Health Policy Review

An Updated Analysis of Utilization of Epidural Procedures in Managing Chronic Pain in the Medicare Population from 2000 to 2018

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Background: With increasing costs of health care in the United States, attention is focused on expensive conditions. Musculoskeletal disorders with low back and neck pain account for the third highest amount of various disease categories. Minimally invasive interventional techniques for managing spinal pain, including epidural injections, have been considered to be growing rapidly. However, recent analyses of utilization of interventional techniques from 2000 to 2018 has shown a decline of 2.6% and a decline of 21% from 2009 to 2018 for epidural and adhesiolysis procedures.

Objectives: The objectives of this analysis of epidural procedures from 2000 to 2018 are to provide an update on utilization of epidural injections in managing chronic pain in the fee-for-service (FFS) Medicare population, with a comparative analysis of 2000 to 2009 and 2009 to 2018.

Study Design: Utilization patterns and variables of epidural injections in managing chronic spinal pain from 2000 to 2009 and from 2009 to 2018 in the FFS Medicare population in the United States.

Methods: This analysis was performed by utilizing master data from CMS, physician/supplier procedure summary from 2000 to 2018. The analysis was performed by the assessment of utilization patterns using guidance from Strengthening the Reporting of Observational Studies in Epidemiology (STROBE).

Results: Overall, epidural procedures declined at a rate of 20.7% per 100,000 Medicare enrollees in FFS Medicare in the United States from 2009 to 2018, with an annual decline of 2.5%. However, from 2000 to 2009, there was an increase of 89.2%, with an annual increase of 7.3%. This analysis showed a decline in all categories, with an annual decrease of 4.7% for lumbar interlaminar and caudal epidural injections, 4.7% decline for cervical/thoracic transforaminal epidural injections, 1.1% decline for lumbar/sacral transforaminal epidural injections, and finally 0.4% decline for cervical/thoracic interlaminar epidural injections. Overall declines from 2009 to 2018 were highest for cervical and thoracic transforaminal injections with 35.1%, followed by lumbar interlaminar and caudal epidural injections of 34.9%, followed by 9.4% for lumbar/sacral transforaminal epidurals, and 3.5% for cervical and thoracic interlaminar epidurals.

Limitations: This analysis was limited by noninclusion of Medicare Advantage plans, which constitutes almost 30% of the Medicare population. In addition, utilization data for individual states continues to be sparse and may not be accurate or representative of the population.

Conclusions: The declining utilization of epidural injections in all categories with an annual of 2.5% and overall decrease of 20.7% from 2009 to 2018 compared with annual increases of 7.3% and overall increase of 89.2% from 2000 to 2009 shows a slow decline of utilization of all epidural injections.

Key words: Chronic spinal pain, interlaminar epidural injections, caudal epidural injections, transforaminal epidural injections, utilization patterns

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The Affordable Care Act (ACA) was enacted to improve access, quality of care, and reduce health care costs in US health care (1-3). The effectiveness of measures to control costs and the overall effectiveness of ACA, which was signed into law in March 2010, in achieving its primary goals has been questioned (2,4-11). US health care spending continues to increase and reached $3.65 trillion in 2018 (1). Further, the National Health Expenditures survey estimated an average annual growth rate of 5.5% from 2018 to 2027 (2). However, the analysis of growth in medical prices in 2018 showed that the majority of growth was with private health insurance of 6.7% compared with 3.7% in Medicare and 2.2% in Medicaid despite the expansion of the ACA (12). Overall, health care spending per person increased to $11,212. Further, US spending on personal and public health care from 1996 to 2013 showed an estimated spending of $134.5 billion in managing low back and neck pain, along with an additional $129.8 billion in managing other musculoskeletal disorders, with total spending on musculoskeletal disorders, including low back and neck pain, of approximately $264.3 billion in 2016 (13). Alongside increasing health care costs, disability in the United States continues to increase and half of the US health care burden is attributed to morbidity and chronic disability (14). Low back pain continues to rank as the number one cause of disability with neck pain as number 3 (14-16). However, despite increasing disability, there is also increase in utilization of various modalities in managing spinal pain (15-31).

Utilization of interventional techniques in managing spinal pain continues to be under scrutiny because of the application of various regulations and modes to reduce utilization. Over the years, all modalities of pain management have shown significant escalation in utilization, including opioids (11,15-31). Prescription opioids have created an opioid epidemic in the United States with escalating deaths, even though in recent years, there have been declines in prescriptions, as well as prescription opioid-related deaths (11,15,32,33). Further, best practices in pain management also have been established by the Department of Health and Human Services (4).

The recent analysis of utilization patterns of interventional techniques from 2000 to 2018 showed an overall decline of utilization of all interventional techniques at an annual rate of 0.8%, and from 2009 to 2018 with an overall decline of 6.7% (30). However, to follow the previous assessment of epidural procedures with an annual decline of 1.8% and overall decline of 12% from 2009 to 2016, the recent analysis from 2000 to 2018 showed an annual decline of 2.6% and overall decline of 21% for epidural injections and adhesiolysis procedures. Thus these data show continued de-escalation of interventional techniques in general and epidural procedures in particular (30-33). Further, recent analysis of epidural injections from 2000 to 2016 (31) showed a reversal of the utilization ratio of interlaminar epidurals to transforaminal epidurals from 7 in 2000 to 1 in 2016 (31). Despite the criticism and decline in utilization, there is an extensive and growing literature demonstrating the clinical and cost utility of epidural procedures in managing spinal pain in the form of randomized controlled trials (RCTs), systematic reviews, cost utility analysis, and evidence for real-word scenarios in managing spinal pain (34-64). Even then, discordant opinions and conclusions continue with discussions and at times arguments, with lack of agreement between proponents and opponents of the effectiveness and appropriateness of multiple interventional techniques (52,53,58,59). The lack of effectiveness is emphasized by the opponents, whereas proponents argue that there is significant evidence for conflicts of interest in interpretation leading to inappropriate conclusions as the basis for discordant results (52,53,58,59). Consequently, multiple attempts continue to be made to control the utilization of epidural injections and interventional techniques, and all types of modalities in general by means of reimbursement reductions, tightening of coverage regulations, coding changes, bundling, modification of local coverage determinations (LCDs), and increased oversight from multiple organizations and agencies.

This retrospective cohort study of utilization patterns of epidural injections was performed based on data from the fee-for-service (FFS) Medicare population in the United States from 2000 to 2018. This analysis also updates our recent publication (31).

Methods

The database used for this study were the public use files or nonidentifiable data, which is nonattributable and nonconfidential, available through the Centers for Medicare and Medicaid Services (CMS) (65). We also utilized Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidance (66).

Study Design

The design of the study was to assess usage or utilization patterns and variables of multiple epidural procedures, excluding adhesiolysis and continuous epidurals and neurolytic procedures, in managing chronic pain from 2000 to 2018 in the Medicare FFS population in the United States.

Setting

The National Database of Specialty Usage Data files from CMS in the FFS Medicare population in the United States (65).

Patients

All of the patients available from the database, which included all of the FFS Medicare recipients whether they were on Medicare due to Social Security disability, Social Security insurance, or retirement, from 2000 to 2018.

Variables

Variables assessed included not only the usage patterns of various types of epidurals procedures in the Medicare population from 2000 to 2018, but multiple characteristics in reference to the Medicare population and the growth of the Medicare population.

Historically, interventional pain physicians represented by the specialties of interventional pain management (-09), pain medicine (-72), anesthesiology (-05), physical medicine and rehabilitation (-25), neurology (-13), and psychiatry (-26) have performed epidural procedures. A multitude of other specialties perform interventional procedures infrequently. Thus based on Medicare designations, orthopedic surgery (-20), general surgery (-17), and neurosurgery (-14) as a surgical group; diagnostic radiology (-30) and interventional radiology (-94) as a radiologic group; all other physicians as a separate group; and all other providers were considered as other providers.

The Current Procedural Terminology (CPT) procedure codes for epidural procedures utilized were those in effect during 2000 to 2018 as follows:

- Epidural procedures (CPT 62310, 62311, 64479, 64480, 64483, 64484)

These data were also assessed based on the place of service – facility (ambulatory surgery center or hospital outpatient department) or nonfacility (office).

Data Sources

All of the analyzed data were obtained from the CMS Physician/Supplier Procedure Summary Master Data from 2000 to 2018 (65). These data included all FFS Medicare patients younger than the age of 65 years and older than the age of 65 years receiving epidural procedures irrespective of the type of disability.

Measures

The dataset from CMS consists of 100% data with CPT codes with modifiers indicating additional procedures or bilateral procedure, specialty codes, a place of service, a Medicare carrier number, total services and charges submitted, allowed and denied services, and amounts paid. The usage pattern analysis included all allowed services configured by taking services submitted minus services denied and any services with zero payments. Consequently, allowed services were assessed for each procedure, and rates were calculated based on Medicare beneficiaries for the corresponding year and are reported as rate of procedures per 100,000 Medicare beneficiaries. In this analysis, usage patterns were analyzed only once based on the location rather than duplicating the measurements for physician services and facility services.

Bias

The American Society of Interventional Pain Physicians (ASIPP) purchased the data from CMS. The study was conducted with the internal resources of the primary authors' practice without external funding or grants, either from industry or elsewhere.

In this analysis, we have utilized all patients enrolled in FFS Medicare, instead of only patients aged 65 years or older as in other evaluations (67,68), because of the finding that a significant proportion of patients younger than the age of 65 years undergo epidural procedures (69,70). With emerging affordable insurance under Obamacare, increasing disability and increasing population over the age of 65 years, Medicare represents the second largest health care payer next to Medicaid in the United States, with over 59.6 million beneficiaries in 2018 (71). Consequently, the epidural procedures performed on Medicare beneficiaries increasingly represent a large proportion of the procedures for chronic pain in the United States.

Study Size

The study size is large, with the inclusion of all patients under Medicare FFS undergoing epidural procedures in all settings for all regions in the United States for chronic spinal pain from 2000 to 2018.

Data Compilation

These data were compiled using Microsoft Access 2003 and Microsoft Excel 2003 (Microsoft Corporation, Redmond, WA).

Results

Patients

Patients in this assessment included all FFS Medicare recipients from 2000 to 2018.

Descriptive Data of Population Characteristics

As shown in Table 1, from 2000 to 2018, the US population older than 65 years of age increased 49.2% at an annual growth rate of 2.2%. Total US population also increased 15.9% at an annual growth rate of 0.8%. The number of individuals participating in Medicare grew at an annual rate of 2.3%, 1.6%, and 3% from 2000 to 2018, 2000 to 2009, and 2009 to 2018, respectively.

The rate of all epidural procedures except adhesiolysis per 100,000 individuals of the Medicare population declined from 2009 to 2018 at an annual rate of 2.5%, in contrast to an annual growth rate of 3.1% and 9%, from 2000 to 2018, and from 2000 to 2009, respectively. Figure 1 shows a comparative analysis of annual US population growth, Medicare participation, and utilization of epidural injection procedures.

Utilization Characteristics

Table 2 and Figs. 2 to 4 show the utilization characteristics of epidural injection procedures in the FFS Medicare population from 2000 to 2018.

The utilization patterns showed that in 2000, 73.7% of the procedures consisted of lumbar interlaminar epidural injections, whereas in 2018, the utilization declined to 34.5%, with lumbar transforaminal increasing from 14.6% in 2000 to 53% in 2018. In addition, as shown in Fig. 3, epidural injections constituted 57% of all interventional services in 2000 compared with 39% in 2018.

Figure 4 illustrates frequency of utilization of epidural injections with annual changes for all types of procedures.

Appendix Table 1 shows utilization of epidural injections with only primary codes indicating number of encounters rather than services. Overall, there was a significant decline of 2.5% of the patients from 2009 to 2018 per year with a total of 20.7%. Further, lumbar interlaminar and caudal epidural injections faced the highest reductions with annual decline of 4.7% with a total decline of 34.9% from 2009 to 2018.

Appendix Fig. 1 shows change of the rate for 2000 to 2009 and 2009 to 2018.

Specialty Characteristics

Appendix Table 2 and Appendix Fig. 2 shows frequency of utilization of epidural injection procedures based on specialty designation.

State Distribution Characteristics

Appendix Table 3 shows the rate of utilization of epidural injections (rates per 100,000) in the Medicare population from 2009 to 2018 based on Medicare carrier of 2016.

Further analysis was also carried out as shown in Appendix Tables 4 and 5, with Appendix Table 4 showing lumbar interlaminar or caudal epidural injection with CPT 62311, and Appendix Table 5 showing primary code of lumbar/sacral transforaminal epidural injections. CPT 64483 showed no significant changes in utilization declines, either with caudal or interlaminar epidural injections or with transforaminal epidural injections overall. However, transforaminal epidural injections showed a 0.1% annual increase in Noridian states, and 1.2% in the states covered by Palmetto.

We also assessed the rate of utilization of epidural techniques from 2009 to 2018 based on the rates of highest to lowest utilization, as shown in Appendix Table 6. The greatest declines were observed in Maine, Texas, Minnesota, Michigan, West Virginia, Ohio, New Mexico, Tennessee, Wisconsin, and Rhode Island, with annual declines of 4% or more. As shown in Appendix Table 6, Utah showed the highest increase of annual rate of 2.4% with Delaware of 2.1% and Alaska of 1.4% and Arizona of 1.2%. The largest declines were seen in Maine, Texas, Minnesota, Michigan, West Virginia, Ohio, New Mexico, Tennessee, Wisconsin, and Rhode Island, up to 4% in annual rate.

