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Factors Affecting Utilization of Steroid Injections in the Treatment of Lumbosacral Degenerative Conditions in the United States

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ABSTRACT

Background: Lumbar degenerative conditions are an extremely common set of diagnoses with a large spectrum of treatment options. Epidural steroid injections (ESI) are widely used but have come under increased scrutiny as we move toward a value-based model of health care. We assessed current utilization of epidural steroid injections, changes in utilization over time, and the influence of payer type and geographic region within the United States on their utilization. In addition, we analyzed the relationship between ESIs and surgical rates across states.

Methods: The Medicare 5% national sample administrative database (SAF5) and a large national database from a commercial health care company (HORTH0) were used to catalog clinical data for patients with lumbar degenerative conditions. Specific queries into the rate of ESIs and lumbar surgery were also performed within this group.

Results: There were 4 108 121 patients found between 2005 and 2015 in the SAF5 and HORTH0 databases carrying a diagnosis related to lumbar degenerative conditions. The overall yearly injection rates for patients with lumbar degenerative conditions ranged from 9.84% to 10.18%. In patients older than 65, the rate of ESI was higher for Medicare as compared with private payer insurance (16.27% versus 14.14%, $P < .001$). There was a higher rate of ESI for patients who eventually underwent surgery in the Medicare group as compared with the commercial group (55.30% versus 40.40%, $P < .001$). There was a positive correlation between rates of ESI with the rate of surgery between states.

Conclusions: There is considerable variation in treatment of lumbar degenerative conditions with ESI based on payer type. There was increased utilization of lumbar ESI between 2007 and 2012, although this change was less than 0.5%. The data also suggest a positive correlation between rates of ESIs and surgical intervention across states. This points to areas in the country with high utilization of both ESI and surgery in the treatment of lumbar degenerative conditions.

Level of Evidence: III, economic and decision analysis

Lumbar Spine

Keywords: lumbar spine, degenerative conditions, epidural steroid injection, resource allocation

INTRODUCTION

Epidural steroid injections (ESIs) are widely used in the treatment of symptomatic lumbar degenerative conditions. These are considered “conservative” modalities in the treatment spectrum and are often used to treat symptoms in an attempt to avoid or at least delay surgical intervention. Conflicting results of the efficacy of ESIs for the treatment of common lumbar conditions have been published.^{1–4} Despite questions regarding their efficacy, ESIs are still frequently performed. To date there have been few publications assessing the factors that influence the utilization of ESIs and assessing whether their use influences the rate of lumbar surgery.

There is considerable evidence that nonclinical factors, including geographic regions, type of third-party payers, and concentrations of physicians, impact treatment patterns and utilization of health care resources.^{5–7} In patients with degenerative lumbar conditions, treatments supported by varying levels of evidence are commonly applied. Physical therapy, chiropractor treatment and behavioral therapy have shown incremental improvements in treatment of back pain.⁸ There has been conflicting evidence on the role of lumbar ESI in alleviating pain related to lumbar degeneration.^{9,10} With more-severe symptoms, in appropriately selected patients, surgery has been shown to provide sustained improvement in pain and physical function.^{11,12}

Table 1. ICD-9 codes and CPT codes used within analysis.

Diagnosis or Treatment	Relevant ICD-9 Codes
Lumbar degenerative conditions	ICD-9-D-7244, ICD-9-D-72252, ICD-9-D-72273, ICD-9-D-72210, ICD-9-D-72142, ICD-9-D-7213, ICD-9-D-72190, ICD-9-D-7393, ICD-9-D-72402, ICD-9-D-7384, ICD-9-D-7242, ICD-9-D-8472
Lumbar degenerative conditions—steroid injection	CPT-62311, CPT-64483, CPT-64484
Lumbar degenerative conditions—surgical intervention	CPT-22558, CPT-22585, CPT-22842, CPT-22843, CPT-22844, CPT-22845, CPT-22851, CPT-22845, CPT-22612, CPT-22614, CPT-22630, CPT-22632, CPT-22633, CPT-63005, CPT-63017, CPT-63012, CPT-63030, CPT-63042, CPT-63047

Abbreviations: ICD, International Classification of Diseases; CPT, current procedural terminology.

The goals of the current study were to assess current utilization of ESIs and changes in utilization over time and to analyze the influence of payer type and geographic region within the United States on their utilization. In addition we analyzed the relationship between ESIs and surgical rates across states.

