

# CHAPTER 7

## **NUTRITIONAL STATUS ON DIALYSIS**

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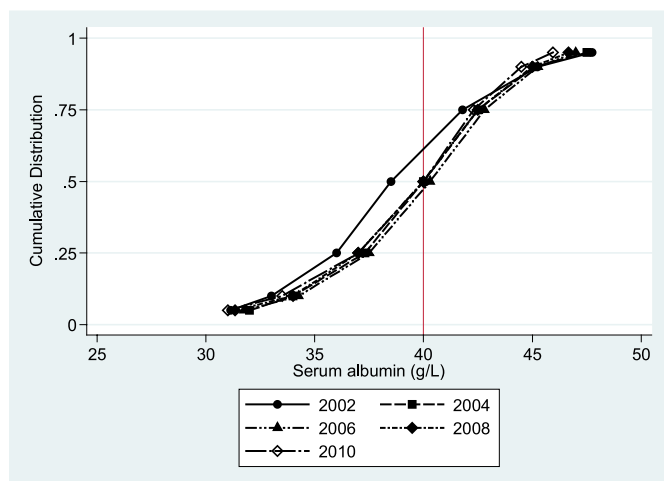
**SECTION 7.1: SERUM ALBUMIN LEVELS ON DIALYSIS**

For HD patients, mean serum albumin levels in 2010 of 38.9 g/L, and the median serum albumin levels of 39.3 g/L is still below the desired level of  $\geq 40$  g/L and has dropped compared to 2009. The percentage of patients with very low serum albumin of  $<35$ g/L has increased by 3% while patients with desirable serum albumin of  $\geq 40$ g/L has dropped by 7% compared to 2009. Nevertheless, improving trends are still indicated from the cumulative distribution graph of albumin in HD patients (Figure 7.1.1) over the 10 years.

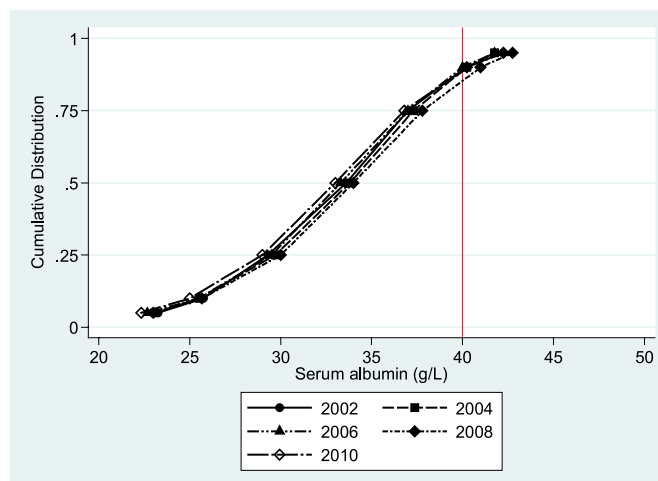
**Table 7.1.1:** Distribution of serum albumin, HD patients, 2001-2010

Year	Number of patients	Mean	SD	Median	LQ	UQ	% patients $<30$ g/L	% patients 30- $<35$ g/L	% patients 35- $<40$ g/L	% patients $\geq 40$ g/L
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	14548	39.4	5.1	40	37	42.3	3	10	36	50
2009	16941	39.4	5.1	40	37	42.3	3	11	35	51
2010	18502	38.9	4.9	39.3	36.3	41.8	4	13	40	44

**Figure 7.1.1:** Cumulative distribution of Albumin, HD patients 2001-2010



**Figure 7.1.2:** Cumulative distribution of serum albumin, PD patients 2001-2010



In PD patients, the downward trend in mean serum albumin levels for patients on PD continued; from 33.3 g/L in 2001 to 32.1g/L in 2010 (Table 7.1.2). Percentage of patients with unsatisfactory serum albumin ( $<35$  g/L) increased 4% from 2009. Similarly, the percentage of patients with good serum albumin levels of  $\geq 40$ g/L dipped further from 11 % in 2009 to 8% in 2010. The cumulative distribution graph (Figure 7.1.2) showed that trends have not changed since 2001.

