UK Renal Registry 15th Annual Report: Chapter 6 Haemoglobin, Ferritin and Erythropoietin amongst UK Adult Dialysis Patients in 2011: 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 2011, the median Hb of patients at the time of starting dialysis in the UK was 10 g/dl with 51% of patients having a Hb $\geqslant$10.0 g/dl.
- The UK median Hb in patients starting HD was 9.7 g/dl (IQR 8.8–10.7) and in patients starting PD was 10.9 g/dl (IQR 9.9–11.9).
- In 2011, at start of dialysis in the UK, 55% of patients presenting early had Hb $\geqslant$10.0 g/dl whilst 37% of patients presenting late had Hb $\geqslant$10.0 g/dl.
- The median Hb of prevalent patients on HD in the UK was 11.2 g/dl with an IQR of 10.3–12.1 g/dl.
- The median Hb of prevalent patients on PD in the UK was 11.4 g/dl with an IQR of 10.5–12.3 g/dl.
- In 2011, 82% of HD and 85% of PD UK patients had Hb $\geqslant$10 g/dl.
- In 2011, 56% of HD patients and 53% of PD UK patients had Hb $\geqslant$10 and $\leqslant$12 g/dl.
- In the UK, the median ferritin in HD patients was 436 µg/L (IQR 292–625) 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 273 µg/L (IQR 153–446) with 86% of PD patients having a ferritin $\geqslant$100 µg/L.
- In 2011, the mean erythropoietin stimulating agent (ESA) dose was higher for HD than PD patients (8,740 vs. 6,624 IU/week) in England, Wales and Northern Ireland.

Introduction

This chapter describes the UK Renal Registry (UKRR) data relating to the management of anaemia in dialysis patients during 2011. The chapter reports outcomes of submitted variables and analyses of these variables in the context of the UK Renal Association – Anaemia in CKD guidelines and recommendations.

In this report haemoglobin levels are given in g/dl as the majority of UK laboratories were using these units in 2011. It is intended to switch to reporting haemoglobin levels in g/L in the 16th annual report.

Anaemia in adults with CKD is diagnosed when the Hb concentration is <13.0 g/dl in males and <12.0 g/dl in females [1]. The degree of renal impairment affects the likelihood of any patient developing anaemia. Although current treatment with ESAs is not recommended unless Hb falls consistently below 11.0 g/dl, other causes of anaemia should be excluded in patients with Hb below normal range.

The renal National Service Framework (NSF) part one [2] and the RA minimum standards document 3rd edition [3] state that individuals with chronic kidney disease (CKD) should achieve a haemoglobin (Hb) of at least 10 g/dl within six 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 six months after meeting a nephrologist. However, an indication of the attainment of this standard is given by the Hb of the incident patient population 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 European Best Practice Guidelines (EBPG) [4] 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) [5] 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 [6] and the 4th edition of the RA Clinical Practice Guidelines 2006 [7] recommended an outcome Hb of between 10.5 and 12.5 g/dl (with ESA dose changes considered at 11 and 12 g/dl) to allow 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 [8]. This guidance specified that pre-HD Hb concentration should be maintained between 10 and 12 g/dl. The 5th edition of the UK Renal Association's Anaemia in CKD guideline 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. The rationale behind choosing a wide target Hb range (10–12 g/dl) is that when the target Hb level is narrow (e.g. 1 g/dl), variability in achieved Hb levels around the target is high, the fraction of prevalent patients with achieved Hb levels within the target range is low and ESA dose titration is required frequently during maintenance therapy. Therefore, as this chapter analyses 2011 data, this revised target has been used for both HD and PD patients. There are also some analyses showing attainment of the minimum standard of Hb $\geqslant 10.0$ g/dl. The KDIGO website [10] is a useful resource for comparison of international anaemia guidelines.

In patients on peritoneal dialysis (PD), the timing of the blood sample draw is not critical because plasma volume in these patients remains relatively constant. In haemodialysis (HD) patients, interdialytic weight gain contributes to a decrease in Hb level, whereas intradialytic ultrafiltration leads to an increase in Hb level. Thus, a predialysis sample underestimates the euvolaemic Hb level, whereas a postdialysis sample overestimates the euvolaemic Hb. Given the relationship between Hb level and the dialysis related weight change, midweek pre-dialysis sampling should be optimal for regular Hb monitoring [11].

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 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 $>6\%$ indicates ongoing iron deficiency.

To achieve adequate iron status across a patient population, RA guidelines advocate population target medians for ferritin of 200–500 µg/L in HD patients

and 100–500 μg/L for PD patients, 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. Serum ferritin level is less reliable in the evaluation of iron stores in HD patients, because ferritin level is affected by other factors in addition to iron storage status. In relatively healthy HD patients, before widespread use of IV iron therapy, the finding of a ferritin level less than 50 ng/mL was not uncommon and was associated with absent bone marrow iron in approximately 80% of patients. However, in HD patients with several comorbidities, absent iron stores may still be found at ferritin levels approaching or even exceeding 200 ng/mL [12].

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.

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 with the lowest possible doses are desirable. The health economics of anaemia therapy using ESAs has been subject to a NICE systematic review which concludes that treating to a target Hb 11–12 g/dl is cost effective in HD patients.

The risks associated with low (<10 g/dl) and high (>13 g/dl) Hb are not necessarily equivalent. Two important studies of patients not yet on dialysis – CHOIR [13] and CREATE [14] showed an increased risk among the patients assigned to the higher Hb targets and adverse cardiovascular events. In the TREAT study [15] although there was no difference between the two arms in the primary outcome of death, cardiovascular event or end stage renal disease, there was an increase in fatal or nonfatal stroke in the treatment arm.

Methods

The incident and prevalent RRT cohorts for 2011 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.

For the analyses of Hb for incident patients, those patients commencing RRT on PD or HD were included whilst those receiving a pre-emptive transplant were excluded. Hb measurements from after starting dialysis but still within the same quarter of the year were used. Therefore, depending on when in the quarter a patient started RRT the Hb could be from 0 to 90 days later. The haemoglobin values the registry receives from the renal systems should be the closest available measurement to the end of the quarter. Patients who died within the first 90 days on treatment were excluded. Results are also shown with the cohort subdivided into early and late presenters (date first seen by a nephrologist more or less than 90 days respectively).

For the analyses of prevalent patients, those patients receiving dialysis on 31st December 2011 were included if they had been on the same modality of dialysis in the same centre for at least three months. In order to improve completeness the last available measurement for each patient from the last two quarters for Hb and from the last three quarters for ferritin was used. Scotland was excluded from the analysis for ferritin for PD patients as this data was not available.

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 (10 patients for the analyses of incident patients) were also excluded from the plots. The number preceding the centre name in the caterpiller plots indicates the percentage of data that was missing for that centre.

The data were analysed to calculate summary statistics including maximum, minimum and average (mean and median) values. Standard deviations and inter-quartile ranges (IQR) were also calculated. These are shown using caterpillar plots giving median values and the inter-quartile ranges.

The percentages achieving RA and other standards were calculated for Hb and ferritin. These are displayed using caterpillar plots with the percentages meeting the targets and 95% confidence intervals (CIs) shown. Funnel plots show the distribution of the percentages meeting the various targets and also whether any of the centres are significantly different from the average.

Longitudinal analysis was performed to show overall changes in achievement of standards from 1998 to 2011.

Erythropoietin data from the last quarter of 2011 were used to define which patients were receiving ESAs. Scotland was excluded from this analysis as data regarding ESA was not included in its return. Each individual was defined as being on ESA if a drug type and/or a dose was present in the data. Centres reporting fewer than 70% of HD patients or fewer than 50% of PD patients being treated with ESAs were considered to have incomplete data and were 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 as it appears in the data. The percentage of patients on ESAs is calculated from these data and incomplete data returns risk seriously impacting on any conclusions drawn.

For analyses of ESA dose, values are presented as weekly erythropoietin dose. Doses of less than 150 IU/week (likely to be darbepoietin) were harmonised with erythropoietin data by multiplying by 200. No adjustments were made with respect to route of administration.

Previous reports have only used the dose from the final quarter of the year. This year, starting with the cohort of patients receiving ESAs in the final quarter and having a dose value present for that quarter, any further dose values available from the earlier three quarters of the year (provided the patient was on the same treatment and receiving the same drug in those quarters) were used. The average (mean) of the available values was then used in analyses rather than the dose in the final quarter.

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 the data source, 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

Anaemia management in incident dialysis patients

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 percentage of data returned and outcome Hb are listed in table 6.1. Six centres were not included in this analysis due to either being small centres who submitted data on fewer than 10 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 10.0 g/dl. The percentage of patients having a Hb $\geqslant$10.0 g/dl has fallen over the last couple of years to 51% (53.6% and 55% for 2010 and 2009 cohorts respectively). The variation between centres remained high (25–74%). Using only centres with presentation time data, the median Hb in the late presenters was 9.4 g/dl with only 37% of patients having a Hb $\geqslant$10.0 g/dl compared to a median Hb of 10.1 g/dl and 55% of the patients having a Hb $\geqslant$10.0 g/dl in the early presenters group. In the late presenters group there was a large variation between centres in percentage of patients having a Hb $\geqslant$10.0 g/dl (0%–73%). The lower median Hb in late presenters may reflect inadequate pre-dialysis care with limited anaemia management, but alternatively, those presenting late may be more likely to have anaemia of multisystem disease or inter-current illness.

Median Hb of patients at dialysis start was also examined by modality and was 9.7 g/dl (IQR 8.8–10.7 g/dl) and 10.9 g/dl (IQR 9.9–11.9 g/dl) for HD and PD patients respectively. When initiating dialysis, 44.5% of HD patients had a Hb $\geqslant$10.0 g/dl, compared with 74.0% of PD patients.

The median starting Hb by centre is shown in figure 6.1 and the percentage starting with a Hb $\geqslant$10.0 g/dl by centre is given in figure 6.2.

Incident dialysis patients from 2010 were followed for one year and the median haemoglobin (and percentage with a Hb $\geqslant$10.0 g/dl) of survivors on the same treatment at the same centre after a year was calculated for each quarter. This was sub-analysed by modality and length of pre-RRT care (figures 6.3 and 6.4). Hb was higher in the second quarter on dialysis than the quarter of start reflecting the treatment administered. Over 80% of incident patients surviving to a year had Hb $\geqslant$10 g/dl regardless of the modality or the length of pre-RRT care.

The annual distribution of Hb in incident dialysis patients is shown in figure 6.5. Since 2006, the proportion of incident patients with Hb $\geqslant$12 g/dl has fallen from 17% to 10% and the proportion of patients with Hb $<$10.0 g/dl has increased from 40% to 49%.

ESA by time on dialysis in early vs. late presenters

Figure 6.6 shows that there was a relatively small difference betweeen early and late presenters in the percentage of patients receiving an ESA in the first quarter for both HD and PD patients. The differences disappear within six months of starting dialysis.

Anaemia management in prevalent dialysis patients

Compliance with data returns for haemoglobin and serum ferritin and percentages on ESA are shown for the 71 renal centres in the UK in tables 6.2 for both HD and PD patients. Completeness of data returns was generally good for Hb and ferritin. The percentages on ESA are shown as they appear in the data received by the registry. For some centres the ESA data is completely missing and for others it appears to be partially complete

Table 6.1. Haemoglobin data for incident patients starting haemodialysis or peritoneal dialysis during 2011, both overall and by presentation time

	All incident patients				Early presenters only (⩾3 months)		Late presenters only (<3 months)	
Centre	% data return	N with data	Median Hb g/dl	% Hb ⩾10 g/dl	Median Hb g/dl	% Hb ⩾10 g/dl	Median Hb g/dl	% Hb ⩾10 g/dl
England								
B Heart	100	102	9.9	49	10.0	51		
B QEH	94	182	9.9	49	10.2	56	9.3	27
Basldn	100	41	9.3	32	9.6	40	8.8	10
Bradfd	98	46	9.8	43	9.8	44		
Brightn	97	99	10.3	62				
Bristol	100	112	9.9	47	10.1	54	8.9	17
Camb	99	94	9.8	48	10.3	54	9.4	33
Carlis	100	23	10.6	57	10.6	58		
Carsh	98	182	10.3	60	10.3	62	10.2	55
Chelms	97	31	10.2	68	10.6	74		
Colchr	41	18						
Covnt	96	78	9.9	50				
Derby	97	68	10.4	65	10.4	63	10.4	73
Donc	98	41	9.6	41	10.4	54	8.9	9
Dorset	92	58	10.3	64	10.6	73	9.3	33
Dudley	100	25	9.6	44	10.1	55		
Exeter	100	103	9.8	45	9.8	44	9.4	40
Glouc	100	49	10.1	51	10.2	52		
Hull	98	93	10.4	62				
Ipswi	93	25	10.1	52	10.3	60		
Kent	97	102	9.9	47	10.0	52	9.3	26
L Barts	97	227	9.5	39				
L Guys	51	49	9.6	37	9.5	34		
L Kings	100	130	9.3	25	9.5	30	8.9	0
L Rfree	68	104	10.7	65				
L St.G	95	58	9.6	34				
L West	72	222	10.6	70	10.8	71	10.5	70
Leeds	100	119	9.5	35	9.6	40	8.9	20
Leic	97	218	10.0	52	10.1	55	9.6	40
Liv Ain	87	53	10.4	60				
Liv RI	92	78	11.0	71				
M RI	98	123	10.1	54				
Middlbr	96	79	9.6	42	9.8	44	8.4	33
Newc	99	75	9.9	48	10.2	57	8.6	17
Norwch	99	75	10.3	60	10.5	64	10.0	50
Nottm	99	86	10.0	50	10.0	53	9.7	36
Oxford	99	136	10.2	59	10.4	64	9.4	25
Plymth	49	23						
Ports	100	173	10.1	58	10.3	65	9.4	32
Prestn	98	125	9.6	38	9.8	42	8.9	26
Redng	97	90	9.7	43				
Salford	100	110	9.9	48				
Sheff	100	113	9.9	47	10.0	52	8.9	26
Shrew	98	55	10.5	71	10.6	71		
Stevng	100	101	9.7	42	9.8	46	9.3	23
Sthend	100	27	10.4	63	10.0	62		
Stoke	100	87	10.5	66	10.4	64	10.8	70
Sund	98	49	10.6	69	11.0	77		
Truro	97	28	10.4	61	10.4	63		
Wirral	85	47	10.0	51				

