

# UK Renal Registry 20th Annual Report: Chapter 8 Biochemical Variables in UK Adult Dialysis Patients in 2016: National and Centre-specific Analyses

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## Keywords

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

## Summary

In 2016

- 59.9% of haemodialysis (HD) patients and 58.7% of peritoneal dialysis (PD) patients achieved the Renal Association (RA) audit measure for phosphate (<1.7 mmol/L).
- 40.1% of HD and 41.3% of PD patients had a serum phosphate above the RA audit standard ( $\geq 1.7$  mmol/L).
- Simultaneous control of all three parameters

(calcium, phosphate and parathyroid hormone (PTH)) within current target ranges was achieved by 27.3% of HD and 33.2% of PD patients.

- 78.7% of HD and 79.7% of PD patients had adjusted calcium in the recommended target range of 2.2–2.5 mmol/L.
- 55.2% of HD and 60.3% of PD patients had phosphate between 1.1–1.7 mmol/L.
- 58.3% of HD and 65.7% of PD patients had a serum PTH between 16–72 pmol/L.
- 17.9% of HD and 13.4% of PD patients had a serum PTH >72 pmol/L.
- 62.2% of HD and 80.7% of PD patients achieved the audit measure for bicarbonate (18–24 mmol/L for HD patients and 22–30 mmol/L for PD patients).
- 84.1% of HD patients (for whom data were available) had pre-dialysis potassium between 4.0–6.0 mmol/L.

## Introduction

This chapter analyses the routine biochemistry data of patients on established haemodialysis (HD) and peritoneal dialysis (PD) from all renal centres in the UK in 2016. The UK Renal Registry (UKRR) collects data from all renal centres in England, Wales and Northern Ireland and receives Scottish data via the Scottish Renal Registry. The attainment of biochemistry parameters is compared at a renal centre and national level as well as against national performance measures as set out in the Renal Association (RA) guidelines.

The audit measures listed in table 8.1 applied in 2016 and are obtained from several different RA guidelines [1] which are updated over time:

- CKD-mineral bone disease 2015 guideline [2]
- Haemodialysis 2009 guideline [3] – update due in 2018
- Peritoneal dialysis 2010 guideline [4]
- Cardiovascular disease 2010 guideline [5]

No new guidelines were published during the 2016 calendar year and therefore the same audit standards apply as were used for the 2015 analyses. In 2017, updated KDIGO international chronic kidney disease – mineral bone disorder (CKD-MBD) guidelines were published which have not advocated changes in target biochemical parameters in relation to dialysis patients citing the ongoing lack of strong evidence [6]. They highlight the importance in identifying trends in parameters rather than reacting to isolated measurements and to understand the complex interplay of the variables involved. They advise that clinicians individualise treatment and suggest that changes aimed at improving biochemical parameters could have inadvertent detrimental effects which are more difficult to measure such as in relation to bone mineral density or arterial calcification. In this context, out of range observations (e.g. hyperphosphataemia or PTH below target range) need to be interpreted cautiously as they may relate to different clinical problems or population characteristics.

The most recent RA renal bone disease guidelines offer two audit measures, firstly the proportion of patients with

**Table 8.1.** Summary of Renal Association audit measures for biochemical variables [1]

RA audit measure or guideline	Included in UKRR annual report	Reason
<b>CKD-MBD in CKD stage 5D audit measures</b>		
Percentage of patients CKD5D with serum PO <sub>4</sub> <1.7 mmol/L	Yes	
Percentage of patients with all bone parameters within target range (Ca/P/PTH)	Yes	Target ranges used for this analysis: adjusted calcium 2.2–2.5 mmol/L, phosphate 1.1–1.7 mmol/L (please note this is different from audit measure of <1.7 mmol/L) and PTH 16–72 pmol/L (2–9 × upper end of reference range)
<b>Peritoneal dialysis guidelines</b>		
Cumulative frequency curves of plasma bicarbonate	Partly	Summary measures at centre and country level are presented in various formats but not as cumulative frequency curves
<b>Haemodialysis guidelines</b>		
Cumulative frequency curves of pre-dialysis potassium concentration	Partly	Summary measures at centre and country level are presented in various formats but not as cumulative frequency curves.
Cumulative frequency curves of pre-dialysis serum calcium (adjusted for albumin) and phosphate concentrations	Partly	Summary measures at centre and country level are presented in various formats but not as cumulative frequency curves
<b>Cardiovascular disease in CKD guidance</b>		
Record of HbA1c concentrations in IFCC (mmol/mol) and/or DCCT (%) units	No	Poor data completeness
Cholesterol concentrations in patients prescribed HMG CoA reductase inhibitors	No	The UKRR has previously reported summary statistics for total cholesterol and aims to improve data completeness. Reliable information is not currently available within the UKRR data on statin prescription

CKD-MBD – chronic kidney disease mineral bone disease; PO<sub>4</sub> – phosphate; Ca – calcium; P – phosphorous; PTH – parathyroid hormone; HbA1c – glycated haemoglobin; IFCC – International Federation of Clinical Chemistry and Laboratory Medicine; DCCT – Diabetes Control and Complications Trial

serum phosphate <1.7 mmol/L and secondly the proportion of patients with all bone parameters within target range [2]. The target range for phosphate recommended in the guideline is 1.1–1.7 mmol/L (not <1.7 mmol/L as for the phosphate audit measure). Therefore the authors have interpreted the latter audit measure to include this recommended target range for phosphate of 1.1–1.7 mmol/L which results in different measures of phosphate being used at different points in the chapter and readers should be aware of this when interpreting these results.

For the first time, a sufficient number of centres have returned data in relation to pre-dialysis potassium. The most recent RA haemodialysis guideline recommends an audit measure of cumulative frequency curves of pre-dialysis potassium and includes a target range for pre-dialysis potassium of 4.0–6.0 mmol/L [3]. There is no recommendation on serum potassium levels in the most recent peritoneal dialysis guidelines [4].

All parameters from haemodialysis patients audited in this report have used data collected mid-week before a ‘short-gap’ dialysis session in line with recommendations from the bone mineral guidelines as well as the haemodialysis guidelines [2, 3].

## Methods

The analyses presented in this chapter relate to biochemical variables in the prevalent dialysis cohort in the UK. The cohort studied were patients prevalent on dialysis treatment on 31 December 2016. Patients receiving dialysis for less than 90 days and those who had changed modality or renal centre in the last 90 days were excluded. HD and PD cohorts were analysed separately. A full definition of the cohort including inclusion and exclusion criteria is available in appendix B ([www.renalreg.org/publications-reports/](http://www.renalreg.org/publications-reports/)).

The biochemical variables analysed in this chapter were serum phosphate, calcium (adjusted for albumin), parathyroid hormone, bicarbonate and potassium. The method of data collection and validation by the UKRR has been previously described [7]. In brief, for each quarter of 2016 the UKRR extracted biochemical data electronically from clinical information systems in renal centres in England, Wales and Northern Ireland (E,W & NI). Cambridge renal centre (Addenbrooke’s) was unable to submit 2016 data at patient level prior to the UKRR closing the database and only provided summary numbers of patients starting RRT by treatment modality. This centre is therefore excluded from most analyses in this chapter. Scottish centres have only been included in analyses relating to adjusted calcium and phosphate control, with data for their prevalent dialysis cohort being supplied directly by the Scottish Renal Registry. The UKRR does not currently collect data regarding different assay methods mainly because a single dialysis centre may process samples in several different laboratories. The audit measure used for serum phosphate was <1.7 mmol/L in both the HD and PD cohorts [2]. However, for the audit measure of composite control of bone parameters it is recommended that all parameters are within the target range and this includes phosphate within the range of 1.1–1.7 mmol/L, so two different phosphate measures are in use in this chapter. 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, the formula provided by each centre (or, if this is not available, a formula in widespread use) was used to calculate adjusted calcium [8]. The audit measure for adjusted calcium depends on the local reference range [2]. For the purposes of these analyses, the UKRR has used the RA guideline standard of adjusted calcium between 2.2–2.5 mmol/L as the audit measure [2]. There are also a variety of methods and reference ranges in use to measure PTH. To enable some form of comparative audit the UKRR has used two to nine times the median upper limit of the reference range (8 pmol/L) as the audit measure in line with the RA clinical practice guidelines and KDIGO 2017 guidance, which is unchanged from the previous KDIGO 2009 guidance [2, 6]. This equates to a PTH range of 16–72 pmol/L. The audit measure used for serum bicarbonate in the HD cohort was 18–24 mmol/L and in the PD cohort was 22–30 mmol/L as per the most recent guidelines [3, 4]. The audit measure for pre-dialysis serum potassium in the HD cohort uses the latest RA guideline

**Table 8.2.** Summary of clinical guideline target ranges and conversion factors from SI units

Biochemical variable	Clinical guideline measure	Conversion factor from SI units
Phosphate*	HD patients: 1.1–1.7 mmol/L PD patients: 1.1–1.7 mmol/L	mg/dl = mmol/L × 3.1
Calcium (adjusted)	Normal range (ideally 2.2–2.5 mmol/L)	mg/dl = mmol/L × 4
Parathyroid hormone	2–9 times upper limit of normal	ng/L = pmol/L × 9.4
Bicarbonate	HD patients: 18–24 mmol/L PD patients: 22–30 mmol/L	mg/dl = mmol/L × 6.1
Potassium	HD patients: 4.0–6.0 mmol/L	mEq/L = mmol/L

\*There are two measures for phosphate in use: 1. phosphate clinical audit measure is <1.7 mmol/L while 2. the combined CKD-MBD audit measure assesses all parameters within the target ranges listed in the table which includes phosphate within 1.1–1.7 mmol/L

which is 4.0–6.0 mmol/L [3]. A summary of the current RA audit measures for these variables and conversion factors to SI units are given in table 8.2.

Quarterly values were extracted from the database for the last two quarters for calcium, phosphate, bicarbonate and potassium and the last three quarters for PTH. Patients who did not have these data were excluded from the analyses. Data completeness was analysed at centre and country level. All patients were included in analyses but centres with less than 50% completeness were excluded from plots and tables showing centre level performance. Data were also excluded from plots and tables when there were fewer than ten patients with data, both at centre or country level. These data were analysed to calculate summary descriptive statistics (maximum, minimum, mean with the corresponding standard deviation, median and interquartile range). Where applicable, the percentage achieving the RA standard or other surrogate clinical performance measure was also calculated.

The simultaneous control of all three components of bone and mineral disorder (BMD) parameters were analysed in combination. The proportion of patients with control of none, one, two or three parameters are presented. For the purpose of these analyses an adjusted calcium between 2.2–2.5 mmol/L, a phosphate level being maintained between 1.1–1.7 mmol/L and a PTH level between two and nine times the upper limit of normal (i.e. 16–72 pmol/L), were evaluated in combination.

Centres reported 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 have been rounded in an attempt to make centres more comparable.

Centres were requested to send pre-dialysis potassium levels for HD patients. Outlying centres were contacted and it was identified that post-dialysis potassium data had inadvertently been submitted and these centres have been excluded from the analysis. However, post-dialysis samples may remain within the analysis for some centres. Future data extracts will aim to ensure that only pre-dialysis results be submitted.

### Haemodialysis

**Table 8.3.** Summary statistics for serum phosphate in haemodialysis patients in 2016

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
<b>England</b>							
B Heart	100.0	373	1.8	0.6	1.7	1.4	2.0
B QEH	99.6	934	1.5	0.4	1.5	1.2	1.8
Basldn	98.0	147	1.6	0.5	1.6	1.3	1.9
Bradfd	99.1	226	1.5	0.5	1.5	1.2	1.8
Brightn	99.8	418	1.7	0.6	1.6	1.3	2.0
Bristol	100.0	470	1.6	0.5	1.6	1.3	2.0
Camb*							
Carlis	100.0	88	1.6	0.5	1.5	1.3	1.9
Carsh	99.6	771	1.6	0.5	1.5	1.2	1.8
Chelms	100.0	118	1.6	0.5	1.6	1.3	1.8
Colchr	83.6	92	1.5	0.4	1.4	1.2	1.7
Covnt	99.7	345	1.7	0.5	1.6	1.3	1.9
Derby	100.0	227	1.5	0.5	1.5	1.2	1.8
Donc	100.0	177	1.6	0.4	1.6	1.3	1.9

The number preceding the centre name in each figure indicates the percentage of missing data for that centre for that variable. Funnel plot analyses were used to identify outlying centres [9]. The percentage within range for each standard was plotted against centre size along with the upper and lower 95% and 99.9% confidence limits. Centres can be identified on these plots by looking up the number of patients treated in each centre 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 2006 to 2016 and were recalculated for each previous year using the rounding procedure.

All data are presented unadjusted for case-mix.  
The data were analysed using SAS 9.3.

## Results

### Mineral and bone variables

#### Phosphate

In 2016 the following RA clinical practice guideline regarding phosphate management was applicable:

#### **Guideline 3.2 CKD-MBD: Serum phosphate in dialysis patients**

***‘We suggest that serum phosphate in dialysis patients, measured before a “short-gap” dialysis session in haemodialysis patients, should be maintained between 1.1 and 1.7 mmol/L.’*** [2]

***Audit measure: Percentage of patients CKD5D with serum PO4 <1.7 mmol/L*** [2]

**Table 8.3.** Continued

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
Dorset	100.0	263	1.6	0.5	1.5	1.3	1.9
Dudley	100.0	185	1.5	0.4	1.5	1.3	1.8
Exeter	100.0	423	1.6	0.5	1.5	1.2	1.8
Glouc	100.0	228	1.6	0.5	1.6	1.2	1.9
Hull	100.0	302	1.6	0.5	1.6	1.3	1.9
Ipswi	99.3	135	1.5	0.6	1.4	1.2	1.8
Kent	100.0	387	1.8	0.6	1.7	1.4	2.1
L Barts	99.8	953	1.6	0.5	1.6	1.3	1.9
L Guys	99.8	643	1.5	0.5	1.4	1.1	1.8
L Kings	99.8	544	1.5	0.5	1.5	1.2	1.7
L Rfree	99.9	652	1.6	0.5	1.5	1.2	1.8
L St.G	96.9	314	1.5	0.5	1.5	1.2	1.8
L West	91.6	1,262	1.5	0.5	1.4	1.1	1.8
Leeds	100.0	485	1.7	0.5	1.6	1.3	2.0
Leic	99.9	881	1.6	0.5	1.6	1.3	1.9
Liv Ain	97.1	170	1.4	0.5	1.4	1.1	1.8
Liv Roy	97.7	335	1.6	0.5	1.5	1.2	1.8
M RI	94.1	458	1.6	0.5	1.5	1.2	1.9
Middlbr	100.0	310	1.7	0.6	1.6	1.3	1.9
Newc	100.0	287	1.6	0.5	1.5	1.3	1.9
Norwch	99.7	301	1.7	0.5	1.6	1.3	1.9
Nottm	99.7	364	1.5	0.5	1.5	1.3	1.7
Oxford	100.0	401	1.6	0.6	1.5	1.2	2.0
Plymth	99.2	127	1.6	0.6	1.5	1.2	1.7
Ports	99.8	582	1.7	0.6	1.6	1.3	2.0
Prestn	100.0	531	1.7	0.5	1.6	1.3	2.0
Redng	100.0	288	1.6	0.5	1.5	1.3	1.8
Salford	98.3	356	1.6	0.6	1.5	1.2	1.9
Sheff	99.7	576	1.6	0.5	1.5	1.2	1.9
Shrew	100.0	189	1.6	0.5	1.6	1.3	1.9
Stevng	99.8	490	1.7	0.5	1.6	1.3	2.0
Sthend	100.0	109	1.7	0.5	1.7	1.4	2.0
Stoke	99.1	319	1.6	0.5	1.5	1.3	1.8
Sund	0.0	0					
Truro	100.0	156	1.5	0.4	1.4	1.3	1.8
Wirral	98.9	177	1.5	0.5	1.4	1.2	1.8
Wolve	99.0	291	1.5	0.5	1.4	1.1	1.7
York	100.0	181	1.4	0.5	1.3	1.0	1.6
<b>N Ireland</b>							
Antrim	100.0	115	1.3	0.4	1.3	1.0	1.6
Belfast	100.0	185	1.5	0.5	1.5	1.1	1.8
Newry	100.0	80	1.6	0.5	1.6	1.3	1.9
Ulster	100.0	96	1.4	0.5	1.4	1.1	1.7
West NI	100.0	118	1.6	0.5	1.5	1.3	1.9
<b>Scotland</b>							
Abrdn	99.5	217	1.6	0.5	1.5	1.3	1.8
Airdrie	98.8	171	1.4	0.5	1.4	1.0	1.7
D & Gall	97.9	46	1.6	0.5	1.6	1.3	1.9
Dundee	98.8	164	1.8	0.5	1.7	1.5	2.1
Edinb	99.6	268	1.8	0.5	1.7	1.4	2.0
Glasgw	98.9	531	1.7	0.5	1.7	1.4	2.0
Inverns	80.0	68	1.9	0.5	1.8	1.5	2.2
Klmarnk	100.0	128	1.4	0.5	1.3	1.1	1.6
Krkldy	100.0	135	1.6	0.4	1.5	1.3	1.8
<b>Wales</b>							
Bangor	100.0	68	1.5	0.5	1.5	1.1	1.8
Cardff	99.8	480	1.7	0.5	1.6	1.3	2.0

**Table 8.3.** Continued

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
Clwyd	100.0	68	1.7	0.5	1.7	1.3	2.0
Swanse	100.0	343	1.5	0.5	1.5	1.2	1.8
Wrexm	100.0	113	1.3	0.4	1.3	1.0	1.5
<b>England</b>	<b>97.7</b>	<b>19,041</b>	<b>1.6</b>	<b>0.5</b>	<b>1.5</b>	<b>1.2</b>	<b>1.9</b>
<b>N Ireland</b>	<b>100.0</b>	<b>594</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>98.3</b>	<b>1,728</b>	<b>1.7</b>	<b>0.5</b>	<b>1.6</b>	<b>1.3</b>	<b>1.9</b>
<b>Wales</b>	<b>99.9</b>	<b>1,072</b>	<b>1.6</b>	<b>0.5</b>	<b>1.5</b>	<b>1.2</b>	<b>1.9</b>
<b>UK</b>	<b>97.9</b>	<b>22,435</b>	<b>1.6</b>	<b>0.5</b>	<b>1.5</b>	<b>1.2</b>	<b>1.9</b>

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

\*Cambridge renal centre was unable to submit serum phosphate data for 2016

**Table 8.4.** Percentage of haemodialysis patients with serum phosphate below and equal to or above 1.7 mmol/L, as specified in the RA audit measure, by centre in 2016

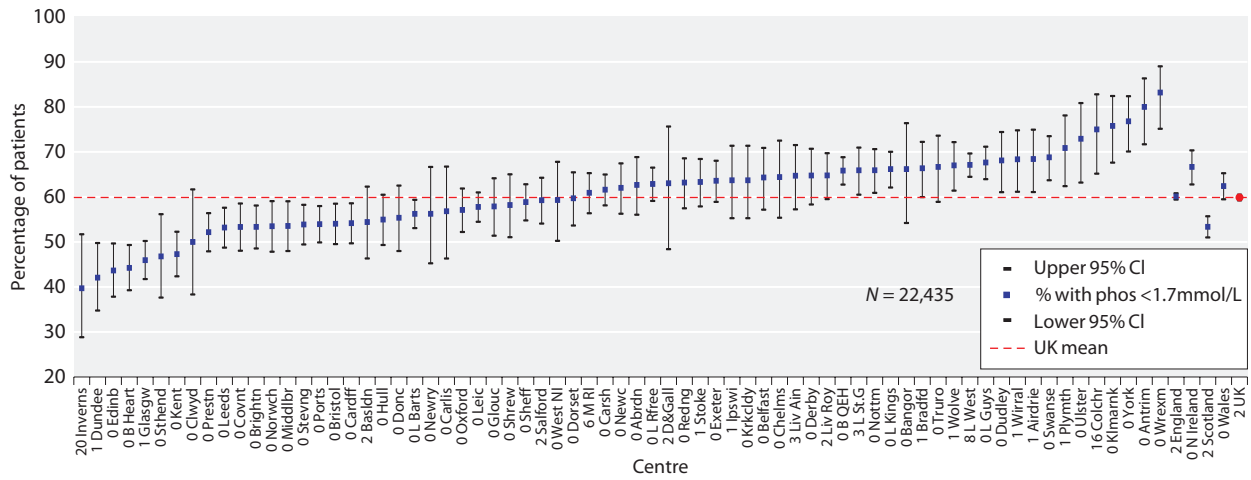
Centre	N	% phos <1.7 mmol/L	Lower 95% CI	Upper 95% CI	% phos ≥1.7 mmol/L	Change in % <1.7 mmol/L from 2015	95% LCL change	95% UCL change
<b>England</b>								
B Heart	373	44.2	39.3	49.3	55.8	-13.9	-20.9	-6.9
B QEH	934	65.9	62.7	68.8	34.2	-5.6	-9.9	-1.4
Basldn	147	54.4	46.3	62.3	45.6	-12.0	-23.0	-1.0
Bradfd	226	66.4	60.0	72.2	33.6	-2.3	-11.0	6.4
Brightn	418	53.4	48.6	58.1	46.7	-3.5	-10.4	3.3
Bristol	470	54.0	49.5	58.5	46.0	-8.7	-15.0	-2.5
Carlis	88	56.8	46.3	66.7	43.2	-11.2	-26.0	3.6
Carsh	771	61.6	58.1	65.0	38.4	-5.6	-10.4	-0.8
Chelms	118	64.4	55.4	72.5	35.6	4.3	-7.6	16.2
Colchr	92	75.0	65.2	82.8	25.0	4.3	-8.1	16.6
Covnt	345	53.3	48.1	58.5	46.7	-3.8	-11.2	3.7
Derby	227	64.8	58.3	70.7	35.2	-3.6	-12.3	5.2
Donc	177	55.4	48.0	62.5	44.6	-8.4	-18.8	2.0
Dorset	263	59.7	53.7	65.5	40.3	-14.8	-22.7	-7.0
Dudley	185	68.1	61.1	74.4	31.9	-0.5	-10.4	9.4
Exeter	423	63.6	58.9	68.0	36.4	-3.8	-10.3	2.7
Glouc	228	57.9	51.4	64.1	42.1	-3.4	-12.5	5.7
Hull	302	55.0	49.3	60.5	45.0	-7.2	-14.9	0.5
Ipswi	135	63.7	55.3	71.4	36.3	-10.7	-21.8	0.3
Kent	387	47.3	42.4	52.3	52.7	-5.5	-12.5	1.5
L Barts	953	56.2	53.1	59.4	43.8	-4.2	-8.7	0.2
L Guys	643	67.7	63.9	71.2	32.4	2.3	-2.9	7.5
L Kings	544	66.2	62.1	70.0	33.8	-7.9	-13.4	-2.4
L Rfree	652	62.9	59.1	66.5	37.1	-3.0	-8.2	2.1
L St.G	314	65.9	60.5	71.0	34.1	-5.2	-12.5	2.1
L West	1,262	67.1	64.5	69.7	32.9	-2.1	-5.8	1.5
Leeds	485	53.2	48.7	57.6	46.8	-7.4	-13.6	-1.1
Leic	881	57.8	54.5	61.0	42.2	-2.5	-7.2	2.1
Liv Ain	170	64.7	57.2	71.5	35.3	-13.1	-22.8	-3.3
Liv Roy	335	64.8	59.5	69.7	35.2	1.2	-5.9	8.4
M RI*	458	60.9	56.4	65.3	39.1	-1.6	-8.0	4.7

**Table 8.4.** Continued

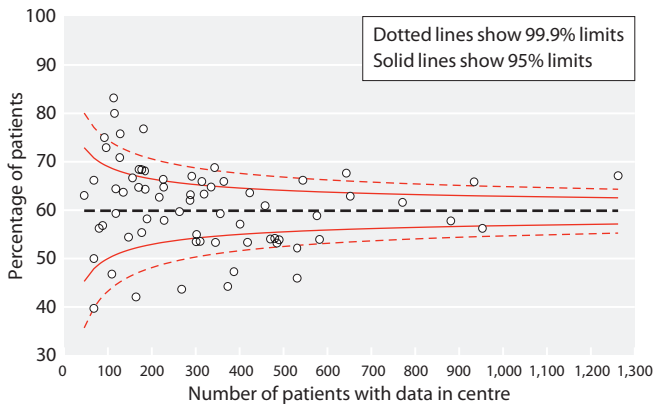
Centre	N	% phos <1.7 mmol/L	Lower 95% CI	Upper 95% CI	% phos ≥1.7 mmol/L	Change in % <1.7 mmol/L from 2015	95% LCL change	95% UCL change
Middlbr	310	53.6	48.0	59.0	46.5	-5.3	-13.0	2.5
Newc	287	62.0	56.3	67.5	38.0	-1.1	-9.1	6.8
Norwch	301	53.5	47.8	59.1	46.5	-15.8	-23.4	-8.2
Nottm	364	65.9	60.9	70.6	34.1	-7.4	-14.1	-0.7
Oxford	401	57.1	52.2	61.9	42.9	0.8	-6.1	7.6
Plymth	127	70.9	62.4	78.1	29.1	11.6	0.1	23.2
Ports	582	54.0	49.9	58.0	46.1	-2.3	-7.9	3.3
Prestn	531	52.2	47.9	56.4	47.8	-5.4	-11.3	0.6
Redng	288	63.2	57.5	68.6	36.8	-2.1	-9.9	5.8
Salford*	356	59.3	54.1	64.3	40.7	-5.0	-12.0	2.1
Sheff	576	58.9	54.8	62.8	41.2	-5.0	-10.7	0.7
Shrew	189	58.2	51.1	65.0	41.8	-1.7	-11.6	8.2
Stevng	490	53.9	49.4	58.3	46.1	-4.7	-10.9	1.6
Sthend	109	46.8	37.6	56.2	53.2	-9.7	-22.9	3.5
Stoke	319	63.3	57.9	68.4	36.7	-1.5	-9.0	6.1
Truro	156	66.7	58.9	73.6	33.3	-4.2	-14.6	6.3
Wirral	177	68.4	61.2	74.8	31.6	0.9	-8.8	10.7
Wolve	291	67.0	61.4	72.2	33.0	4.1	-3.7	11.8
York	181	76.8	70.1	82.4	23.2	-3.2	-12.2	5.8
<b>N Ireland</b>								
Antrim	115	80.0	71.7	86.3	20.0	3.7	-7.0	14.4
Belfast	185	64.3	57.2	70.9	35.7	1.5	-8.5	11.5
Newry	80	56.3	45.3	66.7	43.8	-8.0	-23.0	6.9
Ulster	96	72.9	63.2	80.9	27.1	9.4	-3.7	22.5
West NI	118	59.3	50.3	67.8	40.7	0.9	-11.8	13.6
<b>Scotland</b>								
Abrdn	217	62.7	56.1	68.9	37.3	-11.5	-20.3	-2.7
Airdrie	171	68.4	61.1	74.9	31.6	-1.7	-11.4	8.0
D & Gall	46	63.0	48.4	75.6	37.0	-0.2	-19.6	19.2
Dundee	164	42.1	34.8	49.8	57.9	-5.9	-16.5	4.8
Edinb	268	43.7	37.8	49.7	56.3	-5.5	-14.1	3.1
Glasgw	531	46.0	41.8	50.2	54.1	-8.3	-14.2	-2.3
Inverns	68	39.7	28.8	51.7	60.3	-9.6	-25.8	6.5
Klmarnk	128	75.8	67.6	82.4	24.2	8.0	-3.0	19.1
Krkldy	135	63.7	55.3	71.4	36.3	-0.4	-12.0	11.1
<b>Wales</b>								
Bangor	68	66.2	54.2	76.4	33.8	-8.2	-23.0	6.7
Cardff	480	54.2	49.7	58.6	45.8	-11.5	-17.7	-5.3
Clwyd	68	50.0	38.3	61.7	50.0	-4.0	-20.3	12.4
Swanse	343	68.8	63.7	73.5	31.2	0.4	-6.6	7.3
Wrexm	113	83.2	75.1	89.0	16.8	-5.7	-15.0	3.6
<b>England</b>	<b>19,041</b>	<b>60.1</b>	<b>59.4</b>	<b>60.8</b>	<b>39.9</b>	<b>-4.2</b>	<b>-5.1</b>	<b>-3.2</b>
<b>N Ireland</b>	<b>594</b>	<b>66.7</b>	<b>62.8</b>	<b>70.3</b>	<b>33.3</b>	<b>1.7</b>	<b>-3.7</b>	<b>7.2</b>
<b>Scotland</b>	<b>1,728</b>	<b>53.4</b>	<b>51.0</b>	<b>55.7</b>	<b>46.6</b>	<b>-5.3</b>	<b>-8.6</b>	<b>-2.0</b>
<b>Wales</b>	<b>1,072</b>	<b>62.4</b>	<b>59.5</b>	<b>65.3</b>	<b>37.6</b>	<b>-6.1</b>	<b>-10.2</b>	<b>-2.1</b>
<b>UK</b>	<b>22,435</b>	<b>59.9</b>	<b>59.2</b>	<b>60.5</b>	<b>40.1</b>	<b>-4.2</b>	<b>-5.1</b>	<b>-3.3</b>