MATERIALS AND METHODS

Two national databases were used to collect information on patients with lumbar degenerative conditions. The Medicare 5% national sample administrative database as well as one from Humana (a for-profit, publicly traded health insurance provider) were queried using software from PearlDiver (PearlDiver Technologies, Colorado Springs, Colorado). The Humana database is a collection of all health care coding over time for patients with Humana health insurance. Both the Medicare database and Humana database have been used in numerous publications.^{13–15} These databases are compliant with all regulations associated with the Health Insurance Portability and Accountability Act, as all patient identifiers were removed from the clinical/financial data. No Institutional Review Board authorization was required to conduct this study.

The database query began by first identifying the current procedural terminology (CPT) codes and International Classification of Diseases (ICD-9) codes relevant to our topic of interest. For lumbar degenerative conditions, we used a variety of ICD-9 codes to select patients who had ever been diagnosed with lumbar degenerative disorders. The ICD-9 codes that were used for our analysis are shown in Table 1. Similarly, relevant CPT Codes for ESIs and spinal surgery were identified and are also included in Table 1. In both the Medicare database (SAF5) and the Humana database (HORTH0), we first selected those patients with lumbar degenerative conditions. From this cohort we identified

patients who had ESI and/or a lumbar surgical procedure. For patients who did have surgery, we also determined what portion of these patients had an ESI prior to their surgery.

We grouped certain states into discrete geographic regions to determine variability in rates of ESI and surgery across the United States. The South included Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia. The Midwest included Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. The Northeast included Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. The West included Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

The costs associated with ESI in patients with lumbar degenerative conditions were aggregated to determine the financial impact of these procedures. Reimbursements from both the SAF5 and HORTH0 databases were aggregated.

A Pearson chi-square test was used to compare the proportion of patients who had an ESI between both the HORTH0 and SAF5 data sets. A linear regression analysis was performed to determine statistically significant linear relationships between treatment variables. Specifically, comparisons were made between the surgical rate/injection rate versus time and surgical rate versus injection rate for states.

RESULTS

Demographic information for patients included within this study from both the HORTH0 database as well as the SAF5 database are shown in detail in Tables 2 and 3. There were 4 108 121 patients with symptomatic lumbar degenerative conditions analyzed in the current study. In both databases the

Table 2. Patient demographics for the symptomatic lumbar degeneration, surgical, and ESI cohorts from the Medicare database.

Patient Characteristic	Symptomatic Lumbar Degeneration	ESI Group	Surgery Group
Sex			
Male	40.32% (495 842)	37.33% (74 138)	45.30% (28 416)
Female	59.68% (733 925)	62.66% (124 444)	54.70% (34 313)
Age distribution			
<65	15.51% (190 737)	16.09% (31 955)	20.83% (13 066)
65–69	22.24% (273 500)	20.29% (40 296)	25.42% (15 945)
70–74	19.64% (241 526)	20.15% (40 018)	22.42% (14 046)
75–79	17.14% (210 782)	18.46% (36 661)	17.38% (10 902)
80–84	14.02% (172 413)	14.87% (29 532)	9.95% (6241)
85+	11.45% (140 808)	10.14% (20 138)	4.00% (2509)
Geographic region			
Northeast	17.97% (220 989)	15.26% (30 306)	13.35% (8374)
Midwest	24.56% (302 031)	25.80% (51 239)	24.12% (15 130)
South	39.84% (489 939)	41.37% (82 161)	44.21% (27 732)
West	17.63% (216 808)	17.57% (34 894)	18.33% (11 498)

Abbreviation: ESI, epidural steroid injection.

majority of patients are older than 65 years, although as anticipated a larger portion of patients in the SAF5 database are older than 65 years. The South is the most-represented geographic region in both databases.

The rate of ESI per year for patients with lumbar degenerative conditions between 2007 and 2012 is shown in Table 4 and Figure 1. There is no significant change in the rate of ESI/y between 2007 and 2012 for the combined SAF5 and HORTHO databases ($P = .119$). Our analysis also explored the variation of care based on payer type for ESI. In order to properly compare the patients from our private payer database with Medicare patients, we only included patients older than 65 for both databases for this analysis. We identified a higher rate of ESI for patients in the Medicare group compared with the private payer group for patients older than 65 years (16.27% versus 14.14%, respectively; $P < .001$). A state-by-state breakdown

of ESI rates revealed that 43 of 50 states in the United States had statistically significant higher rates of ESI in the Medicare cohort compared with the private pay cohort, as shown in Table 5. A map showing the state-by-state overall ESI rate is shown in Figure 2. A map showing the state-by-state overall lumbar surgery rate is shown in Figure 3.

