

CHAPTER 10

Management of Renal Bone Disease in Dialysis Patients

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SECTION 10.1: TREATMENT OF RENAL BONE DISEASE

From 1998 to 2007, calcium carbonate remained as the main phosphate binder used. Majority of HD patients (92%) and CAPD patients (88%) received calcium carbonate as phosphate binder. The number of patients on aluminium based phosphate binders continued to decrease in both HD and CAPD patients. An increasing number of patients received lanthanum as phosphate binders although the number remains small. (Tables 10.1.1 & 10.1.2)

Calcitriol remained the main Vitamin D used in treatment of renal bone disease in both HD and CAPD patients. The percentage of patients on calcitriol therapy has increased in both HD and CAPD patients since 2001. However, an increasing number of patients is using paracalcitol since 2006. (Tables 10.1.1 & 10.1.2)

The number of parathyroidectomies done in HD patients had increased from 152 to 181 in year 2007 but the number had decreased from 15 to 11 in CAPD patients. (Tables 10.1.1 & 10.1.2)

Table 10.1.1 Treatment for renal bone disease, HD patients, 1998- 2007

Year	No. of subjects	No. of subjects on CaCO ₃	% on CaCO ₃	No. of subjects on Al(OH) ₃	No. of subjects on lanthanum	No. of subjects on calcitriol	% on Calcitriol	No. of subjects on paracalcitol	No. of subjects had Para-thyroidectomy
1998	2141	1956	91	343	0	652	30	0	0
1999	2996	2693	90	244	0	770	26	0	0
2000	4392	3977	91	239	0	1084	25	0	0
2001	5194	4810	93	145	0	1145	22	0	0
2002	6108	5536	91	171	0	1375	23	0	0
2003	7017	6424	92	118	0	1690	24	0	0
2004	8163	7407	91	106	0	2028	25	0	0
2005	9351	8568	92	98	0	2555	27	0	43
2006	11682	10776	92	71	14	3783	32	15	152
2007	12891	11853	92	57	37	4893	38	32	181

Table 10.1.2 Treatment for renal bone disease, CAPD patients, 1998- 2007

Year	No. of subjects	No. of subjects on CaCO ₃	% on CaCO ₃	No. of subjects on Al(OH) ₃	No. of subjects on lanthanum	No. of subjects on calcitriol	% on calcitriol	No. of subjects on paracalcitol	No. of subjects had Para-thyroidectomy
1998	541	425	79	46	0	110	20	0	0
1999	610	450	74	36	0	75	12	0	0
2000	662	522	79	15	0	96	15	0	0
2001	781	588	75	5	0	84	11	0	0
2002	891	713	80	6	0	130	15	0	0
2003	1231	1039	84	10	0	238	19	0	0
2004	1327	1124	85	18	0	304	23	0	0
2005	1398	1186	85	13	0	314	22	0	4
2006	1552	1323	85	7	3	375	24	3	15
2007	1806	1585	88	4	11	514	28	3	11

SECTION 10.2: SERUM CALCIUM AND PHOSPHATE CONTROL

The median corrected serum calcium level decreased to 2.2 mmol/l in HD patients (Table 10.2.1 and Fig 10.2.1) but remained at 2.4 mmol/l in CAPD patients (Table 10.2.2 and Fig 10.2.2). In 2007, the percentage of patients who achieved target serum calcium level of 2.1 to 2.37 mmol/l had increased in both HD and CAPD patients.

Table 10.2.1: Distribution of corrected serum calcium, HD patients, 1998- 2007

Year	No of subject	Mean	SD	Median	LQ	UQ	%patients ≥ 2.1 & ≤ 2.37 mmol/L
1998	2060	2.3	0.3	2.3	2.2	2.5	44
1999	2732	2.3	0.3	2.3	2.2	2.5	39
2000	3703	2.4	0.3	2.3	2.2	2.5	42
2001	4618	2.4	0.2	2.4	2.2	2.5	40
2002	5485	2.3	0.3	2.3	2.2	2.5	43
2003	6465	2.3	0.2	2.3	2.2	2.4	46
2004	7535	2.3	0.2	2.3	2.2	2.4	47
2005	8630	2.3	0.2	2.3	2.2	2.4	49
2006	10881	2.3	0.2	2.3	2.1	2.4	50
2007	12260	2.2	0.2	2.2	2.1	2.4	52

Figure 10.2.1 Cumulative distribution of corrected serum calcium, HD patients, 1998-2007

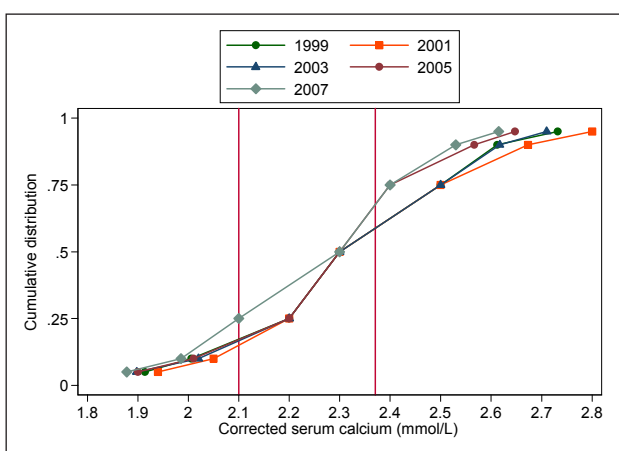


Figure 10.2.2: Cumulative distribution of corrected serum calcium, CAPD patients, 1998-2007

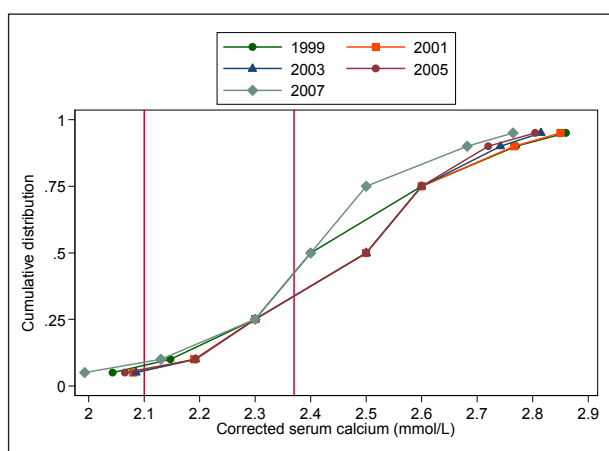


Table 10.2.2: Distribution of corrected serum calcium, CAPD patients, 1998- 2007

Year	No of subject	Mean	SD	Median	LQ	UQ	%patients ≥ 2.1 & ≤ 2.37 mmol/L
1998	535	2.4	0.3	2.4	2.3	2.6	30
1999	593	2.5	0.2	2.5	2.3	2.6	25
2000	635	2.5	0.2	2.5	2.3	2.6	25
2001	744	2.5	0.3	2.5	2.4	2.7	22
2002	859	2.5	0.2	2.5	2.3	2.6	24
2003	1167	2.4	0.2	2.5	2.3	2.6	27
2004	1276	2.5	0.2	2.5	2.3	2.6	23
2005	1338	2.4	0.2	2.4	2.3	2.6	30
2006	1495	2.4	0.2	2.4	2.3	2.5	38
2007	1748	2.4	0.2	2.4	2.2	2.5	42

The median serum phosphate level was higher among HD patients (1.7 mmol/l) compared to CAPD patients (1.6 mmol/l). (Tables and Fig 10.2.3 and 10.2.4) In 2007, the percentage of patients who achieved target serum phosphate level of 1.13 to 1.78 mmol/l had increased to 47% among HD patients and 55% among CAPD patients.