Centres missing from the table were excluded from analysis due to low patient numbers or poor data completeness

\*Salford and Manchester RI have been involved in the SPIRiT study; an RCT comparing low phosphate control (0.8–1.4 mmol/L) with high phosphate control (1.8–2.4 mmol/L); HD patients only were recruited



**Fig. 8.1.** Percentage of haemodialysis patients with serum phosphate below 1.7 mmol/L as specified by the RA audit measure, by centre in 2016



**Fig. 8.2.** Funnel plot of percentage of haemodialysis patients with serum phosphate below 1.7 mmol/L as specified by the RA clinical audit measure, by centre in 2016

*Peritoneal dialysis*

**Table 8.5.** Summary statistics for phosphate in peritoneal dialysis patients in 2016

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
<b>England</b>							
B Heart	100.0	72	1.8	0.5	1.8	1.5	2.2
B QEH	100.0	125	1.6	0.5	1.6	1.3	1.8
Basldn	100.0	30	1.6	0.4	1.5	1.3	1.8
Bradfd	100.0	22	1.7	0.5	1.8	1.3	2.1
Brightn	100.0	56	1.6	0.4	1.6	1.4	1.9
Bristol	100.0	42	1.7	0.5	1.6	1.4	1.9
Camb <sup>a</sup>							
Carlisle	96.8	30	1.6	0.4	1.6	1.3	1.9
Carsh	92.1	93	1.6	0.4	1.5	1.3	1.9
Chelms	88.9	24	1.7	0.6	1.5	1.3	1.9
Colchr <sup>b</sup>							
Covnt	96.6	57	1.5	0.4	1.5	1.2	1.7
Derby	100.0	71	1.5	0.4	1.4	1.2	1.6
Donc	100.0	25	1.5	0.3	1.5	1.3	1.6



**Table 8.5.** Continued

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
Dorset	100.0	33	1.4	0.4	1.3	1.2	1.6
Dudley	100.0	48	1.8	0.5	1.8	1.5	2.1
Exeter	100.0	73	1.6	0.5	1.6	1.2	1.8
Glouc	97.0	32	1.6	0.4	1.6	1.2	1.8
Hull	100.0	61	1.6	0.4	1.6	1.4	1.9
Ipswi	97.0	32	1.5	0.4	1.5	1.3	1.7
Kent	97.7	42	1.5	0.5	1.4	1.2	1.6
L Barts	97.8	175	1.6	0.4	1.6	1.3	1.9
L Guys	100.0	32	1.7	0.4	1.7	1.4	1.8
L Kings	100.0	75	1.6	0.4	1.5	1.3	1.8
L Rfree	97.8	135	1.6	0.4	1.5	1.4	1.8
L St.G	97.3	36	1.6	0.4	1.6	1.3	1.9
L West	90.6	77	1.6	0.5	1.6	1.4	1.9
Leeds	100.0	36	1.7	0.4	1.8	1.4	1.9
Leic	98.6	69	1.5	0.3	1.5	1.3	1.7
Liv Ain	100.0	23	1.8	0.7	1.7	1.4	1.9
Liv Roy	98.4	63	1.4	0.4	1.3	1.2	1.7
M RI	98.0	48	1.6	0.5	1.6	1.3	2.0
Middlbr	100.0	22	1.8	0.4	1.7	1.5	2.1
Newc	100.0	46	1.7	0.5	1.7	1.5	2.0
Norwch	100.0	41	1.7	0.5	1.6	1.4	1.8
Nottm	100.0	67	1.6	0.4	1.6	1.3	1.8
Oxford	100.0	80	1.7	0.5	1.6	1.4	1.8
Plymth	93.6	29	1.5	0.4	1.4	1.3	1.8
Ports	95.5	64	1.8	0.5	1.7	1.5	2.1
Prestn	100.0	35	1.6	0.4	1.5	1.3	1.9
Redng	100.0	44	1.7	0.4	1.6	1.4	1.9
Salford	98.9	89	1.7	0.5	1.6	1.4	2.0
Sheff	100.0	47	1.6	0.4	1.5	1.3	1.8
Shrew	100.0	29	1.6	0.3	1.6	1.4	1.7
Stevng	100.0	16	1.5	0.3	1.6	1.3	1.8
Sthend	100.0	24	1.5	0.4	1.5	1.3	1.8
Stoke	98.6	70	1.7	0.5	1.7	1.4	2.0
Sund	100.0	17	1.5	0.4	1.5	1.1	1.7
Truro	100.0	17	1.7	0.4	1.7	1.4	2.0
Wirral	93.3	14	1.7	0.3	1.8	1.6	1.9
Wolve	92.2	59	1.6	0.4	1.6	1.3	1.8
York	100.0	27	1.5	0.4	1.5	1.1	1.6
<b>N Ireland</b>							
Antrim	100.0	14	1.4	0.3	1.4	1.2	1.5
Belfast	100.0	22	1.6	0.4	1.5	1.3	1.9
Newry	100.0	19	1.5	0.3	1.4	1.2	1.8
Ulster	100.0	5					
West NI	100.0	9					
<b>Scotland</b>							
Abrdn	100.0	19	1.7	0.5	1.6	1.3	2.1
Airdrie	95.2	20	1.4	0.3	1.4	1.3	1.6
D&Gall	100.0	10	1.6	0.3	1.6	1.4	2.0
Dundee	100.0	13	1.7	0.3	1.7	1.4	1.9
Edinb	90.3	28	1.9	0.6	1.7	1.4	2.1
Glasgw	97.7	42	1.6	0.3	1.6	1.4	1.8
Inverns	33.3	3					
Klmarnk	96.4	27	1.7	0.4	1.6	1.4	1.9
Krkcldy	100.0	15	1.7	0.5	1.6	1.4	1.8

**Table 8.5.** Continued

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
<b>Wales</b>							
Bangor	100.0	15	1.5	0.3	1.5	1.2	1.6
Cardff	95.5	64	1.7	0.5	1.6	1.4	1.9
Clwyd	100.0	14	1.5	0.5	1.5	1.2	1.9
Swanse	100.0	58	1.7	0.5	1.6	1.3	2.0
Wrexm	100.0	28	1.5	0.5	1.5	1.3	1.9
<b>England</b>	<b>98.1</b>	<b>2,574</b>	<b>1.6</b>	<b>0.4</b>	<b>1.6</b>	<b>1.3</b>	<b>1.9</b>
<b>N Ireland</b>	<b>100.0</b>	<b>69</b>	<b>1.5</b>	<b>0.3</b>	<b>1.4</b>	<b>1.3</b>	<b>1.8</b>
<b>Scotland</b>	<b>93.7</b>	<b>177</b>	<b>1.7</b>	<b>0.4</b>	<b>1.6</b>	<b>1.4</b>	<b>1.9</b>
<b>Wales</b>	<b>98.4</b>	<b>179</b>	<b>1.6</b>	<b>0.5</b>	<b>1.6</b>	<b>1.3</b>	<b>1.9</b>
<b>UK</b>	<b>97.9</b>	<b>2,999</b>	<b>1.6</b>	<b>0.4</b>	<b>1.6</b>	<b>1.3</b>	<b>1.9</b>

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

<sup>a</sup>Cambridge renal centre was unable to submit serum phosphate data for 2016

<sup>b</sup>Colchester – no PD patients

**Table 8.6.** Percentage of peritoneal dialysis patients with serum phosphate below and equal to or above 1.7 mmol/L as specified in the RA audit measure in 2016

Centre	N	% phos <1.7 mmol/L	Lower 95% CI	Upper 95% CI	% with phos ≥1.7 mmol/L	Change in % <1.7 mmol/L from 2015	95% LCL change	95% UCL change
<b>England</b>								
B Heart	72	36.1	25.9	47.8	63.9	-13.9	-32.9	5.2
B QEH	125	60.0	51.2	68.2	40.0	1.3	-11.0	13.6
Basldn	30	56.7	38.8	72.9	43.3	4.8	-21.1	30.7
Bradfd	22	45.5	26.5	65.9	54.6	9.7	-22.9	42.3
Brightn	56	57.1	44.0	69.4	42.9	-7.9	-25.6	9.9
Bristol	42	61.9	46.6	75.2	38.1	0.2	-20.0	20.4
Carlis	30	63.3	45.1	78.4	36.7	6.7	-18.1	31.4
Carsh	93	61.3	51.1	70.6	38.7	2.6	-11.5	16.7
Chelms	24	62.5	42.2	79.2	37.5	8.0	-20.5	36.4
Covnt	57	64.9	51.8	76.1	35.1	-13.9	-29.7	2.0
Derby	71	77.5	66.3	85.7	22.5	7.6	-6.7	21.9
Donc	25	80.0	60.0	91.4	20.0	13.3	-13.5	40.2
Dorset	33	75.8	58.5	87.4	24.2	-1.4	-21.6	18.8
Dudley	48	39.6	26.9	53.9	60.4	-22.0	-41.1	-2.8
Exeter	73	57.5	46.0	68.3	42.5	-12.9	-28.4	2.6
Glouc	32	59.4	41.9	74.7	40.6	2.2	-22.8	27.3
Hull	61	50.8	38.5	63.1	49.2	-5.4	-22.9	12.0
Ipswi	32	75.0	57.4	87.0	25.0	8.3	-14.9	31.6
Kent	42	78.6	63.7	88.5	21.4	10.1	-7.5	27.6
L Barts	175	55.4	48.0	62.6	44.6	-7.1	-17.4	3.1
L Guys	32	43.8	27.9	61.0	56.3	-18.3	-43.0	6.3
L Kings	75	68.0	56.7	77.5	32.0	10.5	-4.6	25.6
L Rfree	135	62.2	53.8	70.0	37.8	5.1	-6.7	16.8
L St.G	36	52.8	36.8	68.3	47.2	-12.3	-34.0	9.3
L West	77	58.4	47.2	68.9	41.6	-12.7	-29.2	3.8
Leeds	36	47.2	31.7	63.3	52.8	1.2	-20.2	22.6
Leic	69	69.6	57.8	79.2	30.4	7.5	-7.1	22.1
Liv Ain	23	43.5	25.2	63.7	56.5	-19.5	-46.7	7.8
Liv Roy	63	74.6	62.5	83.8	25.4	18.9	2.4	35.3
M RI	48	56.3	42.1	69.5	43.8	-2.4	-21.3	16.5
Middlbr	22	45.5	26.5	65.9	54.6	-26.0	-57.5	5.5
Newc	46	45.7	32.0	60.0	54.4	-12.2	-33.5	9.1
Norwch	41	61.0	45.5	74.5	39.0	0.3	-23.2	23.7

**Table 8.6.** Continued

Centre	N	% phos <1.7 mmol/L	Lower 95% CI	Upper 95% CI	% with phos ≥1.7 mmol/L	Change in % <1.7 mmol/L from 2015	95% LCL change	95% UCL change
Nottm	67	65.7	53.6	76.0	34.3	-3.1	-19.1	13.0
Oxford	80	58.8	47.7	69.0	41.3	1.8	-13.6	17.1
Plymth	29	58.6	40.4	74.8	41.4	-15.5	-39.8	8.9
Ports	64	42.2	30.8	54.5	57.8	-5.2	-22.9	12.6
Prestn	35	57.1	40.6	72.3	42.9	-12.3	-33.1	8.6
Redng	44	52.3	37.7	66.4	47.7	-24.0	-42.3	-5.7
Salford	89	50.6	40.3	60.8	49.4	3.0	-12.0	18.0
Sheff	47	59.6	45.2	72.5	40.4	2.4	-16.7	21.5
Shrew	29	62.1	43.6	77.6	37.9	10.2	-15.6	36.0
Stevng	16	56.3	32.4	77.5	43.8	25.5	-9.5	60.4
Sthend	24	70.8	50.2	85.4	29.2	-2.5	-31.3	26.3
Stoke	70	50.0	38.5	61.5	50.0	-14.7	-31.0	1.6
Sund	17	58.8	35.2	79.0	41.2	5.0	-30.8	40.8
Truro	17	47.1	25.5	69.7	52.9	-16.1	-48.2	16.0
Wirral	14	28.6	11.2	56.1	71.4	-6.7	-39.5	26.1
Wolve	59	62.7	49.8	74.0	37.3	-8.9	-25.3	7.5
York	27	77.8	58.6	89.7	22.2	15.9	-10.1	41.9
<b>N Ireland</b>								
Antrim	14	86	57	96	14	15.1	-13.3	43.5
Belfast	22	64	42	81	36	0.5	-29.1	30.1
Newry	19	68	45	85	32	-20.5	-45.9	5.0
<b>Scotland</b>								
Abrdn	19	53	31	73	47	9.8	-21.1	40.6
Airdrie	20	80	57	92	20			
D & Gall	10	60.0	29.7	84.2	40.0	0.0	-42.9	42.9
Dundee	13	38.5	17.0	65.6	61.5	-17.8	-53.7	18.1
Edinb	28	42.9	26.2	61.3	57.1	-16.0	-45.7	13.8
Glasgw	42	64.3	48.9	77.2	35.7	12.0	-8.7	32.7
Klmarnk	27	55.6	36.9	72.8	44.4	22.2	-2.5	46.9
Krkldy	15	60.0	34.8	80.8	40.0	10.0	-24.9	44.9
<b>Wales</b>								
Bangor	15	80.0	53.0	93.4	20.0	33.9	0.0	67.7
Cardff	64	54.7	42.5	66.4	45.3	-1.0	-17.9	15.8
Clwyd	14	71.4	44.0	88.9	28.6	17.6	-18.4	53.6
Swanse	58	56.9	44.0	68.9	43.1	-1.3	-19.5	17.0
Wrexm	28	57.1	38.7	73.8	42.9	-0.4	-25.3	24.5
<b>England</b>	<b>2,574</b>	<b>58.6</b>	<b>56.6</b>	<b>60.4</b>	<b>41.5</b>	<b>-2.8</b>	<b>-5.4</b>	<b>-0.1</b>
<b>N Ireland</b>	<b>55</b>	<b>70.9</b>	<b>57.7</b>	<b>81.4</b>	<b>29.1</b>	<b>-3.2</b>	<b>-19.9</b>	<b>13.6</b>
<b>Scotland</b>	<b>174</b>	<b>57.5</b>	<b>50.0</b>	<b>64.6</b>	<b>42.5</b>	<b>9.2</b>	<b>-1.3</b>	<b>19.7</b>
<b>Wales</b>	<b>179</b>	<b>59.2</b>	<b>51.9</b>	<b>66.2</b>	<b>40.8</b>	<b>3.2</b>	<b>-6.9</b>	<b>13.4</b>
<b>UK</b>	<b>2,999</b>	<b>58.7</b>	<b>57.0</b>	<b>60.5</b>	<b>41.3</b>	<b>-1.8</b>	<b>-4.3</b>	<b>0.6</b>

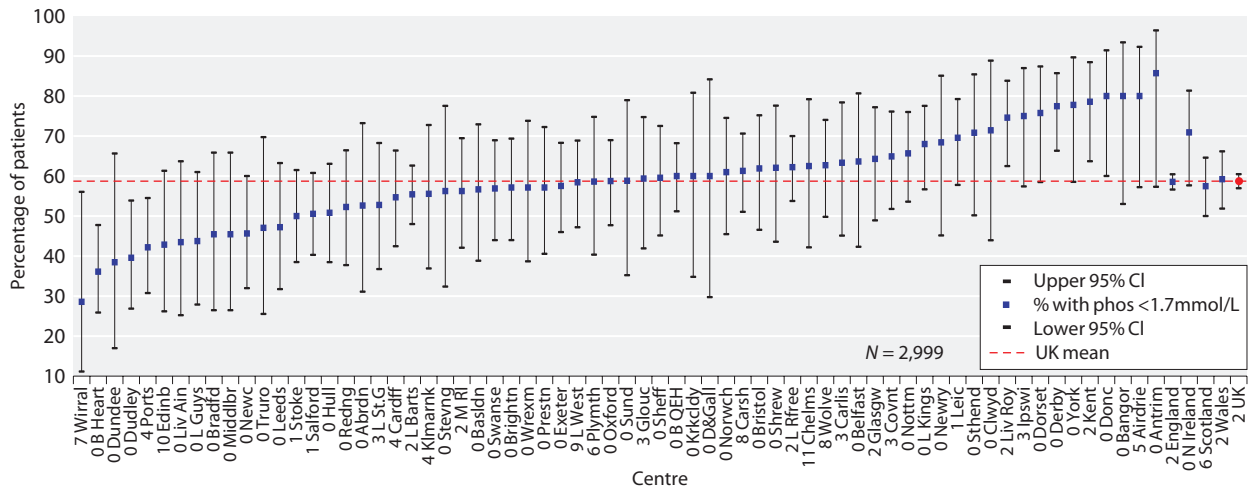
Centres missing from the table were excluded from analysis due to low patient numbers, poor data completeness or no patients on PD  
Blank cells indicate no data for 2015

Overall, data from 22,435 HD and 2,999 PD patients across the UK were included in the analyses of serum phosphate in 2016. The overall data completeness for serum phosphate across the UK was 97.9% for both HD and PD patients, with some variation between centres (tables 8.3, 8.5). HD centre returns were all >90%, except Cambridge and Sunderland at 0%, and Colchester and Inverness with completeness between 80–85%. For PD patients, Cambridge also returned no

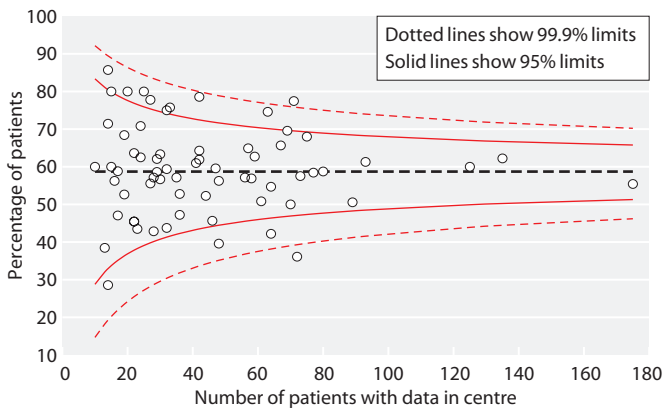
data and only two other centres (Chelmsford and Inverness) returned less than 90% data, compared with five centres in the previous audit.

The individual centre means and standard deviations are shown in tables 8.3 and 8.5 for HD and PD patients respectively.

For those receiving HD, 59.9% of patients achieved a phosphate level below 1.7 mmol/L, the audit measure specified by the RA, and for those on PD this was



**Fig. 8.3.** Percentage of peritoneal dialysis patients with serum phosphate below 1.7 mmol/L as specified by the RA audit measure, by centre in 2016

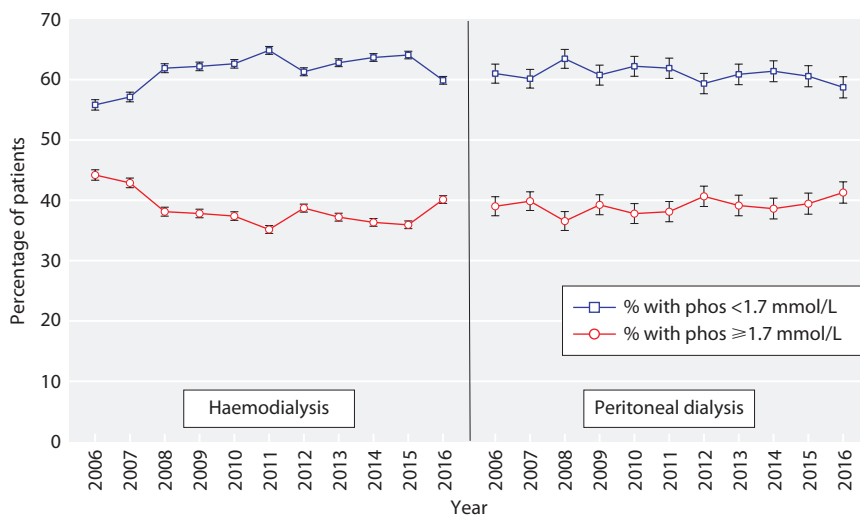


**Fig. 8.4.** Funnel plot of percentage of peritoneal dialysis patients with phosphate below 1.7 mmol/L as specified by the RA clinical audit measure, by centre in 2016

58.7% (tables 8.4, 8.6). In 2015, the equivalent figures were 64.1% and 60.5% respectively.

There was inter-centre variation in the proportion of patients below and equal to or above the phosphate target specified by the clinical performance audit measure. The majority of centres saw a fall in the proportion of HD patients attaining the phosphate target (figures 8.1–8.4, tables 8.4, 8.6).

Funnel plots for HD patients with controlled phosphataemia (<1.7 mmol/L), show a number of centres attaining this standard in a significantly high proportion of patients: Antrim, Birmingham QEH, Kilmarnock, London Guys, London West, Swansea, Wrexham and York. All these centres achieved above the 99.9% upper confidence interval following correction for centre size.



**Fig. 8.5.** Longitudinal change in percentage of patients with phosphate below and equal to or above 1.7 mmol/L, as specified by the RA clinical audit measure, by dialysis modality 2006–2016

In addition, a number of centres had achieved the serum phosphate control standard in a lower than expected proportion of patients (being below the lower 99.9% confidence interval): Birmingham Heartlands, Dundee, Edinburgh, Glasgow, Inverness, Kent and Preston (figure 8.2).

Funnel plots for PD patients indicated that the control of phosphate levels were similar in all centres. Only two significant outliers were identified, Birmingham Heartlands and Derby, achieving the serum phosphate control standard respectively in a lower and in a higher than expected proportion of PD patients (figure 8.4).

Longitudinal analysis demonstrates that the proportion of HD and PD patients with hyperphosphataemia had seen modest improvement over the last decade however this proportion has increased in both modalities this year (figure 8.5). Data showing the performance of centres in attaining phosphate control within the guideline target range (1.1–1.7 mmol/L) can be found in appendix 1 of this chapter (rather than the audit measure of <1.7 mmol/L presented here).

*Simultaneous control of adjusted calcium, phosphate and PTH in preventing severe hyperparathyroidism*

In 2016 the following RA audit measure for combined biochemical control applied:

***'Percentage of patients with all bone parameters within target range (Calcium/Phosphate/PTH)' [2]***

The RA guideline does not explicitly outline the target ranges to be used in the audit measure itself therefore the authors have interpreted this to include the target ranges suggested for each biochemical measure in the guideline. Therefore the combined audit measure comprised the following: phosphate 1.1–1.7 mmol/L, adjusted calcium 2.2–2.5 mmol/L and PTH 16–72 pmol/L. Please note this phosphate measure is discrepant with the preceding audit measure for phosphate alone (of <1.7 mmol/L). This section presents only the audit measure of composite control, however data regarding attainment of each of the three components individually can be found in appendix 1.

There were combined biochemical results to assess mineral bone disease available from 57 HD and 55 PD centres, including 17,684 HD and 2,366 PD patients, from England, Wales and Northern Ireland in 2016. Table 8.7 demonstrates the percentage of patients achieving results within the target range for none, one, two or all three bone mineral parameters, by centre for patients receiving HD and figure 8.6 shows the variation between centres in the proportion achieving control of all three parameters. Table 8.8 and figure 8.7 show the same data for patients receiving PD.

