Chapter 9: Factors Influencing Haemoglobin

Summary

- The percentage of patients achieving a serum ferritin above 100 µg/L was similar to 2003 for both HD (96% vs 95%) and PD (86% vs 87%).
- Between renal units, for HD patients there is a linear relationship between %Hb $\geqslant$10 g/dl and %ferritin >200 µg/L which is achieved by 85% of HD patients and 62% of PD patients.
- Median ferritin was higher for HD (424 µg/L; quartile range 275–623 µg/L) than for PD (251 µg/L; quartile range 149–413 µg/L).
- There remains a wide difference in achieved ferritin outcome between different centres, medians ranging from 200 to 700 µg/L. In HD there are an increasing number of renal units with median ferritin $\geqslant$500 µg/L (11 of 49 renal units).
- The percentage of patients with serum ferritin >800 µg/L (and potential toxicity) shows a linear relationship with median ferritin for both HD and PD modalities. The contribution of acute phase responses to this relationship is uncertain.
- With improved population Hb, calibration against a minimum standard of %Hb $\geqslant$10 g/dl may not reflect differences in median Hb. Compliance with %Hb $\geqslant$10 g/dl does not improve beyond a median outcome Hb of 12 g/dl (for HD or PD).
- Compliance with Hb $\geqslant$11 g/dl continues to improve in a linear fashion with increasing median Hb (for HD and PD).
- In patients new to HD the median ferritin increases progressively over 20 months from 175 µg/L to 450 µg/L.
- Compared to 2003 the percentage of patients treated with Erythropoiesis Stimulating Agents (ESAs) in 2004 was unchanged for HD (91% vs 91%) and higher for PD (80% vs 77%).
- ESA doses were higher in patients on HD (mean 9,500 units/wk; median 8,000 units/wk) than in PD (mean 6,000 units/wk; median 4,000 units/wk), though ESA data are not yet fully reliable for agent, administration and dose frequency.
- A significantly higher percentage of women than men received ESAs in both HD (92% vs 90% $p = 0.004$) and PD (83% vs 79% $p = 0.03$) modalities.
- Unit performance has been tending to stabilise in this area and further useful information is likely to depend on the collection and presentation of additional variables such as transferrin saturation, reticulocyte Hb concentration, CRP and details of the agents, doses, and administration of ESAs and iron.

Introduction

National and international recommendations for the goals of iron status in chronic kidney disease remain unchanged from previous reports. The 2002 Renal Association Standards Document (SDIII) revised European Best Practice Guidelines (EBPGII) and Dialysis Outcomes Quality Initiatives (KDOQI) guidelines 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 also recommend:

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

in addition, EBPGII adds:

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

To achieve adequate iron status across a patient population, SDIII and EBPGII advocate population medians for ferritin of 200–500 μg/L, for TSAT of 30–40%, for hypochromic red cells of <2.5% and CHr of 35 pg/cell. EBPGII comments that:

> ***a serum ferritin 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.

Serum ferritin has several disadvantages as an index of iron status.

1. It is a marker of storage iron rather than available iron;
2. it behaves as an acute phase reactant, and is therefore increased in inflammatory states and malignancy;
3. it is raised in liver disease;
4. there is limited evidence about the sampling delay after IV administration necessary to allow an accurate reflection of iron stores.

Of the alternative measures of iron status available, HRC and CHr are generally considered superior to TSAT. However, both require specialised analysers to which few UK renal units have easy access and HRC is inaccurate/unreliable if analysis is delayed. 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. The collection of TSAT values would enhance explanations of renal unit results, as would knowledge of the agents, routes, frequency and doses of administered iron. However, the drive to higher serum ferritin, towards conventional 'toxic' limits, in order to maximise the effects of ESAs, partly obviates the role of TSAT or other variables in assessing 'functional iron deficiency'.

Information on the use of ESAs has been collected from units where data was available. Doses of darbepoeitin have been converted at protein mass equivalence (200 : 1) and reported as a weekly dose. However, route of administration and frequency of administration data are incomplete and make comparative analysis difficult. Data are presented as total weekly erythropoeitin dose.

Completeness of data returns

The completeness of serum ferritin returns to the Registry over 6 months is shown in Table 9.1. Not all sites use serum ferritin as the sole indicator of iron status.

In all figures where data are shown by the individual centre, the number adjacent to the name of the renal unit indicates the percentage of missing data at that time point.

Table 9.1: Completeness of serum ferritin returns

Centre	Ferritin HD %	Ferritin PD %
Bangor	88	79
Barts	0	0
Basildn	97	100
Bradford	100	100
Brighton	56	88
Bristol	98	98
Cambridge	55	91
Carlisle	93	93
Carshalton	74	80
Chelmsford	88	91
Clwyd	81	100
Coventry	99	83
Cardiff	95	91
Derby	79	64
Dorset	95	97
Dudley	75	88
Exeter	97	100
Gloucester	96	92
Guys	82	91
H&CX	98	97
Heartlands	86	100
Hull	95	93
Ipswich	98	67
Kings	93	90
Leeds	98	98
Leicester	97	93
Liverpool	91	93
ManWst	56	85
Middlesbrough	92	100
Newcastle	100	100
Norwich	97	100
Nottingham	96	97
Oxford	92	82
Plymouth	90	86
Portsmouth	99	79
Preston	97	100
QEH	94	93
Reading	97	96
Sheffield	99	97
Shrewsbury	100	97
Stevenage	92	95
Southend	98	95
Sunderland	91	92
Swansea	98	99
Truro	99	92
Wirral	1	15
Wolverhampton	100	100
Wrexham	84	93
York	91	95
England	87	85
Wales	87	86
England & Wales	87	85

Serum ferritin

Serum ferritin and inter-quartile ranges are presented in Table 9.2 and Figure 9.1 for haemodialysis and Table 9.3 and Figure 9.2 for peritoneal dialysis. The percentages of patients achieving a serum ferritin over 100 μg/L and 200 μg/L for each modality are shown in Figures 9.3 to 9.6.

All centres except one achieved a median ferritin outcome in compliance with the EBPG standard of over 200 μg/L for HD. All units except one achieved at least 85% ferritin >100 μg/L. This year's data in HD suggest a renal unit median ferritin of 300 μg/L to ensure 85–90% achieve the RA Standard ferritin value. 95% compliance is achieved at a median ferritin of 400–450 μg/L.

As in previous reports the overall median was higher for HD (424 μg/L) than for PD (251 μg/L). It is difficult to argue for a ferritin outcome similar to HD for the PD population with the Hb outcome in PD as good as presented at much lower doses of ESA. The median Hb and ferritin outcomes show a linear relationship up to a ferritin of approximately 300 μg/L in PD (Figures 9.7 and 9.8).

As units have increased the use of intravenous iron to increase the median ferritin outcome, the proportion of patients with a ferritin >800 μg/L inevitably increases (Figure 9.9) with about 15% of patients having a ferritin >800 μg/L at a median ferritin of 500 μg/L. The median ferritin outcome appears to approximate to the ceiling for iron administration in clinical systems known to undertake frequent and regular review of iron status.

If ferritin >800 μg/L is associated with increased risk of toxicity, without additional benefit in terms of increase in Hb or reduction in ESA dose, then an upper limit for further iron therapy may need to be considered as approximately 500 μg/L.

EBPGII advocate a population outcome median for ferritin of 200–500 μg/L. Nearly half the renal units in the UK have a median greater than 400 μg/L with 8 out of 47 centres that submitted ferritin data) reaching a median ferritin >500 μg/L.

