

CHAPTER 7

Nutritional Status on Dialysis

Ahmad Fauzi Abdul Rahman
Tilakavati Karupaiah
Winnie Chee Siew Swee

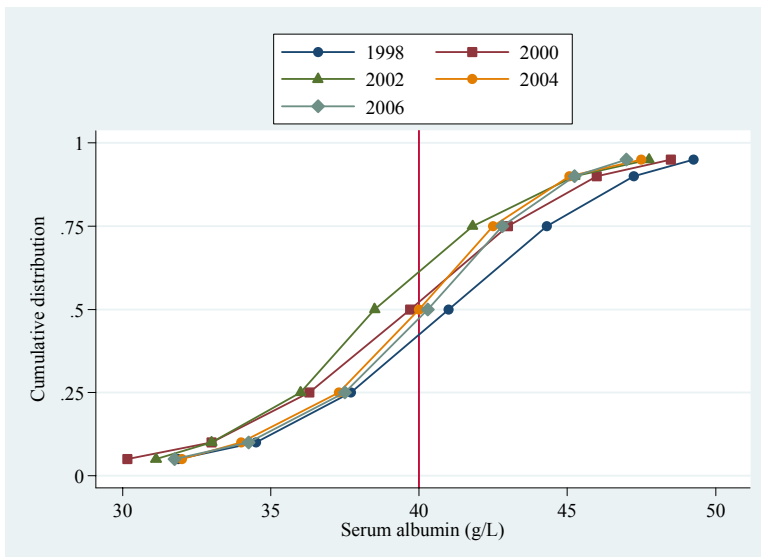
SECTION 7.1: SERUM ALBUMIN LEVELS ON DIALYSIS

Patient numbers increased by 2057 for HD in 2006. Mean serum albumin levels in 2006 was 39.9 g/L, which is just at the borderline for mortality risk (>40 g/L). However, the overall trend for percentage distribution of patients for serum albumin has remained unchanged since 2003. The percentage of well-nourished patients (serum albumin >40g/L) remained above 50% with the rest of the patients mainly in the 35-40g/L range. Percentage of patients with serum albumin levels <35g/L was only 11-18%. Improving trends are also shown from the cumulative distribution graph of serum albumin in HD patients for 2006 (Figure 7.1.1).

Table 7.1.1: Distribution of serum Albumin, HD patients 1997-2006

Year	No. of subjects	Mean	SD	Median	LQ	UQ	% patients <30g/L	% patients 30-<35g/L	% patients 35-<40g/L	% patients ≥40g/L
1997	1644	40.9	6.2	41	37.7	44.3	3	8	30	59
1998	2075	41.2	6.5	41	37.5	44.7	3	9	28	59
1999	2755	39.7	6.1	39.7	36.3	43	4	13	35	49
2000	3733	38.6	7	39	36	42	5	11	41	43
2001	4666	39	5.6	38.5	36	41.8	3	15	44	38
2002	5568	39.2	5.6	39	36.5	42	3	12	42	43
2003	6524	39.9	5.4	40	37.3	42.5	3	9	35	52
2004	7581	39.9	5.3	40	37	42.8	3	10	34	53
2005	8706	40	5.2	40.3	37.5	42.8	3	9	33	56
2006	10763	39.9	5.3	40.3	37.5	42.8	3	9	33	54

