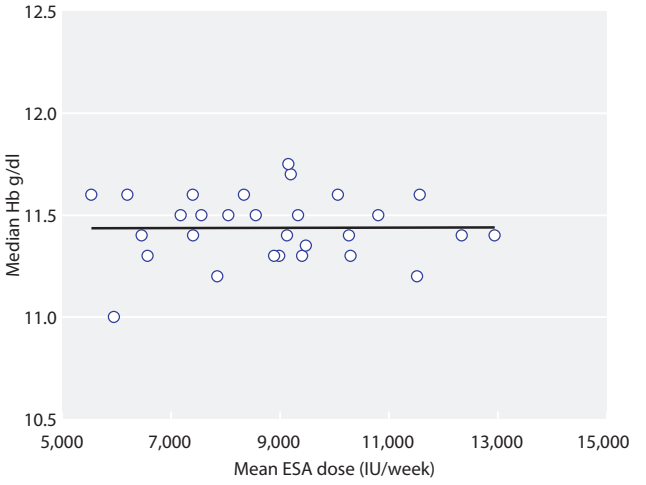

Fig. 8.47. Median Hb versus mean ESA dose in patients treated with HD by centre in 2010

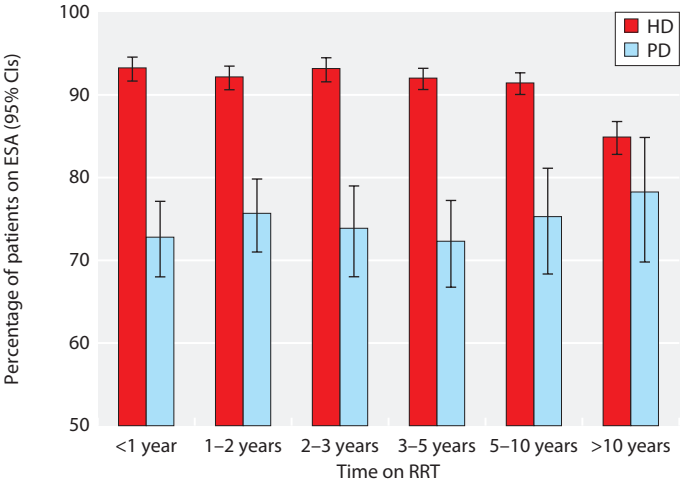

Fig. 8.46. Percentage of patients on ESA by time on RRT (2010)

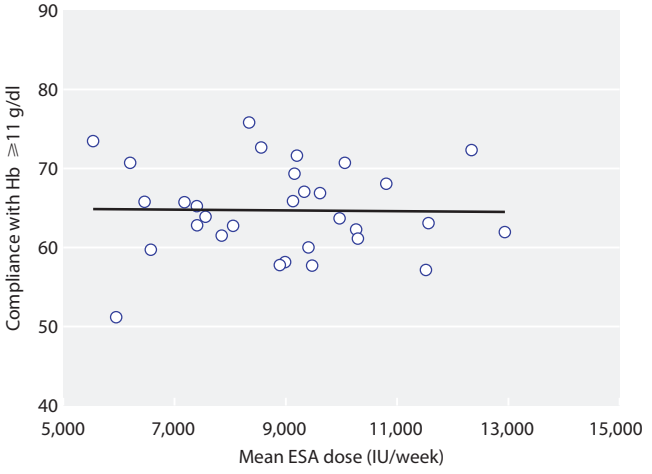

Fig. 8.48. Compliance with European Best Practice Guidelines versus mean ESA dose in patients treated with HD by centre in 2010