Appendix Table 7 shows utilization of epidural injection services in the Medicare population in alphabetical order.

Site-of-Service Characteristics

Epidural injection procedures, along with other interventional techniques, are provided in multiple settings including hospital outpatient departments, ambulatory surgical centers, and in physician offices with resultant implications for payment. There has been a

Table 1. *Characteristics of Medicare beneficiaries and epidural procedures excluding percutaneous adhesiolysis, continuous epidurals, and neurolytic epidurals.*

	US Population			Medicare Beneficiaries				Epidural Services*			
Year	Total Population (,000)	≥ 65 Years (,000)		Number (,000)	% to US Population	≥ 65 years (,000) (Percent)	< 65 years (,000) Percent	Services (all codes)	Rate	Services (primary codes only)	Rate
		Number	Percent								
2000	282,172	35,077	12.4%	39,632	14.0%	34,262 (86.5%)	5,370 (13.5%)	839,474 (80%)	2,118	792,563	2,000
2001	285,040	35,332	12.4%	40,045	14.0%	34,478 (86.1%)	5,567 (13.9%)	989,034 (78%)	2,470	927,364	2,316
2002	288,369	35,605	12.3%	40,503	14.0%	34,698 (85.7%)	5,805 (14.3%)	1,172,248 (74%)	2,894	1,082,298	2,672
2003	290,211	35,952	12.4%	41,126	14.2%	35,050 (85.2%)	6,078 (14.8%)	1,342,829 (71%)	3,265	1,213,014	2,950
2004	292,892	36,302	12.4%	41,729	14.2%	35,328 (84.7%)	6,402 (15.3%)	1,611,887 (65%)	3,863	1,397,749	3,350
2005	295,561	36,752	12.4%	42,496	14.4%	35,777 (84.2%)	6,723 (15.8%)	1,747,771 (65%)	4,113	1,510,354	3,554
2006	299,395	37,264	12.4%	43,339	14.5%	36,317 (83.8%)	7,022 (16.2%)	1,844,182 (63%)	4,255	1,575,656	3,636
2007	301,290	37,942	12.6%	44,263	14.7%	36,966 (83.5%)	7,297 (16.5%)	1,915,227 (62%)	4,327	1,618,656	3,657
2008	304,056	38,870	12.8%	45,412	14.9%	37,896 (83.4%)	7,516 (16.6%)	2,017,132 (61%)	4,442	1,675,681	3,690
2009	307,006	39,570	12.9%	45,801	14.9%	38,177 (83.4%)	7,624 (16.6%)	2,112,511 (59%)	4,612	1,733,339	3,785
2010	308,746	40,268	13.0%	46,914	15.2%	38,991 (83.1%)	7,923 (16.9%)	2,205,307 (57%)	4,701	1,792,291	3,820
2011	311,583	41,370	13.3%	48,300	15.5%	40,000 (82.8%)	8,300 (17.2%)	2,289,213 (58%)	4,740	1,864,066	3,859
2012	313,874	43,144	13.8%	50,300	16.0%	41,900 (83.3%)	8,500 (16.9%)	2,304,993 (58%)	4,582	1,892,951	3,763
2013	316,129	44,704	14.1%	51,900	16.4%	43,100 (83.0%)	8,800 (17.0%)	2,259,887 (58%)	4,354	1,854,380	3,573
2014	318,892	46,179	14.5%	53,500	16.8%	44,600 (83.4%)	8,900 (16.5%)	2,255,668 (57%)	4,216	1,826,336	3,414
2015	320,897	47,734	14.88%	54,900	17.1%	46,000 (83.8%)	9,000 (16.4%)	2,276,267 (57%)	4,146	1,845,604	3,362
2016	323,127	49,244	15.24%	56,500	17.5%	47,500 (84.1%)	9,000 (15.9%)	2,316,285 (58%)	4,100	1,882,269	3,331
2017	326,625	51,055	15.63%	58,000	17.8%	49,200 (84.83%)	8,900 (15.34%)	2,247,240 (54%)	3,875	1,835,796	3,165
2018	327,167	52,347	16.00%	59,600	18.2%	50,800 (85.23%)	8,800 (14.77%)	2,186,893 (54%)	3,669	1,788,915	3,002
Percentage of Change from											
2000-2018	15.9%	49.2%		50.4%		48.3%	63.9%	160.5%	73.2%	125.7%	50.1%
GM	0.8%	2.3%		2.3%		2.2%	2.8%	5.5)%	3.1%	4.6%	2.3%
2000-2009	8.8%	12.8%		15.6%		11.4%	42.0%	151.6%	117.8%	118.7%	89.2%
GM	0.9%	1.3%		1.6%		1.2%	4.0%	10.8%	9.0%	9.1%	7.3%
2009-2018	6.6%	32.3%		30.1%		33.1%	15.4%	3.5%	-20.4%	3.2%	-20.7%
GM	0.7%	3.2%		3.0%		3.2%	1.6%	0.4%	-2.5%	0.4%	-2.5%

Rate = rate per 100,000 Medicare beneficiaries; GM = geometric average change. Epidural Services = 62310-C/T or interlaminar epidural injections; 62311-L/S interlaminar epidural injections; 64479-C/T transforaminal epidural injections; 64480-C/T transforaminal epidural injections add-on; 64483-L/S transforaminal epidural injections; 64484-L/S transforaminal epidural injections add-on.

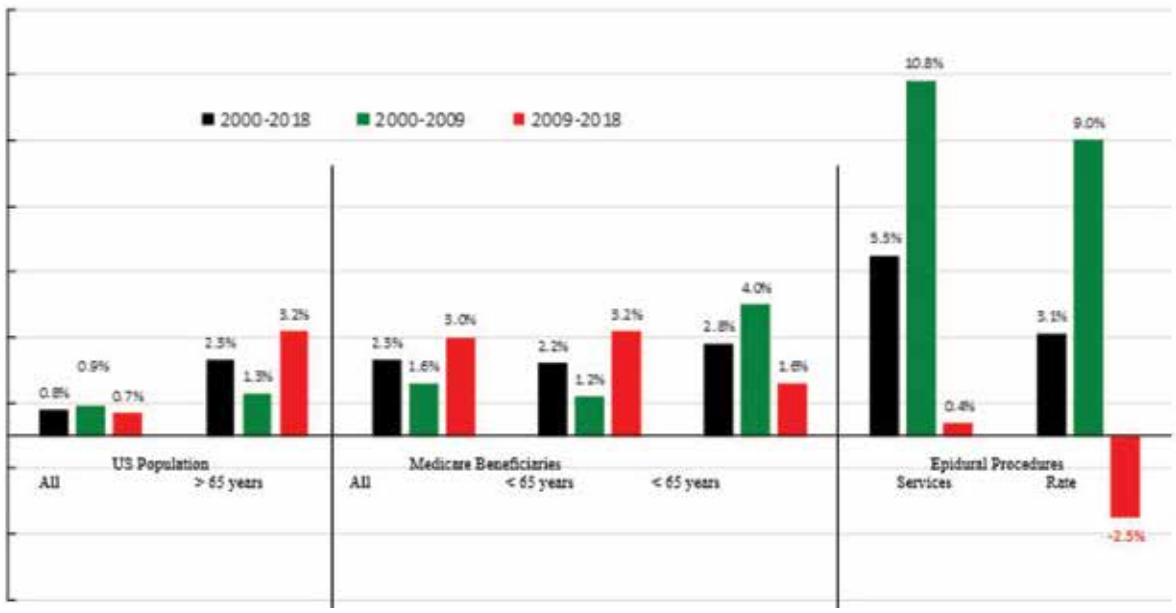
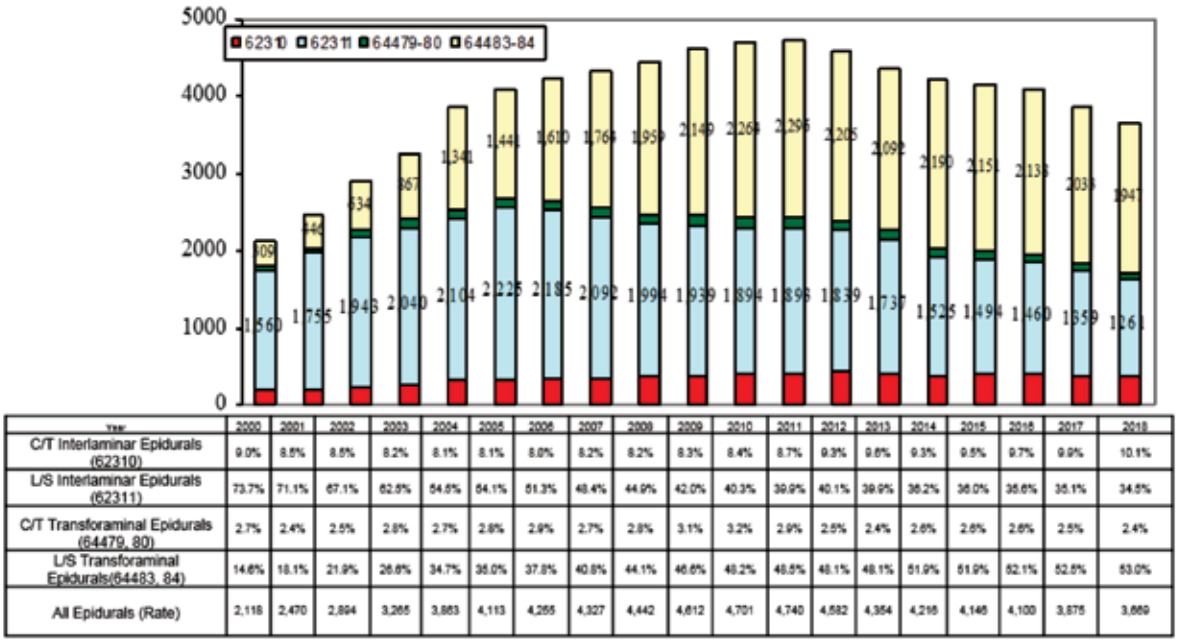


Fig. 1. *Comparative analysis of annual US population growth, Medicare participation and utilization of epidural services.*



YEAR	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
C/T Interlaminar Epidurals (62310)	9.0%	8.5%	8.5%	8.2%	8.1%	8.1%	8.0%	8.2%	8.2%	8.3%	8.4%	8.7%	9.3%	9.6%	9.3%	9.5%	9.7%	9.9%	10.1%
L/S Interlaminar Epidurals (62311)	73.7%	71.1%	67.1%	62.5%	54.5%	54.1%	51.3%	48.4%	44.9%	42.0%	40.3%	39.9%	40.1%	39.9%	36.2%	36.0%	35.6%	35.1%	34.5%
C/T Transforaminal Epidurals (64479, 80)	2.7%	2.4%	2.5%	2.6%	2.7%	2.6%	2.9%	2.7%	2.8%	3.1%	3.2%	2.9%	2.5%	2.4%	2.6%	2.6%	2.6%	2.5%	2.4%
L/S Transforaminal Epidurals(64483, 84)	14.6%	18.1%	21.9%	26.6%	34.7%	36.0%	37.8%	40.8%	44.1%	46.6%	48.2%	48.5%	48.1%	48.1%	51.9%	51.9%	52.1%	52.5%	53.0%
All Epidurals (Rate)	2,118	2,470	2,894	3,265	3,863	4,113	4,255	4,327	4,442	4,612	4,701	4,740	4,582	4,354	4,216	4,146	4,100	3,875	3,669

Fig. 2. *Frequency of utilization of epidural injections by procedures from 2000 to 2018, in Medicare recipients.*

Table 2. *Utilizations of epidural injections in the FFS Medicare population from 2000 to 2018.*

