

CHAPTER 8

**BLOOD PRESSURE CONTROL
AND
DYSLIPIDAEMIA**

S Prasad Menon
Lee Wan Tin

8.1: Blood Pressure Control on Dialysis

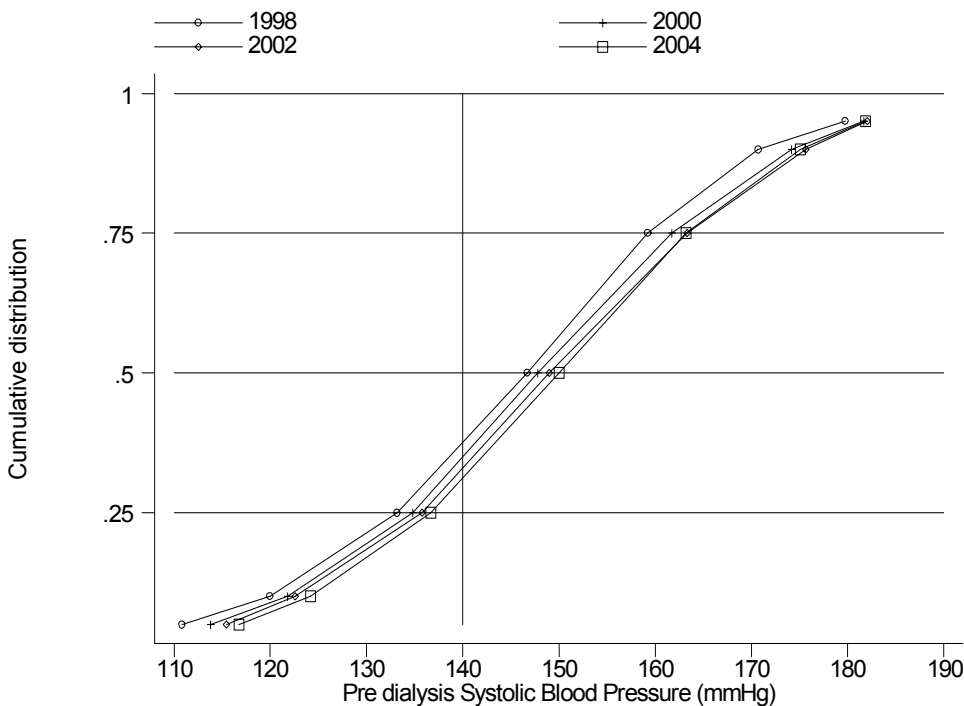
Between 1997 and 2001, there was a trend where the mean and median predialysis systolic BP tended to increase. This trend has plateaued in the last few years. This higher pre systolic BP probably reflects the trend in accepting older patients onto the dialysis programme.

In 2004, the mean and median predialysis systolic BP in HD patients were 149.8 mm Hg and 150 mm Hg respectively (Table 8.1.1), which was similar to the 2003 figures.

Table 8.1.1: Distribution of Pre dialysis Systolic Blood Pressure (mmHg), HD patients 1997-2004

Year	No. of subjects	Mean	SD	Median	LQ	UQ	% patients <120 mmHg	% patients 120-<140 mmHg	% patients 140-<160 mmHg	% patients 160-<180 mmHg	% patients ≥180 mmHg
1997	1659	144.5	20.8	144.2	130.8	158.1	11	30	35	19	4
1998	2108	146	20.5	146.7	133.2	159.2	10	27	39	19	5
1999	2965	148.7	20.8	148.5	135.3	162.2	8	25	38	23	6
2000	4310	148	20.6	147.8	134.8	161.7	9	25	38	23	6
2001	5147	148.8	20.9	148.8	134.9	162.6	8	25	37	23	7
2002	5911	149.2	20.6	149	135.8	163.3	8	24	38	24	6
2003	6839	149.7	20.2	149.8	136.4	162.9	7	24	39	23	7
2004	7856	149.8	20	150	136.7	163.2	7	23	39	25	6

Figure 8.1.1: Cumulative distribution of Pre dialysis Systolic Blood Pressure (mmHg), HD patients 1997-2004



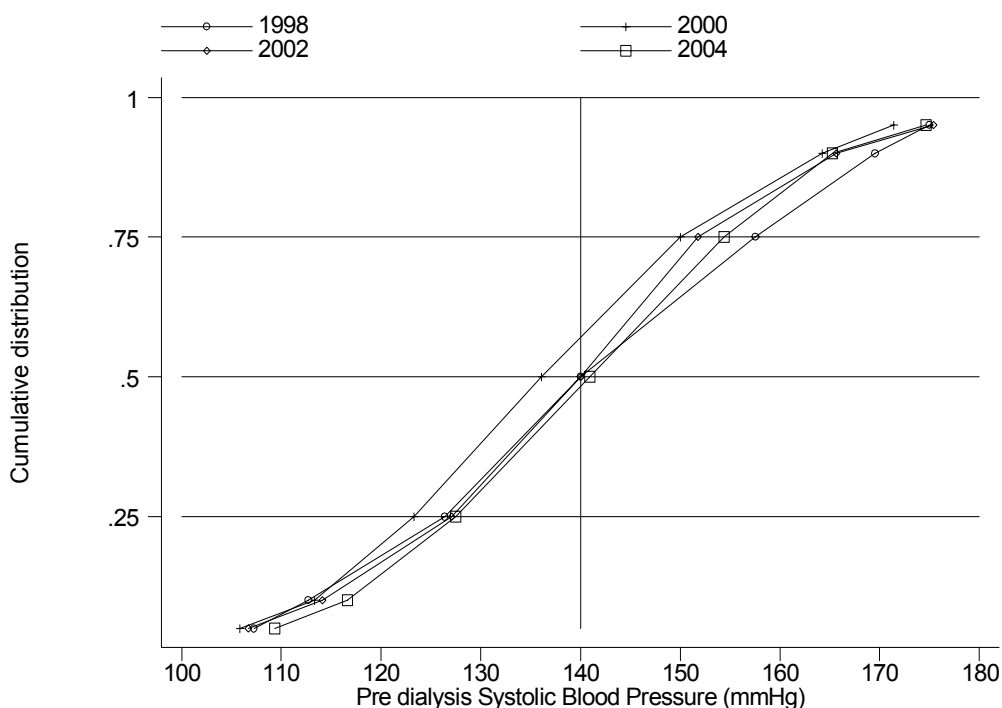
As in the previous years, the mean and median predialysis systolic BP in CAPD patients continued to be lower than that of HD patients, i.e. 141 mm Hg and 140.9 mm Hg respectively (Table 8.1.2).

