# Chapter 8: Management of Anaemia in Haemodialysis and Peritoneal Dialysis Patients

Donald Richardson, Alex Hodsman, Dirk van Schalkwyk, Charlie Tomson and Graham Warwick

## Summary


- 41% of UK patients commence RRT with an Hb <10.0 g/l. The mean Hb at commencement of RRT is 10.3 g/dl.
- 85% of patients on dialysis in the UK have a Hb ⩾10.0 g/dl by 6 months after commencement of RRT.
- The median Hb on haemodialysis in the UK is 11.8 g/dl with an IQR of 10.7–12.8 g/dl. 86% of haemodialysis patients in the UK have a Hb ⩾10.0 g/dl. The median Hb on peritoneal dialysis in the UK is 12.0 g/dl with an IQR of 11.0–12.9 g/dl. 90% of peritoneal dialysis patients in the UK have a Hb ⩾10.0 g/dl.
- In the UK, 49% of patients on PD and 48% of patients on haemodialysis have a Hb between 10.5–12.5 g/dl.
- The median ferritin in UK haemodialysis patients is 413 μg/L (IQR 262–623), 95% of UK haemodialysis patients have a ferritin ⩾100 μg/L.
- The median ferritin in UK PD patients is 256 μg/L (IQR 147–421), 86% of UK peritoneal dialysis patients have a ferritin ⩾100 μg/L.
- A higher proportion of HD patients than PD patients receive ESA therapy (88% vs 76%). The ESA dose is higher for HD than PD patients (9204 vs 6080 IU/week).


## Introduction

This chapter describes data reported to the Renal Registry relating to management of renal anaemia through 2005. The chapter reports outcomes of submitted variables and analyses of these variables in the context of established guidelines and recommendations. More recently introduced NICE guidelines are also quoted to place current outcomes into context with future expectations.

## Methods

This chapter analyses the incident and prevalent RRT cohort for 2005. The Registry extracts quarterly data electronically from renal units in England, Wales and Northern Ireland and is sent data annually from the Scottish Renal Registry. Patients treated by dialysis during the last quarter of 2005 were included in the analysis if they had been on the same modality of dialysis in the same centre for 3 months. The last available measurement of haemoglobin and ferritin from each patient in the last two quarters of 2005 was used for analysis. For incident patients, data from their first quarter on dialysis was used. Patients who do not have this data are excluded from the analyses. Data from Northern Ireland and Scotland are included for the first time this year. Patients are analysed as a complete cohort and divided by modality into groups. Some analysis is also done on a combined dialysis group.

The completeness of data items are analysed at unit and country level. All patients are included in analyses but units with less than 50% completeness are excluded from the caterpillar plots showing unit performance. Both at unit and country level, data are also excluded from plots when there are less than 20 patients with data. The number preceding the centre name in each figure indicates the percentage of missing data for that centre.

The data are analysed to calculate summary statistics. These are maximum, minimum and average (mean and median) values. Standard deviation and quartile ranges are also calculated. These data are represented as caterpillar plots showing median values and quartile ranges.

The percentage achieving Renal Association standards is also calculated for haemoglobin. The percentage of patients achieving serum ferritin $\geqslant 100\,\mu g/L$ and $\geqslant 200\,\mu g/L$ have also been calculated. These are represented as caterpillar plots with 95% confidence intervals shown. For the percentage achieving standards $\chi^2$ values have also been calculated to identify significant variability between centres and between nations.

Longitudinal analysis has also been done to calculate overall changes in achievement of standards annually from 1998 to 2005.

## Haemoglobin

The NSF part 1[1] and the Renal Association standards document 3rd edition[2] state that individuals with CKD should achieve a haemoglobin of 10 g/dl within 6 months of being seen by a nephrologist, unless there is a specific reason why it could not be achieved. The UK Renal Registry does not collect a specific haemoglobin value 6 months from meeting a nephrologist. Some indication of whether the standard is reached comes from the Hb at the start of renal replacement therapy. The Registry plans to collect pre-dialysis data for patients who then commence RRT.

The European Best Practice Guidelines (EBPG)[3] set a minimum target of 11 g/dl for all patients and United States (KDOQI)[4] guidelines set a target haemoglobin range of 11–12 g/dl. The NICE guidelines published in 2006[5] now recommend a target haemoglobin of between 10.5 and 12.5 g/dl (with ESA dose changes considered at 11 and 12 g/dl), perhaps recognising the difficulty of narrowing the distribution of haemoglobin to between 11–12 g/dl. For this reason data are also presented in terms of the new NICE guidelines. However, it should be recognised that the data reported in this chapter were collected before the publication of the NICE guidelines. In light of the normalisation of haemoglobin study in haemodialysis patients[6] (Besarab *et al.*, NEJM), and also now the results of the CREATE[7] and CHOIR[8] studies in CKD patients demonstrating similar outcomes regards increased mortality at higher target Hb, the new NICE desired outcome range 10.5–12.5 g/dl may be very relevant to reduction in patient risk as well as the most cost effective use of resources.

### *Haemoglobin of patients with CKD*

In patients new to dialysis, the starting haemoglobin currently gives the only indication we have of concordance with current anaemia management recommendations in the pre-dialysis group. Patients not receiving dialysis (conservative care) are by definition excluded from the dataset. The Registry aims to collate data on a defined pre-dialysis/non-dialysis group in the future.

The percentage of data returned and outcome haemoglobin are listed in Table 8.1. Analyses on

**Table 8.1: Haemoglobin levels for new patients starting haemodialysis or peritoneal dialysis**

| Centre | % data return | Median Hb g/dl | 90% range | Interquartile range | % Hb $\geqslant$ 10 g/dl |
|---|---|---|---|---|---|
| Abrdn | 100 | 10.5 | 8.9–12.8 | 9.6–11.0 | 70 |
| Airdrie | 44 | n/a | n/a | n/a | n/a |
| Antrim | 60 | 11.3 | 9.7–13.2 | 10.5–11.9 | 88 |
| B Heart | 96 | 9.9 | 7.4–13.0 | 9.0–11.2 | 50 |
| B QEH | 83 | 10.0 | 7.7–12.7 | 9.3–11.2 | 53 |
| Bangor | 100 | 10.5 | 8.0–13.7 | 9.5–11.6 | 71 |
| Basldn | 100 | 10.4 | 7.4–12.8 | 9.3–11.6 | 60 |
| Belfast | 88 | 10.1 | 6.5–13.3 | 8.6–11.3 | 52 |
| Bradfd | 98 | 10.3 | 7.9–12.9 | 9.2–11.7 | 56 |
| Brightn | 74 | 10.6 | 7.9–14.1 | 9.7–11.5 | 63 |
| Bristol | 100 | 10.2 | 7.5–14.2 | 9.2–11.5 | 55 |
| Camb | 80 | 10.5 | 8.4–14.1 | 9.5–12.0 | 61 |
| Cardff | 99 | 10.6 | 8.0–13.5 | 9.6–11.6 | 68 |
| Carlis | 100 | 10.9 | 8.8–13.7 | 9.4–11.6 | 67 |
| Carsh | 95 | 10.6 | 8.2–13.2 | 9.4–11.7 | 65 |
| Chelms | 97 | 9.8 | 7.0–14.9 | 8.8–10.8 | 45 |

**Table 8.1: (continued)**

| Centre | % data return | Median Hb g/dl | 90% range | Interquartile range | % Hb ⩾10 g/dl |
|---|---|---|---|---|---|
| Clwyd | 86 | 10.7 | 8.7–12.9 | 10.0–11.2 | 75 |
| Covnt | 85 | 10.1 | 7.4–13.1 | 9.3–11.3 | 55 |
| D&Gall | 100 | n/a | n/a | n/a | n/a |
| Derby | 84 | 10.1 | 7.7–12.4 | 9.1–10.9 | 53 |
| Dorset | 100 | 10.7 | 7.9–13.5 | 9.7–12.2 | 63 |
| Dudley | 100 | 10.4 | 7.1–13.2 | 9.3–11.3 | 62 |
| Dundee | 76 | 10.8 | 7.5–16.6 | 9.4–11.9 | 63 |
| Dunfn | 100 | n/a | n/a | n/a | n/a |
| Edinb | 100 | 10.6 | 9.3–13.2 | 9.8–11.4 | 67 |
| Exeter | 100 | 9.7 | 7.4–12.6 | 9.0–10.7 | 46 |
| GlasRI | 100 | 10.2 | 8.3–12.3 | 9.4–11.0 | 65 |
| GlasWI | 97 | 10.5 | 8.6–15.6 | 10.1–12.9 | 83 |
| Glouc | 100 | 10.0 | 8.0–12.8 | 8.8–11.2 | 54 |
| Hull | 93 | 10.1 | 7.3–12.8 | 8.8–11.1 | 53 |
| Inverns | 75 | n/a | n/a | n/a | n/a |
| Ipswi | 100 | 10.4 | 8.4–13.6 | 9.5–11.5 | 67 |
| Klmarnk | 78 | n/a | n/a | n/a | na |
| L Barts | 0 | n/a | n/a | n/a | n/a |
| L Guys | 82 | 10.4 | 8.1–13.8 | 9.4–12.0 | 60 |
| L H&CX | 99 | 10.2 | 8.2–12.7 | 9.3–11.1 | 61 |
| L Kings | 99 | 10.2 | 8.0–13.6 | 9.4–11.4 | 56 |
| L Rfree | 97 | 10.2 | 8.1–13.1 | 9.5–11.2 | 66 |
| Leeds | 100 | 10.7 | 7.3–13.4 | 9.2–11.85 | 59 |
| Leic | 99 | 10.0 | 7.6–12.9 | 9.1–11.0 | 52 |
| Livrpl | 92 | 10.8 | 8.6–13.9 | 9.8–12.0 | 71 |
| ManWst | 87 | 10.4 | 8.0–13.5 | 9.4–11.8 | 62 |
| Middlbr | 99 | 9.9 | 7.2–12.7 | 8.8–11.3 | 48 |
| Newc | 95 | 10.7 | 7.4–12.5 | 9.2–11.6 | 60 |
| Newry | 33 | n/a | n/a | n/a | n/a |
| Norwch | 98 | 10.3 | 8.2–13.3 | 9.4–11.4 | 63 |
| Nottm | 99 | 10.1 | 7.8–12.6 | 9.0–11.0 | 52 |
| Oxford | 99 | 10.3 | 8.3–13.1 | 9.5–11.7 | 64 |
| Plymth | 70 | 10.2 | 8.0–12.3 | 9.4–11.5 | 63 |
| Ports | 99 | 10.3 | 8.3–13.6 | 9.3–11.9 | 56 |
| Prestn | 95 | 9.9 | 7.1–13.6 | 8.7–11.3 | 48 |
| Redng | 100 | 10.3 | 7.9–13.5 | 9.1–11.6 | 56 |
| Sheff | 100 | 10.2 | 7.9–13.2 | 9.0–11.5 | 54 |
| Shrew | 98 | 11.2 | 8.6–14.0 | 10.2–12.1 | 82 |
| Stevng | 86 | 10.4 | 8.7–13.0 | 9.8–11.7 | 73 |
| Sthend | 94 | 10.1 | 7.3–12.5 | 8.9–11.1 | 59 |
| Sund | 100 | 10.4 | 7.7–14.2 | 9.4–11.6 | 59 |
| Swanse | 100 | 9.5 | 7.8–12.9 | 8.9–10.8 | 38 |
| Truro | 100 | 10.2 | 7.6–12.3 | 9.4–11.2 | 67 |
| Tyrone | 95 | 10.1 | 7.4–12.3 | 9.4–11.0 | 56 |
| Ulster | 89 | n/a | n/a | n/a | n/a |
| Wirral | 2 | n/a | n/a | n/a | n/a |
| Wolve | 96 | 10.3 | 7.4–14.0 | 9.2–11.6 | 57 |
| Wrexm | 54 | 9.9 | 6.9–12.9 | 9.1–11.7 | 42 |
| York | 100 | 10.8 | 7.7–13.5 | 10.0–11.6 | 76 |
| Eng | 89 | 10.3 | 7.8–13.3 | 9.3–11.5 | 58 |
| NI | 76 | 10.4 | 6.9–13.2 | 8.9–11.4 | 59 |
| Sct | 90 | 10.5 | 8.2–14.2 | 9.6–11.5 | 69 |
| Wls | 94 | 10.3 | 7.9–13.2 | 9.2–11.5 | 59 |
| UK | 89 | 10.3 | 7.8–13.3 | 9.3–11.5 | 59 |

Note: Median Hb for units with less than 20 new patients or data returns <50% are not shown

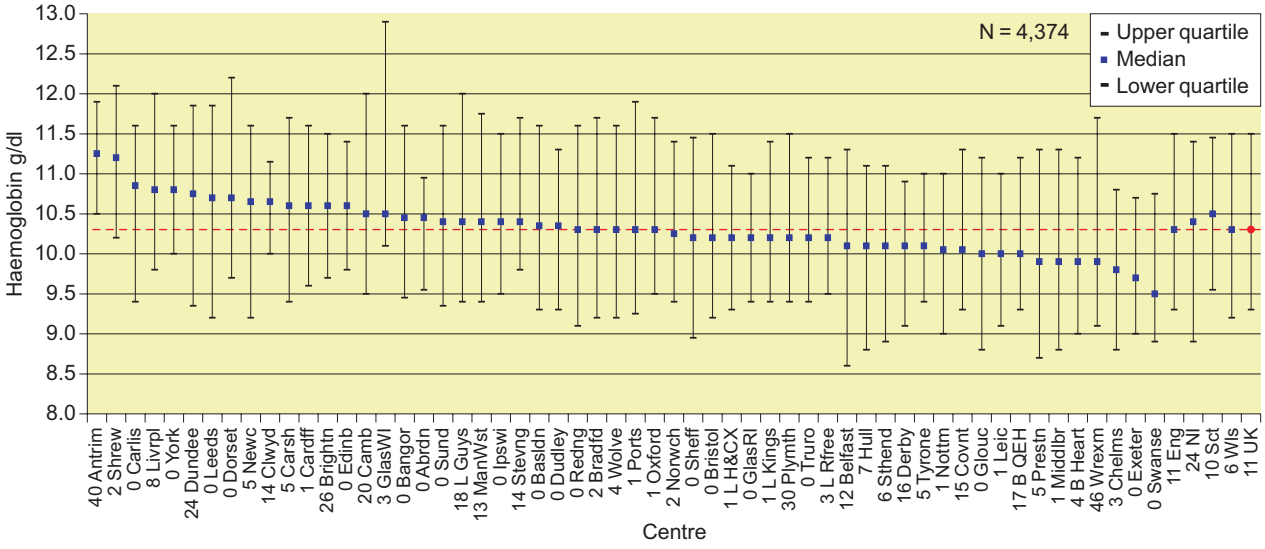


**Figure 8.1: Haemoglobin median and interquartile range for incident patients**

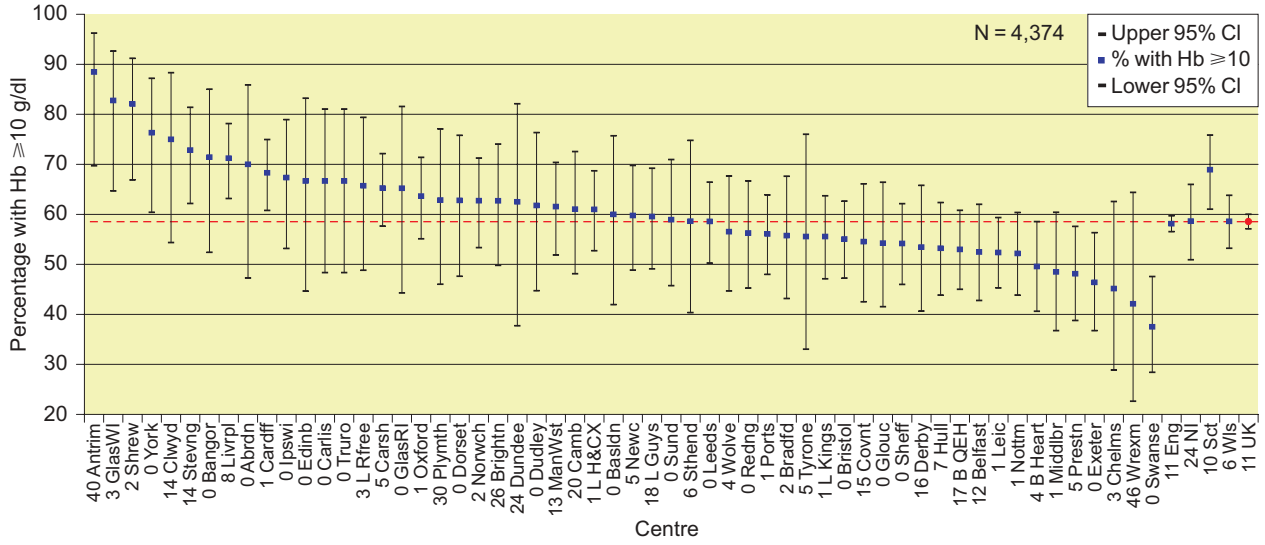


**Figure 8.2: Percentage of incident patients, by centre, achieving RA target**

unit returns with incomplete data sets are obviously open to criticism. Returns of <50% are excluded from unit level analysis. It is unlikely, although possible, that exclusion of data from these units will alter the overall conclusions.

The current starting median haemoglobin in the UK is 10.3 g/dl with 59% of patients starting dialysis with an Hb ⩾10 g/dl. Thus 41% of patients commence dialysis therapy with an Hb <10.0 g/dl. There is a wide range of compliance with the audit standard of Hb ⩾10 g/dl between units, from 38–88%. The wide range in starting Hb may reflect different practices in referral to nephrologists or differences in funding for predialysis ESA therapy. The median starting Hb is shown in Figure 8.1 and the percentage starting with an Hb ⩾10.0 g/dl by unit are given in Figure 8.2.

The distribution of haemoglobin in incident patients by unit is shown in Figure 8.3.

Figures 8.4 and 8.5 illustrate the improvement in correction of anaemia over the first year of haemodialysis in incident patients. Data on the haemoglobin prior to starting RRT and the relationship between this variable and comorbidity is presented in Chapter 6[9].

