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UK Renal Registry 18th Annual Report: Chapter 8 Haemoglobin, Ferritin and Erythropoietin amongst UK Adult Dialysis Patients in 2014: 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 2014:

- The median haemoglobin (Hb) of patients at the time of starting dialysis was 100 g/L with 50% of patients having a Hb ⩾100 g/L.
- The median Hb in patients starting haemodialysis (HD) was 97 g/L (IQR 87–106) and in patients starting peritoneal dialysis (PD) was 108 g/L (IQR 100–117).
- At start of dialysis, 54% of patients presenting early had Hb ⩾100 g/L whilst only 33% of patients presenting late had Hb ⩾100 g/L.
- The median Hb of prevalent patients on HD was 111 g/L with an IQR of 103–120 g/L.
- The median Hb of prevalent patients on PD was 112 g/L with an IQR of 103–121 g/L.
- 81% of HD patients and 83% of PD patients had Hb ⩾100 g/L.
- 58% of HD patients and 56% of PD patients had Hb ⩾100 and ⩽120 g/L.
- The median ferritin in HD patients was 432 μg/L (IQR 274–631) and 95% of HD patients had a ferritin ⩾100 μg/L.
- The median ferritin in PD patients was 292 μg/L (IQR 168–479) with 88% of PD patients having a ferritin ⩾100 μg/L.

In England, Wales and Northern Ireland in 2014:

- The median erythropoietin stimulating agent (ESA) dose was higher for HD than PD patients (7,333 vs. 4,148 IU/week).

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Introduction

Anaemia is a common feature of Chronic Kidney Disease (CKD) and when untreated is strongly associated with poor outcomes, resulting in increased hospitalisations and mortality. This chapter describes analyses of the UK Renal Registry (UKRR) data relating to the management of anaemia in dialysis patients during 2014.

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 National Institute of Clinical Excellence (NICE) systematic review which concluded that treating to a target haemoglobin (Hb) 110–120 g/L is cost effective in HD patients [5]. The NICE guidance was updated in June 2015 [6] but this will not have influenced the data reported in this chapter from 2014.

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 8.1 lists the audit measures from these guidelines along with reasons for the exclusion of some of the measures.

The Proactive IV irOn Therapy in haemodiALysis patients (PIVOTAL) trial is a randomised control trial that has been recruiting in the UK since November 2013 in 40 renal centres (target 2,000 participants) to test the efficacy and safety of high-dose IV iron supplementation in incident haemodialysis patients. This is unlikely to have had a large impact on the centre level data presented in this chapter [7].

Methods

Most of the analyses in this chapter use the incident or prevalent renal replacement therapy (RRT) cohorts for 2014.

Table 8.1. Summary of recommended Renal Association audit measures relevant to anaemia management

RA audit measure	Included in UKRR annual report?	Reason for exclusion
1. Proportion of CKD patients with eGFR <30 ml/min by 4 variable MDRD method with an annual Hb level	No	Data not available for the period covered by this report
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	Data not available for the period covered by this report
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	Data not available for the period covered by this report/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

Some analyses use data from earlier years. 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.

The UKRR extracted quarterly data electronically from renal centres in England, Wales and Northern Ireland (E,W&NI) taking the latest available result from each quarter.

Data from Scotland were provided by the Scottish Renal Registry (SRR). For Q2 and Q4 the data provided were from May and November respectively due to the SRR's bi-annual census. For Q1 and Q3 the earliest available results in the quarter were provided. Data was provided for patients on treatment on 1st February, 1st May, 1st August and 1st November respectively for the four quarters. Therefore, for people who started treatment in the later part of each quarter, data was not available for the quarter of start. So, in order to improve completeness for the analysis of incident patients (see below), the cohort used for Scotland was patients starting treatment between 2nd November 2013 and 1st November 2014 inclusive and the definition of quarters was adjusted (e.g. for patients starting treatment from 2nd August 2014 up to 1st November 2014 the Hb data from Q4 was used).

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. 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 these analyses only centres with at least 75% completeness of presentation time data were included.

For the analyses of prevalent dialysis patients those patients receiving dialysis on 31st December 2014 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 was used for Hb and from the last three quarters for ferritin.

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 and 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 were significantly different from the average. Longitudinal analyses were performed to show overall changes in achievement of standards over time.

Erythropoietin data from the last quarter of 2014 were used to define which patients were receiving ESAs. Scotland was excluded from this analysis as data about ESAs 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 three 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 8.2. Results are not shown for London Guys as no Hb data was available. The median Hb of patients at the time of starting dialysis in the UK was 100 g/L. The median Hb when starting dialysis is shown in figure 8.1. The percentage of patients having a Hb $\geqslant$100 g/L was again 50% after falling over the previous years from the 55% seen for the 2009 cohort. The percentage starting with a Hb $\geqslant$100 g/L by centre is given in figure 8.2.

The variation between centres in the proportion of patients starting dialysis with Hb $\geqslant$100 g/L remained high (27–89%). Using the centres that had provided the date of first presentation with good completeness, the

Table 8.2. Haemoglobin data for incident patients starting RRT on haemodialysis or peritoneal dialysis during 2014, both overall and by presentation time

	All incident dialysis patients				Early presenters (⩾90 days)		Late presenters (<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	87	95	34	94	31		
B QEH	97	194	100	51	101	55	93	35
Basldn	98	41	91	37	93	40		
Bradfd	99	70	95	39	95	38	96	
Brightn	98	129	102	57	104	63	96	40
Bristol	100	119	103	74	103	73	102	70
Camb	84	76	101	53				
Carlis	100	34	109	68	111	79		
Carsh	100	225	100	50				
Chelms	98	44	109	84	109	86		
Colchr	52	17	97	29				
Covnt	98	102	99	46	99	48	90	17
Derby	100	69	103	59	104	63	95	43
Donc	98	50	98	46	101	52		
Dorset	99	72	100	53	101	57		
Dudley	97	38	100	53	102	59		
Exeter	98	126	106	89	106	90		
Glouc	100	49	105	61				
Hull	71	61	101	57				
Ipswi	79	26	95	42	101	53		
Kent	100	138	100	50	101	53	88	32
L Barts	99	274	98	47				
L Guys	0	0						
L Kings	100	139	96	38	97	42	92	21
L Rfree	100	185	100	54	104	59	92	34
L St.G	99	81	97	42				
L West	59	179	103	61	103	61		
Leeds	96	114	93	32	95	36	88	18
Leic	100	206	95	41	97	45	91	24
Liv Ain	100	55	100	51	103	55		
Liv Roy	100	97	100	54	101	59	91	31
M RI	100	140	98	46				
Middlbr	100	80	95	44	99	50	93	24
Newc	98	90	101	52	101	55	96	36
Norwch	99	71	94	44				
Nottm	99	82	98	45	101	51		
Oxford	100	157	95	39	98	44	90	21
Plymth	100	42	101	55				
Ports	100	195	101	53				
Prestn	99	136	96	41	96	42	96	36
Redng	100	92	102	55	108	63	92	35
Salford	98	128	98	48				
Sheff	100	128	96	43	97	46	85	9
Shrew	98	60	104	60	105	65	101	50
Stevng	99	135	98	45	97	44	100	50
Sthend	100	27	98	41	101	59	93	10
Stoke	95	88	102	57	102	61	97	41
Sund	95	54	97	46	96	44	100	54
Truro	100	33	102	61	101	60		
Wirral	85	34	101	53	102	61		
Wolve	90	63	97	44	98	46		
York	82	40	100	50				

Table 8.2. Continued

Centre	All incident dialysis patients				Early presenters (⩾90 days)		Late presenters (<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	97	30	91	27	91	30		
Belfast	95	40	98	48	100	53		
Newry	100	17	108	65	109	69		
Ulster	95	18	102	61	103	69		
West NI	100	34	98	50	102	57		
Scotland								
Abrdn	94	51	98	43				
Airdrie	94	49	98	37				
D & Gall	100	17	108	71				
Dundee	98	44	102	61				
Edinb	99	68	103	51				
Glasgw	99	133	100	51				
Inverns	95	21	102	62				
Klmarnk	94	31	95	42				
Krkcldy	97	30	103	57				
Wales								
Bangor	91	20	107	65	107	65		
Cardff	100	143	102	59	102	60	96	46
Clwyd	80	20	97	35				
Swanse	100	96	99	45	101	51	92	27
Wrexm	98	39	99	49	100	52		
England	**93**	**4,972**	**100**	**50**	**101**	**54**	**94**	**34**
N Ireland	**97**	**139**	**97**	**47**	**100**	**54**	**87**	**8**
Scotland	**97**	**444**	**100**	**51**				
Wales	**98**	**318**	**100**	**52**	**102**	**57**	**95**	**34**
UK	**94**	**5,873**	**100**	**50**	**101**	**54**	**94**	**33**

Blank cells: centres excluded from analyses due to poor data completeness or low patient numbers
Presentation time data has not been collected from the Scottish Renal Registry
For Scottish centres the cohort is patients starting RRT on dialysis between 2/11/2013 and 1/11/2014 inclusive

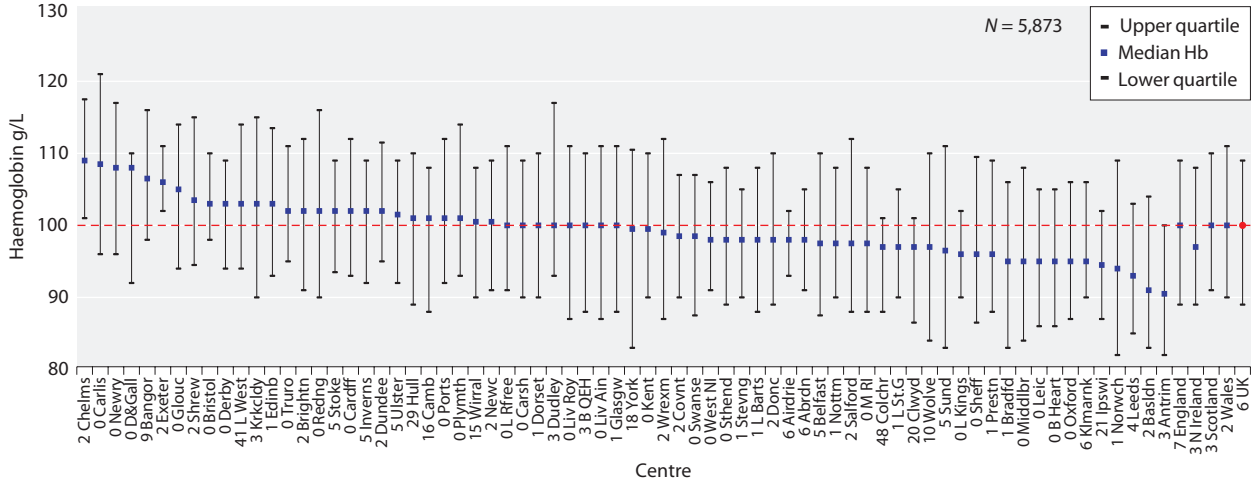

Fig. 8.1. Median haemoglobin for incident dialysis patients at start of dialysis treatment in 2014

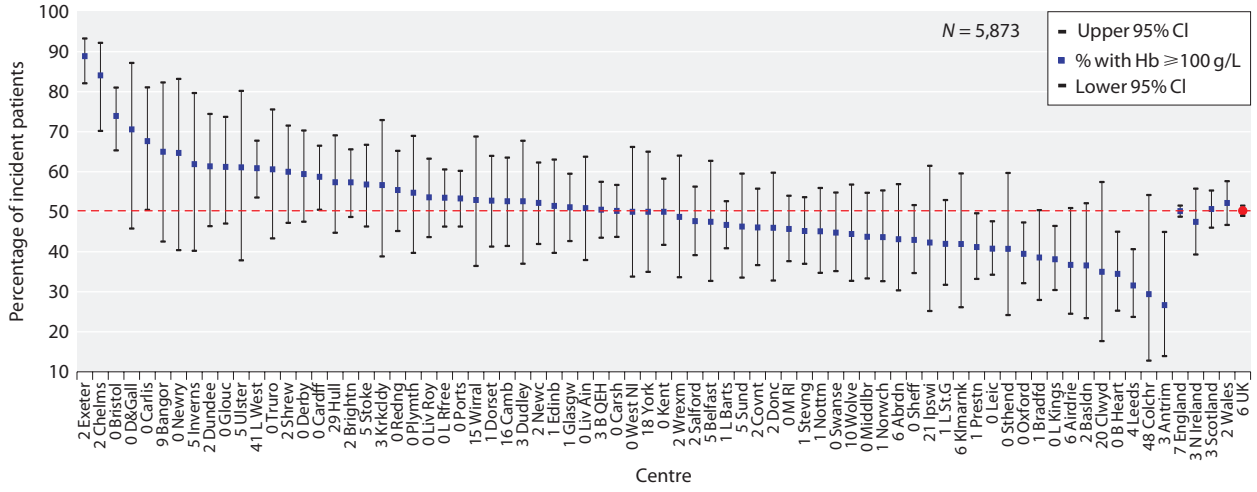

Fig. 8.2. Percentage of incident dialysis patients with Hb ⩾100 g/L at start of dialysis treatment in 2014

median Hb in the late presenters was 94 g/L with only 33% of patients having a Hb ⩾100 g/L compared with a median Hb of 101 g/L and 54% of patients having a Hb ⩾100 g/L in the early presenters. In both groups there was large variation between centres in the percentage of patients having a Hb ⩾100 g/L (9–70% in the late presenters and 30–90% in the early presenters).

