Chapter 8: Factors Influencing Haemoglobin

Summary

- The median serum ferritin on HD continued to show a small annual rise from 405 mcg/L in 2001 to 420 mcg/L in 2002, with the percentage of patients exceeding a median serum ferritin of 100mcg/L rising from 93% to 94%. In contrast the median serum ferritin for PD patients remained unchanged at 249 mcg/L.

- The rise in median serum ferritin on HD was due to a higher percentage of ferritin values between 300 and 699 mcg/L and a corresponding fall in the percentage of values less than 300 mcg/L in haemodialysis patients. The percentage of patients with a ferritin above 700 mcg/L did not increase this year. In contrast, the ferritin distribution in peritoneal dialysis patients was similar to 2002.

- Although the median serum ferritin exceeded 100 mcg/L by 6 months after starting treatment by haemodialysis or peritoneal dialysis, levels continued to increase during the first two years on dialysis, reaching the overall modality median by 2 years.

Introduction

The 2002 Renal Association 3rd Standards document (SDIII), European Best Practice Guidelines (EBPG) and Dialysis Outcomes Quality Initiatives (DOQI) guidelines all advocate:

> ***a target serum ferritin of greater than 100*** *μmol in patients with CKD*

and advise that:

> ***levels consistently exceeding 800*** *μmol/L, which carry the risk of iron toxicity without conferring additional benefit and should be avoided.*

The three guidelines also agree target values for red cell hypochromicity of less than 10% and for transferrin saturation (TSATs) of greater than 20%. To achieve these minimum criteria across the CKD population, SDIII and EBPG advocate population target medians of 200–500 μmol/L for ferritin, <2.5% for red cell hypochromicity and 30–40% for transferrin saturation. As serum ferritin is the most accessible, widely used and comprehensively recorded parameter in UK renal units, it remains the chosen index of iron status for this report.

Data on haematinics other than iron are not currently collected by the Registry and do not therefore appear in this report. Serum B_{12} and folate levels are however routinely measured by renal units and since deficiencies of either are easily and cheaply corrected, it is unlikely that B_{12} or folate deficiency contribute significantly to renal anaemia or poor erythropoietin response in UK renal units.

Because of variations in the recording of erythropoietin data on renal computer systems and the provision of erythropoietin from primary care in some parts of the UK, comprehensive and accurate data on erythropoietin usage are difficult to gather, though where available these were included in the last three Registry reports. The increasing usage of darbepoietin/Aranesp, which was licensed for use in the UK in 2001, has complicated the electronic data collection, with dosage errors produced for patients on fortnightly and monthly doses. As a result it has not been possible to include information about erythropoietin in this report. These

problems will be addressed in preparation of the 2004 report, which will include all available data on the prescription of both erythropoietin and darbepoietin.

For renal units that are measuring red hypochromicity and have this data available via their laboratory link, the Registry will add this to its database as a new data item for 2004, along with B12 and red cell folate.

Serum ferritin

The distribution of ferritin concentration is presented in Table 8.1 for haemodialysis and Table 8.2 for peritoneal dialysis. The percentage of patients achieving a serum ferritin of over 100 mcg/L is presented graphically in Figures 8.1 and 8.2 and the median serum ferritin with interquartile range appears in Figures 8.3 and 8.4.

All centres achieved a median ferritin over 100 mcg/L for both HD and PD, though as in previous reports, median ferritin and the percentage of patients exceeding a ferritin of 100 mcg/L were consistently higher in HD than PD patients. Behind this general picture however, several units had fewer than 75% of PD patients with serum ferritin over 100mcg/L, though this applied to only one centre for patients on haemodialysis.

Centres with the highest median ferritin for HD (Reading, Cardiff, Liverpool and Preston) all had upper quartile values exceeding 800 mcg/L and in the case of the Reading unit, the median value was 796, with an upper quartile of over 1000mcg/L. However, PD patients from this unit, whilst also iron replete, had median values less than half those of their HD peers (328 vs 796), suggesting that even in units with an aggressive iron replacement policy, practical difficulties continue to constrain the administration of intravenous iron to home dialysis patients. Despite the generally higher ferritin in HD than PD patients, several units (e.g. Newcastle, Sunderland and Carlisle) achieved a median ferritin for PD which was very similar to (and in the case of the Carlisle unit higher than) that for HD. This demonstrates that consistent provision of iron across all modalities is possible, though at present is achieved in only a small number of units. It would be of interest to compare iron programmes in these centres with those in units reporting larger disparities in achieved ferritin between HD and PD.

