UK Renal Registry 17th Annual Report: Chapter 7 Haemoglobin, Ferritin and Erythropoietin amongst UK Adult Dialysis Patients in 2013: 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 the UK in 2013:

- The median haemoglobin (Hb) of patients at the time of starting dialysis was 100 g/L with 50% of patients having a Hb $\geqslant$100 g/L.
- The median Hb in patients starting haemodialysis (HD) was 97 g/L (IQR 88–106) and in patients starting peritoneal dialysis (PD) was 109 g/L (IQR 99–118).
- At start of dialysis, 53% of patients presenting early had Hb $\geqslant$100 g/L whilst only 36% of patients presenting late had Hb $\geqslant$100 g/L.
- The median Hb of prevalent patients on HD was 112 g/L with an IQR of 103–120 g/L.
- The median Hb of prevalent patients on PD was 113 g/L with an IQR of 103–122 g/L.
- For both HD and PD patients, 83% had Hb $\geqslant$100 g/L.
- 59% of HD patients and 55% of PD patients had Hb $\geqslant$100 and $\leqslant$120 g/L.
- The median ferritin in HD patients was 424 μg/L (IQR 280–616) and 95% of HD patients had a ferritin $\geqslant$100 μg/L.

In England, Wales and Northern Ireland in 2013:

- The median ferritin in PD patients was 285 μg/L (IQR 167–473) with 88% of PD patients having a ferritin $\geqslant$100 μg/L.
- The median erythropoietin stimulating agent (ESA) dose was higher for HD than PD patients (7,333 vs. 4,000 IU/week).

Introduction

This chapter describes analyses of the UK Renal Registry (UKRR) data relating to the management of anaemia in dialysis patients during 2013.

The diagnosis and management of anaemia in chronic kidney disease and the standards to be achieved have been detailed in the Kidney Disease Improving Global Outcomes (KDIGO), Kidney Disease Outcomes Quality Initiative (KDOQI), European Best Practice Guidelines (EBPG) and UK Renal Association guidelines [1–4]. The health economics of anaemia therapy using ESAs has also been subject to a NICE systematic review which concluded that treating to a target haemoglobin (Hb) 110–120 g/L is cost effective in HD patients [5].

This chapter reports on the analyses of data items collected by the UKRR largely in the context of the 5th edition of the UK Renal Association's Anaemia in CKD guidelines and recommendations which was published at the end of 2010 [4]. Table 7.1 lists the audit measures from these guidelines along with explanations for why some of the measures were not reported on.

Methods

The incident and prevalent renal replacement therapy (RRT) cohorts for 2013 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. Haemoglobin levels are given in g/L as the majority of UK laboratories have now switched to reporting using these units rather than g/dl.

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 data could be from zero to 90 days later. The haemoglobin values the UKRR receives 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, 90 or more days and less than 90 days before starting dialysis respectively).

For the analyses of prevalent patients, those patients receiving dialysis on 31st December 2013 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

Table 7.1. Summary of recommended Renal Association audit measures relevant to anaemia management

	RA audit measure	Included in UKRR annual report?	Reason for non-inclusion
1.	Proportion of CKD patients with eGFR <30 ml/min by 4 variable MDRD method with an annual Hb level	No	UKRR does not currently collect CKD data
2.	Proportion of patients starting an ESA without prior measurement of serum ferritin and/or TSAT	No	UKRR does not know when all patients start ESA treatment UKRR does not collect TSAT data
3.	Proportion of patients on renal replacement therapy with Hb level <10 who are not prescribed an ESA	Yes	
4.	Each renal unit should audit the type, route and frequency of administration and weekly dose of ESA prescribed	UKRR reports the completeness of these data items	
5.	The proportion of CKD stage 4–5 patients with Hb 10–12 g/dl	No	UKRR does not currently collect CKD data
6.	The proportion of patients treated with an ESA with Hb >12 g/dl	Yes	
7.	Each renal unit should monitor ESA dose adjustments	No	UKRR does not collect this data
8.	Proportion of patients with serum ferritin levels <100 ng/ml at start of treatment with ESA	No	UKRR does not know when all patients start ESA treatment
9.	Proportion of pre-dialysis and PD patients receiving iron therapy; type: oral vs. parenteral	No	UKRR does not currently collect CKD data/poor data completeness
10.	Proportion of HD patients receiving IV iron	No	Poor data completeness
11.	Prevalence of resistance to ESA among renal replacement therapy patients	Yes	
12.	Proportion of HD patients who received a blood transfusion within the past year	No	Data held at NHS Blood and Transplant

measurement for each patient from the last two quarters was used for Hb and from the last three quarters for ferritin. Scotland was excluded from the analysis for ferritin for PD patients as this data was not included in its return.

The completeness of data items were 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 level results. Centres providing relevant data from less than 10 patients were also excluded from the plots. The number preceding the centre name in the caterpillar plots is the percentage of patients who have data missing.

Summary statistics including minimum, maximum, interquartile ranges (IQR), averages (mean and median) and standard deviations were calculated. The median values and the IQRs are shown using caterpillar plots. The percentages achieving standards were also calculated. 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 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 2013.

Erythropoietin data from the last quarter of 2013 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 60% of HD patients or fewer than 45% 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 was 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. Patients who were not receiving ESAs were not included in analyses of dose (rather than being included with dose = 0).

Until two years ago, UKRR annual reports only used the dose from the final quarter of the year. Now, 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 were used (provided the patient was on the same treatment and receiving the same drug in those quarters). 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 data 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.

The percentage of data returned and outcome Hb are listed in table 7.2. Results are not shown for two centres (Carshalton, London Guys) because data completeness was less than 50%, results are not shown for Dumfries & Galloway as there were less than 10 patients with data.

The median Hb of patients at the time of starting dialysis in the UK was 100 g/L. The median starting Hb by centre is shown in figure 7.1. The percentage of patients having a Hb $\geqslant$100 g/L has fallen over the last several years to 50% from 55% in the 2009 cohort. The percentage starting with a Hb $\geqslant$100 g/L by centre is given in figure 7.2.

The variation in the proportion of patients starting dialysis with Hb $\geqslant$100 g/L between centres remained high (27–90%). Using only centres with time of presentation data, the median Hb in the late presenters was 94 g/L with only 36% of patients having a Hb $\geqslant$100 g/L compared with a median Hb of 101 g/L and 53% of patients having a Hb $\geqslant$100 g/L in the early presenters group. In both groups there was a large amount of variation between centres in the percentage of patients having a Hb $\geqslant$100 g/L (7–66% in the late presenters and 29–93% in the early presenters). The lower median Hb in late presenters may reflect inadequate pre-dialysis care with limited anaemia management, anaemia of multisystem disease or inter-current illness.

Median Hb of patients at the time of starting HD was 97 g/L (IQR 88–106 g/L) and in those starting PD it was 109 g/L (IQR 99–118 g/L). When starting dialysis, 43% of HD patients had a Hb $\geqslant$100 g/L, compared with 74% of PD patients.

Incident dialysis patients from 2012 were followed for one year and the median haemoglobin (and percentage with a Hb $\geqslant$100 g/L) of survivors on the same treatment at the same centre after a year was calculated for each quarter. Only patients who had Hb data for each of the four time points were included in this analysis. This was sub-analysed by modality and length of pre-RRT care (figures 7.3, 7.4). Hb was higher in the second quarter on dialysis than during the quarter at start of dialysis reflecting the benefits of treatment administered. Over 79% of incident patients surviving to a year had Hb

Table 7.2. Haemoglobin data for incident patients starting haemodialysis or peritoneal dialysis during 2013, both overall and by presentation time

	All incident patients				Early presenters only (⩾90 days)		Late presenters only (<90 days)	
Centre	% data return	*N* with data	Median Hb g/L	% Hb ⩾100 g/L	Median Hb g/L	% Hb ⩾100 g/L	Median Hb g/L	% Hb ⩾100 g/L
England								
B Heart	100	88	96	40	97	41		
B QEH	92	150	99	47	100	51	94	37
Basldn	100	31	94	32	92	32		
Bradfd	88	46	95	43	94	43		
Brightn	97	114	103	55	106	57	95	46
Bristol	100	141	105	84				
Camb	81	76	102	53	102	53	104	54
Carlis	100	32	111	72	111	69		
Carsh	38	68						
Chelms	86	32	106	56	106	61		
Colchr	79	22	93	27	94	36		
Covnt	95	69	97	46	97	45	107	60
Derby	100	70	101	54	102	58		
Donc	100	50	102	56	104	59		
Dorset	100	66	101	53	103	61	93	27
Dudley	100	38	96	42	96	47		
Exeter	100	92	107	90	107	93		
Glouc	100	40	101	53	101	54		
Hull	77	65	100	51	102	55		
Ipswi	94	33	100	52	101	58		
Kent	99	126	97	43	98	46	92	30
L Barts	99	249	99	49				
L Guys	20	20						
L Kings	100	154	94	36	97	40	88	21
L Rfree	99	194	101	53	101	55	98	47
L St.G	84	48	94	40				
L West	68	175	104	63	104	62	104	66
Leeds	98	134	93	28	94	29	93	25
Leic	100	249	97	43	98	48	92	24
Liv Ain	98	49	99	49	101	54		
Liv Roy	100	62	98	47	103	54	90	23
M RI	98	143	99	47	99	47	101	50
Middlbr	99	95	97	44	98	48	87	30
Newc	99	69	101	52	102	54	93	33
Norwch	100	63	97	43				
Nottm	100	84	96	37	98	45	83	7
Oxford	100	128	101	52	102	54	95	39
Plymth	100	51	100	51				
Ports	100	167	103	56	104	59	98	42
Prestn	100	125	97	44	96	43	99	48
Redng	99	99	100	53	102	59	87	30
Salford	98	104	95	40				
Sheff	100	117	96	42	99	47	86	20
Shrew	100	52	102	62	102	61		
Stevng	99	141	98	43	97	43	98	42
Sthend	100	37	101	51	101	56		
Stoke	93	79	102	58	106	70	91	25
Sund	95	40	100	50	102	58		
Truro	100	36	103	64	107	72		
Wirral	93	52	103	58				
Wolve	96	77	96	38	97	44	91	8
York	86	31	94	29				

Table 7.2. Continued

Centre	All incident patients				Early presenters only (⩾90 days)		Late presenters only (<90 days)	
	% data return	*N* with data	Median Hb g/L	% Hb ⩾100 g/L	Median Hb g/L	% Hb ⩾100 g/L	Median Hb g/L	% Hb ⩾100 g/L
N Ireland								
Antrim	96	23	92	35	96	42		
Belfast	94	46	98	46	98	47	94	36
Newry	100	21	107	71	107	74		
Ulster	96	24	101	50	102	50		
West NI	96	24	109	79	109	82		
Scotland								
Abrdn	100	49	96	45				
Airdrie	68	34	105	59				
D & Gall	88	7						
Dundee	88	36	96	44				
Edinb	98	57	100	54				
Glasgw	82	118	97	43				
Inverns	89	17	104	65				
Klmarnk	69	25	97	44				
Krkcldy	97	32	101	53				
Wales								
Bangor	100	21	98	48	96	42		
Cardff	99	140	104	61	104	62	100	50
Clwyd	100	12	104	58				
Swanse	100	88	100	51	100	51	101	53
Wrexm	91	29	107	66	109	73		
England	**92**	**4,573**	**99**	**50**	**100**	**52**	**94**	**36**
N Ireland	**96**	**138**	**102**	**54**	**102**	**58**	**94**	**33**
Scotland	**86**	**375**	**98**	**49**				
Wales	**98**	**290**	**102**	**57**	**102**	**58**	**100**	**50**
UK	**92**	**5,376**	**100**	**50**	**101**	**53**	**94**	**36**

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

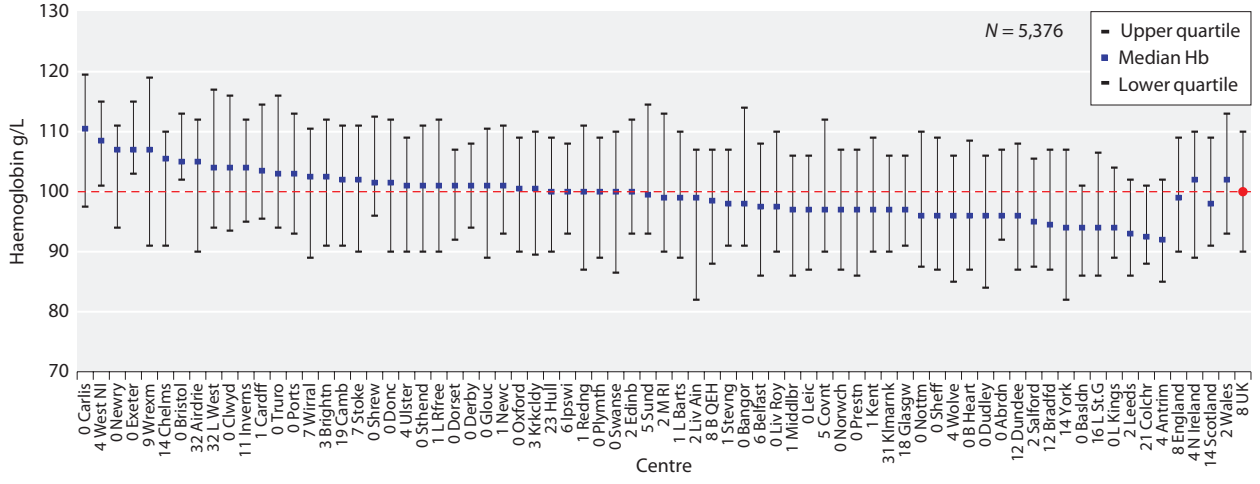

Fig. 7.1. Median haemoglobin for incident dialysis patients at start of dialysis treatment in 2013