The rate of lumbar surgery did not change significantly between 2007 and 2012 (Table 6 and Figure 4). Similar to ESI, considerable geographic variation in the rates of lumbar surgeries was identified (Table 7). States with the highest and lowest rates of ESI and lumbar surgery are shown in Tables 8a and 8b. Significant variation in rates of diagnosis of symptomatic lumbar degenerative conditions ($P < .001$), surgery ($P < .001$), and ESI ($P < .001$) was observed between geographic regions in the United States as well (Table 9).

The rate of steroid injections and the rate of surgery were compared between states. A positive

Table 3. Patient demographics for the symptomatic lumbar degeneration, surgical, and ESI cohorts from the HORTHO database.

Patient Characteristic	Symptomatic Lumbar Degeneration	ESI Group	Surgery Group
Sex			
Male	42.32% (1 218 119)	40.63% (149 300)	48.72% (63 922)
Female	57.68% (1 660 234)	59.37% (218 163)	51.28% (67 281)
Age distribution			
<60	33.79% (972 595)	26.86% (98 700)	31.77% (41 683)
60–64	8.23% (236 888)	9.16% (33 659)	10.37% (13 605)
65–69	17.45% (502 272)	18.02% (66 217)	20.21% (26 516)
70–74	15.63% (449 886)	17.61% (64 710)	18.38% (24 115)
75–79	11.31% (325 541)	13.38% (49 166)	11.42% (14 983)
80–84	7.48% (215 300)	8.82% (32 410)	5.53% (7255)
85+	6.11% (175 867)	6.16% (22 635)	2.32% (3043)
Geographic region			
Northeast	2.09% (60 157)	2.06% (7569)	1.99% (2610)
Midwest	24.87% (715 846)	26.39% (96 973)	25.25% (33 129)
South	63.43% (1 825 739)	61.27% (225 145)	62.69% (82 251)
West	9.61% (276 609)	10.29% (37 812)	10.07% (13 212)

Abbreviations: ESI, epidural steroid injection; HORTHO, Humana orthopaedic database.

Table 4. The combined rate of ESI for 2007 to 2012 for patients diagnosed with back pain. The rate of ESI is based on the total number of patients treated with ESI divided by the number of patients with lumbar degenerative conditions over the same period.

Year	Rate of ESI for Patients With Lumbar Degenerative Conditions per Year, %
2007	9.84
2008	9.98
2009	10.11
2010	10.17
2011	10.18
2012	10.05

Abbreviation: ESI, epidural steroid injection.

correlation between rates of ESI and lumbar surgery was identified ($P = .001$) (Table 7 and Figure 5A). A similar analysis was performed isolating only those patients older than 65 years within the HORTHO and SAF5 databases (Figure 5B). As with the general population, the rate of injections did correlate positively with the rate of surgery across states for the elderly ($P < .0001$).

A breakout analysis was performed on the rate of ESI in patients who undergo surgery in the private payer and the Medicare cohorts. Once again, when comparing these 2 databases, we only included those patients who were older than 65 years. There was a higher rate of ESI for patients who eventually underwent surgery in the Medicare group as compared with the commercial payer group (55.30% versus 40.40%, $P < .001$).

The average Medicare reimbursement for ESI (\$635 \pm \$32) was significantly higher than for the private payer cohort (\$524 \pm \$74) ($P = .03$).

DISCUSSION

The current study identifies that geography and the type of third party payer all factor in the

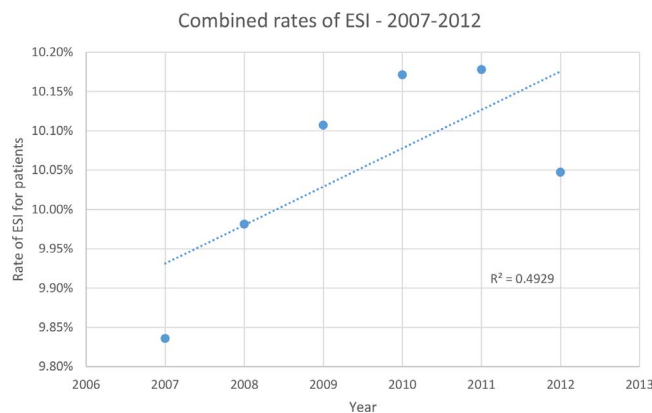


Figure 1. Rate of epidural steroid injection over time combining both the Humana and Medicare databases ($P = .119$). Abbreviation: ESI, epidural steroid injection.