As in last year's report, no relationship exists either for HD or PD patients between the percentage achieving a haemoglobin level of greater than 10 g/dl and the percentage with serum ferritin above the target level of 100 mcg/L. The apparent relationship identified in last year's report between the percentage of haemodialysis patients with a serum ferritin above 200 mcg/L and a haemoglobin level greater than 10 g/dl is less pronounced this year (Figure 8.5) and as before there is no clear relationship between the percentage of PD patients with ferritin greater than 200 mcg/L and the percentage achieving the haemoglobin standard (Figure 8.6).

Table 8.1. Serum ferritin concentrations in HD patients

Centre	% data return	Median ferritin	90% range	Quartile range	% ferritin > 100ug/L
Bangr	100.0	524	199–1126	199–660	100
Bradf	100.0	455	182–888	182–597	99
Bristl	99.4	329	39–835	39–502	87
Camb	72.6	166	11–639	11–300	63
Carls	92.0	314	140–692	140–464	100
Carsh	75.6	409	111–793	111–541	95
Clwyd	97.8	295	140–570	140–383	96
Covnt	98.0	306	74–923	74–441	92
Crdff	92.8	622	148–1264	148–836	96
Extr	97.9	325	117–902	117–411	97
Glouc	98.3	288	93–982	93–509	94
Guys	88.5	484	58–1395	58–690	92
H&C	99.6	563	234–1299	234–740	97
Heart	90.4	178	32–513	32–280	78
Hull	95.0	420	152–847	152–548	99
Ipswi	100.0	349	45–720	45–485	82
Kings	98.0	466	162–1083	162–667	97
Leic	97.2	352	84–968	84–524	93
LGI	97.3	488	167–1052	167–604	97
Livrpl	96.5	599	73–1293	73–846	94
Middlbr	92.9	392	53–1221	53–639	90
Newc	40.2	532	133–1322	133–902	96
Notts	92.9	516	225–1105	225–655	99
Oxfrd	98.2	315	71–944	71–460	90
Plym	84.5	437	159–1304	159–555	99
Ports	91.3	274	77–711	77–398	93
Prstn	97.7	572	138–1322	138–821	98
Redng	96.8	796	326–1496	326–1060	99
Sheff	99.8	480	100–801	100–611	95
Stevn	69.5	507	100–1086	100–738	95
Sthend	97.2	347	155–613	155–397	97
StJms	100.0	459	165–805	165–565	98
Sund	97.1	392	71–1356	71–628	93
Swnse	67.3	403	84–1385	84–614	95
Truro	96.6	545	212–989	212–666	98
Wirrl	37.9	475	71–1064	71–669	94
Wolve	98.9	428	203–829	203–562	98
Words	90.2	374	61–938	61–568	90
Wrex	83.0	469	269–1040	269–702	98
York	88.6	455	234–904	234–588	100
Eng	91.8	416	82–1062	82–605	94
Wls	86.0	498	138–1190	138–734	96
E&W	91.3	420	85–1074	85–617	94

Table 8.2. Serum ferritin concentrations in PD patients

Centre	% data return	Median ferritin	90% range	Quartile range	% ferritin > 100ug/L
Bangr	87	301	46–898	134–596	85
Bradf	100	351	46–1162	203–549	92
Bristl	100	231	46–892	115–402	82
Camb	97	138	19–536	64–216	65
Carls	96	373	73–1446	263–792	92
Carsh	88	246	96–823	183–399	94
Clwyd	100	299	103–601	109–448	100
Covnt	96	176	38–784	114–318	78
Crdff	95	204	30–884	128–386	81
Extr	100	205	70–665	137–327	90
Glouc	92	181	47–631	137–401	82
Guys	97	207	39–838	120–362	77
H&C	98	330	49–944	165–536	86
Heart	95	241	32–834	131–355	86
Hull	92	345	103–821	247–436	95
Ipswi	91	227	38–832	117–356	83
Kings	99	275	65–610	172–377	90
Leic	100	312	69–847	191–540	90
LGI	97	365	36–888	280–565	92
Livrpl	97	242	41–849	114–419	79
Middlbr	97	516	220–1520	356–957	97
Newc	55	494	259–940	414–701	100
Notts	97	193	66–798	122–368	84
Oxfrd	97	239	33–698	127–341	79
Plym	98	172	49–584	85–298	69
Ports	78	211	38–1026	135–348	83
Prstn	100	201	39–758	117–356	77
Redng	100	328	59–647	260–430	93
Sheff	100	256	60–772	157–403	87
Stevn	62	204	70–636	137–327	91
Sthend	54	188	32–822	87–404	73
StJms	100	268	118–708	200–485	95
Sund	100	414	105–1102	323–523	100
Swnse	93	256	87–836	193–450	94
Truro	96	172	24–552	114–297	75
Wolve	100	180	49–543	104–293	78
Words	94	205	26–946	108–496	78
Wrex	96	346	118–760	237–471	96
York	100	337	114–802	182–402	96
Eng	95	249	45–838	141–415	84
Wls	94	258	39–851	149–447	88
E&W	95	249	45–838	142–418	85

