

## **CHAPTER 9**

# **Management of Renal Bone Disease in Dialysis Patients**

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**SECTION 9.1: TREATMENT OF RENAL BONE DISEASE**

In 2006, no major changes were found in the treatment of renal bone disease. Majority of HD patients (92%) and CAPD patients (84%) received calcium carbonate as phosphate binder. From 1997 to 2006, calcium carbonate remained as the main phosphate binder used in both HD and CAPD patients. The percentage of patients on aluminium phosphate binders remained low in both groups of patients. The percentage of patients on Vitamin D therapy was increasing in HD patients since 2001. The number of parathyroidectomies done in 2006 was 151 compared to 43 in 2005. The data regarding parathyroidectomies prior to 2005 is not available. (tables 9.1.1 & 9.1.2)

**Table 9.1.1:** Treatment for Renal Bone Disease, HD patients 1997-2006

Year	No. of subjects	No. of subjects on CaCO <sub>3</sub>	% on CaCO <sub>3</sub>	No. of subjects on Al(OH) <sub>3</sub>	% on Al(OH) <sub>3</sub>	No. of subjects on Vitamin D	% on Vitamin D	No. of subjects with parathyroid ectomy	% with parathyroid ectomy
1997	1695	1543	91	417	25	694	41	NA	NA
1998	2141	1956	91	343	16	652	30	NA	NA
1999	2996	2693	90	244	8	770	26	NA	NA
2000	4392	3977	91	239	5	1084	25	NA	NA
2001	5194	4810	93	145	3	1145	22	NA	NA
2002	6108	5536	91	171	3	1375	23	NA	NA
2003	7018	6425	92	118	2	1690	24	NA	NA
2004	8164	7408	91	106	1	2029	25	NA	NA
2005	9351	8568	92	98	1	2555	27	43	0
2006	11497	10600	92	69	1	3712	32	151	1

NA = not available

**Table 9.1.2:** Treatment for Renal Bone Disease, CAPD patients 1997-2006

Year	No. of subjects	No. of subjects on CaCO <sub>3</sub>	% on CaCO <sub>3</sub>	No. of subjects on Al(OH) <sub>3</sub>	% on Al(OH) <sub>3</sub>	No. of subjects on Vitamin D	% on Vitamin D	No. of subjects with parathyroid ectomy done	% with parathyroid ectomy done
1997	476	393	83	57	12	114	24	NA	NA
1998	541	425	79	46	9	110	20	NA	NA
1999	610	450	74	36	6	75	12	NA	NA
2000	662	522	79	15	2	96	15	NA	NA
2001	781	588	75	5	1	84	11	NA	NA
2002	891	713	80	6	1	130	15	NA	NA
2003	1231	1039	84	10	1	238	19	NA	NA
2004	1327	1124	85	18	1	304	23	NA	NA
2005	1398	1186	85	13	1	314	22	4	0
2006	1550	1321	85	7	0	375	24	15	1

NA = not available

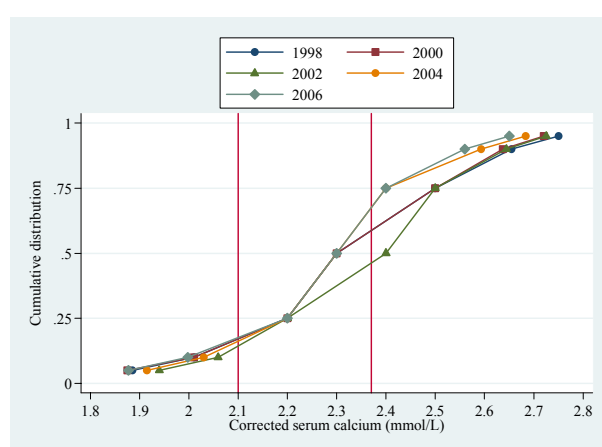
## SECTION 9.2: SERUM CALCIUM AND PHOSPHATE CONTROL

The median corrected serum calcium level remained at 2.3 mmol/l in HD patients (table 9.2.1 & fig. 9.2.1) and 2.4 mmol/l in CAPD patients (table 9.2.2 & fig 9.2.2). In 2006, 50% of patients on HD and 38% of CAPD patients had achieved the target serum calcium level of 2.1 to 2.37 mmol/l as advocated by K/DOQI guidelines.

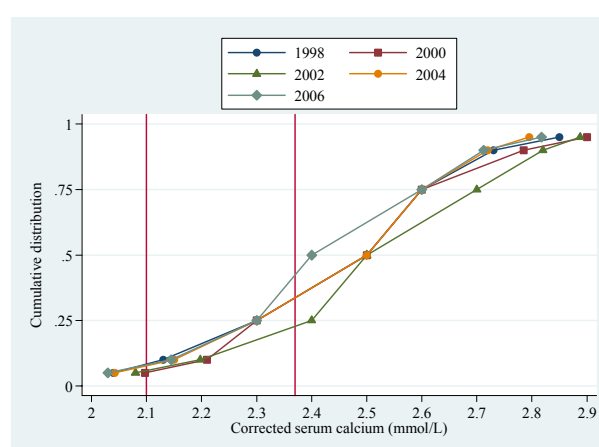
**Table 9.2.1:** Distribution of corrected Serum Calcium, HD patients 1997-2006

Year	No. of Subjects	Mean	SD	Median	LQ	UQ	% patients $\geq 2.1$ & $\leq 2.37$ mmol/L
1997	1633	2.3	0.3	2.3	2.2	2.5	40
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	6466	2.3	0.2	2.3	2.2	2.4	46
2004	7536	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	10717	2.3	0.2	2.3	2.1	2.4	50

**Figure 9.2.1:** Cumulative distribution of corrected Serum Calcium, HD patients 1997-2006



**Figure 9.2.2:** Cumulative distribution of corrected Serum Calcium, CAPD patients 1997-2006



**Table 9.2.2:** Distribution of corrected Serum Calcium, CAPD patients 1997-2006

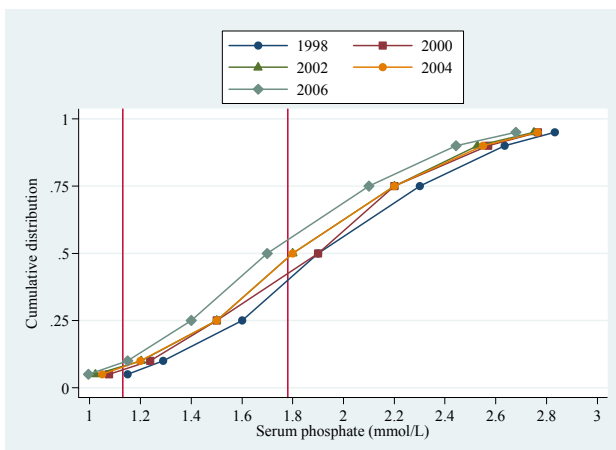
Year	No. of Subjects	Mean	SD	Median	LQ	UQ	% patients $\geq 2.1$ & $\leq 2.37$ mmol/L
1997	469	2.5	0.3	2.5	2.3	2.6	25
1998	535	2.4	0.3	2.4	2.3	2.6	30
1999	593	2.5	0.2	2.5	2.3	2.6	25
2000	635	2.5	0.2	2.5	2.3	2.6	25
2001	744	2.5	0.3	2.5	2.4	2.7	22
2002	859	2.5	0.2	2.5	2.3	2.6	24
2003	1167	2.4	0.2	2.5	2.3	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	1494	2.4	0.2	2.4	2.3	2.5	38

The median serum phosphate levels were higher among HD patients (1.7 mmol/l) compared to CAPD patients (1.6 mmol/l). (tables and figs 9.2.3 & 9.2.4). In 2006, 46 % of patients on HD and 54% of CAPD patients had achieved the target serum phosphate of 1.13 to 1.78 mmol/l as advocated by K/DOQI guidelines.