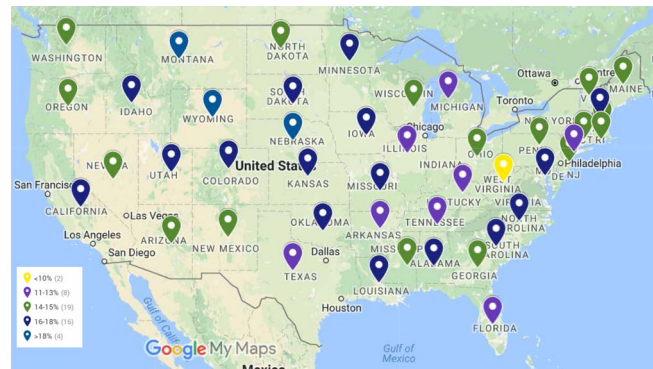


Figure 2. Map of lumbar epidural steroid injection rates.

utilization of ESIs for lumbar degenerative conditions. From 2007 to 2012 there was no statistically significant change in the rate of ESI nor the rate of surgery for patients with lumbar degenerative conditions. These rates of ESI and surgery never varied more than a percentage point. We also identified a significant variation in utilization of ESIs across geographic regions. Isolating the effect of payer characteristic, there is a significantly higher rate of lumbar ESI for patients with Medicare as compared with a commercial insurance company. Our state-by-state analysis demonstrated an association between higher rates of ESI and higher rates of surgery.

There has been conflicting evidence on the role of ESI in alleviating radicular or neurogenic pain.^{9,10} During the period 1994–2001, there was a 271% increase in the number of ESI procedures.¹⁶ The current study shows the use of ESI in patients with symptomatic lumbar degenerative conditions largely leveled off between the years 2007 and 2012 for both Medicare and private insurance patients. During this same period, ESIs have come under increasing scrutiny, and narrow guidelines for their indications have been proposed. For instance, the North

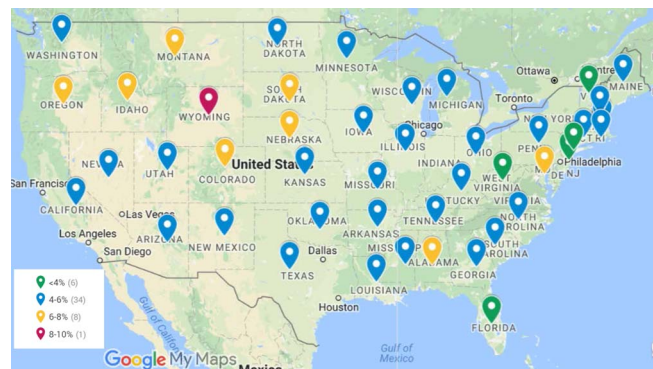


Figure 3. Map of lumbar surgery rates.

Table 5. Rate of ESI for elderly patients. All *P* values in bold are significant.

