
Chapter 10

Biochemistry profile of patients receiving dialysis in the UK in 2007: national and centre-specific analyses

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Key Words

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

Abstract

Introduction: The UK Renal Association Clinical Practice Guidelines include clinical performance measures for biochemical parameters in dialysis patients [1]. The UK Renal Registry (UKRR) annually audits dialysis centre performance against these measures as part of its role in promoting continuous quality improvement. **Methods:** Cross sectional performance analyses were undertaken to compare dialysis centre achievement of clinical audit measures for prevalent haemodialysis (HD) and peritoneal dialysis (PD) cohorts in 2007. The biochemical variables studied were phosphate, adjusted calcium, parathyroid hormone, bicarbonate and total cholesterol. In addition longitudinal analyses were performed (2000–2007) to show changes in achievement of clinical performance measures over time. **Results:** Serum phosphate was between 1.1–1.8 mmol/L in 53% of HD and 64% of PD patients. Since 2003 there has been annual improvement in phosphate control for both HD and PD patients, largely through a reduction in phosphate >1.8 mmol/L. PD patients this year also showed a reduction

in the percentage with a low phosphate. Adjusted calcium was between 2.2–2.6 mmol/L in 73% of HD and 78% of PD patients. Parathyroid hormone was between 16–32 pmol/L in 25% of HD and 27% of PD patients. The audit measure for bicarbonate was achieved in 71% of HD and 50% of PD patients. There was inter-centre variation for all variables studied. **Conclusions:** The UKRR consistently demonstrates inter-centre variation in achievement of biochemical clinical audit measures. Understanding the causes of this variation is an important part of improving the care of dialysis patients in the UK.

Introduction

The UKRR collected routine biochemical data from clinical information systems in renal centres in England, Wales and Northern Ireland. Annual cross sectional analyses were undertaken on some of these variables to determine centre level performance against national (Renal Association) clinical performance measures. This enabled UK renal centres to compare their own performance against each other and to the UK average performance [2]. The UK Renal Association Clinical Practice Guidelines were revised and the final version

of the 4th edition of these guidelines was published in November 2007 (although a draft version was available for some time prior to this) [1]. Audit data for 2007 therefore spanned the adoption of these guidelines which included revision of some of the audit measures. 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) needed 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. The format of data presentation has been revised compared to previous UKRR reports [2]. To supplement these performance analyses, summary statistical data enhanced understanding of the population characteristics of each centre and longitudinal analyses demonstrated changes over time.

Methods

These analyses relate to biochemical variables in the prevalent dialysis cohort in England, Wales and Northern Ireland in 2007. The cohort studied were patients prevalent on dialysis treatment on 31/12/07. HD and PD cohorts were analysed separately.

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 2007 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. 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 [2]. The audit measure for adjusted calcium in the 4th edition of the Renal Association Clinical Practice Guidelines depends on a local reference range [1]. To enable comparative

audit the UKRR has continued to use adjusted calcium between 2.2–2.6 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. This equates to 16–32 pmol/L and is comparable to KDOQI (15–31 pmol/L) [2, 4, 5]. The measure used for serum bicarbonate in the PD cohort was 25–29 mmol/L (the same as previous years) as the new audit measure specifies that serum bicarbonate should be maintained in the ‘normal range’. A summary of the current Renal Association audit measures and conversion factors to SI units are given in table 10.1.

Quarterly values were extracted from the database for the last two quarters of 2007 for calcium, bicarbonate and phosphate, the last three quarters for iPTH 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% completeness were excluded from plots showing centre performance. Data were also excluded from plots when there were less than 20 patients with data at centre 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. 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 units’ [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 cross-referencing the ‘n’ value with the proportion of patients achieving the audit measure in the relevant table. Longitudinal analyses were performed for some data to calculate overall changes in achievement of a performance measure annually from 2000 to 2007. All data were unadjusted for case-mix.

Results

Mineral and bone parameters

Phosphate

The 4th edition of the Renal Association Clinical Practice Guidelines states:

Table 10.1. Summary of clinical audit measures and conversion factors from SI units

Biochemical variable	Clinical audit measure	Conversion factor from SI units
Phosphate	1.1–1.8 mmol/L	mg/dl = mmol/L × 3.1
Calcium	Normal range (ideally <2.5 mmol/L)	mg/dl = mmol/L × 4
Parathyroid hormone	2–4 times upper limit of normal	ng/L = pmol/L × 9.5
Bicarbonate	HD patients: 20–26 mmol/L PD patients: normal range	mg/dl = mmol/L × 6.1
Cholesterol	No audit measure	mg/dl = mmol/L × 38.6

‘Serum phosphate in dialysis patients (measured before a “short gap” dialysis session in HD patients) should be maintained between 1.1 and 1.8 mmol/L.’ (Module 2: Complications) [1]

The data for serum phosphate were 90% complete for HD patients and 95% complete for PD patients overall although there was considerable variation between centres. Data from HD patients in Coventry and London West and PD patients in London West were not included as there was a problem with data extraction (tables 10.2 and 10.4).

The individual centres’ means and standard deviations are shown in tables 10.2 and 10.4.

There was between centre variation in the proportion of patients below, within and above the range specified by the clinical performance measure (figures

10.1–10.12). Fifty three percent (CI 53–54%) of HD patients and 64% (CI 62–66%) of PD patients achieved a phosphate between 1.1–1.8 mmol/L (tables 10.3 and 10.5). The proportion of HD patients with hyperphosphataemia was 31% (CI 31–32%) compared to 33% in 2006 and the proportion with hypophosphataemia was 15% (CI 15–16%) compared to 13% in 2006 (table 10.3 and figure 10.13). The proportion of PD patients with hyperphosphataemia was 26% (CI 24–27%) compared to 25% in 2006 and the proportion with hypophosphataemia was 10% (CI 9–11%) compared to 12% in 2006 (table 10.5 and figure 10.13).

Adjusted Calcium

The 4th edition of the Renal Association Clinical Practice Guidelines states:

Table 10.2. Summary statistics for phosphate in all haemodialysis patients in 2007

Centre	% completeness	Number of patients with data	Mean	SD	Median	Lower quartile	Upper quartile
Antrim	99.2	122	1.55	0.51	1.48	1.18	1.81
B Heart	93.6	334	1.71	0.51	1.66	1.34	2.02
B QEH	95.7	662	1.63	0.49	1.59	1.31	1.89
Bangor	96.7	58	1.64	0.45	1.62	1.24	2.03
Basldn	98.4	121	1.66	0.52	1.58	1.30	1.97
Belfast	96.3	237	1.60	0.54	1.55	1.20	1.84
Bradfd	99.4	158	1.62	0.54	1.52	1.25	1.95
Brightn	99.7	297	1.53	0.50	1.51	1.18	1.81
Bristol	100.0	428	1.72	0.52	1.68	1.38	2.00
Camb	56.0	186	1.58	0.57	1.54	1.17	1.83
Cardff	97.1	442	1.63	0.51	1.58	1.28	1.96
Carlisle	95.1	77	1.82	0.49	1.78	1.49	2.07
Carsh	84.6	444	1.66	0.57	1.61	1.28	1.94
Chelms	100.0	94	1.58	0.49	1.53	1.18	1.92
Clwyd	94.0	63	1.45	0.53	1.40	1.10	1.73
Covnt	0.0	0					
Derby	100.0	183	1.63	0.56	1.58	1.25	1.93
Derry	100.0	41	1.73	0.66	1.64	1.23	2.01
Donc	100.0	54	1.68	0.63	1.60	1.20	2.10
Dorset	100.0	139	1.63	0.51	1.57	1.28	2.00
Dudley	86.4	95	1.61	0.57	1.58	1.28	1.93
Exeter	99.2	260	1.64	0.53	1.56	1.27	1.90
Glouc	99.4	161	1.62	0.48	1.56	1.28	1.95
Hull	97.7	291	1.51	0.58	1.49	1.12	1.84
Ipswi	100.0	90	1.64	0.48	1.62	1.27	1.91
L Barts	99.8	550	1.63	0.53	1.61	1.29	1.91
L Guys	96.6	429	1.48	0.50	1.50	1.10	1.80
L Kings	100.0	309	1.51	0.46	1.45	1.16	1.81
L Rfree	82.2	465	1.50	0.57	1.43	1.08	1.86
L West	35.7	351					
Leeds	97.5	463	1.59	0.52	1.52	1.25	1.91
Leic	98.9	626	1.68	0.49	1.64	1.33	1.97

Table 10.2. Continued

Centre	% completeness	Number of patients with data	Mean	SD	Median	Lower quartile	Upper quartile
Liv Ain	98.2	109	1.59	0.52	1.56	1.21	1.91
Liv RI	93.1	366	1.59	0.53	1.53	1.22	1.84
M Hope	85.9	262	1.57	0.60	1.46	1.14	1.91
M RI	70.4	221	1.59	0.58	1.51	1.19	1.94
Middlbr	98.5	257	1.72	0.57	1.64	1.35	2.02
Newc	100.0	208	1.60	0.56	1.56	1.23	1.86
Newry	98.8	82	1.62	0.54	1.53	1.21	1.88
Norwch	90.1	210	1.63	0.51	1.54	1.29	1.88
Nottm	98.3	339	1.58	0.52	1.50	1.20	1.90
Oxford	99.1	323	1.59	0.52	1.57	1.20	1.90
Plymth	98.3	117	1.75	0.55	1.67	1.36	2.03
Ports	99.2	370	1.79	0.58	1.74	1.43	2.14
Prestn	99.5	381	1.68	0.54	1.61	1.30	2.00
Redng	100.0	210	1.38	0.45	1.39	1.01	1.69
Sheff	99.0	507	1.72	0.48	1.66	1.38	2.02
Shrew	97.3	143	1.92	0.60	1.83	1.49	2.27
Stevng	94.8	291	1.71	0.51	1.62	1.35	1.99
Sthend	97.4	112	1.60	0.52	1.53	1.19	1.91
Stoke	99.6	241	1.54	0.54	1.50	1.11	1.80
Sund	96.0	142	1.66	0.57	1.59	1.28	1.99
Swanse	99.3	273	1.54	0.53	1.47	1.17	1.84
Truro	99.3	142	1.74	0.49	1.67	1.46	1.93
Tyrone	97.2	69	1.66	0.48	1.60	1.30	1.96
Ulster	100.0	74	1.58	0.43	1.52	1.24	1.88
Wirral	94.2	161	1.50	0.54	1.40	1.12	1.80
Wolve	99.6	252	1.58	0.60	1.51	1.15	1.87
Wrexm	98.7	73	1.45	0.50	1.47	1.15	1.71
York	100.0	107	1.66	0.54	1.54	1.32	1.91
England	88.7	12,738	1.62	0.54	1.57	1.25	1.91
N Ireland	98.0	625	1.60	0.53	1.54	1.23	1.88
Wales	97.6	909	1.58	0.52	1.52	1.21	1.89
E, W & NI	89.6	14,272	1.61	0.54	1.56	1.24	1.91

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

Table 10.3. Percentage of haemodialysis patients within, below and above the range for phosphate (1.1–1.8 mmol/L) in 2007

Centre	N	% phos 1.1–1.8 mmol/L			% phos <1.1 mmol/L			% phos >1.8 mmol/L		
		Lower 95% CI	Upper 95% CI		Lower 95% CI	Upper 95% CI		Lower 95% CI	Upper 95% CI	
Antrim	122	56.6	47.7	65.1	18.0	12.2	25.9	25.4	18.5	33.9
B Heart	334	54.5	49.1	59.8	9.0	6.4	12.6	36.5	31.5	41.8
B QEH	662	60.9	57.1	64.5	10.0	7.9	12.5	29.2	25.8	32.7
Bangor	58	50.0	37.4	62.6	8.6	3.6	19.1	41.4	29.5	54.3
Basldn	121	53.7	44.8	62.4	14.1	8.9	21.4	32.2	24.5	41.1
Belfast	237	55.7	49.3	61.9	17.3	13.0	22.7	27.0	21.7	33.0
Bradfd	158	51.3	43.5	59.0	13.9	9.4	20.2	34.8	27.8	42.6
Brightn	297	54.2	48.5	59.8	20.2	16.0	25.2	25.6	21.0	30.9
Bristol	428	51.4	46.7	56.1	10.1	7.5	13.3	38.6	34.1	43.3
Camb	186	54.3	47.1	61.3	18.3	13.4	24.5	27.4	21.5	34.3
Cardff	442	52.5	47.8	57.1	14.7	11.7	18.3	32.8	28.6	37.3
Carlisle	77	46.8	36.0	57.9	6.5	2.7	14.7	46.8	36.0	57.9

Table 10.3. Continued

Centre	N	% phos 1.1–1.8 mmol/L	Lower 95% CI	Upper 95% CI	% phos <1.1 mmol/L	Lower 95% CI	Upper 95% CI	% phos >1.8 mmol/L	Lower 95% CI	Upper 95% CI
Carsh	444	52.0	47.4	56.6	13.7	10.8	17.3	34.2	30.0	38.8
Chelms	94	56.4	46.2	66.0	14.9	9.0	23.6	28.7	20.5	38.7
Clwyd	63	55.6	43.2	67.3	23.8	14.9	35.8	20.6	12.4	32.4
Derby	183	52.5	45.2	59.6	14.2	9.9	20.1	33.3	26.9	40.5
Derry	41	41.5	27.6	56.9	14.6	6.7	29.0	43.9	29.7	59.2
Donc	54	50.0	37.0	63.0	14.8	7.6	26.9	35.2	23.7	48.7
Dorset	139	54.7	46.4	62.8	11.5	7.2	18.0	33.8	26.4	42.1
Dudley	95	52.6	42.6	62.4	14.7	8.9	23.4	32.6	24.0	42.7
Exeter	260	55.8	49.7	61.7	14.2	10.5	19.0	30.0	24.7	35.9
Glouc	161	57.1	49.4	64.6	11.8	7.7	17.8	31.1	24.4	38.6
Hull	291	47.1	41.4	52.8	24.4	19.8	29.7	28.5	23.6	34.0
Ipswi	90	60.0	49.6	69.6	8.9	4.5	16.8	31.1	22.4	41.4
L Barts	550	53.3	49.1	57.4	15.1	12.3	18.3	31.6	27.9	35.6
L Guys	429	61.5	56.8	66.0	18.7	15.2	22.6	19.8	16.3	23.9
L Kings	309	55.3	49.8	60.8	19.4	15.4	24.2	25.2	20.7	30.4
L Rfree	465	45.2	40.7	49.7	27.3	23.5	31.5	27.5	23.7	31.8
Leeds	463	52.7	48.1	57.2	16.4	13.3	20.1	30.9	26.8	35.2
Leic	626	54.8	50.9	58.7	8.5	6.5	10.9	36.7	33.1	40.6
Liv Ain	109	55.1	45.6	64.1	16.5	10.7	24.7	28.4	20.8	37.6
Liv RI	366	54.4	49.2	59.4	18.6	14.9	22.9	27.1	22.8	31.8
M Hope	262	44.7	38.7	50.7	23.3	18.6	28.8	32.1	26.7	38.0
M RI	221	50.7	44.1	57.2	18.6	14.0	24.2	30.8	25.0	37.2
Middlbr	257	47.1	41.1	53.2	13.6	9.9	18.4	39.3	33.5	45.4
Newc	208	56.3	49.4	62.8	15.9	11.5	21.5	27.9	22.2	34.4
Newry	82	57.3	46.4	67.5	13.4	7.6	22.6	29.3	20.5	40.0
Norwch	210	55.2	48.5	61.8	11.9	8.2	17.0	32.9	26.8	39.5
Nottm	339	61.1	55.8	66.1	13.6	10.3	17.6	25.4	21.0	30.3
Oxford	323	53.9	48.4	59.2	16.7	13.0	21.2	29.4	24.7	34.6
Plymth	117	47.0	38.2	56.1	10.3	5.9	17.2	42.7	34.1	51.8
Ports	370	47.6	42.5	52.7	9.2	6.6	12.6	43.2	38.3	48.3
Prestn	381	50.7	45.7	55.7	12.3	9.4	16.0	37.0	32.3	42.0
Redng	210	50.0	43.3	56.7	30.5	24.6	37.0	19.5	14.7	25.4
Sheff	507	52.1	47.7	56.4	8.1	6.0	10.8	39.8	35.7	44.2
Shrew	143	43.4	35.5	51.6	3.5	1.5	8.1	53.2	45.0	61.2
Stevng	291	56.0	50.3	61.6	7.9	5.3	11.6	36.1	30.8	41.8
Sthend	112	51.8	42.6	60.9	14.3	8.9	22.1	33.9	25.8	43.2
Stoke	241	57.7	51.4	63.8	19.1	14.6	24.5	23.2	18.3	29.0
Sund	142	49.3	41.2	57.5	15.5	10.4	22.4	35.2	27.8	43.4
Swanse	273	54.6	48.6	60.4	18.3	14.2	23.4	27.1	22.2	32.7
Truro	142	54.9	46.7	62.9	7.0	3.8	12.6	38.0	30.4	46.3
Tyrone	69	56.5	44.7	67.7	7.3	3.1	16.3	36.2	25.8	48.1
Ulster	74	59.5	48.0	70.0	12.2	6.5	21.8	28.4	19.3	39.6
Wirral	161	59.0	51.3	66.3	17.4	12.3	24.0	23.6	17.7	30.8
Wolve	252	48.4	42.3	54.6	22.6	17.9	28.2	29.0	23.7	34.9
Wrexm	73	56.2	44.7	67.0	23.3	15.0	34.3	20.6	12.8	31.3
York	107	52.3	42.9	61.6	13.1	7.9	20.9	34.6	26.2	44.1
England	12,738	53.2	52.3	54.0	15.4	14.8	16.0	31.5	30.7	32.3
N Ireland	625	55.7	51.8	59.5	15.0	12.5	18.1	29.3	25.8	33.0
Wales	909	53.5	50.2	56.7	16.7	14.4	19.3	29.8	26.9	32.9
E, W & NI	14,272	53.3	52.5	54.1	15.4	14.9	16.0	31.3	30.5	32.0

Table 10.4. Summary statistics for phosphate in peritoneal dialysis patients in 2007

Centre	% completeness	Number of patients with data	Mean	SD	Median	Lower quartile	Upper quartile
Antrim	94	16					
B Heart	97	31	1.43	0.32	1.40	1.20	1.59
B QEH	86	118	1.56	0.46	1.53	1.23	1.81
Bangor	100	31	1.46	0.37	1.44	1.09	1.75
Basldn	100	26	1.50	0.38	1.42	1.25	1.67
Belfast	96	57	1.63	0.46	1.62	1.28	1.99
Bradfd	100	36	1.58	0.48	1.56	1.19	1.86
Brightn	100	78	1.43	0.34	1.43	1.21	1.62
Bristol	100	72	1.70	0.45	1.68	1.42	2.00
Camb	100	47	1.36	0.33	1.40	1.12	1.56
Cardff	99	147	1.62	0.43	1.55	1.34	1.85
Carlis	100	11					
Carsh	97	113	1.59	0.41	1.57	1.34	1.85
Chelms	97	36	1.57	0.31	1.50	1.36	1.80
Clwyd	92	13					
Covnt	86	65	1.51	0.45	1.45	1.17	1.82
Derby	100	71	1.50	0.31	1.47	1.26	1.67
Derry	100	4					
Donc	100	33	1.63	0.46	1.50	1.40	1.80
Dorset	96	56	1.47	0.34	1.45	1.23	1.75
Dudley	94	54	1.59	0.44	1.50	1.33	1.82
Exeter	100	70	1.50	0.36	1.46	1.24	1.73
Glouc	100	30	1.72	0.41	1.72	1.49	2.03
Hull	95	83	1.63	0.39	1.60	1.40	1.83
Ipswi	98	45	1.68	0.46	1.63	1.32	1.89
L Barts	100	218	1.53	0.43	1.49	1.24	1.76
L Guys	98	60	1.50	0.40	1.50	1.30	1.80
L Kings	99	75	1.55	0.43	1.50	1.27	1.75
L Rfree	95	120	1.54	0.39	1.48	1.29	1.81
L West	2	64					
Leeds	99	99	1.57	0.51	1.49	1.21	1.80
Leic	99	180	1.62	0.50	1.51	1.30	1.87
Liv Ain	n/a	n/a					
Liv RI	91	92	1.59	0.44	1.58	1.29	1.75
M Hope	95	116	1.54	0.43	1.54	1.25	1.79
M RI	100	115	1.62	0.45	1.56	1.26	1.96
Middlbr	92	25	1.61	0.39	1.53	1.39	1.84
Newc	100	46	1.76	0.43	1.69	1.45	1.98
Newry	100	13					
Norwch	96	57	1.54	0.39	1.50	1.24	1.79
Nottm	100	135	1.56	0.40	1.50	1.30	1.80
Oxford	100	133	1.63	0.50	1.55	1.34	1.84
Plymth	100	38	1.55	0.46	1.45	1.28	1.73
Ports	83	92	1.83	0.44	1.83	1.46	2.08
Prestn	99	77	1.68	0.44	1.68	1.42	1.97
Redng	100	86	1.41	0.36	1.36	1.18	1.56
Sheff	100	88	1.71	0.41	1.65	1.48	1.91
Shrew	94	33	1.71	0.51	1.67	1.36	1.93
Stevng	97	38	1.56	0.33	1.54	1.33	1.81
Sthend	94	18					
Stoke	100	90	1.61	0.40	1.60	1.30	1.80
Sund	100	10					
Swanse	96	74	1.49	0.40	1.47	1.23	1.69
Truro	100	23	1.70	0.41	1.57	1.37	2.09
Tyrone	100	5					
Ulster	100	2					
Wirral	68	28					
Wolve	98	53	1.55	0.44	1.49	1.27	1.72
Wrexm	90	30	1.68	0.42	1.56	1.46	1.85
York	96	23	1.56	0.31	1.60	1.31	1.81
England	95	3,143	1.58	0.43	1.29	1.53	1.81
N Ireland	97	94	1.61	0.41	1.28	1.62	1.90
Wales	97	286	1.58	0.42	1.32	1.53	1.83
E, W & NI	95	3,523	1.58	0.43	1.30	1.53	1.82