Both these figures suggest that availability of and/or better utilisation of ESA products for

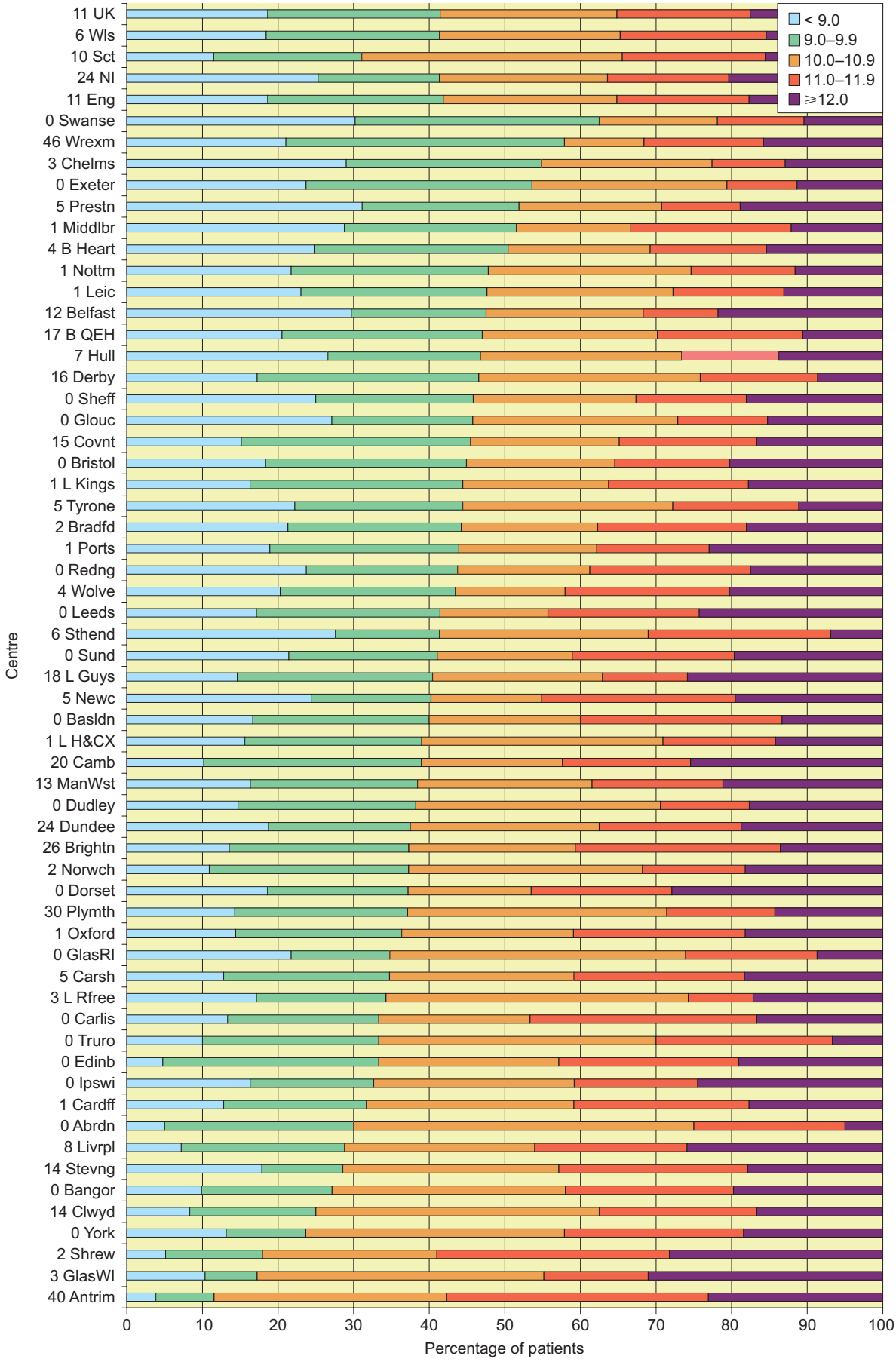


**Figure 8.3: Distribution of haemoglobin in incident dialysis patients**

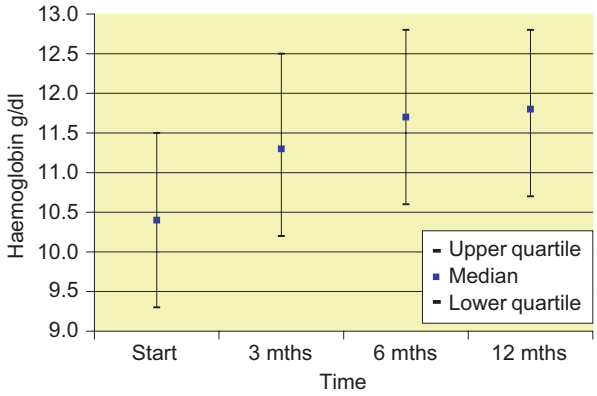


**Figure 8.4: Quarterly median haemoglobin for incident patients in 2005**

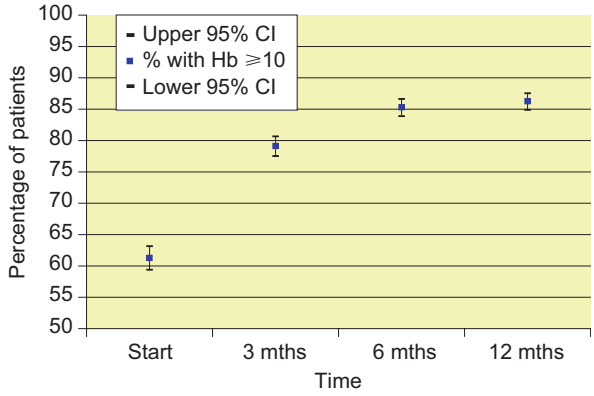


**Figure 8.5: Quarterly percentage of incident patients with haemoglobin ⩾10 g/dl in 2005**

use in the dialysis population is much improved in recent times with 85% compliance by 6 months after commencement of dialysis. It is uncertain whether poor availability of ESA funding, reluctance to treat or late referral is responsible for the ongoing prevalence of relative anaemia in patients commencing RRT.

## Haemoglobin of prevalent haemodialysis patients

The compliance with data returns and haemoglobin outcome for haemodialysis patients are shown in Table 8.2.

The median haemoglobin for haemodialysis patients by unit and compliance with the minimum standard Hb ⩾10 g/dl and the Hb ⩾11 g/dl standard are shown in Figures 8.6, 8.7 and 8.8 respectively.

The distribution of Hb in the haemodialysis population is shown, by unit, in Figure 8.9. The compliance with the new NICE guidelines for outcome haemoglobin 10.5–12.5 g/dl is shown in Figure 8.10. It should be noted that the dataset predates the NICE guidelines published in 2006. In Table 8.2 the inter-quartile range for the UK is 1.9 g/dl. Even at the 'ideal' median Hb of 11.5 g/dl and a normal distribution for

**Table 8.2: Haemoglobin data for prevalent patients on haemodialysis**

| Centre | % data return | Median Hb g/dl | 90% range | Quartile range | Mean Hb g/dl | Standard deviation | % with Hb ⩾10 | % with Hb ⩾11 |
|---|---|---|---|---|---|---|---|---|
| Abrdn | 98 | 11.7 | 9.1–14.2 | 10.5–12.5 | 11.6 | 1.5 | 88 | 64 |
| Airdrie | 100 | 12.0 | 8.9–14.4 | 10.8–12.7 | 11.7 | 1.6 | 86 | 72 |
| Antrim | 92 | 12.1 | 10.5–13.9 | 11.4–13.0 | 12.2 | 1.1 | 98 | 88 |
| B Heart | 94 | 11.6 | 8.9–14.0 | 10.2–12.4 | 11.4 | 1.6 | 81 | 60 |
| B QEH | 97 | 11.8 | 8.7–14.5 | 10.5–12.9 | 11.7 | 1.8 | 84 | 68 |
| Bangor | 94 | 11.8 | 8.9–13.6 | 11.0–12.7 | 11.7 | 1.5 | 84 | 77 |
| Basldn | 99 | 11.8 | 9.1–13.9 | 10.5–12.5 | 11.5 | 1.5 | 81 | 66 |
| Belfast | 93 | 11.8 | 9.0–14.5 | 10.7–12.9 | 11.8 | 1.7 | 86 | 71 |
| Bradfd | 100 | 12.8 | 9.8–14.8 | 11.8–13.8 | 12.7 | 1.6 | 94 | 85 |
| Brightn | 69 | 10.6 | 8.2–13.1 | 9.4–11.9 | 10.6 | 1.6 | 69 | 46 |
| Bristol | 100 | 12.0 | 9.0–14.3 | 10.9–12.9 | 11.9 | 1.6 | 90 | 73 |
| Camb | 69 | 11.4 | 8.5–13.5 | 10.0–12.6 | 11.3 | 1.6 | 76 | 58 |
| Cardff | 98 | 12.2 | 9.3–14.7 | 11.1–13.3 | 12.1 | 1.7 | 90 | 77 |
| Carlis | 93 | 11.4 | 9.0–14.6 | 10.2–12.4 | 11.4 | 1.7 | 83 | 64 |
| Carsh | 88 | 11.7 | 8.9–14.8 | 10.6–12.8 | 11.8 | 1.7 | 86 | 70 |
| Chelms | 98 | 11.7 | 8.9–14.1 | 10.6–12.6 | 11.5 | 1.7 | 85 | 65 |
| Clwyd | 94 | 12.0 | 10.3–13.9 | 11.4–12.7 | 12.1 | 1.2 | 96 | 86 |
| Covnt | 98 | 11.3 | 8.9–13.7 | 10.4–12.4 | 11.4 | 1.5 | 85 | 63 |
| D&Gall | 100 | 10.9 | 9.1–13.6 | 10.1–12.0 | 11.1 | 1.4 | 76 | 49 |

**Table 8.2: (continued)**

| Centre | % data return | Median Hb g/dl | 90% range | Quartile range | Mean Hb g/dl | Standard deviation | % with Hb ⩾10 | % with Hb ⩾11 |
|---|---|---|---|---|---|---|---|---|
| Derby | 100 | 11.8 | 8.3–14.3 | 10.6–13.0 | 11.7 | 1.9 | 81 | 68 |
| Dorset | 99 | 11.8 | 8.7–13.9 | 10.7–12.7 | 11.6 | 1.6 | 87 | 71 |
| Dudley | 84 | 11.3 | 8.2–14.6 | 9.7–12.5 | 11.2 | 1.9 | 70 | 51 |
| Dundee | 95 | 11.8 | 8.4–13.7 | 10.7–12.6 | 11.6 | 1.6 | 86 | 72 |
| Dunfn | 99 | 11.5 | 8.9–13.8 | 10.5–12.4 | 11.4 | 1.6 | 83 | 67 |
| Edinb | 98 | 12.1 | 9.7–14.0 | 11.2–12.9 | 12.0 | 1.3 | 94 | 81 |
| Exeter | 99 | 11.4 | 8.7–13.5 | 10.5–12.3 | 11.3 | 1.5 | 84 | 66 |
| GlasRI | 98 | 11.6 | 8.5–13.9 | 10.5–12.6 | 11.5 | 1.6 | 83 | 67 |
| GlasWI | 98 | 11.8 | 8.8–14.3 | 10.6–12.8 | 11.6 | 1.7 | 84 | 68 |
| Glouc | 99 | 12.2 | 9.1–14.1 | 11.0–13.0 | 11.9 | 1.6 | 86 | 76 |
| Hull | 99 | 11.7 | 8.6–13.7 | 10.7–12.6 | 11.6 | 1.5 | 85 | 69 |
| Inverns | 96 | 12.0 | 9.7–14.1 | 11.0–12.7 | 11.8 | 1.4 | 92 | 75 |
| Ipswi | 100 | 11.6 | 9.2–13.4 | 10.7–12.4 | 11.5 | 1.4 | 87 | 67 |
| Klmarnk | 99 | 12.0 | 8.8–14.4 | 10.8–13.1 | 11.9 | 1.7 | 85 | 72 |
| L Barts | 0 | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| L Guys | 89 | 11.5 | 8.9–13.8 | 10.3–12.6 | 11.4 | 1.6 | 81 | 61 |
| L H&CX | 99 | 11.9 | 9.1–13.9 | 10.9–12.7 | 11.7 | 1.5 | 88 | 73 |
| L Kings | 100 | 11.4 | 8.5–13.5 | 10.3–12.3 | 11.3 | 1.6 | 81 | 61 |
| L Rfree | 93 | 11.4 | 9.1–13.6 | 10.4–12.4 | 11.4 | 1.4 | 83 | 62 |
| Leeds | 100 | 12.4 | 9.7–15.0 | 11.3–13.3 | 12.3 | 1.5 | 94 | 83 |
| Leic | 98 | 11.8 | 9.1–14.0 | 10.8–12.7 | 11.7 | 1.6 | 88 | 71 |
| Livrpl | 98 | 12.1 | 9.1–14.9 | 10.9–13.3 | 12.1 | 1.7 | 88 | 72 |
| ManWst | 81 | 11.9 | 8.7–14.3 | 10.4–12.7 | 11.6 | 1.7 | 82 | 66 |
| Middlbr | 99 | 11.8 | 8.7–13.9 | 10.7–12.7 | 11.6 | 1.6 | 86 | 69 |
| Newc | 100 | 12.1 | 8.7–14.5 | 11.1–12.9 | 11.8 | 1.8 | 88 | 76 |
| Newry | 96 | 12.0 | 9.5–14.0 | 11.2–12.6 | 11.9 | 1.3 | 95 | 78 |
| Norwch | 100 | 12.1 | 9.7–14.0 | 11.3–13.0 | 12.0 | 1.3 | 94 | 80 |
| Nottm | 100 | 11.3 | 8.9–13.7 | 10.6–12.3 | 11.4 | 1.5 | 87 | 63 |
| Oxford | 99 | 11.7 | 9.1–14.4 | 10.7–12.7 | 11.7 | 1.6 | 87 | 70 |
| Plymth | 92 | 11.4 | 8.0–14.2 | 10.3–12.4 | 11.3 | 1.7 | 81 | 58 |
| Ports | 99 | 12.0 | 8.8–14.3 | 10.7–13.1 | 11.8 | 1.7 | 85 | 70 |
| Prestn | 97 | 11.5 | 9.2–14.0 | 10.5–12.6 | 11.6 | 1.5 | 85 | 64 |
| Redng | 99 | 11.8 | 9.4–13.8 | 10.8–12.5 | 11.7 | 1.3 | 87 | 72 |
| Sheff | 99 | 11.9 | 9.2–14.5 | 10.9–12.9 | 11.9 | 1.6 | 90 | 72 |
| Shrew | 100 | 12.2 | 9.7–14.4 | 11.4–13.0 | 12.2 | 1.4 | 94 | 83 |
| Stevng | 83 | 11.5 | 9.1–13.4 | 10.5–12.5 | 11.4 | 1.4 | 86 | 66 |
| Sthend | 97 | 11.6 | 9.1–13.6 | 10.7–12.3 | 11.4 | 1.3 | 85 | 66 |
| Sund | 98 | 11.7 | 8.3–14.5 | 10.4–13.0 | 11.7 | 1.8 | 83 | 66 |
| Swanse | 97 | 11.8 | 9.3–14.4 | 10.8–12.9 | 11.9 | 1.5 | 89 | 72 |
| Truro | 99 | 11.3 | 9.2–12.9 | 10.5–11.9 | 11.3 | 1.1 | 89 | 66 |
| Tyrone | 93 | 12.1 | 9.7–13.9 | 11.3–12.9 | 12.0 | 1.5 | 92 | 82 |
| Ulster | 100 | 12.1 | 9.4–13.7 | 11.0–12.7 | 11.9 | 1.2 | 92 | 84 |
| Wirral | 7 | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Wolve | 100 | 12.2 | 8.8–14.8 | 11.1–13.3 | 12.2 | 1.7 | 92 | 78 |
| Wrexm | 82 | 11.8 | 7.3–13.8 | 10.0–12.6 | 11.2 | 1.9 | 77 | 62 |
| York | 100 | 12.5 | 8.6–15.3 | 11.6–13.3 | 12.4 | 1.7 | 90 | 85 |
| Eng | 90 | 11.7 | 8.9–14.2 | 10.6–12.7 | 11.7 | 1.6 | 86 | 69 |
| NI | 94 | 12.0 | 9.2–14.2 | 11.0–12.9 | 11.9 | 1.5 | 91 | 77 |
| Sct | 98 | 11.8 | 8.9–14.1 | 10.7–12.7 | 11.7 | 1.6 | 86 | 70 |
| Wls | 95 | 12.0 | 9.1–14.5 | 10.9–13.1 | 11.9 | 1.6 | 88 | 75 |
| UK | 92 | 11.8 | 9.0–14.2 | 10.7–12.8 | 11.7 | 1.6 | 86 | 70 |