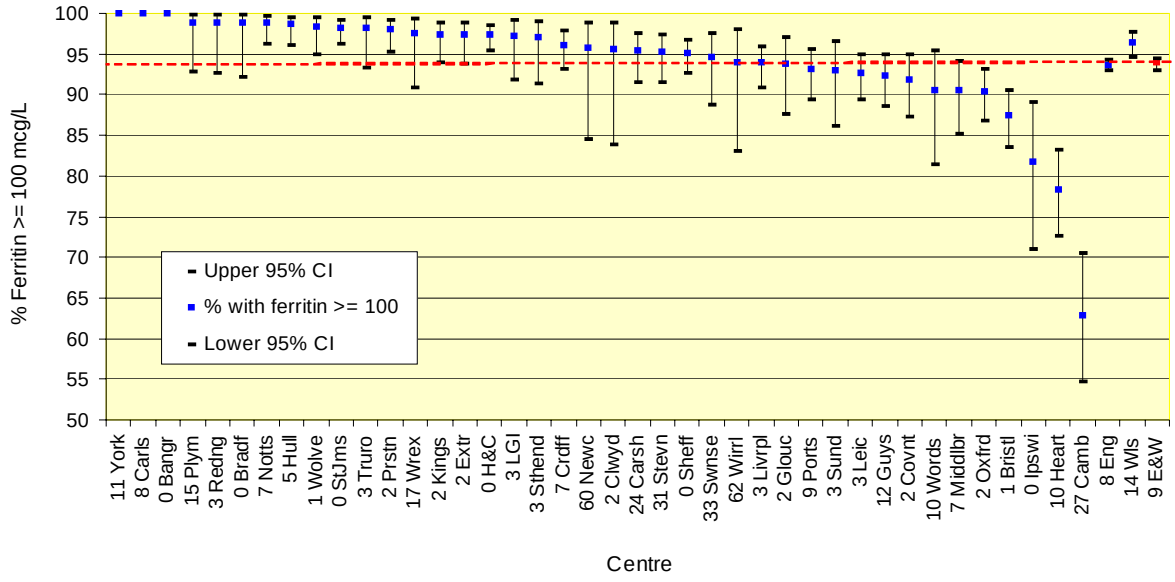


Figure 8.1. Percentage of HD patients with serum ferritin ≥ 100 mcg/L

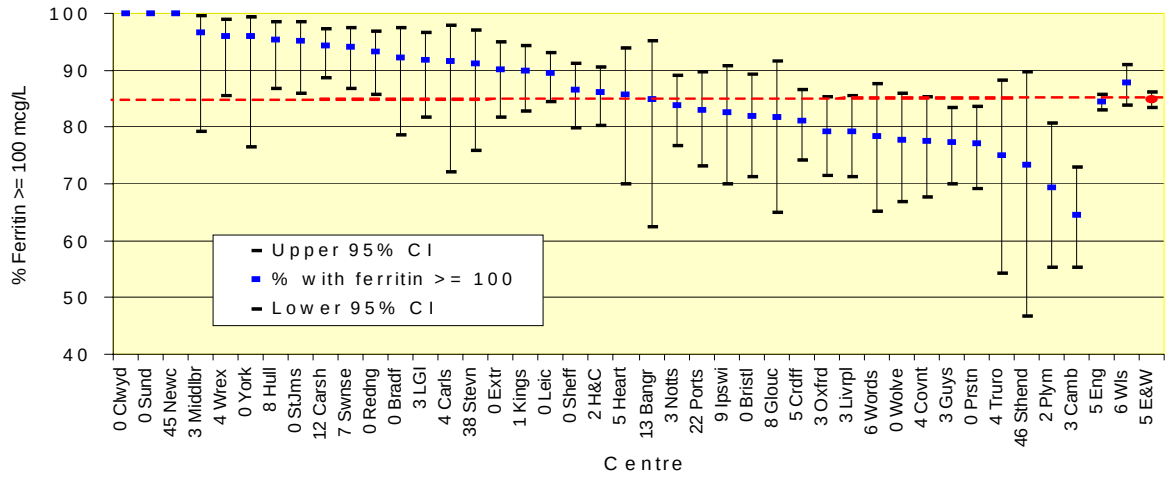


Figure 8.2. Percentage of PD patients with serum ferritin ≥ 100 mcg/L

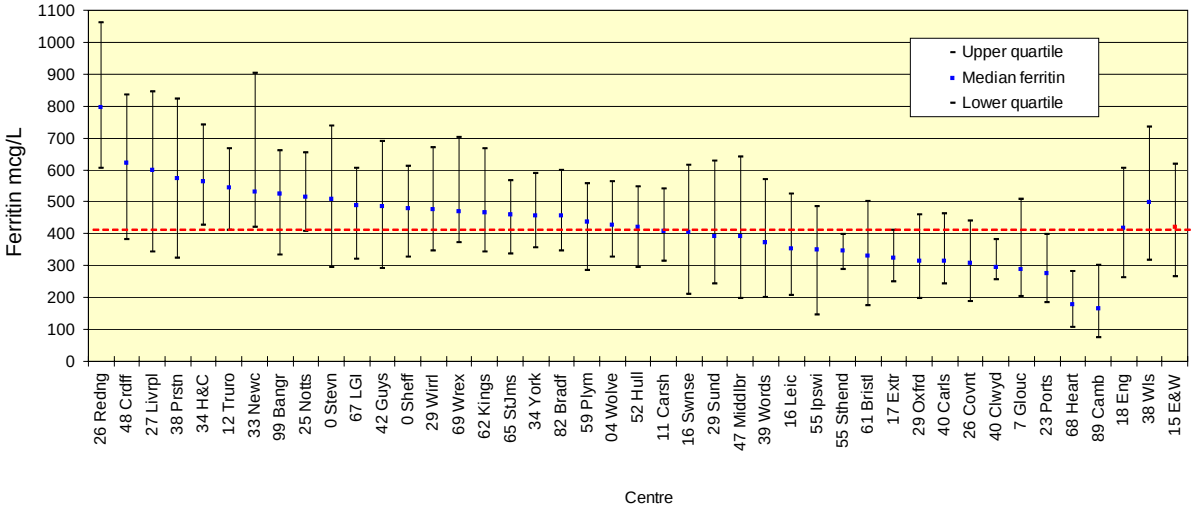


Figure 8.3. Median serum ferritin: haemodialysis

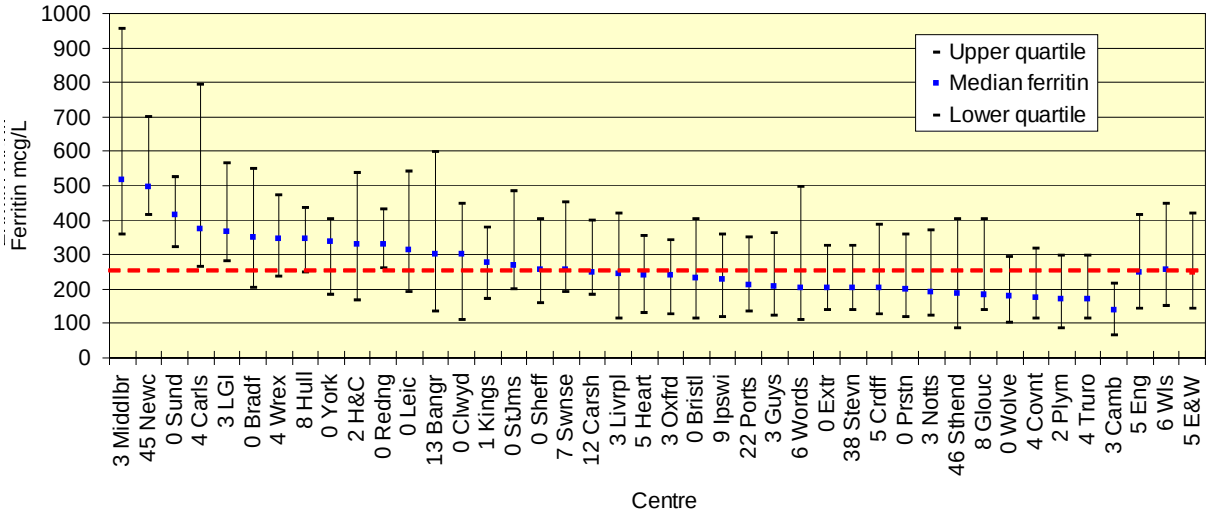


Figure 8.4. Median serum ferritin: peritoneal dialysis

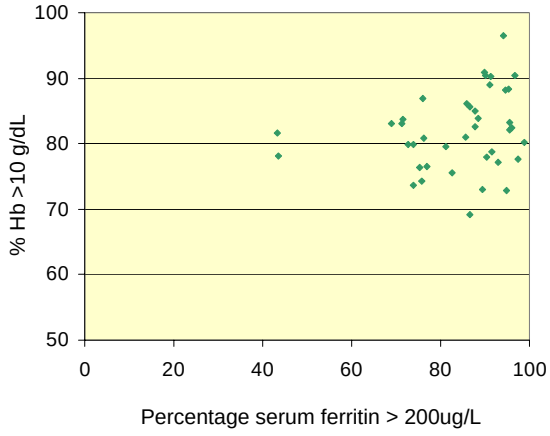


Figure 8.5. Percentage of patients with serum ferritin >200 mcg/L and Hb >10g/dl on HD

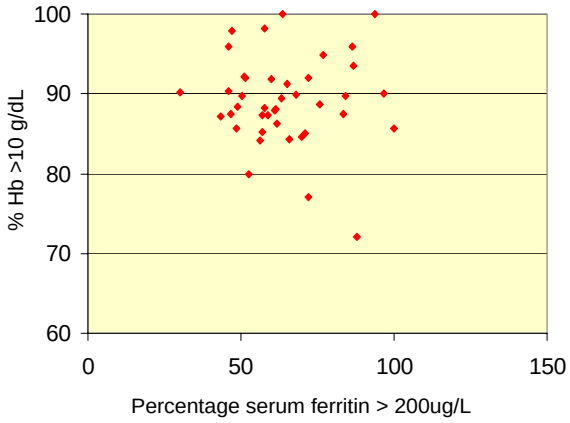


Figure 8.6. Percentage of patients with serum ferritin >200 mcg/L and Hb >10 g/dl on PD

Changes in serum ferritin 1999–2002 in England and Wales

Figures 8.7 and 8.8 show that the rise in serum ferritin values between 300 and 699 mcg/L and the corresponding fall in values below 300 mcg/L identified in last year's report continued for haemodialysis patients during 2002. However, for patients on peritoneal dialysis there was little change in ferritin distribution between 2001 and 2002. This again suggests that units were aspiring to target values for ferritin of greater than 100 mcg/L and that whilst this was achievable for unit-based HD patients who receive intravenous iron on dialysis, it remained difficult to attain in home dialysis patients, who need separate arrangements for the provision of intravenous iron. Whilst data relating to home haemodialysis patients are not reported separately, it is likely that ferritin values in this group were similar to or lower than those in peritoneal dialysis patients, reflecting regulatory constraints on self-administration of parenteral iron and the consequent dependence of this patient group on hospital based provision.