Table 10.2.3: Distribution of serum phosphate, HD patients, 1998- 2007

Year	No of subjects	mean	SD	Median	LQ	UQ	%patients with phosphate <1.13 mmol/L	%patients with phosphate ≥1.13&<1.78 mmol/L	%patients with phosphate ≥1.78&≤2.6 mmol/L	%patients with phosphate >2.6 mmol/L
1998	2051	1.9	0.5	1.9	1.6	2.2	4	35	52	10
1999	2861	1.9	0.5	1.9	1.5	2.2	7	37	47	9
2000	4080	1.9	0.6	1.8	1.5	2.2	8	37	46	9
2001	4765	1.9	0.5	1.8	1.5	2.2	7	40	45	8
2002	5679	1.9	0.5	1.8	1.5	2.2	7	38	45	10
2003	6587	1.8	0.5	1.8	1.5	2.2	7	41	43	9
2004	7619	1.8	0.5	1.8	1.5	2.2	8	42	42	7
2005	8834	1.8	0.5	1.7	1.4	2.1	9	45	40	6
2006	11129	1.8	0.5	1.7	1.4	2.1	9	46	39	6
2007	12407	1.8	0.5	1.7	1.4	2.1	9	47	39	5

Figure 10.2.3: Cumulative distribution of serum phosphate, HD patients, 1998-2007

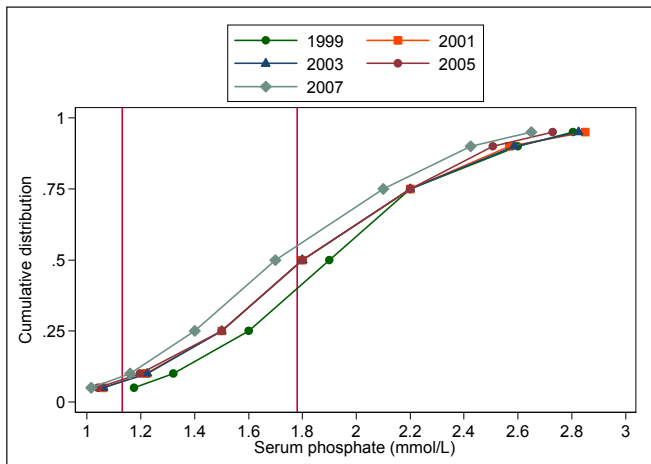


Figure 10.2.4: Cumulative distribution of serum phosphate, CAPD patients, 1998-2007

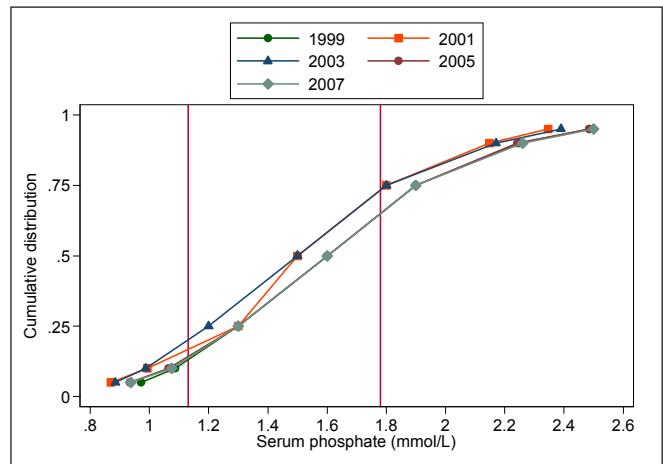


Table 10.2.4: Distribution of serum phosphate, CAPD patients, 1998- 2007

Year	No of subjects	mean	SD	Median	LQ	UQ	%patients with phosphate <1.13 mmol/L	%patients with phosphate ≥1.13&<1.78 mmol/L	%patients with phosphate ≥1.78&≤2.6 mmol/L	%patients with phosphate >2.6 mmol/L
1998	537	1.6	0.5	1.6	1.3	1.9	12	55	30	3
1999	583	1.6	0.5	1.6	1.3	1.9	11	56	30	3
2000	633	1.5	0.5	1.5	1.3	1.8	17	55	26	2
2001	732	1.5	0.5	1.5	1.2	1.8	21	53	24	2
2002	862	1.5	0.5	1.5	1.2	1.8	21	52	25	2
2003	1173	1.6	0.5	1.5	1.2	1.9	16	53	28	3
2004	1278	1.6	0.5	1.6	1.3	1.9	15	52	29	3
2005	1343	1.6	0.5	1.6	1.3	1.9	15	52	29	3
2006	1511	1.6	0.5	1.6	1.3	1.9	13	54	29	4
2007	1757	1.6	0.5	1.6	1.3	1.9	13	55	27	5

In year 2007, the median corrected calcium phosphate product had remained at 3.8 mmol²/L² among HD patients and declined to 3.6 mmol²/L² among CAPD patients (Tables and Figs 10.2.5 and 10.2.6)

Table 10.2.5: Distribution of corrected calcium x phosphate product, HD patients 1998-2007

Year	No of subjects	mean	SD	Median	LQ	UQ	Percent patients with calcium phosphate product:			
							<3.5 mmol ² /L ²	≥3.5 to <4.5 mmol ² /L ²	≥4.5 to <5.5 mmol ² /L ²	≥5.5 mmol ² /L ²
1998	2020	4.5	1.2	4.4	3.7	5.2	21	32	28	19
1999	2698	4.4	1.3	4.3	3.4	5.2	27	29	26	18
2000	3650	4.4	1.3	4.3	3.5	5.2	25	31	25	19
2001	4555	4.3	1.3	4.2	3.4	5.2	27	31	24	18
2002	5403	4.4	1.3	4.3	3.4	5.2	27	31	24	19
2003	6382	4.2	1.3	4.1	3.3	5.1	30	31	23	16
2004	7413	4.2	1.3	4.1	3.3	5	32	32	22	15
2005	8496	4	1.3	3.9	3.2	4.8	36	32	20	12
2006	10758	4	1.2	3.8	3.1	4.7	38	32	19	11
2007	12157	3.9	1.2	3.8	3.1	4.6	38	33	19	10

Figure 10.2.5: Cumulative distribution of corrected calcium x phosphate product, HD patients 1998- 2007

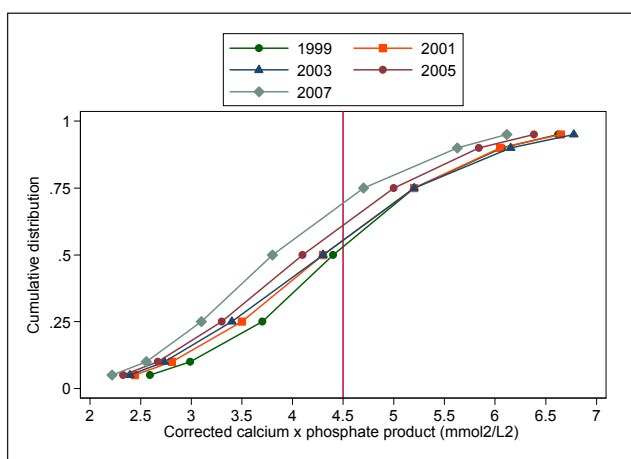


Figure 10.2.6: Cumulative distribution of corrected calcium x phosphate product, CAPD patients 1998- 2007

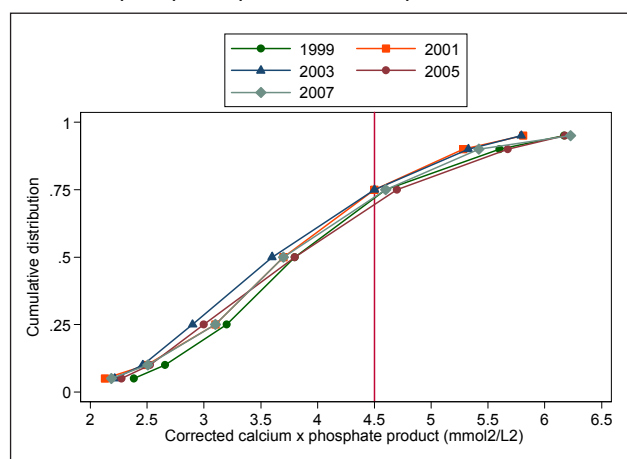


Table 10.2.6: Distribution of corrected calcium x phosphate product, CAPD patients 1998-2007

