

**Supplementary File S5: Descriptive statistics and prevalence of abnormalities in the NHANES-II lumbar x-rays.**

**TABLE 1: Descriptive statistics for Anterior disc heights (ADH), before and after [in brackets] trimming. Trimming excluded all discs with definitive osteophytes/sclerosis or where the average disc height, disc angle, anterior sagittal plane offset (ASPO), posterior sagittal plane offset (PSPO), disc area, endplate width ratio, or superior height/width ratio was outside of the 95% confidence intervals established when all data were included.**

Level	N	Mean	StdDev	CV	Median	Skewness	Kurtosis
<b>L1L2</b>	7175	25.43	4.5	0.18	25.57	-0.38	4.15
	[3835]	[26.09]	[3.18]	[0.12]	[26.07]	[0.08]	[2.58]
<b>L2L3</b>	7369	28.79	4.96	0.17	29.16	-0.69	4.43
	[3565]	[29.97]	[3.33]	[0.11]	[29.97]	[0]	[2.58]
<b>L3L4</b>	7374	32.07	5.32	0.17	32.46	-0.72	4.45
	[3436]	[33.39]	[3.6]	[0.11]	[33.38]	[-0.03]	[2.67]
<b>L4L5</b>	7290	36.76	7.07	0.19	37.67	-0.8	4.05
	[3776]	[39.19]	[4.31]	[0.11]	[39.27]	[-0.07]	[2.68]
<b>L5S1</b>	6836	41.52	9.4	0.23	42.39	-0.42	3.04
	[4315]	[44.26]	[6.39]	[0.14]	[44.41]	[-0.08]	[2.45]

**Table 2: Descriptive statistics for Posterior Disc Heights (PDH), before and after [in brackets] trimming.**

Level	N	Mean	StdDev	CV	Median	Skewness	Kurtosis
<b>L1L2</b>	7175	17.61	3.12	0.18	17.56	0.1	3.68
	[3835]	[18.08]	[2.57]	[0.14]	[18]	[0.13]	[2.79]
<b>L2L3</b>	7369	17.07	3.69	0.22	17.1	-0.11	3.45
	[3565]	[18.11]	[2.84]	[0.16]	[18.03]	[0.09]	[2.74]
<b>L3L4</b>	7374	17.47	3.95	0.23	17.58	-0.16	3.31
	[3436]	[18.72]	[3.04]	[0.16]	[18.67]	[0.03]	[2.81]
<b>L4L5</b>	7290	17.44	4.61	0.26	17.73	-0.22	3.11
	[3776]	[18.69]	[3.52]	[0.19]	[18.71]	[-0.03]	[3.02]
<b>L5S1</b>	6836	13.49	4.61	0.34	13.41	0.18	3.06
	[4315]	[14.21]	[3.97]	[0.28]	[14.11]	[0.09]	[3]

**Table 3: Descriptive statistics for Average Disc Height (AvgDH), before and after [in brackets] trimming.**

Level	N	Mean	StdDev	CV	Median	Skewness	Kurtosis
<b>L1L2</b>	7175	21.52	3.15	0.15	21.58	-0.29	3.9
	[3835]	[22.08]	[2.34]	[0.11]	[22.01]	[0.08]	[2.39]
<b>L2L3</b>	7369	22.93	3.69	0.16	23.23	-0.67	4.31
	[3565]	[24.04]	[2.46]	[0.1]	[24.02]	[0.03]	[2.41]
<b>L3L4</b>	7374	24.77	4	0.16	25.11	-0.73	4.34
	[3436]	[26.05]	[2.72]	[0.1]	[26.03]	[-0.06]	[2.44]
<b>L4L5</b>	7290	27.1	5.08	0.19	27.84	-0.84	3.9
	[3776]	[28.94]	[3.13]	[0.11]	[28.98]	[-0.13]	[2.53]
<b>L5S1</b>	6836	27.5	5.81	0.21	28.21	-0.4	2.94
	[4315]	[29.23]	[3.94]	[0.13]	[29.39]	[-0.12]	[2.47]