State	Medicare 5%— ESI Patients	Medicare 5%— Back Pain Patients	Medicare 5% Database, %	Humana— ESI Patients	Humana— Back Pain Patients	Private Payer Database, %	<i>P</i> Value
Alaska	219	1514	14.46	42	317	13.25	0.32
Alabama	4699	25 384	18.51	3457	22 484	15.38	3.52E-47
Arkansas	1696	12 418	13.66	2358	21 589	10.92	9.76E-58
Arizona	3685	21 547	17.10	5820	38 262	15.21	1.84E-15
California	14 434	89 528	16.12	3483	25 524	13.65	1.46E-24
Colorado	2892	13 777	20.99	4138	22 318	18.54	2.79E-113
Connecticut	2104	14 779	14.24	167	1097	15.22	0.014
Delaware	625	4358	14.34	155	1107	14.00	0.15
Florida	14 289	84 553	16.90	39 037	33 0289	11.82	0
Georgia	5766	34 165	16.88	8407	55 901	15.04	7.72E-19
Hawaii	238	3084	7.72	290	4246	6.83	5.32E-67
Idaho	1003	5294	18.95	1290	9454	13.65	3.98E-16
Illinois	8356	49 796	16.78	8187	57 148	14.33	3.50E-28
Indiana	6172	26 118	23.63	8479	42 334	20.03	0
Iowa	2662	15 614	17.05	2648	17 752	14.92	5.55E-11
Kansas	3299	16 183	20.39	3677	19 840	18.53	5.40E-105
Kentucky	2615	20 603	12.69	9641	73 870	13.05	1.69E-59
Louisiana	2660	14 958	17.78	15 294	76 832	19.91	3.13E-284
Massachusetts	3411	23 376	14.59	438	3072	14.26	0.044
Maryland	4339	27 419	15.82	252	1675	15.04	5.70E-4
Maine	826	6015	13.73	241	2173	11.09	7.42E-08
Michigan	5464	42 207	12.95	4152	36 634	11.33	2.68E-100
Minnesota	3161	17 919	17.64	3618	25 808	14.02	2.29E-23
Mississippi	1975	11 356	17.39	3203	20 643	15.52	1.19E-11
Missouri	5349	29 137	18.36	6930	41 314	16.77	1.88E-67
Montana	947	4493	21.08	1564	8852	17.67	9.51E-35
North Carolina	7538	45 293	16.64	9952	65 983	15.08	4.29E-19
North Dakota	633	4215	15.02	367	2954	12.42	2.73E-4
Nebraska	1784	8530	20.91	936	6105	15.33	6.23E-45
New Hampshire	984	5880	16.73	216	1637	13.19	9.90E-05
New Jersey	6099	46 550	13.10	259	2080	12.45	1.40E-28
New Mexico	929	6079	15.28	1005	8434	11.92	1.68E-13
Nevada	1257	6941	18.11	3250	27 049	12.02	7.49E-47
New York	7339	61 422	11.95	913	8427	10.83	3.28E-107
Ohio	7496	50 406	14.87	17 283	12 7035	13.60	8.24E-39
Oklahoma	2808	15 395	18.24	2421	16 046	15.09	6.01E-25
Oregon	1737	11 797	14.72	391	3256	12.01	6.53E-06
Pennsylvania	7781	49 640	15.67	3341	24 912	13.41	4.15E-14
Rhode Island	449	3151	14.25	40	326	12.27	0.089
South Carolina	3849	18 807	20.47	6395	38 568	16.58	1.93E-96
South Dakota	966	5006	19.30	829	5684	14.58	3.96E-15
Tennessee	4159	27 118	15.34	8007	65 335	12.26	1.28E-74
Texas	13 009	74 911	17.37	19 535	132 677	14.72	2.13E-63
Utah	1639	6921	23.68	3072	15 207	20.20	2.26E-136
Virginia	5071	30 222	16.78	7506	56 917	13.19	4.24E-43
Vermont	399	2791	14.30	67	524	12.79	0.099
Washington	3640	22718	16.02	2193	18 473	11.87	1.15E-31
Wisconsin	3833	21 138	18.13	7738	46 177	16.76	7.77E-52
West Virginia	900	9106	9.88	2773	31 421	8.83	2.72E-211
Wyoming	481	2277	21.12	295	1611	18.31	1.51E-16

Abbreviation: ESI, epidural steroid injection.

American Spine Society has set guidelines for lumbar transforaminal epidural steroid injections, including their limited use for patients with sciatica with displaced or entrapped disc herniations.¹⁷ Given these narrow indications, it is not surprising that the rate of ESI has largely remained stable.

As with the rates of ESI, surgical rates for patients with lumbar degenerative conditions have remained relatively consistent between 2007 and 2012 at approximately 2% to 3%. Note that this yearly rate is smaller than the geographic rates mentioned due to

the fact that there is a discrete time period in which patients with lumbar degenerative conditions may be treated with surgery. This has occurred during a time when there have been significant increases in total amounts spent on treatment for low back pain.¹⁸ An overwhelming majority of the increases in costs are associated with use of nonsurgical treatments such as the use of opioids, magnetic resonance imaging, and ESIs.^{19,20} Previous research has suggested that despite these added costs, the burden of low back pain has remained substantial.²¹

Table 6. The combined rate of lumbar surgery from 2007 to 2012 for patients diagnosed with back pain. The rate of surgery is based on the total number of patients treated with a lumbar surgery divided by the number of patients with lumbar degenerative conditions over the same period.