Overall, 5.0% of HD and 3.3% of PD patients across England, Wales and Northern Ireland had none of the three bone mineral parameters controlled within the target ranges described above. Control of one parameter was reported in 24.8% of HD and 20.5% of PD patients;

**Table 8.7.** Percentage of haemodialysis patients achieving simultaneous control of the three key bone and mineral disorder parameters (adjusted calcium, phosphate and parathyroid hormone) by centre, in 2016

Centre	N	Number of parameters			
		None	One	Two	Three
<b>England</b>					
B Heart	367	8.7	28.9	38.1	24.3
Basldn	132	9.8	19.7	38.6	31.8
Bradfd	225	5.8	23.1	41.8	29.3
Brightn	406	5.4	25.9	45.8	22.9
Bristol	468	5.6	29.5	42.3	22.6
Carlis	87	2.3	26.4	44.8	26.4
Carsh	641	5.6	23.7	40.7	30.0
Chelms	118	2.5	19.5	50.0	28.0
Colchr	89	3.4	15.7	36.0	44.9
Covnt	341	3.8	28.7	39.9	27.6
Derby	227	4.8	18.5	43.6	33.0
Donc	176	5.1	17.6	42.6	34.7
Dorset	261	2.3	29.1	39.8	28.7
Dudley	180	3.9	18.9	44.4	32.8

**Table 8.7.** Continued

Centre	N	Number of parameters			
		None	One	Two	Three
Exeter	412	2.2	26.2	47.3	24.3
Glouc	226	4.4	23.5	42.9	29.2
Hull	290	5.9	25.9	43.1	25.2
Ipswi	135	6.7	25.2	43.7	24.4
Kent	386	4.7	27.5	45.3	22.5
L Barts	929	5.4	24.9	43.4	26.4
L Guys	453	3.3	19.6	43.5	33.6
L Kings	528	5.1	25.4	43.0	26.5
L Rfree	647	3.9	23.6	42.7	29.8
L St.G	294	5.4	22.1	51.0	21.4
L West	1,012	7.2	30.9	42.6	19.3
Leeds	476	5.9	27.7	42.4	23.9
Leic	857	5.3	25.6	43.5	25.7
Liv Ain	119	4.2	36.1	45.4	14.3
Liv Roy	264	6.1	24.2	40.2	29.5
M RI	437	5.5	29.3	41.4	23.8
Middlbr	300	4.0	26.7	41.7	27.7
Newc	287	3.8	24.4	42.2	29.6
Norwch	297	5.4	19.9	41.4	33.3
Nottm	356	4.2	21.6	42.1	32.0
Oxford	399	4.5	22.6	42.6	30.3
Plymth	122	2.5	22.1	41.0	34.4
Ports	558	6.3	23.3	44.3	26.2
Prestn	494	4.5	22.9	45.3	27.3
Redng	286	4.9	22.7	39.9	32.5
Shrew	183	3.8	19.7	39.3	37.2
Stevng	479	4.6	18.8	45.1	31.5
Sthend	99	13.1	26.3	43.4	17.2
Stoke	256	3.5	19.5	43.0	34.0
Truro	156	3.2	27.6	39.7	29.5
Wirral	128	2.3	21.9	45.3	30.5
Wolve	285	7.4	29.5	43.9	19.3
York	173	3.5	31.8	39.3	25.4
<b>N Ireland</b>					
Antrim	115	1.7	21.7	40.0	36.5
Belfast	183	3.8	29.0	48.1	19.1
Newry	80	5.0	21.3	36.3	37.5
Ulster	94	9.6	20.2	47.9	22.3
West NI	117	2.6	14.5	47.0	35.9
<b>Wales</b>					
Bangor	67	4.5	34.3	40.3	20.9
Cardff	469	5.1	23.9	43.5	27.5
Clwyd	65	4.6	30.8	43.1	21.5
Swanse	342	2.3	19.9	43.9	33.9
Wrexm	111	4.5	31.5	35.1	28.8
<b>England</b>	<b>16,041</b>	<b>5.1</b>	<b>24.9</b>	<b>42.9</b>	<b>27.1</b>
<b>N Ireland</b>	<b>589</b>	<b>4.2</b>	<b>22.2</b>	<b>44.7</b>	<b>28.9</b>
<b>Wales</b>	<b>1,054</b>	<b>4.1</b>	<b>24.5</b>	<b>42.5</b>	<b>28.9</b>
<b>E, W &amp; NI</b>	<b>17,684</b>	<b>5.0</b>	<b>24.8</b>	<b>42.9</b>	<b>27.3</b>

Centres excluded if they did not have at least 50% completeness for all of the three variables

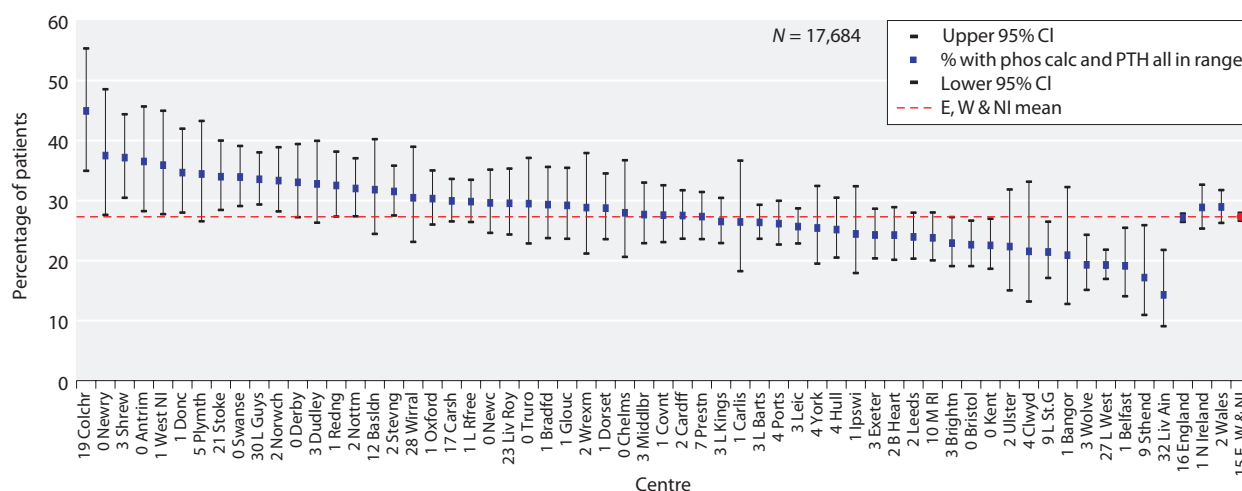
**Table 8.8.** Percentage of peritoneal dialysis patients achieving simultaneous control of the three key bone and mineral disorder parameters (adjusted calcium, phosphate and parathyroid hormone) by centre, in 2016

Centre	N	Number of parameters			
		None	One	Two	Three
<b>England</b>					
B Heart	68	2.9	33.8	38.2	25.0
Basldn	30	0.0	16.7	36.7	46.7
Bradfd	21	4.8	42.9	33.3	19.0
Brightn	52	1.9	19.2	55.8	23.1
Bristol	42	7.1	11.9	40.5	40.5
Carlis	30	0.0	16.7	40.0	43.3
Carsh	78	3.8	21.8	43.6	30.8
Chelms	22	13.6	22.7	40.9	22.7
Covnt	54	1.9	24.1	51.9	22.2
Derby	69	2.9	10.1	44.9	42.0
Donc	25	0.0	8.0	32.0	60.0
Dorset	32	6.3	25.0	37.5	31.3
Dudley	39	5.1	23.1	53.8	17.9
Exeter	73	1.4	19.2	49.3	30.1
Glouc	24	4.2	29.2	25.0	41.7
Hull	56	1.8	23.2	39.3	35.7
Ipswi	31	0.0	9.7	38.7	51.6
Kent	41	2.4	17.1	48.8	31.7
L Barts	162	4.3	22.8	42.0	30.9
L Guys	27	3.7	7.4	48.1	40.7
L Kings	66	3.0	25.8	53.0	18.2
L Rfree	131	3.1	17.6	39.7	39.7
L St.G	35	2.9	22.9	40.0	34.3
L West	69	7.2	14.5	47.8	30.4
Leeds	36	5.6	27.8	50.0	16.7
Leic	65	3.1	10.8	52.3	33.8
Liv Ain	22	0.0	40.9	36.4	22.7
Liv Roy	63	1.6	22.2	39.7	36.5
M RI	47	2.1	25.5	44.7	27.7
Middlbr	15	0.0	6.7	66.7	26.7
Newc	41	9.8	29.3	31.7	29.3
Norwch	31	6.5	16.1	38.7	38.7
Nottm	66	4.5	13.6	39.4	42.4
Oxford	78	2.6	12.8	46.2	38.5
Plymth	26	3.8	19.2	38.5	38.5
Ports	55	1.8	20.0	50.9	27.3
Prestn	34	0.0	23.5	47.1	29.4
Redng	42	4.8	21.4	35.7	38.1
Shrew	29	0.0	10.3	31.0	58.6
Stevng	14	0.0	21.4	42.9	35.7
Sthend	17	5.9	17.6	35.3	41.2
Stoke	62	6.5	35.5	35.5	22.6
Sund	17	5.9	11.8	47.1	35.3
Truro	15	0.0	20.0	60.0	20.0
Wirral	12	8.3	8.3	66.7	16.7
Wolve	57	1.8	19.3	35.1	43.9
York	25	0.0	24.0	48.0	28.0
<b>N Ireland</b>					
Antrim	14	0.0	14.3	57.1	28.6
Belfast	21	4.8	9.5	47.6	38.1
Newry	19	0.0	21.1	42.1	36.8

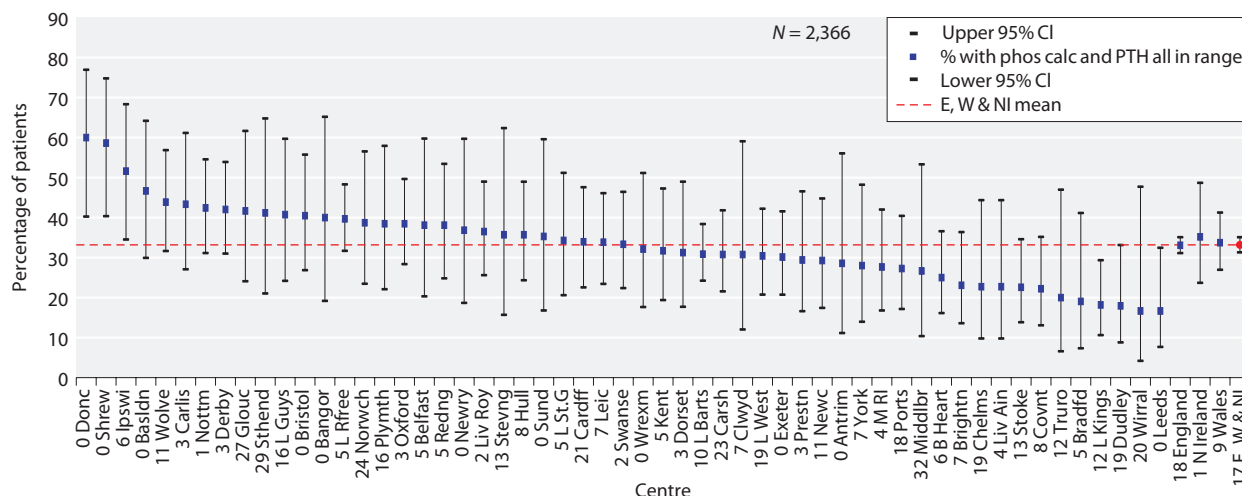
**Table 8.8.** Continued

Centre	N	Number of parameters			
		None	One	Two	Three
<b>Wales</b>					
Bangor	15	0.0	20.0	40.0	40.0
Cardff	53	3.8	28.3	34.0	34.0
Clwyd	13	0.0	30.8	38.5	30.8
Swanse	57	3.5	21.1	42.1	33.3
Wrexm	28	3.6	32.1	32.1	32.1
<b>England</b>	<b>2,146</b>	<b>3.4</b>	<b>20.3</b>	<b>43.2</b>	<b>33.1</b>
<b>N Ireland</b>	<b>54</b>	<b>1.9</b>	<b>14.8</b>	<b>48.1</b>	<b>35.2</b>
<b>Wales</b>	<b>166</b>	<b>3.0</b>	<b>25.9</b>	<b>37.3</b>	<b>33.7</b>
<b>E, W &amp; NI</b>	<b>2,366</b>	<b>3.3</b>	<b>20.5</b>	<b>42.9</b>	<b>33.2</b>

Centres excluded if they did not have at least 50% completeness for all of the three variables

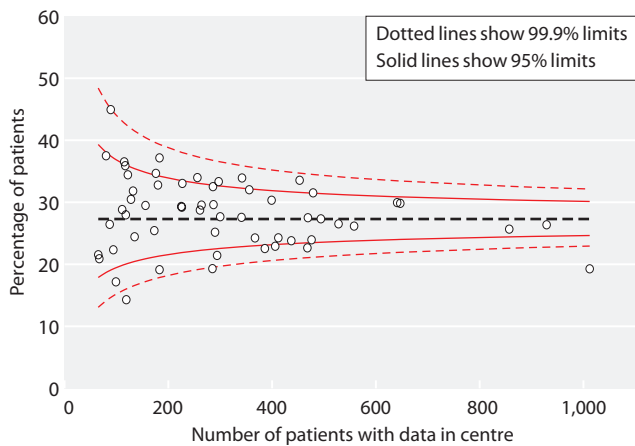


**Fig. 8.6.** Percentage of HD patients achieving simultaneous control of the three key mineral bone disorders (adjusted calcium, phosphate and parathyroid hormone) in preventing severe hyperparathyroidism, by centre in 2016

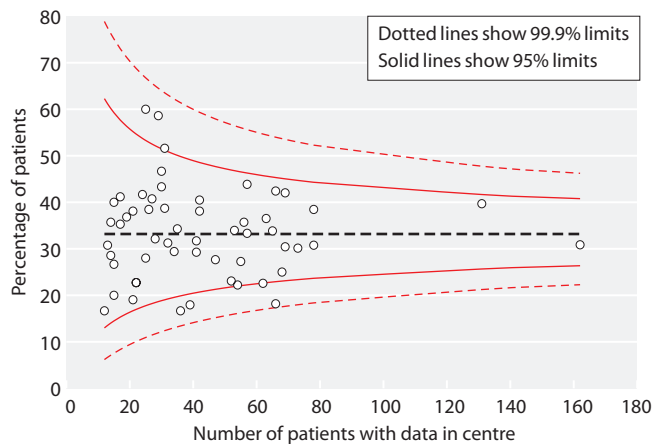


**Fig. 8.7.** Percentage of PD patients achieving simultaneous control of all three mineral bone disorders (adjusted calcium, phosphate and parathyroid hormone) in preventing severe hyperparathyroidism, by centre in 2016





**Fig. 8.8.** Funnel plot of percentage of HD patients achieving simultaneous control of all three mineral bone disorders (adjusted calcium, phosphate and parathyroid hormone) in preventing severe hyperparathyroidism, by centre in 2016



**Fig. 8.9.** Funnel plot of percentage of PD patients achieving simultaneous control of all three mineral bone disorders (adjusted calcium, phosphate and parathyroid hormone) in preventing severe hyperparathyroidism, by centre in 2016

of two parameters in 42.9% of both HD and PD patients; of all three parameters in 27.3% of HD and 33.2% of PD patients (tables 8.7, 8.8). In 2015, 27.6% of HD and 33.1% of PD patients achieved simultaneous control of all three parameters.

Figures 8.8 and 8.9 are funnel plots showing the percentage with control of the three bone mineral parameters by centre (who contributed data to these analyses). There was some variation in the percentage achieving simultaneous control of the three bone mineral parameters for HD patients, with three centres being below the 99.9% confidence interval and none above. There was even less variation for PD centres with no centre above or below the 99.9% confidence interval.

### Haemodialysis

**Table 8.9.** Summary statistics for serum bicarbonate in haemodialysis patients by centre in 2016

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
<b>England</b>							
B Heart	97.9	365	22.0	3.0	22	20	24
B QEH	98.6	925	23.2	2.5	23	22	25
Basldn	98.0	147	23.2	2.9	23	22	25
Bradfd	99.6	227	24.1	2.6	24	22	26
Brightn	98.3	412	22.9	3.1	23	21	25
Bristol	100.0	470	23.9	2.4	24	22	25
Camb*							
Carlis	100.0	88	21.7	2.1	22	20	23
Carsh	70.8	548	25.2	2.5	25	24	27
Chelms	100.0	118	22.4	2.2	22	21	24

### Bicarbonate

In 2016 the following RA clinical practice guidelines regarding bicarbonate management were applicable:

#### **Haemodialysis Guideline 6.3 – HD: Pre-dialysis serum bicarbonate concentrations**

*‘We suggest that pre-dialysis serum bicarbonate concentrations, measured with minimum delay after venepuncture, should be between 18 and 24 mmol/L’ [3]*

#### **Peritoneal Dialysis Guideline 6.2 – PD: Metabolic factors**

*‘We recommend that plasma bicarbonate should be maintained within the normal range’ [4]*

**Table 8.9.** Continued

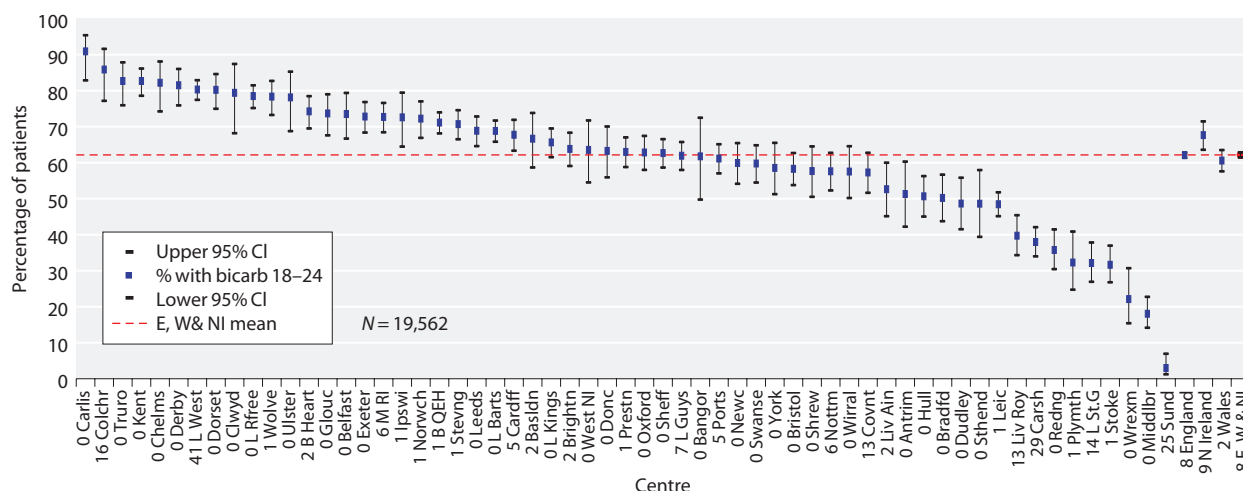
Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
Colchr	83.6	92	22.9	1.8	23	22	24
Covnt	87.3	302	23.8	3.2	24	22	26
Derby	100.0	227	22.3	2.7	22	20	24
Donc	100.0	177	23.6	2.7	23	22	25
Dorset	100.0	263	22.4	2.5	23	21	24
Dudley	100.0	185	24.7	2.8	25	23	27
Exeter	100.0	423	22.9	2.8	23	21	24
Glouc	100.0	228	22.5	2.7	23	21	24
Hull	100.0	302	24.3	2.5	24	23	26
Ipswi	99.3	135	21.4	3.1	21	20	24
Kent	100.0	387	21.6	2.6	22	20	23
L Barts	99.8	953	22.6	3.0	23	21	25
L Guys	93.0	599	23.6	3.1	24	22	26
L Kings	99.8	544	23.7	2.0	24	22	25
L Rfree	99.7	651	22.0	2.8	22	20	24
L St.G	86.4	280	25.7	2.9	26	24	28
L West	59.4	818	20.0	2.7	20	18	22
Leeds	100.0	485	22.9	2.9	23	21	25
Leic	98.8	871	24.9	3.7	25	22	27
Liv Ain	97.7	171	24.6	3.6	24	22	27
Liv Roy	86.6	297	25.4	3.2	25	23	28
M RI	94.1	458	22.1	3.0	22	20	24
Middlbr	100.0	310	27.1	3.0	27	25	29
Newc	100.0	287	23.5	3.2	24	21	25
Norwch	99.0	299	22.3	2.9	22	20	24
Nottm	93.7	342	24.1	2.7	24	23	26
Oxford	100.0	401	22.8	3.3	23	21	25
Plymth	99.2	127	24.9	2.9	25	24	27
Ports	95.4	556	23.3	3.1	23	21	25
Prestn	99.3	527	23.3	2.8	24	22	25
Redng	100.0	288	25.3	3.0	25	23	27
Salford	8.8	32					
Sheff	99.7	576	23.6	3.0	24	22	25
Shrew	100.0	189	23.3	3.1	23	21	26
Stevng	99.4	488	23.3	2.5	23	22	25
Sthend	100.0	109	24.1	3.0	24	22	26
Stoke	99.1	319	25.9	2.7	26	24	28
Sund	75.3	168	29.0	1.9	29	28	30
Truro	100.0	156	21.2	2.7	21	19	23
Wirral	100.0	179	24.3	2.5	24	23	26
Wolve	99.0	291	20.1	2.7	20	18	22
York	100.0	181	24.1	2.7	24	22	26
<b>N Ireland</b>							
Antrim	100.0	115	24.7	2.8	24	23	27
Belfast	100.0	185	23.0	3.4	23	21	24
Newry	33.8	27					
Ulster	100.0	96	22.9	2.0	23	22	24
West NI	100.0	118	23.0	3.0	23	22	25
<b>Wales</b>							
Bangor	100.0	68	23.9	3.0	23	22	25
Cardff	94.8	456	22.0	3.6	22	20	24
Clwyd	100.0	68	22.7	2.3	23	21	24

**Table 8.9.** Continued

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
Swanse	100.0	343	23.6	2.9	24	22	26
Wrexm	100.0	113	26.4	2.8	27	25	28
<b>England</b>	<b>92.2</b>	<b>17,973</b>	<b>23.3</b>	<b>3.2</b>	<b>23</b>	<b>21</b>	<b>25</b>
<b>N Ireland</b>	<b>91.1</b>	<b>541</b>	<b>23.3</b>	<b>3.0</b>	<b>23</b>	<b>22</b>	<b>25</b>
<b>Wales</b>	<b>97.7</b>	<b>1,048</b>	<b>23.2</b>	<b>3.5</b>	<b>23</b>	<b>21</b>	<b>26</b>
<b>E, W &amp; NI</b>	<b>92.5</b>	<b>19,562</b>	<b>23.3</b>	<b>3.2</b>	<b>23</b>	<b>21</b>	<b>25</b>

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

\*Cambridge renal centre was unable to submit bicarbonate data for 2016

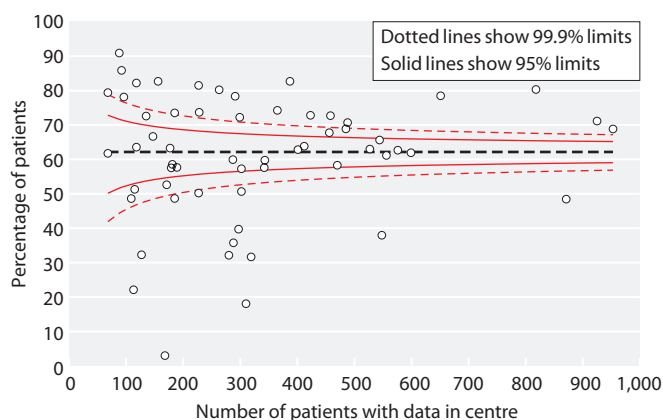


**Fig. 8.10.** Percentage of haemodialysis patients with serum bicarbonate within range (18–24 mmol/L) by centre in 2016

A total of 19,562 HD and 2,538 PD patients’ data were available for serum bicarbonate analysis from England, Wales and Northern Ireland in 2016. Data were 92.5% complete for HD patients and 88.3% complete for PD patients (tables 8.9, 8.11). Data completeness for serum bicarbonate levels in HD and PD patients has not changed significantly over a decade. The proportion of HD patients with serum bicarbonate within the audit measure range was 62.2% in 2016 (95% CI 61.5–62.8%) (table 8.10); the mean bicarbonate in HD patients was 23.3 mmol/L (table 8.9). The proportion with serum bicarbonate within the audit standard in PD patients was 80.7% (CI 79.2–82.2%) (table 8.12). The mean bicarbonate level in PD patients was 25.1 mmol/L (table 8.11).

As in previous reports, inter-centre variation was observed in attainment of the audit standard (tables 8.10, 8.12, figures 8.10–8.13). The funnel plot of serum bicarbonate values in 2016 for HD patients (figure 8.11) showed a large dispersal of attainment, 21 centres being

above the 99.9% limit and 13 below the 99.9% limit. In contrast, the funnel plot for PD patients (figure 8.13) showed few outliers. Sample processing, case-mix, differences in dialysis, residual renal function and oral



**Fig. 8.11.** Funnel plot for percentage of haemodialysis patients within range for bicarbonate (18–24 mmol/L) by centre in 2016

**Table 8.10.** Percentage of haemodialysis patients within, below and above the range for bicarbonate (18–24 mmol/L) by centre in 2016

Centre	N	% bicarb 18–24 mmol/L	Lower 95% CI	Upper 95% CI	% bicarb <18 mmol/L	% bicarb >24 mmol/L	Change in % within range from 2015	95% LCL change	95% UCL change
<b>England</b>									
B Heart	365	74.3	69.5	78.5	5.8	20.0	−3.9	−9.9	2.2
B QEH	925	71.1	68.1	74.0	1.2	27.7	0.6	−3.6	4.7
Basldn	147	66.7	58.7	73.8	3.4	29.9	−19.5	−28.9	−10.1
Bradfd	227	50.2	43.8	56.7	1.3	48.5	−0.5	−9.8	8.8
Brightn	412	63.8	59.1	68.3	4.1	32.0	−14.9	−21.0	−8.8
Bristol	470	58.3	53.8	62.7	1.3	40.4	−26.8	−32.2	−21.3
Carlis	88	90.9	82.9	95.4	0.0	9.1	0.2	−8.7	9.2
Carsh	548	38.0	34.0	42.1	0.4	61.7	−5.1	−10.9	0.7
Chelms	118	82.2	74.2	88.1	2.5	15.3	9.7	−0.4	19.9
Colchr	92	85.9	77.2	91.6	0.0	14.1	0.0	−9.7	9.8
Covnt	302	57.3	51.6	62.8	2.3	40.4	−4.2	−12.0	3.6
Derby	227	81.5	75.9	86.0	3.1	15.4	1.9	−5.5	9.2
Donc	177	63.3	55.9	70.1	1.7	35.0	−12.2	−21.9	−2.5
Dorset	263	80.2	75.0	84.6	2.7	17.1	−2.4	−9.0	4.2
Dudley	185	48.7	41.5	55.8	0.5	50.8	−11.6	−22.1	−1.1
Exeter	423	72.8	68.4	76.8	2.8	24.4	−2.3	−8.2	3.7
Glouc	228	73.7	67.6	79.0	4.0	22.4	−3.7	−11.7	4.2
Hull	302	50.7	45.0	56.3	0.7	48.7	−14.0	−21.6	−6.3
Ipswi	135	72.6	64.5	79.5	9.6	17.8	18.3	6.9	29.8
Kent	387	82.7	78.6	86.1	5.7	11.6	5.8	0.2	11.4
L Barts	953	68.8	65.8	71.7	4.8	26.3	−9.3	−13.3	−5.4
L Guys	599	61.9	58.0	65.7	1.7	36.4	7.7	2.1	13.3
L Kings	544	65.6	61.5	69.5	0.4	34.0	−0.2	−5.9	5.5
L Rfree	651	78.5	75.2	81.5	5.4	16.1	0.7	−3.8	5.2
L St.G	280	32.1	26.9	37.8	0.7	67.1	−14.6	−22.5	−6.6
L West	818	80.3	77.5	82.9	15.3	4.4	−0.1	−4.0	3.8
Leeds	485	68.9	64.6	72.8	3.9	27.2	1.5	−4.4	7.4
Leic	871	48.5	45.1	51.8	1.4	50.2	4.5	−0.3	9.2
Liv Ain	171	52.6	45.1	60.0	1.8	45.6	−1.6	−12.5	9.3
Liv Roy	297	39.7	34.3	45.4	1.0	59.3	2.4	−5.3	10.1
M RI	458	72.7	68.4	76.6	6.3	21.0	−5.0	−10.6	0.6
Middlbr	310	18.1	14.2	22.8	0.0	81.9	−5.8	−12.1	0.5
Newc	287	59.9	54.2	65.4	3.8	36.2	−5.0	−12.9	2.9
Norwch	299	72.2	66.9	77.0	4.4	23.4	−1.3	−8.4	5.8
Nottm	342	57.6	52.3	62.7	1.5	40.9	18.3	10.9	25.6
Oxford	401	62.8	58.0	67.4	5.5	31.7	−1.6	−8.3	5.1
Plymth	127	32.3	24.7	40.9	2.4	65.4	6.9	−4.1	17.9
Ports	556	61.2	57.0	65.1	4.1	34.7	2.9	−2.8	8.6
Prestn	527	63.0	58.8	67.0	3.2	33.8	1.5	−4.3	7.4
Redng	288	35.8	30.4	41.5	1.7	62.5	−22.8	−30.7	−14.8
Sheff	576	62.7	58.7	66.5	1.7	35.6	−8.2	−13.7	−2.7
Shrew	189	57.7	50.5	64.5	3.7	38.6	−2.8	−12.6	7.1
Stevng	488	70.7	66.5	74.6	1.2	28.1	−4.3	−9.9	1.4
Sthend	109	48.6	39.4	58.0	2.8	48.6	−3.2	−16.5	10.1
Stoke	319	31.7	26.8	37.0	0.0	68.3	−2.1	−9.8	5.7
Sund	168	3.0	1.2	7.0	0.0	97.0	−3.3	−7.5	0.9
Truro	156	82.7	75.9	87.9	7.1	10.3	7.7	−1.5	16.9
Wirral	179	57.5	50.2	64.6	0.0	42.5	2.9	−7.6	13.5
Wolve	291	78.4	73.3	82.7	15.5	6.2	5.6	−1.4	12.6
York	181	58.6	51.3	65.5	0.0	41.4	−4.9	−15.5	5.7
<b>N Ireland</b>									
Antrim	115	51.3	42.2	60.3	0.0	48.7	26.7	14.7	38.8
Belfast	185	73.5	66.7	79.4	2.2	24.3	−9.1	−17.6	−0.5

