

# **CHAPTER 7**

## **Nutritional Status on Dialysis**

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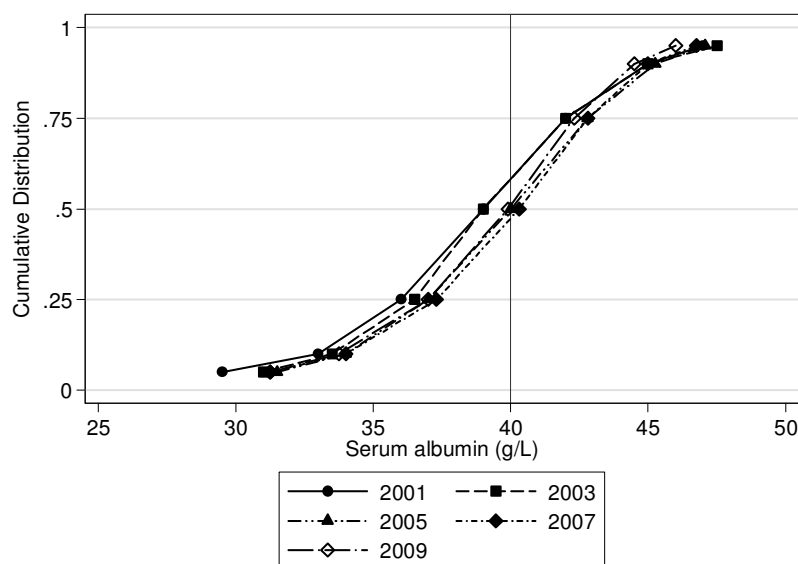
**SECTION 7.1: SERUM ALBUMIN LEVELS ON DIALYSIS**

Patient numbers on HD increased by 2062 from 2008 which represents a 14% increase. Mean serum albumin levels in 2009 stood at 39.4 g/L, which is just below the desired level of >40 g/L. However, the overall trend for percentage distribution of patients for serum albumin remains unchanged since 2001, i.e. >39 g/L. In 2009, the percent well-nourished patients (>40g/L) is at 51% whilst 35% of patients are in the 35-40g/L range. Improving trends are also indicated from the cumulative distribution graph of albumin in HD patients (Figure 7.1.1).

**Table 7.1.1:** Distribution of serum albumin, HD patients, 2000-2009

Year	No. of subjects	Mean	SD	Median	LQ	UQ	% patients <30g/L	% patients 30-<35g/L	% patients 35-<40g/L	% patients ≥40g/L
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	10928	39.8	5.4	40.3	37.3	42.8	3	10	33	54
2007	12315	39.7	5.3	40	37	42.5	3	10	35	52
2008	14497	39.4	5.1	39.9	37	42.3	3	10	36	50
2009	16559	39.4	5.1	40	37	42.3	3	11	35	51