Year	Rate of Lumbar Surgery for Patients With Lumbar Degenerative Conditions per Year, %
2007	2.32
2008	2.36
2009	2.47
2010	2.52
2011	2.45
2012	2.48

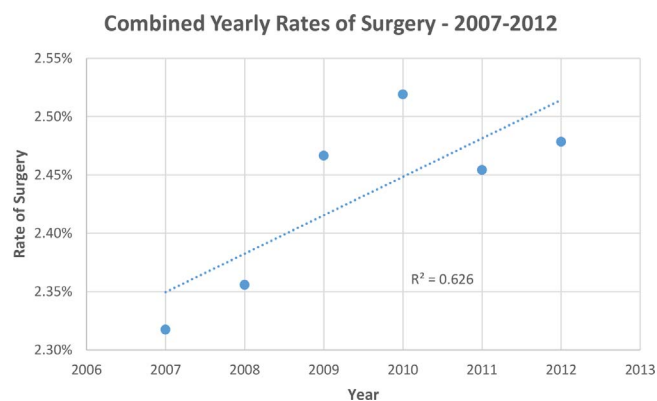


Figure 4. There is no significant increase/decrease in the rate of surgery between the years 2007 and 2012 for patients with back pain ($P = .061$).

Table 7. Combined rates of surgery and epidural steroid injection across states.

State	Total Surgical Patients	Total Injection Patients	Total Back Pain Patients	Rate of Surgery, %	Rate of Injections, %
Alaska	164	326	2238	7.33	14.57
Alabama	4341	12 354	71 319	6.09	17.32
Arkansas	2517	6093	49 352	5.10	12.35
Arizona	3872	13 251	92 519	4.19	14.32
California	6194	21 248	140 949	4.39	15.07
Colorado	4320	10 306	62 449	6.92	16.50
Connecticut	833	2610	18 507	4.50	14.10
Delaware	310	946	6479	4.78	14.60
Florida	22 950	77 713	652 130	3.52	11.92
Georgia	10 078	25 847	189 231	5.33	13.66
Hawaii	230	608	8333	2.76	7.30
Idaho	1274	2763	17 801	7.16	15.52
Illinois	7656	24 008	184 774	4.14	12.99
Indiana	5704	20 262	107 111	5.33	18.92
Iowa	1827	6127	38 905	4.70	15.75
Kansas	2835	9335	56 943	4.98	16.39
Kentucky	8985	21 530	191 854	4.68	11.22
Louisiana	8311	25 770	146 038	5.69	17.65
Massachusetts	1557	4741	33 077	4.71	14.33
Maryland	2279	5343	33 699	6.76	15.86
Maine	478	1378	10 478	4.56	13.15
Michigan	5602	13 454	116 030	4.83	11.60
Minnesota	2531	7881	51 187	4.94	15.40
Mississippi	2940	8456	56 391	5.21	15.00
Missouri	5440	16 882	105 665	5.15	15.98
Montana	1082	2860	15 538	6.96	18.41
North Carolina	8183	23 918	148 181	5.52	16.14
North Dakota	382	1129	8148	4.69	13.86
Nebraska	1119	3254	17 725	6.31	18.36
New Hampshire	403	1487	9272	4.35	16.04
New Jersey	1662	7481	57 379	2.90	13.04
New Mexico	848	2515	18 778	4.52	13.39
Nevada	2128	5915	43 829	4.86	13.50
New York	2967	10 027	85 927	3.45	11.67
Ohio	11 169	32 212	238 021	4.69	13.53
Oklahoma	2569	7415	43 109	5.96	17.20
Oregon	1377	2570	18 781	7.33	13.68
Pennsylvania	4601	13 690	92 771	4.96	14.76
Rhode Island	217	667	4531	4.79	14.72
South Carolina	4602	14 191	79 358	5.80	17.88
South Dakota	855	2013	12 134	7.05	16.59
Tennessee	8398	18 359	149 278	5.63	12.30
Texas	21 306	52 797	411 701	5.18	12.82
Utah	1881	6223	34 978	5.38	17.79
Virginia	6325	17 013	117 044	5.40	14.54
Vermont	150	546	4022	3.73	13.58
Washington	2754	7039	51 012	5.40	13.80
Wisconsin	5343	17 456	124 546	4.29	14.02
West Virginia	2035	4828	51 828	3.93	9.32
Wyoming	439	899	4547	9.65	19.77

Table 8a. States with the 5 highest and lowest rates for ESI.