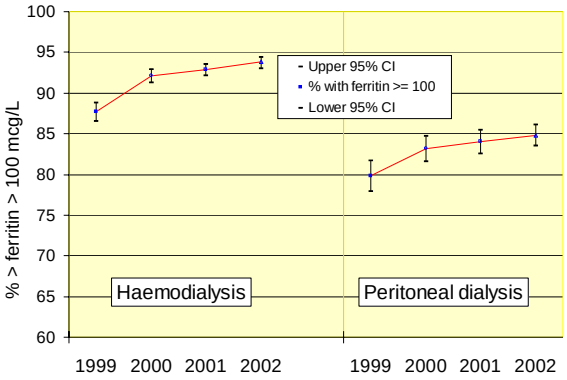
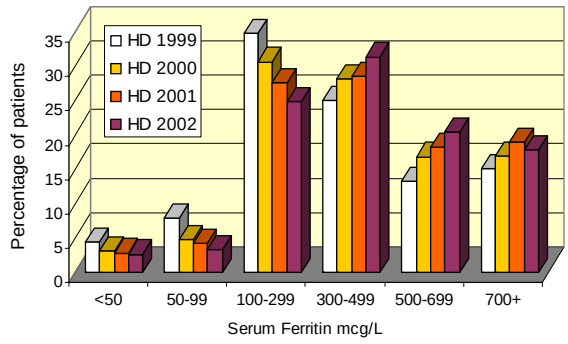
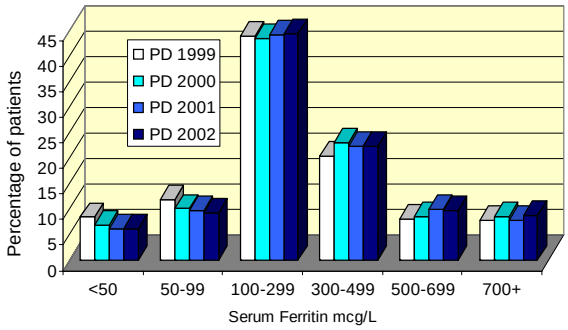


Figure 8.7. Change in achievement of serum ferritin > 100 mcg/L, 1999–2002



(a)



(b)

Figure 8.8. (a) Serum ferritin distribution 1999–2002 haemodialysis. (b) Serum ferritin distribution 1999–2002 peritoneal dialysis

Serum ferritin and length of time on renal replacement therapy

Median and lower quartile values for serum ferritin were above target for both HD (Figure 8.9) and PD (Figure 8.10) patients by the sixth month on dialysis and continued to increase throughout the first two years of renal replacement therapy, reaching the overall median for the modality only by the second year. For peritoneal dialysis patients,

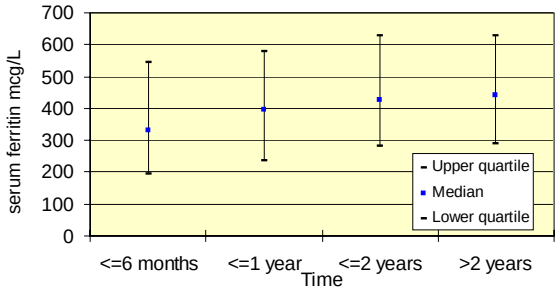


Figure 8.9. Median ferritin by length of time on renal replacement therapy: haemodialysis

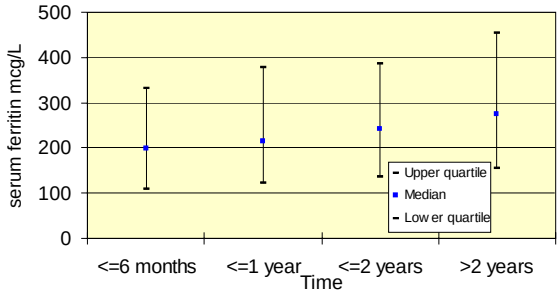


Figure 8.10. Median ferritin by length of time on renal replacement therapy: peritoneal dialysis

levels rose further (to exceed the overall median) after two years on dialysis. Despite achievement of the recommended target for ferritin soon after the commencement of dialysis, units continued to drive up ferritin levels, presumably in pursuit of a higher local target, for a further 18 months or more. It would be of interest to compare ferritin immediately before the commencement of dialysis with values at six months, to establish whether units achieving a higher ferritin in the dialysis population gained advantage by the commencement of intravenous iron in the pre-dialysis phase. Since pre-dialysis ferritin values are not submitted to the Registry at present, this cannot be tested using available data.

Changes in serum ferritin by centre 1999–2002

Figures 8.11 and 8.12 show the changes of median serum ferritin in each centre from 1999–2002 according to modalities.