**Figure 7.1.1:** Cumulative distribution of Albumin, HD patients 2000-2009

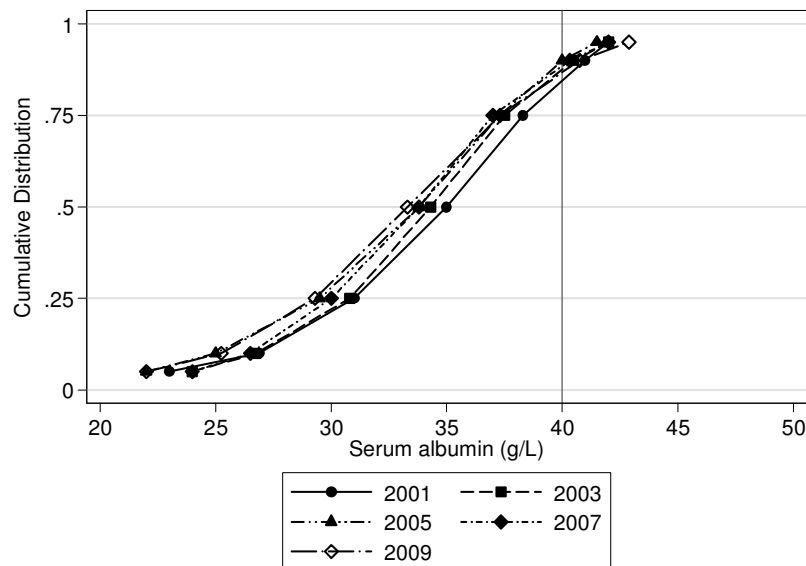


The number of PD patients increased to 2135 with an increment of 5.6% compared to the previous year. The downward trend in mean serum albumin levels for patients on PD continued; from 34.3 g/L in 2000 to 32.7g/L in 2009 (Table 7.1.2). Percentage of patients with unsatisfactory serum albumin (<35 g/L) increased from 48% in 2000 to 64% by 2009. This was despite a 2% improvement in the number of patients with serum albumin >40g/L in 2009 compared to 2008. The cumulative distribution graph in 2009, reflects the continuing trend that percent of PD patients with serum albumin <35 g/L is increasing (Figure 7.1.2).

**Table 7.1.2:** Distribution of serum albumin, PD patients, 2000-2009

Year	No. of subjects	Mean	SD	Median	LQ	UQ	% patients <30g/L	% patients 30-<35g/L	% patients 35-<40g/L	% patients ≥40g/L
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	1498	33.5	6.1	33.8	30	37	25	33	30	12
2007	1753	33.6	6.2	34	30	37.8	25	31	30	14
2008	2021	33.1	6.4	33.3	29.3	37.3	28	32	27	13
2009	2135	32.7	6.4	33	29	36.8	30	34	25	11

**Figure 7.1.2:** Cumulative distribution of serum albumin, PD patients 2000-2009



A wide variation between HD centers was observed for those achieving serum albumin  $\geq 40\text{g/L}$  (target albumin) for 2009. The median was 52% for the year 2009. The trend in the percent of HD centres achieving a median  $>50\%$  since 2003 is continuing but decreasing. The best centre had all (100%) patients achieving serum albumin  $\geq 40\text{g/L}$  (target albumin), whilst the worst center had zero patients achieving this target. For all HD centres, greater than 16.6-fold variation in meeting albumin target was observed (Table 7.1.3) Indicating the wide variation amongst 385 HD centres reporting the proportion of patients able to achieve the target serum albumin  $\geq 40\text{g/L}$  for the year 2009 (Figure 7.1.3).

**Table 7.1.3:** Variation in Proportion of patients with serum albumin  $\geq 40\text{g/L}$  among HD centres 2009

Year	No. of centers	Min	5th centile	LQ	Median	UQ	95th centile	Max
2000	92	0	7	24	43	62.5	83	91
2001	117	0	3	17	40	57	85	100
2002	142	0	9	26	44	62	84	100
2003	172	0	17	40	55	70	92	100
2004	201	0	12	34	57	73	88	100
2005	229	4	13	43	56	70	86	100
2006	279	0	10	38	54	70	87	100
2007	311	0	14	38	54	67	86	100
2008	350	0	7	34	51	66	84	100
2009	385	0	6	36	52	65	84	100