**Table 7.1.2:** Distribution of serum albumin, PD patients, 2001-2010

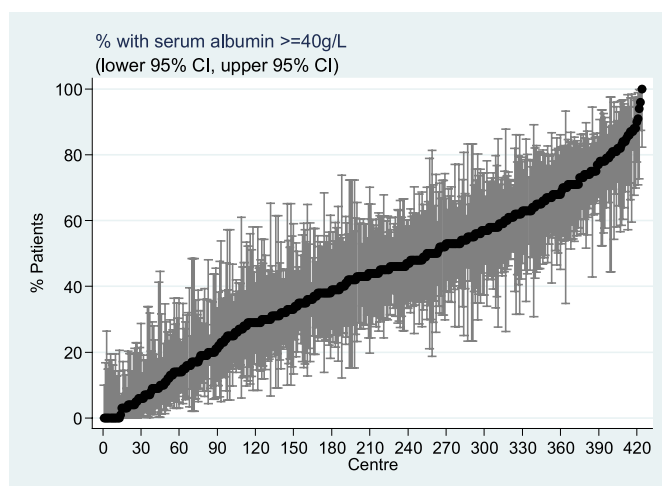
Year	Number of patients	Mean	SD	Median	LQ	UQ	% patients $<30$ g/L	% patients 30- $<35$ g/L	% patients 35- $<40$ g/L	% patients $\geq 40$ g/L
2001	750	33.3	6.2	33.6	29.3	37	27	33	28	12
2002	862	33.9	5.9	34.3	30.8	37.5	21	35	33	12
2003	1180	33.3	5.8	33.8	29.7	37.3	26	33	30	11
2004	1284	33	6	33.8	29.5	37.3	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	2138	32.7	6.4	33	29	36.8	30	34	25	11
2010	2305	32.1	6.2	32.3	28.5	36	33	35	24	8

The trend in the percent of HD centres achieving a median >50% since 2003 decreased in 2010. In fact, the number of centers which proportion of patients achieving  $\geq 40\text{g/L}$  for serum albumin have decreased to 44% in 2010 compared to 53% in 2009. Figure 7.1.3. indicated a wide variation amongst 424 HD centers reporting the proportion of patients able to achieve the target serum albumin  $\geq 40\text{g/L}$  for the year 2010, and only 1 center reported 100% of their patients achieved serum albumin of  $\geq 40\text{g/L}$ .

**Table 7.1.3:** Variation in Proportion of patients with serum albumin  $\geq 40\text{g/L}$  among HD centres 2001-2010

Year	Number of centers	Min	5 <sup>th</sup> centile	LQ	Median	UQ	95 <sup>th</sup> centile	Max
2001	116	0	3	15	40	58	85	100
2002	141	0	8	26	43	62	85	100
2003	175	0	18	39	55	70	92	100
2004	203	2	12	35	57	73	88	100
2005	229	4	11	42	56	69	86	100
2006	281	0	12	37	53	70	87	100
2007	313	0	13	37	54	68	86	100
2008	357	0	8	35	50	67	82	100
2009	401	0	7	36	53	65	82	100
2010	424	0	4	26.5	44	60.5	81	100

**Figure 7.1.3:** Variation in Proportion of patients with serum albumin  $\geq 40\text{g/L}$ , HD centres 2010



**Figure 7.1.4:** Variation in Proportion of patients with serum albumin  $\geq 40\text{g/L}$ , PD centres 2010

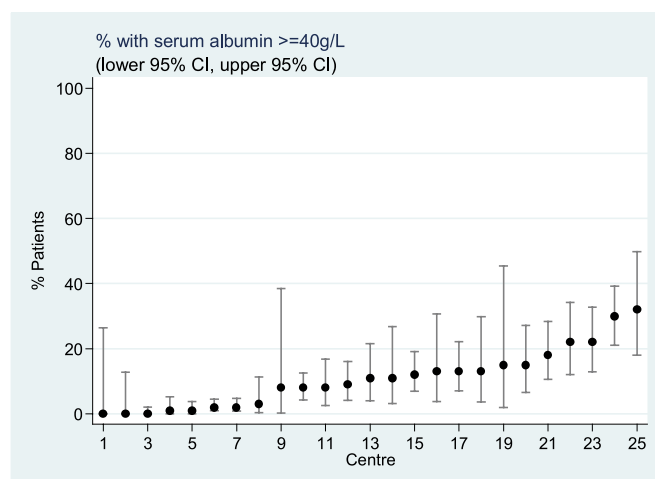


Table 7.1.4 indicates that for 25 PD centers in 2010, no center reported the maximum proportion of patients achieving the target serum albumin  $\geq 40\text{g/L}$  was 100% whilst majority of centers reported achieving less than this target. All the centers were only able to achieve less than 20% of 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 2001-2010