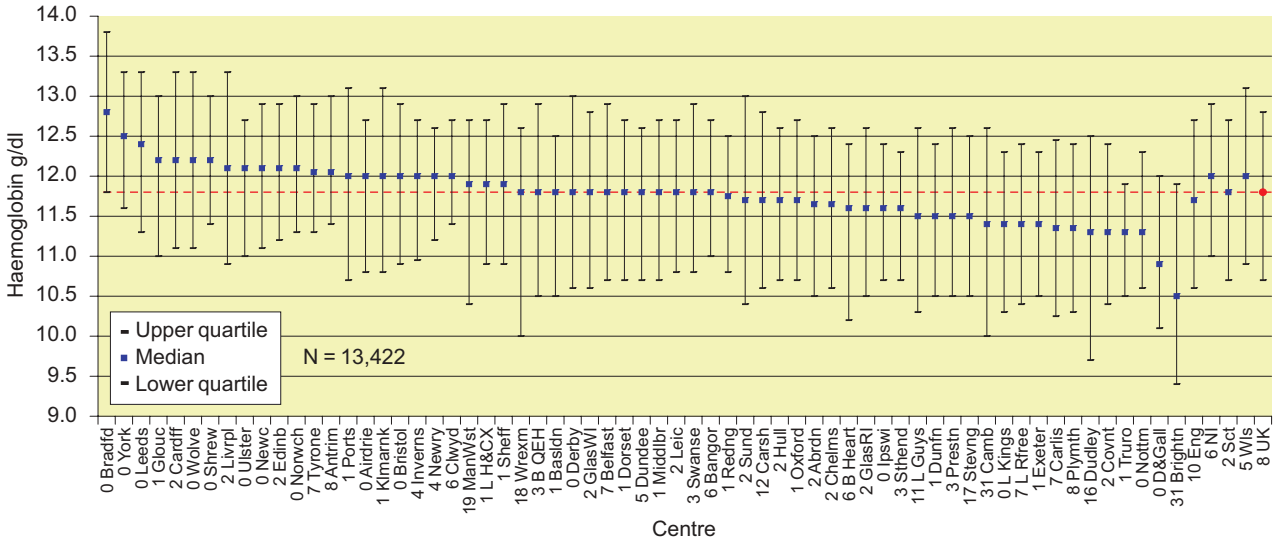


**Figure 8.6: Median haemoglobin: HD**

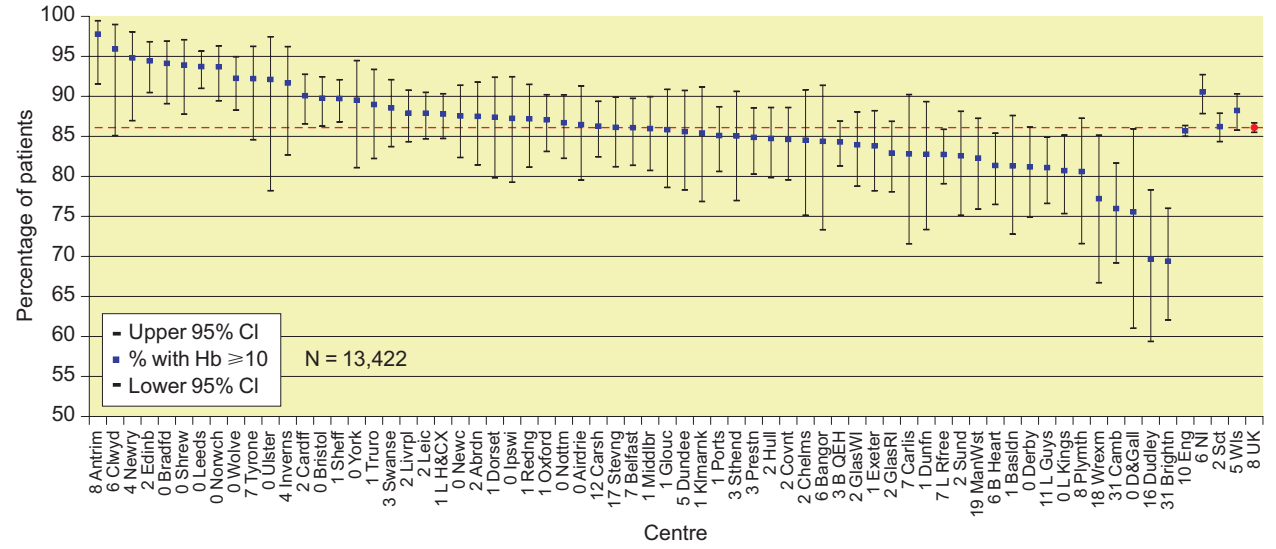


**Figure 8.7: Percentage of HD patients with Hb ⩾10 g/dl**

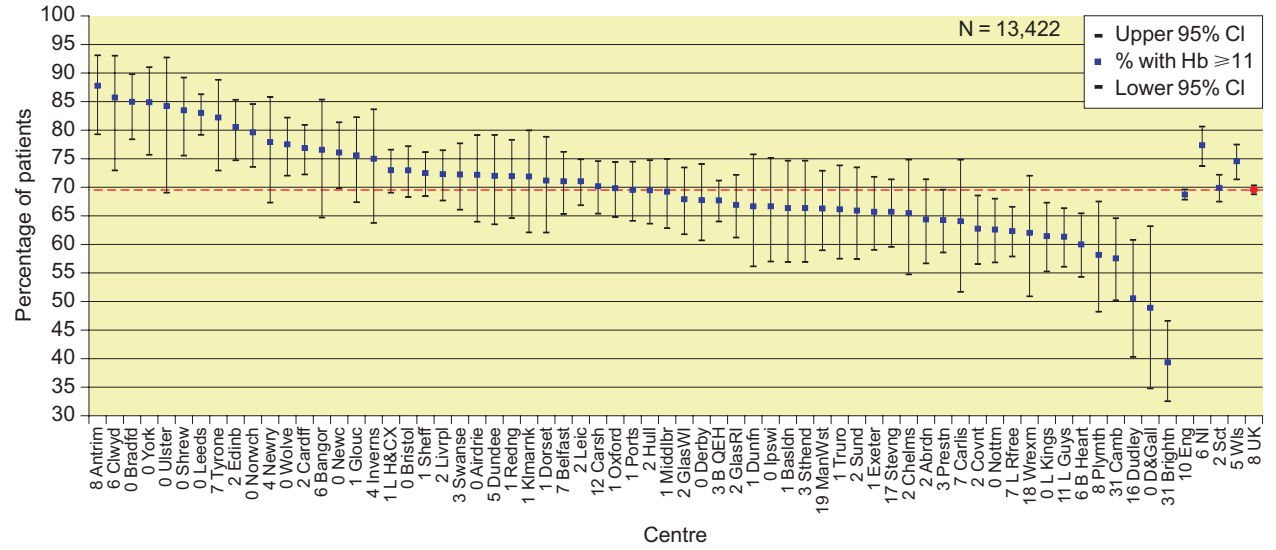


**Figure 8.8: Percentage of HD patients with Hb ⩾11 g/dl**

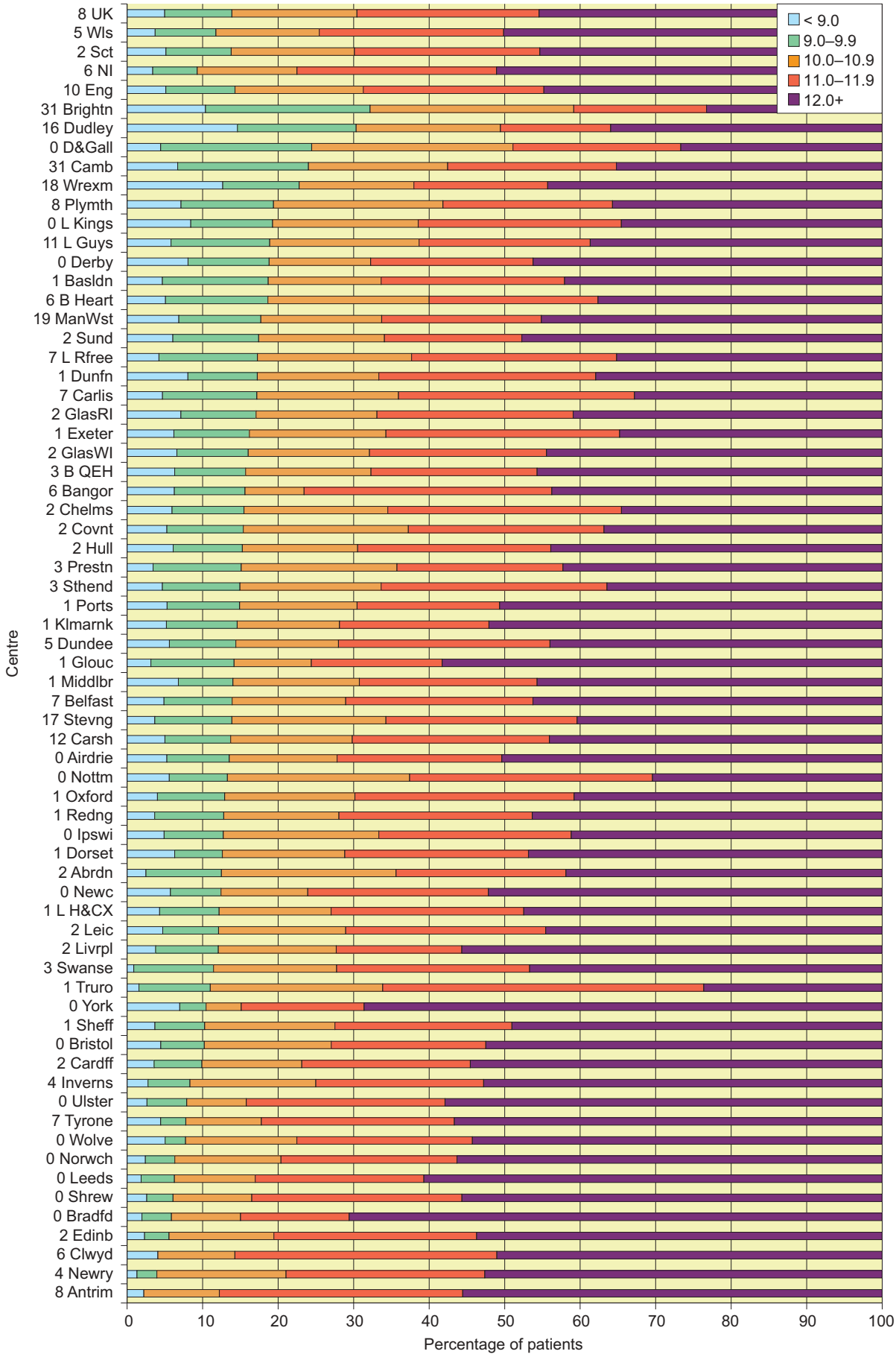


**Figure 8.9: Distribution of haemoglobin in patients on HD**

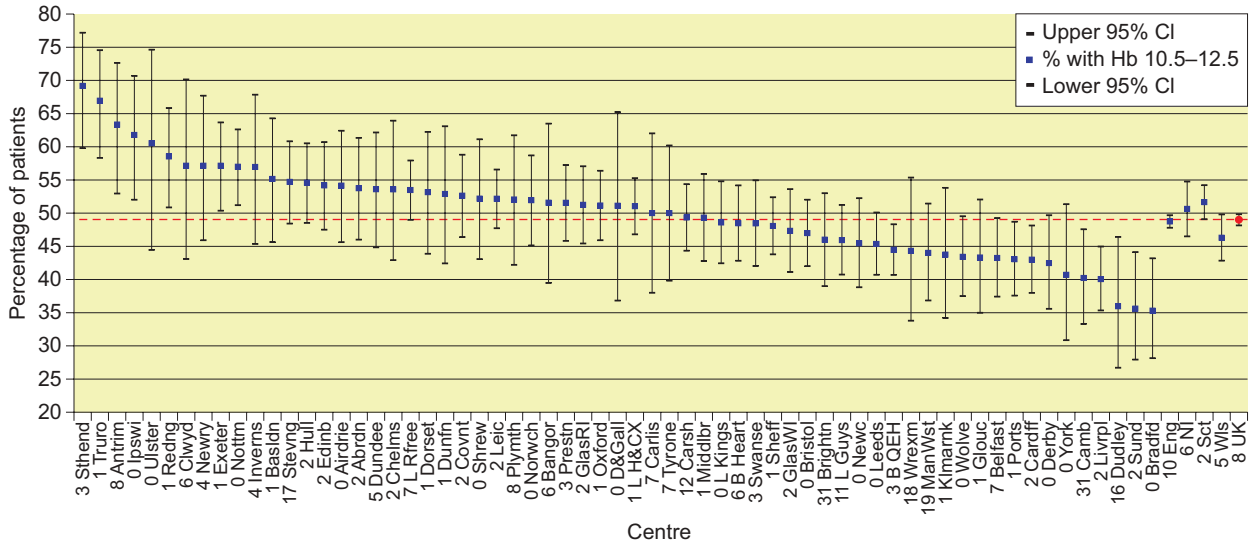


**Figure 8.10: Percentage of HD patients with Hb ⩾10.5 and ⩽12.5 g/dl**

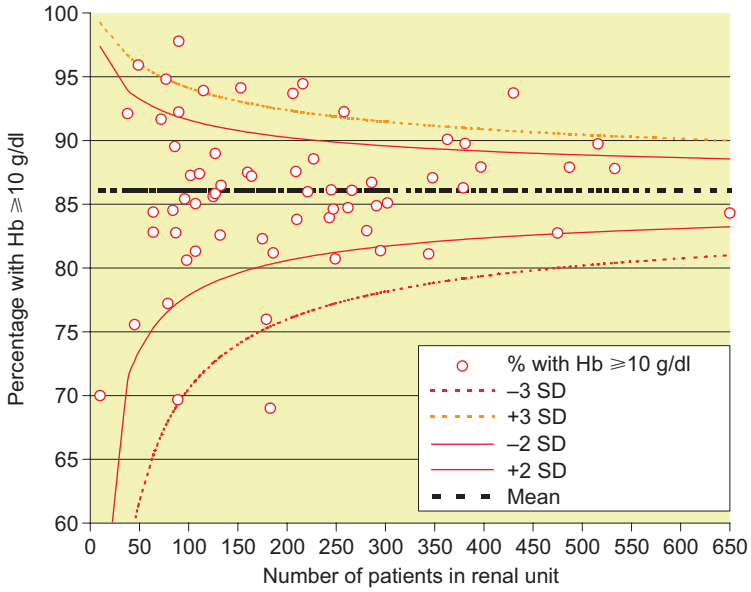


**Figure 8.11: Funnel plot for percentage of HD patients with Hb ⩾10 g/dl**

Hb, compliance is unlikely to be greater than ~50% unless the Hb distribution can be systematically narrowed.

The funnel plot for haemoglobin outcome allows a unit to identify whether its Hb outcome is statistically different from the national distribution of Hb outcomes. This is true for high or low unit Hb outcomes. In the context of the NICE guidelines this may become increasingly useful to use in conjunction with a measure of compliance with 10.5–12.5 g/dl outcome range. A funnel plot for compliance with UK minimum standards for Hb is shown in Figure 8.11 and should be used in conjunction with Table 8.3 to identify an individual unit by size (X axis) and percentage achieving Hb >10 g/dl (Y axis).

## *Haemoglobin of prevalent peritoneal dialysis patients*

The compliance with data returns and haemoglobin outcome for peritoneal dialysis patients are shown in Table 8.4.

The median haemoglobin for peritoneal dialysis patients by unit and compliance with the UK minimum standard Hb ⩾10 g/dl and

**Table 8.3: Percentage of HD patients achieving Renal Association audit standard of Hb ⩾10 g/dl by unit for 2005**

| Centre | Total | % with Hb ⩾10 g/dl | Centre | Total | % with Hb ⩾10 g/dl |
|---|---|---|---|---|---|
| Abrdn | 160 | 88 | Klmarnk | 96 | 85 |
| Airdrie | 133 | 86 | L Guys | 344 | 81 |
| Antrim | 90 | 98 | L H&CX | 533 | 88 |
| B Heart | 295 | 81 | L Kings | 249 | 81 |
| B QEH | 650 | 84 | L Rfree | 475 | 83 |
| Bangor | 64 | 84 | Leeds | 430 | 94 |
| Basldn | 107 | 81 | Leic | 487 | 88 |
| Belfast | 266 | 86 | Livrpl | 397 | 88 |
| Bradfd | 153 | 94 | ManWst | 175 | 82 |
| Brightn | 183 | 69 | Middlbr | 221 | 86 |
| Bristol | 381 | 90 | Newc | 209 | 88 |
| Camb | 179 | 76 | Newry | 77 | 95 |
| Cardff | 363 | 90 | Norwch | 206 | 94 |
| Carlis | 64 | 83 | Nottm | 286 | 87 |
| Carsh | 379 | 86 | Oxford | 348 | 87 |
| Chelms | 84 | 85 | Plymth | 98 | 81 |
| Clwyd | 49 | 96 | Ports | 302 | 85 |
| Covnt | 247 | 85 | Prestn | 291 | 85 |
| D&Gall | 45 | 76 | Redng | 164 | 87 |
| Derby | 186 | 81 | Sheff | 516 | 90 |
| Dorset | 111 | 87 | Shrew | 115 | 94 |
| Dudley | 89 | 70 | Stevng | 245 | 86 |
| Dundee | 125 | 86 | Sthend | 107 | 85 |
| Dunfn | 87 | 83 | Sund | 132 | 83 |
| Edinb | 216 | 94 | Swanse | 227 | 89 |
| Exeter | 210 | 84 | Truro | 127 | 89 |
| GlasRI | 281 | 83 | Tyrone | 90 | 92 |
| GlasWI | 243 | 84 | Ulster | 38 | 92 |
| Glouc | 127 | 86 | Wirral | 10 | 70 |
| Hull | 262 | 85 | Wolve | 258 | 92 |
| Inverns | 72 | 92 | Wrexm | 79 | 77 |
| Ipswi | 102 | 87 | York | 86 | 90 |

EBPG standard of Hb ⩾11 g/dl are shown in Figures 8.12, 8.13 and 8.14.

The compliance with the new NICE guidelines for outcome haemoglobin 10.5–12.5 g/dl is shown in Figure 8.15. Again, the dataset predates the NICE guidelines published in 2006. In Table 8.4 the inter-quartile range for the UK for the PD population is also 1.9 g/dl (as for HD). The same comments apply regarding compliance for the PD population as for the HD population.

The distribution of haemoglobin in peritoneal dialysis patients is shown in Figure 8.16.

A funnel plot for compliance with UK minimum standards for Hb in peritoneal dialysis is shown in Figure 8.17. The graph is to be used in reference with Table 8.5.

## *Haemoglobin in incident patients*

The percentage of new and prevalent patients compliant with Hb ⩾10.0 g/dl is shown in Figure 8.18.

Compliance with UK and EBPG standards in each unit are correlated with the median Hb outcome in each unit. This is shown in Figures 8.19–22. These graphs demonstrate that, in general, it is necessary to shift the distribution of haemoglobin values in a population to the right in order to ensure that only a small proportion of the population have values falling below a given audit standard. However,

**Table 8.4: Haemoglobin data for prevalent patients on peritoneal dialysis**

| Centre | % data return | Median Hb g/dl | 90% range | Quartile range | Mean Hb g/dl | Standard deviation | % with Hb ⩾10 | % with Hb ⩾11 |
|---|---|---|---|---|---|---|---|---|
| Abrdn | 95 | 11.9 | 8.2–14.2 | 11.0–13.3 | 11.8 | 1.8 | 86 | 76 |
| Airdrie | 100 | 11.8 | 10.0–12.9 | 11.1–12.3 | 11.8 | 1.5 | 96 | 81 |
| Antrim | 83 | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| B Heart | 100 | 11.9 | 8.3–13.2 | 10.7–12.5 | 11.5 | 1.4 | 91 | 69 |
| B QEH | 94 | 11.9 | 7.9–14.6 | 10.9–12.9 | 11.8 | 1.8 | 86 | 74 |
| Bangor | 100 | 12.9 | 10.4–14.9 | 12.4–13.5 | 13.0 | 1.3 | 100 | 91 |
| Basldn | 100 | 12.5 | 9.8–14.2 | 11.7–13.5 | 12.4 | 1.5 | 90 | 87 |
| Belfast | 92 | 11.9 | 9.5–14.9 | 11.1–12.9 | 12.1 | 1.6 | 91 | 81 |
| Bradfd | 100 | 12.3 | 10.7–15.9 | 11.5–13.1 | 12.6 | 1.5 | 100 | 87 |
| Brightn | 87 | 12.1 | 8.9–14.4 | 11.3–13.0 | 12.1 | 1.7 | 88 | 82 |
| Bristol | 100 | 12.3 | 10.3–14.0 | 11.6–13.1 | 12.3 | 1.3 | 95 | 87 |
| Camb | 100 | 12.4 | 10.2–14.4 | 11.4–13.3 | 12.3 | 1.4 | 99 | 81 |
| Cardff | 98 | 12.2 | 10.0–14.6 | 11.4–13.1 | 12.3 | 1.5 | 96 | 84 |
| Carlis | 100 | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Carsh | 94 | 12.1 | 8.7–15.5 | 11.1–13.0 | 12.1 | 1.8 | 93 | 78 |
| Chelms | 97 | 12.1 | 9.3–14.4 | 11.0–13.1 | 12.1 | 1.5 | 94 | 78 |
| Clwyd | 92 | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Covnt | 97 | 12.1 | 9.3–15.1 | 10.6–13.3 | 11.9 | 1.8 | 81 | 68 |
| D&Gall | 100 | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Derby | 98 | 11.8 | 9.8–13.8 | 10.9–12.6 | 11.9 | 1.4 | 92 | 75 |
| Dorset | 94 | 12.0 | 8.8–14.6 | 11.4–12.8 | 12.0 | 1.5 | 90 | 85 |
| Dudley | 96 | 11.9 | 8.8–14.2 | 10.3–12.8 | 11.7 | 1.7 | 82 | 67 |
| Dundee | 98 | 12.0 | 10.3–14.3 | 11.6–12.9 | 12.2 | 1.2 | 95 | 88 |
| Dunfn | 100 | 12.2 | 10.6–13.5 | 11.7–13.0 | 12.2 | 1.1 | 95 | 86 |
| Edinb | 98 | 11.5 | 8.8–14.2 | 10.3–12.7 | 11.5 | 1.6 | 85 | 61 |
| Exeter | 100 | 12.0 | 9.6–14.2 | 10.7–12.7 | 11.8 | 1.4 | 90 | 73 |
| GlasRI | 96 | 11.4 | 9.6–13.6 | 10.7–12.7 | 11.7 | 1.8 | 91 | 70 |
| GlasWI | 99 | 11.7 | 8.1–14.1 | 10.5–12.3 | 11.5 | 1.8 | 83 | 70 |
| Glouc | 97 | 11.4 | 9.3–14.8 | 10.6–12.8 | 11.6 | 1.7 | 85 | 65 |
| Hull | 96 | 11.9 | 8.8–14.9 | 10.8–13.2 | 12.0 | 2.0 | 85 | 71 |
| Inverns | 42 | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Ipswi | 98 | 12.4 | 10.2–15.2 | 11.7–13.3 | 12.5 | 1.5 | 97 | 89 |
| Klmarnk | 96 | 11.9 | 9.6–14.2 | 11.1–12.7 | 12.0 | 1.3 | 91 | 81 |
| L Barts | 0 | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| L Guys | 100 | 11.5 | 7.8–13.8 | 10.9–12.8 | 11.5 | 1.8 | 89 | 74 |
| L H&CX | 98 | 11.8 | 9.6–14.9 | 11.0–12.9 | 11.9 | 1.6 | 92 | 78 |
| L Kings | 100 | 12.4 | 9.0–14.1 | 11.1–13.4 | 12.1 | 1.7 | 90 | 82 |
| L Rfree | 98 | 11.2 | 9.4–13.6 | 10.5–12.0 | 11.3 | 1.2 | 87 | 65 |
| Leeds | 98 | 12.2 | 10.0–15.6 | 11.4–13.5 | 12.5 | 1.6 | 96 | 85 |
| Leic | 98 | 11.7 | 8.3–14.3 | 10.5–12.5 | 11.6 | 1.8 | 86 | 69 |
| Livrpl | 96 | 12.4 | 10.3–14.3 | 11.6–13.2 | 12.4 | 1.4 | 96 | 86 |
| ManWst | 89 | 11.9 | 8.3–14.7 | 10.3–13.3 | 11.8 | 2.0 | 81 | 66 |
| Middlbr | 100 | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Newc | 100 | 12.5 | 8.0–14.3 | 10.8–13.3 | 12.0 | 1.9 | 86 | 74 |
| Newry | 86 | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Norwch | 100 | 12.2 | 9.3–14.0 | 11.5–12.9 | 12.1 | 1.4 | 91 | 80 |