Median Hb of patients at the time of starting HD was 97 g/L (IQR 87–106 g/L) and in those starting PD it was 108 g/L (IQR 100–117 g/L). When starting dialysis, 43% of HD patients had a Hb ⩾100 g/L, compared with 75% of PD patients.

Incident dialysis patients from 2013 were followed for one year and the median haemoglobin (and percentage with a Hb ⩾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 8.3, 8.4). Hb was higher in the second quarter on dialysis than during the quarter at start of dialysis reflecting the benefits of treatment administered. Over 75% of incident patients surviving to a year had Hb ⩾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 8.5. Since 2005, the proportion of incident dialysis patients with Hb ⩾120 g/L has fallen from 16% to 9%. The proportion of patients with Hb <100 g/L at the time of starting dialysis has increased from 43% in 2005 to 50% in 2014. In the 2014 cohort whose date of presentation was available, 67% of patients in the late presentation group had Hb <100 g/L compared with 46% in the early presentation group.

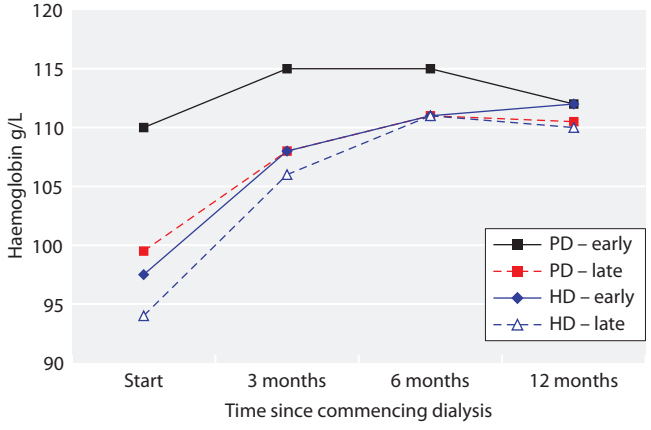

Fig. 8.3. Median haemoglobin, by time on dialysis and length of pre-RRT care, for incident dialysis patients in 2013

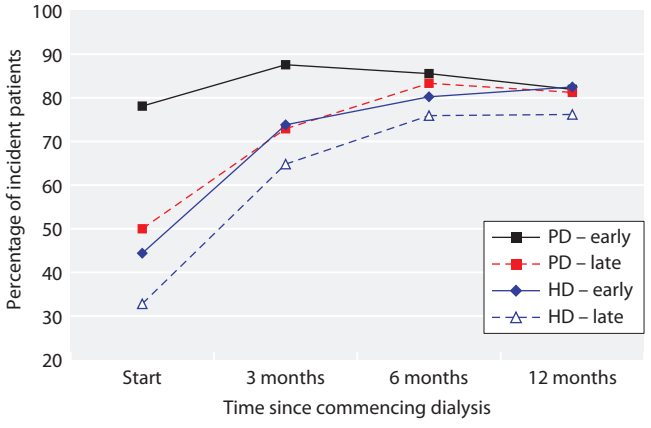

Fig. 8.4. Percentage of incident dialysis patients in 2013 with Hb ⩾100 g/L, by time on dialysis and by length of pre-RRT care

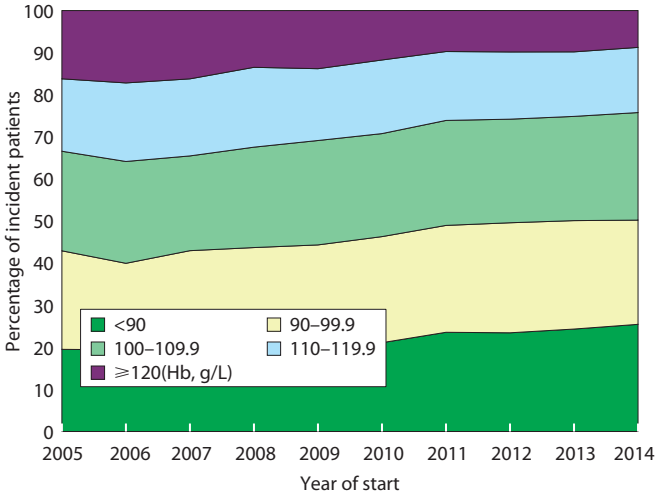

Fig. 8.5. Distribution of haemoglobin in incident dialysis patients by year of start

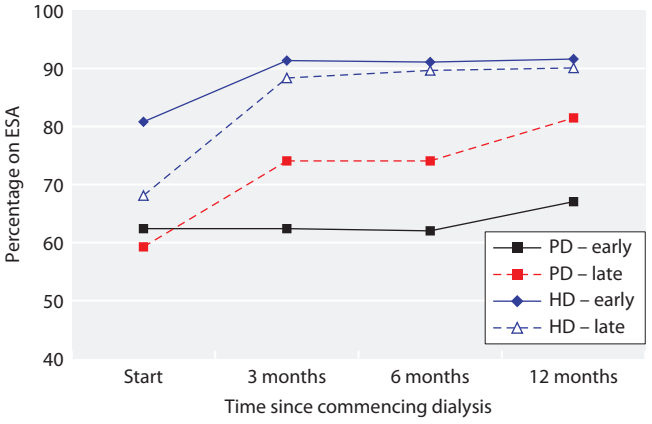

Fig. 8.6. Percentage of incident dialysis patients in 2013 on ESA, by time on dialysis and by length of pre-RRT care

ESA by time on dialysis in early vs. late presenters

Incident dialysis patients from 2013 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 (figure 8.6). 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. For PD patients there was little difference between the early and late groups at start but there was a difference at the later time points. However, caution is advised when interpreting this as the number (27) of patients in the PD late presenter group was small.

Anaemia management in prevalent dialysis patients

Compliance with data returns for Hb and serum ferritin are shown for the 71 renal centres in the UK in table 8.3 for HD and PD patients. Completeness of data

Table 8.3. Percentage completeness of data returns for haemoglobin and serum ferritin and percentages on ESA for prevalent HD and PD patients in 2014

	HD				PD			
Centre	*N*	Hb	Ferritin	% on ESA	*N*	Hb	Ferritin	% on ESA
England								
B Heart	398	100	99	76	32	100	97	47
B QEH	893	99	99	85	117	100	100	60
Basldn	157	99	100	90	26	96	100	69
Bradfd	196	100	100	95	16	100	94	81
Brightn	398	99	99	0	55	100	93	0
Bristol	495	100	99	90	55	100	100	67
Camb	360	88	80	0	31	90	84	0
Carlis	60	100	3	67	24	100	54	88
Carsh	727	95	94	0	120	93	92	0
Chelms	127	99	100	94	19	95	95	47
Colchr	111	95	92	12				
Covnt	330	100	99	87	85	95	92	68
Derby	220	100	100	0	71	100	99	0
Donc	166	100	98	86	24	100	100	71
Dorset	264	100	98	95	46	100	98	83
Dudley	160	99	98	3	50	98	88	2
Exeter	383	100	100	93	83	100	99	77
Glouc	204	100	98	91	39	97	87	72
Hull	302	100	100	74	67	97	97	49
Ipswi	115	99	98	56	30	100	97	33
Kent	374	100	100	93	58	100	100	50
L Barts	905	100	100	0	199	99	91	0

Table 8.3. Continued

	HD				PD			
Centre	*N*	Hb	Ferritin	% on ESA	*N*	Hb	Ferritin	% on ESA
L Guys	615	0	67	14	26	0	65	0
L Kings	504	100	100	92	79	100	100	66
L Rfree	664	100	100	0	125	98	99	0
L St.G	284	100	99	0	45	100	98	0
L West	1,312	95	97	0	57	86	89	0
Leeds	471	100	100	91	49	100	100	82
Leic	837	100	100	98	108	100	98	83
Liv Ain	150	100	100	0	35	100	100	0
Liv Roy	343	100	100	0	49	98	100	0
M RI	473	93	84	0	61	100	98	0
Middlbr	305	100	98	75	13	100	100	69
Newc	266	100	100	67	44	93	91	0
Norwch	309	100	100	89	30	100	100	70
Nottm	341	100	100	87	72	100	100	71
Oxford	415	100	100	94	76	100	97	80
Plymth	129	100	99	0	33	100	79	0
Ports	560	100	99	8	66	98	100	3
Prestn	521	100	96	83	46	100	100	76
Redng	265	100	99	87	62	100	97	2
Salford	382	100	1	67	72	94	0	13
Sheff	555	100	100	88	52	100	100	48
Shrew	174	100	99	90	26	100	96	62
Stevng	447	100	99	0	26	100	96	0
Sthend	110	100	100	93	16	100	100	69
Stoke	308	86	98	1	72	100	100	0
Sund	200	100	100	90	14	100	100	57
Truro	136	100	99	0	18	100	100	0
Wirral	189	99	98	0	20	80	80	0
Wolve	287	100	100	82	72	99	99	65
York	124	100	100	90	21	100	100	57
N Ireland								
Antrim	111	99	100	92	13	100	100	85
Belfast	189	100	99	94	15	100	100	73
Newry	86	97	37	90	14	100	100	86
Ulster	94	100	100	97	4	100	100	100
West NI	99	100	100	95	11	100	100	91
Scotland								
Abrdn	194	100	100		26	100	96	
Airdrie	177	100	100		7	100	100	
D & Gall	46	98	98		14	100	93	
Dundee	165	99	98		21	100	100	
Edinb	259	100	99		19	100	84	
Glasgw	540	100	99		36	100	100	
Inverns	67	100	85		11	100	100	
Klmarnk	132	100	100		35	100	100	
Krkcldy	140	100	98		14	100	0	
Wales								
Bangor	78	100	100	69	15	100	100	40
Cardff	458	100	100	40	72	100	69	14
Clwyd	83	100	100	7	11	91	91	18
Swanse	322	100	100	84	50	98	98	56
Wrexm	102	100	100	30	23	100	100	9
England	**19,021**	**95**	**95**		**2,732**	**97**	**93**	
N Ireland	**579**	**99**	**91**		**57**	**100**	**100**	
Scotland	**1,720**	**100**	**99**		**183**	**100**	**90**	
Wales	**1,043**	**100**	**100**		**171**	**99**	**86**	
UK	**22,363**	**96**	**95**		**3,143**	**98**	**93**	

Blank cells: centres with no PD patients or because data was not available
All 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. Therefore, country averages are not shown – these can be found in tables 8.4 and 8.5

returns was generally good for Hb and ferritin. For Hb, data were not available from London Guys. For ferritin, results are not given in later tables and figures for Carlisle (HD), Kirkcaldy (PD), Newry (HD) and Salford (HD & PD) because completeness was below 50%. Percentages on ESA are also shown in table 8.3. These are as they appear in the data received by the UKRR. For some centres, there were no data and for others the proportion of patients reported to be on ESA was very low. For the latter centres it is presumed that there were either problems with data entry and/or data transfer. Centres have been excluded from analyses of ESA use if fewer than 60% of HD patients or 45% of PD patients were reported to be receiving ESA.

Summary statistics for haemoglobin, serum ferritin and ESA are shown for the 71 renal centres in the UK in table 8.4 for HD and table 8.5 for PD patients.

Haemoglobin in prevalent haemodialysis patients

The median Hb of patients on HD in the UK was 111 g/L (IQR 103–120 g/L) and 81% of HD patients had a Hb $\geqslant$100 g/L (table 8.4). The median Hb by centre is shown in figure 8.7. Figure 8.8 shows compliance with the target range of Hb $\geqslant$100 and $\leqslant$120 g/L. The UK average (58%) was similar to that for 2013 (59%) after rising for several years (53% in 2010, 56% in 2011, 57% in 2012). 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 8.9.

