

## Supplementary Table 1.

Annual lumbar puncture counts, rates, and percentages of procedures by provider specialty over time

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	CAGR*
<b>Annual LP rates and counts#</b>															
<b>LP Count</b>	2,457	2,956	2,769	2,635	2,631	2,489	2,537	2,614	2,762	2,652	2,686	2,636	2,511	2,691	-
<b>LP Rate#</b>	163.3	199.7	192.0	187.7	191.3	182.6	185.5	190.7	201.0	191.9	195.1	190.7	191.4	203.4	1.7%
<b>(95% CI)</b>	(156.9- 169.8)	(192.6- 207.1)	(185.0- 199.3)	(180.6- 195.0)	(184.0- 198.7)	(175.5- 189.9)	(178.4- 192.9)	(183.5- 198.2)	(193.6- 208.6)	(184.7- 199.4)	(187.8- 202.6)	(183.5- 198.1)	(184.0- 199.0)	(195.8- 211.3)	
<b>Percentages of LPs by specialty by year</b>															
<b>Radiology</b>	37.1%	40.3%	42.4%	44.6%	42.5%	44.7%	45.4%	48.4%	46.9%	50.2%	52.1%	54.1%	54.5%	54.0%	2.9%
<b>EM</b>	17.4%	19.0%	19.6%	18.5%	20.2%	19.7%	19.8%	20.1%	21.1%	18.9%	17.8%	16.8%	15.4%	14.9%	-1.2%
<b>Neurology</b>	23.5%	20.9%	19.0%	18.3%	17.3%	14.6%	14.7%	12.2%	11.5%	11.4%	10.4%	10.6%	9.8%	10.0%	-6.4%
<b>NPP</b>	4.2%	2.5%	2.7%	2.5%	3.2%	4.4%	4.1%	4.4%	5.4%	6.0%	5.8%	6.0%	6.5%	7.5%	4.5%
<b>Neurosurgery</b>	4.8%	4.2%	4.7%	4.0%	4.9%	4.7%	4.2%	4.3%	4.6%	4.4%	4.4%	3.9%	4.1%	4.5%	-0.4%
<b>Primary Care</b>	5.1%	5.2%	5.0%	4.3%	3.6%	4.0%	3.6%	4.2%	3.2%	3.1%	3.0%	2.9%	3.4%	2.6%	-5.1%
<b>Anesthesiology</b>	4.5%	4.7%	4.0%	3.9%	4.2%	4.6%	4.5%	3.3%	3.7%	2.6%	3.0%	2.5%	3.0%	2.3%	-4.9%
<b>All Other</b>	3.4%	3.3%	2.7%	3.8%	4.0%	3.2%	3.7%	3.0%	3.8%	3.4%	3.6%	3.3%	3.4%	4.2%	1.5%

# = counts and rates (per 100,000) are calculated using a 5% sample of Medicare beneficiaries

CI = Confidence Interval

EM = Emergency Medicine

NPP = Non-physician provider

CAGR\* = compound annual growth rate, 2004 versus 2017

## Supplementary Table 2.

Mean patient Charlson Comorbidity Index scores of lumbar punctures performed by radiologists versus all other specialties

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2005 - 2017 Mean (SD)	CAGR*
<b>All Specialties</b>	1.92	2.26	2.37	2.28	2.41	2.44	2.46	2.66	2.63	2.65	2.59	2.90	3.01	2.50 (2.67)	3.8%
<b>Non-Radiology</b>	1.84	2.16	2.23	2.26	2.27	2.40	2.50	2.51	2.5	2.51	2.52	2.76	2.92	2.39 (2.59)	3.9%
<b>Radiology</b>	2.03	2.38	2.54	2.30	2.59	2.49	2.43	2.84	2.76	2.77	2.65	3.01	3.09	2.62 (2.75)	3.6%
<b>P value#</b>	< 0.05	< 0.05	< 0.05	0.62	< 0.05	0.22	0.34	< 0.05	< 0.05	< 0.05	0.07	< 0.05	< 0.05	< 0.05	

#t-test for whether the mean CCI value, in a given year, is significantly different between Non-Radiologists and Radiologists. P value < 0.05 indicates the proportion is statistically different.

CAGR\* = compound annual growth rate, 2005 versus 2017

SD = standard deviation

### Supplementary Table 3.

Percentages of Lumbar Punctures performed by Radiologists in 2004 and 2017 by State