Year	Cervical/Thoracic Interlaminar Epidurals (CPT 62310)			Lumbar Interlaminar and Caudal Epidurals (CPT 62311)			Cervical/Thoracic Transforaminal Epidurals					Lumbar/Sacral Transforaminal Epidurals				
							CPT 64479	CPT 64480	Total	Rate	CFPY	CPT 64483	CPT 64484	Total	Rate	CFPY
	Services	Rate	CFPY*	Services	Rate	CFPY	Services	Services	Services			Services	Services	Services		
2000	75,741	191	-	618,362	1,560	-	13,454	9,434	22,888	58	-	85,006	37,477	122,483	309	-
2001	84,385	211	10.3%	702,713	1,755	12.5%	14,732	8,537	23,269	58	0.6%	125,534	53,133	178,667	446	44.4%
2002	99,117	245	16.1%	786,919	1,943	10.7%	18,583	10,835	29,418	73	25.0%	177,679	79,115	256,794	634	42.1%
2003	109,783	267	9.1%	838,858	2,040	5.0%	21,882	15,769	37,651	92	26.0%	242,491	114,046	356,537	867	36.7%
2004	130,649	313	17.3%	878,174	2,104	3.2%	25,182	18,094	43,276	104	13.3%	363,744	196,044	559,788	1,341	54.7%
2005	141,652	333	6.5%	945,350	2,225	5.7%	27,844	20,525	48,369	114	9.8%	395,508	216,892	612,400	1,441	7.4%
2006	146,748	339	1.6%	946,961	2,185	-1.8%	29,822	23,073	52,895	122	7.2%	452,125	245,453	697,578	1,610	11.7%
2007	156,415	353	4.4%	926,029	2,092	-4.3%	29,938	22,266	52,204	118	-3.4%	506,274	274,305	780,579	1,764	9.6%
2008	165,636	365	3.2%	905,419	1,994	-4.7%	32,286	24,003	56,289	124	5.1%	572,340	317,448	889,788	1,959	11.1%
2009	175,503	383	5.1%	888,166	1,939	-2.7%	37,012	27,487	64,499	141	13.6%	632,658	351,685	984,343	2,149	9.7%
2010	184,750	394	2.8%	888,421	1,894	-2.3%	40,003	29,888	69,891	149	5.8%	679,117	383,128	1,062,245	2,264	5.4%
2011	200,134	414	5.2%	914,324	1,893	0.0%	38,970	26,628	65,598	136	-8.8%	710,638	398,519	1,109,157	2,296	1.4%
2012	213,390	424	2.4%	925,179	1,839	-2.8%	35,945	21,293	57,238	114	-16.2%	718,437	390,749	1,109,186	2,205	-4.0%
2013	217,393	419	-1.3%	901,468	1,737	-5.6%	34,699	20,409	55,108	106	-6.7%	700,820	385,098	1,085,918	2,092	-5.1%
2014	208,741	390	-6.9%	815,858	1,525	-12.2%	37,944	21,587	59,531	111	4.8%	763,793	407,745	1,171,538	2,190	4.7%
2015	215,897	393	0.8%	820,227	1,494	-2.0%	37,855	21,115	58,970	107	-3.5%	771,625	409,548	1,181,173	2,151	-1.7%
2016	224,118	397	0.9%	824,822	1,460	-2.3%	38,741	20,467	59,208	105	-2.4%	794,588	413,549	1,208,137	2,138	-0.6%
2017	223,060	385	-3.0%	788,456	1,359	-6.9%	37,648	18,915	56,563	98	-6.9%	786,632	392,529	1,179,161	2,033	-4.9%
2018	220,470	370	-3.8%	751,846	1,261	-7.2%	37,184	17,251	54,435	91	-6.3%	779,415	380,727	1,160,142	1,947	-4.3%
2000-2018	191.1%	93.6%		21.6%	-19.1%		176.4%	82.9%	137.8%	58.2%		816.9%	915.9%	847.2%	529.8%	
GM	6.1%	3.7%		1.1%	-1.2%		5.8%	3.4%	4.9%	2.6%		13.1%	13.8%	13.3%	10.8%	
2000-2009	131.7%	100.5%		43.6%	24.3%		175.1%	191.4%	181.8%	143.8%		644.3%	838.4%	703.7%	595.4%	
GM	9.8%	8.0%		4.1%	2.4%		11.9%	12.6%	12.2%	10.4%		25.0%	28.2%	26.1%	24.0%	
2009-2018	25.6%	-3.5%		-15.3%	-34.9%		0.5%	-37.2%	-15.6%	-35.1%		23.2%	8.3%	17.9%	-9.4%	
GM	2.6%	-0.4%		-1.8%	-4.7%		0.1%	-5.0%	-1.9%	-4.7%		2.3%	0.9%	1.8%	-1.1%	

CFPY - percentage of change from previous year of rate; GM = geometric average change.

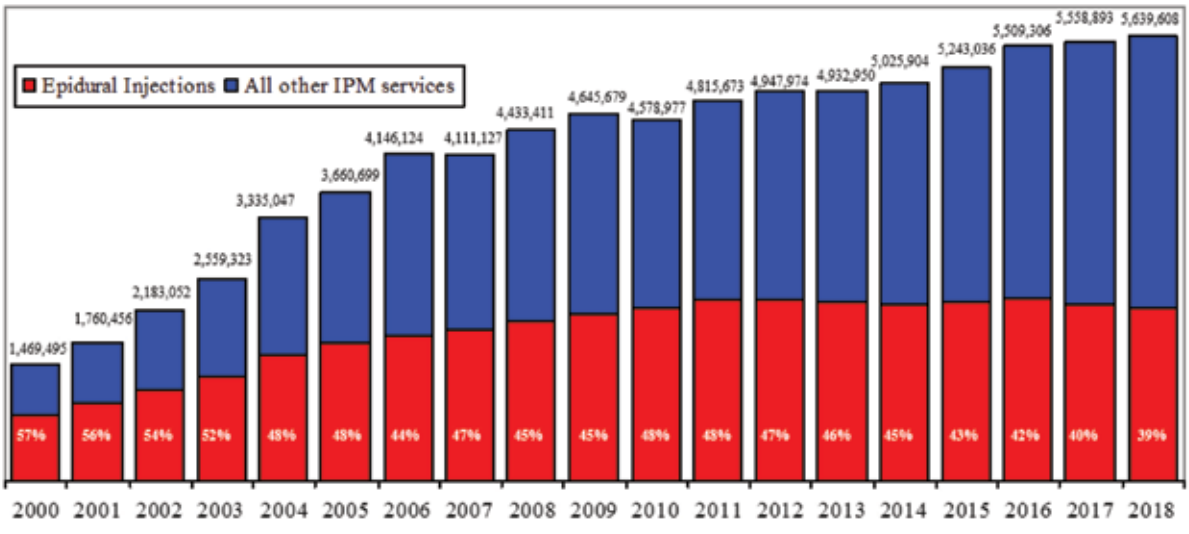


Fig. 3. *Frequency of utilization of epidural injections and all other interventional pain management procedures from 2000 to 2018 in Medicare recipients.*

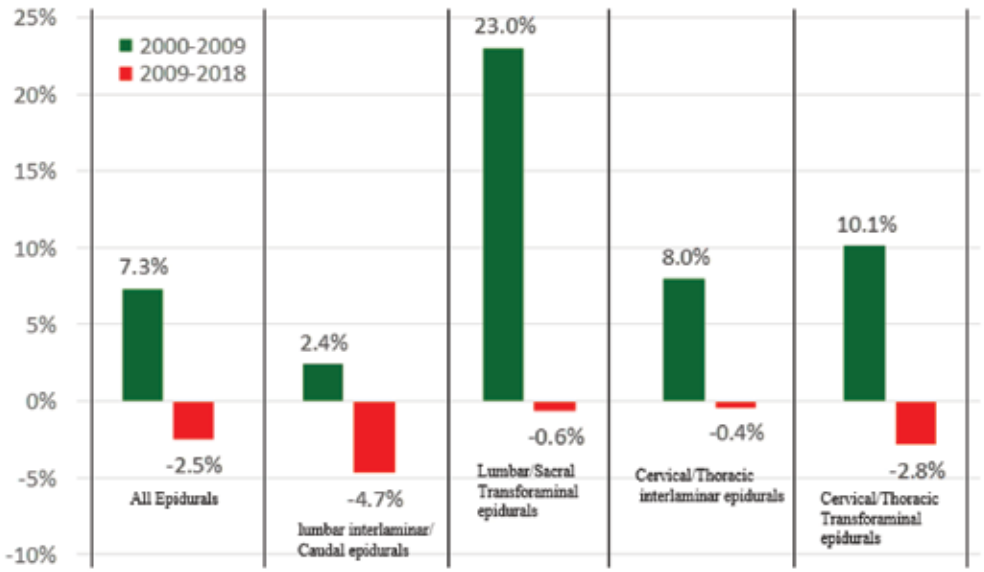


Fig. 4. *Frequency of utilization of epidural injections (annual change in the rate) by procedures from 2000 to 2018, in Medicare recipients.*

significant shift over the years in the performance of epidural injection procedures based on the location of the procedures performed, as shown in Fig. 5.

Services Compared with Rate

This manuscript provides both total number of services and rate per 100,000 population from 2000 to 2018, as shown in Fig. 6. Total number of services consistently continue to increase at a very slow pace, whereas rates of services per 100,000 Medicare population show slight declines starting in 2010.

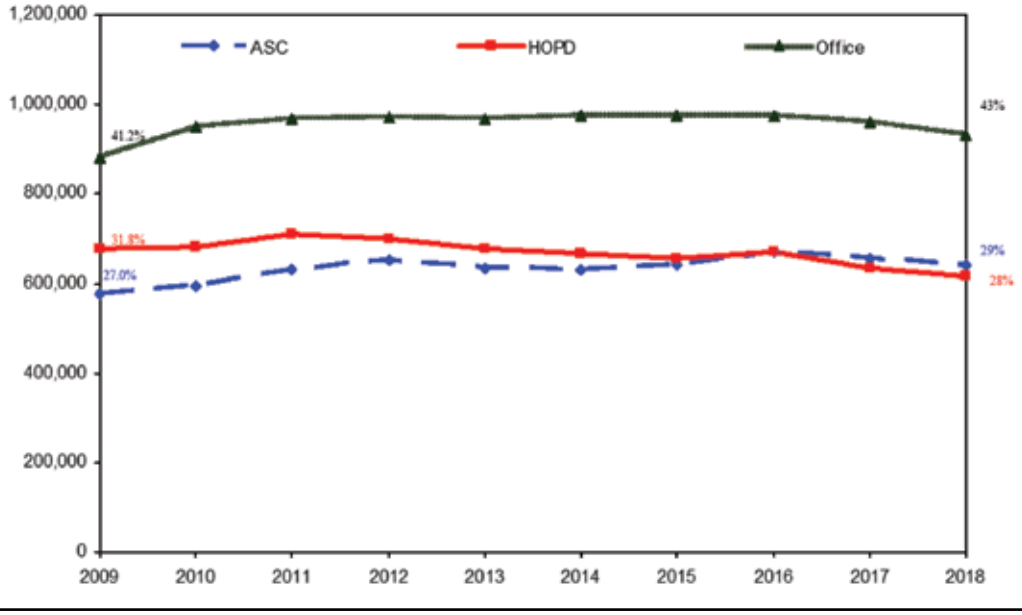


Fig. 5. *Epidural services by place of services for Medicare beneficiaries from 2009 to 2018.*
ASC = ambulatory surgery center; HOPD = hospital outpatient department.

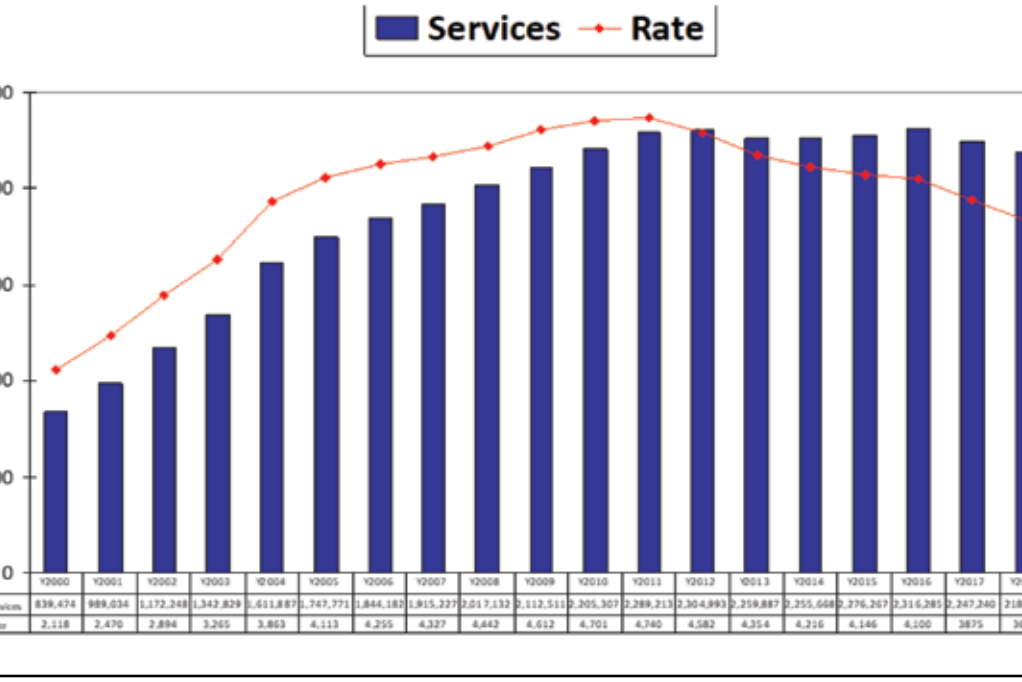


Fig. 6. *Total number of epidural services and rate per 100,000 population from 2000 to 2018.*

Discussion

Utilization of epidural injections in the Medicare FFS population shows continued decline of 20.7% from 2009 to 2018, with an annual decline of 2.5%. The results of this updated assessment are similar to the previous assessment wherein epidural injections declined 1.8% annually and a total of 12% from 2009 to 2016. This is also similar to overall utilization of interventional techniques showing a decline of 6.7% from 2009 to 2018, with an annual decline of 0.8% per 100,000 FFS Medicare population, despite an increase of 0.7% per year of population growth (3.2% of those age 65 years or older) and a 3% annual increase in Medicare population from 2009 to 2018.

All epidural injections declined at a rate of 2.5%, with an overall decline from 2000 to 2018 of 20.7%. Further analysis also showed that the greatest decline was in cervical and thoracic transforaminal epidural injections, 35.1%, with an annual decline of 4.7%, followed by lumbar interlaminar and caudal epidural injections of annual rate of 4.7% and overall rate of 34.9%, followed by a decline of 1.1% annually and overall decline of 9.4% from 2009 to 2018 of lumbar and sacral transforaminal epidurals, and finally the smallest decline was noted with cervical and thoracic interlaminar epidural procedures at an annual rate of 0.4% and overall rate of 3.5% from 2009 to 2018. However, when utilizing only primary codes, the data are somewhat different for those codes with add-on codes, namely transforaminal epidural injections. Based on primary codes, cervical and thoracic transforaminal epidurals, CPT 64479, decreased 2.8% per year with a total decrease of 22.8% from 2009 to 2018. In contrast, the decrease was smaller for lumbar/sacral transforaminal epidurals, CPT 64483, with a decline of 0.6% annually and 5.3% from 2009 to 2018. Further, the proportion of utilization of epidural injections declined compared with all other interventional pain management procedures from 2000 to 2018. In 2000, epidural injections constituted 57% of total interventional procedures, whereas the proportion of epidural procedures declined to 39% in 2018.