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

n/a not applicable

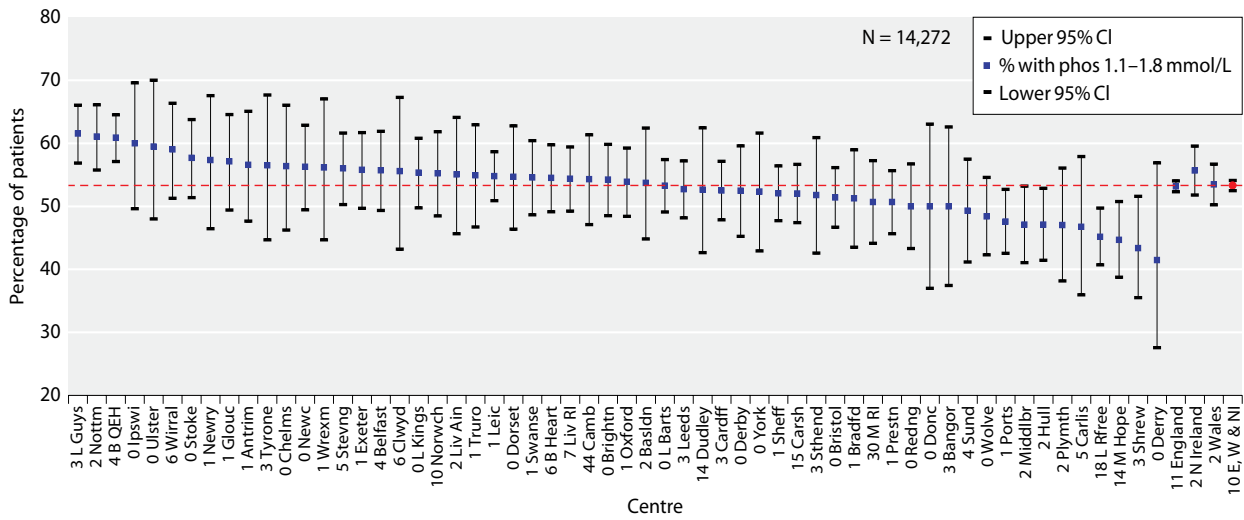


Fig. 10.1. Percentage of haemodialysis patients with phosphate 1.1–1.8 mmol/L by centre in 2007

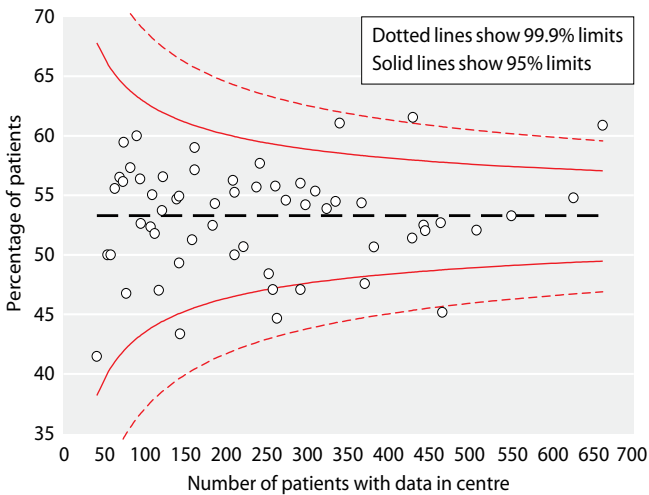


Fig. 10.2. Funnel plot of percentage of haemodialysis patients with phosphate 1.1–1.8 mmol/L by centre in 2007

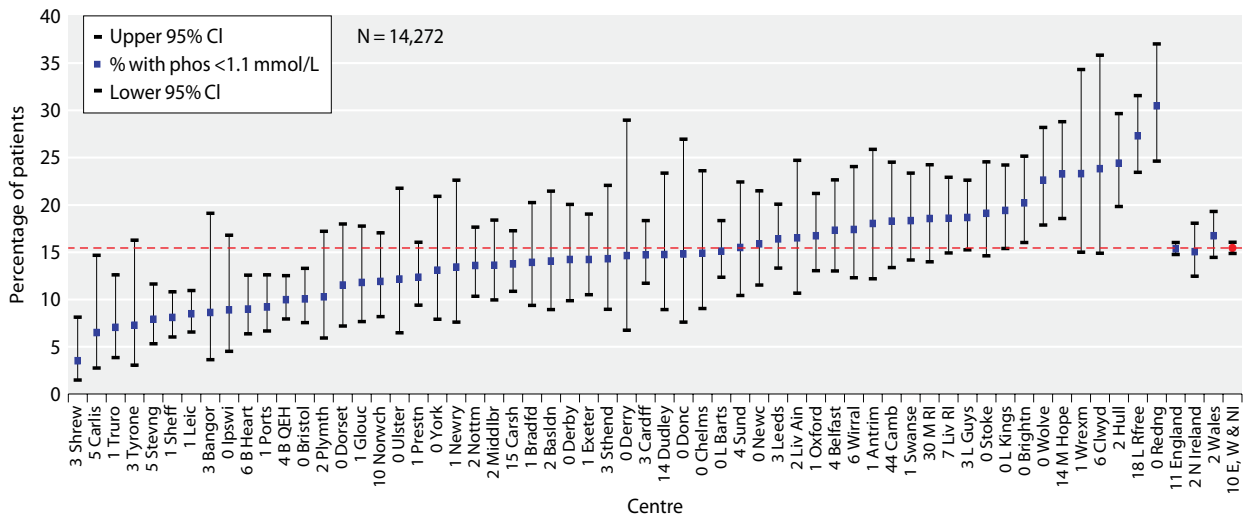


Fig. 10.3. Percentage of haemodialysis patients with phosphate <1.1 mmol/L by centre in 2007

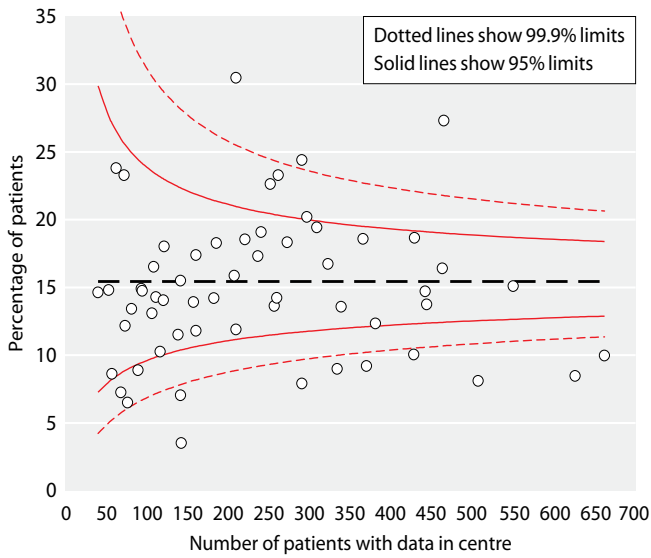


Fig. 10.4. Funnel plot of percentage of haemodialysis patients with phosphate <1.1 mmol/L by centre in 2007

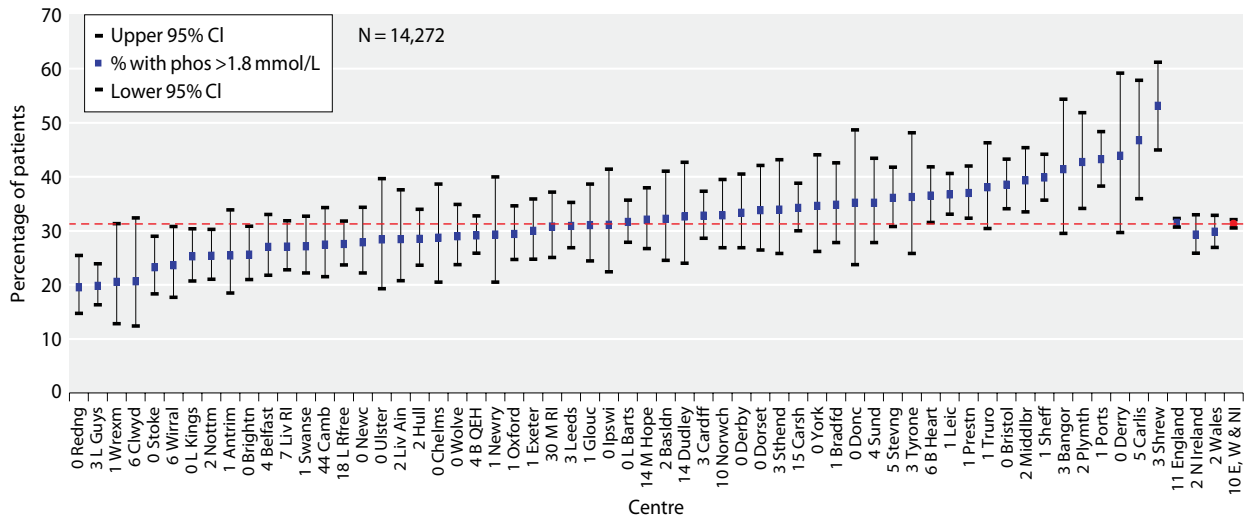


Fig. 10.5. Percentage of haemodialysis patients with phosphate >1.8 mmol/L by centre in 2007

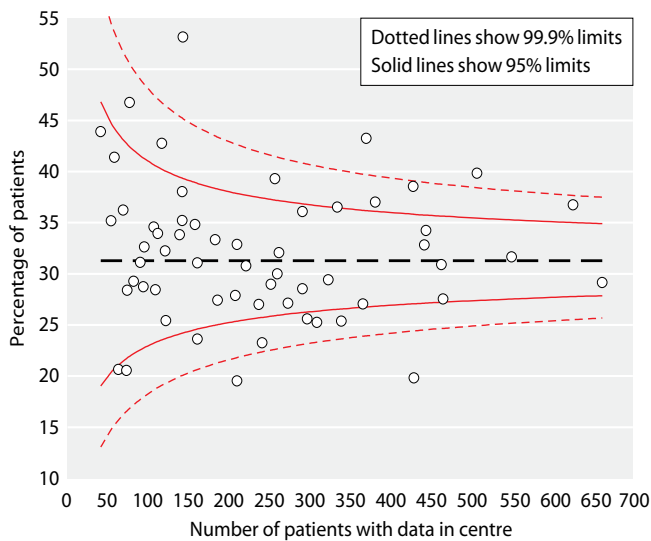


Fig. 10.6. Funnel plot of percentage of haemodialysis patients with phosphate >1.8 mmol/L by centre in 2007

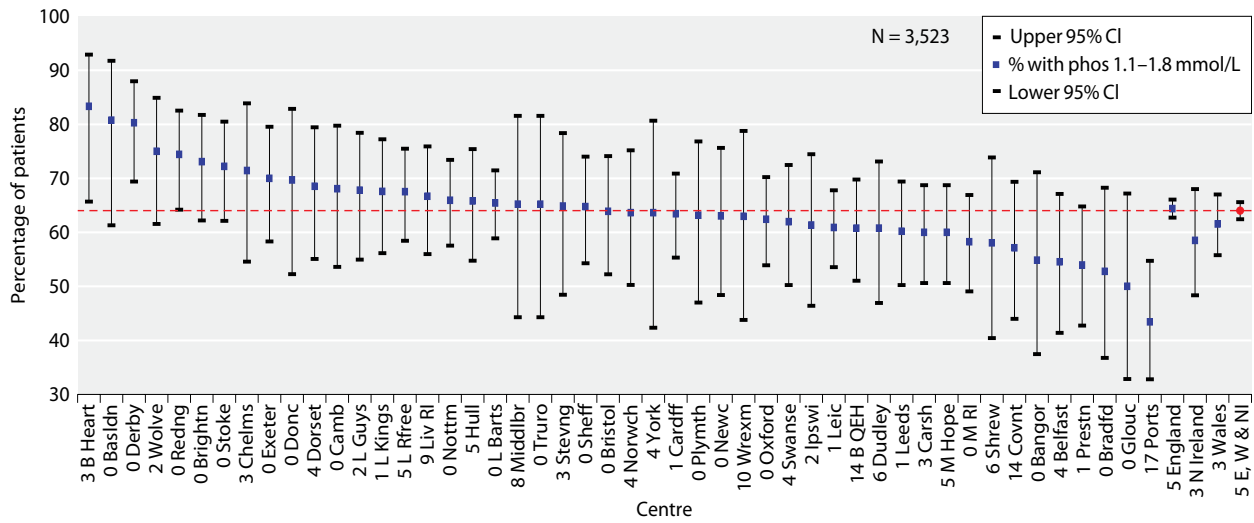


Fig. 10.7. Percentage of peritoneal dialysis patients with phosphate 1.1–1.8 mmol/L by centre in 2007

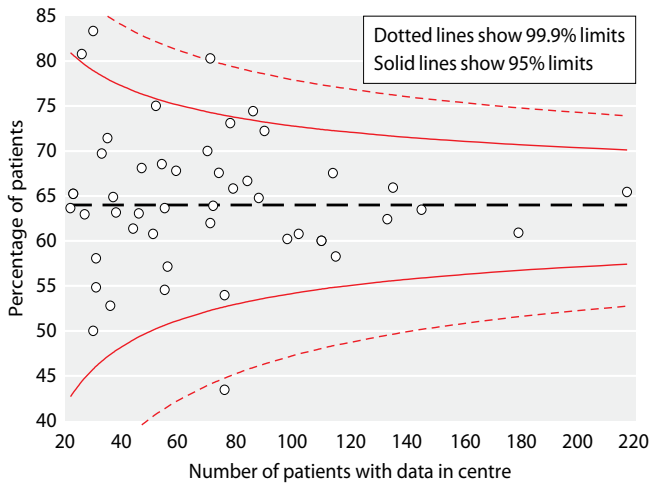


Fig. 10.8. Funnel plot of percentage of peritoneal dialysis patients with phosphate 1.1–1.8 mmol/L by centre in 2007

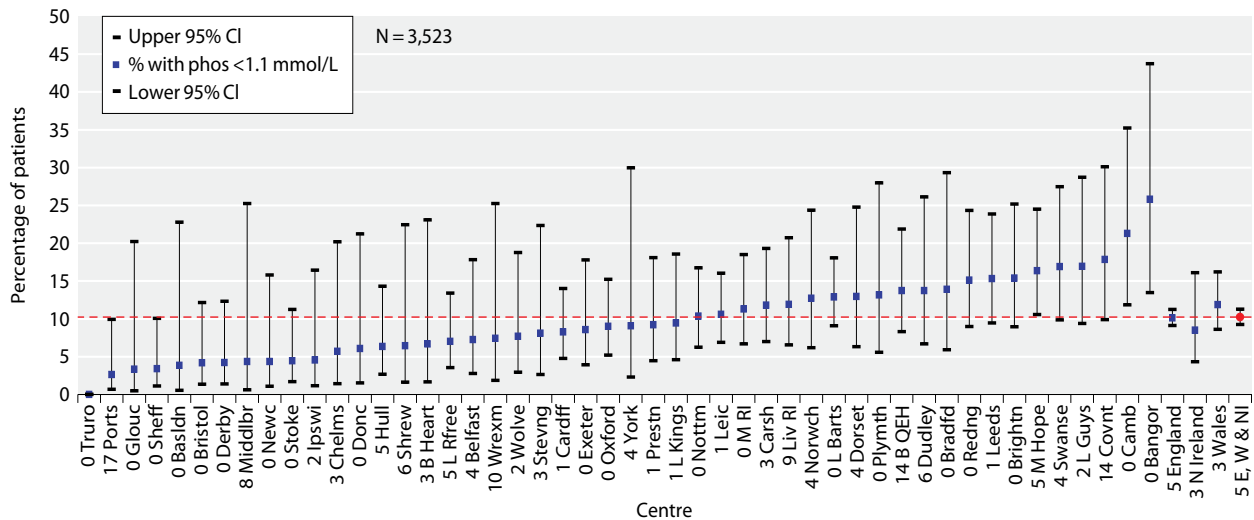


Fig. 10.9. Percentage of peritoneal dialysis patients with phosphate <1.1 mmol/L by centre in 2007

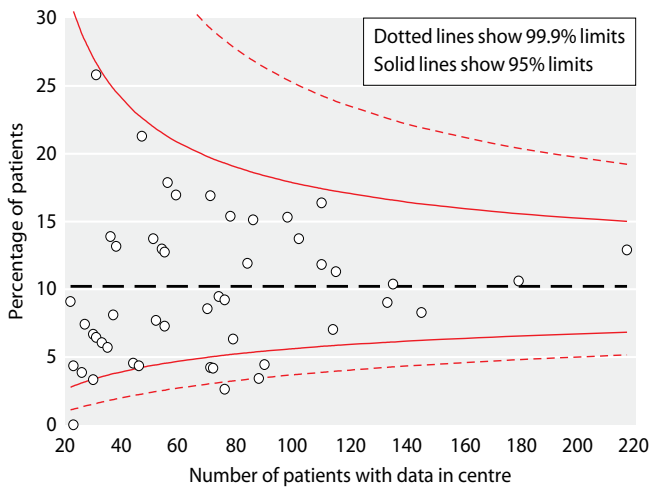


Fig. 10.10. Funnel plot of percentage of peritoneal dialysis patients with phosphate <1.1 mmol/L by centre in 2007

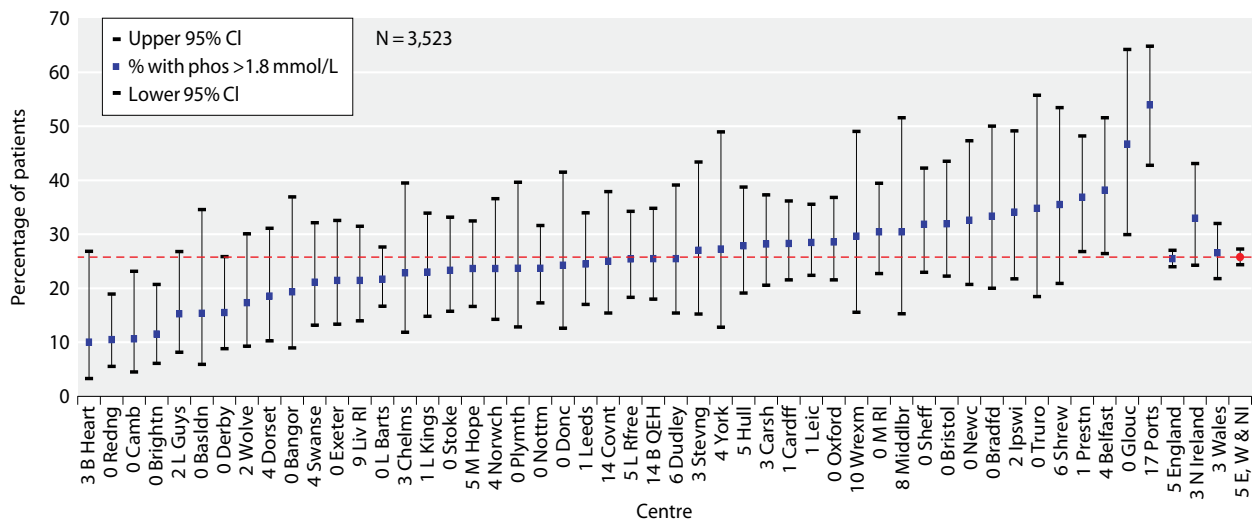


Fig. 10.11. Percentage of peritoneal dialysis patients with phosphate >1.8 mmol/L by centre in 2007

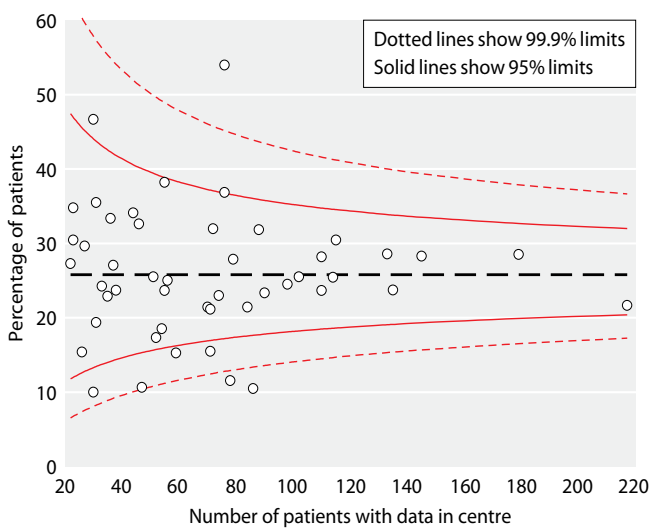


Fig. 10.12. Funnel plot of percentage of peritoneal dialysis patients with phosphate above the range (>1.8 mmol/L) by centre in 2007

Table 10.5. Percentage of peritoneal dialysis patients within, below and above the range for phosphate (1.1–1.8 mmol/L) in 2007