Table 6.1. Continued

Centre	All incident patients				Early presenters only (⩾3 months)		Late presenters only (<3 months)	
	% data return	N with data	Median Hb g/dl	% Hb ⩾10 g/dl	Median Hb g/dl	% Hb ⩾10 g/dl	Median Hb g/dl	% Hb ⩾10 g/dl
Wolve	97	65	9.8	48	9.8	47	10.0	50
York	100	38	9.6	34	9.6	41		
N Ireland								
Antrim	95	21	9.8	43	10.0	50		
Belfast	89	47	9.9	47	9.6	42		
Newry	97	37	10.2	54	10.3	62		
Ulster	100	34	10.0	50	10.0	50		
West NI	97	30	10.3	57	10.5	57		
Scotland								
Abrdn	83	39	9.5	41				
Airdrie	79	37	9.5	32				
D & Gall	40	4						
Dundee	96	52	10.2	56				
Dunfn	58	23	10.3	65				
Edinb	80	49	10.4	59				
Glasgw	49	72						
Inverns	31	4						
Klmarnk	50	15	9.2	47				
Wales								
Bangor	100	19	10.7	74	10.9	82		
Cardff	99	160	10.1	56	10.1	57	9.9	42
Clwyd	100	6						
Swanse	97	101	10.1	51	10.1	56	9.3	32
Wrexm	100	21	10.5	67	10.5	67		
England	**93**	**4,535**	**10.0**	**51**	**10.1**	**55**	**9.4**	**37**
N Ireland	**95**	**169**	**10.0**	**50**	**10.0**	**51**	**9.6**	**44**
Scotland	**66**	**295**	**9.9**	**49**				
Wales	**99**	**307**	**10.1**	**56**	**10.2**	**59**	**9.6**	**37**
UK	**91**	**5,306**	**10.0**	**51**	**10.1**	**55**	**9.4**	**37**

Blank cells – centres excluded from analyses due to poor data completeness or low patient numbers or because presentation time data not available

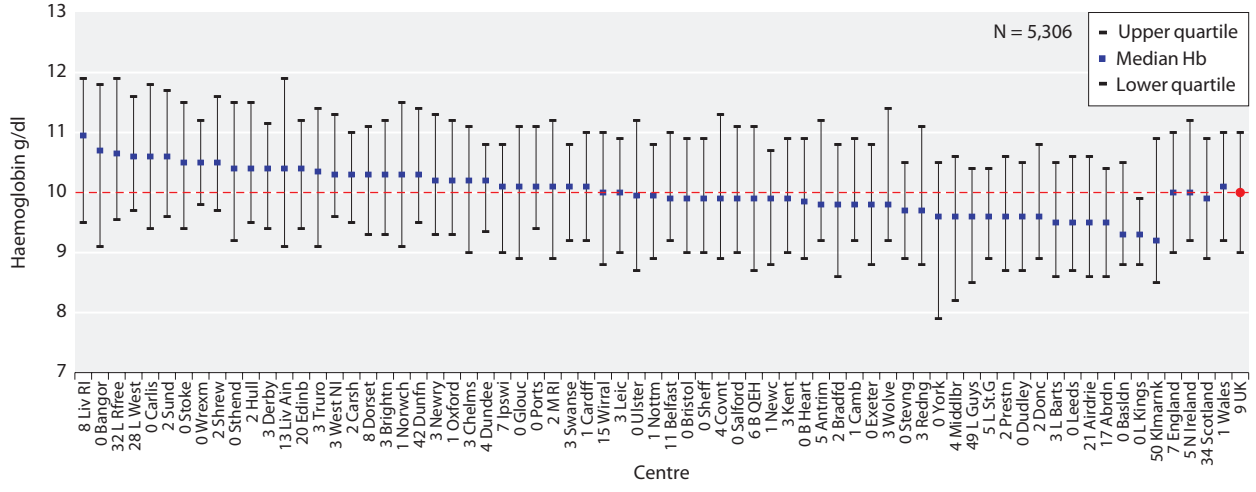

Fig. 6.1. Median haemoglobin for incident dialysis patients at start of dialysis treatment in 2011

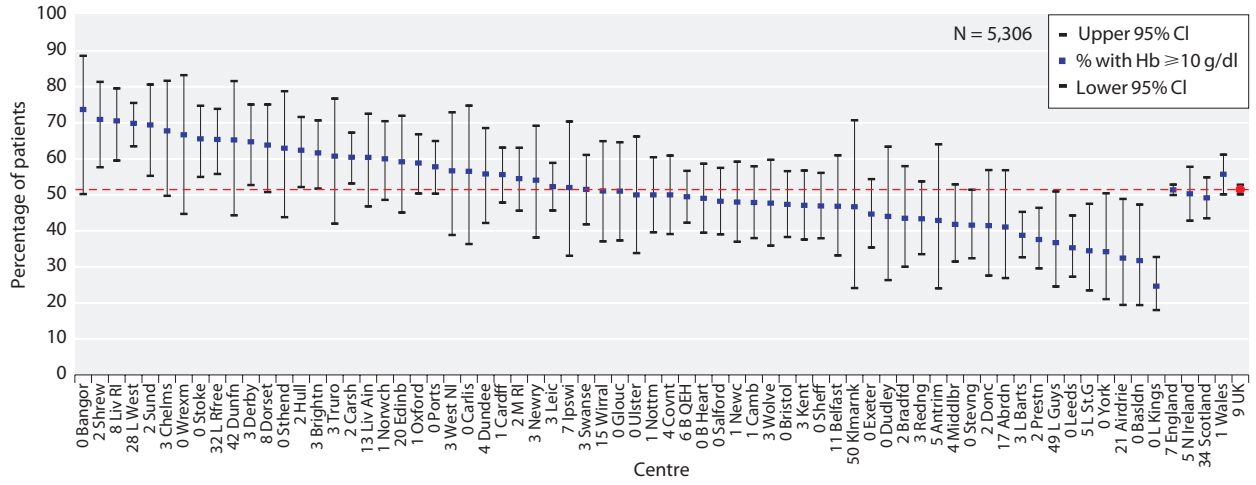

Fig. 6.2. Percentage of incident dialysis patients with Hb ⩾10 g/dl at start of dialysis treatment in 2011

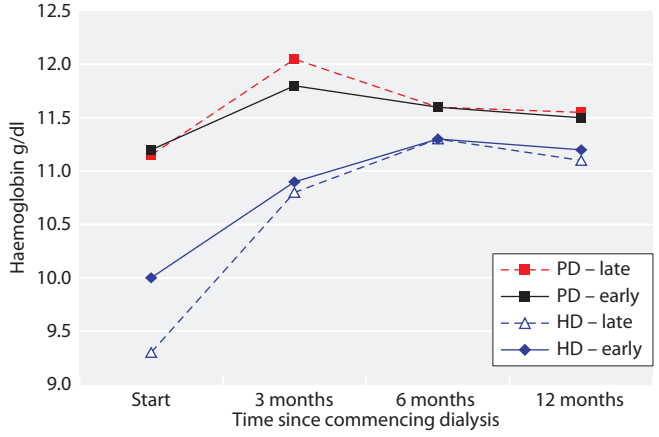

Fig. 6.3. Median haemoglobin, by time on dialysis and length of pre-RRT care, for incident dialysis patients in 2010

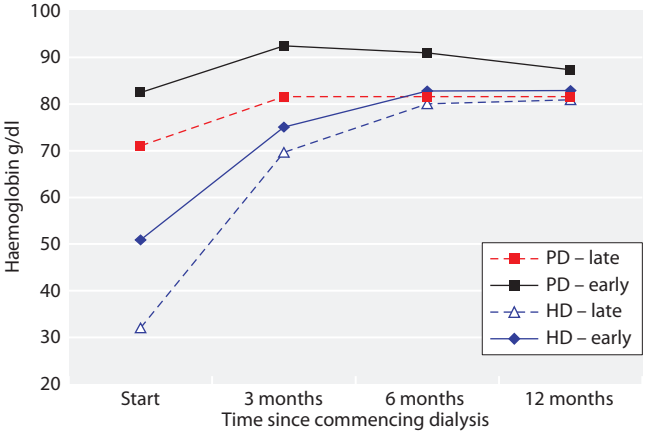

Fig. 6.4. Percentage of incident dialysis patients in 2010 with Hb ⩾10 g/dl, by time on dialysis and by length of pre-RRT care

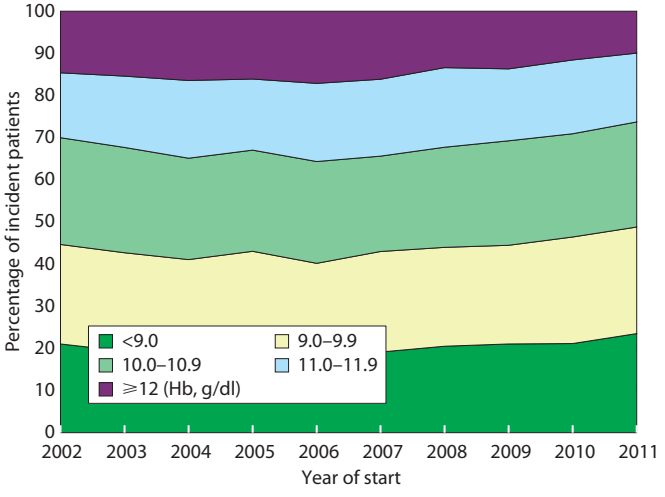

Fig. 6.5. Distribution of haemoglobin in incident dialysis patients by year of start

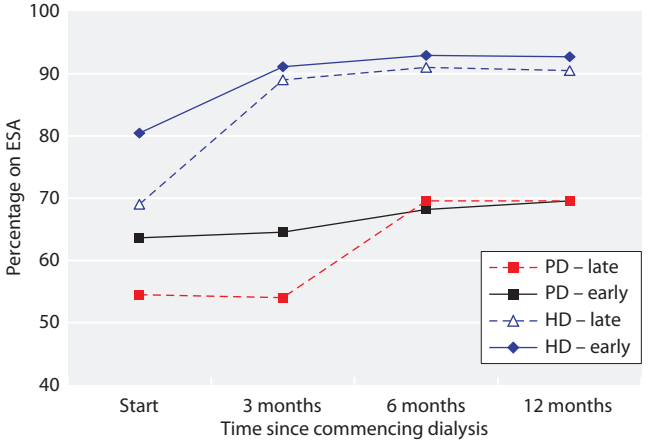

Fig. 6.6. Percentage of incident dialysis patients in 2010 on ESA, by time on dialysis and by length of pre-RRT care

Table 6.2. Percentage compliance for data returns for haemoglobin and serum ferritin and percentages on ESA for prevalent HD and PD patients in 2011

	HD				PD			
		% completeness				% completeness		
Centre	N	Hb	Ferritin	% on ESA	N	Hb	Ferritin	% on ESA
England								
B Heart	413	100	99	76	38	100	100	61
B QEH	831	99	98	85	147	99	99	65
Basldn	138	98	98	86	25	100	96	60
Bradfd	181	99	97	95	28	96	96	79
Brightn	313	99	93	0	66	98	88	0
Bristol	445	100	100	93	60	100	98	70
Camb	334	99	87	15	32	100	100	72
Carlis	60	100	93	60	17	100	100	59
Carsh	704	93	91	0	94	95	98	0
Chelms	113	100	100	98	22	100	100	86
Colchr	105	96	94	23				
Covnt	334	99	99	93	79	97	89	70
Derby	193	99	99	0	101	100	100	0
Donc	153	100	97	92	21	100	100	76
Dorset	222	100	98	3	45	100	98	9
Dudley	137	100	99	4	50	98	84	8
Exeter	340	100	99	96	63	100	100	76
Glouc	183	100	96	94	34	94	91	62
Hull	308	99	98	0	78	96	92	0
Ipswi	119	100	67	86	30	100	93	87
Kent	353	100	98	90	61	100	100	3
L Barts	818	99	98	0	152	98	97	0
L Guys	578	84	77	21	28	100	100	11
L Kings	431	100	99	0	77	99	99	0
L Rfree	659	72	79	0	81	80	100	0
L St.G	275	98	96	0	53	96	96	0
L West	1317	98	98	0	32	94	100	0
Leeds	468	100	100	92	81	100	100	86
Leic	784	99	99	98	139	99	99	85
Liv Ain	160	94	93	46	13	100	100	23
Liv RI	362	99	99	88	59	98	98	80
M RI	453	87	85	0	71	100	97	0
Middlbr	285	98	98	81	14	93	93	64
Newc	239	100	100	76	41	100	100	2
Norwch	291	100	98	92	48	100	100	58
Nottm	385	100	100	90	74	100	100	68
Oxford	374	100	99	91	82	100	100	82
Plymth	124	44	97	29	40	83	93	70
Ports	468	100	99	11	83	99	95	17
Prestn	486	99	99	87	54	100	100	59
Redng	245	100	100	96	74	99	99	3
Salford	337	90	21	95	97	100	1	93
Sheff	560	100	100	89	54	100	100	59
Shrew	176	100	99	95	27	96	89	67
Stevng	387	100	99	0	26	100	96	0
Sthend	116	100	100	92	16	100	100	44
Stoke	292	100	99	1	69	100	100	0
Sund	162	100	96	96	13	100	92	69
Truro	139	100	100	1	22	100	95	0
Wirral	181	75	70	2	36	75	53	0