The percentage of patients with predialysis systolic BP < 140 mm Hg was lower in HD patients as compared with CAPD patients, 30% vs. 47% (Tables 8.1.1 and 8.1.2)

Table 8.1.2: Distribution of Pre dialysis Systolic Blood Pressure (mmHg), CAPD patients 1997-2004

Year	No. of subjects	Mean	SD	Median	LQ	UQ	% patients <120 mmHg	% patients 120-<140 mmHg	% patients 140-<160 mmHg	% patients 160-<180 mmHg	% patients ≥180 mmHg
1997	468	142.7	20.3	142.9	128.3	156.3	13	31	37	17	3
1998	519	141	21.2	140	126.4	157.5	16	34	29	18	3
1999	576	141	19.8	140	127.2	156	14	35	34	15	2
2000	638	137.2	20.4	136.1	123.3	150	18	39	29	13	2
2001	739	139	20.2	137.5	125.8	151.7	16	38	30	13	3
2002	843	139.8	20.5	140	127.1	151.8	14	36	34	12	4
2003	1156	140.5	20.1	140	126.7	154.1	15	35	32	15	3
2004	1260	141	19.8	140.9	127.5	154.4	13	34	35	13	3

Figure 8.1.2: Cumulative distribution of Pre dialysis Systolic Blood Pressure (mmHg), CAPD patients 1997-2004



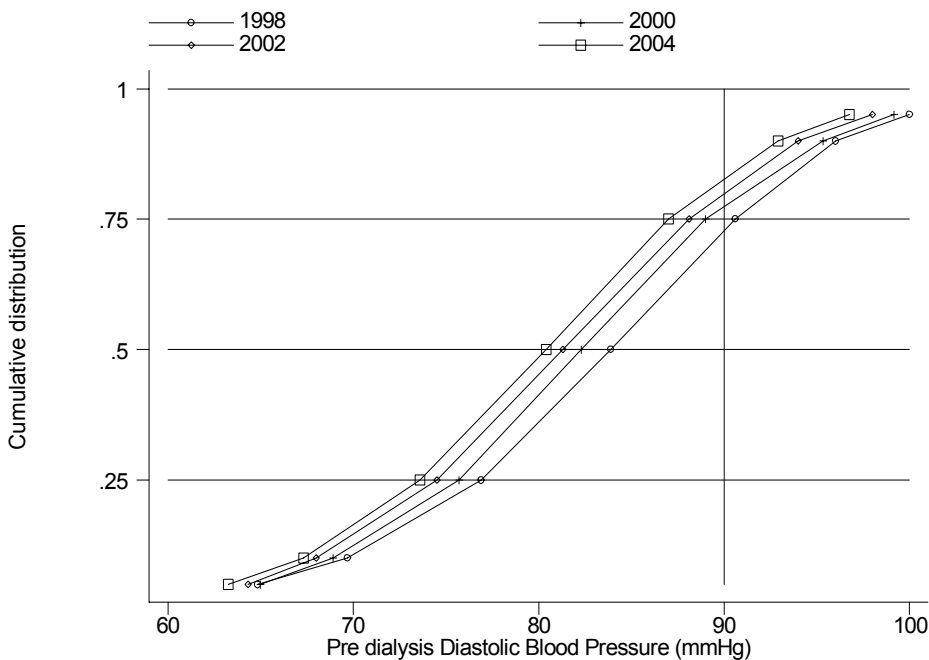
In comparison with the predialysis systolic BP, the predialysis diastolic BP appeared to be better controlled in the HD patients in 2004.

The mean and median predialysis diastolic BP were 80.3 mm Hg and 80.4 mm Hg respectively (Fig 8.1.3). The percentage of HD patients with the predialysis diastolic BP < 90 mm Hg was 84%.

Table 8.1.3: Distribution of Pre dialysis Diastolic Blood Pressure (mmHg), HD patients 1997-2004

Year	No. of subjects	Mean	SD	Median	LQ	UQ	% patients <70 mmHg	% patients 70-<80 mmHg	% patients 80-<90 mmHg	% patients 90-<100 mmHg	% patients ≥100 mmHg
1997	1660	83.7	10.9	84.2	77	90.7	10	23	38	22	6
1998	2108	83.5	10.7	83.9	76.9	90.6	10	24	38	23	5
1999	2965	83.5	10.5	83.5	77.1	90	10	24	40	21	6
2000	4309	82.2	10.4	82.3	75.7	89	11	28	39	18	4
2001	5146	81.6	10.4	81.7	75	88.3	12	30	37	17	4
2002	5907	81.2	10.4	81.3	74.5	88.1	13	30	37	16	3
2003	6837	80.6	10.2	80.8	73.9	87.2	14	32	37	14	3
2004	7854	80.3	10.2	80.4	73.6	87	15	32	36	14	3

Figure 8.1.3: Cumulative distribution of Pre dialysis Diastolic Blood Pressure (mmHg), HD patients 1997-2004

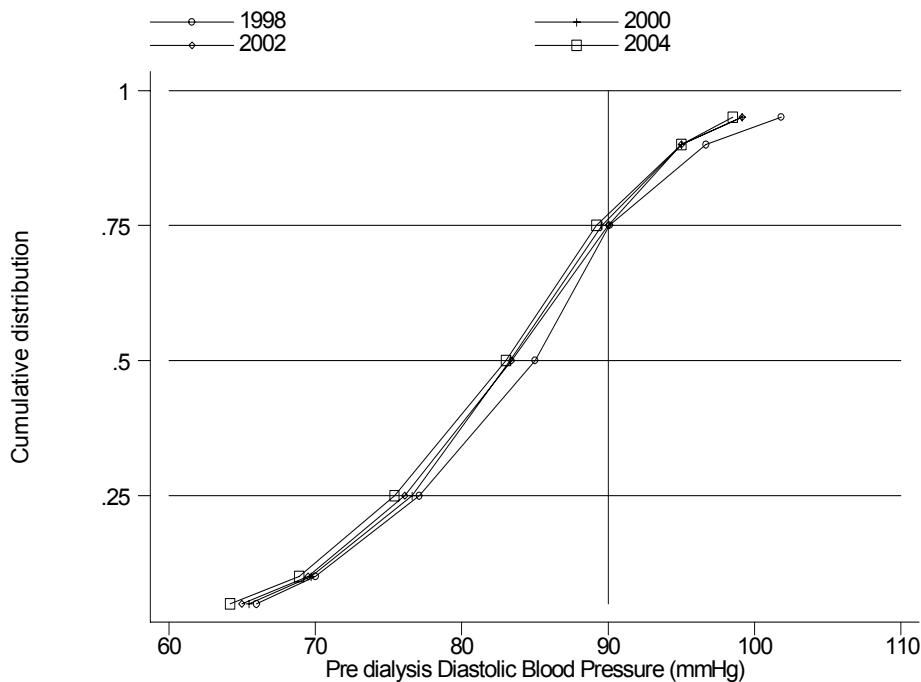


In CAPD patients, the mean and median predialysis diastolic BP in 2004 was 82.2 mm Hg and 83 mm Hg respectively. 78% of CAPD patients had satisfactory control with predialysis diastolic BP < 90 mm Hg.