In addition, of further significance is increase of lumbosacral transforaminal epidural injections from 14.6% of all epidurals in 2000 to 53% in 2018, reversing the trend of lumbosacral interlaminar epidural injections from 73.7% in 2000 to 34.5% in 2018, a substantial change in the utilization patterns for both procedures.

State distribution characteristics also are shown in Appendix Table 3. These are based on the Medicare carrier of 2016 per 100,000 FFS Medicare population. The results showed that despite differences in policies allowing up to 6 procedures per year per region in some jurisdictions, and a maximum of 5 during the first year, and 4 in subsequent years per region in other jurisdictions, yet a total of 6 for whole spine regions, there were no significant differences in utilization patterns.

In addition to the earlier mentioned data, further analysis was shown in Appendix Tables 4 and 5. As described, lumbar interlaminar or caudal epidural injections declined overall 33% with no significant difference noted among the states. Although there was no change in the utilization patterns, as shown in Appendix Table 5, transforaminal epidural injections increased 0.1% at an annual rate in Noridian states, and 1.2% in the states covered by Palmetto. Further, overall declines were 6% total and 0.6% annually in non-Noridian states compared with Noridian states with an overall increase of 1% and increase of 0.1% annually. Very few states showed increases in utilization of transforaminal epidural injections, but only 2 states showed minor increases with interlaminar epidural injections. This assessment also showed no significant differences in utilization patterns based on site of service, indicating lack of significant movement of interventional pain physicians to hospital employment compared with other specialties (72,73). Physician practice benchmark survey (72) showed in 2018, a new milestone was reached – 2018 marked the first year in which there were fewer physician owners (45.9%) than employees (47.4%). Further, 2016 benchmark survey showed for the first time, less than 50% of physicians (47.1%) had an ownership stake in their practice (73,74), yet some of the reports have shown that only 1 in 3 doctors today are independent (74).

The majority of the declines may be attributed to the FFS Medicare population price changes (75,76). Those data reflected the significant reduction in reimbursement patterns starting in 2015, coupled with bundling of fluoroscopy into physician payments in 2016 (75-78). Multiple regulations were initiated to control the utilization of medical procedures starting in early 2009 with the passage of the Stimulus Act (79), which was followed by the passage of ACA and related regulations (1-3,5-10). Multiple LCDs, spearheaded by Noridian Medicare Administrative Contractors (MAC), seem to have had no significant effect (80).

Despite the decline in utilization, it is considered that utilization of all medical procedures, including

interventional techniques, is rather escalating. This is in contrast to the increases in elderly and Medicare populations. As described in our previous manuscript, the changes continue in the present manuscript in the population younger than 65 years of age on Medicare with disabilities rather than age as the annual growth rate was 1.6% from 2009 to 2018 in contrast to 4% from 2000 to 2009. This is in the face of complaints of escalating disability in all sectors, specifically in patients with spinal pain (81,82), and this reflects the fact that the majority of individuals, after obtaining disability, have been enrolled in Medicaid instead of Medicare. The only one aspect in which there was a slight increase in transforaminal epidural injections in some of the states, the only one factor with slower decreases of lumbosacral transforaminal epidural injections and rapid decrease of lumbar interlaminar and caudal epidural injections, may be based on differences in price patterns (75-78). Additionally, another epidural procedure that is not included in this analysis, percutaneous epidural adhesiolysis, has shown substantially higher reductions than epidural injections with issuance of noncoverage policy for percutaneous adhesiolysis (34,80,83,84), and this was despite significant evidence of clinical and cost effectiveness (42,54,85-88).

There are a multitude of reasons and unintended consequences of the decreased utilization of interventional techniques in general, and epidural injections in particular, may be considered as a contributing factor to the astronomical increase in opioid deaths (11). A multitude of efforts have been made to curb the opioid epidemic (89-92). Despite a decline in the number of opioid prescriptions and morphine equivalent dosages, opioid deaths have been escalating due to an epidemic of illicit fentanyl and heroin. Consequently, Best Practices in Pain Management recommends a multidisciplinary approach with the inclusion of interventional techniques (4). It should be noted that criticisms of lack of evidence, excessive utilization, and even contribution to increased opioid use remain to be just arguments rather than facts (31). Given the increase in the prevalence of spinal pain and its impact on health together with the escalating opioid epidemic and astronomical increase in death, and the discordant opinions from both proponents and opponents despite multiple favorable systematic reviews, numerous RCTs, and cost utility analysis (40-48,51,53,54,56,58-60), it appears that interventional techniques and epidural injections are over scrutinized. Thus, on the basis of the present analysis, utilization continues to be lower for epidural injections compared with other modalities of treatments in managing spinal pain.

Conclusions

The declining utilization of epidural injections in all categories with an annual total of 2.5% and from 2009 to 2018 of 20.7% compared with an annual increases of 7.3% and overall increase of 89.2% from 2000 to 2009 shows a slow decline of utilization of all epidural injections. However, the utilization patterns, even though declining, may still be considered as high. Further, this analysis showed a decline in utilization with reduction in health care expenditure despite an increase in the Medicare population and proven effectiveness in the literature, based on LCDs, stricter regulations, and potentially biased synthesis of literature, leading to reduced access and increased contribution to the opioid epidemic.

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Author Contributions

The study was designed by LM, VP, and JAH.

Statistical analysis was performed by VP.

All authors contributed to the preparation of the manuscript, reviewed, and approved the content with the final version.

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Appendix Fig. 1. *Frequency of utilization of epidural injections (change in the rate) by procedures from 2000 to 2018, in Medicare recipients.*

Appendix Fig. 2. *Frequency of utilization of epidural injections by procedures from 2000 to 2018 in Medicare recipients by specialty groups.*

Appendix Table 1. *Utilizations of epidural injections in the FFS Medicare population from 2000 to 2018 (only primary codes).*

Appendix Table 2. *Utilization patterns of epidural injections by various specialty groups from 2000 to 2018 in Medicare recipients.*

Appendix Table 3. *Utilizations of epidural injections (rates per 100,000) in the Medicare population from 2009 to 2018 based on Medicare carrier of 2016.*

Appendix Table 4. *Utilizations of caudal and interlaminar epidural injections (CPT 62311 - rates per 100,000) in the FFS Medicare population from 2009 to 2018 based on Medicare carrier of 2016.*

Appendix Table 5. *Utilizations of lumbar/sacral transforaminal epidural injections (CPT 64483 - rates per 100,000) in the FFS Medicare population from 2009 to 2018 based on Medicare carrier of 2016.*

Appendix Table 6. *Utilizations of epidural injections (rates per 100,000) in the Medicare population from 2009 to 2018 (percentage of change in decreasing order).*

Appendix Table 7. *Utilizations of epidural injections services in the Medicare population from 2009 to 2018.*

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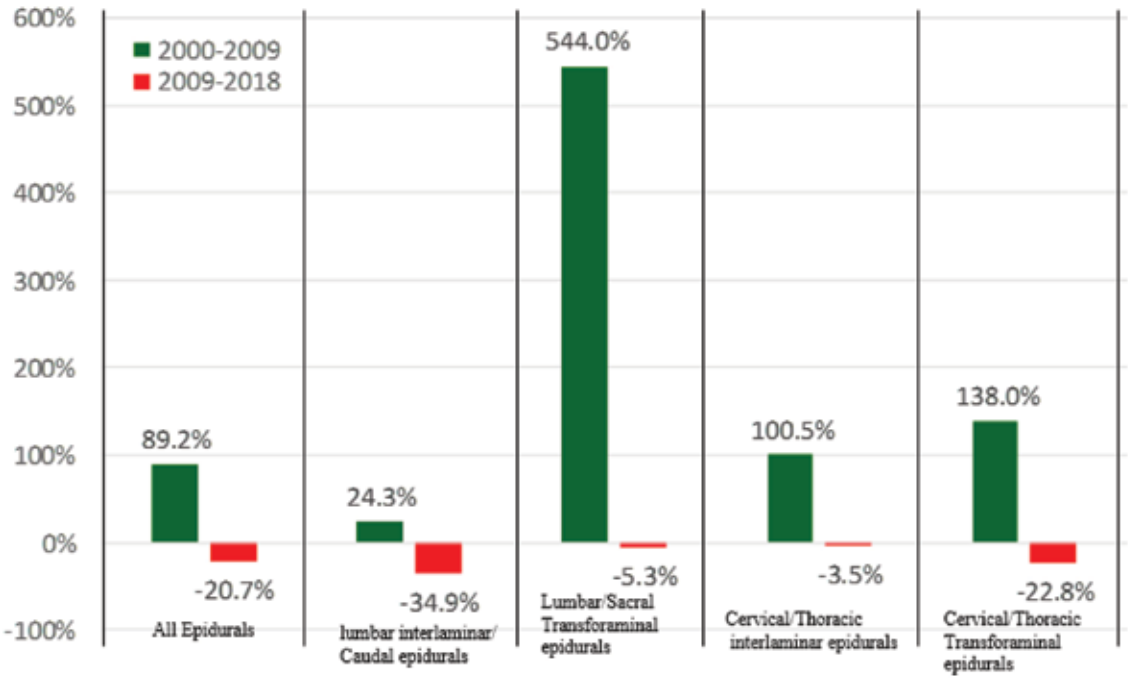
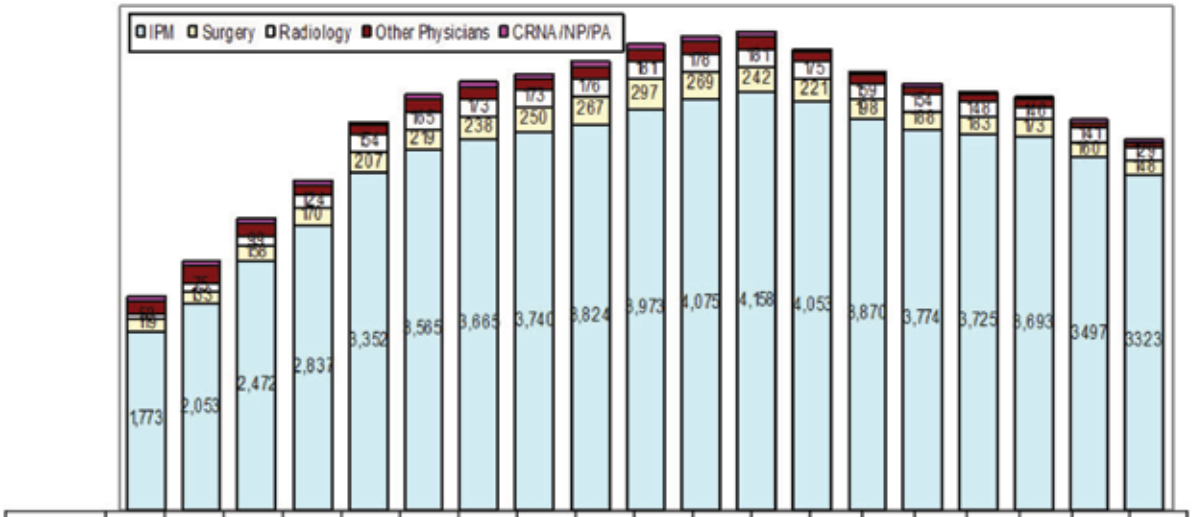


Appendix Fig. 1. *Frequency of utilization of epidural injections (change in the rate) by procedures from 2000 to 2018, in Medicare recipients.*



Specialty	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
IPM	83.7%	83.1%	85.4%	86.9%	86.8%	86.7%	86.1%	86.4%	86.1%	86.1%	86.7%	87.7%	88.4%	88.9%	89.5%	89.8%	90.1%	90.2%	90.6%
Surgery	5.6%	5.4%	5.4%	5.2%	5.4%	5.3%	5.6%	5.6%	6.0%	6.4%	5.7%	5.1%	4.8%	4.6%	4.5%	4.2%	4.2%	4.1%	4.0%
Radiology	2.7%	3.0%	3.4%	3.8%	4.0%	4.0%	4.1%	4.0%	4.0%	3.9%	3.8%	3.8%	3.8%	3.7%	3.6%	3.6%	3.6%	3.6%	3.6%
General Physician	2.6%	1.9%	1.9%	1.9%	1.9%	1.9%	2.2%	1.8%	1.7%	1.8%	2.1%	1.7%	1.3%	1.4%	1.1%	1.5%	1.5%	1.4%	1.3%
Other Physician	3.7%	4.7%	2.2%	1.0%	0.9%	0.9%	0.9%	1.0%	1.3%	0.9%	0.9%	0.9%	0.9%	0.8%	0.7%	0.6%	0.6%	0.6%	0.6%
CRNA, NP & PA	1.7%	1.9%	1.7%	1.3%	1.0%	1.1%	1.1%	1.0%	0.9%	0.8%	0.8%	0.8%	0.7%	0.7%	0.6%	0.6%	0.6%	0.6%	0.6%

