

Supplementary File S6: Descriptive statistics and prevalence of abnormalities in pooled neutral-lateral standing 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
L1L2	2671 [978]	26.31 [27.84]	5.35 [2.56]	0.2 [0.09]	26.74 [27.82]	-0.77 [0.04]	4.49 [2.34]
L2L3	2837 [1052]	30.29 [32.49]	6.24 [2.76]	0.21 [0.09]	31.28 [32.57]	-1.16 [-0.06]	5.02 [2.4]
L3L4	2854 [1045]	33.86 [36.39]	6.83 [2.98]	0.2 [0.08]	35.02 [36.51]	-1.13 [-0.09]	4.91 [2.37]
L4L5	2838 [989]	35.72 [39.78]	9.4 [4.27]	0.26 [0.11]	37.48 [40.1]	-0.71 [-0.3]	3.12 [2.54]
L5S1	2697 [1012]	38.69 [42.24]	10.23 [5.32]	0.26 [0.13]	39.51 [42.5]	-0.27 [-0.15]	2.61 [2.29]

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

Level	N	Mean	StdDev	CV	Median	Skewness	Kurtosis
L1L2	2671 [978]	16.01 [16.85]	3.37 [2.28]	0.21 [0.14]	16.05 [16.78]	-0.19 [0.19]	3.54 [2.58]
L2L3	2837 [1052]	15.64 [16.9]	3.87 [2.29]	0.25 [0.14]	15.94 [16.9]	-0.47 [0.02]	3.66 [2.69]
L3L4	2854 [1045]	16.07 [17.68]	4.17 [2.35]	0.26 [0.13]	16.53 [17.7]	-0.49 [0.01]	3.52 [2.9]
L4L5	2838 [989]	15.53 [17.2]	4.55 [3.19]	0.29 [0.19]	15.95 [17.28]	-0.17 [-0.06]	2.88 [2.81]
L5S1	2697 [1012]	11.97 [12.76]	4.36 [3.64]	0.36 [0.29]	11.71 [12.56]	0.33 [0.29]	3.15 [3.09]

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

Level	N	Mean	StdDev	CV	Median	Skewness	Kurtosis
L1L2	2671	21.16	3.69	0.17	21.57	-0.91	4.73
	[978]	[22.35]	[1.9]	[0.09]	[22.23]	[0.13]	[2.19]
L2L3	2837	22.97	4.55	0.2	23.8	-1.16	4.85
	[1052]	[24.7]	[2.14]	[0.09]	[24.76]	[-0.03]	[2.26]
L3L4	2854	24.96	5.02	0.2	25.88	-1.08	4.53
	[1045]	[27.04]	[2.31]	[0.09]	[27.08]	[-0.07]	[2.32]
L4L5	2838	25.63	6.31	0.25	26.66	-0.64	2.95
	[989]	[28.49]	[3.27]	[0.11]	[28.73]	[-0.32]	[2.39]
L5S1	2697	25.33	5.99	0.24	25.89	-0.25	2.6
	[1012]	[27.5]	[3.43]	[0.12]	[27.59]	[-0.04]	[2.16]

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

Level	N	Mean	StdDev	CV	Median	Skewness	Kurtosis
L1L2	2671	6.08	2.98	0.49	6.3	-0.38	3.52
	[978]	[6.49]	[1.78]	[0.27]	[6.58]	[-0.14]	[2.1]
L2L3	2837	8.59	2.94	0.34	8.92	-0.68	4.01
	[1052]	[9.14]	[1.6]	[0.18]	[9.25]	[-0.25]	[2.24]
L3L4	2854	10.27	3.03	0.29	10.5	-0.62	4.07
	[1045]	[10.8]	[1.6]	[0.15]	[10.78]	[-0.14]	[2.23]
L4L5	2838	11.54	4.42	0.38	12.22	-0.65	3.59
	[989]	[12.9]	[2.18]	[0.17]	[13.03]	[-0.31]	[2.41]
L5S1	2697	15.34	5.9	0.38	15.83	-0.23	2.68
	[1012]	[16.92]	[3.5]	[0.21]	[17.31]	[-0.24]	[2.18]

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
L1L2	2671 [978]	-6.57 [-6.29]	2.61 [1.5]	-0.4 [-0.24]	-6.42 [-6.24]	-0.32 [-0.09]	4.14 [2.46]
L2L3	2837 [1052]	-8.03 [-8]	2.99 [1.65]	-0.37 [-0.21]	-8.04 [-8.01]	0.47 [0.05]	6.45 [2.48]
L3L4	2854 [1045]	-6.64 [-7.54]	4.49 [1.91]	-0.68 [-0.25]	-7.32 [-7.67]	1.93 [0.28]	9.74 [2.88]
L4L5	2838 [989]	-3.31 [-6.43]	9.06 [4.2]	-2.74 [-0.65]	-6.17 [-7.17]	1.53 [1.77]	5.06 [6.71]
L5S1	2697 [1012]	-9.17 [-10.41]	6.26 [3.44]	-0.68 [-0.33]	-9.6 [-10.4]	1.4 [0.13]	9.19 [2.66]