Table 9.2: Serum ferritin in HD patients

Centre	% data return	Median ferritin	90% range	Quartile range	% ferritin >100 µg/L
Bangor	88	453	158–1,022	329–730	98
Barts	0	n/a	n/a	n/a	n/a
Basildon	97	310	114–508	227–358	97
Bradford	100	493	206–982	374–705	98
Brighton	56	255	39–1,500	140–480	83
Bristol	98	471	155–1,199	309–730	99
Cambridge	55	197	43–579	115–303	82
Carlisle	93	339	130–853	241–449	99
Carshalton	74	344	79–987	238–480	94
Chelmsford	88	472	104–1,056	289–581	96
Clwyd	81	319	122–592	203–432	98
Coventry	99	329	76–1,101	211–519	93
Cardiff	95	519	106–1,175	319–713	95
Derby	79	365	99–952	279–554	95
Dorset	95	467	159–850	330–599	100
Dudley	75	430	140–948	276–564	100
Exeter	97	326	119–620	235–414	98
Gloucester	96	342	70–827	208–555	91
Guys	82	403	92–1,144	270–612	95
H&CX	98	681	209–1,433	392–878	98
Heartlands	86	280	56–699	153–413	90
Hull	95	385	151–796	278–520	98
Ipswich	98	403	116–885	225–579	95
Kings	93	459	187–966	347–624	100
Leeds	98	500	217–904	402–621	100
Leicester	97	384	124–989	247–561	97
Liverpool	91	593	100–1,650	334–891	95
ManWst	56	429	51–1,229	226–774	91
Middlesbrough	92	460	78–1,644	290–806	93
Newcastle	100	478	206–1,143	368–678	100
Norwich	97	430	161–1,101	310–645	98
Nottingham	96	479	222–1,003	374–625	99
Oxford	92	329	72–823	209–449	93
Plymouth	90	392	117–1,449	278–578	96
Portsmouth	99	310	102–719	217–406	96
Preston	97	671	183–1,517	457–876	97
QEH	94	283	85–637	197–397	93
Reading	97	646	258–1,081	459–810	99
Sheffield	99	561	206–1,073	432–747	98
Shrewsbury	100	403	94–1,025	270–573	95
Stevenage	92	412	119–911	251–551	98
Southend	98	358	153–680	293–425	97
Sunderland	91	409	144–1,057	258–580	99
Swansea	98	380	88–786	230–533	93
Truro	99	515	230–1,086	375–681	99
Wirral	1	n/a	n/a	n/a	n/a
Wolverhampton	100	464	212–798	368–552	100
Wrexham	84	497	125–963	328–686	96
York	91	617	307–1,006	501–767	100
England	87	422	115–1,081	275–621	96
Wales	87	447	98–1,096	286–653	95
England & Wales	87	424	114–1,081	275–623	96

Table 9.3: Serum ferritin in PD patients

Centre	% data return	Median ferritin	90% range	Quartile range	% ferritin >100 µg/l
Bangor	79	278	40–678	178–399	95
Barts	0	n/a	n/a	n/a	n/a
Basildon	100	301	120–1,412	185–414	95
Bradford	100	259	33–788	131–402	89
Brighton	88	295	63–1,200	215–480	93
Bristol	98	194	26–638	102–323	76
Cambridge	91	195	62–645	125–361	83
Carlisle	93	410	61–1,580	256–873	92
Carshalton	80	237	47–812	125–368	85
Chelmsford	91	276	64–893	187–500	87
Clwyd	100	203	32–569	141–250	83
Coventry	83	159	24–840	82–367	67
Cardiff	91	226	41–674	119–350	81
Derby	64	309	141–759	235–411	100
Dorset	97	219	66–507	149–345	88
Dudley	88	203	36–830	136–277	84
Exeter	100	163	64–565	120–276	86
Gloucester	92	246	65–554	175–400	92
Guys	91	228	62–722	180–287	87
H&CX	97	279	60–1,118	179–582	90
Heartlands	100	249	42–713	135–363	79
Hull	93	280	84–655	183–372	90
Ipswich	67	309	42–588	166–433	83
Kings	90	251	86–775	189–356	94
Leeds	98	377	86–878	209–465	95
Leicester	93	297	56–861	163–466	89
Liverpool	93	251	70–753	153–413	89
ManWst	85	188	38–779	109–303	79
Middlbrough	100	429	46–1,711	197–521	94
Newcastle	100	313	84–1,098	239–466	93
Norwich	100	478	77–838	364–607	93
Nottingham	97	214	60–578	151–297	89
Oxford	82	214	59–1,065	108–475	79
Plymouth	86	200	42–621	101–426	75
Portsmouth	79	206	34–499	125–278	78
Preston	100	236	64–651	138–398	87
QEH	93	146	32–588	82–245	67
Reading	96	442	102–889	353–499	96
Sheffield	97	300	69–851	188–437	92
Shrewsbury	97	286	97–714	183–455	94
Stevenage	95	184	46–534	115–313	77
Southend	95	315	54–865	170–542	95
Sunderland	92	483	298–1,183	457–743	100
Swansea	99	229	49–766	135–367	83
Truro	92	215	41–900	152–333	83
Wirral	15	n/a	n/a	n/a	n/a
Wolverhampton	100	267	55–779	184–524	88
Wrexham	93	418	204–963	294–576	100
York	95	238	59–530	148–381	86
England	85	251	54–826	150–413	86
Wales	86	247	49–851	139–396	85
England & Wales	85	251	52–830	149–413	86

