Health Services Research

Declining Utilization and Inflation-Adjusted Expenditures for Epidural Procedures in Chronic Spinal Pain in the Medicare Population

Laxmaiah Manchikanti, MD[1], Vidyasagar Pampati, MSc[1], Amol Soin, MD[2], Mahendra R. Sanapati, MD[1], Alan D. Kaye, MD, PhD[3], and Joshua A. Hirsch, MD[4]

From: [1]Pain Management Centers of America, Paducah, KY and Evansville, IN; [2]Ohio Pain Clinic, Centerville, OH, Wright State University, Dayton, OH; [3]LSU School of Medicine, Shreveport, LA and New Orleans, LA; [4]Massachusetts General Hospital and Harvard Medical School, Boston, MA

Address Correspondence:
Laxmaiah Manchikanti, MD
Pain Management Centers of America
67 Lakeview Drive
Paducah, KY 42001
E-mail: drlm@thepainmd.com

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Background: Despite epidurals being one of the most common interventional pain procedures for managing chronic spinal pain in the United States, expenditure analysis lacks assessment in correlation with utilization patterns.

Objectives: This investigation was undertaken to assess expenditures for epidural procedures in the fee-for-service (FFS) Medicare population from 2009 to 2018.

Study Design: The present study was designed to assess expenditures in all settings, for all providers in the FFS Medicare population from 2009 to 2018 in the United States. In this manuscript:
- A patient was described as receiving epidural procedures throughout the year.
- A visit was considered to include all regions treated during the visit.
- An episode was considered as one treatment per region utilizing primary codes only.
- Services or procedures were considered as all procedures including bilateral and multiple levels.

A standard 5% national sample of the Centers for Medicare and Medicaid Services (CMS) physician outpatient billing claims data for those enrolled in the FFS Medicare program from 2009 to 2018 was utilized. All the expenditures were presented with allowed costs and adjusted to inflation to 2018 US dollars.

Results: Total expenditures were $723,981,594 in 2009, whereas expenditures of 2018 were $829,987,636, with an overall 14.6% increase, or an annual increase of 1.5%. However, the inflation-adjusted rate was $847,058,465 in 2009, compared to $829,987,636 in 2018, a reduction overall of 2% and an annual reduction of 0.2%. Inflation-adjusted per patient annual costs decreased from $988.93 in 2009 to $819.27 in 2018 with a decrease of 17.2% or an annual decline of 2.1%. In addition, inflation-adjusted costs per procedure decreased from $399.77 to $377.94, or 5.5% overall and 0.6% annually.

Per procedure, episode, visit, and patient expenses were higher for transforaminal epidural procedures than lumbar interlaminar/caudal epidural procedures. Overall, costs of transforaminal epidurals increased 27.6% or 2.7% annually, whereas lumbar interlaminar and caudal epidural injections cost were reduced 2.7%, or 0.3% annually. Inflation-adjusted costs for transforaminal epidurals increased 9.1% or 1.0% annually and declined 16.9 or 2.0% annually for lumbar interlaminar and caudal epidural injections.

Limitations: Expenditures for epidural procedures in chronic spinal pain were assessed only in the FFS Medicare population. This excluded over 30% of the Medicare population, which is enrolled in Medicare Advantage plans.

Conclusions: After adjusting for inflation, there was a decrease of expenditures for epidural procedures of 2%, or 0.2% annually, from 2009 to 2018. However, prior to inflation, the increases were noted at 14.6% and 1.5%. Inflation-adjusted costs per patient, per visit, and per procedure also declined. The proportion of Medicare patients per 100,000 receiving epidural procedures decreased 9.1%, or 1.1% annually. However, assessment of individual procedures showed higher costs for transforaminal epidural procedures compared to lumbar interlaminar and caudal epidural procedures.

Key words: Chronic spinal pain, epidural procedures, caudal epidural, lumbar interlaminar epidural, cervical interlaminar epidural, thoracic interlaminar epidural, lumbar transforaminal epidural procedures, Medicare expenditures

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Interventional techniques have been a focus of utilization trends and subsequent increases in costs in recent years, accompanied by the application of multiple regulations and measures to reduce utilization and expenditures (1-8). One of the measures utilized for these purposes has been the enactment of the Affordable Care Act (ACA) to improve access, quality of care, and to reduce health care costs in the United States (9-11). However, the real effectiveness of these measures to control costs and the overall effectiveness of the ACA, which was signed into law in March of 2010, has been questioned in its ability to fulfill these objectives (10).