Figure 7.1.1: Cumulative distribution of Albumin, HD patients 1997-2006



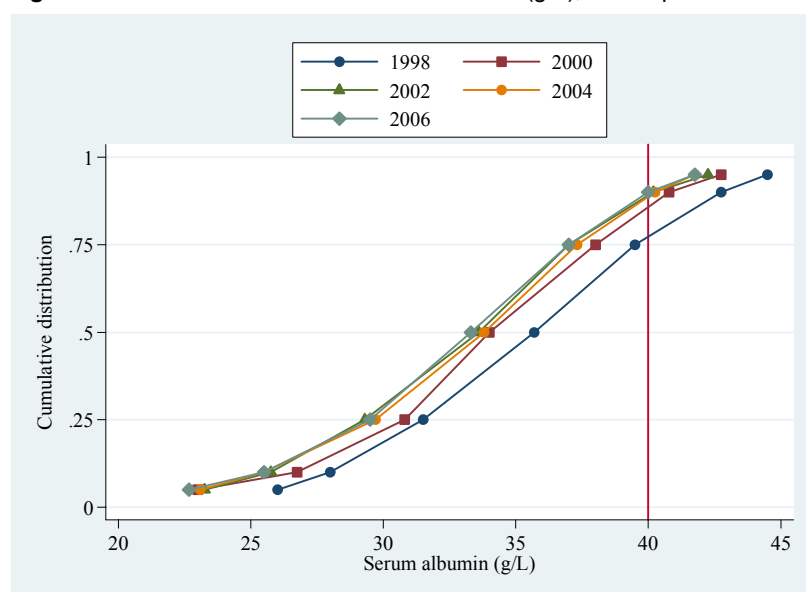
The trend in mean serum albumin levels for patients on CAPD has remained static since 2001 despite initial downward trend noted from 1997-2001. Percentage of patients at increased mortality risk (<35 g/L) also increased initially from 1997 until 2001 (44% in 1997 to 60% by 2001). However the proportion of patients with serum albumin <35g/L has remained static since 2001(56-60%). For the year 2006, mean serum albumin values was 33.5 ± 6.1 g/L. Overall 58% of this population has values less than 35 g/L compared to only 12% at ≥ 40g/L. There was a 2% improvement in the number of patients with serum albumin >40g/L in 2006 compared to 2005. (Table 7.1.2)

The cumulative distribution graph in 2006, reflects the trend that percentage of CAPD patients with serum albumin <35 g/L had remained static since 2002 (Figure 7.1.2). The cumulative distribution of serum Albumin values for 2006 confirms that >50% of the population (of 1497) had level below 35g/L and >75% had level below 40g/L.

Table 7.1.2: Distribution of serum Albumin (g/L), CAPD patients 1997-2006

Year	No. of subjects	Mean	SD	Median	LQ	UQ	% patients <30g/L	% patients 30-<35g/L	% patients 35-<40g/L	% patients ≥40g/L
1997	471	35.7	6.8	35.7	31.5	39.5	16	28	34	22
1998	536	35.8	6.7	36	32	39.7	16	25	35	24
1999	597	34.1	6.6	34	30.8	38	21	33	32	14
2000	640	34.3	6.1	35	31	38.3	20	28	37	14
2001	750	33.3	6.2	33.6	29.3	37	27	33	28	12
2002	862	33.9	5.9	34.3	30.8	37.5	21	35	33	12
2003	1180	33.3	5.8	33.8	29.7	37.3	26	33	30	11
2004	1284	33	6	33.8	29.5	37.3	27	32	30	11
2005	1346	33.2	6.4	33.3	29.5	37	27	33	30	10
2006	1497	33.5	6.1	33.8	30	37	25	33	30	12

Figure 7.1.2: Cumulative distribution of Albumin (g/L), CAPD patients 1997-2006



There is a wide variation in the median for HD centres in the proportion of patients with serum albumin ≥ 40 g/L from 1997-2006. The trend had been encouraging for the past 4 years whereby the median percentages of serum albumin more than 40g/L is above 50%. For the year 2006, the median was 55%.

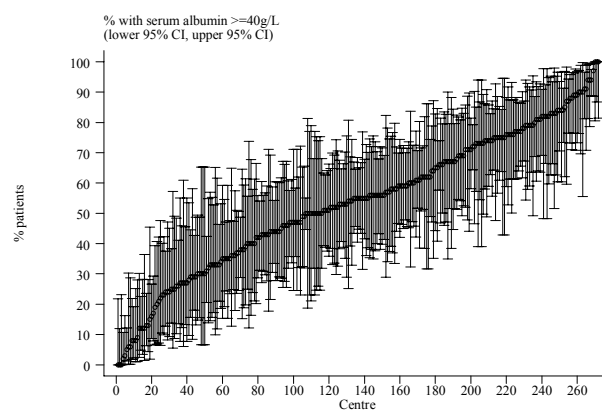
The best centre had all (100%) patients achieving serum albumin ≥ 40 g/L(target albumin). For all HD centres, a greater than 8-fold variation in meeting the albumin target was observed. (Table 7.1.3)

Figure 7.1.3 indicates the wide variation amongst the 272 HD centers reporting the proportion of patients able to achieve the target serum albumin (≥ 40 g/L) for the year 2006.