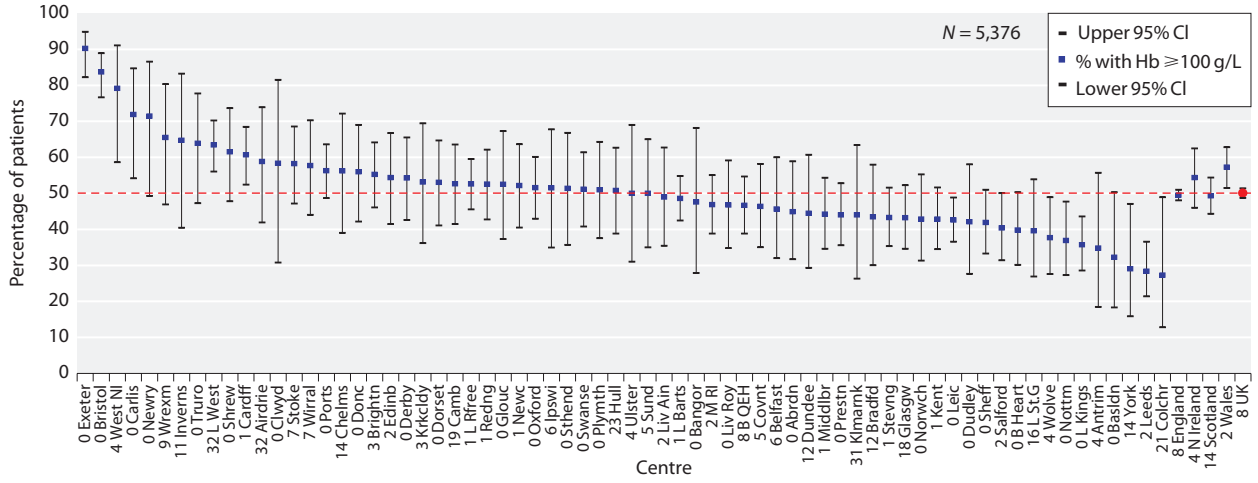

Fig. 7.2. Percentage of incident dialysis patients with Hb ⩾100 g/L at start of dialysis treatment in 2013

⩾100 g/L regardless of the modality or the length of pre-RRT care.

The annual distribution of Hb in incident dialysis patients is shown in figure 7.5. Since 2006, the proportion of incident patients with Hb ⩾120 g/L has fallen from 17% to 10% and the proportion of patients with Hb <100 g/L continues to gradually increase over the years from 40% to 50%. In the 2013 cohort with presentation time data, 64% of patients in the late presentation group had Hb <100 g/L compared with 47% in the early presentation group.

ESA by time on dialysis in early vs. late presenters

Incident dialysis patients from 2012 were followed for one year and the percentages receiving an ESA were calculated for each quarter for survivors on the same treatment at the same centre after a year. This was sub-analysed by modality and length of pre-RRT care

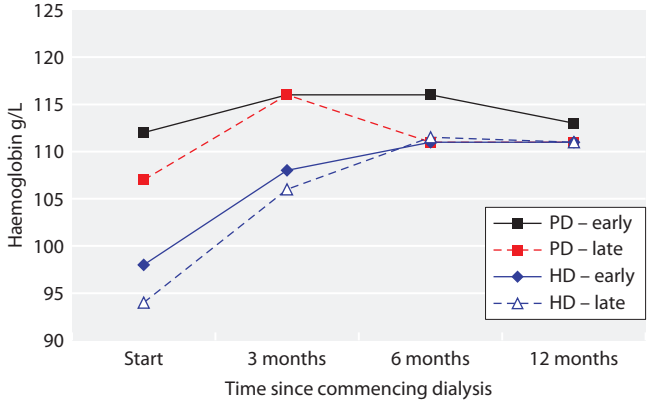

Fig. 7.3. Median haemoglobin, by time on dialysis and length of pre-RRT care, for incident dialysis patients in 2012

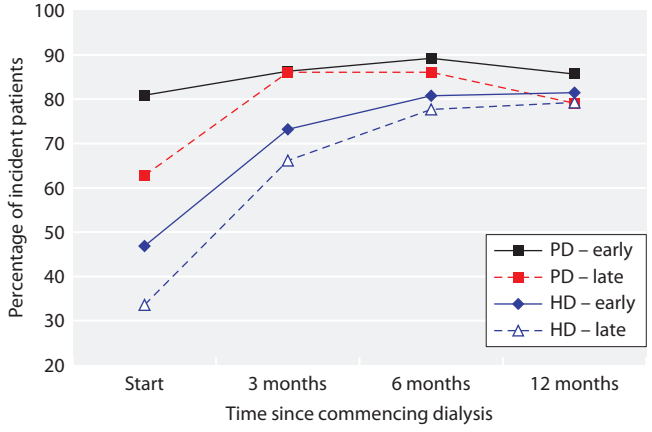

Fig. 7.4. Percentage of incident dialysis patients in 2012 with Hb ⩾100 g/L, by time on dialysis and by length of pre-RRT care

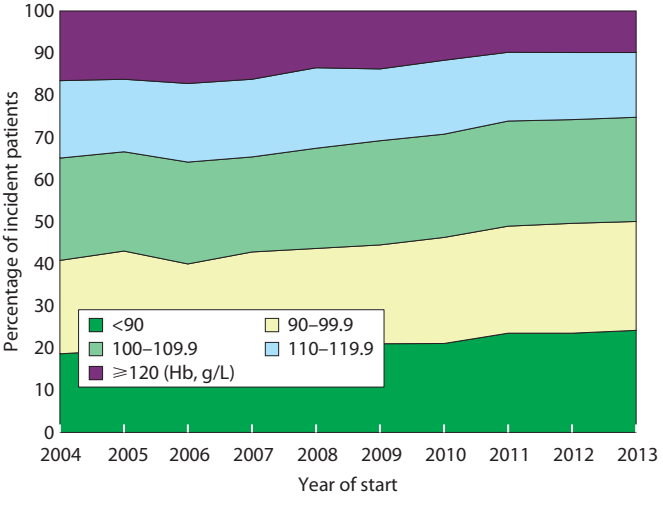

Fig. 7.5. Distribution of haemoglobin in incident dialysis patients by year of start

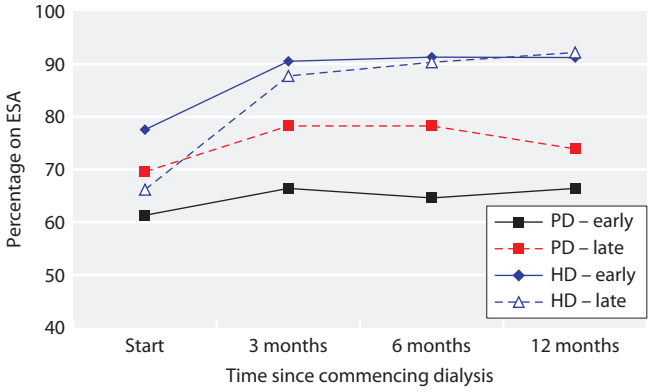

Fig. 7.6. Percentage of incident dialysis patients in 2012 on ESA, by time on dialysis and by length of pre-RRT care

(figure 7.6). For HD patients at the start of treatment there was a difference between early and late presenters in the percentage of patients receiving an ESA. This difference was greatly reduced by three months after starting and had disappeared within one year of starting dialysis. For PD patients there was a similar difference between the early and late group and this difference persisted over the first year after starting dialysis. However, caution is advised in interpreting this figure as the number (23) of patients in the PD late group was relatively small.

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 table 7.3 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 UKRR. For some centres, the ESA data was completely missing and for others it appears to be partially complete (i.e. very low percentages of patients appearing to be on

Table 7.3. Percentage completeness of data returns for haemoglobin and serum ferritin and percentages on ESA for prevalent HD and PD patients in 2013

	HD				PD			
Centre	*N*	Hb	Ferritin	% on ESA	*N*	Hb	Ferritin	% on ESA
England								
B Heart	401	100	99	77	35	100	100	60
B QEH	885	100	99	88	129	100	99	59
Basldn	152	99	99	91	30	100	100	63
Bradfd	186	100	99	96	26	100	100	62
Brightn	372	98	82	0	66	100	80	0
Bristol	485	100	99	91	57	100	95	63
Camb	356	51	76	52	19	95	100	53
Carlis	58	100	43	76	23	100	96	78
Carsh	698	95	93	0	105	94	94	0
Chelms	109	99	99	93	20	100	100	50
Colchr	109	93	91	5				
Covnt	354	100	100	86	72	99	90	50
Derby	203	100	100	0	78	99	97	0
Donc	146	100	99	90	30	100	97	80
Dorset	244	100	99	95	39	100	100	72
Dudley	163	95	94	2	47	100	96	2
Exeter	376	100	100	92	63	100	100	75
Glouc	188	100	98	89	31	100	81	81
Hull	299	100	100	77	72	100	99	49
Ipswi	112	100	100	77	24	100	100	71
Kent	376	100	99	91	57	100	95	54
L Barts	883	100	99	0	178	99	92	0
L Guys	591	0	74	18	28	0	64	0
L Kings	466	100	99	93	79	99	99	72
L Rfree	688	99	99	0	108	100	81	0
L St.G	255	99	98	0	45	98	100	0
L West	1,317	99	98	0	52	100	100	0
Leeds	470	100	100	86	62	100	100	79
Leic	828	100	100	97	135	97	96	74

Table 7.3. Continued

	HD				PD			
Centre	*N*	Hb	Ferritin	% on ESA	*N*	Hb	Ferritin	% on ESA
Liv Ain	148	99	99	0	26	100	100	0
Liv Roy	334	99	100	0	51	100	100	0
M RI	486	93	90	0	69	99	96	0
Middlbr	322	98	98	75	11	100	100	64
Newc	257	100	100	63	36	89	86	0
Norwch	305	100	99	91	35	100	100	77
Nottm	354	100	100	88	68	100	100	69
Oxford	405	100	100	91	83	99	99	78
Plymth	120	100	98	0	29	100	79	0
Ports	545	100	99	10	77	100	96	10
Prestn	508	99	100	91	52	100	100	83
Redng	260	100	100	83	64	100	100	5
Salford	362	88	0	52	75	97	0	0
Sheff	556	100	100	88	61	100	100	59
Shrew	176	100	99	90	26	100	100	62
Stevng	431	99	98	0	37	97	84	0
Sthend	110	100	100	95	15	100	100	60
Stoke	288	85	80	1	81	99	98	0
Sund	177	100	99	91	8	100	100	75
Truro	139	100	100	0	18	100	100	0
Wirral	198	99	99	0	27	78	70	0
Wolve	277	100	100	83	78	100	100	63
York	129	100	100	89	25	100	100	64
N Ireland								
Antrim	120	99	99	95	15	100	100	80
Belfast	199	100	99	92	26	100	100	88
Newry	84	95	21	92	17	100	100	88
Ulster	103	100	100	96	4	100	100	100
West NI	107	97	62	94	14	100	100	79
Scotland								
Abrdn	206	98	96		21	100		
Airdrie	177	99	95		12	100		
D & Gall	44	100	95		11	91		
Dundee	163	99	79		18	94		
Edinb	255	100	93		25	100		
Glasgw	561	99	89		39	100		
Inverns	63	100	65		13	92		
Klmarnk	126	100	88		39	97		
Krkcldy	142	99	92		18	94		
Wales								
Bangor	84	100	100	79	12	100	100	33
Cardff	460	100	100	38	66	100	80	12
Clwyd	72	100	100	86	14	100	100	14
Swanse	311	100	100	86	53	100	96	74
Wrexm	96	100	73	89	19	100	53	58
England	**18,657**	**95**	**95**	**90**	**2,762**	**98**	**93**	**74**
N Ireland	**613**	**99**	**82**	**92**	**76**	**100**	**100**	**78**
Scotland	**1,737**	**99**	**89**		**196**	**97**		
Wales	**1,023**	**100**	**97**	**89**	**164**	**100**	**85**	**58**
UK	**22,030**	**95**	**94**	**88***	**3,198**	**98**	**92***	**68***

Blank cells: centres with no PD patients or because data was not available
Percentages on ESA are shown, but it is believed that there were data problems for those centres with apparently less than 60% of HD patients or 45% 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
*These overall averages are for E,W & NI (not UK)

ESAs). It is believed that there were problems with data entry and/or data transfer for those centres where the percentage on ESA was less than 60% for HD patients or 45% for PD patients. 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 7.4 for HD and 7.5 for PD patients respectively.