Table 6.2. Continued

	HD				PD			
		% completeness				% completeness		
Centre	N	Hb	Ferritin	% on ESA	N	Hb	Ferritin	% on ESA
Wolve	295	99	99	86	63	100	100	68
York	123	100	98	85	19	95	100	89
N Ireland								
Antrim	123	100	99	93	12	100	100	92
Belfast	209	98	98	89	28	100	96	79
Newry	100	99	65	98	9	100	100	67
Ulster	101	100	100	95	3	100	100	100
West NI	137	100	66	91	17	100	94	71
Scotland								
Abrdn	202	100	95		22	100		
Airdrie	158	100	94		8	100		
D & Gall	49	86	98		13	46		
Dundee	175	99	97		18	94		
Dunfn	137	100	99		26	100		
Edinb	240	99	95		35	100		
Glasgw	571	96	83		42	57		
Inverns	78	95	50		18	83		
Klmarnk	141	94	89		39	77		
Wales								
Bangor	85	100	100	86	20	100	100	60
Cardff	458	99	97	65	94	99	97	13
Clwyd	59	100	100	46	8	100	88	63
Swanse	328	100	100	44	49	100	100	45
Wrexm	81	100	44	93	15	93	27	53
England	**17,949**	**96**	**94**	**90**	**2,829**	**98**	**94**	**74**
N Ireland	**670**	**99**	**87**	**92**	**69**	**100**	**97**	**78**
Scotland	**1,751**	**97**	**89**		**221**	**83**		
Wales	**1,011**	**100**	**94**	**89**	**186**	**99**	**92**	**58**
UK	**21,381**	**97**	**94**	**90***	**3,305**	**97**	**94***	**73***

*The overall averages given are for E,W & NI (not UK)
Blank cells – centres with no PD patients or because data not available
Percentages on ESA are shown, but it is believed that there were data problems for those centres with apparently less than 70% of HD patients or 50% of PD patients on ESA
The country level averages for the % on ESA are based only on those centres whose % was above the limits mentioned above

with, for example, only 10 or 20% of patients appearing to be on ESAs. It is believed that there were problems with data entry and/or data transfer in those centres with apparently less than 70% of HD patients or 50% of PD patients on ESA. These centres have been excluded from further analyses of ESA use.

Summary statistics for haemoglobin, serum ferritin and ESA are shown for the 71 renal centres in the UK in tables 6.3 for HD and 6.4 for PD patients respectively.

Haemoglobin in prevalent haemodialysis patients

The median Hb of patients on HD in the UK was 11.2 g/dl with an IQR of 10.3–12.1 g/dl and 82% of HD patients had a Hb $\geqslant$10.0 g/dl (table 6.3). The median Hb by centre is shown in figure 6.7. The UK median dropped from 11.5 g/dl to 11.2 g/dl between 2010 and 2011. Compliance with the target range of Hb $\geqslant$10 and $\leqslant$12 g/dl increased from 52.7% in 2010 to 56.1% in 2011 (figure 6.8). The percentages of HD patients with Hb below 10 g/dl and above 12 g/dl, as well as the percentages meeting the target, are shown by centre in figure 6.9.

Funnel plots are shown for the minimum (Hb $\geqslant$10.0 g/dl) and target range (Hb $\geqslant$10 and $\leqslant$12 g/dl) in figures 6.10 and 6.11 respectively. Many centres complied well with respect to both the minimum and

Table 6.3. Summary statistics for haemoglobin, serum ferritin and ESA for prevalent HD patients in 2011

Centre	N with Hb data	Median Hb g/dl	% Hb ⩾10 g/dl	% Hb 10–12 g/dl	Median ferritin µg/L	% ferritin ⩾100 µg/L	% ferritin >200 and ⩽500 µg/L	% on ESA	Median ESA dose (IU/week)	% with Hb ⩾10 g/dl and not on ESA
England										
B Heart	413	11.1	78	53	336	93	60	76	8,800	22
B QEH	821	11.0	78	58	390	97	68	85	6,000	14
Basldn	135	11.0	80	63	341	96	80	86	6,000	11
Bradfd	179	11.3	75	47	523	99	40	95	6,708	4
Brightn	309	11.1	81	57	474	98	50			
Bristol	445	11.3	82	56	599	97	29	93	7,500	7
Camb	332	11.2	79	56	320	88	53			
Carlis	60	11.6	88	53	482	100	54			
Carsh	657	11.0	79	60	368	94	60			
Chelms	113	11.1	77	54	449	100	57	98	10,000	1
Colchr	101	11.3	88	64	653	99	20			
Covnt	332	10.8	73	58	303	92	71	93	11,050	7
Derby	192	11.6	91	57	406	97	51			
Donc	153	11.4	81	54	497	99	45	92	7,000	8
Dorset	222	11.4	85	54	495	98	46			
Dudley	137	11.3	82	53	321	86	57			
Exeter	340	11.1	81	56	278	96	71	96	7,789	4
Glouc	183	11.4	90	66	384	95	49	94		6
Hull	305	11.5	90	58	411	99	65			
Ipswi	119	11.4	86	55	624	98	26	86	7,625	12
Kent	352	11.1	85	66	468	94	40	90	8,250	8
L Barts	809	10.8	75	60	461	96	51			
L Guys	485	10.9	77	59	554	98	34			
L Kings	430	10.5	70	61	567	98	33			
L Rfree	474	11.6	85	46	499	96	34			
L St.G	269	10.8	74	57	434	97	50			
L West	1,291	11.4	88	56	491	98	48			
Leeds	468	11.3	84	57	512	95	37	92	4,000	7
Leic	778	11.4	82	54	353	95	60	98	6,250	1
Liv Ain	150	11.6	91	59	572	96	31			
Liv RI	359	11.9	89	45	459	94	34	88	8,000	11
M RI	394	11.6	86	49	394	95	62			
Middlbr	280	11.3	78	43	679	94	21	81	5,750	16
Newc	239	11.3	84	56	430	92	41	76	9,225	22
Norwch	290	11.4	89	59	489	96	37	92	8,000	7
Nottm	384	11.2	84	61	561	99	32	90	8,250	9
Oxford	374	11.1	79	54	286	91	55	91	8,000	9
Plymth	55				734	98	25			
Ports	468	11.5	86	49	313	94	59			
Prestn	482	11.1	82	57	593	92	26	87		12
Redng	245	11.2	82	56	509	98	42	96		4
Salford	302	10.9	78	53				95	6,000	3
Sheff	560	11.2	81	52	491	97	45	89	7,500	10
Shrew	176	11.5	91	59	394	95	58	95	7,500	5
Stevng	387	11.3	83	58	432	97	49			
Sthend	116	10.8	78	61	316	97	70	92	9,000	8
Stoke	292	11.4	86	55	540	99	38			
Sund	162	11.5	90	56	598	98	31	96	8,788	3
Truro	139	11.0	81	65	507	99	47			
Wirral	135	11.0	73	52	513	99	40			
Wolve	293	11.4	87	55	466	97	52	86	6,000	13
York	123	10.8	80	63	414	93	66	85	4,000	13

Table 6.3. Summary statistics for haemoglobin, serum ferritin and ESA for prevalent HD patients in 2011

Centre	N with Hb data	Median Hb g/dl	% Hb ⩾10 g/dl	% Hb 10–12 g/dl	Median ferritin µg/L	% ferritin ⩾100 µg/L	% ferritin >200 and ⩽500 µg/L	% on ESA	Median ESA dose (IU/week)	% with Hb ⩾10 g/dl and not on ESA
N Ireland										
Antrim	123	11.2	86	66	401	98	52	93	6,500	6
Belfast	205	11.3	81	55	419	96	43	89	8,000	10
Newry	99	11.7	94	58	501	95	40	98	6,000	2
Ulster	101	11.0	84	67	552	99	35	95	5,417	5
West NI	137	11.5	89	61	613	88	20	91	9,000	9
Scotland										
Abrdn	201	11.1	80	60	554	98	36			
Airdrie	158	11.4	87	58	768	99	22			
D & Gall	42	11.3	90	81	589	94	23			
Dundee	174	11.4	87	60	445	90	35			
Dunfn	137	11.5	83	47	521	91	32			
Edinb	238	11.8	91	48	407	88	44			
Glasgw	549	11.2	80	55	439	92	38			
Inverns	74	12.0	92	45	248	97	56			
Klmarnk	132	11.5	77	48	333	94	50			
Wales										
Bangor	85	11.3	92	59	435	99	58	86	9,000	13
Cardff	455	11.4	85	55	323	96	64			
Clwyd	59	11.6	90	58	336	97	63			
Swanse	328	11.2	83	67	354	91	50			
Wrexm	81	11.7	89	49				93	7,000	7
England	**17,309**	**11.2**	**82**	**56**	**440**	**96**	**48**	**90**	**7,500**	**9**
N Ireland	**665**	**11.3**	**86**	**60**	**477**	**95**	**40**	**92**	**7,000**	**7**
Scotland	**1,705**	**11.4**	**83**	**54**	**465**	**93**	**37**			
Wales	**1,008**	**11.3**	**86**	**59**	**344**	**95**	**59**	**89**	**7,583**	**10**
UK	**20,687**	**11.2**	**82**	**56**	**436**	**96**	**47**	**90**	**7,450**	**9**

Blank cells – centres excluded from analyses due to poor data completeness or low patient numbers or because the data item was not available
ESA data only shown for those centres for which the % on ESA was 70% or more
For ESA the overall averages given are for E,W & NI not UK

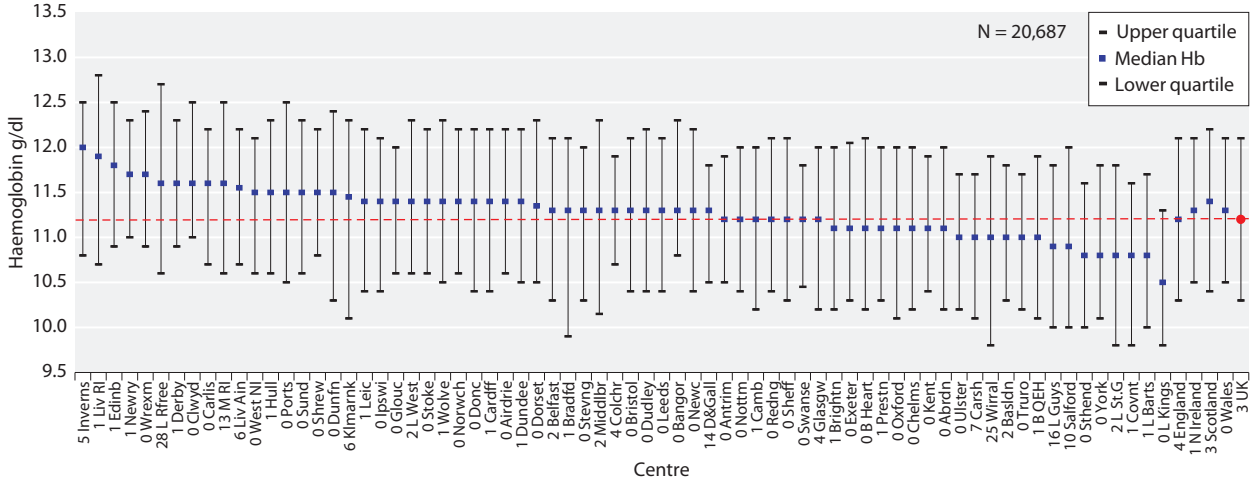

Fig. 6.7. Median haemoglobin in patients treated with HD by centre in 2011

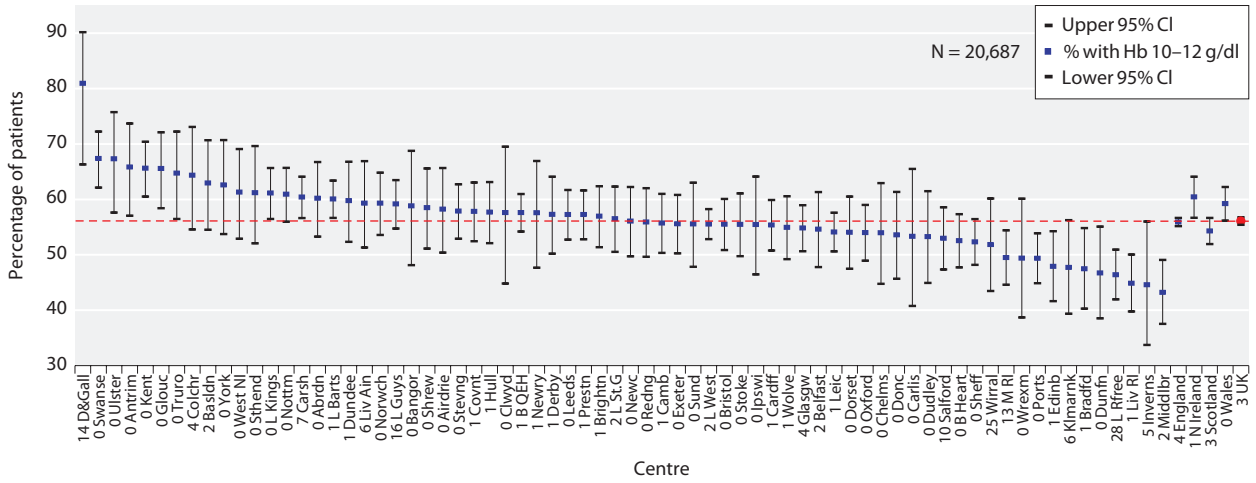

Fig. 6.8. Percentage of HD patients with Hb $\geqslant$10 and $\leqslant$12 g/dl by centre in 2011

target range Hb standards. Some centres fell within 3 SDs of the mean in the funnel plot for the percentage of patients with Hb $\geqslant$10 and $\leqslant$12 g/dl (figure 6.11) and yet had a poor compliance with the percentage with Hb $\geqslant$10.0 g/dl (figure 6.10) (for example Coventry, London Barts and London Kings). On the contrary some centres complied well with the percentage with Hb $\geqslant$10.0 g/dl but had a poor compliance with percentage of patients with Hb $\geqslant$10 and $\leqslant$12 g/dl (for example London Royal Free and Liverpool Royal had 31–44% of their patients with Hb >12.0 g/dl). This demonstrates that compliance with one standard can be achieved without compliance with another standard. Table 6.3 can be used in conjunction with figures 6.10 and 6.11 to identify centres.