Appendix Fig. 2. *Frequency of utilization of epidural injections by procedures from 2000 to 2018 in Medicare recipients by specialty groups.*

Appendix Table 1. *Utilizations of epidural injections in the FFS Medicare population from 2000 to 2018 (only primary codes).*

HCPCS	Cervical/Thoracic Interlaminar Epidurals (CPT 62310)		Lumbar Interlaminar and Caudal Epidurals (CPT 62311)		Interlaminar and Caudal Epidurals			Cervical/Thoracic Transforaminal Epidurals (CPT 64479)		Lumbar/Sacral Transforaminal Epidurals (CPT 64483)		Total Transforaminal (64479 & 64483)			All epidural injections		
Year	Services	Rate	Services	Rate	Services	Rate	PCFPY	Services	Rate	Services	Rate	Services	Rate	PCFPY	Services	Rate	PCFPY
2000	75,741	191	618,362	1,560	694,103	1,751		13,454	34	85,006	214	98,460	248		792,563	2,000	
2001	84,385	211	702,713	1,755	787,098	1,966	12.2%	14,732	37	125,534	313	140,266	350	41.0%	927,364	2,316	15.8%
2002	99,117	245	786,919	1,943	886,036	2,188	11.3%	18,583	46	177,679	439	196,262	485	38.3%	1,082,298	2,672	15.4%
2003	109,783	267	838,858	2,040	948,641	2,307	5.4%	21,882	53	242,491	590	264,373	643	32.7%	1,213,014	2,950	10.4%
2004	130,649	313	878,174	2,104	1,008,823	2,418	4.8%	25,182	60	363,744	872	388,926	932	45.0%	1,397,749	3,350	13.6%
2005	141,652	333	945,350	2,225	1,087,002	2,558	5.8%	27,844	66	395,508	931	423,352	996	6.9%	1,510,354	3,554	6.1%
2006	146,748	339	946,961	2,185	1,093,709	2,524	-1.3%	29,822	69	452,125	1,043	481,947	1,112	11.6%	1,575,656	3,636	2.3%
2007	156,415	353	926,029	2,092	1,082,444	2,445	-3.1%	29,938	68	506,274	1,144	536,212	1,211	8.9%	1,618,656	3,657	0.6%
2008	165,636	365	905,419	1,994	1,071,055	2,359	-3.6%	32,286	71	572,340	1,260	604,626	1,331	9.9%	1,675,681	3,690	0.9%
2009	175,503	383	888,166	1,939	1,063,669	2,322	-1.5%	37,012	81	632,658	1,381	669,670	1,462	9.8%	1,733,339	3,785	2.6%
2010	184,750	394	888,421	1,894	1,073,171	2,288	-1.5%	40,003	85	679,117	1,448	719,120	1,533	4.8%	1,792,291	3,820	0.9%
2011	200,134	414	914,324	1,893	1,114,458	2,307	0.9%	38,970	81	710,638	1,471	749,608	1,552	1.2%	1,864,066	3,859	1.0%
2012	213,390	424	925,179	1,839	1,138,569	2,264	-1.9%	35,945	71	718,437	1,428	754,382	1,500	-3.4%	1,892,951	3,763	-2.5%
2013	217,393	419	901,468	1,737	1,118,861	2,156	-4.8%	34,699	67	700,820	1,350	735,519	1,417	-5.5%	1,854,380	3,573	-5.1%
2014	208,741	390	815,858	1,525	1,024,599	1,915	-11.2%	37,944	71	763,793	1,428	801,737	1,499	5.7%	1,826,336	3,414	-4.5%
2015	215,897	393	820,227	1,494	1,036,124	1,887	-1.5%	37,855	69	771,625	1,406	809,480	1,474	-1.6%	1,845,604	3,362	-1.5%
2016	224,118	397	824,822	1,460	1,048,940	1,857	-1.6%	38,741	69	794,588	1,406	833,329	1,475	0.0%	1,882,269	3,331	-0.9%
2017	223,060	385	788,456	1,359	1,011,516	1,744	-6.1%	37,648	65	786,632	1,356	824,280	1,421	-3.6%	1,835,796	3,165	-5.0%
2018	220,470	370	751,846	1,261	972,316	1,631	-6.5%	37,184	62	779,415	1,308	816,599	1,370	-3.6%	1,788,915	3,002	-5.2%
2000-2018	191.1%	93.6%	21.6%	-19.1%	40.1%	-6.8%		176.4%	83.8%	816.9%	509.7%	729.4%	451.5%		125.7%	50.1%	
GM	6.1%	3.7%	1.1%	-1.2%	1.9%	-0.4%		5.8%	3.4%	13.1%	10.6%	12.5%	10.0%		4.6%	2.3%	
2000-2009	131.7%	100.5%	43.6%	24.3%	53.2%	32.6%		175.1%	138.0%	644.3%	544.0%	580.1%	488.5%		118.7%	89.2%	
GM	9.8%	8.0%	4.1%	2.4%	4.9%	3.2%		11.9%	10.1%	25.0%	23.0%	23.7%	21.8%		9.1%	7.3%	
2009-2018	25.6%	-3.5%	-15.3%	-34.9%	-8.6%	-29.8%		0.5%	-22.8%	23.2%	-5.3%	21.9%	-6.3%		3.2%	-20.7%	
GM	2.6%	-0.4%	-1.8%	-4.7%	-1.0%	-3.8%		0.1%	-2.8%	2.3%	-0.6%	2.2%	-0.7%		0.4%	-2.5%	

PCFPY = percentage of change from previous year of rate; GM = geometric average change.

Appendix Table 2. *Utilization patterns of epidural injections by various specialty groups from 2000 to 2018 in Medicare recipients.*

Speciality	Interventional Pain Management #		Surgical (neuro, general, & orthopedic)		Radiology		General Physicians		Other Providers (CRNA, NP & PA)		Total	
Year	Services	Rate	Services	Rate	Services	Rate	Services	Rate	Services	Rate	Services	Rate
2000	702,731 (83.7%)	1,773	47,213 (5.6%)	119	22,794 (2.7%)	58	52,429 (6.2%)	132	14,307 (1.7%	36	839,474	2,118
2001	822,285 (83.1%)	2,053	53,358 (5.4%)	133	29,996 (3.0%)	75	64,997 (6.6%)	162	18,398 (1.9%)	46	989,034	2,470
2002	1,001,336 (85.4%)	2,472	63,811 (5.4%)	158	40,217 (3.4%)	99	47,478 (4.1%)	117	19,406 (1.7%)	48	1,172,248	2,894
2003	1,166,621 (86.9%)	2,837	69,854 (5.2%)	170	50,812 (3.8%)	124	38,549 (2.9%)	94	16,993 (1.3%)	41	1,342,829	3,265
2004	1,398,808 (86.8%)	3,352	86,546 (5.4%)	207	64,320 (4.0%)	154	45,402 (2.8%)	109	16,811 (1.0%)	40	1,611,887	3,863
2005	1,514,949 (86.7%)	3,565	92,890 (5.3%)	219	70,015 (4.0%)	165	50,376 (2.9%)	119	19,541 (1.1%)	46	1,747,771	4,113
2006	1,588,564 (86.1%)	3,665	103,129 (5.6%)	238	74,830 (4.1%)	173	58,055 (3.1%)	134	19,604 (1.1%)	45	1,844,182	4,255
2007	1,655,227 (86.4%)	3,740	110,571 (5.8%)	250	76,511 (4.0%)	173	53,916 (2.8%)	122	19,002 (1.0%)	43	1,915,227	4,327
2008	1,736,392 (86.1%)	3,824	121,250 (6.0%)	267	79,895 (4.0%)	176	61,246 (3.0%)	135	18,349 (0.9%)	40	2,017,132	4,442
2009	1,819,868 (86.1%)	3,973	135,910 (6.4%)	297	82,865 (3.9%)	181	57,096 (2.7%)	125	16,772 (0.8%)	37	2,112,511	4,612
2010	1,911,762 (86.7%)	4,075	126,119 (5.7%)	269	83,670 (3.8%)	178	65,610 (3.0%)	140	18,146 (0.8%)	39	2,205,307	4,701
2011	2,008,135 (87.7%)	4,158	117,001 (5.1%)	242	87,447 (3.8%)	181	58,974 (2.6%)	122	17,656 (0.8%)	37	2,289,213	4,740
2012	2,038,618 (88.4%)	4,053	111,135 (4.8%)	221	88,123 (3.8%)	175	50,243 (2.2%)	100	16,874 (0.7%)	34	2,304,993	4,582
2013	2,008,620 (88.9%)	3,870	103,000 (4.6%)	198	82,766 (3.7%)	159	49,848 (2.2%)	96	15,653 (0.7%)	30	2,259,887	4,354
2014	2,019,328 (89.5%)	3,774	100,658 (4.5%)	188	82,257 (3.6%)	154	39,876 (1.8%)	75	13,549 (0.6%)	25	2,255,668	4,216
2,015	2,045,138 (89.8%)	3,725	100,262 (4.4%)	183	81,034 (3.6%)	148	36,088 (1.6%)	66	13,745 (0.6%)	25	2,276,267	4,146
2,016	2,086,614 (90.1%)	3,693	97,656 (4.2%)	173	82,397 (3.6%)	146	34,722 (1.5%)	61	14,896 (0.6%)	26	2,316,285	4,100
2,017	2,028,083 (90.2%)	3,497	92,546 (4.1%)	160	81,559 (3.6%)	141	31,275 (1.4%)	54	13,777 (0.6%)	24	2,247,240	3,875

Appendix Table 2 (con't). *Utilization patterns of epidural injections by various specialty groups from 2000 to 2018 in Medicare recipients.*

Speciality	Interventional Pain Management #		Surgical (neuro, general, & orthopedic)		Radiology		General Physicians		Other Providers (CRNA, NP & PA)		Total	
Year	Services	Rate	Services	Rate	Services	Rate	Services	Rate	Services	Rate	Services	Rate
2,018	1,980,578 (90.6%)	3,323	88,170 (4.0%)	148	76,959 (3.5%)	129	27,527 (1.3%)	46	13,659 (0.6%)	23	2,186,893	3,669
Change from 2000-2018	181.8%	87.4%	86.7%	24.2%	237.6%	124.5%	-47.5%	-65.1%	-4.5%	-36.5%	160.5%	73.2%
GM	5.9%	3.6%	3.5%	1.2%	7.0%	4.6%	-3.5%	-5.7%	-0.3%	-2.5%	5.5%	3.1%
Change from 2000-2009	159.0%	124.1%	187.9%	149.1%	263.5%	214.6%	8.9%	-5.8%	17.2%	1.4%	151.6%	117.8%
GM	11.2%	9.4%	12.5%	10.7%	15.4%	13.6%	1.0%	-0.7%	1.8%	0.2%	10.8%	9.0%
Change from 2009-2018	9%	-16%	-35%	-50%	-7%	-29%	-52%	-63%	-19%	-37%	4%	-20%
GM	0.9%	-2.0%	-4.7%	-7.4%	-0.8%	-3.7%	-7.8%	-10.4%	-2.3%	-5.1%	0.4%	-2.5%

Rate = per 100,000 Medicare Beneficiaries; GM = geometric change; IPM = interventional pain management: anesthesiology, pain management; PM&R, neurology, psychiatry; General Physicians: family practice, general practice & internal medicine.

Appendix Table 3. *Utilizations of epidural injections (rates per 100,000) in the Medicare population from 2009 to 2018 based on Medicare carrier of 2016.*