**Table 8.10.** Continued

Centre	N	% bicarb 18–24 mmol/L	Lower 95% CI	Upper 95% CI	% bicarb <18 mmol/L	% bicarb >24 mmol/L	Change in % within range from 2015	95% LCL change	95% UCL change
Ulster	96	78.1	68.8	85.3	1.0	20.8	−6.3	−17.3	4.8
West NI	118	63.6	54.5	71.7	3.4	33.1	−24.9	−35.4	−14.5
<b>Wales</b>									
Bangor	68	61.8	49.8	72.5	1.5	36.8	−1.1	−16.8	14.7
Cardff	456	67.8	63.3	71.9	8.3	23.9	7.1	0.8	13.4
Clwyd	68	79.4	68.2	87.4	0.0	20.6	12.3	−2.0	26.6
Swanse	343	59.8	54.5	64.8	2.0	38.2	−4.3	−11.5	3.0
Wrexm	113	22.1	15.4	30.7	0.9	77.0	−2.1	−13.5	9.3
<b>England</b>	<b>17,973</b>	<b>62.1</b>	<b>61.4</b>	<b>62.8</b>	<b>3.4</b>	<b>34.5</b>	<b>−2.4</b>	<b>−3.4</b>	<b>−1.4</b>
<b>N Ireland</b>	<b>541</b>	<b>67.7</b>	<b>63.6</b>	<b>71.5</b>	<b>1.9</b>	<b>30.5</b>	<b>−3.0</b>	<b>−8.4</b>	<b>2.4</b>
<b>Wales</b>	<b>1,048</b>	<b>60.6</b>	<b>57.6</b>	<b>63.5</b>	<b>4.5</b>	<b>34.9</b>	<b>1.7</b>	<b>−2.6</b>	<b>5.9</b>
<b>E, W &amp; NI</b>	<b>19,562</b>	<b>62.2</b>	<b>61.5</b>	<b>62.8</b>	<b>3.5</b>	<b>34.4</b>	<b>−2.2</b>	<b>−3.2</b>	<b>−1.3</b>

Centres missing from the table were excluded from analysis due to low patient numbers or poor data completeness

*Peritoneal dialysis*

**Table 8.11.** Summary statistics for serum bicarbonate in peritoneal dialysis patients by centre in 2016

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
<b>England</b>							
B Heart	100.0	72	22.5	2.7	23	21	25
B QEH	91.2	114	24.4	3.2	24	22	27
Basldn	100.0	30	26.5	3.6	26	24	30
Bradfd	100.0	22	27.9	3.1	28	26	30
Brightn	98.2	55	27.0	2.9	27	25	29
Bristol	100.0	42	23.2	2.4	23	22	25
Camb <sup>a</sup>							
Carlis	100.0	31	25.0	3.1	25	23	27
Carsh	0.0	–					
Chelms	85.2	23	24.5	3.5	24	22	27
Colchr <sup>b</sup>							
Covnt	94.9	56	25.7	3.4	25	23	28
Derby	100.0	71	23.9	3.0	24	23	26
Donc	100.0	25	24.5	2.5	25	23	26
Dorset	100.0	33	23.4	3.5	23	21	26
Dudley	100.0	48	25.6	3.8	25	23	29
Exeter	100.0	73	24.0	2.9	24	22	26
Glouc	97.0	32	24.0	3.7	23	22	27
Hull	100.0	61	25.9	2.8	26	24	28
Ipswi	97.0	32	25.7	3.6	26	24	28
Kent	95.4	41	24.9	3.5	25	23	27
L Barts	97.8	175	23.5	3.6	24	21	26
L Guys	100.0	32	25.5	2.8	26	24	27
L Kings	100.0	75	27.4	2.3	28	26	29
L Rfree	85.5	118	25.2	3.6	25	23	28
L St.G	97.3	36	24.6	2.5	25	23	27
L West	87.1	74	23.1	2.9	23	21	25
Leeds	100.0	36	27.2	3.7	28	26	30
Leic	95.7	67	25.9	3.4	26	24	28
Liv Ain	100.0	23	26.2	2.6	26	25	28

**Table 8.11.** Continued

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
Liv Roy	98.4	63	26.4	2.8	26	24	29
M RI	98.0	48	24.7	2.6	25	24	26
Middlbr	100.0	22	27.6	2.5	27	26	29
Newc	100.0	46	25.8	3.7	26	24	27
Norwch	100.0	41	23.3	2.7	23	21	25
Nottm	49.3	33					
Oxford	81.3	65	24.1	3.3	24	21	26
Plymth	96.8	30	23.7	3.4	24	22	26
Ports	92.5	62	25.7	2.8	26	24	28
Prestn	100.0	35	23.8	2.8	24	22	26
Redng	100.0	44	27.0	3.0	27	25	29
Salford	11.1	10					
Sheff	97.9	46	23.4	3.0	23	21	26
Shrew	100.0	29	26.3	2.8	26	24	27
Stevng	93.8	15	24.4	2.3	24	22	26
Sthend	100.0	24	26.0	3.4	27	24	29
Stoke	100.0	71	28.1	3.1	28	26	30
Sund	41.2	7					
Truro	88.2	15	26.1	2.7	26	24	28
Wirral	100.0	15	27.5	2.6	28	25	30
Wolve	92.2	59	23.7	2.5	24	22	25
York	100.0	27	26.0	1.9	26	25	27
<b>N Ireland</b>							
Antrim	100.0	14	25.5	2.4	26	24	27
Belfast	100.0	22	25.1	2.7	25	23	27
Newry	100.0	19	24.6	4.1	26	21	27
Ulster	100.0	5					
West NI	100.0	9					
<b>Wales</b>							
Bangor	100.0	15	25.9	3.7	26	25	28
Cardff	74.6	50	24.2	3.6	25	21	27
Clwyd	100.0	14	23.5	2.5	23	22	25
Swanse	100.0	58	26.8	2.9	27	25	29
Wrexm	100.0	28	27.6	3.3	27	25	30
<b>England</b>	<b>87.8</b>	<b>2,304</b>	<b>25.0</b>	<b>3.4</b>	<b>25</b>	<b>23</b>	<b>27</b>
<b>N Ireland</b>	<b>100.0</b>	<b>69</b>	<b>25.1</b>	<b>3.2</b>	<b>26</b>	<b>23</b>	<b>27</b>
<b>Wales</b>	<b>90.7</b>	<b>165</b>	<b>25.8</b>	<b>3.5</b>	<b>26</b>	<b>24</b>	<b>28</b>
<b>E, W &amp; NI</b>	<b>88.3</b>	<b>2,538</b>	<b>25.1</b>	<b>3.4</b>	<b>25</b>	<b>23</b>	<b>27</b>

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

<sup>a</sup>Cambridge renal centre was unable to submit bicarbonate data for 2016

<sup>b</sup>Colchester – no PD patients

bicarbonate prescriptions may all contribute to the variation observed.

Serial trends in serum bicarbonate measures between 2006 and 2016 by dialysis modality are presented in figure 8.14. Achievement of bicarbonate audit measures has not changed significantly over the past decade for either modality. There has been a consistent difference between the modalities in the percentage with raised bicarbonate measures.

### Potassium

In 2016 the following RA clinical practice guideline regarding potassium management in haemodialysis was applicable:

#### **Haemodialysis Guideline 6.4 – HD: Pre-dialysis serum potassium concentrations**

**‘We suggest that pre-dialysis serum potassium should be between 4.0 and 6.0 mmol/L in HD patients.’ [3]**

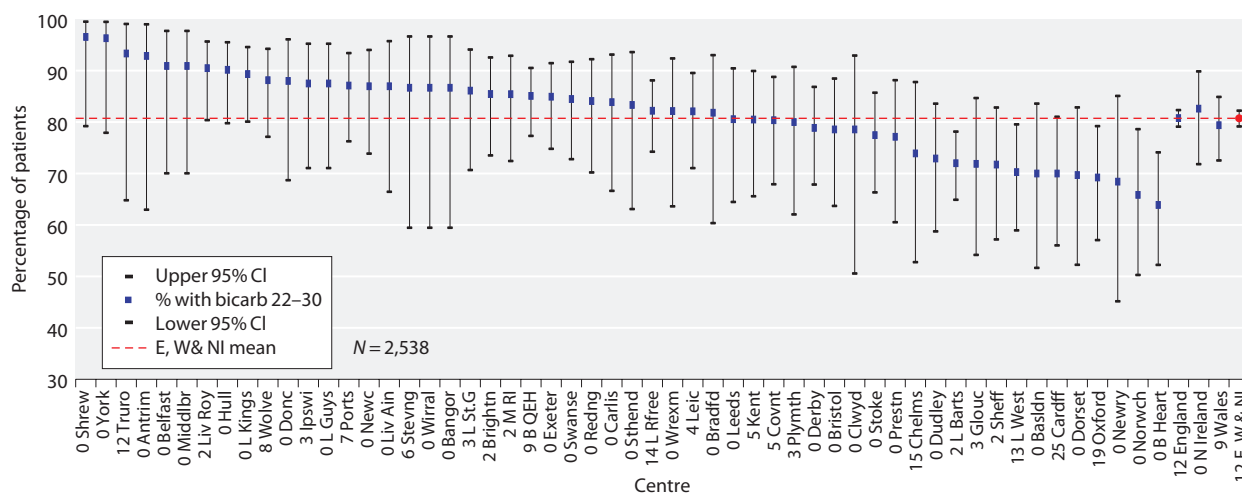
**Table 8.12.** Percentage of peritoneal dialysis patients within, below and above the range for bicarbonate (22–30 mmol/L) by centre in 2016

Centre	N	% bicarb 22–30 mmol/L	Lower 95% CI	Upper 95% CI	% bicarb <22 mmol/L	% bicarb >30 mmol/L	Change in % within range from 2015	95% LCL change	95% UCL change
<b>England</b>									
B Heart	72	63.9	52.2	74.1	36.1	0.0	8.9	−10.1	27.9
B QEH	114	85.1	77.3	90.5	14.0	0.9	3.8	−5.9	13.6
Basldn	30	70.0	51.7	83.6	10.0	20.0	−15.2	−36.4	6.0
Bradfd	22	81.8	60.4	93.0	4.6	13.6	−10.5	−32.2	11.2
Brightn	55	85.5	73.5	92.6	3.6	10.9	3.8	−9.7	17.3
Bristol	42	78.6	63.7	88.5	21.4	0.0	33.9	15.0	52.8
Carlisle	31	83.9	66.6	93.1	9.7	6.5	3.9	−15.4	23.2
Chelms	23	73.9	52.8	87.8	17.4	8.7	−7.9	−32.0	16.2
Covnt	56	80.4	67.9	88.8	10.7	8.9	−2.7	−16.6	11.1
Derby	71	78.9	67.9	86.8	21.1	0.0	−1.9	−15.1	11.2
Donc	25	88.0	68.7	96.1	12.0	0.0	26.9	1.0	52.8
Dorset	33	69.7	52.3	82.9	30.3	0.0	1.1	−20.8	23.1
Dudley	48	72.9	58.8	83.6	16.7	10.4	−13.6	−29.2	2.0
Exeter	73	84.9	74.8	91.5	15.1	0.0	7.5	−5.3	20.2
Glouc	32	71.9	54.2	84.7	25.0	3.1	−10.3	−31.3	10.8
Hull	61	90.2	79.8	95.5	4.9	4.9	10.5	−1.9	22.8
Ipswi	32	87.5	71.1	95.2	9.4	3.1	−5.1	−20.2	10.0
Kent	41	80.5	65.6	89.9	14.6	4.9	−4.7	−20.1	10.7
L Barts	175	72.0	64.9	78.2	26.9	1.1	−9.6	−18.3	−0.8
L Guys	32	87.5	71.1	95.2	6.3	6.3	4.7	−13.2	22.6
L Kings	75	89.3	80.1	94.6	2.7	8.0	−3.1	−12.2	6.0
L Rfree	118	82.2	74.2	88.1	15.3	2.5	−1.3	−11.1	8.5
L St.G	36	86.1	70.7	94.1	13.9	0.0	−9.2	−22.2	3.7
L West	74	70.3	59.0	79.6	28.4	1.4	5.1	−12.2	22.3
Leeds	36	80.6	64.5	90.4	11.1	8.3	10.6	−7.6	28.7
Leic	67	82.1	71.1	89.5	9.0	9.0	7.4	−5.4	20.2
Liv Ain	23	87.0	66.5	95.7	4.4	8.7	−5.6	−22.6	11.3
Liv Roy	63	90.5	80.4	95.7	3.2	6.4	2.0	−8.8	12.8
M RI	48	85.4	72.4	92.9	12.5	2.1	9.6	−5.3	24.4
Middlbr	22	90.9	70.0	97.7	0.0	9.1	33.8	5.2	62.3
Newc	46	87.0	73.9	94.0	10.9	2.2	0.1	−14.4	14.6
Norwch	41	65.9	50.3	78.6	31.7	2.4	−0.8	−23.8	22.1
Oxford	65	69.2	57.1	79.2	27.7	3.1	−3.6	−18.9	11.7
Plymth	30	80.0	62.1	90.7	20.0	0.0	−0.8	−21.6	20.1
Ports	62	87.1	76.3	93.4	9.7	3.2	3.8	−9.2	16.7
Prestn	35	77.1	60.5	88.1	22.9	0.0	−8.6	−25.6	8.4
Redng	44	84.1	70.2	92.2	2.3	13.6	−4.1	−17.6	9.5
Sheff	46	71.7	57.2	82.8	28.3	0.0	7.4	−10.6	25.5
Shrew	29	96.6	79.2	99.5	0.0	3.5	7.7	−5.9	21.2
Stevng	15	86.7	59.5	96.6	13.3	0.0	11.7	−18.3	41.6
Sthend	24	83.3	63.1	93.6	12.5	4.2	−16.7	−31.6	−1.8
Stoke	71	77.5	66.3	85.7	1.4	21.1	−10.8	−23.2	1.6
Truro	15	93.3	64.8	99.1	0.0	6.7	5.1	−14.8	24.9
Wirral	15	86.7	59.5	96.6	0.0	13.3	−1.6	−24.6	21.5
Wolve	59	88.1	77.1	94.2	11.9	0.0	22.5	8.4	36.5
York	27	96.3	77.9	99.5	3.7	0.0	15.4	−2.9	33.6
<b>N Ireland</b>									
Antrim	14	92.9	63.0	99.0	7.1	0.0	4.6	−15.8	25.0
Belfast	22	90.9	70.0	97.7	9.1	0.0	1.4	−16.9	19.7
Newry	19	68.4	45.2	85.1	26.3	5.3	−14.9	−42.0	12.2

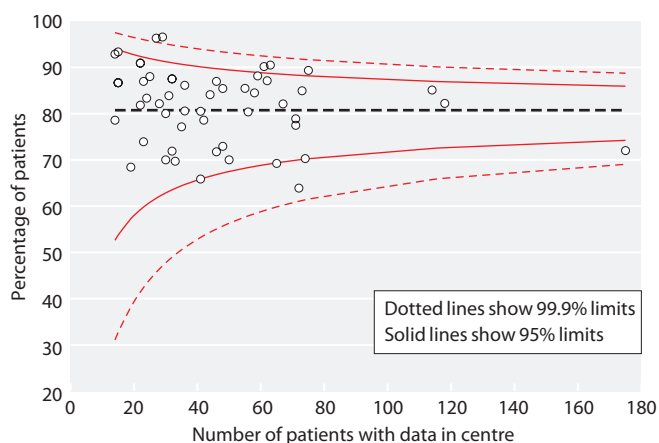
**Table 8.12.** Continued

Centre	N	% bicarb 22–30 mmol/L	Lower 95% CI	Upper 95% CI	% bicarb <22 mmol/L	% bicarb >30 mmol/L	Change in % within range from 2015	95% LCL change	95% UCL change
<b>Wales</b>									
Bangor	15	86.7	59.5	96.6	6.7	6.7	-5.6	-28.1	16.8
Cardff	50	70.0	56.0	81.0	28.0	2.0	-21.2	-35.6	-6.8
Clwyd	14	78.6	50.6	92.9	21.4	0.0	1.6	-29.8	33.1
Swanse	58	84.5	72.8	91.7	1.7	13.8	-6.3	-18.4	5.8
Wrexm	28	82.1	63.6	92.4	0.0	17.9	0.3	-19.0	19.7
<b>England</b>	<b>2,304</b>	<b>80.8</b>	<b>79.1</b>	<b>82.3</b>	<b>14.8</b>	<b>4.4</b>	<b>1.1</b>	<b>-1.2</b>	<b>3.4</b>
<b>N Ireland</b>	<b>69</b>	<b>82.6</b>	<b>71.8</b>	<b>89.9</b>	<b>14.5</b>	<b>2.9</b>	<b>-4.3</b>	<b>-16.3</b>	<b>7.6</b>
<b>Wales</b>	<b>165</b>	<b>79.4</b>	<b>72.5</b>	<b>84.9</b>	<b>11.5</b>	<b>9.1</b>	<b>-9.0</b>	<b>-16.7</b>	<b>-1.3</b>
<b>E, W &amp; NI</b>	<b>2,538</b>	<b>80.7</b>	<b>79.2</b>	<b>82.2</b>	<b>14.6</b>	<b>4.7</b>	<b>0.3</b>	<b>-1.9</b>	<b>2.5</b>

Centres missing from the table were excluded from analysis due to low patient numbers or poor data completeness



**Fig. 8.12.** Percentage of peritoneal dialysis patients with serum bicarbonate within range (22–30 mmol/L) by centre in 2016



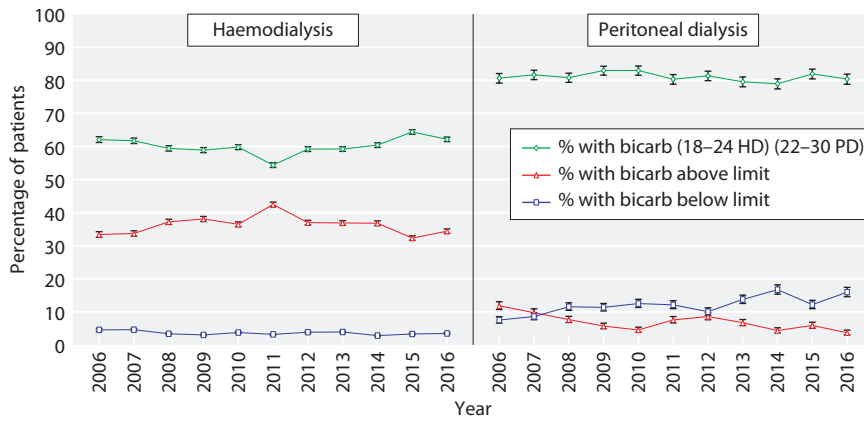
**Fig. 8.13.** Funnel plot for percentage of peritoneal dialysis patients within range for bicarbonate (22–30 mmol/L) by centre in 2016

The PD guideline contains no recommendation with regard to serum potassium.

A total of 10,568 HD patients' data were available for serum potassium analysis from 27 centres in England, all five centres in Northern Ireland but no centres in Wales in 2016. In total, data were 50.0% complete for HD patients (table 8.13). However, when considering only centres that submitted at least some data for serum potassium, centre completeness was 98% or higher apart from Stoke. The proportion of HD patients with serum potassium within the audit measure range was 84.1% in 2016 (95% CI 83.4–84.8%) (table 8.14); the mean serum potassium in HD patients was 4.9 mmol/L (table 8.13).

Some inter-centre variation was observed in attainment of the audit standard (table 8.14, figures 8.15, 8.16). One centre was above and one below the 99.9%





**Fig. 8.14.** Longitudinal change in percentage of patients within the range for bicarbonate by dialysis modality 2006–2016

### Haemodialysis

**Table 8.13.** Summary statistics for serum potassium in haemodialysis patients by centre in 2016

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
<b>England</b>							
B Heart	100.0	373	4.9	0.8	4.8	4.4	5.3
B QEH	99.8	936	4.9	0.8	4.8	4.4	5.4
Basldn	98.0	147	4.7	0.7	4.7	4.3	5.2
Bradfd	99.6	227	4.7	0.8	4.6	4.1	5.1
Brightn	0.0	0					
Bristol	100.0	470	4.7	0.7	4.6	4.2	5.1
Camb <sup>a</sup>							
Carlis <sup>b</sup>	0.0	0					
Carsh	0.0	0					
Chelms	100.0	118	5.1	0.6	5.1	4.7	5.4
Colchr <sup>b</sup>	0.0	0					
Covnt <sup>c</sup>	0.0	0					
Derby	0.0	0					
Donc	100.0	177	4.9	0.7	4.8	4.4	5.3
Dorset	100.0	263	4.9	0.7	4.9	4.4	5.3
Dudley	100.0	185	4.9	0.8	4.9	4.4	5.4
Exeter	100.0	423	4.6	0.8	4.6	4.1	5.1
Glouc	0.0	0					
Hull	100.0	302	4.7	0.7	4.7	4.3	5.2
Ipswi	0.0	0					
Kent	100.0	387	4.7	0.9	4.8	4.2	5.3
L Barts	0.0	0					
L Guys <sup>c</sup>	0.0	0					
L Kings	0.0	0					
L Rfree	99.9	652	5.0	0.8	5	4.4	5.5
L St.G	0.0	0					
L West	0.0	0					
Leeds	100.0	485	5.2	0.7	5.2	4.7	5.7
Leic	100.0	882	5.0	0.8	4.9	4.4	5.4
Liv Ain	0.0	0					
Liv Roy	0.0	0					
M RI	0.0	0					
Middlbr	100.0	310	4.9	0.7	4.8	4.4	5.3
Newc	0.0	0					
Norwch	99.7	301	5.2	0.6	5.2	4.8	5.6
Nottm	99.7	364	4.9	0.7	4.9	4.5	5.3
Oxford	100.0	401	5.0	0.7	4.9	4.5	5.4
Plymth	99.2	127	4.7	0.8	4.7	4.2	5.2

**Table 8.13.** Continued

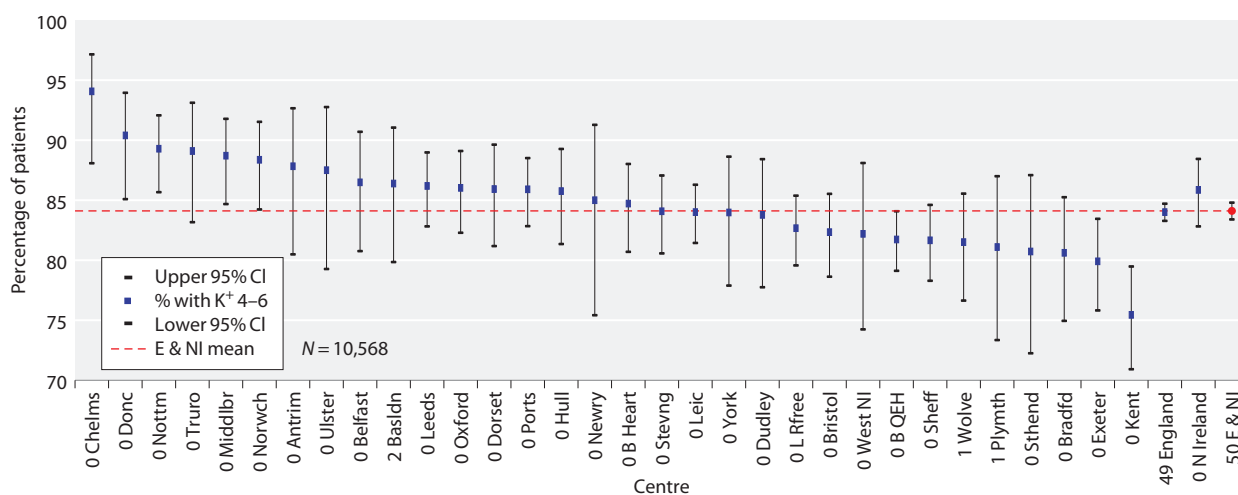
Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
Ports	99.8	582	4.9	0.7	4.8	4.4	5.3
Prestn	0.0	0					
Redng	0.0	0					
Salford	0.0	0					
Sheff	100.0	578	5.0	0.8	5	4.5	5.5
Shrew	0.0	0					
Stevng	99.8	490	5.0	0.8	5.05	4.5	5.5
Sthend	100.0	109	4.7	0.7	4.7	4.2	5.1
Stoke	17.4	56					
Sund	0.0	0					
Truro	100.0	156	4.9	0.6	4.9	4.5	5.3
Wirral	0.0	0					
Wolve	99.3	292	4.9	0.8	4.8	4.3	5.3
York	100.0	181	5.1	0.7	5.1	4.6	5.7
<b>N Ireland</b>							
Antrim	100.0	115	4.9	0.7	4.8	4.5	5.4
Belfast	100.0	185	5.1	0.7	5.1	4.6	5.6
Newry	100.0	80	5.1	0.8	5	4.6	5.5
Ulster	100.0	96	5.0	0.7	5	4.5	5.4
West NI	100.0	118	4.9	0.8	4.8	4.5	5.3
<b>Wales</b>							
Bangor	0.0	0					
Cardff	0.0	0					
Clwyd	0.0	0					
Swanse	0.0	0					
Wrexm	0.0	0					
<b>England</b>	<b>51.2</b>	<b>9,974</b>	<b>4.9</b>	<b>0.8</b>	<b>4.9</b>	<b>4.4</b>	<b>5.4</b>
<b>N Ireland</b>	<b>100.0</b>	<b>594</b>	<b>5.0</b>	<b>0.7</b>	<b>5</b>	<b>4.5</b>	<b>5.4</b>
<b>Wales</b>	<b>0.0</b>	<b>0</b>					
<b>E, W &amp; NI</b>	<b>50.0</b>	<b>10,568</b>	<b>4.9</b>	<b>0.8</b>	<b>4.9</b>	<b>4.4</b>	<b>5.4</b>

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

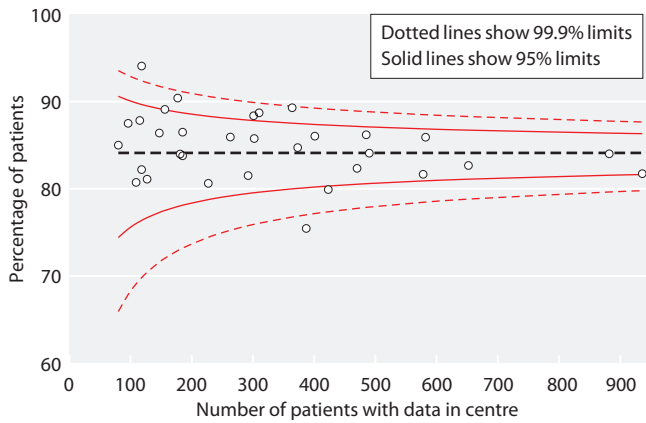
<sup>a</sup>Cambridge renal centre was unable to submit patient-level data for 2016

<sup>b</sup>Carlisle and Colchester renal centres submitted potassium data rounded to unit in HD patients, and were therefore excluded from this analysis

<sup>c</sup>Coventry and London Guys renal centres returned potassium data post-haemodialysis and were therefore excluded from this analysis



**Fig. 8.15.** Percentage of haemodialysis patients with serum potassium within range (4–6 mmol/L) by centre in 2016



**Fig. 8.16.** Funnel plot for percentage of haemodialysis patients within range for serum potassium (4–6 mmol/L) by centre in 2016

confidence interval limits. The serum potassium measurement will be particularly sensitive to differences in the timing and technique of sample processing by centre.