	2004		2017	
	% LPs by Radiologists	95% CI	% LPs by Radiologists	95% CI
<b>Alabama</b>	50.9%	50.4 - 51.5%	60.5%	59.8 - 61.1%
<b>Alaska</b>	50.0%	47.8 - 52.2%	14.3%	13.1 - 15.5%
<b>Arizona</b>	45.3%	44.6 - 45.9%	59.2%	58.6 - 59.8%
<b>Arkansas</b>	42.9%	42.2 - 43.6%	73.7%	73.0 - 74.4%
<b>California</b>	33.5%	33.2 - 33.8%	45.9%	45.6 - 46.2%
<b>Colorado</b>	31.7%	31.0 - 32.5%	51.4%	50.7 - 52.2%
<b>Connecticut</b>	31.6%	31.0 - 32.2%	45.7%	45.0 - 46.5%
<b>Delaware</b>	28.6%	27.4 - 29.8%	40.0%	38.8 - 41.2%
<b>District of Columbia</b>	100.0%	100.0 - 100.0%	83.3%	81.8 - 84.9%
<b>Florida</b>	50.4%	50.1 - 50.7%	58.9%	58.6 - 59.2%
<b>Georgia</b>	30.2%	29.7 - 30.6%	37.2%	36.7 - 37.7%
<b>Hawaii</b>	50.0%	48.6 - 51.4%	90.9%	90.1 - 91.7%
<b>Idaho</b>	57.1%	56.0 - 58.3%	57.9%	56.8 - 59.0%
<b>Illinois</b>	29.5%	29.2 - 29.9%	47.4%	47.0 - 47.8%
<b>Indiana</b>	48.8%	48.3 - 49.2%	67.9%	67.3 - 68.4%
<b>Iowa</b>	35.3%	34.7 - 35.9%	77.4%	76.8 - 78.0%
<b>Kansas</b>	55.0%	54.3 - 55.7%	60.0%	59.2 - 60.8%
<b>Kentucky</b>	21.4%	20.9 - 21.9%	30.4%	29.8 - 31.1%
<b>Louisiana</b>	66.7%	66.0 - 67.3%	63.9%	63.2 - 64.6%
<b>Maine</b>	14.3%	13.6 - 15.0%	41.7%	40.6 - 42.8%
<b>Maryland</b>	30.6%	30.0 - 31.1%	55.6%	55.0 - 56.1%
<b>Massachusetts</b>	13.3%	13.0 - 13.7%	38.9%	38.4 - 39.4%
<b>Michigan</b>	29.9%	29.6 - 30.3%	52.1%	51.7 - 52.6%
<b>Minnesota</b>	38.2%	37.6 - 38.8%	56.3%	55.4 - 57.1%
<b>Mississippi</b>	57.1%	56.4 - 57.9%	85.3%	84.8 - 85.8%
<b>Missouri</b>	35.6%	35.0 - 36.1%	60.0%	59.4 - 60.6%
<b>Montana</b>	18.2%	17.3 - 19.1%	47.1%	45.8 - 48.3%
<b>Nebraska</b>	21.4%	20.7 - 22.2%	58.3%	57.4 - 59.2%
<b>Nevada</b>	53.8%	52.8 - 54.9%	80.6%	79.8 - 81.3%
<b>New Hampshire</b>	11.1%	10.4 - 11.8%	45.5%	44.4 - 46.5%
<b>New Jersey</b>	25.0%	24.6 - 25.4%	53.5%	53.1 - 54.0%

<b>New Mexico</b>	16.7%	15.9 - 17.5%	35.0%	34.0 - 36.0%
<b>New York</b>	24.7%	24.5 - 25.0%	43.5%	43.2 - 43.9%
<b>North Carolina</b>	27.9%	27.5 - 28.3%	40.0%	39.5 - 40.5%
<b>North Dakota</b>	40.0%	38.6 - 41.4%	33.3%	31.9 - 34.8%
<b>Ohio</b>	45.8%	45.5 - 46.2%	60.0%	59.6 - 60.4%
<b>Oklahoma</b>	33.3%	32.7 - 34.0%	38.5%	37.8 - 39.1%
<b>Oregon</b>	19.2%	18.6 - 19.9%	58.1%	57.3 - 58.8%
<b>Pennsylvania</b>	29.3%	29.0 - 29.7%	56.4%	56.0 - 56.8%
<b>Rhode Island</b>	6.7%	5.9 - 7.4%	12.5%	11.5 - 13.5%
<b>South Carolina</b>	26.8%	26.3 - 27.4%	55.0%	54.4 - 55.6%
<b>South Dakota</b>	100.0%	100.0 - 100.0%	100.0%	100.0 - 100.0%
<b>Tennessee</b>	41.2%	40.7 - 41.7%	67.2%	66.7 - 67.8%
<b>Texas</b>	55.2%	54.9 - 55.5%	67.8%	67.5 - 68.1%
<b>Utah</b>	59.1%	58.1 - 60.1%	38.5%	37.4 - 39.5%
<b>Vermont</b>	20.0%	18.8 - 21.2%	50.0%	48.6 - 51.4%
<b>Virginia</b>	27.5%	27.1 - 28.0%	40.0%	39.5 - 40.5%
<b>Washington</b>	44.7%	44.2 - 45.3%	60.7%	60.2 - 61.3%
<b>West Virginia</b>	16.7%	16.0 - 17.3%	40.0%	39.0 - 41.0%
<b>Wisconsin</b>	37.3%	36.7 - 37.8%	54.2%	53.6 - 54.9%
<b>Wyoming</b>	57.1%	55.4 - 58.9%	57.1%	55.6 - 58.7%

LP = Lumbar Puncture

CI = Confidence Interval