Haemoglobin in prevalent peritoneal dialysis patients

Overall, 85% of patients on PD had a Hb $\geqslant$10.0 g/dl (table 6.4). The median Hb of patients on PD in the UK in 2011 was 11.4 g/dl with an IQR of 10.5–12.3 g/dl which compares with 11.6 g/dl in 2010. The median Hb by centre is shown in figure 6.12. The compliance with Hb $\geqslant$10.0 and $\leqslant$12.0 g/dl is shown in figure 6.13. In 2011, 53% of prevalent PD patients had a Hb within the target range. The distribution of Hb in PD patients by centre is shown in figure 6.14. The funnel plots for percentage with Hb $\geqslant$10.0 g/dl and for the percentage of patients with Hb $\geqslant$10 and $\leqslant$12 g/dl are shown in figures 6.15 and 6.16 respectively. Table 6.4 can be used in conjunction with figures 6.15 and 6.16 to identify centres in the funnel plot.

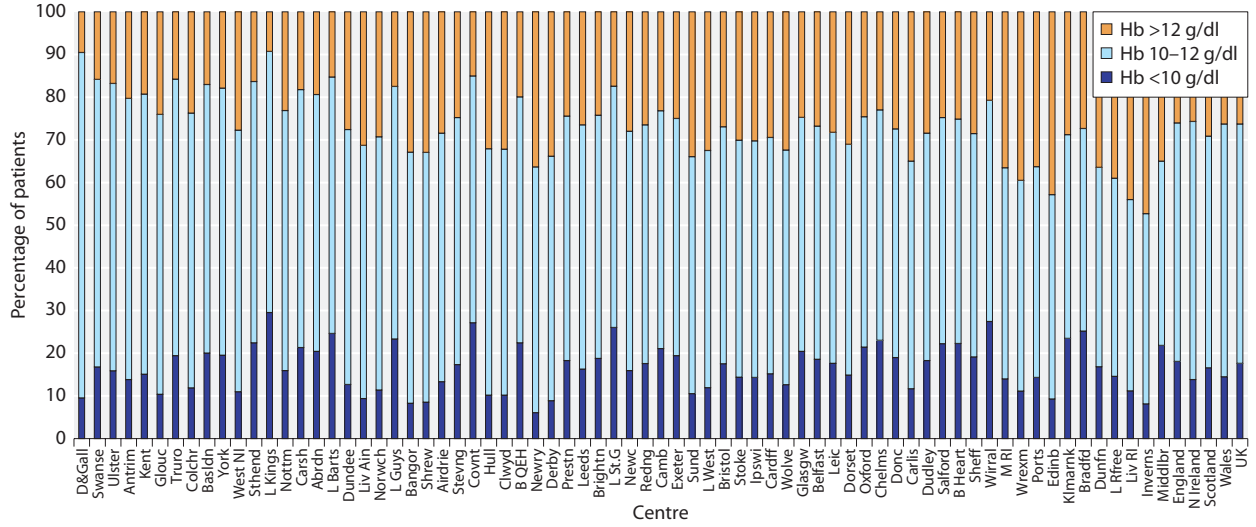

Fig. 6.9. Distribution of haemoglobin in patients treated with HD by centre in 2011

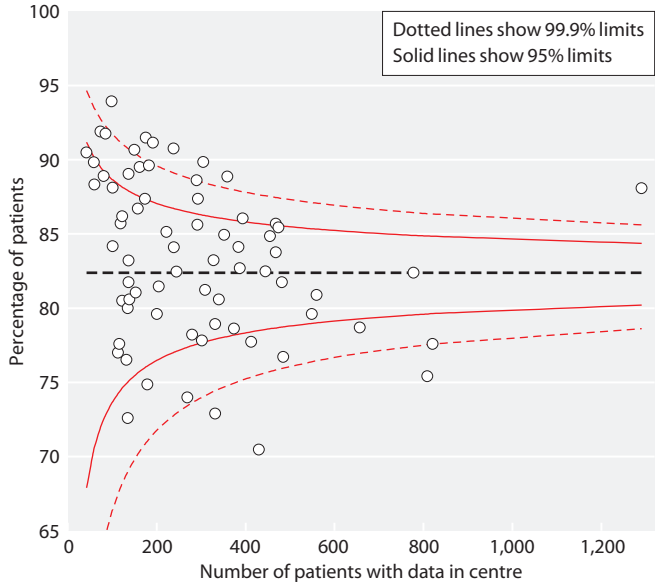

Fig. 6.10. Funnel plot of percentage of HD patients with Hb ⩾10 g/dl by centre in 2011

Relationship between Hb in incident and prevalent dialysis patients in 2011

The relationship between the percentage of incident and prevalent dialysis (HD and PD) patients with a Hb ⩾10.0 g/dl is shown in figure 6.17. As expected, all centres had a higher percentage of prevalent patients achieving a Hb ⩾10.0 g/dl than that for incident patients. Overall in the UK, 83% of prevalent patients, compared with 51% of incident patients, had a Hb ⩾10.0 g/dl in 2011. Compliance with 'current' minimum standards by year (1998–2011) for incident and prevalent patients (all dialysis patients) is shown in figure 6.18. Since 2006 there has been a decline in achieving this standard for incident and prevalent patients.

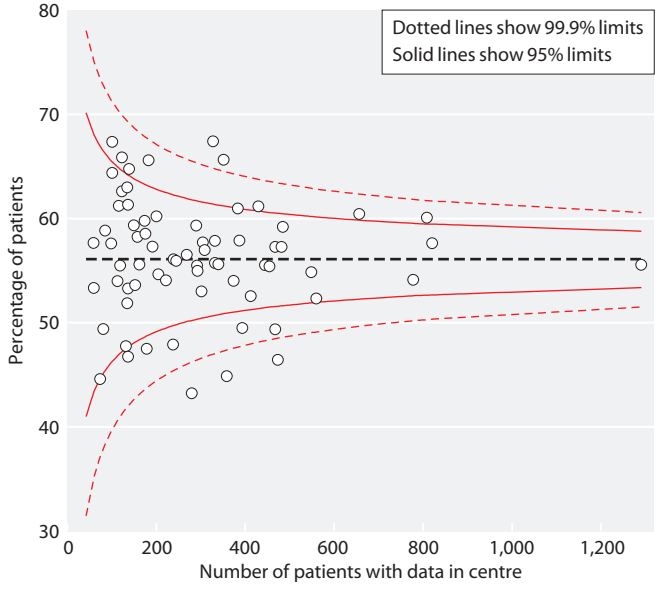

Fig. 6.11. Funnel plot of percentage of HD patients with Hb ⩾10 and ⩽12 g/dl by centre in 2011

Ferritin in prevalent haemodialysis patients

The median and IQR for serum ferritin for patients treated with HD are shown in figure 6.19. The percentages with serum ferritin ⩾100 µg/L, >200 µg/L and ⩽500 µg/L, and ⩾800 µg/L are shown in figures 6.20, 6.21 and 6.22 respectively. Most centres achieved greater than 90% compliance with a serum ferritin ⩾100 µg/L for HD patients. The HD population had a median ferritin value of 436 µg/L, IQR 292–625. Twenty-one of the 69 units who had returns for ferritin had greater than 20% (21–43%) of their patients with ferritin ⩾800 µg/L (figure 6.22). The serum ferritin correlated poorly with median Hb achieved and ESA dose demonstrating that serum ferritin is a poor index of iron status.

Ferritin in prevalent peritoneal dialysis patients

The median and IQR for serum ferritin for patients treated with PD are shown in figure 6.23. The percentages with serum ferritin ⩾100 µg/L, >100 µg/L and ⩽500 µg/L, and ⩾800 µg/L are shown in figures 6.24, 6.25 and 6.26 respectively. The PD population had a lower median ferritin value at 273 µg/L, IQR 153–446. In 2011, 27 centres reported less than 90% of PD patients compliant with serum ferritin ⩾100 µg/L, although this had little bearing on their achieved median Hb or median ESA dose when compared with other centres.

Erythropoietin stimulating agents in prevalent haemodialysis patients

As shown in previous reports there was substantial variation in the average dose of ESA prescription used. The median dose for prevalent HD patients in England, Wales and Northern Ireland was 7,450 IU/week and varied from 4,000 IU/week (Leeds) to 11,050 IU/week (Coventry). These results have been consistent over the last two years with a median Hb of 11.3 g/dl and 10.8 g/dl for Leeds and Coventry respectively (table 6.3).

Erythropoietin stimulating agents in prevalent peritoneal dialysis patients

In 2011, the median dose was substantially lower in prevalent PD patients at 4,750 (range 1,500–12,000) IU/week (table 6.4) compared to HD patients.

Table 6.4. Summary statistics for haemoglobin, serum ferritin and ESA for prevalent PD patients in 2011

Centre	N with Hb data	Median Hb g/dl	% Hb ⩾10 g/dl	% Hb 10–12 g/dl	Median ferritin µg/L	% ferritin ⩾100 µg/L	% ferritin >100 and ⩽500 µg/L	% on ESA	Median ESA dose (IU/week)	% with Hb ⩾10 g/dl and not on ESA
England										
B Heart	38	11.7	95	53	235	89	84	61	4,000	37
B QEH	146	11.4	81	53	247	77	57	65	5,000	33
Basldn	25	10.9	64	28	140	71	71	60	3,000	40
Bradfd	27	11.6	85	59	195	93	63	79	3,750	19
Brightn	65	11.4	78	48	295	91	72			
Bristol	60	11.4	92	58	343	88	59	70	3,292	30
Camb	32	11.7	94	53	346	94	75	72	4,000	28
Carlis	17									
Carsh	89	11.1	83	54	197	82	70			
Chelms	22	11.7	91	50	200	91	82	86	4,000	14
Colchr	n/a									
Covnt	77	11.4	81	51	241	87	70	70	8,000	26
Derby	101	11.2	85	57	330	92	63			
Donc	21	11.7	90	52	209	95	86	76	3,000	24
Dorset	45	11.7	89	42	348	93	70			
Dudley	49	12.1	88	37	124	67	62			
Exeter	63	11.7	92	51	198	86	83	76	4,000	22
Glouc	32	11.7	88	53	143	68	61	62		34
Hull	75	11.2	84	56	371	94	68			
Ipswi	30	11.3	87	47	272	86	61	87	3,875	10
Kent	61	11.3	85	51	324	90	72			
L Barts	149	11.0	81	56	285	86	65			
L Guys	28	10.5	75	61	232	86	68			
L Kings	76	10.6	70	54	242	91	83			
L Rfree	65	11.2	82	52	477	93	46			
L St.G	51	11.6	84	47	327	92	78			
L West	30	11.4	87	63	250	91	69			
Leeds	81	11.3	83	63	320	94	75	86	4,000	14
Leic	138	11.4	86	60	409	94	66	85	4,000	14
Liv Ain	13									
Liv RI	58	11.6	91	59	361	88	55	80	8,000	19
M RI	71	11.5	77	41	160	81	75			
Middlbr	13									
Newc	41	11.8	80	44	494	85	37			
Norwch	48	11.9	96	56	172	71	58	58	4,000	40
Nottm	74	10.8	76	54	291	86	62	68		30
Oxford	82	11.2	87	65	219	88	72	82	6,000	18
Plymth	33	11.5	82	45	284	81	57	70	9,000	24
Ports	82	12.0	88	39	317	92	75			
Prestn	54	11.4	87	59	296	81	52	59		35
Redng	73	11.5	89	58	341	92	67			
Salford	97	11.4	86	46				93	12,000	7
Sheff	54	11.4	87	56	449	89	50	59	4,417	37
Shrew	26	12.0	92	46	303	92	71	67	6,000	35
Stevng	26	11.8	100	65	225	80	72			
Sthend	16									
Stoke	69	11.3	88	52	416	90	54			
Sund	13									
Truro	22	11.5	91	59	308	100	95			
Wirral	27	11.4	74	59						
Wolve	63	11.4	83	49	202	75	57	68	4,000	30
York	18									