Haemoglobin in prevalent haemodialysis patients

The median Hb of patients on HD in the UK was 112 g/L with an IQR of 103–120 g/L and 83% of HD patients had a Hb $\geqslant$100 g/L (table 7.4). The median Hb by centre is shown in figure 7.7. Compliance with the target range of Hb $\geqslant$100 and $\leqslant$120 g/L (figure 7.8) continues to increase year on year, 53% in 2010, 56% in 2011, 57% in 2012 and 59% in 2013. The percentages of HD patients with Hb below 100 g/L and above 120 g/L, as well as the percentages meeting the target, are shown by centre in figure 7.9.

Funnel plots are shown for the minimum (Hb $\geqslant$100 g/L) and target range (Hb $\geqslant$100 and $\leqslant$120 g/L) in figures 7.10 and 7.11 respectively. Many centres complied well with respect to both the minimum and target range Hb standards. Some centres complied well with the percentage with Hb $\geqslant$100 g/L (figure 7.10) but had a poor compliance with percentage of patients with Hb $\geqslant$100 and $\leqslant$120 g/L (figure 7.11). Table 7.4 can be used in conjunction with figures 7.10 and 7.11 to identify centres.

Haemoglobin in prevalent peritoneal dialysis patients

Overall, 83% of patients on PD had a Hb $\geqslant$100 g/L (table 7.5). The median Hb of patients on PD in the UK in 2013 was 113 g/L with an IQR of 103–122 g/L. The median Hb by centre is shown in figure 7.12. The

Table 7.4. Summary statistics for haemoglobin, serum ferritin and ESA for prevalent HD patients in 2013

Centre	*N* with Hb data	Median Hb g/L	% Hb $\geqslant$100 g/L	% Hb 100–120 g/L	Median ferritin μg/L	% ferritin $\geqslant$100 μg/L	% ferritin >200 and $\leqslant$500 μg/L	% on ESA	Median ESA dose (IU/week)	% with Hb $\geqslant$100 g/L and not on ESA
England										
B Heart	401	111	81	59	344	96	62	77	7,500	21
B QEH	881	110	79	63	351	94	68	88	6,500	11
Basldn	151	108	72	54	348	93	69	91	6,000	6
Bradfd	186	114	81	55	538	99	38	96	6,500	4
Brightn	363	109	77	58	535	99	36			
Bristol	485	112	96	69	560	98	33	91	7,500	9
Camb	180	110	82	62	322	92	60			
Carlis	58	120	97	50				76	4,000	24
Carsh	660	111	83	65	351	95	70			
Chelms	108	116	90	61	627	99	19	93	8,000	7
Colchr	101	114	80	46	556	99	37			
Covnt	354	109	76	63	364	97	65	86	10,000	10
Derby	203	115	87	58	449	95	44			
Donc	146	115	82	49	388	98	55	90	6,250	10
Dorset	244	114	86	62	515	97	40	95	8,000	5
Dudley	155	111	83	60	317	93	66			
Exeter	376	114	97	76	266	86	52	92	7,250	8
Glouc	188	114	91	60	361	90	44	89		11
Hull	299	113	84	56	387	96	67	77	6,000	20
Ipswi	112	111	81	56	622	96	27	77	6,000	19
Kent	376	111	83	58	470	95	38	91	8,250	7
L Barts	882	110	78	58	438	95	52			
L Guys	0				657	96	24			
L Kings	465	107	76	68	564	97	34	93	7,500	7
L Rfree	681	111	83	63	496	95	37			
L St.G	253	111	78	57	407	97	59			
L West	1,303	115	90	63	360	96	67			
Leeds	470	109	81	65	473	96	43	86	4,500	12
Leic	827	112	79	52	348	96	63	97	6,000	2

Table 7.4. Continued

Centre	*N* with Hb data	Median Hb g/L	% Hb ⩾100 g/L	% Hb 100–120 g/L	Median ferritin μg/L	% ferritin ⩾100 μg/L	% ferritin >200 and ⩽500 μg/L	% on ESA	Median ESA dose (IU/week)	% with Hb ⩾100 g/L and not on ESA
Liv Ain	147	114	81	55	516	94	33			
Liv Roy	332	115	81	47	482	90	34			
M RI	452	113	83	56	378	95	56			
Middlbr	317	113	83	54	817	96	24	75	5,000	21
Newc	257	111	81	54	421	95	47	63	11,900	32
Norwch	304	116	87	52	486	94	37	91	8,000	9
Nottm	354	110	80	64	579	98	26	88	6,750	11
Oxford	405	112	82	55	296	93	60	91	8,000	8
Plymth	120	113	83	59	905	98	15			
Ports	544	115	85	50	507	96	38			
Prestn	504	110	79	62	577	95	30	91		8
Redng	260	115	82	50	496	98	46	83	14,000	10
Salford	319	107	73	55						
Sheff	555	113	83	53	457	97	49	88	7,500	11
Shrew	176	114	87	57	414	96	51	90	8,250	9
Stevng	426	111	82	62	616	97	29			
Sthend	110	108	76	70	346	100	83	95	9,500	5
Stoke	244	114	83	53	310	93	55			
Sund	177	115	85	57	524	97	35	91	9,423	9
Truro	139	112	82	63	416	97	58			
Wirral	196	113	84	58	458	96	54			
Wolve	277	114	83	50	479	95	42	83	7,500	17
York	129	111	83	63	429	96	67	89	4,250	10
N Ireland										
Antrim	119	113	88	62	462	97	45	95	6,375	5
Belfast	198	112	80	55	435	94	38	92	8,250	8
Newry	80	113	86	59				92	4,500	8
Ulster	103	111	84	66	626	100	25	96	6,000	3
West NI	104	110	82	64	605	94	26	94	8,000	6
Scotland										
Abrdn	202	107	70	56	648	97	26			
Airdrie	176	112	84	64	606	99	35			
D & Gall	44	109	80	66	664	100	26			
Dundee	161	110	81	65	335	89	50			
Edinb	254	117	90	52	476	94	34			
Glasgw	556	114	85	54	421	94	41			
Inverns	63	112	86	71	292	98	80			
Klmarnk	126	113	79	53	302	84	50			
Krkcldy	141	116	86	55	517	89	24			
Wales										
Bangor	84	114	90	64	386	95	58	79	8,250	18
Cardff	460	112	79	55	293	95	64			
Clwyd	72	118	89	53	348	100	79	86		14
Swanse	311	111	82	62	372	92	43	86	8,000	14
Wrexm	96	109	78	55	419	99	60	89	5,500	10
England	**17,652**	**112**	**83**	**59**	**427**	**95**	**49**	**88**	**7,500**	**11**
N Ireland	**604**	**112**	**83**	**60**	**522**	**96**	**35**	**94**	**6,500**	**6**
Scotland	**1,723**	**113**	**83**	**57**	**458**	**94**	**38**			
Wales	**1,023**	**112**	**81**	**58**	**331**	**94**	**58**	**85**	**7,500**	**14**
UK	**21,002**	**112**	**83**	**59**	**424**	**95**	**48**	**88***	**7,333***	**11***

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 60% or more
*For ESA, these overall averages are for E,W & NI (not UK)

Table 7.5. Summary statistics for haemoglobin, serum ferritin and ESA for prevalent PD patients in 2013

Centre	*N* with Hb data	Median Hb g/L	% Hb ⩾100 g/L	% Hb 100–120 g/L	Median ferritin μg/L	% ferritin ⩾100 μg/L	% ferritin >100 and ⩽500 μg/L	% on ESA	Median ESA dose (IU/week)	% with Hb ⩾100 g/L and not on ESA
England										
B Heart	35	110	80	54	271	91	69	60	5,000	34
B QEH	129	112	80	51	306	88	66	59	4,000	40
Basldn	30	110	77	63	138	70	63	63	4,000	33
Bradfd	26	112	77	42	250	77	58	62	6,750	35
Brightn	66	117	92	58	428	94	53			
Bristol	57	115	95	67	358	96	72	63	5,500	37
Camb	18	111	89	67	283	95	95	53	3,450	44
Carlis	23	116	96	57	474	100	55	78	4,000	22
Carsh	99	110	66	44	191	80	74			
Chelms	20	116	95	55	167	80	80	50	3,000	50
Colchr	n/a									
Covnt	71	115	85	49	267	80	65	50	8,000	46
Derby	77	115	78	49	446	97	51			
Donc	30	116	83	57	390	97	69	80	4,500	20
Dorset	39	115	82	49	301	97	77	72	3,950	28
Dudley	47	109	85	62	150	60	51			
Exeter	63	112	98	70	204	83	73	75	3,000	24
Glouc	31	108	74	58	154	60	60	81		19
Hull	72	113	82	53	311	97	76	49	4,000	46
Ipswi	24	112	83	67	439	79	33	71	5,000	25
Kent	57	111	84	61	280	91	63	54	4,000	42
L Barts	177	113	80	49	228	90	71			
L Guys	0				216	72	67			
L Kings	78	111	81	62	242	87	73	72	4,375	24
L Rfree	108	110	70	46	508	98	48			
L St.G	44	113	82	55	237	89	76			
L West	52	106	65	50	268	88	75			
Leeds	62	111	77	58	333	94	71	79	4,250	21
Leic	131	113	89	63	307	92	69	74	4,000	25
Liv Ain	26	106	65	50	328	92	65			
Liv Roy	51	112	75	47	302	82	59			
M RI	68	114	81	43	207	82	74			
Middlbr	11	117	100	64	336	100	73	64	3,000	36
Newc	32	115	84	56	400	94	48			
Norwch	35	116	91	51	189	69	51	77	3,400	23
Nottm	68	111	81	60	387	91	65	69	2,875	29
Oxford	82	113	84	55	247	83	68	78	6,000	16
Plymth	29	115	76	41	306	83	48			
Ports	77	114	88	56	381	97	64			
Prestn	52	115	88	50	372	94	60	83		17
Redng	64	119	92	50	441	95	56			
Salford	73	112	79	51						
Sheff	61	113	77	44	480	95	51	59	6,000	38
Shrew	26	112	88	46	253	81	62	62	4,000	38
Stevng	36	117	92	64	223	71	58			
Sthend	15	117	93	67	146	93	93	60		40
Stoke	80	115	85	54	415	91	53			
Sund	8									
Truro	18	115	89	56	176	72	67			
Wirral	21	103	57	48	588	100	42			
Wolve	78	112	81	56	204	81	73	63	6,000	36
York	25	117	80	40	217	88	76	64	2,438	36

Table 7.5. Continued

Centre	*N* with Hb data	Median Hb g/L	% Hb ⩾100 g/L	% Hb 100–120 g/L	Median ferritin μg/L	% ferritin ⩾100 μg/L	% ferritin >100 and ⩽500 μg/L	% on ESA	Median ESA dose (IU/week)	% with Hb ⩾100 g/L and not on ESA
N Ireland										
Antrim	15	114	87	67	346	100	73	80	6,000	20
Belfast	26	111	88	65	246	92	77	88	3,000	12
Newry	17	106	94	88	287	88	71	88	4,800	12
Ulster	4									
West NI	14	114	93	64	332	93	57	79	2,000	21
Scotland										
Abrdn	21	112	76	57						
Airdrie	12	114	92	67						
D & Gall	10	112	80	60						
Dundee	17	115	82	71						
Edinb	25	109	76	60						
Glasgw	39	111	92	74						
Inverns	12	119	92	58						
Klmarnk	38	113	76	47						
Krkcldy	17	113	88	71						
Wales										
Bangor	12	121	92	42	212	75	67			
Cardff	66	112	88	53	112	57	55			
Clwyd	14	114	86	57	246	71	57			
Swanse	53	113	91	64	380	94	69	74	4,000	26
Wrexm	19	112	84	47	256	100	90	58	7,450	42
England	**2,702**	**113**	**82**	**54**	**288**	**88**	**65**	**67**	**4,000**	**31**
N Ireland	**76**	**111**	**91**	**71**	**308**	**93**	**71**	**86**	**4,000**	**14**
Scotland	**191**	**112**	**83**	**62**						
Wales	**164**	**113**	**88**	**55**	**201**	**76**	**64**	**69**	**4,688**	**31**
UK	**3,133**	**113**	**83**	**55**	**285***	**88***	**65***	**68***	**4,000***	**31***

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 45% or more
*For ferritin and for ESA these overall averages are for E,W & NI (not UK)