## Discussion

Observational data continues to accumulate linking disordered calcium, phosphate and PTH levels with higher mortality in dialysis patients [10–16]. Despite this, trial data on specific target values or the best treatment approaches are lacking as reflected in recently published international guidelines [6]. The guidelines re-enforce the importance in identifying trends in parameters rather than reacting to isolated measurements and to appreciate the complex interdependency of parameters.

This chapter presents the results of mineral bone disease management for patients established on regular dialysis in the UK. Over the last decade there have been modest improvements in the attainment of target measures. In the latest analysis, a stable proportion of patients with all bone parameters within target range masks higher levels of hyperphosphataemia with improvement in attainment of target PTH. Increased

**Table 8.14.** Percentage of haemodialysis patients within, below and above the range for serum potassium (4–6 mmol/L) by centre in 2016

Centre	N	% potassium 4–6 mmol/L	Lower 95% CI	Upper 95% CI	% potassium <4 mmol/L	% potassium >6 mmol/L
<b>England</b>						
B Heart	373	84.7	80.7	88.0	9.4	5.9
B QEH	936	81.7	79.1	84.1	11.4	6.8
Basldn	147	86.4	79.9	91.1	10.2	3.4
Bradfd	227	80.6	75.0	85.3	15.9	3.5
Bristol	470	82.3	78.6	85.5	15.5	2.1
Chelms	118	94.1	88.1	97.2	2.5	3.4
Donc	177	90.4	85.1	94.0	6.2	3.4
Dorset	263	85.9	81.2	89.6	8.8	5.3
Dudley	185	83.8	77.8	88.4	7.0	9.2
Exeter	423	79.9	75.8	83.5	18.0	2.1
Hull	302	85.8	81.4	89.3	10.9	3.3
Kent	387	75.5	70.9	79.5	19.1	5.4
L Rfree	652	82.7	79.6	85.4	10.4	6.9
Leeds	485	86.2	82.8	89.0	2.5	11.3
Leic	882	84.0	81.4	86.3	8.5	7.5
Middlbr	310	88.7	84.7	91.8	6.8	4.5
Norwch	301	88.4	84.2	91.5	2.0	9.6
Nottm	364	89.3	85.7	92.1	5.5	5.2
Oxford	401	86.0	82.3	89.1	6.5	7.5
Plymth	127	81.1	73.4	87.0	15.8	3.2
Ports	582	85.9	82.8	88.5	9.5	4.6
Sheff	578	81.7	78.3	84.6	9.0	9.3
Stevng	490	84.1	80.6	87.1	6.7	9.2
Sthend	109	80.7	72.3	87.1	16.5	2.8
Truro	156	89.1	83.2	93.1	7.1	3.9
Wolve	292	81.5	76.6	85.6	12.0	6.5
York	181	84.0	77.9	88.6	2.8	13.3

**Table 8.14.** Continued

Centre	N	% potassium 4–6 mmol/L	Lower 95% CI	Upper 95% CI	% potassium <4 mmol/L	% potassium >6 mmol/L
<b>N Ireland</b>						
Antrim	115	87.8	80.5	92.7	7.0	5.2
Belfast	185	86.5	80.8	90.7	4.3	9.2
Newry	80	85.0	75.4	91.3	3.8	11.3
Ulster	96	87.5	79.3	92.8	4.2	8.3
West NI	118	82.2	74.2	88.1	7.6	10.2
<b>England</b>	<b>9,974</b>	<b>84.0</b>	<b>83.3</b>	<b>84.7</b>	<b>9.7</b>	<b>6.3</b>
<b>N Ireland</b>	<b>594</b>	<b>85.9</b>	<b>82.8</b>	<b>88.4</b>	<b>5.4</b>	<b>8.8</b>
<b>Wales</b>	<b>0</b>					
<b>E, W &amp; NI</b>	<b>10,568</b>	<b>84.1</b>	<b>83.4</b>	<b>84.8</b>	<b>9.4</b>	<b>6.5</b>

Centres missing from the table were excluded from analysis due to low patient numbers or poor data completeness

hyperphosphataemia was seen across the majority of centres although there continued to be significant inter and intra centre variation in the attainment of target measures in part reflecting the challenge of managing the varied CKD-MBD phenotypes [6, 13]. As previously described, there were problems related to variations in calcium and PTH measurements between centres [17]. Comorbidity, dialysis dose and dialysate concentrations, as well as the use of phosphate binders, calcium mimetics and vitamin D analogues are also likely to be significant confounding variables at the patient level. The hope is that the expanded dataset will allow adjustment for these covariates in the near future.

Serum bicarbonate levels have not changed significantly compared with recent years, but there remained marked variation between centres in HD patients. The UKRR has previously conducted a limited survey [18] into the possible underlying causes of serum bicarbonate variation. The study examined 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. Studies have identified an increased risk of death stratified by a reduced pre-dialysis serum bicarbonate level (<17 mmol/L) or with raised levels (>27 mmol/L) [19–21], as well as with raised dialysate bicarbonate concentrations [11]. Future analysis of management of acidosis will have to re-explore the factors associated with an increased trend in developing alkalosis in HD patients.

Sufficient data were received from renal centres for the first time to analyse pre-dialysis potassium levels. Observational data has shown that pre-dialysis potassium levels both above 6.0 mmol/L and below 4.0 mmol/L have been associated with higher mortality thus forming the basis

for the current guideline target range [3, 22–23]. More recent analysis of the DOPPS data has shown, that after adjustment for patient factors including nutritional indicators, only higher potassium levels remained associated with higher mortality. Of the samples collected, 84.1% were within the target range which is slightly higher than the international data (81%) which included UK data [24]. Serum potassium levels are likely to be particularly sensitive to differences in the timing and processing of samples as well as differences in case-mix. Inter and intra centre variability therefore needs to be interpreted with caution. The current analysis used data collected before a ‘short-gap’ dialysis session in line with guidelines but in future it is planned to also analyse potassium collected before a ‘long-gap’ session if data completeness permits.

Conflicts of interest: the authors declare no conflict of interest

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## Appendix 1 Attainment of individual standard for adjusted calcium, phosphate and PTH

This appendix includes analyses of the individual mineral bone measures that are included in the composite audit measure, namely adjusted calcium, phosphate and PTH within the recommended target ranges.

### Adjusted calcium

In 2016, the following RA clinical practice guideline regarding calcium management was applicable:

### Guideline 2.2 CKD-MBD: Serum calcium in dialysis patients (stage 5D)

*'We suggest that 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 haemodialysis patients. Ideally, adjusted serum calcium should be maintained between 2.2 and 2.5 mmol/L, with avoidance of hypercalcaemic episodes (2D)' [2]*

In 2016, data from 22,552 HD and 3,006 PD patients across the UK were available for serum adjusted calcium

### Haemodialysis

**Table 8.15.** Summary statistics for adjusted calcium in haemodialysis patients in 2016

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
<b>England</b>							
B Heart	100.0	373	2.4	0.2	2.4	2.3	2.5
B QEH	99.7	935	2.3	0.2	2.3	2.2	2.4
Basldn	98.0	147	2.4	0.2	2.4	2.3	2.5
Bradfd	99.1	226	2.4	0.1	2.4	2.4	2.5
Brightn	99.8	418	2.4	0.2	2.3	2.2	2.4
Bristol	100.0	470	2.4	0.2	2.4	2.3	2.5
Camb*							
Carlis	100.0	88	2.3	0.2	2.3	2.2	2.4
Carsh	99.7	772	2.3	0.2	2.3	2.2	2.4
Chelms	100.0	118	2.3	0.2	2.3	2.2	2.4
Colchr	83.6	92	2.4	0.1	2.4	2.3	2.5
Covnt	99.7	345	2.3	0.2	2.3	2.2	2.4
Derby	100.0	227	2.4	0.1	2.4	2.3	2.5
Donc	100.0	177	2.3	0.2	2.3	2.3	2.4
Dorset	100.0	263	2.3	0.2	2.3	2.2	2.4
Dudley	100.0	185	2.3	0.2	2.3	2.2	2.4
Exeter	100.0	423	2.3	0.1	2.3	2.2	2.4
Glouc	100.0	228	2.4	0.2	2.3	2.3	2.5
Hull	100.0	302	2.4	0.2	2.4	2.3	2.5
Ipswi	99.3	135	2.4	0.2	2.4	2.2	2.5
Kent	100.0	387	2.4	0.2	2.4	2.3	2.5
L Barts	99.8	953	2.3	0.2	2.3	2.2	2.4
L Guys	99.8	643	2.4	0.2	2.4	2.3	2.4
L Kings	99.8	544	2.3	0.2	2.3	2.2	2.4
L Rfree	99.9	652	2.3	0.2	2.3	2.2	2.4
L St.G	96.9	314	2.3	0.2	2.3	2.2	2.4
L West	85.6	1,180	2.3	0.2	2.3	2.2	2.5
Leeds	100.0	485	2.4	0.2	2.4	2.3	2.5
Leic	99.9	881	2.3	0.2	2.3	2.2	2.4
Liv Ain	97.1	170	2.4	0.2	2.4	2.3	2.4
Liv Roy	98.0	336	2.3	0.2	2.3	2.2	2.5
M RI	94.1	458	2.4	0.2	2.4	2.3	2.5
Middlbr	100.0	310	2.3	0.2	2.3	2.1	2.4

**Table 8.15.** Continued

Centre	% completeness	Patients with data <i>N</i>	Mean	SD	Median	Lower quartile	Upper quartile
Newc	100.0	287	2.3	0.2	2.3	2.2	2.4
Norwch	99.7	301	2.4	0.2	2.4	2.3	2.5
Nottm	99.7	364	2.3	0.2	2.3	2.2	2.4
Oxford	100.0	401	2.4	0.2	2.3	2.3	2.4
Plymth	99.2	127	2.3	0.2	2.3	2.2	2.4
Ports	99.8	582	2.3	0.2	2.3	2.2	2.4
Prestn	93.8	498	2.3	0.2	2.3	2.2	2.4
Redng	100.0	288	2.3	0.2	2.3	2.2	2.4
Salford	97.5	353	2.3	0.2	2.3	2.2	2.4
Sheff	99.8	577	2.3	0.2	2.3	2.2	2.4
Shrew	100.0	189	2.4	0.2	2.4	2.3	2.5
Stevng	99.8	490	2.4	0.2	2.3	2.2	2.5
Sthend	100.0	109	2.4	0.2	2.4	2.3	2.6
Stoke	98.8	318	2.4	0.2	2.4	2.3	2.5
Sund	100.0	223	2.3	0.2	2.2	2.1	2.3
Truro	100.0	156	2.3	0.2	2.3	2.2	2.4
Wirral	99.4	178	2.3	0.2	2.3	2.2	2.4
Wolve	99.0	291	2.4	0.2	2.4	2.3	2.5
York	100.0	181	2.4	0.1	2.4	2.3	2.5
<b>N Ireland</b>							
Antrim	100.0	115	2.4	0.2	2.4	2.3	2.5
Belfast	100.0	185	2.3	0.2	2.3	2.2	2.4
Newry	100.0	80	2.4	0.2	2.4	2.3	2.5
Ulster	99.0	95	2.5	0.1	2.5	2.4	2.6
West NI	100.0	118	2.3	0.1	2.3	2.2	2.4
<b>Scotland</b>							
Abrdn	99.5	217	2.4	0.2	2.4	2.3	2.5
Airdrie	100.0	173	2.4	0.2	2.4	2.3	2.5
D & Gall	97.9	46	2.3	0.2	2.3	2.2	2.4
Dundee	98.8	164	2.4	0.2	2.4	2.3	2.5
Edinb	100.0	269	2.4	0.2	2.4	2.3	2.5
Glasgw	100.0	537	2.4	0.2	2.4	2.3	2.5
Inverns	80.0	68	2.4	0.2	2.3	2.3	2.4
Klmarnk	100.0	128	2.4	0.2	2.4	2.3	2.6
Krkldy	100.0	135	2.4	0.2	2.3	2.3	2.4
<b>Wales</b>							
Bangor	100.0	68	2.3	0.2	2.3	2.2	2.4
Cardff	99.8	480	2.4	0.2	2.4	2.3	2.5
Clwyd	100.0	68	2.4	0.1	2.4	2.3	2.5
Swanse	100.0	343	2.4	0.2	2.4	2.3	2.4
Wrexm	100.0	113	2.3	0.1	2.3	2.2	2.4
<b>England</b>	<b>98.3</b>	<b>19,150</b>	<b>2.3</b>	<b>0.2</b>	<b>2.3</b>	<b>2.2</b>	<b>2.4</b>
<b>N Ireland</b>	<b>99.8</b>	<b>593</b>	<b>2.4</b>	<b>0.2</b>	<b>2.3</b>	<b>2.2</b>	<b>2.5</b>
<b>Scotland</b>	<b>98.8</b>	<b>1,737</b>	<b>2.4</b>	<b>0.2</b>	<b>2.4</b>	<b>2.3</b>	<b>2.5</b>
<b>Wales</b>	<b>99.9</b>	<b>1,072</b>	<b>2.4</b>	<b>0.2</b>	<b>2.4</b>	<b>2.3</b>	<b>2.5</b>
<b>UK</b>	<b>98.4</b>	<b>22,552</b>	<b>2.3</b>	<b>0.2</b>	<b>2.3</b>	<b>2.2</b>	<b>2.4</b>

\*Cambridge renal centre was unable to submit calcium data for 2016

**Table 8.16.** Percentage of haemodialysis patients within, below and above the range for adjusted calcium (2.2–2.5 mmol/L) in 2016

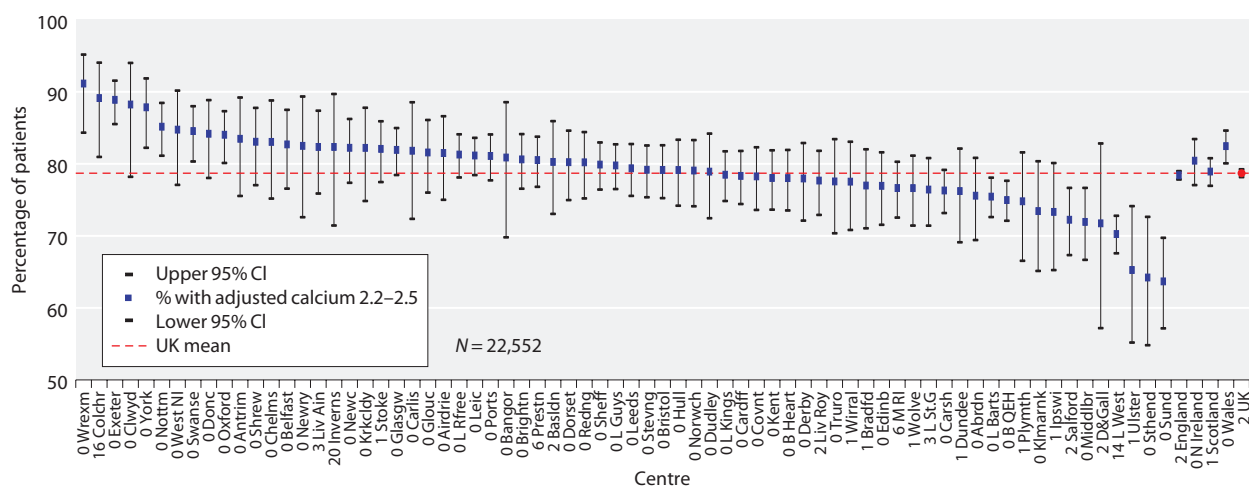
Centre	N	% adjusted Ca 2.2–2.5 mmol/L	Lower 95% CI	Upper 95% CI	% adjusted Ca <2.2 mmol/L	% adjusted Ca >2.5 mmol/L	Change in % within range from 2015	95% LCL change	95% UCL change
<b>England</b>									
B Heart	373	78.0	73.5	81.9	6.2	15.8	-2.7	-8.4	3.0
B QEH	935	75.0	72.1	77.7	18.4	6.6	-1.4	-5.3	2.5
Basldn	147	80.3	73.1	85.9	2.0	17.7	-2.0	-10.8	6.9
Bradfd	226	77.0	71.1	82.0	2.2	20.8	-12.0	-18.8	-5.1
Brightn	418	80.6	76.6	84.1	9.3	10.1	-1.4	-6.7	4.0
Bristol	470	79.2	75.2	82.6	3.0	17.9	-10.6	-15.2	-6.1
Carlis	88	81.8	72.4	88.6	14.8	3.4	11.2	-1.9	24.2
Carsh	772	76.3	73.2	79.2	17.6	6.1	-0.5	-4.7	3.8
Chelms	118	83.1	75.2	88.8	10.2	6.8	4.8	-4.9	14.4
Colchr	92	89.1	81.0	94.1	0.0	10.9	-0.5	-9.1	8.1
Covnt	345	78.3	73.6	82.3	13.0	8.7	-0.4	-6.6	5.7
Derby	227	78.0	72.1	82.9	2.6	19.4	6.9	-1.1	15.0
Donc	177	84.2	78.0	88.9	9.0	6.8	-1.7	-9.3	5.9
Dorset	263	80.2	75.0	84.6	17.1	2.7	-5.8	-12.1	0.6
Dudley	185	78.9	72.5	84.2	15.1	6.0	-1.2	-9.8	7.4
Exeter	423	88.9	85.5	91.6	3.8	7.3	-2.0	-6.1	2.1
Glouc	228	81.6	76.0	86.1	9.2	9.2	-5.1	-11.8	1.7
Hull	302	79.1	74.2	83.4	5.3	15.6	2.9	-3.6	9.4
Ipswi	135	73.3	65.3	80.1	13.3	13.3	-1.9	-12.4	8.7
Kent	387	78.0	73.6	81.9	6.7	15.3	4.4	-1.6	10.4
L Barts	953	75.5	72.6	78.1	14.7	9.9	3.0	-1.0	7.0
L Guys	643	79.8	76.5	82.7	9.5	10.7	-0.9	-5.3	3.5
L Kings	544	78.5	74.8	81.7	17.5	4.0	-2.5	-7.3	2.3
L Rfree	652	81.3	78.1	84.1	13.5	5.2	0.4	-3.9	4.6
L St.G	314	76.4	71.4	80.8	15.3	8.3	-1.6	-8.2	5.0
L West	1,180	70.3	67.6	72.8	15.5	14.2	-3.3	-6.9	0.3
Leeds	485	79.4	75.6	82.8	4.7	15.9	-4.9	-9.8	-0.1
Leic	881	81.2	78.4	83.6	10.4	8.4	0.3	-3.4	4.1
Liv Ain	170	82.4	75.9	87.4	8.2	9.4	-2.6	-10.7	5.4
Liv Roy	336	77.7	72.9	81.8	11.9	10.4	-2.8	-8.9	3.2
M RI	458	76.6	72.5	80.3	8.3	15.1	-4.8	-10.0	0.5
Middlbr	310	71.9	66.7	76.7	26.5	1.6	6.0	-1.2	13.2
Newc	287	82.2	77.4	86.2	10.8	7.0	1.5	-4.8	7.9
Norwch	301	79.1	74.1	83.3	4.7	16.3	3.3	-3.3	10.0
Nottm	364	85.2	81.1	88.5	7.7	7.1	2.2	-3.2	7.6
Oxford	401	84.0	80.1	87.3	6.0	10.0	5.6	0.2	11.0
Plymth	127	74.8	66.5	81.6	20.5	4.7	1.0	-9.7	11.6
Ports	582	81.1	77.7	84.1	10.1	8.8	2.1	-2.4	6.7
Prestn	498	80.5	76.8	83.8	16.1	3.4	-1.2	-6.0	3.7
Redng	288	80.2	75.2	84.4	11.8	8.0	0.4	-6.1	7.0
Salford	353	72.2	67.3	76.7	16.4	11.3	-3.1	-9.5	3.3
Sheff	577	79.9	76.4	83.0	13.7	6.4	-0.6	-5.3	4.0
Shrew	189	83.1	77.0	87.8	6.9	10.1	3.4	-4.4	11.2
Stevng	490	79.2	75.4	82.6	8.6	12.2	0.6	-4.6	5.7
Sthend	109	64.2	54.8	72.6	10.1	25.7	-9.8	-22.1	2.4
Stoke	318	82.1	77.5	85.9	8.5	9.4	-2.9	-8.7	3.0
Sund	223	63.7	57.2	69.7	30.5	5.8	-8.7	-17.4	0.1
Truro	156	77.6	70.4	83.4	14.7	7.7	-8.6	-17.2	0.1
Wirral	178	77.5	70.8	83.1	15.2	7.3	-4.2	-12.6	4.2
Wolve	291	76.6	71.4	81.1	8.3	15.1	-2.0	-8.8	4.8
York	181	87.9	82.2	91.9	3.9	8.3	0.3	-6.9	7.4



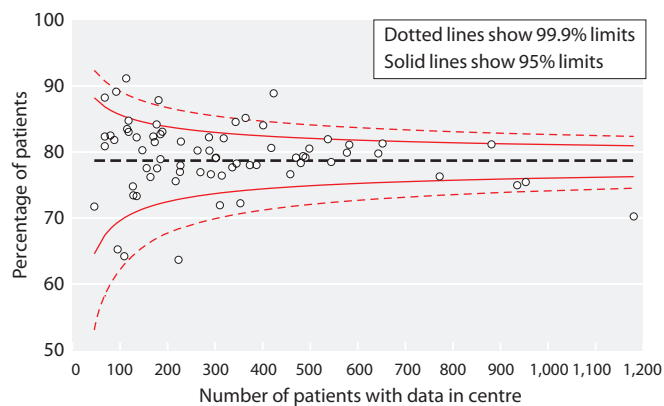
**Table 8.16.** Continued

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 in % within range from 2015	95% LCL change	95% UCL change
<b>N Ireland</b>									
Antrim	115	83.5	75.5	89.2	7.8	8.7	5.4	-4.8	15.6
Belfast	185	82.7	76.6	87.5	11.4	6.0	-4.5	-11.9	2.9
Newry	80	82.5	72.6	89.4	10.0	7.5	-12.7	-22.2	-3.2
Ulster	95	65.3	55.2	74.1	2.1	32.6	6.3	-7.5	20.1
West NI	118	84.8	77.1	90.2	11.9	3.4	10.4	0.1	20.8
<b>Scotland</b>									
Abrdn	217	75.6	69.4	80.8	7.8	16.6	3.4	-5.0	11.8
Airdrie	173	81.5	75.0	86.6	7.5	11.0	-0.1	-8.3	8.1
D & Gall	46	71.7	57.2	82.8	19.6	8.7	-4.3	-21.9	13.3
Dundee	164	76.2	69.1	82.1	4.3	19.5	-7.4	-16.0	1.1
Edinb	269	77.0	71.5	81.6	6.0	17.1	13.4	5.5	21.2
Glasgw	537	81.9	78.5	85.0	5.4	12.7	-1.5	-6.0	3.0
Inverns	68	82.4	71.4	89.7	11.8	5.9	0.5	-12.0	13.0
Klmarnk	128	73.4	65.1	80.4	1.6	25.0	-6.4	-16.8	4.0
Krkldy	135	82.2	74.8	87.8	8.9	8.9	2.8	-6.6	12.3
<b>Wales</b>									
Bangor	68	80.9	69.8	88.6	11.8	7.4	0.1	-12.7	12.9
Cardff	480	78.3	74.4	81.8	6.9	14.8	2.0	-3.3	7.4
Clwyd	68	88.2	78.2	94.0	2.9	8.8	6.7	-4.9	18.3
Swanse	343	84.6	80.3	88.0	7.3	8.2	1.2	-4.3	6.7
Wrexm	113	91.2	84.3	95.2	5.3	3.5	12.4	2.8	22.0
<b>England</b>	<b>19,150</b>	<b>78.4</b>	<b>77.8</b>	<b>79.0</b>	<b>11.7</b>	<b>9.9</b>	<b>-0.9</b>	<b>-1.8</b>	<b>-0.1</b>
<b>N Ireland</b>	<b>593</b>	<b>80.4</b>	<b>77.1</b>	<b>83.4</b>	<b>9.1</b>	<b>10.5</b>	<b>1.0</b>	<b>-3.6</b>	<b>5.6</b>
<b>Scotland</b>	<b>1,737</b>	<b>78.9</b>	<b>77.0</b>	<b>80.8</b>	<b>6.5</b>	<b>14.6</b>	<b>0.7</b>	<b>-2.0</b>	<b>3.5</b>
<b>Wales</b>	<b>1,072</b>	<b>82.5</b>	<b>80.1</b>	<b>84.6</b>	<b>6.9</b>	<b>10.6</b>	<b>2.9</b>	<b>-0.4</b>	<b>6.3</b>
<b>UK</b>	<b>22,552</b>	<b>78.7</b>	<b>78.2</b>	<b>79.2</b>	<b>11.0</b>	<b>10.3</b>	<b>-0.6</b>	<b>-1.3</b>	<b>0.2</b>

Centres missing from the table were excluded from analysis due to low patient numbers or poor data completeness



**Fig. 8.17.** Percentage of haemodialysis patients with adjusted calcium within range (2.2–2.5 mmol/L) by centre in 2016



**Fig. 8.18.** Funnel plot of percentage of haemodialysis patients with adjusted calcium within range (2.2–2.5 mmol/L) by centre in 2016

analysis. The data were 98.4% complete for HD patients and 98.1% complete for PD patients overall, although there was inter-centre variation (tables 8.15, 8.17).

Belfast, Colchester, London West and Preston did not return locally adjusted calcium results for most or all of

their patients, whilst Sunderland, Wirral, Liverpool Aintree, Dorset and Portsmouth returned adjusted calcium results for only a proportion of their patients. Hence these data are shown after adjustment using a generic formula, and specific formulae provided some years ago by the laboratories serving Colchester, London West and Preston, have been applied.