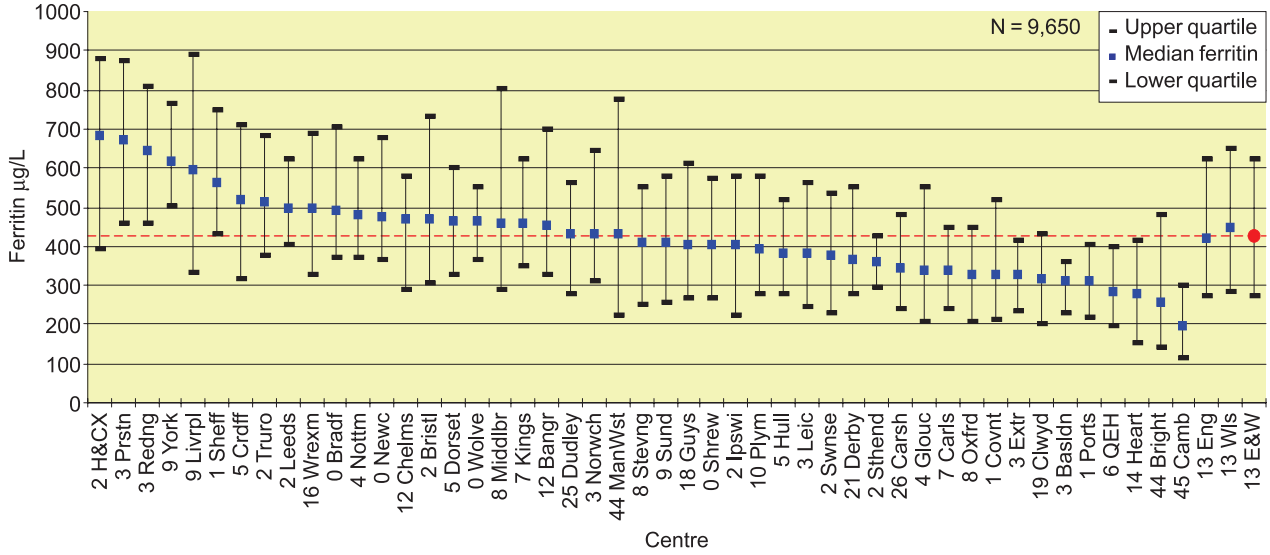

Figure 9.1: Median serum ferritin: haemodialysis

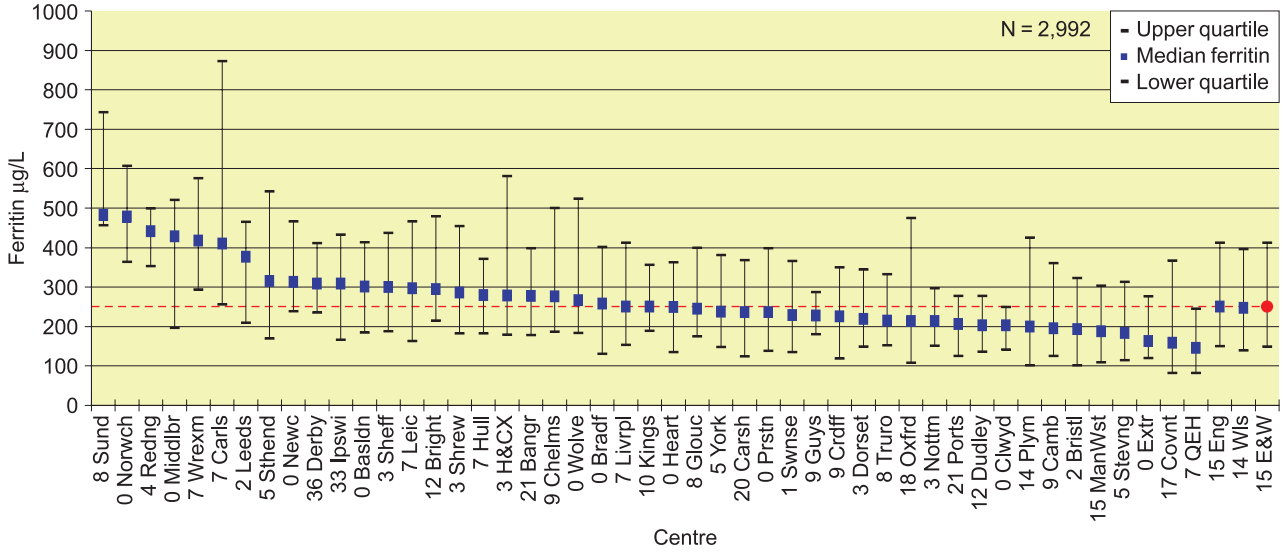

Figure 9.2: Median serum ferritin: peritoneal dialysis

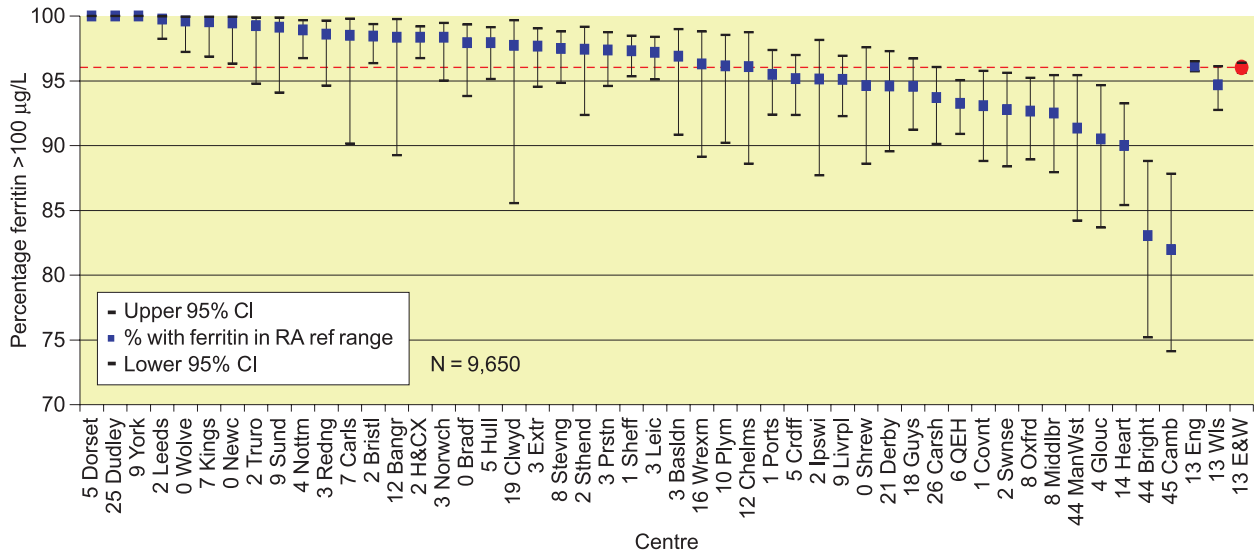

Figure 9.3: Percentage of HD patients with serum ferritin $\geqslant$ 100 µg/L

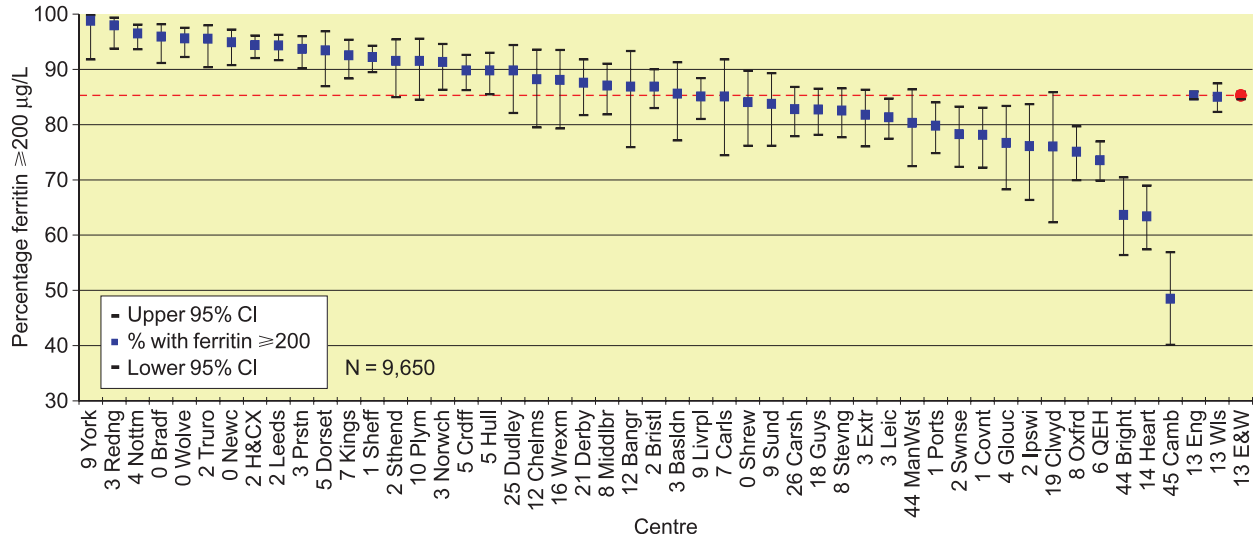

Figure 9.4: Percentage of HD patients with serum ferritin ⩾200 µg/L

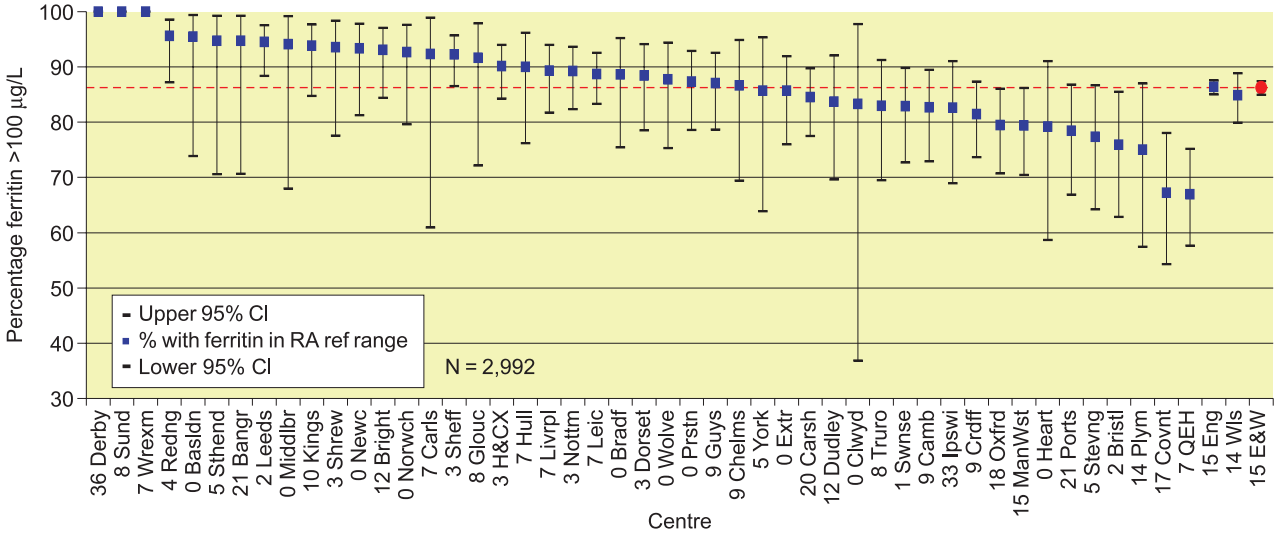

Figure 9.5: Percentage of PD patients with serum ferritin ⩾100 µg/L

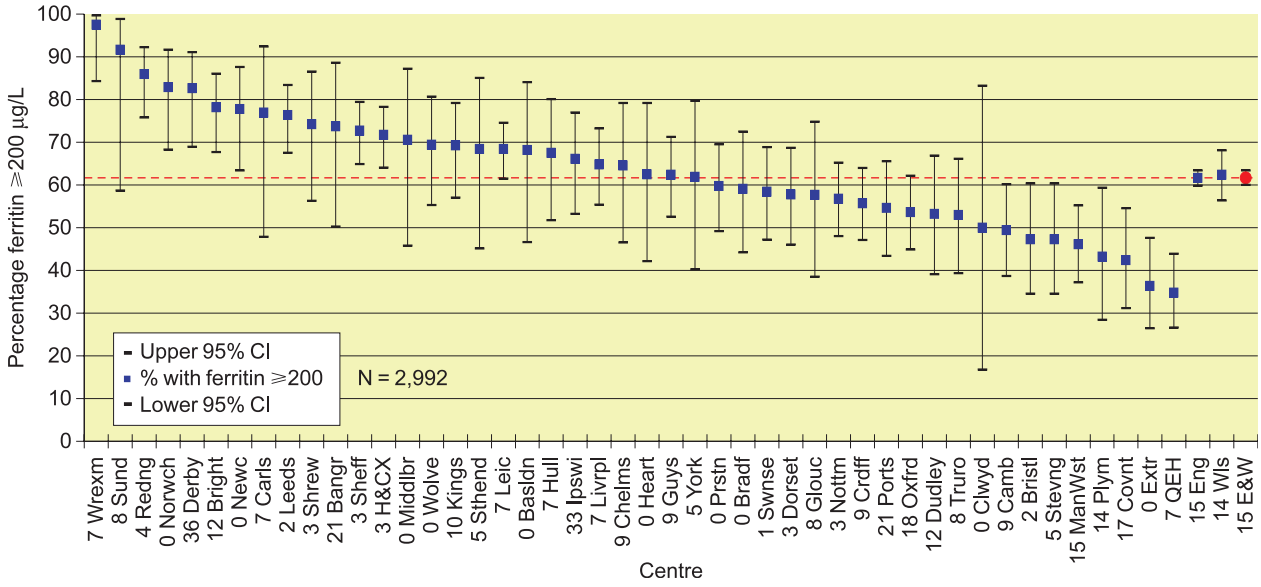

Figure 9.6: Percentage of PD patients with serum ferritin ⩾200 µg/L