**Table 8.4: (continued)**

| Centre | % data return | Median Hb g/dl | 90% range | Quartile range | Mean Hb g/dl | Standard deviation | % with Hb ⩾10 | % with Hb ⩾11 |
|---|---|---|---|---|---|---|---|---|
| Nottm | 100 | 11.4 | 9.5–13.7 | 10.7–12.2 | 11.5 | 1.3 | 89 | 70 |
| Oxford | 100 | 12.2 | 8.9–14.4 | 11.2–13.0 | 12.1 | 1.6 | 90 | 79 |
| Plymth | 92 | 12.1 | 10.5–14.2 | 11.2–13.2 | 12.2 | 1.2 | 100 | 82 |
| Ports | 99 | 12.2 | 9.3–15.6 | 10.8–13.3 | 12.2 | 1.9 | 90 | 72 |
| Prestn | 98 | 11.5 | 7.6–13.6 | 10.2–12.3 | 11.2 | 1.8 | 78 | 63 |
| Redng | 100 | 12.0 | 9.4–15.2 | 11.1–13.0 | 12.1 | 1.7 | 91 | 78 |
| Sheff | 100 | 12.0 | 9.2–14.7 | 10.9–12.9 | 11.9 | 1.7 | 90 | 74 |
| Shrew | 100 | 12.4 | 10.3–15.3 | 11.5–13.4 | 12.5 | 1.4 | 100 | 88 |
| Stevng | 98 | 11.7 | 9.9–14.4 | 10.8–12.7 | 11.8 | 1.5 | 91 | 68 |
| Sthend | 95 | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Sund | 100 | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Swanse | 99 | 12.2 | 9.4–14.0 | 10.9–12.9 | 11.9 | 1.5 | 89 | 75 |
| Truro | 100 | 12.1 | 9.4–14.5 | 11.4–12.9 | 12.2 | 1.5 | 94 | 82 |
| Tyrone | 80 | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Ulster | 100 | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Wirral | 4 | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Wolve | 100 | 12.5 | 10.5–15.7 | 11.6–13.3 | 12.6 | 1.5 | 98 | 91 |
| Wrexm | 80 | 12.7 | 10.1–14.3 | 11.4–13.4 | 12.4 | 1.3 | 97 | 88 |
| York | 100 | 12.4 | 10.7–14.0 | 11.2–13.2 | 12.3 | 1.2 | 100 | 83 |
| Eng | 91 | 12.0 | 9.2–14.6 | 11.0–12.9 | 11.9 | 1.7 | 90 | 76 |
| NI | 89 | 12.0 | 9.5–14.6 | 11.3–13.0 | 12.2 | 1.5 | 93 | 83 |
| Sct | 93 | 11.9 | 9.0–14.2 | 11.0–12.7 | 11.8 | 1.6 | 89 | 75 |
| Wls | 95 | 12.3 | 9.8–14.4 | 11.3–13.2 | 12.3 | 1.5 | 95 | 82 |
| UK | 92 | 12.0 | 9.2–14.5 | 11.0–12.9 | 12.0 | 1.6 | 90 | 76 |

Note: Median Hb for units with less than 20 new patients or data returns <50% are not shown

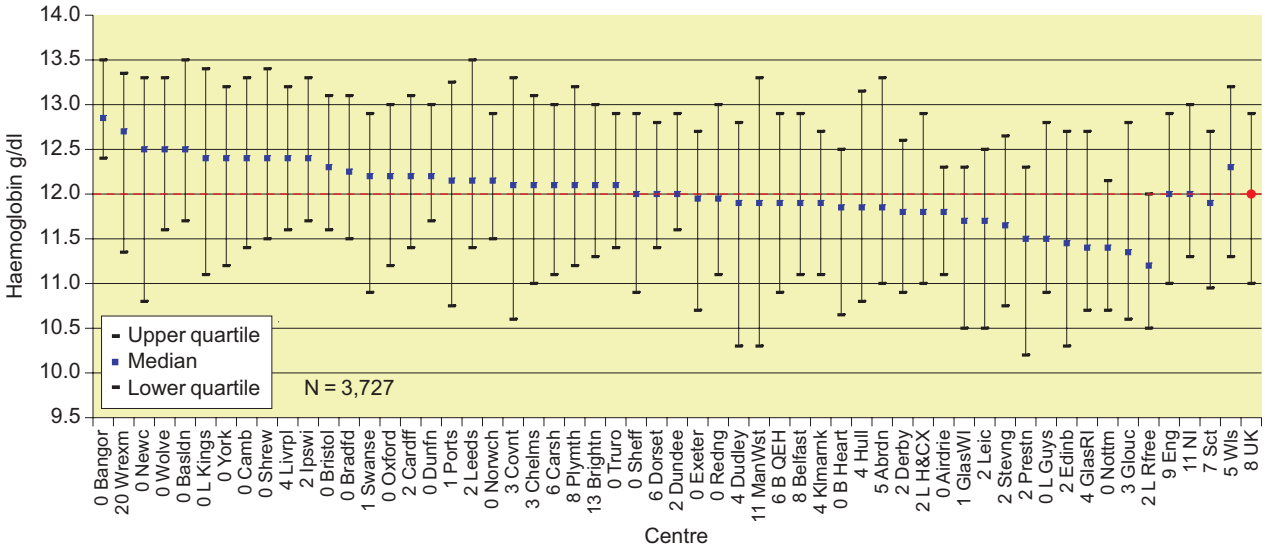


**Figure 8.12: Median haemoglobin: PD**

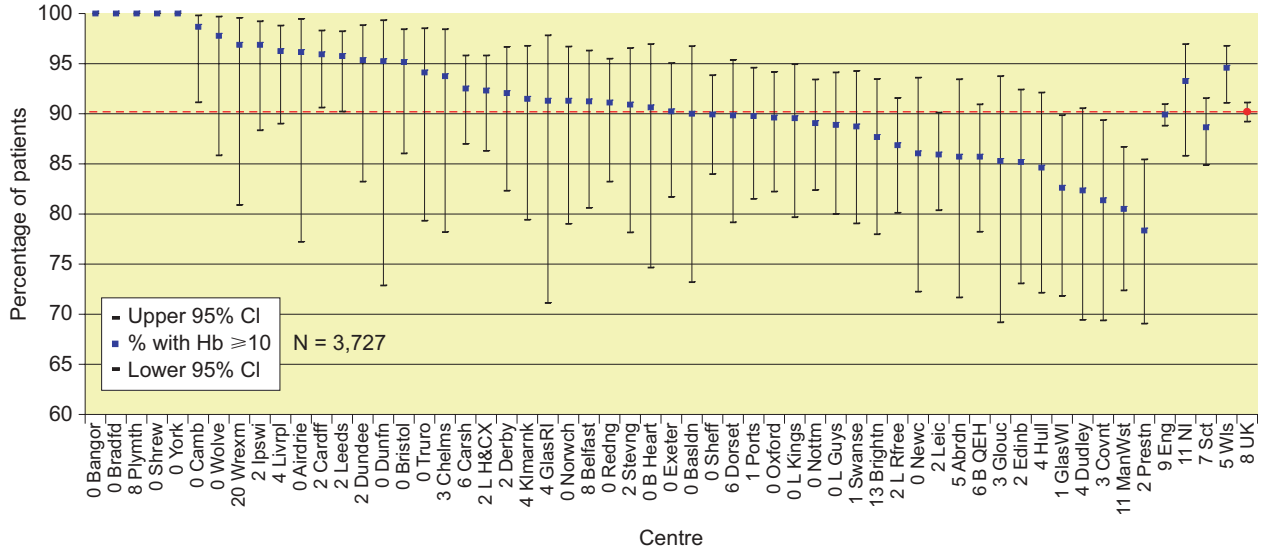


**Figure 8.13: Percentage of PD patients with Hb ⩾10 g/dl**

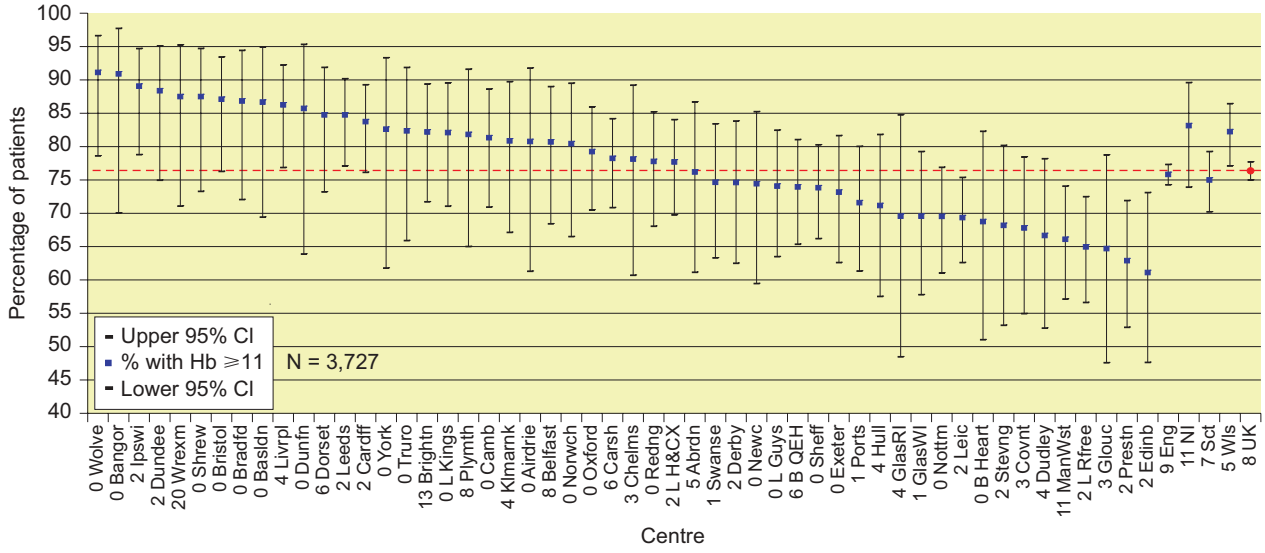


**Figure 8.14: Percentage of PD patients with Hb ⩾11 g/dl**

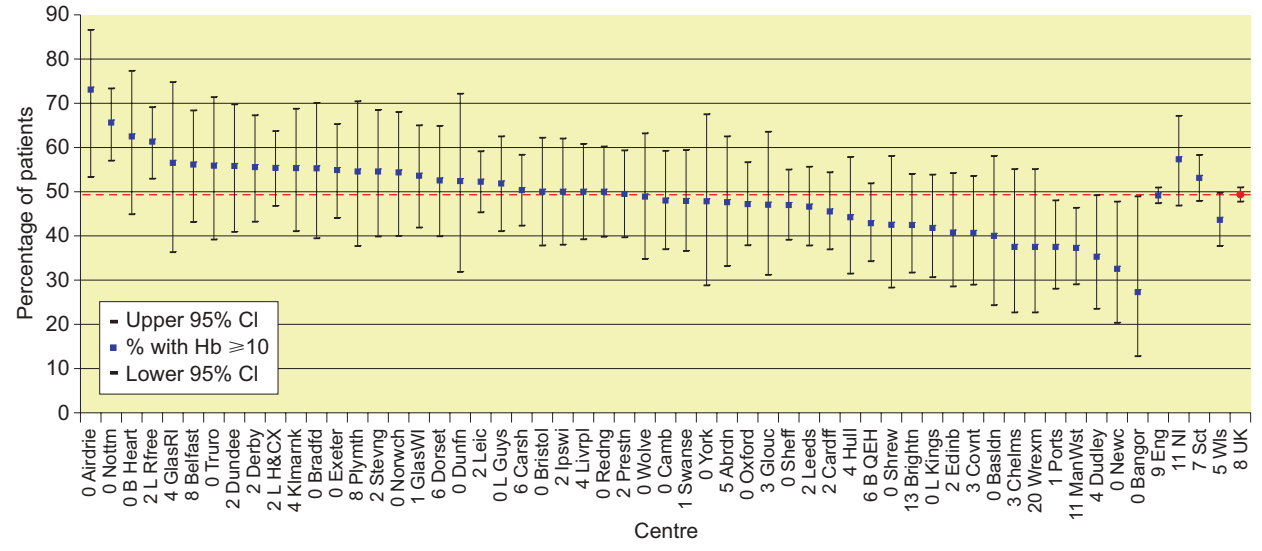


**Figure 8.15: Percentage of PD patients with Hb ⩾10.5 and ⩽12.5 g/dl**

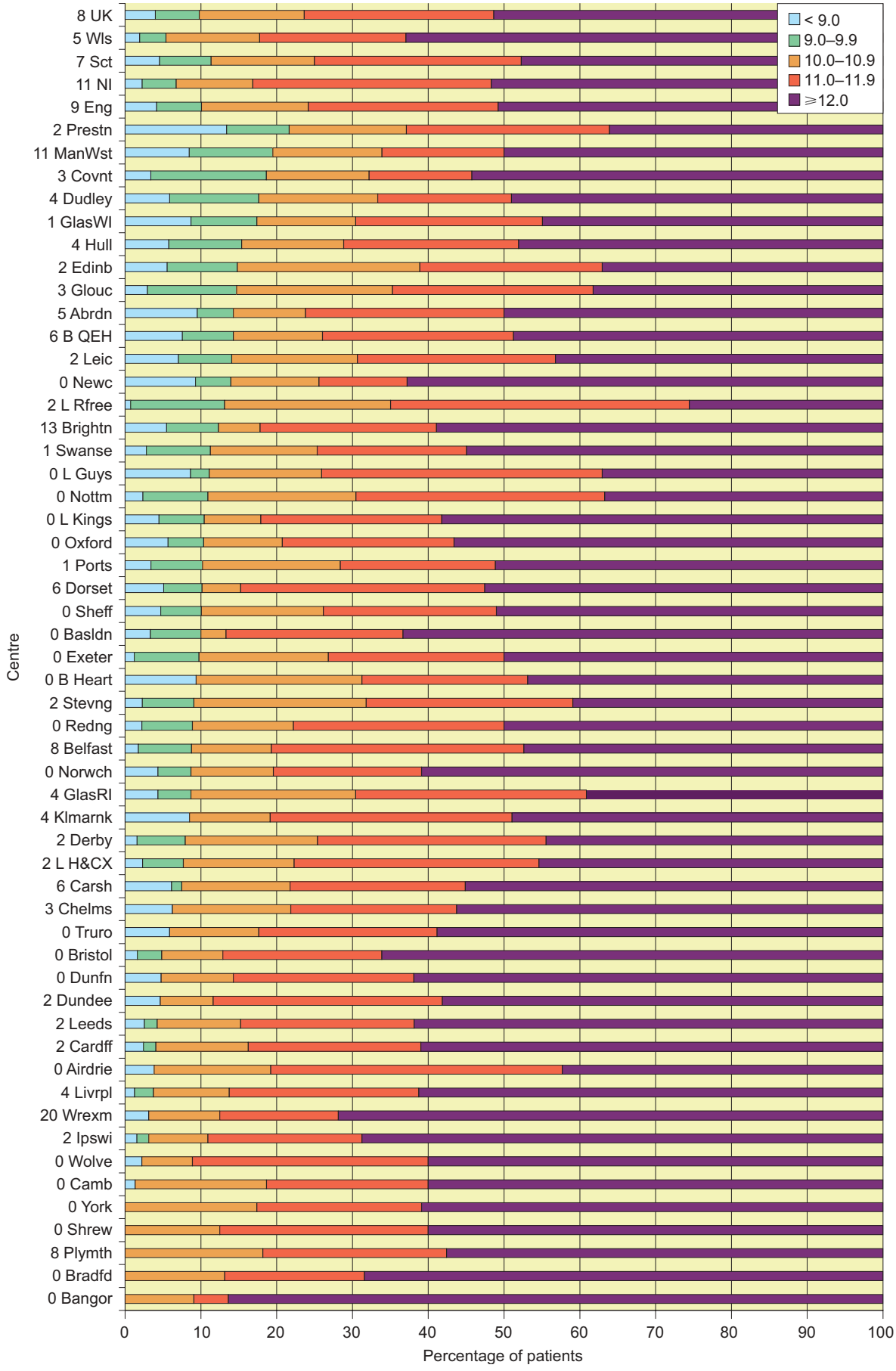


**Figure 8.16: Distribution of haemoglobin in patients on PD**

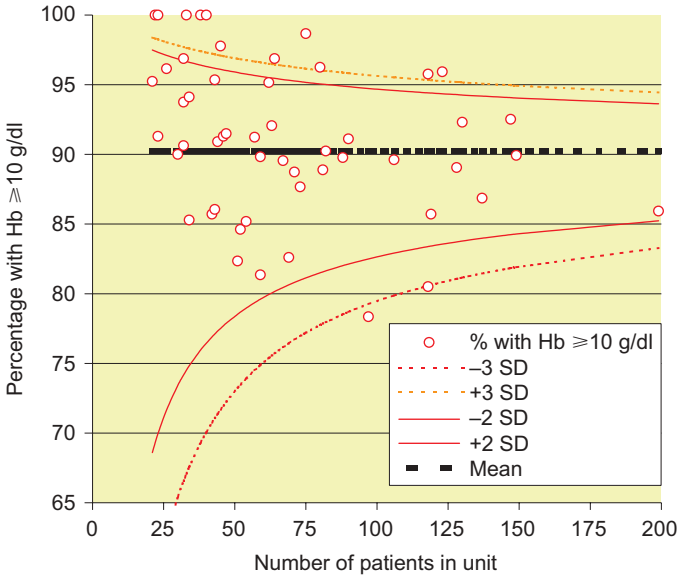


**Figure 8.17: Funnel plot for percentage of PD patients with Hb ⩾10 g/dl**

**Table 8.5: Percentage of PD patients achieving Hb ⩾10 g/dl by unit**

| Centre | Total | % with Hb ⩾10 g/dl | Centre | Total | % with Hb ⩾10 g/dl |
|---|---|---|---|---|---|
| Abrdn | 42 | 86 | Ipswi | 64 | 97 |
| Airdrie | 26 | 96 | Klmarnk | 47 | 91 |
| B Heart | 32 | 91 | L Guys | 81 | 89 |
| B QEH | 119 | 86 | L H&CX | 130 | 92 |
| Bangor | 22 | 100 | L Kings | 67 | 90 |
| Basldn | 30 | 90 | L Rfree | 137 | 87 |
| Belfast | 57 | 91 | Leeds | 118 | 96 |
| Bradfd | 38 | 100 | Leic | 199 | 86 |
| Brightn | 73 | 88 | Livrpl | 80 | 96 |
| Bristol | 62 | 95 | ManWst | 118 | 81 |
| Camb | 75 | 99 | Newc | 43 | 86 |
| Cardff | 123 | 96 | Norwch | 46 | 91 |
| Carsh | 147 | 93 | Nottm | 128 | 89 |
| Chelms | 32 | 94 | Oxford | 106 | 90 |
| Covnt | 59 | 81 | Plymth | 33 | 100 |
| Derby | 63 | 92 | Ports | 88 | 90 |
| Dorset | 59 | 90 | Prestn | 97 | 78 |
| Dudley | 51 | 82 | Redng | 90 | 91 |
| Dundee | 43 | 95 | Sheff | 149 | 90 |
| Dunfn | 21 | 95 | Shrew | 40 | 100 |
| Edinb | 54 | 85 | Stevng | 44 | 91 |
| Exeter | 82 | 90 | Swanse | 71 | 89 |
| GlasRI | 23 | 91 | Truro | 34 | 94 |
| GlasWI | 69 | 83 | Wolve | 45 | 98 |
| Glouc | 34 | 85 | Wrexm | 32 | 97 |
| Hull | 52 | 85 | York | 23 | 100 |