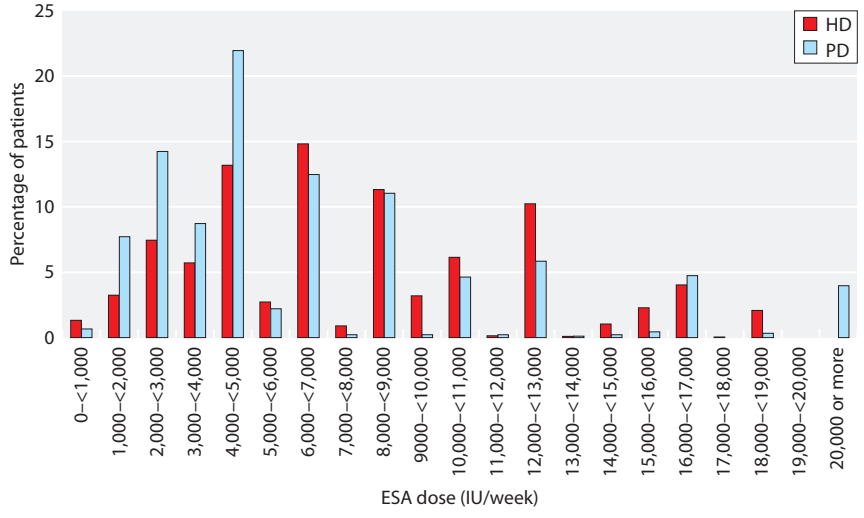

Fig. 8.49. Frequency distribution of weekly ESA dose in 2010

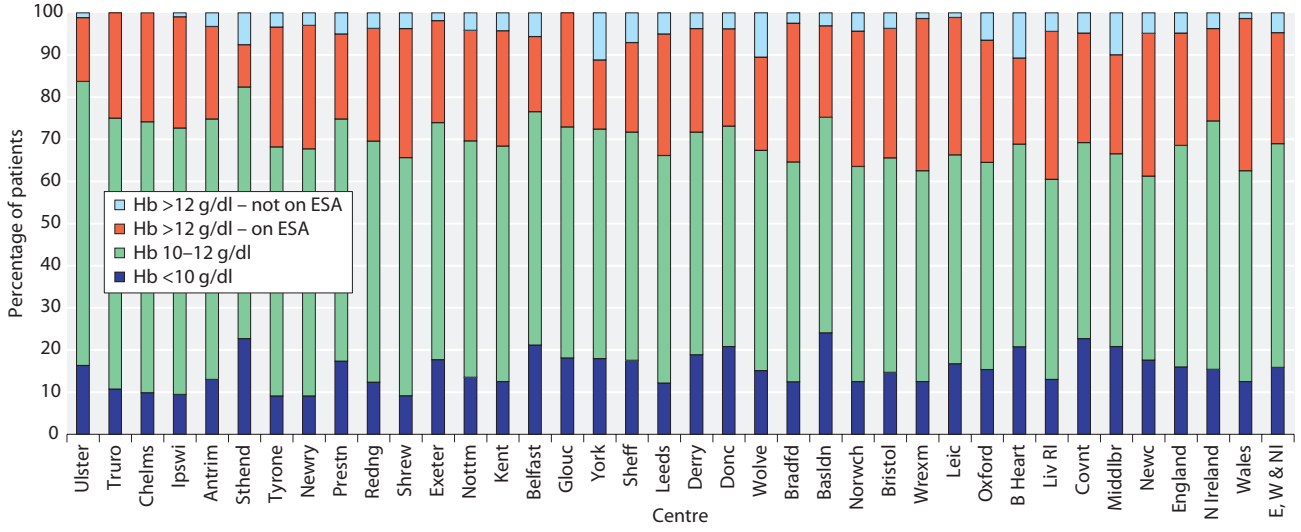

Fig. 8.50. Distribution of haemoglobin in patients treated with HD and the proportion of patients with Hb >12 g/dl receiving ESA by centre in 2010

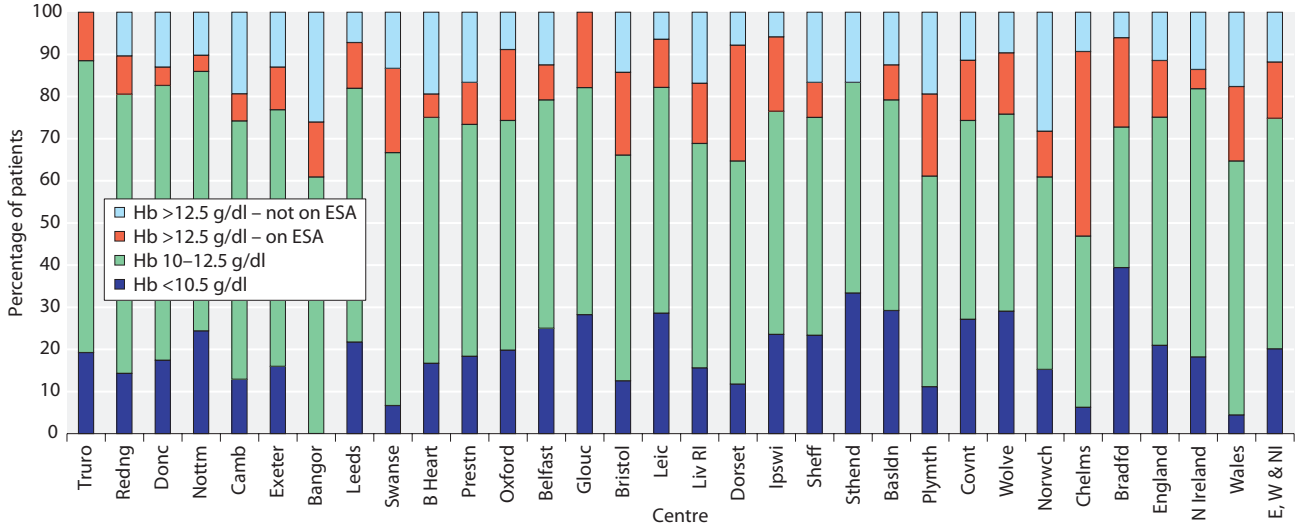

Fig. 8.51. Distribution of haemoglobin in patients treated with PD and the proportion of patients with Hb >12.5 g/dl receiving ESA by centre in 2010

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 (84.6% and 87.2% respectively). As would be anticipated, a greater proportion of prevalent patients (85.0%) than incident patients (53.6%) had a Hb ⩾10.0 g/dl in 2010.

In the UK the median Hb of patients on HD was 11.5 g/dl with an IQR of 10.5–12.3 g/dl, and the median Hb of patients on PD was 11.6 g/dl with an IQR of 10.6–12.5 g/dl. These UK averages are similar to those published in the last few UKRR reports.

Compliance with advice regarding iron stores as reflected by ferritin remained stable in the UK with 96% of HD patients and 86% of PD patients achieving a serum ferritin greater than 100 µg/L.

The analysis of ESA usage was limited by incomplete data returns. From the available data, 91% of HD patients and 74% of PD patients were on

ESA treatment in England, Wales and Northern Ireland.

New guidelines introduced in 2010 [8, 9] mean that from the 15th Annual Report all RRT patients on ESA treatment will be measured against the Hb target of 10–12 g/dl. It will be of interest how this affects median Hb levels and ESA use over the next few years.

Conflicts of interest: none

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