State	R2009	R2010	R2011	R2012	R2013	R2014	R2015	R2016	R2017	R2018	Change	GM
Cahaba												
Alabama	6,510	6,305	6,699	7,029	6,572	6,514	6,651	6,579	5,221	5,073	-22.1%	-2.7%
Georgia	6,402	6,121	6,410	6,360	5,817	5,579	5,776	5,258	5,054	4,529	-29.3%	-3.8%
Tennessee	4,560	4,205	4,358	4,210	3,646	3,511	3,569	3,548	3,316	3,112	-31.8%	-4.2%
Total	5,809	5,525	5,797	5,817	5,286	5,131	5,266	5,034	4,524	4,202	-27.7%	-3.5%
CFPY	1%	-5%	5%	0%	-9%	-3%	3%	-4%	-10%	-7%		
CGS												
Kentucky	4,537	4,760	4,883	5,127	4,768	4,400	4,442	4,227	4,233	4,100	-9.6%	-1.1%
Ohio	4,484	4,262	4,227	4,050	3,826	3,600	3,416	3,563	3,280	3,018	-32.7%	-4.3%
Total	4,499	4,404	4,415	4,359	4,097	3,831	3,711	3,753	3,551	3,326	-26.1%	-3.3%
	3.9%	-2.1%	0.3%	-1.3%	-6.0%	-6.5%	-3.1%	1.1%	-5.4%	-6.3%		
First Coast												
Florida	5,917	5,793	5,707	5,456	5,074	4,970	5,017	4,767	4,322	4,148	-29.9%	-3.9%
CFPY	-5.5%	-2.1%	-1.5%	-4.4%	-7.0%	-2.0%	1.0%	-5.0%	-9.3%	-4.0%		
NGS												
Connecticut	3,375	3,444	3,681	3,611	3,452	3,418	3,359	3,259	3,019	2,584	-23.4%	-2.9%
Illinois	4,610	4,946	4,969	4,927	4,868	4,647	4,582	4,488	4,372	4,094	-11.2%	-1.3%
Maine	3,344	3,271	3,232	3,269	3,147	3,192	3,041	2,662	2,346	1,816	-45.7%	-6.6%
Massachusetts	3,344	3,501	3,767	3,965	4,027	3,921	3,959	3,838	3,678	3,568	6.7%	0.7%
Minnesota	2,612	2,526	2,500	2,403	2,139	1,971	1,958	1,816	1,604	1,502	-42.5%	-6.0%
New Hampshire	4,603	5,000	5,210	4,864	4,573	4,248	4,290	3,854	3,624	3,436	-25.3%	-3.2%
New York	2,930	2,979	2,952	2,982	3,081	3,117	3,186	3,063	2,882	2,763	-5.7%	-0.6%
Rhode Island	2,626	3,157	2,988	2,689	2,323	2,388	2,460	2,255	1,999	1,816	-30.9%	-4.0%
Vermont	2,925	2,691	2,677	2,581	2,594	2,558	2,600	2,518	2,561	2,428	-17.0%	-2.0%
Wisconsin	3,905	3,742	3,866	3,841	3,562	3,339	3,219	3,156	2,838	2,670	-31.6%	-4.1%
Total	3,472	3,573	3,626	3,620	3,565	3,471	3,466	3,342	3,149	2,958	-14.8%	-1.8%
CFPY	3.4%	2.9%	1.5%	-0.2%	-1.5%	-2.6%	-0.2%	-3.6%	-5.8%	-6.1%		
Noridian												
Alaska	2,837	2,978	3,087	3,371	3,614	3,472	3,656	3,323	3,050	3,210	13.1%	1.4%
Arizona	4,919	5,343	5,780	6,080	5,918	5,927	6,059	5,807	5,444	5,494	11.7%	1.2%
California	3,433	3,665	3,731	3,716	3,675	3,450	3,513	3,222	2,934	2,840	-17.3%	-2.1%
Idaho	4,217	4,000	4,208	4,291	4,299	4,130	4,254	3,884	3,369	3,260	-22.7%	-2.8%
Montana	4,029	3,816	4,054	3,962	4,001	4,017	4,011	3,831	3,517	3,405	-15.5%	-1.9%
Nevada	5,265	5,446	5,638	5,612	5,314	4,748	5,097	4,585	3,877	3,747	-28.8%	-3.7%
North Dakota	5,221	5,066	4,798	4,847	4,598	4,423	4,247	4,340	4,232	3,975	-23.9%	-3.0%
Oregon	2,054	2,006	2,197	2,373	2,353	2,047	2,044	1,852	1,581	1,577	-23.2%	-2.9%
South Dakota	4,801	4,644	4,671	4,717	4,764	4,348	4,617	4,343	4,287	4,096	-14.7%	-1.7%
Utah	5,135	5,260	5,590	6,453	6,523	6,630	6,923	6,641	6,255	6,364	23.9%	2.4%
Washington	3,058	3,122	3,084	3,024	2,993	2,787	2,617	2,406	2,296	2,191	-28.3%	-3.6%
Wyoming	3,641	3,675	3,518	3,779	3,852	4,025	4,179	4,282	4,052	3,921	7.7%	0.8%
Total	3,655	3,830	3,948	4,010	3,961	3,763	3,824	3,552	3,261	3,193	-12.6%	-1.5%
CFPY	1.9%	4.8%	3.1%	1.6%	-1.2%	-5.0%	1.6%	-7.1%	-8.2%	-2.1%		
Novitas												
Arkansas	4,329	4,313	4,352	4,370	4,288	4,268	4,476	4,707	4,823	4,667	7.8%	0.8%
Colorado	4,180	4,354	4,406	4,389	4,304	4,168	4,109	3,935	3,531	3,421	-18.2%	-2.2%

Appendix Table 3 (con't). *Utilizations of epidural injections (rates per 100,000) in the Medicare population from 2009 to 2018 based on Medicare carrier of 2016.*

State	R2009	R2010	R2011	R2012	R2013	R2014	R2015	R2016	R2017	R2018	Change	GM
DC	28,206	30,987	33,524	33,612	39,910	39,658	42,391	34,844	34,116	32,360	14.7%	1.5%
Delaware	5,033	5,398	5,735	5,828	5,660	5,902	6,346	6,367	5,920	6,088	21.0%	2.1%
Louisiana	6,233	6,108	6,335	6,432	6,037	5,759	5,758	5,385	4,990	4,530	-27.3%	-3.5%
Maryland	4,071	4,166	4,512	4,265	4,469	4,625	4,937	4,668	4,261	4,164	2.3%	0.3%
Mississippi	5,751	5,941	5,887	5,732	5,404	5,491	5,942	5,835	5,698	5,307	-7.7%	-0.9%
New Jersey	4,036	4,133	4,224	4,045	4,121	4,201	4,404	4,268	3,912	3,742	-7.3%	-0.8%
New Mexico	2,948	3,107	3,069	2,740	2,722	2,417	2,310	2,077	2,152	1,997	-32.2%	-4.2%
Oklahoma	5,243	5,342	5,608	5,576	5,787	6,119	6,410	5,727	5,742	5,396	2.9%	0.3%
Pennsylvania	3,349	3,635	3,765	3,825	3,934	3,895	3,839	3,672	3,385	3,249	-3.0%	-0.3%
Texas	7,041	6,938	6,712	6,124	5,565	5,416	5,479	5,201	4,533	4,051	-42.5%	-6.0%
Total	5,178	5,281	5,342	5,142	5,014	4,973	5,088	4,848	4,458	4,169	-19.5%	-2.4%
CFPY	3.6%	2.0%	1.1%	-3.7%	-2.5%	-0.8%	2.3%	-4.7%	-8.1%	-6.5%		
Palmetto GBA												
North Carolina	5,121	5,205	5,537	5,582	5,278	4,781	4,820	4,764	4,467	4,238	-17.2%	-2.1%
South Carolina	6,863	7,125	7,334	7,401	7,019	6,789	6,979	6,663	6,154	5,921	-13.7%	-1.6%
Virginia	3,636	3,564	3,783	3,812	3,782	3,885	4,086	4,012	3,851	3,801	4.5%	0.5%
West Virginia	2,225	2,262	2,429	2,453	2,477	2,286	1,831	1,740	1,713	1,469	-34.0%	-4.5%
Total	4,731	4,806	5,069	5,114	4,933	4,704	4,774	4,655	4,391	4,219	-10.8%	-1.3%
CFPY	4.0%	1.6%	5.5%	0.9%	-3.5%	-4.6%	1.5%	-2.5%	-5.7%	-3.9%		
WPS												
Indiana	5,381	5,411	5,619	5,477	5,407	5,248	5,263	5,083	4,635	4,360	-19.0%	-2.3%
Iowa	3,538	3,517	3,551	3,499	3,316	3,132	3,187	3,084	2,944	2,837	-19.8%	-2.4%
Kansas	6,360	6,617	6,900	7,006	6,791	6,709	6,680	6,310	5,883	5,825	-8.4%	-1.0%
Michigan	5,230	6,266	5,572	5,370	5,116	4,858	4,672	4,286	3,743	3,370	-35.6%	-4.8%
Missouri	6,500	6,596	6,515	6,482	6,099	5,880	5,659	5,307	4,886	4,650	-28.5%	-3.7%
Nebraska	4,542	4,385	4,348	4,426	4,357	4,173	4,207	4,131	3,895	3,716	-18.2%	-2.2%
Total	5,402	5,791	5,611	5,515	5,293	5,091	4,990	4,705	4,275	4,017	-25.6%	-3.2%
CFPY	3.4%	7.2%	-3.1%	-1.7%	-4.0%	-3.8%	-2.0%	-5.7%	-9.1%	-6.1%		
US Total	4,612	4,701	4,740	4,582	4,354	4,216	4,146	4,100	4,013	3,669	-20.4%	-2.5%
CFPY	3.8%	1.9%	0.8%	-3.3%	-5.0%	-3.2%	-1.7%	-1.1%	-2.1%	-8.6%		

CFPY = change from previous year of rate; GM = geometric average change.

Appendix Table 4. *Utilizations of caudal and interlaminar epidural injections (CPT 62311 - rates per 100,000) in the FFS Medicare population from 2009 to 2018 based on Medicare carrier of 2016.*

State	R2009	R2010	R2011	R2012	R2013	R2014	R2015	R2016	R2017	R2018	Change	GM
Cahaba												
Alabama	3,357	3,336	3,407	3,465	3,232	2,954	2,860	2,846	2,348.27	2,315.57	-31%	-4.0%
Georgia	2,320	2,105	2,091	1,999	1,698	1,511	1,436	1,351	1,208.76	1,047.80	-55%	-8.5%
Tennessee	2,554	2,285	2,200	2,136	1,750	1,626	1,594	1,604	1,501.65	1,331.02	-48%	-7.0%
Total	2,680	2,497	2,479	2,437	2,121	1,929	1,860	1,824	1,597.73	1,464.30	-45%	-6.5%
CGS												
Kentucky	3,116	3,242	3,265	3,493	3,213	2,850	2,711	2,543	2,338.71	2,230.06	-28%	-3.6%
Ohio	1,977	1,856	1,776	1,845	1,727	1,478	1,330	1,340	1,220.69	1,100.01	-44%	-6.3%
Total	2,301	2,252	2,203	2,317	2,155	1,873	1,727	1,684	1,539.20	1,421.48	-38%	-5.2%
First Coast												
Florida	2,399	2,297	2,235	2,168	1,978	1,657	1,649	1,632	1,480.69	1,384.11	-42%	-5.9%
NGS												
Connecticut	1,635	1,609	1,621	1,631	1,542	1,413	1,461	1,454	1,292.46	1,040.64	-36%	-4.9%
Illinois	1,868	1,901	1,959	2,041	1,994	1,692	1,571	1,502	1,438.91	1,288.33	-31%	-4.0%
Maine	2,002	1,949	2,006	2,156	2,191	2,088	1,884	1,727	1,426.66	1,003.18	-50%	-7.4%
Massachusetts	1,647	1,697	1,822	1,935	1,952	1,874	1,864	1,875	1,774.69	1,688.09	2%	0.3%
Minnesota	1,200	1,118	1,085	1,094	946	830	793	715	624.44	549.22	-54%	-8.3%
New Hampshire	2,864	2,960	2,895	2,826	2,735	2,230	2,185	2,056	1,799.35	1,779.87	-38%	-5.1%
New York	1,126	1,112	1,107	1,127	1,111	997	1,007	1,025	964.21	922.35	-18%	-2.2%
Rhode Island	1,269	1,512	1,515	1,434	1,433	1,401	1,452	1,345	1,200.96	1,004.98	-21%	-2.6%
Vermont	1,392	1,340	1,386	1,467	1,473	1,487	1,541	1,563	1,602.33	1,494.37	7%	0.8%
Wisconsin	2,040	1,857	1,803	1,780	1,629	1,414	1,262	1,239	1,107.03	1,035.34	-49%	-7.3%
Total	1,548	1,534	1,552	1,590	1,543	1,377	1,332	1,307	1,211.68	1,108.03	-28%	-3.6%
Noridian												
Alaska	1,445	1,378	1,507	1,525	1,640	1,598	1,576	1,336	1,286.47	1,418.49	-2%	-0.2%
Arizona	1,837	1,846	1,885	1,903	1,778	1,404	1,364	1,298	1,138.20	1,096.76	-40%	-5.6%
California	1,146	1,117	1,143	1,224	1,184	1,053	1,048	972	850.46	798.55	-30%	-3.9%
Idaho	1,797	1,620	1,648	1,735	1,666	1,532	1,582	1,490	1,230.46	1,146.34	-36%	-4.9%
Montana	2,014	1,887	2,032	1,945	1,971	1,860	1,760	1,722	1,537.41	1,468.19	-27%	-3.4%
Nevada	1,292	1,279	1,324	1,371	1,432	1,210	1,174	1,078	951.61	860.18	-33%	-4.4%
North Dakota	3,669	3,790	3,615	3,622	3,548	3,301	3,222	3,220	3,143.71	2,879.81	-22%	-2.7%
Oregon	649	631	636	642	580	501	477	433	387.82	356.13	-45%	-6.4%
South Dakota	2,680	2,457	2,528	2,587	2,451	2,169	2,294	2,178	2,251.47	2,056.10	-23%	-2.9%
Utah	2,138	2,061	2,202	2,519	2,442	2,059	2,043	2,002	1,949.59	1,969.25	-8%	-0.9%
Washington	1,378	1,328	1,315	1,194	1,167	982	882	859	769.68	745.54	-46%	-6.6%
Wyoming	2,007	1,811	1,570	1,612	1,461	1,535	1,465	1,493	1,473.49	1,352.75	-33%	-4.3%
Total	1,349	1,312	1,337	1,384	1,338	1,164	1,141	1,074	959.83	910.12	-33%	-4.3%
Novitas												
Arkansas	2,418	2,444	2,542	2,673	2,589	2,300	2,462	2,622	2,649.33	2,476.35	2%	0.3%
Colorado	1,881	1,880	1,933	1,893	1,712	1,438	1,350	1,255	1,086.23	979.34	-48%	-7.0%
DC	10,088	9,426	9,369	9,272	10,247	9,195	9,507	7,706	7,399.15	6,774.72	-33%	-4.3%
Delaware	1,641	1,714	1,727	1,706	1,598	1,418	1,433	1,744	1,573.99	1,627.45	-1%	-0.1%
Louisiana	1,957	1,945	1,921	1,934	1,823	1,626	1,657	1,583	1,380.08	1,279.78	-35%	-4.6%
Maryland	1,297	1,239	1,261	1,319	1,309	1,268	1,307	1,242	1,169.59	1,136.17	-12%	-1.5%
Mississippi	2,500	2,560	2,665	2,601	2,494	2,518	2,587	2,587	2,425.81	2,326.47	-7%	-0.8%

