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# UK Renal Registry 14th Annual Report: Chapter 9 Biochemical Variables amongst UK Adult Dialysis patients in 2010: national and centre-specific analyses

Rishi Pruthi<sup>a</sup>, David Pitcher<sup>a</sup>, Anne Dawnay<sup>b</sup>

<sup>a</sup>UK Renal Registry, Bristol, UK; <sup>b</sup>University College London Hospitals, London, UK

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## Key Words

Bicarbonate · Biochemical variables · Calcium · Cholesterol · Dialysis · Haemodialysis · Parathyroid hormone · Peritoneal dialysis · Phosphate · Quality improvement

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## Summary

- 56% of HD patients and 69% of PD patients achieved the audit measure for phosphate.

- 30% of HD and 22% of PD patients had a serum phosphate above the audit standard range for their respective RRT modality.
- 75% of HD and 76% of PD patients had adjusted calcium between 2.2–2.5 mmol/L.
- 28% of HD and 31% of PD patients had a serum PTH between 16–32pmol/L.
- 60% of HD and 80% of PD patients achieved the audit measure for bicarbonate.

## Introduction

The UK Renal Registry (UKRR) collects routine biochemical data from clinical information systems in renal centres in England, Wales and Northern Ireland and receives data from Scotland via the Scottish Renal Registry. Annual cross sectional analyses are undertaken on some of these variables to determine centre level performance against national (Renal Association) clinical performance measures [1]. This enables UK renal centres to compare their own performance against each other and to the UK average performance [2]. Currently the 5th edition of the UK Renal Association clinical practice guidelines is in practice. This edition commenced in a graded manner in 2009 and includes an expanded number of guideline modules compared to previous editions. For the purpose of this report only, guideline modules and their respective audit measures published prior to 2010, such as Haemodialysis [1] (published in December 2009) have been incorporated into this report to reflect performance targets available in 2010.

Audit measures for kidney disease increasingly include tighter specification limits in conjunction with a growing evidence base. Out of range observations (e.g. hyperphosphataemia and hypophosphataemia) need to be interpreted cautiously as they may relate to different clinical problems or population characteristics. These will therefore require different strategies to improve centre performance of clinical audit measures. To supplement these performance analyses, summary statistical data have been provided to enhance understanding of the population characteristics of each centre and longitudinal analyses demonstrate changes over time.

## Methods

These analyses relate to biochemical variables in the prevalent dialysis cohort in England, Wales and Northern Ireland in 2010.

Scotland is also only included in analyses pertaining to phosphate control. The cohort studied were patients prevalent on dialysis treatment on 31st December 2010, excluding patients receiving dialysis for less than 90 days and those who had changed modality or renal centre in the last 90 days. HD and PD cohorts were analysed separately. A full definition of this cohort including inclusion and exclusion criteria is included in appendix B [www.renalreg.com/report-area/report-2011/appendix-B.pdf](http://www.renalreg.com/report-area/report-2011/appendix-B.pdf).

The biochemical variables analysed were phosphate, calcium, parathyroid hormone, bicarbonate and cholesterol. The method of data collection and validation by the UKRR has been described elsewhere [3]. For each quarter of 2010 the UKRR extracted biochemical data electronically from clinical information systems in UK dialysis centres. The UKRR does not collect data regarding different assay methods mainly because a single dialysis centre may process samples in several different laboratories. Scottish centres have only been included in analyses relating to phosphate control, with data for their prevalent dialysis cohort being supplied directly by the Scottish Renal Registry. The audit measure used for serum phosphate in the HD cohort was 1.1–1.7 mmol/L [1] as per the updated haemodialysis guidelines and in the PD cohort was 1.1–1.8 mmol/L [7]. For centres providing adjusted calcium values, these data were analysed directly as it is these values on which clinical decisions within centres are based. For centres providing unadjusted calcium values, a formula in widespread use was used to calculate adjusted calcium [4]. The audit measure for adjusted calcium depends on a local reference range [1, 7]. The UKRR has used adjusted calcium between 2.2–2.5 mmol/L as an audit measure. There are also a variety of methods and reference ranges in use to measure parathyroid hormone. To enable some form of comparative audit the UKRR has chosen 2–4 times the median upper laboratory value as the audit measure in line with the 4th edition of the Renal Association clinical practice guidelines that were current during 2010 [7]. This equates to 16–32 pmol/L and is comparable to KDOQI (15–31 pmol/L) [5]. The audit measure used for serum bicarbonate in the HD cohort was 18–24 mmol/L as per the updated haemodialysis guidelines [1] and in the PD cohort was 22–30 mmol/L [7]. A summary of the current Renal Association audit measures and conversion factors to SI units are given in table 9.1.

Quarterly values were extracted from the database for the last two quarters for calcium, phosphate and bicarbonate; the last three quarters for PTH and the entire year for cholesterol. Patients who did not have these data were excluded from the analyses. The completeness of data were analysed at centre and country level. All patients were included in analyses but centres with less than 50%

**Table 9.1.** Summary of clinical audit measures and conversion factors from SI units

Biochemical variable	Clinical audit measure	Conversion factor from SI units
Phosphate	HD Patients: 1.1–1.7 mmol/L PD Patients: 1.1–1.8 mmol/L	mg/dl = mmol/L × 3.1
Calcium (adjusted)	Normal range (ideally <2.5 mmol/L)	mg/dl = mmol/L × 4
Parathyroid hormone	2–4 times upper limit of normal	ng/L = pmol × 9.5
Bicarbonate	HD Patients: 18–24 mmol/L PD Patients: 22–30 mmol/L	mg/dl = mmol/L × 6.1
Cholesterol	No audit measure	mg/dl = mmol/L × 38.6

completeness were excluded from plots showing centre performance. Data were also excluded from plots when there were less than 20 patients with data both at centre or country level. These data were analysed to calculate summary statistics (maximum, minimum, mean and median values in addition to standard deviation and quartile ranges). Where applicable, the percentage achieving the Renal Association or other surrogate clinical performance measure was also calculated.

Centres report several biochemical variables with different levels of accuracy, leading to problems in comparative evaluation. For example, in the case of serum bicarbonate, data can be submitted as integer values but some centres submit data to one decimal place. All data has been rounded up in an attempt to make all centres more comparable.

The number preceding the centre name in each figure indicates the percentage of missing data for that centre. Funnel plot analysis was used to identify 'outlying centres' [6]. The percentage achieving each standard was plotted against centre size along with the upper and lower 95% and 99.9% limits. Centres can be identified on these plots by looking up the number of patients treated in each centre provided in the relevant table and finding this value on the x-axis. Longitudinal analyses were performed for some data to calculate overall changes in achievement of a performance measure annually from 2000 to 2010 and were recalculated for each previous year using the rounding procedure. All data were unadjusted for case-mix.

## Results and discussions

### *Mineral and bone variables*

#### *Phosphate*

In 2010 the following Renal Association clinical practice guidelines regarding phosphate management was applicable:

***'We suggest that pre-dialysis (mid-week) serum phosphate, if elevated, should be lowered towards the normal range such as between 1.1 and 1.7 mmol/L (2C)' (Module: Haemodialysis) [1]***

***For PD patients, 'Serum phosphate in dialysis patients should be maintained between 1.1 and 1.8 mmol/L' (Module 2: Complications) [7]***

The data completeness for serum phosphate across the UK was 96% for both HD patients and PD patients although there was considerable variation between centres (tables 9.2 and 9.4). The individual centre means and standard deviations are shown in tables 9.2 and 9.4. Fifty-six percent (CI 55–57%) of HD patients

**Table 9.2.** Summary statistics for phosphate in haemodialysis patients in 2010

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
Abrdn	92.4	169	1.5	0.5	1.4	1.2	1.7
Airdrie	92.6	151	1.6	0.5	1.5	1.3	1.9
Antrim	100.0	123	1.2	0.4	1.1	1.0	1.4
B Heart	98.5	390	1.7	0.5	1.6	1.3	1.9
B QEH	84.9	697	1.6	0.5	1.5	1.2	1.8
Bangor	98.8	81	1.6	0.5	1.5	1.2	1.8
Basldn	97.7	129	1.4	0.5	1.4	1.1	1.7
Belfast	98.2	213	1.6	0.5	1.5	1.2	2.0
Bradfd	97.0	160	1.4	0.5	1.3	1.0	1.7
Brightn	98.1	317	1.6	0.5	1.6	1.2	1.9
Bristol	100.0	430	1.6	0.5	1.6	1.3	1.9
Camb	94.0	300	1.6	0.5	1.5	1.2	1.8
Cardff	98.7	447	1.6	0.5	1.5	1.2	1.9
Carlisle	98.1	51	1.5	0.5	1.6	1.1	1.8
Carsh	98.4	673	1.6	0.5	1.5	1.2	1.8
Chelms	100.0	112	1.6	0.4	1.5	1.3	1.8
Clwyd	96.7	59	1.5	0.5	1.5	1.1	1.9
Colchr	97.0	96	1.5	0.4	1.5	1.3	1.6
Covnt	99.1	329	1.5	0.5	1.4	1.2	1.8
D & Gall	95.9	47	1.6	0.4	1.5	1.2	1.9
Derby	99.5	201	1.6	0.5	1.5	1.3	1.9
Derry	100.0	53	1.5	0.5	1.4	1.1	1.6
Donc	100.0	130	1.6	0.5	1.5	1.3	1.9
Dorset	100.0	226	1.5	0.4	1.5	1.2	1.8
Dudley	99.3	143	1.7	0.5	1.6	1.3	2.0

**Table 9.2.** Continued

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
Dundee	90.5	142	1.6	0.5	1.5	1.2	1.8
Dunfn	95.7	110	1.6	0.5	1.5	1.2	1.9
Edinb	95.3	243	1.6	0.5	1.6	1.3	2.0
Exeter	100.0	322	1.6	0.5	1.5	1.2	1.8
Glasgw	91.7	522	1.7	0.6	1.6	1.3	2.0
Glouc	100.0	177	1.6	0.5	1.6	1.3	1.9
Hull	99.0	309	1.6	0.5	1.6	1.3	1.9
Inverns	90.6	77	1.7	0.5	1.6	1.4	1.9
Ipswi	99.1	105	1.5	0.5	1.5	1.1	1.8
Kent	98.5	327	1.6	0.5	1.6	1.3	1.9
Klmarnk	89.4	127	1.4	0.5	1.4	1.2	1.7
L Barts	99.1	743	1.6	0.5	1.5	1.2	1.9
L Guys	86.5	460	1.4	0.5	1.4	1.1	1.7
L Kings	100.0	390	1.6	0.5	1.5	1.2	1.9
L Rfree	88.7	571	1.5	0.5	1.5	1.2	1.8
L St.G	98.5	263	1.5	0.5	1.4	1.1	1.7
L West	99.4	1,234	1.4	0.5	1.3	1.1	1.7
Leeds	100.0	437	1.5	0.5	1.5	1.2	1.8
Leic	99.7	730	1.6	0.4	1.5	1.2	1.8
Liv Ain <sup>a</sup>	7.4	10					
Liv RI	98.4	361	1.5	0.5	1.5	1.1	1.8
M Hope	76.3	257	1.5	0.6	1.5	1.1	1.9
M RI	89.5	393	1.6	0.5	1.5	1.2	1.9
Middlbr	98.9	260	1.6	0.5	1.5	1.2	1.8
Newc	99.2	245	1.6	0.5	1.6	1.2	1.9
Newry	99.0	99	1.5	0.5	1.5	1.2	1.8
Norwch	99.3	297	1.6	0.4	1.5	1.3	1.8
Nottm	100.0	385	1.5	0.4	1.4	1.2	1.7
Oxford	100.0	352	1.6	0.5	1.6	1.3	2.0
Plymth	99.2	123	1.5	0.6	1.5	1.2	1.8
Ports	100.0	444	1.7	0.5	1.7	1.3	2.0
Prestn	99.6	465	1.7	0.5	1.6	1.3	1.9
Redng	100.0	243	1.4	0.4	1.3	1.2	1.6
Sheff	100.0	565	1.7	0.5	1.6	1.3	1.9
Shrew	97.3	181	1.5	0.4	1.5	1.2	1.8
Stevng	98.6	356	1.6	0.5	1.6	1.3	1.9
Sthend	100.0	119	1.6	0.4	1.6	1.3	1.9
Stoke	100.0	278	1.5	0.5	1.5	1.2	1.8
Sund	54.6	90	1.6	0.5	1.6	1.2	1.9
Swanse	100.0	323	1.5	0.4	1.5	1.2	1.7
Truro	100.0	140	1.7	0.5	1.6	1.3	2.0
Tyrone	97.8	88	1.6	0.4	1.6	1.3	1.9
Ulster	100.0	86	1.4	0.4	1.4	1.1	1.6
Wirral	94.2	163	1.5	0.5	1.4	1.1	1.8
Wolve	100.0	285	1.4	0.5	1.4	1.1	1.7
Wrexm	100.0	72	1.4	0.6	1.3	1.0	1.7
York	95.0	133	1.5	0.5	1.4	1.1	1.7
<b>England</b>	<b>95.8</b>	<b>16,597</b>	<b>1.6</b>	<b>0.5</b>	<b>1.5</b>	<b>1.2</b>	<b>1.8</b>
<b>N Ireland</b>	<b>99.0</b>	<b>662</b>	<b>1.5</b>	<b>0.5</b>	<b>1.4</b>	<b>1.1</b>	<b>1.8</b>
<b>Scotland</b>	<b>92.4</b>	<b>1,588</b>	<b>1.6</b>	<b>0.5</b>	<b>1.5</b>	<b>1.3</b>	<b>1.9</b>
<b>Wales</b>	<b>99.1</b>	<b>982</b>	<b>1.5</b>	<b>0.5</b>	<b>1.5</b>	<b>1.2</b>	<b>1.8</b>
<b>UK</b>	<b>95.8</b>	<b>19,829</b>	<b>1.6</b>	<b>0.5</b>	<b>1.5</b>	<b>1.2</b>	<b>1.8</b>

<sup>a</sup>Poor data completeness from L Ain in 2010 due to technical difficulties with data extraction

**Table 9.3.** Percentage of haemodialysis patients within, below and above the range specified in the RA audit measure for phosphate (1.1–1.7mmol/L) in 2010

Centre	N	% phos 1.1–1.7 mmol/L	Lower 95% CI	Upper 95% CI	% phos <1.1 mmol/L	% phos >1.7 mmol/L	Change from 2009		
							% within range	95% LCL	95% UCL
Abrdn	169	58.6	51.0	65.8	17.8	23.7			
Airdrie	151	55.0	47.0	62.7	11.9	33.1			
Antrim	123	56.9	48.0	65.4	31.7	11.4	3.6	-12.9	20.0
B Heart	390	54.6	49.6	59.5	7.4	38.0	-7.2	-16.3	1.9
B QEH	697	57.3	53.5	60.9	11.3	31.4	-9.1	-15.6	-2.6
Bangor	81	59.3	48.3	69.4	12.4	28.4	-13.7	-33.1	5.7
Basldn	129	55.0	46.4	63.4	20.9	24.0	-8.8	-24.5	6.9
Belfast	213	46.0	39.4	52.7	16.9	37.1	-14.7	-26.9	-2.5
Bradfd	160	51.3	43.5	58.9	27.5	21.3	-9.7	-24.0	4.7
Brightn	317	49.8	44.4	55.3	15.1	35.0	-9.2	-19.7	1.3
Bristol	430	55.6	50.9	60.2	7.9	36.5	-1.0	-9.9	7.9
Camb	300	61.3	55.7	66.7	9.7	29.0	-2.4	-13.4	8.7
Cardff	447	53.9	49.3	58.5	11.4	34.7	-6.1	-14.7	2.5
Carlisle	51	52.9	39.4	66.1	21.6	25.5	-15.5	-39.5	8.6
Carsh	673	58.5	54.8	62.2	11.3	30.2	-6.4	-13.4	0.6
Chelms	112	66.1	56.8	74.2	8.0	25.9	5.5	-11.2	22.2
Clwyd	59	49.2	36.7	61.7	20.3	30.5	-7.0	-29.5	15.5
Colchr	96	72.9	63.2	80.9	7.3	19.8	-1.2	-18.0	15.5
Covnt	329	57.5	52.0	62.7	15.8	26.8	0.6	-9.5	10.8
D & Gall	47	55.3	41.1	68.8	10.6	34.0			
Derby	201	61.2	54.3	67.7	9.0	29.9	-5.8	-17.6	6.1
Derry	53	66.0	52.4	77.4	13.2	20.8	-5.6	-28.1	16.9
Donc	130	59.2	50.6	67.3	10.8	30.0	-3.6	-20.1	12.9
Dorset	226	62.0	55.5	68.0	12.4	25.7	-9.3	-20.8	2.3
Dudley	143	50.4	42.2	58.5	10.5	39.2	-6.2	-22.0	9.6
Dundee	142	60.6	52.3	68.3	12.0	27.5			
Dunfn	110	54.6	45.2	63.6	14.6	30.9			
Edinb	243	49.4	43.1	55.7	13.2	37.5			
Exeter	322	59.0	53.6	64.3	10.9	30.1	-4.2	-14.3	5.9
Glasgw	522	49.6	45.3	53.9	8.8	41.6			
Glouc	177	57.1	49.7	64.2	7.9	35.0	-6.5	-20.0	6.9
Hull	309	51.8	46.2	57.3	12.0	36.3	-7.4	-17.8	3.0
Inverns	77	62.3	51.1	72.4	6.5	31.2			
Ipswi	105	57.1	47.5	66.2	15.2	27.6	-5.8	-23.5	12.0
Kent	327	59.0	53.6	64.2	11.0	30.0	-2.9	-12.9	7.1
Klmarnk	127	59.8	51.1	68.0	18.9	21.3			
L Barts	743	52.1	48.5	55.7	16.6	31.4	-5.4	-12.3	1.5
L Guys	460	55.4	50.9	59.9	23.0	21.5	-2.8	-11.0	5.3
L Kings	390	56.7	51.7	61.5	10.8	32.6	-8.1	-17.2	1.0
L Rfree	571	56.9	52.8	60.9	15.9	27.2	0.1	-7.7	7.9
L St.G	263	55.5	49.5	61.4	19.8	24.7	-5.1	-16.4	6.3
L West	1,234	55.6	52.8	58.3	24.6	19.9	-0.7	-6.0	4.5
Leeds	437	54.2	49.5	58.9	16.7	29.1	-6.9	-15.5	1.7
Leic	730	61.4	57.8	64.8	9.9	28.8	-5.2	-11.7	1.3
Liv RI	361	55.1	50.0	60.2	16.6	28.3	-9.1	-18.4	0.3
M Hope	257	47.1	41.1	53.2	21.8	31.1	-10.8	-21.8	0.2
M RI	393	52.2	47.2	57.1	14.8	33.1	-2.8	-13.2	7.7
Middlbr	260	58.9	52.8	64.7	11.2	30.0	-0.4	-11.5	10.7
Newc	245	54.7	48.4	60.8	13.1	32.2	-4.2	-15.5	7.2
Newry	99	60.6	50.7	69.7	12.1	27.3	11.7	-6.7	30.0
Norwch	297	63.3	57.7	68.6	6.4	30.3	-1.2	-11.4	9.1
Nottm	385	63.1	58.2	67.8	14.0	22.9	0.7	-8.3	9.7