Centre	N	% phos 1.1–1.8 mmol/L	Lower 95% CI	Upper 95% CI	% phos <1.1 mmol/L	Lower 95% CI	Upper 95% CI	% phos >1.8 mmol/L	Lower 95% CI	Upper 95% CI
B Heart	30	83.3	65.7	92.9	6.7	1.7	23.1	10.0	3.3	26.8
B QEH	102	60.8	51.0	69.8	13.7	8.3	21.9	25.5	18.0	34.8
Bangor	31	54.8	37.4	71.1	25.8	13.5	43.7	19.4	9.0	36.9
Basldn	26	80.8	61.3	91.8	3.9	0.5	22.8	15.4	5.9	34.5
Belfast	55	54.6	41.4	67.1	7.3	2.8	17.8	38.2	26.4	51.6
Bradfd	36	52.8	36.8	68.3	13.9	5.9	29.3	33.3	20.0	50.0
Brightn	78	73.1	62.2	81.7	15.4	9.0	25.2	11.5	6.1	20.7
Bristol	72	63.9	52.2	74.1	4.2	1.4	12.1	31.9	22.2	43.5
Camb	47	68.1	53.6	79.8	21.3	11.9	35.2	10.6	4.5	23.1
Cardff	145	63.5	55.3	70.9	8.3	4.8	14.0	28.3	21.6	36.1
Carsh	110	60.0	50.6	68.7	11.8	7.0	19.3	28.2	20.6	37.3
Chelms	35	71.4	54.6	83.9	5.7	1.4	20.2	22.9	11.9	39.5
Covnt	56	57.1	44.0	69.4	17.9	9.9	30.1	25.0	15.4	37.9
Derby	71	80.3	69.4	88.0	4.2	1.4	12.3	15.5	8.8	25.9
Donc	33	69.7	52.3	82.9	6.1	1.5	21.2	24.2	12.6	41.5
Dorset	54	68.5	55.1	79.5	13.0	6.3	24.8	18.5	10.3	31.1
Dudley	51	60.8	46.9	73.1	13.7	6.7	26.1	25.5	15.4	39.1
Exeter	70	70.0	58.3	79.6	8.6	3.9	17.8	21.4	13.4	32.6
Glouc	30	50.0	32.8	67.2	3.3	0.5	20.2	46.7	29.9	64.2
Hull	79	65.8	54.8	75.4	6.3	2.7	14.3	27.9	19.1	38.7
Ipswi	44	61.4	46.4	74.5	4.6	1.1	16.4	34.1	21.7	49.1
L Barts	217	65.4	58.9	71.5	12.9	9.1	18.1	21.7	16.7	27.6
L Guys	59	67.8	54.9	78.4	17.0	9.4	28.7	15.3	8.1	26.8
L Kings	74	67.6	56.2	77.2	9.5	4.6	18.5	23.0	14.8	33.9
L Rfree	114	67.5	58.4	75.5	7.0	3.6	13.4	25.4	18.3	34.2
Leeds	98	60.2	50.2	69.4	15.3	9.4	23.9	24.5	17.0	34.0
Leic	179	60.9	53.6	67.8	10.6	6.9	16.0	28.5	22.4	35.5
Liv RI	84	66.7	56.0	75.9	11.9	6.5	20.7	21.4	13.9	31.5
M Hope	110	60.0	50.6	68.7	16.4	10.6	24.5	23.6	16.6	32.5
M RI	115	58.3	49.1	66.9	11.3	6.7	18.5	30.4	22.7	39.4
Middlbr	23	65.2	44.3	81.6	4.4	0.6	25.2	30.4	15.3	51.5
Newc	46	63.0	48.4	75.6	4.4	1.1	15.8	32.6	20.7	47.3
Norwch	55	63.6	50.3	75.2	12.7	6.2	24.4	23.6	14.3	36.6
Nottm	135	65.9	57.5	73.4	10.4	6.2	16.8	23.7	17.3	31.6
Oxford	133	62.4	53.9	70.2	9.0	5.2	15.2	28.6	21.5	36.8
Plymth	38	63.2	47.0	76.8	13.2	5.6	28.0	23.7	12.8	39.6
Ports	76	43.4	32.8	54.7	2.6	0.7	9.9	54.0	42.7	64.8
Prestn	76	54.0	42.7	64.8	9.2	4.5	18.1	36.8	26.8	48.2
Redng	86	74.4	64.2	82.5	15.1	9.0	24.3	10.5	5.5	18.9
Sheff	88	64.8	54.3	74.0	3.4	1.1	10.0	31.8	23.0	42.2
Shrew	31	58.1	40.4	73.9	6.5	1.6	22.4	35.5	20.9	53.4
Stevng	37	64.9	48.5	78.4	8.1	2.6	22.3	27.0	15.2	43.4
Stoke	90	72.2	62.1	80.5	4.4	1.7	11.3	23.3	15.7	33.2
Swanse	71	62.0	50.2	72.5	16.9	9.9	27.5	21.1	13.2	32.1
Truro	23	65.2	44.3	81.6	0.0	0.0	0.0	34.8	18.4	55.7
Wolve	52	75.0	61.6	84.9	7.7	2.9	18.8	17.3	9.3	30.0
Wrexm	27	63.0	43.8	78.8	7.4	1.9	25.3	29.6	15.6	49.0
York	22	63.6	42.3	80.7	9.1	2.3	30.0	27.3	12.8	48.9
England	3,143	64.4	62.7	66.1	10.1	9.1	11.2	25.5	24.0	27.0
N Ireland	94	58.5	48.3	68.0	8.5	4.3	16.1	33.0	24.3	43.1
Wales	286	61.5	55.8	67.0	11.9	8.6	16.2	26.6	21.8	32.0
E, W & NI	3,523	64.0	62.4	65.6	10.2	9.3	11.3	25.8	24.4	27.2

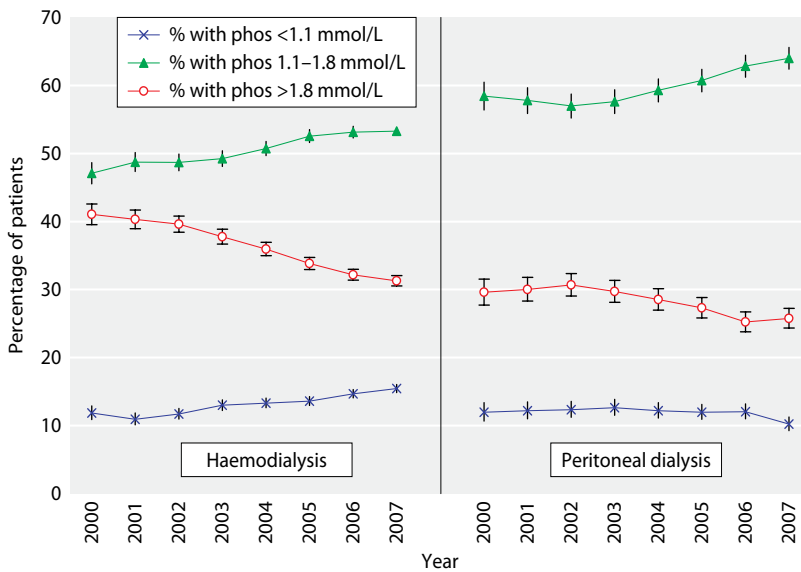


Fig. 10.13. Longitudinal change in percentage of patients with phosphate <1.1 mmol/L, 1.1–1.8 mmol/L and >1.8 mmol/L by dialysis modality 2000–2007

‘Serum calcium, adjusted for albumin concentration should be maintained within the normal reference range for the laboratory used (measured before a “short gap” dialysis session in HD patients) and ideally kept below 2.5 mmol/L.’ (Module 2: Complications) [1]

The audit measure for calcium in the 4th edition of the Renal Association clinical practice guidelines does not specify a lower limit for calcium and advises that adjusted calcium should be ideally within the normal range. For this reason the UKRR has continued to use 2.2–2.6 mmol/L as an audit measure for 2007 data. The guideline does however recommend that adjusted calcium should be <2.5 mmol/L. The UKRR is considering using 2.2–2.5 mmol/L as the audit measure for adjusted calcium in subsequent analyses. The data for adjusted calcium were 91% complete for HD patients and 96% complete for PD patients overall although there was between centre variation. Data from HD patients in London West were not included as there was a problem with data extraction

(tables 10.6 and 10.8). Seventy three percent (CI 72–73%) of HD patients and 78% (CI 77–80%) of PD patients achieved adjusted calcium between 2.2–2.6 mmol/L (tables 10.7 and 10.9). The proportion of HD patients with hypercalcaemia was 7% (CI 7–8%) compared to 9% in 2006 and the proportion with hypocalcaemia was 20% (CI 20–21%) compared to 17% in 2006 (table 10.7). The proportion of PD patients with hypercalcaemia was 9% (CI 8–10%) compared to 25% in 2006 and the proportion with hypocalcaemia was 13% (CI 12–14%) compared to 10% in 2006 (table 10.9 and figure 10.26).

As was the case for phosphate, there was between centre variation in unadjusted analyses for the proportion of patients below, within and above the range specified by the clinical performance measure (figures 10.14–10.25). There was greater variation in the proportion of patients within range for adjusted calcium compared to phosphate most notably for HD patients. The funnel plot shows a greater number of centres outlying the 3SD limit i.e. there is over dispersion.

Table 10.6. Summary statistics for adjusted calcium in haemodialysis patients in 2007

Centre	% completeness	Number of patients with data	Mean	SD	Median	Lower quartile	Upper quartile
Antrim	99	122	2.35	0.16	2.32	2.26	2.46
B Heart	94	334	2.28	0.21	2.28	2.17	2.39
B QEH	96	666	2.30	0.19	2.31	2.20	2.42
Bangor	95	57	2.37	0.19	2.34	2.26	2.45
Basldn	98	121	2.41	0.15	2.40	2.32	2.52
Belfast	96	237	2.32	0.19	2.31	2.20	2.42
Bradfd	99	158	2.42	0.16	2.44	2.34	2.50
Brightn	71	211	2.29	0.19	2.31	2.17	2.42

Table 10.6. Continued

Centre	% completeness	Number of patients with data	Mean	SD	Median	Lower quartile	Upper quartile
Bristol	100	428	2.47	0.18	2.47	2.37	2.57
Camb	56	186	2.32	0.21	2.28	2.18	2.45
Cardff	97	442	2.35>	0.19	2.35	2.23	2.46
Carlis	95	77	2.24	0.22	2.28	2.08	2.41
Carsh	85	444	2.27	0.21	2.27	2.15	2.40
Chelms	100	94	2.30	0.18	2.30	2.19	2.40
Clwyd	94	63	2.37	0.15	2.38	2.28	2.46
Covnt	98	275	2.24	0.21	2.23	2.09	2.37
Derby	100	183	2.40	0.16	2.39	2.29	2.52
Derry	100	41	2.44	0.15	2.43	2.36	2.55
Donc	100	54	2.37	0.19	2.37	2.24	2.45
Dorset	99	137	2.32	0.22	2.33	2.20	2.47
Dudley	90	99	2.37	0.25	2.35	2.24	2.51
Exeter	99	260	2.34	0.19	2.34	2.23	2.47
Glouc	100	162	2.39	0.17	2.37	2.26	2.50
Hull	98	291	2.39	0.18	2.39	2.30	2.51
Ipswi	100	90	2.41	0.17	2.40	2.32	2.50
L Barts	100	550	2.29	0.21	2.29	2.17	2.42
L Guys	97	429	2.32	0.19	2.32	2.21	2.43
L Kings	100	309	2.29	0.16	2.29	2.19	2.38
L Rfree	83	467	2.27	0.18	2.28	2.17	2.38
L West	43	425					
Leeds	97	463	2.39	0.17	2.38	2.28	2.49
Leic	99	625	2.36	0.19	2.35	2.24	2.47
Liv Ain	98	109	2.38	0.17	2.38	2.30	2.49
Liv RI	94	368	2.39	0.20	2.38	2.26	2.51
M Hope	86	262	2.29	0.19	2.27	2.16	2.41
M RI	70	221	2.27	0.21	2.28	2.15	2.38
Middlbr	99	258	2.35	0.21	2.35	2.23	2.49
Newc	100	208	2.37	0.15	2.35	2.28	2.46
Newry	99	82	2.28	0.17	2.29	2.20	2.40
Norwch	91	211	2.44	0.13	2.42	2.34	2.52
Nottm	98	339	2.36	0.17	2.36	2.26	2.46
Oxford	99	323	2.38	0.20	2.36	2.26	2.49
Plymth	98	117	2.28	0.24	2.28	2.16	2.45
Ports	99	370	2.36	0.18	2.36	2.25	2.47
Prestn	99	381	2.27	0.20	2.27	2.15	2.39
Redng	100	210	2.29	0.18	2.31	2.20	2.40
Sheff	99	507	2.32	0.17	2.34	2.23	2.43
Shrew	99	145	2.37	0.20	2.40	2.20	2.50
Stevng	95	293	2.38	0.17	2.38	2.27	2.48
Sthend	97	112	2.35	0.16	2.37	2.25	2.47
Stoke	100	242	2.42	0.19	2.41	2.32	2.54
Sund	96	142	2.45	0.20	2.45	2.33	2.55
Swanse	99	273	2.30	0.19	2.29	2.18	2.41
Truro	99	142	2.38	0.17	2.38	2.26	2.50
Tyrone	97	69	2.39	0.14	2.38	2.31	2.47
Ulster	100	74	2.45	0.15	2.45	2.35	2.53
Wirral	94	161	2.37	0.17	2.36	2.27	2.46
Wolve	99	250	2.32	0.18	2.31	2.20	2.41
Wrexm	99	73	2.45	0.17	2.44	2.34	2.54
York	89	95	2.33	0.13	2.34	2.25	2.43
England	91	13,004	2.34	0.21	2.34	2.22	2.46
N Ireland	98	625	2.35	0.18	2.35	2.24	2.46
Wales	98	908	2.34	0.19	2.34	2.23	2.46
E, W & NI	91	14,537	2.34	0.21	2.34	2.22	2.46

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

Table 10.7. Percentage of haemodialysis patients within, below and above the range for adjusted calcium (2.2–2.6 mmol/L) in 2007

Centre	N	% adjusted Ca 2.2–2.6 mmol/L			% adjusted Ca <2.2 mmol/L			% adjusted Ca >2.6 mmol/L		
		Lower 95% CI	Upper 95% CI	Upper 95% CI	Lower 95% CI	Upper 95% CI	Lower 95% CI	Upper 95% CI	Upper 95% CI	
Antrim	122	79.5	71.4	85.8	14.8	9.5	22.2	5.7	2.8	11.6
B Heart	334	65.0	59.7	69.9	29.3	24.7	34.5	5.7	3.7	8.8
B QEH	666	70.7	67.2	74.1	23.7	20.7	27.1	5.6	4.1	7.6
Bangor	57	75.4	62.7	84.9	10.5	4.8	21.5	14.0	7.2	25.6
Basldn	121	86.8	79.5	91.7	6.6	3.3	12.7	6.6	3.3	12.7
Belfast	237	68.4	62.2	74.0	24.1	19.0	29.9	7.6	4.8	11.7
Bradfd	158	85.4	79.1	90.1	5.1	2.6	9.8	9.5	5.8	15.2
Brightn	211	63.5	56.8	69.7	31.8	25.8	38.3	4.7	2.6	8.6
Bristol	428	75.9	71.7	79.8	3.5	2.1	5.7	20.6	17.0	24.7
Camb	186	64.0	56.8	70.6	29.0	23.0	36.0	7.0	4.1	11.7
Cardff	442	73.5	69.2	77.4	19.5	16.0	23.4	7.0	5.0	9.8
Carlisle	77	55.8	44.7	66.5	40.3	29.9	51.5	3.9	1.3	11.4
Carsh	444	59.9	55.3	64.4	35.6	31.3	40.2	4.5	2.9	6.9
Chelms	94	67.0	56.9	75.8	26.6	18.7	36.4	6.4	2.9	13.5
Clwyd	63	82.5	71.2	90.1	11.1	5.4	21.5	6.4	2.4	15.7
Covnt	275	50.2	44.3	56.1	45.5	39.7	51.4	4.4	2.5	7.5
Derby	183	84.2	78.1	88.8	7.7	4.6	12.5	8.2	5.0	13.2
Derry	41	82.9	68.3	91.6	4.9	1.2	17.5	12.2	5.2	26.1
Donc	54	79.6	66.8	88.4	11.1	5.1	22.6	9.3	3.9	20.4
Dorset	137	69.3	61.1	76.5	24.1	17.7	32.0	6.6	3.5	12.1
Dudley	99	64.7	54.8	73.4	20.2	13.4	29.3	15.2	9.4	23.6
Exeter	260	71.9	66.2	77.1	21.2	16.6	26.5	6.9	4.4	10.7
Glouc	162	84.0	77.5	88.8	8.6	5.2	14.1	7.4	4.3	12.6
Hull	291	79.7	74.7	84.0	11.3	8.2	15.5	8.9	6.2	12.8
Ipswi	90	74.4	64.5	82.4	11.1	6.1	19.4	14.4	8.6	23.3
L Barts	550	64.7	60.6	68.6	29.8	26.1	33.8	5.5	3.8	7.7
L Guys	429	72.7	68.3	76.7	22.1	18.5	26.3	5.1	3.4	7.7
L Kings	309	71.2	65.9	76.0	26.9	22.2	32.1	1.9	0.9	4.3
L Rfree	467	64.2	59.8	68.5	32.6	28.5	36.9	3.2	2.0	5.3
Leeds	463	79.9	76.0	83.3	11.9	9.2	15.2	8.2	6.0	11.1
Leic	625	74.4	70.8	77.7	16.2	13.5	19.3	9.4	7.4	12.0
Liv Ain	109	82.6	74.3	88.6	10.1	5.7	17.3	7.3	3.7	14.0
Liv RI	368	71.7	66.9	76.1	15.8	12.4	19.9	12.5	9.5	16.3
M Hope	262	61.1	55.0	66.8	32.8	27.4	38.7	6.1	3.8	9.7
M RI	221	60.6	54.0	66.9	33.0	27.2	39.5	6.3	3.8	10.4
Middlbr	258	69.8	63.9	75.1	20.2	15.7	25.5	10.1	7.0	14.4
Newc	208	85.1	79.6	89.3	8.7	5.5	13.3	6.3	3.7	10.5
Newry	82	74.4	63.9	82.7	24.4	16.3	34.8	1.2	0.2	8.2
Norwch	211	88.6	83.6	92.3	2.4	1.0	5.6	9.0	5.8	13.7
Nottm	339	81.4	76.9	85.2	12.4	9.3	16.3	6.2	4.1	9.3
Oxford	323	74.0	68.9	78.5	14.6	11.1	18.8	11.5	8.4	15.4
Plymth	117	58.1	49.0	66.7	32.5	24.6	41.5	9.4	5.3	16.2
Ports	370	81.1	76.8	84.8	12.4	9.4	16.2	6.5	4.4	9.5
Prestn	381	63.5	58.6	68.2	33.6	29.0	38.5	2.9	1.6	5.1
Redng	210	71.9	65.5	77.6	24.8	19.4	31.1	3.3	1.6	6.8
Sheff	507	78.3	74.5	81.7	18.7	15.6	22.4	3.0	1.8	4.9
Shrew	145	82.8	75.7	88.1	10.3	6.3	16.5	6.9	3.8	12.3
Stevng	293	78.2	73.1	82.5	12.6	9.3	16.9	9.2	6.4	13.1
Sthend	112	83.0	74.9	88.9	13.4	8.2	21.0	3.6	1.4	9.1
Stoke	242	74.8	68.9	79.9	9.5	6.4	13.9	15.7	11.6	20.9
Sund	142	77.5	69.9	83.6	8.5	4.9	14.3	14.1	9.3	20.8
Swanse	273	66.7	60.9	72.0	28.2	23.2	33.8	5.1	3.1	8.5
Truro	142	73.9	66.1	80.5	13.4	8.7	20.0	12.7	8.1	19.2
Tyrone	69	89.9	80.2	95.1	7.3	3.1	16.3	2.9	0.7	10.9

Table 10.7. Continued

Centre	N	% adjusted Ca 2.2–2.6 mmol/L			% adjusted Ca <2.2 mmol/L			% adjusted Ca >2.6 mmol/L		
		Lower 95% CI	Upper 95% CI	% adjusted	Lower 95% CI	Upper 95% CI	% adjusted	Lower 95% CI	Upper 95% CI	% adjusted
Ulster	74	72.1	89.5	82.4	1.3	11.8	4.1	7.4	23.3	
Wirral	161	73.9	86.1	80.8	8.7	19.2	13.0	3.4	11.2	
Wolve	250	65.3	76.5	71.2	18.4	28.8	23.2	3.3	9.2	
Wrexm	73	68.7	87.2	79.5	1.3	12.0	4.1	9.6	26.8	
York	95	74.3	89.4	83.2	8.9	23.4	14.7	0.5	8.0	
England	13,004	71.5	73.0	72.3	19.7	21.1	20.4	6.9	7.8	
N Ireland	625	72.8	79.5	76.3	14.1	19.9	16.8	5.1	9.2	
Wales	908	69.7	75.5	72.7	17.3	22.4	19.7	6.1	9.5	
E, W & NI	14,537	71.7	73.2	72.5	19.6	20.9	20.2	6.9	7.8	

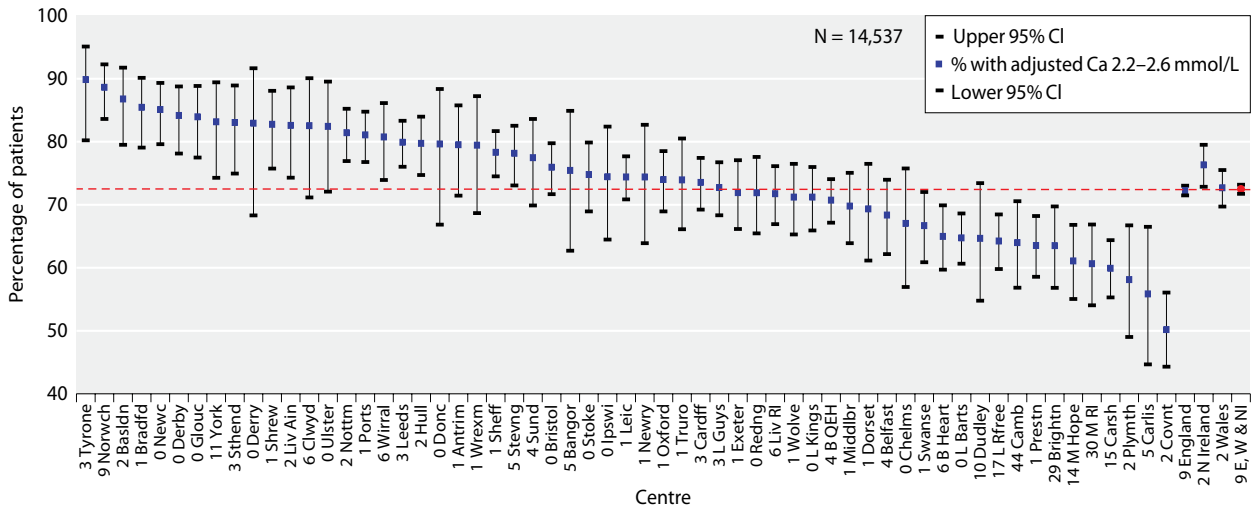


Fig. 10.14. Percentage of haemodialysis patients with adjusted calcium 2.2–2.6 mmol/L by centre in 2007