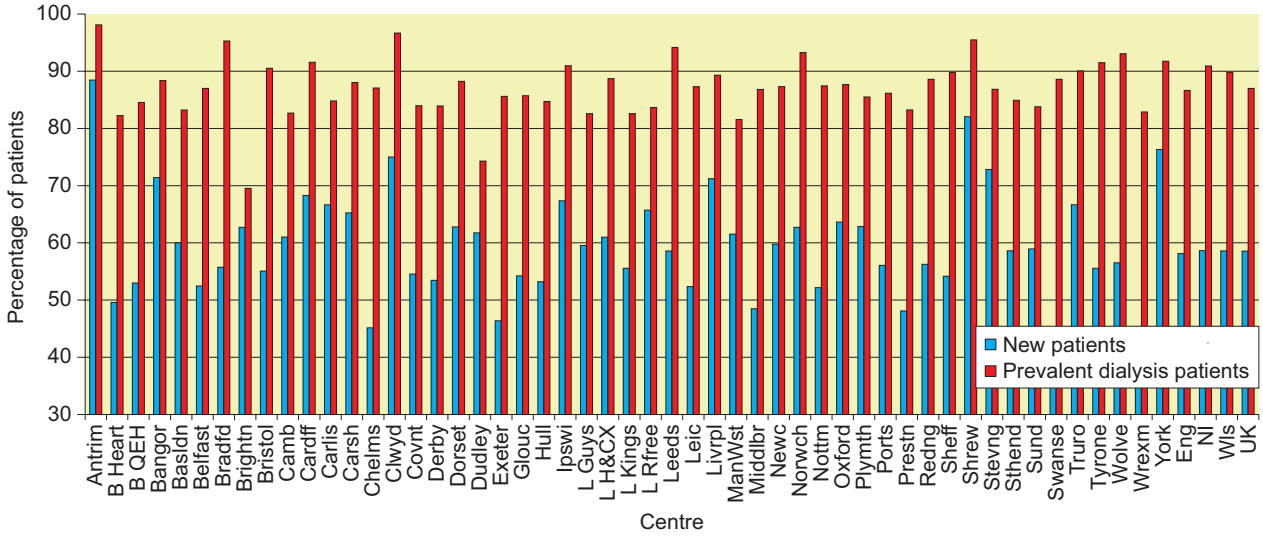


**Figure 8.18: Percentage of new and prevalent dialysis patients with Hb ⩾10 g/dl**

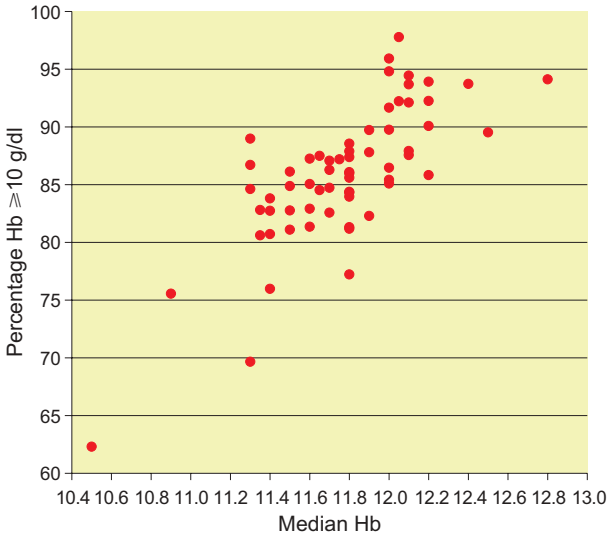


**Figure 8.19: Percentage of patients with Hb ⩾10 g/dl plotted against median Hb: HD**

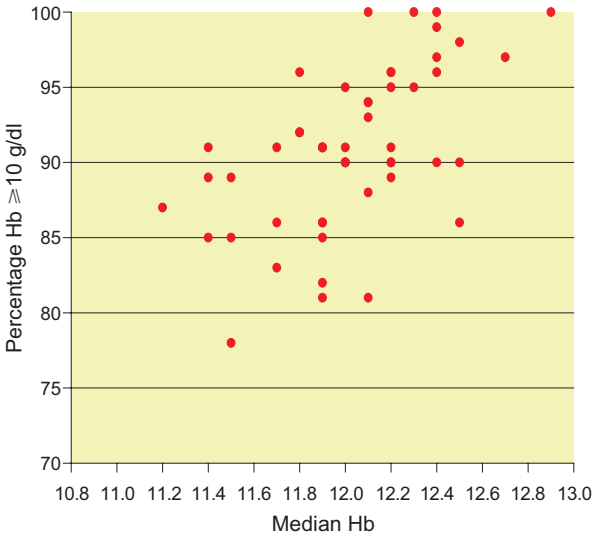


**Figure 8.21: Percentage of patients with Hb ⩾10 g/dl plotted against median Hb: PD**

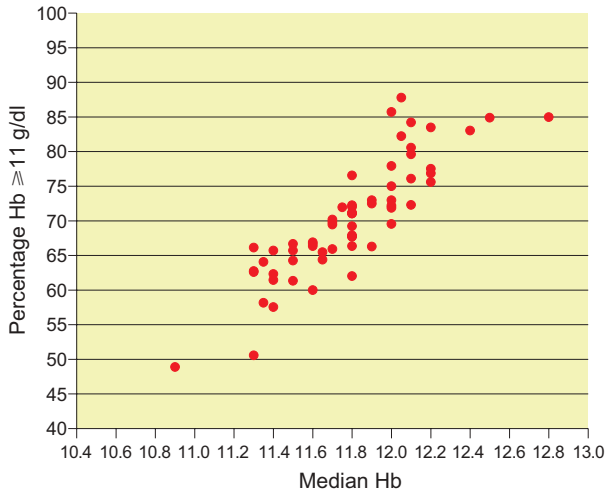


**Figure 8.20: Percentage of patients with Hb ⩾11 g/dl plotted against median Hb: HD**

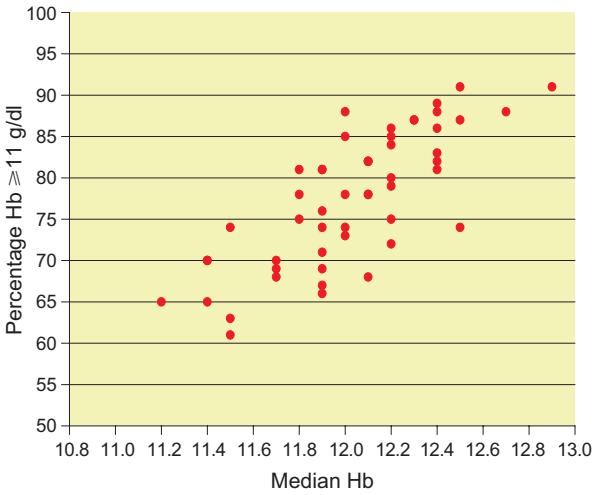


**Figure 8.22: Percentage of patients with Hb ⩾11 g/dl plotted against median Hb: PD**

they also demonstrate that there is considerable variation between units in the relationship between median Hb and percentage achieving the audit standard; some units are able to achieve a high proportion meeting the standard at a lower median Hb than others. This is achieved by narrowing the distribution of Hb values. Tables 8.2 and 8.4 also demonstrate this: the standard deviation for Hb values varies considerably between units. Preliminary analysis of previous years' data shows that some renal units have achieved a narrow distribution of Hb values year on year – for instance, Truro. Those with a low standard deviation have succeeded in narrowing the distribution of Hb values, and are therefore able to achieve a higher proportion of patients with Hb values above the minimum audit standard without also achieving a high proportion of patients with high Hb values. The

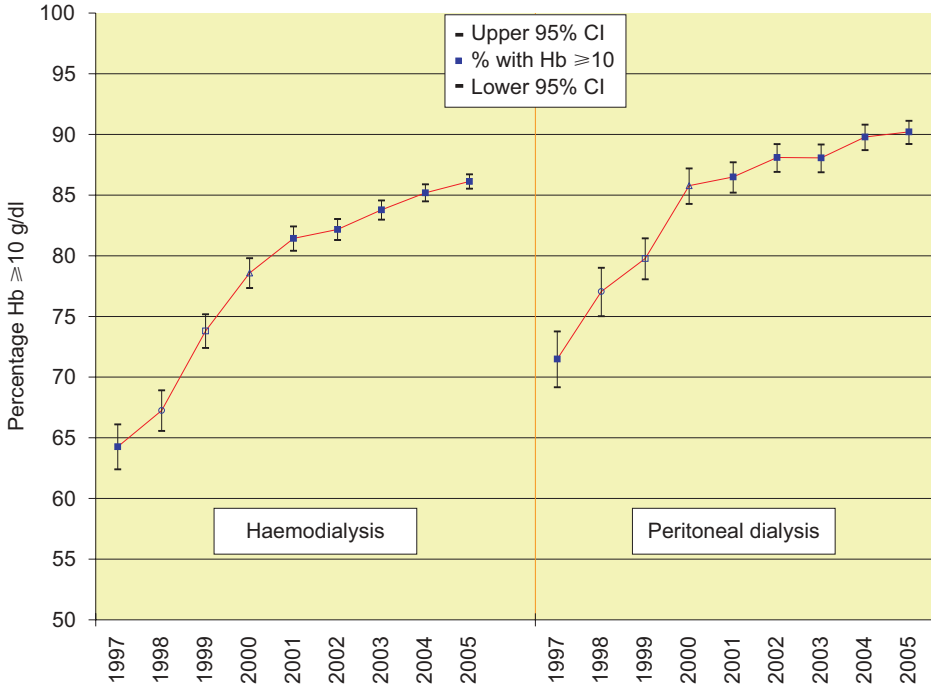


**Figure 8.23: Percentage of dialysis patients with Hb ⩾10 g/dl 1997–2005**

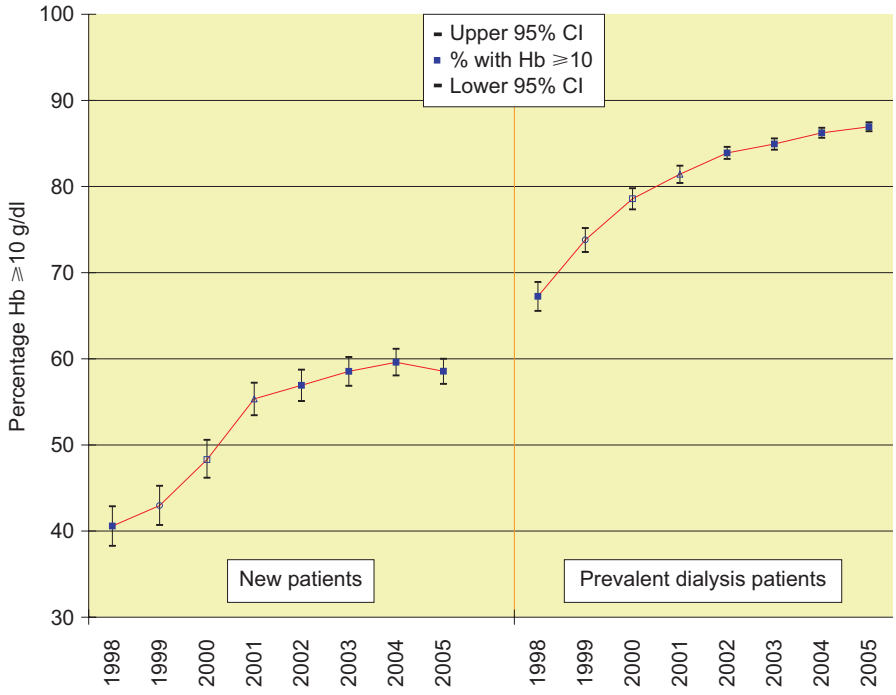


**Figure 8.24: Percentage of new dialysis patients with Hb ⩾10 g/dl 1998–2005**

accumulating evidence that full correction of anaemia may be harmful in kidney disease, together with the high cost of full correction, should drive attempts to learn from those units that have successfully narrowed the distribution of values.

Haemoglobin outcome in England and Wales for haemodialysis and peritoneal dialysis populations in terms of compliance with Hb $\geqslant$10.0 g/dl continue to increase year on year (Figure 8.23).

Equally, compliance for Hb $\geqslant$10.0 g/dl in patients new to dialysis in England and Wales continues to increase (Figure 8.24).

## Changes in Haemoglobin by length of time on dialysis over time

In the haemodialysis population the median haemoglobin outcome improves in the first 6 months to become compliant with the UK minimum standard and remains stable up to 2 years post commencement of dialysis therapy. In the peritoneal dialysis population however the Hb outcome improves out to 1 year and then decreases out to 2 years. It is uncertain whether this reflects fall in residual renal function, salt and water overload, or other factors as yet undetermined. The actual outcome in the PD population however, decreases to the same level as for HD patients from a higher baseline (Figures 8.25, 8.26).

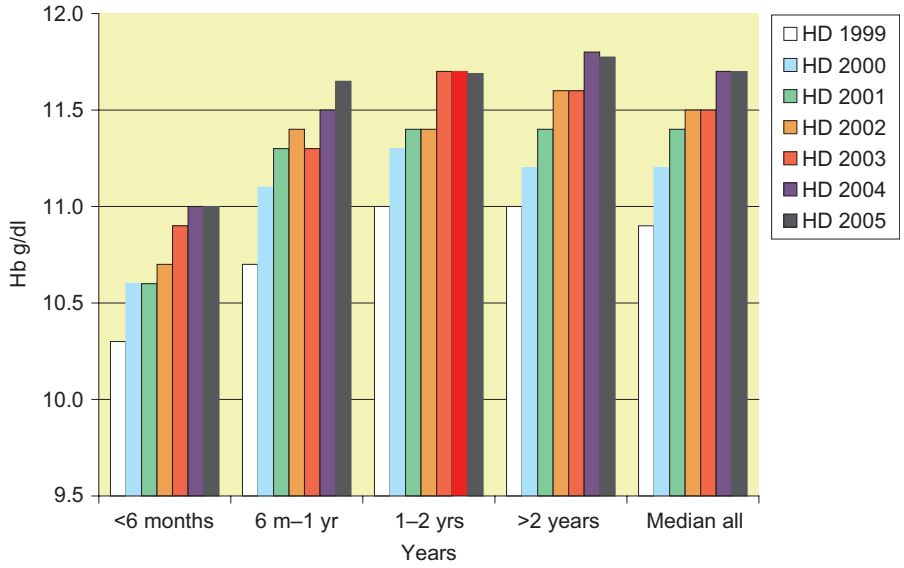


**Figure 8.25: Median Haemoglobin by length of time on RRT: HD**

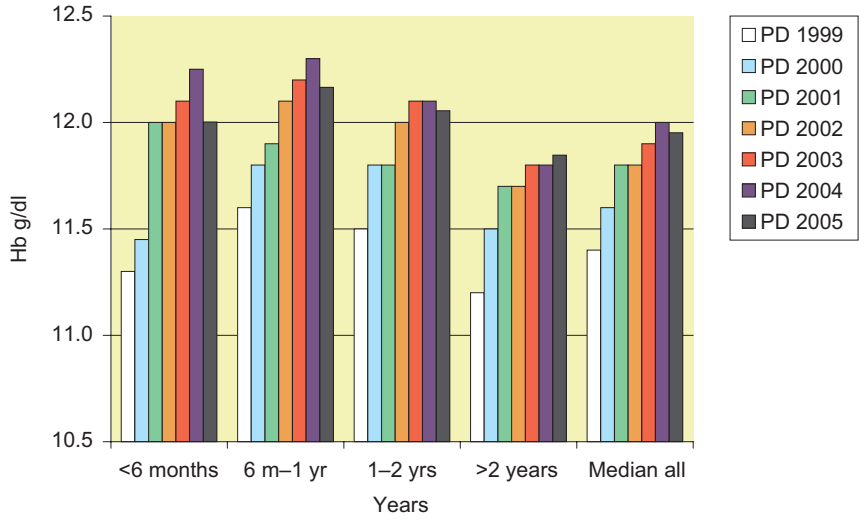


**Figure 8.26: Median Haemoglobin by length of time on RRT: PD**

## Factors affecting Haemoglobin

National and international recommendations for target iron status in chronic kidney disease remain unchanged from previous reports. The 2002 Renal Association Standards Document (SDIII)[2], revised European Best Practice Guidelines (EBPGII)[3] and Dialysis Outcomes Quality Initiatives (DOQI) guidelines[4] and UK NICE Anaemia guidelines[5] all recommend:

***a target serum ferritin greater than 100 µg/L and percentage transferrin saturation (TSAT) more than 20% in patients with chronic kidney disease***

SDIII and EBPGII recommend:

***less than 10% hypochromic red cells (HRC) (evidence level B)***

in addition, EBPGII adds:

***a target reticulocyte Hb content (CHr) greater than 29 pg/cell (evidence level B)***

***KDOQI recommends ferritin >200 µg/L for HD patients***

***The NICE Guidelines suggest a hypochromic red cells value >6% suggests ongoing iron deficiency (HRC)***

To achieve adequate iron status across a patient population, SDIII and EBPGII advocate population targets for ferritin of 200–500 µg/L, for TSAT of 30–40%, for hypochromic red cells of <2.5% and CHr of ~35 pg/cell. EBPGII comments that a serum ferritin target for the treatment population of 200–250 µg/L ensures that 85–90% of patients attain a serum ferritin of 100 µg/L.

All guidelines advise that:

***serum ferritin levels should not exceed 800 µg/L since the risk of iron toxicity increases without conferring additional benefit. The KDOQI and NICE guidelines advise against IV iron administration to patients with a ferritin >500 µg/l.***

Serum ferritin has several disadvantages as an index of iron status. It measures storage iron rather than available iron; behaves as an acute phase reactant, and is therefore increased in inflammatory states, malignancy and liver disease; and may not accurately reflect iron stores if measured within a week of the administration of intravenous iron. Of the alternative measures of iron status available, HRC and CHr are generally considered superior to TSAT. Both however require specialised analysers to which few UK renal units have easy access. Since TSAT is measured infrequently in many centres, and most UK units continue to use serum ferritin for routine iron management, ferritin remains the chosen index of iron status for this report.

Information on the use of Erythropoietin Stimulating Agents was excluded from the 2003 report due to data collection problems. These problems were addressed, allowing ESA data from 23 units to be presented in the 2004 report and for 30 units in the 2005 report. In the 2006 report these data remain incomplete but have improved with 36 units returning ESA data. Work continues to establish more comprehensive ESA returns. Data are presented as total weekly erythropoietin dose. Doses of darbepoietin were harmonised with erythropoietin data by multiplying by 200 and correcting for any frequency of administration less than weekly. No adjustments are made with regard to frequency or route of administration.

### Completeness of serum ferritin returns for HD and PD

The completeness of serum ferritin returns to the Registry is shown in Table 8.6.

Not all sites use serum ferritin as the sole indicator of iron status. Completeness of ferritin returned from England and Wales improved compared to 2005. Scotland is included here for the first time. Lack of an automated biochemistry or haematology link into the IT renal system might account for a very low rate of return in some units. In other cases of missing data, renal units may need to address organisational processes to ensure that serum ferritin is checked.