Year	No of subjects	mean	SD	Median	LQ	UQ	Percent patients with calcium phosphate product:			
							<3.5 mmol ² /L ²	≥3.5 to <4.5 mmol ² /L ²	≥4.5 to <5.5 mmol ² /L ²	≥5.5 mmol ² /L ²
1998	533	4	1.1	3.8	3.2	4.6	38	35	16	11
1999	580	4	1.2	3.8	3.2	4.8	36	33	22	10
2000	621	3.8	1.1	3.7	3.1	4.5	44	31	17	8
2001	723	3.8	1.1	3.6	2.9	4.5	46	30	18	7
2002	856	3.8	1.2	3.6	2.9	4.5	45	29	18	8
2003	1162	3.9	1.2	3.7	3	4.6	43	29	17	10
2004	1274	4	1.2	3.8	3	4.7	41	30	18	12
2005	1333	3.9	1.3	3.7	3	4.6	43	29	17	11
2006	1494	3.9	1.2	3.7	3.1	4.6	43	31	17	9
2007	1745	3.8	1.2	3.6	3	4.5	46	29	15	10

In 2007, the median corrected serum calcium level among HD patients from 299 centres ranged from 1.8 to 2.4 mmol/l. (Tables 10.2.7 and Fig 10.2.7a) The median corrected serum calcium level among CAPD patients from 23 centres ranged from 2.2 to 2.4 mmol/l. (Tables 10.2.8 and Fig 10.2.8a)

Table 10.2.7: Variation in corrected serum calcium level among HD centres, 2007
a) median serum calcium level among HD patients

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1998	49	2	2.1	2.3	2.3	2.4	2.4	2.5
1999	68	1.6	2	2.3	2.3	2.4	2.5	2.6
2000	93	2	2.1	2.3	2.3	2.4	2.6	3.2
2001	116	2	2.1	2.3	2.4	2.4	2.5	2.6
2002	138	1.9	2.1	2.2	2.3	2.4	2.5	2.6
2003	169	2	2.1	2.2	2.3	2.4	2.5	2.5
2004	198	1.9	2.1	2.2	2.3	2.4	2.4	2.5
2005	227	1.8	2	2.2	2.3	2.3	2.4	2.5
2006	278	1.9	2.1	2.2	2.3	2.3	2.4	2.5
2007	299	1.8	2	2.2	2.2	2.3	2.4	2.6

Figure 10.2.7(a): Variation in median serum calcium among HD patients, HD centres, 2007

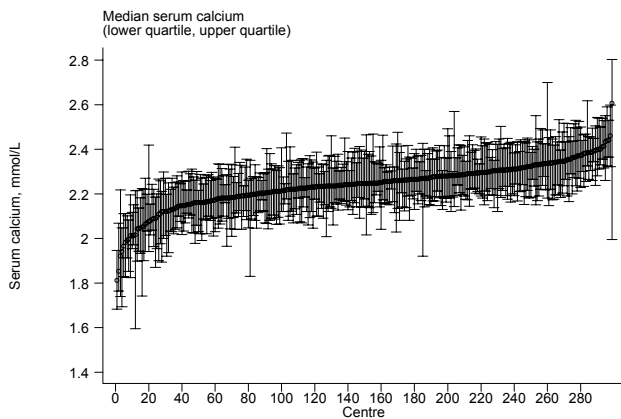


Figure 10.2.8(a): Variation in median serum calcium level among CAPD patients, CAPD centres, 2007

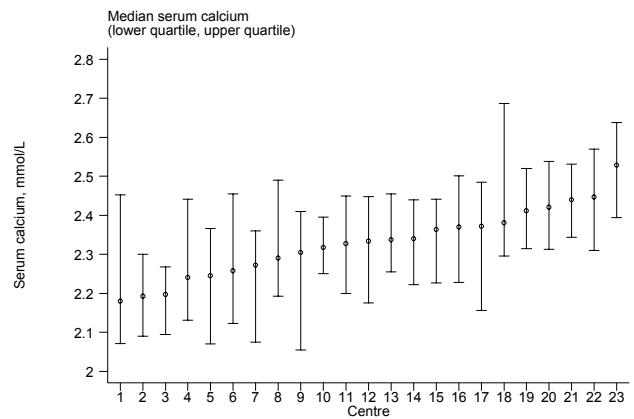


Table 10.2.8: Variation in corrected serum calcium level among CAPD centres, 2007
a). median serum calcium level among CAPD patients

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1998	9	2.2	2.2	2.3	2.4	2.4	2.6	2.6
1999	10	2.4	2.4	2.4	2.5	2.6	2.6	2.6
2000	11	2.4	2.4	2.4	2.5	2.5	2.6	2.6
2001	12	2.3	2.3	2.4	2.5	2.5	2.6	2.6
2002	15	2.4	2.4	2.4	2.4	2.5	2.6	2.6
2003	19	2.2	2.2	2.4	2.4	2.5	2.6	2.6
2004	19	2.2	2.2	2.4	2.4	2.5	2.5	2.5
2005	20	2.2	2.2	2.3	2.4	2.4	2.5	2.6
2006	22	2.2	2.2	2.3	2.4	2.4	2.5	2.6
2007	23	2.2	2.2	2.3	2.3	2.4	2.4	2.5

We reviewed the proportion of patients with serum calcium level achieving target of 2.1 to 2.37 mmol/l. The median was 52% for HD centres (Table & Fig 10.2.7b) and 43% for CAPD centres (Table & Fig 10.2.8b). There is a great variation between the HD centres with regards to the proportion of patients with serum calcium 2.1 to 2.37 mmol/l, ranging from 8 to 95%. There is also a great variation between the CAPD centres with regards to the proportion of patients with serum calcium 2.1 to 2.37 mmol/l, ranging from 19 to 63%.

Table 10.2.7(b): Proportion of patients with serum calcium 2.1 to 2.37 mmol/L, HD centres, 2007

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1998	49	12	21	36	43	53	70	78
1999	68	0	10	25	38.5	46	59	79
2000	93	0	15	31	42	50	65	96
2001	116	7	12	29	40	50	64	85
2002	138	5	15	33	44	53	64	73
2003	169	13	24	36	46	54	68	91
2004	198	8	22	38	47	58	70	82
2005	227	0	18	38	50	58	70	81
2006	278	12	29	41	50	60	71	88
2007	299	8	27	45	52	61	74	95

Figure 10.2.7(b): Variation in proportion of patients with serum calcium 2.1 to 2.37 mmol/L, HD centres, 2007

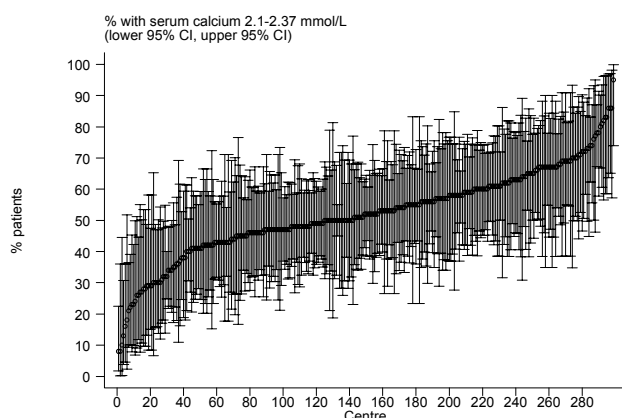


Figure 10.2.8(b): Variation in proportion of patients with serum calcium 2.1 to 2.37 mmol/L, CAPD centres, 2007

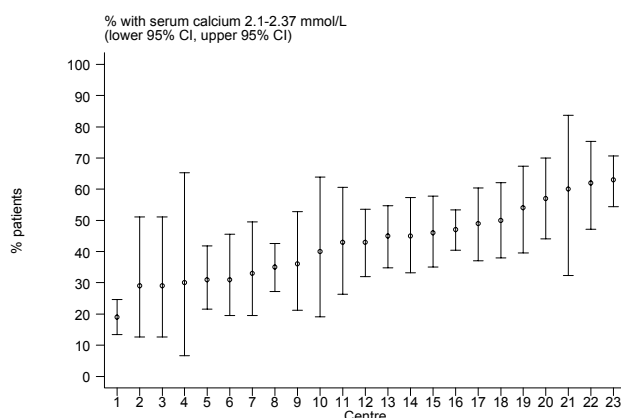


Table 10.2.8(b): Proportion of patients with serum calcium 2.1 to 2.37 mmol/L, CAPD centres