**Figure 7.1.3:** Variation in Proportion of patients with serum albumin  $\geq 40\text{g/L}$ , HD centres 2009

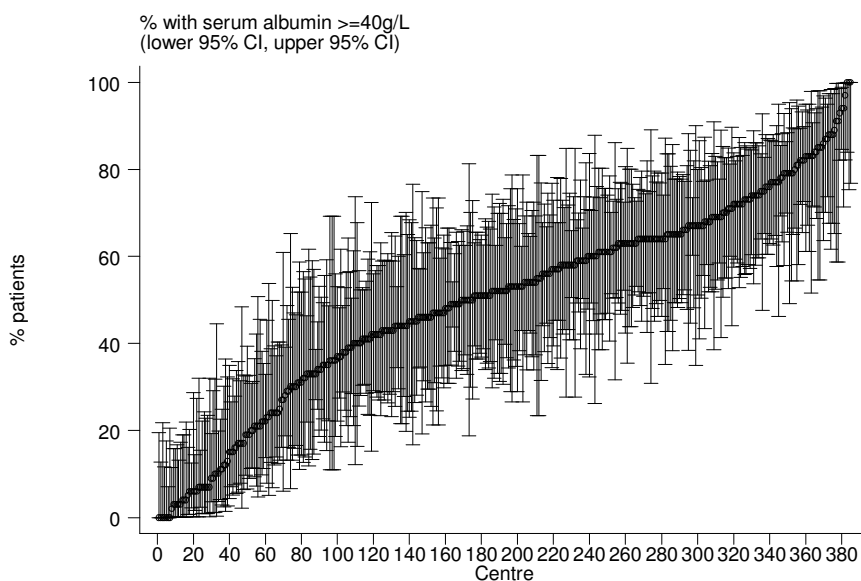
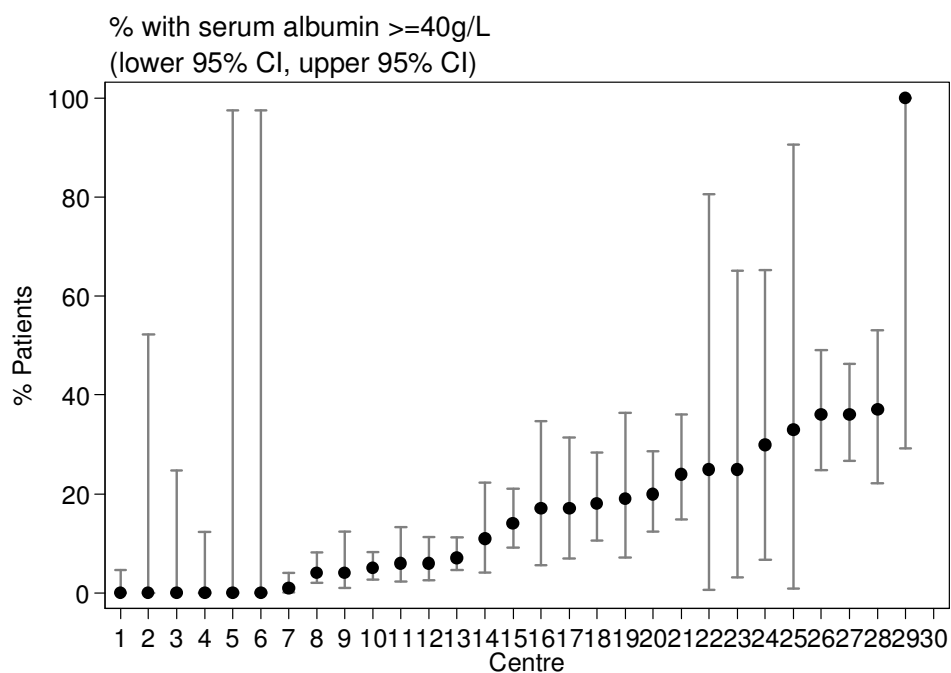


Table 7.1.4 indicates that for 29 PD centers in 2009, one center reported the maximum proportion of patients achieving the target serum albumin  $\geq 40\text{g/L}$  was 100% whilst majority of centers reported achieving less than this target. Overall 19 centres reported  $<20\%$  of their patients achieving the target serum albumin  $\geq 40\text{g/L}$ . (Figure 7.1.4)

**Table 7.1.4:** Variation in Proportion of patients with serum albumin  $\geq 40\text{g/L}$  among PD centres 2009

Year	No. of centers	Min	5th centile	LQ	Median	UQ	95th centile	Max
2000	19	0	0	0	11	25	42	42
2001	21	0	0	0	8	28	43	67
2002	22	0	0	5	9.5	25	36	100
2003	25	0	0	4	12	19	50	58
2004	27	0	0	0	11	21	35	50
2005	27	0	0	3	11	22	29	50
2006	28	0	0	1.5	11	20.5	44	69
2007	27	0	0	3	14	22	36	59
2008	28	0	0	2	15	25.5	50	54
2009	29	0	0	4	14	25	37	100

**Figure 7.1.4:** Variation in Proportion of patients with serum albumin  $\geq 40\text{g/L}$ , PD centres 2009



**SECTION 7.2: BODY MASS INDEX (BMI) ON DIALYSIS**

Table 7.2.1 indicates the mean BMI for HD patients from 2000 to 2009. For the year 2009 the mean BMI was  $23.8 \pm 8.2$  for a HD population of 13416. This indicates that overall mean BMI trend is stabilizing at  $>23$  [22.9 in 2000 to 23.5 in 2008] despite a 3-fold increase in patient numbers from 2000 onwards. An increasing trend of improved BMI is observed for HD patients, with the percentage of HD patients with BMI  $\geq 25$  increasing from 22% in 2000 to 33% in 2009. The percent number of patients with BMI  $<18.5$  is at 13%.