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 8.10 and 8.11 respectively. Many centres complied well with respect to both the minimum and target range Hb standards. Some centres complied well

Table 8.4. Summary statistics for haemoglobin, serum ferritin and ESA for prevalent HD patients in 2014

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	398	110	83	66	374	97	59	76	6,667	22
B QEH	887	109	77	61	425	96	55	85	6,250	13
Basldn	156	108	71	51	334	94	73	90	6,500	8
Bradfd	196	113	86	58	454	97	54	95	7,000	4
Brightn	395	109	78	60	581	98	30			
Bristol	495	111	95	71	577	97	31	90	7,250	9
Camb	318	113	79	55	309	93	56			
Carlis	60	117	88	52				67	4,833	33
Carsh	691	110	82	66	347	95	67			
Chelms	126	118	90	47	607	98	16	94	10,000	6
Colchr	105	112	87	60	575	99	32			
Covnt	329	107	72	63	384	97	62	87	8,750	10
Derby	220	115	87	56	455	95	45			
Donc	166	110	75	55	435	99	55	86	6,875	13
Dorset	264	115	90	60	462	99	52	95	8,000	4
Dudley	159	110	80	65	334	92	66			
Exeter	383	112	97	77	286	92	55	93	7,333	7
Glouc	204	114	90	58	387	93	50	91		9
Hull	301	111	77	56	387	97	64	74	5,000	20
Ipswi	114	109	78	59	575	96	32			
Kent	374	109	79	56	474	93	36	93	7,750	6
L Barts	904	109	79	63	497	95	38			
L Guys	0				560	95	31			
L Kings	504	108	74	63	488	93	40	92	7,500	8
L Rfree	664	112	82	60	567	95	29			
L St.G	284	111	80	55	407	95	55			
L West	1,247	114	89	63	336	95	65			
Leeds	471	109	78	56	495	93	37	91	4,500	8
Leic	836	113	80	53	336	93	62	98	6,000	2

Table 8.4. 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	150	110	78	57	618	94	23			
Liv Roy	343	112	78	51	382	88	39			
M RI	438	113	82	52	360	93	53			
Middlbr	304	111	79	54	935	98	16	75	4,000	20
Newc	266	114	85	58	436	91	38	67	11,866	29
Norwch	309	113	84	55	496	97	38	89	9,000	10
Nottm	341	110	80	69	497	96	45	87	7,000	13
Oxford	415	110	75	49	266	91	46	94	10,000	5
Plymth	129	113	83	55	808	97	15			
Ports	559	115	84	50	493	95	40			
Prestn	521	111	82	58	619	94	27	83		14
Redng	265	116	82	44	520	99	44	87	12,653	9
Salford	381	110	73	49				67	7,500	24
Sheff	555	111	77	51	490	97	44	88	7,875	9
Shrew	174	113	88	56	380	96	61	90	8,000	9
Stevng	447	111	79	59	673	98	22			
Sthend	110	107	76	68	331	99	83	93	10,000	7
Stoke	265	114	83	55	314	94	54			
Sund	200	115	80	50	437	93	35	90	9,039	10
Truro	136	111	83	66	462	96	51			
Wirral	187	110	83	63	440	96	53			
Wolve	286	116	84	48	485	92	38	82	7,333	17
York	124	108	76	57	431	98	62	90	4,000	10
N Ireland										
Antrim	110	114	83	53	518	98	40	92	6,250	7
Belfast	189	114	86	57	416	93	38	94	8,000	6
Newry	83	105	75	64				90	4,750	10
Ulster	94	111	82	57	691	100	16	97	5,000	3
West NI	99	112	82	69	542	96	36	95	7,500	5
Scotland										
Abrdn	194	108	75	59	593	97	33			
Airdrie	177	112	85	59	644	98	29			
D & Gall	45	115	91	73	772	98	20			
Dundee	164	112	85	62	326	90	50			
Edinb	258	116	87	48	447	89	30			
Glasgw	540	111	78	53	427	93	40			
Inverns	67	112	82	60	345	88	58			
Klmarnk	132	108	74	55	307	83	39			
Krkcldy	140	113	82	58	291	85	34			
Wales										
Bangor	78	114	90	62	320	97	54	69		28
Cardff	458	111	77	54	275	92	58			
Clwyd	83	112	83	57	361	100	70			
Swanse	322	110	80	65	333	88	47	84	8,125	16
Wrexm	102	114	89	65	513	99	39			
England	**18,156**	**111**	**82**	**58**	**436**	**95**	**46**	**87**	**7,400**	**11**
N Ireland	**575**	**112**	**82**	**59**	**543**	**96**	**33**	**93**	**6,000**	**6**
Scotland	**1,717**	**112**	**81**	**56**	**435**	**92**	**37**			
Wales	**1,043**	**111**	**81**	**59**	**308**	**92**	**53**	**81**	**8,125**	**18**
UK	**21,491**	**111**	**81**	**58**	**432**	**95**	**45**	**87***	**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 8.5. Summary statistics for haemoglobin, serum ferritin and ESA for prevalent PD patients in 2014

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	32	116	97	66	272	84	74	47	6,000	53
B QEH	117	111	82	58	352	91	68	60	4,000	39
Basldn	25	107	68	52	156	73	58	69	4,125	24
Bradfd	16	114	88	56	289	80	67	81	6,747	19
Brightn	55	111	80	55	381	94	51			
Bristol	55	112	91	64	315	95	67	67	6,000	31
Camb	28	115	86	61	239	88	65			
Carlis	24	114	96	71	238	92	92	88	4,000	13
Carsh	111	108	74	56	184	84	78			
Chelms	18	117	94	78	176	78	78	47		50
Colchr	n/a									
Covnt	81	112	78	54	283	85	60	68	8,000	28
Derby	71	111	82	56	410	97	63			
Donc	24	117	83	46	427	100	75	71	5,000	29
Dorset	46	111	85	61	322	98	82	83	4,000	17
Dudley	49	112	90	61	109	57	50			
Exeter	83	113	99	70	218	88	76	77	4,000	23
Glouc	38	108	76	53	160	76	74	72		24
Hull	65	111	83	60	376	97	74	49	4,000	45
Ipswi	30	112	77	43	346	90	55			
Kent	58	111	90	72	280	88	71	50	4,000	47
L Barts	197	113	82	51	264	88	60			
L Guys	0				198	82	65			
L Kings	79	110	77	56	217	94	84	66	4,583	32
L Rfree	123	107	72	48	607	94	32			
L St.G	45	113	87	62	291	95	86			
L West	49	115	92	67	234	94	84			
Leeds	49	109	78	59	324	96	69	82	5,200	18
Leic	108	110	77	56	301	92	73	83	3,675	17
Liv Ain	35	115	77	46	361	89	51			
Liv Roy	48	117	88	46	313	88	69			
M RI	61	114	84	51	219	83	73			
Middlbr	13	112	92	85	329	100	69	69		31
Newc	41	114	76	61	440	93	53			
Norwch	30	116	87	57	244	83	53	70	5,000	27
Nottm	72	109	69	54	433	97	65	71		26
Oxford	76	113	83	62	275	93	84	80	8,000	20
Plymth	33	119	91	52	412	96	54			
Ports	65	116	88	46	433	100	65			
Prestn	46	112	89	65	334	91	54	76		22
Redng	62	117	89	48	388	93	50			
Salford	68	117	91	57						
Sheff	52	117	88	52	378	90	52	48	6,000	52
Shrew	26	113	85	46	225	64	48	62	5,500	38
Stevng	26	113	88	62	309	84	72			
Sthend	16	113	88	69	177	69	63	69		31
Stoke	72	113	83	57	337	89	63			
Sund	14	116	86	50	415	100	57	57		43
Truro	18	119	89	44	184	78	78			
Wirral	16	114	88	69	350	94	63			
Wolve	71	112	79	49	164	72	66	65	5,000	27
York	21	108	86	52	259	81	71	57	3,000	38

Table 8.5. 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	13	115	100	62	629	100	46	85	4,250	15
Belfast	15	111	100	80	359	87	73	73	3,000	27
Newry	14	113	93	71	309	100	86	86	2,500	14
Ulster	4									
West NI	11	113	100	73	270	82	73	91	2,500	9
Scotland										
Abrdn	26	118	85	54	224	92	72			
Airdrie	7									
D & Gall	14	110	86	71	373	92	54			
Dundee	21	114	76	52	430	90	57			
Edinb	19	116	100	68	292	75	50			
Glasgw	36	110	72	53	258	92	75			
Inverns	11	111	100	82	166	73	73			
Klmarnk	35	106	74	51	347	86	57			
Krkcldy	14	115	93	79						
Wales										
Bangor	15	115	93	60	219	73	60			
Cardff	72	116	82	46	122	54	50			
Clwyd	10	117	100	70	328	70	50			
Swanse	49	113	82	49	335	96	71	56	3,125	41
Wrexm	23	115	87	57	235	87	74			
England	**2,658**	**112**	**83**	**56**	**294**	**89**	**66**	**68**	**4,500**	**30**
N Ireland	**57**	**113**	**95**	**70**	**385**	**93**	**67**	**84**	**3,000**	**16**
Scotland	**183**	**112**	**83**	**60**	**283**	**87**	**64**			
Wales	**169**	**114**	**85**	**51**	**208**	**76**	**62**	**56**	**3,125**	**41**
UK	**3,067**	**112**	**83**	**56**	**292**	**88**	**65**	**68***	**4,148***	**30***

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 ESA these overall averages are for E,W & NI (not UK)

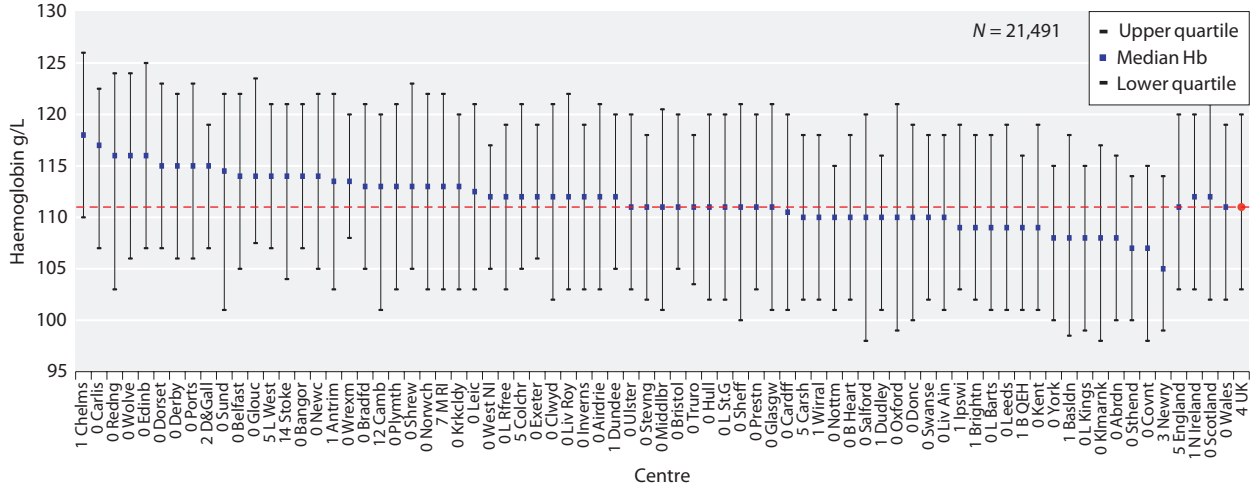

Fig. 8.7. Median haemoglobin in patients treated with HD by centre in 2014

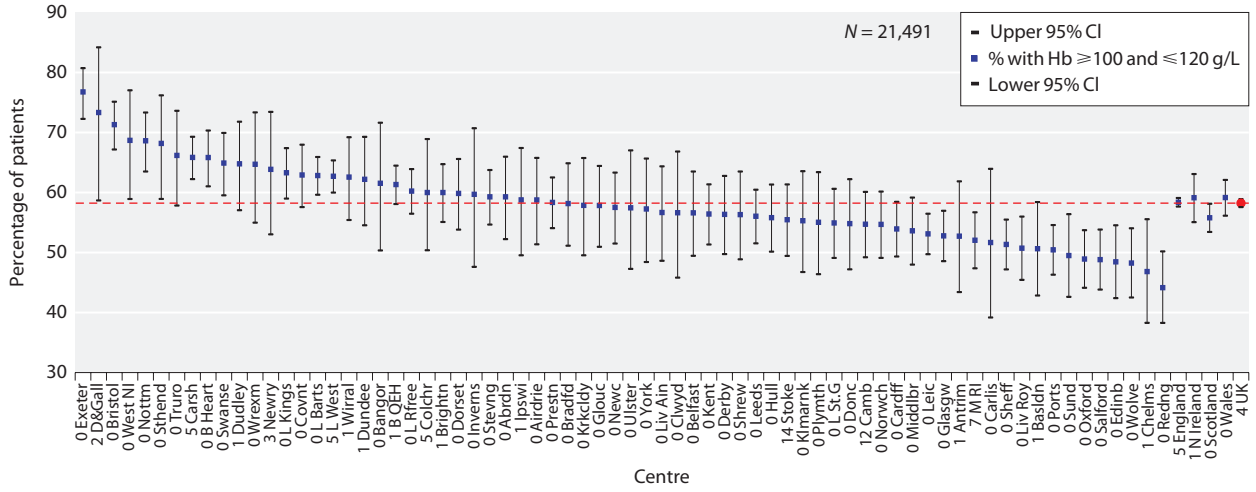

Fig. 8.8. Percentage of HD patients with Hb ⩾100 and ⩽120 g/L by centre in 2014

with the percentage with Hb ⩾100 g/L (figure 8.10) but had a poor compliance with percentage of patients with Hb ⩾100 and ⩽120 g/L (figure 8.11). Table 8.4 can be used in conjunction with figures 8.10 and 8.11 to identify centres.