### Serum ferritin

Percentage returns, median serum ferritin concentrations and interquartile ranges are presented in Table 8.7 and Figure 8.27 for haemodialysis and Table 8.8 and Figure 8.28 for peritoneal dialysis. The percentages of patients achieving a serum ferritin over 100 µg/L and over 200 µg/L are shown in Figures 8.29 and

**Table 8.6: Completeness of serum ferritin returns**

| Centre | HD % | PD % | Centre | HD % | PD % |
|---|---|---|---|---|---|
| Abrdn | 1 | 0 | L H&CX | 99 | 98 |
| Airdrie | 0 | 0 | L Kings | 100 | 100 |
| Antrim | 96 | 94 | L Rfree | 84 | 97 |
| B Heart | 94 | 100 | Leeds | 100 | 98 |
| B QEH | 97 | 96 | Leic | 95 | 96 |
| Bangor | 94 | 95 | Livrpl | 96 | 98 |
| Basldn | 99 | 100 | ManWst | 60 | 90 |
| Belfast | 90 | 85 | Middlbr | 97 | 100 |
| Bradfd | 100 | 100 | Newc | 100 | 95 |
| Brightn | 64 | 86 | Newry | 99 | 93 |
| Bristol | 100 | 100 | Norwch | 100 | 100 |
| Camb | 65 | 100 | Nottm | 100 | 100 |
| Cardff | 96 | 97 | Oxford | 89 | 95 |
| Carlis | 93 | 100 | Plymth | 98 | 97 |
| Carsh | 82 | 85 | Ports | 98 | 96 |
| Chelms | 98 | 91 | Prestn | 100 | 100 |
| Clwyd | 90 | 92 | Redng | 98 | 96 |
| Covnt | 98 | 85 | Sheff | 99 | 100 |
| D&Gall | 0 | 0 | Shrew | 100 | 100 |
| Derby | 97 | 86 | Stevng | 99 | 98 |
| Dorset | 99 | 97 | Sthend | 96 | 95 |
| Dudley | 73 | 92 | Sund | 93 | 100 |
| Dundee | 0 | 2 | Swanse | 98 | 99 |
| Dunfn | 0 | 0 | Truro | 98 | 100 |
| Edinb | 0 | 0 | Tyrone | 3 | 80 |
| Exeter | 100 | 100 | Ulster | 100 | 100 |
| GlasRI | 0 | 0 | Wirral | 3 | 0 |
| GlasWI | 0 | 0 | Wolve | 99 | 100 |
| Glouc | 98 | 91 | Wrexm | 82 | 80 |
| Hull | 97 | 98 | York | 100 | 100 |
| Inverns | 0 | 0 | Eng | 89 | 90 |
| Ipswi | 98 | 78 | NI | 79 | 88 |
| Klmarnk | 0 | 0 | Sct | 0 | 0 |
| L Barts | 1 | 0 | Wls | 95 | 94 |
| L Guys | 87 | 100 | UK | 80 | 81 |

**Table 8.7: Serum ferritin in HD patients**

| Centre | % data return | Median ferritin | 90% range | Quartile range | % ferritin $\geqslant 100\,\mu g/L$ |
|---|---|---|---|---|---|
| Antrim | 96 | 421 | 138–994 | 274–586 | 96.8 |
| B Heart | 94 | 228 | 61–642 | 156–325 | 89.2 |
| B QEH | 97 | 269 | 91–551 | 180–362 | 93.5 |
| Bangor | 94 | 630 | 209–1,322 | 459–799 | 100.0 |
| Basldn | 99 | 334 | 120–604 | 250–415 | 98.1 |
| Belfast | 90 | 469 | 115–1,109 | 290–673 | 95.3 |
| Bradfd | 100 | 520 | 176–1,104 | 356–699 | 98.0 |
| Brightn | 64 | 293 | 44–1,200 | 160–440 | 86.5 |
| Bristol | 100 | 442 | 112–1,132 | 288–646 | 96.3 |
| Camb | 65 | 260 | 52–1,030 | 167–407 | 87.6 |

**Table 8.7: (continued)**

| Centre | % data return | Median ferritin | 90% range | Quartile range | % ferritin ⩾100 μg/L |
|---|---|---|---|---|---|
| Cardff | 96 | 491 | 159–1,058 | 333–696 | 99.2 |
| Carlis | 93 | 337 | 172–745 | 228–504 | 98.4 |
| Carsh | 82 | 306 | 66–722 | 200–410 | 92.9 |
| Chelms | 98 | 472 | 203–1,087 | 341–671 | 98.8 |
| Clwyd | 90 | 328 | 168–613 | 239–449 | 100.0 |
| Covnt | 98 | 290 | 57–973 | 165–464 | 88.7 |
| Derby | 97 | 454 | 141–1,178 | 301–652 | 96.1 |
| Dorset | 99 | 451 | 162–774 | 275–555 | 99.1 |
| Dudley | 73 | 338 | 39–992 | 254–513 | 92.2 |
| Exeter | 100 | 335 | 139–685 | 250–436 | 98.1 |
| Glouc | 98 | 365 | 73–911 | 237–600 | 92.0 |
| Hull | 97 | 397 | 161–840 | 297–529 | 99.6 |
| Ipswi | 98 | 398 | 64–1,067 | 215–611 | 91.0 |
| L Barts | 1 | n/a | n/a | n/a | n/a |
| L Guys | 87 | 399 | 90–1,023 | 263–575 | 92.6 |
| L H&CX | 99 | 585 | 141–1,330 | 342–859 | 96.6 |
| L Kings | 100 | 442 | 138–970 | 300–586 | 97.2 |
| L Rfree | 84 | 397 | 83–1,121 | 245–557 | 93.8 |
| Leeds | 100 | 518 | 179–953 | 393–667 | 97.4 |
| Leic | 95 | 360 | 90–1,080 | 223–562 | 93.6 |
| Livrpl | 96 | 530 | 88–1,390 | 302–777 | 94.1 |
| ManWst | 60 | 541 | 95–1,676 | 238–866 | 93.0 |
| Middlbr | 97 | 443 | 73–1,674 | 247–813 | 93.6 |
| Newc | 100 | 411 | 191–971 | 298–574 | 97.6 |
| Newry | 99 | 438 | 159–1,030 | 288–618 | 100.0 |
| Norwch | 100 | 874 | 300–1,493 | 557–1,134 | 99.5 |
| Nottm | 100 | 586 | 240–1,139 | 456–745 | 98.6 |
| Oxford | 89 | 301 | 68–849 | 181–408 | 90.4 |
| Plymth | 98 | 384 | 152–816 | 254–549 | 97.1 |
| Ports | 98 | 277 | 97–791 | 203–384 | 93.6 |
| Prestn | 100 | 630 | 124–1,500 | 451–918 | 95.3 |
| Redng | 98 | 678 | 286–1,192 | 458–906 | 100.0 |
| Sheff | 99 | 543 | 104–1,257 | 370–738 | 95.2 |
| Shrew | 100 | 363 | 111–804 | 213–563 | 96.5 |
| Stevng | 99 | 489 | 190–963 | 351–668 | 99.0 |
| Sthend | 96 | 337 | 196–681 | 270–426 | 99.1 |
| Sund | 93 | 369 | 103–1,327 | 237–581 | 94.4 |
| Swanse | 98 | 393 | 78–770 | 247–544 | 93.9 |
| Truro | 98 | 485 | 204–909 | 352–637 | 99.2 |
| Tyrone | 3 | n/a | n/a | n/a | n/a |
| Ulster | 100 | 421 | 122–882 | 311–539 | 97.4 |
| Wirral | 3 | n/a | n/a | n/a | n/a |
| Wolve | 99 | 454 | 148–1,158 | 343–603 | 97.7 |
| Wrexm | 82 | 523 | 129–1,262 | 345–635 | 97.5 |
| York | 100 | 579 | 233–916 | 441–740 | 98.8 |
| Eng | 89 | 407 | 101–1,140 | 259–620 | 95.0 |
| NI | 79 | 438 | 133–1,037 | 287–635 | 96.6 |
| Wls | 95 | 465 | 136–999 | 304–645 | 97.6 |
| UK | 80 | 413 | 105–1,127 | 262–623 | 95.3 |

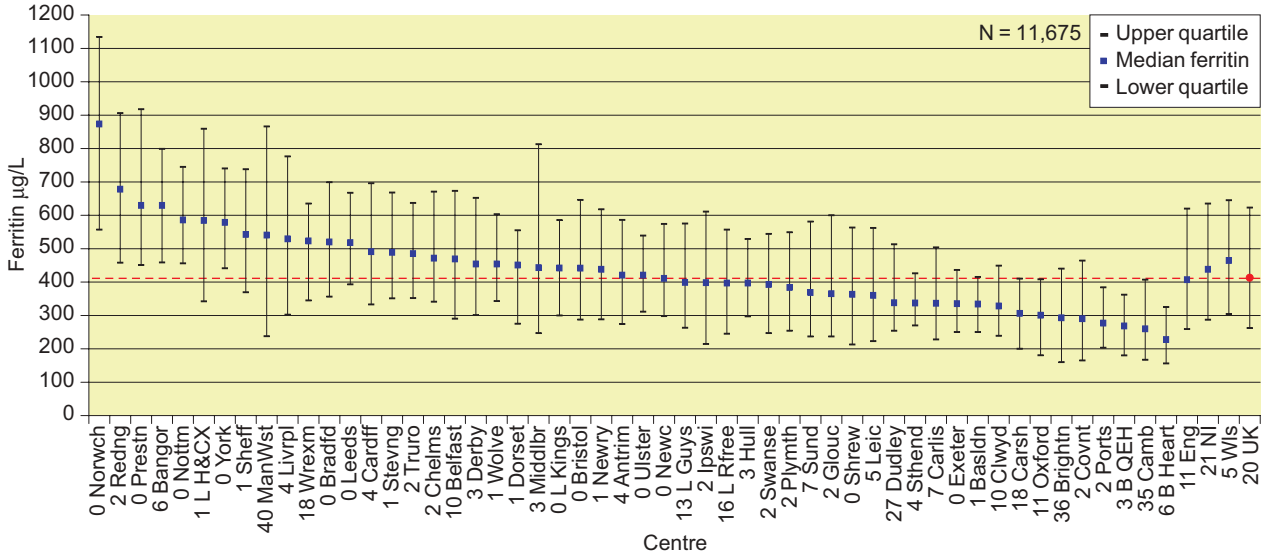


**Figure 8.27: Median serum ferritin: haemodialysis**

**Table 8.8: Serum ferritin in PD patients**

| Centre | % data return | Median ferritin | 90% range | Quartile range | % ferritin ⩾100 µg/L |
|---|---|---|---|---|---|
| Antrim | 94 | n/a | n/a | n/a | n/a |
| B Heart | 100 | 173 | 36–663 | 95–254 | 75 |
| B QEH | 96 | 158 | 25–535 | 80–287 | 65 |
| Bangor | 95 | 298 | 44–679 | 169–461 | 86 |
| Basldn | 100 | 193 | 34–780 | 92–321 | 73 |
| Belfast | 85 | 206 | 49–1,070 | 104–404 | 75 |
| Bradfd | 100 | 290 | 35–959 | 138–473 | 82 |
| Brightn | 86 | 290 | 77–830 | 175–455 | 93 |
| Bristol | 100 | 229 | 24–596 | 133–361 | 87 |
| Camb | 100 | 198 | 31–557 | 93–307 | 75 |
| Cardff | 97 | 204 | 34–762 | 96–345 | 73 |
| Carlis | 100 | n/a | n/a | n/a | n/a |
| Carsh | 85 | 160 | 28–564 | 99–256 | 74 |
| Chelms | 91 | 260 | 77–442 | 131–357 | 93 |
| Clwyd | 92 | n/a | n/a | n/a | n/a |
| Covnt | 85 | 216 | 20–565 | 94–369 | 75 |
| Derby | 86 | 322 | 96–829 | 218–489 | 95 |
| Dorset | 97 | 264 | 91–727 | 203–374 | 93 |
| Dudley | 92 | 215 | 26–735 | 107–371 | 78 |
| Exeter | 100 | 209 | 54–573 | 151–305 | 84 |
| Glouc | 91 | 180 | 83–674 | 150–305 | 91 |
| Hull | 98 | 295 | 98–636 | 226–414 | 94 |
| Ipswi | 78 | 184 | 26–703 | 54–323 | 67 |
| L Barts | 0 | n/a | n/a | n/a | n/a |
| L Guys | 100 | 220 | 79–604 | 151–335 | 89 |
| L H&CX | 98 | 263 | 57–1,371 | 165–435 | 88 |
| L Kings | 100 | 267 | 53–626 | 162–375 | 90 |
| L Rfree | 97 | 351 | 79–1,242 | 197–598 | 93 |
| Leeds | 98 | 335 | 88–748 | 245–484 | 95 |
| Leic | 96 | 272 | 57–983 | 164–481 | 91 |
| Livrpl | 98 | 256 | 89–796 | 154–432 | 90 |

**Table 8.8: (continued)**

| Centre | % data return | Median ferritin | 90% range | Quartile range | % ferritin ⩾100 µg/L |
|---|---|---|---|---|---|
| ManWst | 90 | 215 | 63–890 | 126–373 | 87 |
| Middlbr | 100 | n/a | n/a | n/a | n/a |
| Newc | 95 | 327 | 95–788 | 195–454 | 93 |
| Newry | 93 | n/a | n/a | n/a | n/a |
| Norwch | 100 | 389 | 113–832 | 280–667 | 96 |
| Nottm | 100 | 329 | 93–984 | 208–458 | 93 |
| Oxford | 95 | 224 | 40–887 | 115–458 | 77 |
| Plymth | 97 | 262 | 26–1,289 | 112–505 | 77 |
| Ports | 96 | 239 | 71–754 | 141–367 | 89 |
| Prestn | 100 | 251 | 54–915 | 123–437 | 86 |
| Redng | 96 | 493 | 80–928 | 345–630 | 93 |
| Sheff | 100 | 270 | 52–856 | 193–454 | 90 |
| Shrew | 100 | 289 | 58–819 | 214–404 | 90 |
| Stevng | 98 | 172 | 26–620 | 119–270 | 82 |
| Sthend | 95 | n/a | n/a | n/a | n/a |
| Sund | 100 | n/a | n/a | n/a | n/a |
| Swanse | 99 | 204 | 32–756 | 131–367 | 80 |
| Truro | 100 | 198 | 70–555 | 117–282 | 88 |
| Tyrone | 80 | n/a | n/a | n/a | n/a |
| Ulster | 100 | n/a | n/a | n/a | n/a |
| Wirral | 0 | n/a | n/a | n/a | n/a |
| Wolve | 100 | 189 | 59–664 | 127–384 | 87 |
| Wrexm | 80 | 372 | 154–645 | 276–487 | 100 |
| York | 100 | 388 | 240–892 | 297–470 | 100 |
| Eng | 90 | 259 | 49–830 | 150–425 | 86 |
| NI | 88 | 224 | 51–814 | 115–391 | 81 |
| Wls | 94 | 229 | 34–756 | 126–370 | 79 |
| UK | 81 | 256 | 49–816 | 147–422 | 86 |

Note: Median Hb for units with less than 20 new patients or data returns <50% are not shown