Table 7.1.3: Variation in Proportion of patients with serum albumin ≥ 40 g/L among HD centres 2006

Year	No. of centres	Min	5 th Centile	LQ	Median	UQ	95 th Centile	Max
1997	44	0	10	32.5	61	76.5	95	97
1998	49	7	15	31	58	80	95	96
1999	70	2	8	23	52	65	91	100
2000	94	0	8	22	42.5	62	82	93
2001	116	0	3	17	41	57	82	100
2002	142	0	8	26	44	63	86	100
2003	166	0	17	39	54.5	70	92	100
2004	198	0	10	34	57	73	89	100
2005	226	4	9	43	56	72	88	100
2006	272	0	12	37	55	73	89	100

Figure 7.1.3: Variation in Proportion of patients with serum albumin ≥ 40 g/L, HD centres 2006



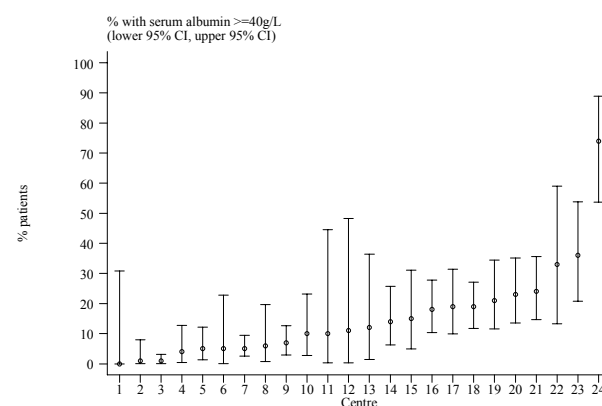
24 CAPD centers participated in 2006. The median percentage of centers with serum albumin 40g/L shows a decreasing trend (28% in 1997 to 16% in 2001 and the latest in 2006 was only 11.5%). The median was 11.5 for the year 2006. The maximum proportion of patients achieving the target serum albumin ≥ 40 g/L was 74% whilst majority of centers reported less than 40% of patients achieving this target. For all CAPD centres, greater than 36-fold variation in meeting the albumin target was observed. (Table 7.1.4)

Figure 7.1.4 indicates the wide variation amongst 24 CAPD centres reporting the proportion of patients achieving the target serum albumin ≥ 40 g/L for the year 2006.

Table 7.1.4: Variation in Proportion of patients with serum albumin ≥ 40 g/L among CAPD centres 2006

Year	No. of centres	Min	5 th Centile	LQ	Median	UQ	95 th Centile	Max
1997	7	5	5	10	28	29	59	59
1998	9	3	3	18	27	34	45	45
1999	10	2	2	8	14.5	18	29	29
2000	11	0	0	5	13	28	42	42
2001	12	2	2	4.5	16	27	36	36
2002	15	4	4	7	12	21	36	36
2003	19	1	1	9	14	23	55	55
2004	19	1	1	8	13	22	34	34
2005	21	0	1	6	13	22	27	29
2006	24	0	1	5	11.5	20	36	74

Figure 7.1.4: Variation in Proportion of patients with serum albumin ≥ 40 g/L, CAPD centres 2006



SECTION 7.2: BODY MASS INDEX (BMI) ON DIALYSIS

Table 7.2.1 indicates that overall mean BMI for HD patients from 1997 to 2006 was stabilizing at 23. An improving trend in mean BMI [22.9 in 2000 to 23.3 in 2006] was detected despite a 3-fold increase in patient numbers. The percentage of HD patients with BMI ≥ 25 increased from 20% in 1997 to 29% in 2006. This may perhaps reflect an increasing number of overweight diabetic patients coming into dialysis or perhaps an improved dietary intake amongst patients.

For the year 2006 and a HD population of 9495, mean BMI value was 23.3 ± 7.7 . Encouragingly, 14% of this group had values less than 18.5 compared to 29% at ≥ 25 .