**Table 9.3.** Continued

Centre	N	% phos 1.1–1.7 mmol/L	Lower 95% CI	Upper 95% CI	% phos <1.1 mmol/L	% phos >1.7 mmol/L	Change from 2009		
							% within range	95% LCL	95% UCL
Oxford	352	52.3	47.1	57.5	10.5	37.2	−6.8	−16.6	2.9
Plymth	123	57.7	48.8	66.1	14.6	27.6	0.2	−16.4	16.8
Ports	444	44.1	39.6	48.8	11.0	44.8	−14.7	−23.3	−6.1
Prestn	465	54.6	50.1	59.1	8.6	36.8	−5.8	−14.3	2.6
Redng	243	65.4	59.2	71.2	18.1	16.5	−1.6	−12.6	9.4
Sheff	565	56.1	52.0	60.2	7.1	36.8	−5.5	−13.0	2.1
Shrew	181	59.1	51.8	66.0	13.8	27.1	−5.0	−18.1	8.2
Stevng	356	52.8	47.6	58.0	9.0	38.2	−4.1	−13.8	5.6
Sthend	119	57.1	48.1	65.7	7.6	35.3	−7.6	−23.8	8.7
Stoke	278	60.8	54.9	66.4	13.3	25.9	−4.4	−15.0	6.1
Sund	90	52.2	42.0	62.3	11.1	36.7	−6.3	−23.2	10.6
Swanse	323	65.3	60.0	70.3	11.5	23.2	−4.2	−13.8	5.4
Truro	140	58.6	50.3	66.4	5.0	36.4	1.5	−13.8	16.9
Tyrone	88	61.4	50.8	70.9	6.8	31.8	−4.1	−23.1	14.8
Ulster	86	65.1	54.5	74.4	19.8	15.1	−1.6	−20.1	17.0
Wirral	163	55.8	48.1	63.3	17.8	26.4	−10.0	−23.9	3.8
Wolve	285	54.0	48.2	59.7	21.4	24.6	−8.7	−19.3	1.9
Wrexm	72	52.8	41.3	64.0	26.4	20.8	−8.7	−30.0	12.7
York	133	58.7	50.1	66.7	17.3	24.1	−13.6	−28.9	1.7
<b>England</b>	<b>16,597</b>	<b>56.2</b>	<b>55.5</b>	<b>57.0</b>	<b>13.8</b>	<b>30.0</b>	<b>−5.1</b>	<b>−6.5</b>	<b>−3.7</b>
<b>N Ireland</b>	<b>662</b>	<b>56.3</b>	<b>52.5</b>	<b>60.1</b>	<b>17.7</b>	<b>26.0</b>	<b>−3.8</b>	<b>−10.7</b>	<b>3.2</b>
<b>Scotland</b>	<b>1,588</b>	<b>54.0</b>	<b>51.5</b>	<b>56.4</b>	<b>12.2</b>	<b>33.9</b>			
<b>Wales</b>	<b>982</b>	<b>57.7</b>	<b>54.6</b>	<b>60.8</b>	<b>13.1</b>	<b>29.1</b>	<b>−6.2</b>	<b>−11.8</b>	<b>−0.5</b>
<b>UK</b>	<b>19,829</b>	<b>56.1</b>	<b>55.4</b>	<b>56.8</b>	<b>13.8</b>	<b>30.1</b>	<b>−5.3*</b>	<b>−6.6</b>	<b>−4.0</b>

Blank cells denote Scottish centres where calculation of change in target attainment was not feasible, as the UKRR did not have historical data for comparison

**Table 9.4.** Summary statistics for phosphate in peritoneal dialysis patients in 2010

Centre	% completeness	Patients with data			Median	Lower quartile	Upper quartile
		N	Mean	SD			
Abrdn	96.4	27	1.7	0.5	1.7	1.3	2.0
Airdrie	100.0	11					
Antrim	100.0	11					
B Heart	97.2	35	1.5	0.4	1.5	1.3	1.7
B QEH	89.3	125	1.5	0.4	1.4	1.2	1.8
Bangor	100.0	23	1.5	0.3	1.5	1.3	1.8
Basldn	100.0	24	1.5	0.3	1.4	1.3	1.7
Belfast	96.0	24	1.6	0.5	1.5	1.2	2.0
Bradfd	100.0	33	1.7	0.5	1.6	1.4	2.0
Brightn	98.7	74	1.4	0.4	1.3	1.1	1.6
Bristol	100.0	56	1.6	0.4	1.6	1.3	1.9
Camb	100.0	31	1.4	0.4	1.3	1.2	1.7
Cardff	100.0	87	1.6	0.4	1.5	1.2	1.9
Carlisle	100.0	12					
Carsh	97.9	91	1.6	0.4	1.6	1.3	1.9
Chelms	100.0	32	1.6	0.4	1.6	1.3	2.0
Clwyd	80.0	4					
Covnt	95.8	69	1.4	0.4	1.4	1.2	1.6
D & Gall	100.0	6					
Derby	98.9	88	1.5	0.4	1.4	1.2	1.7
Derry	100.0	2					

**Table 9.4.** Continued

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
Donc	100.0	23	1.6	0.5	1.6	1.3	1.7
Dorset	98.0	50	1.5	0.3	1.4	1.3	1.6
Dudley	98.3	57	1.7	0.6	1.6	1.3	1.8
Dundee	95.0	19					
Dunfn	100.0	26	1.7	0.5	1.7	1.3	2.0
Edinb	97.9	47	1.6	0.4	1.7	1.3	1.9
Exeter	100.0	69	1.5	0.4	1.4	1.2	1.7
Glasgw	93.6	44	1.6	0.3	1.6	1.5	1.8
Glouc	100.0	39	1.8	0.6	1.7	1.3	2.1
Hull	100.0	62	1.7	0.4	1.7	1.3	1.9
Inverns	0.0	0					
Ipswi	100.0	35	1.7	0.4	1.7	1.2	2.0
Kent	100.0	67	1.5	0.3	1.4	1.2	1.6
Klmarnk	75.0	30	1.6	0.5	1.6	1.2	1.9
L Barts	98.3	170	1.5	0.4	1.4	1.1	1.7
L Guys	97.7	42	1.6	0.5	1.5	1.3	1.8
L Kings	100.0	84	1.5	0.4	1.4	1.2	1.7
L Rfree	100.0	63	1.5	0.3	1.4	1.2	1.6
L St.G	98.2	53	1.5	0.5	1.4	1.3	1.6
L West	100.0	31	1.5	0.5	1.5	1.2	1.8
Leeds	98.8	83	1.5	0.4	1.5	1.2	1.7
Leic	99.3	140	1.5	0.4	1.5	1.2	1.7
Liv Ain	0.0	0					
Liv RI	98.7	77	1.5	0.4	1.5	1.2	1.8
M Hope	71.8	79	1.7	0.6	1.7	1.3	2.1
M RI	100.0	75	1.7	0.5	1.6	1.4	2.0
Middlbr	94.4	17					
Newc	100.0	45	1.6	0.5	1.6	1.3	1.9
Newry	100.0	8					
Norwch	95.7	44	1.5	0.4	1.5	1.2	1.7
Nottm	100.0	78	1.6	0.4	1.5	1.4	1.8
Oxford	100.0	101	1.7	0.4	1.7	1.5	2.0
Plymth	97.7	42	1.6	0.4	1.6	1.3	1.9
Ports	100.0	91	1.7	0.5	1.6	1.3	2.0
Prestn	100.0	60	1.7	0.4	1.7	1.4	2.0
Redng	98.7	77	1.5	0.3	1.4	1.3	1.6
Sheff	100.0	60	1.6	0.3	1.6	1.3	1.8
Shrew	94.4	17					
Stevng	96.4	27	1.5	0.4	1.4	1.2	1.6
Sthend	100.0	18					
Stoke	100.0	65	1.5	0.3	1.5	1.3	1.7
Sund	100.0	29	1.5	0.6	1.6	1.2	1.9
Swanse	100.0	45	1.5	0.4	1.6	1.2	1.7
Truro	100.0	26	1.5	0.6	1.4	1.2	1.8
Tyrone	85.7	6					
Ulster	100.0	2					
Wirral	48.6	17					
Wolve	100.0	62	1.5	0.4	1.4	1.2	1.7
Wrexm	95.0	19					
York	100.0	17					
<b>England</b>	<b>96.8</b>	<b>2,862</b>	<b>1.6</b>	<b>0.4</b>	<b>1.5</b>	<b>1.3</b>	<b>1.8</b>
<b>N Ireland</b>	<b>96.4</b>	<b>53</b>	<b>1.6</b>	<b>0.4</b>	<b>1.5</b>	<b>1.3</b>	<b>1.9</b>
<b>Scotland</b>	<b>85.0</b>	<b>210</b>	<b>1.6</b>	<b>0.4</b>	<b>1.6</b>	<b>1.4</b>	<b>1.9</b>
<b>Wales</b>	<b>98.9</b>	<b>178</b>	<b>1.6</b>	<b>0.4</b>	<b>1.5</b>	<b>1.3</b>	<b>1.8</b>
<b>UK</b>	<b>96.0</b>	<b>3,303</b>	<b>1.6</b>	<b>0.4</b>	<b>1.5</b>	<b>1.3</b>	<b>1.8</b>

Blank cells denote centres excluded from analyses due to low patient numbers or poor data completeness



(61% in 2009) and 69% (CI 67–71%) of PD patients (70% in 2009) achieved a phosphate level within the target range specified by the RA clinical audit measure (tables 9.3, 9.5). The proportion of HD patients with hyperphosphataemia was 30% compared to 24% in 2009 and the proportion with hypophosphataemia was 14% compared to 2009 when it was 15% (table 9.3, figures 9.1, 9.2). The proportion of PD patients with hyperphosphataemia was 22% compared to 23% in 2009 and the proportion with hypophosphataemia was 9% compared to 8% in 2009 (table 9.5, figures 9.3, 9.4). Compared with 2009, fewer haemodialysis patients achieved the target range due to an increase in the numbers above the upper limit that was lowered from 1.8 mmol/L to 1.7 mmol/L for 2010. Longitudinal analysis using the 2010 ranges showed no evidence of a deterioration in phosphate control

for England, Northern Ireland and Wales combined (figure 9.5).

There was significant between centre variation in the proportion of patients below, within and above the range specified by the clinical performance measure (figures 9.1–9.4). For haemodialysis patients, two centres (Colchester and Swansea) performed significantly better than the national average whereas one centre (Portsmouth) was significantly worse (figure 9.2, table 9.3) with a large proportion of patients with phosphate greater than 1.7 mmol/L.

The 5th Renal Association clinical practice guidelines on CKD–Mineral and Bone Disorders was finalised on 6th December 2010 and recommends that phosphate be maintained between 1.1 and 1.7 mmol/L for all dialysis patients and this audit standard will be used in next year's report [8].

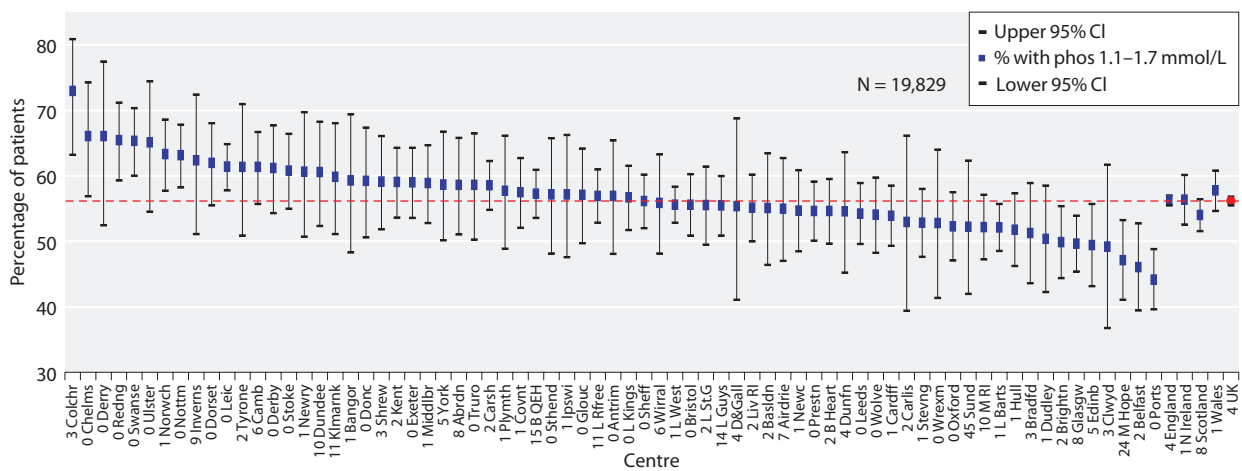
**Table 9.5.** Percentage of peritoneal dialysis patients within, below and above the range specified in the RA audit measure for phosphate (1.1–1.8 mmol/L) in 2010

Centre	N	% phos 1.1–1.8 mmol/L	Lower 95% CI	Upper 95% CI	% phos <1.1 mmol/L	% phos >1.8 mmol/L	Change from 2009		
							% within range	95% LCL	95% UCL
Abrdn	27	63.0	43.8	78.8	7.4	29.6	–13.0	–45.6	19.5
B Heart	35	68.6	51.7	81.7	14.3	17.1	3.2	–28.3	34.6
B QEH	125	73.6	65.2	80.6	6.4	20.0	2.8	–12.0	17.5
Bangor	23	91.3	71.1	97.8	4.4	4.4	–1.8	–21.2	17.6
Basldn	24	87.5	67.6	95.9	4.2	8.3	15.5	–13.5	44.5
Belfast	24	58.3	38.3	75.9	12.5	29.2	14.2	–19.8	48.2
Bradfd	33	51.5	34.9	67.8	9.1	39.4	–3.3	–35.5	28.9
Brightn	74	73.0	61.8	81.9	13.5	13.5	15.6	–4.8	36.0
Bristol	56	69.6	56.5	80.2	3.6	26.8	13.8	–8.4	36.0
Camb	31	74.2	56.3	86.5	12.9	12.9	–16.1	–40.6	8.3
Cardff	87	63.2	52.6	72.7	10.3	26.4	–13.1	–30.4	4.3
Carsh	91	63.7	53.4	72.9	8.8	27.5	–4.4	–21.8	12.9
Chelms	32	59.4	41.9	74.7	9.4	31.3	–27.3	–54.8	0.2
Covnt	69	75.4	63.9	84.1	13.0	11.6	–2.6	–21.2	16.1
Derby	88	72.7	62.5	81.0	13.6	13.6	–11.4	–27.5	4.7
Donc	23	73.9	52.8	87.8	4.4	21.7	–8.2	–38.3	21.9
Dorset	50	84.0	71.1	91.8	2.0	14.0	10.9	–9.8	31.7
Dudley	57	71.9	59.0	82.0	3.5	24.6	5.3	–18.1	28.6
Dunfn	26	61.5	42.1	77.9	0.0	38.5	–14.7	–49.0	19.7
Edinb	47	57.5	43.1	70.7	8.5	34.0	–2.2	–27.8	23.4
Exeter	69	78.3	67.0	86.5	5.8	15.9	–0.4	–19.1	18.2
Glasgw	44	79.6	65.2	89.0	4.6	15.9	9.7	–12.9	32.3
Glouc	39	53.9	38.3	68.7	5.1	41.0	–11.0	–39.9	17.9
Hull	62	62.9	50.3	74.0	4.8	32.3	–4.8	–26.9	17.2
Ipswi	35	54.3	37.9	69.8	5.7	40.0	9.1	–20.4	38.5
Kent	67	76.1	64.5	84.8	7.5	16.4	–11.4	–28.5	5.8
Klmarnk	30	56.7	38.8	72.9	6.7	36.7	8.3	–24.6	41.2
L Barts	170	63.5	56.0	70.4	18.8	17.7	0.1	–13.5	13.7
L Guys	42	73.8	58.6	84.9	9.5	16.7	5.6	–19.6	30.8
L Kings	84	69.1	58.4	78.0	14.3	16.7	4.3	–15.5	24.2