**Table 4: Descriptive statistics for Disc Angle (DA), before and after [in brackets] trimming.**

Level	N	Mean	StdDev	CV	Median	Skewness	Kurtosis
<b>L1L2</b>	7175	4.62	2.65	0.57	4.66	-0.23	3.8
	[3835]	[4.73]	[2]	[0.42]	[4.72]	[0.02]	[2.41]
<b>L2L3</b>	7369	6.91	2.78	0.4	6.99	-0.25	3.73
	[3565]	[6.97]	[2.22]	[0.32]	[6.97]	[0.01]	[2.36]
<b>L3L4</b>	7374	8.49	2.85	0.34	8.55	-0.25	3.84
	[3436]	[8.52]	[2.26]	[0.27]	[8.49]	[0.01]	[2.43]
<b>L4L5</b>	7290	11.09	3.61	0.33	11.33	-0.36	3.73
	[3776]	[11.76]	[2.76]	[0.24]	[11.83]	[-0.1]	[2.54]
<b>L5S1</b>	6836	16.19	5.34	0.33	16.49	-0.26	3.1
	[4315]	[17.37]	[4.19]	[0.24]	[17.47]	[-0.07]	[2.45]

**Table 5: Descriptive statistics for Anterior Sagittal Plane Offset (ASPO), before and after [in brackets] trimming. Note that a positive ASPO informs the anterior inferior corner of the superior vertebra is anterior to the anterior superior corner of the inferior vertebra using the superior endplate of the inferior vertebra to define the coordinate system.**

Level	N	Mean	StdDev	CV	Median	Skewness	Kurtosis
<b>L1L2</b>	7175	-5.95	2.39	-0.4	-5.76	-0.52	4.65
	[3835]	[-5.49]	[1.62]	[-0.3]	[-5.48]	[-0.09]	[2.56]
<b>L2L3</b>	7369	-7.33	2.79	-0.38	-7.27	-0.02	5.23
	[3565]	[-6.95]	[1.91]	[-0.27]	[-6.93]	[-0.04]	[2.51]
<b>L3L4</b>	7374	-6.34	3.4	-0.54	-6.5	0.78	6.38
	[3436]	[-6.43]	[2.14]	[-0.33]	[-6.45]	[0.01]	[2.74]
<b>L4L5</b>	7290	-5.49	5.23	-0.95	-6.24	1.62	8.55
	[3776]	[-6.77]	[3.12]	[-0.46]	[-6.88]	[0.26]	[2.98]
<b>L5S1</b>	6836	-9.65	6.34	-0.66	-10.32	1.56	9.41
	[4315]	[-11.15]	[4.16]	[-0.37]	[-11.23]	[0.15]	[2.79]

**Table 6: Descriptive statistics for Posterior Sagittal Plane Offset (PSPO), before and after [in brackets] trimming. Note that a positive PSPO informs the posterior inferior corner of the superior vertebra is posterior to the posterior superior corner of the inferior vertebra using the superior endplate of the inferior vertebra to define the coordinate system.**

Level	N	Mean	StdDev	CV	Median	Skewness	Kurtosis
<b>L1L2</b>	7175	2.7	2.12	0.78	2.57	0.42	4.48
	[3835]	[2.35]	[1.46]	[0.62]	[2.32]	[0.09]	[2.53]
<b>L2L3</b>	7369	4.04	2.38	0.59	4.02	0.05	9.25
	[3565]	[3.92]	[1.6]	[0.41]	[3.9]	[0]	[2.51]
<b>L3L4</b>	7374	4.12	2.96	0.72	4.35	-1.23	8.48
	[3436]	[4.41]	[1.87]	[0.42]	[4.46]	[-0.14]	[2.71]
<b>L4L5</b>	7290	4.04	4.7	1.16	4.82	-2	11.21
	[3776]	[5.22]	[2.75]	[0.53]	[5.44]	[-0.39]	[3.18]
<b>L5S1</b>	6836	6.07	5.71	0.94	6.85	-2.3	13.57
	[4315]	[7.17]	[3.48]	[0.49]	[7.27]	[-0.25]	[3.02]