Those formulae may not be applicable to the calcium and albumin methods used locally in 2016 and may have over- or under-estimated the adjusted calcium. These centres are served by laboratories that report adjusted calcium results and therefore it is hoped that adjusted calcium values be reported to the UKRR in future.

Of HD patients, 78.7% (95% CI 78.2–79.2%) and of PD patients 79.7% (95% CI 78.3–81.1%) had an adjusted calcium between 2.2–2.5 mmol/L (tables 8.16, 8.18, figures 8.17, 8.19).

The proportion of hypocalcaemic patients in the UK was 11.0% for HD and 8.3% for PD (tables 8.16, 8.18). The proportion of hypercalcaemic patients in the UK was 10.3% for HD and 12.0% for PD (tables 8.16, 8.18).

#### Peritoneal dialysis

**Table 8.17.** Summary statistics for adjusted calcium in peritoneal dialysis patients in 2016

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
<b>England</b>							
B Heart	100.0	72	2.3	0.2	2.3	2.2	2.4
B QEH	100.0	125	2.3	0.2	2.3	2.2	2.5
Basldn	100.0	30	2.4	0.1	2.4	2.3	2.5
Bradfd	100.0	22	2.5	0.1	2.5	2.4	2.5
Brightn	100.0	56	2.4	0.2	2.4	2.3	2.5
Bristol	100.0	42	2.4	0.1	2.4	2.3	2.5
Camb <sup>a</sup>							
Carlisle	100.0	31	2.3	0.1	2.3	2.3	2.4
Carsh	92.1	93	2.3	0.2	2.3	2.2	2.4
Chelms	88.9	24	2.4	0.2	2.4	2.3	2.5
Colchr <sup>b</sup>							
Covnt	98.3	58	2.4	0.1	2.4	2.3	2.4
Derby	100.0	71	2.5	0.1	2.5	2.4	2.5
Donc	100.0	25	2.4	0.1	2.4	2.3	2.5
Dorset	100.0	33	2.3	0.2	2.3	2.2	2.4
Dudley	100.0	48	2.3	0.2	2.3	2.2	2.4
Exeter	100.0	73	2.3	0.2	2.3	2.2	2.5
Glouc	97.0	32	2.4	0.2	2.4	2.3	2.5
Hull	100.0	61	2.4	0.1	2.4	2.3	2.5
Ipswi	100.0	33	2.4	0.1	2.3	2.3	2.4
Kent	97.7	42	2.5	0.2	2.5	2.4	2.6
L Barts	97.8	175	2.3	0.2	2.3	2.2	2.4
L Guys	100.0	32	2.4	0.1	2.4	2.3	2.5
L Kings	100.0	75	2.3	0.2	2.3	2.2	2.4
L Rfree	97.8	135	2.3	0.2	2.4	2.2	2.5
L St.G	97.3	36	2.4	0.1	2.4	2.3	2.5
L West	90.6	77	2.4	0.2	2.4	2.3	2.5

**Table 8.17.** Continued

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
Leeds	100.0	36	2.4	0.2	2.4	2.3	2.5
Leic	98.6	69	2.4	0.2	2.4	2.3	2.5
Liv Ain	100.0	23	2.4	0.1	2.3	2.3	2.4
Liv Roy	98.4	63	2.4	0.2	2.4	2.2	2.5
M RI	98.0	48	2.4	0.1	2.4	2.3	2.5
Middlbr	100.0	22	2.2	0.1	2.2	2.2	2.3
Newc	97.8	45	2.4	0.2	2.4	2.3	2.5
Norwch	100.0	41	2.4	0.2	2.4	2.3	2.5
Nottm	100.0	67	2.3	0.2	2.4	2.2	2.4
Oxford	100.0	80	2.4	0.1	2.4	2.3	2.5
Plymth	96.8	30	2.3	0.2	2.4	2.2	2.4
Ports	98.5	66	2.4	0.2	2.4	2.3	2.4
Prestn	100.0	35	2.4	0.1	2.4	2.3	2.5
Redng	100.0	44	2.4	0.1	2.4	2.3	2.5
Salford	98.9	89	2.4	0.2	2.4	2.3	2.5
Sheff	100.0	47	2.3	0.1	2.3	2.2	2.4
Shrew	100.0	29	2.4	0.1	2.4	2.4	2.5
Stevng	100.0	16	2.3	0.2	2.4	2.2	2.4
Sthend	100.0	24	2.4	0.2	2.4	2.3	2.5
Stoke	91.6	65	2.4	0.2	2.4	2.3	2.5
Sund	100.0	17	2.3	0.2	2.3	2.2	2.3
Truro	100.0	17	2.3	0.2	2.4	2.2	2.5
Wirral	100.0	15	2.4	0.1	2.3	2.2	2.4
Wolve	93.8	60	2.3	0.2	2.3	2.2	2.4
York	100.0	27	2.4	0.2	2.4	2.3	2.5
<b>N Ireland</b>							
Antrim	100.0	14	2.4	0.1	2.4	2.3	2.5
Belfast	100.0	22	2.4	0.2	2.4	2.3	2.5
Newry	100.0	19	2.4	0.2	2.4	2.3	2.5
Ulster	100.0	5					
West NI	100.0	9					
<b>Scotland</b>							
Abrdn	100.0	19	2.4	0.2	2.4	2.2	2.5
Airdrie	100.0	21	2.3	0.2	2.3	2.3	2.4
D & Gall	100.0	10	2.4	0.2	2.4	2.3	2.4
Dundee	100.0	13	2.5	0.2	2.5	2.3	2.6
Edinb	100.0	31	2.4	0.2	2.4	2.3	2.5
Glasgw	100.0	43	2.5	0.2	2.5	2.4	2.5
Inverns	33.3	3					
Klmarnk	96.4	27	2.4	0.2	2.4	2.3	2.5
Krkldy	100.0	15	2.5	0.1	2.5	2.4	2.6
<b>Wales</b>							
Bangor	100.0	15	2.3	0.1	2.3	2.3	2.4
Cardff	95.5	64	2.4	0.1	2.4	2.3	2.5
Clwyd	100.0	14	2.5	0.2	2.5	2.4	2.5
Swanse	100.0	58	2.4	0.2	2.4	2.3	2.5
Wrexm	100.0	28	2.4	0.2	2.4	2.3	2.5
<b>England</b>	<b>98.2</b>	<b>2,576</b>	<b>2.4</b>	<b>0.2</b>	<b>2.4</b>	<b>2.3</b>	<b>2.5</b>
<b>N Ireland</b>	<b>100.0</b>	<b>69</b>	<b>2.4</b>	<b>0.2</b>	<b>2.4</b>	<b>2.3</b>	<b>2.5</b>
<b>Scotland</b>	<b>96.3</b>	<b>182</b>	<b>2.4</b>	<b>0.2</b>	<b>2.4</b>	<b>2.3</b>	<b>2.5</b>
<b>Wales</b>	<b>98.4</b>	<b>179</b>	<b>2.4</b>	<b>0.2</b>	<b>2.4</b>	<b>2.3</b>	<b>2.5</b>
<b>UK</b>	<b>98.1</b>	<b>3,006</b>	<b>2.4</b>	<b>0.2</b>	<b>2.4</b>	<b>2.3</b>	<b>2.5</b>

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

<sup>a</sup>Cambridge renal centre was unable to submit calcium data for 2016

<sup>b</sup>Colchester – no PD patients

**Table 8.18.** Percentage of peritoneal dialysis patients within, below and above the range for adjusted calcium (2.2–2.5 mmol/L) in 2016

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 in % within range from 2015	95% LCL change	95% UCL change
<b>England</b>									
B Heart	72	79.2	68.3	87.0	12.5	8.3	−3.3	−18.4	11.7
B QEH	125	77.6	69.5	84.1	12.8	9.6	2.4	−8.2	13.0
Basldn	30	90.0	73.2	96.7	3.3	6.7	8.5	−9.6	26.7
Bradfd	22	77.3	55.6	90.2	0.0	22.7	−1.3	−29.0	26.4
Brightn	56	78.6	66.0	87.4	8.9	12.5	3.6	−11.8	18.9
Bristol	42	81.0	66.3	90.2	0.0	19.1	0.1	−16.3	16.5
Carlis	31	87.1	70.3	95.1	9.7	3.2	−6.2	−21.0	8.6
Carsh	93	73.1	63.2	81.1	21.5	5.4	−5.4	−17.7	6.9
Chelms	24	70.8	50.2	85.4	16.7	12.5	7.2	−19.9	34.3
Covnt	58	82.8	70.8	90.5	8.6	8.6	3.7	−10.1	17.4
Derby	71	77.5	66.3	85.7	1.4	21.1	9.0	−5.5	23.4
Donc	25	88.0	68.7	96.1	4.0	8.0	10.2	−12.8	33.3
Dorset	33	69.7	52.3	82.9	18.2	12.1	−16.0	−35.5	3.5
Dudley	48	83.3	70.1	91.4	10.4	6.3	21.8	4.9	38.7
Exeter	73	87.7	78.0	93.5	4.1	8.2	7.4	−4.5	19.3
Glouc	32	68.8	51.0	82.3	9.4	21.9	0.9	−22.7	24.5
Hull	61	85.3	74.0	92.1	0.0	14.8	8.7	−5.0	22.4
Ipswi	33	90.9	75.3	97.0	6.1	3.0	28.0	7.3	48.6
Kent	42	71.4	56.1	83.0	0.0	28.6	10.3	−8.5	29.2
L Barts	175	74.9	67.9	80.7	18.9	6.3	−10.0	−18.3	−1.7
L Guys	32	84.4	67.5	93.3	3.1	12.5	12.0	−8.6	32.5
L Kings	75	76.0	65.1	84.3	17.3	6.7	−5.3	−18.2	7.7
L Rfree	135	76.3	68.4	82.7	14.1	9.6	−5.7	−15.4	4.1
L St.G	36	80.6	64.5	90.4	0.0	19.4	15.4	−3.8	34.7
L West	77	71.4	60.4	80.4	5.2	23.4	11.8	−4.9	28.5
Leeds	36	75.0	58.5	86.5	2.8	22.2	−19.0	−34.6	−3.4
Leic	69	82.6	71.8	89.9	4.4	13.0	5.8	−6.6	18.1
Liv Ain	23	91.3	71.1	97.8	4.4	4.4	6.1	−11.6	23.8
Liv Roy	63	79.4	67.6	87.6	4.8	15.9	−10.8	−23.3	1.7
M RI	48	87.5	74.9	94.3	2.1	10.4	3.0	−10.2	16.2
Middlbr	22	77.3	55.6	90.2	22.7	0.0	−1.3	−29.0	26.4
Newc	45	84.4	70.8	92.4	2.2	13.3	5.5	−11.2	22.2
Norwch	41	80.5	65.6	89.9	12.2	7.3	16.2	−5.3	37.7
Nottm	67	83.6	72.7	90.7	11.9	4.5	−5.5	−17.2	6.2
Oxford	80	90.0	81.3	94.9	2.5	7.5	0.1	−9.2	9.5
Plymth	30	80.0	62.1	90.7	16.7	3.3	−1.5	−22.0	19.0
Ports	66	86.4	75.8	92.8	3.0	10.6	8.8	−4.8	22.3
Prestn	35	82.9	66.7	92.1	8.6	8.6	9.4	−8.2	27.0
Redng	44	86.4	72.8	93.7	2.3	11.4	5.0	−9.2	19.2
Salford	89	71.9	61.7	80.3	6.7	21.4	6.1	−7.8	19.9
Sheff	47	80.9	67.1	89.7	12.8	6.4	−4.9	−19.4	9.7
Shrew	29	89.7	72.4	96.6	3.5	6.9	0.8	−15.5	17.0
Stevng	16	81.3	55.3	93.8	6.3	12.5	−11.1	−35.1	12.9
Sthend	24	75.0	54.4	88.3	4.2	20.8	1.7	−26.6	30.0
Stoke	65	69.2	57.1	79.2	6.2	24.6	−6.6	−22.1	8.9
Sund	17	76.5	51.5	90.9	17.7	5.9	−15.8	−40.7	9.0
Truro	17	76.5	51.5	90.9	17.7	5.9	−23.5	−43.7	−3.4
Wirral	15	93.3	64.8	99.1	0.0	6.7	22.7	−2.3	47.8
Wolve	60	80.0	68.0	88.3	10.0	10.0	6.9	−7.8	21.5
York	27	74.1	54.7	87.1	7.4	18.5	−11.6	−33.9	10.7
<b>N Ireland</b>									
Antrim	14	85.7	57.3	96.4	0.0	14.3	15.1	−13.3	43.5
Belfast	22	77.3	55.6	90.2	4.6	18.2	−1.7	−27.0	23.7
Newry	19	84.2	60.9	94.8	5.3	10.5	12.0	−14.4	38.4

**Table 8.18.** 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 in % within range from 2015	95% LCL change	95% UCL change
<b>Scotland</b>									
Abrdn	19	79.0	55.5	91.9	5.3	15.8	12.3	-15.0	39.5
Airdrie*	21	90.5	68.9	97.6	4.8	4.8			
D & Gall	10	70.0	37.6	90.0	10.0	20.0	0.0	-40.2	40.2
Dundee	13	69.2	40.9	88.0	0.0	30.8	6.7	-27.8	41.3
Edinb	31	80.7	63.1	91.0	3.2	16.1	15.9	-10.7	42.6
Glasgw	43	76.7	61.9	87.0	2.3	20.9	1.7	-16.2	19.7
Klmarnk	27	85.2	66.5	94.3	3.7	11.1	6.4	-12.9	25.7
Krkldy	15	73.3	46.7	89.6	0.0	26.7	-14.2	-41.8	13.5
<b>Wales</b>									
Bangor	15	86.7	59.5	96.6	13.3	0.0	25.1	-6.4	56.7
Cardff	64	79.7	68.1	87.8	6.3	14.1	10.7	-3.9	25.3
Clwyd	14	78.6	50.6	92.9	0.0	21.4	1.6	-29.8	33.1
Swanse	58	86.2	74.8	93.0	3.5	10.3	0.8	-12.1	13.6
Wrexm	28	82.1	63.6	92.4	3.6	14.3	6.4	-14.0	26.8
<b>England</b>	<b>2,576</b>	<b>79.5</b>	<b>77.9</b>	<b>81.1</b>	<b>8.9</b>	<b>11.6</b>	<b>1.1</b>	<b>-1.1</b>	<b>3.4</b>
<b>N Ireland</b>	<b>69</b>	<b>79.7</b>	<b>68.6</b>	<b>87.6</b>	<b>7.3</b>	<b>13.0</b>	<b>5.8</b>	<b>-8.3</b>	<b>19.9</b>
<b>Scotland</b>	<b>182</b>	<b>79.7</b>	<b>73.2</b>	<b>84.9</b>	<b>3.3</b>	<b>17.0</b>	<b>7.2</b>	<b>-1.6</b>	<b>16.0</b>
<b>Wales</b>	<b>179</b>	<b>82.7</b>	<b>76.4</b>	<b>87.6</b>	<b>5.0</b>	<b>12.3</b>	<b>7.5</b>	<b>-0.8</b>	<b>15.9</b>
<b>UK</b>	<b>3,006</b>	<b>79.7</b>	<b>78.3</b>	<b>81.1</b>	<b>8.3</b>	<b>12.0</b>	<b>2.0</b>	<b>-0.1</b>	<b>4.1</b>

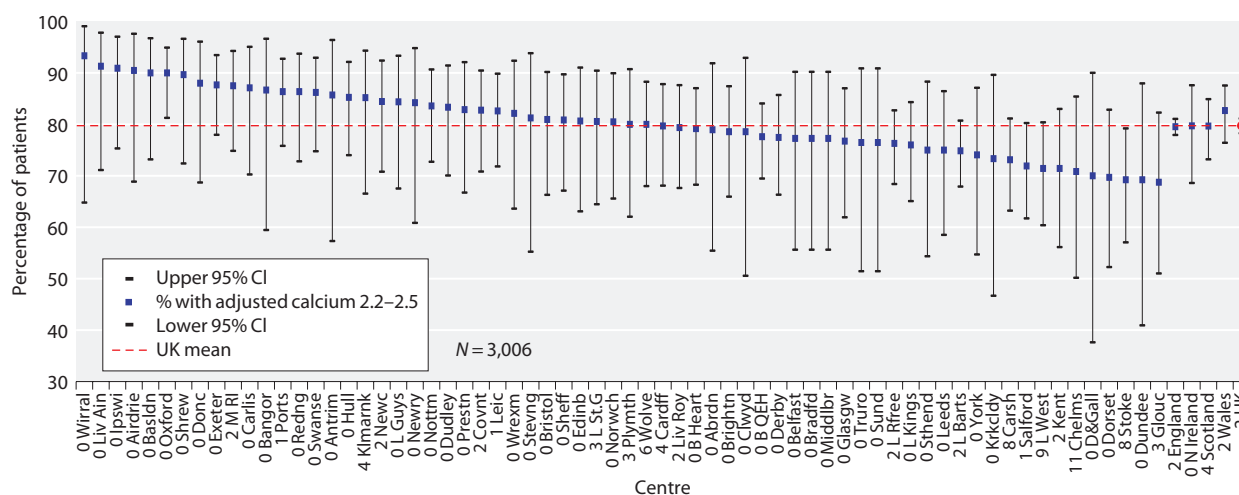
Centres missing from the table were excluded from analysis due to low patient numbers or poor data completeness

\*Blank cells indicate no data for 2015

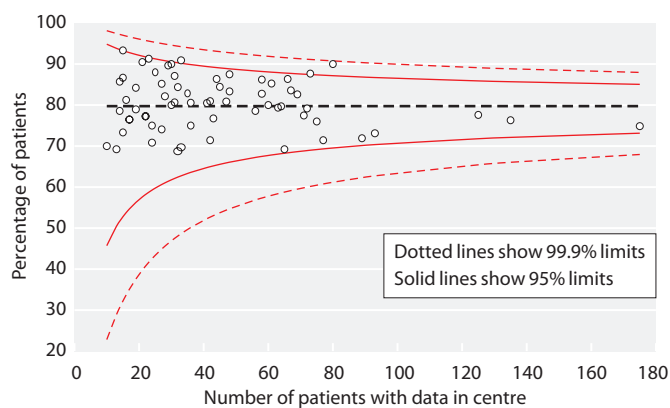
Figure 8.18 presents the funnel plot of HD patients attaining adjusted calcium levels between 2.2 and 2.5 mmol/L in 2016. Two centre’s results fell below the lower 99.9% confidence interval: London West and Sunderland. However, data for both centres may be misleading since London West and Sunderland failed to return locally adjusted calcium results on all and half of their HD patients respectively. The percentage of HD patients

with serum calcium within the reference range was significantly higher than the average (above the 99.9% confidence limit) in Exeter, Nottingham, Wrexham and York.

Figure 8.20 presents the funnel plot of PD patients attaining the adjusted calcium levels between 2.2 and 2.5 mmol/L in 2016. Once corrected for centre size, no centre was significantly lower or higher than the national average.



**Fig. 8.19.** Percentage of peritoneal dialysis patients with adjusted calcium within range (2.2–2.5 mmol/L) by centre in 2016



**Fig. 8.20.** Funnel plot of percentage of peritoneal dialysis patients with adjusted calcium within range (2.2–2.5 mmol/L) by centre in 2016

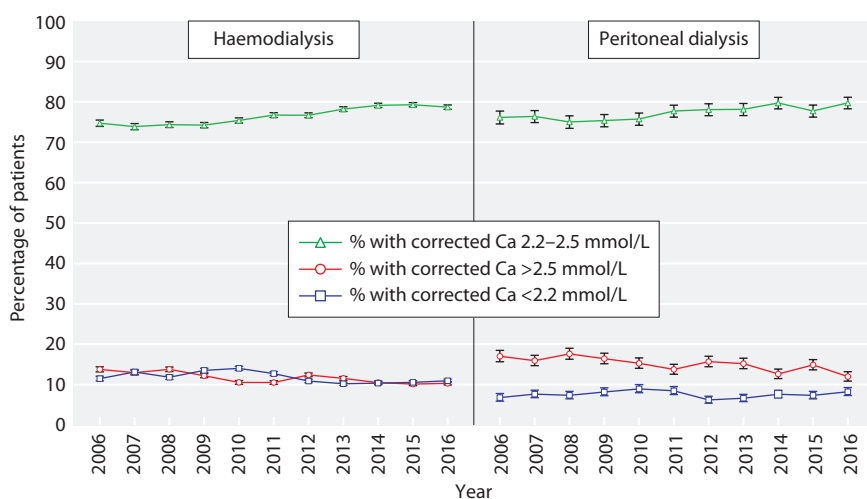
Longitudinal measures of serum adjusted calcium show stable attainment of national standards over the last decade (figure 8.21).

### Phosphate

In 2016 the following Renal Association clinical practice guideline regarding phosphate management was applicable:

### Guideline 3.2 CKD-MBD: Serum phosphate in dialysis patients

*‘We suggest that serum phosphate in dialysis patients, measured before a “short-gap” dialysis session in haemodialysis patients, should be maintained between 1.1 and 1.7 mmol/L (2C)’ [2]*



**Fig. 8.21.** 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 2006–2016

### Haemodialysis

**Table 8.19.** Percentage of haemodialysis patients with serum phosphate within, below or above the target range of 1.1–1.7 mmol/L, as specified in the RA guidelines, by centre in 2016

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 in % within range from 2015	95% LCL change	95% UCL change
<b>England</b>									
B Heart	373	43.7	38.8	48.8	8.9	47.5	–11.2	–26.4	4.1
B QEH	934	63.2	60.0	66.2	10.4	26.5	0.5	–12.0	13.0
Basldn	147	57.1	49.0	64.9	7.5	35.4	3.2	–12.0	18.4
Bradfd	226	56.6	50.1	63.0	16.4	27.0	–1.0	–15.5	13.6
Brightn	418	51.0	46.2	55.7	10.3	38.8	–5.4	–20.0	9.1
Bristol	470	47.9	43.4	52.4	12.3	39.8	–12.7	–27.4	2.0
Carlis	88	55.7	45.2	65.7	11.4	33.0	2.4	–14.9	19.6
Carsh	771	59.0	55.5	62.4	11.0	30.0	–1.0	–14.1	12.2
Chelms	118	62.7	53.7	71.0	6.8	30.5	10.5	–4.4	25.4
Colchr	92	68.5	58.3	77.1	10.9	20.7	1.5	–13.2	16.2
Covnt	345	55.1	49.8	60.3	6.7	38.3	–2.3	–16.5	11.9

**Table 8.19.** 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 in % within range from 2015	95% LCL change	95% UCL change
Derby	227	59.9	53.4	66.1	12.8	27.3	1.5	−12.7	15.7
Donc	177	57.6	50.2	64.7	7.3	35.0	−6.2	−21.0	8.7
Dorset	263	55.1	49.1	61.0	12.2	32.7	−10.6	−24.9	3.8
Dudley	185	65.4	58.3	71.9	9.2	25.4	2.6	−11.6	16.7
Exeter	423	57.9	53.2	62.5	13.2	28.8	−2.3	−16.0	11.4
Glouc	228	54.4	47.9	60.7	11.8	33.8	−5.5	−20.3	9.3
Hull	302	54.0	48.3	59.5	8.9	37.1	−3.4	−17.7	11.0
Ipswi	135	54.8	46.4	63.0	16.3	28.9	−3.3	−19.0	12.4
Kent	387	47.8	42.9	52.8	6.2	46.0	−7.0	−21.9	7.8
L Barts	953	52.5	49.3	55.6	12.5	35.1	0.9	−13.1	14.8
L Guys	643	52.3	48.4	56.1	19.8	28.0	−2.5	−16.6	11.6
L Kings	544	61.8	57.6	65.8	13.6	24.6	0.0	−13.1	13.0
L Rfree	652	56.1	52.3	59.9	14.1	29.8	−2.4	−16.0	11.2
L St.G	314	56.7	51.2	62.1	15.6	27.7	2.3	−11.9	16.4
L West	1,262	55.2	52.5	58.0	18.5	26.3	−2.7	−16.1	10.8
Leeds	485	50.7	46.3	55.2	9.5	39.8	−3.9	−18.4	10.5
Leic	881	58.5	55.2	61.7	8.6	32.9	3.6	−9.6	16.8
Liv Ain	170	48.8	41.4	56.3	24.7	26.5	−8.7	−24.6	7.2
Liv Roy	335	60.3	55.0	65.4	11.6	28.1	1.8	−11.7	15.4
M RI*	458	50.2	45.7	54.8	14.6	35.2	−1.6	−16.1	13.0
Middlbr	310	56.5	50.9	61.9	7.7	35.8	−1.4	−15.5	12.7
Newc	287	57.8	52.1	63.4	10.5	31.7	0.0	−14.1	14.0
Norwch	301	58.1	52.5	63.6	5.7	36.2	−6.4	−20.3	7.5
Nottm	364	64.6	59.5	69.3	10.7	24.7	−0.2	−13.2	12.8
Oxford	401	51.9	47.0	56.7	12.7	35.4	2.6	−11.8	17.1
Plymth	127	63.0	54.3	70.9	12.6	24.4	3.0	−11.9	17.9
Ports	582	50.5	46.5	54.6	12.0	37.5	0.3	−14.0	14.6
Prestn	531	52.4	48.1	56.6	7.9	39.7	−4.6	−18.8	9.6
Redng	288	57.3	51.5	62.9	11.8	30.9	−1.9	−16.1	12.2
Salford*	356	50.8	45.7	56.0	15.7	33.4	−1.7	−16.3	12.9
Sheff	576	55.2	51.1	59.2	12.7	32.1	−3.9	−17.7	9.9
Shrew	189	62.4	55.3	69.1	4.8	32.8	4.1	−10.1	18.3
Stevng	490	55.1	50.7	59.5	8.6	36.3	−0.9	−14.8	13.1
Sthend	109	46.8	37.6	56.2	8.3	45.0	−6.0	−22.8	10.8
Stoke	319	59.6	54.1	64.8	11.3	29.2	4.5	−9.3	18.4
Truro	156	66.0	58.3	73.0	7.7	26.3	3.5	−10.8	17.8
Wirral	177	57.1	49.7	64.2	15.3	27.7	6.2	−8.7	21.1
Wolve	291	51.9	46.2	57.6	23.7	24.4	3.3	−11.5	18.0
York	181	55.3	47.9	62.3	27.1	17.7	−4.8	−20.1	10.6
<b>N Ireland</b>									
Antrim	115	59.1	49.9	67.7	29.6	11.3	−2.3	−17.8	13.3
Belfast	185	47.6	40.5	54.8	22.7	29.7	2.2	−13.6	18.0
Newry	80	52.5	41.6	63.2	10.0	37.5	−7.0	−24.0	9.9
Ulster	96	61.5	51.4	70.6	19.8	18.8	1.0	−14.8	16.9
West NI	118	59.3	50.3	67.8	8.5	32.2	−1.7	−17.3	13.8
<b>Scotland</b>									
Abrdn	217	57.1	50.5	63.6	11.5	31.3	−1.9	−16.5	12.7
Airdrie	171	51.5	44.0	58.9	26.9	21.6	−4.9	−20.3	10.6
D & Gall	46	56.5	42.1	70.0	10.9	32.6	−6.8	−25.4	11.9
Dundee	164	45.7	38.3	53.4	5.5	48.8	−4.6	−20.5	11.4
Edinb	268	47.4	41.5	53.4	4.5	48.1	−6.2	−21.6	9.1
Glasgw	531	50.3	46.0	54.5	5.5	44.3	−2.8	−17.2	11.6
Inverns	68	45.6	34.2	57.5	1.5	52.9	−3.8	−21.5	14.0
Klmarnk	128	57.8	49.1	66.1	24.2	18.0	−0.3	−15.8	15.3
Krkcldy	135	61.5	53.0	69.3	8.9	29.6	1.2	−13.9	16.2

**Table 8.19.** 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 in % within range from 2015	95% LCL change	95% UCL change
<b>Wales</b>									
Bangor	68	51.5	39.7	63.1	22.1	26.5	-13.9	-30.9	3.1
Cardff	480	53.5	49.1	58.0	7.1	39.4	-6.2	-20.4	7.9
Clwyd	68	44.1	32.9	56.0	10.3	45.6	-8.5	-26.3	9.3
Swanse	343	59.5	54.2	64.6	14.6	26.0	-2.8	-16.5	10.9
Wrexm	113	59.3	50.0	68.0	30.1	10.6	5.8	-10.3	21.8
<b>England</b>	<b>19,041</b>	<b>55.6</b>	<b>54.8</b>	<b>56.3</b>	<b>12.2</b>	<b>32.2</b>	<b>-1.6</b>	<b>-14.7</b>	<b>11.5</b>
<b>N Ireland</b>	<b>594</b>	<b>55.1</b>	<b>51.0</b>	<b>59.0</b>	<b>19.0</b>	<b>25.9</b>	<b>-1.1</b>	<b>-14.9</b>	<b>12.7</b>
<b>Scotland</b>	<b>1,728</b>	<b>51.8</b>	<b>49.4</b>	<b>54.1</b>	<b>9.8</b>	<b>38.4</b>	<b>-3.2</b>	<b>-17.0</b>	<b>10.6</b>
<b>Wales</b>	<b>1,072</b>	<b>55.3</b>	<b>52.3</b>	<b>58.3</b>	<b>13.1</b>	<b>31.6</b>	<b>-4.6</b>	<b>-18.1</b>	<b>8.9</b>
<b>UK</b>	<b>22,435</b>	<b>55.2</b>	<b>54.6</b>	<b>55.9</b>	<b>12.3</b>	<b>32.5</b>	<b>-1.8</b>	<b>-15.0</b>	<b>11.3</b>

Centres missing from the table were excluded from analysis due to low patient numbers or poor data completeness

\*Salford and Manchester RI have been involved in the SPIRiT study – an RCT comparing low phosphate control (0.8–1.4 mmol/L) with high phosphate control (1.8–2.4 mmol/L); HD patients only were recruited

For those receiving HD, 55.2% of patients achieved a phosphate level between 1.1–1.7 mmol/L, the guideline specified by the RA (as opposed to the audit measure), and for those on PD this was 60.3% (tables 8.19, 8.20).