In fact, Peterson (12), in a manuscript of "The ACA a Decade in: Resilience, Impact, and Vulnerabilities," described that possession of an insurance card does not mean that one is well insured and without barriers to needed health care services. Further, he also concluded that the ACA had done nothing to reduce the aggregate percentage of what the Commonwealth Fund identifies as the "underinsured" – those facing out of pocket costs so significant that they lead to foregoing primary or specialist medical care, missing treatments, or not filling prescriptions. With extensive financial vulnerabilities, as many as 30% of the elderly forego care due to the expenses. In fact, US health care spending continues to increase and reached $3.8146 trillion in 2019 (13). In addition, the national health expenditure survey estimated an average annual growth rate of 5.4% from 2019 to 2028.

Manchikanti et al (14) published an analysis of utilization trends and Medicare expenditures of spinal interventional techniques from 2000 to 2008. The data showed that Medicare recipients receiving spinal interventional techniques increased 186.8%, at an annual rate increase of 14.1% per 100,000 fee-for-service (FFS) Medicare beneficiaries. Overall, approved amounts throughout the FFS population in the US were $362,347,025 in 2000 compared to $1,231,180,420 in 2008, a 240% increase for all spinal interventional techniques.

In addition to these data, estimates continue to be onerous (15,16). A recent follow up study on US spending on personal health and public health care from 1996 to 2016, showed an estimated spending of $129.8 billion on other musculoskeletal disorders with $134.5 billion spent on back and neck pain in 2016 (15,16). Additionally, spending on back and neck pain, and musculoskeletal disorders moved to the number 1 and 2 categories. Despite these extensive expenditures, spinal pain disability continues as the number one cause of disability, whereas neck pain ranks as number 3 (17-21).

Recently developed guidance from the Department of Health and Human Services (HHS) on Best Practices in Pain Management prominently focuses on interventional techniques (20). The opioid epidemic, which was under control until 2018, has started increasing since 2019, with exploding patterns in 2020 due to COVID-19 (22-32). In fact, reduced access to interventional techniques has been considered as one of the reasons for increasing abuse patterns, as patients are sent to the street because of their inability to undergo interventional techniques and at the same time, an inability to receive appropriate opioid prescriptions (22-25). This has led to significant stress among physicians in 2020 (28). In addition, COVID-19 has also affected education and training (30,31). More recently, many practices are being sold to the hospitals or other organizations causing the extinction of independent practices (33). COVID-19's storm and reduced access may cause further declines in utilization patterns as well as costs (22-32).

The utilization patterns of interventional techniques overall from 2000 to 2018 showed a decline of all interventional techniques at an annual rate of 0.8% with an overall decline of 6.7% (1). Specifically, epidural procedure utilization has declined at a rate of 20.7% per 100,000 Medicare enrollees from 2009 to 2018, with an annual decline of 2.5%. There were escalating increases in earlier years of 89.2%, with an annual increase of 7.3% from 2000 to 2009 (2). This analysis specifically showed a decline in all categories, with an annual decrease of 4.7% for lumbar interlaminar and caudal epidural procedures, 4.7% decline for cervical and thoracic transforaminal epidural procedures, 1.1% decline for lumbosacral transforaminal epidural procedures, and finally, 0.4% decline for cervical and thoracic interlaminar epidural procedures. Thus, this analysis showed that from 2009 to 2018, the highest declines were noted for cervical and thoracic transforaminal epidural procedures with 35.1%, closely followed by lumbar interlaminar and caudal epidural procedures of 34.9%, and with a distant follow-up of 9.4% for lumbosacral transforaminal epidurals, and the least decline of 3.5% for cervical and thoracic interlaminar epidurals. This manuscript revealed interesting trends with 3 to 4 times higher increases of lumbar interlaminar and caudal epidural procedures compared to lumbosacral

transforaminal epidurals, showing a reversal of the previous trend (2).