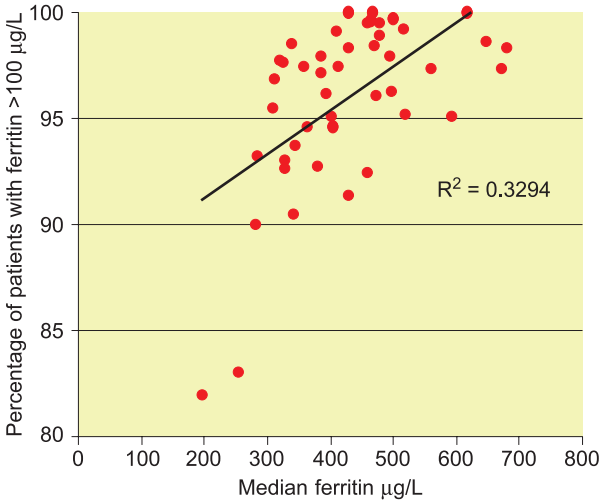

Figure 9.7: Median ferritin vs compliance with RA standard for ferritin by centre in HD

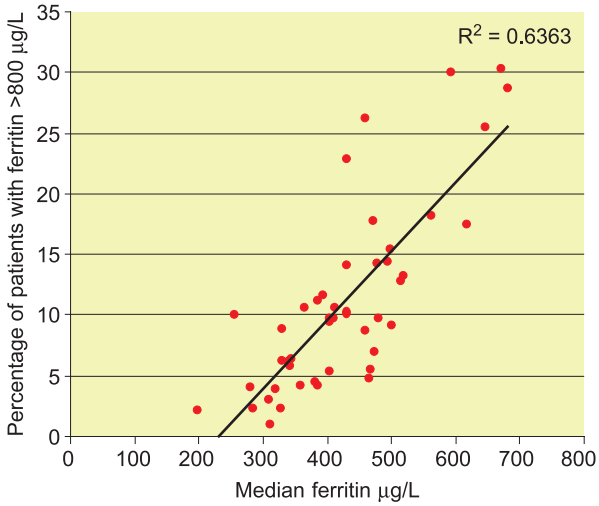

Figure 9.9: Median ferritin vs ferritin >800 µg/L by centre HD

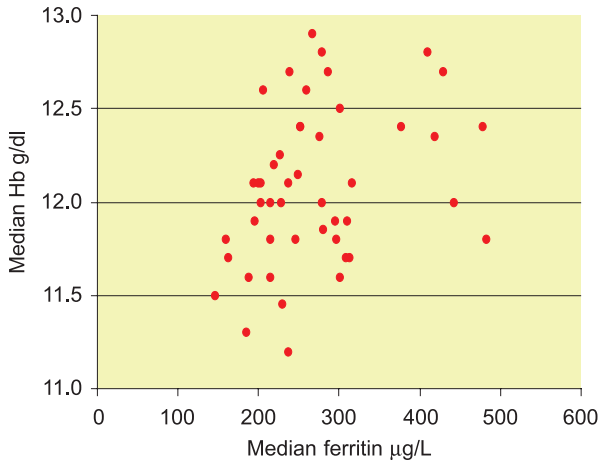

Figure 9.8: Median ferritin by median Hb by centre PD

Changes in serum ferritin 1999–2004 in England and Wales

There is good overall achievement of therapeutic goals for ferritin in HD and PD. The improvement in ferritin in HD in recent years appears to have stabilised. PD outcomes have remained relatively stable for the last 6 years (Figures 9.10 to 9.12).