Haemoglobin in prevalent peritoneal dialysis patients

Overall, 83% of patients on PD had a Hb ⩾100 g/L (table 8.5). The median Hb of patients on PD in the UK in 2014 was 112 g/L (IQR 103–121 g/L). The median Hb by centre is shown in figure 8.12. The compliance with Hb ⩾100 and ⩽120 g/L is shown in figure 8.13. In 2014, 56% of prevalent PD patients had a Hb within the target range. The distribution of Hb in PD patients by centre is shown in figure 8.14. 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 8.15 and 8.16 respectively. Table 8.5 can be used in conjunction with figures 8.15 and 8.16 to identify centres in the funnel plots.

Relationship between Hb in incident and prevalent dialysis patients in 2014

The relationship between the percentage of incident and prevalent dialysis (HD and PD) patients with a Hb ⩾100 g/L is shown in figure 8.17. As expected, all centres had a higher percentage of prevalent patients achieving a Hb ⩾100 g/L than that for incident patients. Overall in

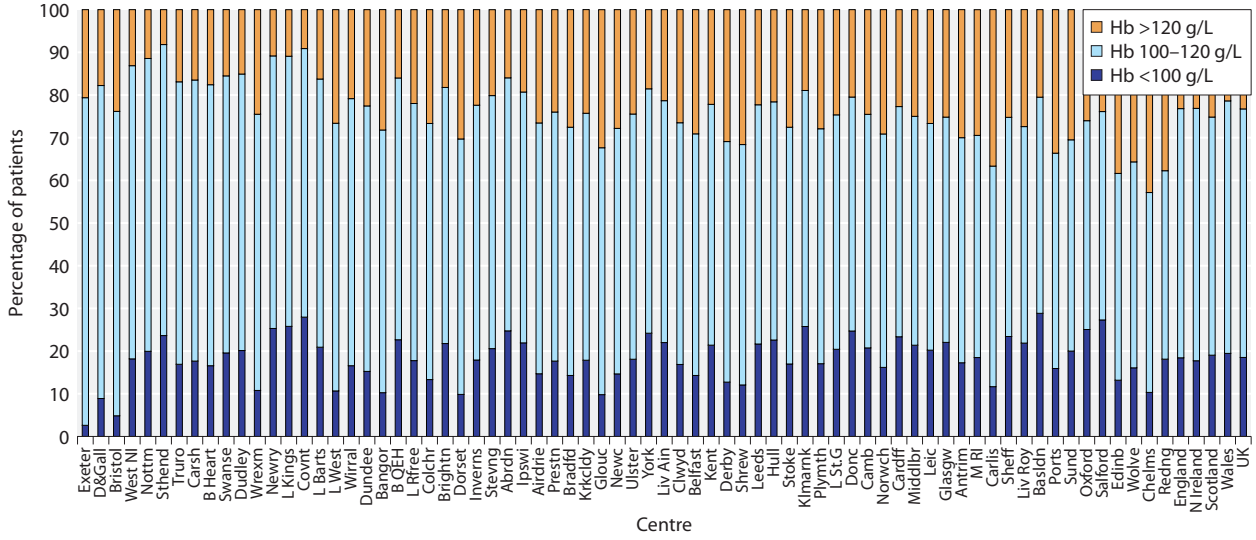

Fig. 8.9. Distribution of haemoglobin in patients treated with HD by centre in 2014

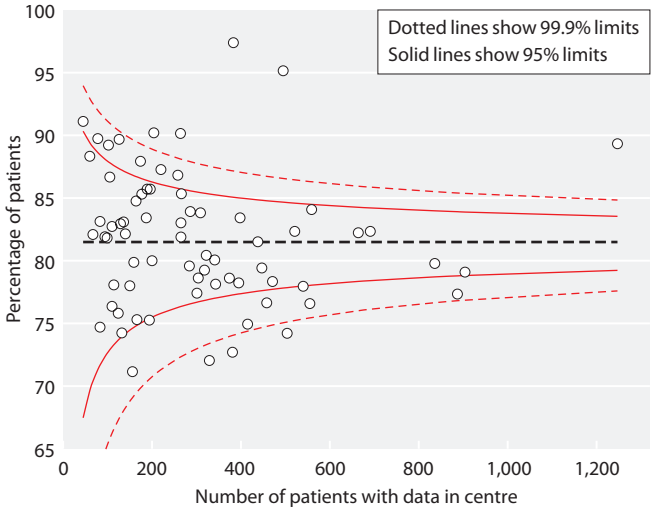

Fig. 8.10. Funnel plot of percentage of HD patients with Hb ⩾100 g/L by centre in 2014

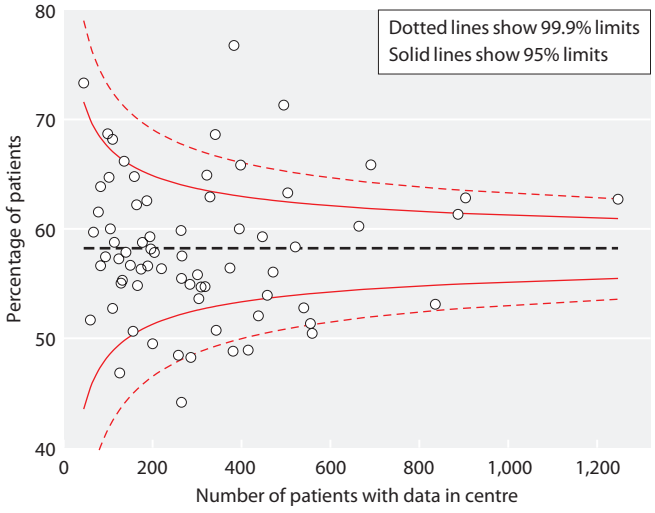

Fig. 8.11. Funnel plot of percentage of HD patients with Hb ⩾100 and ⩽120 g/L by centre in 2014

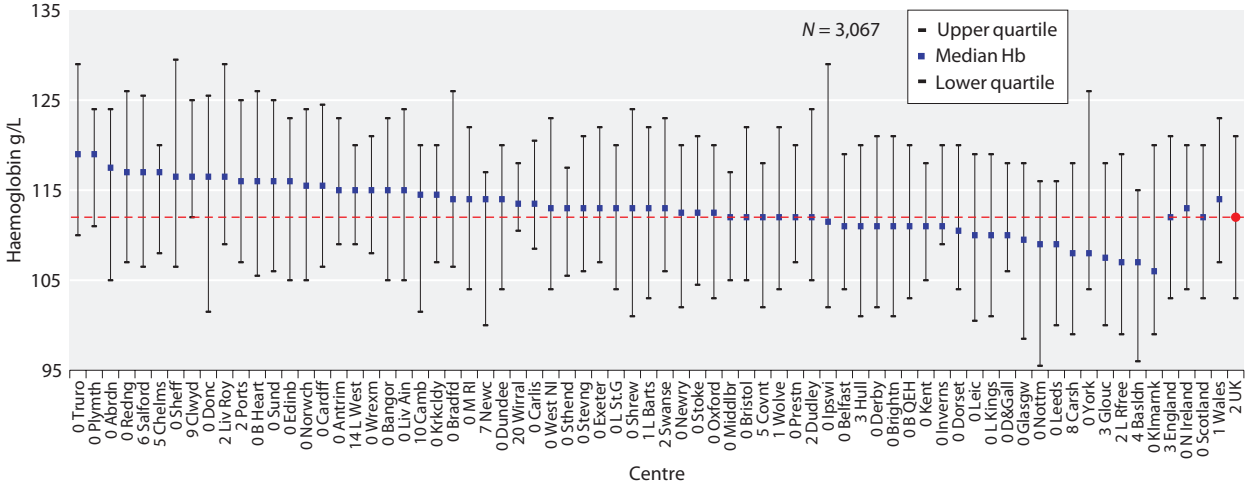

Fig. 8.12. Median haemoglobin in patients treated with PD by centre in 2014

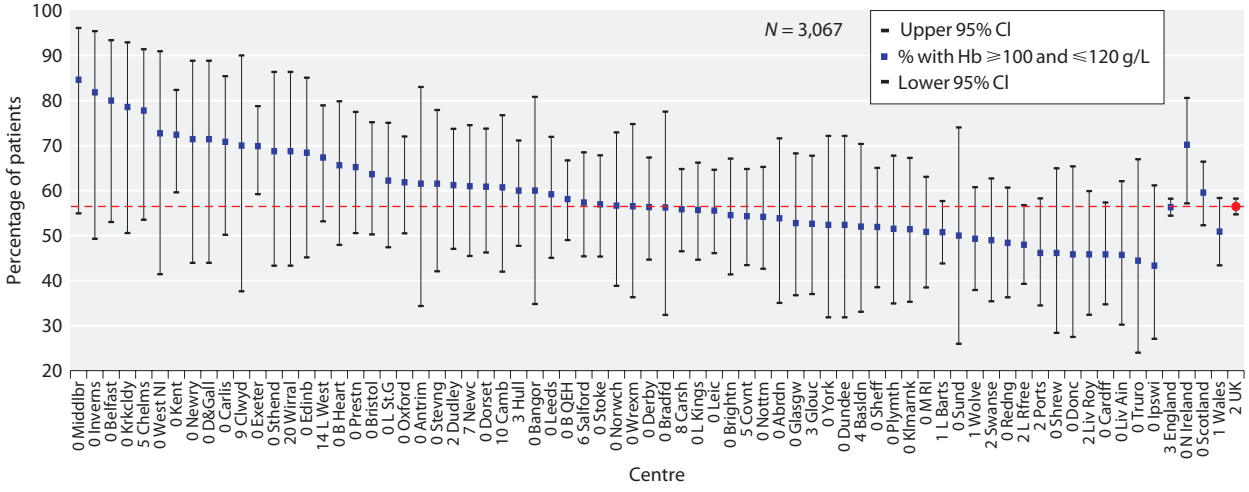

Fig. 8.13. Percentage of PD patients with Hb ⩾100 and ⩽120 g/L by centre in 2014

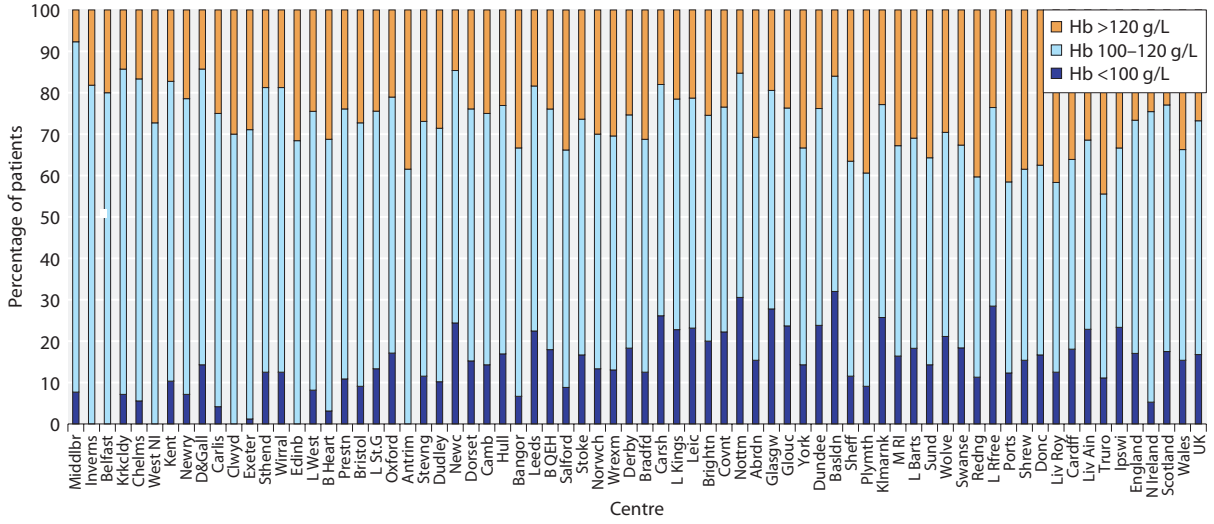

Fig. 8.14. Distribution of haemoglobin in patients treated with PD by centre in 2014