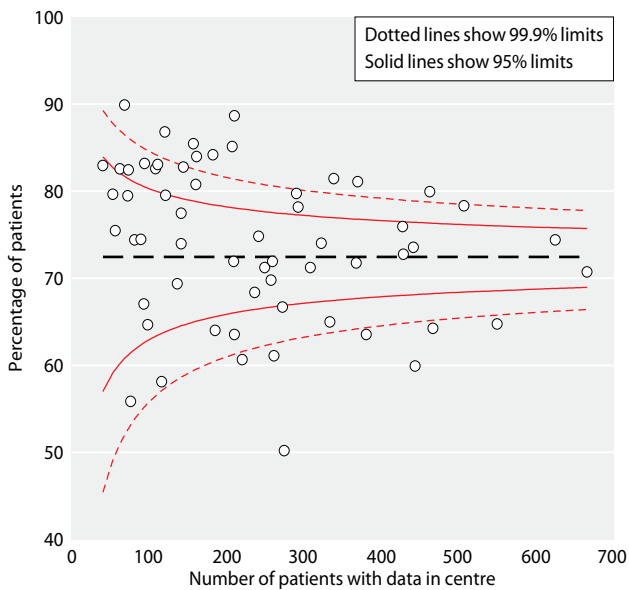


Fig. 10.15. Funnel plot of percentage of haemodialysis patients with adjusted calcium 2.2–2.6 mmol/L by centre in 2007

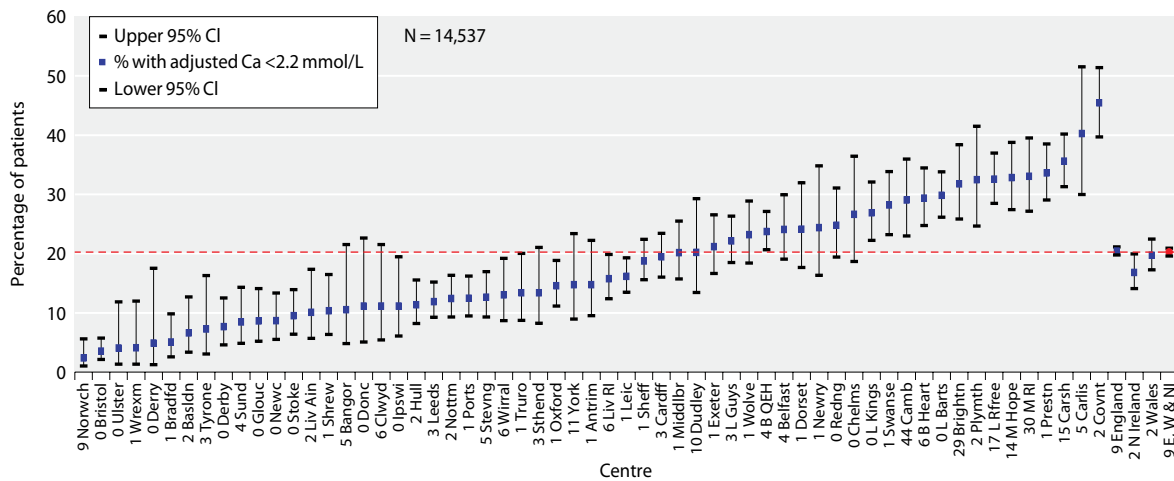


Fig. 10.16. Percentage of haemodialysis patients with adjusted calcium <2.2 mmol/L by centre in 2007

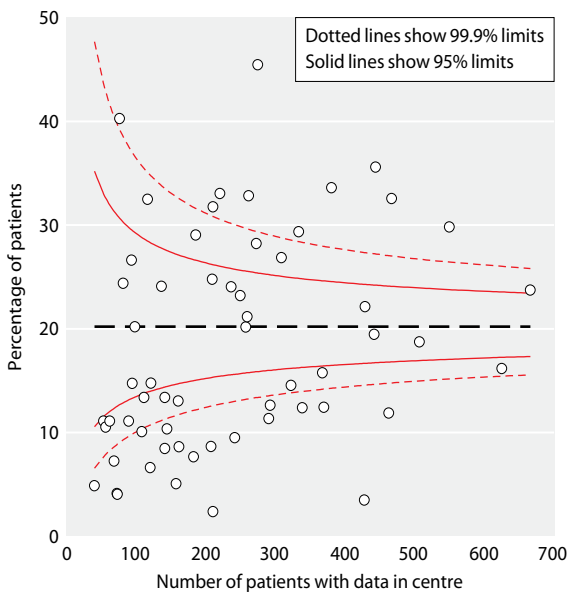


Fig. 10.17. Funnel plot of percentage of haemodialysis patients with adjusted calcium <2.2 mmol/L by centre in 2007

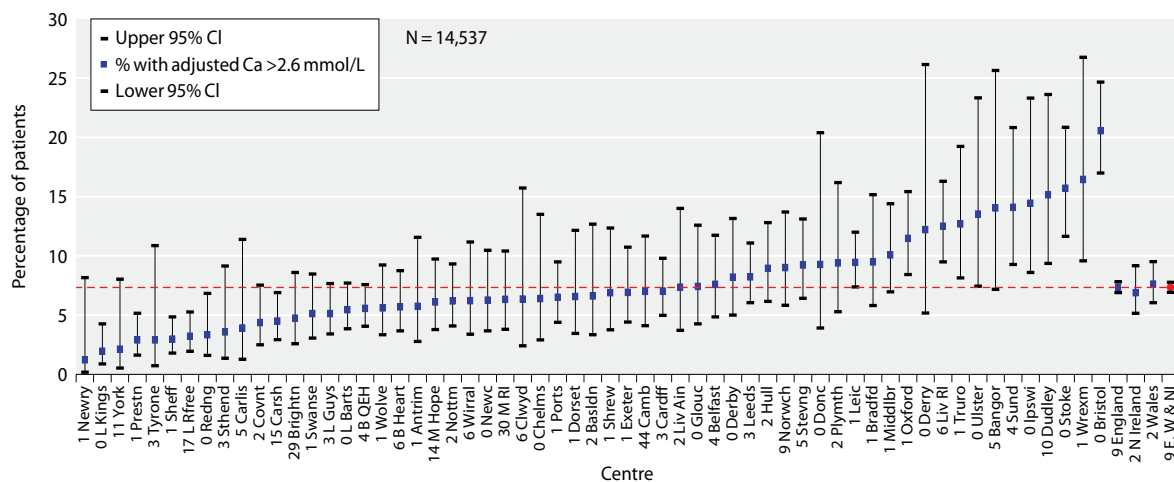


Fig. 10.18. Percentage of haemodialysis patients with adjusted calcium >2.6 mmol/L by centre in 2007

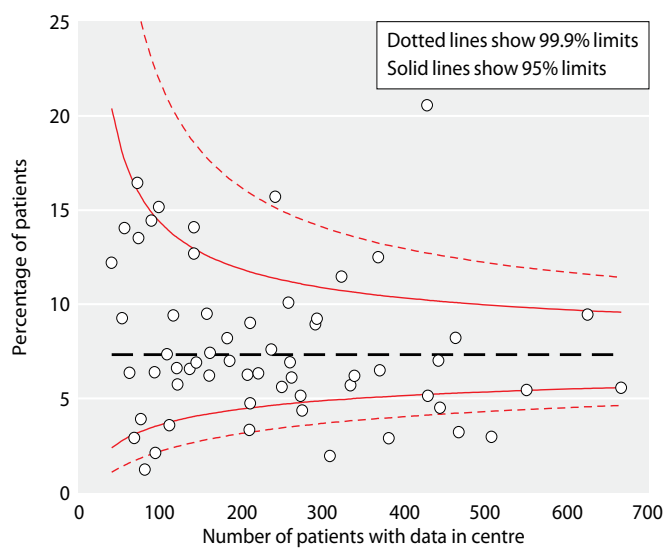


Fig. 10.19. Funnel plot of percentage of haemodialysis patients with adjusted calcium >2.6 mmol/L by centre in 2007

Table 10.8. Summary statistics for adjusted calcium in peritoneal dialysis patients in 2007

Centre	% completeness	Number of patients with data	Mean	SD	Median	Lower quartile	Upper quartile
Antrim	94	15					
B Heart	97	30	2.36	0.11	2.36	2.28	2.41
B QEH	86	102	2.33	0.15	2.32	2.22	2.41
Bangor	100	31	2.39	0.19	2.44	2.32	2.50
Basldn	100	26	2.37	0.13	2.38	2.31	2.46
Belfast	96	55	2.35	0.16	2.31	2.25	2.45
Bradfd	100	36	2.43	0.15	2.43	2.35	2.51
Brightn	100	78	2.39	0.16	2.39	2.29	2.49
Bristol	100	72	2.47	0.16	2.48	2.39	2.55
Camb	100	47	2.32	0.17	2.31	2.18	2.45
Cardff	99	145	2.35	0.16	2.33	2.26	2.43
Carlisle	100	11					
Carsh	97	110	2.28	0.18	2.28	2.15	2.38
Chelms	97	35	2.39	0.15	2.38	2.26	2.52
Clwyd	92	12					
Covnt	92	60	2.26	0.17	2.26	2.15	2.33
Derby	100	71	2.40	0.14	2.40	2.32	2.49
Derry	100	4					
Donc	100	33	2.39	0.15	2.40	2.29	2.53
Dorset	100	56	2.38	0.15	2.38	2.26	2.48
Dudley	94	51	2.38	0.19	2.34	2.26	2.48
Exeter	100	70	2.32	0.15	2.30	2.22	2.41
Glouc	100	30	2.40	0.15	2.43	2.29	2.49

Table 10.8. Continued

Centre	% completeness	Number of patients with data	Mean	SD	Median	Lower quartile	Upper quartile
Hull	95	79	2.48	0.14	2.46	2.40	2.56
Ipswi	98	44	2.44	0.14	2.44	2.37	2.52
L Barts	100	217	2.37	0.20	2.34	2.24	2.47
L Guys	98	59	2.37	0.14	2.38	2.26	2.45
L Kings	99	74	2.29	0.14	2.29	2.22	2.36
L Rfree	95	114	2.35	0.19	2.35	2.24	2.46
L West	5	3					
Leeds	99	98	2.39	0.14	2.40	2.31	2.50
Leic	99	179	2.42	0.16	2.42	2.32	2.53
Liv Ain	n/a	0					
Liv RI	92	85	2.45	0.18	2.42	2.32	2.59
M Hope	95	110	2.28	0.17	2.29	2.17	2.39
M RI	100	115	2.31	0.16	2.32	2.23	2.41
Middlbr	92	23	2.30	0.22	2.37	2.24	2.41
Newc	100	46	2.43	0.20	2.43	2.27	2.56
Newry	100	13					
Norwch	96	55	2.44	0.13	2.47	2.37	2.53
Nottm	100	135	2.46	0.14	2.46	2.38	2.54
Oxford	100	133	2.40	0.19	2.42	2.31	2.52
Plymth	100	38	2.45	0.17	2.48	2.34	2.55
Ports	83	76	2.40	0.19	2.39	2.29	2.51
Prestn	99	76	2.38	0.17	2.38	2.24	2.50
Redng	100	86	2.37	0.15	2.37	2.27	2.47
Sheff	100	88	2.40	0.15	2.41	2.31	2.50
Shrew	94	31	2.43	0.21	2.40	2.30	2.60
Stevng	100	38	2.42	0.16	2.39	2.34	2.54
Sthend	94	17					
Stoke	100	90	2.51	0.18	2.49	2.42	2.59
Sund	100	10					
Swanse	96	71	2.28	0.14	2.27	2.20	2.36
Truro	100	23	2.36	0.14	2.33	2.27	2.48
Ulster	100	2					
Wirral	68	19					
Wolve	98	52	2.33	0.16	2.31	2.25	2.40
Wrexm	90	27	2.45	0.14	2.43	2.34	2.52
York	96	22	2.36	0.12	2.38	2.29	2.46
England	95	3,153	2.38	0.18	2.38	2.27	2.49
N Ireland	97	94	2.35	0.16	2.32	2.25	2.45
Wales	97	286	2.34	0.16	2.33	2.25	2.44
E, W & NI	96	3,533	2.38	0.18	2.38	2.27	2.48

Blank cells denote centres excluded from analyses due to low patient numbers or poor data completeness
n/a not applicable

Table 10.9. Percentage of peritoneal dialysis patients within, below and above the range for adjusted calcium (2.2–2.6 mmol/L) in 2007

Centre	N	% adjusted Ca 2.2–2.6 mmol/L			% adjusted Ca <2.2 mmol/L			% adjusted Ca >2.6 mmol/L		
		Lower 95% CI	Upper 95% CI	Upper 95% CI	Lower 95% CI	Upper 95% CI	Lower 95% CI	Upper 95% CI	Upper 95% CI	
B Heart	30	90.0	73.2	96.7	6.7	1.7	23.1	3.3	0.5	20.2
B QEH	102	74.5	65.2	82.0	18.6	12.2	27.4	6.9	3.3	13.7
Bangor	31	93.6	77.6	98.4	6.5	1.6	22.4	0.0	0.0	0.0
Basldn	26	88.5	69.7	96.2	7.7	1.9	26.1	3.9	0.5	22.8
Belfast	55	81.8	69.4	89.9	10.9	5.0	22.2	7.3	2.8	17.8
Bradfd	36	77.8	61.5	88.5	5.6	1.4	19.7	16.7	7.7	32.5
Brightn	78	82.1	71.9	89.1	10.3	5.2	19.2	7.7	3.5	16.1
Bristol	72	77.8	66.8	85.9	2.8	0.7	10.4	19.4	11.9	30.2
Camb	47	70.2	55.8	81.5	25.5	15.1	39.8	4.3	1.1	15.5
Cardff	145	79.3	72.0	85.1	15.2	10.2	22.0	5.5	2.8	10.6
Carsh	110	60.0	50.6	68.7	34.6	26.3	43.9	5.5	2.5	11.6
Chelms	35	85.7	70.0	93.9	5.7	1.4	20.2	8.6	2.8	23.4
Covnt	60	56.7	44.0	68.5	38.3	27.0	51.1	5.0	1.6	14.4
Derby	71	83.1	72.6	90.1	9.9	4.8	19.3	7.0	3.0	15.8
Donc	33	87.9	71.8	95.4	9.1	3.0	24.7	3.0	0.4	18.6
Dorset	56	91.1	80.3	96.2	5.4	1.7	15.3	3.6	0.9	13.2
Dudley	51	76.5	63.0	86.1	7.8	3.0	19.1	15.7	8.0	28.4
Exeter	70	70.0	58.3	79.6	22.9	14.5	34.1	7.1	3.0	16.0
Glouc	30	83.3	65.7	92.9	6.7	1.7	23.1	10.0	3.3	26.8
Hull	79	86.1	76.6	92.1	1.3	0.2	8.4	12.7	7.0	22.0
Ipswi	44	84.1	70.2	92.2	4.6	1.1	16.4	11.4	4.8	24.5
L Barts	217	71.0	64.6	76.6	15.7	11.4	21.1	13.4	9.5	18.6
L Guys	59	86.4	75.2	93.1	10.2	4.6	20.8	3.4	0.9	12.6
L Kings	74	77.0	66.1	85.2	20.3	12.6	30.9	2.7	0.7	10.2
L Rfree	114	77.2	68.6	84.0	17.5	11.6	25.6	5.3	2.4	11.2
Leeds	98	84.7	76.2	90.6	10.2	5.6	17.9	5.1	2.1	11.7
Leic	179	79.3	72.8	84.6	8.9	5.6	14.1	11.7	7.8	17.3
Liv RI	85	72.9	62.6	81.3	7.1	3.2	14.8	20.0	12.8	29.8
M Hope	110	66.4	57.1	74.6	31.8	23.8	41.1	1.8	0.5	7.0
M RI	115	78.3	69.8	84.9	19.1	12.9	27.4	2.6	0.8	7.8
Middlbr	23	82.6	61.8	93.3	17.4	6.7	38.2	0.0	0.0	0.0
Newc	46	65.2	50.6	77.5	15.2	7.4	28.6	19.6	10.5	33.5
Norwch	55	90.9	80.0	96.2	5.5	1.8	15.6	3.6	0.9	13.4
Nottm	135	88.2	81.5	92.6	2.2	0.7	6.7	9.6	5.7	15.9
Oxford	133	76.7	68.8	83.1	12.0	7.5	18.7	11.3	6.9	17.9
Plymth	38	79.0	63.2	89.1	5.3	1.3	18.8	15.8	7.3	31.0
Ports	76	77.6	66.9	85.6	10.5	5.4	19.7	11.8	6.3	21.2
Prestn	76	76.3	65.5	84.5	14.5	8.2	24.3	9.2	4.5	18.1
Redng	86	86.1	77.0	91.9	9.3	4.7	17.5	4.7	1.8	11.7
Sheff	88	86.4	77.5	92.1	6.8	3.1	14.4	6.8	3.1	14.4
Shrew	31	80.7	63.1	91.0	6.5	1.6	22.4	12.9	4.9	29.7
Stevng	38	76.3	60.4	87.2	5.3	1.3	18.8	18.4	9.0	33.9
Stoke	90	74.4	64.5	82.4	3.3	1.1	9.8	22.2	14.8	32.0
Swanse	71	77.5	66.3	85.7	21.1	13.2	32.1	1.4	0.2	9.3
Truro	23	78.3	57.2	90.7	8.7	2.2	28.9	13.0	4.3	33.6
Wolve	52	76.9	63.6	86.4	15.4	7.9	27.9	7.7	2.9	18.8
Wrexm	27	88.9	70.7	96.4	0.0	0.0	0.0	11.1	3.6	29.3
York	22	90.9	70.0	97.7	9.1	2.3	30.0	0.0	0.0	0.0
England	3,153	78.0	76.5	79.4	12.9	11.8	14.1	9.1	8.1	10.1
N Ireland	94	77.7	68.2	85.0	13.8	8.2	22.4	8.5	4.3	16.1
Wales	286	81.1	76.2	85.2	14.3	10.7	18.9	4.6	2.7	7.7
E, W & NI	3,533	78.3	76.9	79.6	13.1	12.0	14.2	8.7	7.8	9.7

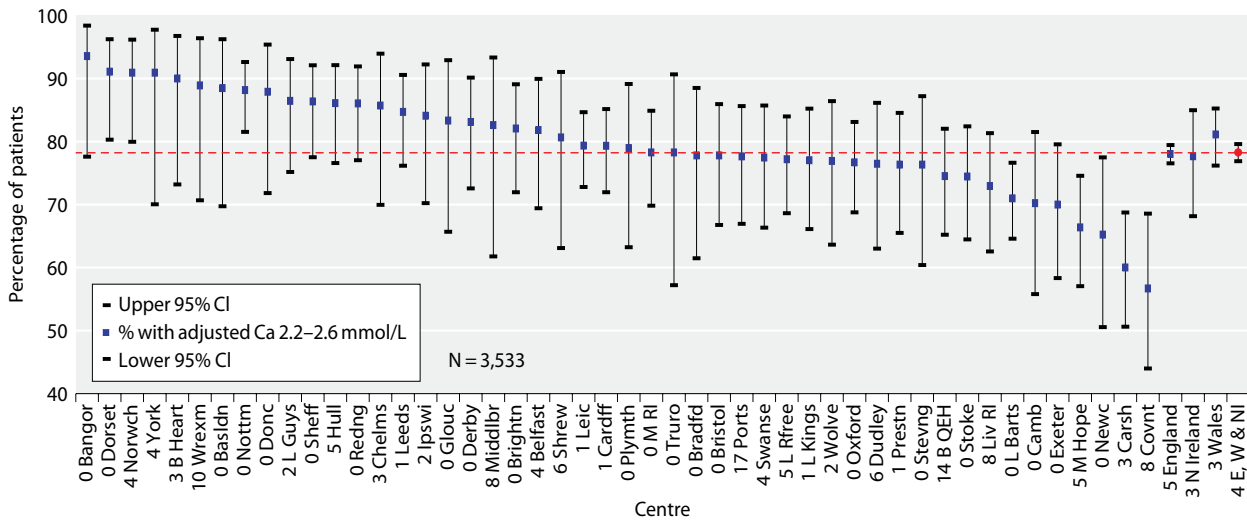


Fig. 10.20. Percentage of peritoneal dialysis patients with adjusted calcium 2.2–2.6 mmol/L by centre in 2007

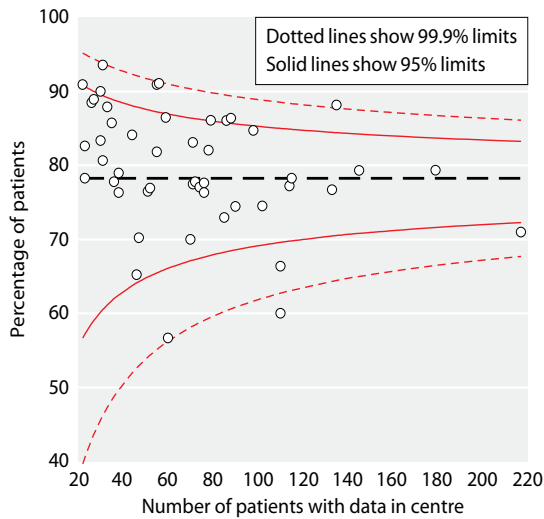


Fig. 10.21. Funnel plot of percentage of peritoneal dialysis patients with adjusted calcium 2.2–2.6 mmol/L by centre in 2007