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1998	9	13	13	23	38	40	64	64
1999	10	5	5	21	28	32	42	42
2000	11	14	14	18	25	33	48	48
2001	12	11	11	18	24	34.5	38	38
2002	15	12	12	20	25	34	41	41
2003	19	9	9	19	33	40	58	58
2004	19	11	11	18	26	31	53	53
2005	20	16	17	24.5	34	40	48	51
2006	22	16	23	35	43.5	49	61	76
2007	23	19	29	31	43	50	62	63

With regards to the proportion of patients with serum phosphate level 1.13 – 1.78 mmol/l. the median was 46% for HD centres (Table & Fig 10.2.9b) and 53% for CAPD centres (Table & Fig 10.2.10 b). There is a great variation between the HD centres with regards to the proportion of patients with serum phosphate 1.13 – 1.78 mmol/l, ranging from 15 to 92%.(Table 10.2.9b) Among the CAPD centres, the proportion of patients with serum phosphate 1.13 – 1.78 mmol/l, ranged from 39 to 79%. (Table 10.2.10 b)

Table 10.2.9: Variation in serum phosphate level among HD centres, 2007
(a) Median serum phosphate level among HD patients

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1998	49	1.5	1.5	1.8	1.9	2	2.2	2.6
1999	68	1.1	1.6	1.8	1.9	2	2.1	2.1
2000	101	1.4	1.6	1.7	1.9	2	2.2	3.7
2001	117	1.3	1.5	1.7	1.8	1.9	2.1	2.4
2002	145	1.3	1.5	1.8	1.9	2	2.2	2.4
2003	176	0.8	1.5	1.7	1.8	1.9	2.2	2.4
2004	199	1.3	1.5	1.7	1.8	1.9	2.1	2.3
2005	229	0.8	1.4	1.6	1.8	1.9	2	2.2
2006	282	0.9	1.5	1.6	1.7	1.8	2.1	2.5
2007	304	0.9	1.4	1.6	1.7	1.8	2	2.6

Figure 10.2.9(a): Variation in median serum phosphate level among HD patients, HD centres, 2007

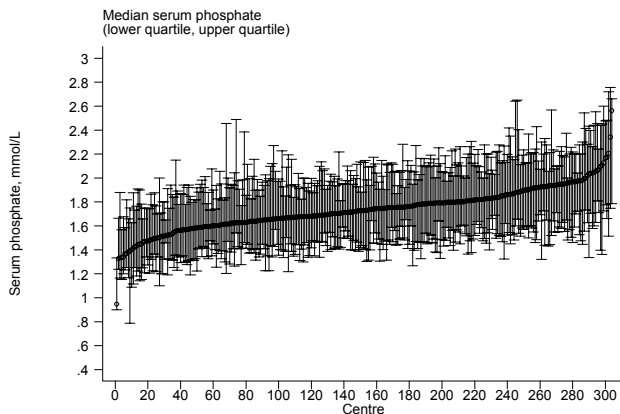
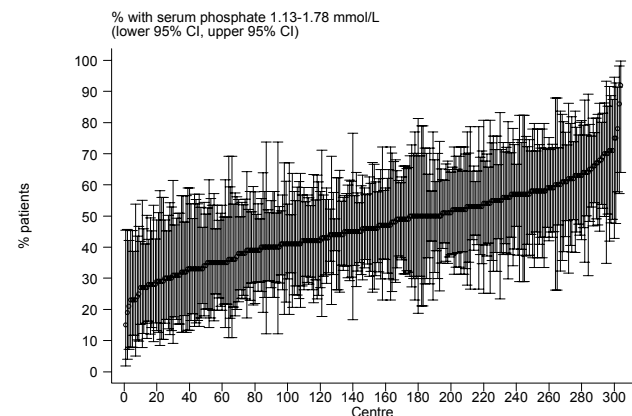


Figure 10.2.9(b): Variation in proportion of patients with serum phosphate 1.13 to 1.78 mmol/L, HD centres,



(b) Proportion of patients with serum phosphate 1.13 to 1.78 mmol/L, HD centres, 2007

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1998	49	9	18	29	34	44	63	70
1999	68	8	17	26.5	36	44.5	59	63
2000	101	9	18	29	36	44	57	73
2001	117	0	21	33	38	47	61	67
2002	145	6	14	29	36	45	63	91
2003	176	9	19	31.5	40	49	66	93
2004	199	0	18	31	40	52	67	92
2005	229	9	23	35	42	53	68	90
2006	282	12	26	39	45	54	68	92
2007	304	15	28	39	46	55	67	92

Table 10.2.10: Variation in serum phosphate levels among CAPD centres, to 2007

(a) Median serum phosphate level among CAPD patients

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1998	9	1.4	1.4	1.5	1.6	1.6	1.8	1.8
1999	9	1.5	1.5	1.5	1.6	1.6	1.7	1.7
2000	11	1.3	1.3	1.4	1.5	1.6	1.7	1.7
2001	12	1.3	1.3	1.4	1.5	1.7	1.9	1.9
2002	15	1.4	1.4	1.4	1.5	1.6	2	2
2003	19	1.2	1.2	1.4	1.5	1.6	1.7	1.7
2004	19	1.4	1.4	1.5	1.5	1.7	1.8	1.8
2005	20	1.4	1.4	1.5	1.5	1.7	1.9	1.9
2006	22	1.3	1.4	1.5	1.6	1.7	1.8	1.9
2007	23	1.3	1.4	1.5	1.6	1.7	1.9	2.4

Figure 10.2.10(a): Variation in median serum phosphate level among CAPD patients, CAPD centres 2007

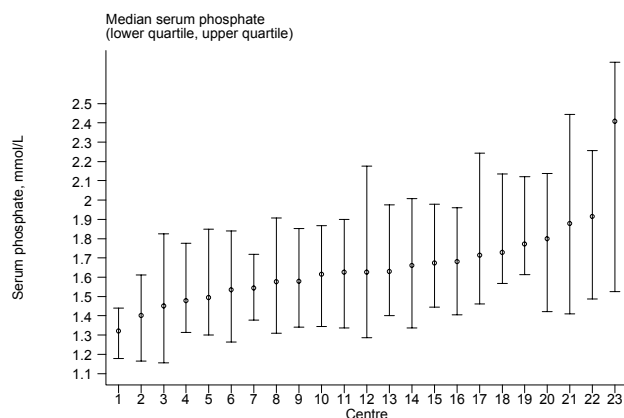
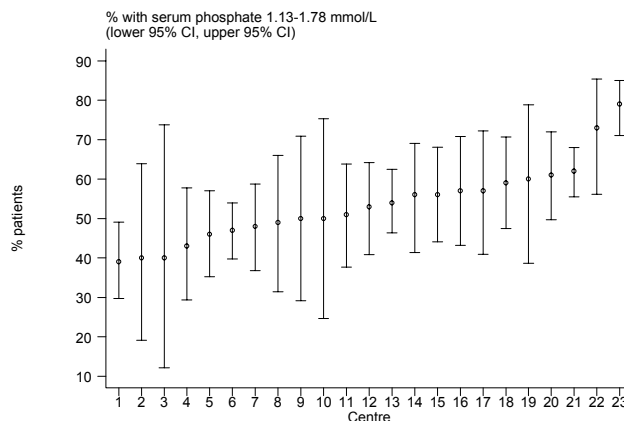


Figure 10.2.10(b): Variation in proportion of patients with serum phosphate 1.13 to 1.78 mmol/L, CAPD centres



(b) Proportion of patients with serum phosphate 1.13 to 1.78 mmol/L, CAPD centres 2007

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1998	9	43	43	54	60	61	80	80
1999	9	45	45	51	58	63	68	68
2000	11	43	43	48	53	61	65	65
2001	12	42	42	48.5	54	58	78	78
2002	15	40	40	47	53	60	84	84
2003	19	40	40	47	54	61	76	76
2004	19	37	37	49	52	63	76	76
2005	20	40	41	45.5	52.5	59	73	76
2006	22	38	43	48	52.5	58	66	68
2007	23	39	40	47	53	59	73	79