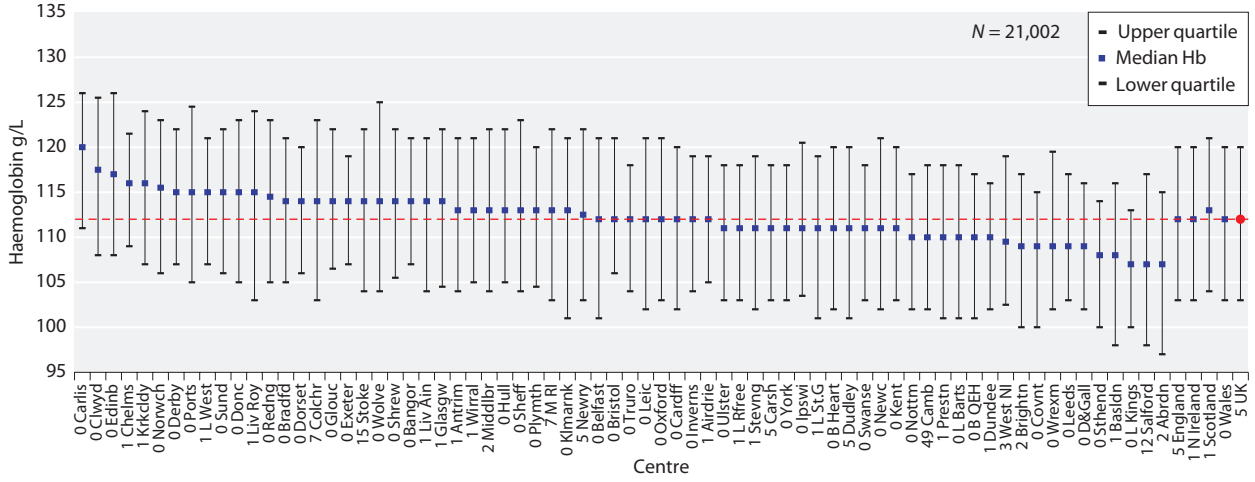

Fig. 7.7. Median haemoglobin in patients treated with HD by centre in 2013

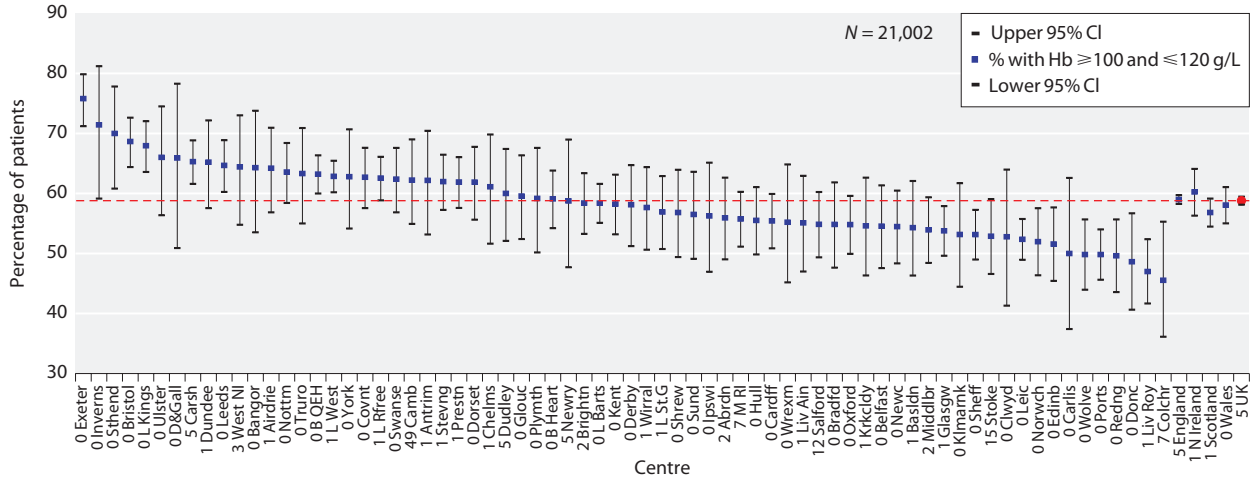

Fig. 7.8. Percentage of HD patients with Hb ⩾100 and ⩽120 g/L by centre in 2013

compliance with Hb ⩾100 and ⩽120 g/L is shown in figure 7.13. In 2013, 55% of prevalent PD patients had a Hb within the target range. The distribution of Hb in PD patients by centre is shown in figure 7.14. The funnel plots for percentage with Hb ⩾100 g/L and for the percentage of patients with Hb ⩾100 and ⩽120 g/L are shown in figures 7.15 and 7.16 respectively. Table 7.5 can be used in conjunction with figures 7.15 and 7.16 to identify centres in the funnel plot.

Relationship between Hb in incident and prevalent dialysis patients in 2013

The relationship between the percentage of incident and prevalent dialysis (HD and PD) patients with a Hb ⩾100 g/L is shown in figure 7.17. As expected, all centres had a higher percentage of prevalent patients achieving a Hb ⩾100 g/L than that for incident patients. Overall in the UK, 83% of prevalent patients, compared with 50% of incident patients, had a Hb ⩾100 g/L in 2013. Compliance with the current minimum standard (Hb ⩾100 g/L) is shown by year (1998–2013) for incident and prevalent patients (all dialysis patients) in figure 7.18. The decline in achieving this standard appears to be levelling off.

Ferritin in prevalent haemodialysis patients

The median and IQR for serum ferritin for patients treated with HD are shown in figure 7.19. The percentages with serum ferritin ⩾100 μg/L, >200 μg/L to

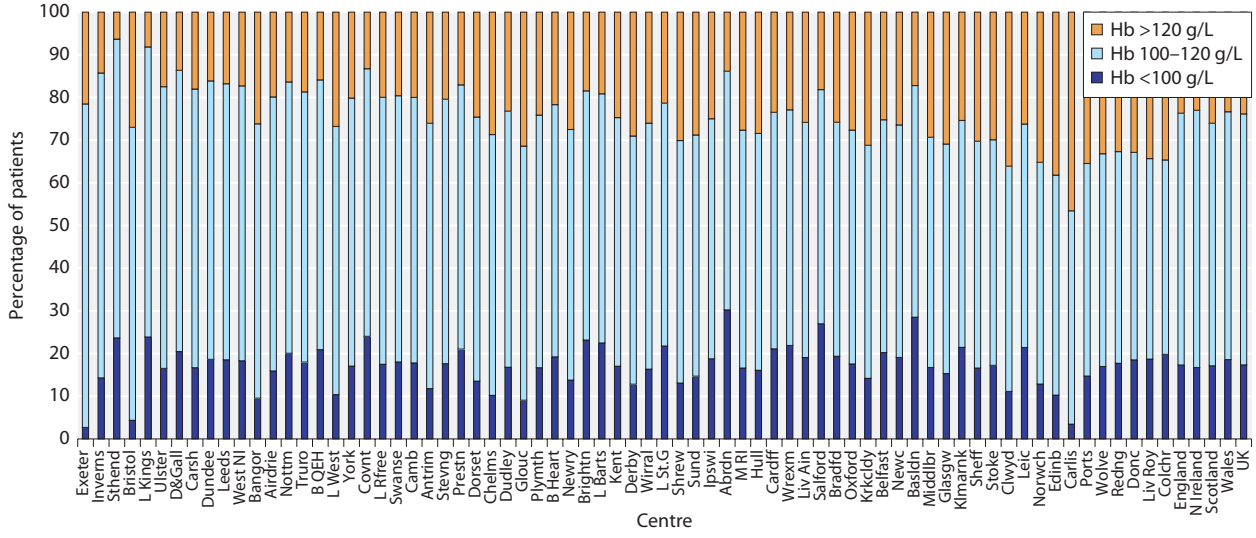

Fig. 7.9. Distribution of haemoglobin in patients treated with HD by centre in 2013

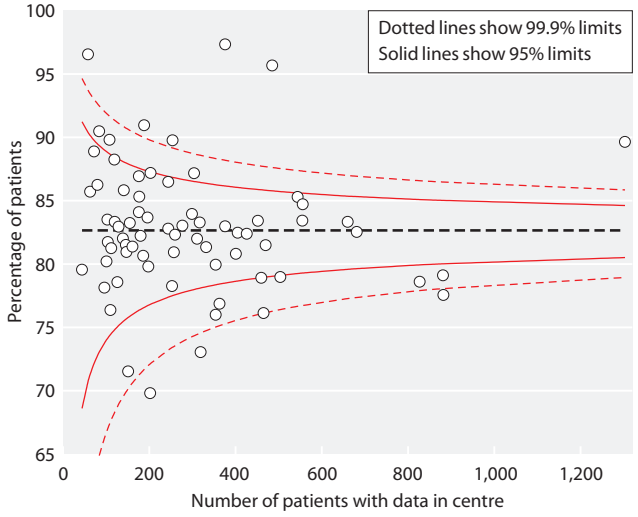

Fig. 7.10. Funnel plot of percentage of HD patients with Hb ⩾100 g/L by centre in 2013

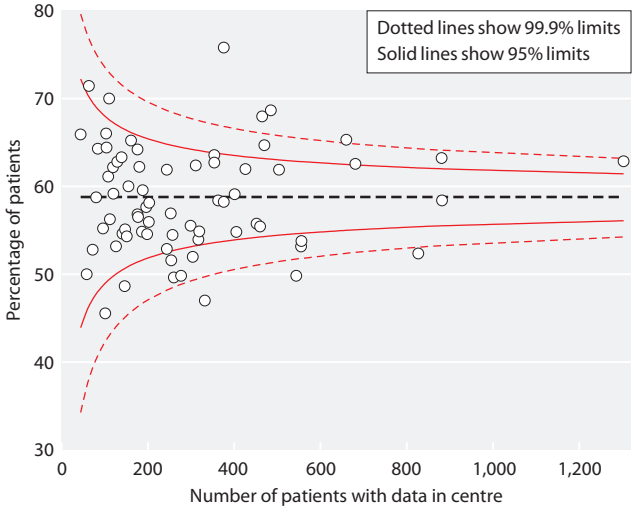

Fig. 7.11. Funnel plot of percentage of HD patients with Hb ⩾100 and ⩽120 g/L by centre in 2013