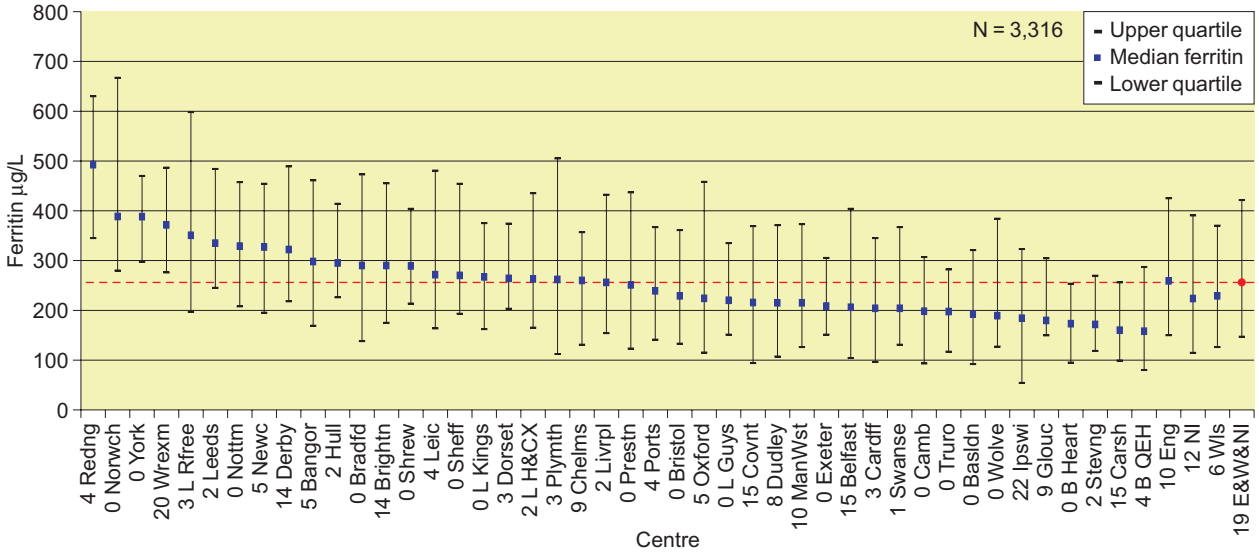


**Figure 8.28: Median serum ferritin: peritoneal dialysis**

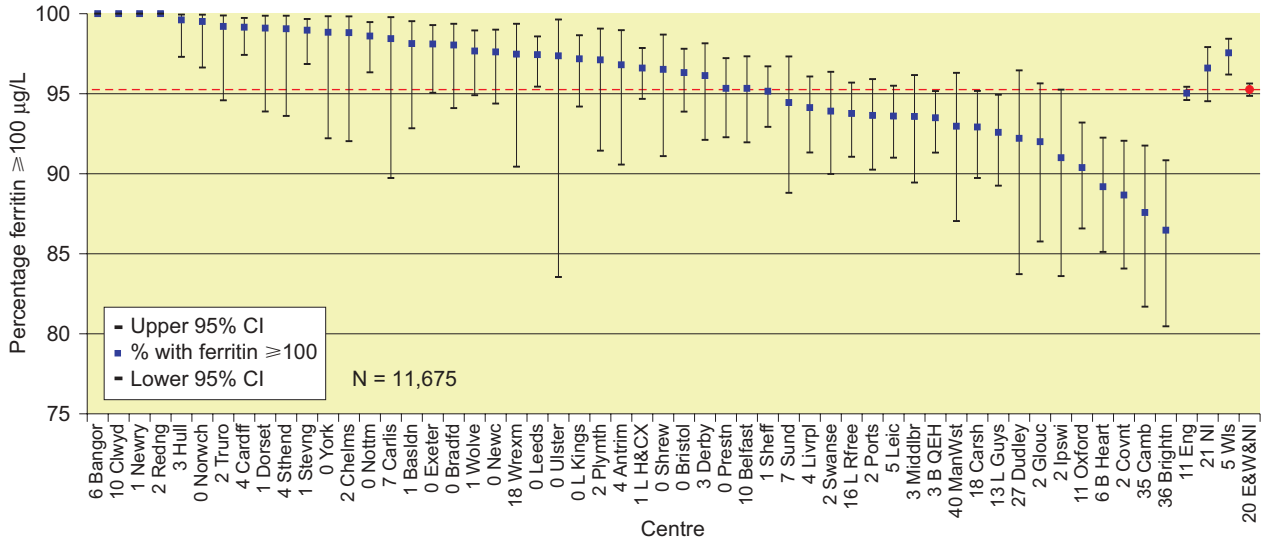


**Figure 8.29: Percentage of HD patients with serum ferritin ⩾100 µg/L**

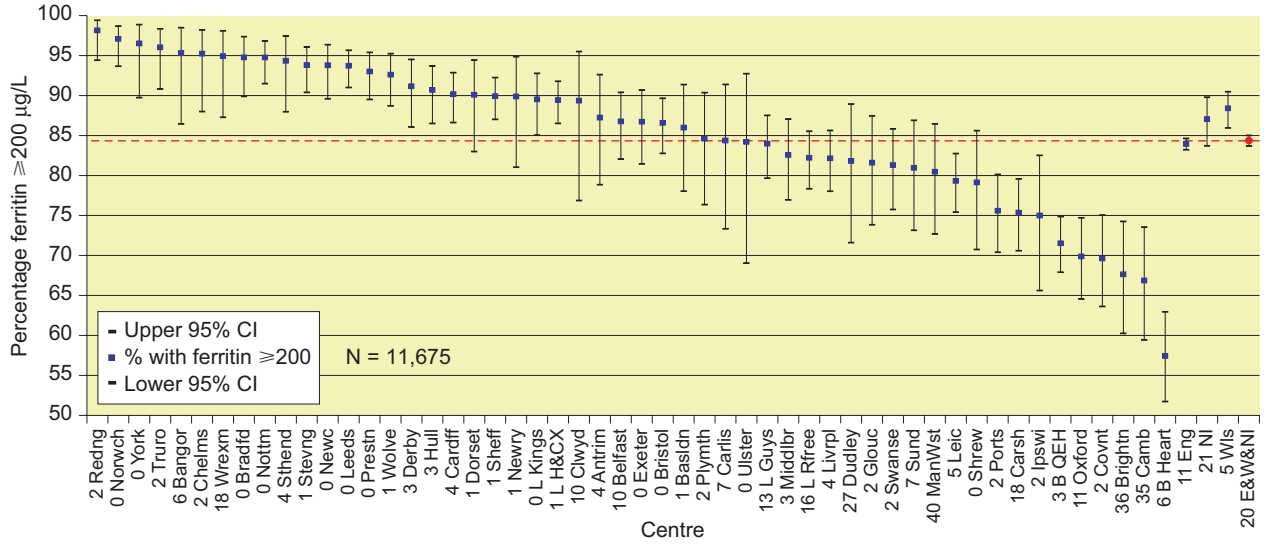


**Figure 8.30: Percentage of HD patients with serum ferritin ⩾200 µg/L**

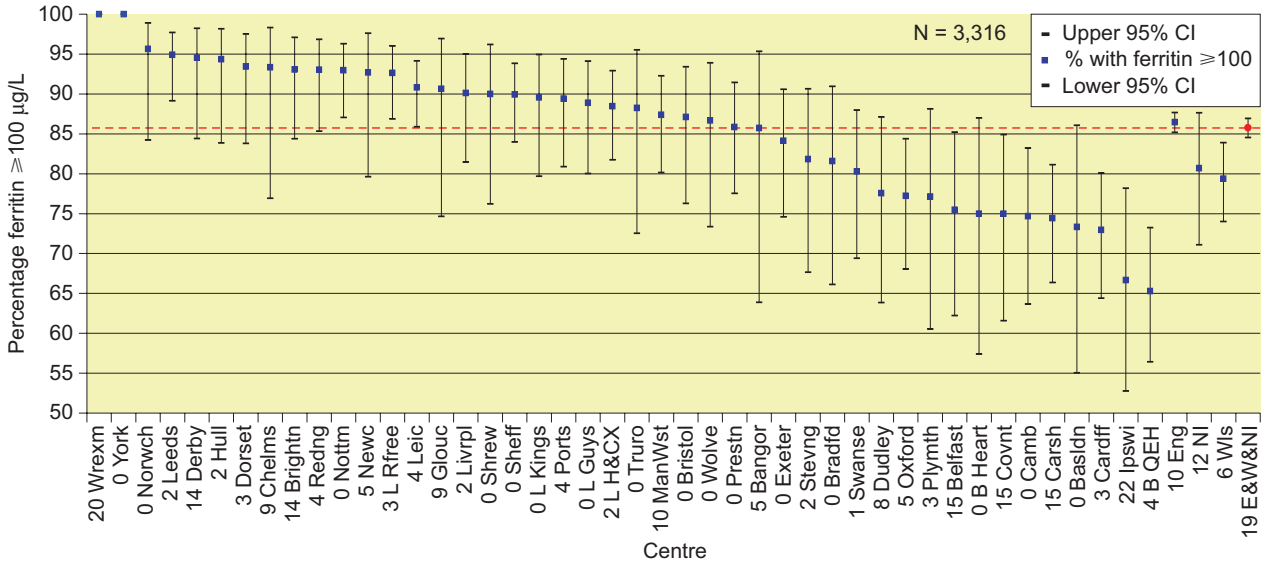


**Figure 8.31: Percentage of PD patients with serum ferritin ⩾100 µg/L**

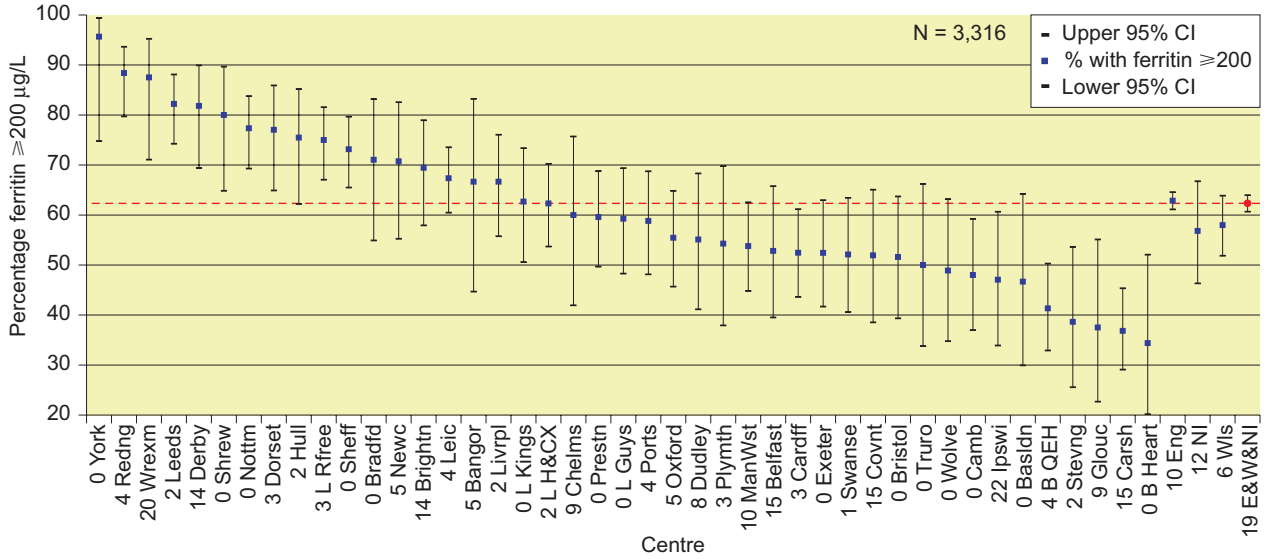


**Figure 8.32: Percentage of PD patients with serum ferritin ⩾200 µg/L**

8.30 respectively, for HD, and for PD in Figures 8.31 and 8.32.

Percentage of serum ferritin ⩾800 µg/l in HD and PD are shown in Table 8.9.

All centres achieved greater than 85% compliance with a serum ferritin over 100 µg/L for HD. The PD population has lower ferritin values (PD 256 µg/l, (IQR 147–422) vs HD 413 µg/l, (IQR 262–623)) but all units have

**Table 8.9: Percentage of patients with serum ferritin ⩾800 µg/L**

| | HD | | PD | |
|---|---|---|---|---|
| **Centre** | **% Ferritin ⩾800** | **95% CI** | **% Ferritin ⩾800** | **95% CI** |
| Antrim | 10 | 5.1–17.4 | 0 | n/a |
| B Heart | 2 | 0.7–4.0 | 3 | 0.4–19.1 |
| B QEH | 1 | 0.6–2.5 | 2 | 0.4–6.4 |
| Bangor | 25 | 15.9–37.0 | 5 | 0.7–27.1 |
| Basldn | 2 | 0.5–7.2 | 3 | 0.5–20.2 |
| Belfast | 14 | 9.9–18.4 | 9 | 4.0–20.7 |
| Bradfd | 14 | 9.1–20.1 | 8 | 2.6–21.8 |
| Brightn | 11 | 7.2–16.9 | 7 | 2.9–15.6 |
| Bristol | 15 | 11.8–19.0 | 2 | 0.2–10.6 |
| Camb | 7 | 4.1–12.1 | 0 | n/a |
| Cardff | 16 | 12.6–20.2 | 3 | 1.2–8.4 |
| Carlis | 3 | 0.8–11.7 | 0 | n/a |
| Carsh | 4 | 2.2–6.2 | 3 | 1.1–7.7 |
| Chelms | 14 | 8.3–23.5 | 0 | n/a |
| Clwyd | 2 | 0.3–13.6 | 0 | n/a |
| Covnt | 9 | 5.9–13.2 | 0 | n/a |
| Derby | 15 | 10.9–21.5 | 5 | 1.8–15.6 |
| Dorset | 4 | 1.4–9.2 | 5 | 1.6–14.2 |
| Dudley | 5 | 2.0–13.0 | 4 | 1.0–14.9 |
| Exeter | 4 | 2.2–8.0 | 4 | 1.2–10.7 |
| Glouc | 8 | 4.4–14.2 | 3 | 0.4–19.1 |
| Hull | 7 | 4.1–10.3 | 2 | 0.3–12.2 |
| Ipswi | 9 | 4.7–16.4 | 2 | 0.3–12.6 |
| L Barts | 33 | 4.3–84.6 | – | – |
| L Guys | 11 | 7.8–14.5 | 4 | 1.2–10.9 |

**Table 8.9: (continued)**

| | HD | | PD | |
|---|---|---|---|---|
| **Centre** | **% Ferritin ⩾800** | **95% CI** | **% Ferritin ⩾800** | **95% CI** |
| L H&CX | 28 | 24.6–32.3 | 12 | 7.1–18.3 |
| L Kings | 8 | 5.6–12.6 | 1 | 0.2–9.8 |
| L Rfree | 12 | 9.1–15.2 | 15 | 9.7–21.7 |
| Leeds | 12 | 8.9–15.0 | 4 | 1.8–9.8 |
| Leic | 11 | 8.2–13.8 | 8 | 4.7–12.3 |
| Livrpl | 23 | 19.3–27.7 | 5 | 1.9–12.4 |
| ManWst | 29 | 21.7–37.3 | 8 | 4.0–13.9 |
| Middlbr | 25 | 19.5–30.9 | 14 | 3.6–42.7 |
| Newc | 14 | 10.2–19.8 | 5 | 1.2–17.5 |
| Newry | 13 | 6.9–22.0 | 0 | n/a |
| Norwch | 56 | 49.5–62.9 | 7 | 2.1–18.4 |
| Nottm | 19 | 14.8–23.8 | 6 | 3.2–12.0 |
| Oxford | 6 | 3.9–9.3 | 8 | 4.0–15.0 |
| Plymth | 6 | 2.6–12.3 | 6 | 1.4–20.2 |
| Ports | 4 | 2.5–7.3 | 4 | 1.1–10.4 |
| Prestn | 35 | 29.8–40.6 | 7 | 3.4–14.1 |
| Redng | 31 | 24.8–39.0 | 10 | 5.5–18.9 |
| Sheff | 19 | 16.2–23.0 | 6 | 3.2–11.2 |
| Shrew | 5 | 2.4–11.1 | 5 | 1.3–17.9 |
| Stevng | 13 | 9.4–17.1 | 2 | 0.3–14.4 |
| Sthend | 3 | 0.9–8.4 | 0 | n/a |
| Sund | 16 | 10.5–23.3 | 30 | 10.0–62.4 |
| Swanse | 4 | 2.4–7.9 | 4 | 1.4–12.3 |
| Truro | 9 | 4.9–15.1 | 0 | n/a |
| Tyrone | 67 | 15.4–95.7 | 0 | n/a |
| Ulster | 5 | 1.3–18.7 | 0 | n/a |
| Wirral | 60 | 20.0–90.0 | – | – |
| Wolve | 8 | 5.1–11.8 | 2 | 0.3–14.2 |
| Wrexm | 11 | 6.0–20.5 | 0 | n/a |
| York | 12 | 6.4–20.3 | 9 | 2.2–28.9 |
| Eng | 13 | 12.8–14.1 | 6 | 4.8–6.4 |
| NI | 12 | 9.6–15.6 | 6 | 2.4–12.9 |
| Wls | 12 | 9.9–14.5 | 3 | 1.6–6.1 |
| UK | 13 | 12.7–13.9 | 5 | 4.7–6.2 |

median values for PD greater than 100 μg/l and 36 of the 44 plotted units have 25th percentile for ferritin greater than 100 μg/l.

### *Changes in serum ferritin 1999–2005*

Over time the percentage of patients on HD and PD with a ferritin ⩾100 and the ferritin outcome has levelled off with a median ferritin in the HD population just over 400 μg/L and in the PD population, 250 μg/L (see Figures 8.33 and 8.34).

### *Serum ferritin and length of time on renal replacement therapy*

Ferritin outcome climbs steadily over the first 2 years on dialysis (see Figures 8.35 and 8.36).

## *Erythropoiesis Stimulating Agents*

36 renal units now submit data on ESA utilisation. For the UK, only 14% and 10% of HD and PD respectively patients had an Hb <10 g/dl.

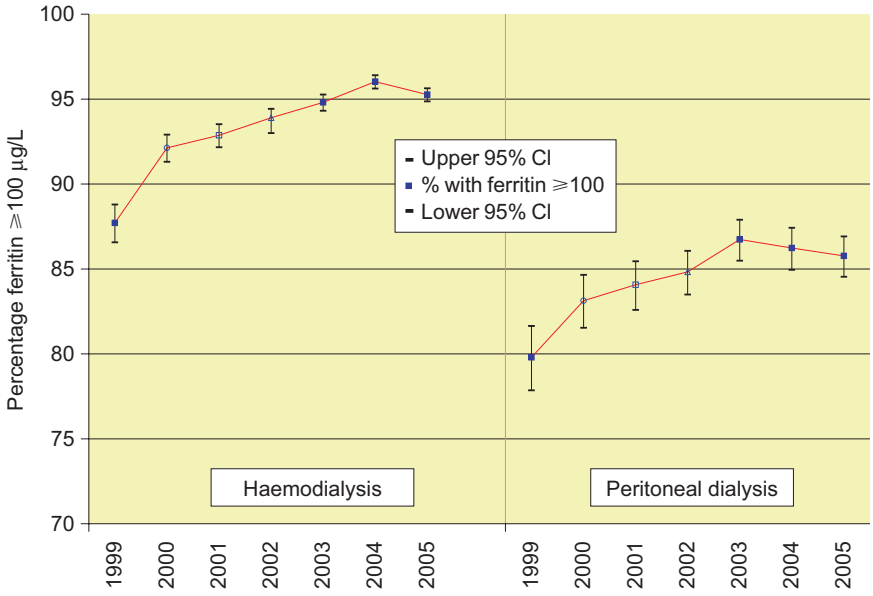


**Figure 8.33: Change in achievement of serum ferritin ⩾100 µg/L: 1999–2005**

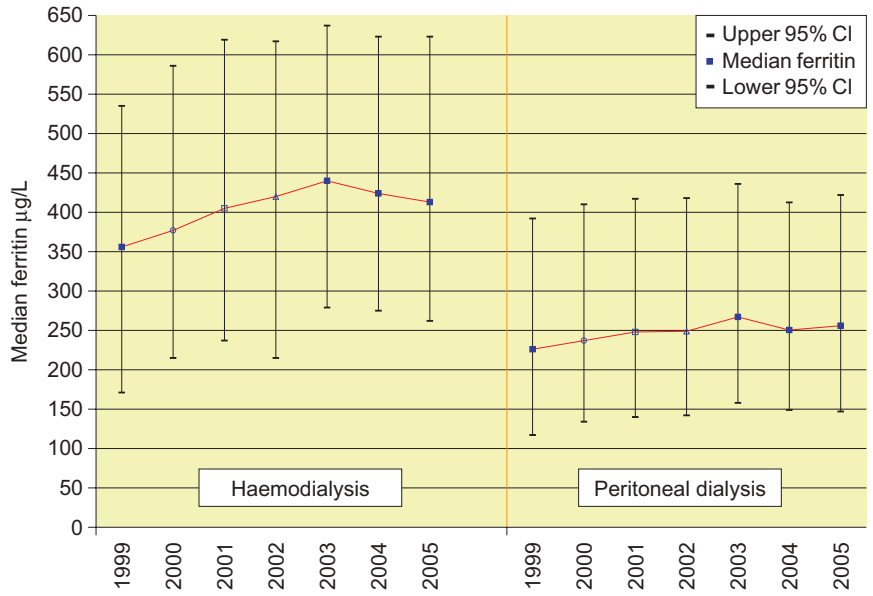


**Figure 8.34: Change in median serum ferritin: 1999–2005**

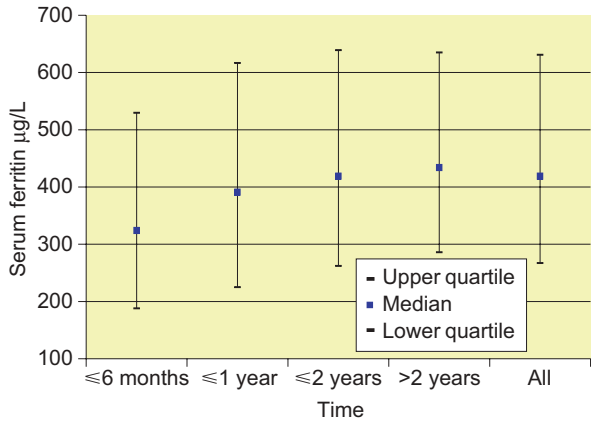


**Figure 8.35: Median ferritin by length of time on RRT: HD**

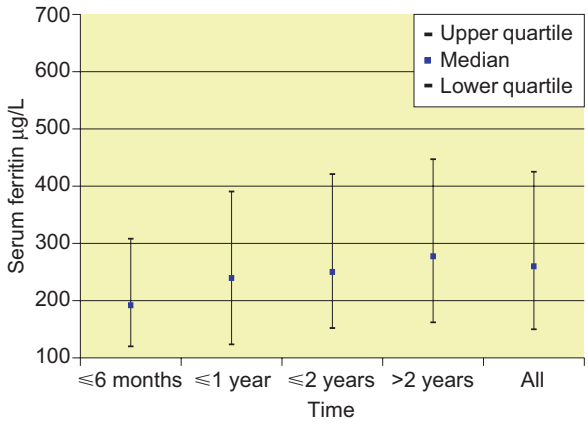


**Figure 8.36: Median serum ferritin by length of time on RRT: PD**

This would leave a medium size renal unit (700,000 population), with approximately 200 patients on HD and 100 on PD, ***with 28 and 10 patients respectively with a haemoglobin <10 g/dl***. These numbers are very small and interpretation of the variation in percentage of patients with an Hb <10 g/dl and not on ESAs should be viewed with caution.

In a similar way to the rest of the Registry data, the ESA data is collected from renal IT systems, although, as previously, in contrast to the automated laboratory links, this relies on manual data entry. The reliability of these data depends on who is entering the data (doctor, EPO nurse, or data clerk), whether the renal unit is prescribing the ESA directly (within the renal unit budget) or whether ESAs are prescribed by the GP (i.e. from the PCT budget). In the latter case, the data in the renal IT system may not always be updated from the GP letter or the GP may decline to prescribe ESAs at the higher dose advised by the nephrologist.