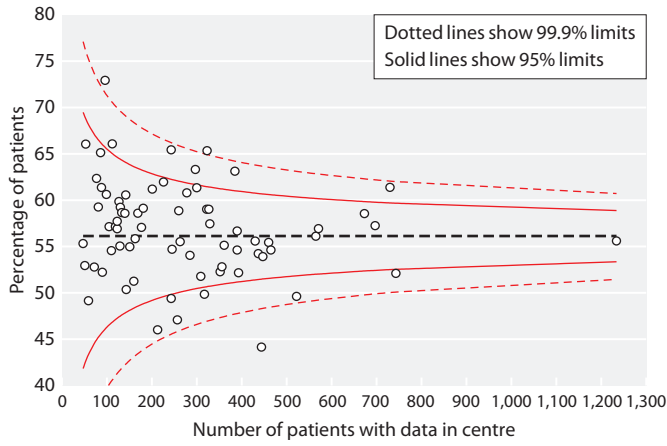


**Table 9.5.** Continued

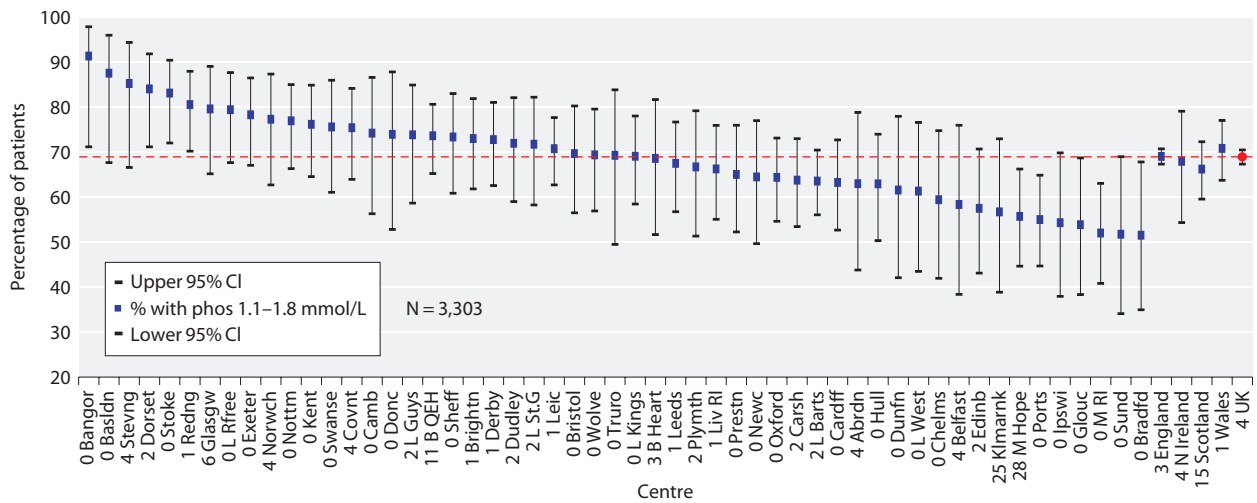
Centre	N	% phos 1.1–1.8 mmol/L	Lower 95% CI	Upper 95% CI	% phos <1.1 mmol/L	% phos >1.8 mmol/L	Change from 2009		
							% within range	95% LCL	95% UCL
L Rfree	63	79.4	67.6	87.6	11.1	9.5	2.0	-17.0	20.9
L St.G	53	71.7	58.2	82.2	13.2	15.1	-5.1	-26.7	16.5
L West	31	61.3	43.5	76.5	16.1	22.6	-9.7	-40.5	21.2
Leeds	83	67.5	56.7	76.7	14.5	18.1	0.4	-18.3	19.1
Leic	140	70.7	62.7	77.7	10.0	19.3	1.1	-12.9	15.0
Liv RI	77	66.2	55.0	75.9	10.4	23.4	-8.1	-27.0	10.7
M Hope	79	55.7	44.6	66.2	7.6	36.7	2.9	-16.1	21.9
M RI	75	52.0	40.8	63.0	8.0	40.0	-6.6	-26.8	13.6
Newc	45	64.4	49.6	76.9	8.9	26.7	2.4	-23.1	28.0
Norwch	44	77.3	62.7	87.3	9.1	13.6	6.8	-17.3	30.9
Nottm	78	76.9	66.3	85.0	7.7	15.4	12.6	-4.8	30.0
Oxford	101	64.4	54.6	73.1	3.0	32.7	0.9	-16.9	18.7
Plymth	42	66.7	51.3	79.2	4.8	28.6	-9.6	-35.5	16.2
Ports	91	55.0	44.7	64.8	12.1	33.0	-2.2	-22.0	17.6
Prestn	60	65.0	52.2	75.9	6.7	28.3	-2.7	-24.5	19.1
Redng	77	80.5	70.2	87.9	6.5	13.0	1.1	-15.8	17.9
Sheff	60	73.3	60.8	83.0	3.3	23.3	-4.6	-24.2	15.0
Stevng	27	85.2	66.5	94.3	7.4	7.4	25.9	-4.2	56.0
Stoke	65	83.1	72.0	90.4	6.2	10.8	11.0	-7.4	29.5
Sund	29	51.7	34.1	68.9	20.7	27.6	-15.0	-49.4	19.5
Swanse	45	75.6	61.0	85.9	8.9	15.6	1.7	-21.8	25.1
Truro	26	69.2	49.5	83.8	19.2	11.5	7.3	-28.6	43.3
Wolve	62	69.4	56.9	79.5	14.5	16.1	-3.8	-27.2	19.6
<b>England</b>	<b>2,862</b>	<b>69.0</b>	<b>67.3</b>	<b>70.7</b>	<b>9.4</b>	<b>21.6</b>	<b>0.3</b>	<b>-2.9</b>	<b>3.4</b>
<b>N Ireland</b>	<b>53</b>	<b>67.9</b>	<b>54.3</b>	<b>79.0</b>	<b>5.7</b>	<b>26.4</b>	<b>6.3</b>	<b>-15.8</b>	<b>28.4</b>
<b>Scotland</b>	<b>210</b>	<b>66.2</b>	<b>59.5</b>	<b>72.3</b>	<b>5.7</b>	<b>28.1</b>	<b>1.0</b>	<b>-10.8</b>	<b>12.8</b>
<b>Wales</b>	<b>178</b>	<b>70.8</b>	<b>63.7</b>	<b>77.0</b>	<b>8.4</b>	<b>20.8</b>	<b>-6.6</b>	<b>-18.3</b>	<b>5.1</b>
<b>UK</b>	<b>3,303</b>	<b>68.9</b>	<b>67.3</b>	<b>70.5</b>	<b>9.1</b>	<b>22.0</b>	<b>0.1</b>	<b>-2.9</b>	<b>3.0</b>



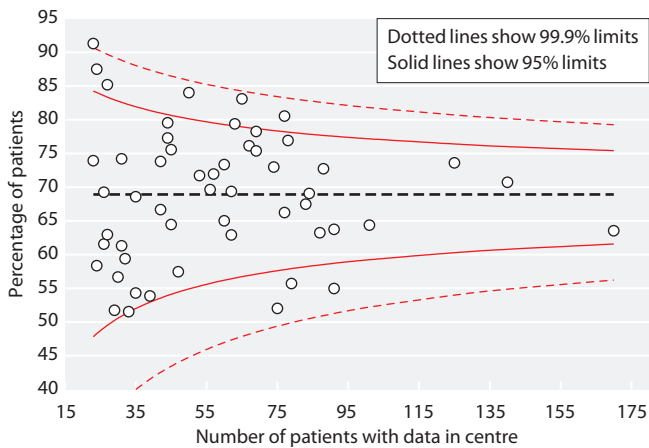
**Fig. 9.1.** Percentage of haemodialysis patients with phosphate within the range specified by the RA clinical audit measure (1.1–1.7 mmol/L) by centre in 2010



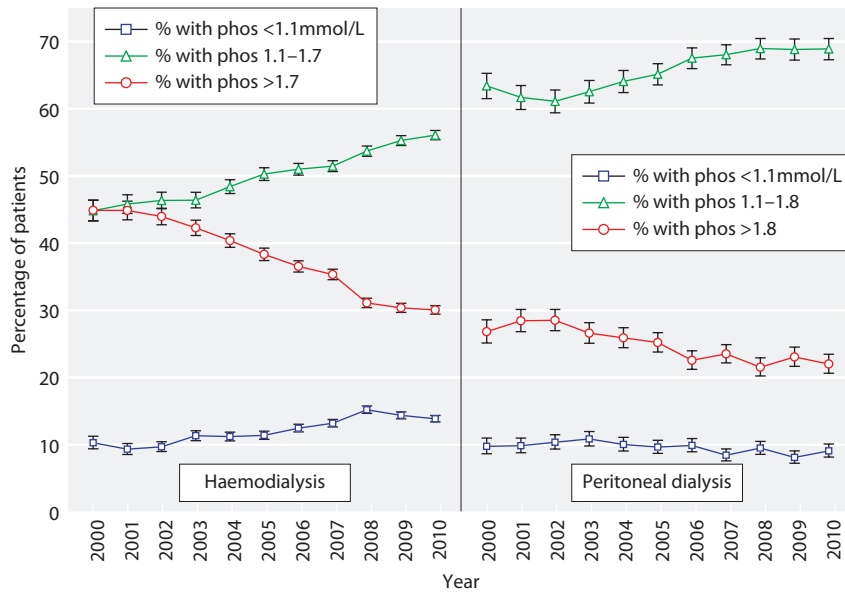
**Fig. 9.2.** Funnel plot of percentage of haemodialysis patients with phosphate within the range specified by the RA clinical audit measure (1.1–1.7mmol/L) by centre in 2010



**Fig. 9.3.** Percentage of peritoneal dialysis patients with phosphate within the range specified by the RA clinical audit measure (1.1–1.8 mmol/L) by centre in 2010



**Fig. 9.4.** Funnel plot of percentage of peritoneal dialysis patients with phosphate within the range specified by the RA clinical audit measure (1.1–1.8 mmol/L) by centre in 2010



**Fig. 9.5.** Longitudinal change in percentage of patients with phosphate below, within and above the 2010 RA standards by dialysis modality 2000–2010

#### Adjusted calcium

In 2010 the following Renal Association clinical practice guideline regarding calcium management was applicable:

***‘We suggest that pre-dialysis (mid-week) serum calcium, adjusted for serum albumin should be within the normal range (2C)’ (Module: Haemodialysis) [1]***

***For PD patients, ‘Serum calcium, adjusted for albumin concentration, should be maintained within the normal reference range for the laboratory used and ideally kept below 2.5 mmol/L. (Module 2: Complications) [7]***

The current guidelines are based upon adjusted serum calcium. A variety of formulae have been proposed to permit calculation of the ‘adjusted’ total calcium (i.e. an estimation of the expected total calcium were the serum albumin normal) from the total calcium and albumin concentration, but there are no data to support the use of mathematical corrections of serum calcium amongst patients with ERF. This topic was discussed in considerable detail last year and most of the shortcomings remain. However the ongoing restructuring of pathology into a smaller number of services together with harmonisation should increase measurement uniformity across laboratories and hence renal units.

Meanwhile, centres must work with their laboratories to ensure that the calcium results are adjusted correctly for the methods in use. These problems must be borne in mind when trying to interpret the following

figures that compare serum adjusted calcium achieved in different renal centres. These issues raise the question as to whether these comparisons between centres of achievement of the calcium guidelines are of value, and also raises questions about the guidelines themselves.

The audit measure for calcium in the current Renal Association clinical practice guidelines does not specify a lower limit for calcium and advises that adjusted calcium should ideally be within the normal range as per earlier guidance. Previously the UKRR used 2.2–2.5 mmol/L as the audit measure for adjusted calcium and in the absence of any change in guidance has maintained this range in this report to allow consistency. The data for adjusted calcium was 94% complete for HD patients and 96% complete for PD patients overall, although there was between centre variation (tables 9.6, 9.8). Seventy-five percent (CI 75–76%) of HD patients and 76% (CI 74–77%) of PD patients achieved adjusted calcium between 2.2–2.5 mmol/L (tables 9.7, 9.9), not significantly different from 2009. The proportion of HD patients with hypercalcaemia was 11% compared to 12% in 2009 and the proportion with hypocalcaemia was 14% compared to 13% in 2009. For peritoneal dialysis patients the proportion of patients with hypercalcaemia was 15% compared to 17% in 2009 and the proportion with hypocalcaemia was 9% compared to 8% in 2009 (tables 9.7, 9.9, figures 9.6 to 9.9). The changes in the percentages above, below and within range for the period 2000 to 2010 for England, Northern Ireland and Wales combined are shown in figure 9.10. The percentage of patients achieving the audit standard

**Table 9.6** Summary statistics for adjusted calcium in haemodialysis patients in 2010

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
Antrim	100	123	2.4	0.15	2.3	2.3	2.4
B Heart	98	390	2.3	0.20	2.3	2.2	2.4
B QEH	65	534	2.3	0.21	2.2	2.1	2.4
Bangor	99	81	2.3	0.16	2.3	2.2	2.4
Basldn	98	129	2.4	0.15	2.4	2.3	2.5
Belfast	98	213	2.3	0.16	2.3	2.2	2.4
Bradfd	97	160	2.4	0.17	2.4	2.3	2.4
Brightn	72	232	2.3	0.19	2.3	2.2	2.4
Bristol	100	430	2.5	0.19	2.5	2.4	2.6
Camb	94	300	2.3	0.18	2.3	2.2	2.4
Cardff*	95	431	2.4	0.18	2.4	2.3	2.5
Carlisle	98	51	2.3	0.17	2.3	2.2	2.5
Carsh	98	673	2.3	0.19	2.3	2.2	2.4
Chelms	100	112	2.4	0.14	2.4	2.3	2.5
Clwyd	97	59	2.3	0.23	2.3	2.2	2.4
Colchr	97	96	2.4	0.17	2.4	2.3	2.5
Covnt	100	331	2.3	0.18	2.2	2.1	2.4
Derby	100	202	2.4	0.14	2.4	2.3	2.5
Derry	100	53	2.4	0.17	2.4	2.3	2.5
Donc	100	130	2.4	0.13	2.4	2.3	2.5
Dorset	88	198	2.3	0.16	2.3	2.2	2.4
Dudley	90	129	2.4	0.22	2.4	2.3	2.6
Exeter	100	322	2.3	0.18	2.3	2.2	2.4
Glouc	100	177	2.4	0.13	2.3	2.3	2.4
Hull	99	309	2.4	0.18	2.4	2.3	2.5
Ipswi	100	106	2.3	0.16	2.3	2.2	2.4
Kent	97	323	2.4	0.17	2.4	2.3	2.5
L Barts	99	743	2.3	0.19	2.3	2.2	2.4
L Guys	86	460	2.3	0.19	2.3	2.2	2.4
L Kings	100	390	2.3	0.15	2.3	2.2	2.4
L Rfree	89	573	2.3	0.19	2.3	2.1	2.4
L St.G	99	263	2.3	0.17	2.3	2.2	2.4
L West*	94	1,172	2.4	0.17	2.4	2.3	2.5
Leeds	100	437	2.4	0.16	2.3	2.3	2.5
Leic	100	730	2.4	0.17	2.3	2.2	2.4
Liv Ain	9	12					
Liv RI	93	343	2.4	0.17	2.3	2.2	2.5
M Hope	76	257	2.3	0.19	2.3	2.2	2.4
M RI	90	393	2.2	0.18	2.2	2.1	2.3
Middlbr	99	260	2.3	0.20	2.3	2.2	2.4
Newc	99	245	2.2	0.16	2.2	2.1	2.3
Newry	99	99	2.3	0.19	2.3	2.2	2.4
Norwch	98	294	2.4	0.15	2.4	2.3	2.5
Nottm	100	384	2.4	0.17	2.4	2.3	2.5
Oxford	100	352	2.4	0.15	2.4	2.3	2.5
Plymth	99	123	2.3	0.20	2.3	2.2	2.4
Ports	100	442	2.4	0.18	2.3	2.2	2.5
Prestn	92	428	2.3	0.17	2.3	2.2	2.4
Redng	100	243	2.4	0.15	2.4	2.3	2.5
Sheff	100	565	2.3	0.16	2.3	2.2	2.4
Shrew	97	181	2.4	0.17	2.4	2.3	2.5
Stevng	99	357	2.4	0.15	2.4	2.3	2.5
Sthend	100	119	2.4	0.17	2.4	2.4	2.6
Stoke	96	267	2.4	0.17	2.4	2.3	2.5
Sund	55	90	2.4	0.20	2.4	2.3	2.5
Swanse	100	323	2.3	0.17	2.2	2.1	2.4

**Table 9.6** Continued

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
Truro	100	140	2.3	0.16	2.3	2.2	2.4
Tyrone	98	88	2.5	0.14	2.5	2.4	2.5
Ulster	100	86	2.5	0.14	2.5	2.4	2.5
Wirral	92	160	2.4	0.17	2.4	2.3	2.5
Wolve	100	285	2.3	0.20	2.3	2.2	2.4
Wrexm	100	72	2.4	0.18	2.4	2.2	2.5
York	85	119	2.4	0.18	2.4	2.3	2.5
<b>England</b>	<b>93</b>	<b>16,161</b>	<b>2.3</b>	<b>0.19</b>	<b>2.3</b>	<b>2.2</b>	<b>2.4</b>
<b>N Ireland</b>	<b>99</b>	<b>662</b>	<b>2.4</b>	<b>0.17</b>	<b>2.4</b>	<b>2.2</b>	<b>2.5</b>
<b>Wales</b>	<b>97</b>	<b>966</b>	<b>2.3</b>	<b>0.19</b>	<b>2.3</b>	<b>2.2</b>	<b>2.5</b>
<b>E, W &amp; NI</b>	<b>94</b>	<b>17,789</b>	<b>2.3</b>	<b>0.19</b>	<b>2.3</b>	<b>2.2</b>	<b>2.4</b>

Blank cells denote centres excluded from analyses due to low patient numbers or poor data completeness

\*These centres supplied uncorrected calcium and were corrected using the formula:

adjusted calcium = unadjusted calcium + [(40 – albumin) × 0.02]

**Table 9.7.** Percentage of haemodialysis patients within, below and above the range for adjusted calcium (2.2–2.5 mmol/L) in 2010

Centre	N	% adjusted Ca 2.2–2.5 mmol/L	Lower 95% CI	Upper 95% CI	% adjusted Ca <2.2 mmol/L	adjusted Ca >2.5 mmol/L	Change from 2009		
							% within range	95% LCL	95% UCL
Antrim	123	82.9	75.2	88.6	8.1	8.9	5.4	–7.7	18.6
B Heart	390	66.7	61.8	71.2	24.6	8.7	–5.0	–13.5	3.6
B QEH	534	68.2	64.1	72.0	27.2	4.7	–0.9	–8.2	6.3
Bangor	81	81.5	71.5	88.5	14.8	3.7	–1.0	–16.9	15.0
Basldn	129	79.1	71.2	85.2	3.1	17.8	9.1	–4.8	23.0
Belfast	213	77.5	71.4	82.6	17.4	5.2	0.2	–10.1	10.6
Bradfd	160	82.5	75.8	87.6	6.3	11.3	–6.0	–16.1	4.2
Brightn	232	71.1	65.0	76.6	21.6	7.3	4.6	–7.0	16.3
Bristol	430	65.4	60.7	69.7	5.4	29.3	3.1	–5.5	11.7
Camb	300	73.0	67.7	77.7	17.3	9.7	0.8	–9.4	11.0
Cardff <sup>a</sup>	431	77.5	73.3	81.2	7.7	14.9	3.6	–3.9	11.1
Carlisle	51	78.4	65.1	87.6	9.8	11.8	10.0	–11.7	31.8
Carsh	673	67.8	64.1	71.2	23.2	9.1	–5.4	–12.0	1.2
Chelms	112	85.7	78.0	91.1	4.5	9.8	1.3	–11.1	13.7
Clwyd	59	66.1	53.2	77.0	18.6	15.3	–7.9	–28.6	12.8
Colchr	96	71.9	62.1	80.0	4.2	24.0	6.8	–11.0	24.5
Covnt	331	64.7	59.4	69.6	27.8	7.6	–0.1	–9.8	9.7
Derby	202	73.8	67.3	79.4	2.0	24.3	–7.2	–17.5	3.2
Derry	53	77.4	64.2	86.7	7.6	15.1	–6.0	–25.3	13.4
Donc	130	86.2	79.1	91.1	5.4	8.5	8.1	–5.0	21.1
Dorset	198	82.8	76.9	87.5	9.1	8.1	–0.8	–11.2	9.5
Dudley	129	62.0	53.4	70.0	7.8	30.2	0.3	–15.8	16.4
Exeter	322	79.5	74.7	83.6	13.0	7.5	7.3	–1.6	16.1
Glouc	177	88.7	83.1	92.6	6.2	5.1	6.6	–3.1	16.3
Hull	309	78.3	73.4	82.6	9.7	12.0	0.7	–7.9	9.4
Ipswi	106	79.3	70.5	85.9	14.2	6.6	1.7	–13.2	16.6
Kent	323	78.3	73.5	82.5	5.9	15.8	7.8	–1.1	16.8
L Barts	743	69.3	65.9	72.5	23.4	7.3	4.6	–2.0	11.1
L Guys	460	71.7	67.5	75.7	20.9	7.4	3.3	–4.3	10.8
L Kings	390	81.3	77.1	84.9	14.6	4.1	–0.3	–7.6	7.0
L Rfree	573	66.8	62.9	70.6	27.4	5.8	–0.1	–7.5	7.2
L St.G	263	82.5	77.4	86.6	10.3	7.2	4.6	–4.6	13.7
L West <sup>a</sup>	1,172	77.8	75.4	80.1	5.6	16.6	–1.8	–6.2	2.6