Despite the continued criticism along with declining utilization, cost utility analysis in favor of epidural procedures compared to multiple other modalities of treatments, has been published in numerous performed studies (34-43).

To date, there has not been a systematic assessment of the cost of epidural procedures since 2008 (14). In this manuscript, Manchikanti et al (14) assessed the growth of spinal interventional pain management techniques, along with Medicare expenditures from 2000 to 2008. However, in that analysis, the authors did not look at facet joint interventions or epidural procedures, and their costs separately. Recently, Manchikanti et al (44) assessed trends of expenditures and utilization patterns for facet joint interventions in the FFS Medicare population. This analysis showed that even after adjusting for inflation, there was a significant increase in the expenditures for facet joint interventions with an overall 53% increase. Inflation-adjusted cost per year declined 7% overall and 0.8% annually from $1,925 to $1,785, and inflation-adjusted cost per visit also declined 11% overall and 1.3% annually from $952 in 2009 to $850 in 2018.

This manuscript, therefore, was undertaken to assess expenditures and utilization patterns of epidural procedures from 2009 to 2018.

Methods

This analysis of expenditures and utilization patterns in the FFS Medicare population was performed utilizing a retrospective cohort analysis with methodology as described by the Strengthening and Reporting of Observational Studies in Epidemiology (STROBE) (45). The data was obtained from the Centers for Medicare and Medicaid Services' (CMS) physician outpatient billing claims for those enrolled in the FFS Medicare program for 2009 through 2018, consisting of the standard 5% national sample (46). The sample data consisting of 5% from CMS, has been reported to be unbiased and unpredictable to avoid divulging of any patient characteristics. However, the data does allow appropriate tracking of patients over time and across databases. Consequently, the Institutional Review Board (IRB) approval was not required.

Study Design

The estimation of expenditures for epidural procedures in FFS Medicare recipients was designed as a retrospective cohort study calculating the trends of costs and utilization patterns from 2009 to 2018 in the United States (46). In this analysis:

- A patient was considered as undergoing epidural procedures throughout the year, irrespective of number of visits, episodes, or services.
- A visit included all regions treated during the visit.
- An episode was considered as one per region utilizing primary codes only.
- Services or procedures were considered as all procedures, multiple levels including add-on codes and bilaterals.

Setting

The standard 5% national sample data was obtained from the CMS services physician outpatient billing claims for those enrolled in the FFS Medicare program from 2009 to 2018. Participants included all Medicare FFS recipients receiving epidural procedures. The current procedural terminology (CPT) codes included in this analysis are listed in Table 1.

Data Sources

CMS physician outpatient billing claims for those enrolled in the FFS Medicare program from 2009 to 2018 provided the appropriate data, facilitating the analysis.

Table 1. *CPT codes utilized for epidural procedures from 2009 to 2018.*

CPT Code	Description
64479	Cervical/Thoracic Transforaminal Epidurals
64480	Cervical/Thoracic Transforaminal Epidurals add-on
64483	Lumbar/Sacral Transforaminal Epidurals
64484	Lumbar/Sacral Transforaminal Epidurals add-on
Codes Until 2016	
62310	Cervical/Thoracic Interlaminar Epidurals
62311	Lumbar Interlaminar and Caudal Epidurals
Codes from 2017 to 2018	
62320 (62310)	Cervical/Thoracic Interlaminar Epidurals without fluoroscopy
62321(62310)	Cervical/Thoracic Interlaminar Epidurals with fluoroscopy
62322 (62311)	Lumbar Interlaminar and Caudal Epidurals without fluoroscopy
62323 (62311)	Lumbar Interlaminar and Caudal Epidurals with fluoroscopy

Data Compilation

Data was compiled utilizing Microsoft 365 Access and Microsoft 365 Excel (Microsoft, Redmond, WA). We removed all epidural procedure services with zero allowed payments. One hundred percent data was obtained by multiplication with 20 to scale up from our 5% sample to the full M-FFS population. The data were calculated for overall services for each procedure, and the rate of services, based on utilization per 100,000 FFS Medicare beneficiaries. Expenditures were also calculated for physician and facility, which included allowable charges for physician and facility (ambulatory surgery center [ASC], hospital outpatient department [HOPD], office setting). All the expenditures were presented with allowed costs and were adjusted for inflation to 2018 US dollars. HOPD facility allowed charges were estimated based on National Average rates.