Table 6.4. Continued

Centre	N with Hb data	Median Hb g/dl	% Hb ⩾10 g/dl	% Hb 10–12 g/dl	Median ferritin µg/L	% ferritin ⩾100 µg/L	% ferritin >100 and ⩽500 µg/L	% on ESA	Median ESA dose (IU/week)	% with Hb ⩾10 g/dl and not on ESA
N Ireland										
Antrim	12									
Belfast	28	10.7	82	57	267	93	70	79	4,000	21
Newry	9									
Ulster	3									
West NI	17									
Scotland										
Abrdn	22	11.6	86	55						
Airdrie	8									
D & Gall	6									
Dundee	17									
Dunfn	26	11.8	92	50						
Edinb	35	10.8	80	57						
Glasgw	24	11.1	92	67						
Inverns	15									
Klmarnk	30	11.2	83	53						
Wales										
Bangor	20	12.4	100	40	148	65	45	60	1,500	40
Cardff	93	11.6	87	47	96	48	46			
Clwyd	8									
Swanse	49	11.3	82	53	243	86	69			
Wrexm	14									
England	**2,766**	**11.4**	**85**	**53**	**284**	**87**	**66**	**74**	**5,000**	**25**
N Ireland	**69**	**11.4**	**90**	**57**	**281**	**90**	**67**	**78**	**3,000**	**22**
Scotland	**183**	**11.5**	**86**	**54**						
Wales	**184**	**11.6**	**87**	**47**	**134**	**64**	**56**	**58**	**4,000**	**40**
UK	**3,202**	**11.4**	**85**	**53**	**273**	**86**	**65**	**73**	**4,750**	**25**

Blank cells – centres excluded from analyses due to poor data completeness or low patient numbers or because the data item was not available
n/a – no PD patients
ESA data only shown for those centres for which the % on ESA was 50% or more
For ferritin and for ESA the overall avaerages given are for E,W & NI not UK

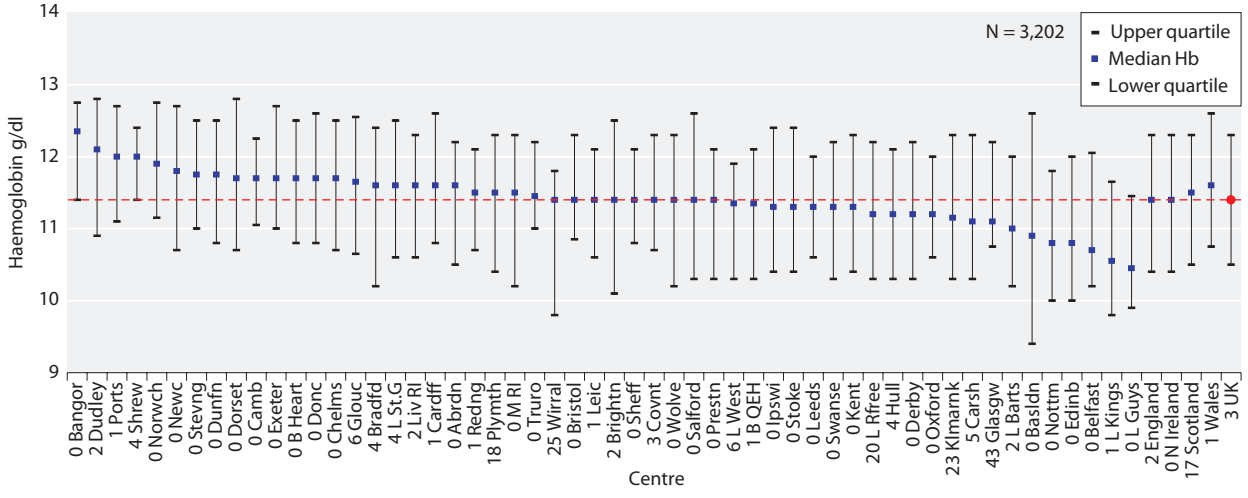

Fig. 6.12. Median haemoglobin in patients treated with PD by centre in 2011

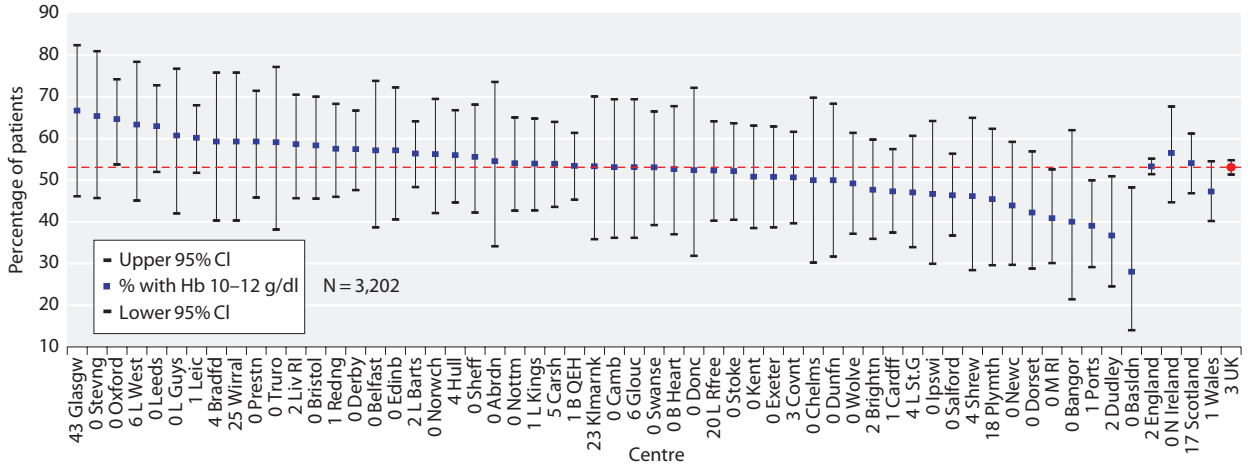

Fig. 6.13. Percentage of PD patients with Hb ⩾10 and ⩽12 g/dl by centre in 2011

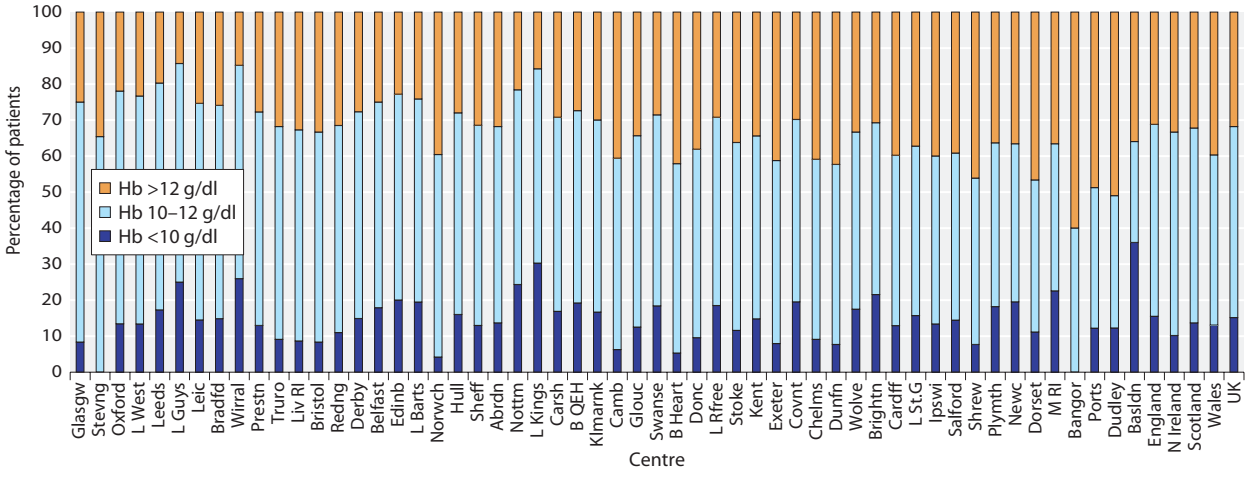

Fig. 6.14. Distribution of haemoglobin in patients treated with PD by centre in 2011

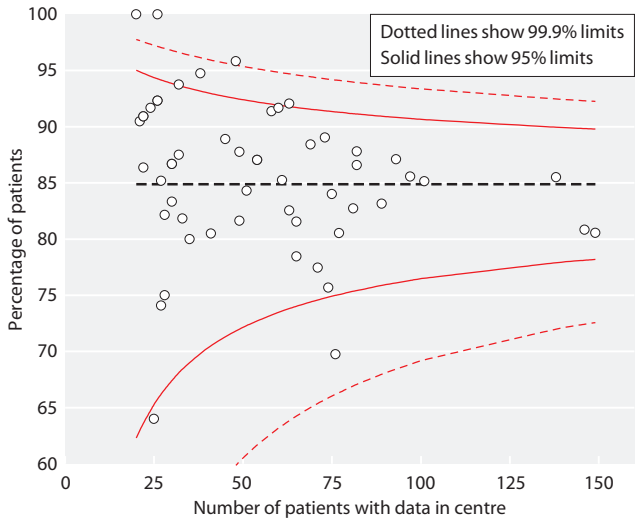

Fig. 6.15. Funnel plot of percentage of PD patients with Hb ⩾10 g/dl by centre in 2011

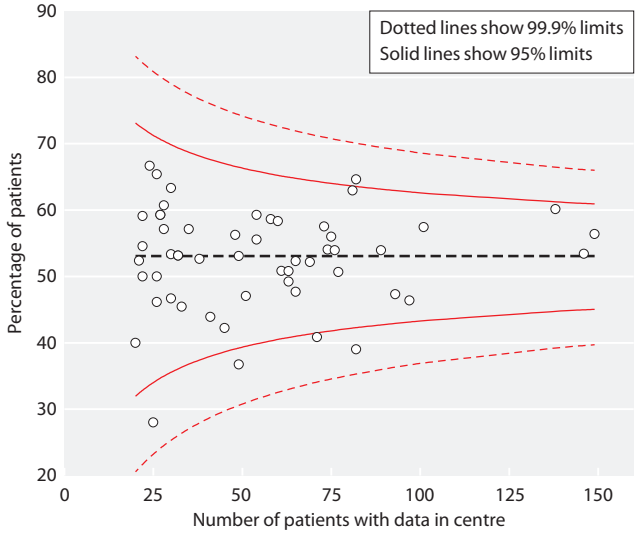

Fig. 6.16. Funnel plot of percentage of PD patients with Hb ⩾10 g/dl and ⩽12 g/dl by centre in 2011

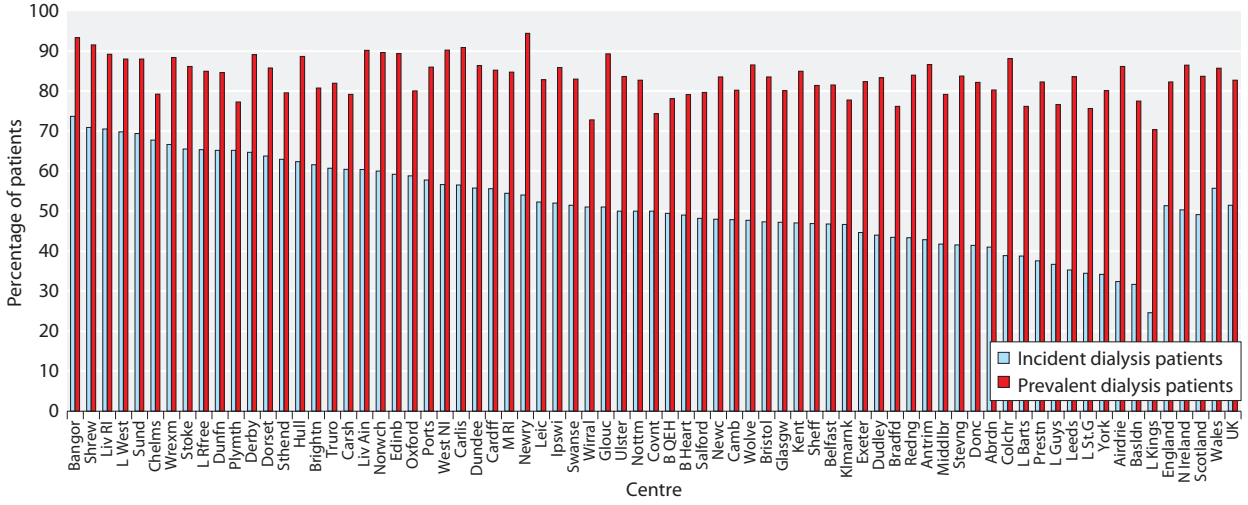

Fig. 6.17. Percentage of incident and prevalent dialysis patients with Hb ⩾10 g/dl by centre in 2011

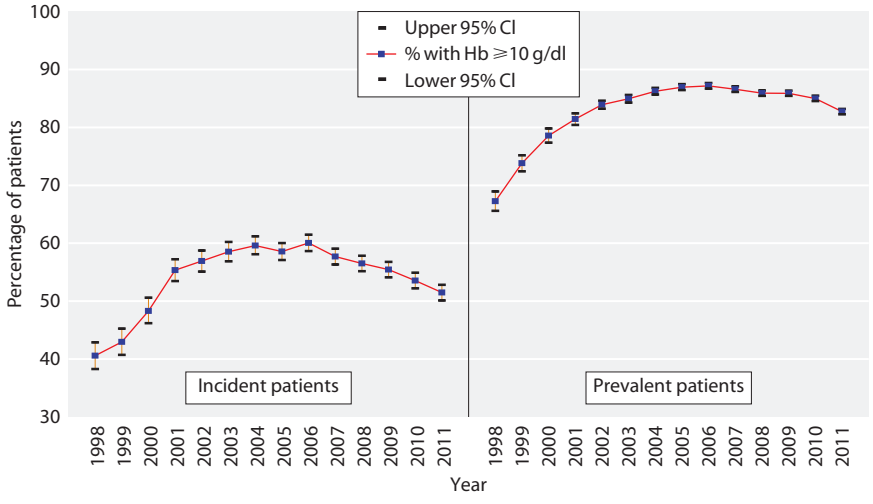

Fig. 6.18. Percentage of incident and prevalent dialysis patients (1998–2011) with Hb ⩾10 g/dl