**Table 9.7.** Continued

Centre	N	% adjusted Ca 2.2–2.5 mmol/L	Lower 95% CI	Upper 95% CI	% adjusted Ca <2.2 mmol/L	adjusted Ca >2.5 mmol/L	Change from 2009		
							% within range	95% LCL	95% UCL
Leeds	437	81.7	77.8	85.1	7.8	10.5	8.0	0.8	15.2
Leic	730	81.9	79.0	84.5	9.5	8.6	2.7	-2.6	8.1
Liv RI	343	80.5	75.9	84.3	8.8	10.8	4.6	-3.5	12.7
M Hope	257	71.2	65.4	76.4	19.1	9.7	3.3	-6.9	13.4
M RI	393	59.5	54.6	64.3	36.9	3.6	-0.7	-11.0	9.6
Middlbr	260	71.9	66.2	77.1	17.3	10.8	0.6	-9.6	10.8
Newc	245	57.1	50.9	63.2	40.8	2.0	-23.6	-33.9	-13.3
Newry	99	78.8	69.6	85.7	16.2	5.1	17.1	0.4	33.8
Norwch	294	82.0	77.2	86.0	7.1	10.9	8.3	-0.6	17.2
Nottm	384	78.9	74.5	82.7	2.9	18.2	4.0	-3.8	11.9
Oxford	352	84.1	79.9	87.6	5.1	10.8	5.0	-2.6	12.6
Plymth	123	75.6	67.3	82.4	12.2	12.2	-0.5	-14.9	13.9
Ports	442	75.8	71.6	79.6	12.0	12.2	-4.9	-12.1	2.3
Prestn	428	77.1	72.9	80.8	19.4	3.5	5.1	-2.7	12.8
Redng	243	84.4	79.2	88.4	7.0	8.6	1.6	-7.0	10.3
Sheff	565	80.5	77.1	83.6	12.4	7.1	0.7	-5.4	6.8
Shrew	181	78.5	71.9	83.8	6.1	15.5	-5.6	-16.2	4.9
Stevng	357	83.5	79.3	87.0	3.9	12.6	8.3	0.4	16.1
Sthend	119	69.8	60.9	77.3	4.2	26.1	-6.7	-21.5	8.1
Stoke	267	73.4	67.8	78.4	10.1	16.5	-4.7	-14.3	4.8
Sund	90	77.8	68.0	85.2	6.7	15.6	2.9	-11.4	17.3
Swanse	323	70.0	64.8	74.7	25.7	4.3	-0.8	-10.1	8.5
Truro	140	76.4	68.7	82.7	15.0	8.6	-8.0	-20.3	4.3
Tyrone	88	79.6	69.9	86.7	0.0	20.5	10.5	-6.6	27.6
Ulster	86	76.7	66.7	84.5	0.0	23.3	-0.3	-16.8	16.3
Wirral	160	83.1	76.5	88.2	8.1	8.8	2.8	-8.3	13.8
Wolve	285	74.4	69.0	79.1	14.0	11.6	4.0	-5.6	13.6
Wrexm	72	77.8	66.8	85.9	12.5	9.7	10.6	-8.6	29.9
York	119	83.2	75.4	88.9	5.9	10.9	-0.8	-13.5	12.0
<b>England</b>	<b>16,161</b>	<b>75.2</b>	<b>74.5</b>	<b>75.9</b>	<b>14.1</b>	<b>10.7</b>	<b>0.8</b>	<b>-0.4</b>	<b>2.1</b>
<b>N Ireland</b>	<b>662</b>	<b>78.9</b>	<b>75.6</b>	<b>81.8</b>	<b>10.1</b>	<b>11.0</b>	<b>4.3</b>	<b>-1.7</b>	<b>10.2</b>
<b>Wales</b>	<b>966</b>	<b>74.6</b>	<b>71.8</b>	<b>77.3</b>	<b>15.3</b>	<b>10.0</b>	<b>1.6</b>	<b>-3.6</b>	<b>6.7</b>
<b>E, W &amp; NI</b>	<b>17,789</b>	<b>75.3</b>	<b>74.7</b>	<b>75.9</b>	<b>14.0</b>	<b>10.7</b>	<b>1.0</b>	<b>-0.2</b>	<b>2.2</b>

<sup>a</sup>These centres supplied uncorrected calcium and were corrected using the formula:  
adjusted calcium = unadjusted calcium + [(40 - albumin) × 0.02]

**Table 9.8.** Summary statistics for adjusted calcium in peritoneal dialysis patients in 2010

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
Antrim	91	10					
B Heart	97	35	2.3	0.17	2.3	2.2	2.4
B QEH	90	126	2.3	0.19	2.3	2.2	2.4
Bangor	100	23	2.4	0.16	2.4	2.3	2.6
Basldn	100	24	2.4	0.16	2.5	2.4	2.5
Belfast	96	24	2.3	0.17	2.4	2.2	2.5
Bradfd	100	33	2.4	0.15	2.4	2.3	2.4
Brightn	99	74	2.4	0.16	2.4	2.3	2.4
Bristol	100	56	2.6	0.14	2.5	2.5	2.6
Camb	100	31	2.3	0.14	2.3	2.2	2.4
Cardff <sup>a</sup>	100	87	2.4	0.16	2.4	2.3	2.4
Carlis	100	12					

**Table 9.8.** Continued

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
Carsh	98	91	2.3	0.18	2.3	2.2	2.4
Chelms	100	32	2.4	0.14	2.4	2.3	2.5
Clwyd	80	4					
Covnt	97	70	2.3	0.16	2.3	2.2	2.4
Derby	99	88	2.5	0.16	2.5	2.4	2.6
Derry	100	2					
Donc	100	23	2.4	0.11	2.4	2.4	2.5
Dorset	82	42	2.4	0.14	2.4	2.3	2.5
Dudley	93	54	2.4	0.14	2.4	2.3	2.5
Exeter	100	69	2.3	0.19	2.3	2.2	2.4
Glouc	100	39	2.4	0.18	2.4	2.3	2.6
Hull	100	62	2.5	0.17	2.4	2.4	2.5
Ipswi	100	35	2.4	0.16	2.3	2.2	2.5
Kent	93	62	2.4	0.21	2.4	2.4	2.5
L Barts	98	170	2.4	0.19	2.3	2.2	2.5
L Guys	98	42	2.4	0.15	2.4	2.3	2.5
L Kings	100	84	2.3	0.15	2.3	2.2	2.4
L Rfree	100	63	2.3	0.16	2.2	2.2	2.4
L St.G	98	53	2.4	0.14	2.4	2.4	2.5
L West <sup>a</sup>	100	31	2.5	0.16	2.5	2.4	2.6
Leeds	99	83	2.3	0.16	2.3	2.2	2.4
Leic	99	140	2.4	0.16	2.4	2.3	2.5
Liv Ain	0	0					
Liv RI	94	73	2.3	0.18	2.4	2.2	2.5
M Hope	72	79	2.3	0.20	2.3	2.2	2.4
M RI	100	75	2.3	0.18	2.3	2.2	2.4
Middlbr	94	17					
Newc	100	45	2.3	0.19	2.3	2.2	2.4
Newry	100	8					
Norwch	98	45	2.5	0.12	2.5	2.4	2.5
Nottm	100	78	2.5	0.15	2.5	2.4	2.6
Oxford	100	101	2.4	0.19	2.5	2.3	2.5
Plymth	98	42	2.4	0.16	2.4	2.3	2.5
Ports	100	91	2.4	0.19	2.4	2.3	2.5
Prestn	85	51	2.4	0.19	2.4	2.3	2.5
Redng	99	77	2.4	0.16	2.4	2.4	2.5
Sheff	100	60	2.3	0.12	2.3	2.3	2.4
Shrew	94	17					
Stevng	100	28	2.4	0.13	2.4	2.3	2.5
Sthend	100	18					
Stoke	94	61	2.4	0.15	2.4	2.3	2.5
Sund	100	29	2.5	0.22	2.4	2.4	2.6
Swanse	100	45	2.3	0.13	2.3	2.2	2.4
Truro	100	26	2.4	0.18	2.4	2.3	2.5
Tyrone	86	6					
Ulster	100	2					
Wirral	49	17					
Wolve	100	62	2.4	0.18	2.3	2.2	2.5
Wrexm	95	19					
York	100	17					
<b>England</b>	<b>96</b>	<b>2,833</b>	<b>2.4</b>	<b>0.18</b>	<b>2.4</b>	<b>2.3</b>	<b>2.5</b>
<b>N Ireland</b>	<b>95</b>	<b>52</b>	<b>2.4</b>	<b>0.17</b>	<b>2.4</b>	<b>2.3</b>	<b>2.5</b>
<b>Wales</b>	<b>99</b>	<b>178</b>	<b>2.4</b>	<b>0.16</b>	<b>2.4</b>	<b>2.3</b>	<b>2.5</b>
<b>E, W &amp; NI</b>	<b>96</b>	<b>3,063</b>	<b>2.4</b>	<b>0.18</b>	<b>2.4</b>	<b>2.3</b>	<b>2.5</b>

Blank cells denote centres excluded from the analysis due to low patient numbers or poor data completeness

<sup>a</sup>These centres supplied uncorrected calcium and were corrected using the formula:  
adjusted calcium = unadjusted calcium + [(40 - albumin) × 0.02]



**Table 9.9.** Percentage of peritoneal dialysis patients within, below and above the range for adjusted calcium (2.2–2.5 mmol/L) in 2010

Centre	N	% adjusted Ca 2.2–2.5 mmol/L	Lower 95% CI	Upper 95% CI	% adjusted Ca <2.2 mmol/L	adjusted Ca >2.5 mmol/L	Change from 2009		
							% within range	95% LCL	95% UCL
B Heart	35	80.0	63.6	90.2	14.3	5.7	10.8	-18.4	39.9
B QEH	126	71.4	62.9	78.6	18.3	10.3	-6.9	-21.1	7.3
Bangor	23	69.6	48.5	84.8	4.4	26.1	4.1	-29.6	37.7
Basldn	24	70.8	50.2	85.4	8.3	20.8	2.8	-31.1	36.8
Belfast	24	83.3	63.1	93.6	16.7	0.0	-7.9	-31.1	15.4
Bradfd	33	81.8	65.0	91.6	9.1	9.1	-8.5	-30.6	13.6
Brightn	74	83.8	73.6	90.6	8.1	8.1	-4.5	-19.4	10.5
Bristol	56	51.8	38.9	64.5	1.8	46.4	-15.9	-38.5	6.7
Camb	31	87.1	70.3	95.1	9.7	3.2	12.9	-12.6	38.5
Cardff <sup>a</sup>	87	79.3	69.5	86.6	11.5	9.2	6.1	-10.0	22.2
Carsh	91	78.0	68.4	85.4	14.3	7.7	-3.8	-18.5	10.9
Chelms	32	84.4	67.5	93.3	3.1	12.5	17.7	-10.0	45.4
Covnt	70	74.3	62.8	83.2	15.7	10.0	-0.4	-19.3	18.6
Derby	88	67.1	56.6	76.0	2.3	30.7	-20.8	-36.7	-4.8
Donc	23	87.0	66.5	95.7	0.0	13.0	19.1	-10.0	48.2
Dorset	42	85.7	71.7	93.4	2.4	11.9	8.2	-12.6	28.9
Dudley	54	77.8	64.8	86.9	0.0	22.2	-4.0	-25.0	16.9
Exeter	69	73.9	62.3	82.9	14.5	11.6	-1.5	-21.2	18.2
Glouc	39	66.7	50.7	79.6	7.7	25.6	-11.7	-37.9	14.4
Hull	62	74.2	61.9	83.6	1.6	24.2	-3.2	-23.1	16.6
Ipswi	35	82.9	66.7	92.1	5.7	11.4	1.9	-20.8	24.6
Kent	62	67.7	55.2	78.2	8.1	24.2	7.4	-14.7	29.5
L Barts	170	77.1	70.1	82.8	9.4	13.5	1.5	-10.6	13.5
L Guys	42	81.0	66.3	90.2	7.1	11.9	-7.7	-27.6	12.2
L Kings	84	81.0	71.1	88.0	13.1	6.0	3.0	-14.0	20.1
L Rfree	63	69.8	57.5	79.9	23.8	6.4	5.3	-16.3	27.0
L St.G	53	81.1	68.4	89.5	0.0	18.9	7.9	-12.7	28.5
L West <sup>a</sup>	31	64.5	46.6	79.1	0.0	35.5	-16.1	-44.9	12.6
Leeds	83	78.3	68.2	85.9	10.8	10.8	0.7	-15.8	17.2
Leic	140	75.0	67.2	81.5	5.7	19.3	-2.1	-15.1	11.0
Liv RI	73	72.6	61.3	81.6	16.4	11.0	-6.1	-24.2	12.1
M Hope	79	70.9	60.0	79.8	19.0	10.1	-2.3	-19.4	14.9
M RI	75	76.0	65.1	84.3	18.7	5.3	-3.3	-20.3	13.6
Newc	45	71.1	56.4	82.4	22.2	6.7	7.1	-17.6	31.8
Norwch	45	82.2	68.3	90.9	0.0	17.8	0.8	-20.4	22.0
Nottm	78	61.5	50.4	71.6	2.6	35.9	5.1	-14.0	24.2
Oxford	101	71.3	61.7	79.3	4.0	24.8	7.9	-9.5	25.2
Plymth	42	81.0	66.3	90.2	0.0	19.1	12.5	-12.4	37.5
Ports	91	81.3	72.0	88.1	5.5	13.2	10.7	-6.5	27.8
Prestn	51	78.4	65.1	87.6	7.8	13.7	-9.5	-28.0	9.0
Redng	77	81.8	71.6	88.9	5.2	13.0	-7.2	-22.0	7.5
Sheff	60	83.3	71.7	90.8	13.3	3.3	3.9	-13.8	21.6
Stevng	28	82.1	63.6	92.4	0.0	17.9	11.8	-17.6	41.1
Stoke	61	82.0	70.3	89.7	3.3	14.8	10.3	-8.7	29.4
Sund	29	62.1	43.6	77.6	0.0	37.9	3.7	-31.1	38.6
Swanse	45	84.4	70.8	92.4	11.1	4.4	14.9	-7.5	37.2
Truro	26	73.1	53.3	86.6	11.5	15.4	25.5	-10.5	61.4
Wolve	62	75.8	63.7	84.9	8.1	16.1	0.2	-22.1	22.5
<b>England</b>	<b>2,833</b>	<b>75.6</b>	<b>74.0</b>	<b>77.2</b>	<b>8.8</b>	<b>15.6</b>	<b>0.2</b>	<b>-2.7</b>	<b>3.2</b>
<b>N Ireland</b>	<b>52</b>	<b>78.9</b>	<b>65.7</b>	<b>87.9</b>	<b>11.5</b>	<b>9.6</b>	<b>-7.5</b>	<b>-25.4</b>	<b>10.5</b>
<b>Wales</b>	<b>178</b>	<b>79.2</b>	<b>72.6</b>	<b>84.6</b>	<b>9.6</b>	<b>11.2</b>	<b>7.8</b>	<b>-3.5</b>	<b>19.2</b>
<b>E, W &amp; NI</b>	<b>3,063</b>	<b>75.9</b>	<b>74.3</b>	<b>77.4</b>	<b>8.9</b>	<b>15.3</b>	<b>0.5</b>	<b>-2.3</b>	<b>3.3</b>

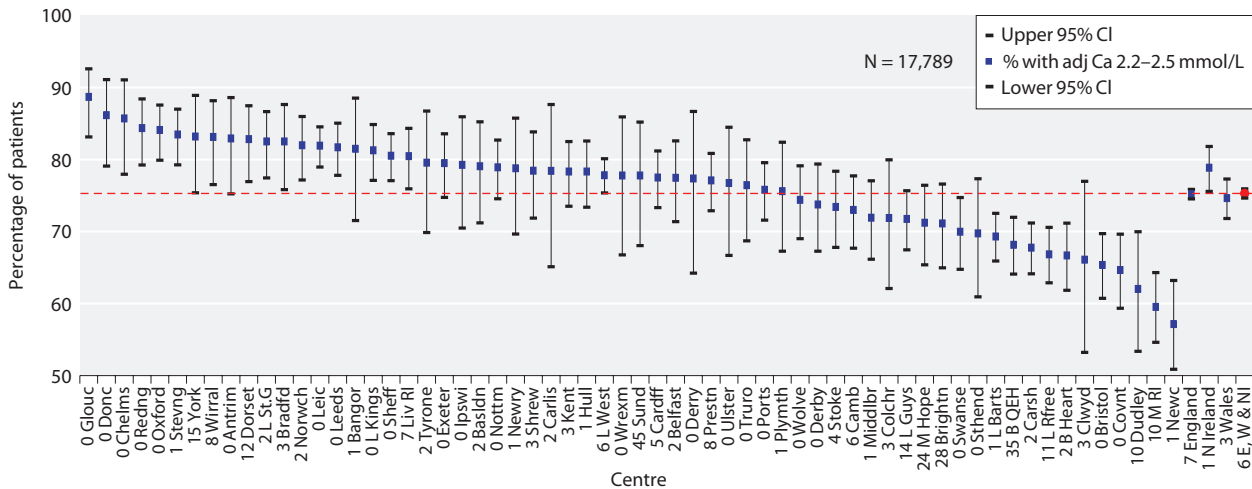
<sup>a</sup>These centres supplied uncorrected calcium and were corrected using the formula:  
adjusted calcium = unadjusted calcium + [(40 - albumin) × 0.02]

for calcium appears to have plateaued for both HD and PD patients.

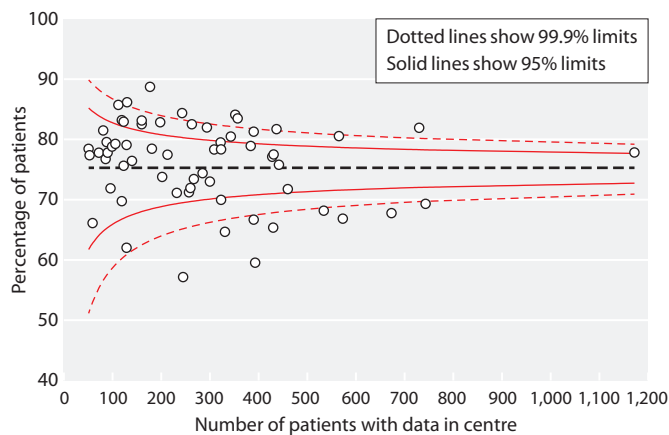
Similar to that seen in earlier phosphate analyses, there was significant between centre variation in unadjusted analyses for the proportion of patients below, within and above the range specified by the clinical performance measure (figures 9.6–9.10). There was greater variation in the proportion of patients within range for adjusted calcium than phosphate, most notably for HD patients. The funnel plot shows a greater number of centres outlying the 3SD limit indicating over dispersion in the data possibly due to differences in calcium adjustment factors between centres. In particular, 81% of haemodialysis patients in Newcastle achieved the target range in 2009 with a mean for the population of 2.4 mmol/L but only 57% in 2010 with a mean for the

population of 2.2 mmol/L. Further investigation revealed that this decrease coincided with a change in the laboratory analysers that resulted in a downward shift in calcium and an upward shift in albumin – since the equation for calculating adjusted calcium was not changed this would result in a decrease in adjusted calcium. This serves to emphasise the need for laboratories to use the appropriate equation for albumin-adjustment of calcium.