Many centres showed marked differences in iron status between their HD and PD populations suggesting that iron replacement practices are different for the two modalities, either by design (policy), because of separate team management or possibly because of logistical

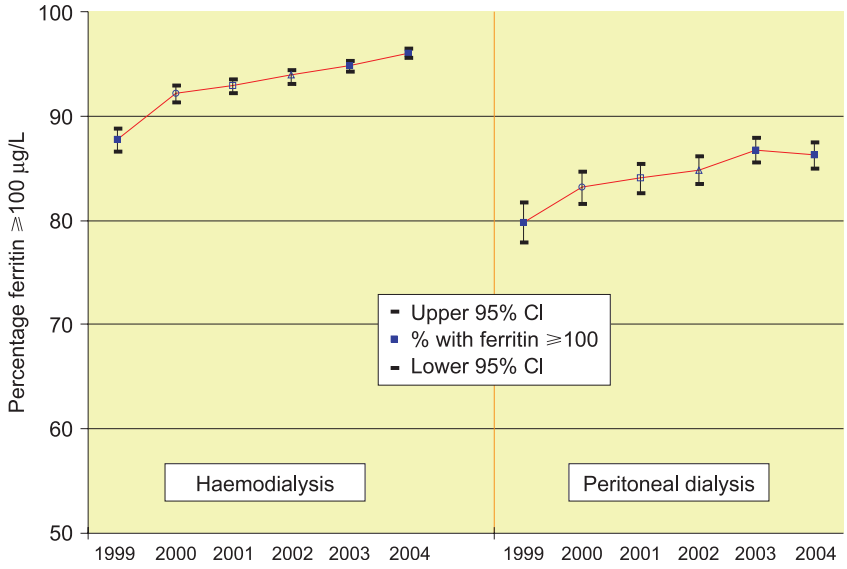

Figure 9.10: Change in achievement of serum ferritin >100 µg/L, 1999–2004

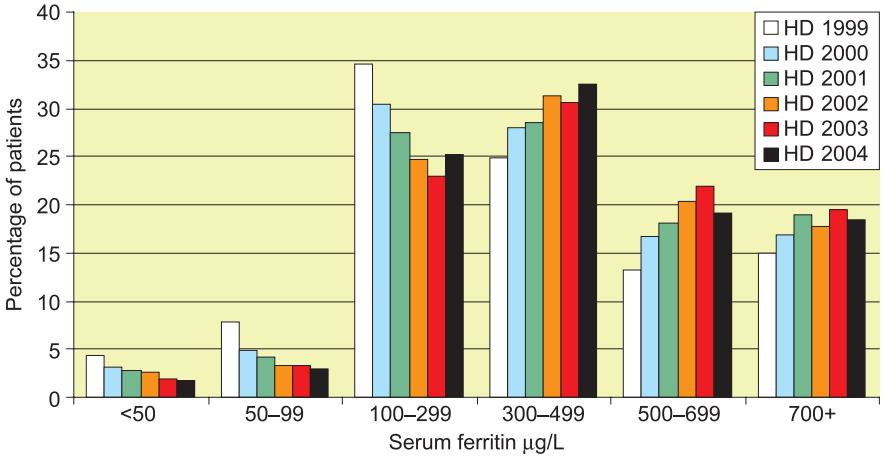

Figure 9.11: Serum ferritin distribution 1999–2004 haemodialysis

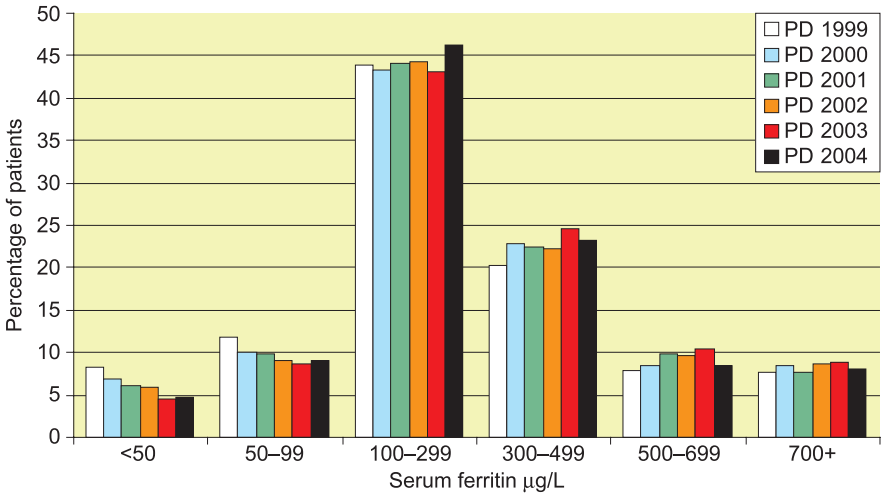

Figure 9.12: Serum ferritin distribution 1999–2004 peritoneal dialysis

problems in providing regular intravenous iron to PD patients.

Given that only one centre for HD had a median serum ferritin less than 200 µg/L, it is unsurprising that no relationship exists for HD between the percentage of patients with serum ferritin above 200 µg/L and a haemoglobin level ⩾10 g/dl (Figures 9.13 and 9.14).

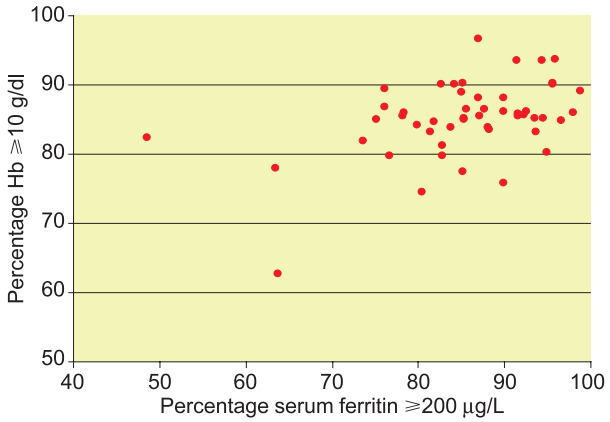

Figure 9.13: Percentage of patients with serum ferritin >200 µg/L and Hb ⩾10 g/dl on HD

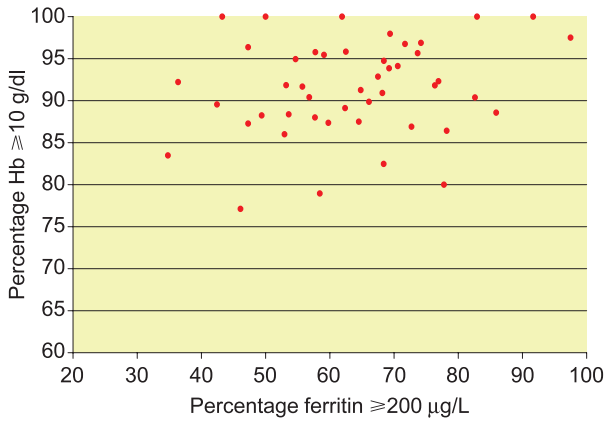

Figure 9.14: Percentage of patients with serum ferritin >200 µg/L and Hb ⩾10 g/dl on PD

Serum ferritin and length of time on renal replacement therapy (RRT)

As in the 2004 Report, the median and lower quartile values for serum ferritin were above 100 µg/L for both HD and PD by the sixth month on dialysis. As before, however, median ferritin continued to increase beyond this time, reaching the respective modality median only two years after the start of dialysis (Figures 9.15 and 9.16).

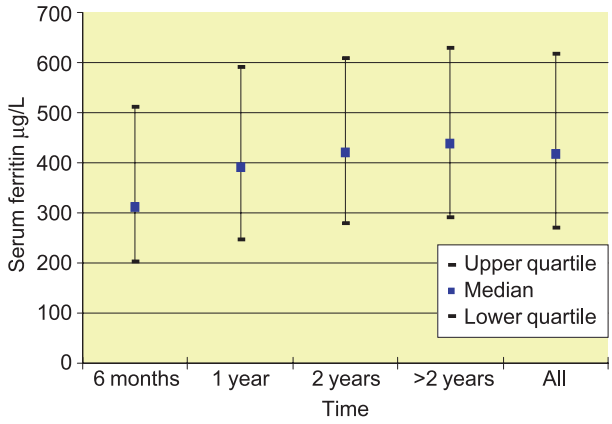

Figure 9.15: Median ferritin by length of time on RRT: HD

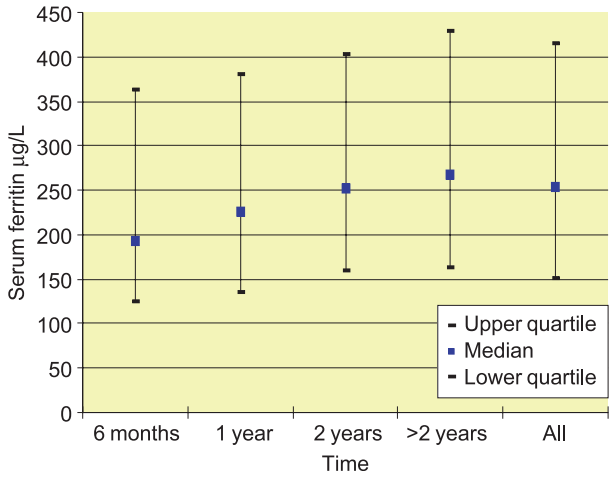

Figure 9.16: Median ferritin by length of time on RRT: PD

Changes in serum ferritin by centre 1999–2004

In HD, serial ferritin values seem to be relatively stable over 2003–2004 (Figure 9.17). Rising medians, and falling levels in units with higher outcomes in earlier years, are followed by stability, suggesting the acceptance of successful achievement of goals. A few units, however, show >15% of patients with a ferritin >800 µg/L.