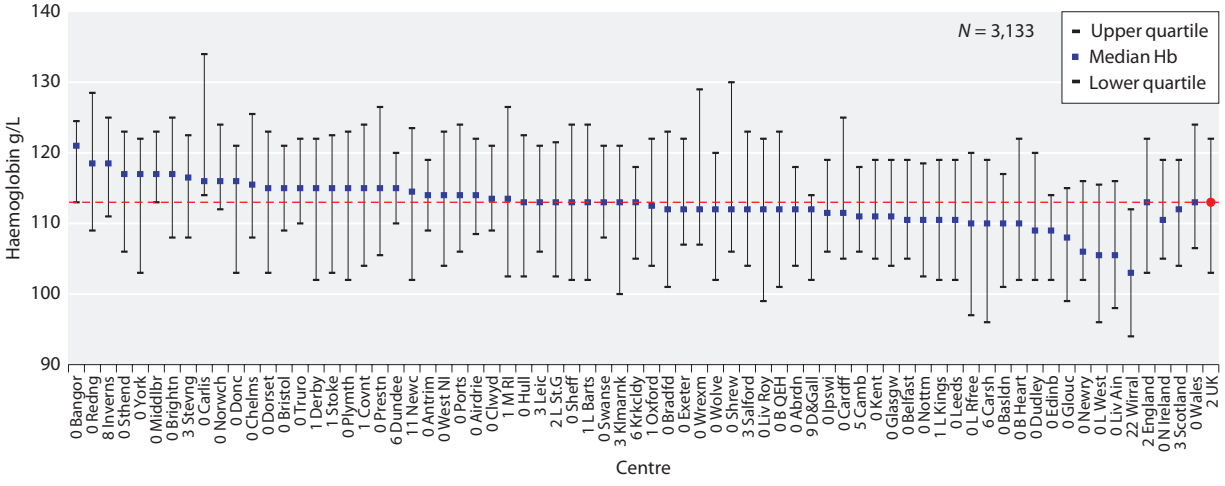

Fig. 7.12. Median haemoglobin in patients treated with PD by centre in 2013

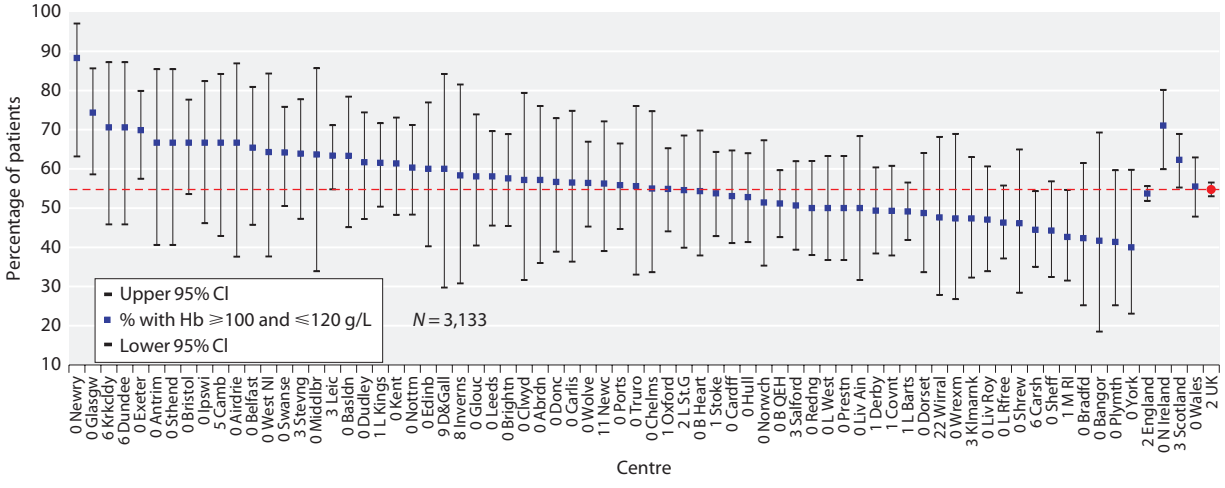

Fig. 7.13. Percentage of PD patients with Hb ⩾100 and ⩽120 g/L by centre in 2013

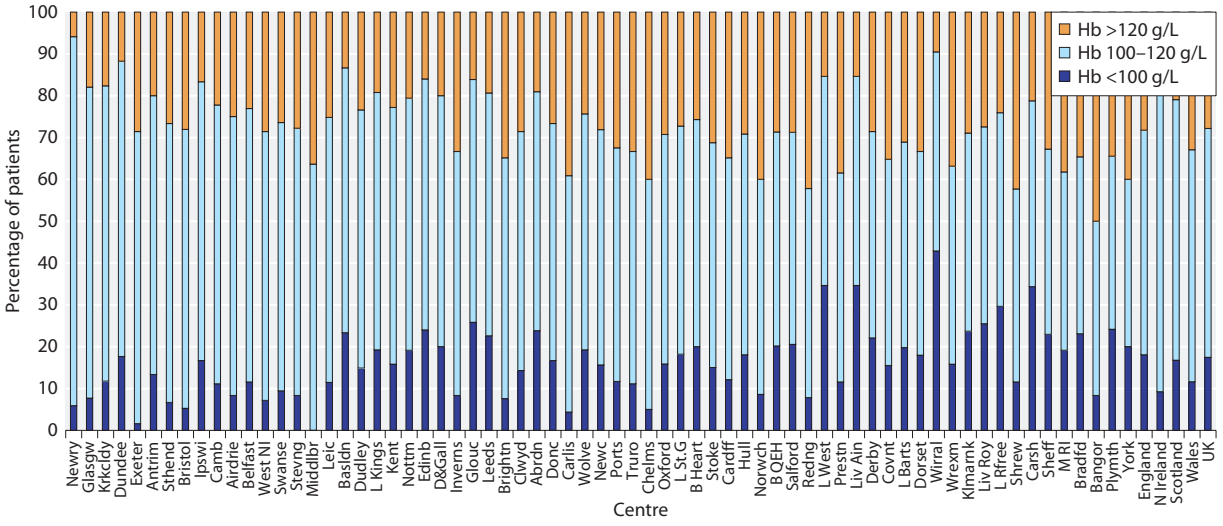

Fig. 7.14. Distribution of haemoglobin in patients treated with PD by centre in 2013

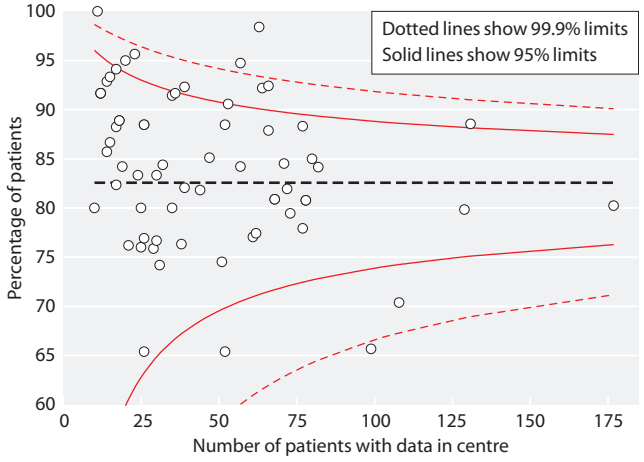

Fig. 7.15. Funnel plot of percentage of PD patients with Hb ⩾100 g/L by centre in 2013

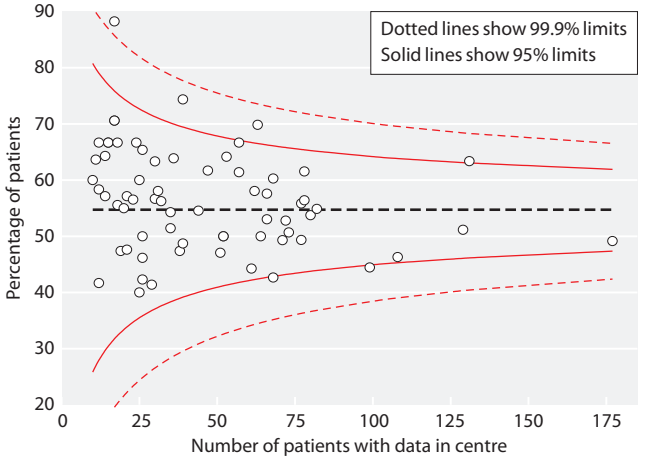

Fig. 7.16. Funnel plot of percentage of PD patients with Hb ⩾100 g/L and ⩽120 g/L by centre in 2013

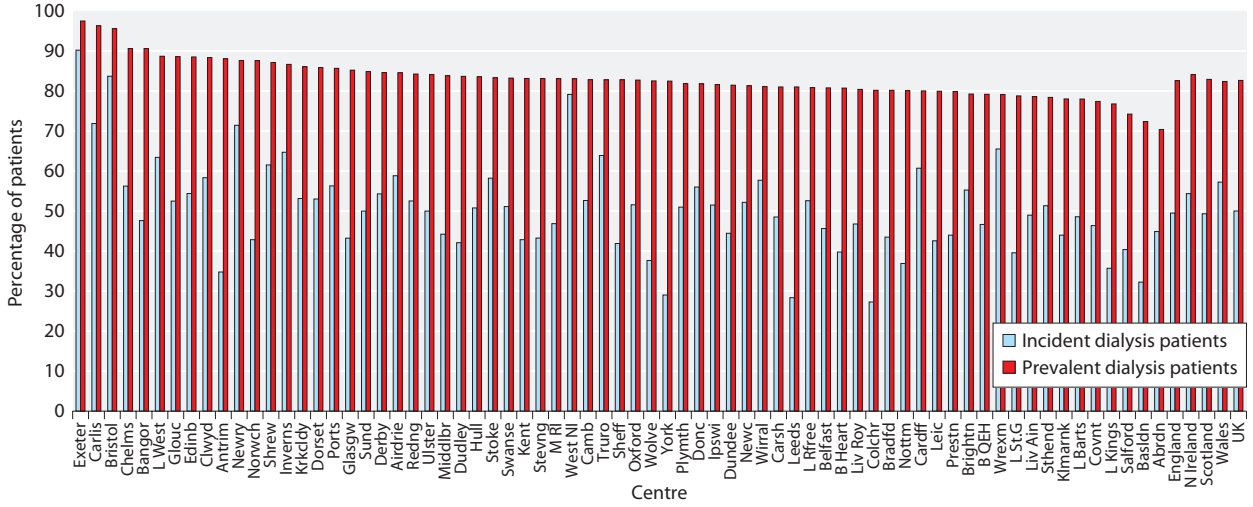

Fig. 7.17. Percentage of incident and prevalent dialysis patients with Hb ⩾100 g/L by centre in 2013

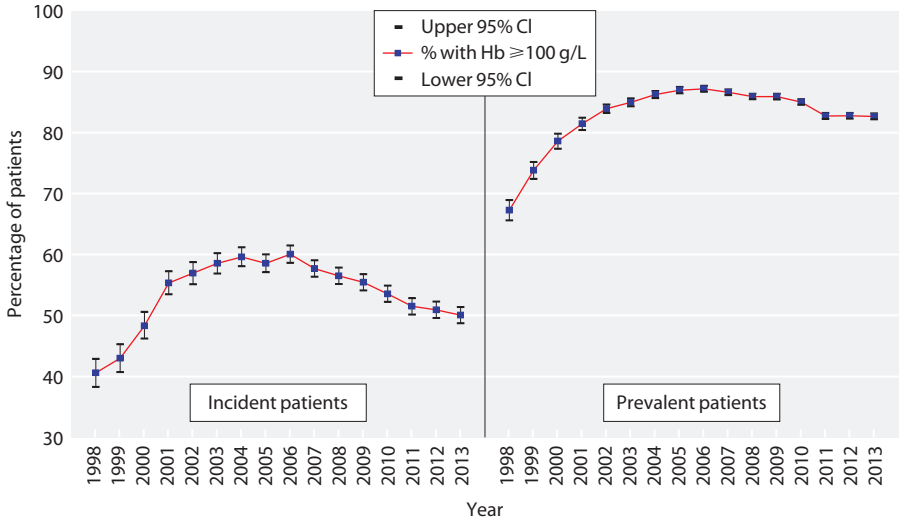

Fig. 7.18. Percentage of incident and prevalent dialysis patients (1998–2013) with Hb ⩾100 g/L

⩽500 μg/L, and ⩾800 μg/L are shown in figures 7.20, 7.21 and 7.22 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 424 μg/L, IQR 280–616. Twenty centres had greater than 20% (20–60%) of their patients having ferritin ⩾800 μg/L (figure 7.22). Twelve of these 20 had values over 25%. The serum ferritin correlated poorly with median Hb achieved and ESA dose (table 7.4).

Ferritin in prevalent peritoneal dialysis patients

The median and IQR for serum ferritin for patients treated with PD are shown in figure 7.23. The percentages with serum ferritin ⩾100 μg/L, >100 μg/L and ⩽500 μg/L, and ⩾800 μg/L are shown in figures 7.24, 7.25 and 7.26 respectively. The PD population had a lower median ferritin value (285 μg/L, IQR 167–473) than the HD population. Twenty-nine centres reported less than 90% of PD patients being compliant with serum ferritin ⩾100 μg/L, although this appeared to have little bearing on their achieved median Hb or median ESA dose when compared with other centres (table 7.5).

Erythropoietin stimulating agents in prevalent haemodialysis patients

As shown in previous reports there was substantial variation in the average dose of ESA prescription used.