Table 8.1.4: Distribution of Pre dialysis Diastolic Blood Pressure (mmHg), CAPD patients 1997-2004

Year	No. of subjects	Mean	SD	Median	LQ	UQ	% patients <70 mmHg	% patients 70-<80 mmHg	% patients 80-<90 mmHg	% patients 90-<100 mmHg	% patients ≥100 mmHg
1997	467	85.3	10.6	85.8	79.8	91.4	6	19	41	26	8
1998	519	84.3	11.3	85	77.1	90.1	8	24	36	24	8
1999	576	84	10.9	84.2	77.9	90	9	20	44	20	7
2000	638	82.9	11	83.3	76.6	89.6	10	24	41	20	5
2001	739	83.1	10.9	82.7	76.4	89.6	9	29	38	18	6
2002	843	82.8	10.8	83.4	76.1	90	11	24	41	21	5
2003	1158	82.2	10.9	82.3	75.5	89.4	12	26	38	19	4
2004	1259	82.2	10.5	83	75.4	89.2	11	28	39	18	4

Figure 8.1.4: Cumulative distribution of Pre dialysis Diastolic Blood Pressure (mmHg), CAPD patients 1997-2004



When comparing centers, there was a variation among HD centers with 25% of HD centers having a median predialysis systolic BP below 144.7 mm Hg while another 25% have median predialysis systolic BP above 154.7 mm Hg (Table 8.1.5).

Table 8.1.5: Variation in BP control among HD centres 2004

(a) Median Systolic blood pressure (mmHg) among HD patients

Year	No. of centres	Min	5 th Centile	LQ	Median	UQ	95 th Centile	Max
1997	46	120.5	130.4	140	144.9	151.9	158	159.8
1998	46	128.7	134.8	141.3	146.8	150	157.7	158.1
1999	69	132.1	135.5	143	149	155.3	164.5	170.2
2000	99	130.6	135	141.2	147.5	154.3	163	173.8
2001	116	126.7	136.3	143.1	148.8	155.7	162.9	185.8
2002	133	122.9	137.6	144.3	149	153.8	163.2	171.4
2003	156	124.6	136.3	144.5	150.8	155.6	163.2	171.4
2004	184	122.1	136.9	144.7	150.1	154.7	162.9	171

Figure 8.1.5(a): Variation in median systolic blood pressure (mmHg) among HD patients, HD centres 2004

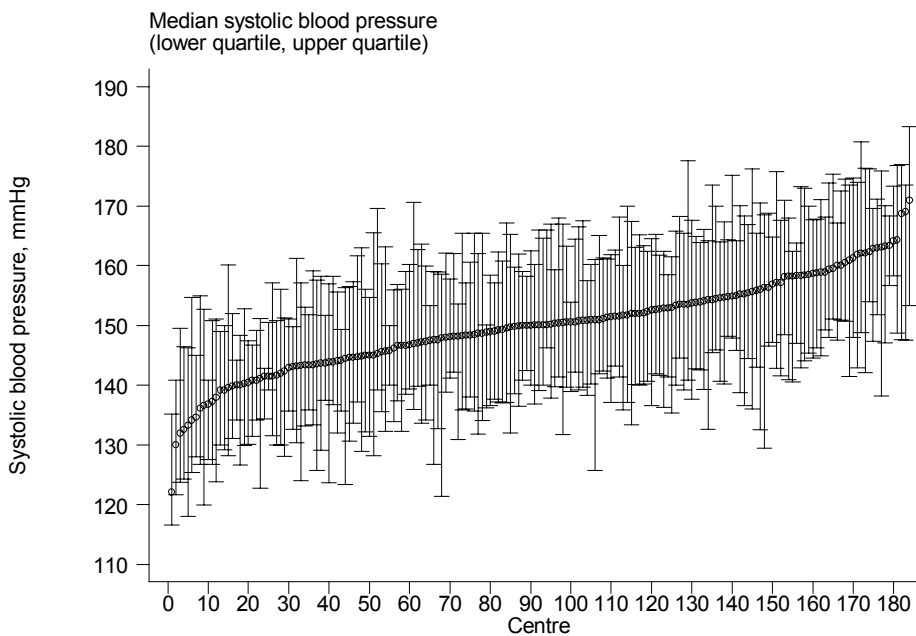


Table 8.1.5(b) Median Diastolic blood pressure (mmHg) among HD patients

Year	No. of centres	Min	5 th Centile	LQ	Median	UQ	95 th Centile	Max
1997	46	70	78	82.1	83.6	85.6	87.7	92.5
1998	46	76.9	78.6	82.6	84.1	85.8	89.8	90.7
1999	69	76.8	79.8	81.4	83.4	86.3	90	94.5
2000	99	74.4	76.8	80	82.5	84.7	88.5	95.7
2001	116	73.6	75.8	79.9	82	84.2	88.1	91.3
2002	133	72	75.2	79.1	81	84	88.3	101.4
2003	156	73.3	75.1	78.6	80.8	83.8	86.8	97.5
2004	184	70.6	74	78.6	80.7	83.1	86.8	93.3

Figure 8.1.5(b): Variation in median diastolic blood pressure (mmHg) among HD patients, HD centres 2004

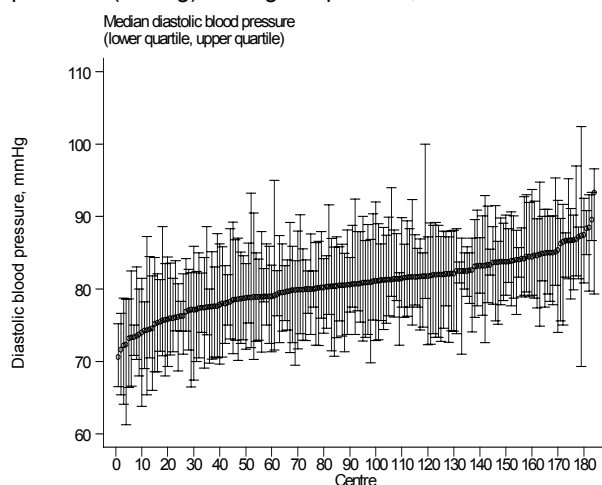


Figure 8.1.5(c): Variation in proportion of HD patients with pre dialysis blood pressure \leq 140/90 mmHg, HD centres 2004