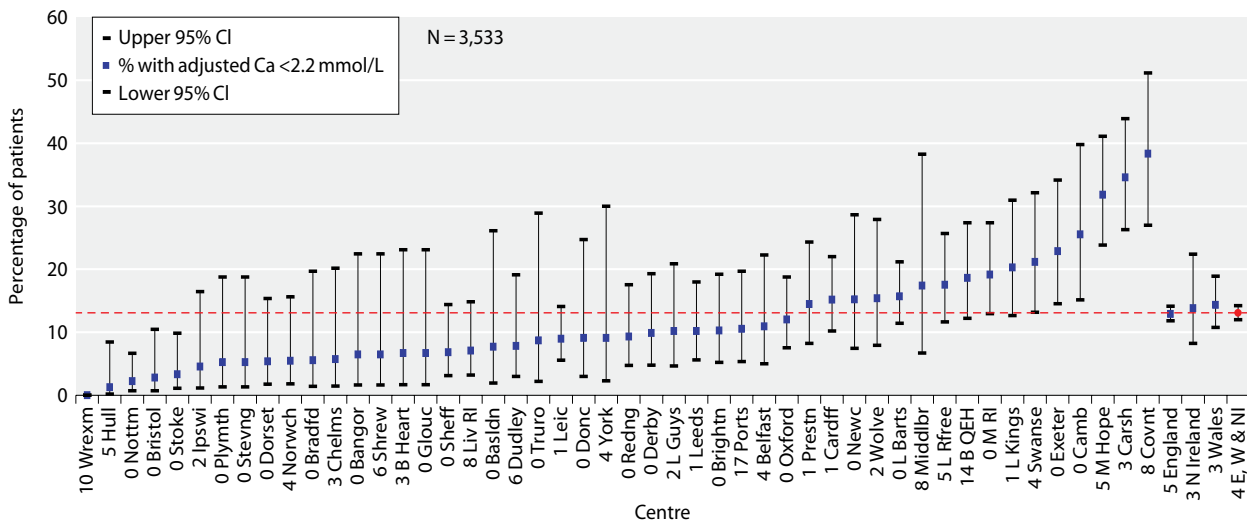


Fig. 10.22. Percentage of peritoneal dialysis patients with adjusted calcium <2.2 mmol/L by centre in 2007

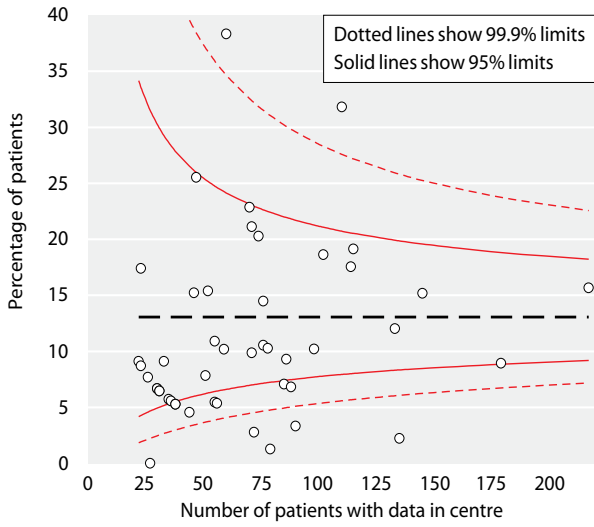


Fig. 10.23. Funnel plot of percentage of peritoneal dialysis patients with adjusted calcium <2.2 mmol/L by centre in 2007

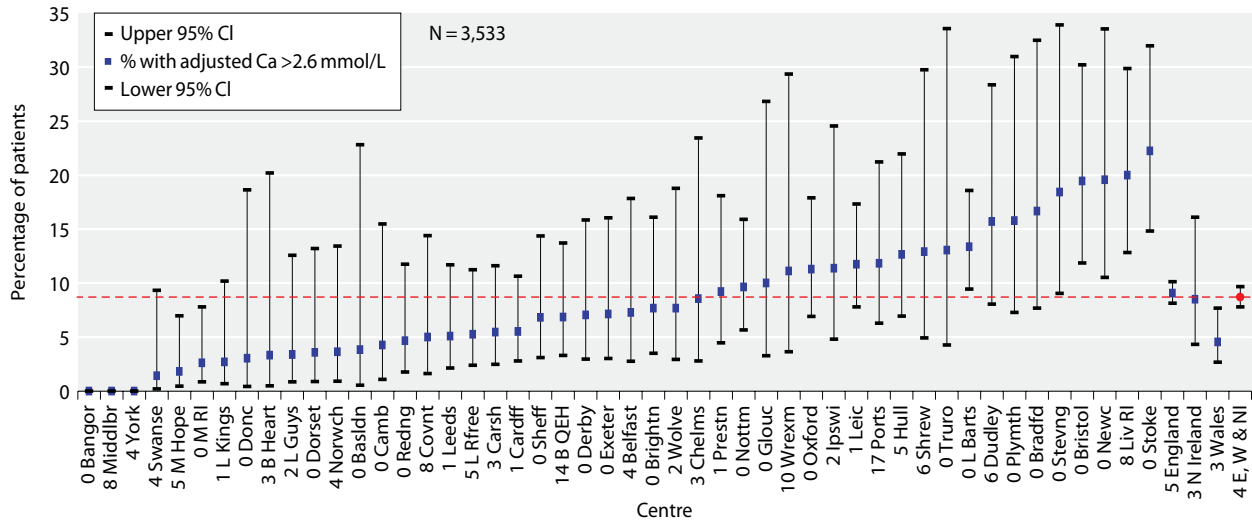


Fig. 10.24. Percentage of peritoneal dialysis patients with adjusted calcium >2.6 mmol/L by centre in 2007

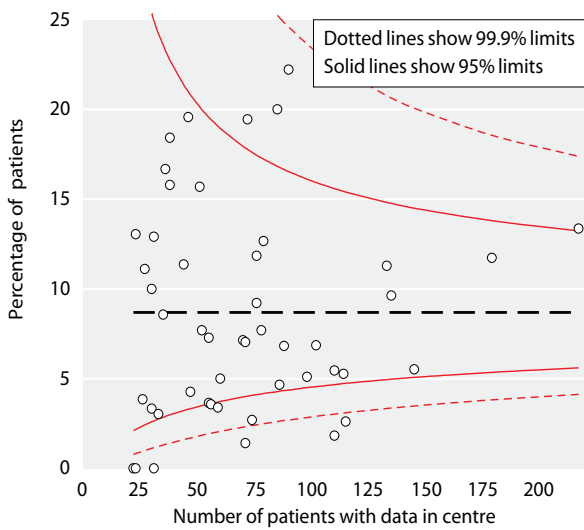


Fig. 10.25. Funnel plot of percentage of peritoneal dialysis patients with adjusted calcium >2.6 mmol/L by centre in 2007

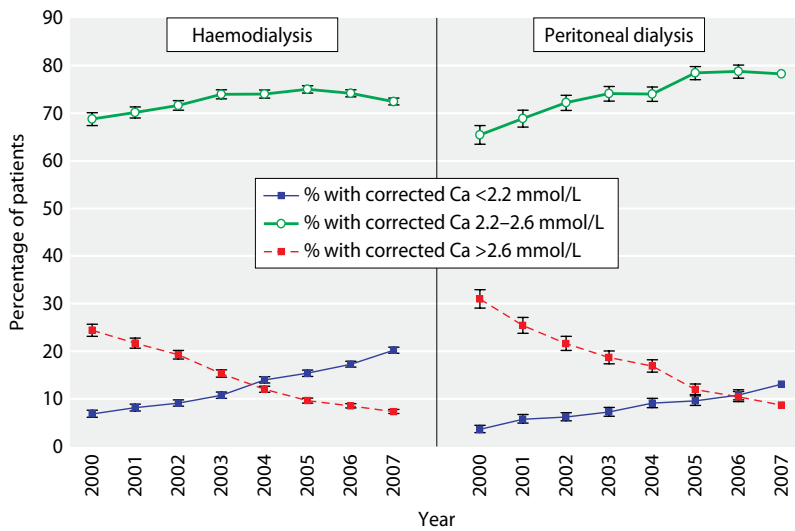


Fig. 10.26. Longitudinal change in percentage of patients with adjusted calcium <2.2 mmol/L, 2.2–2.6 mmol/L and >2.6 mmol/L by dialysis modality 2000–2007

Parathyroid hormone

The 4th edition of the Renal Association clinical practice guidelines states:

‘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) [1]

The data for parathyroid hormone were 82% complete for HD patients and 84% complete for PD patients overall although there was between centre variation (tables 10.10 and 10.12). Twenty five percent (CI 24–26%) of HD patients and 27% (26–29%) of PD patients achieved a parathyroid hormone between 16–32 pmol/L (tables

10.11 and 10.13). The proportion of HD patients with a parathyroid hormone above the upper limit of the range was 40% (CI 40–41%) and the proportion with parathyroid hormone below the lower limit of the range was 35% (CI 34–36%) (table 10.11). The proportion of PD patients with parathyroid hormone above the upper limit of the range was 40% (CI 39–42%) and the proportion with parathyroid hormone below the lower limit of the range was 33% (CI 31–34%) (table 10.13). The proportion of dialysis patients achieving the Renal Association audit measure has reduced considerably with the introduction of a lower specification of the audit measure. Again there was between centre variation in unadjusted analyses for the proportion of patients below, within and above the range specified by the clinical performance measure (figures 10.27–10.38).

Table 10.10. Summary statistics for PTH in haemodialysis patients in 2007

Centre	% completeness	Number of patients with data	Mean	SD	Median	Lower quartile	Upper quartile
Antrim	99	122	32.7	33.9	22.7	11.8	41.7
B Heart	86	308	41.5	38.8	29.7	15.7	56.7
B QEH	62	428	24.1	15.3	22.7	11.2	36.5
Bangor	95	57	27.5	32.0	20.3	8.1	34.1
Basldn	98	121	43.4	49.0	29.9	13.8	49.8
Belfast	92	227	40.7	35.8	29.8	15.2	53.6
Bradfd	98	156	37.9	43.1	22.5	8.9	49.2
Brightn	96	287	44.5	45.3	32.5	12.6	58.8
Bristol	97	413	29.3	32.3	18.5	8.3	39.2
Camb	48	160					
Cardff	90	411	27.2	32.6	17.6	4.6	36.5
Carlisle	94	76	41.8	39.9	31.6	14.2	51.3

Table 10.10. Continued

Centre	% completeness	Number of patients with data	Mean	SD	Median	Lower quartile	Upper quartile
Carsh	30	158					
Chelms	98	92	42.3	44.5	26.6	16.4	53.2
Clwyd	88	59	34.1	38.3	22.0	10.0	40.0
Covnt	80	224	62.9	71.3	42.0	16.5	81.0
Derby	99	182	29.4	34.9	18.3	10.8	34.4
Derry	100	41	36.5	22.4	34.8	19.8	46.1
Donc	100	54	50.3	52.9	28.8	9.2	71.4
Dorset	87	121	34.1	29.8	27.0	12.4	44.7
Dudley	76	84	54.3	102.8	23.2	9.3	47.3
Exeter	94	245	22.6	32.0	12.2	4.7	26.0
Glouc	98	159	28.2	35.7	17.4	9.2	31.0
Hull	90	269	30.6	34.9	17.0	6.7	43.4
Ipswi	99	89	35.6	40.3	21.7	11.7	41.7
L Barts	99	546	49.3	51.7	33.1	14.0	64.2
L Guys	96	427	47.4	44.5	35.0	15.8	67.0
L Kings	2	5					
L Rfree	79	448	36.2	36.7	25.0	13.0	46.5
L West	24	238					
Leeds	95	450	27.3	27.3	18.2	10.1	34.8
Leic	96	610	39.7	39.9	28.8	9.7	57.7
Liv Ain	76	84	29.8	36.9	18.5	9.0	31.5
Liv RI	90	355	39.9	39.2	27.0	15.0	52.0
M Hope	80	245	34.8	44.1	18.3	8.0	37.4
M RI	65	203	42.0	38.9	32.8	12.2	56.8
Middlbr	90	234	54.7	90.9	29.8	14.5	60.0
Newc	98	204	32.9	30.1	23.5	13.0	40.9
Newry	96	80	56.3	57.2	38.5	16.3	73.8
Norwch	84	196	39.3	39.0	26.7	16.2	44.8
Nottm	97	333	48.0	50.5	31.9	15.6	62.6
Oxford	93	303	46.7	48.3	31.7	14.1	62.2
Plymth	71	84	43.2	47.7	28.0	8.7	59.3
Ports	83	311	43.8	49.9	26.3	9.0	59.9
Prestn	96	368	35.5	34.2	24.0	11.9	48.5
Redng	97	204	23.0	22.8	17.8	6.7	32.8
Sheff	98	502	51.0	47.7	37.3	17.2	69.6
Shrew	95	140	36.0	34.8	24.9	12.6	41.7
Stevng	96	296	47.8	43.3	38.0	19.0	57.0
Sthend	92	106	56.6	47.9	44.3	22.6	80.5
Stoke	97	234	41.5	41.9	28.7	14.2	51.9
Sund	97	144	25.3	27.9	14.3	6.6	33.5
Swanse	97	266	43.9	127.5	20.2	9.2	52.9
Truro	99	142	32.1	35.3	22.9	10.6	40.5
Tyrone	96	68	43.2	30.7	34.8	22.9	58.0
Ulster	100	74	36.4	32.2	25.1	13.8	46.7
Wirral	64	109	40.6	40.4	28.1	14.3	53.2
Wolve	99	251	25.8	35.8	14.1	6.2	30.5
Wrexm	91	67	24.2	28.5	12.9	5.5	34.7
York	98	105	31.7	36.5	21.8	11.2	35.7
England	80	11,508	38.9	44.8	25.2	11.2	49.7
N Ireland	96	612	40.6	37.9	28.6	15.2	52.8
Wales	92	860	32.6	76.2	18.5	6.8	40.1
E, W & NI	82	12,980	38.6	47.2	24.9	11.0	49.3

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

Table 10.11. Percentage of haemodialysis patients within, below and above the range for PTH (16–32 pmol/L) in 2007

Centre	N	% PTH			% PTH			% PTH		
		16–32 pmol/L	Lower 95% CI	Upper 95% CI	<16 pmol/L	Lower 95% CI	Upper 95% CI	>32 pmol/L	Lower 95% CI	Upper 95% CI
Antrim	122	30.3	22.8	39.0	36.9	28.8	45.8	32.8	25.1	41.6
B Heart	308	27.3	22.6	32.5	26.3	21.7	31.5	46.4	40.9	52.0
B QEH	428	33.6	29.3	38.3	34.6	30.2	39.2	31.8	27.5	36.3
Bangor	57	22.8	13.7	35.4	43.9	31.7	56.9	33.3	22.4	46.4
Basldn	121	27.3	20.1	35.9	29.8	22.3	38.5	43.0	34.5	51.9
Belfast	227	26.0	20.7	32.1	27.3	21.9	33.5	46.7	40.3	53.2
Bradfd	156	25.6	19.4	33.1	37.2	30.0	45.0	37.2	30.0	45.0
Brightn	287	19.2	15.0	24.1	30.3	25.3	35.9	50.5	44.8	56.3
Bristol	413	25.4	21.5	29.9	44.3	39.6	49.1	30.3	26.0	34.9
Cardff	411	24.3	20.4	28.7	47.0	42.2	51.8	28.7	24.5	33.3
Carlis	76	25.0	16.6	35.9	27.6	18.8	38.7	47.4	36.5	58.5
Chelms	92	34.8	25.8	45.0	23.9	16.3	33.7	41.3	31.7	51.6
Clwyd	59	23.7	14.6	36.2	40.7	29.0	53.6	35.6	24.5	48.5
Covnt	224	16.1	11.8	21.5	24.6	19.4	30.6	59.4	52.8	65.6
Derby	182	29.1	23.0	36.1	43.4	36.4	50.7	27.5	21.5	34.4
Derry	41	34.2	21.4	49.7	12.2	5.2	26.1	53.7	38.5	68.1
Donc	54	22.2	13.1	35.2	31.5	20.6	44.9	46.3	33.6	59.5
Dorset	121	24.8	17.9	33.3	32.2	24.5	41.1	43.0	34.5	51.9
Dudley	84	23.8	15.9	34.1	36.9	27.3	47.7	39.3	29.5	50.1
Exeter	245	19.2	14.7	24.6	60.4	54.2	66.3	20.4	15.8	25.9
Glouc	159	30.2	23.6	37.8	45.9	38.3	53.7	23.9	17.9	31.1
Hull	269	18.6	14.4	23.7	48.7	42.8	54.7	32.7	27.4	38.6
Ipswi	89	30.3	21.7	40.6	32.6	23.7	43.0	37.1	27.7	47.5
L Barts	546	20.5	17.3	24.1	28.2	24.6	32.1	51.3	47.1	55.5
L Guys	427	21.3	17.7	25.5	25.3	21.4	29.6	53.4	48.7	58.1
L Rfree	448	31.0	26.9	35.5	31.0	26.9	35.5	38.0	33.6	42.5
Leeds	450	29.1	25.1	33.5	42.9	38.4	47.5	28.0	24.0	32.3
Leic	610	19.7	16.7	23.0	34.9	31.2	38.8	45.4	41.5	49.4
Liv Ain	84	33.3	24.1	44.0	41.7	31.6	52.4	25.0	16.9	35.3
Liv RI	355	30.1	25.6	35.1	26.8	22.4	31.6	43.1	38.0	48.3
M Hope	245	23.3	18.4	29.0	46.5	40.4	52.8	30.2	24.8	36.2
M RI	203	21.2	16.1	27.3	28.1	22.3	34.7	50.7	43.9	57.6
Middlbr	234	26.1	20.9	32.1	27.8	22.4	33.9	46.2	39.9	52.6
Newc	204	30.4	24.5	37.0	34.3	28.1	41.1	35.3	29.0	42.1
Newry	80	17.5	10.7	27.4	25.0	16.7	35.6	57.5	46.5	67.8
Norwch	196	35.7	29.3	42.7	23.5	18.1	29.9	40.8	34.2	47.8
Nottm	333	24.0	19.7	28.9	26.1	21.7	31.1	49.9	44.5	55.2
Oxford	303	20.8	16.6	25.7	29.4	24.5	34.8	49.8	44.2	55.4
Plymth	84	19.1	12.0	28.9	35.7	26.2	46.5	45.2	35.0	55.9
Ports	311	19.0	15.0	23.7	37.9	32.7	43.5	43.1	37.7	48.7
Prestn	368	28.8	24.4	33.6	32.6	28.0	37.6	38.6	33.8	43.7
Redng	204	25.5	20.0	31.9	48.0	41.3	54.9	26.5	20.9	33.0
Sheff	502	21.1	17.8	24.9	23.7	20.2	27.6	55.2	50.8	59.5
Shrew	140	27.9	21.1	35.9	33.6	26.3	41.8	38.6	30.9	46.9
Stevng	296	32.8	27.7	38.3	13.9	10.4	18.3	53.4	47.7	59.0
Sthend	106	22.6	15.7	31.6	17.0	11.0	25.4	60.4	50.8	69.2
Stoke	234	28.2	22.8	34.3	28.6	23.2	34.8	43.2	37.0	49.6
Sund	144	18.1	12.6	25.2	55.6	47.4	63.5	26.4	19.8	34.2
Swanse	266	23.3	18.6	28.8	41.4	35.6	47.4	35.3	29.8	41.3
Truro	142	25.4	18.9	33.1	38.7	31.1	47.0	35.9	28.5	44.1
Tyrone	68	29.4	19.8	41.3	14.7	8.1	25.2	55.9	44.0	67.2
Ulster	74	28.4	19.3	39.6	31.1	21.6	42.5	40.5	30.0	52.0
Wirral	109	33.0	24.9	42.4	26.6	19.2	35.7	40.4	31.6	49.8
Wolve	251	20.7	16.2	26.2	55.8	49.6	61.8	23.5	18.7	29.2
Wrexm	67	14.9	8.2	25.6	58.2	46.2	69.4	26.9	17.6	38.7
York	105	28.6	20.8	37.9	41.0	32.0	50.6	30.5	22.4	39.9
England	11,508	24.7	23.9	25.5	34.5	33.6	35.4	40.8	39.9	41.7
N Ireland	612	27.0	23.6	30.6	27.0	23.6	30.6	46.1	42.2	50.0
Wales	860	23.1	20.4	26.1	45.5	42.2	48.8	31.4	28.4	34.6
E, W & NI	12,980	24.7	24.0	25.5	34.9	34.0	35.7	40.4	39.6	41.3

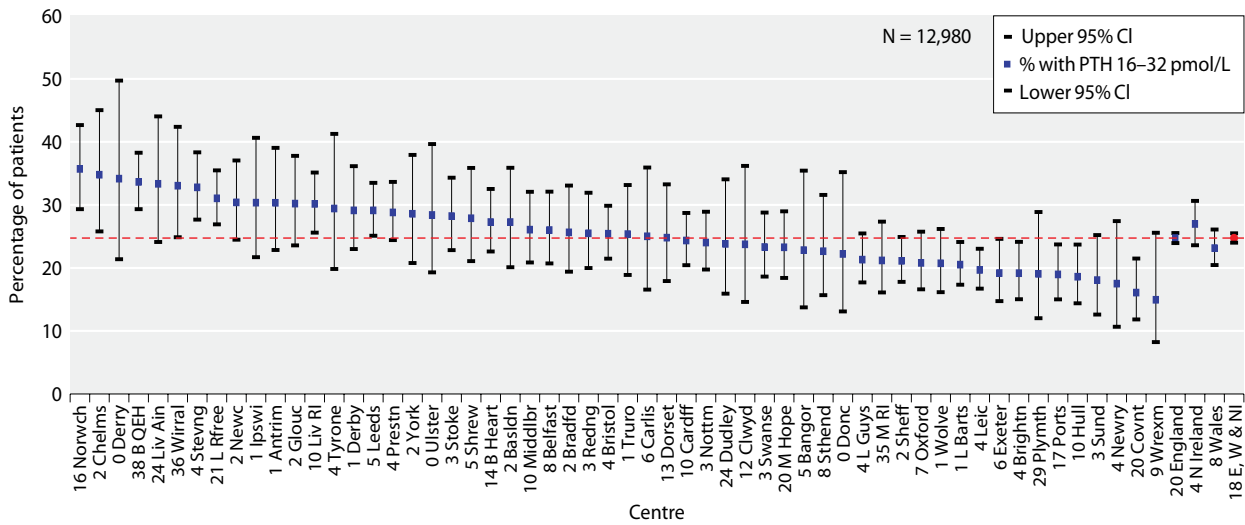


Fig. 10.27. Percentage of haemodialysis patients with PTH 16–32 pmol/L by centre in 2007