**Table 7: Descriptive statistics for Ventral disc heights (VDH), before and after [in brackets] trimming.**

Level	N	Mean	StdDev	CV	Median	Skewness	Kurtosis
<b>L1L2</b>	7175	26.46	4.71	0.18	26.6	-0.39	4.21
	[3835]	[27.11]	[3.33]	[0.12]	[27.12]	[0.08]	[2.61]
<b>L2L3</b>	7369	29.93	5.18	0.17	30.25	-0.62	4.39
	[3565]	[31.05]	[3.53]	[0.11]	[31.01]	[0.04]	[2.6]
<b>L3L4</b>	7374	32.63	5.46	0.17	33.04	-0.66	4.38
	[3436]	[33.9]	[3.72]	[0.11]	[33.82]	[-0.01]	[2.66]
<b>L4L5</b>	7290	36.86	7.23	0.2	37.81	-0.72	3.96
	[3776]	[39.36]	[4.45]	[0.11]	[39.43]	[-0.03]	[2.71]
<b>L5S1</b>	6836	41.73	9.64	0.23	42.61	-0.38	3.06
	[4315]	[44.61]	[6.62]	[0.15]	[44.77]	[-0.06]	[2.5]

**Table 8: Descriptive statistics for Dorsal disc heights (DDH), before and after [in brackets] trimming.**

Level	N	Mean	StdDev	CV	Median	Skewness	Kurtosis
<b>L1L2</b>	7175	18.28	3.19	0.17	18.24	0.09	3.55
	[3835]	[18.74]	[2.64]	[0.14]	[18.65]	[0.14]	[2.79]
<b>L2L3</b>	7369	17.73	3.71	0.21	17.79	-0.12	3.41
	[3565]	[18.75]	[2.86]	[0.15]	[18.69]	[0.09]	[2.73]
<b>L3L4</b>	7374	17.82	3.92	0.22	17.95	-0.18	3.35
	[3436]	[19.06]	[3]	[0.16]	[19.02]	[0.03]	[2.81]
<b>L4L5</b>	7290	17.61	4.61	0.26	17.93	-0.25	3.15
	[3776]	[18.94]	[3.47]	[0.18]	[18.98]	[-0.02]	[3.02]
<b>L5S1</b>	6836	13.95	4.46	0.32	13.92	0.14	3.28
	[4315]	[14.82]	[3.74]	[0.25]	[14.74]	[0.1]	[2.98]

**Table 9: Descriptive statistics for Mid-Plane Disc Angles (MPA), before and after [in brackets] trimming.**

Level	N	Mean	StdDev	CV	Median	Skewness	Kurtosis
<b>L1L2</b>	7175	2.6	3.26	1.25	2.66	-0.23	3.82
	[3835]	[2.81]	[2.66]	[0.95]	[2.78]	[0.07]	[2.93]
<b>L2L3</b>	7369	6.27	3.39	0.54	6.33	-0.16	3.44
	[3565]	[6.36]	[2.93]	[0.46]	[6.3]	[0.09]	[2.72]
<b>L3L4</b>	7374	9.14	3.56	0.39	9.14	-0.07	3.53
	[3436]	[9.24]	[3.1]	[0.34]	[9.18]	[0.1]	[2.93]
<b>L4L5</b>	7290	15.04	4.44	0.3	15.16	-0.17	3.64
	[3776]	[15.8]	[3.71]	[0.23]	[15.83]	[0.02]	[2.92]
<b>L5S1</b>	6836	24	5.71	0.24	24.3	-0.33	3.34
	[4315]	[25.27]	[4.56]	[0.18]	[25.43]	[-0.17]	[2.77]

**Table 10: Descriptive statistics for Centroid Sagittal Plane Offset (CSPO), before and after [in brackets] trimming.**

Level	N	Mean	StdDev	CV	Median	Skewness	Kurtosis
<b>L1L2</b>	7175	-5.16	2.52	-0.49	-4.97	-0.59	4.55
	[3835]	[-4.68]	[1.92]	[-0.41]	[-4.64]	[-0.17]	[2.96]
<b>L2L3</b>	7369	-7.4	2.65	-0.36	-7.3	-0.17	5.45
	[3565]	[-7.01]	[1.96]	[-0.28]	[-6.97]	[-0.1]	[3.06]
<b>L3L4</b>	7374	-7.98	3	-0.38	-8.1	0.86	7.08
	[3436]	[-8.14]	[2.03]	[-0.25]	[-8.16]	[0.05]	[2.91]
<b>L4L5</b>	7290	-8.25	4.64	-0.56	-8.98	1.94	10.65
	[3776]	[-9.29]	[2.84]	[-0.31]	[-9.48]	[0.39]	[3.38]
<b>L5S1</b>	6836	4.28	6.13	1.43	3.92	1.15	7.99
	[4315]	[3.52]	[4.69]	[1.33]	[3.69]	[-0.29]	[3.5]

Tables 11 to 17: Percent of levels with abnormalities. This includes all levels in all lumbar spines from the NHANES-II study. Abnormalities were identified by standardized (Z) scores in units of std dev from average normal.