Year on year changes of median ferritin in PD patients (Figure 9.18) have been less pronounced than in the HD population, although a minority have more than 15% <100 µg/L. Even so, the Hb outcomes reach the RA Standard of 85% Hb ⩾10 g/dl.

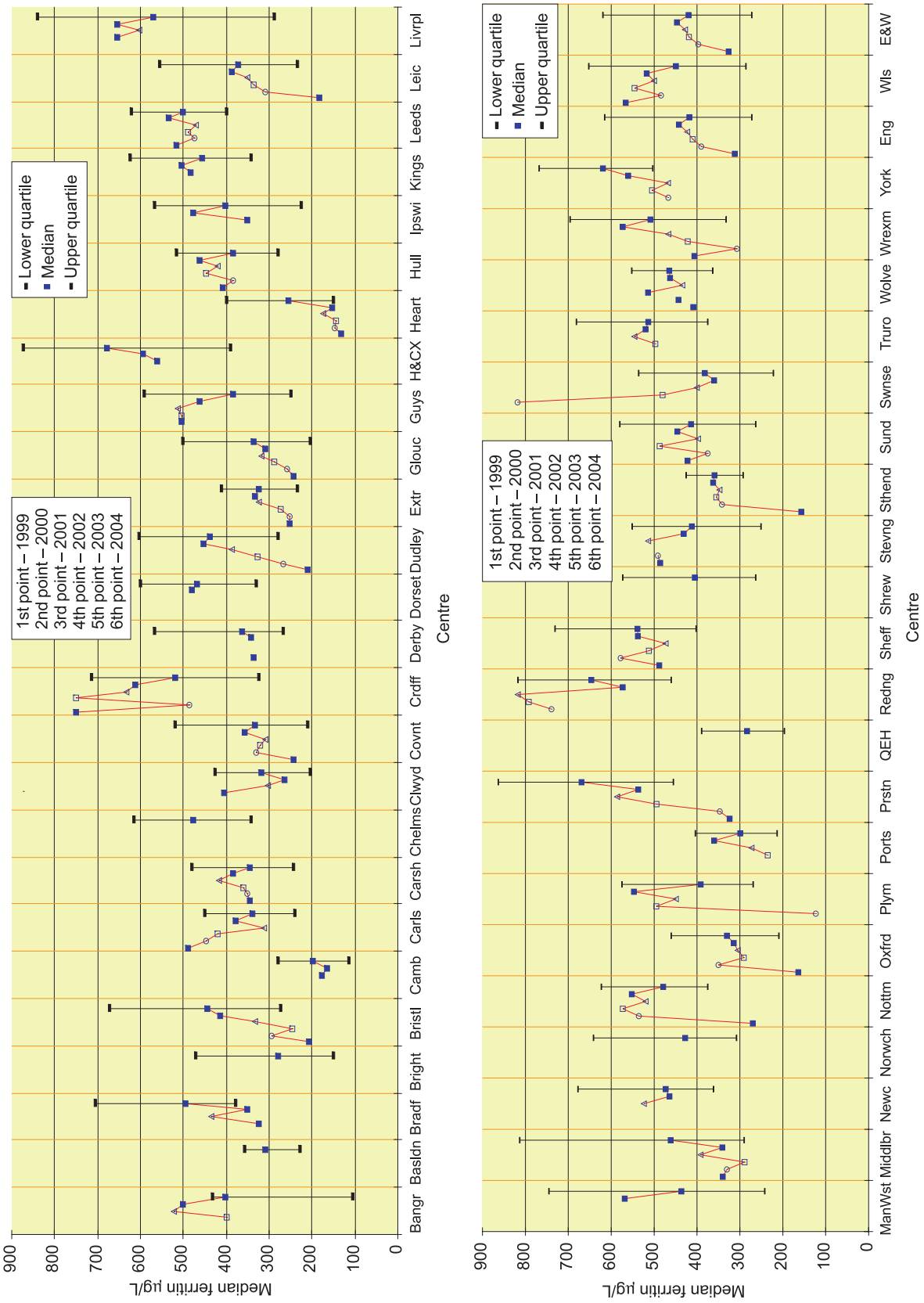

Figure 9.17: Serial ferritin in haemodialysis patients

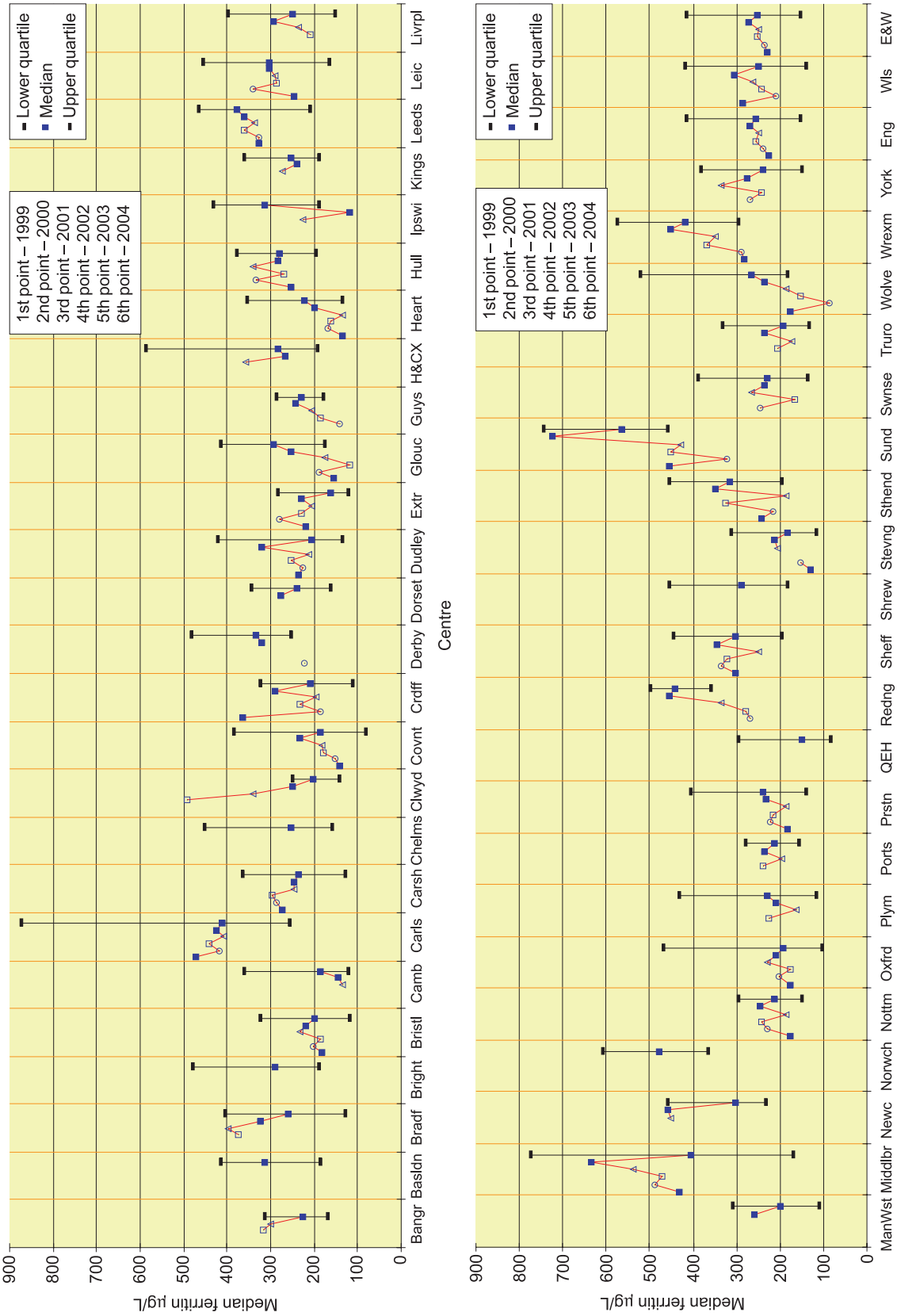

Figure 9.18: Serial ferritin in peritoneal dialysis patients

Erythropoietin stimulating agents

The Hb outcomes across England and Wales are approaching the UK RA Standard although a small number of units still have >15% of point prevalent values in patients on HD with an Hb $\leqslant$10.0 g/dl. Investigation as to the reasons why need to be undertaken at a local level, given that there continues to be an annual increase in the haemoglobin achieved by renal units. For England and Wales, only 11% of HD and 8% of PD patients had an Hb $\leqslant$10 g/dl in these point prevalent data. In HD patients 69% have an Hb $\geqslant$11 g/dl and 80% for PD.

ESA data is collected from renal IT systems in a similar way to the rest of the Registry data, although in contrast to the automated laboratory links, this relies on manual initial data entry. The reliability of these data is likely to depend on who is making the entry (doctor, EPO nurse, or data clerk), whether the renal unit is prescribing the ESA directly (within the renal unit budget), with or without using the computer system, or whether ESAs are prescribed in Primary Care (from the Primary Care Trust budget). In the latter case, the data in the renal IT system may not always be updated in parallel with the GP letter or the GP may decline to prescribe ESAs at the doses advised by the nephrologist.

Weekly ESA dose effectiveness depends on the route of administration, frequency of administration, compliance (patient or clinician administration) and possibly the agent used. Of the 17 units with Hb outcome at less than 85% $\geqslant$10 g/dl, the previous RA Standard, 10 units have provided ESA data. The mean EPO equivalent dose for these 10 units (9,744) is greater than the national mean (9,571) suggesting that availability of ESA is not the only factor involved in achieving desirable outcome ranges.

Patients treated and dose variation

ESA data were returned by 30 centres for HD (Table 9.4), and (the same) 30 centres for PD (Table 9.5). For HD the same proportion of patients were treated with ESAs compared to the 2004 report (90% male, 92% female). In PD a slight increase occurred (79% male, 83% female) though achieved haemoglobins were higher.

The percentage of patients receiving ESAs ranged from 62–99% (mean 91%) for HD and from 50–95% (mean 80%), for PD.

The difference between modalities appears to reflect lower ESA requirements in the PD population, rather than being due to problems in providing ESAs for this group. In some units there may be difficulties in provision of ESAs reflected in low percentage on ESA therapy, yet the Hb outcomes appear reasonable, and do not distinguish them.