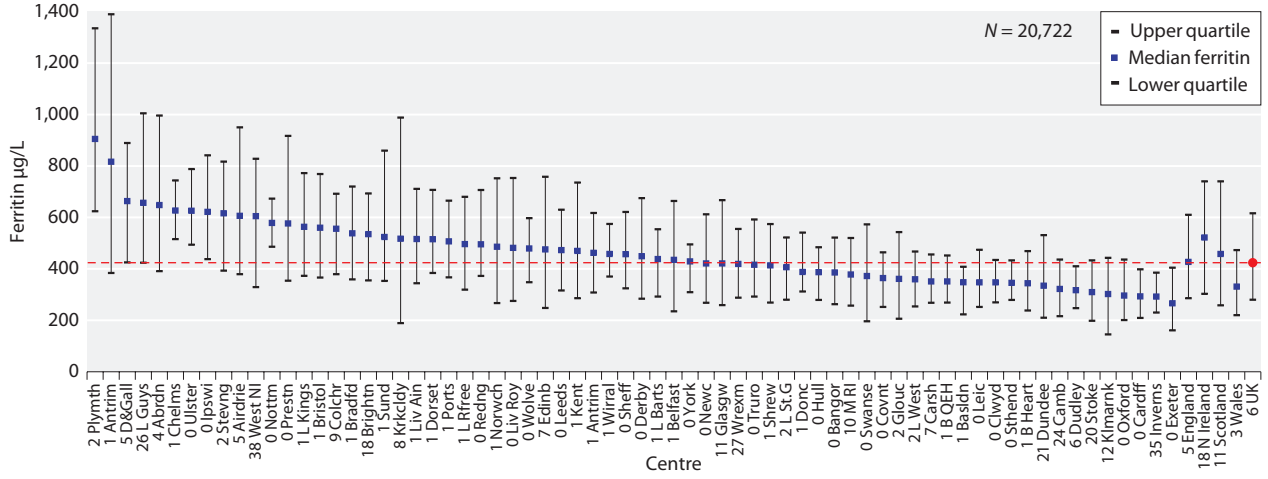

Fig. 7.19. Median ferritin in patients treated with HD by centre in 2013

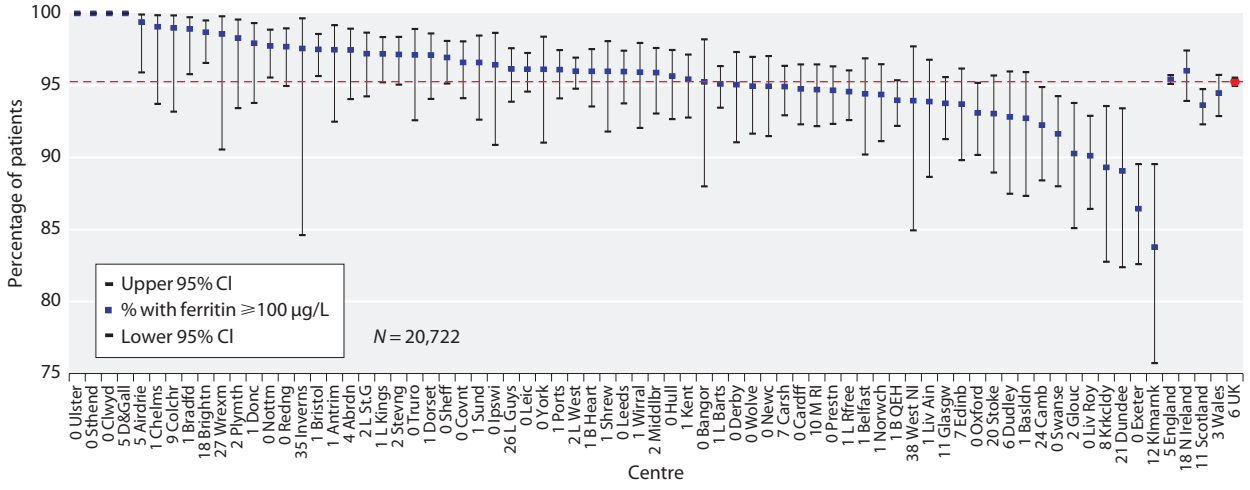

Fig. 7.20. Percentage of HD patients with ferritin ⩾100 µg/L by centre in 2013

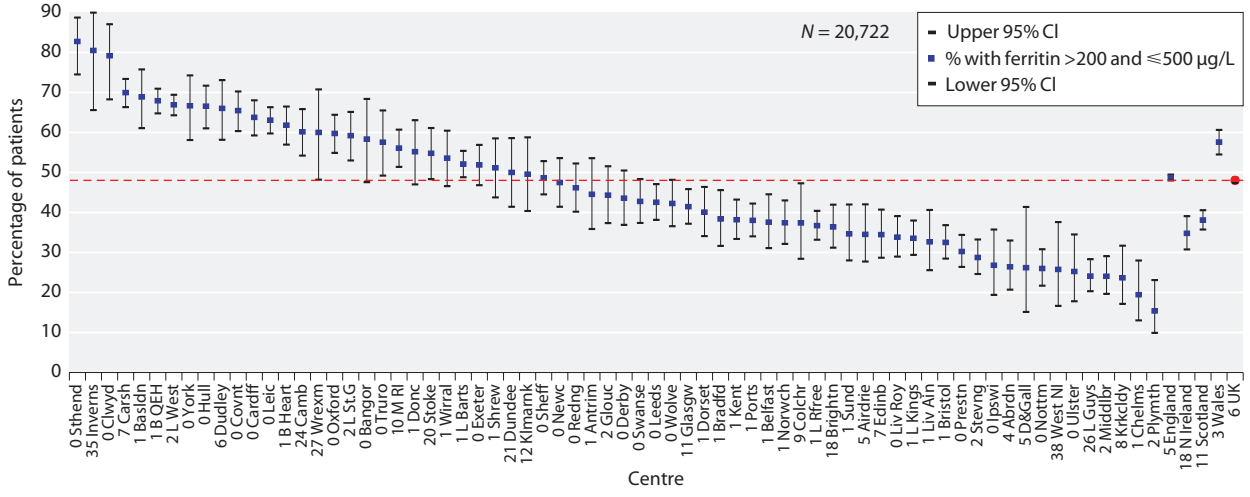

Fig. 7.21. Percentage of HD patients with ferritin >200 µg/L and ⩽500 µg/L by centre in 2013

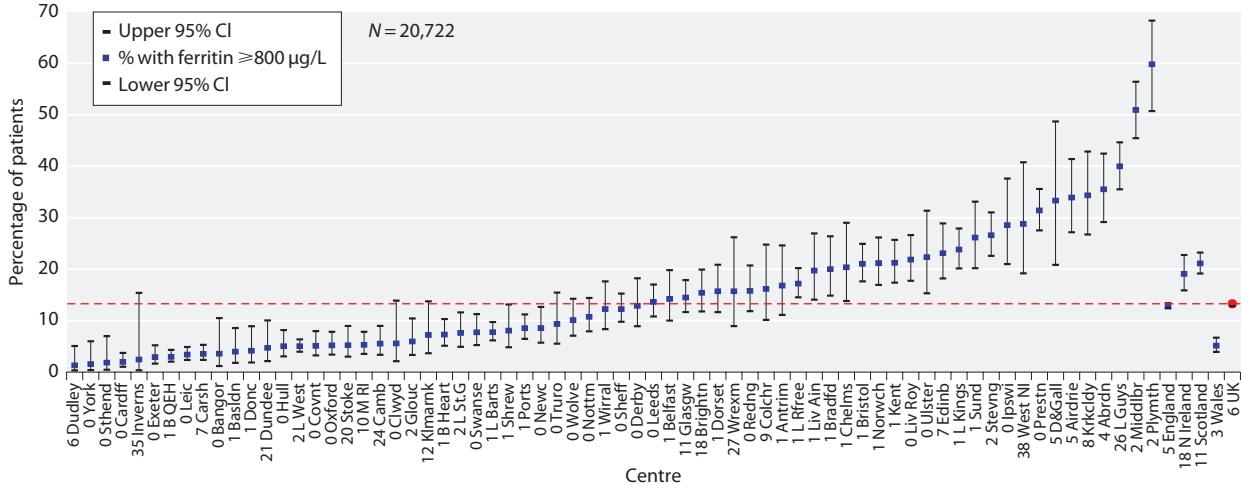

Fig. 7.22. Percentage of HD patients with ferritin ⩾800 µg/L by centre in 2013

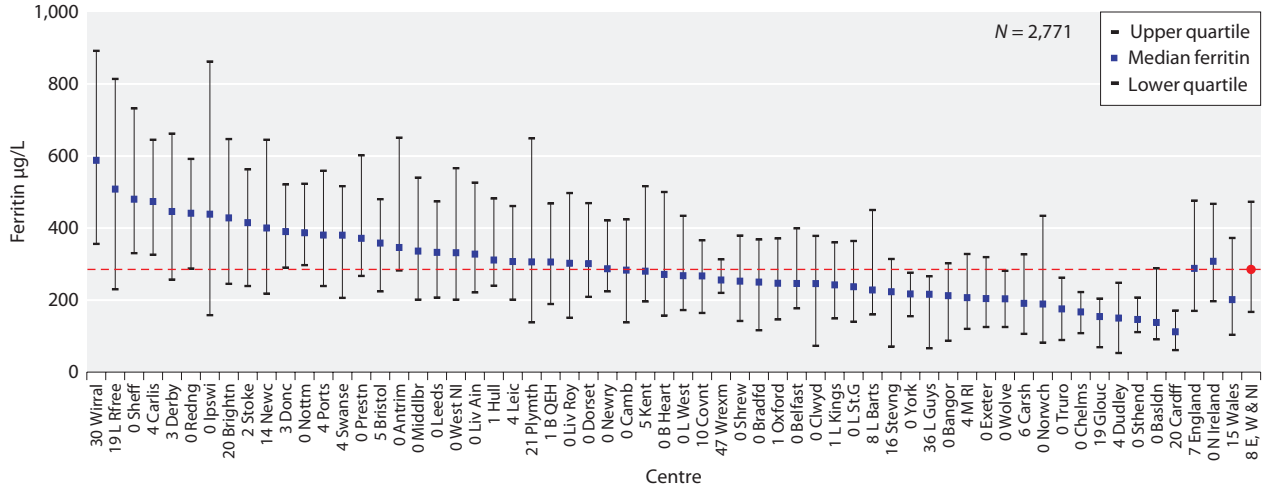

Fig. 7.23. Median ferritin in patients treated with PD by centre in 2013

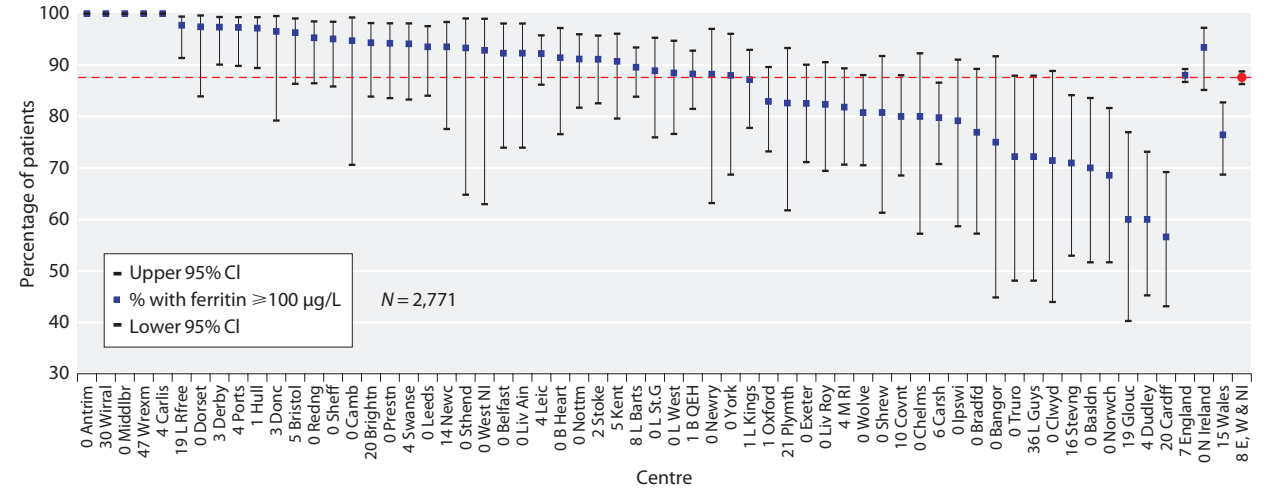

Fig. 7.24. Percentage of PD patients with ferritin ⩾100 µg/L by centre in 2013

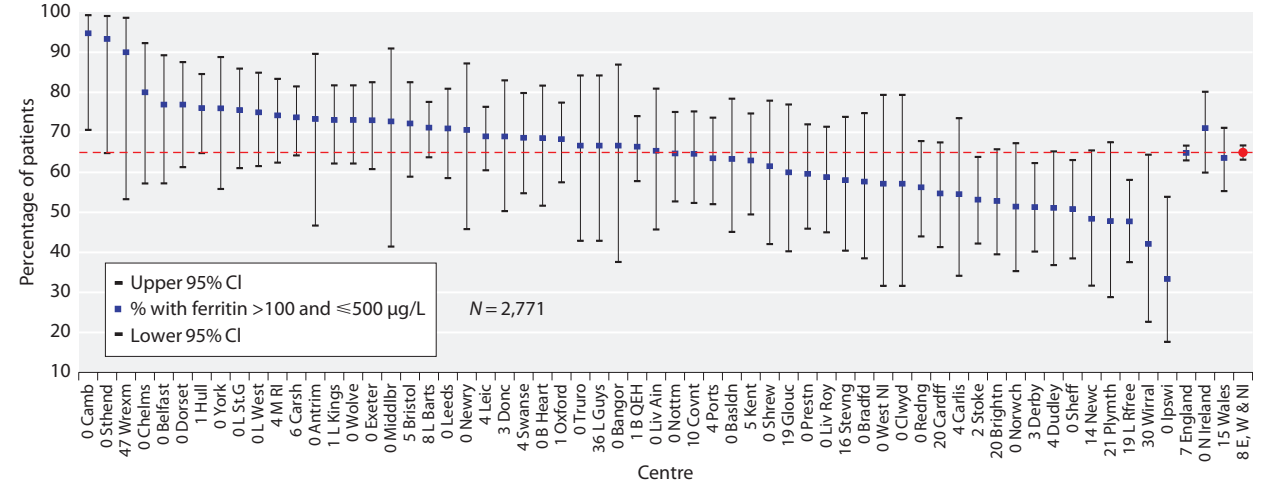

Fig. 7.25. Percentage of PD patients with ferritin >100 µg/L and ⩽500 µg/L by centre in 2013

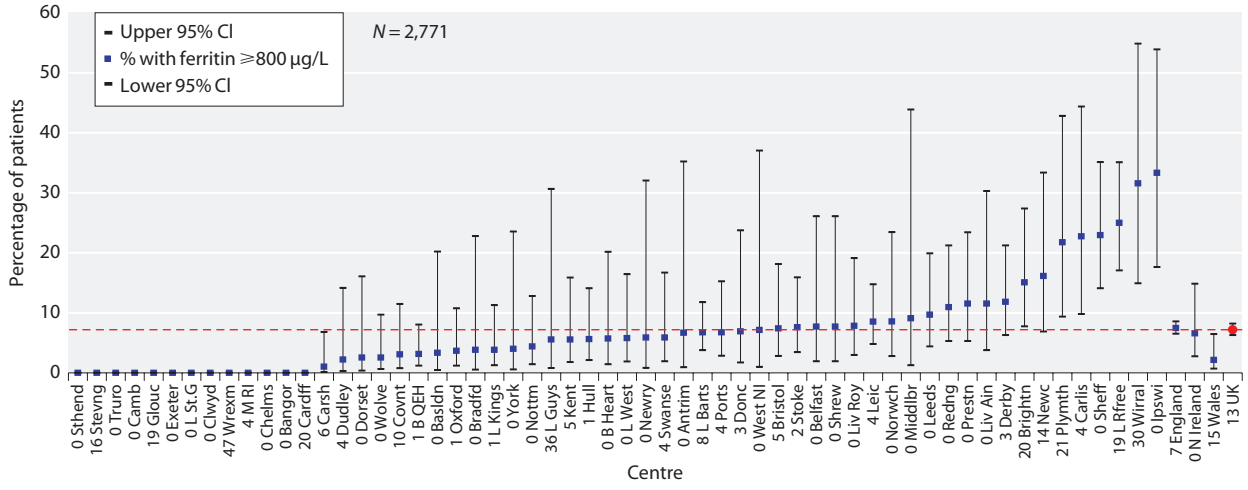

Fig. 7.26. Percentage of PD patients with ferritin ⩾800 µg/L by centre in 2013

The median dose for prevalent HD patients in England, Wales and Northern Ireland was 7,333 IU/week. The median dose varied from 4,000 IU/week (Carlisle) to 14,000 IU/week (Reading) with a median Hb for these centres of 120 g/L (Carlisle) and 115 g/L (Reading) (table 7.4). The 2013 median dose was similar to that for 2012 (7,248 IU/week).