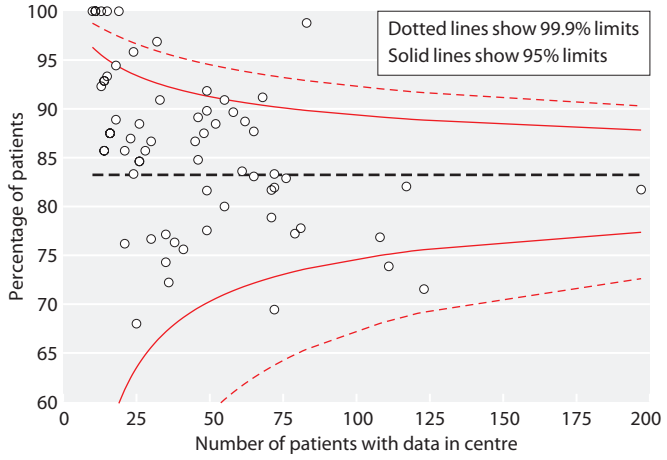

Fig. 8.15. Funnel plot of percentage of PD patients with Hb ⩾100 g/L by centre in 2014

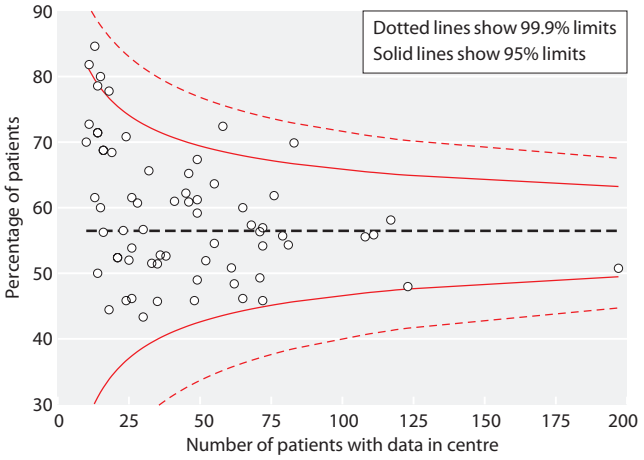

Fig. 8.16. Funnel plot of percentage of PD patients with Hb ⩾100 g/L and ⩽120 g/L by centre in 2014

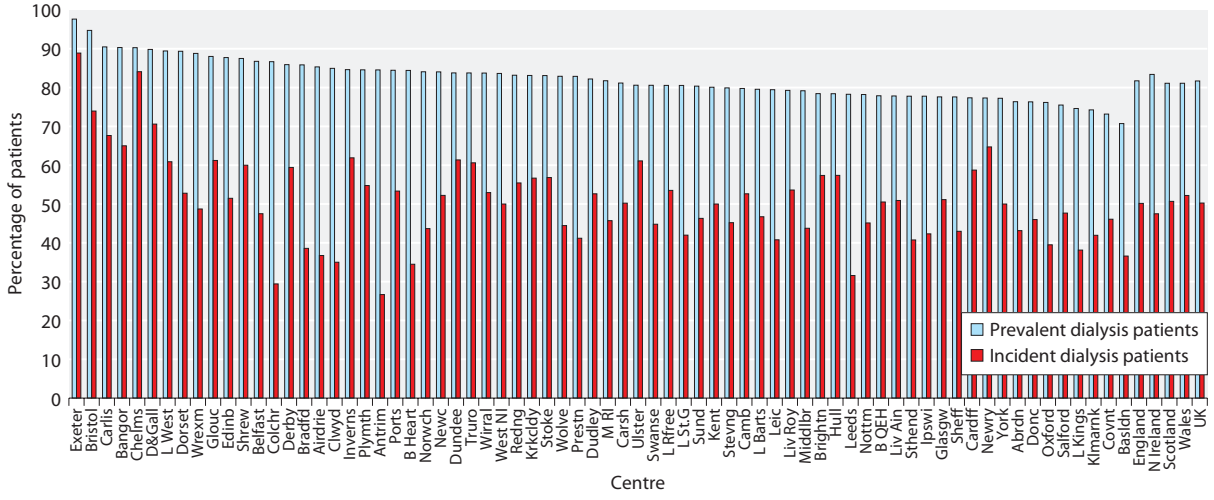

Fig. 8.17. Percentage of incident and prevalent dialysis patients with Hb ⩾100 g/L by centre in 2014

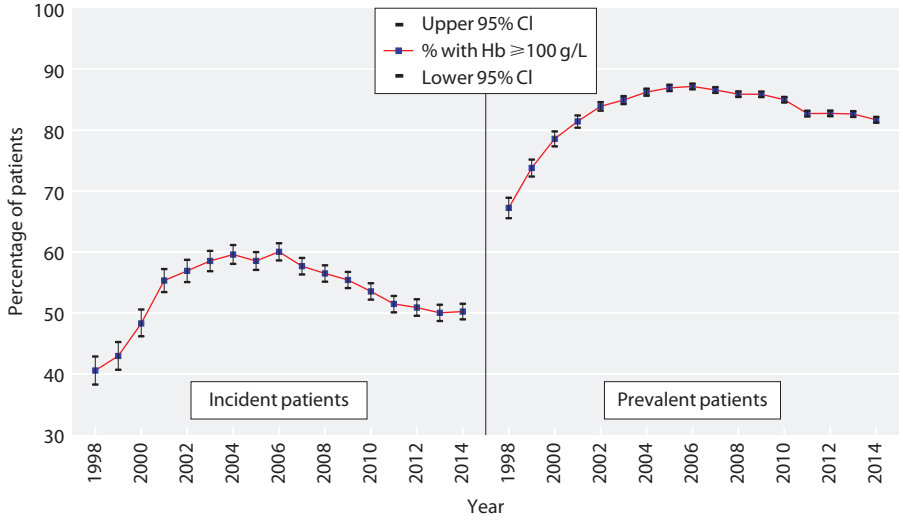

Fig. 8.18. Percentage of incident and prevalent dialysis patients (1998–2014) with Hb ⩾100 g/L

the UK, 82% of prevalent patients, compared with 50% of incident patients, had a Hb ⩾100 g/L in 2014. Compliance with the current minimum standard (Hb ⩾100 g/L) is shown by year (1998–2014) for incident and prevalent dialysis patients in figure 8.18. 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 8.19. The percentages with serum ferritin ⩾100 μg/L, >200 μg/L to ⩽500 μg/L, and ⩾800 μg/L are shown in figures 8.20, 8.21 and 8.22 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 432 μg/L (IQR 274–631 μg/L). Seventeen centres had greater than 20% of their patients having ferritin ⩾800 μg/L (figure 8.22) but serum ferritin correlated poorly with median Hb achieved and ESA dose (table 8.4).

Ferritin in prevalent peritoneal dialysis patients

The median and IQR for serum ferritin for patients treated with PD are shown in figure 8.23. The percentages with serum ferritin ⩾100 μg/L, >100 μg/L and ⩽500 μg/L, and ⩾800 μg/L are shown in figures 8.24, 8.25 and 8.26 respectively. The PD population had a lower median ferritin value (292 μg/L, IQR 168–479)

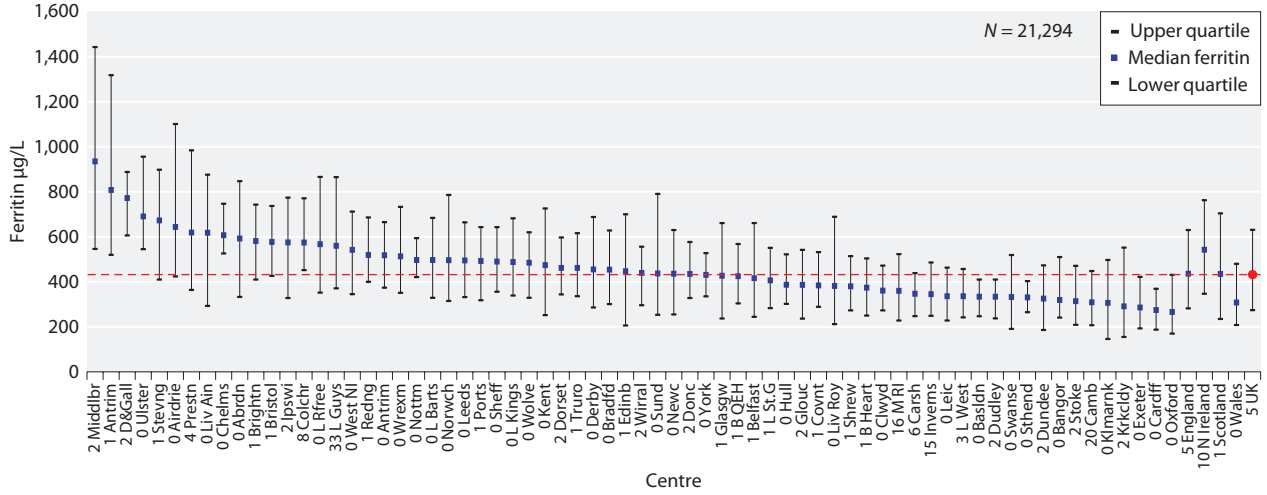

Fig. 8.19. Median ferritin in patients treated with HD by centre in 2014

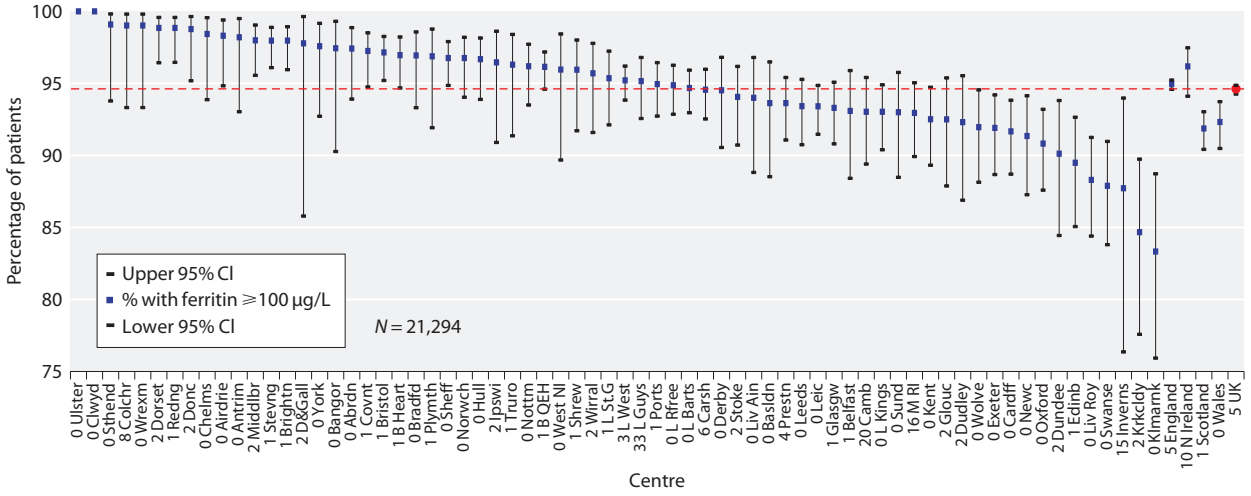

Fig. 8.20. Percentage of HD patients with ferritin ⩾100 µg/L by centre in 2014

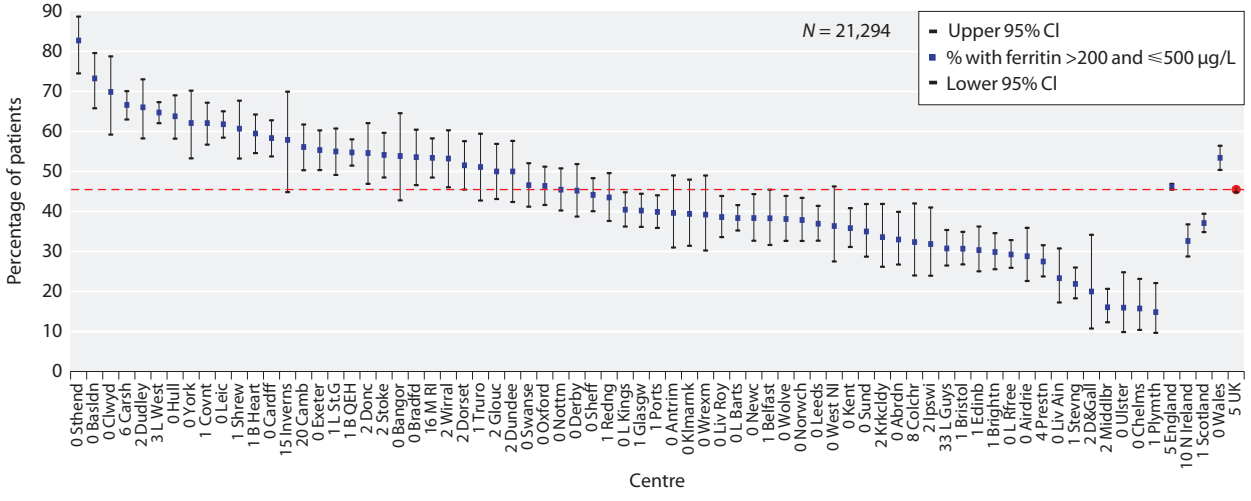

Fig. 8.21. Percentage of HD patients with ferritin >200 µg/L and ⩽500 µg/L by centre in 2014