Year	Number of centers	Min	5 <sup>th</sup> centile	LQ	Median	UQ	95 <sup>th</sup> centile	Max
2001	12	1	1	4.5	16	27.5	36	36
2002	15	5	5	6	10	24	36	36
2003	18	1	1	8	14	19	58	58
2004	18	2	2	8	14	21	35	35
2005	19	1	1	7	14	23	29	29
2006	22	1	1	6	12.5	22	42	70
2007	22	0	1	11	14	21	36	61
2008	23	0	1	4	15	25	37	52
2009	23	0	0	6	14	23	36	37
2010	25	0	0	2	11	15	30	32

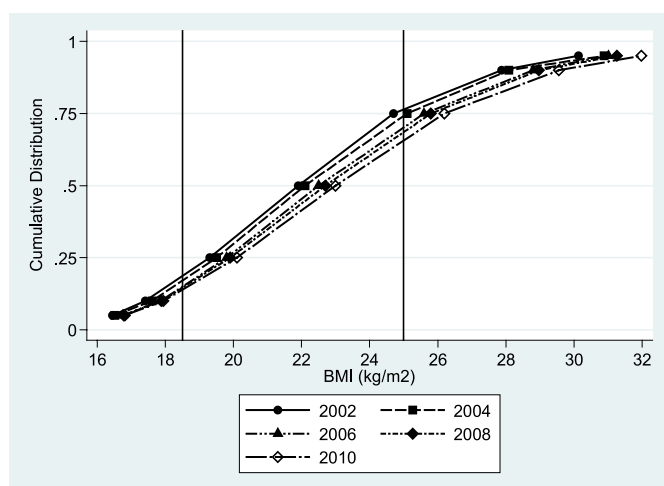
**SECTION 7.2: BODY MASS INDEX (BMI) ON DIALYSIS**

Table 7.2.1 indicates the mean BMI for HD patients from 2001 to 2010. For the year 2010 the mean BMI was 23.9 kg/m<sup>2</sup>. An increasing trend of improved BMI is observed for HD patients, with the percentage of HD patients with BMI ≥25 increased from 23% in 2001 to 35% in 2010. The percent number of patients with BMI <18.5 is at 12%. Figure 7.2.1 reflects the increasing BMI trends as the curve for 2010 continues in moving right.

**Table 7.2.1:** Distribution of BMI, HD patients, 2001-2010

Year	Number of patients	Mean	SD	Median	LQ	UQ	% patients <18.5	% patients 18.5-25	% patients ≥25
2001	4551	23	11	21.9	19.3	24.7	18	59	23
2002	5104	23.2	10.6	22	19.5	24.9	16	59	24
2003	5990	23.1	9.7	22.1	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	10509	23.4	7.9	22.7	19.9	25.8	14	56	30
2008	12217	23.5	7.5	22.8	20.1	26	13	55	31
2009	13714	23.8	8.2	23	20.1	26.2	13	54	33
2010	14582	23.9	7.9	23.2	20.3	26.5	12	53	35

**Figure 7.2.1:** Cumulative distribution of BMI, HD patients 2001-2010



**Figure 7.2.2:** Cumulative distribution of BMI, PD patients 2001-2010

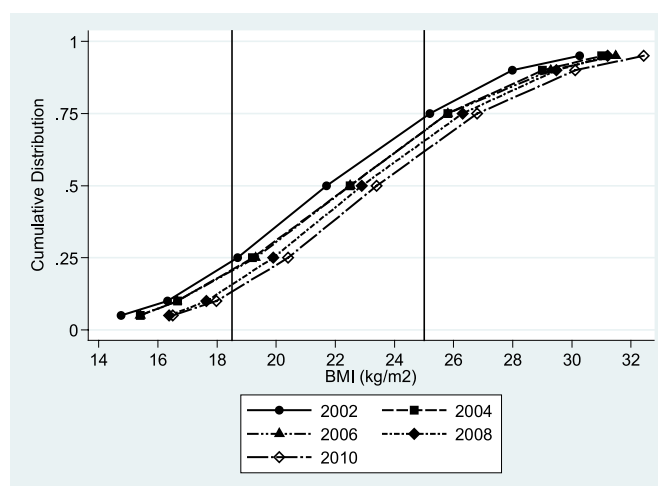


Table 7.2.2. indicates that mean BMI for PD patients from 2001 to 2010 is increasing from 22 to 24.5 despite a 3-fold increase in patient numbers. The percentage of PD patients with BMI ≥25 increased from 27% in 2001 to 39% in 2010. The shifting of the cumulative distribution curve for 2010 to the right reflects the small increases in BMI compared to the previous years. (Figure 7.2.2)