Figure 7.2.1 reflects the increasing BMI trends as curve for 2009 continues in moving right. About 75% of the HD population is at BMI 26.

**Table 7.2.1:** Distribution of BMI, HD patients, 2000-2009

Year	No.	Mean	SD	Median	LQ	UQ	% patients <18.5	% patients 18.5-25	% patients $\geq 25$
2000	3859	22.9	11.7	21.6	19.3	24.5	18	60	22
2001	4551	23	11	21.9	19.3	24.7	18	59	23
2002	5103	23.2	10.6	22	19.5	24.9	16	59	24
2003	5989	23.1	9.7	22.2	19.5	25.1	16	58	26
2004	6775	23.3	9	22.4	19.8	25.4	14	58	28
2005	7838	23.4	9	22.5	19.8	25.6	14	57	29
2006	9791	23.3	7.9	22.6	19.9	25.7	14	56	29
2007	10507	23.4	7.9	22.7	19.9	25.8	14	56	30
2008	12199	23.5	7.5	22.8	20.1	26	14	55	31
2009	13416	23.8	8.2	23	20.1	26.1	13	54	33

**Figure 7.2.1:** Cumulative distribution of BMI, HD patients 2000-2009

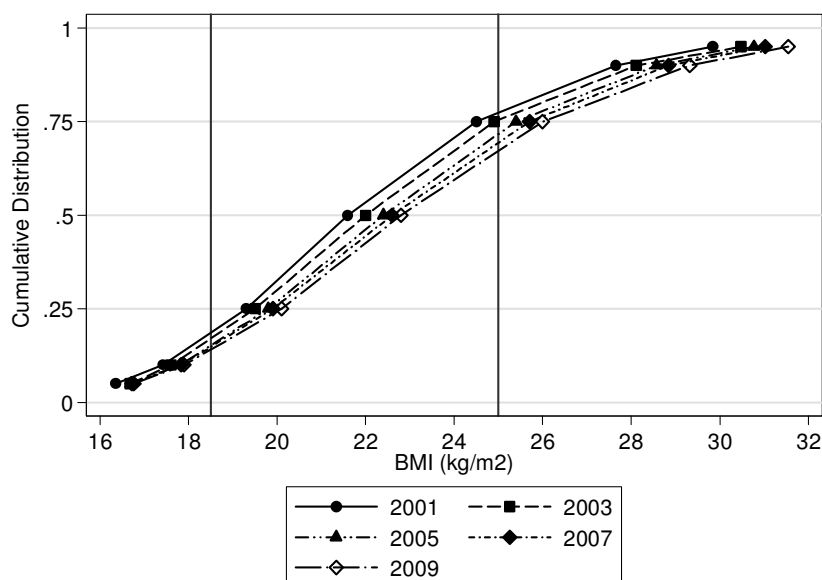
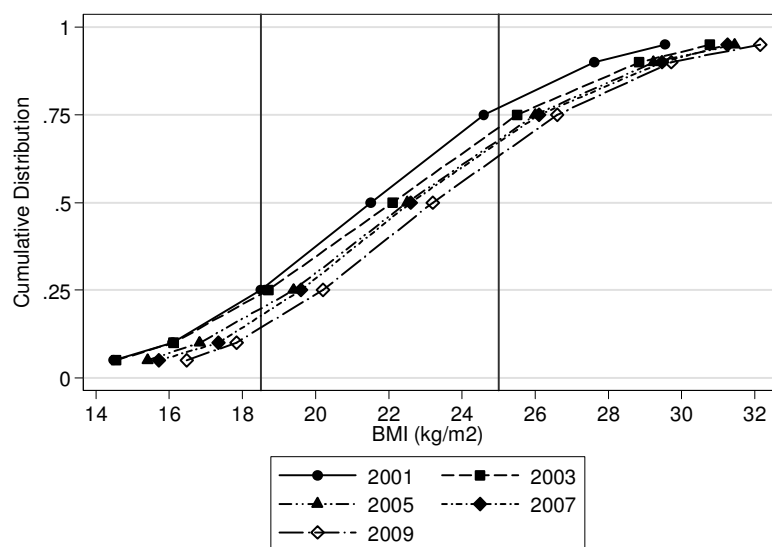