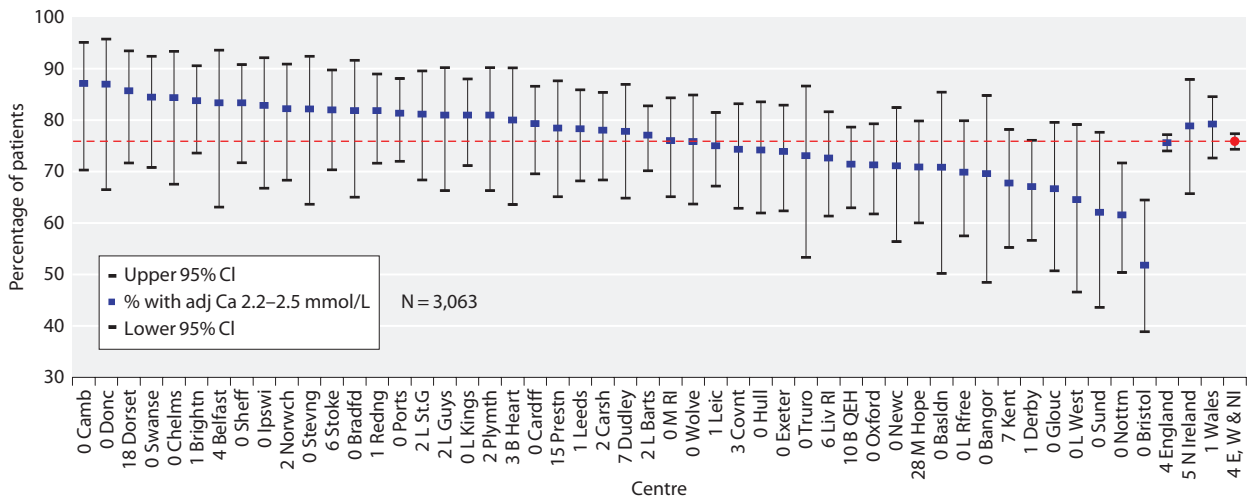
The 5th Renal Association clinical practice guidelines on CKD–Mineral and Bone Disorders was finalised on 6th December 2010 and recommends that calcium, adjusted for albumin, be maintained within the reference range and ideally between 2.2 and 2.5 mmol/L for all dialysis patients [8] – the audit standard will therefore remain the same in next year’s report.



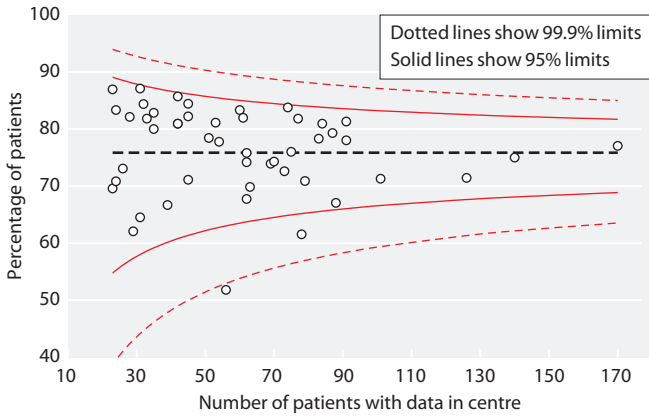
**Fig. 9.6.** Percentage of haemodialysis patients with adjusted calcium within range (2.2–2.5 mmol/L) by centre in 2010



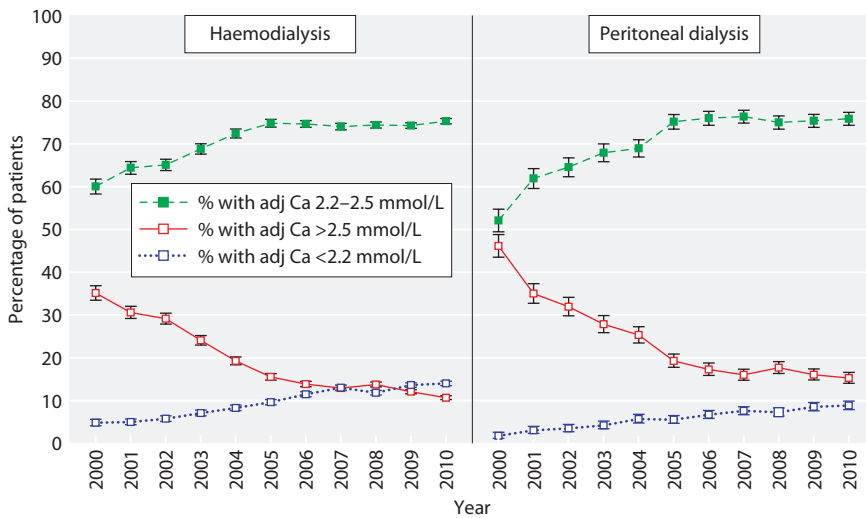
**Fig. 9.7.** Funnel plot of percentage of haemodialysis patients with adjusted calcium within range (2.2–2.5 mmol/L) by centre in 2010



**Fig. 9.8.** Percentage of peritoneal dialysis patients with adjusted calcium within range (2.2–2.5 mmol/L) by centre in 2010



**Fig. 9.9.** Funnel plot of percentage of peritoneal dialysis patients with adjusted calcium within range (2.2–2.5 mmol/L) by centre in 2010



**Fig. 9.10.** Longitudinal change in percentage of patients with adjusted calcium <2.2 mmol/L, 2.2–2.5 mmol/L and >2.5 mmol/L by dialysis modality 2000–2010

*Parathyroid hormone*

At the beginning of 2010 no new guidelines regarding the target range for PTH in dialysis patients had yet been published with clinical practice being dictated by the 4th edition of the Renal Association Clinical Practice Guidelines which stated:

***‘The target range for parathyroid hormone measured using an intact PTH assay should be between 2 and 4 times the upper limit of normal for the intact PTH assay used. The same target range should apply when using the whole molecule PTH assay.’ (Module 2: Complications) [7]***

The data for parathyroid hormone were 87% complete for HD patients and 89% complete for PD patients overall, although there was between centre variation (tables 9.10, 9.12). Twenty-eight percent (CI 27–29%) of HD patients and 31% (29–32%) of PD patients achieved a parathyroid hormone between 16–32 pmol/L (tables 9.11, 9.13). The proportion of HD patients with a parathyroid hormone above the upper limit of the range was 43% and the proportion with parathyroid hormone below the lower limit of the range was 29%. The proportion of PD patients with parathyroid hormone above the upper limit of the range was 40% and the proportion with parathyroid hormone below the lower limit

**Table 9.10.** Summary statistics for PTH in haemodialysis patients in 2010

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
Antrim	100	123	26	20	21	11	35
B Heart	93	369	39	43	27	13	51
B QEH	50	412	37	47	25	10	48
Bangor	100	82	27	34	20	13	31
Basldn	97	128	36	32	26	14	48
Belfast	94	205	47	44	32	17	67
Bradfd	95	157	34	39	21	11	41
Brightn	97	312	35	41	23	9	46
Bristol	96	414	37	35	28	15	49
Camb	60	191	34	50	24	11	40
Cardff	96	436	50	44	38	22	61
Carlisle	98	51	33	31	24	11	44
Carsh	4	27					
Chelms	100	112	35	25	30	17	43
Clwyd	93	57	35	35	24	10	48
Colchr	97	96	28	25	20	10	35
Covnt	99	329	36	41	23	12	45
Derby	99	199	33	41	24	14	38
Derry	100	53	43	30	32	22	61
Donc	100	130	47	40	34	20	61
Dorset	96	217	28	29	18	8	37
Dudley	94	135	41	47	27	11	52
Exeter	98	317	22	27	14	6	25
Glouc	99	175	30	28	22	11	36
Hull	95	297	46	58	26	10	59
Ipswi	100	106	49	49	33	16	56
Kent	97	322	47	41	36	21	58
L Barts	99	739	50	50	35	17	61
L Guys	74	394	47	49	30	14	61
L Kings	93	364	49	43	36	16	70
L Rfree	84	541	35	35	24	12	46
L St.G	97	258	47	45	32	19	58
L West	89	1103	57	57	39	17	76
Leeds	99	433	32	32	24	12	42
Leic	99	726	43	42	30	14	64
Liv Ain	4	6					
Liv RI	98	359	39	38	27	13	54
M Hope	72	243	39	41	23	12	51
M RI	85	374	48	46	36	19	63

**Table 9.10.** Continued

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
Middlbr	93	244	43	39	34	17	57
Newc	83	204	33	26	27	13	46
Newry	99	99	34	42	24	11	38
Norwch	96	286	34	31	27	15	43
Nottm	99	380	35	38	24	11	44
Oxford	96	338	48	45	34	19	64
Plymth	94	116	21	22	15	7	27
Ports	95	420	37	44	22	7	50
Prestn	99	463	38	34	29	14	51
Redng	99	241	31	27	25	16	40
Sheff	97	547	43	41	30	15	56
Shrew	97	181	36	39	19	10	48
Stevng	97	349	56	51	38	29	76
Sthend	94	112	59	52	47	25	75
Stoke	92	256	51	39	41	23	68
Sund	94	155	45	45	32	16	58
Swanse	71	230	44	38	33	18	58
Truro	99	139	27	28	18	9	38
Tyrone	98	88	37	22	32	23	47
Ulster	100	86	21	18	17	8	29
Wirral	61	106	37	35	25	16	47
Wolve	98	280	23	31	14	7	29
Wrexm	97	70	23	22	19	10	29
York	89	125	36	34	28	11	47
<b>England</b>	<b>86</b>	<b>14,978</b>	<b>41</b>	<b>43</b>	<b>28</b>	<b>13</b>	<b>53</b>
<b>N Ireland</b>	<b>98</b>	<b>654</b>	<b>36</b>	<b>35</b>	<b>27</b>	<b>15</b>	<b>44</b>
<b>Wales</b>	<b>88</b>	<b>875</b>	<b>43</b>	<b>41</b>	<b>31</b>	<b>17</b>	<b>53</b>
<b>E, W &amp; NI</b>	<b>87</b>	<b>16,507</b>	<b>41</b>	<b>43</b>	<b>28</b>	<b>13</b>	<b>53</b>

Blank cells denote centres excluded from analyses due to low patient numbers or poor data completeness

**Table 9.11.** Percentage of haemodialysis patients within, below and above the range for PTH (16–32 pmol/L) in 2010

Centre	N	% PTH 16–32 pmol/L	Lower 95% CI	Upper 95% CI	% PTH <16 pmol/L	% PTH >32 pmol/L	Change from 2009		
							% within range	95% LCL	95% UCL
Antrim	123	35.0	27.1	43.8	39.0	26.0	1.6	−14.1	17.3
B Heart	369	28.7	24.3	33.6	29.8	41.5	2.8	−5.7	11.3
B QEH	412	25.2	21.3	29.7	36.4	38.4	−8.6	−16.3	−0.9
Bangor	82	42.7	32.5	53.6	32.9	24.4	4.8	−15.4	25.1
Basldn	128	31.3	23.8	39.8	28.1	40.6	−0.3	−15.2	14.6
Belfast	205	30.2	24.4	36.9	20.0	49.8	4.7	−6.6	15.9
Bradfd	157	28.0	21.6	35.6	37.6	34.4	4.5	−8.3	17.3
Brightn	312	25.3	20.8	30.4	38.5	36.2	−0.7	−10.2	8.7
Bristol	414	32.6	28.3	37.3	26.1	41.3	1.8	−6.6	10.3
Camb	191	30.4	24.3	37.3	35.6	34.0			
Cardff	436	26.4	22.5	30.7	16.5	57.1	−5.6	−13.5	2.4
Carlis	51	23.5	13.9	37.0	37.3	39.2	−4.5	−26.2	17.2
Chelms	112	38.4	29.9	47.7	18.8	42.9	9.0	−7.3	25.4

Table 9.11. Continued

Centre	N	% PTH 16–32 pmol/L	Lower 95% CI	Upper 95% CI	% PTH <16 pmol/L	% PTH >32 pmol/L	Change from 2009		
							% within range	95% LCL	95% UCL
Clwyd	57	26.3	16.5	39.2	38.6	35.1	4.3	−15.6	24.1
Colchr	96	33.3	24.7	43.3	41.7	25.0	−1.5	−19.5	16.5
Covnt	329	28.9	24.2	34.0	32.8	38.3	1.4	−7.8	10.6
Derby	199	41.2	34.6	48.2	28.1	30.7	3.6	−8.6	15.8
Derry	53	39.6	27.5	53.2	11.3	49.1	17.2	−5.2	39.6
Donc	130	32.3	24.8	40.8	16.2	51.5	0.3	−15.6	16.2
Dorset	217	25.4	20.0	31.6	43.3	31.3	−1.0	−11.9	10.0
Dudley	135	24.4	17.9	32.4	34.1	41.5	−0.1	−14.6	14.5
Exeter	317	26.5	21.9	31.6	55.2	18.3	−1.9	−11.2	7.4
Glouc	175	30.9	24.5	38.1	37.1	32.0	3.0	−9.7	15.6
Hull	297	21.6	17.2	26.6	34.7	43.8	1.3	−7.3	10.0
Ipswi	106	27.4	19.7	36.6	22.6	50.0	−7.0	−23.8	9.7
Kent	322	28.3	23.6	33.4	16.5	55.3			
L Barts	739	23.8	20.9	27.0	22.6	53.6	−1.9	−8.0	4.1
L Guys	394	24.4	20.4	28.9	28.7	47.0	1.8	−5.6	9.2
L Kings	364	21.7	17.8	26.2	23.9	54.4	0.0	−7.9	7.9
L Rfree	541	30.7	26.9	34.7	32.4	37.0	−2.5	−10.0	5.0
L St.G	258	31.4	26.0	37.3	19.0	49.6	3.1	−7.5	13.8
L West	1,103	21.6	19.3	24.1	22.5	55.9	−2.5	−7.2	2.1
Leeds	433	34.2	29.9	38.8	31.4	34.4	4.3	−3.9	12.4
Leic	726	24.2	21.3	27.5	28.2	47.5	1.6	−4.2	7.4
Liv RI	359	27.3	22.9	32.1	30.4	42.3	−0.6	−9.2	8.0
M Hope	243	31.7	26.2	37.8	32.9	35.4			
M RI	374	23.5	19.5	28.1	21.1	55.4	0.7	−8.7	10.1
Middlbr	244	25.4	20.3	31.3	23.8	50.8	−2.1	−12.3	8.1
Newc	204	30.4	24.5	37.0	29.9	39.7	1.7	−9.4	12.7
Newry	99	38.4	29.4	48.3	30.3	31.3	1.8	−16.2	19.8
Norwch	286	33.9	28.7	39.6	27.6	38.5	−5.6	−16.0	4.8
Nottm	380	33.7	29.1	38.6	32.4	34.0	3.1	−5.6	11.8
Oxford	338	26.3	21.9	31.3	21.0	52.7	5.7	−2.8	14.1
Plymth	116	31.9	24.1	40.9	51.7	16.4	4.0	−11.7	19.6
Ports	420	21.7	18.0	25.9	41.7	36.7	0.1	−7.4	7.5
Prestn	463	26.8	23.0	31.0	28.9	44.3	−8.0	−16.2	0.2
Redng	241	41.5	35.4	47.8	24.5	34.0	5.4	−6.0	16.7
Sheff	547	26.5	23.0	30.4	26.7	46.8	−1.1	−8.0	5.8
Shrew	181	30.9	24.6	38.0	34.3	34.8	2.4	−10.1	14.9
Stevng	349	25.5	21.2	30.3	13.2	61.3	3.1	−5.3	11.5
Sthend	112	24.1	17.1	32.9	12.5	63.4	−5.9	−21.2	9.5
Stoke	256	23.8	19.0	29.4	13.3	62.9	−7.0	−17.0	3.1
Sund	155	25.8	19.5	33.3	24.5	49.7	−0.3	−13.1	12.5
Swanse	230	29.6	24.0	35.8	20.0	50.4	−0.5	−11.6	10.5
Truro	139	25.9	19.3	33.8	43.9	30.2	−3.2	−17.1	10.7
Tyrone	88	40.9	31.2	51.4	10.2	48.9	2.8	−16.4	22.0
Ulster	86	33.7	24.6	44.3	46.5	19.8	−4.2	−23.0	14.6
Wirral	106	41.5	32.5	51.1	24.5	34.0	6.0	−11.2	23.2
Wolve	280	26.1	21.3	31.5	53.9	20.0	1.3	−8.2	10.8
Wrexm	70	32.9	22.9	44.6	42.9	24.3	−0.5	−21.1	20.1
York	125	24.8	18.0	33.1	31.2	44.0	−5.8	−20.9	9.2
<b>England</b>	<b>14,978</b>	<b>27.4</b>	<b>26.7</b>	<b>28.1</b>	<b>29.3</b>	<b>43.3</b>	<b>−0.2</b>	<b>−1.6</b>	<b>1.1</b>
<b>N Ireland</b>	<b>654</b>	<b>35.0</b>	<b>31.5</b>	<b>38.8</b>	<b>26.6</b>	<b>38.4</b>	<b>3.5</b>	<b>−3.2</b>	<b>10.2</b>
<b>Wales</b>	<b>875</b>	<b>29.3</b>	<b>26.3</b>	<b>32.4</b>	<b>22.5</b>	<b>48.2</b>	<b>−2.0</b>	<b>−7.7</b>	<b>3.6</b>
<b>E, W &amp; NI</b>	<b>16,507</b>	<b>27.8</b>	<b>27.1</b>	<b>28.5</b>	<b>28.8</b>	<b>43.4</b>	<b>−0.2</b>	<b>−1.5</b>	<b>1.1</b>

Blank cells denote a centre with low patient numbers last year precluding calculation of the change in target attainment

**Table 9.12.** Summary statistics for PTH in peritoneal dialysis patients in 2010

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
Antrim	100	11					
B Heart	86	31	28	18	23	15	39
B QEH	85	119	23	23	15	7	30
Bangor	100	23	24	16	24	7	32
Basldn	100	24	38	32	34	16	50
Belfast	96	24	50	48	33	16	63
Bradfd	94	31	59	54	47	16	93
Brightn	95	71	36	30	30	17	48
Bristol	91	51	37	37	28	11	45
Camb	100	31	31	18	29	17	43
Cardff	98	85	43	34	35	21	59
Carlis	100	12					
Carsh	3	3					
Chelms	100	32	40	38	29	15	50
Clwyd	80	4					
Covnt	93	67	31	31	20	11	44
Derby	98	87	25	25	19	14	30
Derry	100	2					
Donc	96	22	46	35	38	21	66
Dorset	86	44	24	25	15	8	28
Dudley	90	52	31	30	20	13	39
Exeter	99	68	24	23	21	10	32
Glouc	95	37	39	42	29	13	49
Hull	92	57	27	26	18	9	31
Ipswi	100	35	49	34	41	28	64
Kent	99	66	39	25	32	23	57
L Barts	95	165	32	33	24	12	45
L Guys	98	42	34	25	26	18	49
L Kings	96	81	48	32	41	22	65
L Rfree	98	62	31	26	24	12	38
L St.G	98	53	40	32	28	15	51
L West	87	27	56	35	58	31	79
Leeds	100	84	34	23	33	17	52
Leic	94	132	39	38	27	14	64
Liv Ain	0	0					
Liv RI	97	76	28	25	20	12	35
M Hope	71	78	35	36	23	14	46
M RI	99	74	44	37	31	18	59
Middlbr	72	13					
Newc	53	24	24	19	18	10	36
Newry	100	8					
Norwch	72	33	25	23	18	12	26
Nottm	97	76	30	22	30	9	48
Oxford	90	91	50	40	45	19	62
Plymth	98	42	23	16	23	9	33
Ports	82	75	37	34	25	14	47
Prestn	100	60	34	28	27	18	45
Redng	99	77	33	30	26	14	41
Sheff	90	54	42	35	34	21	53
Shrew	89	16					
Stevng	96	27	45	57	29	19	57
Sthend	89	16					
Stoke	92	60	56	40	46	27	76
Sund	97	28	26	25	17	7	38
Swanse	96	43	36	25	31	21	47
Truro	92	24	36	25	28	17	60