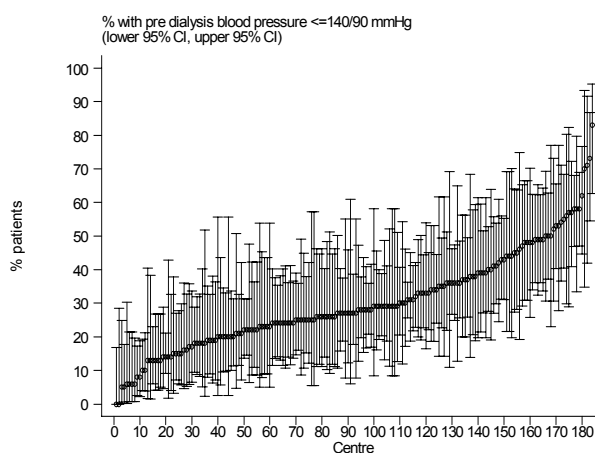


Table 8.1.5(c) Proportion of HD patients with Pre dialysis Blood Pressure \leq 140/90 mmHg

Year	No. of centres	Min	5 th Centile	LQ	Median	UQ	95 th Centile	Max
1997	46	15	17	30	38	45	76	88
1998	46	6	18	26	32	43	60	67
1999	69	0	11	23	32	43	60	67
2000	99	0	12	23	33	45	63	71
2001	116	0	8	21	32	42	57	75
2002	133	0	9	22	31	40	53	80
2003	156	0	8	20	27	40	60	80
2004	184	0	8	20.5	27	38	57	83

Similarly 25% of CAPD centers had median predialysis systolic BP below 137.7 mm Hg while another 25% of CAPD centers had a median predialysis systolic BP above 143.3 mm Hg (Table 8.1.6).

There was also some variation in the median predialysis diastolic BP in HD patients across the various centers (Table 8.1.5). The figures for CAPD patients are as given in the Table 8.1.6 (b).

Table 8.1.6: Variation in BP control among CAPD centres 2004

(a) Median Systolic blood pressure (mmHg) among CAPD patients

Year	No. of centres	Min	5 th Centile	LQ	Median	UQ	95 th Centile	Max
1997	7	124	124	139.4	142.5	150	151.6	151.6
1998	9	109	109	134.5	143.2	145.8	156.5	156.5
1999	9	90	90	133.7	140	144.9	152.8	152.8
2000	11	112.7	112.7	131.3	135	139.3	150.8	150.8
2001	12	119.6	119.6	133.7	137	138.2	149	149
2002	14	124.4	124.4	135.2	140.6	144.2	148.2	148.2
2003	17	122.2	122.2	131	142.2	146.9	151.5	151.5
2004	17	127.7	127.7	137.7	139.5	143.3	149.3	149.3

Figure 8.1.6(a): Variation in median systolic blood pressure (mmHg) among CAPD patients, CAPD centres 2004

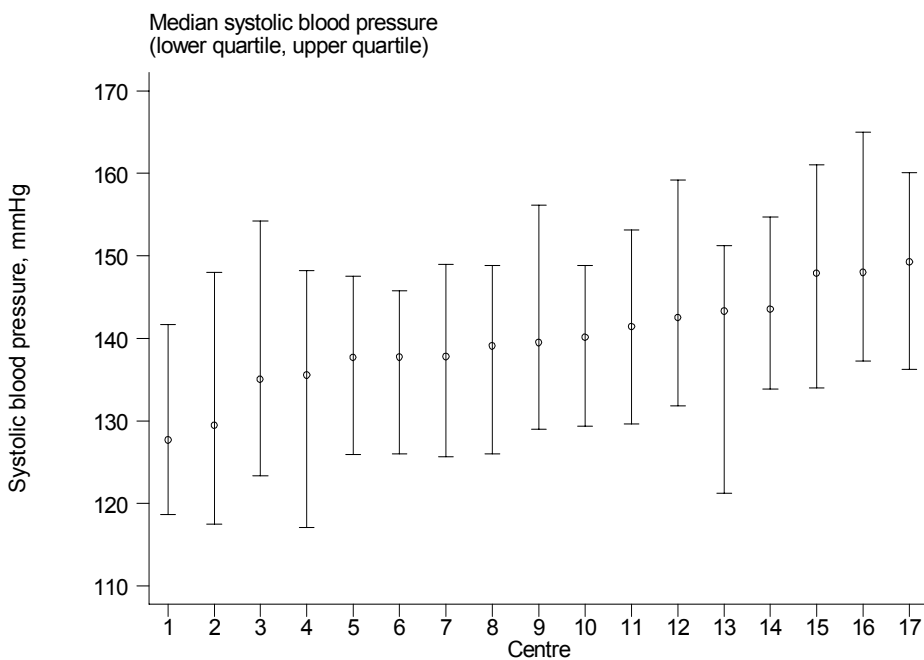


Table 8.1.6(b) Median Diastolic blood pressure (mmHg) among CAPD patients

Year	No. of centres	Min	5 th Centile	LQ	Median	UQ	95 th Centile	Max
1997	7	82.5	82.5	85.3	86	86	88.7	88.7
1998	9	70.7	70.7	84	85.8	86.3	87.3	87.3
1999	9	70	70	81.7	84.3	85.8	87	87
2000	11	69.8	69.8	80	83	84.4	88	88
2001	12	77.6	77.6	81.3	82.7	84.8	88	88
2002	14	79.2	79.2	82.3	84.2	85.3	90.2	90.2
2003	17	63.8	63.8	80.8	82.9	84.4	89.5	89.5
2004	17	77.5	77.5	82.9	83.8	84.5	87	87

Figure 8.1.6(b): Variation in median diastolic blood pressure (mmHg) among CAPD patients, CAPD centres 2004

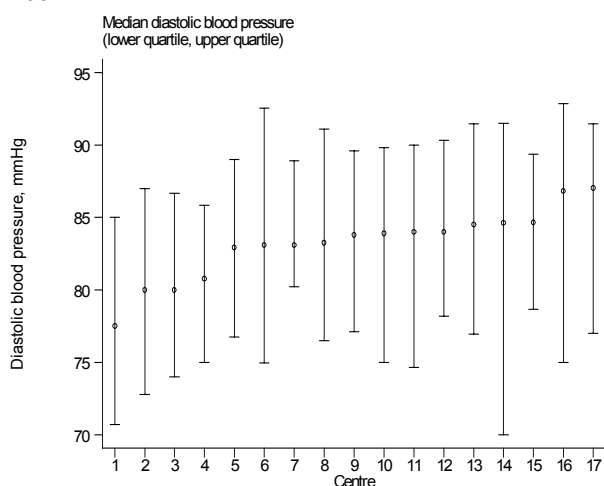


Figure 8.1.6(c): Variation in proportion of CAPD patients with pre dialysis blood pressure $\leq 140/90$ mmHg, CAPD centres 2004