As in previous reports, the percentage of patients achieving a haemoglobin over 10 g/dl without ESAs, was markedly higher for PD than HD, despite a higher median ferritin in the HD population of 424 μg/L compared with that of 251 μg/L in the PD population. This reflects the greater susceptibility of HD patients to blood loss, iron deficiency, and inflammation.

HD patients continued to receive larger doses of ESAs than their PD peers (median 8,000 vs 4,000 units/wk; mean 9,500 vs 6,000 units/week respectively). 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 adequacy. Bradford in particular has a median Hb of 12.7 & 12.6 for HD and PD respectively with relatively low reported mean EPO doses of 7,713 and 4,714 IU/wk respectively.

Age and ESA provision

Only minor variations were seen with age in the percentage of HD & PD patients treated with ESAs (Figure 9.19).

ESA prescription and gender

As in previous reports, a greater percentage of women than men were treated with ESAs in both dialysis modalities, despite a lower achieved haemoglobin in women (Tables 9.8 and 9.9). For both modalities, more men than women achieved a haemoglobin over 10 g/dl without ESAs (Tables 9.6 and 9.7 and Figures 9.20 and 9.21).

Table 9.4: ESA prescribing in HD patients

Treatment centre	% data return	Median ferritin	90% range	Quartile range	% ferritin >100 µg/L	Mean Hb	Mean weekly dose for pts on EPO	Median Hb	Median dose for HD pts on EPO
Basildon	97	310	114–508	227–358	97	11.5	10,380	11.5	10,000
Bradford	100	493	206–982	374–705	98	12.4	7,710	12.7	6,000
Bristol	98	471	155–1,199	309–730	99	11.6	8,550	11.6	6,000
Carlisle	93	339	130–853	241–449	99	11.4	9,660	11.4	7,500
Chelmsford	88	472	104–1,056	289–581	96	11.7	10,480	11.7	9,000
Clwyd	81	319	122–592	203–432	98	12.7	8,950	12.6	8,000
Coventry	99	329	76–1,101	211–519	93	11.4	11,560	11.4	10,000
Dorset	95	467	159–850	330–599	100	11.7	11,190	12.0	12,000
Dudley	75	430	140–948	276–564	100	11.1	7,440	11.2	6,000
Exeter	97	326	119–620	235–414	98	11.5	8,470	11.5	7,500
Gloucester	96	342	70–827	208–555	91	11.4	10,890	11.4	9,000
Heartlands	86	280	56–699	153–413	90	11.2	9,370	11.3	8,000
Ipswich	98	403	116–885	225–579	95	11.4	9,190	11.5	8,000
Leeds	98	500	217–904	402–621	100	12.4	8,960	12.4	8,000
Leicester	97	384	124–989	247–561	97	11.5	9,900	11.6	9,000
Liverpool	91	593	100–1,650	334–891	95	12.3	10,280	12.4	9,000
ManWst	56	429	51–1,229	226–774	91	11.1	9,660	11.1	8,000
Middlesbrough	92	460	78–1,644	290–806	93	11.7	7,040	11.9	6,000
Norwich	97	430	161–1,101	310–645	98	11.8	10,020	11.8	8,000
Oxford	92	329	72–823	209–449	93	11.4	8,860	11.5	8,000
Plymouth	90	392	117–1,449	278–578	97	11.5	9,430	11.3	8,000
QEH	94	283	85–637	197–397	93	11.5	10,640	11.6	10,000
Sheffield	99	561	206–1,073	432–747	97	11.6	10,340	11.6	8,000
Shrewsbury	100	403	94–1,025	270–573	95	11.7	11,040	12.0	10,000
Stevenage	92	412	119–910	251–551	98	11.8	10,480	12.0	8,000
Southend	98	358	153–680	293–425	97	11.2	7,540	11.4	6,000
Sunderland	91	409	144–1,057	258–580	99	11.8	8,540	12.0	9,000
Truro	99	515	230–1,086	375–681	99	11.5	5,060	11.6	4,000
Wolverhampton	100	464	212–798	368–552	100	12.3	10,240	12.6	8,000
York	91	617	307–1,006	501–767	100	12.4	9,250	12.8	8,000
England	87	422	115–1,081	275–621	96	11.6	9,590	11.7	8,000
Wales	87	447	98–1,096	286–653	95	11.9	8,710	12.0	8,000
England & Wales	87	424	114–1,081	275–623	96	11.7	9,570	11.7	8,000