Erythropoietin stimulating agents in prevalent peritoneal dialysis patients

For prevalent PD patients the median dose was substantially lower than for HD patients. The median dose was 4,000 IU/week with a range of 2,000 to 8,000 (table 7.5). The 2013 median dose is similar to that for 2012 (4,250 IU/week).

ESA prescription and association with achieved haemoglobin

For HD patients, centre level median Hb is plotted against median ESA dose in figure 7.27 and compliance with the RA standards for Hb ⩾100 g/L and ⩽120 g/L is plotted against median ESA dose in figure 7.28. For these figures, Hb data was only used for those patients who were receiving an ESA and had dose data available. There was no strong relationship in either figure.

It is known that not all patients treated with dialysis who have a Hb above 120 g/L 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

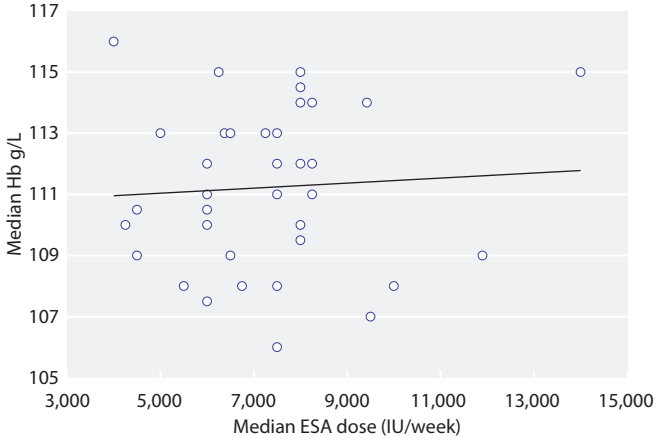

Fig. 7.27. Median Hb versus median ESA dose in HD patients on ESA, by centre in 2013

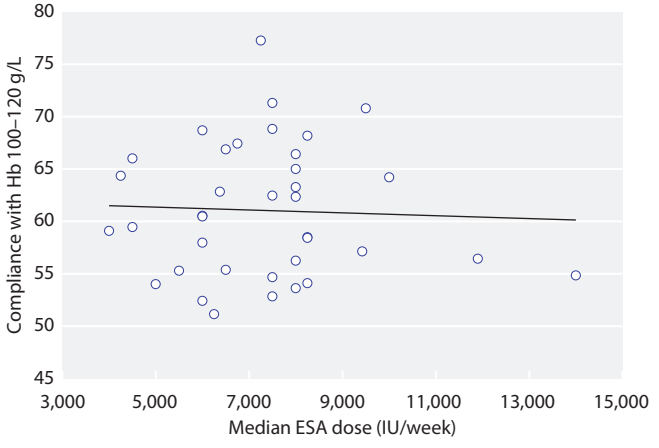

Fig. 7.28. Compliance with Hb 100–120 g/L versus median ESA dose in HD patients on ESA, by centre in 2013

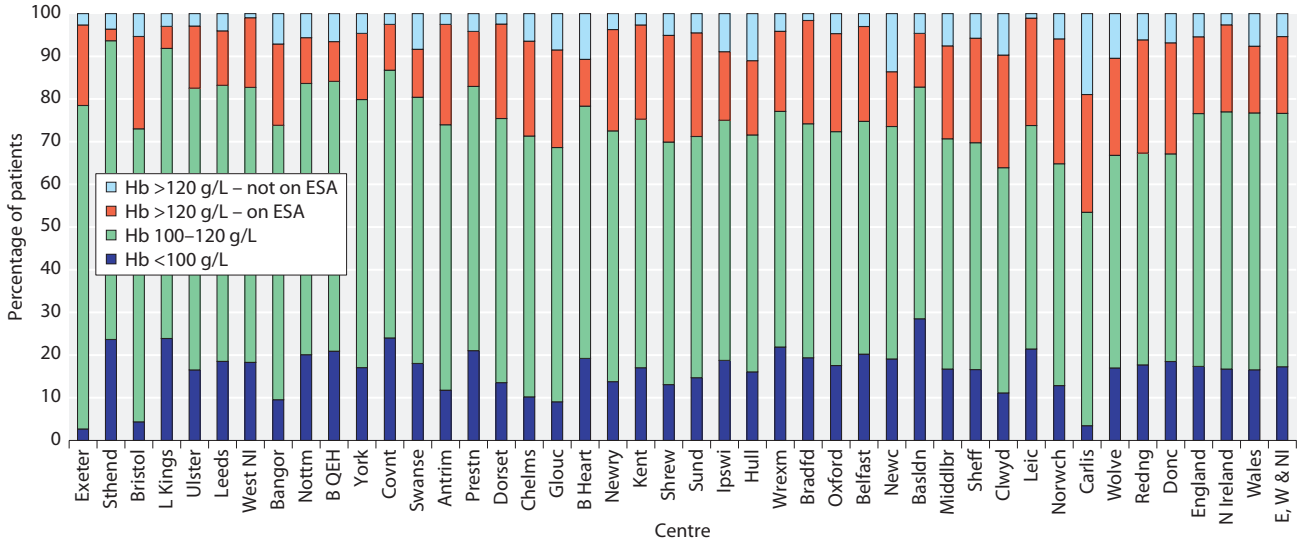

Fig. 7.29. Distribution of haemoglobin in patients treated with HD and the proportion of patients with Hb >120 g/L receiving ESA by centre in 2013

detrimental to achieve a high Hb in renal patients were based only upon patients treated with ESAs [6,7].

Figures 7.29 and 7.30 show the percentages of HD and PD patients in each centre whose Hb lies above, within or below the RA guidelines of 100–120 g/L. These charts also show the proportion of patients with a Hb above the upper limit who were receiving, or were not receiving an ESA. These analyses are restricted to the centres with acceptable ESA returns as stipulated above. These figures show that 23% of HD patients had a Hb >120 g/L. Most of these patients (77%) were on ESAs. Whereas for PD, 28% of patients had a Hb >120 g/L, but only about 47% of these were on ESAs.

ESA prescription: age and modality associations

The proportion of patients on an ESA was higher for HD (88%) than PD (68%) and this difference was present and similar across all age groups (figure 7.31). The

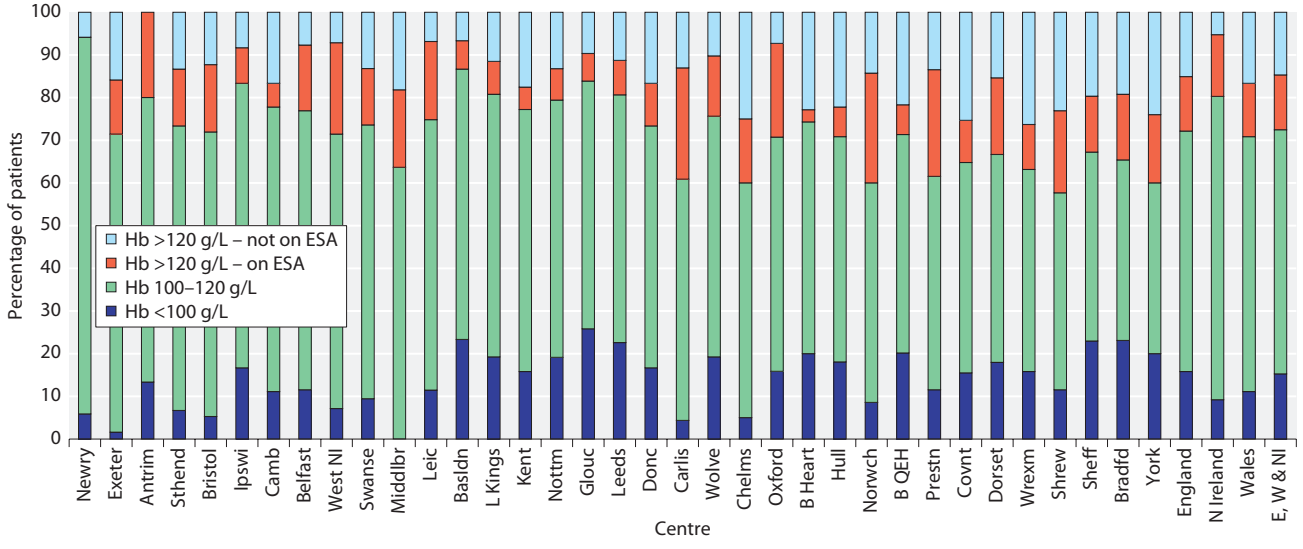

Fig. 7.30. Distribution of haemoglobin in patients treated with PD and the proportion of patients with Hb >120 g/L receiving ESA by centre in 2013

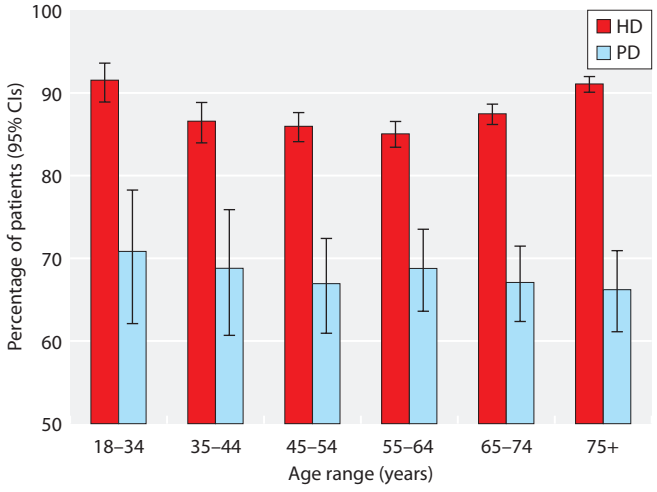

Fig. 7.31. Percentage of dialysis patients on ESA, by age group and treatment modality (2013)

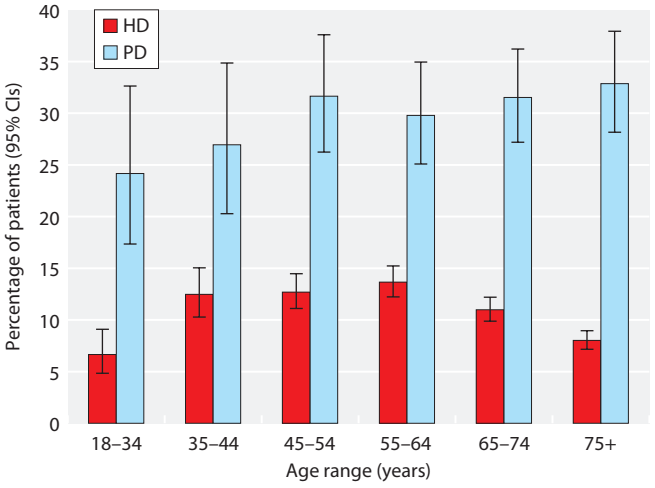

Fig. 7.32. Percentage of whole cohort (2013) who are not on ESA and have Hb ⩾100 g/L, by age group and treatment modality

proportion of patients who had a Hb ⩾100 g/L without requiring ESA (by age group and modality) is shown in figure 7.32.

ESAs and time on renal replacement therapy

The percentage of patients on ESA by time on RRT and dialysis modality is shown in figure 7.33. This is a cross-sectional analysis at the final quarter of 2013. Patients who had previously changed RRT modality were included in this analysis. The proportion of PD patients requiring ESA rises with duration of RRT from 63% 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 were receiving ESA treatment than patients on PD for any given duration on RRT.