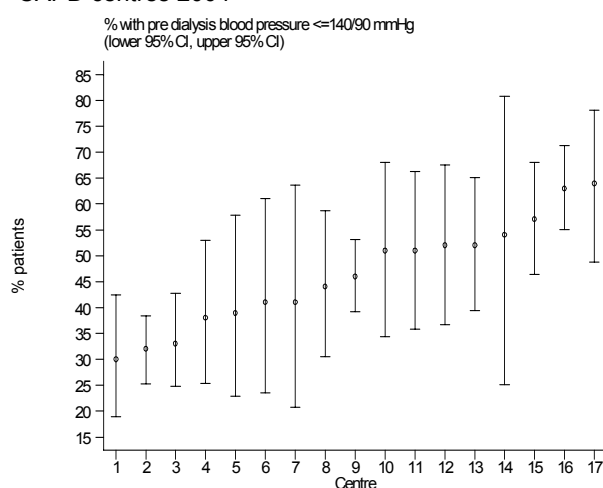


Table 8.1.6(c) Proportion of CAPD patients with Pre dialysis Blood Pressure $\leq 140/90$ mmHg

Year	No. of centres	Min	5 th Centile	LQ	Median	UQ	95 th Centile	Max
1997	7	26	26	35	41	46	59	59
1998	9	35	35	41	44	49	100	100
1999	9	30	30	40	47	56	100	100
2000	11	23	23	53	56	60	96	96
2001	12	36	36	47	53	60	89	89
2002	14	21	21	35	45	51	68	68
2003	17	28	28	37	44	66	100	100
2004	17	30	30	39	46	52	64	64

8.2: Dyslipidaemia in Dialysis Patients

The previous trend of better total cholesterol control in HD patients in comparison with CAPD patients continued in 2004, with 71% of HD patients having total cholesterol level < 5.3 mmol/l versus 53% of CAPD patients having total cholesterol level < 5.3 mmol/l (Table 8.2.1 and 8.2.2).

Table 8.2.1: Distribution of serum Cholesterol (mmol/L), HD patients 1997-2004

Year	No. of subjects	Mean	SD	Median	LQ	UQ	% patients <3.5 mmol/L	% patients 3.5-<5.3 mmol/L	% patients 5.3-<6.2 mmol/L	% patients ≥6.2 mmol/L
1997	1158	5.1	1.4	5.1	4.2	5.9	8	49	24	19
1998	1166	5.1	1.3	5	4.2	5.8	7	53	22	17
1999	1872	5	1.3	4.9	4.1	5.7	10	54	20	15
2000	2956	5	1.2	4.9	4.2	5.8	8	53	23	16
2001	3898	5.1	1.3	4.9	4.2	5.8	8	52	24	16
2002	4751	5	1.2	4.9	4.2	5.7	9	55	24	13
2003	5811	4.8	1.1	4.8	4.1	5.5	9	59	21	11
2004	6644	4.7	1.1	4.7	4	5.4	11	60	21	8

Figure 8.2.1: Cumulative distribution of Cholesterol (mmol/L), HD patients 1997-2004

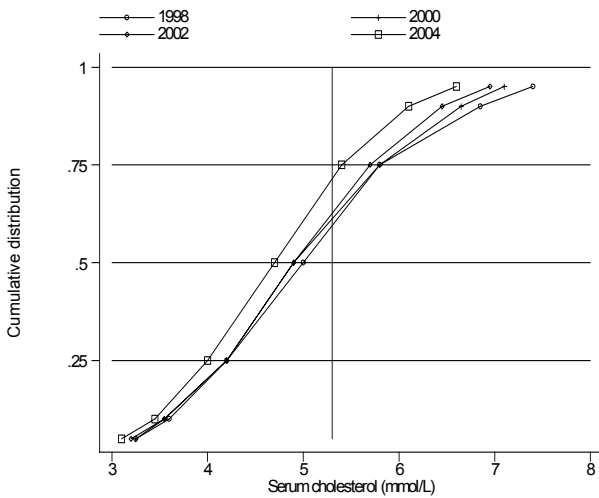


Figure 8.2.2: Cumulative distribution of Cholesterol (mmol/L), CAPD patients 1997-2004

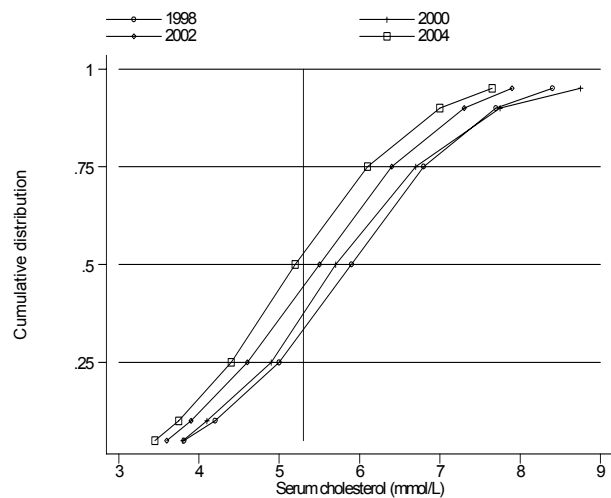


Table 8.2.2: Distribution of serum Cholesterol (mmol/L), CAPD patients 1997-2004

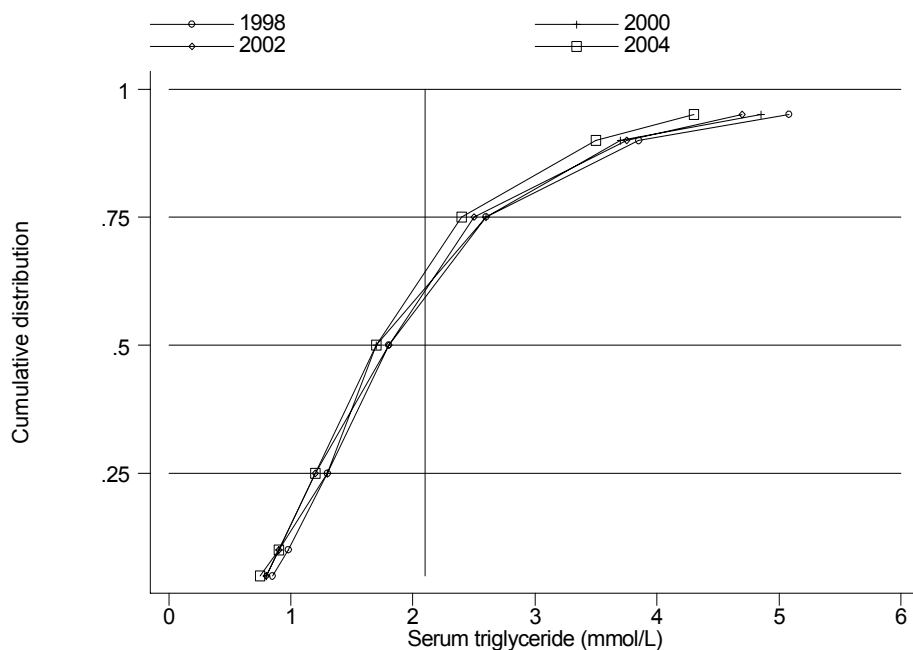
Year	No. of subjects	Mean	SD	Median	LQ	UQ	% patients <3.5 mmol/L	% patients 3.5-<5.3 mmol/L	% patients 5.3-<6.2 mmol/L	% patients ≥6.2 mmol/L
1997	420	6.1	1.4	6	5.1	6.9	2	27	28	43
1998	348	6	1.4	5.9	5	6.8	3	29	28	41
1999	434	5.7	1.4	5.6	4.9	6.4	3	37	30	31
2000	526	5.9	1.6	5.7	4.9	6.7	3	31	30	36
2001	581	5.8	1.4	5.7	4.8	6.6	2	36	27	35
2002	766	5.6	1.4	5.5	4.6	6.4	4	38	28	29
2003	1106	5.4	1.4	5.3	4.4	6.1	5	45	27	23
2004	1231	5.3	1.4	5.2	4.4	6.1	5	48	26	21