Figure 7.2.1 reflects the increasing BMI trends as the curve for 2006 is moving right. About 70% of the population (of 9495) were at BMI of 25

Table 7.2.1: Distribution of BMI, HD patients 1997-2006

Year	No of subjects	Mean	SD	Median	LQ	UQ	% patients <18.5	% patients 18.5-25	% patients ≥ 25
1997	1545	23.6	16.3	21.5	19.1	24.2	19	61	20
1998	1980	24.1	18.3	21.6	19.1	24.3	19	60	21
1999	2708	23.5	15.9	21.4	19.2	24.4	18	61	21
2000	3854	22.9	11.7	21.7	19.3	24.5	18	60	22
2001	4544	23	11	21.9	19.3	24.7	18	59	23
2002	5090	23.2	10.6	22.1	19.5	24.9	16	59	24
2003	5971	23.1	9.7	22.1	19.5	25.1	16	58	26
2004	6749	23.3	9	22.4	19.8	25.4	14	58	28
2005	7799	23.4	9	22.5	19.8	25.6	14	57	29
2006	9526	23.3	7.7	22.5	19.9	25.7	14	56	29

Figure 7.2.1: Cumulative distribution of BMI, HD patients 1997-2006

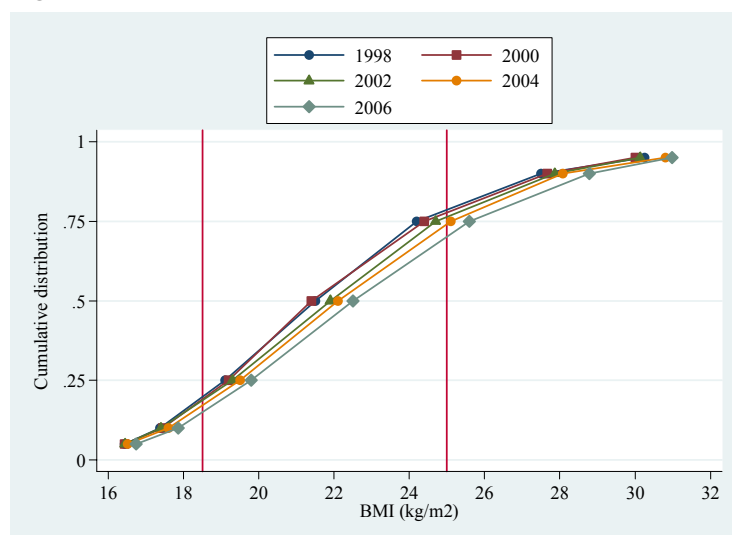


Table 7.2.2. indicates that mean BMI for CAPD patients from 1997 to 2006 was increasing from 22.6 to 23.4 despite a 3-fold increase in patient numbers. The percentage of CAPD patients with BMI ≥ 25 increased from 23% in 1997 to 33% in 2006. Patients with BMI of <18.5 had dropped from 21% in year 1997 to 16% in year 2006. This may perhaps reflect an increased number of overweight diabetic patients coming into dialysis.

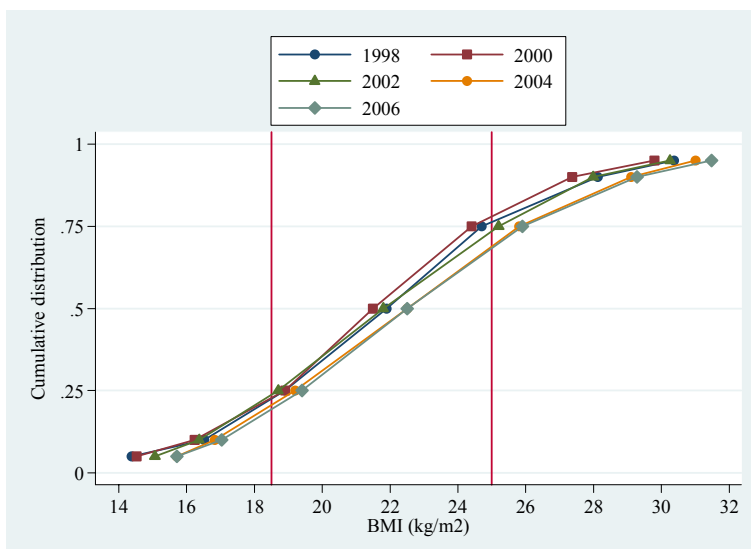
For the year 2006 and a CAPD population of 1413 patients, the mean BMI was 23.4 ± 8.2 and only 16% had BMI <18.5 .

Figure 7.2.2 reflects increasing BMI trends as the curve for 2006 is moving right. For the year 2006, only about 65% of the population (of 1413) were at a BMI of <25 . This figure is lower than 1998 [population =491] and 2000 [population =602] for which $>75\%$ of their populations had BMI below 25.