Table 7.2.2. indicates that mean BMI for PD patients from 2000 to 2009 is increasing from 21.6 to 24.1 despite a 3-fold increase in patient numbers. The percentage of PD patients with BMI  $\geq 25$  increased from 22% in 2000 to 38% in 2009. The shifting of the cumulative distribution curve for 2009 to the right reflects the small increases in BMI compared to the previous years. (Figure 7.2.2)

**Table 7.2.2:** Distribution of BMI, PD patients 2000-2009

Year	No.	Mean	SD	Median	LQ	UQ	% patients <18.5	% patients 18.5-25	% patients $\geq 25$
2000	603	21.6	4.6	21.5	18.5	24.6	25	53	22
2001	665	22	5.1	21.7	18.7	25.2	24	50	27
2002	752	22.2	5.1	22.1	18.7	25.5	24	47	30
2003	1072	22.8	6.9	22.5	19.2	25.8	20	50	30
2004	1176	23.1	7.3	22.5	19.4	26	19	50	31
2005	1223	23	7.2	22.5	19.3	25.8	20	50	30
2006	1421	23.3	8.3	22.6	19.6	26.1	16	50	33
2007	1620	23.4	5.9	22.9	19.9	26.3	15	51	34
2008	1876	23.8	7.7	23.2	20.2	26.6	14	50	36
2009	1945	24.1	8.5	23.4	20.4	26.8	13	50	38

**Figure 7.2.2:** Cumulative distribution of BMI, PD patients 2000-2009



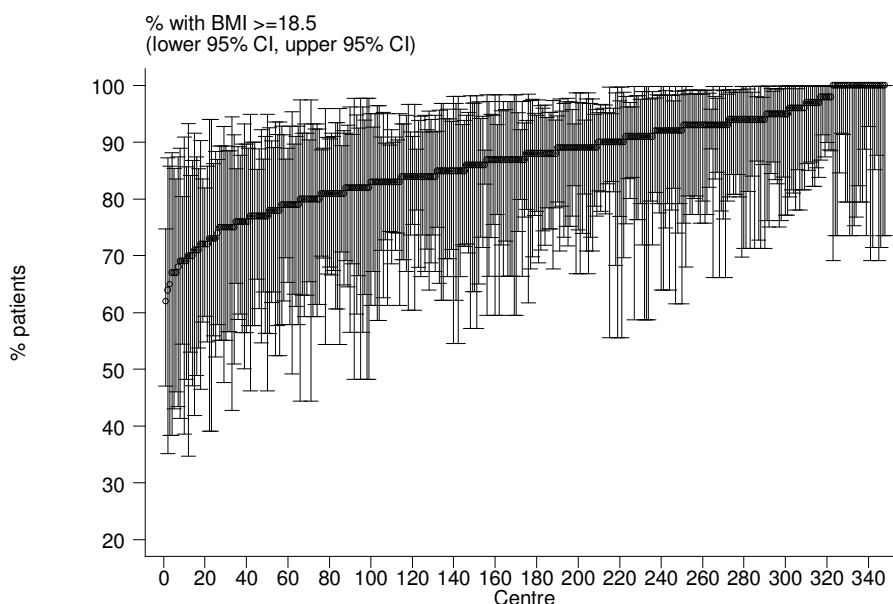
The variation in HD centres with proportion of patients with BMI  $\geq 18.5$  for 2009 is given in Table 7.2.3. The median for HD centers achieving the BMI target was 87.5% for the year 2009 and this trend is continuing from the previous years. One centre had all (100%) patients achieving BMI  $\geq 18.5$ , whilst the worst center had 62% of patients achieving this target. For all HD centres, a 1.6-fold variation in meeting the BMI target was observed.