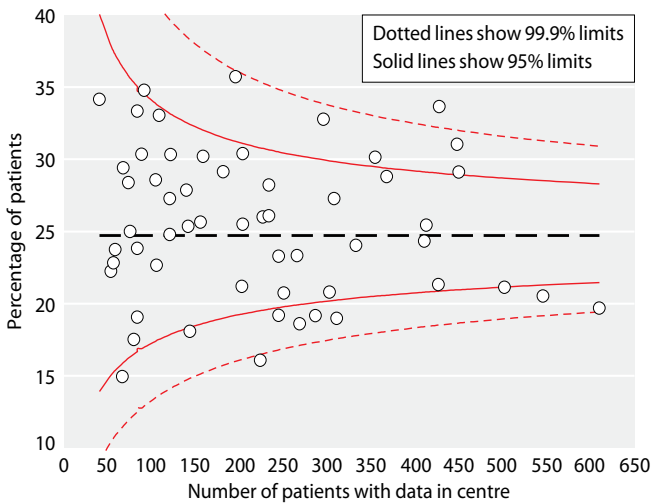


Fig. 10.28. Funnel plot of percentage of haemodialysis patients with PTH 16–32 pmol/L by centre in 2007

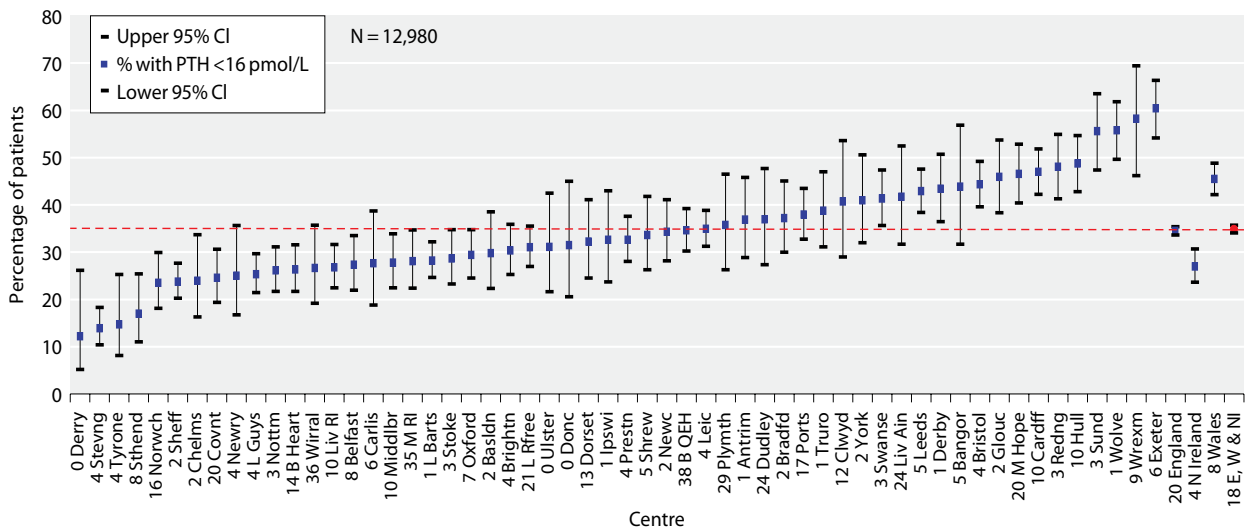


Fig. 10.29. Percentage of haemodialysis patients with PTH <16 pmol/L by centre in 2007

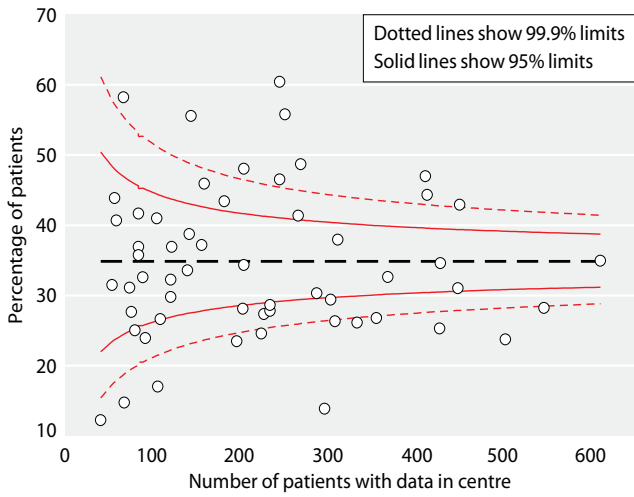


Fig. 10.30. Funnel plot of percentage of haemodialysis patients with PTH <16 pmol/L by centre in 2007

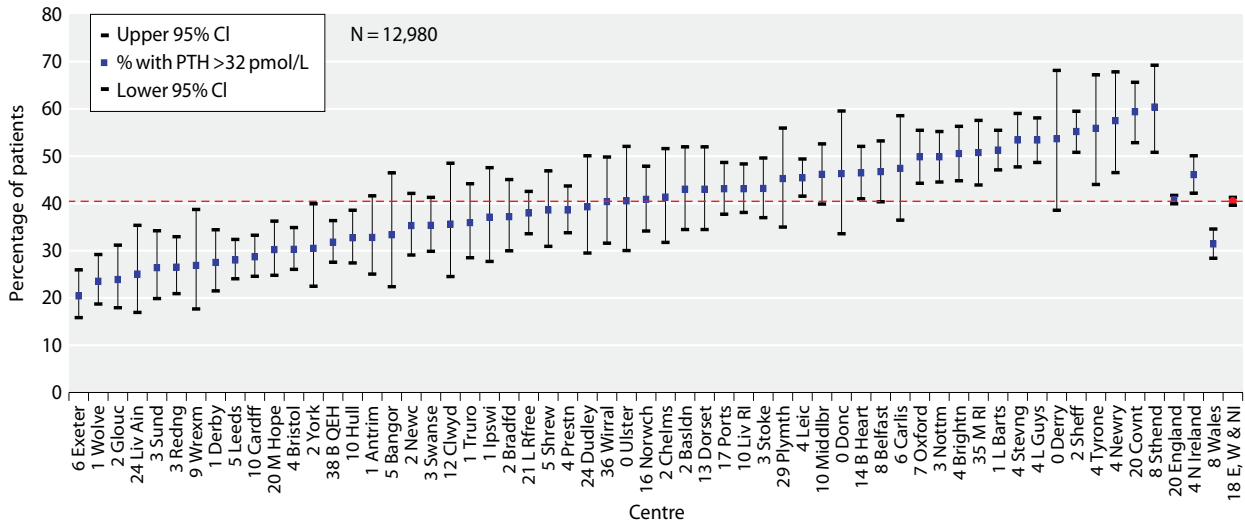


Fig. 10.31. Percentage of haemodialysis patients with PTH >32 pmol/L by centre in 2007

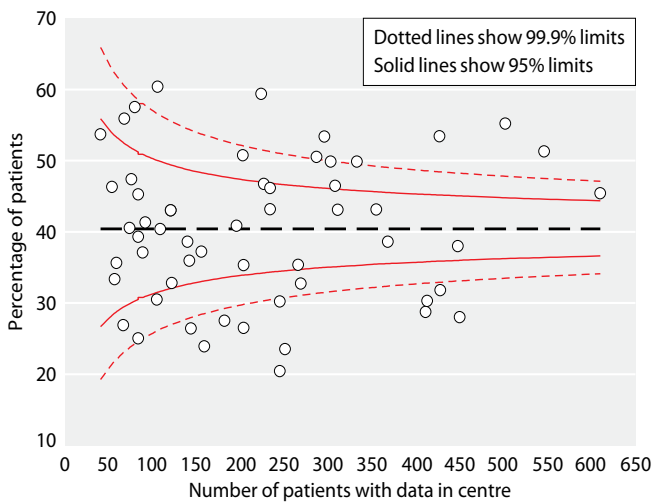


Fig. 10.32. Funnel plot of percentage of haemodialysis patients with PTH >32 pmol/L by centre in 2007

Table 10.12. Summary statistics for PTH in peritoneal dialysis patients in 2007

Centre	% completeness	Number of patients with data	Mean	SD	Median	Lower quartile	Upper quartile
Antrim	94	15					
B Heart	81	25	30.0	35.2	16.7	11.3	29.8
B QEH	73	86	22.1	16.3	18.9	8.2	36.2
Bangor	100	31	27.5	32.0	16.8	7.4	28.6
Basldn	100	26	43.3	28.3	34.6	21.9	65.7
Belfast	93	53	54.6	36.7	47.4	22.4	79.7
Bradfd	89	32	45.2	47.6	37.6	14.2	52.6
Brightn	97	76	34.2	30.6	26.7	14.8	44.4
Bristol	96	69	44.6	48.7	24.2	10.5	56.2
Camb	96	45	34.0	30.4	25.5	15.3	39.7
Cardff	97	143	51.9	41.4	40.4	21.5	67.2
Carlis	100	11					
Carsh	7	8					
Chelms	94	34	35.9	27.4	33.2	20.2	40.9
Clwyd	77	10					
Covnt	77	50	31.3	34.2	19.0	10.0	42.0
Derby	99	70	22.4	19.1	18.2	10.2	28.6
Derry	75	3					
Donc	45	15					
Dorset	86	48	22.0	25.2	13.8	7.1	21.9
Dudley	74	40	46.3	43.0	31.9	15.7	66.9
Exeter	99	69	24.8	20.6	19.9	9.0	30.3
Glouc	87	26	22.6	18.4	20.1	12.1	28.0
Hull	69	57	29.4	41.9	19.1	8.7	30.8
Ipswi	96	43	41.9	37.1	32.2	19.5	53.2
L Barts	89	193	32.7	36.6	19.5	9.0	41.0
L Guys	93	56	38.1	37.0	25.1	13.7	51.5
L Kings	1	1					
L Rfree	94	113	26.8	21.1	22.0	12.0	34.0
L West	56	36	41.5	31.6	26.7	18.1	69.6
Leeds	98	97	34.7	33.7	26.4	13.1	47.4
Leic	93	167	41.0	38.1	35.9	15.8	53.9
Liv Ain	n/a	0					
Liv RI	85	78	34.8	31.1	23.0	13.0	50.0
M Hope	86	100	25.0	22.9	19.8	7.0	31.4
M RI	99	114	41.0	31.4	32.2	20.0	57.7
Middlbr	76	19					
Newc	96	44	25.8	24.6	21.2	6.0	36.8
Newry	92	12					
Norwch	74	42	22.5	22.1	16.9	8.5	24.7
Nottm	95	128	31.4	38.4	17.7	8.7	35.3
Oxford	92	123	45.4	42.5	33.7	13.6	61.5
Plymth	61	23	33.0	38.2	21.8	10.0	26.3
Ports	57	52	52.1	51.5	37.1	14.0	68.4
Prestn	97	75	44.4	31.7	35.7	23.4	62.7
Redng	98	84	25.0	21.1	20.1	13.2	29.6
Sheff	85	75	56.1	44.5	49.6	25.8	69.8
Shrew	97	32	25.8	26.2	16.6	8.5	29.2
Stevng	87	33	54.5	45.1	38.0	28.5	66.5
Sthend	72	13					
Stoke	92	83	52.5	50.8	39.7	14.5	69.1
Sund	90	9					
Swanse	95	70	36.8	28.0	29.3	15.8	53.9
Truro	96	22	36.2	55.9	20.0	7.1	51.2
Tyrone	100	5					
Ulster	100	2					
Wirral	64	18					
Wolve	92	49	27.4	40.0	17.7	9.8	25.7
Wrexm	77	23	36.7	46.6	20.5	7.1	43.3
York	96	22	26.2	25.1	20.1	7.3	31.6
England	83	2,731	35.2	35.8	24.1	11.9	46.9
N Ireland	93	90	44.3	34.8	32.2	19.9	64.7
Wales	94	277	44.5	41.1	33.5	15.3	58.7
E, W & NI	84	3,098	36.3	36.4	25.0	12.2	48.0

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

n/a not applicable

Table 10.13. Percentage of peritoneal dialysis patients within, below and above the range for PTH (16–32 pmol/L) in 2007

Centre	N	% PTH 16–32 pmol/L			% PTH <16 pmol/L			% PTH >32 pmol/L		
		Lower 5% CI	Upper 95% CI		Lower 95% CI	Upper 95% CI		Lower 95% CI	Upper 95% CI	
B Heart	25	32.0	16.9	52.2	44.0	26.3	63.4	24.0	11.2	44.2
B QEH	86	26.7	18.5	37.1	45.4	35.2	55.9	27.9	19.5	38.3
Bangor	31	29.0	15.9	47.1	48.4	31.7	65.5	22.6	11.2	40.4
Basldn	26	30.8	16.2	50.6	15.4	5.9	34.5	53.9	35.1	71.6
Belfast	53	28.3	17.8	41.8	9.4	4.0	20.7	62.3	48.6	74.2
Bradfd	32	18.8	8.7	35.9	28.1	15.3	45.8	53.1	36.1	69.4
Brightn	76	39.5	29.2	50.8	26.3	17.7	37.3	34.2	24.5	45.5
Bristol	69	18.8	11.3	29.8	37.7	27.1	49.6	43.5	32.3	55.3
Camb	45	37.8	24.9	52.6	26.7	15.8	41.3	35.6	23.1	50.4
Cardff	143	18.9	13.3	26.1	18.2	12.7	25.4	62.9	54.7	70.5
Chelms	34	29.4	16.6	46.6	17.7	8.2	34.1	52.9	36.5	68.8
Covnt	50	22.0	12.6	35.5	44.0	31.0	57.9	34.0	22.3	48.1
Derby	70	31.4	21.7	43.2	47.1	35.8	58.8	21.4	13.4	32.6
Dorset	48	20.8	11.6	34.6	62.5	48.2	74.9	16.7	8.6	29.9
Dudley	40	25.0	14.0	40.5	25.0	14.0	40.5	50.0	35.0	65.0
Exeter	69	34.8	24.5	46.7	40.6	29.7	52.5	24.6	15.9	36.1
Glouc	26	50.0	31.7	68.3	30.8	16.2	50.6	19.2	8.2	38.7
Hull	57	31.6	20.9	44.7	43.9	31.7	56.9	24.6	15.1	37.3
Ipswi	43	27.9	16.6	43.0	20.9	11.3	35.6	51.2	36.6	65.6
L Barts	193	22.3	17.0	28.7	41.5	34.7	48.5	36.3	29.8	43.3
L Guys	56	33.9	22.8	47.2	30.4	19.8	43.5	35.7	24.3	49.0
L Rfree	113	34.5	26.3	43.7	36.3	28.0	45.5	29.2	21.6	38.2
L West	36	27.8	15.7	44.4	25.0	13.6	41.5	47.2	31.7	63.3
Leeds	97	24.7	17.2	34.3	32.0	23.5	41.9	43.3	33.8	53.3
Leic	167	19.8	14.4	26.5	25.2	19.2	32.3	55.1	47.5	62.5
Liv RI	78	28.2	19.4	39.2	34.6	24.9	45.8	37.2	27.2	48.4
M Hope	100	36.0	27.2	45.8	40.0	30.9	49.9	24.0	16.6	33.3
M RI	114	30.7	22.9	39.7	19.3	13.1	27.6	50.0	40.9	59.1
Newc	44	27.3	16.2	42.1	40.9	27.5	55.8	31.8	19.8	46.8
Norwch	42	31.0	18.9	46.3	47.6	33.2	62.5	21.4	11.5	36.3
Nottm	128	27.3	20.3	35.7	44.5	36.2	53.2	28.1	21.0	36.5
Oxford	123	21.1	14.8	29.2	27.6	20.5	36.2	51.2	42.4	59.9
Plymth	23	52.2	32.5	71.2	30.4	15.3	51.5	17.4	6.7	38.2
Ports	52	17.3	9.3	30.0	26.9	16.6	40.5	55.8	42.2	68.6
Prestn	75	28.0	19.0	39.2	14.7	8.3	24.6	57.3	46.0	68.0
Redng	84	45.2	35.0	55.9	34.5	25.2	45.3	20.2	13.0	30.2
Sheff	75	17.3	10.3	27.6	14.7	8.3	24.6	68.0	56.7	77.5
Shrew	32	31.3	17.7	49.0	46.9	30.6	63.9	21.9	10.8	39.3
Stevng	33	24.2	12.6	41.5	9.1	3.0	24.7	66.7	49.2	80.5
Stoke	83	18.1	11.2	27.8	25.3	17.1	35.7	56.6	45.8	66.8
Swanse	70	27.1	18.0	38.7	27.1	18.0	38.7	45.7	34.5	57.4
Truro	22	22.7	9.8	44.4	40.9	22.8	61.8	36.4	19.3	57.7
Wolve	49	32.7	21.1	46.8	44.9	31.7	58.9	22.5	12.9	36.2
Wrexm	23	13.0	4.3	33.6	47.8	28.8	67.5	39.1	21.8	59.8
York	22	36.4	19.3	57.7	40.9	22.8	61.8	22.7	9.8	44.4
England	2,731	27.4	25.8	29.1	33.9	32.1	35.7	38.7	36.9	40.6
N Ireland	90	34.4	25.4	44.8	15.6	9.4	24.6	50.0	39.8	60.2
Wales	277	21.3	16.9	26.5	26.7	21.8	32.2	52.0	46.1	57.8
E, W & NI	3,098	27.1	25.5	28.6	32.7	31.1	34.4	40.3	38.5	42.0

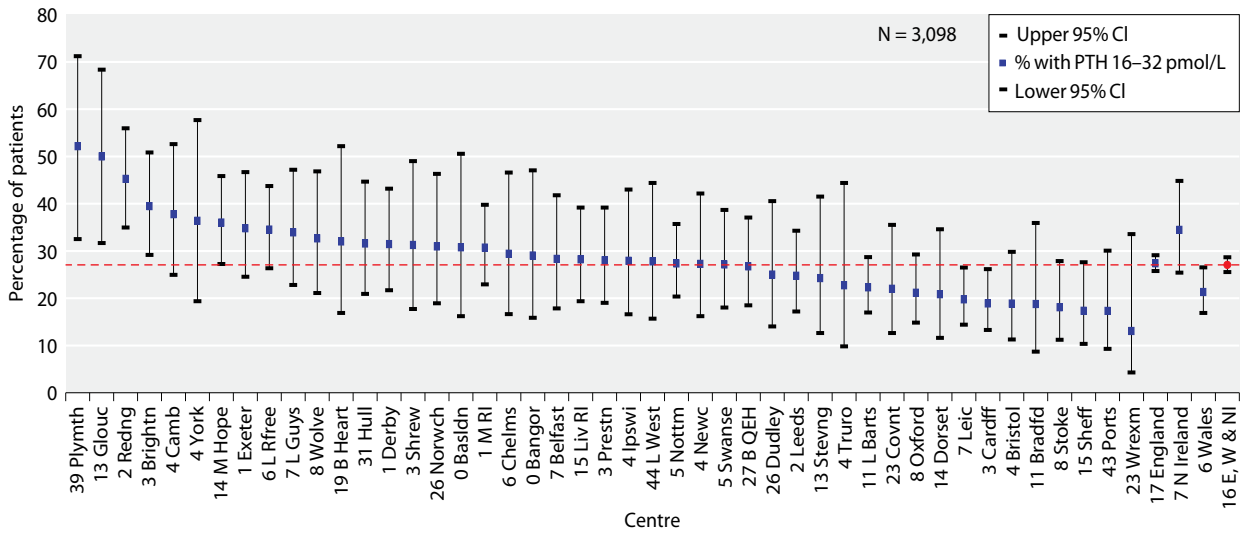


Fig. 10.33. Percentage of peritoneal dialysis patients with PTH 16–32 pmol/L by centre in 2007

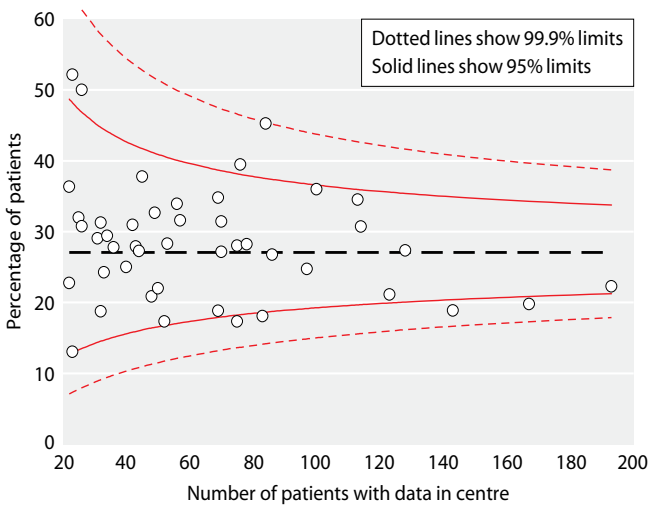


Fig. 10.34. Funnel plot of percentage of peritoneal dialysis patients with PTH 16–32 pmol/L by centre in 2007