## *Patients treated and dose variation – ESA prescription and modality.*

Table 8.10 reports data on ESA use in the HD population and Table 8.11 similarly for the PD population. It remains the case that ESA requirements are greater for HD than PD

**Table 8.10: ESA prescribing in HD patients**

| Centre | % on EPO | Mean weekly dose for pts on EPO | Median weekly dose for pts on EPO | % of those with Hb <10 g/dl who are on EPO | % with Hb ⩾10 g/dl and not on EPO |
|---|---|---|---|---|---|
| Antrim | 97 | 8,348 | 8,000 | 100 | 3 |
| B Heart | 88 | 10,561 | 10,000 | 96 | 11 |
| B QEH | 100 | 10,853 | 10,000 | 100 | n/a |
| Bangor | 91 | 8,434 | 6,000 | 90 | 3 |
| Basldn | 93 | 9,700 | 9,000 | 100 | 6 |
| Belfast | 87 | 9,011 | 8,000 | 100 | 9 |
| Bradfd | 96 | 6,386 | 6,000 | 100 | 4 |
| Bristol | 95 | 8,753 | 6,000 | 100 | 5 |
| Camb | 60 | 10,468 | 8,000 | 84 | 13 |
| Cardff | 93 | 9,125 | 8,000 | 92 | 5 |
| Carlis | 57 | 10,436 | 10,000 | 70 | 33 |
| Chelms | 92 | 10,867 | 8,000 | 100 | 7 |
| Clwyd | 79 | 7,683 | 6,000 | 100 | 16 |
| Covnt | 67 | 10,565 | 8,000 | 55 | 26 |
| Dudley | 95 | 7,563 | 6,000 | 100 | 4 |
| Exeter | 94 | 8,183 | 6,000 | 97 | 5 |
| Glouc | 95 | 10,479 | 9,000 | 94 | 4 |
| Ipswi | 86 | 9,838 | 8,000 | 69 | 10 |
| L Guys | 64 | n/a | n/a | 62 | 29 |
| Leeds | 95 | 7,276 | 6,000 | 89 | 4 |
| Leic | 94 | 9,099 | 8,000 | 97 | 5 |
| Livrpl | 93 | 9,216 | 8,000 | 98 | 5 |
| Middlbr | 91 | 6,720 | 6,000 | 97 | 8 |
| Oxford | 84 | 8,547 | 8,000 | 100 | 15 |
| Plymth | 95 | 9,313 | 9,000 | 95 | 3 |
| Redng | 90 | 6,000 | 6,000 | 100 | 10 |
| Sheff | 92 | 10,255 | 8,000 | 98 | 8 |
| Shrew | 93 | 11,049 | 12,000 | 86 | 6 |
| Sthend | 93 | 8,816 | 6,000 | 100 | 6 |
| Sund | 90 | 9,099 | 9,000 | 96 | 8 |
| Swanse | 91 | 9,830 | 8,000 | 88 | 7 |
| Truro | 78 | 5,690 | 4,000 | 86 | 20 |
| Tyrone | 90 | 8,459 | 6,000 | 100 | 9 |
| Ulster | 92 | 7,771 | 6,000 | 100 | 8 |

**Table 8.10: (continued)**

| Centre | % on EPO | Mean weekly dose for pts on EPO | Median weekly dose for pts on EPO | % of those with Hb <10 g/dl who are on EPO | % with Hb ⩾10 g/dl and not on EPO |
|---|---|---|---|---|---|
| Wolve | 93 | 10,494 | 8,500 | 95 | 6 |
| York | 98 | 8,262 | 6,000 | 89 | 1 |
| Eng | 88 | 9,241 | 8,000 | 91 | 9 |
| NI | 90 | 8,681 | 8,000 | 100 | 8 |
| Wls | 91 | 9,298 | 8,000 | 91 | 6 |
| UK | 88 | 9,204 | 8,000 | 92 | 8 |

**Table 8.11: ESA prescribing in PD patients**

| Centre | % on EPO | Mean weekly dose for pts on EPO | Median weekly dose for pts on EPO | % of those with Hb <10 g/dl who are on EPO | % with Hb ⩾10 g/dl and not on EPO |
|---|---|---|---|---|---|
| Antrim | 67 | 2,397 | 2,000 | n/a | 27 |
| B Heart | 75 | 7,917 | 8,000 | 100 | 25 |
| B QEH | 100 | 7,521 | 6,000 | 100 | n/a |
| Bangor | 73 | 4,533 | 4,000 | n/a | 27 |
| Basldn | 67 | 4,200 | 3,500 | 100 | 33 |
| Belfast | 46 | 5,640 | 4,500 | 80 | 49 |
| Bradfd | 66 | 5,412 | 4,000 | n/a | 34 |
| Bristol | 79 | 4,316 | 4,000 | 100 | 21 |
| Camb | 72 | 7,080 | 5,300 | 100 | 28 |
| Cardff | 83 | n/a | n/a | 100 | 15 |
| Carlis | 40 | 5,833 | 3,500 | 100 | 60 |
| Chelms | 76 | 6,360 | 5,000 | 50 | 22 |
| Clwyd | 50 | 7,667 | 7,000 | n/a | 45 |
| Covnt | 49 | 7,867 | 4,500 | 36 | 39 |
| Dudley | 89 | 5,140 | 4,000 | 100 | 12 |
| Exeter | 84 | 5,040 | 4,000 | 100 | 16 |
| Glouc | 77 | 7,822 | 6,000 | 100 | 24 |
| Ipswi | 71 | 4,907 | 4,000 | 100 | 30 |
| L Guys | 49 | 3,600 | 3,600 | 56 | 46 |
| Leeds | 78 | 5,609 | 4,000 | 100 | 20 |
| Leic | 77 | 5,154 | 4,000 | 96 | 22 |
| Livrpl | 87 | 5,157 | 4,000 | 100 | 13 |
| Middlbr | 57 | 4,875 | 4,000 | n/a | 43 |
| Oxford | 87 | 5,379 | 4,000 | 91 | 12 |
| Plymth | 89 | 5,581 | 6,000 | n/a | 12 |
| Redng | 70 | 6,000 | 6,000 | 88 | 29 |
| Sheff | 79 | 8,881 | 6,000 | 93 | 21 |
| Shrew | 88 | 7,147 | 6,000 | n/a | 13 |
| Sthend | 80 | 5,467 | 4,000 | 100 | 16 |
| Sund | 70 | 6,071 | 6,000 | n/a | 30 |
| Swanse | 75 | 8,401 | 6,000 | 100 | 24 |
| Truro | 85 | 3,772 | 3,500 | 100 | 15 |
| Tyrone | 40 | 3,000 | 3,000 | n/a | 25 |
| Ulster | 100 | 5,000 | 5,000 | n/a | n/a |
| Wolve | 82 | 5,545 | 4,000 | 100 | 18 |
| York | 87 | 5,389 | 4,000 | n/a | 13 |
| Eng | 77 | 6,043 | 4,000 | 89 | 22 |
| NI | 51 | 4,597 | 4,000 | 67 | 43 |
| Wls | 78 | 7,557 | 6,000 | 100 | 21 |
| UK | 76 | 6,080 | 4,000 | 89 | 22 |

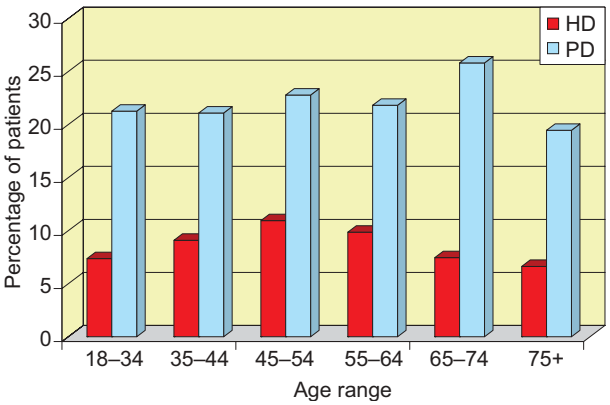


**Figure 8.37: Percentage of patients who are not on EPO and have Hb ⩾10 g/dl, by age group and modality**

patients with a higher proportion of HD patients requiring ESA therapy (88% vs 76%) and the ESA dose is higher for HD than PD patients (9,204 vs 6,080 IU/week). A significantly higher proportion of PD patients maintain a haemoglobin ⩾10 g/dl without a requirement for ESA therapy (Figure 8.37).

## *Age and ESA provision*

ESA requirements are higher on HD than PD across the age spectrum (Figure 8.38). In the anaemic patients, the difference in ESA use between HD and PD appears to differ across the age spectrum (Figure 8.39), however, the numbers this plot is based on are relatively small which may account for the apparent large drop for PD patients aged 55–64.

## *ESA prescription and gender*

Haemoglobin levels in females are lower than in males and ESA utilisation is higher for females than males (Table 8.12). A greater proportion of females require ESA therapy than males but

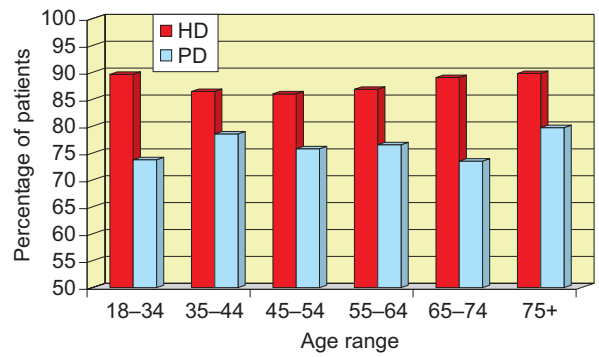


**Figure 8.38: Percentage of dialysis patients on EPO, by age group and modality**

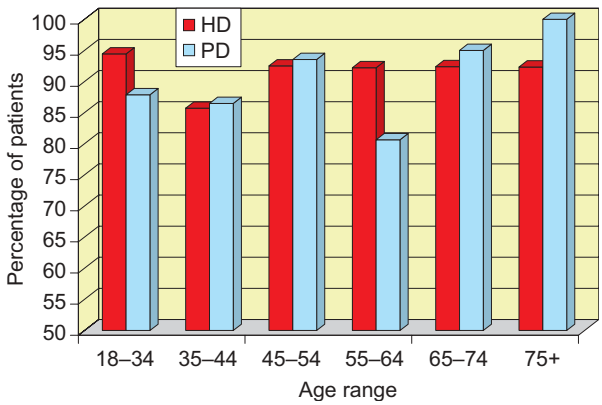


**Figure 8.39: Percentage of patients with Hb ⩾10 g/dl who are on EPO, by age group and gender**

**Table 8.12: Percentage of patients on EPO, by gender and modality**

| Gender | Treatment modality | % on EPO |
|---|---|---|
| Male | HD | 87 |
| Female | HD | 90 |
| Male | PD | 74 |
| Female | PD | 80 |

the difference is greater in the PD population (Figures 8.40 and 8.41).

## *ESAs and time on renal replacement therapy*

From Table 8.13 the percentage of HD patients receiving ESAs during their first year of dialysis corresponds with the overall national median percentage for the HD population (88%). For PD, the percentage treated with ESAs during the first year of dialysis was slightly below that of the overall national median (76%), but subsequently exceeded this from 2–3 years onwards. As in last years Report, this may reflect delay in the commencement of ESAs in PD patients, or

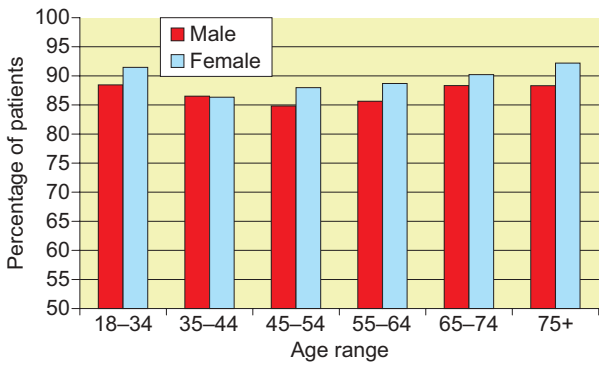


**Figure 8.40: Provision of EPO by age and gender: HD**

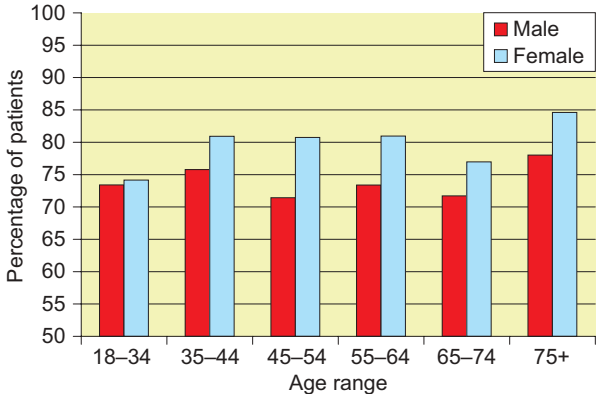


**Figure 8.41: Provision of EPO by age and gender: PD**

more probably the effect of a progressive loss of residual renal function from the second year of RRT onwards, resulting in increasing anaemia and therefore ESA requirements.

## *ESA dose and success with guideline compliance*

As in previous reports, centres prescribing higher doses of ESAs were not necessarily more successful in meeting haemoglobin targets, reflecting the importance of other influences on renal anaemia including iron status, residual renal function, case mix and dialysis dose (Figures 8.42 and 8.43).

**Table 8.13: Percentage of patients on EPO by time on RRT**

| Time on treatment | <1 year | 1–2 years | 2–3 years | 3–5 years | 5–10 years | >10 years |
|---|---|---|---|---|---|---|
| % patients HD | 85 (1,148) | 87 (1,316) | 90 (1,018) | 91 (1,403) | 90 (1,327) | 85 (894) |
| % patients PD | 70 (322) | 76 (341) | 76 (264) | 80 (273) | 77 (229) | 78 (138) |

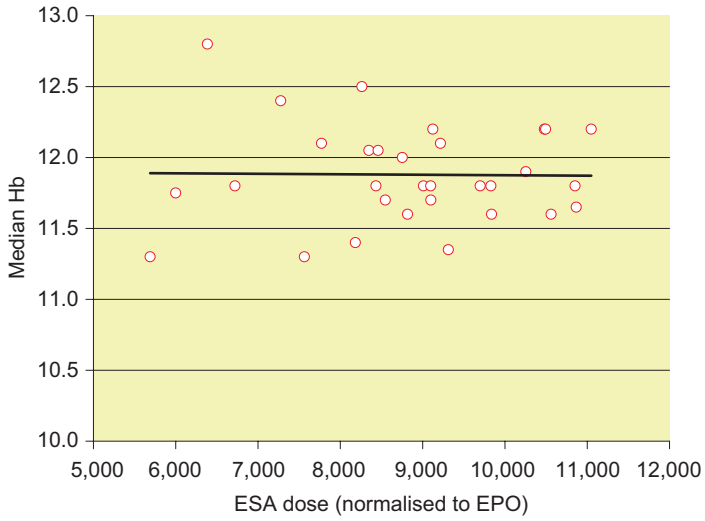


**Figure 8.42: Median Hb versus mean ESA dose**

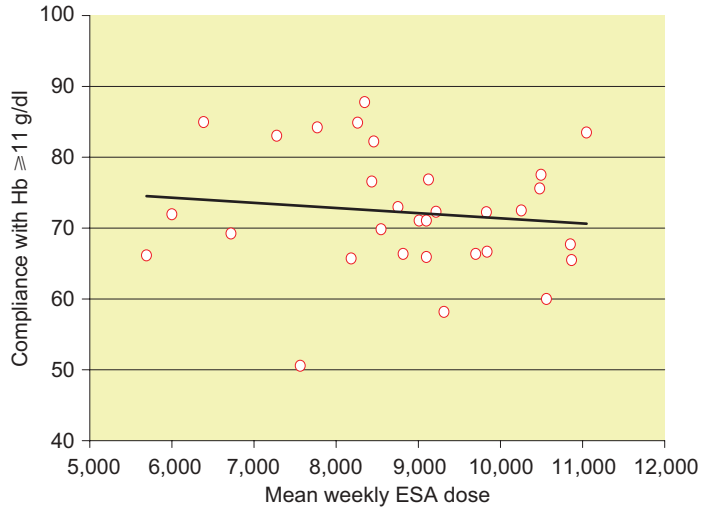


**Figure 8.43: Compliance with EBPG versus mean ESO dose**

## Conclusion

Haemoglobin outcome for patients on haemodialysis and peritoneal dialysis in the UK are increasingly compliant with Renal Association minimum standards. Haemoglobin outcomes reside below the EBPG outcome that declares all patients should achieve a haemoglobin >11.0 g/dl. Recently published NICE guidance, however, suggests that higher outcomes are not cost effective. The presentation in this year's report of percentage of patients between 10.5 and 12.5 g/dl alongside the funnel plots for Hb outcome may enable units to plan their desired future Hb outcome in light of the NICE guidance. Ferritin outcome appears to have reached a steady state in the UK dialysis population and the percentage of patients with serum ferritin greater than 100 μmol/L seen in this year's report show that the provision of intravenous iron for UK dialysis patients is maintained.

Although the returns on ESA treatment remain incomplete, the number of units returning data has increased. The doses received remained higher in HD than PD, though in contrast to HD, the number of PD patients receiving ESAs increased with time on dialysis. The haemoglobin outcome does not show a relationship with prescribed ESA dose amongst the dataset submitted to the registry. However ESA type, frequency of administration and route of administration may all affect the dose requirements in addition to the other variables mentioned above that can affect erythropoetic response.

Overall, the data demonstrate that UK renal units continue to accord a high priority to the management of factors influencing haemoglobin. Local priorities in the treatment of renal anaemia may need to be adjusted in line with new NICE guidance.

## References


1. Department of Health. The National Service Framework for Renal Services. Part One: Dialysis and Transplantation. London: Department of Health, 2004:1–50.
2. Renal Association. Treatment of adults and children with renal failure: standards and audit measures. 3rd Edition. London: Royal College of Physicians of London and the Renal Association, 2002.
3. Revised European Best Practice Guidelines for the Management of Anaemia in Patients with Chronic Renal Failure. *Nephrol Dial Transplant* 2004;19,Supplement 2:ii1–ii47.
4. NKF-K/DOQI Clinical Practice Guidelines for Anemia of Chronic Kidney Disease: update 2000. *Am J Kidney Dis* 2001;37(1 Suppl 1):S182–238.
5. National Collaborating Centre for Chronic Conditions. Anaemia management in chronic kidney disease: national clinical guideline for management in adults and children. London: Royal College of Physicians, 2006.
6. Besarab A, Bolton WK, Browne JK, Egrie JC, Nissenson AR, Okamoto DM, *et al*. The effects of normal as compared with low hematocrit values in patients with cardiac disease who are receiving hemodialysis and epoetin. *N Engl J Med* 1998;339(9):584–90.
7. Drueke TB, Locatelli F, Clyne N, Eckardt KU, Macdougall IC, Tsakiris D, *et al*. Normalization of hemoglobin level in patients with chronic kidney disease and anemia. *N Engl J Med* 2006;355(20):2071–84.
8. Singh AK, Szczech L, Tang KL, Barnhart H, Sapp S, Wolfson M, *et al*. Correction of anemia with epoetin alfa in chronic kidney disease. *N Engl J Med* 2006; 355(20):2085–98.
9. Charlie Tomson, Uday Udayaraj, Julie Gilg and David Ansell. Chapter 6: Co-morbidities in UK Patients at the Start Renal Replacement Therapy. In: UK Renal Registry Report 2006. UK Renal Registry, Bristol, UK.