A smaller variation is present amongst 348 HD centers reporting the proportion of patients able to achieve the target BMI  $\geq 18.5$  for the year 2009. About 300 HD centres reported 75% of their patients achieving this target.

**Table 7.2.3:** Variation in Proportion of patients with BMI  $\geq 18.5$  among HD centres 2009

Year	No. of centers	Min	5th centile	LQ	Median	UQ	95th centile	Max
2000	91	53	65	77	83	89	96	100
2001	111	60	65	77	84	88	92	100
2002	133	55	67	79	85	89	100	100
2003	156	60	70	79	84	91	100	100
2004	189	62	68	82	86	91	100	100
2005	208	50	70	80.5	88	93	100	100
2006	262	53	70	80	86	92	100	100
2007	285	54	71	81	87	92	100	100
2008	330	58	70	82	88	93	100	100
2009	348	62	72	82	87.5	93	100	100

**Figure 7.2.3:** Variation in Proportion of patients with BMI  $\geq 18.5$  among HD centres 2009





For 21 PD centers in 2009, the maximum proportion of patients achieving the target BMI  $\geq 18.5$  was 97% whilst the worst centres reported 29% of the patients achieving this target. This represented a 3.3-fold difference in variation.

Figure 7.2.4 indicates that only 2 centers reported <50% of their patients achieving the target BMI  $\geq 18.5$  whilst 17 centers reported higher proportions (>75%) meeting the target.

**Table 7.2.4:** Variation in Proportion of patients with BMI  $\geq 18.5$  among PD centres 2009

Year	No. of centers	Min	5th centile	LQ	Median	UQ	95th centile	Max
2000	11	11	11	63	76	87	90	90
2001	11	15	15	72	77	88	92	92
2002	15	16	16	63	81	85	87	87
2003	18	17	17	74	81.5	88	96	96
2004	18	27	27	75	82.5	89	94	94
2005	18	17	17	69	83.5	87	91	91
2006	22	13	23	78	84	91	92	93
2007	22	14	21	76	87	92	97	100
2008	22	21	26	78	88	91	95	100
2009	21	29	42	80	89	93	95	97

**Figure 7.2.4:** Variation in Proportion of patients with BMI  $\geq 18.5$  among PD centres 2009

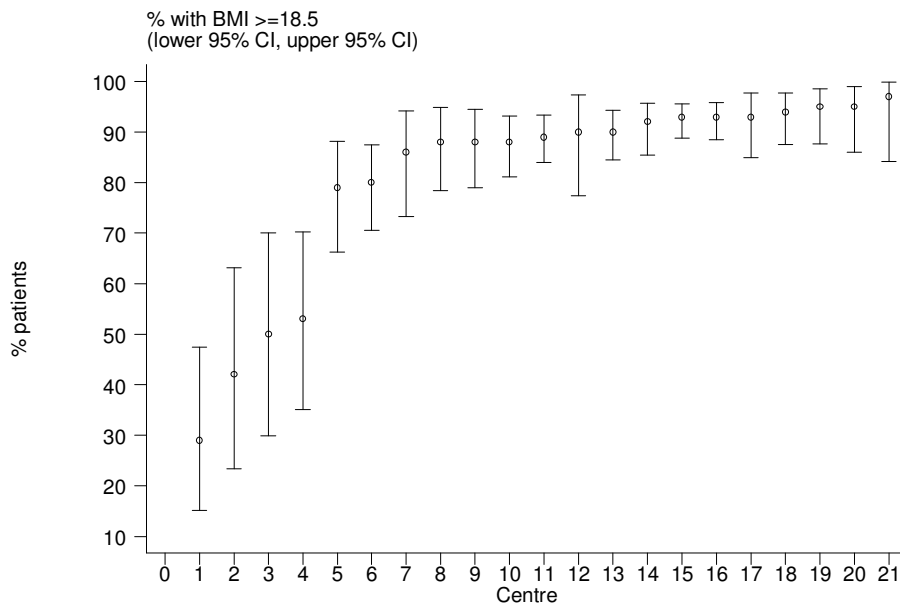


Table 7.2.5 and Figure 7.2.5 indicate a wide variation (23.3%) in the nutritional status of patients at 311 HD centers. Only 4% of patients in one centre met the criteria of BMI  $\geq 18.5$  and serum albumin  $\geq 40$  g/dL in contrast to 93% of patients in the best center meeting the criteria. A decreasing trend in centres with severely malnourished patients is observed.