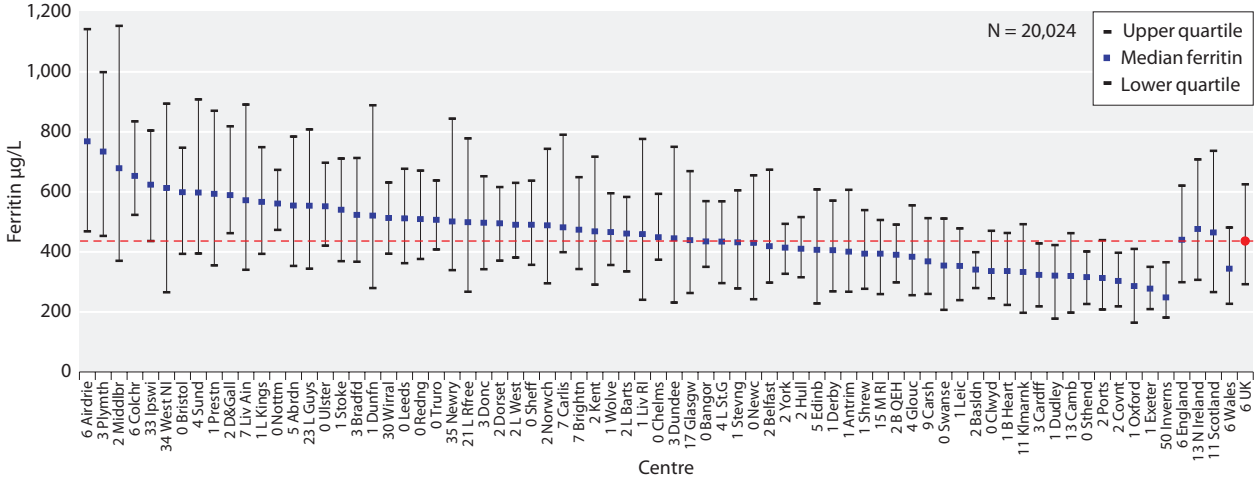

Fig. 6.19. Median ferritin in patients treated with HD by centre in 2011

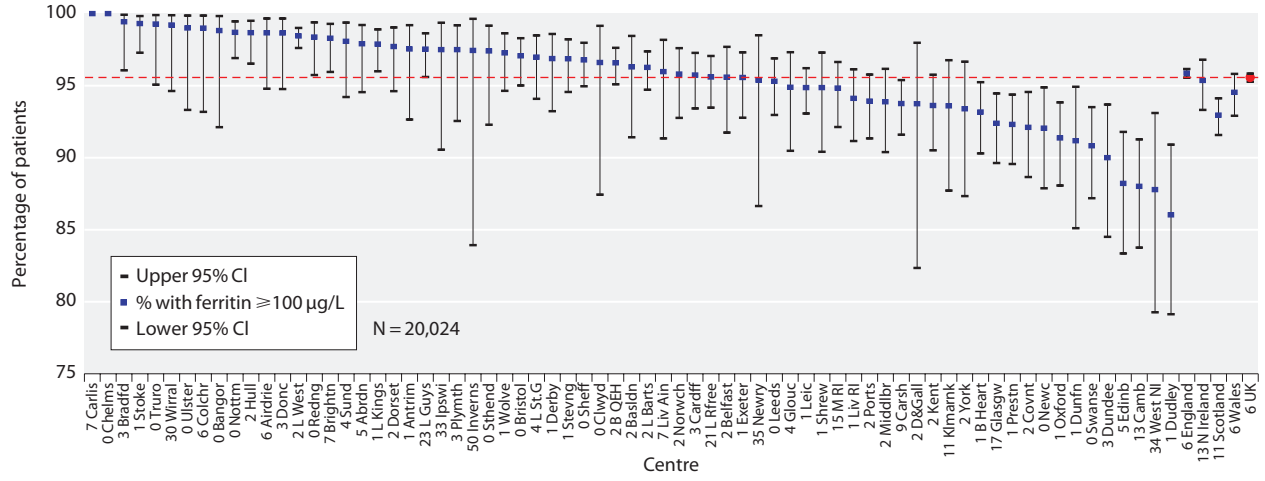

Fig. 6.20. Percentage of HD patients with ferritin ⩾100 µg/L by centre in 2011

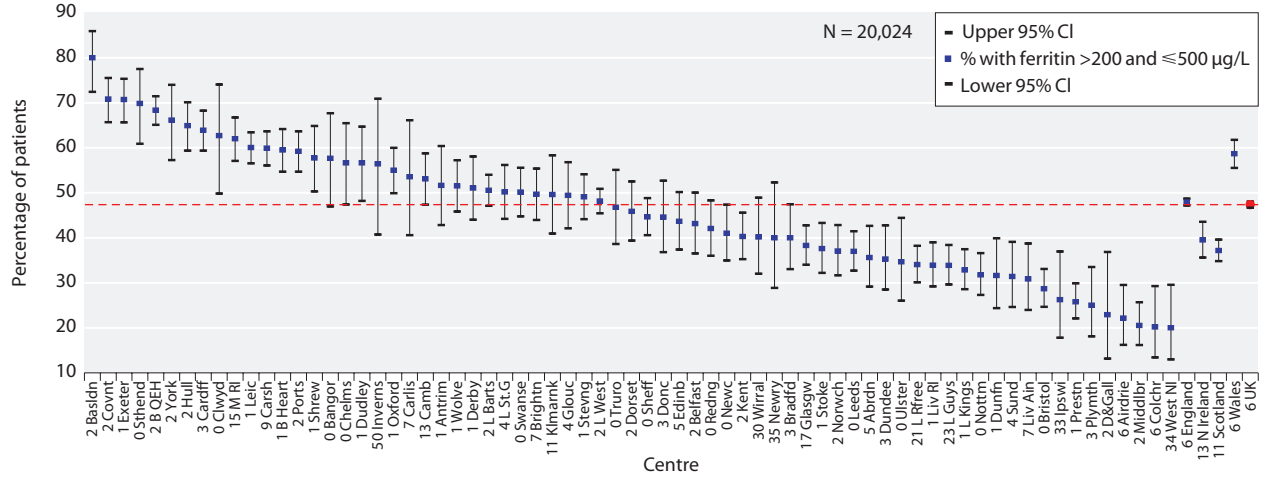

Fig. 6.21. Percentage of HD patients with ferritin >200 µg/L and ⩽500 µg/L by centre in 2011

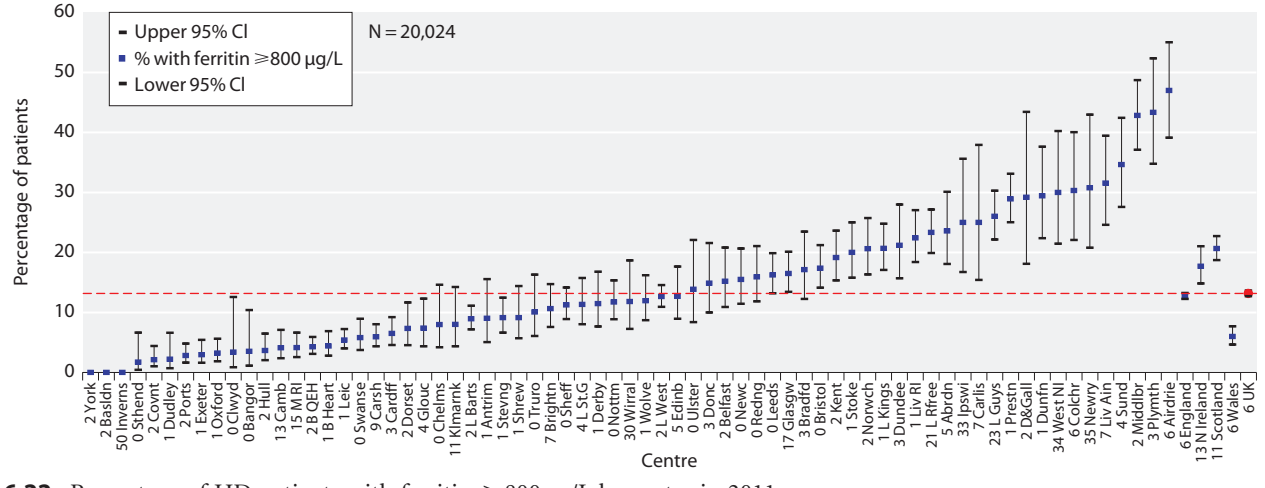

Fig. 6.22. Percentage of HD patients with ferritin ⩾800 µg/L by centre in 2011

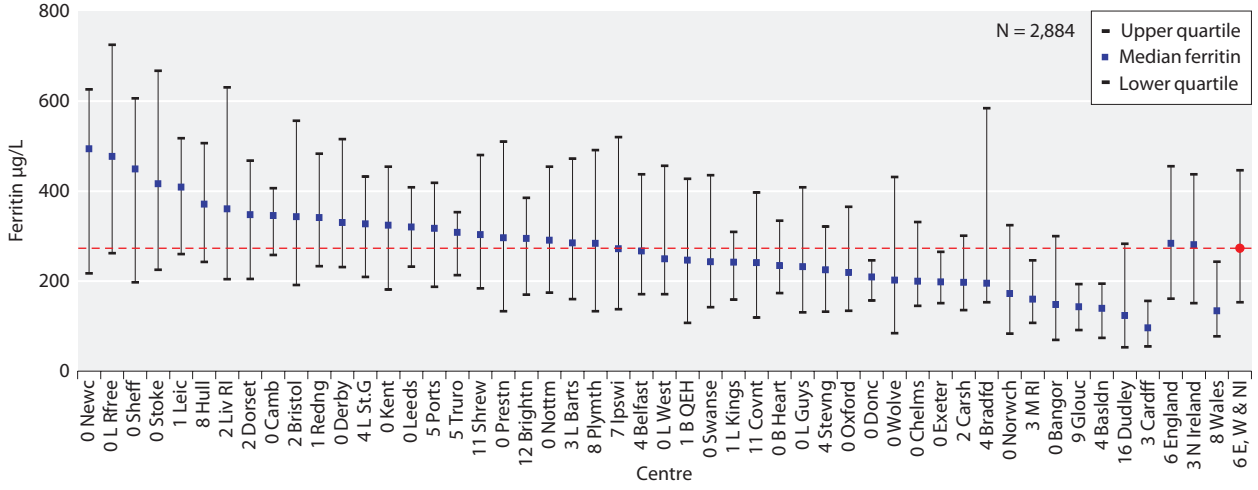

Fig. 6.23. Median ferritin in patients treated with PD by centre in 2011

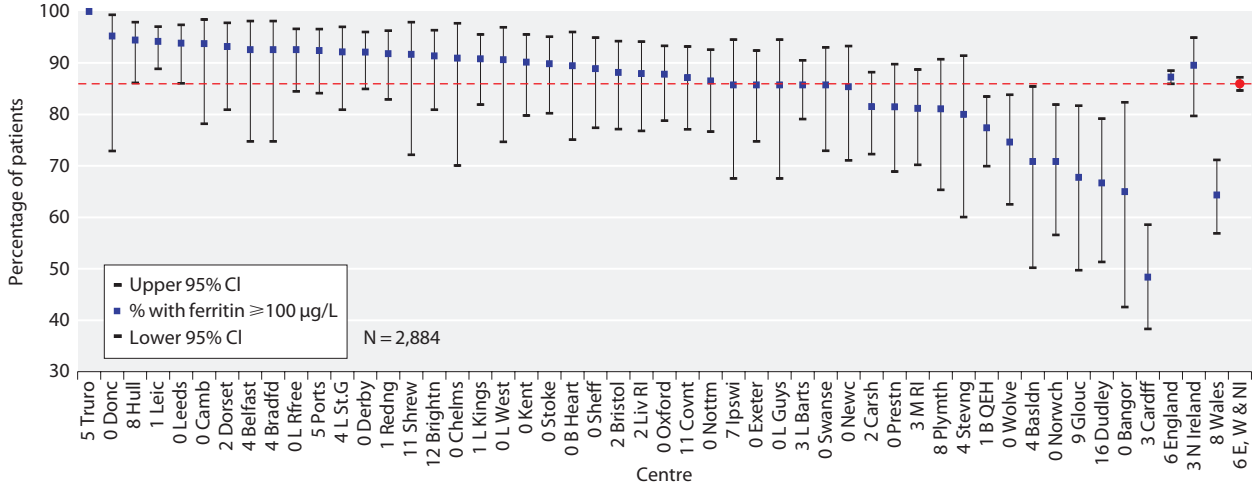

Fig. 6.24. Percentage of PD patients with ferritin ⩾100 µg/L by centre in 2011

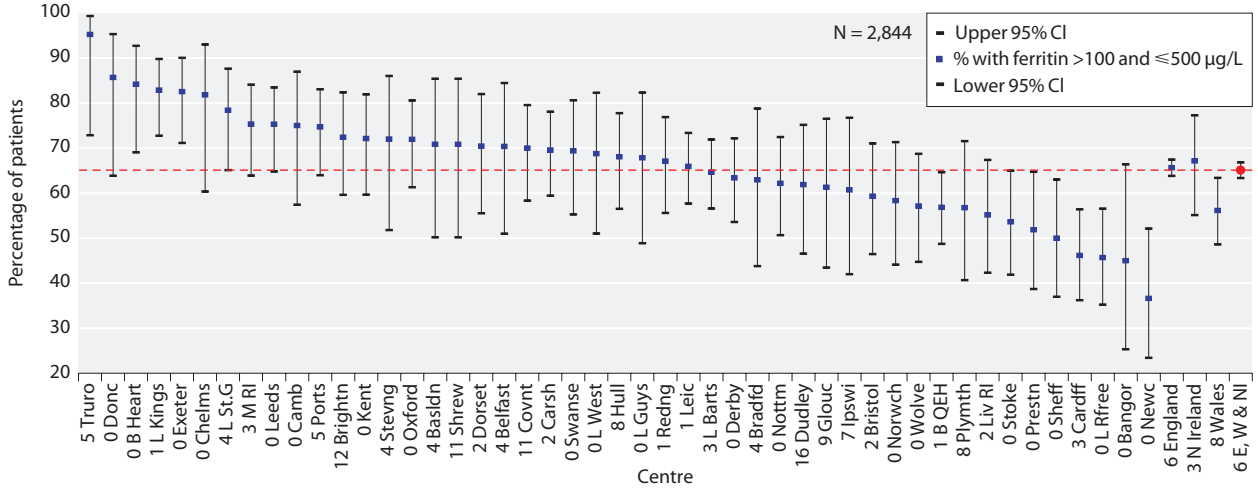

Fig. 6.25. Percentage of PD patients with ferritin >100 µg/L and ⩽500 µg/L by centre in 2011