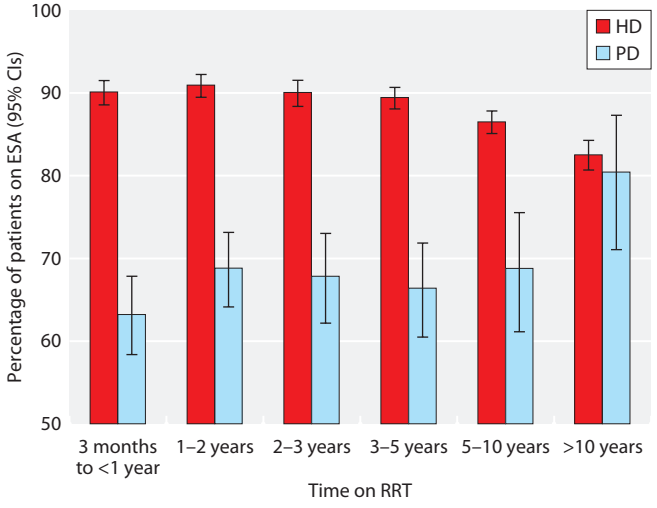

Fig. 7.33. Percentage of patients on ESA by time on RRT (2013)

Resistance to ESA therapy

Figure 7.34 shows the frequency distribution of weekly ESA dose adjusted for weight by treatment modality. Data in the literature on prevalence of ESA resistance in the ERF population is very sparse. 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***

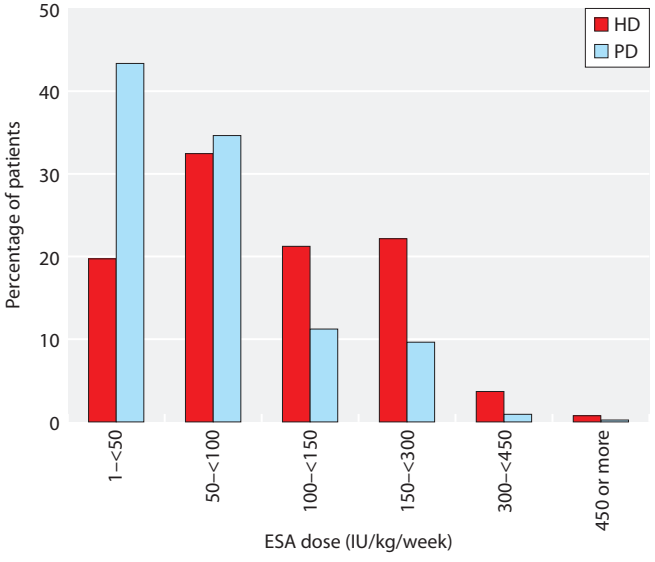

Fig. 7.34. Frequency distribution of mean weekly ESA dose corrected for weight in 2013

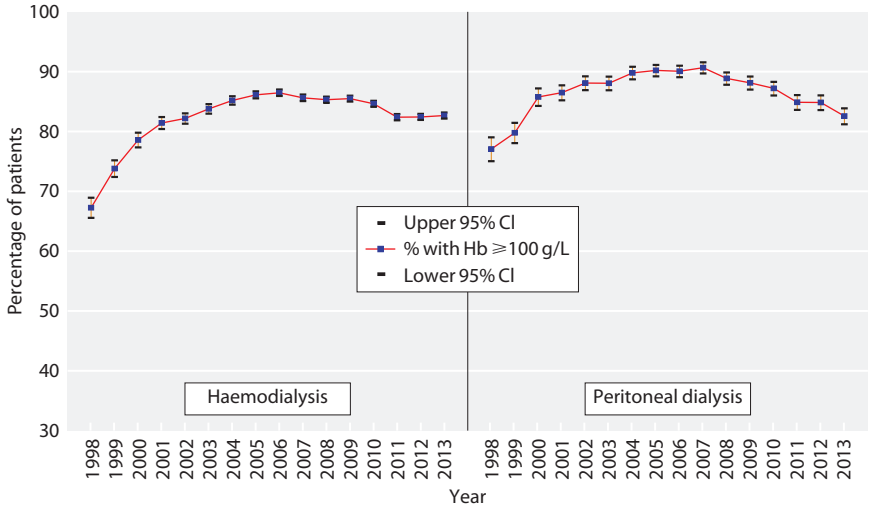

Fig. 7.35. Percentage of prevalent HD and PD patients (1998–2013) with Hb ⩾100 g/L

>1.5 mcg/kg/week'. For the purposes of this analysis the centres were restricted to those with good completeness for weight (over 75%) and ESA dose data (35 centres for HD and 18 centres for PD). As per the above definition and assuming that HD patients largely receive ESA intravenously and PD patients receive ESA subcutaneously, the prevalence of high doses of ESA was 0.7% ($n = 57$) and 1.1% ($n = 5$) for HD and PD patients respectively. For these patients the dose range for HD was 452–795 IU/kg/week and for PD 329–450 IU/kg/week. For patients on HD with high ESA doses, 44% ($n = 25$) had Hb <100 g/L and 39% were within 100–120 g/L. For patients on PD with high ESA doses, 40% ($n = 2$) had Hb <100 g/L and 60% were within 100–120 g/L. The percentage of patients with ESA resistance, defined by those failing to reach Hb ⩾100 g/L are 0.3% for HD and 0.5% for PD. Caution needs to be applied when interpreting these results as the numbers for the above calculations are small.

Success with guideline compliance

Compliance with current minimum standards by year (1998 to 2013) is shown in figure 7.35 for prevalent patients (by treatment modality).

Figure 7.36 shows the percentage of anaemic patients (Hb <100 g/L) receiving an ESA. A minority of patients had a Hb <100 g/L and were not receiving ESA therapy. Across the age groups this was between 3–9% for HD patients and 6–19% for PD patients. There are several potential explanations for this. Treatment with ESA may have been stopped in patients who were unresponsive or avoided in those with malignancy. Others may have been on ESA treatment but not had it recorded.

Table 7.6 shows that the percentage of all patients treated with an ESA and having Hb >120 g/L ranged between 3–29% for HD and between 0–26% for PD. For HD, there was a small percentage of patients having ferritin levels <100 μg/L and being on an ESA (0–10%). The percentages were somewhat higher for PD (0–31%).

Table 7.7 shows the percentage completeness for drug type, dose, 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.

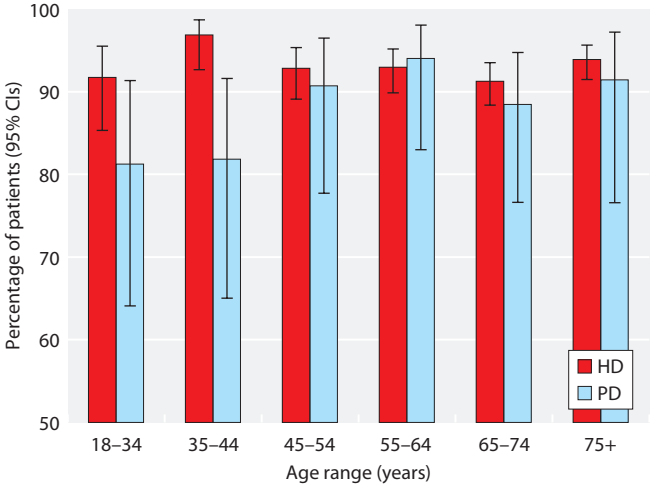

Fig. 7.36. Percentage of patients with Hb <100 g/L who were on ESA, by age group and treatment modality (2013)

Table 7.6. Percentage of patients with serum ferritin levels <100 μg/L and on ESA and percentage of patients with Hb >120 g/L and on ESA by modality

	HD		PD	
Centre	% with Hb >120 g/L and on ESA	% with ferr <100 μg/L and on ESA	% with Hb >120 g/L and on ESA	% with ferr <100 μg/L and on ESA
England				
B Heart	11	1	3	7
B QEH	9	1	7	1
Basldn	13	5	7	13
Bradfd	24	0	15	0
Bristol	22	2	16	0
Camb			6	0
Carlis	28	0	26	0
Chelms	22	1	15	6
Covnt	11	2	10	5
Donc	26	1	10	0
Dorset	22	2	18	3
Exeter	19	10	13	8
Glouc	23	7	6	31
Hull	17	2	7	2
Ipswi	16	1	8	0
Kent	22	3	5	0
L Kings	5	1	8	9
Leeds	13	2	8	2
Leic	25	4	18	3
Middlbr	22	3	18	0
Newc	13	2		
Norwch	29	3	26	21
Nottm	11	0	7	0
Oxford	23	6	22	11
Prestn	13	2	25	6
Redng	27	2		
Sheff	25	1	13	0
Shrew	25	2	19	0
Sthend	3	0	13	0
Sund	24	2		
Wolve	23	2	14	12
York	16	1	16	0
N Ireland				
Antrim	24	0	20	0
Belfast	22	5	15	9
Newry	24	8	0	12
Ulster	15	0		
West NI	16	3	21	9
Wales				
Bangor	19	1		
Clwyd	26	0		
Swanse	11	3	13	0
Wrexm	19	2	11	0
England	**18**	**2**	**13**	**5**
N Ireland	**20**	**2**	**14**	**7**
Wales	**16**	**2**	**13**	**0**
E, W & NI	**18**	**2**	**13**	**5**

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

Table 7.7. Percentage completeness for type, dose, 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	310	100	100	0	0	21	100	100	0	0
B QEH	776	100	100	100	0	76	100	100	100	0
Basldn	138	100	100	100	100	19	100	100	100	100
Bradfd	179	100	99	99	97	16	100	100	100	100
Bristol	439	100	100	0	0	36	100	100	0	0
Camb						10	100	100	0	0
Carlis	44	100	100	0	0	18	100	100	0	0
Chelms	101	100	100	100	100	10	100	100	100	100
Covnt	305	100	98	0	0	36	100	100	0	0
Donc	131	100	100	100	100	24	100	100	100	100
Dorset	231	100	100	97	100	28	100	100	96	100
Exeter	346	100	99	0	0	47	100	100	0	0
Glouc	167	100	0	0	0	25	100	0	0	0
Hull	229	100	100	100	98	35	100	100	100	100
Ipswi	86	100	100	0	0	17	100	100	0	0
Kent	344	100	100	99	100	31	100	100	100	100
L Kings	434	100	100	0	0	57	100	100	0	0
Leeds	406	100	100	100	100	49	100	100	100	98
Leic	806	100	100	0	0	100	100	100	0	0
Middlbr	240	100	100	0	0	7	100	100	0	0
Newc	163	100	100	0	0					
Norwch	277	100	100	98	100	27	100	100	85	96
Nottm	313	100	97	0	0	47	100	60	0	0
Oxford	369	100	100	0	0	65	100	100	0	0
Prestn	462	100	16	0	0	43	100	5	0	0
Redng	217	100	100	0	0					
Sheff	487	100	99	0	0	36	100	100	0	0
Shrew	159	100	100	91	95	16	100	100	94	100
Sthend	104	100	86	0	0	9	100	44	0	0
Sund	161	100	100	0	0					
Wolve	229	100	100	100	100	49	100	100	98	100
York	115	100	100	100	99	16	100	100	100	100
N Ireland										
Antrim	114	100	100	100	100	12	100	100	100	100
Belfast	183	100	100	99	100	23	100	100	100	100
Newry	77	100	100	99	100	15	100	100	80	100
Ulster	99	100	100	100	100					
West NI	101	100	100	98	100	11	100	100	100	100
Wales										
Bangor	66	100	100	0	0					
Clwyd	62	100	18	98	100					
Swanse	266	100	100	100	99	39	100	100	100	100
Wrexm	85	100	100	98	100	11	100	100	82	100
England	**8,768**	**100**	**93**	**37**	**29**	**976**	**100**	**91**	**40**	**33**
N Ireland	**574**	**100**	**100**	**99**	**100**	**65**	**100**	**100**	**95**	**100**
Wales	**479**	**100**	**89**	**85**	**86**	**50**	**100**	**100**	**96**	**100**
E, W & NI	**9,821**	**100**	**93**	**43**	**36**	**1,091**	**100**	**92**	**46**	**40**

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

Conclusions

Renal centres strive to meet the Renal Association standards in order to prevent adverse outcomes associated with low Hb such as impaired quality of life, increased hospitalisation, increased cardiovascular events and increased cardiovascular and all-cause mortality.

Haemoglobin outcomes for patients on HD and PD were largely compliant with the RA minimum standard of Hb $\geqslant$100 g/L (both 83%). As would be anticipated, a greater proportion of prevalent patients (83%) than incident patients (50%) had a Hb $\geqslant$100 g/L in 2013. The median Hb of patients on HD was 112 g/L with an IQR of 103–120 g/L, and the median Hb of patients on PD was 113 g/L with an IQR of 103–122 g/L.

Compliance with advice regarding iron stores as reflected by ferritin remained stable with 95% of HD patients and 88% 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, 88% of HD patients and 68% of PD patients were on ESA treatment. The percentage of patients treated with an ESA and having Hb $>$120 g/L ranged between centres from 3–29% for HD and from 0–26% for PD. There was a small percentage of patients with ferritin levels $<$100 μg/L and receiving an ESA. There was substantial variation between centres in the average dose of ESA prescribed. Attainment of Hb targets correlated poorly with median ferritin and ESA usage.

The prevalence of ESA resistance was 0.3% and 0.5% for HD and PD patients respectively.

Conflicts of interest: none

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