Table 7.2.2: Distribution of BMI, CAPD patients 1997-2006

Year	No of subjects	Mean	SD	Median	LQ	UQ	% patients <18.5	% patients 18.5-25	% patients ≥ 25
1997	420	22.6	12.5	21.9	18.9	24.7	21	56	23
1998	491	22	11.1	21.3	18.7	24	23	57	20
1999	552	21.7	4.5	21.5	18.9	24.4	22	56	22
2000	602	21.7	4.5	21.5	18.6	24.6	25	53	22
2001	663	22.1	5	21.8	18.7	25.2	23	50	27
2002	750	22.3	4.9	22.1	18.7	25.5	23	47	30
2003	1068	22.9	6.8	22.5	19.2	25.8	20	50	30
2004	1172	23.1	7.2	22.6	19.5	26	18	51	31
2005	1221	23	7.1	22.5	19.4	25.9	19	51	30
2006	1413	23.4	8.2	22.6	19.7	26.1	16	51	33

Figure 7.2.2: Cumulative distribution of BMI, CAPD patients 1997-2006



Less variation was observed for BMI measurements amongst 259 HD centers for 2006.

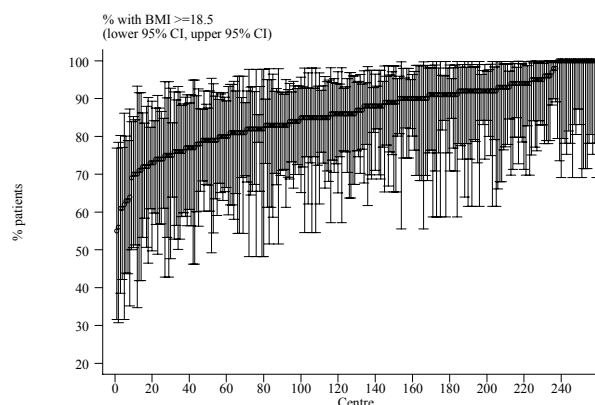
The median of the participating centers achieving BMI of ≥ 18.5 was 87%. The best centre had all (100%) patients achieving BMI ≥ 18.5 (target), while the worst centre had 55% of patients achieving this target. For all HD centres, there was a 1.4-fold variation in meeting the target BMI (≥ 18.5). (Table 7.2.3)

Table 7.2.3: Variation in Proportion of patients with BMI ≥ 18.5 among HD centres 2006

Year	No. of centres	Min	5 th Centile	LQ	Median	UQ	95 th Centile	Max
1997	44	62	64	74.5	81	88	100	100
1998	48	58	68	75.5	81.5	86	95	100
1999	72	59	67	78	82	90	95	100
2000	96	55	67	75	82	89	96	100
2001	110	60	68	77	83	89	94	100
2002	131	55	67	78	85	90	100	100
2003	156	55	69	79	84	91	100	100
2004	188	57	68	80	86	91	100	100
2005	208	64	70	81	88	93	100	100
2006	259	55	71	81	87	92	100	100

Figure 7.2.3 indicates the variation amongst 258 HD centers reporting the proportion of patients achieving the target BMI (≥ 18.5) for the year 2006. The center with the least number of patients of BMI >18.5 recorded a percentage of 55%

Figure 7.2.3: Variation in Proportion of patients with BMI ≥ 18.5 , HD centres 2006



There was a stable trend in the proportion of CAPD patients with BMI ≥ 18.5 from 1997 to 2006. For 23 CAPD centers in 2006, the maximum proportion of patients achieving the target BMI (≥ 18.5) was 93% whilst the worst centres reported 30% of the patients achieving this target. This represented a 2.4-fold difference in variation. (Table 7.2.4)

Table 7.2.4: Variation in Proportion of patients with BMI ≥ 18.5 among CAPD centres 2006

Year	No. of centres	Min	5 th Centile	LQ	Median	UQ	95 th Centile	Max
1997	7	50	50	74	81	88	93	93
1998	9	0	0	71	80	89	91	91
1999	9	0	0	71	75	83	93	93
2000	11	11	11	60	76	88	90	90
2001	11	15	15	72	77	88	92	92
2002	15	19	19	65	81	85	87	87
2003	19	17	17	63	81	88	96	96
2004	19	25	25	71	81	89	95	95
2005	19	17	17	67	84	88	91	91
2006	23	30	38	76	84	91	93	94

Figure 7.2.4 indicates that only one center reported the lowest proportion of patients achieving the target BMI ≥ 18.5 whilst 18 centers reported higher proportions ($>75\%$).