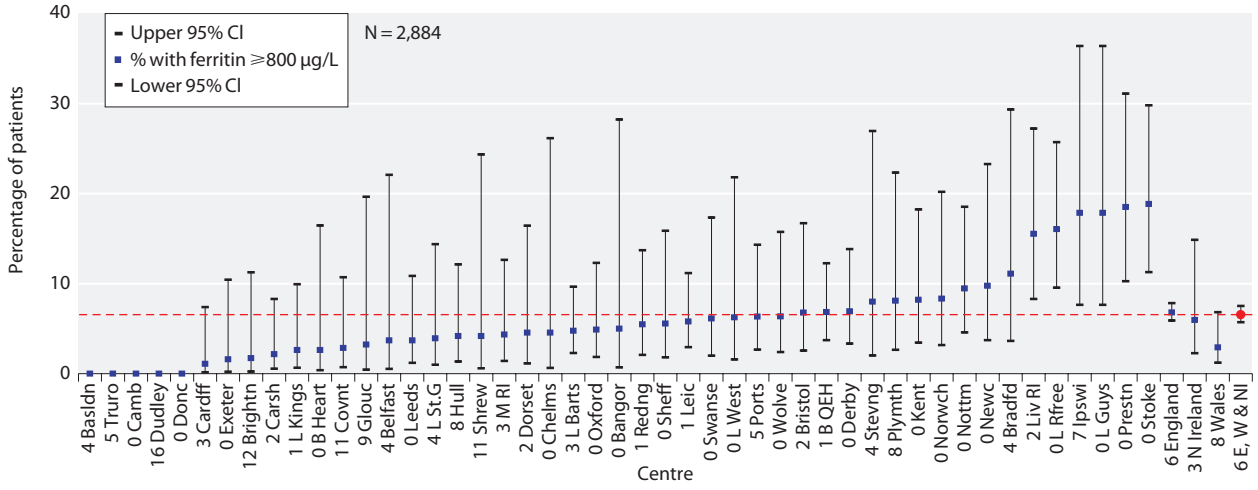

Fig. 6.26. Percentage of PD patients with ferritin ⩾800 µg/L by centre in 2011

ESA prescription: age and modality associations

The proportion of patients on an ESA was higher for HD (90%) than PD (73%) and this difference was present and similar across all age groups (figure 6.27). The percentage of the whole cohort which maintained a Hb ⩾10 g/dl without requiring ESA (by age group and modality) is shown in figure 6.28. This was highest at 12% (6–12%) in the 45–54 age group for HD and highest for PD at 27% (16–27%) in the 75+ age group.

Figure 6.29 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. The Renal Association guidelines state that units should audit the ***"Proportion of patients on renal replacement therapy with Hb level <10 who are not prescribed an ESA"***. Across the age groups this was between 3–7% for HD patients and 3–16% for PD patients. There are several potential explanations for this. Treatment with ESA may have been stopped in some patients who were unresponsive or avoided in those with malignancy. Some patients may have recently become anaemic and not yet started therapy. Others may have been on ESA treatment but not had it recorded.

ESAs and time on renal replacement therapy

The percentage of patients on ESA by time on RRT and dialysis modality is shown in figure 6.30. This is a cross-sectional analysis at the final quarter of 2011. Patients who had previously changed RRT modality were still included in this analysis. The proportion of

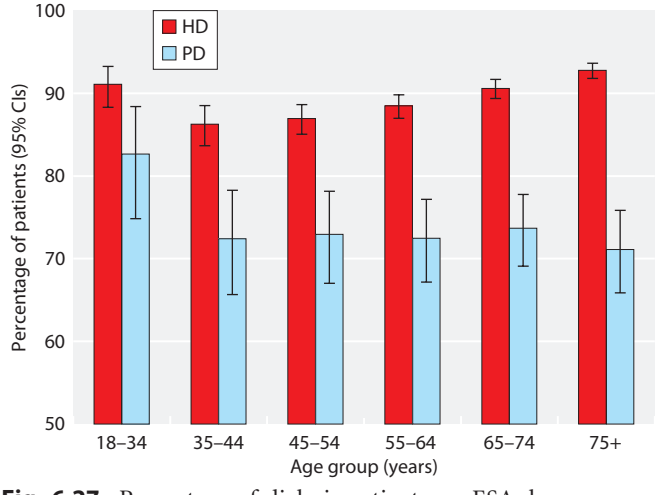

Fig. 6.27. Percentage of dialysis patients on ESA, by age group and treatment modality (2011)

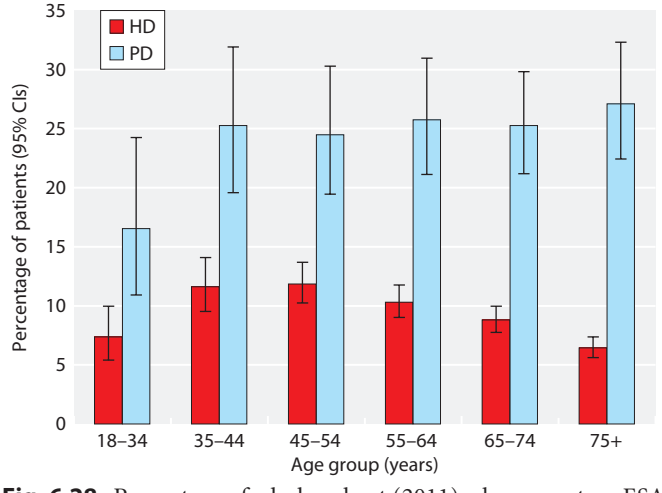

Fig. 6.28. Percentage of whole cohort (2011) who are not on ESA and have Hb ⩾10 g/dl, by age group and treatment modality

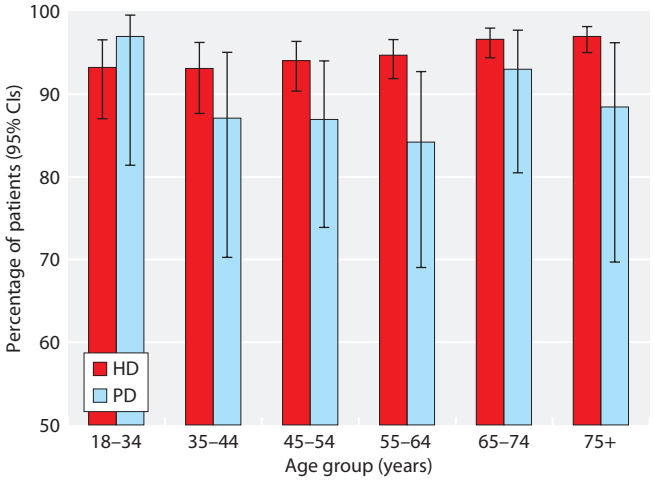

Fig. 6.29. Percentage of patients with Hb <10 g/dl who are on ESA, by age group and treatment modality (2011)

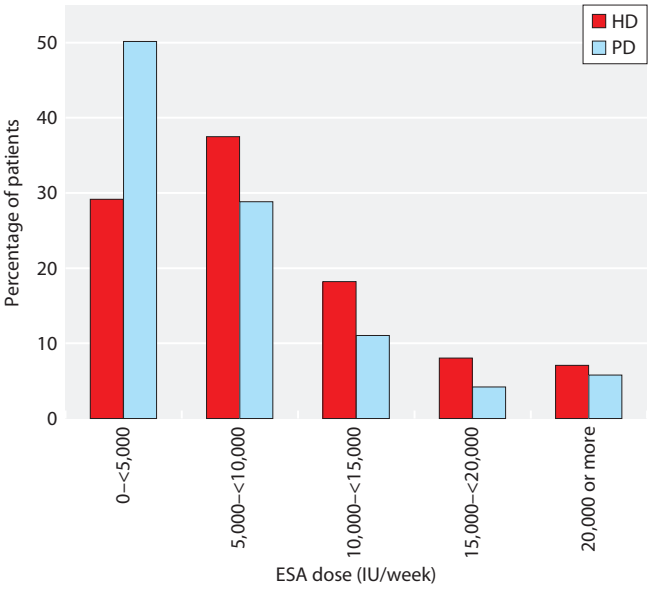

Fig. 6.31. Frequency distribution of mean weekly ESA dose in 2011

PD patients requiring ESA rises with duration of RRT from 70% after 3–12 months, to 80% after 10 or more years. This almost certainly reflects 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 for any given duration on RRT.

Resistance to ESA therapy

Figure 6.31 shows the frequency distribution of weekly ESA dose by treatment modality.

RA guidelines define resistance to ESA therapy as failure to reach the target Hb level despite SC epoetin dose >300 IU/kg/week (450 IU/kg/week IV epoetin) or darbepoetin dose >1.5 mcg/kg/week. For a 70 kilo patient this equates to approximately 21,000 IU/week for PD and 31,000 IU/week for HD. For those centres with good ESA completeness, the percentage of patients with EPO dose >20,000 IU/week was 5.8% and 7.1% for PD and HD respectively. In order to establish the true prevalence of ESA resistance in the UK, knowledge of patient weight and ESA dose will be needed.

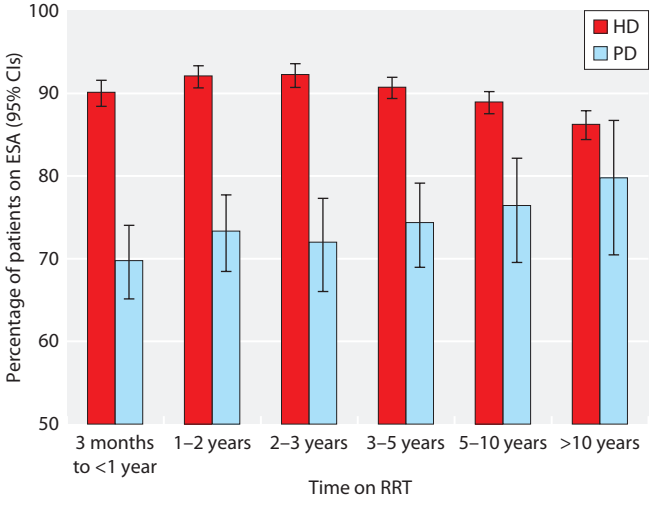

Fig. 6.30. Percentage of patients on ESA by time on RRT (2011)

Success with guideline compliance

Compliance with current minimum standards by year (1998 to 2011) is shown in figure 6.32 for prevalent patients (by treatment modality).

There is no strong relationship between centres' mean ESA dose and median Hb for HD patients (figure 6.33) or compliance with the RA standards for Hb ⩾10 g/dl and ⩽12 g/dl in HD patients (figure 6.34). This is not surprising as the most anaemic patients and those least responsive to ESAs are those given the biggest doses.