**Table 7.2.5:** Variation in Proportion of patients with BMI  $\geq 18.5$  and serum albumin  $\geq 40$  g/dL among HD centres 2009

Year	No. of centers	Min	5th centile	LQ	Median	UQ	95th centile	Max
1999	63	2	7	23	44	61	71	83
2000	83	0	8	20	36	50	73	81
2001	105	0	3	10	32	50	69	100
2002	124	0	6	25.5	37.5	55	73	100
2003	150	0	18	34	47	62	78	100
2004	181	3	10	34	51	64	79	100
2005	198	5	10	38	50	63	80	90
2006	251	0	9	35	47	64	77	92
2007	270	0	9	32	47	60	74	93
2009	311	0	4	30	45	60	76	93

**Figure 7.2.5:** Variation in Proportion of patients with BMI  $\geq 18.5$  and serum albumin  $\geq 40$  g/dL among HD centres 2009

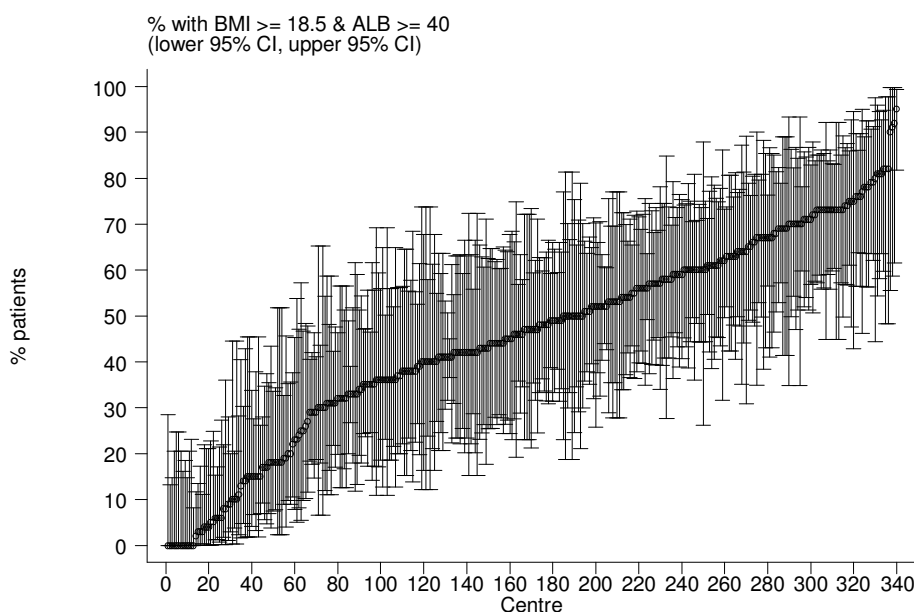


Table 7.2.6 and Figure 7.2.6 indicate a wide variation (15.2%) in the nutritional status of patients at 22 PD centres. Only 5% of patients in one centre met the criteria of BMI  $\geq 18.5$  and serum albumin  $\geq 40$  g/dL in contrast to 76% of patients in the best center meeting the criteria. An increasing trend in improvement of nutritional status is observed with these centres.

**Table 7.2.6:** Variation in Proportion of patients with BMI  $\geq 18.5$  and serum albumin  $\geq 40$  g/dL among PD centres 2009

Year	No. of centers	Min	5th centile	LQ	Median	UQ	95th centile	Max
1999	9	0	0	31	34	38	55	55
2000	11	0	0	24	38	61	75	75
2001	11	5	5	22	36	46	71	71
2002	15	10	10	20	40	50	67	67
2003	19	10	10	21	35	47	77	77
2004	19	9	9	20	44	56	81	81
2005	18	8	8	22	33.5	54	67	67
2006	22	7	10	24	43.5	55	63	65
2007	22	11	13	18	45.5	58	70	76
2009	22	5	8	17	34	54	71	76

**Figure 7.2.6:** Variation in Proportion of patients with BMI  $\geq 18.5$  and serum albumin  $\geq 40$  g/dL among PD centres 2009