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
L1L2	2671 [978]	3.19 [2.96]	2.28 [1.36]	0.72 [0.46]	3.05 [2.94]	0.39 [0.07]	4.81 [2.39]
L2L3	2837 [1052]	4.94 [4.91]	2.48 [1.38]	0.5 [0.28]	4.89 [4.82]	-0.56 [0.07]	8.44 [2.54]
L3L4	2854 [1045]	4.79 [5.63]	3.91 [1.6]	0.81 [0.28]	5.49 [5.76]	-2.38 [-0.46]	12.18 [2.9]
L4L5	2838 [989]	2.2 [5]	8.18 [3.71]	3.72 [0.74]	5.16 [5.8]	-1.72 [-2.07]	5.5 [7.85]
L5S1	2697 [1012]	6.41 [7.28]	5.22 [2.83]	0.81 [0.39]	7.11 [7.51]	-2.21 [-0.42]	13.62 [2.79]

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

Level	N	Mean	StdDev	CV	Median	Skewness	Kurtosis
L1L2	2671	27.38	5.62	0.21	27.84	-0.76	4.54
	[978]	[28.95]	[2.7]	[0.09]	[29.03]	[0.07]	[2.48]
L2L3	2837	31.34	6.5	0.21	32.4	-1.14	4.99
	[1052]	[33.61]	[2.92]	[0.09]	[33.75]	[-0.05]	[2.44]
L3L4	2854	34.18	7.03	0.21	35.37	-1.08	4.75
	[1045]	[36.76]	[3.08]	[0.08]	[36.86]	[-0.12]	[2.4]
L4L5	2838	35.53	9.64	0.27	37.02	-0.6	2.94
	[989]	[39.71]	[4.44]	[0.11]	[39.94]	[-0.28]	[2.52]
L5S1	2697	38.86	10.47	0.27	39.66	-0.24	2.61
	[1012]	[42.49]	[5.49]	[0.13]	[42.64]	[-0.15]	[2.35]

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

Level	N	Mean	StdDev	CV	Median	Skewness	Kurtosis
L1L2	2671	16.64	3.44	0.21	16.65	-0.19	3.64
	[978]	[17.49]	[2.33]	[0.13]	[17.44]	[0.2]	[2.6]
L2L3	2837	16.25	3.92	0.24	16.57	-0.51	3.72
	[1052]	[17.54]	[2.3]	[0.13]	[17.52]	[0.03]	[2.68]
L3L4	2854	16.37	4.2	0.26	16.87	-0.55	3.57
	[1045]	[18.03]	[2.31]	[0.13]	[18.03]	[-0.02]	[2.89]
L4L5	2838	15.57	4.63	0.3	15.97	-0.17	2.8
	[989]	[17.37]	[3.17]	[0.18]	[17.54]	[-0.11]	[2.69]
L5S1	2697	12.48	4.17	0.33	12.33	0.28	3.13
	[1012]	[13.38]	[3.44]	[0.26]	[13.2]	[0.32]	[3.12]

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

Level	N	Mean	StdDev	CV	Median	Skewness	Kurtosis
L1L2	2671	3.44	3.67	1.07	3.67	-0.38	3.48
	[978]	[4.1]	[2.54]	[0.62]	[4.15]	[-0.09]	[2.83]
L2L3	2837	7.83	3.53	0.45	8.03	-0.59	4.26
	[1052]	[8.43]	[2.36]	[0.28]	[8.5]	[-0.12]	[2.93]
L3L4	2854	11	3.66	0.33	11.2	-0.39	3.93
	[1045]	[11.53]	[2.53]	[0.22]	[11.55]	[-0.11]	[3.18]
L4L5	2838	15.34	4.85	0.32	15.69	-0.44	3.7
	[989]	[16.55]	[3.08]	[0.19]	[16.68]	[-0.14]	[2.99]
L5S1	2697	22.95	6.16	0.27	23.39	-0.23	2.79
	[1012]	[24.71]	[3.87]	[0.16]	[24.97]	[-0.27]	[2.52]