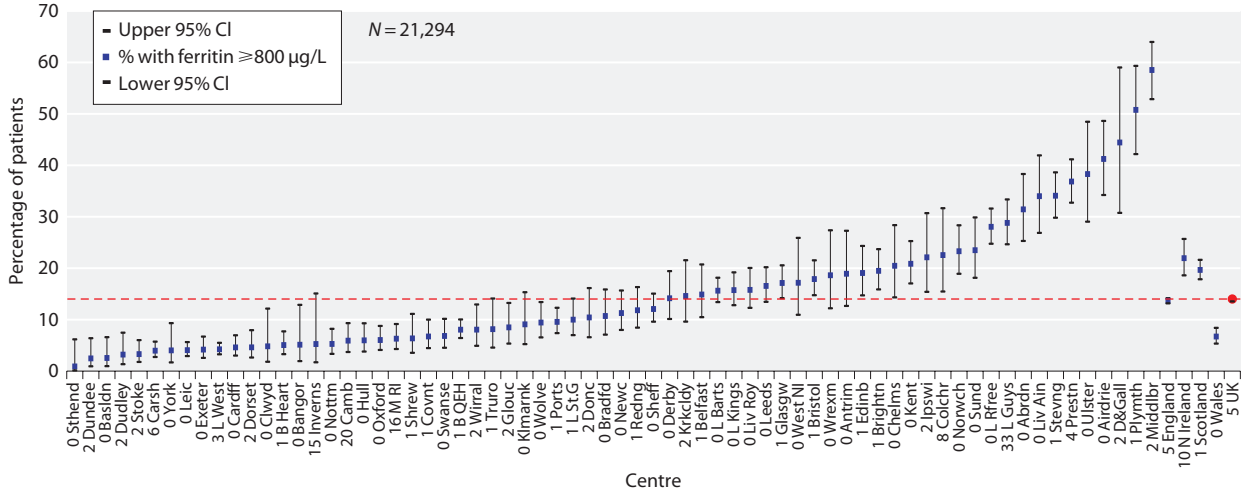

Fig. 8.22. Percentage of HD patients with ferritin ⩾800 µg/L by centre in 2014

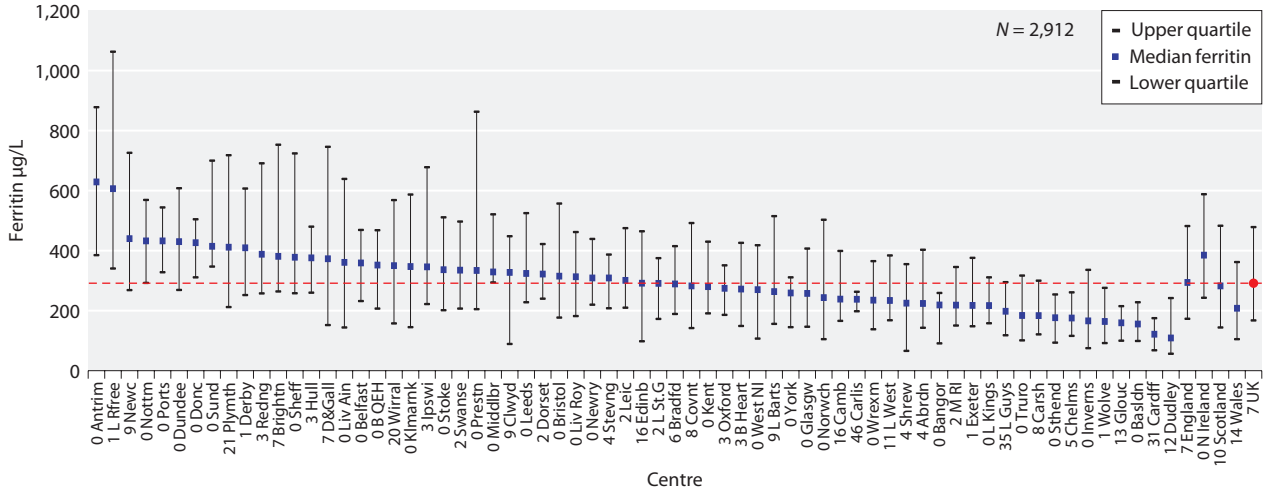

Fig. 8.23. Median ferritin in patients treated with PD by centre in 2014

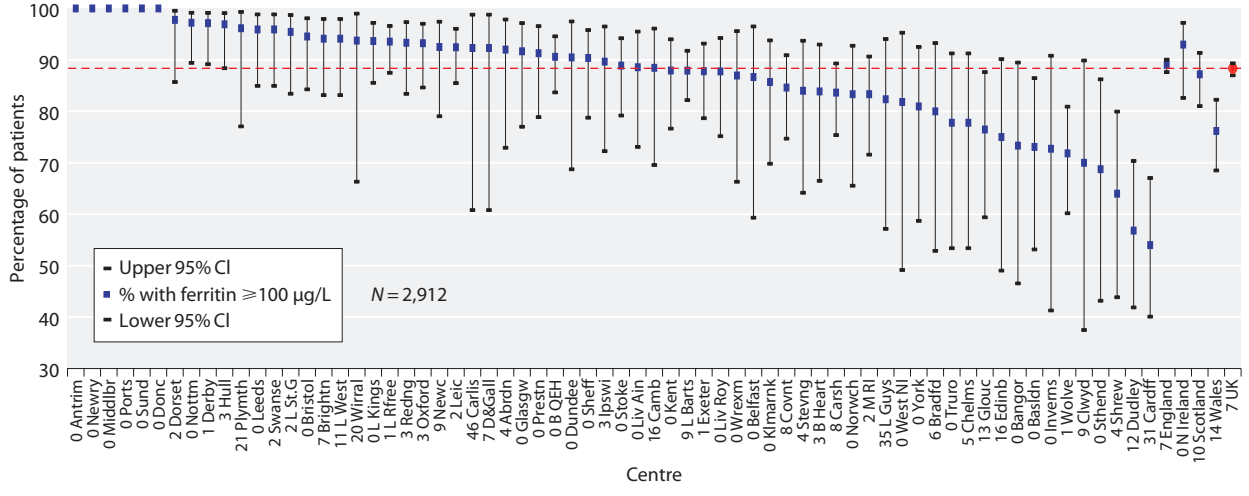

Fig. 8.24. Percentage of PD patients with ferritin ⩾100 µg/L by centre in 2014

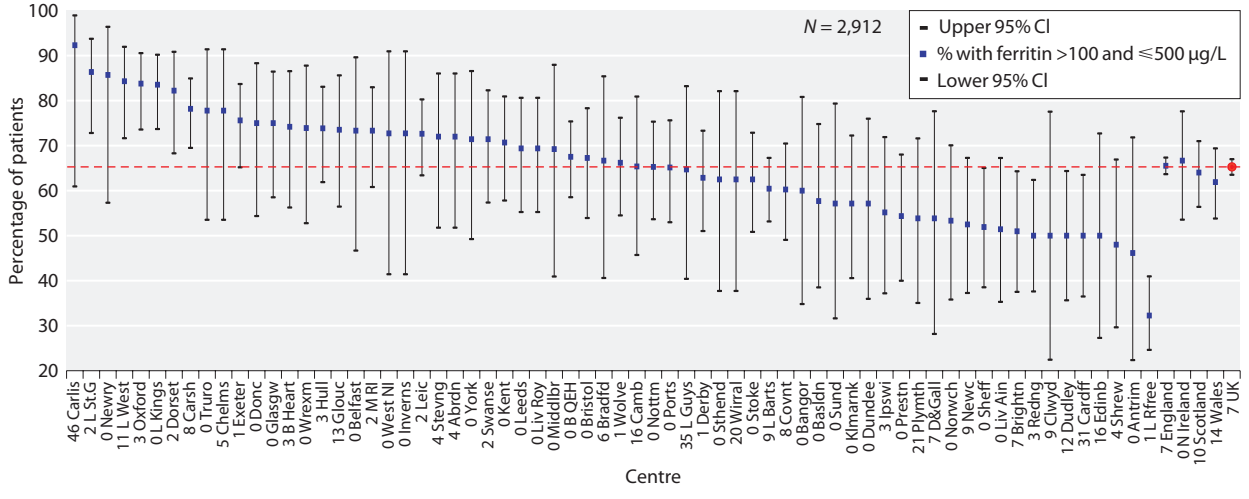

Fig. 8.25. Percentage of PD patients with ferritin >100 µg/L and ⩽500 µg/L by centre in 2014

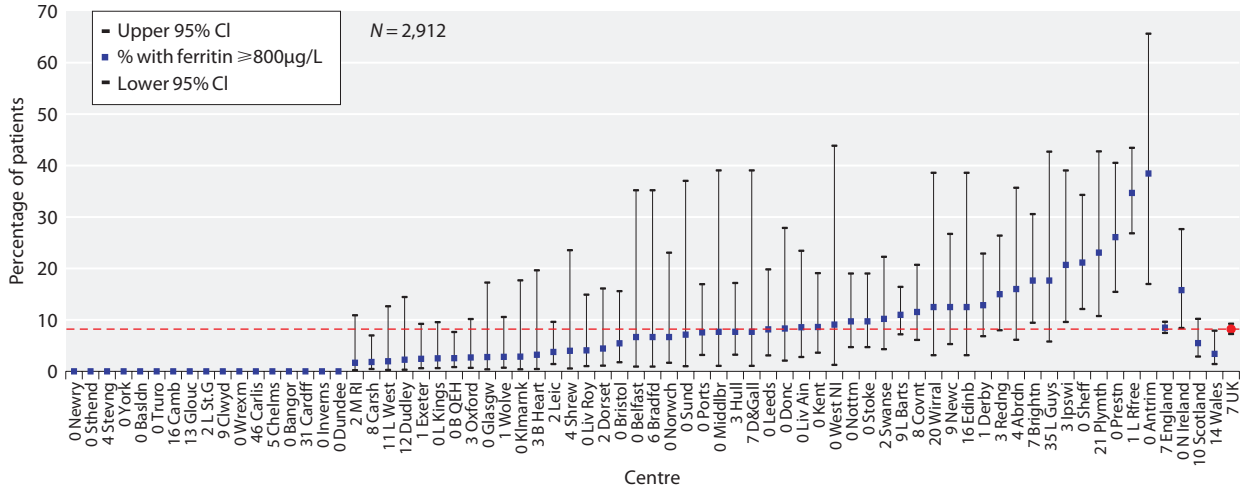

Fig. 8.26. Percentage of PD patients with ferritin ⩾800 µg/L by centre in 2014

than the HD population. Thirty-four centres reported fewer 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 8.5).