Top States for ESI
1. Wyoming
2. Indiana
3. Montana
4. Nebraska
5. South Carolina
Lowest States for ESI
46. New York
47. Michigan
48. Kentucky
49. West Virginia
50. Hawaii

Abbreviation: ESI, epidural steroid injection.

Prior studies have suggested that variations in treatment based on payer type may relate in part to lower physician reimbursement rates from Medicare.²² The effect of payments on care is obviously complex and may be more nuanced than the dollar amount reimbursed. For example, there is evidence that reduced payment delays for Medicare-related services increase physician treatment of Medicare patients.²³ The influence of payer type is not always consistent, and there is conflicting evidence on the impact of insurance carrier on treatment patterns.²⁴ In the current study, Medicare patients had a higher rate of ESIs than age-matched patients with private insurance. The reasons for this are unclear but may reflect different patient expectations given that those covered by Medicare are more likely to have exited the workforce. The type of payer may also affect the type of physician exposure, with certain specialists perhaps more likely to limit access to Medicare patients, resulting in different treatment patterns based on physicians' specialty or training. Treatment decisions may also be the result of differing financial incentives for alternate treatments based on payer status. In addition, despite studies confirming good surgical results in selected patients with lumbar degenerative conditions,^{25–27} during the time period of the current study there has been aggressive private payer pushback against spinal surgery, resulting in surgery being denied or delayed. Clearly, further research is required to understand why Medicare patients are more often funneled towards ESI for treatment of lumbar degenerative conditions across the country. The data point to nonclinical factors influencing the treatment pathway for patients with this diagnosis.

Geographic variation in care has been well documented.^{5,28,29} Fisher et al³⁰ showed that Medicare enrollees in higher-spending regions received significantly more end-of-life care than lower-spend-

Table 8b. States with the 5 highest and lowest rates of surgery.

Top States for Surgery
1. Wyoming
2. Oregon
3. Arkansas
4. Idaho
5. South Dakota
Lowest States for Surgery
46. Vermont
47. Florida
48. New York
49. New Jersey
50. Hawaii

ing geographic regions. The current study identified variations in rate of lumbar ESI between states and across geographic regions. The authors acknowledge that in some instances these differences in ESI may be small, as with Pennsylvania (14.76%) and Rhode Island (14.72%). Still, the rates of ESI in other areas of the country did show large variations, as were found between Alabama (17.32%) and Arkansas (14.57%). The reason for these differences can be difficult to explain by clinical factors alone. Importantly, the study confirmed an association between higher rates of ESIs and higher rates of surgery, with states generally having consistently high or low rates of both surgery and ESI. Rates of both ESI and lumbar surgery were higher in more-rural states. Interestingly, Wyoming was a significant outlier, with rates of ESIs and surgery of 19.77% and 9.65%, respectively. This can be compared with Hawaii, where rates for ESIs and surgery were 7.30% and 2.76%, respectively. Furthermore, these states have similar populations of lumbar degenerative changes (both have fewer than 10 000 patients with lumbar degenerative conditions). The reason for this large disparity warrants further investigation. Our data further suggest that increased use of ESIs does not correspond to any reduction in the rates of lumbar surgery. In fact, the data confirm that certain states consume greater resources, with higher rates of both non-surgical and surgical resources for the treatment of patients with lumbar degenerative conditions. Whether this higher utilization of resources translates into improved clinical outcomes and provides value or is reflective of overutilization remains to be determined.

In both the private payer and Medicare cohorts who eventually went on to surgery, more than 50% had received an ESI as a part of their treatment. In the Medicare cohort a higher proportion of patients had received an ESI prior to surgery than the private payer cohort. The effectiveness of ESI for