**Table 11: Percent with disc heights > normal**

Level	zADH>2	zADH>3	zPDH>2	zPDH>3	zVDH>2	zVDH>3	zDDH>2	zDDH>3
<b>L1L2</b>	5.1	1.0	3.8	0.6	5.1	0.9	3.7	0.6
<b>L2L3</b>	3.9	0.4	3.1	0.3	3.9	0.6	3.2	0.3
<b>L3L4</b>	3.4	0.4	2.8	0.4	3.9	0.5	2.7	0.5
<b>L4L5</b>	3.1	0.4	3.0	0.4	3.1	0.5	2.8	0.4
<b>L5S1</b>	3.3	0.2	3.3	0.5	3.1	0.3	3.0	0.5

**Table 12: Percent with disc Heights < normal**

Level	zADH<-2	zADH<-3	zPDH<-2	zPDH<-3	zVDH<-2	zVDH<-3	zDDH<-2	zDDH<-3
<b>L1L2</b>	9.2	2.8	6.1	0.9	8.9	2.8	6.0	0.9
<b>L2L3</b>	12.0	4.5	10.0	2.6	11.0	4.2	9.9	2.4
<b>L3L4</b>	12.2	4.9	11.0	2.9	11.5	4.7	11.1	3.1
<b>L4L5</b>	16.4	8.3	11.4	3.1	16.4	8.0	12.0	3.5
<b>L5S1</b>	15.3	5.7	5.4	0.4	15.2	5.5	6.7	0.6

**Table 13: Percent with disc angles > normal. A large positive disc angle would be where the anterior disc height is much greater than it should be relative to the posterior disc height.**

Level	zDA>2	zDA>3	zMPA>2	zMPA>3
<b>L1L2</b>	5.7	0.9	4.0	0.5
<b>L2L3</b>	4.4	0.6	3.7	0.4
<b>L3L4</b>	5.2	0.8	3.9	0.5
<b>L4L5</b>	3.0	0.5	2.7	0.4
<b>L5S1</b>	3.0	0.2	2.5	0.1

**Table 14: Percent with disc angles < normal**

Level	zDA<-2	zDA<-3	zMPA<-2	zMPA<-3
L1L2	6.7	1.7	5.8	1.4
L2L3	6.0	1.1	4.3	0.9
L3L4	5.7	1.4	4.2	0.8
L4L5	9.2	2.9	6.7	1.4
L5S1	9.5	2.3	9.3	2.1

**Table 15: Percent with SPO > normal**

Level	zASPO>2	zASPO>3	zPSPO>2	zPSPO>3	zCSPO>2	zCSPO>3
L1L2	4.2	0.8	10.8	3.7	2.4	0.4
L2L3	5.2	1.4	8.4	2.2	4.0	0.9
L3L4	8.5	3.6	5.3	1.3	7.2	3.2
L4L5	12.6	6.6	2.3	0.3	11.0	6.0
L5S1	10.4	4.5	2.5	0.2	6.2	2.7

**Table 16: Percent with SPO < normal**

Level	zASPO<-2	zASPO<-3	zPSPO<-2	zPSPO<-3	zCSPO<-2	zCSPO<-3
L1L2	11.6	4.3	4.2	0.9	9.1	3.0
L2L3	10.1	3.4	6.3	2.0	8.3	2.6
L3L4	7.6	2.1	8.7	4.0	5.5	1.3
L4L5	2.9	0.4	12.1	6.6	2.2	0.3
L5S1	2.6	0.2	9.4	4.9	3.4	0.6

**Table 17: Percent with average disc height > or < normal**

Level	zavgDH>2	zavgDH>3	zavgDH<-2	zavgDH<-3
L1L2	4.4	0.7	8.8	2.6
L2L3	3.6	0.4	13.1	5.5
L3L4	2.7	0.2	13.3	5.6
L4L5	2.3	0.1	16.8	8.8
L5S1	3.1	0.3	15.9	6.2

## References

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