**Table 9.12.** Continued

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
Tyrone	100	7					
Ulster	100	2					
Wirral	40	14					
Wolve	95	59	18	13	15	9	28
Wrexm	90	18					
York	100	17					
<b>England</b>	<b>89</b>	<b>2,620</b>	<b>35</b>	<b>32</b>	<b>26</b>	<b>13</b>	<b>47</b>
<b>N Ireland</b>	<b>98</b>	<b>54</b>	<b>42</b>	<b>39</b>	<b>29</b>	<b>19</b>	<b>49</b>
<b>Wales</b>	<b>96</b>	<b>173</b>	<b>36</b>	<b>29</b>	<b>30</b>	<b>19</b>	<b>47</b>
<b>E, W &amp; NI</b>	<b>89</b>	<b>2,847</b>	<b>35</b>	<b>32</b>	<b>27</b>	<b>14</b>	<b>47</b>

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

**Table 9.13.** Percentage of peritoneal dialysis patients within, below and above the range for PTH (16–32 pmol/L) in 2010

Centre	N	% PTH 16–32 pmol/L	Lower 95% CI	Upper 95% CI	% PTH <16 pmol/L	% PTH >32 pmol/L	Change from 2009		
							% within range	95% LCL	95% UCL
B Heart	31	41.9	26.1	59.6	25.8	32.3	−3.5	−39.2	32.2
B QEH	119	25.2	18.2	33.8	50.4	24.4	−10.7	−26.7	5.2
Bangor	23	47.8	28.8	67.5	30.4	21.7	20.2	−14.1	54.6
Basldn	24	25.0	11.7	45.6	25.0	50.0	−7.0	−40.2	26.2
Belfast	24	25.0	11.7	45.6	25.0	50.0	−11.4	−42.8	20.1
Bradfd	31	19.4	9.0	36.9	22.6	58.1	0.8	−25.8	27.4
Brightn	71	33.8	23.8	45.5	21.1	45.1	2.0	−18.7	22.7
Bristol	51	27.5	17.0	41.2	31.4	41.2	0.0	−21.7	21.8
Camb	31	41.9	26.1	59.6	19.4	38.7	9.7	−21.8	41.2
Cardff	85	28.2	19.7	38.7	17.7	54.1	−0.9	−18.3	16.4
Chelms	32	25.0	13.0	42.6	28.1	46.9	−1.7	−30.4	27.0
Covnt	67	23.9	15.2	35.5	41.8	34.3	−3.8	−23.4	15.8
Derby	87	49.4	39.1	59.8	33.3	17.2	−3.0	−22.9	16.8
Donc	22	31.8	16.0	53.4	13.6	54.6	7.7	−25.1	40.5
Dorset	44	20.5	11.0	34.9	59.1	20.5	−4.6	−27.6	18.5
Dudley	52	28.9	18.2	42.5	38.5	32.7	17.0	−3.8	37.7
Exeter	68	32.4	22.4	44.3	44.1	23.5	−5.4	−27.0	16.3
Glouc	37	27.0	15.2	43.4	32.4	40.5	1.2	−26.5	28.9
Hull	57	33.3	22.4	46.4	42.1	24.6	5.0	−17.6	27.7
Ipswi	35	31.4	18.3	48.3	8.6	60.0	−9.1	−37.2	19.1
Kent	66	37.9	27.1	50.1	16.7	45.5			
L Barts	165	30.9	24.3	38.4	33.3	35.8	0.2	−12.9	13.4
L Guys	42	38.1	24.8	53.4	19.1	42.9	2.4	−24.8	29.5
L Kings	81	17.3	10.5	27.1	17.3	65.4	−3.3	−20.0	13.3
L Rfree	62	32.3	21.9	44.8	32.3	35.5	6.5	−14.5	27.4
L St.G	53	30.2	19.4	43.7	26.4	43.4	−1.3	−24.3	21.7
L West	27	18.5	7.9	37.5	7.4	74.1	−0.8	−27.4	25.8
Leeds	84	26.2	17.9	36.6	23.8	50.0	−12.6	−31.0	5.8
Leic	132	30.3	23.1	38.7	28.8	40.9	0.2	−14.3	14.6
Liv RI	76	32.9	23.3	44.2	39.5	27.6	−1.3	−21.1	18.4
M Hope	78	37.2	27.2	48.4	30.8	32.1			
M RI	74	33.8	24.0	45.2	18.9	47.3	2.8	−16.4	21.9
Newc	24	16.7	6.4	36.9	41.7	41.7	−5.8	−30.7	19.2
Norwch	33	33.3	19.5	50.8	45.5	21.2	1.8	−27.0	30.5
Nottm	76	17.1	10.2	27.3	34.2	48.7	−6.7	−22.3	9.0

**Table 9.13.** Continued

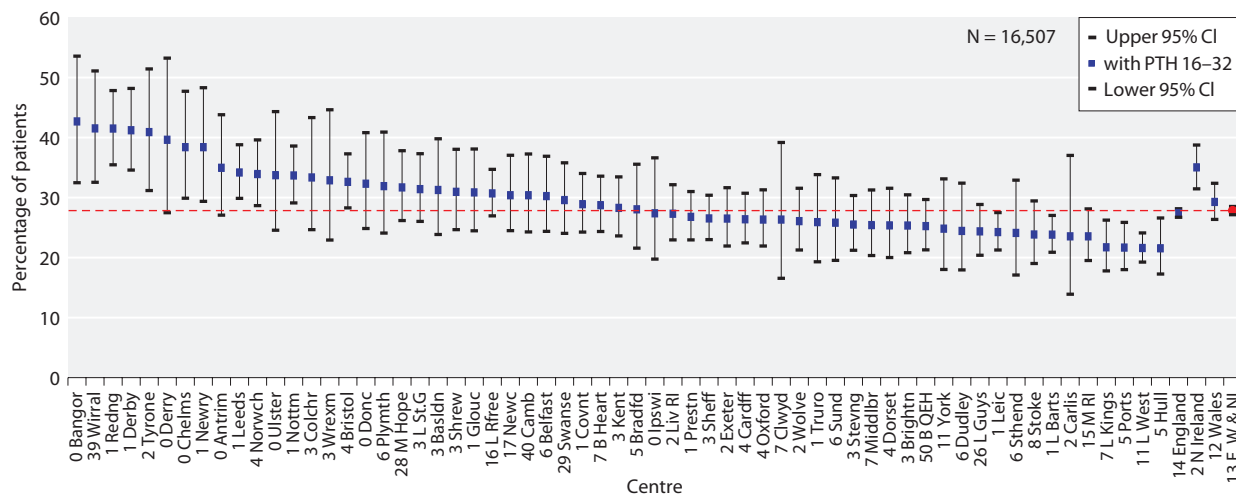
Centre	N	% PTH 16–32 pmol/L	Lower 95% CI	Upper 95% CI	% PTH <16 pmol/L	% PTH >32 pmol/L	Change from 2009		
							% within range	95% LCL	95% UCL
Oxford	91	22.0	14.6	31.6	18.7	59.3	-2.2	-18.5	14.1
Plymth	42	33.3	20.8	48.7	38.1	28.6	-7.2	-35.2	20.8
Ports	75	37.3	27.2	48.8	28.0	34.7	11.9	-8.3	32.1
Prestn	60	38.3	27.0	51.1	21.7	40.0	-11.7	-34.5	11.2
Redng	77	32.5	23.0	43.7	31.2	36.4	8.9	-10.0	27.7
Sheff	54	29.6	19.0	43.0	16.7	53.7	-12.7	-35.8	10.3
Stevng	27	37.0	21.2	56.2	18.5	44.4	7.9	-26.0	41.8
Stoke	60	23.3	14.3	35.6	8.3	68.3	-7.2	-28.1	13.7
Sund	28	17.9	7.6	36.4	50.0	32.1	-15.5	-47.9	17.0
Swanse	43	32.6	20.3	47.7	20.9	46.5	0.0	-26.1	26.1
Truro	24	37.5	20.8	57.8	20.8	41.7			
Wolve	59	37.3	26.0	50.2	50.9	11.9	5.6	-19.2	30.4
<b>England</b>	<b>2,620</b>	<b>30.3</b>	<b>28.5</b>	<b>32.1</b>	<b>30.1</b>	<b>39.7</b>	<b>-0.6</b>	<b>-3.9</b>	<b>2.8</b>
<b>N Ireland</b>	<b>54</b>	<b>38.9</b>	<b>26.9</b>	<b>52.4</b>	<b>18.5</b>	<b>42.6</b>	<b>0.5</b>	<b>-22.0</b>	<b>23.1</b>
<b>Wales</b>	<b>173</b>	<b>34.1</b>	<b>27.4</b>	<b>41.5</b>	<b>21.4</b>	<b>44.5</b>	<b>2.1</b>	<b>-10.6</b>	<b>14.8</b>
<b>E, W &amp; NI</b>	<b>2,847</b>	<b>30.7</b>	<b>29.0</b>	<b>32.4</b>	<b>29.3</b>	<b>40.0</b>	<b>-0.4</b>	<b>-3.6</b>	<b>2.7</b>

Blank cells denote a centre with low patient numbers last year precluding calculation of the change in target attainment

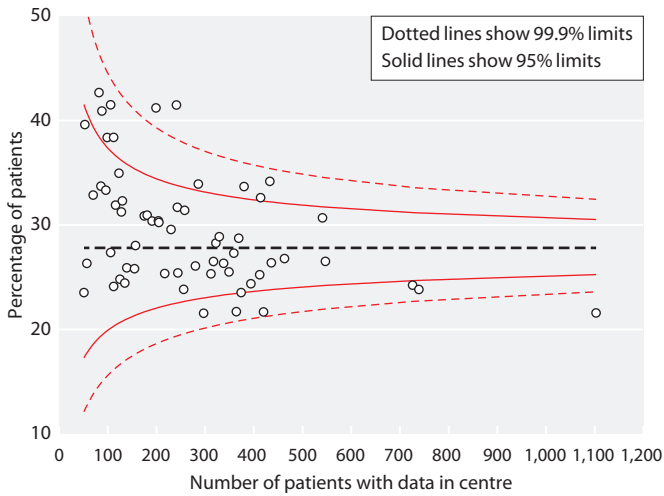
of the range was 29% (tables 9.11, 9.13, figures 9.11 to 9.14). Again there was significant between centre variation in unadjusted analyses for the proportion of patients below, within and above the range specified by the clinical performance measure although individual centre performance was little changed from last year.

A significant contributor to centre variation will be the assay used to measure PTH. This has been demonstrated by a study undertaken by the Scottish Clinical Biochemistry Managed Diagnostic Network in association with the Scottish Renal Registry. Analysis of samples

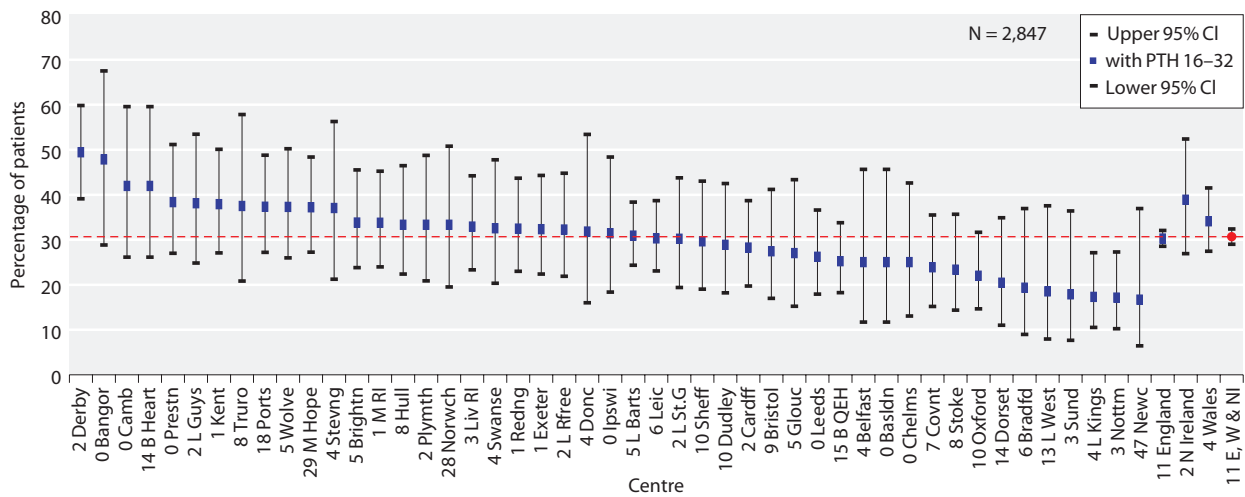
from 106 haemodialysis patients by six different PTH immunoassays in common use showed a 1.2- to 2.7-fold variation in results in spite of similar reference ranges for each method [9]. Since current guidelines refer to multiples of the upper reference limit, 53% of patients were classified differently by different methods with implications for treatment eg with Cinacalcet. In an excellent accompanying editorial, Garrett and Goldsmith [10] also highlighted the high biological variability of PTH and its poor ability to predict skeletal or patient outcomes. Whether more accurate and specific assays



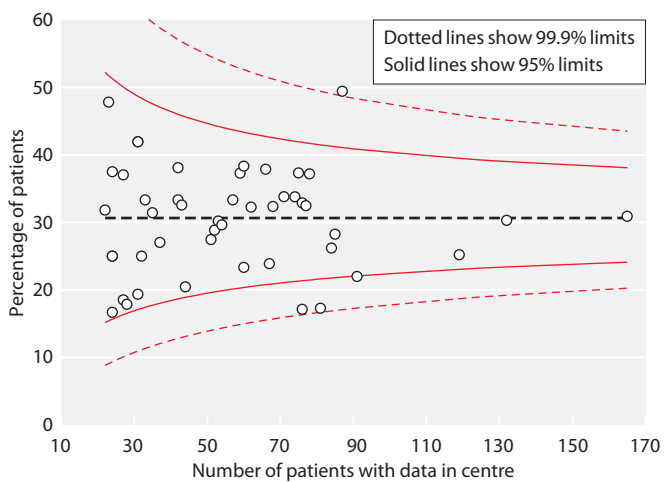
**Fig. 9.11.** Percentage of haemodialysis patients with PTH within range (16–32 pmol/L) by centre in 2010



**Fig. 9.12.** Funnel plot of percentage of haemodialysis patients with PTH within range (16–32 pmol/L) by centre in 2010



**Fig. 9.13.** Percentage of peritoneal dialysis patients with PTH within range (16–32 pmol/L) by centre in 2010



**Fig. 9.14.** Funnel plot of percentage of peritoneal dialysis patients with PTH within range (16–32 pmol/L) by centre in 2010

would improve this or whether PTH will be supplanted by other markers such as bone specific alkaline phosphatase that also have greater pre-analytical stability remains to be determined [11].

Improvement of PTH assays to achieve consensus results within CKD patients requires manufacturers to consider two principal factors: adoption of a common reference preparation for standardisation, such as the WHO international standard 95/646, and selection of pairs of antibodies that do not detect PTH fragments such as 7–84 that accumulate in CKD. Meanwhile Almond et al. [9] and a recent editorial review [12] urge adoption of assay-specific action limits for PTH in CKD patients. However this approach raises a number of difficult governance issues. There is already evidence that the manufacturers of the major diagnostic platforms used throughout the world have started to respond. The Roche assay used by Almond et al. [9] was PTH (intact) that was not standardised and cross-reacted with PTH 7–84. Roche have recently launched the more expensive PTH (1–84) that is standardised against the WHO international standard 95/646 and has  $\leq 0.1\%$  cross-reactivity with both PTH (1–34) and PTH (7–84) (information supplied by Roche Diagnostics).

#### *Mineral and bone variables*

There are convincing observational data that hyperphosphataemia is associated with increased mortality in dialysis patients but the data linking calcium and parathyroid hormone to patient survival are less clear [13–17]. A recent cohort study has demonstrated that simultaneous achievement of all three audit measures does appear to be associated with better outcomes [18].

The UKRR has consistently demonstrated between centre variation in achievement of audit measures for bone and mineral parameters but little is understood about the causes of this ‘centre effect’. The complexity of the clinical processes required to manage mineral and bone disorders is probably further confounded by case-mix. Finally it is important to consider data quality and the potential for measurement bias particularly in light of the variability in assay methods for parathyroid hormone as discussed above. However, detecting these centre level differences is an important step in understanding the factors associated with exceptional performance. The latest version of the Renal Association clinical practice guidelines, finalised in December 2010, suggests the maintenance of serum PTH between 2 and 9 times the upper limit of the normal range. There is already some evidence of changing practice in this

regard with a rise in the percentage of HD patients with a PTH  $> 32$  pmol/L over the last five years.

#### *Bicarbonate*

In 2010 the following Renal Association clinical practice guidelines regarding bicarbonate management was applicable:

***‘We suggest that pre-dialysis (mid-week) serum bicarbonate concentrations measured with minimum delay after venepuncture should be between 18 and 24 mmol/L. (2C)’ (Module: Haemodialysis) [1]***

***‘For PD patients, Plasma bicarbonate should be maintained within the normal range.’ (Module 3b: Peritoneal dialysis) [7]***

Citing evidence for reduced risk of adverse events, the Haemodialysis module of the 5th edition of the Renal Association clinical practice guidelines published in December 2009 [1] recommended a target range for serum bicarbonate of 18–24 mmol/L, a reduction from the previous guideline range of 20–26 mmol/L.

Bicarbonate data were 90% complete for HD patients and 89% complete for PD patients (tables 9.14, 9.16). With the introduction of a lower bicarbonate target range in haemodialysis patients for 2010, the proportion of patients achieving the audit measure has fallen in this group from 72% in 2009 to 60% in 2010 (CI 59–60%) although the mean bicarbonate decreased slightly from 24 mmol/L in 2009 to 23 mmol/L in 2010, (table 9.14). The proportion achieving the standard in PD patients comparatively shows little change at 80% (CI 79–82%). Collectively there was significant inter-centre variation for both HD and PD (tables 9.15, 9.17, figures 9.15, 9.16). There was even greater between centre variation in the proportion of patients with bicarbonate values above and below the specified range for the audit measure (tables 9.15, 9.17). The UKRR has previously conducted a limited survey into the possible underlying causes of this variation. The study predominantly looked at measures of sample processing and of dialysis treatment. It did not adjust for case-mix and was unable to detect any significant differences between centres. However, it is possible that there may be unmeasured processes including dialysis and oral bicarbonate prescription that might account for the variation observed [19].