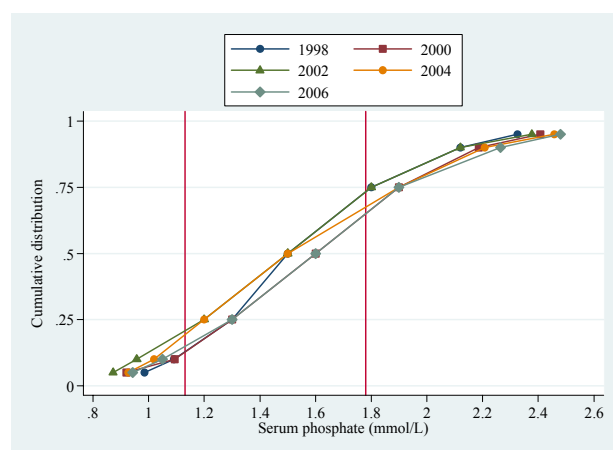
**Table 9.2.3:** Distribution of Serum Phosphate, HD patients 1997-2006

Year	No of Subjects	Mean	SD	Median	LQ	UQ	% patients <1.13 mmol/L	% patients ≥1.13 & <1.78 mmol/L	% patients ≥1.78 & ≤2.6 mmol/L	% patients > 2.6 mmol/L
1997	1649	1.9	0.5	1.9	1.6	2.3	5	37	48	11
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	6588	1.8	0.5	1.8	1.5	2.2	7	41	43	9
2004	7620	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	10963	1.8	0.5	1.7	1.4	2.1	9	46	39	6

**Figure 9.2.3:** Cumulative distribution of Serum Phosphate, HD patients 1997-2006



**Figure 9.2.4:** Cumulative distribution of Serum Phosphate, CAPD patients 1997-2006



**Table 9.2.4:** Distribution of Serum Phosphate, CAPD patients 1997-2006

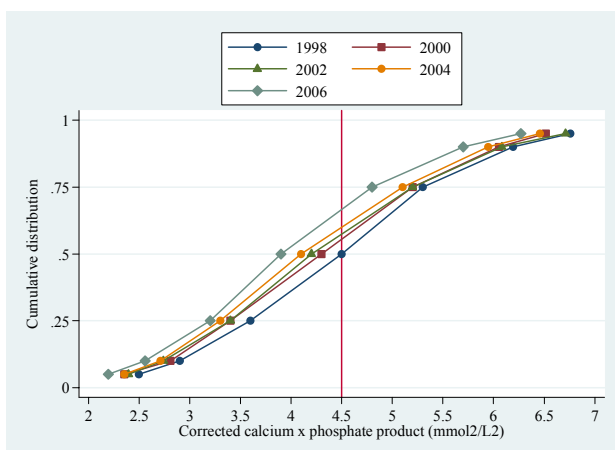
Year	No of Subjects	Mean	SD	Median	LQ	UQ	% patients <1.13 mmol/L	% patients ≥1.13 & <1.78 mmol/L	% patients ≥1.78 & ≤2.6 mmol/L	% patients > 2.6 mmol/L
1997	470	1.6	0.4	1.5	1.3	1.8	13	58	27	2
1998	537	1.6	0.5	1.6	1.3	1.9	12	55	30	3
1999	583	1.6	0.5	1.6	1.3	1.9	11	56	30	3
2000	633	1.5	0.5	1.5	1.3	1.8	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	1510	1.6	0.5	1.6	1.3	1.9	13	54	29	4

The median corrected calcium phosphate product had declined from 3.9 mmol<sup>2</sup>/L<sup>2</sup> in 2005 to 3.8 mmol<sup>2</sup>/L<sup>2</sup> in HD patients and remained at 3.7 mmol<sup>2</sup>/L<sup>2</sup> in CAPD patients. (tables and figs 9.2.5 & 9.2.6).

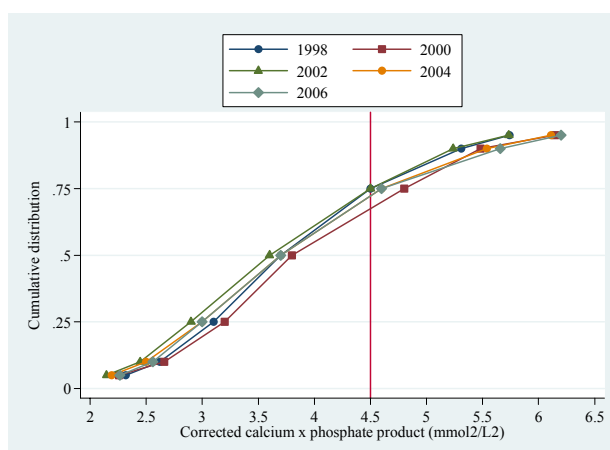
**Table 9.2.5:** Distribution of corrected calcium x phosphate product, HD patients 1997-2006

Year	No of Subjects	Mean	SD	Median	LQ	UQ	% patients <3.5 mmol <sup>2</sup> /L <sup>2</sup>	% patients ≥3.5 & <4 mmol <sup>2</sup> /L <sup>2</sup>	% patients ≥4 & <4.5 mmol <sup>2</sup> /L <sup>2</sup>	% patients ≥4.5 & <5 mmol <sup>2</sup> /L <sup>2</sup>	% patients ≥5 & <5.5 mmol <sup>2</sup> /L <sup>2</sup>	% patients ≥5.5 mmol <sup>2</sup> /L <sup>2</sup>
1997	1615	4.5	1.3	4.5	3.6	5.3	23	14	15	17	12	20
1998	2020	4.5	1.2	4.4	3.7	5.2	21	15	18	15	13	19
1999	2698	4.4	1.3	4.3	3.4	5.2	27	14	15	14	11	18
2000	3650	4.4	1.3	4.3	3.5	5.2	25	15	16	15	10	19
2001	4555	4.3	1.3	4.2	3.4	5.2	27	16	16	13	11	18
2002	5403	4.4	1.3	4.3	3.4	5.2	27	16	15	13	10	19
2003	6383	4.2	1.3	4.1	3.3	5.1	30	16	15	13	10	16
2004	7414	4.2	1.3	4.1	3.3	5	32	16	15	12	10	15
2005	8496	4	1.3	3.9	3.2	4.8	36	17	14	11	9	12
2006	10595	4	1.2	3.8	3.1	4.7	38	17	15	11	8	11