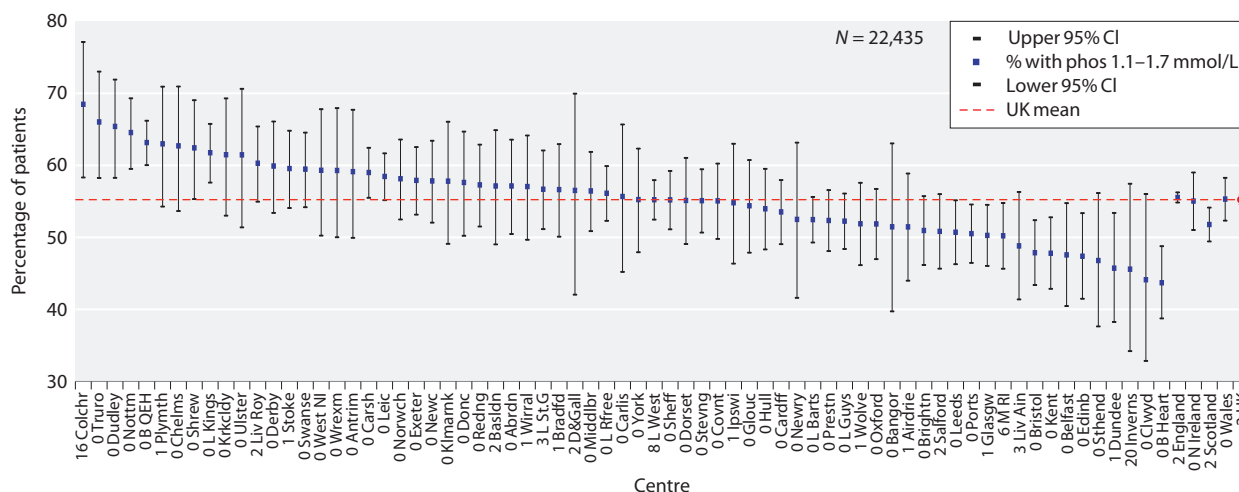
There was inter-centre variation in the proportion of patients within the phosphate target range specified by the clinical guideline (figures 8.22–8.25, tables 8.19, 8.20).

Funnel plots for HD patients with phosphate within the target range (1.1–1.7 mmol/L), show two centres (Birmingham Queen Elizabeth, Nottingham) attaining this standard in a significantly high proportion of patients (being above the 99.9% upper confidence interval following correction for centre size). In addition, only one

centre (Birmingham Heartlands) had achieved the serum phosphate control standard in a lower than expected proportion of patients (being below the lower 99.9% confidence interval), (figure 8.23). Differences in outlier status can be seen when this guideline target measure is applied compared to the audit measure of phosphate <1.7 mmol/L, namely fewer centres were found to be outliers.

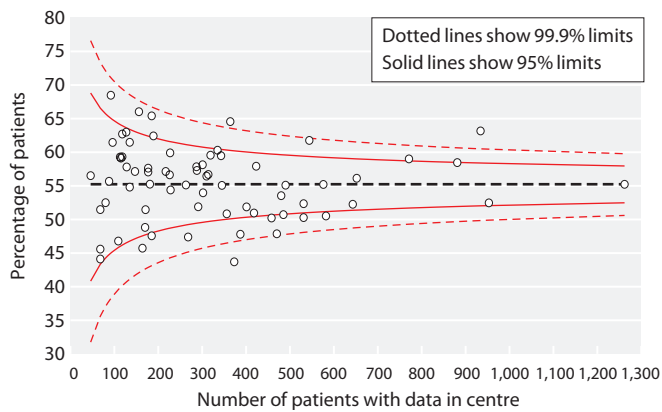
The funnel plot for PD patients indicated that the control of phosphate levels was similar in all centres. No significant outliers were identified (figure 8.25).

Longitudinal analysis had demonstrated stable performance against the clinical guideline recommendation



**Fig. 8.22.** Percentage of haemodialysis patients with phosphate within the range specified by the RA guideline (1.1–1.7 mmol/L) by centre in 2016





**Fig. 8.23.** Funnel plot of percentage of haemodialysis patients with phosphate within the range specified by the RA guideline (1.1–1.7 mmol/L) by centre in 2016

for those receiving HD and PD in recent years although there has been an increase in hyperphosphataemia in 2016 in both treatment modalities (figure 8.26).

#### Parathyroid hormone

At the beginning of 2016 the following RA guideline for PTH applied:

#### Guideline 4.2.1 CKD-MBD: Target range of serum PTH in patients on dialysis

*‘We suggest that the target range for parathyroid hormone measured using an intact PTH assay should be between 2 and 9 times the upper limit of normal for the assay used (2C)’ [2]*

#### Peritoneal dialysis

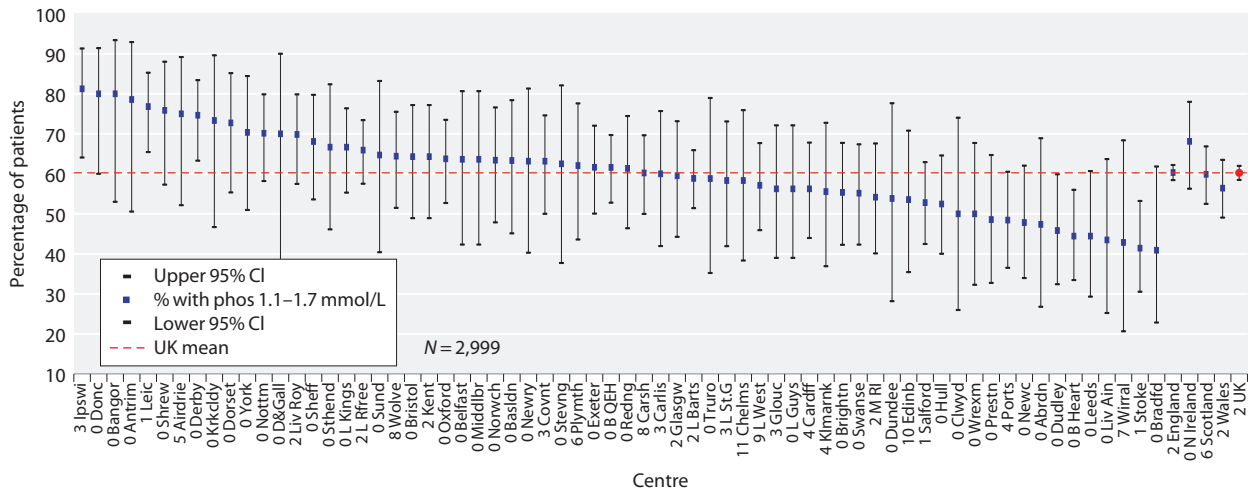
**Table 8.20.** Percentage of peritoneal dialysis patients within, below and above the range specified in the RA guideline for phosphate (1.1–1.7 mmol/L) in 2016

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 in % within range from 2015	95% LCL change	95% UCL change
<b>England</b>									
B Heart	72	44.4	33.5	56.0	2.8	52.8	−5.6	−24.8	13.7
B QEH	125	61.6	52.8	69.7	5.6	32.8	5.4	−6.9	17.7
Basldn	30	63.3	45.1	78.4	6.7	30.0	4.1	−21.2	29.4
Bradfd	22	40.9	22.8	61.8	9.1	50.0	5.2	−27.2	37.6
Brightn	56	55.4	42.3	67.7	8.9	35.7	−13.0	−30.5	4.6
Bristol	42	64.3	48.9	77.2	2.4	33.3	0.5	−19.5	20.4
Carlis	30	60.0	42.0	75.7	6.7	33.3	−3.3	−27.9	21.3
Carsh	93	60.2	50.0	69.6	6.5	33.3	2.6	−11.6	16.8
Chelms	24	58.3	38.3	75.9	4.2	37.5	17.4	−11.1	45.9
Covnt	57	63.2	50.0	74.6	14.0	22.8	−5.0	−21.8	11.8
Derby	71	74.7	63.3	83.4	9.9	15.5	7.5	−7.3	22.3
Donc	25	80.0	60.0	91.4	4.0	16.0	−3.3	−26.6	20.0
Dorset	33	72.7	55.4	85.2	15.2	12.1	−4.4	−25.0	16.2
Dudley	48	45.8	32.4	59.9	0.0	54.2	−23.4	−42.3	−4.5
Exeter	73	61.6	50.1	72.0	9.6	28.8	−11.6	−26.8	3.6
Glouc	32	56.3	39.0	72.1	9.4	34.4	−4.5	−29.4	20.5
Hull	61	52.5	40.0	64.6	11.5	36.1	−6.9	−24.3	10.5
Ipswi	32	81.3	64.1	91.3	3.1	15.6	18.3	−4.4	41.0
Kent	42	64.3	48.9	77.2	16.7	19.1	−2.4	−21.6	16.8
L Barts	175	58.9	51.4	65.9	5.1	36.0	−1.5	−11.7	8.7
L Guys	32	56.3	39.0	72.1	6.3	37.5	−9.3	−33.7	15.1
L Kings	75	66.7	55.3	76.4	8.0	25.3	7.9	−7.3	23.1
L Rfree	135	65.9	57.5	73.4	4.4	29.6	5.0	−6.5	16.5
L St.G	36	58.3	41.9	73.1	5.6	36.1	−6.8	−28.3	14.7
L West	77	57.1	45.9	67.7	7.8	35.1	−6.3	−23.5	10.8
Leeds	36	44.4	29.3	60.7	5.6	50.0	−3.6	−24.9	17.8
Leic	69	76.8	65.4	85.3	2.9	20.3	17.9	3.8	31.9
Liv Ain	23	43.5	25.2	63.7	8.7	47.8	−15.8	−43.2	11.7

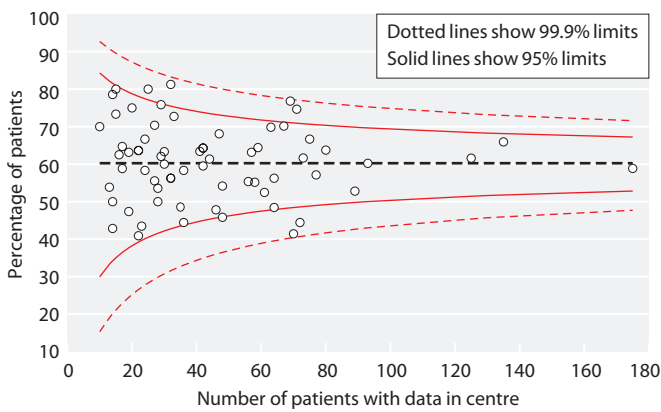
**Table 8.20.** Continued

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 in % within range from 2015	95% LCL change	95% UCL change
Liv Roy	63	69.8	57.5	79.9	14.3	15.9	15.7	−1.1	32.6
M RI	48	54.2	40.1	67.6	12.5	33.3	2.5	−16.6	21.5
Middlbr	22	63.6	42.3	80.7	0.0	36.4	−7.8	−38.8	23.3
Newc	46	47.8	34.0	62.1	4.4	47.8	−12.7	−33.9	8.5
Norwch	41	63.4	47.9	76.6	4.9	31.7	2.7	−20.6	26.0
Nottm	67	70.2	58.2	79.9	3.0	26.9	−1.7	−17.3	13.8
Oxford	80	63.8	52.7	73.5	3.8	32.5	1.7	−13.3	16.7
Plymth	29	62.1	43.6	77.6	10.3	27.6	−0.9	−26.3	24.5
Ports	64	48.4	36.5	60.5	4.7	46.9	−6.0	−23.8	11.9
Prestn	35	48.6	32.7	64.7	8.6	42.9	−16.7	−38.0	4.5
Redng	44	61.4	46.4	74.5	2.3	36.4	−16.6	−34.5	1.2
Salford	89	52.8	42.5	62.9	3.4	43.8	−4.5	−19.4	10.4
Sheff	47	68.1	53.6	79.8	0.0	31.9	2.0	−16.2	20.2
Shrew	29	75.9	57.3	88.0	0.0	24.1	9.2	−14.4	32.8
Stevng	16	62.5	37.7	82.1	12.5	25.0	16.4	−19.7	52.4
Sthend	24	66.7	46.1	82.4	8.3	25.0	0.0	−30.4	30.4
Stoke	70	41.4	30.5	53.2	11.4	47.1	−24.8	−40.9	−8.6
Sund	17	64.7	40.4	83.2	11.8	23.5	18.6	−16.8	53.9
Truro	17	58.8	35.2	79.0	5.9	35.3	−4.3	−36.2	27.6
Wirral	14	42.9	20.7	68.4	7.1	50.0	−4.2	−39.3	30.9
Wolve	59	64.4	51.5	75.5	5.1	30.5	−2.8	−19.4	13.9
York	27	70.4	51.0	84.4	11.1	18.5	13.2	−14.1	40.5
<b>N Ireland</b>									
Antrim	14	78.6	50.6	92.9	7.1	14.3	19.8	−12.0	51.5
Belfast	22	63.6	42.3	80.7	4.6	31.8	0.5	−29.1	30.1
Newry	19	63.2	40.3	81.3	5.3	31.6	−20.2	−47.9	7.5
<b>Scotland</b>									
Abrdn	19	47.4	26.8	68.9	10.5	42.1	4.5	−26.3	35.4
Airdrie	20	75.0	52.2	89.2	10.0	15.0			
D & Gall	10	70.0	37.6	90.0	0.0	30.0	30.0	−11.6	71.6
Dundee	13	53.9	28.2	77.6	0.0	46.2	−2.4	−38.8	34.0
Edinb	28	53.6	35.4	70.8	0.0	46.4	−11.1	−40.4	18.1
Glasgw	42	59.5	44.3	73.1	4.8	35.7	−1.8	−22.5	18.8
Klmarnk	27	55.6	36.9	72.8	7.4	37.0	16.2	−8.9	41.3
Krkldy	15	73.3	46.7	89.6	0.0	26.7	4.6	−27.3	36.5
<b>Wales</b>									
Bangor	15	80.0	53.0	93.4	6.7	13.3	33.9	0.0	67.7
Cardff	64	56.3	44.0	67.8	6.3	37.5	−6.6	−23.2	10.0
Clwyd	14	50.0	26.0	74.0	21.4	28.6	−11.5	−48.8	25.7
Swanse	58	55.2	42.3	67.4	5.2	39.7	−3.0	−21.3	15.3
Wrexm	28	50.0	32.3	67.7	17.9	32.1	−7.6	−32.6	17.5
<b>England</b>	<b>2,574</b>	<b>60.3</b>	<b>58.4</b>	<b>62.2</b>	<b>6.6</b>	<b>33.1</b>	<b>−1.6</b>	<b>−4.2</b>	<b>1.1</b>
<b>N Ireland</b>	<b>69</b>	<b>68.1</b>	<b>56.3</b>	<b>78.0</b>	<b>4.4</b>	<b>27.5</b>	<b>−2.9</b>	<b>−18.2</b>	<b>12.5</b>
<b>Scotland</b>	<b>177</b>	<b>59.9</b>	<b>52.5</b>	<b>66.9</b>	<b>4.5</b>	<b>35.6</b>	<b>7.1</b>	<b>−3.2</b>	<b>17.4</b>
<b>Wales</b>	<b>179</b>	<b>56.4</b>	<b>49.1</b>	<b>63.5</b>	<b>8.9</b>	<b>34.6</b>	<b>−2.8</b>	<b>−13.0</b>	<b>7.3</b>
<b>UK</b>	<b>2,999</b>	<b>60.3</b>	<b>58.5</b>	<b>62.0</b>	<b>6.6</b>	<b>33.2</b>	<b>−1.2</b>	<b>−3.6</b>	<b>1.3</b>

Centres missing from the table were excluded from analysis due to low patient numbers or poor data completeness  
Blank cells indicate no data for 2015



**Fig. 8.24.** Percentage of peritoneal dialysis patients with phosphate within the range specified by the RA guideline (1.1–1.7 mmol/L) by centre in 2016

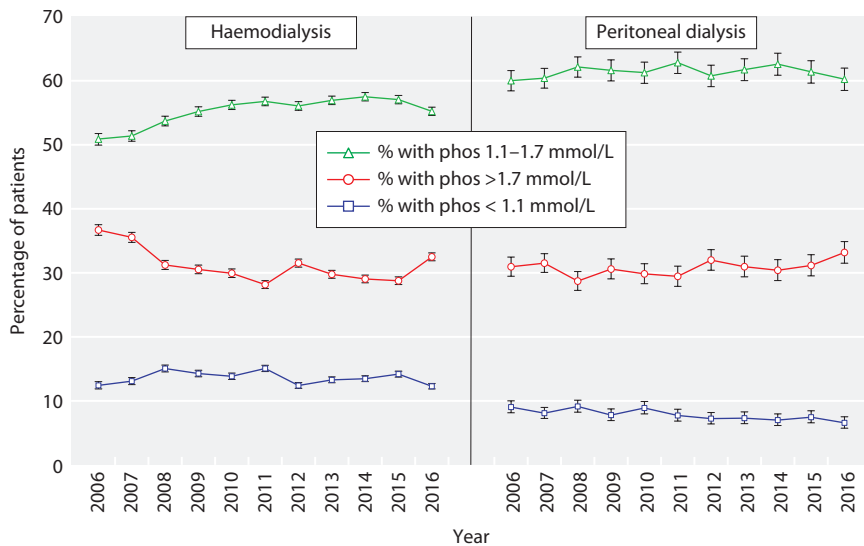


**Fig. 8.25.** Funnel plot of percentage of peritoneal dialysis patients with phosphate within the range specified by the RA guideline (1.1–1.7 mmol/L) by centre in 2016

PTH results from 18,420 HD patients and 2,404 PD patients from England, Northern Ireland and Wales were available for analysis from 2016. The data were 87.1% complete for HD patients and 83.7% for PD patients overall, although there was inter-centre variation (tables 8.21, 8.23). For the analyses, Birmingham Queen Elizabeth, Cambridge, Salford and Sheffield were excluded due to poor data completeness.

Median PTH amongst HD patients was 32 pmol/L (IQR 16–58 pmol/L) and amongst PD patients was 31 pmol/L (IQR 18–52 pmol/L) for the three countries.

Of HD patients, 58.3% (95% CI 57.6–59.0%) and of PD patients, 65.7% (95% CI 63.8–67.6%) achieved a PTH between 16–72 pmol/L (tables 8.22, 8.24, figures 8.27, 8.29).



**Fig. 8.26.** Longitudinal change in percentage of patients with phosphate below, within and above the RA guideline by dialysis modality 2006–2016

**Table 8.21.** Summary statistics for PTH in haemodialysis patients in 2016

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
<b>England</b>							
B Heart	98.4	367	57.1	46.1	45	22	80
B QEH	29.2	274					
Basldn	88.0	132	51.1	35.4	44	25	72
Bradfd	99.1	226	37.8	33.9	29	14	51
Brightn	96.9	406	50.9	57.0	34	16	66
Bristol	99.6	468	41.8	42.4	30	13	55
Camb*							
Carlis	98.9	87	31.4	33.1	23	11	40
Carsh	83.1	643	63.1	57.7	46	23	82
Chelms	100.0	118	50.7	47.6	39	19	67
Colchr	84.6	93	33.4	28.5	26	14	43
Covnt	98.6	341	38.2	40.0	28	14	46
Derby	100.0	227	40.0	42.6	31	16	50
Donc	99.4	176	60.6	48.9	49	30	72
Dorset	99.2	261	33.4	30.7	25	13	43
Dudley	97.3	180	35.0	34.2	27	14	42
Exeter	97.4	412	24.6	25.9	17	8	30
Glouc	99.1	226	42.6	45.8	31	16	51
Hull	96.0	290	45.7	50.0	31	15	55
Ipswi	99.3	135	33.4	31.3	24	12	43
Kent	99.7	386	55.9	49.9	38	19	76
L Barts	97.3	929	51.3	44.1	38	23	67
L Guys	70.3	453	26.9	15.0	27	15	40
L Kings	96.9	528	45.1	44.9	30	14	62
L Rfree	99.1	647	39.5	35.1	30	15	52
L St.G	90.7	294	58.8	58.0	43	18	77
L West	79.8	1,100	62.2	60.9	44	20	85
Leeds	98.1	476	43.2	50.2	28	13	52
Leic	97.3	858	47.9	50.3	32	13	65
Liv Ain	68.0	119	23.8	31.3	12	6	26
Liv Roy	77.6	266	42.4	38.6	30	15	57
M RI	89.7	437	49.5	56.6	33	16	61
Middlbr	96.8	300	50.2	42.4	42	22	63
Newc	100.0	287	54.3	56.5	37	18	71
Norwch	98.7	298	38.4	39.5	30	16	49
Nottm	97.5	356	40.9	42.2	27	13	51
Oxford	99.5	399	47.4	39.5	36	21	65
Plymth	95.3	122	50.8	46.2	38	22	63
Ports	95.7	558	51.7	48.5	38	20	69
Prestn	99.3	527	48.0	48.4	35	19	61
Redng	99.3	286	45.8	44.1	33	20	57
Salford	28.7	104					
Sheff	0.0						
Shrew	96.8	183	45.3	37.5	37	19	60
Stevng	97.6	479	46.6	39.2	36	23	59
Sthend	90.8	99	67.8	64.4	47	28	91
Stoke	79.8	257	41.2	31.2	32	19	54
Sund	98.7	220	42.9	43.5	29	15	54
Truro	100.0	156	25.4	25.3	19	8	34
Wirral	72.1	129	30.6	21.4	27	15	39
Wolve	97.3	286	35.7	45.7	21	9	45
York	95.6	173	34.5	40.1	19	8	46
<b>N Ireland</b>							
Antrim	100.0	115	32.3	29.4	26	15	40
Belfast	98.9	183	35.7	55.0	20	9	38

**Table 8.21.** Continued

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
Newry	100.0	80	28.6	24.8	23	15	36
Ulster	99.0	95	26.7	24.3	20	11	30
West NI	99.2	117	28.4	19.3	24	15	37
<b>Wales</b>							
Bangor	98.5	67	29.6	37.3	18	10	35
Cardff	97.7	470	47.6	43.5	37	20	63
Clwyd	95.6	65	40.2	40.9	28	11	53
Swanse	99.7	342	39.9	39.6	30	16	52
Wrexm	98.2	111	25.4	31.7	12	5	34
<b>England</b>	<b>86.1</b>	<b>16,775</b>	<b>46.3</b>	<b>46.5</b>	<b>33</b>	<b>16</b>	<b>60</b>
<b>N Ireland</b>	<b>99.3</b>	<b>590</b>	<b>31.2</b>	<b>36.9</b>	<b>23</b>	<b>13</b>	<b>38</b>
<b>Wales</b>	<b>98.3</b>	<b>1,055</b>	<b>41.2</b>	<b>41.2</b>	<b>31</b>	<b>14</b>	<b>54</b>
<b>E, W &amp; NI</b>	<b>87.1</b>	<b>18,420</b>	<b>45.5</b>	<b>46.0</b>	<b>32</b>	<b>16</b>	<b>58</b>

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

\*Cambridge renal centre was unable to submit PTH data for 2016

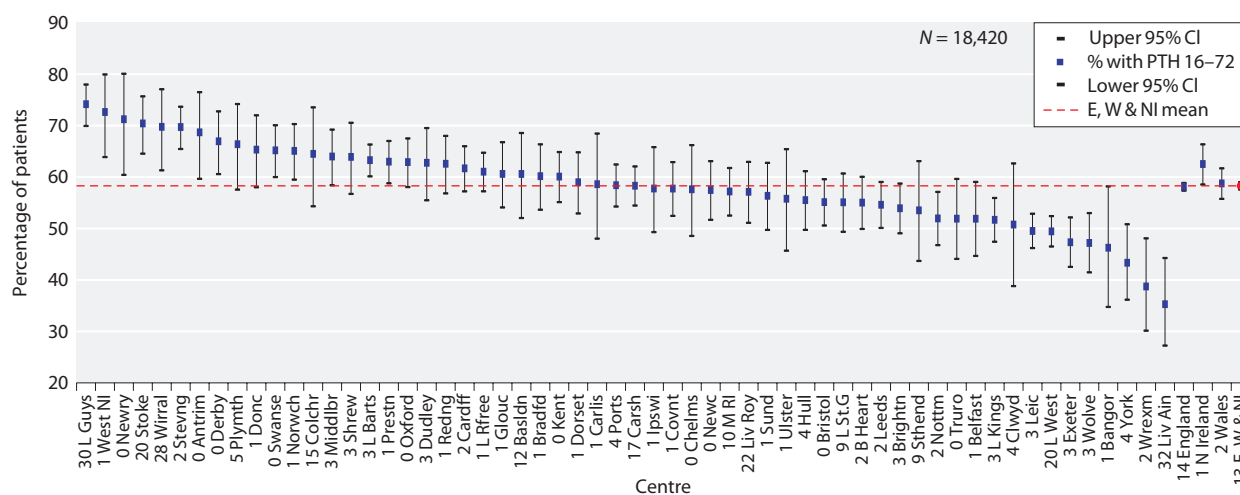
**Table 8.22.** Percentage of haemodialysis patients within, below and above the range for PTH (16–72 pmol/L) in 2016