#### *Total cholesterol*

There is no audit standard for total cholesterol in the Renal Association clinical practice guidelines. Current

**Table 9.14.** Summary statistics for serum bicarbonate in haemodialysis patients by centre in 2010

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
Antrim	100	123	25	2	25	24	26
B Heart	77	305	24	3	24	22	26
B QEH	81	667	25	3	25	23	27
Bangor	99	81	24	3	25	22	26
Basldn	97	128	23	3	23	21	25
Belfast	98	213	22	3	23	21	24
Bradfd	97	160	23	3	22	21	25
Brightn	94	302	23	3	23	21	25
Bristol	100	430	23	3	23	21	25
Camb	92	295	23	2	23	22	25
Cardff	98	442	22	3	22	20	24
Carlis	98	51	22	3	22	19	23
Carsh	98	669	25	3	25	23	27
Chelms	100	112	25	2	25	24	26
Clwyd	97	59	22	3	23	20	24
Colchr	97	96	27	2	27	25	28
Covnt	98	325	25	3	25	23	27
Derby	100	201	24	3	24	22	25
Derry	100	53	21	2	20	19	22
Donc	100	130	23	3	23	21	25
Dorset	100	225	23	3	23	22	25
Dudley	98	141	24	3	24	22	26
Exeter	100	322	23	3	23	21	25
Glouc	100	177	24	3	24	22	26
Hull	99	308	21	2	21	20	23
Ipswi	100	106	23	3	22	21	24
Kent	98	327	20	3	20	18	22
L Barts	99	742	23	3	23	21	24
L Guys	63	336	23	3	23	21	25
L Kings	99	388	25	2	25	24	27
L Rfree	88	568	22	3	22	21	24
L St.G	99	263	26	3	26	24	29
L West	75	927	20	3	20	18	22
Leeds	100	436	22	3	21	20	23
Leic	100	729	25	3.2	25	23	27
Liv Ain	10	13					
Liv RI	98	361	23	3.4	22	21	24
M Hope	8	26					
M RI	89	392	24	3.2	23	21	25
Middlbr	98	257	26	3.4	26	24	28
Newc	0	0					
Newry	98	98	23	2.3	23	22	25
Norwch	98	292	22	2.9	22	20	23
Nottm	81	311	25	3.4	25	24	27
Oxford	100	352	25	3.7	25	22	27
Plymth	99	123	22	2.6	22	20	23
Ports	100	444	23	3.0	23	22	25
Prestn	99	463	23	3.3	23	21	26
Redng	100	243	27	2.8	26	25	28
Sheff	100	565	25	2.7	25	23	27
Shrew	99	185	25	3.3	26	24	27
Stevng	98	352	24	2.8	24	22	26
Sthend	100	119	23	3.1	24	21	25
Stoke	94	260	26	3.9	26	23	29
Sund	98	162	22	3.0	22	20	24
Swanse	100	323	26	3.1	25	23	28

**Table 9.14.** Continued

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
Truro	100	140	22	2.3	21	20	23
Tyrone	98	88	23	2.7	23	21	25
Ulster	100	86	22	2.3	22	21	23
Wirral	92	160	25	3.5	25	23	28
Wolve	100	285	23	3.0	22	21	24
Wrexm	100	72	25	3.0	26	23	27
York	95	133	24	2.9	24	22	26
<b>England</b>	<b>89</b>	<b>15,504</b>	<b>24</b>	<b>3.4</b>	<b>23</b>	<b>21</b>	<b>26</b>
<b>N Ireland</b>	<b>99</b>	<b>661</b>	<b>23</b>	<b>2.8</b>	<b>23</b>	<b>21</b>	<b>25</b>
<b>Wales</b>	<b>99</b>	<b>977</b>	<b>24</b>	<b>3.4</b>	<b>23</b>	<b>21</b>	<b>26</b>
<b>E, W &amp; NI</b>	<b>90</b>	<b>17,142</b>	<b>23</b>	<b>3.4</b>	<b>23</b>	<b>21</b>	<b>26</b>

Blank cells denote centres excluded from analyses due to low patient numbers or poor data completeness

**Table 9.15.** Percentage of haemodialysis patients within, below and above the range for bicarbonate (18–24 mmol/L) by centre in 2010

Centre	N	% bicarb 18–24 mmol/L	Lower 95% CI	Upper 95% CI	% bicarb <18 mmol/L	% bicarb >24 mmol/L	Change from 2009		
							% within range	95% LCL	95% UCL
Antrim	123	38.2	30.1	47.1	0.0	61.8	–41.8	–56.5	–27.1
B Heart	305	57.7	52.1	63.1	1.3	41.0	–17.1	–26.6	–7.6
B QEH	667	45.4	41.7	49.2	1.8	52.8	–30.6	–36.9	–24.2
Bangor	81	49.4	38.7	60.1	0.0	50.6	–20.9	–40.7	–1.1
Basldn	128	65.6	57.0	73.3	6.3	28.1	–12.1	–26.4	2.3
Belfast	213	76.1	69.9	81.3	4.2	19.7	–9.2	–18.9	0.5
Bradfd	160	68.8	61.2	75.5	5.6	25.6	–2.4	–15.7	10.9
Brightn	302	66.6	61.0	71.7	5.0	28.5	–13.1	–22.6	–3.7
Bristol	430	67.9	63.3	72.2	4.0	28.1	–13.5	–21.1	–5.8
Camb	295	68.8	63.3	73.8	1.0	30.2	–4.1	–14.6	6.4
Cardff	442	75.6	71.3	79.4	7.2	17.2	5.3	–2.7	13.3
Carlis	51	74.5	60.9	84.6	3.9	21.6	–9.7	–29.8	10.4
Carsh	669	45.7	42.0	49.5	1.1	53.2	–26.7	–33.6	–19.8
Chelms	112	40.2	31.5	49.5	0.9	58.9	–19.5	–36.5	–2.4
Clwyd	59	79.7	67.5	88.1	3.4	17.0	12.5	–7.1	32.1
Colchr	96	17.7	11.3	26.7	0.0	82.3	–44.1	–60.8	–27.4
Covnt	325	44.0	38.7	49.5	1.2	54.8	–20.4	–30.5	–10.3
Derby	201	62.7	55.8	69.1	2.5	34.8	–8.9	–20.5	2.7
Derry	53	90.6	79.3	96.0	3.8	5.7	15.6	–2.2	33.3
Donc	130	73.1	64.8	80.0	1.5	25.4	–9.8	–23.6	4.0
Dorset	225	71.1	64.9	76.7	0.9	28.0	–14.3	–24.3	–4.3
Dudley	141	53.9	45.6	62.0	0.7	45.4	–15.2	–30.9	0.5
Exeter	322	69.9	64.6	74.6	2.8	27.3	–15.0	–23.5	–6.5
Glouc	177	52.5	45.2	59.8	1.1	46.3	–9.9	–23.5	3.7
Hull	308	89.0	85.0	92.0	4.9	6.2	6.5	–0.9	13.8
Ipswi	106	75.5	66.4	82.7	0.9	23.6	10.5	–6.0	27.0
Kent	327	77.7	72.8	81.9	15.9	6.4	9.3	0.3	18.3
L Barts	742	72.1	68.8	75.2	3.4	24.5	–3.2	–9.3	2.9
L Guys	336	70.5	65.4	75.2	2.4	27.1	–7.7	–15.9	0.4
L Kings	388	34.8	30.2	39.7	0.3	65.0	–27.0	–36.0	–18.0
L Rfree	568	75.7	72.0	79.1	4.1	20.3	4.7	–2.3	11.7
L St.G	263	32.7	27.3	38.6	0.4	66.9	1.3	–9.4	12.0
L West	927	75.9	73.1	78.6	17.8	6.3			
Leeds	436	78.9	74.8	82.5	6.9	14.2	7.7	0.2	15.1
Leic	729	46.6	43.0	50.3	1.0	52.4	–24.4	–30.9	–17.9

**Table 9.15.** Continued

Centre	N	% bicarb 18–24 mmol/L	Lower 95% CI	Upper 95% CI	% bicarb <18 mmol/L	% bicarb >24 mmol/L	Change from 2009		
							% within range	95% LCL	95% UCL
Liv RI	361	71.8	66.9	76.2	4.2	24.1	4.5	−4.3	13.3
M RI	392	63.5	58.6	68.1	2.3	34.2	−5.2	−15.2	4.7
Middlbr	257	31.1	25.8	37.1	1.6	67.3	−21.3	−32.2	−10.4
Newry	98	71.4	61.7	79.5	1.0	27.6	−13.7	−28.8	1.4
Norwch	292	78.1	73.0	82.5	8.6	13.4	1.1	−7.9	10.0
Nottm	311	37.0	31.8	42.5	1.3	61.7	−38.2	−47.6	−28.7
Oxford	352	43.2	38.1	48.4	1.4	55.4	−16.1	−25.8	−6.4
Plymth	123	82.1	74.3	87.9	7.3	10.6	7.6	−6.2	21.3
Ports	444	67.6	63.1	71.8	2.5	30.0	−13.1	−20.6	−5.6
Prestn	463	57.9	53.3	62.3	6.1	36.1	−16.7	−25.0	−8.4
Redng	243	22.6	17.8	28.3	0.0	77.4	−40.4	−50.9	−29.9
Sheff	565	44.1	40.0	48.2	0.5	55.4	−21.9	−29.3	−14.5
Shrew	185	32.4	26.1	39.5	2.7	64.9	−46.7	−58.5	−34.9
Stevng	352	60.5	55.3	65.5	2.3	37.2	−23.1	−31.5	−14.6
Sthend	119	59.7	50.6	68.1	4.2	36.1	−12.6	−28.3	3.1
Stoke	260	31.9	26.5	37.8	0.4	67.7			
Sund	162	74.7	67.4	80.8	6.8	18.5	−6.8	−18.6	5.0
Swanse	323	37.5	32.4	42.9	0.6	61.9	−23.5	−33.4	−13.6
Truro	140	87.9	81.3	92.3	4.3	7.9	1.9	−8.6	12.4
Tyrone	88	67.1	56.6	76.0	1.1	31.8	−6.8	−24.7	11.1
Ulster	86	88.4	79.7	93.6	0.0	11.6	38.9	22.5	55.4
Wirral	160	40.0	32.7	47.8	2.5	57.5	−35.3	−48.5	−22.1
Wolve	285	73.3	67.9	78.2	2.1	24.6	15.1	5.0	25.2
Wrexm	72	33.3	23.5	44.9	2.8	63.9	−41.0	−60.6	−21.3
York	133	55.6	47.1	63.8	0.8	43.6	−19.6	−34.7	−4.4
<b>England</b>	<b>15,504</b>	<b>59.4</b>	<b>58.6</b>	<b>60.1</b>	<b>3.8</b>	<b>36.8</b>	<b>−12.3</b>	<b>−13.8</b>	<b>−10.9</b>
<b>N Ireland</b>	<b>661</b>	<b>69.9</b>	<b>66.3</b>	<b>73.3</b>	<b>2.0</b>	<b>28.1</b>	<b>−7.4</b>	<b>−13.6</b>	<b>−1.2</b>
<b>Wales</b>	<b>977</b>	<b>57.9</b>	<b>54.8</b>	<b>61.0</b>	<b>3.9</b>	<b>38.2</b>	<b>−9.2</b>	<b>−14.9</b>	<b>−3.5</b>
<b>E, W &amp; NI</b>	<b>17,142</b>	<b>59.7</b>	<b>59.0</b>	<b>60.4</b>	<b>3.8</b>	<b>36.5</b>	<b>−12.0</b>	<b>−13.3</b>	<b>−10.6</b>

Blank cells denote a centre with low patient numbers last year precluding calculation of the change in target attainment

**Table 9.16.** Summary statistics for serum bicarbonate in peritoneal dialysis patients by centre in 2010

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
Antrim	36	4					
B Heart	94	34	24	3	25	23	27
B QEH	81	113	25	4	25	22	27
Bangor	91	21	27	3	27	25	30
Basldn	100	24	26	3	26	24	28
Belfast	96	24	25	2	25	23	27
Bradfd	100	33	26	3	25	24	28
Brightn	87	65	24	3	24	23	26
Bristol	100	56	24	3	25	23	26
Camb	100	31	27	3	27	25	29
Cardff	99	86	22	4	23	19	25
Carlis	100	12					
Carsh	88	82	28	4	28	26	31
Chelms	100	32	26	2	26	25	27
Clwyd	80	4					



**Table 9.16.** Continued

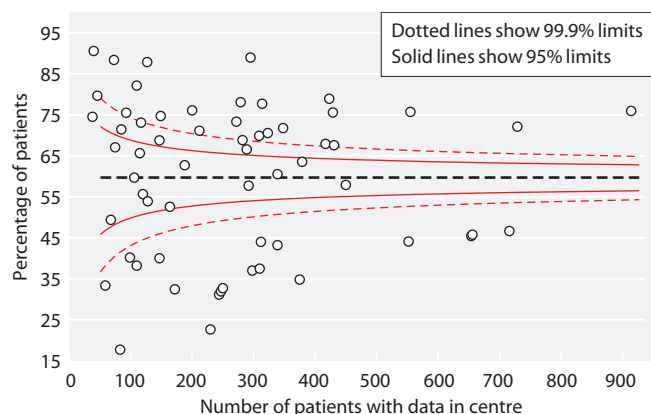
Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
Covnt	92	66	26	3	26	24	28
Derby	99	88	27	4	27	24	29
Derry	100	2					
Donc	91	21	26	3	25	24	29
Dorset	98	50	24	3	24	22	26
Dudley	98	57	26	4	26	24	28
Exeter	100	69	25	4	25	23	27
Glouc	100	39	26	3	26	24	28
Hull	100	62	26	3	26	24	28
Ipswi	100	35	25	3	26	23	27
Kent	100	67	22	3	22	20	24
L Barts	98	170	25	3	25	23	26
L Guys	98	42	24	3	25	22	27
L Kings	99	83	26	2	26	24	28
L Rfree	100	63	25	3	25	22	27
L St.G	98	53	29	3	29	28	31
L West	100	31	23	3	23	21	26
Leeds	99	83	25	3	26	23	27
Leic	95	134	27	4	28	25	30
Liv Ain	0	0					
Liv RI	99	77	24	3	24	22	26
M Hope	8	9					
M RI	99	74	25	3	25	23	27
Middlbr	94	17					
Newc	0	0					
Newry	50	4					
Norwch	96	44	22	2	21	20	23
Nottm	76	59	26	4	26	23	28
Oxford	74	75	26	3	26	24	28
Plymth	98	42	24	3	24	22	25
Ports	93	85	26	3	27	25	29
Prestn	80	48	25	3	25	23	28
Redng	99	77	28	3	28	26	30
Sheff	100	60	26	3	26	24	28
Shrew	89	16					
Stevng	96	27	25	2	24	23	26
Sthend	100	18					
Stoke	95	62	27	4	28	24	30
Sund	100	29	25	3	25	23	27
Swanse	100	45	27	4	27	25	30
Truro	100	26	26	3	26	23	28
Tyrone	86	6					
Ulster	100	2					
Wirral	54	19					
Wolve	100	62	26	3	26	24	28
Wrexm	95	19					
York	100	17					
<b>England</b>	<b>89</b>	<b>2,638</b>	<b>26</b>	<b>4</b>	<b>26</b>	<b>23</b>	<b>28</b>
<b>N Ireland</b>	<b>76</b>	<b>42</b>	<b>25</b>	<b>2</b>	<b>25</b>	<b>23</b>	<b>27</b>
<b>Wales</b>	<b>97</b>	<b>175</b>	<b>25</b>	<b>4</b>	<b>25</b>	<b>22</b>	<b>27</b>
<b>E, W &amp; NI</b>	<b>89</b>	<b>2,855</b>	<b>26</b>	<b>4</b>	<b>26</b>	<b>23</b>	<b>28</b>

Blank cells denote low patient numbers or poor data completeness

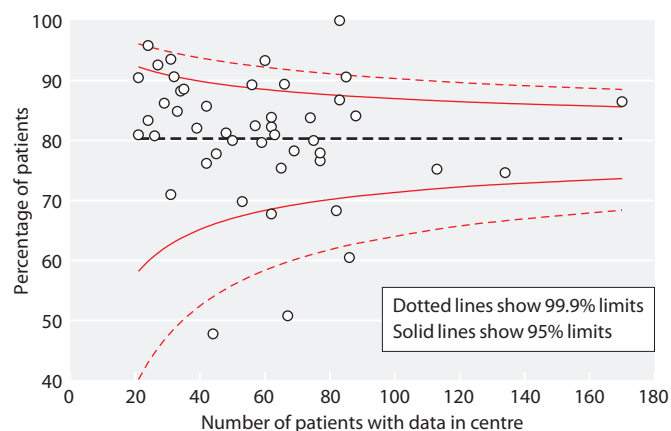
**Table 9.17.** Percentage of peritoneal dialysis patients within, below and above the range for bicarbonate (22–30 mmol/L) by centre in 2010