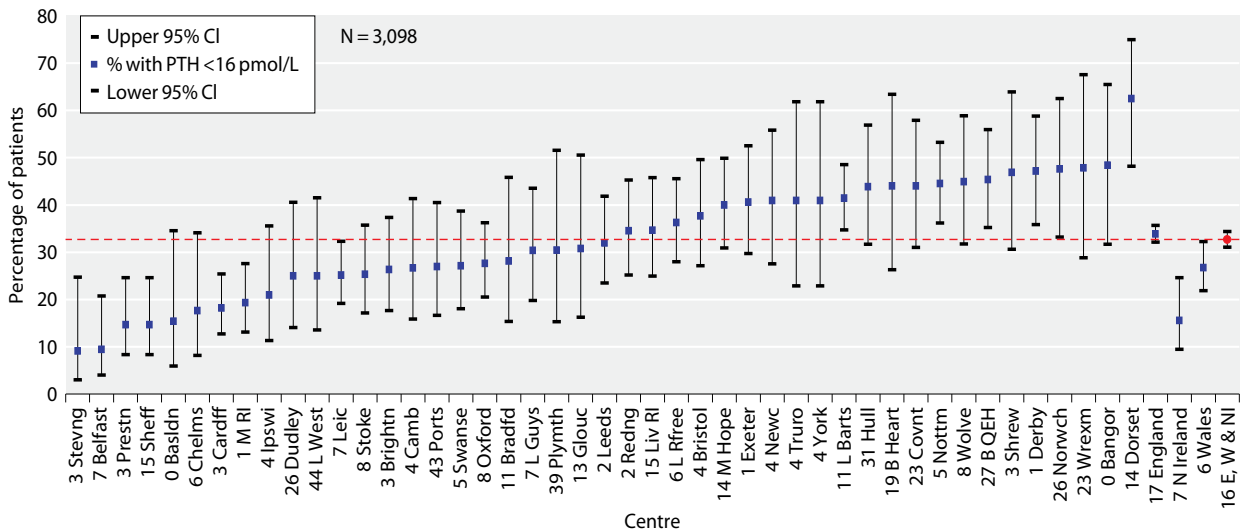


Fig. 10.35. Percentage of peritoneal dialysis patients with PTH <16 pmol/L by centre in 2007

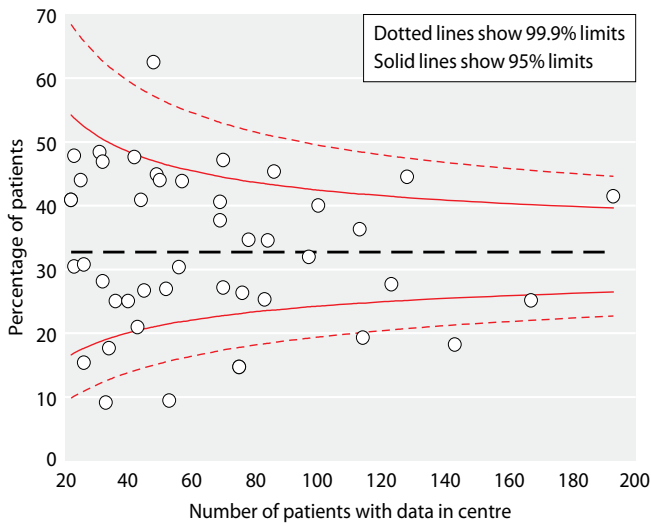


Fig. 10.36. Funnel plot of percentage of peritoneal dialysis patients with PTH <16 pmol/L by centre in 2007

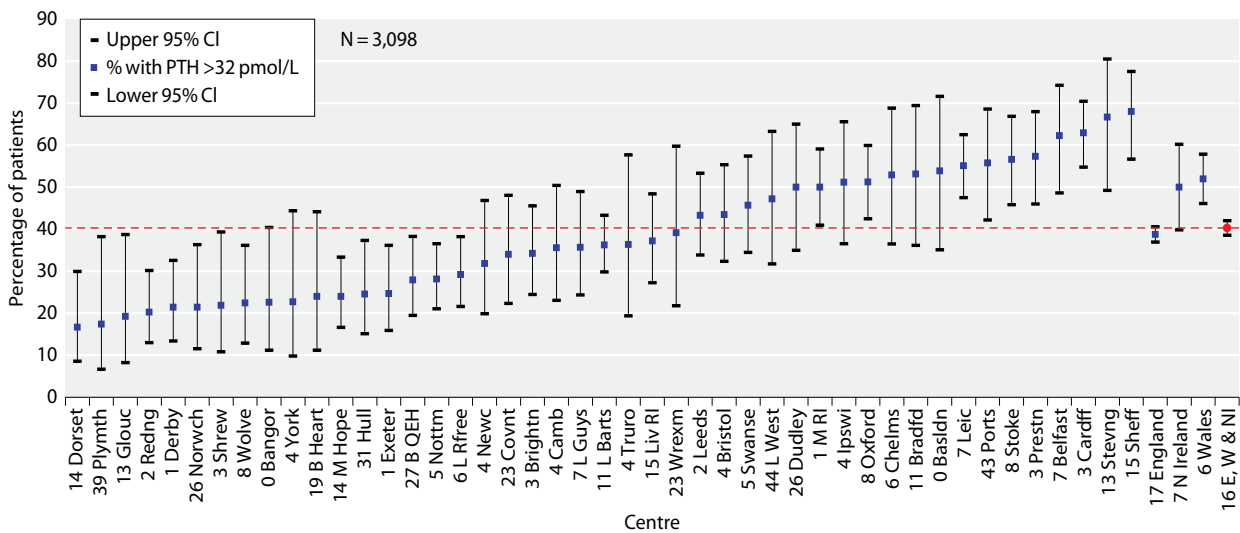


Fig. 10.37. Percentage of peritoneal dialysis patients with PTH >32 pmol/L by centre in 2007

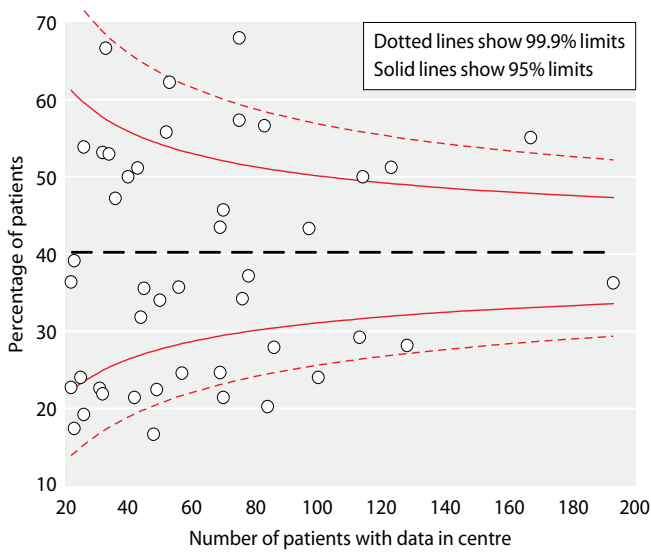


Fig. 10.38. Funnel plot of percentage of peritoneal dialysis patients with PTH >32 pmol/L by centre in 2007

Discussion – Mineral and bone parameters

There were convincing observational data that hyperphosphataemia was associated with increased mortality in dialysis patients but the data linking calcium and parathyroid hormone to patient survival were less clear [7–11]. A recent cohort study has demonstrated that simultaneous achievement of all three audit measures does appear to be associated with better outcomes [12].

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 across the UK for calcium and parathyroid hormone. However, detecting these centre level differences is an important step in understanding the factors associated with exceptional performance.

Bicarbonate

The 4th edition of the Renal Association Clinical Practice Guidelines state:

‘For HD patients pre-dialysis serum bicarbonate concentrations measured with minimum delay after venepuncture and before a ‘short gap’ dialysis session should be between 20 and 26 mmol/L (Module 3a: Haemodialysis)

‘For PD patients, Plasma bicarbonate should be maintained within the normal range.’ (Module 3b: Peritoneal dialysis) [1]

Results and discussion

Bicarbonate data were 82% complete for HD patients and 81% complete for PD patients (tables 10.14 and 10.16). Seventy one percent (CI 70–72%) of HD patients and 50% (CI 49–52%) of PD patients achieved the audit measure for bicarbonate and there was inter-centre variation for both HD and PD (tables 10.15 and 10.17, figures 10.39 and 10.40). 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 10.15 and 10.17). The UKRR 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

Table 10.14. Summary statistics for bicarbonate in haemodialysis patients in 2007

Centre	% completeness	Number of patients with data	Mean	SD	Median	Lower quartile	Upper quartile
Antrim	99	119	24	2.7	24	22	26
B Heart	93	317	25	2.7	25	23	26
B QEH	93	630	24	3.4	24	22	26
Bangor	96	53	23	2.3	23	22	24
Basldn	98	121	21	2.6	22	20	23
Belfast	96	230	24	3.0	24	22	26
Bradfd	99	157	22	2.9	22	20	24
Brightn	100	274	23	2.7	23	21	25
Bristol	100	398	23	2.5	23	22	25
Camb	52	169	24	3.4	24	22	26
Cardff	76	346	20	3.4	20	18	23
Carlisle	95	77	23	2.2	23	22	24
Carsh	83	436	26	4.0	26	23	29
Chelms	100	94	25	2.9	25	23	27
Clwyd	92	61	25	3.5	25	23	26
Covnt	40	109					
Derby	99	172	23	3.0	23	21	25
Derry	100	41	21	1.9	22	20	22
Donc	100	54	22	2.7	22	21	24
Dorset	100	137	26	3.1	26	24	27
Dudley	88	95	25	3.3	25	23	27
Exeter	99	258	22	2.5	23	21	24
Glouc	100	162	25	2.4	25	24	26
Hull	97	278	22	2.9	22	20	24
Ipswi	100	86	21	3.0	21	18	23
L Barts	100	540	24	2.9	24	22	26

Table 10.14. Continued

Centre	% completeness	Number of patients with data	Mean	SD	Median	Lower quartile	Upper quartile
L Guys	84	351	24	3.0	24	22	26
L Kings	0	0					
L Rfree	82	452	24	3.0	24	23	26
L West	21	201					
Leeds	97	445	22	2.9	21	20	23
Leic	90	551	23	3.0	23	21	25
Liv Ain	98	107	22	2.7	22	21	24
Liv RI	94	363	23	3.1	23	21	24
M Hope	1	2					
M RI	66	180	24	3.8	24	22	27
Middlbr	97	252	24	3.0	24	23	26
Newc	100	200	23	3.3	23	21	25
Newry	99	82	25	2.6	25	23	27
Norwch	92	207	21	2.5	22	20	23
Nottm	76	254	24	3.5	24	22	26
Oxford	99	302	22	3.5	22	20	24
Plymth	99	117	23	3.2	23	21	25
Ports	99	370	23	2.7	23	21	25
Prestn	83	302	23	3.0	24	22	26
Redng	100	210	25	3.1	25	23	27
Sheff	99	473	25	2.9	25	23	26
Shrew	100	146	22	3.2	22	20	24
Stevng	95	293	22	3.1	22	20	24
Sthend	97	112	23	2.6	23	21	25
Stoke	1	2					
Sund	97	142	23	2.8	23	21	24
Swanse	99	259	21	3.4	21	18	23
Truro	99	136	23	2.6	23	21	25
Tyrone	97	68	24	3.0	24	22	26
Ulster	100	73	19	1.9	20	18	21
Wirral	94	159	24	3.5	24	22	26
Wolve	100	252	21	3.5	21	19	23
Wrexm	99	73	22	2.8	22	21	25
York	100	106	24	3.1	24	22	26
England	81	11,251	23	3.3	23	21	25
N Ireland	98	613	23	3.2	23	21	26
Wales	87	792	21	3.6	21	19	24
E, W & NI	82	12,656	23	3.4	23	21	25

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

Table 10.15. Percentage of haemodialysis patients within, below and above the range for bicarbonate (20–26 mmol/L) in 2007

Centre	N	% bicarb 20–26 mmol/L			% bicarb <20 mmol/L			% bicarb >26 mmol/L		
		Lower 95% CI	Upper 95% CI		Lower 95% CI	Upper 95% CI		Lower 95% CI	Upper 95% CI	
Antrim	119	76.5	68.0	83.2	5.0	2.3	10.8	18.5	12.5	26.5
B Heart	317	66.9	61.5	71.8	5.4	3.4	8.5	27.8	23.1	33.0
B QEH	630	69.5	65.8	73.0	9.5	7.5	12.1	21.0	18.0	24.3
Bangor	53	77.4	64.2	86.7	9.4	4.0	20.7	13.2	6.4	25.2
Basldn	121	76.9	68.5	83.5	23.1	16.5	31.5	0.0	0.0	0.0
Belfast	230	75.2	69.2	80.4	7.0	4.3	11.1	17.8	13.4	23.3
Bradfd	157	80.3	73.3	85.8	12.7	8.4	18.9	7.0	3.9	12.2
Brightn	274	77.4	72.0	81.9	11.0	7.8	15.2	11.7	8.4	16.1
Bristol	398	84.2	80.3	87.4	7.5	5.3	10.6	8.3	6.0	11.4
Camb	169	66.9	59.4	73.5	8.9	5.4	14.2	24.3	18.4	31.3

Table 10.15. Continued

Centre	N	% bicarb 20–26 mmol/L	Lower 95% CI	Upper 95% CI	% bicarb <20 mmol/L	Lower 95% CI	Upper 95% CI	% bicarb >26 mmol/L	Lower 95% CI	Upper 95% CI
Cardff	346	50.0	44.8	55.3	45.7	40.5	50.9	4.3	2.6	7.1
Carlisle	77	85.7	76.0	91.9	6.5	2.7	14.7	7.8	3.5	16.3
Carsh	436	51.4	46.7	56.0	3.4	2.1	5.6	45.2	40.6	49.9
Chelms	94	62.8	52.6	71.9	3.2	1.0	9.4	34.0	25.2	44.2
Clwyd	61	73.8	61.4	83.3	3.3	0.8	12.2	23.0	14.1	35.1
Derby	172	77.3	70.5	83.0	10.5	6.7	16.0	12.2	8.1	18.0
Derry	41	78.1	62.9	88.2	22.0	11.8	37.1	0.0	0.0	0.0
Donc	54	79.6	66.8	88.4	11.1	5.1	22.6	9.3	3.9	20.4
Dorset	137	59.9	51.4	67.7	3.7	1.5	8.5	36.5	28.9	44.9
Dudley	95	60.0	49.9	69.3	2.1	0.5	8.0	37.9	28.7	48.0
Exeter	258	87.6	83.0	91.1	10.5	7.3	14.8	1.9	0.8	4.6
Glouc	162	75.9	68.8	81.9	1.2	0.3	4.8	22.8	17.0	29.9
Hull	278	76.6	71.3	81.2	20.5	16.2	25.7	2.9	1.5	5.7
Ipswi	86	59.3	48.7	69.1	38.4	28.7	49.0	2.3	0.6	8.8
L Barts	540	76.7	72.9	80.0	7.0	5.2	9.5	16.3	13.4	19.7
L Guys	351	75.5	70.7	79.7	8.3	5.8	11.6	16.2	12.7	20.5
L Rfree	452	70.6	66.2	74.6	5.5	3.8	8.1	23.9	20.2	28.0
Leeds	445	74.6	70.4	78.4	20.0	16.5	24.0	5.4	3.6	7.9
Leic	551	74.4	70.6	77.9	12.0	9.5	15.0	13.6	11.0	16.7
Liv Ain	107	76.6	67.7	83.7	14.0	8.6	22.0	9.4	5.1	16.5
Liv RI	363	75.8	71.1	79.9	13.8	10.6	17.7	10.5	7.7	14.1
M RI	180	63.9	56.6	70.6	8.3	5.1	13.4	27.8	21.7	34.8
Middlbr	252	75.4	69.7	80.3	4.4	2.4	7.7	20.2	15.7	25.7
Newc	200	70.0	63.3	76.0	14.0	9.8	19.5	16.0	11.5	21.8
Newry	82	64.6	53.8	74.2	2.4	0.6	9.2	32.9	23.7	43.8
Norwch	207	77.3	71.1	82.5	21.3	16.2	27.4	1.5	0.5	4.4
Nottm	254	71.3	65.4	76.5	8.7	5.8	12.8	20.1	15.6	25.5
Oxford	302	66.6	61.0	71.7	23.2	18.8	28.3	10.3	7.3	14.2
Plymth	117	72.7	63.9	80.0	17.1	11.3	25.0	10.3	5.9	17.2
Ports	370	78.7	74.2	82.5	11.9	9.0	15.6	9.5	6.9	12.9
Prestn	302	72.2	66.9	77.0	10.9	7.9	15.0	16.9	13.1	21.5
Redng	210	69.5	63.0	75.4	4.3	2.2	8.0	26.2	20.7	32.6
Sheff	473	72.5	68.3	76.4	3.2	1.9	5.2	24.3	20.7	28.4
Shrew	146	70.6	62.7	77.4	23.3	17.1	30.8	6.2	3.2	11.4
Stevng	293	73.4	68.0	78.1	19.5	15.3	24.4	7.2	4.7	10.7
Sthend	112	81.3	73.0	87.4	9.8	5.5	16.9	8.9	4.9	15.8
Sund	142	82.4	75.2	87.8	11.3	7.0	17.6	6.3	3.3	11.7
Swanse	259	56.8	50.7	62.7	38.6	32.9	44.7	4.6	2.7	8.0
Truro	136	84.6	77.5	89.7	6.6	3.5	12.2	8.8	5.1	14.9
Tyrone	68	72.1	60.3	81.4	8.8	4.0	18.3	19.1	11.4	30.2
Ulster	73	54.8	43.3	65.8	45.2	34.2	56.7	0.0	0.0	0.0
Wirral	159	69.2	61.6	75.9	9.4	5.8	15.1	21.4	15.7	28.4
Wolve	252	59.5	53.4	65.4	35.3	29.7	41.4	5.2	3.0	8.7
Wrexm	73	84.9	74.8	91.5	9.6	4.6	18.8	5.5	2.1	13.7
York	106	73.6	64.4	81.1	5.7	2.6	12.0	20.8	14.1	29.5
England	11,251	72.1	71.2	72.9	12.1	11.5	12.7	15.9	15.2	16.6
N Ireland	613	71.5	67.8	74.9	11.8	9.4	14.5	16.8	14.1	20.0
Wales	792	59.1	55.6	62.5	34.3	31.1	37.7	6.6	5.0	8.5
E, W & NI	12,656	71.2	70.4	72.0	13.4	12.9	14.1	15.3	14.7	16.0

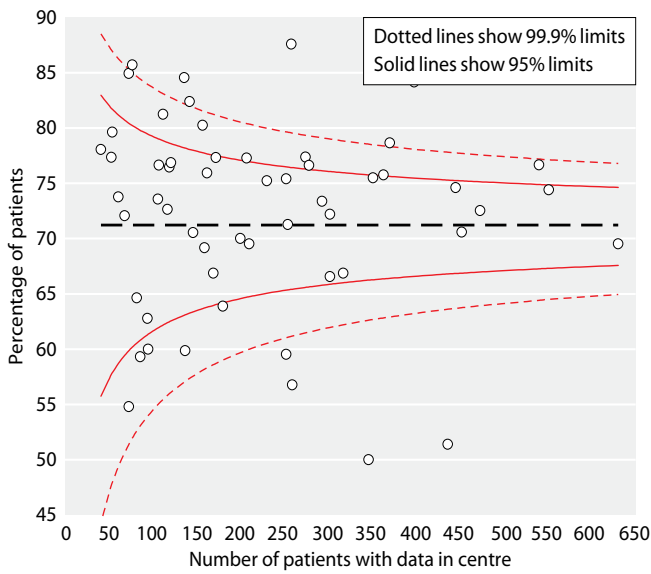


Fig. 10.39. Funnel plot of percentage of haemodialysis patients with bicarbonate 20–26 mmol/L by centre in 2007

Table 10.16. Summary statistics for serum bicarbonate in peritoneal dialysis patients in 2007

Centre	% completeness	Number of patients with data	Mean	SD	Median	Lower quartile	Upper quartile
Antrim	94	15					
B Heart	97	30	26	2.44	26	25	27
B QEH	81	95	26	3.14	26	24	28
Bangor	97	30	26	3.11	26	23	29
Basldn	100	26	26	2.96	26	24	27
Belfast	96	55	27	3.21	27	24	28
Bradfd	100	36	26	2.75	26	24	28
Brightn	97	76	24	2.81	24	23	25
Bristol	100	72	25	2.78	26	24	27
Camb	100	47	28	4.38	28	25	32
Cardff	97	142	22	3.54	22	20	24
Carlisle	100	11					
Carsh	94	106	31	3.64	32	29	34
Chelms	97	35	28	2.46	28	26	30
Clwyd	92	12					
Covnt	54	35	25	2.59	25	24	27
Derby	100	71	27	3.57	27	24	29
Derry	100	4					
Donc	39	13					
Dorset	98	55	25	2.91	26	23	27
Dudley	91	49	26	3.00	26	24	28
Exeter	100	70	24	3.36	24	22	27
Glouc	100	30	27	2.37	27	26	28
Hull	95	79	26	2.77	26	24	28
Ipswi	96	43	25	2.77	25	22	27
L Barts	100	217	27	3.01	26	25	28
L Guys	97	58	24	2.87	23	22	26
L Kings	1	1					
L Rfree	95	114	26	3.36	26	24	28
L West	0	0					
Leeds	99	98	25	3.07	25	23	28
Leic	92	166	25	3.31	26	23	28
Liv RI	92	85	24	3.04	24	22	26