The majority of centres are showing an increase of the median serum ferritin in their

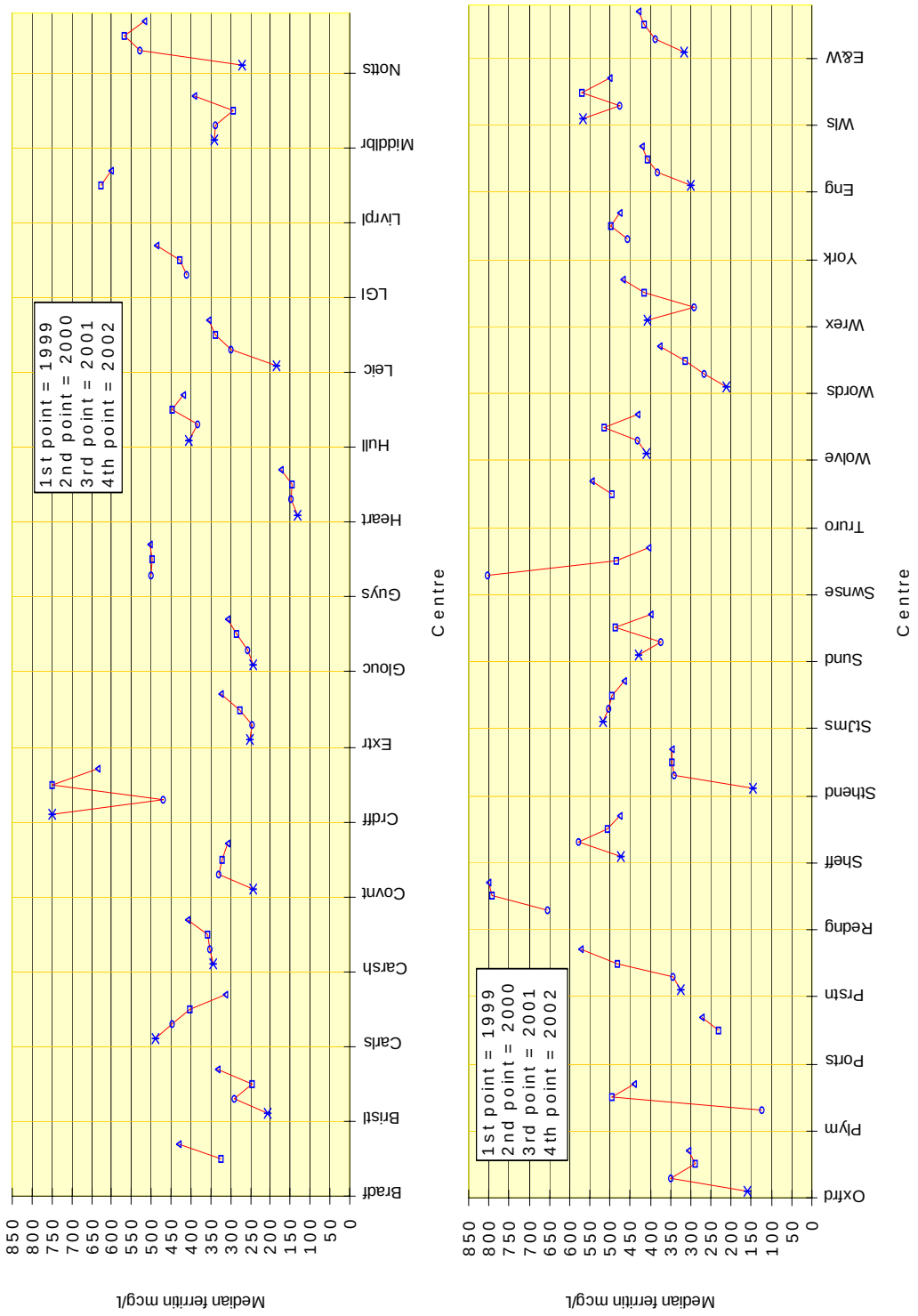


Figure 8.11. Serial ferritin concentration in haemodialysis patients

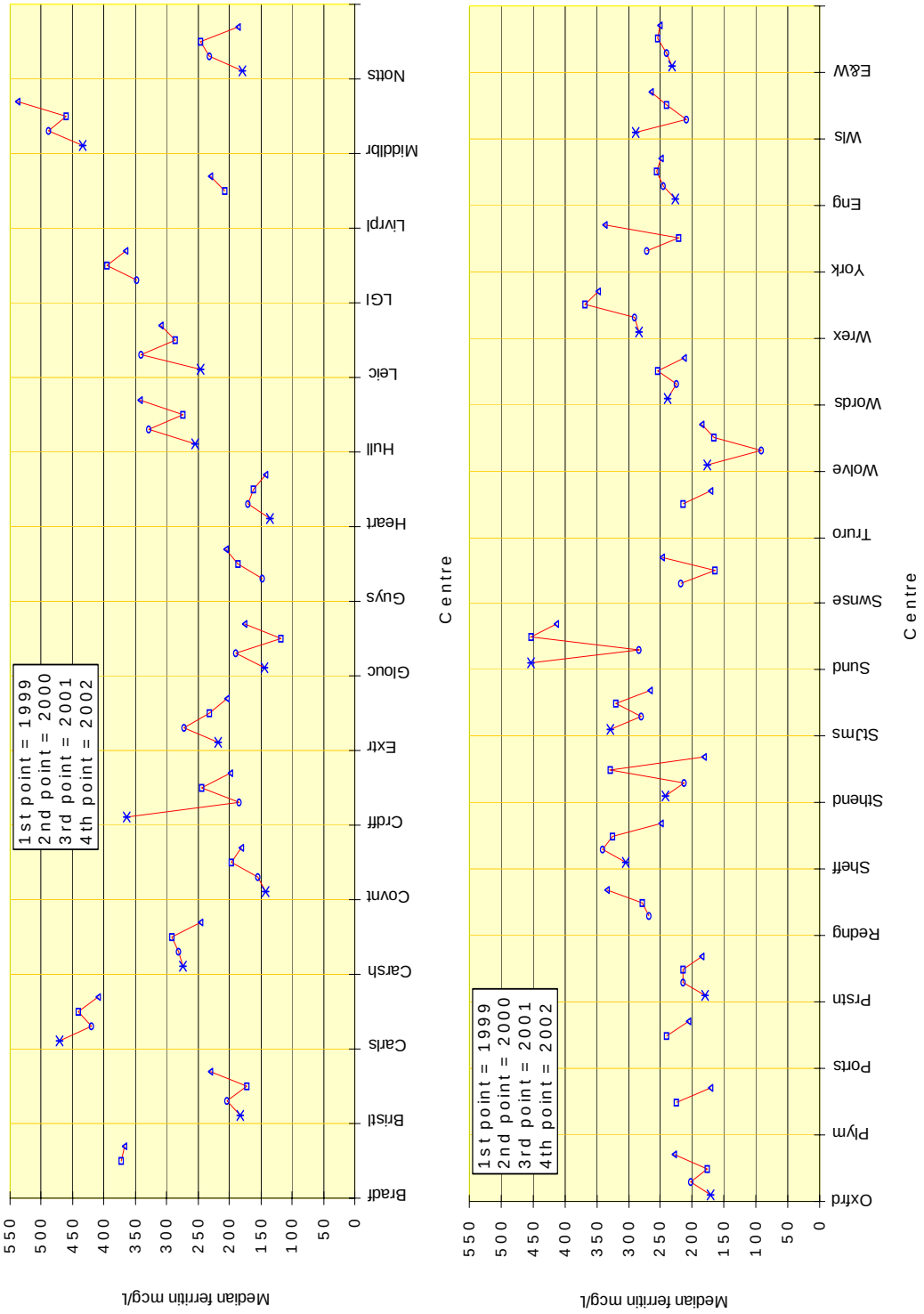


Figure 8.12. Serial ferritin concentration in peritoneal dialysis patients

haemodialysis patients from 1999 to 2002, whereas the patterns for peritoneal dialysis across the centres are more variable.

In 2002, apart from Carlisle, Middlesbrough and Sunderland, all the centres have a higher median serum ferritin for the haemodialysis patients in comparison to the peritoneal dialysis patients.

Conclusion

- Although the great majority of patients met ferritin targets, there remained large variations in achieved serum ferritin between different renal units.

- Achieved ferritin levels remained higher in haemodialysis patients than in the peritoneal dialysis population, though a small number of units achieved similar levels in both groups.

- Despite the attainment of target values by 6 months after commencement of dialysis, median ferritin continued to increase until the second year of dialysis, suggesting that local targets for serum ferritin exceed national recommendations.