Centre	N	% bicarb 22–30 mmol/L	Lower 95% CI	Upper 95% CI	% bicarb <22 mmol/L	% bicarb >30 mmol/L	Change from 2009		
							% within range	95% LCL	95% UCL
B Heart	34	88.2	72.5	95.5	11.8	0.0	−7.8	−25.2	9.7
B QEH	113	75.2	66.5	82.3	19.5	5.3	−5.2	−19.6	9.3
Bangor	21	81.0	58.9	92.7	4.8	14.3	1.6	−27.8	31.1
Basldn	24	83.3	63.1	93.6	12.5	4.2	−16.7	−36.3	3.0
Belfast	24	95.8	75.7	99.4	4.2	0.0	7.6	−10.1	25.3
Bradfd	33	84.9	68.4	93.6	6.1	9.1	−15.2	−31.3	1.0
Brightn	65	75.4	63.5	84.3	21.5	3.1	9.2	−11.2	29.7
Bristol	56	89.3	78.1	95.1	10.7	0.0	10.2	−6.5	26.9
Camb	31	93.6	77.6	98.4	0.0	6.5	6.5	−12.8	25.7
Cardff	86	60.5	49.8	70.2	39.5	0.0	−4.1	−22.6	14.4
Carsh	82	68.3	57.5	77.4	2.4	29.3	−14.1	−30.5	2.4
Chelms	32	90.6	74.7	96.9	6.3	3.1	0.6	−18.8	20.0
Covnt	66	89.4	79.4	94.9	7.6	3.0	2.8	−11.7	17.4
Derby	88	84.1	74.9	90.4	5.7	10.2	−1.3	−15.5	13.0
Donc	21	90.5	68.9	97.6	0.0	9.5	2.5	−21.1	26.0
Dorset	50	80.0	66.7	88.9	18.0	2.0	5.0	−16.3	26.3
Dudley	57	82.5	70.4	90.3	8.8	8.8	1.6	−18.1	21.3
Exeter	69	78.3	67.0	86.5	14.5	7.3	−5.3	−23.1	12.4
Glouc	39	82.1	66.9	91.2	10.3	7.7	−9.8	−29.5	9.8
Hull	62	82.3	70.7	89.9	11.3	6.5	−8.1	−23.9	7.8
Ipswi	35	88.6	73.2	95.6	8.6	2.9	5.2	−15.1	25.6
Kent	67	50.8	39.0	62.5	47.8	1.5	−10.2	−32.5	12.1
L Barts	170	86.5	80.5	90.8	10.6	2.9	1.3	−8.6	11.2
L Guys	42	85.7	71.7	93.4	14.3	0.0	10.7	−11.1	32.6
L Kings	83	100.0	0.0	100.0	0.0	0.0	10.3	0.8	19.8
L Rfree	63	81.0	69.4	88.9	14.3	4.8	0.3	−17.9	18.5
L St.G	53	69.8	56.3	80.6	1.9	28.3	−7.0	−28.8	14.8
L West	31	71.0	53.0	84.2	25.8	3.2			
Leeds	83	86.8	77.6	92.5	9.6	3.6	−5.0	−17.3	7.3
Leic	134	74.6	66.6	81.3	6.0	19.4	−9.4	−21.9	3.1
Liv RI	77	77.9	67.3	85.8	22.1	0.0	−4.1	−20.7	12.4
M RI	74	83.8	73.6	90.6	10.8	5.4	−3.7	−18.0	10.6
Norwch	44	47.7	33.6	62.3	52.3	0.0	−25.0	−51.0	1.0
Nottm	59	79.7	67.5	88.1	8.5	11.9			
Oxford	75	80.0	69.4	87.6	8.0	12.0	0.6	−17.1	18.4
Plymth	42	76.2	61.1	86.7	23.8	0.0	−8.0	−30.8	14.8
Ports	85	90.6	82.3	95.2	5.9	3.5	0.9	−11.7	13.4
Prestn	48	81.3	67.7	90.0	16.7	2.1	−1.5	−20.9	17.9
Redng	77	76.6	65.9	84.8	0.0	23.4	−8.3	−24.8	8.2
Sheff	60	93.3	83.5	97.5	3.3	3.3	6.6	−6.9	20.0
Stevng	27	92.6	74.8	98.1	7.4	0.0	8.6	−14.4	31.5
Stoke	62	67.7	55.2	78.2	11.3	21.0			
Sund	29	86.2	68.5	94.7	13.8	0.0	2.9	−22.8	28.5
Swanse	45	77.8	63.4	87.6	6.7	15.6	−11.4	−31.2	8.5
Truro	26	80.8	61.3	91.8	11.5	7.7	−4.2	−32.9	24.4
Wolve	62	83.9	72.6	91.1	4.8	11.3	−3.9	−21.8	13.9
<b>England</b>	<b>2,638</b>	<b>80.7</b>	<b>79.2</b>	<b>82.2</b>	<b>11.6</b>	<b>7.7</b>	<b>−2.9</b>	<b>−5.6</b>	<b>−0.2</b>
<b>N Ireland</b>	<b>42</b>	<b>90.5</b>	<b>77.2</b>	<b>96.4</b>	<b>7.1</b>	<b>2.4</b>	<b>6.0</b>	<b>−10.1</b>	<b>22.1</b>
<b>Wales</b>	<b>175</b>	<b>72.0</b>	<b>64.9</b>	<b>78.2</b>	<b>22.3</b>	<b>5.7</b>	<b>−3.8</b>	<b>−15.5</b>	<b>8.0</b>
<b>E, W &amp; NI</b>	<b>2,855</b>	<b>80.3</b>	<b>78.8</b>	<b>81.7</b>	<b>12.2</b>	<b>7.5</b>	<b>−2.8</b>	<b>−5.4</b>	<b>−0.1</b>

Blank cells denote low patient numbers last year precluding calculation of change in target attainment



**Fig. 9.15.** Funnel plot for percentage of haemodialysis patients within the range for bicarbonate (18–24 mmol/L) by centre in 2010



**Fig. 9.16.** Funnel plot for percentage of peritoneal dialysis patients within the range for bicarbonate (22–30 mmol/L) by centre in 2010

guidance on lipid management states:

*‘Three hydroxy-3 methylglutaryl-Co-enzyme A reductase inhibitors (statins) should be considered for primary prevention in all CKD including dialysis patients with a 10-year risk of cardiovascular disease, calculated as >20% according to the Joint British Societies’ Guidelines (JBS 2), despite the fact that these calculations have not been validated in patients with renal disease. The target total cholesterol should be <4 mmol/l or a 25% reduction from baseline, and a fasting low density lipoprotein (LDL)-cholesterol of <2 mmol/l or a 30% reduction from baseline, should be achieved, whichever is the greatest reduction in all*

*patients (Evidence in CKD 1–3, Good Practice in CKD 4–5 and dialysis patients). Statins should not be withdrawn from patients in whom they were previously indicated and should continue to be prescribed when such patients start renal replacement therapy (RRT) or change modality. (Good Practice).’ (Module 2: Complications) [7]*

Total cholesterol data were 83% complete for HD patients and 79% complete for PD patients. As there are no specific audit measures for total cholesterol, summary data are presented for each dialysis centre (tables 9.18, 9.19, figures 9.17, 9.18). There are a

**Table 9.18.** Summary statistics for total cholesterol in haemodialysis patients by centre in 2010

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
Antrim	98	120	3.7	0.9	3.6	3.0	4.2
B Heart	97	384	4.2	1.1	4.1	3.4	4.9
B QEH	67	553	3.9	1.0	3.8	3.2	4.5
Bangor	90	74	4.3	1.0	4.1	3.6	4.9
Basldn	97	128	3.5	1.1	3.4	2.8	4.0
Belfast	90	195	3.9	1.2	3.8	3.1	4.7
Bradfd	88	145	3.8	1.0	3.7	3.1	4.2
Brightn	29	95					
Bristol	90	387	4.1	1.3	3.9	3.2	4.8
Camb	66	212	3.8	1.0	3.7	3.1	4.5
Cardff	94	425	3.9	1.1	3.8	3.2	4.5
Carlisle	98	51	4.1	1.2	3.8	3.2	5.0
Carsh	88	604	4.2	1.2	4.0	3.4	4.8
Chelms	94	105	3.6	1.0	3.4	2.9	4.0
Clwyd	92	56	4.0	0.9	4.0	3.3	4.5
Colchr	84	83	3.8	1.1	3.8	3.1	4.3

**Table 9.18.** Continued

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
Covnt	0	1					
Derby	88	177	3.8	1.0	3.6	3.1	4.3
Derry	100	53	3.7	0.9	3.5	3.1	4.2
Donc	88	114	3.9	1.1	3.8	3.1	4.5
Dorset	96	217	4.1	1.0	4.0	3.4	4.6
Dudley	89	128	3.7	1.0	3.7	3.0	4.3
Exeter	96	309	4.0	1.1	3.9	3.2	4.6
Glouc	93	165	3.9	1.0	3.8	3.1	4.5
Hull	59	183	4.1	1.1	4.0	3.3	4.7
Ipswi	91	96	3.9	1.1	3.8	3.3	4.6
Kent	93	310	4.1	1.1	4.0	3.3	4.7
L Barts	98	737	4.1	1.1	3.9	3.3	4.7
L Guys	79	418	4.1	1.1	4.0	3.3	4.7
L Kings	91	354	4.1	1.0	3.9	3.4	4.6
L Rfree	86	552	4.1	1.1	4.0	3.3	4.7
L St.G	95	253	3.8	1.1	3.7	3.0	4.4
L West	98	1,220	3.6	0.9	3.5	3.0	4.1
Leeds	99	432	3.9	0.9	3.8	3.3	4.4
Leic	91	665	3.8	1.0	3.7	3.2	4.4
Liv Ain	3	4					
Liv RI	2	7					
M Hope	71	238	3.7	1.0	3.7	3.0	4.3
M RI	86	377	3.8	1.1	3.7	3.0	4.5
Middlbr	97	256	4.2	1.2	4.1	3.3	5.0
Newc	99	245	3.8	1.0	3.7	3.1	4.5
Newry	99	99	3.5	1.0	3.3	2.8	4.3
Norwch	99	296	4.0	1.0	3.9	3.2	4.6
Nottm	99	380	3.9	1.0	3.7	3.2	4.4
Oxford	84	297	3.8	1.0	3.8	3.0	4.4
Plymth	90	112	3.9	1.0	3.7	3.2	4.6
Ports	64	282	4.0	1.2	3.9	3.2	4.8
Prestn	98	457	3.9	1.0	3.8	3.3	4.5
Redng	99	240	3.9	0.9	3.8	3.3	4.4
Sheff	93	526	4.0	1.1	3.9	3.2	4.7
Shrew	93	173	4.1	1.1	4.0	3.4	4.7
Stevng	17	61					
Sthend	92	110	4.0	1.0	4.0	3.3	4.5
Stoke	96	268	3.9	0.9	3.9	3.2	4.6
Sund	98	161	4.3	1.3	4.1	3.4	4.9
Swanse	99	321	4.0	1.1	3.8	3.2	4.6
Truro	99	138	4.0	1.1	3.9	3.4	4.5
Tyrone	98	88	3.7	0.8	3.6	3.2	4.2
Ulster	100	86	3.5	0.9	3.5	2.9	4.1
Wirral	61	106	3.8	1.0	3.7	3.1	4.3
Wolve	96	275	4.3	1.1	4.3	3.6	5.0
Wrexm	74	53	4.0	1.0	4.0	3.3	4.4
York	94	131	4.4	1.1	4.3	3.6	5.2
<b>England</b>	<b>82</b>	<b>14,218</b>	<b>3.9</b>	<b>1.1</b>	<b>3.8</b>	<b>3.2</b>	<b>4.6</b>
<b>N Ireland</b>	<b>96</b>	<b>641</b>	<b>3.7</b>	<b>1.0</b>	<b>3.6</b>	<b>3.0</b>	<b>4.3</b>
<b>Wales</b>	<b>94</b>	<b>929</b>	<b>4.0</b>	<b>1.1</b>	<b>3.9</b>	<b>3.2</b>	<b>4.6</b>
<b>E, W &amp; NI</b>	<b>83</b>	<b>15,788</b>	<b>3.9</b>	<b>1.1</b>	<b>3.8</b>	<b>3.2</b>	<b>4.6</b>

Blank cells denote low patient numbers or poor data completeness

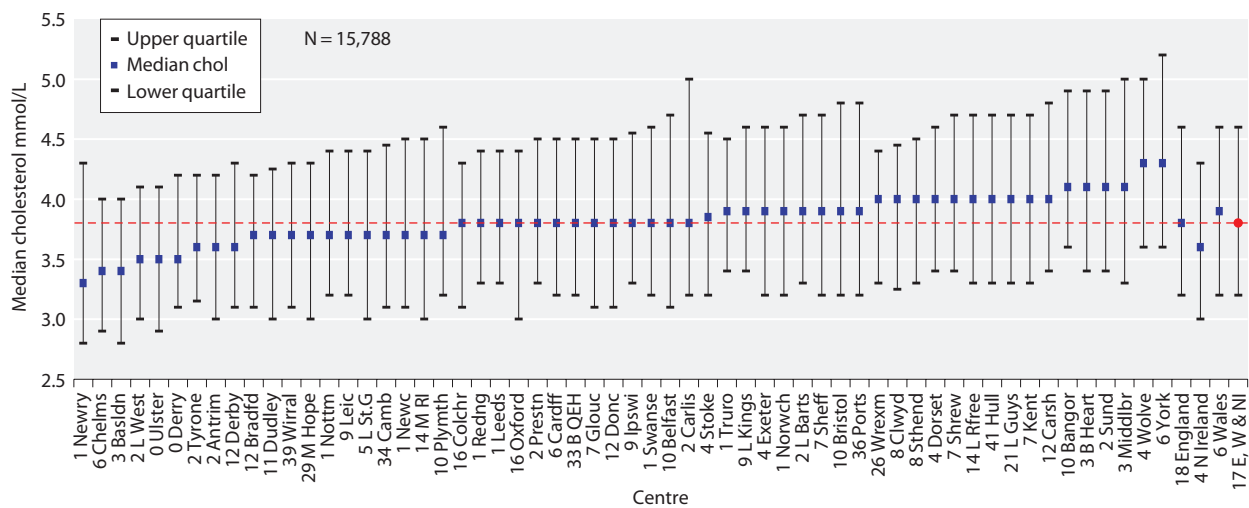
**Table 9.19.** Summary statistics for total cholesterol in peritoneal dialysis patients by centre in 2010

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
Antrim	100	11					
B Heart	100	36	5.3	1.6	5.3	4.1	6.1
B QEH	87	122	4.4	1.2	4.3	3.7	4.8
Bangor	96	22	5.0	1.1	4.8	4.4	5.2
Basldn	100	24	4.3	1.2	4.0	3.7	5.1
Belfast	100	25	4.5	1.0	4.5	4.1	5.0
Bradfd	91	30	4.3	1.0	4.1	3.4	5.1
Brightn	40	30					
Bristol	77	43	4.6	1.3	4.6	3.7	5.5
Camb	100	31	4.1	1.1	4.1	3.2	4.8
Cardff	99	86	4.6	1.2	4.7	3.6	5.4
Carlis	92	11					
Carsh	22	20					
Chelms	84	27	4.0	1.1	3.8	3.2	4.3
Clwyd	60	3					
Covnt	0	0					
Derby	69	61	4.5	1.2	4.5	3.5	5.3
Derry	100	2					
Donc	48	11					
Dorset	92	47	4.5	1.2	4.3	3.6	5.1
Dudley	57	33	4.1	1.2	3.9	3.2	5.0
Exeter	99	68	4.8	1.1	4.6	4.2	5.3
Glouc	100	39	4.6	1.3	4.6	3.6	5.5
Hull	42	26					
Ipswi	100	35	4.4	1.0	4.4	3.6	5.3
Kent	94	63	4.7	1.0	4.7	4.1	5.4
L Barts	97	168	4.4	1.0	4.3	3.7	4.9
L Guys	93	40	4.7	1.1	4.6	3.9	5.3
L Kings	98	82	4.6	1.3	4.4	3.7	5.1
L Rfree	100	63	4.7	1.5	4.5	3.7	5.3
L St.G	98	53	4.6	1.2	4.5	3.6	5.6
L West	100	31	4.4	1.1	4.1	3.4	5.0
Leeds	99	83	4.2	0.8	4.0	3.6	4.8
Leic	95	134	4.3	1.2	4.2	3.5	5.0
Liv Ain	0	0					
Liv RI	1	1					
M Hope	58	64	4.4	1.3	4.3	3.5	5.1
M RI	99	74	4.6	1.1	4.6	3.7	5.3
Middlbr	39	7					
Newc	100	45	4.3	1.1	4.3	3.4	5.0
Newry	100	8					
Norwch	98	45	4.6	1.0	4.6	4.0	5.4
Nottm	90	70	4.5	1.2	4.6	3.6	5.2
Oxford	90	91	4.5	1.2	4.2	3.6	5.0
Plymth	95	41	4.4	1.2	4.1	3.8	5.2
Ports	81	74	4.5	1.3	4.2	3.6	5.2
Prestn	87	52	4.8	1.2	4.6	4.2	5.2
Redng	85	66	4.6	1.4	4.4	3.7	5.2
Sheff	45	27					
Shrew	50	9					
Stevng	75	21	4.9	1.3	4.7	3.8	5.7
Sthend	83	15					
Stoke	98	64	4.1	1.4	4.0	3.2	5.2
Sund	93	27	4.5	0.8	4.4	3.9	5.2
Swanse	78	35	4.6	1.3	4.4	3.7	5.8

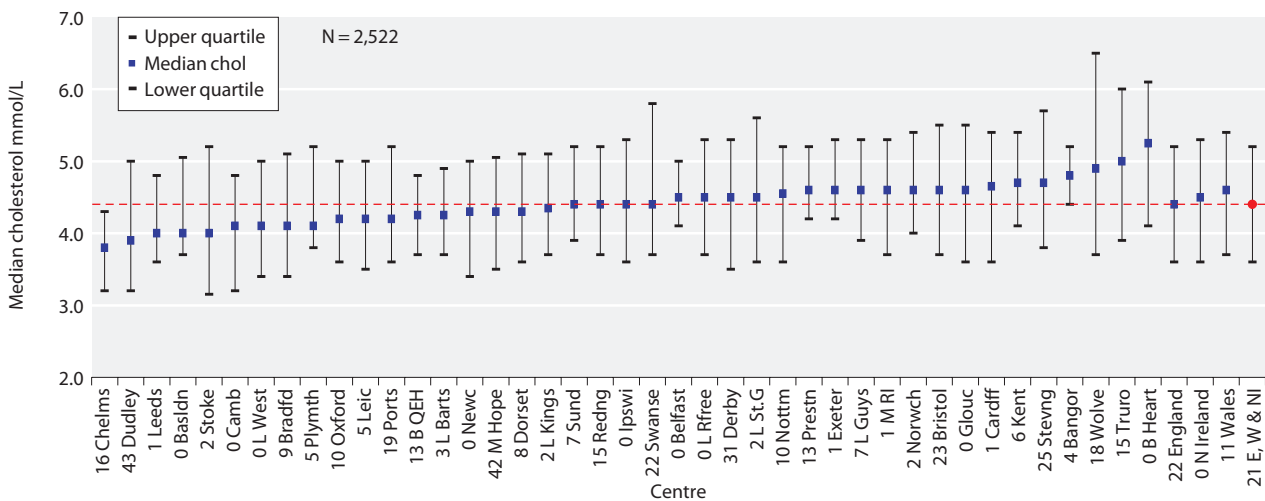
**Table 9.19.** Continued

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
Truro	85	22	4.9	1.3	5.0	3.9	6.0
Tyrone	100	7					
Ulster	100	2					
Wirral	40	14					
Wolve	82	51	5.0	1.8	4.9	3.7	6.5
Wrexm	75	15					
York	88	15					
<b>England</b>	<b>78</b>	<b>2,306</b>	<b>4.5</b>	<b>1.2</b>	<b>4.4</b>	<b>3.6</b>	<b>5.2</b>
<b>N Ireland</b>	<b>100</b>	<b>55</b>	<b>4.5</b>	<b>1.1</b>	<b>4.5</b>	<b>3.6</b>	<b>5.3</b>
<b>Wales</b>	<b>89</b>	<b>161</b>	<b>4.7</b>	<b>1.3</b>	<b>4.6</b>	<b>3.7</b>	<b>5.4</b>
<b>E, W &amp; NI</b>	<b>79</b>	<b>2,522</b>	<b>4.5</b>	<b>1.2</b>	<b>4.4</b>	<b>3.6</b>	<b>5.2</b>

Blank cells denote low patient numbers or poor data completeness



**Fig. 9.17.** Median total cholesterol in haemodialysis patients by centre in 2010



**Fig. 9.18.** Median total cholesterol in peritoneal dialysis patients by centre in 2010

number of case-mix factors (comorbidity, inflammation, malnutrition) which may account for any inter-centre variation in addition to differences in prescription of lipid lowering medication and other therapies known

to influence serum lipid concentration e.g. steroids, sevelamer etc.

Conflicts of interest: none

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