**Table 7.2.2:** Distribution of BMI, PD patients 2001-2010

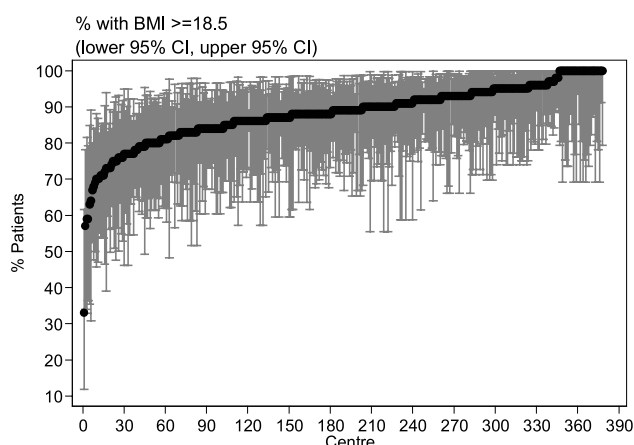
Year	Number of patients	Mean	SD	Median	LQ	UQ	% patients <18.5	% patients 18.5-25	% patients ≥25
2001	665	22	5.1	21.7	18.7	25.2	24	50	27
2002	752	22.2	5.1	22.1	18.7	25.5	24	47	30
2003	1072	22.8	6.9	22.5	19.2	25.8	20	50	30
2004	1176	23.1	7.3	22.5	19.4	26	19	50	31
2005	1223	23	7.2	22.5	19.3	25.8	20	50	30
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	1949	24.1	8.5	23.4	20.4	26.8	13	50	38
2010	2057	24.5	10.1	23.5	20.5	27.2	12	49	39

The variation in HD centres with proportion of patients with BMI  $\geq 18.5$  for 2010 is given in Table 7.2.3. The median for HD centers achieving the BMI target was 89% for the year 2010 and this positive trend is continuing from the previous years. A smaller variation is present amongst 378 HD centers reporting the proportion of patients able to achieve the target BMI  $\geq 18.5$  for the year 2009.

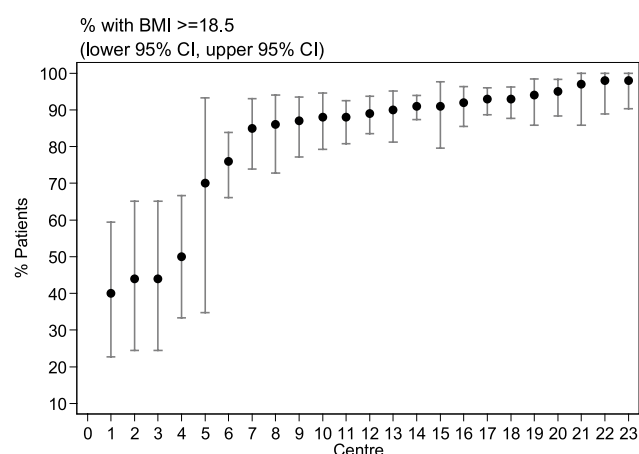
**Table 7.2.3:** Variation in Proportion of patients with BMI  $\geq 18.5$  among HD centres 2001-2010

Year	Number of centers	Min	5 <sup>th</sup> centile	LQ	Median	UQ	95 <sup>th</sup> centile	Max
2001	113	60	65	77	83	89	93	100
2002	133	55	67	79	85	89	100	100
2003	156	60	69	79	84	91	100	100
2004	190	58	68	81	86	92	100	100
2005	206	65	70	80	88	93	100	100
2006	262	53	70	80	86	92	100	100
2007	281	54	71	81	87	92	100	100
2008	331	59	70	82	87	93	100	100
2009	356	62	73	82	88	93	100	100
2010	378	33	73	84	89	94	100	100

**Figure 7.2.3:** Variation in Proportion of patients with BMI  $\geq 18.5$  among HD centres 2010



**Figure 7.2.4:** Variation in Proportion of patients with BMI  $\geq 18.5$  among PD centres 2010



For 23 PD centers in 2010, the maximum proportion of patients achieving the target BMI  $\geq 18.5$  was 98% whilst the worst centres reported 40% of the patients achieving this target. Figure 7.2.4 indicates that only 3 centers reported  $< 50\%$  of their patients achieving the target BMI  $\geq 18.5$  whilst 20 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 2001-2010