This improvement has brought the proportion of CAPD patients with elevated triglyceride levels (>2.3 mmol/l) closer to HD patients' data (27%) in 2004 (Table 8.2.3).

Table 8.2.3: Distribution of serum Triglyceride (mmol/L), HD patients 1997-2004

Year	No. of subjects	Mean	SD	Median	LQ	UQ	% patients <1.7 mmol/L	% patients 1.7-<2.3 mmol/L	% patients 2.3-<3.5 mmol/L	% patients ≥3.5 mmol/L
1997	1074	2.1	1.4	1.8	1.3	2.5	45	24	18	12
1998	1089	2.2	1.5	1.8	1.3	2.6	42	26	20	12
1999	1634	2.1	1.3	1.7	1.2	2.5	49	22	18	11
2000	2393	2.1	1.4	1.7	1.3	2.6	48	22	19	12
2001	3162	2.1	1.4	1.7	1.2	2.5	48	22	17	13
2002	3861	2.1	1.4	1.8	1.2	2.5	47	22	18	12
2003	4715	2	1.3	1.7	1.2	2.5	48	23	18	11
2004	5543	2	1.2	1.7	1.2	2.4	51	22	17	10

Figure 8.2.3: Cumulative distribution of serum Triglyceride (mmol/L), HD patients 1997-2004

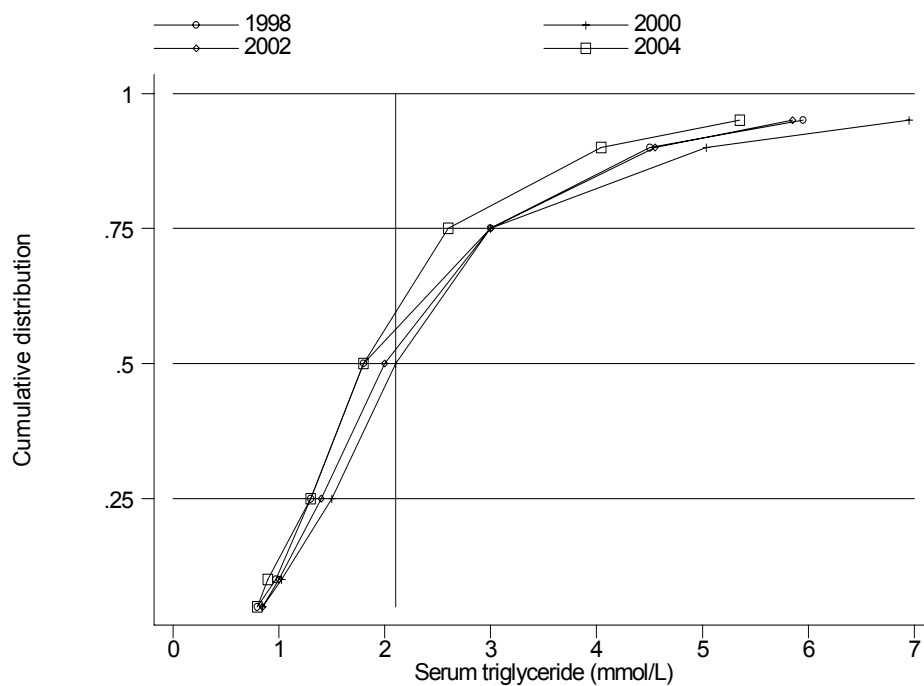


The proportion of patients with elevated triglyceride levels (> 2.3 mmol/l) in CAPD patients in 2004 was less than in previous years (30% in 2004 compared with 35% in 2003 and 44% in 2001) (Table 8.2.4).

Table 8.2.4: Distribution of serum Triglyceride (mmol/L), CAPD patients 1997-2004

Year	No. of subjects	Mean	SD	Median	LQ	UQ	% patients			
							<1.7 mmol/L	1.7-<2.3 mmol/L	2.3-<3.5 mmol/L	≥3.5 mmol/L
1997	413	2.6	1.9	2.2	1.4	3	36	22	25	18
1998	344	2.4	1.8	1.8	1.3	3	42	22	17	19
1999	421	2.4	1.6	2	1.4	3	38	25	18	19
2000	520	2.7	2.2	2.1	1.5	3	33	24	23	21
2001	576	2.6	1.8	2	1.4	3	36	22	22	20
2002	767	2.5	1.7	2	1.4	3	39	21	22	18
2003	1102	2.3	1.6	1.8	1.3	2.8	45	20	21	14
2004	1224	2.2	1.6	1.8	1.3	2.6	47	22	17	13

Figure 8.2.4: Cumulative distribution of serum Triglyceride (mmol/L), CAPD patients 1997-2004



The variation in medium serum cholesterol levels and triglyceride levels among dialysis centers is illustrated in Figure 8.2.5(a) and Figure 8.2.5(c) [HD centers], Figure 8.2.6(a) and Figure 8.2.6(c) [CAPD centers]. This will allow individual dialysis centers to gauge their center's lipid "performance" in comparison to other dialysis centers reporting to the Malaysian Renal Registry.