Appendix Table 4 (con't). *Utilizations of caudal and interlaminar epidural injections (CPT 62311 - rates per 100,000) in the FFS Medicare population from 2009 to 2018 based on Medicare carrier of 2016.*

State	R2009	R2010	R2011	R2012	R2013	R2014	R2015	R2016	R2017	R2018	Change	GM
New Jersey	1,383	1,368	1,396	1,377	1,353	1,234	1,225	1,187	1,014.89	923.41	-33%	-4.4%
New Mexico	1,358	1,166	1,146	1,145	1,052	970	922	881	800.94	734.35	-46%	-6.6%
Oklahoma	2,334	2,299	2,369	2,488	2,467	2,158	2,237	1,996	2,010.29	1,861.51	-20%	-2.5%
Pennsylvania	1,627	1,642	1,670	1,699	1,636	1,476	1,435	1,408	1,362.45	1,314.68	-19%	-2.3%
Texas	1,787	1,710	1,744	1,725	1,557	1,372	1,378	1,353	1,149.99	1,050.95	-41%	-5.7%
Total	1,824	1,792	1,826	1,836	1,742	1,568	1,574	1,532	1,397.07	1,304.94	-28%	-3.7%
Palmetto												
North Carolina	2,370	2,275	2,372	2,455	2,204	1,818	1,804	1,723	1,498.97	1,355.42	-43%	-6.0%
South Carolina	3,295	3,329	3,372	3,423	3,195	2,790	2,795	2,798	2,550.63	2,361.49	-28%	-3.6%
Virginia	1,535	1,410	1,529	1,447	1,431	1,284	1,314	1,240	1,188.71	1,124.08	-27%	-3.4%
West Virginia	959	905	974	882	794	626	543	602	613.52	588.93	-39%	-5.3%
Total	2,162	2,092	2,184	2,194	2,048	1,752	1,752	1,699	1,548.90	1,432.12	-34%	-4.5%
WPS												
Indiana	2,723	2,769	2,731	2,750	2,639	2,349	2,233	2,141	1,967.96	1,858.78	-32%	-4.2%
Iowa	2,536	2,521	2,475	2,488	2,289	2,134	2,085	1,959	1,818.39	1,737.15	-32%	-4.1%
Kansas	3,623	3,633	3,674	3,714	3,561	3,410	3,298	3,207	2,989.85	2,800.77	-23%	-2.8%
Michigan	2,211	2,355	2,233	2,325	2,062	1,664	1,649	1,608	1,454.57	1,294.62	-41%	-5.8%
Missouri	3,478	3,339	3,342	3,375	3,152	2,677	2,559	2,481	2,221.45	2,101.46	-40%	-5.4%
Nebraska	2,595	2,362	2,377	2,337	2,176	1,877	1,721	1,620	1,529.68	1,390.41	-46%	-6.7%
WPS total	2,758	2,773	2,724	2,768	2,563	2,224	2,147	2,074	1,893.88	1,759.44	-36%	-4.9%
Non-Noridian States	2,070	2,025	2,032	2,049	1,918	1,689	1,654	1,611	1,467.67	1,359.17	-34%	-4.6%
Noridian States	1,349	1,312	1,337	1,384	1,338	1,164	1,141	1,074	959.83	910.12	-33%	-4.3%
US Total	1,939	1,894	1,893	1,839	1,737	1,525	1,494	1,460	1,359	1,261	-34.90%	-4.70%

GM = geometric average change.

Appendix Table 5. *Utilizations of lumbar/sacral transforaminal epidural injections (CPT 64483 - rates per 100,000) in the FFS Medicare population from 2009 to 2018 based on Medicare carrier of 2016.*

State Name	R2009	R2010	R2011	R2012	R2013	R2014	R2015	R2016	R2017	R2018	Change	GM
Cahaba												
Alabama	1,290	1,207	1,394	1,510	1,355	1,575	1,604	1,664	1,335	1,338	4%	0.4%
Georgia	2,165	2,124	2,265	2,317	2,138	2,092	2,091	2,015	1,981	1,830	-16%	-1.9%
Tennessee	1,138	1,091	1,192	1,207	1,059	1,095	1,098	1,151	1,069	1,079	-5%	-0.6%
Total	1,581	1,529	1,671	1,730	1,568	1,622	1,632	1,637	1,514	1,457	-8%	-0.9%
CGS												
Kentucky	548	609	648	644	549	601	671	696	811	811	48%	4.5%
Ohio	1,330	1,278	1,278	1,222	1,127	1,188	1,143	1,286	1,206	1,123	-16%	-1.9%
Total	1,107	1,086	1,098	1,056	960	1,019	1,007	1,117	1,093	1,034	-7%	-0.8%
First Coast												
Florida	1,703	1,693	1,659	1,587	1,463	1,636	1,568	1,550	1,416	1,368	-20%	-2.4%
NGS												
Connecticut	1,008	993	1,135	1,097	1,064	1,169	1,060	1,034	991	884	-12%	-1.4%
Illinois	1,576	1,667	1,698	1,633	1,591	1,666	1,644	1,678	1,630	1,594	1%	0.1%
Maine	842	842	792	730	558	633	661	584	614	539	-36%	-4.8%
Massachusetts	997	1,078	1,137	1,202	1,176	1,192	1,167	1,127	1,094	1,076	8%	0.9%
Minnesota	1,019	1,019	994	904	809	770	745	723	657	641	-37%	-5.0%
New Hampshire	1,071	1,176	1,360	1,278	1,126	1,313	1,227	1,136	1,151	1,030	-4%	-0.4%
New York	994	1,014	993	990	997	1,064	1,064	1,021	973	937	-6%	-0.7%
Rhode Island	616	743	679	572	452	525	496	484	410	445	-28%	-3.6%
Vermont	1,128	1,037	947	839	810	779	708	651	638	635	-44%	-6.2%
Wisconsin	1,146	1,139	1,227	1,268	1,182	1,207	1,182	1,203	1,090	1,040	-9%	-1.1%
Total	1,124	1,161	1,184	1,164	1,123	1,176	1,153	1,135	1,084	1,044	-7%	-0.8%
Noridian												
Alaska	899	1,099	1,044	1,151	1,140	1,074	1,112	1,147	901	914	2%	0.2%
Arizona	1,594	1,800	1,988	2,109	2,099	2,340	2,337	2,409	2,308	2,360	48%	4.5%
California	1,143	1,241	1,259	1,216	1,188	1,208	1,181	1,135	1,068	1,044	-9%	-1.0%
Idaho	1,442	1,418	1,517	1,523	1,572	1,582	1,511	1,437	1,249	1,256	-13%	-1.5%
Montana	1,274	1,208	1,218	1,243	1,215	1,345	1,312	1,323	1,246	1,187	-7%	-0.8%
Nevada	1,514	1,551	1,621	1,626	1,472	1,517	1,588	1,539	1,368	1,335	-12%	-1.4%
North Dakota	830	677	568	522	477	579	487	590	550	563	-32%	-4.2%
Oregon	988	974	1,064	1,168	1,131	1,010	951	890	744	766	-22%	-2.8%
South Dakota	1,542	1,597	1,515	1,530	1,646	1,491	1,515	1,537	1,409	1,411	-8%	-1.0%
Utah	1,626	1,775	1,808	2,067	2,112	2,455	2,550	2,533	2,331	2,339	44%	4.1%
Washington	1,148	1,130	1,174	1,229	1,183	1,182	1,104	1,034	1,023	972	-15%	-1.8%
Wyoming	1,110	1,291	1,236	1,508	1,687	1,764	1,803	1,846	1,682	1,701	53%	4.9%
Total	1,222	1,301	1,346	1,362	1,339	1,383	1,359	1,326	1,243	1,231	1%	0.1%
Novitas												
Arkansas	885	890	836	770	703	936	916	993	1,022	1,018	15%	1.6%
Colorado	1,339	1,470	1,446	1,488	1,480	1,592	1,533	1,570	1,437	1,466	9%	1.0%
DC	10,651	12,360	13,414	13,864	16,676	17,871	18,641	15,888	15,322	14,715	38%	3.7%
Delaware	2,052	2,141	2,379	2,499	2,457	2,723	2,771	2,706	2,598	2,606	27%	2.7%
Louisiana	1,983	1,945	2,026	2,058	1,912	1,927	1,857	1,810	1,755	1,646	-17%	-2.1%
Maryland	1,477	1,602	1,730	1,574	1,661	1,774	1,860	1,849	1,670	1,632	11%	1.1%

Appendix Table 5 (con't). *Utilizations of lumbar/sacral transforaminal epidural injections (CPT 64483 - rates per 100,000) in the FFS Medicare population from 2009 to 2018 based on Medicare carrier of 2016.*

State Name	R2009	R2010	R2011	R2012	R2013	R2014	R2015	R2016	R2017	R2018	Change	GM
Mississippi	1,640	1,643	1,590	1,594	1,420	1,434	1,545	1,489	1,523	1,405	-14%	-1.7%
New Jersey	1,410	1,474	1,537	1,475	1,499	1,627	1,677	1,672	1,563	1,524	8%	0.9%
New Mexico	922	1,054	1,031	923	941	841	719	664	726	715	-22%	-2.8%
Oklahoma	1,604	1,697	1,736	1,740	1,901	2,321	2,368	2,107	2,100	1,938	21%	2.1%
Pennsylvania	902	1,003	1,052	1,063	1,108	1,196	1,150	1,135	1,052	1,036	15%	1.6%
Texas	2,121	2,169	2,169	2,046	1,867	1,924	1,869	1,834	1,690	1,541	-27%	-3.5%
Total	1,591	1,672	1,713	1,667	1,631	1,740	1,728	1,697	1,597	1,520	-4%	-0.5%
Palmetto GBA												
North Carolina	1,662	1,804	1,932	1,977	1,896	1,850	1,779	1,854	1,811	1,761	6%	0.6%
South Carolina	1,848	1,989	2,094	2,143	1,989	2,198	2,174	2,160	2,025	2,007	9%	0.9%
Virginia	1,346	1,394	1,412	1,494	1,466	1,642	1,675	1,744	1,670	1,671	24%	2.4%
West Virginia	669	688	734	809	841	841	671	592	598	489	-27%	-3.4%
Total	1,503	1,606	1,689	1,750	1,687	1,766	1,728	1,768	1,704	1,673	11%	1.2%
WPS												
Indiana	1,540	1,564	1,652	1,608	1,555	1,698	1,712	1,744	1,565	1,455	-6%	-0.6%
Iowa	622	602	658	655	638	613	644	669	654	621	0%	0.0%
Kansas	1,478	1,631	1,786	1,879	1,725	1,801	1,795	1,734	1,581	1,664	13%	1.3%
Michigan	1,380	1,846	1,584	1,489	1,447	1,565	1,423	1,368	1,238	1,128	-18%	-2.2%
Missouri	1,572	1,740	1,682	1,655	1,514	1,701	1,577	1,455	1,351	1,293	-18%	-2.2%
Nebraska	1,199	1,242	1,260	1,380	1,417	1,511	1,595	1,692	1,593	1,534	28%	2.8%
total	1,370	1,581	1,520	1,489	1,422	1,539	1,476	1,442	1,319	1,247	-9%	-1.0%
Non Noridian states	1,417	1,481	1,509	1,489	1,424	1,517	1,490	1,482	1,395	1,339	-6%	-0.6%
Noridian states	1,222	1,301	1,346	1,362	1,339	1,383	1,359	1,326	1,243	1,231	1%	0.1%
US Total	1,381	1,448	1,471	1,428	1,350	1,428	1,406	1,406	1,356	1,308	-5.3%	-0.6%

GM = geometric average change.