Table 10.16. Continued

Centre	% completeness	Number of patients with data	Mean	SD	Median	Lower quartile	Upper quartile
Liv Ain	n/a	0					
M Hope	0	0					
M RI	100	115	26	2.69	26	24	27
Middlbr	92	23	28	2.74	27	26	29
Newc	100	46	26	2.88	25	24	28
Newry	69	9					
Norwch	96	55	21	2.35	21	20	23
Nottm	18	24					
Oxford	77	103	26	3.65	25	23	28
Plymth	100	38	25	4.02	25	23	27
Ports	68	63	25	2.78	25	24	27
Prestn	83	64	26	3.13	25	23	28
Redng	100	86	26	2.80	26	24	27
Sheff	100	88	27	3.12	27	25	29
Shrew	100	33	26	2.84	27	24	28
Stevng	95	36	27	3.23	27	24	29
Sthend	94	17					
Stoke	0	0					
Sund	100	10					
Swanse	96	71	25	3.78	25	23	27
Truro	96	22	26	3.46	27	26	29
Tyrone	100	5					
Ulster	100	2					
Wirral	68	19					
Wolve	98	52	26	2.92	27	24	28
Wrexm	90	27	24	2.47	25	23	27
York	100	23	26	2.92	26	23	28
England	80	2,635	26	3.45	26	24	28
N Ireland	93	90	26	3.11	27	24	28
Wales	96	282	23	3.78	24	21	26
E, W & NI	81	3,007	26	3.54	26	23	28

Blank cells denote centres excluded from analyses due to low patient numbers or poor data completeness
n/a not applicable

Table 10.17. Percentage of peritoneal dialysis patients within, below and above the range for bicarbonate (25–29 mmol/L) in 2007

Centre	N	% bicarb 25–29 mmol/L			% bicarb <25 mmol/L			% bicarb >29 mmol/L		
		Lower 95% CI	Upper 95% CI	mmol/L	Lower 95% CI	Upper 95% CI	mmol/L	Lower 95% CI	Upper 95% CI	
B Heart	30	56.7	38.8	72.9	26.7	13.9	45.0	16.7	7.1	34.3
B QEH	95	50.5	40.6	60.4	37.9	28.7	48.0	11.6	6.5	19.7
Bangor	30	46.7	29.9	64.2	43.3	27.1	61.2	10.0	3.3	26.8
Basldn	26	57.7	38.5	74.8	26.9	13.4	46.7	15.4	5.9	34.5
Belfast	55	58.2	44.9	70.4	25.5	15.7	38.5	16.4	8.7	28.6
Bradfd	36	69.4	52.8	82.2	27.8	15.7	44.4	2.8	0.4	17.3
Brightn	76	25.0	16.6	35.9	68.4	57.2	77.9	6.6	2.8	14.9
Bristol	72	62.5	50.8	72.9	34.7	24.7	46.4	2.8	0.7	10.4
Camb	47	48.9	35.1	62.9	17.0	8.8	30.5	34.0	22.0	48.6
Cardff	142	21.8	15.8	29.4	76.1	68.4	82.4	2.1	0.7	6.3
Carsh	106	25.5	18.1	34.6	4.7	2.0	10.8	69.8	60.4	77.8
Chelms	35	62.9	46.0	77.1	8.6	2.8	23.4	28.6	16.1	45.4
Covnt	35	57.1	40.6	72.3	40.0	25.3	56.7	2.9	0.4	17.7
Derby	71	54.9	43.3	66.1	28.2	19.0	39.7	16.9	9.9	27.5

Table 10.17. Continued

Centre	N	% bicarb 25–29 mmol/L			% bicarb <25 mmol/L			% bicarb >29 mmol/L		
		Lower 95% CI	Upper 95% CI	Mean	Lower 95% CI	Upper 95% CI	Mean	Lower 95% CI	Upper 95% CI	
Dorset	55	48.5	73.6	61.8	34.6	23.2	47.9	3.6	0.9	13.4
Dudley	49	26.3	52.9	38.8	44.9	31.7	58.9	16.3	8.4	29.4
Exeter	70	21.7	43.2	31.4	58.6	46.8	69.5	10.0	4.8	19.5
Glouc	30	58.5	88.5	76.7	13.3	5.1	30.6	10.0	3.3	26.8
Hull	79	45.9	67.4	57.0	32.9	23.5	44.0	10.1	5.2	19.0
Ipswi	43	38.7	67.7	53.5	41.9	28.2	56.9	4.7	1.2	16.8
L Barts	217	52.8	65.8	59.5	24.0	18.8	30.1	16.6	12.2	22.1
L Guys	58	29.5	54.3	41.4	58.6	45.7	70.5	0.0	0.0	0.0
L Rfree	114	47.8	65.8	57.0	29.0	21.4	37.9	14.0	8.8	21.7
Leeds	98	44.2	63.7	54.1	34.7	26.0	44.6	11.2	6.3	19.1
Leic	166	43.0	58.1	50.6	38.6	31.5	46.2	10.8	6.9	16.6
Liv RI	85	32.3	53.0	42.4	54.1	43.5	64.4	3.5	1.1	10.4
M RI	115	51.7	69.4	60.9	33.0	25.1	42.1	6.1	2.9	12.2
Middlbr	23	52.8	87.8	73.9	8.7	2.2	28.9	17.4	6.7	38.2
Newc	46	44.1	71.9	58.7	28.3	17.2	42.8	13.0	6.0	26.1
Norwch	55	2.8	17.8	7.3	92.7	82.2	97.2	0.0	0.0	0.0
Oxford	103	38.1	57.2	47.6	39.8	30.8	49.5	12.6	7.5	20.5
Plymth	38	27.6	58.1	42.1	39.5	25.4	55.6	18.4	9.0	33.9
Ports	63	35.7	59.9	47.6	46.0	34.2	58.3	6.4	2.4	15.7
Prestn	64	38.0	62.0	50.0	35.9	25.2	48.3	14.1	7.5	24.9
Redng	86	55.7	75.5	66.3	25.6	17.5	35.8	8.1	3.9	16.1
Sheff	88	55.4	75.0	65.9	19.3	12.4	28.9	14.8	8.8	23.8
Shrew	33	40.5	73.0	57.6	33.3	19.5	50.8	9.1	3.0	24.7
Stevng	36	34.2	65.8	50.0	27.8	15.7	44.4	22.2	11.5	38.5
Swanse	71	40.6	63.4	52.1	38.0	27.5	49.8	9.9	4.8	19.3
Truro	22	42.3	80.7	63.6	22.7	9.8	44.4	13.6	4.5	34.8
Wolve	52	49.7	75.3	63.5	28.9	18.2	42.5	7.7	2.9	18.8
Wrexm	27	30.4	66.4	48.2	48.2	30.4	66.4	3.7	0.5	22.1
York	23	32.5	71.2	52.2	39.1	21.8	59.8	8.7	2.2	28.9
England	2,635	49.9	53.7	51.8	34.8	33.0	36.6	13.4	12.1	14.7
N Ireland	90	45.2	65.5	55.6	30.0	21.5	40.2	14.4	8.6	23.3
Wales	282	30.1	41.2	35.5	58.9	53.0	64.5	5.7	3.5	9.1
E, W & NI	3,007	48.6	52.2	50.4	36.9	35.2	38.7	12.7	11.5	13.9

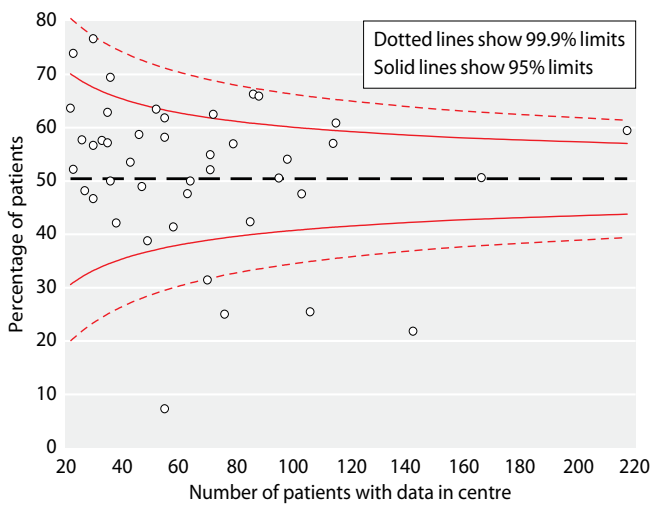


Fig. 10.40. Funnel plot of percentage of peritoneal dialysis patients with bicarbonate 25–29 mmol/L by centre in 2007

and was unable to detect any significant differences between centres. However, it was possible that there may be unmeasured processes including dialysis and oral bicarbonate prescription that might account for the variation observed [13].

Total cholesterol

There is no audit standard for total cholesterol in the 4th edition of the Renal Association Clinical Practice Guidelines. Current 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) [1]

Results and discussion

Total cholesterol data were 80% complete for HD patients and 82% complete for PD patients. As there were no specific audit measures for total cholesterol, summary data were presented for each dialysis centre (tables 10.18 and 10.19, figures 10.41 and 10.42). There were a

Table 10.18. Summary statistics for total cholesterol in haemodialysis patients in 2007

Centre	% completeness	Number of patients with data	Mean	SD	Median	Lower quartile	Upper quartile
Antrim	99	122	3.7	1.0	3.6	3.1	4.1
B Heart	49	174					
B QEH	91	630	3.9	1.1	3.7	3.2	4.4
Bangor	83	50	3.9	1.1	3.8	3.1	4.7
Basldn	98	121	4.1	1.0	4.0	3.5	4.7
Belfast	85	210	3.9	1.1	3.8	3.1	4.4
Bradfd	78	124	4.2	1.0	4.1	3.5	4.9
Brightn	24	72					
Bristol	93	397	4.1	1.1	4.0	3.3	4.7
Camb	51	169	3.7	1.0	3.5	3.1	4.2
Cardff	89	405	3.9	1.0	3.8	3.1	4.5
Carlis	94	76	4.1	1.0	4.1	3.4	4.7
Carsh	64	334	4.2	1.1	4.1	3.4	4.8
Chelms	98	92	3.5	1.0	3.4	2.8	4.3
Clwyd	31	21					
Covnt	0	0					
Derby	90	165	3.9	1.1	3.7	3.1	4.4
Derry	100	41	3.9	0.9	3.7	3.4	4.2
Donc	83	45	3.8	0.8	3.7	3.3	4.1
Dorset	91	126	4.1	1.0	4.0	3.4	4.7
Dudley	97	107	3.7	1.0	3.5	3.0	4.4
Exeter	90	235	4.1	1.2	4.0	3.2	4.7
Glouc	83	135	4.0	1.0	3.9	3.2	4.4
Hull	86	257	4.2	1.1	4.0	3.5	4.9
Ipswi	89	80	3.9	1.1	3.8	3.1	4.7
L Barts	99	548	3.9	1.0	3.7	3.1	4.5
L Guys	96	425	3.8	1.1	3.7	3.1	4.3
L Kings	95	293	3.9	0.9	3.8	3.3	4.4
L Rfree	84	478	3.9	1.0	3.8	3.2	4.4
L West	78	768	4.4	2.9	3.7	3.1	4.5
Leeds	83	393	3.8	1.0	3.7	3.2	4.3

Table 10.18. Continued

Centre	% completeness	Number of patients with data	Mean	SD	Median	Lower quartile	Upper quartile
Leic	96	610	3.8	1.0	3.7	3.1	4.4
Liv Ain	60	67	3.8	1.0	3.7	3.0	4.6
Liv RI	8	33					
M Hope	72	220	3.6	1.0	3.5	3.0	4.2
M RI	63	198	3.6	1.0	3.5	2.9	4.2
Middlbr	97	254	4.2	1.2	4.2	3.4	4.8
Newc	90	187	3.8	1.1	3.6	3.1	4.4
Newry	99	82	3.9	1.0	3.7	3.3	4.5
Norwch	88	205	4.1	1.0	4.0	3.4	4.8
Nottm	84	291	3.8	1.0	3.6	3.1	4.3
Oxford	90	293	3.8	1.1	3.7	3.1	4.4
Plymth	83	99	3.9	0.8	3.8	3.3	4.5
Ports	66	248	4.0	1.2	3.9	3.3	4.6
Prestn	99	379	3.9	0.9	3.8	3.2	4.5
Redng	96	201	3.8	1.0	3.7	3.2	4.4
Sheff	95	487	3.9	1.0	3.8	3.2	4.5
Shrew	99	146	3.9	1.0	3.8	3.2	4.5
Stevng	40	124					
Sthend	93	107	4.1	1.0	4.0	3.3	4.6
Stoke	97	235	3.7	0.9	3.6	3.0	4.3
Sund	97	143	3.8	1.0	3.7	3.1	4.4
Swanse	98	270	3.8	1.0	3.6	3.0	4.3
Truro	99	141	3.9	1.1	3.8	3.2	4.4
Tyrone	97	69	4.0	0.9	3.8	3.4	4.4
Ulster	100	74	4.1	1.0	4.0	3.4	4.7
Wirral	86	147	3.7	1.1	3.5	2.9	4.1
Wolve	96	244	3.8	1.0	3.8	3.1	4.5
Wrexm	62	46	3.9	1.0	3.8	3.3	4.4
York	91	97	4.1	1.1	4.0	3.5	4.8
England	79	11,400	3.9	1.3	3.8	3.2	4.5
N Ireland	94	598	3.9	1.0	3.7	3.2	4.4
Wales	85	792	3.8	1.0	3.7	3.1	4.5
E, W & NI	80	12,790	3.9	1.2	3.8	3.2	4.5

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

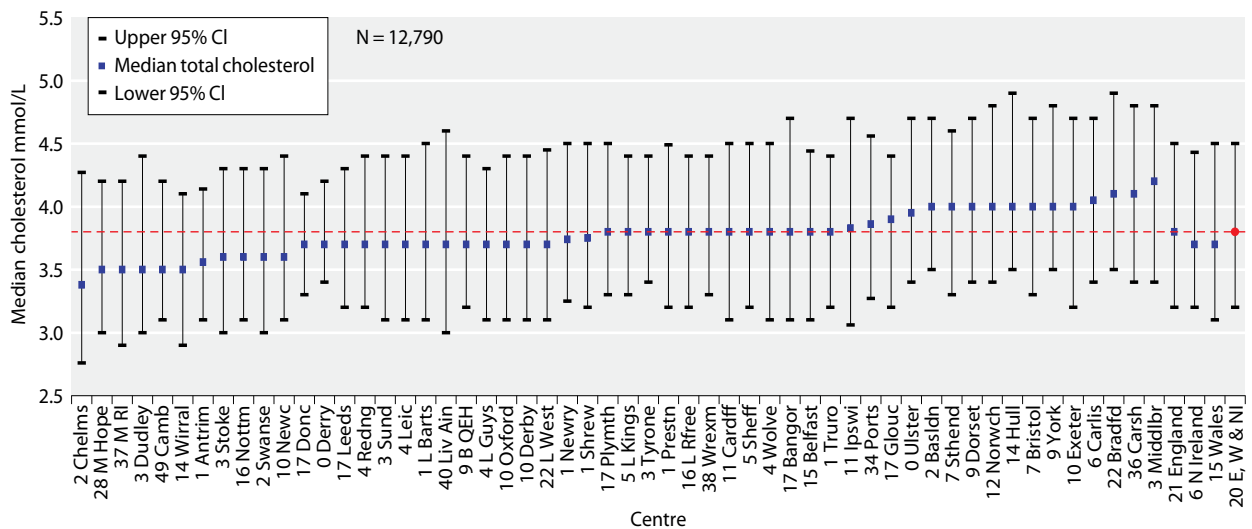


Fig. 10.41. Median total cholesterol in haemodialysis patients by centre in 2007

Table 10.19. Summary statistics for total cholesterol in peritoneal dialysis patients in 2007

Centre	% completeness	Number of patients with data	Mean	SD	Median	Lower quartile	Upper quartile
Antrim	94	15					
B Heart	90	28	4.5	1.1	4.3	3.9	5.3
B QEH	83	98	4.2	1.1	4.2	3.5	4.7
Bangor	87	27	4.8	1.2	4.8	3.9	5.5
Basldn	100	26	4.7	1.0	4.7	4.0	5.4
Belfast	96	55	4.6	1.4	4.2	3.6	5.3
Bradfd	94	34	4.9	1.3	4.6	3.8	5.5
Brightn	62	48	4.4	1.2	4.1	3.6	5.4
Bristol	85	61	4.8	1.6	4.6	3.9	5.5
Camb	100	47	4.2	1.2	4.2	3.2	4.8
Cardff	99	145	4.6	1.3	4.5	3.7	5.3
Carlisle	91	10					
Carsh	63	71	5.0	1.1	5.0	4.0	5.6
Chelms	89	32	4.5	1.2	4.4	3.8	5.0
Clwyd	62	8					
Covnt	0	0					
Derby	49	35					
Derry	100	4					
Donc	24	8					
Dorset	89	50	4.5	1.1	4.4	3.6	5.3
Dudley	76	41	4.0	1.2	3.9	3.2	4.6
Exeter	84	59	4.5	1.3	4.4	3.5	5.3
Glouc	93	28	4.9	1.5	4.8	3.8	5.6
Hull	77	64	4.9	1.1	4.8	4.1	5.7
Ipswi	96	43	4.1	0.7	4.0	3.6	4.5
L Barts	98	214	4.4	1.1	4.3	3.6	5.1
L Guys	98	59	4.7	1.3	4.7	3.8	5.3
L Kings	76	57	4.5	1.2	4.5	3.6	5.1
L Rfree	95	114	4.3	1.0	4.2	3.7	4.9
L West	64	41	4.3	1.0	4.1	3.5	5.0
Leeds	96	95	4.4	1.0	4.2	3.6	5.0
Leic	97	174	4.3	1.0	4.2	3.6	4.9
Liv Ain	n/a	0					
Liv RI	0	0					
M Hope	83	96	4.2	1.1	4.1	3.4	5.0
M RI	94	108	4.1	1.1	4.2	3.3	4.8
Middlbr	88	22	5.3	2.0	4.8	4.1	5.6
Newc	100	46	4.4	1.1	4.3	3.7	5.2
Newry	100	13					
Norwch	96	55	4.8	1.3	4.5	3.8	5.7
Nottm	93	126	4.2	1.0	4.1	3.5	4.9
Oxford	86	115	4.7	1.2	4.7	4.0	5.4
Plymth	84	32	4.3	1.1	4.1	3.6	4.8
Ports	37	34					
Prestn	99	76	4.5	1.3	4.2	3.7	5.1
Redng	99	85	4.4	1.1	4.0	3.7	4.8
Sheff	72	63	4.2	1.2	4.0	3.3	5.1
Shrew	100	33	4.6	1.4	4.3	3.4	5.4
Stevng	58	22	4.6	1.4	4.3	3.4	5.8
Sthend	72	13					
Stoke	100	90	3.7	1.4	3.7	2.6	4.6
Sund	60	6					
Swanse	97	72	4.2	1.2	4.3	3.5	4.7
Truro	96	22	4.3	1.3	3.8	3.4	5.1

Table 10.19. Continued

Centre	% completeness	Number of patients with data	Mean	SD	Median	Lower quartile	Upper quartile
Tyrone	100	5					
Ulster	100	2					
Wirral	68	19					
Wolve	79	42	4.4	1.2	4.3	3.7	5.1
Wrexm	80	24	4.3	1.3	3.9	3.5	5.2
York	83	19					
England	80	2,661	4.4	1.2	4.3	3.6	5.1
N Ireland	97	94	4.5	1.2	4.1	3.7	5.0
Wales	94	276	4.5	1.2	4.4	3.6	5.2
E, W & NI	82	3,031	4.4	1.2	4.3	3.6	5.1

Blank cells denote centres excluded from analyses due to low patient numbers or poor data completeness
n/a not applicable

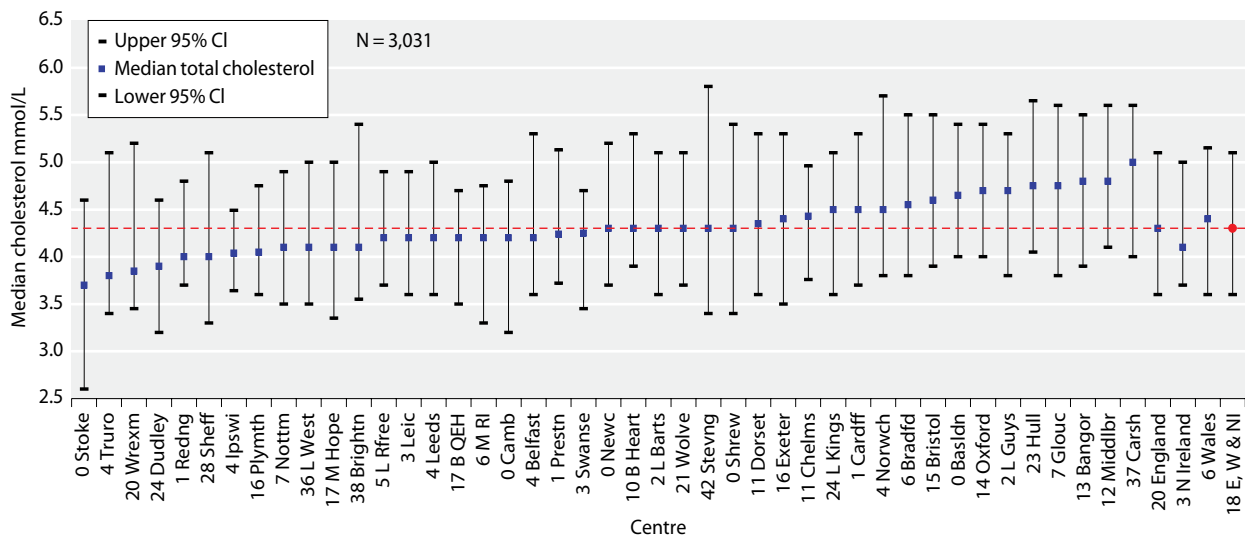


Fig. 10.42. Median total cholesterol in peritoneal dialysis patients by centre in 2007

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 lipid level e.g. steroids, sevelamer etc. The UKRR is planning to collect an enhanced dataset with more detailed

lipid profiles and prescribing data. In conjunction with the awaited results from the SHARP trial [6] this should provide further information about optimal lipid management in UK dialysis patients.

Conflict of interest: none

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