In 2007, the median corrected serum calcium phosphate product among HD patients from 298 centres ranged from 2.2 to 5.4 (Tables 10.2.11 and Fig 10.2.11a). The median corrected serum calcium phosphate product among CAPD patients from 23 centres ranged from 3.1 to 4.6 mmol/l. (Tables 10.2.12 and Fig 10.2.12a)

Table 10.2.11: Variation in corrected calcium x phosphate product among HD centres, 2007
(a) median corrected calcium x phosphate product among HD patients

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1998	49	3.2	3.4	4.1	4.5	4.7	5.2	5.3
1999	66	2.3	3.2	4	4.3	4.7	5.2	5.3
2000	91	3.1	3.5	4	4.3	4.6	5.2	6.2
2001	113	2.9	3.5	3.9	4.2	4.6	5.1	6
2002	138	2.9	3.6	4	4.3	4.5	5.3	6.2
2003	169	2.1	3.3	3.9	4.1	4.5	4.9	5.5
2004	196	2.9	3.4	3.8	4.1	4.4	5	5.6
2005	221	2.1	3.2	3.6	3.9	4.3	4.7	5.6
2006	275	1.8	3.2	3.6	3.9	4.2	4.7	5.2
2007	298	2.2	3.1	3.6	3.9	4.1	4.6	5.4

Figure 10.2.11(a): Variation in median corrected calcium x phosphate product among HD patients, HD centres, 2007

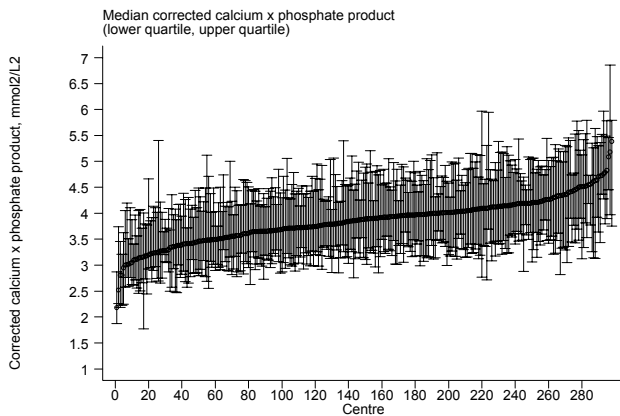


Figure 10.2.12(a): Variation in median corrected calcium x phosphate product among CAPD centres, to 2007

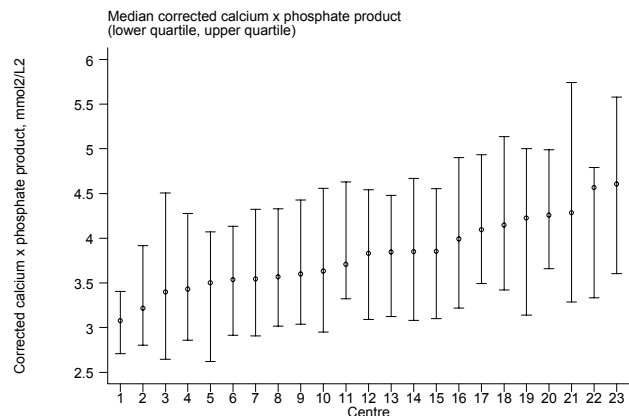


Table 10.2.12: Variation in corrected calcium x phosphate product among CAPD centres, 2007
(a) median corrected calcium x phosphate product among CAPD patients

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1998	9	3.5	3.5	3.6	3.7	3.9	4	4
1999	9	3.6	3.6	3.7	3.9	4.1	4.2	4.2
2000	11	3.4	3.4	3.5	3.7	4	4.3	4.3
2001	12	3.1	3.1	3.4	3.7	3.9	4.3	4.3
2002	15	3.3	3.3	3.4	3.6	4	4.6	4.6
2003	19	2.9	2.9	3.4	3.6	4	4.1	4.1
2004	19	3.2	3.2	3.5	3.8	4	4.4	4.4
2005	20	3.3	3.4	3.6	3.7	4	4.2	4.3
2006	22	3	3.3	3.6	3.7	4	4.3	4.5
2007	23	3.1	3.2	3.5	3.8	4.1	4.6	4.6

With regards to the proportion of patients with calcium phosphate product less than $4.5 \text{ mmol}^2/\text{L}^2$, the median was 72% for HD centres (Table & Fig 10.2.11b) and 73% for CAPD centres (Table & Fig 10.2.12 b). There is again a great variation between the HD centres with regards to the proportion of patients with calcium phosphate product less than $4.5 \text{ mmol}^2/\text{L}^2$, ranging from 30% to 100%. (Table 10.2.11b) Among the CAPD centres, the proportion of patients with calcium phosphate product less than $4.5 \text{ mmol}^2/\text{L}^2$, ranged from 45% to 98%. (Table 10.2.12 b)

Table 10.2.11(b): Proportion of patients with corrected calcium x phosphate $< 4.5 \text{ mmol}^2/\text{L}^2$, HD centres

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1998	49	27	31	41	52	64	83	91
1999	66	19	30	47	55	63	91	95
2000	91	12	27	47	57	67	80	88
2001	113	18	37	47	57	70	82	91
2002	138	11	33	49	57	69	89	100
2003	169	22	33	52	62	72	88	100
2004	196	17	38	54	63.5	73	90	100
2005	221	23	44	58	69	76	91	100
2006	275	30	44	61	70	79	91	100
2007	298	30	47	62	72	80	93	100

Figure 10.2.11(b): Variation in proportion of patients with corrected calcium x phosphate product $< 4.5 \text{ mmol}^2/\text{L}^2$, HD centres 2007

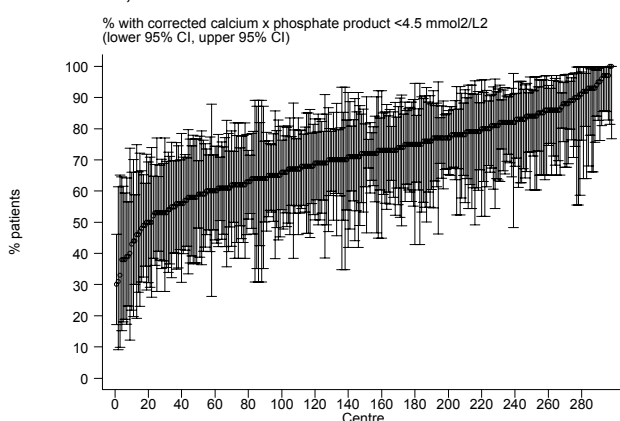


Figure 10.2.12(b): Variation in proportion of patients with corrected calcium x phosphate product $< 4.5 \text{ mmol}^2/\text{L}^2$ CAPD centres, 2007

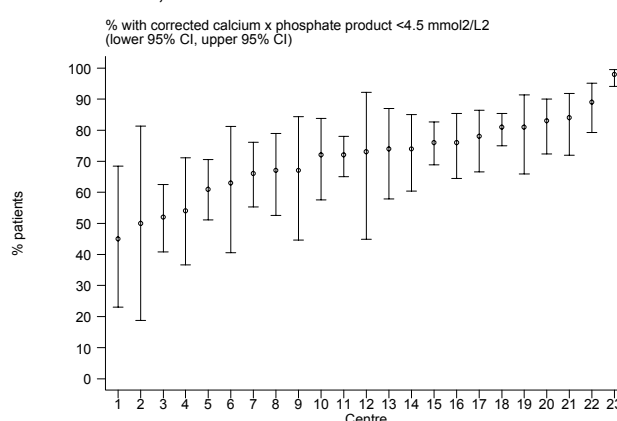


Table 10.2.12(b): Proportion of patients with corrected calcium x phosphate $< 4.5 \text{ mmol}^2/\text{L}^2$, CAPD centres

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1998	9	66	66	71	73	79	91	91
1999	9	59	59	65	72	74	79	79
2000	11	64	64	70	73	81	85	85
2001	12	50	50	71.5	75	81.5	84	84
2002	15	47	47	65	78	82	88	88
2003	19	61	61	64	75	86	100	100
2004	19	57	57	66	72	79	90	90
2005	20	55	55	65.5	73.5	78	84.5	85
2006	22	50	57	67	72	80	88	96
2007	23	45	50	63	73	81	89	98

SECTION 10.3: SERUM PARATHYROID HORMONE CONTROL

Among the HD patients, the mean intact parathyroid hormone (iPTH) level was 246.1 ng/ml while the median was 105 ng/ml. (Table and Fig 10.3.1a) Among the CAPD patients, the mean iPTH level was 248.4 ng/ml while the median was 152.5 ng/ml. (Table and Fig 10.3.2a). The percentage of patients with iPTH less than 150 ng/ml among HD patients had decreased to 58% in 2007 compared to 61% in 2006. The percentage of patients with iPTH less than 150 ng/ml among CAPD patients had also decreased to 52% in 2007 compared to 54% in 2006.