It is known that not all patients treated with dialysis who have a Hb above 12 g/dl 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

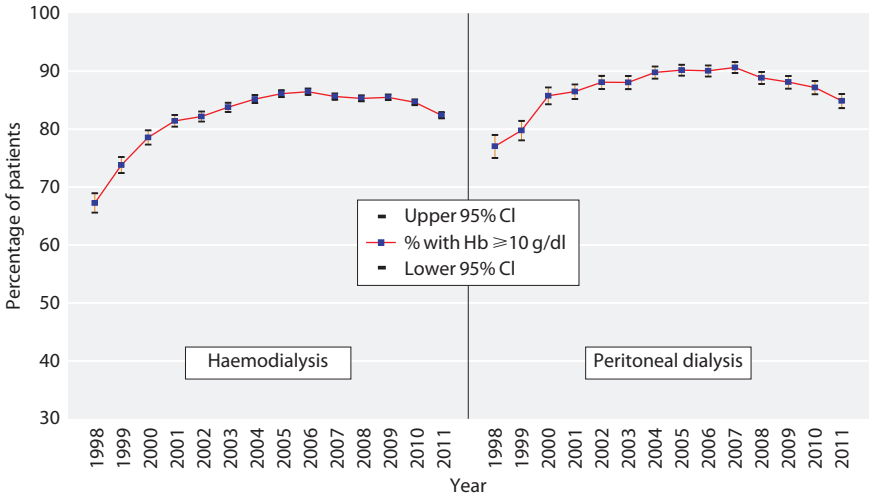

Fig. 6.32. Percentage of prevalent HD and PD patients (1998–2011) with Hb ⩾10 g/dl

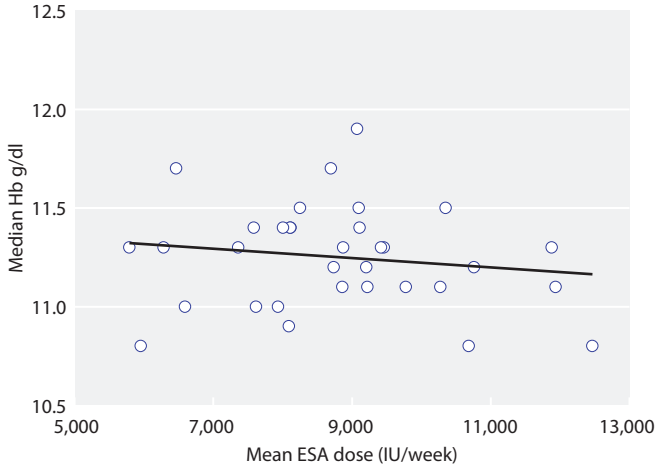

Fig. 6.33. Median Hb versus mean ESA dose in patients treated with HD by centre in 2011

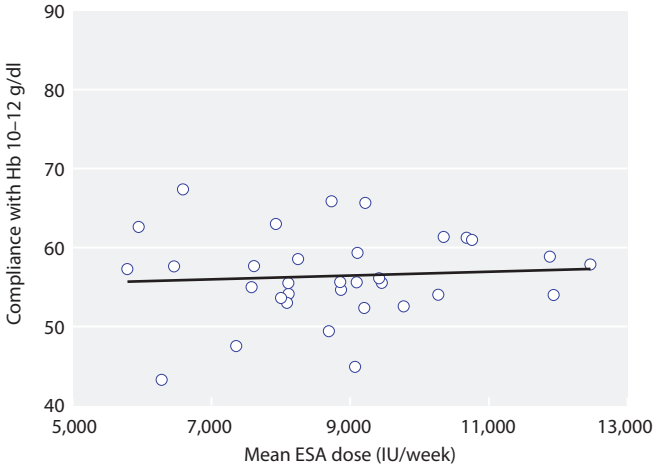

Fig. 6.34. Compliance with Hb 10–12 g/dl versus mean ESA dose in patients treated with HD by centre in 2011

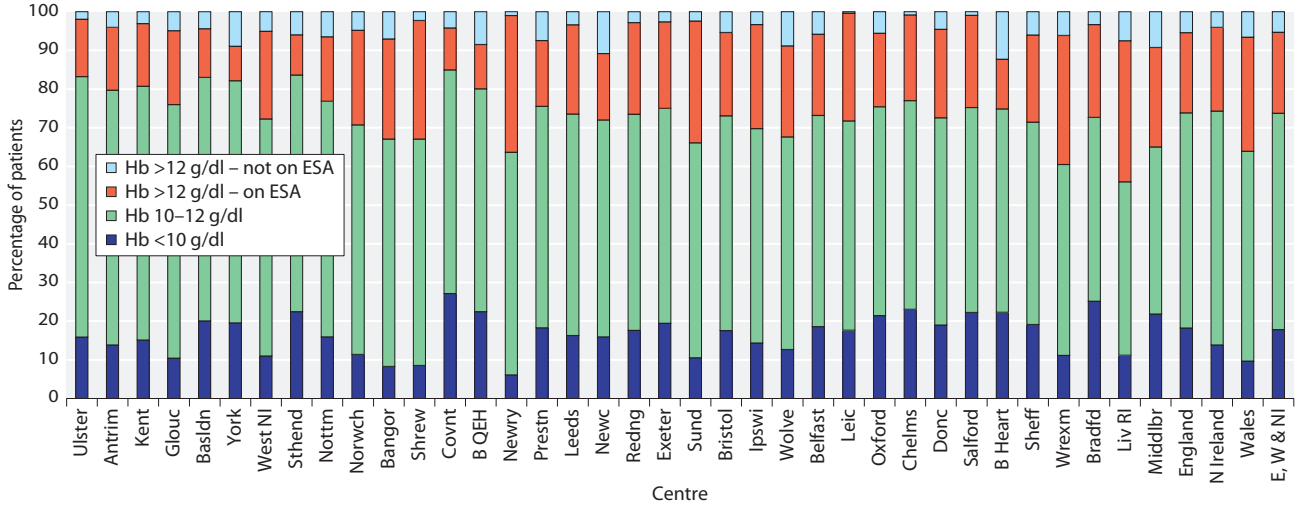

Fig. 6.35. Distribution of haemoglobin in patients treated with HD and the proportion of patients with Hb >12 g/dl receiving ESA by centre in 2011

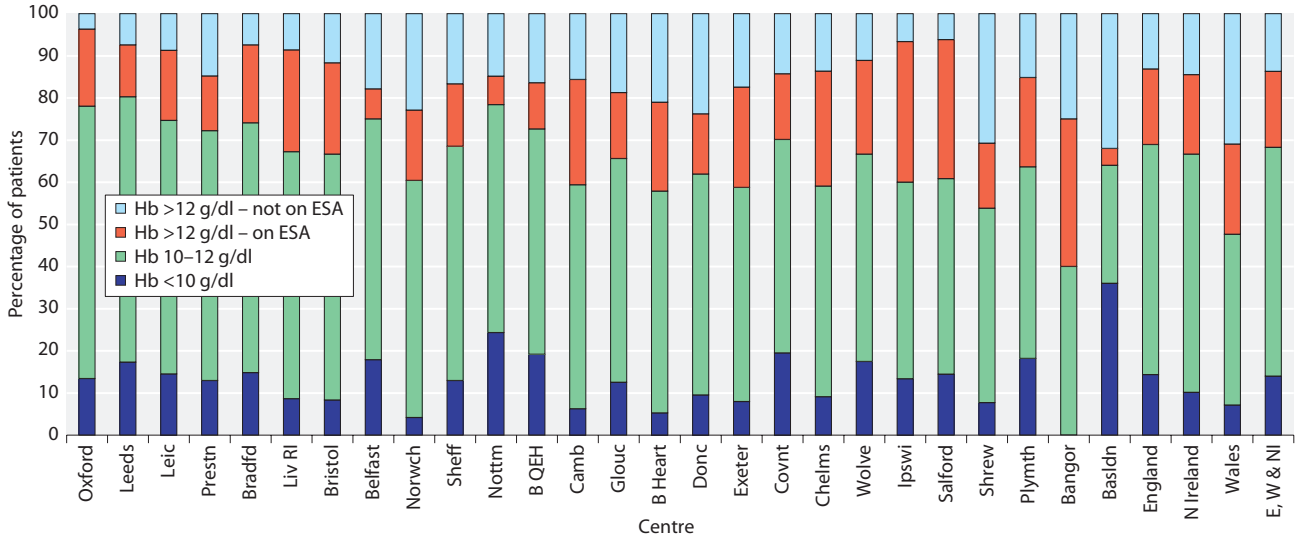

Fig. 6.36. Distribution of haemoglobin in patients treated with PD and the proportion of patients with Hb >12 g/dl receiving ESA by centre in 2011

suggesting that it may be detrimental to achieve a high Hb in renal patients were based only upon patients treated with ESAs [14, 15].

Figures 6.35 and 6.36 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. 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 26% of HD patients had a Hb >12 g/dl. Most of these patients (80%) were on ESAs. Whereas for PD, 32% of patients had a Hb >12.0 g/dl, but only 57% of these were on ESAs.

The Renal Association guideline states that units should audit the ***"Proportion of patients with serum ferritin levels <100 µg/L with an ESA" & "The proportion of patients treated with an ESA with Hb >12 g/dl"***. Table 6.5 shows that the percentage of all patients treated with an ESA and having Hb >12 g/dl ranged between 9–36% for HD and between 4–35% for PD. For HD, there was a small percentage of patients having ferritin levels <100 µg/L and being on an ESA. The percentages were somewhat higher for PD.

Renal Association guidelines state that ***"Each renal unit should audit the type, route and frequency of administration and weekly dose of ESA prescribed"***. Table 6.6 shows the percentage completeness for type, route and frequency of administration for centres reporting ESA data. The completeness was generally good for drug type and dose but patchy for frequency and route of administration.

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 (82% and 85% respectively). As would be anticipated, a greater proportion of prevalent patients (83%) than incident patients (51%) had a Hb ⩾10.0 g/dl in 2011.

In the UK, the median Hb of patients on HD was 11.2 g/dl with an IQR of 10.3–12.1 g/dl, and the median Hb of patients on PD was 11.4 g/dl with an IQR of 10.5–12.3 g/dl.

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, 90% of HD patients and 73% of PD patients were on ESA treatment in England, Wales and Northern Ireland. The percentage of patients treated with an ESA and having Hb >12 g/dl ranged between centres from 9%–36% for HD and from 4%–35% for PD. There was a small percentage of patients with ferritin levels <100 µg/L and receiving an ESA.

Table 6.5. Percentage of patients with serum ferritin levels <100 µg/L and on ESA and percentage of patients with Hb >12 g/dl and on ESA by modality

	HD		PD	
Centre	% with Hb >12 g/dl and on ESA	% with ferr <100 µg/L and on ESA	% with Hb >12 g/dl and on ESA	% with ferr <100 µg/L and on ESA
England				
B Heart	13	3	21	0
B QEH	11	1	11	8
Basldn	13	4	4	14
Bradfd	24	0	19	8
Bristol	22	2	22	4
Camb			25	3
Chelms	22	0	27	5
Covnt	11	5	16	8
Donc	23	1	14	6
Exeter	22	3	24	3
Glouc	19	4	16	22
Ipswi	27	6	33	7
Kent	16	5		
Leeds	23	3	12	4
Leic	28	5	17	1
Liv RI	36	5	24	4
Middlbr	26	4		
Newc	17	4		
Norwch	24	2	17	11
Nottm	17	0	7	4
Oxford	19	7	18	9
Plymth			21	13
Prestn	17	4	13	12
Redng	24	1		
Salford	24		33	
Sheff	23	1	15	2
Shrew	31	4	15	0
Sthend	10	2		
Sund	31	2		
Wolve	24	1	22	16
York	9	2		
N Ireland				
Antrim	16	0		
Belfast	21	2	7	5
Newry	35	0		
Ulster	15	1		
West NI	23	8		
Wales				
Bangor	26	0	35	11
Wrexm	33			
England	**21**	**3**	**18**	**6**
N Ireland	**22**	**2**	**19**	**5**
Wales	**30**	**0**	**21**	**7**
E, W & NI	**21**	**3**	**18**	**6**

Blank cells denote centres excluded from analyses due to poor completeness or small numbers with data

Table 6.6. Percentage completeness for type, route and frequency of administration of ESA

	HD					PD				
Centre	N on ESA	% with drug type	% with dose	% with frequency	% with administration route	N on ESA	% with drug type	% with dose	% with frequency	% with administration route
England										
B Heart	312	100	100	0	0	23	100	100	0	0
B QEH	703	100	100	100	0	96	100	100	100	0
Basldn	119	100	99	100	100	15	100	100	100	100
Bradfd	172	100	100	0	0	22	100	100	0	0
Bristol	414	100	100	0	0	42	100	100	0	0
Camb						23	100	100	0	0
Chelms	111	100	100	100	100	19	100	100	100	100
Covnt	309	100	100	0	0	55	100	96	0	0
Donc	141	100	100	100	99	16	100	100	100	94
Exeter	325	100	99	0	0	48	100	100	0	0
Glouc	172	100	0	0	0	21	100	0	0	0
Ipswi	102	100	100	0	0	26	100	100	0	0
Kent	319	100	100	100	100					
Leeds	432	100	87	0	0	70	100	99	0	0
Leic	769	100	98	0	0	118	100	92	0	0
Liv RI	319	100	100	0	0	47	100	100	0	0
Middlbr	230	100	100	0	0	9	100	100	0	0
Newc	182	100	100	0	0					
Norwch	268	100	100	100	100	28	100	100	100	100
Nottm	347	100	97	0	0	50	100	0	0	0
Oxford	339	100	100	0	0	67	100	100	0	0
Plymth						28	100	96	0	0
Prestn	423	100	6	0	0	32	100	0	0	0
Redng	235	100	0	0	0					
Salford	321	100	95	99	0	90	100	88	99	0
Sheff	501	100	99	0	0	32	100	100	0	0
Shrew	167	100	100	87	95	18	100	100	94	100
Sthend	107	0	100	0	0					
Sund	156	100	99	0	0	9	100	100	0	0
Wolve	254	100	100	0	0	43	100	100	0	0
York	104	100	100	0	0	17	100	88	0	0
N Ireland										
Antrim	114	100	100	100	100	11	100	100	100	100
Belfast	185	100	100	99	100	22	100	100	100	100
Newry	98	100	100	100	100	6	100	100	100	100
Ulster	96	100	100	100	100	3	100	100	100	100
West NI	125	100	99	98	100	12	100	100	100	100
Wales										
Bangor	73	100	59	0	0	12	100	92	0	0
Wrexm	75	100	100	99	100	8	100	100	75	100
England	**8,353**	**99**	**89**	**25**	**13**	**1,074**	**99**	**87**	**26**	**9**
N Ireland	**618**	**100**	**100**	**100**	**100**	**54**	**100**	**100**	**100**	**100**
Wales	**148**	**100**	**80**	**50**	**51**	**20**	**100**	**95**	**30**	**40**
E, W & NI	**9,119**	**99**	**90**	**31**	**20**	**1,148**	**100**	**89**	**29**	**14**

Conflicts of interest: none

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