Table 8.2.5: Variation in dyslipidaemia among HD centres 2004

(a) Median serum cholesterol level among HD patients

Year	No. of centres	Min	5 th Centile	LQ	Median	UQ	95 th Centile	Max
1997	34	4.1	4.3	4.6	5	5.3	5.8	5.9
1998	28	4	4.4	4.8	5	5.2	5.3	5.4
1999	47	3.5	4.3	4.6	4.8	5.1	5.5	5.8
2000	75	4	4.3	4.8	4.9	5.2	5.5	5.8
2001	95	4.2	4.5	4.7	4.9	5.2	5.8	6.3
2002	112	4.4	4.5	4.7	4.9	5.1	5.4	6
2003	142	4	4.3	4.6	4.8	5	5.3	5.6
2004	164	3.8	4.1	4.5	4.7	4.9	5.3	5.7

Figure 8.2.5(a): Variation in median serum cholesterol level among HD patients, HD centres 2004

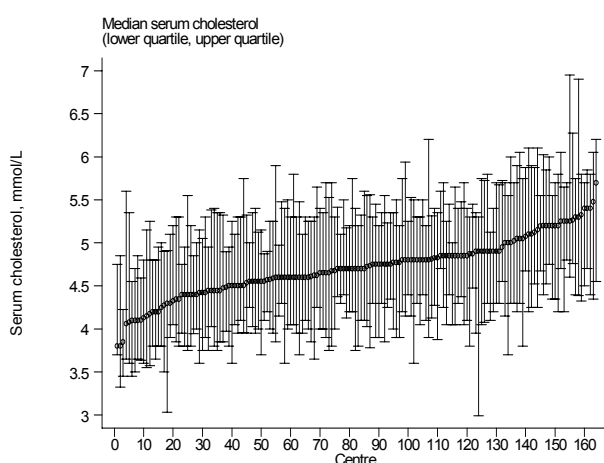


Figure 8.2.5(b): Variation in proportion of patients with serum cholesterol < 5.3 mmol/L, HD centres 2004

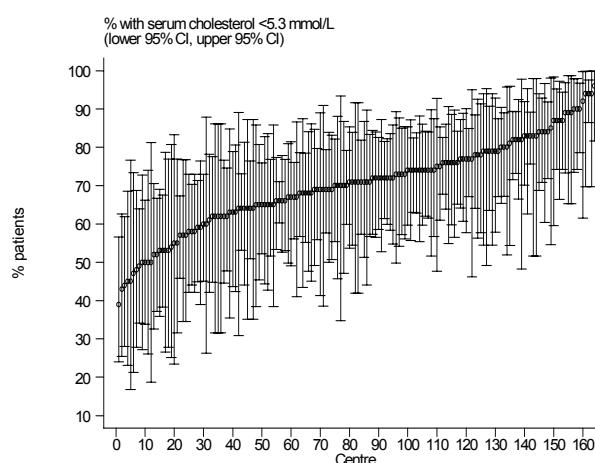


Table 8.2.5(b) Proportion of patients with serum cholesterol < 5.3 mmol/L

Year	No. of centres	Min	5 th Centile	LQ	Median	UQ	95 th Centile	Max
1997	34	33	35	48	57	64	84	92
1998	28	38	42	52	59.5	69	84	89
1999	47	34	38	57	68	76	84	93
2000	75	32	38	51	60	68	83	100
2001	95	13	37	54	60	68	80	90
2002	112	31	42	57	64	70	79	92
2003	142	40	48	61	68	76	84	100
2004	164	39	50	63.5	71	78	89	96

Table 8.2.5(c) Median serum triglyceride level among HD patients

Year	No. of centres	Min	5 th Centile	LQ	Median	UQ	95 th Centile	Max
1997	33	1.3	1.3	1.6	1.8	1.9	2.5	2.9
1998	27	1.4	1.5	1.7	1.8	1.9	2	2.2
1999	39	1.3	1.3	1.5	1.6	1.9	2.3	2.5
2000	59	1.3	1.4	1.5	1.8	2	2.4	2.6
2001	79	.9	1.3	1.5	1.7	1.9	2.5	3.3
2002	95	1.2	1.3	1.6	1.8	1.9	2.3	2.9
2003	122	1.2	1.3	1.6	1.7	1.9	2.2	2.5
2004	150	1	1.3	1.5	1.6	1.9	2.2	2.8

Figure 8.2.5(c): Variation in median serum triglyceride level among HD patients, HD centres 2004

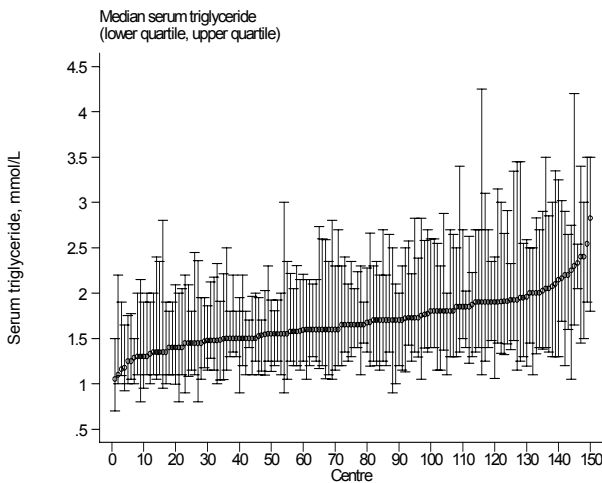


Figure 8.2.5(d): Variation in proportion of patients with serum triglyceride < 2.1 mmol/L, HD centres 2004

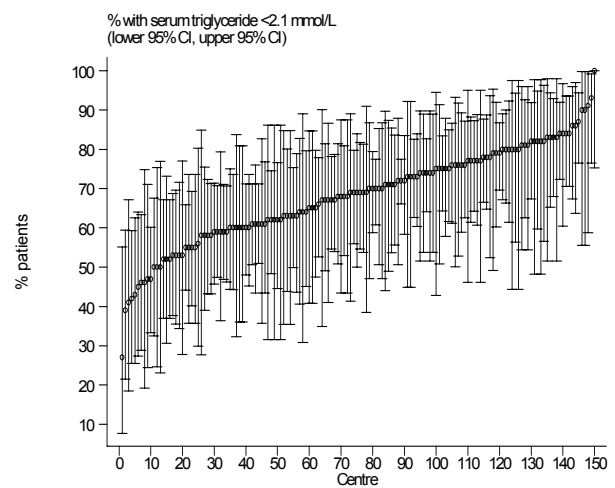


Table 8.2.5(d) Proportion of patients with serum triglyceride < 2.1 mmol/L

Year	No. of centres	Min	5 th Centile	LQ	Median	UQ	95 th Centile	Max
1997	33	29	36	60	65	77	83	85
1998	27	47	53	58	64	69	79	82
1999	39	43	48	61	67	75	90	92
2000	59	17	36	57	65	72	84	100
2001	79	33	41	57	66	74	86	100
2002	95	9	45	58	65	72	83	90
2003	122	30	48	59	67	74	86	100
2004	150	27	46	60	69	77	86	100