In 2007, the diabetic HD patients had a mean iPTH level of 184.4 ng/ml while the median was 71,2 ng/ml. (Table and Fig 10.3.1b). In the non-diabetic HD patients, both the mean and median iPTH levels (289.8 ng/ml and 136 ng/ml respectively) were higher than a diabetic HD patient. (Table and Fig 10.3.1c)

The same trend was also noted in CAPD patients. In 2007, the diabetic CAPD patients had a mean iPTH level of 176.1 ng/ml while the median was 113 ng/ml. (Table and Fig 10.3.2b). In the non-diabetic CAPD patients, both the mean and median iPTH levels (295.9 ng/ml and 197 ng/ml respectively) were higher than diabetic CAPD patients. (Table and Fig 10.3.2c)

Table 10.3.1(a): Distribution of iPTH, HD patients, 2007

Year	No. of Subjects	Mean	SD	Median	LQ	UQ	Percent patients with iPTH:			
							<150 ng/ml	≥150 & ≤300 ng/ml	>300 & ≤500 ng/ml	>500 ng/ml
1998	938	126.1	202	44	15	141	76	12	6	6
1999	1533	185.6	260.7	78.9	23.5	240	64	16	10	10
2000	2244	149.3	230	58	17.6	178.3	72	13	8	7
2001	2760	141.2	219.5	57	18	164.8	73	15	6	7
2002	3391	161.6	248	64	19	191	70	14	8	8
2003	4067	219.1	328.8	79	24.3	263.5	64	14	9	14
2004	4747	212.1	325.6	74.3	22.6	257.5	65	13	10	13
2005	5826	221.6	312.5	83.8	26.5	297	61	14	11	14
2006	7744	219.1	307.2	88	29	292	61	14	11	13
2007	9135	246.1	332.8	105	30.5	336	58	15	12	16

Figure 10.3.1(a): Cumulative distribution of iPTH, HD, 1998- 2007

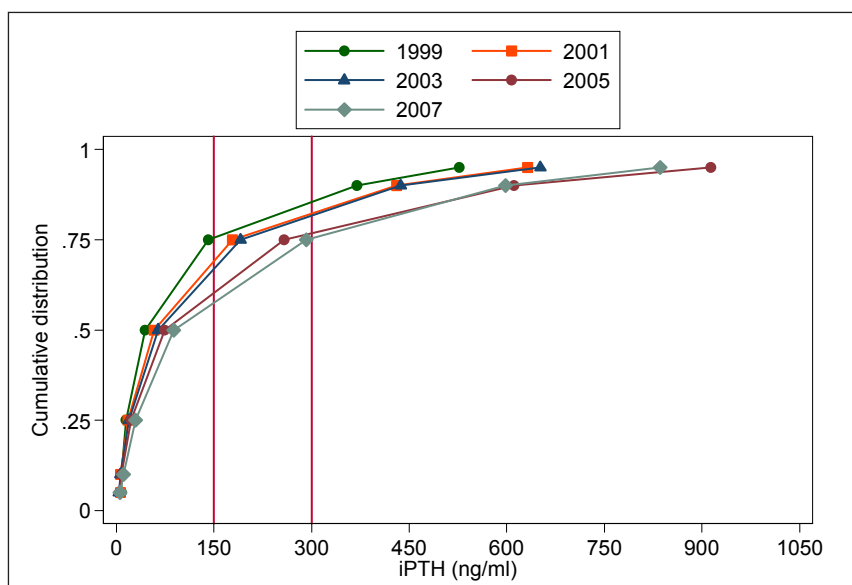


Table 10.3.1(b): Distribution of iPTH, diabetic HD patients, 1998- 2007

Year	No. of Subjects	Mean	SD	Median	LQ	UQ	Percent patients with iPTH:			
							<150 ng/ml	≥150 & ≤300 ng/ml	≥300 & ≤500 ng/ml	>500 ng/ml
1998	185	82.6	137.2	24	11	83	84	9	5	2
1999	336	121.5	181.8	53.5	16	145.8	75	14	6	5
2000	531	87.4	137.1	35.6	10.6	101	83	9	6	2
2001	720	82.5	139.6	32	10.9	89.5	83	11	3	2
2002	967	92.5	161.5	35	11	99	83	10	4	3
2003	1249	122.1	210.8	40.5	13.5	124.5	78	10	6	6
2004	1580	113.5	196.4	38	14	118	80	10	5	5
2005	2160	150.7	248	47.5	16.4	171	72	12	8	8
2006	3141	154.8	252.3	54.4	20.8	173	72	12	8	7
2007	3789	184.4	269.5	71.2	23	237.8	65	14	10	10

Figure 10.3.1(b): Cumulative distribution of iPTH, diabetic HD patients, 1998- 2007

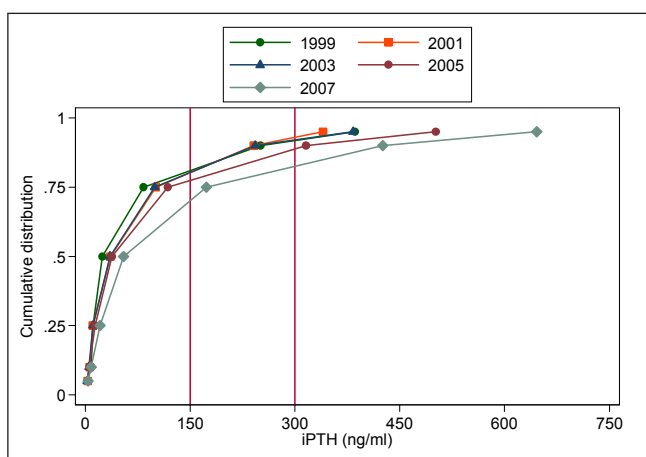


Figure 10.3.1(c): Cumulative distribution of iPTH, non diabetic HD patients, 1998- 2007

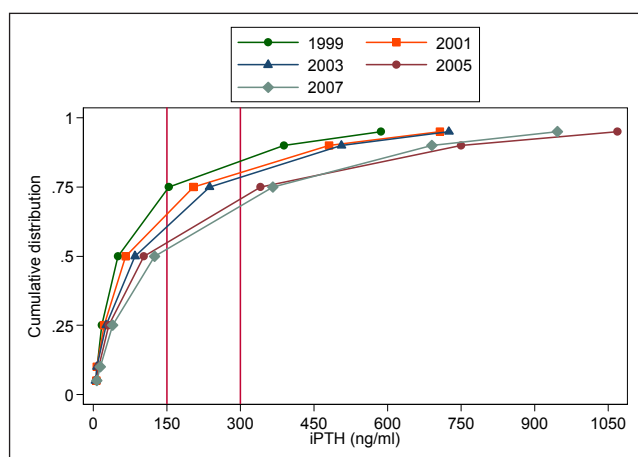


Table 10.3.1(c): Distribution of iPTH, non diabetic HD patients, 1997- 2007

Year	No. of Subjects	Mean	SD	Median	LQ	UQ	Percent patients with iPTH:			
							<150 ng/ml	≥150 & ≤300 ng/ml	>300 & ≤500 ng/ml	>500 ng/ml
1998	753	136.8	213.7	50	17	154	74	12	7	7
1999	1197	203.6	276.3	93.2	26.5	267.2	61	17	11	11
2000	1713	168.5	248.8	65.7	21.8	204	69	14	9	9
2001	2040	162	238.1	71	23.5	198	69	16	7	8
2002	2424	189.2	270.2	85	26	236.8	65	15	10	10
2003	2818	262.1	361	108.8	33.7	331	57	16	10	17
2004	3167	261.4	363.9	102.8	31.1	341	58	14	12	17
2005	3666	263.4	338.1	115	36	365	55	15	13	17
2006	4603	263.1	332.6	124.9	39.6	365.8	54	16	13	17
2007	5346	289.8	365	136	39.1	406	52	15	13	20