Table 9.5: ESA prescribing in PD patients

Treatment centre	% data return	Median ferritin	90% range	Quartile range	% ferritin >100 µg/L	Mean Hb	Mean weekly dose for pts on EPO	Median Hb	Median dose for HD pts on EPO
Basildon	100	301	120–1,412	185–414	95	12.3	5,660	12.5	4,000
Bradford	100	259	33–788	131–402	89	12.7	4,710	12.6	4,000
Bristol	98	194	26–638	102–323	76	12.2	3,970	12.1	4,000
Carlisle	93	410	61–1,580	256–873	92	12.7	8,780	12.8	8,000
Chelmsford	91	276	64–893	187–500	87	11.9	7,000	12.4	5,000
Clwyd	100	203	32–569	141–250	83	12.8	4,400	12.1	4,000
Coventry	83	159	24–840	82–367	67	11.8	8,000	11.8	5,000
Dorset	97	219	66–507	149–345	88	12.4	5,950	12.2	4,000
Dudley	88	203	36–830	136–277	84	12.3	5,670	12.0	6,000
Exeter	100	163	64–565	120–276	86	11.8	6,020	11.7	4,000
Gloucester	92	246	65–554	175–400	92	11.6	5,760	11.8	4,000
Heartlands	100	249	42–713	135–363	79	12.0	6,890	12.2	6,000
Ipswich	67	309	42–588	166–433	83	11.7	6,090	11.7	6,000
Leeds	98	377	86–878	209–465	95	12.4	4,660	12.4	4,000
Leicester	93	297	56–861	163–466	89	11.7	5,620	11.8	4,000
Liverpool	93	251	70–753	153–413	89	12.4	5,880	12.4	6,000
ManWst	85	188	38–779	109–303	79	11.3	6,080	11.6	6,000
Middlesbrough	100	429	46–1,711	197–521	94	12.4	4,600	12.7	4,000
Norwich	100	478	77–838	364–607	93	12.7	6,390	12.4	6,000
Oxford	82	214	59–1,065	108–475	79	11.9	6,660	12.0	6,000
Plymouth	86	200	42–621	101–426	75	12.5	5,400	12.1	6,000
QEH	93	146	32–588	82–245	67	11.5	7,260	11.5	6,000
Sheffield	97	300	69–851	188–437	92	11.6	7,590	11.6	6,000
Shrewsbury	97	286	97–714	183–455	94	12.6	6,080	12.7	6,000
Stevenage	95	184	46–534	115–313	77	11.3	4,400	11.3	3,000
Southend	95	315	54–865	170–542	95	12.4	5,430	12.1	5,000
Sunderland	92	483	298–1,183	457–743	100	11.7	4,800	11.8	4,000
Truro	92	215	41–900	152–333	83	11.8	3,680	11.8	4,000
Wolverhampton	100	267	55–779	184–524	88	12.9	5,900	12.9	4,000
York	95	238	59–530	148–381	86	12.9	4,280	12.7	4,000
England	85	251	54–826	150–413	86	12.0	5,940	12.0	4,000
Wales	86	247	49–851	139–396	85	11.9	4,260	12.0	4,000
England & Wales	85	251	52–830	149–413	86	12.0	5,910	12.0	4,000

Table 9.6: Percentage use of ESAs, by Hb achievement and age, on HD

	% with Hb <10 and on epo	% with Hb ⩾10 who are not on epo
18–34	91	6
35–44	95	10
45–54	95	9
55–64	88	8
65–74	93	7
75+	91	6

Table 9.7: Percentage use of ESAs, by Hb achievement and age, on PD

	% with Hb <10 and on epo	% with Hb ⩾10 who are not on epo
18–34	95	12
35–44	91	15
45–54	95	22
55–64	77	21
65–74	91	18
75+	89	18

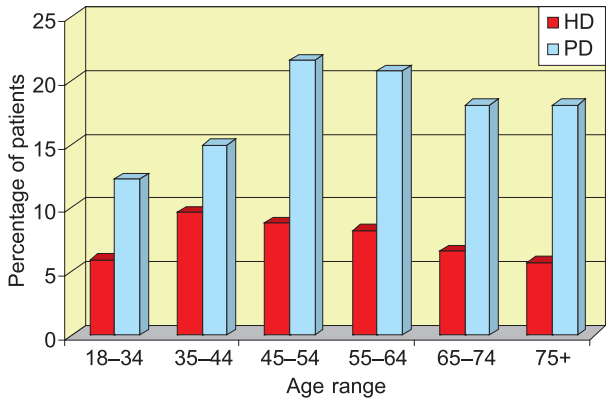

Figure 9.19: Percentage of patients not on EPO with Hb ⩾10 g/dl, by age group and modality

Table 9.8: Percentage ESA use by age and gender, on HD

	Male	Female
18–34	92	91
35–44	87	92
45–54	88	90
55–64	86	93
65–74	91	92
75+	92	91

Table 9.9: Percentage ESA use by age and gender, on PD

	Male	Female
18–34	87	86
35–44	84	86
45–54	74	81
55–64	76	78
65–74	80	85
75+	79	86

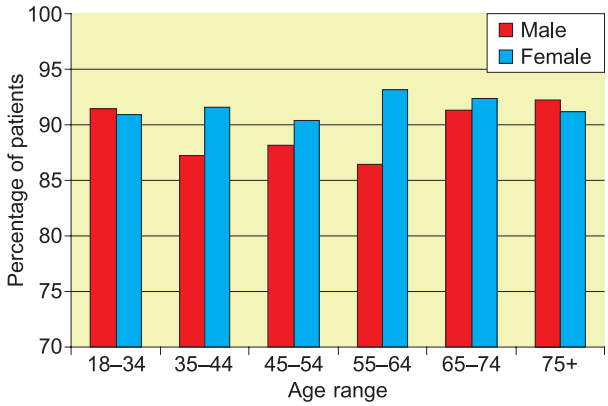

Figure 9.20: Provision of ESAs by age and gender, for patients on HD

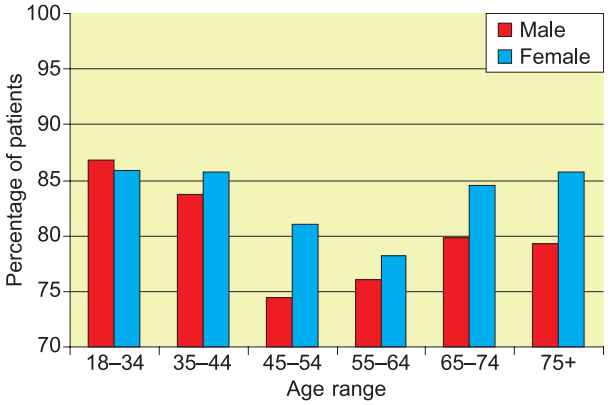

Figure 9.21: Provision of ESAs by age and gender, for patients on PD

Conclusion

The year on year rise in median serum ferritin and the percentage of patients with serum ferritin greater than 100 µmol/L appears to have stabilised in HD and PD. In PD, ferritin outcome has been stable for some time. In HD, the proportion with a ferritin >200 ng/ml has increased further over the last 2 years, suggesting that the provision of intravenous iron for UK dialysis patients is near saturation. Further increases in ferritin in the PD population are

probably unwarranted and results may reflect some clinical hesitation or inability to increase intravenous iron therapy readily in this group.

The proportion of patients with ferritin >800 μg/L is directly linked to median ferritin outcome and centres need to consider how best to avoid toxicity in their patients, when there is little if any benefit demonstrated in increasing the ferritin beyond approximately 500 μg/L. The role of acute phase elements in the values >800 μg/L cannot be assessed without further data on C-reactive protein (CRP), for example. Although the returns on ESA treatment remain incomplete, they show a continuing increase in the number of patients treated compared with 2001 data. The percentage of patients requiring ESAs, and the doses they received, remained markedly higher in HD than PD.

Overall, these data demonstrate that UK renal units continue to improve the outcome for Hb in HD & PD through treatment strategies relating to iron and ESAs. Across England and Wales the UK RA Standard for serum ferritin is close to being met, in point prevalent data, with coincident improvements in Hb outcome.

A more complete and reliable explanation of these results depends on additional data collection, such as TSAT, CRP and the details of ESA and iron treatment. A limit appears to have been reached in the usefulness of descriptive data matching demographic variables with serum ferritin and aggregated ESA data. Improvement in renal unit performance through comparative audit will require a broader base of data collection, possibly through forms of sampling.