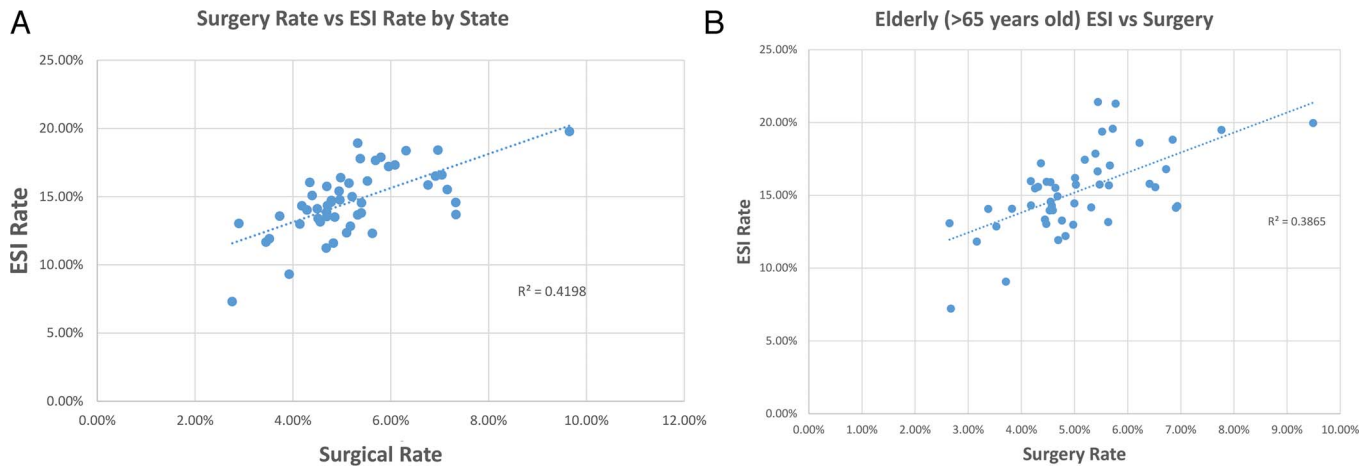


Figure 5. (A) There is a positive correlation between the rate of injections and the rate of surgery for all states. The *P* value for this correlation is less than .0001. (B) As with the general population, there is a positive correlation between the rate of epidural steroid injection (ESI) and rate of surgery among patients older than 65 years. The *P* value of this correlation is less than .0001.

the treatment of sciatica and neurogenic claudication has come under scrutiny.^{18,31} Furthermore, the role of ESI in patients who eventually undergo lumbar surgery is unclear, and recent studies on patients with spinal stenosis have suggested a negative effect on outcomes.³² Further research is required to define the value added and/or cost-effectiveness of ESI for patients eventually requiring surgery. The authors acknowledge that a portion of third-party payers may only approve coverage of lumbar surgery when nonoperative treatments such as ESI are provided for patients.

There are several limitations to this study. As with other large database studies that rely on physician/hospital billing of CPT, ICD-9, and diagnosis related groups (DRG) codes, there are weaknesses associated with discrepancies between claims databases and patient chart reviews.³³ Physicians and hospitals that bill frequently do, however, have a vested interest in accurately billing CPT, ICD-9, and DRG codes in order to avoid fraud and to be properly reimbursed. Although the authors attempted to eliminate age as a confounding factor between the commercial payer and Medicare groups, there may be inherent differences in the health of patients using Medicare as

compared with patients with commercial insurance. As shown in Tables 3 and 4, the geographic distribution of patients is not even. This is especially pronounced for the Humana data set, with the South representing more than 60% of patients. The authors acknowledge this as a source of geographic bias within our study. We also acknowledge that we do not know how the rate of diagnosis of lumbar degenerative conditions varies across states. This may significantly affect comparisons of rates of ESI/surgery in different parts of the country. Similarly, we do not know how closely physicians adhere to national guidelines for treatment of ESI or have validated indications for lumbar surgery across the country. Furthermore, it is impossible to determine the clinical indications for individual patients in regard to ESIs and lumbar surgery based on CPT, ICD-9, and DRG codes alone.

In summary, there is significant variation in utilization of ESIs that is not explained by clinical patient factors alone. Other factors include the geographic location of the patient as well as the type of insurance a patient carries. The data suggest that during the five years of the study, rates of surgical treatment for lumbar degenerative conditions have remained consistent. The data also suggest a

Table 9. Breakdown of the rate of ESI and surgery among geographic regions. These figures represent cumulative rates of surgery or ESI for patients with back pain over multiple years (2007–2012).

Region	Rate of ESI for Patients With Lumbar Degenerative Conditions During 2007–2012	Rate of Surgery for Patients With Lumbar Degenerative Conditions During 2007 and 2012
Midwest	14.51% (596 088)	4.76% (195 546)
Northeast	13.49% (554 185)	4.07% (167 200)
South	13.33% (547 612)	4.84% (198 833)
West	15.25% (626 488)	5.29% (217 319)

Abbreviation: ESI, epidural steroid injection.

positive correlation between rates of ESIs and surgical intervention across states. This points to areas in the country with high utilization of both ESI and surgery in the treatment of this diagnosis.

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