Table 10.3.2(a): Distribution of iPTH, CAPD patients, 1998- 2007

Year	No. of Subjects	Mean	SD	Median	LQ	UQ	Percent patients with iPTH:			
							<150 ng/ml	≥150 & ≤300 ng/ml	>300 & ≤500 ng/ml	>500 ng/ml
1998	280	93.7	117.4	47.5	18.5	126	81	13	5	1
1999	365	132.8	176.4	61.5	21	179.3	71	15	10	4
2000	406	109.8	192.4	46.8	15.5	118	80	12	5	4
2001	531	108	155.8	51.5	13.5	137.6	76	15	6	3
2002	681	160.6	219.1	82	26	196	67	17	8	7
2003	938	230.3	340.3	95	37.4	260	61	18	9	12
2004	1115	216.4	302.9	105	39.5	260	60	19	10	11
2005	1071	247.1	306.4	125.3	39	352	54	18	13	15
2006	1265	224.6	271.9	128	41.5	318	54	20	14	12
2007	1436	248.4	297.1	152.5	51	332.8	50	22	15	14

Figure 10.3.2(a): Cumulative distribution of iPTH, CAPD patients, 1998- 2007

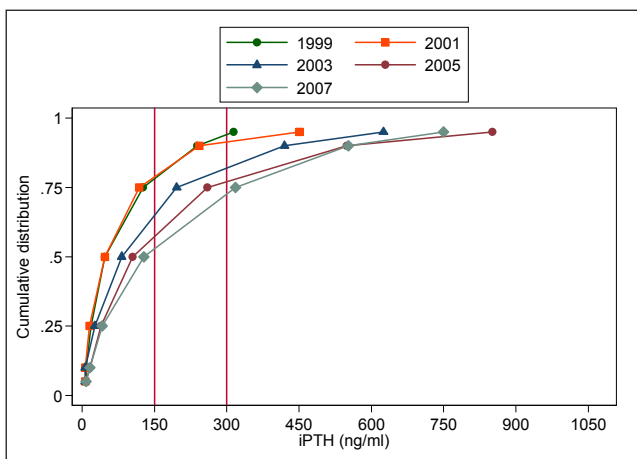


Figure 10.3.2(b): Cumulative distribution of iPTH, diabetic CAPD patients, 1998- 2007

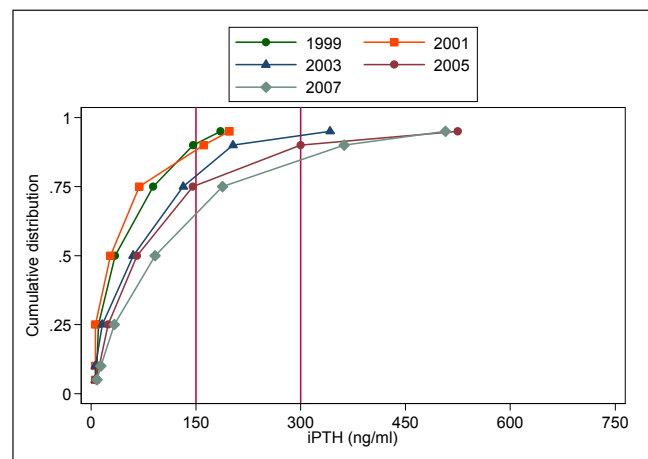


Table 10.3.2(b): Distribution of iPTH, diabetic CAPD patients, 1998-2007

Year	No. of Subjects	Mean	SD	Median	LQ	UQ	Percent patients with iPTH:			
							<150 ng/ml	≥150 & ≤300 ng/ml	>300 & ≤500 ng/ml	>500 ng/ml
1998	84	59.2	68.4	34.3	10.3	88.5	90	7	2	0
1999	100	95.8	145.2	41	17	111.6	81	11	5	3
2000	114	66.2	174.5	27.7	6	69	89	9	2	1
2001	165	65.7	87.6	33.5	7.5	82.5	87	10	2	1
2002	205	101.1	155.5	60	16	132	80	14	3	2
2003	325	121.7	173.9	68	29	154	74	16	6	3
2004	379	130.6	191.5	65.5	24.2	145.5	75	15	4	6
2005	367	159.4	235.6	69.2	23.9	190.5	70	16	7	7
2006	462	151.7	198	91.5	33	187.8	67	19	8	5
2007	569	176.1	202.6	113	42	238	58	25	11	6

Table 10.3.2(c): Distribution of iPTH, non diabetic CAPD patients, 1998- 2007

Year	No. of Subjects	Mean	SD	Median	LQ	UQ	Percent patients with iPTH:			
							<150 ng/ml	≥150 & ≤300 ng/ml	>300 & ≤500 ng/ml	>500 ng/ml
1998	196	108.5	130.3	57.5	22.3	139.3	77	16	6	2
1999	265	146.8	185.2	75	22.5	194	67	16	12	5
2000	292	126.7	196.6	57.3	22.7	139	76	13	6	5
2001	366	127.1	175	67	16.7	168	72	17	7	4
2002	476	186.2	237	98.5	32.3	242	62	19	10	10
2003	613	287.9	389.4	128	50	339	54	18	10	17
2004	736	260.6	338.3	140.3	50	327.8	52	21	12	14
2005	704	292.8	328.4	175	48.2	420	46	19	16	19
2006	803	266.5	298.6	167	50	390	47	21	16	16
2007	867	295.9	337.1	197	57.5	409	44	20	18	18

Figure 10.3.2(c): Cumulative distribution of iPTH, non diabetic CAPD patients, 1998- 2007

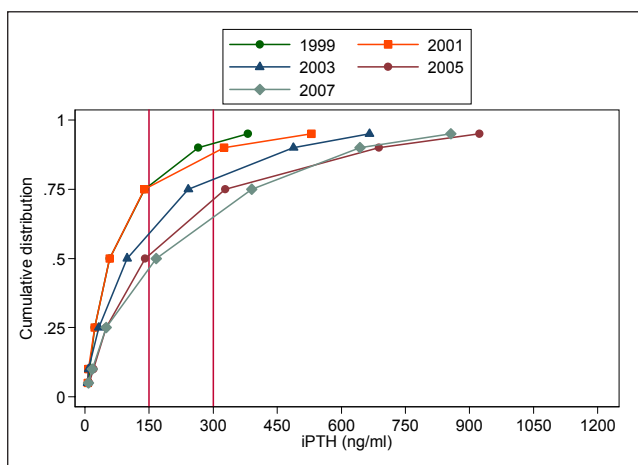


Figure 10.3.3(a): Variation in median iPTH among HD patients, HD centres 2007

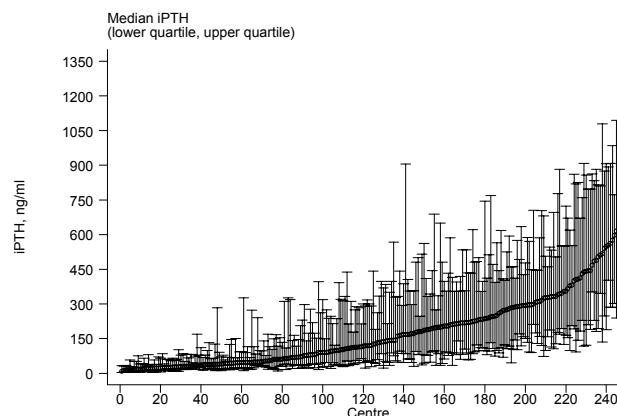


Table 10.3.3: Variation in iPTH among HD centres 2007
(a) Median iPTH among HD patients