**Figure 9.2.5:** Cumulative distribution of corrected Calcium x Phosphate product, HD patients 1997-2006



**Figure 9.2.6:** Cumulative distribution of corrected Calcium x Phosphate product, CAPD patients 1997-2006



**Table 9.2.6:** Distribution of corrected calcium x phosphate product, CAPD patients 1997-2006

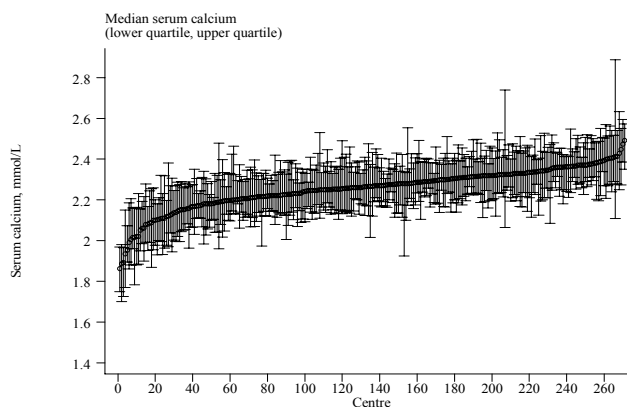
Year	No of Subjects	Mean	SD	Median	LQ	UQ	% patients <3.5 mmol <sup>2</sup> /L <sup>2</sup>	% patients ≥3.5 & <4 mmol <sup>2</sup> /L <sup>2</sup>	% patients ≥4 & <4.5 mmol <sup>2</sup> /L <sup>2</sup>	% patients ≥4.5 & <5 mmol <sup>2</sup> /L <sup>2</sup>	% patients ≥5 & <5.5 mmol <sup>2</sup> /L <sup>2</sup>	% patients ≥5.5 mmol <sup>2</sup> /L <sup>2</sup>
1997	468	3.9	1.1	3.7	3.1	4.5	40	20	15	10	6	7
1998	533	4	1.1	3.8	3.2	4.6	38	18	16	10	6	11
1999	580	4	1.2	3.8	3.2	4.8	36	20	13	12	9	10
2000	621	3.8	1.1	3.7	3.1	4.5	44	19	12	10	7	8
2001	723	3.8	1.1	3.6	2.9	4.5	46	18	12	10	8	7
2002	856	3.8	1.2	3.6	2.9	4.5	45	17	12	11	7	8
2003	1162	3.9	1.2	3.7	3	4.6	43	17	13	10	8	10
2004	1274	4	1.2	3.8	3	4.7	41	15	14	10	8	12
2005	1333	3.9	1.3	3.7	3	4.6	43	15	14	11	6	11
2006	1493	3.9	1.2	3.7	3.1	4.6	43	17	14	10	7	9

In 2006, the median corrected serum calcium level among HD patients from 271 centres ranged from 1.9 to 2.5 mmol/l. The median corrected serum calcium level among CAPD patients from 24 centres ranged from 2.2 to 2.6 mmol/l. (tables 9.2.7a & 9.2.8a).

**Table 9.2.7:** Variation in corrected serum calcium levels among HD centres, 2006  
(a) Median serum calcium level among HD patients

Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	44	2.1	2.2	2.3	2.3	2.4	2.5	2.5
1998	49	2	2.1	2.3	2.3	2.4	2.5	2.5
1999	69	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	139	1.9	2.1	2.2	2.3	2.4	2.5	2.6
2003	164	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	222	1.8	2	2.2	2.3	2.4	2.4	2.6
2006	271	1.9	2.1	2.2	2.3	2.3	2.4	2.5

**Figure 9.2.7(a):** Variation in median serum calcium level among HD patients, HD centres 2006

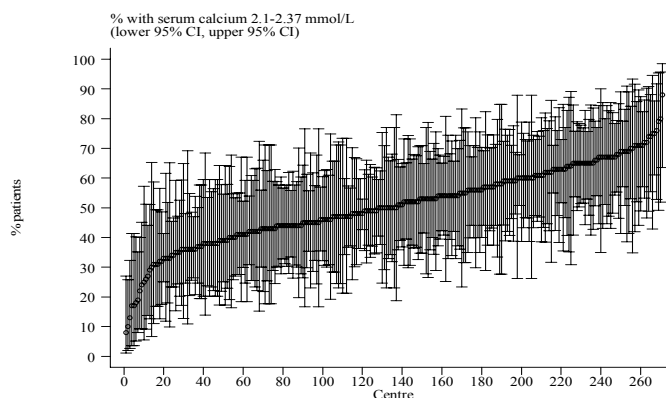


We reviewed the proportion of patients with serum calcium range 2.1 to 2.37 mmol/l. The median was 50% for HD centres (table 9.2.7b) and 47% for CAPD centres (table 9.2.8b) for year 2006. There is great variation between HD centres in the proportion of patients with serum calcium 2.1 to 2.37 mmol/l, ranging from 8% to 88%. The proportion of patients within a centre with serum calcium 2.1 to 2.37 mmol/l among CAPD centres ranges from 0% to 76%.

**Table 9.2.7(b)** Proportion of patients with serum calcium 2.1 to 2.37 mmol/L, HD centres

Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	44	6	15	29.5	42	46.5	63	70
1998	49	12	21	36	45	53	70	76
1999	69	0	10	25	39	46	63	80
2000	93	0	13	32	42	48	65	96
2001	116	0	12	29	40	50	64	85
2002	139	5	17	33	44	54	68	80
2003	164	13	24	36.5	46.5	55	68	83
2004	198	7	20	38	47	58	72	82
2005	222	0	18	37	49.5	57	70	80
2006	271	8	30	42	50	60	71	88

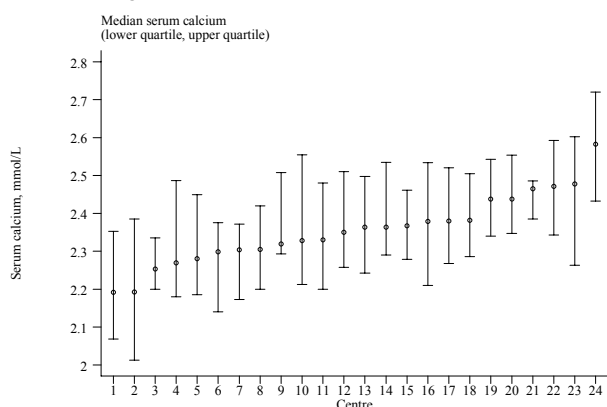
**Figure 9.2.7(b):** Variation in proportion of patients with serum calcium 2.1 to 2.37 mmol/L, HD centres 2006



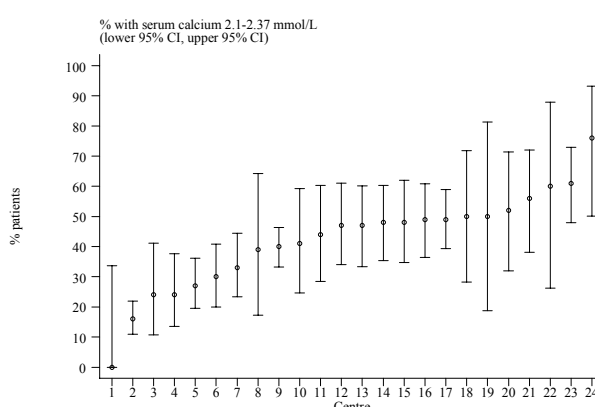
**Table 9.2.8:** Variation in corrected serum calcium levels among CAPD centres, 2006  
(a) Median serum calcium level among CAPD patients

Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	7	2.1	2.1	2.4	2.4	2.5	2.6	2.6
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	2.5	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	2.3	2.3	2.4	2.4	2.5	2.6	2.6
2004	19	2.3	2.3	2.4	2.4	2.5	2.5	2.5
2005	21	2.2	2.3	2.3	2.4	2.4	2.5	2.6
2006	24	2.2	2.2	2.3	2.4	2.4	2.5	2.6

**Figure 9.2.8(a):** Variation in median serum calcium level among CAPD patients, CAPD centres 2006



**Figure 9.2.8(b):** Variation in proportion of patients with serum calcium 2.1-2.37 mmol/L, CAPD centres 2006



(b) Proportion of patients with serum calcium 2.1 - 2.37 mmol/L, CAPD centres

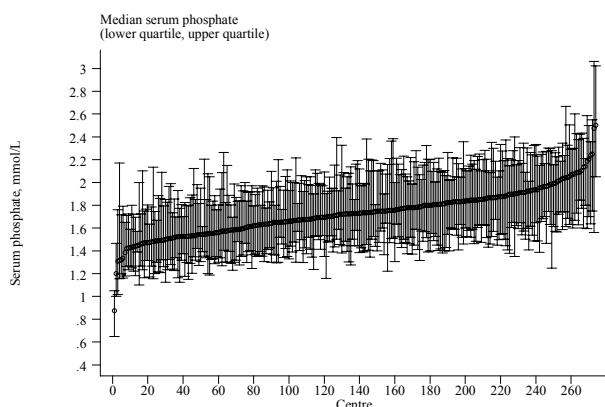
Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	7	10	10	18	26	29	53	53
1998	9	11	11	27	38	40	64	64
1999	10	5	5	21	28	31	42	42
2000	11	13	13	18	25	33	48	48
2001	12	11	11	18	23.5	36	38	38
2002	15	12	12	20	25	33	46	46
2003	19	10	10	19	35	40	64	64
2004	19	10	10	18	26	31	50	50
2005	21	16	18	24	33	40	45	51
2006	24	0	16	31.5	47	50	61	76

With regards to the proportion of patients with serum phosphate level 1.13-1.78 mmol/L, the CAPD centres have a higher median proportion of patients achieving this target (51.5%) compared with HD centres (46%) (tables 9.2.9a & 9.2.9b).

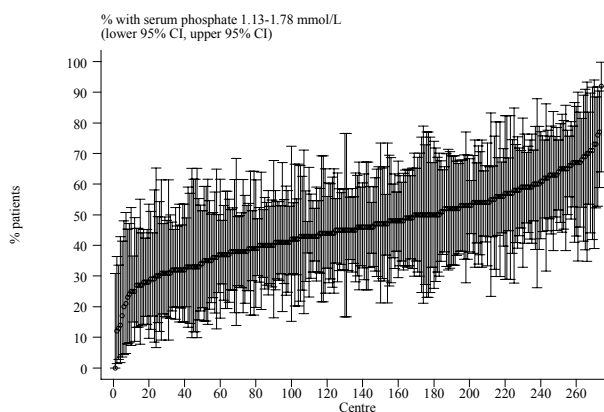
**Table 9.2.9:** Variation in serum phosphate levels among HD centres, 2006  
(a) Median serum phosphate level among HD patients

Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	44	1.3	1.5	1.7	1.9	2.1	2.3	2.8
1998	49	1.5	1.5	1.8	1.9	2.1	2.2	2.6
1999	70	1.1	1.6	1.8	1.9	2	2.1	2.1
2000	100	1.4	1.6	1.7	1.8	2	2.2	3.7
2001	116	1.3	1.5	1.7	1.8	1.9	2.1	2.3
2002	146	1.3	1.5	1.8	1.9	2	2.2	2.4
2003	172	0.9	1.5	1.7	1.8	1.9	2.2	2.4
2004	197	1.3	1.5	1.7	1.8	1.9	2.1	2.2
2005	227	0.8	1.4	1.6	1.7	1.9	2.1	2.3
2006	274	0.9	1.4	1.6	1.7	1.8	2.1	2.5

**Figure 9.2.9 (a):** Variation in median serum phosphate level among HD patients, HD centres 2006



**Figure 9.2.9(b):** Variation in proportion of patients with serum phosphate 1.13-1.78 mmol/L, HD centres 2006



(b) Proportion of patients with serum phosphate 1.13-1.78 mmol/L, HD centres 2006

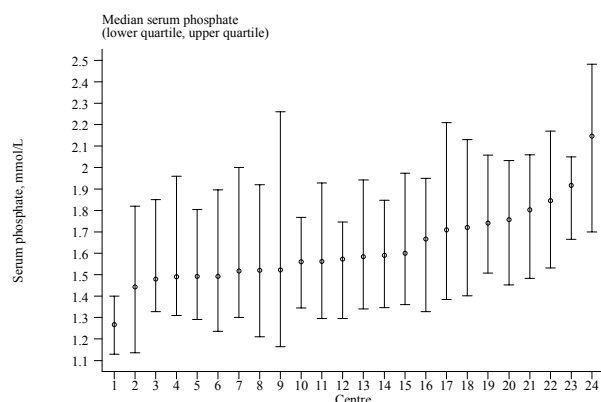
Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	44	7	18	27.5	37	44.5	59	68
1998	49	9	17	29	34	44	63	70
1999	70	8	17	27	35	44	57	63
2000	100	9	18.5	29.5	37	44	57.5	73
2001	116	0	21	33	38	47	61	70
2002	146	5	14	29	36	46	61	91
2003	172	8	19	31	40	48	64	93
2004	197	0	19	31	41	53	68	92
2005	227	10	24	35	44	53	67	77
2006	274	0	27	38	46	54	67	92



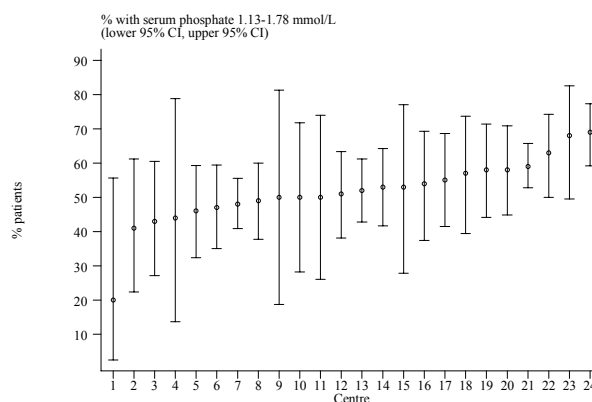
**Table 9.2.10:** Variation in serum phosphate levels among CAPD centres, 2006  
(a) Median serum phosphate level among CAPD patients

Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	7	1.4	1.4	1.5	1.5	1.6	1.7	1.7
1998	9	1.5	1.5	1.5	1.6	1.6	1.8	1.8
1999	9	1.5	1.5	1.6	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	2.1	2.1
2003	19	1.1	1.1	1.5	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	21	1.4	1.4	1.5	1.6	1.7	1.8	1.9
2006	24	1.3	1.4	1.5	1.6	1.7	1.9	2.1

**Figure 9.2.10(a):** Variation in median serum phosphate level among CAPD patients, CAPD centres 2006



**Figure 9.2.10(b):** Variation in proportion of patients with serum phosphate 1.13-1.78 mmol/L, CAPD centres 2006



(b) Proportion of patients with serum phosphate 1.13-1.78 mmol/L, CAPD centres 2006

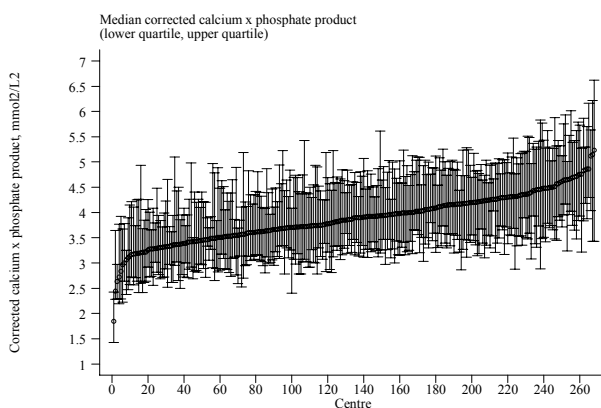
Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	7	53	53	54	58	66	76	76
1998	9	43	43	54	60	61	82	82
1999	9	45	45	51	58	65	68	68
2000	11	46	46	48	53	61	65	65
2001	12	40	40	48.5	54	58	79	79
2002	15	43	43	46	54	60	82	82
2003	19	36	36	47	54	60	81	81
2004	19	34	34	49	52	64	76	76
2005	21	40	43	46	52	58	64	76
2006	24	20	41	47.5	51.5	57.5	68	69

A higher number of CAPD centres have median calcium phosphate product of less than  $4.5 \text{ mmol}^2/\text{L}^2$  as compared to HD centres ( 71.5% versus 70%). There is an increasing trend among HD centres achieving a calcium phosphate product of less than  $4.5 \text{ mmol}^2/\text{L}^2$  and the difference between CAPD centres and HD centres is decreasing. (tables and figs 9.2.11 & 9.2.12)

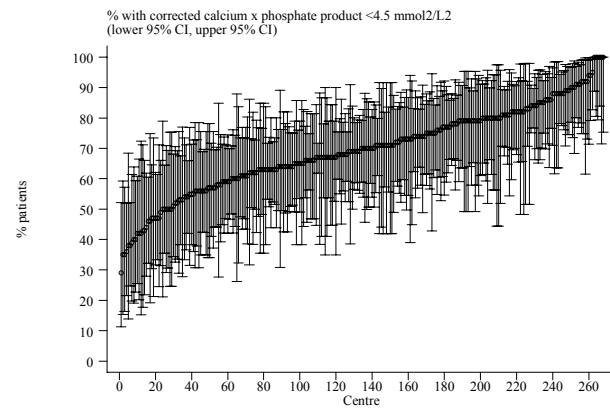
**Table 9.2.11:** Variation in corrected calcium x phosphate product among HD centres, 2006  
(a) Median corrected calcium x phosphate product among HD patients

Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	44	2.9	3.7	4.1	4.4	4.8	5.3	6.2
1998	49	3.2	3.3	4.1	4.5	4.7	5.3	5.3
1999	68	2.3	3.2	4.1	4.4	4.7	5.2	5.3
2000	91	3.1	3.7	4	4.3	4.6	5.1	6.2
2001	112	2.9	3.6	3.9	4.3	4.6	5	5.7
2002	139	2.9	3.6	3.9	4.2	4.6	5.2	6.2
2003	164	2.1	3.4	3.8	4.1	4.5	4.9	5.7
2004	195	2.9	3.3	3.8	4.1	4.4	5	5.5
2005	217	2.1	3.2	3.6	3.9	4.3	4.7	5.6
2006	268	1.8	3.2	3.5	3.9	4.2	4.7	5.2

**Figure 9.2.11(a):** Variation in median corrected calcium x phosphate product among HD patients, HD centres 2006



**Figure 9.2.11(b):** Variation in proportion of patients with corrected calcium x phosphate product <  $4.5 \text{ mmol}^2/\text{L}^2$ , HD centres 2006



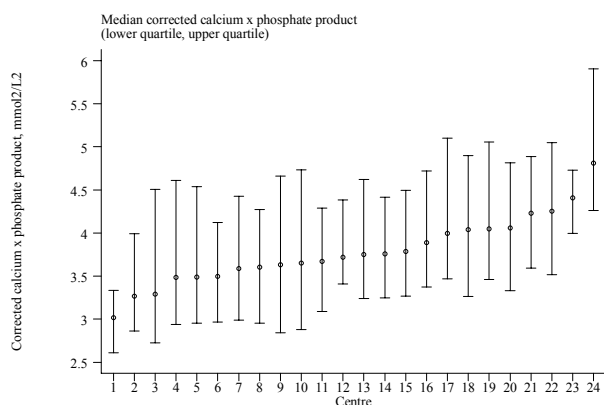
(b) Proportion of patients with corrected calcium x phosphate product <  $4.5 \text{ mmol}^2/\text{L}^2$

Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	44	15	26	38.5	51.5	66	77	100
1998	49	20	30	40	52	65	83	91
1999	68	20	30	47	55	64	90	95
2000	91	12	33	47	57	67	80	88
2001	112	18	38	47	57	70.5	82	91
2002	139	14	33	48	57	69	89	100
2003	164	25	33	51.5	61.5	73	88	100
2004	195	17	36	53	64	74	91	100
2005	217	23	43	58	69	77	90	100
2006	268	29	43	61	70	80	91	100

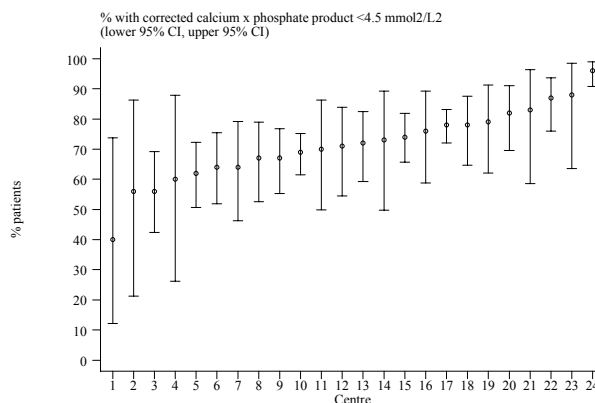
**Table 9.2.12:** Variation in corrected calcium x phosphate product among CAPD centres, 2006  
(a) Median corrected calcium x phosphate product among CAPD patients

Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	7	3.5	3.5	3.6	3.7	3.8	3.9	3.9
1998	9	3.4	3.4	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	3.8	4.3	4.3
2002	15	3.3	3.3	3.4	3.7	4	4.9	4.9
2003	19	2.7	2.7	3.4	3.7	4	4.1	4.1
2004	19	3.2	3.2	3.5	3.8	4	4.4	4.4
2005	21	3.3	3.4	3.6	3.7	4.1	4.3	4.4
2006	24	3	3.3	3.5	3.7	4	4.4	4.8

**Figure 9.2.12(a):** Variation in median corrected calcium x phosphate product among CAPD patients, CAPD centres 2006



**Figure 9.2.12(b):** Variation in proportion of patients with corrected calcium x phosphate product < 4.5 mmol²/L², CAPD centres 2006



**Table 9.2.12(b)** Proportion of patients with corrected calcium x phosphate product < 4.5 mmol²/L²

Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	7	70	70	74	78	82	94	94
1998	9	66	66	71	73	79	91	91
1999	9	59	59	65	72	74	80	80
2000	11	65	65	70	73	81	85	85
2001	12	50	50	71.5	75	80.5	84	84
2002	15	43	43	65	78	83	88	88
2003	19	61	61	64	75	81	100	100
2004	19	57	57	67	72	79	91	91
2005	21	54	56	63	74	77	85	85
2006	24	40	56	64	71.5	78.5	88	96

**SECTION 9.3: SERUM iPTH**

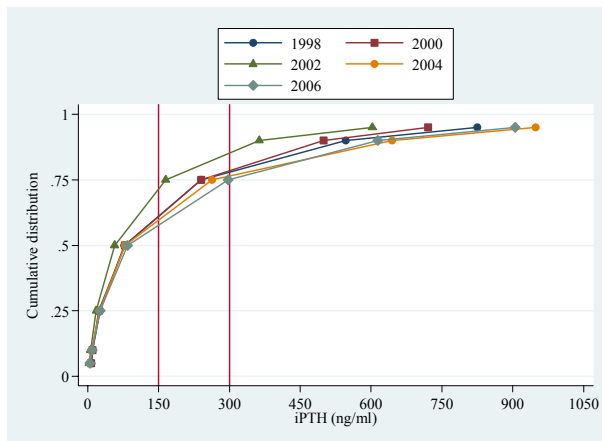
Among patients on HD, the mean iPTH was 220.3 ng/ml while the median was 94.5 ng/ml. Among patients on CAPD, the mean iPTH was 224.57 ng/ml while the median iPTH was 188.9 ng/ml.(table 9.3.1, 9.3.2, 9.3.3, 9.3.4). The majority of patients (61% of HD patients, 54% of CAPD patients) have iPTH level < 150 ng/ml.

Tables and figures 9.3.1 and 9.3.2 (b) and (c) show that diabetics have consistently lower iPTH values than non diabetics.

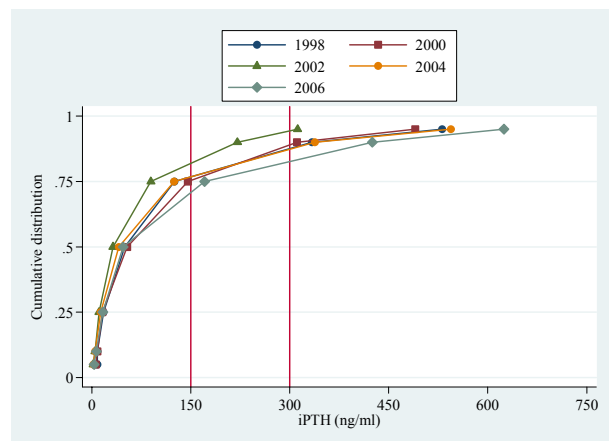
**Table 9.3.1(a):** Distribution of iPTH, HD patients 1997 - 2006

Year	No. of Subjects	Mean	SD	Median	LQ	UQ	% patients <150 ng/ml	% patients ≥150 & ≤300 ng/ml	% patients >300 & ≤500 ng/ml	% patients >500 ng/ml
1997	1088	195.1	282.9	76.8	26	240.3	66	13	9	11
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	4068	219.1	328.8	79	24.3	263.3	64	14	9	14
2004	4748	212.1	325.6	74.3	22.6	257.3	65	13	9	13
2005	5826	221.6	312.5	83.8	26.5	297	61	14	11	14
2006	7645	220.3	307.8	89	29.3	293.6	61	14	11	14

**Figure 9.3.1(a):** Cumulative distribution of iPTH, HD patients 1997-2006



**Figure 9.3.1(b):** Cumulative distribution of iPTH, diabetic HD patients 1997-2006



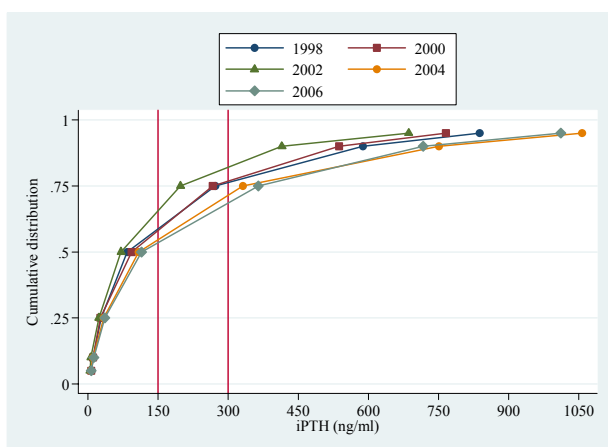
**Table 9.3.1(b)** Distribution of iPTH, diabetic HD patients 1997 - 2006

Year	No. of Subjects	Mean	SD	Median	LQ	UQ	% patients <150 ng/ml	% patients ≥150 & ≤300 ng/ml	% patients >300 & ≤500 ng/ml	% patients >500 ng/ml
1997	200	127.8	216.6	49.5	17.5	125	78	11	7	5
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	530	87.5	137.1	35.8	11	101	83	9	6	2
2001	720	82.5	139.6	32	10.9	89.5	83	11	3	2
2002	966	92.6	161.6	35	11	99	83	10	4	3
2003	1244	122.5	211.2	40.6	13.4	124.8	78	10	6	6
2004	1574	113.7	196.6	38	14	118	80	10	5	5
2005	2151	151.1	248.6	47.6	16.4	171	72	12	8	8
2006	3059	155.2	252.1	55	20.8	174.5	72	12	8	7

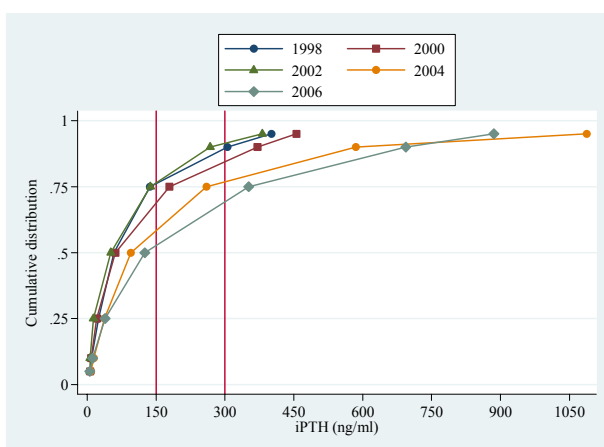
**Table 9.3.1(c)** Distribution of iPTH, non diabetic HD patients 1997 - 2006