Appendix Table 6. *Utilizations of epidural injections (rates per 100,000) in the Medicare population from 2009 to 2018 (percentage of change in decreasing order).*

State	R2009	R2010	R2011	R2012	R2013	R2014	R2015	R2016	R2017	R2018	Change	GM
Utah	5,135	5,260	5,590	6,453	6,523	6,630	6,923	6,641	6,255	6,364	23.9%	2.4%
Delaware	5,033	5,398	5,735	5,828	5,660	5,902	6,346	6,367	5,920	6,088	21.0%	2.1%
DC	28,206	30,987	33,524	33,612	39,910	39,658	42,391	34,844	34,116	32,360	14.7%	1.5%
Alaska	2,837	2,978	3,087	3,371	3,614	3,472	3,656	3,323	3,050	3,210	13.1%	1.4%
Arizona	4,919	5,343	5,780	6,080	5,918	5,927	6,059	5,807	5,444	5,494	11.7%	1.2%
Arkansas	4,329	4,313	4,352	4,370	4,288	4,268	4,476	4,707	4,823	4,667	7.8%	0.8%
Wyoming	3,641	3,675	3,518	3,779	3,852	4,025	4,179	4,282	4,052	3,921	7.7%	0.8%
Massachusetts	3,344	3,501	3,767	3,965	4,027	3,921	3,959	3,838	3,678	3,568	6.7%	0.7%
Virginia	3,636	3,564	3,783	3,812	3,782	3,885	4,086	4,012	3,851	3,801	4.5%	0.5%
Oklahoma	5,243	5,342	5,608	5,576	5,787	6,119	6,410	5,727	5,742	5,396	2.9%	0.3%
Maryland	4,071	4,166	4,512	4,265	4,469	4,625	4,937	4,668	4,261	4,164	2.3%	0.3%
Pennsylvania	3,349	3,635	3,765	3,825	3,934	3,895	3,839	3,672	3,385	3,249	-3.0%	-0.3%
New York	2,930	2,979	2,952	2,982	3,081	3,117	3,186	3,063	2,882	2,763	-5.7%	-0.6%
New Jersey	4,036	4,133	4,224	4,045	4,121	4,201	4,404	4,268	3,912	3,742	-7.3%	-0.8%
Mississippi	5,751	5,941	5,887	5,732	5,404	5,491	5,942	5,835	5,698	5,307	-7.7%	-0.9%
Kansas	6,360	6,617	6,900	7,006	6,791	6,709	6,680	6,310	5,883	5,825	-8.4%	-1.0%
Kentucky	4,537	4,760	4,883	5,127	4,768	4,400	4,442	4,227	4,233	4,100	-9.6%	-1.1%
Illinois	4,610	4,946	4,969	4,927	4,868	4,647	4,582	4,488	4,372	4,094	-11.2%	-1.3%
South Carolina	6,863	7,125	7,334	7,401	7,019	6,789	6,979	6,663	6,154	5,921	-13.7%	-1.6%
South Dakota	4,801	4,644	4,671	4,717	4,764	4,348	4,617	4,343	4,287	4,096	-14.7%	-1.7%
Montana	4,029	3,816	4,054	3,962	4,001	4,017	4,011	3,831	3,517	3,405	-15.5%	-1.9%
Vermont	2,925	2,691	2,677	2,581	2,594	2,558	2,600	2,518	2,561	2,428	-17.0%	-2.0%
North Carolina	5,121	5,205	5,537	5,582	5,278	4,781	4,820	4,764	4,467	4,238	-17.2%	-2.1%
California	3,433	3,665	3,731	3,716	3,675	3,450	3,513	3,222	2,934	2,840	-17.3%	-2.1%
Colorado	4,180	4,354	4,406	4,389	4,304	4,168	4,109	3,935	3,531	3,421	-18.2%	-2.2%
Nebraska	4,542	4,385	4,348	4,426	4,357	4,173	4,207	4,131	3,895	3,716	-18.2%	-2.2%
Indiana	5,381	5,411	5,619	5,477	5,407	5,248	5,263	5,083	4,635	4,360	-19.0%	-2.3%
Iowa	3,538	3,517	3,551	3,499	3,316	3,132	3,187	3,084	2,944	2,837	-19.8%	-2.4%
Alabama	6,510	6,305	6,699	7,029	6,572	6,514	6,651	6,579	5,221	5,073	-22.1%	-2.7%
Idaho	4,217	4,000	4,208	4,291	4,299	4,130	4,254	3,884	3,369	3,260	-22.7%	-2.8%
Oregon	2,054	2,006	2,197	2,373	2,353	2,047	2,044	1,852	1,581	1,577	-23.2%	-2.9%
Connecticut	3,375	3,444	3,681	3,611	3,452	3,418	3,359	3,259	3,019	2,584	-23.4%	-2.9%
North Dakota	5,221	5,066	4,798	4,847	4,598	4,423	4,247	4,340	4,232	3,975	-23.9%	-3.0%
New Hampshire	4,603	5,000	5,210	4,864	4,573	4,248	4,290	3,854	3,624	3,436	-25.3%	-3.2%
Louisiana	6,233	6,108	6,335	6,432	6,037	5,759	5,758	5,385	4,990	4,530	-27.3%	-3.5%
Washington	3,058	3,122	3,084	3,024	2,993	2,787	2,617	2,406	2,296	2,191	-28.3%	-3.6%
Missouri	6,500	6,596	6,515	6,482	6,099	5,880	5,659	5,307	4,886	4,650	-28.5%	-3.7%
Nevada	5,265	5,446	5,638	5,612	5,314	4,748	5,097	4,585	3,877	3,747	-28.8%	-3.7%
Georgia	6,402	6,121	6,410	6,360	5,817	5,579	5,776	5,258	5,054	4,529	-29.3%	-3.8%
Florida	5,917	5,793	5,707	5,456	5,074	4,970	5,017	4,767	4,322	4,148	-29.9%	-3.9%
Rhode Island	2,626	3,157	2,988	2,689	2,323	2,388	2,460	2,255	1,999	1,816	-30.9%	-4.0%
Wisconsin	3,905	3,742	3,866	3,841	3,562	3,339	3,219	3,156	2,838	2,670	-31.6%	-4.1%
Tennessee	4,560	4,205	4,358	4,210	3,646	3,511	3,569	3,548	3,316	3,112	-31.8%	-4.2%
New Mexico	2,948	3,107	3,069	2,740	2,722	2,417	2,310	2,077	2,152	1,997	-32.2%	-4.2%

Appendix Table 6 (con't). *Utilizations of epidural injections (rates per 100,000) in the Medicare population from 2009 to 2018 (percentage of change in decreasing order).*

State	R2009	R2010	R2011	R2012	R2013	R2014	R2015	R2016	R2017	R2018	Change	GM
Ohio	4,484	4,262	4,227	4,050	3,826	3,600	3,416	3,563	3,280	3,018	-32.7%	-4.3%
West Virginia	2,225	2,262	2,429	2,453	2,477	2,286	1,831	1,740	1,713	1,469	-34.0%	-4.5%
Michigan	5,230	6,266	5,572	5,370	5,116	4,858	4,672	4,286	3,743	3,370	-35.6%	-4.8%
Minnesota	2,612	2,526	2,500	2,403	2,139	1,971	1,958	1,816	1,604	1,502	-42.5%	-6.0%
Texas	7,041	6,938	6,712	6,124	5,565	5,416	5,479	5,201	4,533	4,051	-42.5%	-6.0%
Maine	3,344	3,271	3,232	3,269	3,147	3,192	3,041	2,662	2,346	1,816	-45.7%	-6.6%
US Total	4,612	4,701	4,740	4,582	4,354	4,216	4,146	4,100	4,013	3,669	-20.4%	-2.5%

GM = geometric average change.

Appendix Table 7. *Utilizations of epidural injections services in the Medicare population from 2009 to 2018.*

State	S2009	S2010	S2011	S2012	S2013	S2014	S2015	S2016	S2017	S2018	Change	Rate
Alabama	53,873	53,297	57,894	61,970	59,582	60,590	61,867	63,684	52,602	52,135	-3.2%	-0.4%
Alaska	1,779	1,956	2,126	2,336	2,561	2,561	2,697	2,787	2,802	3,089	73.6%	6.3%
Arizona	44,249	49,704	55,621	59,431	59,632	62,226	63,606	65,899	66,785	69,854	57.9%	5.2%
Arkansas	22,526	22,922	23,583	24,137	24,194	24,584	25,785	27,990	29,720	29,294	30.0%	3.0%
California	158,595	174,349	182,832	185,828	181,501	176,353	179,553	181,881	175,054	173,966	9.7%	1.0%
Colorado	25,162	27,204	28,625	29,284	29,497	29,891	29,465	30,907	29,931	30,142	19.8%	2.0%
Connecticut	18,836	19,544	21,234	21,182	19,731	19,921	19,574	20,540	19,767	17,254	-8.4%	-1.0%
DC	21,632	24,211	26,744	27,313	28,431	28,840	30,827	30,809	31,063	29,949	38.4%	3.7%
Delaware	7,301	8,058	8,815	9,167	9,209	9,986	10,738	11,495	11,460	12,244	67.7%	5.9%
Florida	194,604	195,475	198,142	192,471	187,043	190,045	191,855	191,847	185,634	183,040	-5.9%	-0.7%
Georgia	76,431	75,633	82,079	83,869	79,631	79,498	82,301	79,895	82,078	75,913	-0.7%	-0.1%
Idaho	9,361	9,192	9,998	10,422	10,981	10,994	11,325	10,955	10,321	10,440	11.5%	1.2%
Illinois	83,272	90,979	93,025	93,995	91,750	89,535	88,270	92,745	93,971	89,803	7.8%	0.8%
Indiana	53,012	54,422	57,701	57,425	58,325	58,077	58,237	58,477	55,843	53,790	1.5%	0.2%
Iowa	18,103	18,198	18,570	18,586	17,958	17,312	17,619	17,637	17,613	17,375	-4.0%	-0.5%
Kansas	27,058	28,637	30,311	31,404	30,786	31,145	31,014	30,735	29,998	30,476	12.6%	1.3%
Kentucky	33,726	36,171	37,932	40,670	38,610	36,424	36,770	36,473	37,928	37,415	10.9%	1.2%
Louisiana	41,842	41,947	44,525	46,184	44,258	43,354	43,348	42,715	41,349	38,460	-8.1%	-0.9%
Maine	8,665	8,664	8,749	9,038	8,897	9,284	8,845	8,157	7,559	6,017	-30.6%	-4.0%
Maryland	31,110	32,696	36,420	35,288	36,123	38,503	41,103	43,421	41,928	42,124	35.4%	3.4%
Massachusetts	34,758	37,148	40,855	43,788	43,866	43,835	44,264	46,749	46,912	46,561	34.0%	3.3%
Michigan	84,431	103,458	94,129	92,814	91,990	89,458	86,042	81,236	74,174	68,224	-19.2%	-2.3%
Minnesota	20,031	19,851	20,089	19,698	17,965	17,043	16,937	16,571	15,519	14,964	-25.3%	-3.2%
Mississippi	28,065	29,538	29,826	29,621	28,770	29,896	32,348	32,695	33,051	31,366	11.8%	1.2%
Missouri	64,045	66,245	66,596	67,444	64,776	63,956	61,551	60,306	57,795	56,032	-12.5%	-1.5%
Montana	6,633	6,469	7,040	7,046	7,382	7,649	7,638	7,715	7,579	7,596	14.5%	1.5%
Nebraska	12,518	12,236	12,289	12,729	12,608	12,345	12,447	12,959	12,832	12,561	0.3%	0.0%
Nevada	18,059	19,423	20,961	21,317	20,777	19,455	20,884	20,770	19,088	19,177	6.2%	0.7%
New Hampshire	10,005	11,162	11,931	11,258	10,694	10,311	10,414	10,260	10,183	9,971	-0.3%	0.0%
New Jersey	52,646	54,839	57,098	55,748	55,370	57,598	60,383	63,674	60,762	59,318	12.7%	1.3%
New Mexico	8,956	9,738	9,898	9,042	9,026	8,294	7,926	7,742	8,543	8,186	-8.6%	-1.0%
New York	86,042	89,030	89,783	92,237	93,333	96,513	98,643	102,405	100,351	98,355	14.3%	1.5%
North Carolina	74,156	77,550	84,893	87,542	87,088	81,495	82,147	84,274	83,862	81,890	10.4%	1.1%
North Dakota	5,639	5,537	5,281	5,372	5,117	5,003	4,804	5,160	5,251	5,075	-10.0%	-1.2%
Ohio	83,862	81,001	81,732	79,835	76,492	73,700	69,920	76,758	73,758	69,282	-17.4%	-2.1%
Oklahoma	31,026	32,236	34,472	34,900	36,746	39,631	41,515	43,207	40,559	38,991	25.7%	2.6%
Oregon	12,370	12,459	14,071	15,515	15,969	14,463	14,444	13,975	12,771	13,202	6.7%	0.7%
Pennsylvania	75,415	82,985	87,045	89,918	92,753	93,659	92,319	93,035	89,005	87,190	15.6%	1.6%
Rhode Island	4,733	5,777	5,547	5,069	4,224	4,439	4,574	4,585	4,232	3,928	-17.0%	-2.0%
South Carolina	51,377	55,129	58,629	60,759	60,628	60,844	62,551	62,714	61,939	61,607	19.9%	2.0%
South Dakota	6,456	6,342	6,473	6,654	6,843	6,429	6,827	6,780	7,091	7,002	8.5%	0.9%
Tennessee	47,027	44,480	47,350	46,720	42,055	41,709	42,400	43,823	42,938	41,235	-12.3%	-1.4%
Texas	204,170	208,216	208,361	195,204	182,113	183,562	185,719	188,985	176,059	162,809	-20.3%	-2.5%

Appendix Table 7 (con't). *Utilizations of epidural injections services in the Medicare population from 2009 to 2018.*

State	S2009	S2010	S2011	S2012	S2013	S2014	S2015	S2016	S2017	S2018	Change	Rate
Utah	14,062	14,888	16,348	19,322	19,752	20,868	21,789	22,933	23,265	24,589	74.9%	6.4%
Vermont	3,157	3,001	3,068	3,030	3,111	3,164	3,216	3,308	3,566	3,485	10.4%	1.1%
Virginia	40,357	40,648	44,385	45,875	45,673	48,389	50,886	54,133	54,983	55,872	38.4%	3.7%
Washington	28,688	30,354	30,995	31,135	31,626	30,622	28,753	28,632	29,325	28,936	0.9%	0.1%
West Virginia	8,392	8,635	9,378	9,615	9,907	9,290	7,441	7,254	7,329	6,376	-24.0%	-3.0%
Wisconsin	34,826	34,089	35,982	36,434	35,004	33,761	32,539	33,140	31,509	30,507	-12.4%	-1.5%
Wyoming	2,848	2,943	2,882	3,177	3,345	3,611	3,749	4,070	4,130	4,162	46.1%	4.3%

Change = change from 2008 to 2018; GM = geometric average change.