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

Level	N	Mean	StdDev	CV	Median	Skewness	Kurtosis
L1L2	2671	-5.52	2.74	-0.5	-5.27	-0.56	4.2
	[978]	[-5.14]	[1.93]	[-0.38]	[-5.09]	[-0.19]	[3.34]
L2L3	2837	-7.9	2.85	-0.36	-7.76	-0.05	6.23
	[1052]	[-7.59]	[1.85]	[-0.24]	[-7.52]	[-0.15]	[2.82]
L3L4	2854	-8.16	3.95	-0.48	-8.79	1.97	10.23
	[1045]	[-8.8]	[1.92]	[-0.22]	[-8.83]	[0.11]	[3]
L4L5	2838	-6.26	8.05	-1.29	-9.08	1.66	5.24
	[989]	[-8.91]	[3.91]	[-0.44]	[-9.7]	[1.87]	[7.24]
L5S1	2697	4.12	5.77	1.4	3.93	0.88	7.24
	[1012]	[3.72]	[4.42]	[1.19]	[4.17]	[-0.5]	[3.55]

Tables 11 to 17: Percent of levels with abnormalities. This includes all levels in all lumbar spines from the lumbar neutral-lateral X-rays pooled together from 12 studies. Abnormalities were identified by standardized (Z) scores in units of std dev from average normal in the NHANES-II study. Data are presented with respect to the NHANES-II data to facilitate direct comparison to the prevalence data in Tables 11 to 16 of Appendix 5.

Table 11: Percent with disc heights > normal

Level	zADH>2	zADH>3	zPDH>2	zPDH>3	zVDH>2	zVDH>3	zDDH>2	zDDH>3
L1L2	10.1	2.4	1.4	0.2	10.5	2.4	1.4	0.2
L2L3	10.9	2.2	0.8	0.1	10.4	2.3	0.8	0.1
L3L4	12.2	2.3	0.8	0.1	11.1	2.1	0.6	0.1
L4L5	6.5	1.1	1.0	0.2	6.1	1.0	0.7	0.1
L5S1	2.3	0.2	1.8	0.2	2.2	0.1	0.6	0.0

Table 12: Percent with disc Heights < normal

Level	zADH<-2	zADH<-3	zPDH<-2	zPDH<-3	zVDH<-2	zVDH<-3	zDDH<-2	zDDH<-3
L1L2	10.0	5.4	17.1	5.3	10.0	5.2	15.8	5.0
L2L3	11.6	7.3	18.2	7.7	11.4	7.1	17.7	7.4
L3L4	12.2	7.2	18.9	7.8	12.8	7.1	18.4	7.8
L4L5	26.8	16.9	20.6	6.6	28.0	17.4	19.9	5.3
L5S1	26.7	12.8	9.2	0.6	26.3	12.3	4.6	0.2

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
L1L2	18.0	4.6	8.5	1.3
L2L3	15.7	2.6	8.8	1.2
L3L4	15.8	2.8	9.0	1.5
L4L5	6.6	1.0	3.4	0.7
L5S1	2.7	0.3	2.0	0.1

Table 14: Percent with disc angles < normal

Level	zDA<-2	zDA<-3	zMPA<-2	zMPA<-3
L1L2	7.0	1.9	5.9	1.5
L2L3	6.2	1.1	4.4	0.9
L3L4	5.7	1.3	4.2	0.7
L4L5	9.4	3.0	6.6	1.3
L5S1	10.6	2.6	10.1	2.3

Table 15: Percent with SPO > normal

Level	zASPO>2	zASPO>3	zPSPO>2	zPSPO>3	zCSPO>2	zCSPO>3
L1L2	3.7	1.0	15.7	6.3	2.7	0.6
L2L3	4.6	1.8	15.4	4.9	3.0	1.0
L3L4	10.6	6.6	10.9	1.9	9.4	6.3
L4L5	23.6	18.8	2.5	0.2	21.7	18.3
L5S1	12.9	4.6	1.9	0.3	5.2	2.4

Table 16: Percent with SPO < normal

Level	zASPO<-2	zASPO<-3	zPSPO<-2	zPSPO<-3	zCSPO<-2	zCSPO<-3
L1L2	17.3	7.7	3.0	0.8	12.6	5.1
L2L3	15.4	5.1	3.3	1.4	11.8	4.1
L3L4	11.8	2.7	9.3	6.0	7.6	1.9
L4L5	4.5	0.7	21.8	18.6	1.9	0.2
L5S1	2.7	0.2	8.3	4.2	3.6	0.4

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

Level	zavgDH>2	zavgDH>3	zavgDH<-2	zavgDH<-3
L1L2	3.6	0.6	13.3	6.9
L2L3	4.4	0.6	16.1	9.5
L3L4	4.8	0.7	16.7	9.8
L4L5	2.7	0.2	28.9	17.7
L5S1	1.1	0.1	28.0	13.4

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