Year	No. of Subjects	Mean	SD	Median	LQ	UQ	% patients <150 ng/ml	% patients ≥150 & ≤300 ng/ml	% patients >300 & ≤500 ng/ml	% patients >500 ng/ml
1997	888	210.2	293.8	83.8	28.3	272.5	63	14	10	13
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	1714	168.4	248.8	65.6	21.8	204	69	14	9	9
2001	2040	162	238.1	71	23.5	198	69	16	7	8
2002	2425	189.1	270.2	85	26	236	65	15	10	10
2003	2824	261.6	360.8	108	33.5	331	57	16	10	17
2004	3174	260.9	363.6	102.5	31	340.3	58	14	12	17
2005	3675	262.9	337.7	114.6	36	364.5	55	15	13	17
2006	4586	263.8	333	125.3	40	366	54	16	13	18

**Figure 9.3.1(c):** Cumulative distribution of iPTH, non diabetic HD patients 1997-2006



**Figure 9.3.2(a):** Cumulative distribution of iPTH, CAPD patients 1997-2006



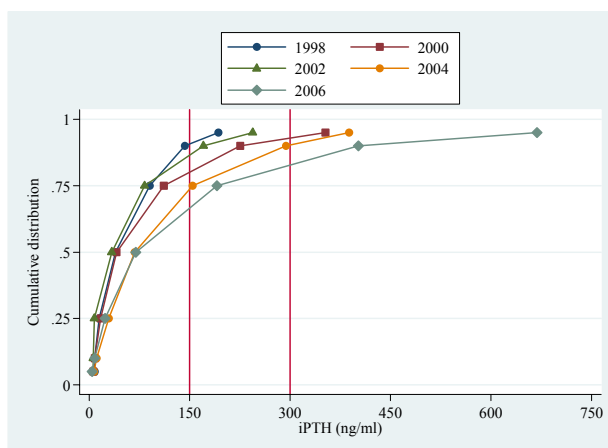
**Table 9.3.2(a):** Distribution of iPTH, CAPD patients 1997 – 2006

Year	No. of Subjects	Mean	SD	Median	LQ	UQ	% patients <150 ng/ml	% patients ≥150 & ≤300 ng/ml	% patients >300 & ≤500 ng/ml	% patients >500 ng/ml
1997	293	112.3	151	58	25	137	78	12	7	3
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	1264	224.7	271.9	128	41.5	318.5	54	20	14	12

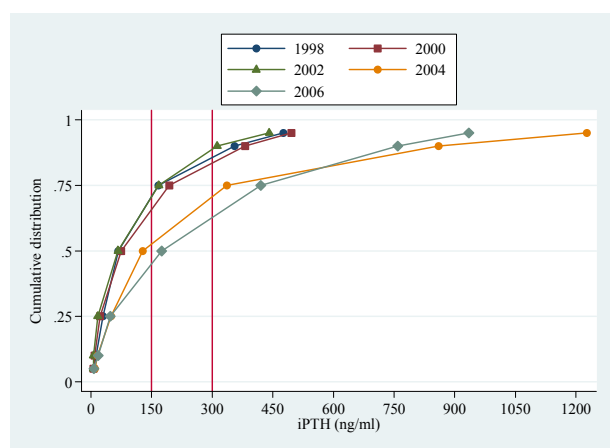
**Table 9.3.2(b)** Distribution of iPTH, diabetic CAPD patients 1997 - 2006

Year	No. of Subjects	Mean	SD	Median	LQ	UQ	% patients <150 ng/ml	% patients ≥150 & ≤300 ng/ml	% patients >300 & ≤500 ng/ml	% patients >500 ng/ml
1997	90	61.3	66.1	39	15	90.5	91	7	2	0
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	326	122.9	175	68	29	154.3	74	16	6	4
2004	380	131	191.4	65.5	24.4	148.3	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

**Figure 9.3.2(b):** Cumulative distribution of iPTH, diabetic CAPD patients 1997-2006



**Figure 9.3.2(c):** Cumulative distribution of iPTH, non diabetic CAPD patients 1997-2006



**Table 9.3.2(c)** Distribution of iPTH, non diabetic CAPD patients 1997 - 2006

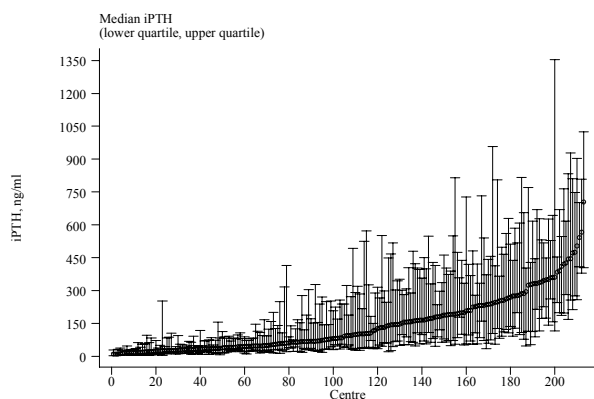
Year	No. of Subjects	Mean	SD	Median	LQ	UQ	% patients <150 ng/ml	% patients ≥150 & ≤300 ng/ml	% patients >300 & ≤500 ng/ml	% patients >500 ng/ml
1997	203	134.9	171.3	68	29.5	167	72	14	9	4
1998	196	108.5	130.3	57.5	22.3	139.3	77	16	6	2
1999	265	146.8	185.2	75	22.5	194	67	16	12	5
2000	292	126.7	196.6	57.3	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	612	287.6	389.6	128	50	336.5	54	18	10	17
2004	735	260.6	338.6	140	50	329	53	21	12	14
2005	704	292.8	328.4	175	48.2	420	46	19	16	19
2006	802	266.8	298.7	167.3	50	390	47	21	16	16

A higher number of CAPD centres had median iPTH 150-300 ng/ml as compared to HD centres (21.5% versus 14%). The proportion of patients with iPTH 150-300 ng/ml among HD centres ranged from 0%-33% while the proportion of patients with iPTH 150-300 ng/ml among CAPD centres ranged from 5% to 31% (Fig 9.3.3, 9.3.4)

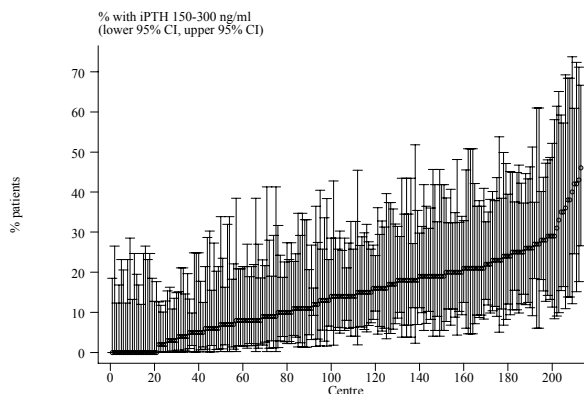
**Table 9.3.3:** Variation in iPTH among HD centres, 2006  
(a) Median iPTH among HD patients

Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	36	8	26	45.5	71.8	112.4	252.5	402.5
1998	30	8	13	24	45.5	105	196.6	221
1999	39	10	17	40.3	80.3	151	304.5	380
2000	59	5.6	15	31.5	48	86.7	352.5	481.8
2001	70	7.3	12.3	27.6	55	101.8	240	550
2002	93	2.9	13	28.4	54	145.5	319.3	466
2003	113	4	10.8	37	92.4	188.5	375.2	624.5
2004	135	3.6	13	29.8	76	223.5	412	854
2005	167	5.8	13.6	38	96	215.3	396.8	612.3
2006	213	9.3	16.8	40	94.5	206.2	410.5	704.5

**Figure 9.3.3(a):** Variation in iPTH among HD patients, HD centres 2006



**Figure 9.3.3(b):** Variation in proportion of patients with iPTH 150-300 ng/ml, HD centres 2006



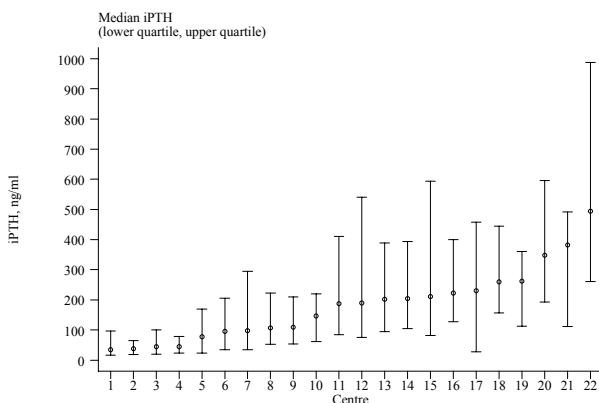
**Table 9.3.3(b)** Proportion of patients with iPTH 150-300 ng/ml

Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	36	0	0	8	11.5	17.5	29	29
1998	30	0	0	5	9.5	16	26	29
1999	39	0	0	9	16	23	36	38
2000	59	0	0	4	10	15	33	42
2001	70	0	0	6	10	21	35	40
2002	93	0	0	2	10	21	31	43
2003	113	0	0	7	14	21	38	45
2004	135	0	0	5	11	20	38	50
2005	167	0	0	6	13	20	33	50
2006	213	0	0	7	14	21	33	46

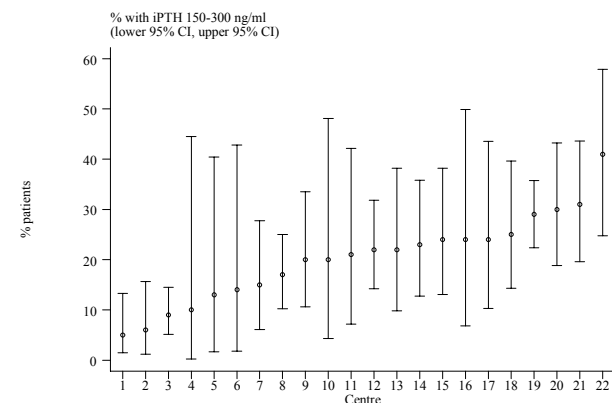
**Table 9.3.4:** Variation in iPTH among CAPD centres, 2006  
(a) Median iPTH among CAPD patients

Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	5	36.5	36.5	44.8	47	81	120	120
1998	5	16	16	57.5	66.3	68	73	73
1999	8	16.5	16.5	52.8	74.5	87.5	263.9	263.9
2000	9	16	16	33	43.3	60.8	122	122
2001	11	15.4	15.4	42.5	56.3	91	274	274
2002	14	27.3	27.3	50	81.1	107	319	319
2003	17	22.3	22.3	70	131	170.5	393	393
2004	18	41	41	76.3	138.8	169.3	329.1	329.1
2005	19	25	25	83.8	181	321.5	496.9	496.9
2006	22	34.5	38.3	96	188.9	230	382	494

**Figure 9.3.4(a):** Variation in median iPTH among CAPD patients, CAPD centres 2006



**Figure 9.3.4(b):** Variation in proportion of patients with iPTH 150-300 ng/ml, CAPD centres 2006



**Table 9.3.4(b)** Proportion of patients with iPTH 150-300 ng/ml

Year	No. of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1997	5	7	7	10	13	15	27	27
1998	5	0	0	13	15	17	24	24
1999	8	6	6	7	14	20.5	26	26
2000	9	0	0	5	12	17	18	18
2001	11	0	0	9	14	17	30	30
2002	14	0	0	10	15.5	21	24	24
2003	17	2	2	16	19	23	33	33
2004	18	7	7	15	21	26	29	29
2005	19	0	0	9	16	23	31	31
2006	22	5	6	14	21.5	24	31	41



## Conclusion

There is no major change in the types of phosphate binders used. Calcium carbonate still remains the major phosphate binder for both HD and CAPD patients in year 2006. The number of patients on aluminium hydroxide is on a decreasing trend. The number of patients on lanthanum and sevelamer is still very small and is not included in this report.

The use of vitamin D has increased. The number of patients on paricalcitol is also very small and is not included in this report. The number of patients who underwent parathyroidectomy has increased by three fold compared to 2005. This may reflect active participation of our endocrine surgeon and is also due to the extension of parathyroidectomy service in other hospitals outside Kuala Lumpur Hospital and Putrajaya Hospital.

Mean corrected serum calcium remains unchanged for both HD (2.3mmol/l) and CAPD (2.4mmol/l) patients since 2002. The availability of low calcium dialysate in hemodialysis helps to keep the mean calcium level lower in HD patients. More CAPD patients achieved target serum calcium (2.1-2.37 mmol/l) compared to year 2005 (from 30 to 38%). Phosphate control continues to be better in CAPD patients. Median corrected serum calcium phosphate product for HD patients shows a decreasing trend from 1997 to 2005 but remained static at 3.9 mmol<sup>2</sup>/l<sup>2</sup> in 2006. Median corrected serum calcium phosphate product for CAPD patients also remains static but is still lower compared to HD (3.7 mmol<sup>2</sup>/l<sup>2</sup> vs 3.9 mmol<sup>2</sup>/l<sup>2</sup>). Furthermore, more CAPD patients achieved corrected serum calcium phosphate product of less than 4.5 mmol<sup>2</sup>/l<sup>2</sup>. Differences in dialysis management have resulted in wide variation of outcome results in serum calcium, phosphate and calcium phosphate product.

Mean serum iPTH level remained static in HD patients (220.3ng/ml); however it has decreased from 247.1ng/ml to 224.7ng/ml in CAPD patients between 2005 and 2006. More HD patients have serum iPTH level of <150ng/ml compared to CAPD patients (61% vs 54%). The percentage of patients achieving the target iPTH level of 150-300ng/ml is low. Only 20% of CAPD patients have serum iPTH between 150-300ng/ml while only 14% in the HD population achieved this target. Again a wide variation of serum iPTH was observed due to differences in dialysis management among dialysis centres. As expected, diabetics had lower iPTH values.

Management of renal bone disease seems to have improved among HD patients over last few years but is still not as good as CAPD patients. Unfortunately, the relationship of these factors in relation to cardiovascular disease outcome has not been determined as yet but hopefully will be done in the future.