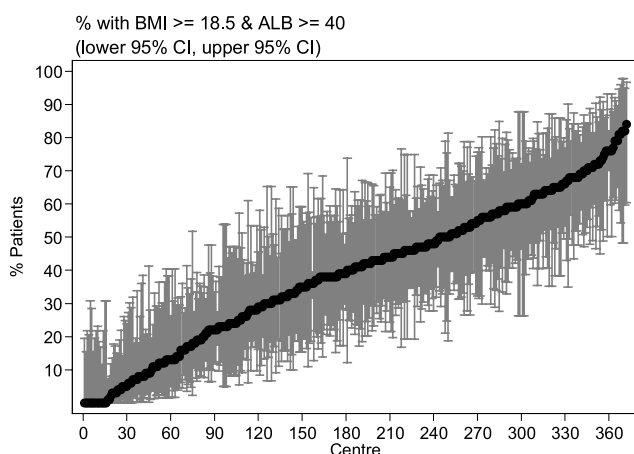
Year	Number of centers	Min	5 <sup>th</sup> centile	LQ	Median	UQ	95 <sup>th</sup> centile	Max
2001	11	15	15	72	77	88	92	92
2002	15	16	16	63	81	85	87	87
2003	18	18	18	74	81	88	96	96
2004	18	28	28	73	81.5	89	94	94
2005	18	17	17	70	83.5	87	91	91
2006	22	13	20	78	84	91	92	92
2007	22	15	17	76	87	92	97	100
2008	22	17	24	78	87.5	91	95	100
2009	21	29	40	80	90	93	95	97
2010	23	40	44	76	89	93	98	98

Table 7.2.5 and Figure 7.2.5 indicate a wide variation in the nutritional status of patients at 372 HD centers. Only 2% of patients in one centre met the criteria of BMI  $\geq 18.5$  and serum albumin  $>40$  g/dL in contrast to 84% of patients in the best center met 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 2001-2010

Year	Number of centers	Min	5 <sup>th</sup> centile	LQ	Median	UQ	95 <sup>th</sup> centile	Max
2001	106	0	0	11	31.5	50	68	100
2002	124	0	7	25.5	36.5	54	73	100
2003	150	0	17	35	47.5	61	78	100
2004	182	0	10	34	50	64	80	100
2005	195	3	11	38	50	62	80	90
2006	247	0	10	33	47	63	76	92
2007	272	0	9	32	47	60.5	74	92
2008	311	0	7	31	47	60	77	93
2009	349	0	5	33	46	61	76	92
2010	372	0	2	23	41	56.5	73	84

**Figure 7.2.5:** Variation in Proportion of patients with BMI  $\geq 18.5$  and serum albumin  $\geq 40$  g/dL among HD centres 2010



**Figure 7.2.6:** Variation in Proportion of patients with BMI  $\geq 18.5$  and serum albumin  $\geq 40$  g/dL among PD centres 2010

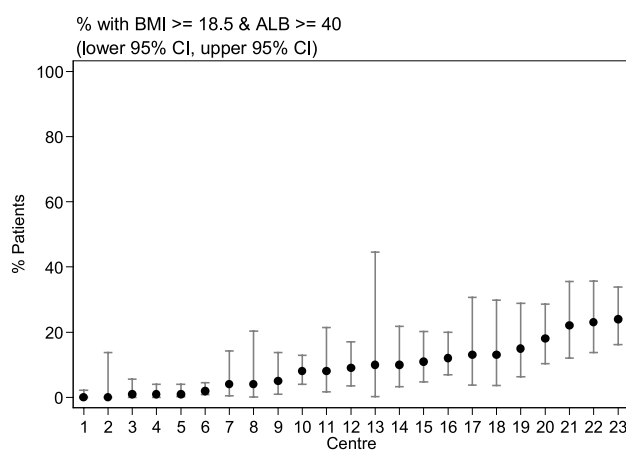


Table 7.2.6 and Figure 7.2.6 indicate a wide variation in the nutritional status of patients at 23 PD centers. Only 2% of patients in one centre met the criteria of BMI  $\geq 18.5$  and serum albumin  $\geq 40$  g/dL in contrast to 24% of patients in the best center meeting the criteria. An increasing 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 2001-2010

Year	Number of centers	Min	5 <sup>th</sup> centile	LQ	Median	UQ	95 <sup>th</sup> centile	Max
2001	11	1	1	5	8	20	24	24
2002	15	0	0	4	10	18	36	36
2003	18	0	0	4	10	16	46	46
2004	18	1	1	5	10.5	16	36	36
2005	18	0	0	4	8.5	17	26	26
2006	22	0	0	4	9.5	15	20	55
2007	22	0	1	4	11.5	19	36	54
2008	22	0	1	4	9	19	26	45
2009	21	0	0	5	10	19	29	35
2010	23	0	0	2	9	13	23	24