Erythropoietin stimulating agents in prevalent haemodialysis patients

As shown in previous reports there was substantial variation in the average dose of ESA prescription used. 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 (Middlesbrough, York) to 12,700 IU/week (Reading) with median Hb for these centres of 111 g/L (Middlesbrough), 108 g/L (York) and 116 g/L (Reading) (table 8.4). The 2014 median dose was the same as that for 2013.

Erythropoietin stimulating agents in prevalent peritoneal dialysis patients

For prevalent PD patients the median dose was lower than for HD patients. The median dose was 4,148 IU/week with a range of 2,500 to 8,000 (table 8.5). The 2014 median dose was similar to that for 2013 (4,000 IU/week).

ESA prescription and association with achieved haemoglobin

For HD patients, centre level median Hb is plotted against median ESA dose in figure 8.27 and compliance with the RA standards for Hb ⩾100 g/L and ⩽120 g/L is plotted against median ESA dose in figure 8.28. For these figures, Hb data was only used for those patients

Fig. 8.27. Median Hb versus median ESA dose in HD patients on ESA, by centre in 2014

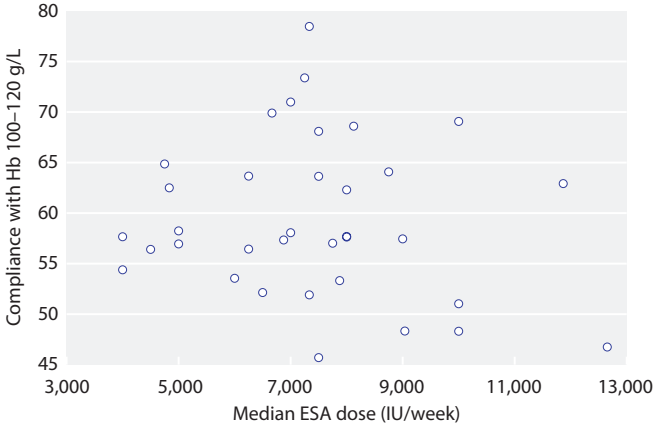

Fig. 8.28. Compliance with Hb 100–120 g/L versus median ESA dose in HD patients on ESA, by centre in 2014

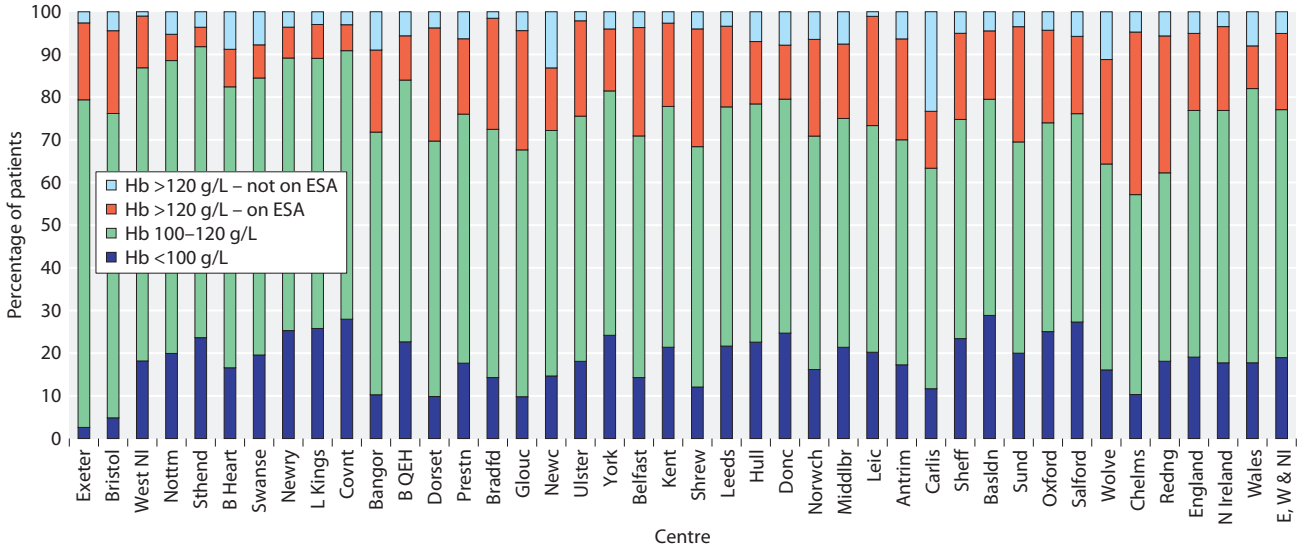

Fig. 8.29. Distribution of haemoglobin in patients treated with HD and the proportion of patients with Hb >120 g/L receiving ESA by centre in 2014

who were receiving an ESA and had dose data available. There was no meaningful 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 detrimental to achieve a high Hb in renal patients were based only upon patients treated with ESAs [8, 9].

Figures 8.29 and 8.30 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 figures show that, in those centres for which useable ESA data was available, 23% of HD

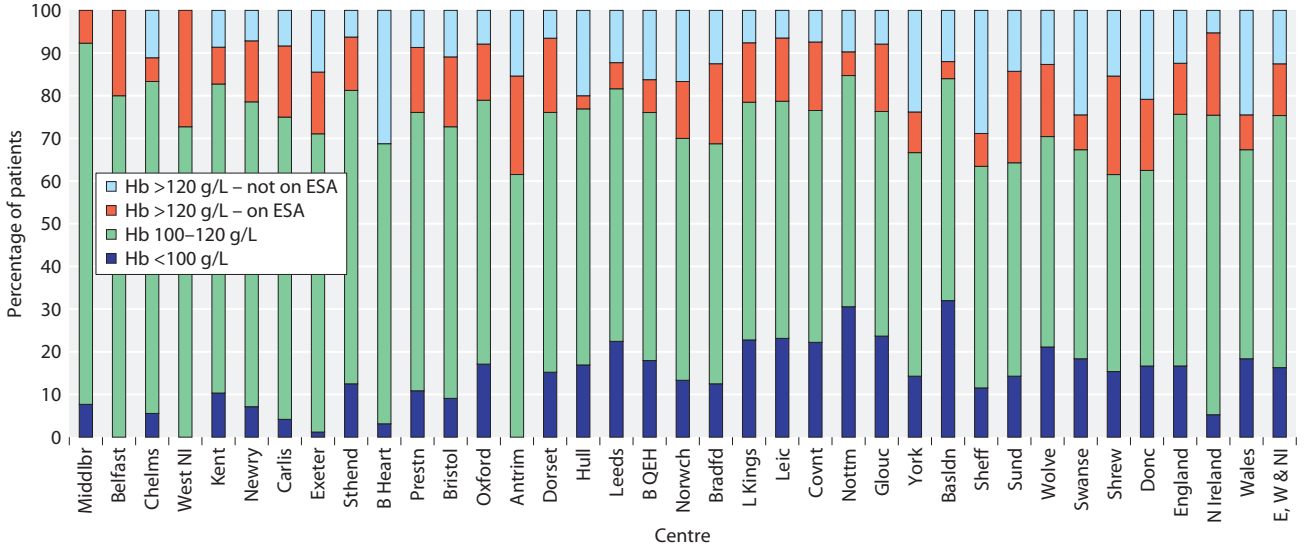

Fig. 8.30. Distribution of haemoglobin in patients treated with PD and the proportion of patients with Hb >120 g/L receiving ESA by centre in 2014

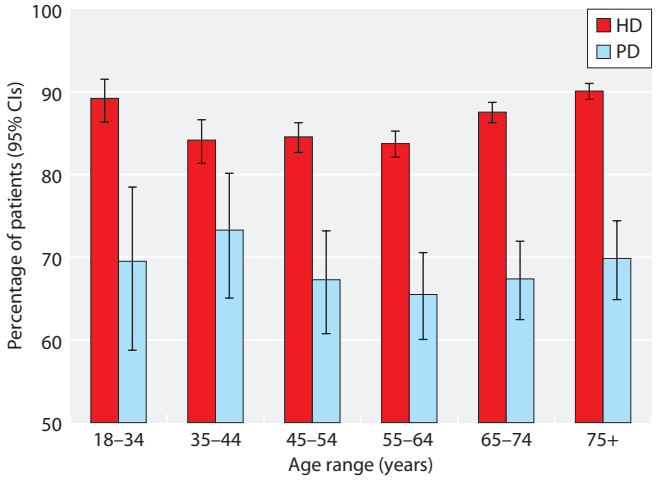

Fig. 8.31. Percentage of dialysis patients on ESA, by age group and treatment modality (2014)

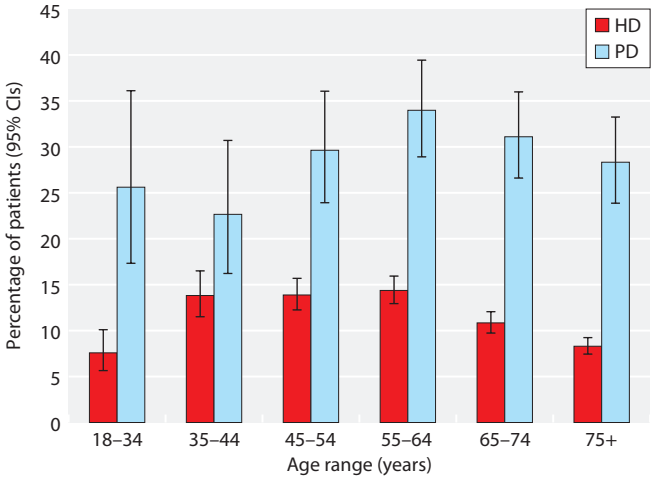

Fig. 8.32. Percentage of whole cohort (2014) who are not on ESA and have Hb ⩾100 g/L, by age group and treatment modality

patients had a Hb >120 g/L and that most of these patients (78%) were on ESAs. For PD, 25% of patients had a Hb >120 g/L but only about half (49%) of these were on ESAs.

ESA prescription: age and modality associations

The proportion of patients on an ESA was higher for HD (87%) than PD (68%) and this difference was present and similar across all age groups (figure 8.31). The proportion of patients who had a Hb ⩾100 g/L without requiring ESA is shown (by age group and modality) in figure 8.32.

ESAs and time on renal replacement therapy

The percentage of patients on ESA by time on RRT and dialysis modality is shown in figure 8.33. This is a cross-sectional analysis at the final quarter of 2014. Patients who had previously changed RRT modality were included in this analysis. The proportion of PD patients on ESA rises with duration of RRT from 65% after 3–12 months to 83% after 10 or more years. For at least the first 10 years on RRT, a greater percentage of HD patients were receiving ESA treatment than patients on PD.

Resistance to ESA therapy

Figure 8.34 shows the frequency distribution of weekly ESA dose adjusted for weight 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 the purposes of this analysis the centres were restricted to those with good completeness for weight (over 75%) and ESA dose data (33 centres for HD and 20 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 1.0% ($N = 76$) and 1.9% ($N = 9$) for HD and PD patients respectively. For these patients the dose range for HD was 450–862 IU/kg/week and for PD 305–509 IU/kg/week. For patients on HD with high ESA doses, 47% ($N = 36$) had Hb <100 g/L and 49% were within 100–120 g/L. For patients on PD with high ESA doses, 44% ($N = 4$) had a Hb <100 g/L and the remaining 56% were within 100–120 g/L. The percentage of

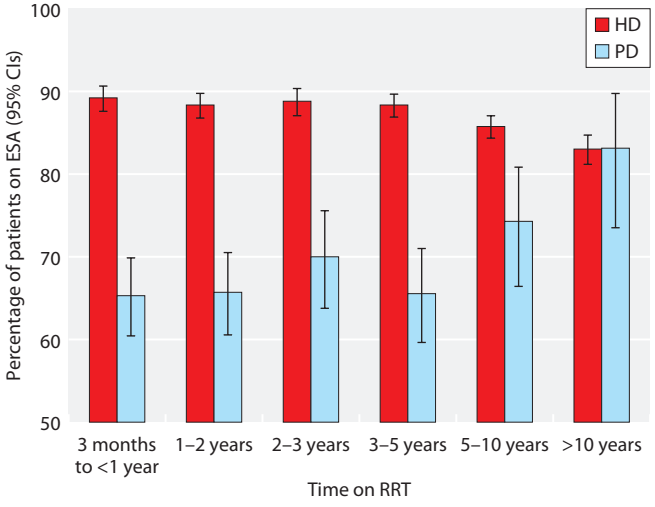

Fig. 8.33. Percentage of patients on ESA by time on RRT (2014)