Table 8.2.6: Variation in dyslipidaemia among CAPD centres 2004

(a) Median serum cholesterol level among CAPD patients

Year	No. of centres	Min	5 th Centile	LQ	Median	UQ	95 th Centile	Max
1997	6	5.8	5.8	5.9	5.9	6.1	6.1	6.1
1998	6	5.1	5.1	5.6	5.8	6.1	6.2	6.2
1999	8	5.3	5.3	5.6	5.7	5.9	6	6
2000	10	4.9	4.9	5.3	5.7	6	6.4	6.4
2001	10	5	5	5.5	5.9	6	6.2	6.2
2002	14	4.9	4.9	5.4	5.6	5.7	6.3	6.3
2003	17	4.6	4.6	5.2	5.3	5.7	6.1	6.1
2004	17	4.6	4.6	5	5.3	5.5	5.9	5.9

Figure 8.2.6(a): Variation in median serum cholesterol level among CAPD patients, CAPD centres 2004

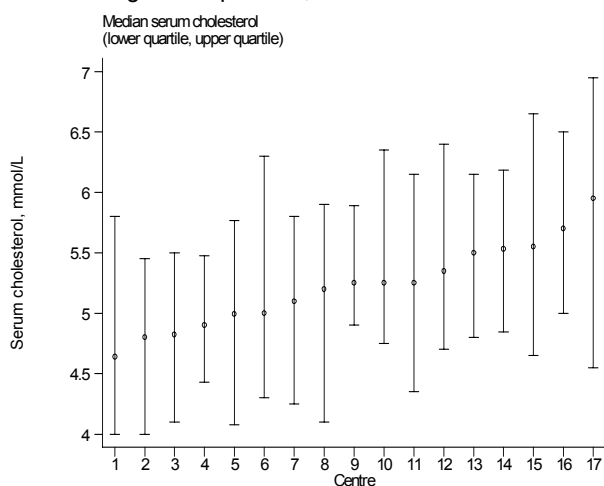


Figure 8.2.6(b): Variation in proportion of patients with serum cholesterol < 5.3 mmol/L, CAPD centres 2004

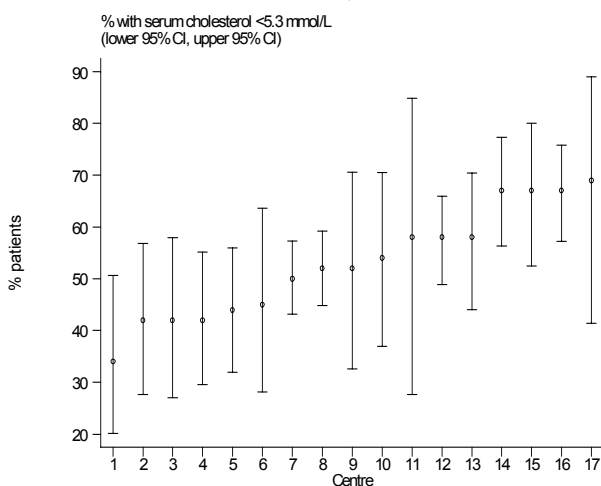


Table 8.2.6(b) Proportion of patients with serum cholesterol < 5.3 mmol/L

Year	No. of centres	Min	5 th Centile	LQ	Median	UQ	95 th Centile	Max
1997	6	27	27	27	29	31	33	33
1998	6	24	24	27	32	38	50	50
1999	8	6	6	29.5	39.5	43.5	50	50
2000	10	11	11	18	31	47	50	50
2001	10	23	23	30	34	44	61	61
2002	14	25	25	36	41	43	80	80
2003	17	0	0	38	48	54	81	81
2004	17	34	34	44	52	58	69	69

Table 8.2.6(c) Median serum triglyceride level among CAPD patients

Year	No. of centres	Min	5 th Centile	LQ	Median	UQ	95 th Centile	Max
1997	6	1.7	1.7	1.9	2.1	2.2	2.4	2.4
1998	6	1.2	1.2	1.5	1.7	1.9	2.1	2.1
1999	8	1.6	1.6	1.9	2	2.1	2.6	2.6
2000	10	1.8	1.8	2	2.1	2.5	2.8	2.8
2001	10	1.5	1.5	1.8	2	2.1	3	3
2002	14	1.6	1.6	1.8	2	2.1	2.4	2.4
2003	17	1.1	1.1	1.7	1.8	2	2.2	2.2
2004	17	1.4	1.4	1.6	1.8	1.9	2.1	2.1

Figure 8.2.6(c): Variation in median serum triglyceride level among CAPD patients, CAPD centres 2004

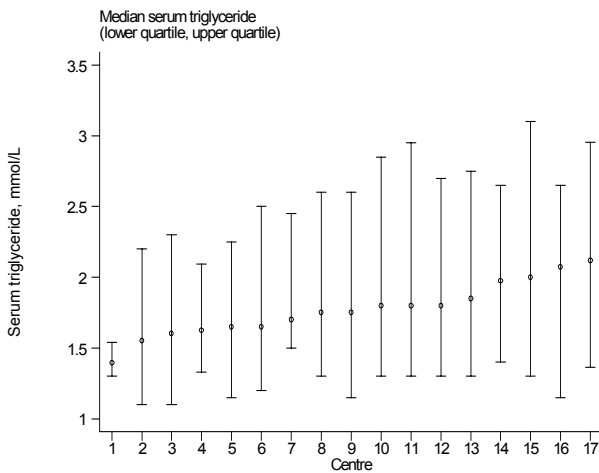


Figure 8.2.6(d): Variation in proportion of patients with serum triglyceride < 2.1 mmol/L, CAPD centres 2004

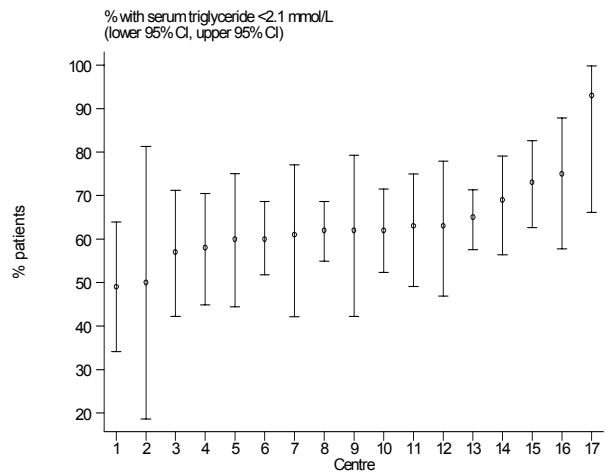


Table 8.2.6(d) Proportion of patients with serum triglyceride < 2.1 mmol/L

Year	No. of centres	Min	5 th Centile	LQ	Median	UQ	95 th Centile	Max
1997	6	40	40	46	52	56	61	61
1998	6	51	51	58	60.5	70	73	73
1999	8	37	37	53	56.5	62.5	71	71
2000	10	18	18	38	51.5	54	67	67
2001	10	28	28	51	52.5	58	68	68
2002	14	37	37	51	54	57	75	75
2003	17	48	48	56	59	62	100	100
2004	17	49	49	60	62	65	93	93