Centre	N	% PTH 16–72 pmol/L	Lower 95% CI	Upper 95% CI	% PTH <16 pmol/L	% PTH >72 pmol/L	Change in % within range from 2015	95% LCL change	95% UCL change
<b>England</b>									
B Heart	367	55.0	49.9	60.1	16.1	28.9	-3.8	-10.8	3.2
Basldn	132	60.6	52.0	68.6	15.2	24.2	2.6	-8.9	14.1
Bradfd	226	60.2	53.7	66.4	28.8	11.1	6.2	-3.1	15.4
Brightn	406	53.9	49.1	58.7	24.4	21.7	-2.8	-9.7	4.1
Bristol	468	55.1	50.6	59.6	27.8	17.1	-0.9	-7.3	5.4
Carlis	87	58.6	48.0	68.5	34.5	6.9	2.5	-12.9	17.8
Carsh	643	58.3	54.5	62.1	12.8	28.9	5.7	0.4	10.9
Chelms	118	57.6	48.6	66.2	20.3	22.0	-5.4	-17.4	6.6
Colchr	93	64.5	54.3	73.6	28.0	7.5	6.0	-7.5	19.5
Covnt	341	57.8	52.5	62.9	29.6	12.6	5.7	-1.8	13.2
Derby	227	67.0	60.6	72.8	22.9	10.1	-6.3	-14.8	2.1
Donc	176	65.3	58.0	72.0	10.2	24.4	3.0	-7.3	13.2
Dorset	261	59.0	52.9	64.8	31.0	10.0	6.8	-1.7	15.2
Dudley	180	62.8	55.5	69.5	26.7	10.6	7.5	-3.1	18.1
Exeter	412	47.3	42.6	52.2	47.6	5.1	3.6	-3.3	10.4
Glouc	226	60.6	54.1	66.8	24.3	15.0	1.9	-7.4	11.1
Hull	290	55.5	49.8	61.1	26.2	18.3	2.0	-5.9	9.9
Ipswi	135	57.8	49.3	65.8	31.1	11.1	-2.4	-14.3	9.5
Kent	386	60.1	55.1	64.9	13.0	26.9	-0.2	-7.0	6.7
L Barts	929	63.3	60.1	66.3	15.0	21.7	1.3	-3.1	5.7
L Guys	453	74.2	69.9	78.0	25.8	0.0	22.1	16.5	27.7
L Kings	528	51.7	47.4	55.9	27.8	20.5	2.3	-3.8	8.4
L Rfree	647	61.1	57.2	64.7	25.5	13.5	-4.5	-9.7	0.7
L St.G	294	55.1	49.4	60.7	18.0	26.9	-0.1	-8.1	8.0
L West	1,100	49.5	46.5	52.4	19.5	31.1	0.5	-3.7	4.7
Leeds	476	54.6	50.1	59.1	29.4	16.0	0.8	-5.6	7.1
Leic	858	49.5	46.2	52.9	28.9	21.6	-0.4	-5.1	4.4
Liv Ain	119	35.3	27.3	44.3	58.0	6.7	-2.0	-13.7	9.7
Liv Roy	266	57.1	51.1	63.0	25.9	16.9	5.9	-2.4	14.2
M RI	437	57.2	52.5	61.8	23.8	19.0	-2.3	-8.8	4.3
Middlbr	300	64.0	58.4	69.2	16.3	19.7	1.6	-6.0	9.2
Newc	287	57.5	51.7	63.1	18.5	24.0	-1.7	-9.7	6.4

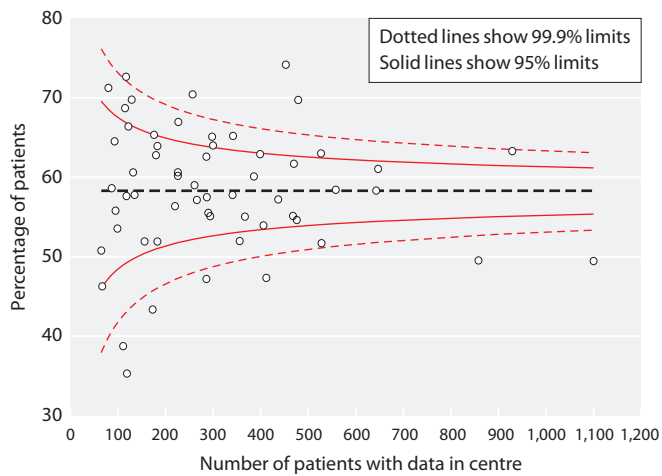
**Table 8.22.** Continued

Centre	N	% PTH 16–72 pmol/L	Lower 95% CI	Upper 95% CI	% PTH <16 pmol/L	% PTH >72 pmol/L	Change in % within range from 2015	95% LCL change	95% UCL change
Norwch	298	65.1	59.5	70.3	23.8	11.1	2.7	-5.0	10.3
Nottm	356	52.0	46.8	57.1	31.2	16.9	-9.3	-16.6	-1.9
Oxford	399	62.9	58.1	67.5	18.8	18.3	4.5	-2.4	11.3
Plymth	122	66.4	57.6	74.2	13.9	19.7	4.6	-7.4	16.6
Ports	558	58.4	54.3	62.5	18.8	22.8	-2.2	-7.9	3.4
Prestn	527	63.0	58.8	67.0	19.4	17.7	5.2	-0.7	11.1
Redng	286	62.6	56.8	68.0	20.3	17.1	-4.1	-11.9	3.8
Shrew	183	63.9	56.7	70.6	18.6	17.5	9.7	-0.3	19.6
Stevng	479	69.7	65.5	73.7	14.2	16.1	6.4	0.4	12.4
Sthend	99	53.5	43.7	63.1	14.1	32.3	4.6	-9.4	18.6
Stoke	257	70.4	64.6	75.7	16.0	13.6	5.5	-2.5	13.6
Sund	220	56.4	49.7	62.8	26.8	16.8	2.6	-6.9	12.1
Truro	156	51.9	44.1	59.7	42.3	5.8	7.2	-4.1	18.5
Wirral	129	69.8	61.3	77.1	25.6	4.7	1.7	-8.9	12.3
Wolve	286	47.2	41.5	53.0	39.9	12.9	-2.8	-11.1	5.5
York	173	43.4	36.2	50.8	42.8	13.9	2.2	-8.8	13.2
<b>N Ireland</b>									
Antrim	115	68.7	59.7	76.5	26.1	5.2	4.7	-7.6	16.9
Belfast	183	51.9	44.7	59.1	39.9	8.2	-0.5	-10.9	10.0
Newry	80	71.3	60.4	80.1	25.0	3.8	4.6	-9.6	18.7
Ulster	95	55.8	45.7	65.4	37.9	6.3	-0.6	-14.7	13.6
West NI	117	72.7	63.9	80.0	26.5	0.9	11.9	-0.2	24.1
<b>Wales</b>									
Bangor	67	46.3	34.8	58.2	47.8	6.0	-10.1	-26.4	6.1
Cardff	470	61.7	57.2	66.0	18.7	19.6	-3.2	-9.4	3.1
Clwyd	65	50.8	38.8	62.7	32.3	16.9	-3.3	-19.9	13.4
Swanse	342	65.2	60.0	70.1	23.1	11.7	2.6	-4.7	9.8
Wrexm	111	38.7	30.2	48.1	54.1	7.2	-3.5	-16.9	9.8
<b>England</b>	<b>16,775</b>	<b>58.1</b>	<b>57.4</b>	<b>58.9</b>	<b>23.4</b>	<b>18.5</b>	<b>1.7</b>	<b>0.6</b>	<b>2.7</b>
<b>N Ireland</b>	<b>590</b>	<b>62.5</b>	<b>58.6</b>	<b>66.4</b>	<b>32.2</b>	<b>5.3</b>	<b>3.5</b>	<b>-2.2</b>	<b>9.1</b>
<b>Wales</b>	<b>1,055</b>	<b>58.8</b>	<b>55.8</b>	<b>61.7</b>	<b>26.5</b>	<b>14.7</b>	<b>-1.8</b>	<b>-6.1</b>	<b>2.4</b>
<b>E, W &amp; NI</b>	<b>18,420</b>	<b>58.3</b>	<b>57.6</b>	<b>59.0</b>	<b>23.8</b>	<b>17.9</b>	<b>1.6</b>	<b>0.6</b>	<b>2.6</b>

Centres missing from the table were excluded from analysis due to low patient numbers or poor data completeness



**Fig. 8.27.** Percentage of haemodialysis patients with PTH within range (16–72 pmol/L) by centre in 2016



**Fig. 8.28.** Funnel plot of percentage of haemodialysis patients with PTH within range (16–72 pmol/L) by centre in 2016

In 2016, the proportion of HD patients with a PTH above the upper limit of the range (>72 pmol/L) was 17.9% and the proportion below the lower limit of the range (<16 pmol/L) was 23.8%.

The proportion of PD patients with PTH above the upper limit (>72 pmol/L) of the range was 13.4% and the proportion below the lower limit of the range (<16 pmol/L) was 20.9% (tables 8.22, 8.24).

There was significant variation by centre following unadjusted analyses for the proportion of patients below, within and above the range specified by the clinical performance measures. The funnel plot (figure 8.28) for HD patients showed above average achievement of the target range in London Guys, Stevenage, Stoke and West NI and below average achievement for Exeter, Leicester, Liverpool Aintree, London West,

### Peritoneal dialysis

**Table 8.23.** Summary statistics for PTH in peritoneal dialysis patients in 2016

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
<b>England</b>							
B Heart	94.4	68	58.5	36.2	61	31	75
B QEH	0.0	0					
Basldn	100.0	30	41.7	26.4	37	22	58
Bradfd	95.5	21	53.8	42.6	39	18	79
Brightn	92.9	52	51.2	70.6	31	17	52
Bristol	100.0	42	30.0	24.5	28	15	34
Camb <sup>a</sup>							
Carlis	100.0	31	35.5	23.4	34	17	43
Carsh	79.2	80	68.0	44.5	58	35	89
Chelms	85.2	23	55.8	55.7	33	20	91
Colchr <sup>b</sup>							
Covnt	93.2	55	28.8	31.8	22	11	37
Derby	97.2	69	32.6	23.2	27	19	38
Donc	100.0	25	34.1	18.4	32	23	38
Dorset	97.0	32	30.2	31.2	20	11	37
Dudley	81.3	39	40.1	32.1	32	15	48
Exeter	100.0	73	27.7	22.4	22	12	38
Glouc	72.7	24	29.8	16.8	26	17	38
Hull	91.8	56	27.2	18.2	24	13	37
Ipswi	97.0	32	22.9	16.1	23	15	27
Kent	97.7	42	36.7	35.2	29	19	48
L Barts	91.6	164	43.8	33.7	37	21	56
L Guys	84.4	27	29.5	12.4	29	18	40
L Kings	88.0	66	61.4	52.2	42	24	92
L Rfree	95.7	132	34.7	24.2	31	19	44
L St.G	94.6	35	36.9	32.3	24	18	38
L West	84.7	72	45.7	38.1	36	26	56
Leeds	100.0	36	43.2	35.8	36	15	68
Leic	92.9	65	39.0	39.2	26	13	49
Liv Ain	95.7	22	20.8	18.9	16	10	28
Liv Roy	98.4	63	21.2	13.6	20	11	30
M RI	95.9	47	49.5	41.3	41	18	60
Middlbr	68.2	15	55.3	40.3	52	27	71

**Table 8.23.** Continued

Centre	% completeness	Patients with data N	Mean	SD	Median	Lower quartile	Upper quartile
Newc	91.3	42	36.4	30.3	26	12	60
Norwch	75.6	31	45.5	30.7	44	27	57
Nottm	98.5	66	36.5	32.4	28	17	46
Oxford	97.5	78	35.7	25.8	32	15	43
Plymth	87.1	27	30.3	20.0	28	17	37
Ports	85.1	57	47.7	35.2	36	23	59
Prestn	97.1	34	33.4	24.2	27	20	37
Redng	95.5	42	39.7	24.6	32	23	65
Salford	0.0	0					
Sheff	0.0	0					
Shrew	100.0	29	45.6	33.1	36	24	57
Stevng	87.5	14	50.2	22.4	50	34	66
Sthend	70.8	17	41.1	28.4	36	23	54
Stoke	94.4	67	50.6	36.0	43	23	70
Sund	100.0	17	26.0	15.3	26	14	39
Truro	88.2	15	35.2	32.7	29	13	34
Wirral	86.7	13	32.2	35.1	23	14	32
Wolve	89.1	57	44.0	43.5	33	21	54
York	92.6	25	38.4	34.8	30	17	49
<b>N Ireland</b>							
Antrim	100.0	14	24.3	19.6	22	7	40
Belfast	95.5	21	29.1	18.8	25	19	40
Newry	100.0	19	24.1	12.8	26	10	34
Ulster	100.0	5					
West NI	100.0	9					
<b>Wales</b>							
Bangor	100.0	15	34.6	26.6	30	15	54
Cardff	80.6	54	55.7	41.4	43	31	75
Clwyd	92.9	13	50.8	41.9	41	22	62
Swanse	98.3	57	38.1	36.9	26	17	45
Wrexm	100.0	28	33.1	25.6	25	15	37
<b>England</b>	<b>82.7</b>	<b>2,169</b>	<b>40.4</b>	<b>35.1</b>	<b>31</b>	<b>18</b>	<b>52</b>
<b>N Ireland</b>	<b>98.6</b>	<b>68</b>	<b>25.2</b>	<b>16.9</b>	<b>24</b>	<b>11</b>	<b>34</b>
<b>Wales</b>	<b>91.8</b>	<b>167</b>	<b>43.6</b>	<b>37.3</b>	<b>32</b>	<b>19</b>	<b>59</b>
<b>E, W &amp; NI</b>	<b>83.7</b>	<b>2,404</b>	<b>40.2</b>	<b>35.0</b>	<b>31</b>	<b>18</b>	<b>52</b>

Blank cells: centres excluded from analysis due to small numbers or poor data completeness

<sup>a</sup>Cambridge renal centre was unable to submit PTH data for 2016

<sup>b</sup>Colchester – no PD patients

**Table 8.24.** Percentage of peritoneal dialysis patients within, below and above the range for PTH (16–72 pmol/L) in 2016

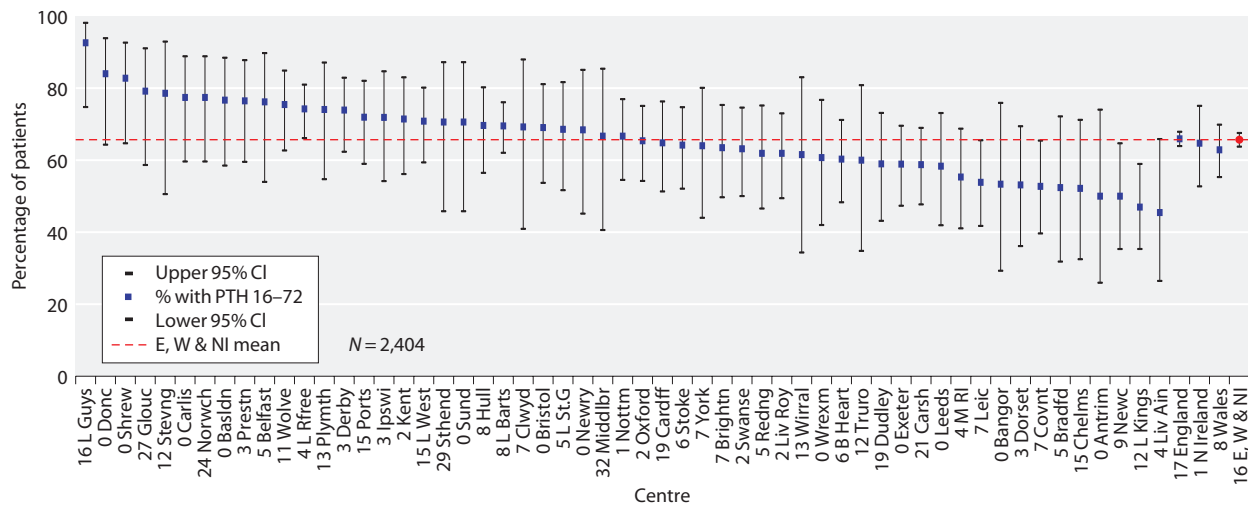
Centre	N	% PTH 16–72 pmol/L	Lower 95% CI	Upper 95% CI	% PTH <16 pmol/L	% PTH >72 pmol/L	Change in % within range from 2015	95% LCL change	95% UCL change
<b>England</b>									
B Heart	68	60.3	48.3	71.2	10.3	29.4	8.9	–10.9	28.8
Basldn	30	76.7	58.5	88.5	13.3	10.0	2.6	–19.8	25.0
Bradfd	21	52.4	31.8	72.2	19.1	28.6	–32.2	–61.2	–3.2
Brightn	52	63.5	49.7	75.3	23.1	13.5	5.8	–12.3	24.0
Bristol	42	69.1	53.7	81.1	26.2	4.8	3.1	–16.7	22.9
Carlis	31	77.4	59.6	88.8	16.1	6.5	10.8	–12.3	33.8
Carsh	80	58.8	47.7	69.0	6.3	35.0	4.6	–10.5	19.7
Chelms	23	52.2	32.5	71.2	21.7	26.1	–9.7	–38.9	19.4
Covnt	55	52.7	39.7	65.4	40.0	7.3	5.1	–13.0	23.2



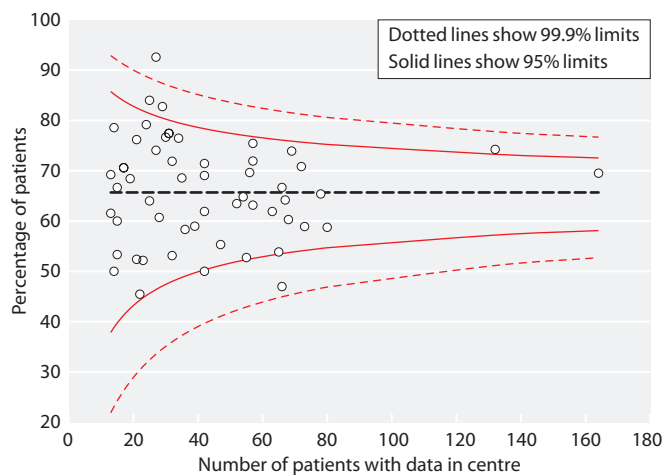
**Table 8.24.** Continued

Centre	N	% PTH 16-72 pmol/L	Lower 95% CI	Upper 95% CI	% PTH <16 pmol/L	% PTH >72 pmol/L	Change in % within range from 2015	95% LCL change	95% UCL change
Derby	69	73.9	62.3	82.9	18.8	7.3	-9.9	-23.5	3.7
Donc	25	84.0	64.3	93.9	12.0	4.0	11.8	-13.4	37.0
Dorset	32	53.1	36.1	69.4	34.4	12.5	-2.0	-27.1	23.0
Dudley	39	59.0	43.2	73.1	25.6	15.4	0.6	-20.2	21.4
Exeter	73	58.9	47.4	69.6	34.3	6.9	2.6	-13.6	18.7
Glouc	24	79.2	58.7	91.1	20.8	0.0	-8.3	-29.3	12.6
Hull	56	69.6	56.5	80.2	28.6	1.8	10.4	-7.4	28.2
Ipswi	32	71.9	54.2	84.7	25.0	3.1	16.3	-8.1	40.7
Kent	42	71.4	56.1	83.0	23.8	4.8	1.1	-17.2	19.4
L Barts	164	69.5	62.1	76.1	15.9	14.6	-0.8	-10.6	9.0
L Guys	27	92.6	74.8	98.1	7.4	0.0	17.6	-2.4	37.5
L Kings	66	47.0	35.3	59.0	18.2	34.9	-7.2	-23.9	9.5
L Rfree	132	74.2	66.1	81.0	16.7	9.1	7.6	-3.6	18.8
L St.G	35	68.6	51.7	81.7	20.0	11.4	22.1	0.6	43.5
L West	72	70.8	59.4	80.2	13.9	15.3	3.5	-13.3	20.3
Leeds	36	58.3	41.9	73.1	27.8	13.9	-15.7	-35.8	4.5
Leic	65	53.9	41.7	65.5	30.8	15.4	3.9	-12.1	19.8
Liv Ain	22	45.5	26.5	65.9	50.0	4.6	-4.6	-34.8	25.7
Liv Roy	63	61.9	49.4	73.0	38.1	0.0	-7.7	-24.7	9.3
M RI	47	55.3	41.1	68.8	23.4	21.3	-7.8	-26.8	11.1
Middlbr	15	66.7	40.6	85.4	13.3	20.0			
Newc	42	50.0	35.3	64.7	31.0	19.1	-2.9	-25.5	19.6
Norwch	31	77.4	59.6	88.8	9.7	12.9	3.7	-20.9	28.4
Nottm	66	66.7	54.5	76.9	24.2	9.1	-6.3	-22.1	9.4
Oxford	78	65.4	54.2	75.1	25.6	9.0	-5.1	-19.8	9.5
Plymth	27	74.1	54.7	87.1	22.2	3.7	26.1	0.4	51.7
Ports	57	71.9	59.0	82.0	7.0	21.1	19.9	1.5	38.2
Prestn	34	76.5	59.5	87.8	17.7	5.9	5.0	-14.0	24.1
Redng	42	61.9	46.6	75.2	19.1	19.1	-19.9	-37.8	-2.0
Shrew	29	82.8	64.7	92.6	6.9	10.3	17.4	-5.5	40.3
Stevng	14	78.6	50.6	92.9	7.1	14.3	42.2	6.6	77.8
Sthend	17	70.6	45.8	87.2	17.7	11.8			
Stoke	67	64.2	52.1	74.7	11.9	23.9	-1.9	-18.4	14.5
Sund	17	70.6	45.8	87.2	29.4	0.0	-6.3	-37.9	25.2
Truro	15	60.0	34.8	80.8	26.7	13.3	10.0	-23.9	43.9
Wirral	13	61.5	34.4	83.0	30.8	7.7	-19.7	-52.3	12.9
Wolve	57	75.4	62.7	84.9	14.0	10.5	12.4	-3.8	28.6
York	25	64.0	44.0	80.1	24.0	12.0	27.6	0.1	55.2
<b>N Ireland</b>									
Antrim	14	50.0	26.0	74.0	42.9	7.1	-20.6	-54.6	13.4
Belfast	21	76.2	54.0	89.7	19.1	4.8	7.8	-20.0	35.5
Newry	19	68.4	45.2	85.1	31.6	0.0	12.9	-18.2	43.9
<b>Wales</b>									
Bangor	15	53.3	29.3	75.9	33.3	13.3	-31.3	-63.3	0.7
Cardff	54	64.8	51.3	76.3	7.4	27.8	5.1	-12.5	22.8
Clwyd	13	69.2	40.9	88.0	7.7	23.1			
Swanse	57	63.2	50.0	74.6	22.8	14.0	2.8	-15.4	21.0
Wrexm	28	60.7	42.0	76.7	28.6	10.7	-15.1	-38.3	8.2
<b>England</b>	<b>2,169</b>	<b>65.9</b>	<b>63.9</b>	<b>67.9</b>	<b>20.8</b>	<b>13.3</b>	<b>2.5</b>	<b>-0.4</b>	<b>5.3</b>
<b>N Ireland</b>	<b>68</b>	<b>64.7</b>	<b>52.7</b>	<b>75.1</b>	<b>32.4</b>	<b>2.9</b>	<b>2.4</b>	<b>-13.7</b>	<b>18.5</b>
<b>Wales</b>	<b>167</b>	<b>62.9</b>	<b>55.3</b>	<b>69.9</b>	<b>18.6</b>	<b>18.6</b>	<b>-2.6</b>	<b>-12.9</b>	<b>7.7</b>
<b>E, W &amp; NI</b>	<b>2,404</b>	<b>65.7</b>	<b>63.8</b>	<b>67.6</b>	<b>20.9</b>	<b>13.4</b>	<b>2.1</b>	<b>-0.6</b>	<b>4.8</b>

Centres missing from the table were excluded from analysis due to low patient numbers or poor data completeness  
Blank cells indicate no data for 2015



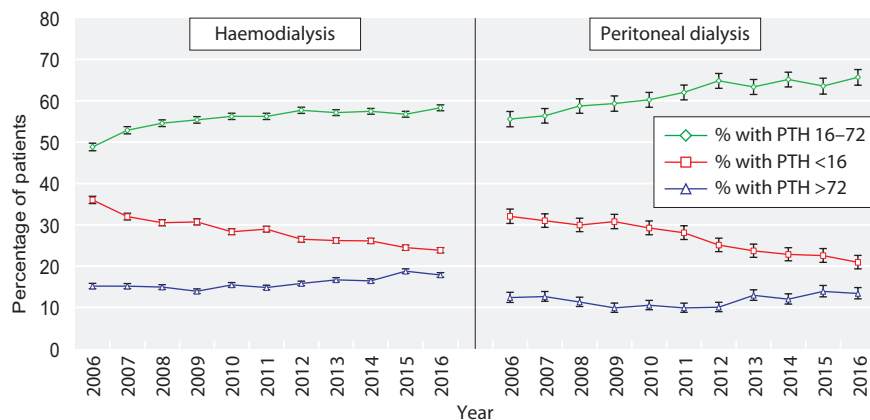
**Fig. 8.29.** Percentage of peritoneal dialysis patients with PTH within range (16–72 pmol/L) by centre in 2016



**Fig. 8.30.** Funnel plot of percentage of peritoneal dialysis patients with PTH within range (16–72 pmol/L) by centre in 2016

Wolverhampton, Wrexham and York. For PD patients (figure 8.30) London Guys was above average achievement of the target range and there were no outliers below the 99.9% confidence interval for the target.

Longitudinal analysis of PTH control measures at the level of the three countries noted sustained reduction in the proportion of patients with low PTH levels (<16 pmol/L) in HD and PD patients. Similarly, there has been a corresponding increase in the fraction of HD and PD patients with PTH levels being maintained within the 16–72 pmol/L range. The fraction of patients with PTH above range (>72 pmol/L) increased from 15.2% in 2006 to 17.9% in 2016 in those receiving HD but was almost unchanged in those receiving PD during the same period (figure 8.31).



**Fig. 8.31.** Longitudinal change in percentage of patients with PTH within range (16–72 pmol/L) by dialysis modality 2006–2016