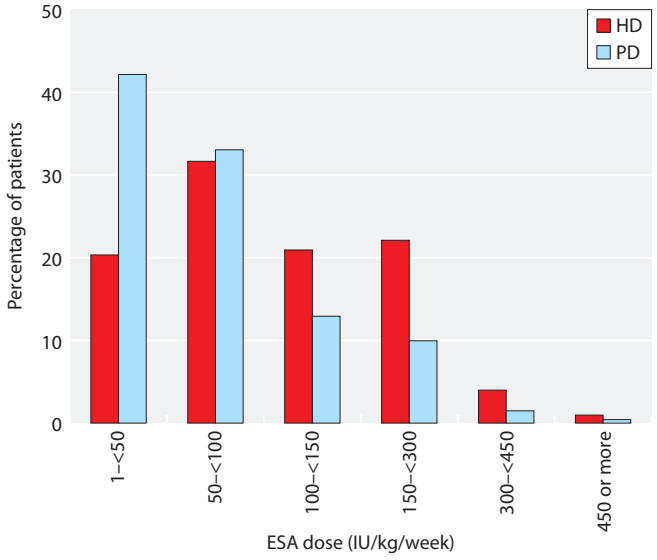

Fig. 8.34. Frequency distribution of mean weekly ESA dose corrected for weight in 2014

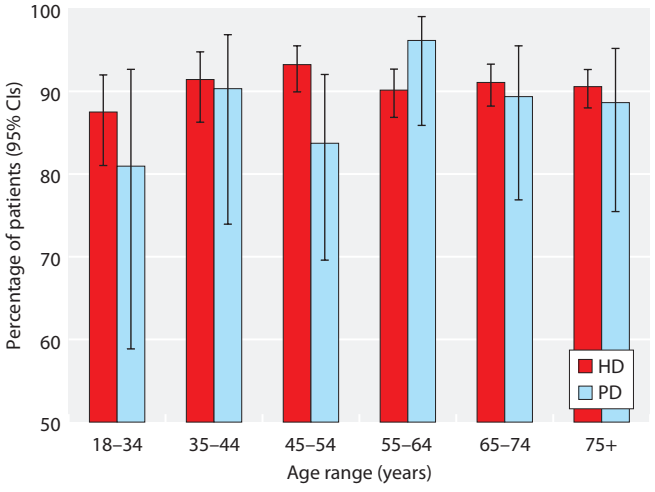

Fig. 8.36. Percentage of patients with Hb <100 g/L who were on ESA, by age group and treatment modality (2014)

patients with ESA resistance, defined as those failing to reach Hb ⩾100 g/L despite a high dose of ESA, were 0.5% for HD and 0.9% for PD.

Success with guideline compliance

Compliance with current minimum standards by year (1998 to 2014) is shown in figure 8.35 for prevalent patients (by treatment modality).

Figure 8.36 shows the percentage of anaemic patients (Hb <100 g/L) receiving an ESA. A minority of patients with Hb <100 g/L were not receiving ESA therapy. Across the age groups this was between 7–13% for HD patients and 4–19% for PD patients.

Table 8.6 shows that the percentage of all patients treated with an ESA and having Hb >120 g/L ranged between 5–38% for HD and between 0–27% for PD. For HD, there was a small percentage of patients having ferritin levels <100 μg/L and being on an ESA (0–8%). The percentages were somewhat higher for PD (0–20%).

Table 8.7 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.

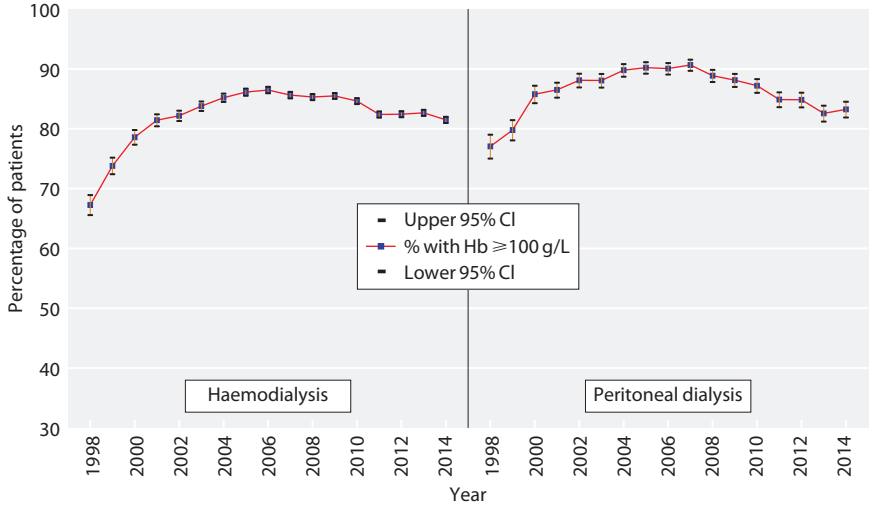

Fig. 8.35. Percentage of prevalent HD and PD patients (1998–2014) with Hb ⩾100 g/L

Table 8.6. Percentage of patients with Hb >120 g/L and on ESA and percentage of patients with serum ferritin levels <100 μg/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	9	1	0	0
B QEH	10	1	8	2
Basldn	16	4	4	15
Bradfd	26	3	19	8
Bristol	19	1	16	2
Carlis	13		17	0
Chelms	38	2	6	13
Covnt	6	1	16	5
Donc	13	0	17	0
Dorset	27	1	17	0
Exeter	18	6	14	4
Glouc	28	4	16	20
Hull	15	1	3	2
Kent	20	7	9	0
L Kings	8	5	14	4
Leeds	19	4	6	0
Leic	26	6	15	4
Middlbr	17	1	8	0
Newc	15	4		
Norwch	23	2	13	10
Nottm	6	0	6	0
Oxford	22	8	13	5
Prestn	18	3	15	5
Redng	32	1		
Salford	18			
Sheff	20	1	8	0
Shrew	28	2	23	0
Sthend	5	1	13	13
Sund	27	4	21	0
Wolve	24	4	17	17
York	15	1	10	0
N Ireland				
Antrim	24	0	23	0
Belfast	25	5	20	13
Newry	7		14	0
Ulster	22	0		
West NI	12	3	27	18
Wales				
Bangor	19	0		
Swanse	8	8	8	0
England	**18**	**3**	**12**	**4**
N Ireland	**20**	**3**	**19**	**7**
Wales	**10**	**6**	**8**	**0**
E, W & NI	**18**	**3**	**12**	**4**

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

Table 8.7. 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	301	100	99	0	0	15	100	100	0	0
B QEH	759	100	100	100	0	70	100	100	100	0
Basldn	141	100	100	99	100	18	100	100	100	100
Bradfd	187	100	99	99	96	13	100	92	92	100
Bristol	447	100	100	0	0	37	100	100	0	0
Carlis	40	100	100	0	0	21	100	100	0	0
Chelms	119	100	100	99	100	9	100	100	100	100
Covnt	286	100	99	0	0	58	100	100	0	0
Donc	143	100	100	100	100	17	100	100	100	100
Dorset	252	100	100	96	100	38	100	100	76	100
Exeter	357	100	99	0	0	64	100	100	0	0
Glouc	185	100	0	0	0	28	100	0	0	0
Hull	224	100	100	100	100	33	100	94	94	100
Kent	349	100	100	99	100	29	100	100	100	100
L Kings	462	100	100	0	0	52	100	100	0	0
Leeds	429	100	100	100	99	40	100	100	100	100
Leic	817	100	100	0	0	90	100	100	0	0
Middlbr	229	100	100	0	0	9	100	100	0	0
Newc	178	100	100	0	0					
Norwch	275	100	100	99	100	21	100	100	90	100
Nottm	295	100	99	0	0	51	100	49	0	0
Oxford	392	100	99	0	0	61	100	93	0	0
Prestn	435	100	19	0	0	35	100	0	0	0
Redng	231	100	100	0	0					
Salford	256	100	100	98	0					
Sheff	490	100	92	0	0	25	100	100	0	0
Shrew	156	100	100	98	97	16	100	100	100	100
Sthend	102	100	95	0	0	11	100	82	0	0
Sund	180	100	100	0	0	8	100	100	0	0
Wolve	235	100	100	99	100	47	100	100	100	100
York	111	100	100	100	98	12	100	92	100	100
N Ireland										
Antrim	102	100	100	100	100	11	100	100	100	100
Belfast	177	100	100	100	100	11	100	100	100	100
Newry	77	100	100	97	100	12	100	100	100	100
Ulster	91	100	100	100	100	4	100	100	100	100
West NI	94	100	100	100	100	10	100	100	100	100
Wales										
Bangor	54	100	0	0	0					
Swanse	269	100	96	96	99	28	100	96	96	100
England	**9,063**	**100**	**93**	**40**	**29**	**928**	**100**	**89**	**38**	**32**
N Ireland	**541**	**100**	**100**	**100**	**100**	**48**	**100**	**100**	**100**	**100**
Wales	**323**	**100**	**80**	**80**	**82**	**28**	**100**	**96**	**96**	**100**
E, W & NI	**9,927**	**100**	**93**	**44**	**34**	**1,004**	**100**	**90**	**42**	**37**

Blank cells: centres with usable ESA data for HD patients but not for PD patients

Conclusions

Anaemia is one of the major problems that contributes to high comorbidity and poor outcomes in dialysis patients. Renal centres continue to strive towards achieving 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. This chapter provides important information regarding the management of anaemia in the UK.

Haemoglobin outcomes for patients on HD and PD were largely compliant with the RA minimum standard of Hb $\geqslant$100 g/L (81% and 83% respectively). The median Hb of patients on HD was 111 g/L with an IQR of 103–120 g/L, and the median Hb of patients on PD was 112 g/L with an IQR of 103–121 g/L. As would be anticipated, a greater proportion of prevalent patients (82%) than incident patients (50%) had a Hb $\geqslant$100 g/L in 2014. In the late presenters only 33% of patients had a Hb $\geqslant$100 g/L compared with 54% in the early presenters. The lower median Hb in late presenters may reflect inadequate pre-dialysis care as late presentation limits therapeutic options. The lower Hb in late presenters could also be due to multisystem disease or inter-current illness. This chapter and previous reports show that since the early 2000s, the proportion of both incident and prevalent dialysis patients with Hb $\geqslant$120 g/L has fallen. This is probably an effect of guideline changes that resulted from evidence from several studies in the early 2000s which in their post hoc analyses demonstrated increased risk of fatal and nonfatal strokes in the group with higher haemoglobin values [10–12].

Compliance with regards to serum ferritin was good overall with 95% of HD patients and 88% of PD patients achieving a serum ferritin of 100 μg/L or greater. Seventeen centres had greater than 20% of their HD patients having ferritin $\geqslant$800 μg/L and six centres had greater than 20% of their PD patients having ferritin $\geqslant$800 μg/L. Across the UK, the average percentage with ferritin $\geqslant$800 μg/L was 14% in HD patients and 8% in PD patients. There is currently a lot of uncertainty regarding the safety of achieving high ferritin levels in dialysis patients. Due to this, a large multicentre study – The Proactive IV irOn Therapy in haemodiALysis patients (PIVOTAL) trial is currently recruiting in over 40 renal centres, to receive either a high dose of intravenous iron or standard low dose of intravenous iron.

The analysis of ESA usage was limited by incomplete data returns. From the available data, 87% of HD patients and 68% of PD patients were on ESA treatment. The attainment of Hb targets correlated poorly with median ferritin and ESA usage. The percentage of patients treated with an ESA and having Hb >120 g/L ranged between centres from 5–38% for HD and from 0–27% for PD. At the other end of the spectrum, the percentage of patients with Hb <10 g/L and not on ESA varied between 7–13% for HD patients and between 4–19% for PD patients. There may be several clinical reasons why some patients with low Hb were not on ESA including cessation of treatment in those who were unresponsive and avoidance of ESA in those with malignancy. Others may have been on ESA but not had it recorded. A small proportion of patients had ferritin levels <100 μg/L and were receiving an ESA. There was substantial variation between centres in the average dose of ESA prescribed for which there is no obvious explanation. For the first 10 years on RRT, a greater percentage of HD patients were receiving ESA treatment than patients on PD. This could be due to several reasons; the prevalence and severity of anaemia is lower in patients on peritoneal dialysis (PD) than in patients on HD [13–14]; this could also be a consequence of earlier loss of residual renal function in HD patients when compared to those on PD [15]. Decline of residual renal function contributes significantly to anaemia and inflammation which results in increasing ESA requirements. The prevalence of ESA resistance was 0.5% and 0.9% for HD and PD patients respectively.

In summary there continues to be variation in anaemia management between centres.

Conflicts of interest: the authors declare no conflicts of interest

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