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1998	31	8	13.1	24	45	107	196.6	221
1999	39	10	17	40.3	77	151	302	396
2000	59	5.6	15.4	30	48.5	94.1	349.8	493
2001	69	7.3	10.4	27.6	56	93	240	550
2002	90	2.9	11.6	27.9	49.7	131	309	660.3
2003	114	4	9.6	37.2	93	210	427	1106
2004	134	3.6	12.4	30.5	77.3	203.5	393.5	702
2005	165	5.8	15.7	37	95	231	366.4	612.3
2006	219	7.7	16.6	41.1	88.8	208.7	377	704.8
2007	245	8.7	20	46.3	119.1	244.7	467.5	615

With regards to the proportion of patients with serum iPTH level 150-300 ng/ml, the median was only 15% for HD centres (Table & Fig 10.3.3b) and 20.5% for CAPD centres (Table & Fig 10.3.4b). There was again a great variation between the HD centres with regards to the proportion of patients with serum iPTH level 150-300 ng/ml,, ranging from 0% to 53%.(Table 10.3.3b) Among the CAPD centres, the proportion of patients with serum iPTH level 150-300 ng/ml, ranged from 0% to 45%. (Table 10.3.4 b)

Table 10.3.3(b): Variation in proportion of patients with iPTH 150-300ng/ml, HD centres, 2007

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1998	31	0	0	5	8	18	26	31
1999	39	0	0	9	16	23	37	38
2000	59	0	0	5	10	15	33	45
2001	69	0	0	6	10	20	31	40
2002	90	0	0	2	10	22	33	45
2003	114	0	0	7	14	22	38	43
2004	134	0	0	5	11	20	36	50
2005	165	0	0	7	13	19	34	50
2006	219	0	0	7	14	20	31	47
2007	245	0	0	8	15	21	31	53

Figure 10.3.3(b): Variation in proportion of patients with iPTH 150-300ng/ml, HD centres, 2007

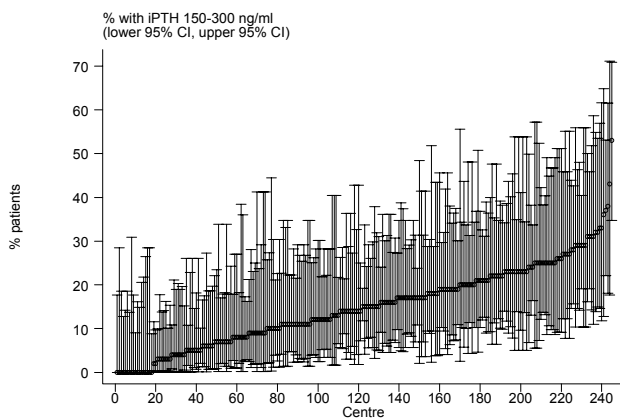


Figure 10.3.4(a): Variation in median iPTH among CAPD patients, CAPD centres, 2007

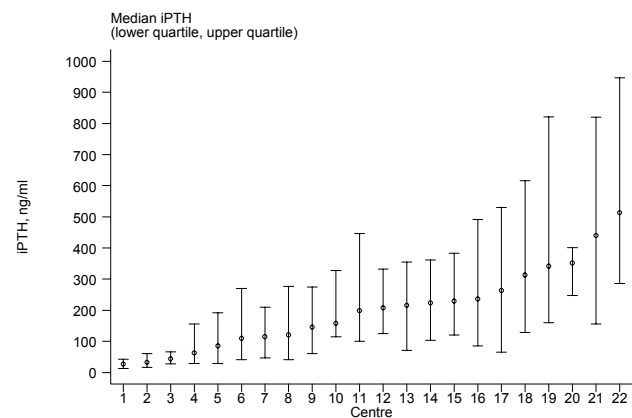


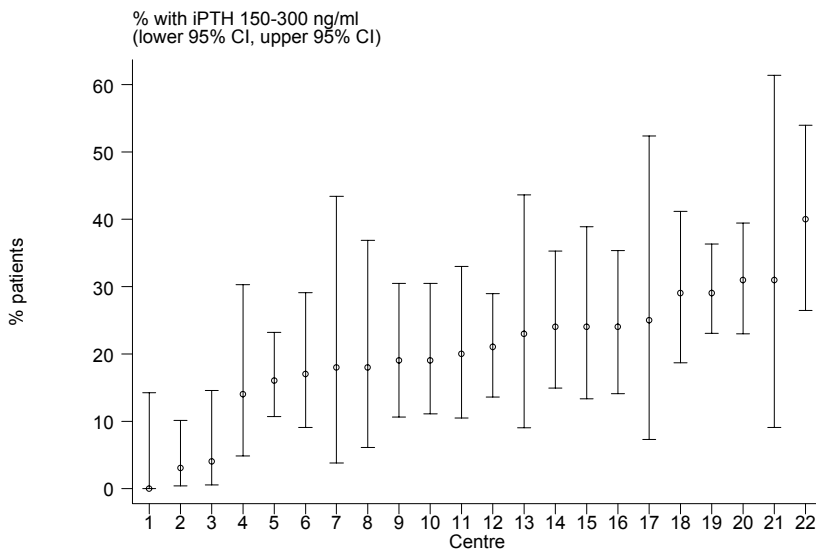
Table 10.3.4: Variation in iPTH among CAPD centres, 2007
(a) Median iPTH among CAPD patients

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1998	5	16	16	57.5	59.5	66.3	74	74
1999	8	16.5	16.5	49.9	75.1	87.5	263.9	263.9
2000	9	16	16	33	46.5	60.8	122	122
2001	11	15.4	15.4	42.5	59.5	91	274	274
2002	14	27.3	27.3	50	82.9	107	280.5	280.5
2003	17	22.3	22.3	70	134	175	393	393
2004	18	41.5	41.5	74.5	138.8	169.3	303.8	303.8
2005	19	25	25	88	179.1	321.5	496.9	496.9
2006	21	34.5	36.9	101	177.5	233	386	411
2007	22	26.3	32	108.8	203.3	263.3	440	513.9

Table 10.3.4(b): Proportion of patients with iPTH 150-300ng/ml, CAPD centres, 2007

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1998	5	0	0	9	15	17	27	27
1999	8	6	6	7	12	21.5	26	26
2000	9	0	0	5	12	17	18	18
2001	11	0	0	9	14	18	30	30
2002	14	0	0	10	15.5	21	24	24
2003	17	2	2	11	18	22	33	33
2004	18	7	7	14	20	25	32	32
2005	19	0	0	11	18	23	31	31
2006	21	5	6	14	20	25	32	42
2007	22	0	3	17	20.5	25	31	40

Figure 10.3.4(b): Variation in proportion of patients with iPTH 150-300ng/ml, CAPD centres 2007



Conclusion

In 2007, there was no major change in the type of phosphate binders used in both HD and CAPD patients. The majority of patients still received calcium carbonate as phosphate binders. Although the numbers were still small, there was a gradual increase in the number of patients receiving lanthanum as phosphate binders. The number of patients on aluminium hydroxide is still on a decreasing trend.

The percentage of HD and CAPD patients on calcitriol was also increasing. The number of patients on newer Vitamin D analogues was still small but showed an increasing trend.

There was an increasing trend in the number of patients who underwent parathyroidectomy for the past three years. This may be due to the availability of the service of endocrine surgeons in more hospitals in Malaysia and also a better awareness and understanding of the morbidity of second hyperparathyroidism.

The mean corrected serum calcium remained lower in the HD patients (2.2 mmol/l) compared to CAPD patients (2.4 mmol/l). Phosphate control continued to be better in CAPD patients. The proportion of CAPD patients achieving target serum phosphate 1.13-1.78 mmol/l was 55% compared to 47% of HD patients. However, the phosphate control in HD patients shows improving trend since 1998. More CAPD patients (76%) achieved the target serum calcium product of less than 4.5 mmol²/L² compared with HD patients (71%).

The mean iPTH level among HD patients had increased from 219.1 ng/ml in year 2006 to 246.1 ng/ml in year 2007. The mean iPTH level among CAPD patients had also increased from 224.6 ng/ml in year 2006 to 248.4 ng/ml in year 2007. The percentage of patients achieving target iPTH of 150-300 ng/ml remained low. Diabetic patients consistently had lower mean and median iPTH level compared with non-diabetic patients in both HD and CAPD patients.

There was consistently wide variation among HD and CAPD centres achieving targets reflecting the differences in management of renal bone disease in different centres.