Figure 7.2.4: Variation in Proportion of patients with BMI ≥ 18.5 , CAPD centres 2006

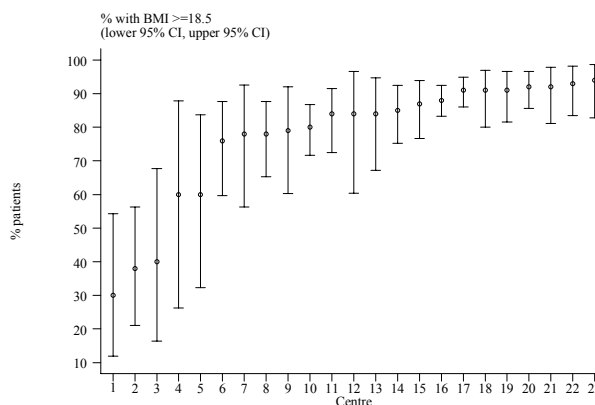


Table 7.2.5 shows that 20 out of 246 HD centres (8.1%) reported patients below BMI of 18.5 and serum albumin of < 30g/L with 7 of these centres (2.8%) at the 95th centile.

Figure 7.2.5 indicates one centre reports 20% of patients falling in this category of severe malnutrition, whilst for 17 of the 20 centres less than 10% of patients were reported in this category

Table 7.2.5: Variation in Proportion of patients with BMI ≤ 18.5 and serum albumin ≤ 30 g/dL among HD centres 2006

Year	No. of centres	Min	5 th Centile	LQ	Median	UQ	95 th Centile	Max
1997	44	0	0	0	0	0	4	8
1998	48	0	0	0	0	0.5	6	8
1999	65	0	0	0	0	1	5	10
2000	87	0	0	0	0	1	9	28
2001	107	0	0	0	0	0	6	10
2002	122	0	0	0	0	0	5	13
2003	149	0	0	0	0	0	5	10
2004	177	0	0	0	0	0	4	9
2005	200	0	0	0	0	0	5.5	14
2006	246	0	0	0	0	0	7	20

Figure 7.2.5: Variation in Proportion of patients BMI ≤18.5 and serum albumin ≤ 30 , HD centres 2006

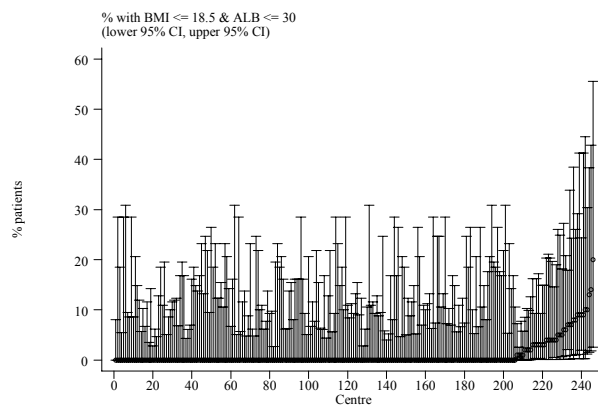


Table 7.2.6 shows that 21 out of 23 CAPD centres (91.3%) reported patients with BMI below 18.5 and serum albumin < 30g/L with 12 of these centres (52.2%) at the 95th centile.

Figure 7.2.6 indicates one centre reported 20% of patients falling in this category of severe malnutrition, whilst 16 centres reported less than 10% of patients in this category.

Table 7.2.6: Variation in Proportion of patients with BMI ≤ 18.5 and serum albumin ≤ 30 g/dL among CAPD centres 2006

Year	No. of centres	Min	5 th Centile	LQ	Median	UQ	95 th Centile	Max
1997	7	0	0	3	6	7	13	13
1998	9	0	0	0	0	3	5	5
1999	9	0	0	0	3	6	29	29
2000	11	0	0	2	5	10	10	10
2001	11	2	2	4	6	9	15	15
2002	15	0	0	0	3	7	20	20
2003	19	0	0	0	4	8	25	25
2004	19	0	0	0	3	6	10	10
2005	19	0	0	3	5	8	12	12
2006	23	0	0	2	4	6	12	21

Figure 7.2.6: Variation in Proportion of patients BMI ≤ 18.5 and serum albumin ≤ 30 g/dL, CAPD centres 2006