Variables

The analysis of trends of utilization and costs patterns of epidural procedures incorporated multiple variables with analysis and costs for all procedures, utilization based on statewide and Medicare Administrative Contractors (MACs) and location of the service provided, either office-, ASC-, or HOPD-based.

Measures

Allowed services were assessed for each procedure. Rates were calculated based on Medicare beneficiaries for the corresponding year and are reported as procedures per 100,000 Medicare beneficiaries. Data was assessed for the total number of procedures performed, as well as the number of visits or sessions for epidural procedures. An episode is considered as one per region, irrespective of number of procedures performed.

Bias

Data was purchased from the CMS by the American Society of Interventional Pain Physicians (ASIPP). The study was conducted with the internal resources of the primary author's practice without external funding. The costs were determined without eliciting any bias. Thus, based on the large size of the dataset derived from a government source, there was no information related to patients' individual identification.

Sample Size

The size of this retrospective cohort study is robust, providing real-world claims data on Medicare patients with inclusion of all Medicare FFS patients undergoing epidural procedures for spinal pain from 2009 to 2018.

Results

Participants and Characteristics

In this analysis, the participants were from the Medicare database undergoing epidural procedures from 2009 to 2018.

Utilization Characteristics

Table 2 shows descriptive data of epidural procedures and population characteristics. Medicare beneficiaries grew at an annual rate of 3%, whereas the US population grew at 0.7%. Allowed epidural services were 2,118,840 in 2009, increasing to 2,196,100, an increase of 3.6%, at a rate of 0.4%, which is much lower than the growth rate of Medicare beneficiaries. Consequently, the rate of these procedures per 100,000 population decreased 20.4%, with an annual decrease of 2.5% from 4,626 in 2009 to 3,685 in 2018. The number of patients receiving epidural procedures increased in terms of absolute number from 856,540 in 2009 to 1,013,080 in 2018, with an overall increase of 18.3%, and an annual increase of 1.9%. However, the overall rate of procedures performed decreased by 9.1% and 1.1% annually with 1,870 per 100,000 Medicare population in 2009 to 1,700 in 2018. Figure 1 shows a graphic display of the rate of epidural procedures by services, episodes, and patients from 2009 to 2018 without increasing any of the aspects, except for decreases in services and rates.

Table 3 shows services and frequency of rates of epidural procedures. Interlaminar/caudal versus transforaminal showing significant differences, as shown in a previous manuscript (2), with an overall decrease of 33.3% and an annual decrease of 4.4% per 100,000 Medicare population. However, with a decrease in services of 6.5% and an annual decrease of 0.7% for transforaminal per 100,000 Medicare population. Figure 2 shows the results in a graphic format.

Appendix Table 1 shows the utilization patterns of epidural procedures by various specialty groups from 2009 to 2018 with overall interventional pain management groups, including interventional pain management, anesthesiology, physical medicine and rehabilitation (PMR), neurology, and pain management. Interventional pain management specialties including PMR, neurology, and psychiatry performed 90.4% of the total patient care with an increased rate of utili-

Table 2. *Characteristics of Medicare beneficiaries and the utilization pattern of epidural interventions from 2009 to 2018.*

	F2009	F2010	F2011	F2012	F2013	F2014	F2015	F2016	F2017	F2018	Change	Rate
US Population	307,006	308,746	311,583	313,874	316,129	318,892	320,897	323,127	326,625	327,167	6.6%	0.7%
≥ 65 years	39,570	40,268	41,370	43,144	44,704	46,179	47,734	49,244	51,055	52,347	32.3%	3.2%
Medicare beneficiaries'	45,801	46,914	48,300	50,300	51,900	53,500	54,900	56,500	58,000	59,600	30.1%	3.0%
≥ 65 years	38,177	38,991	40,000	41,900	43,100	44,600	46,000	47,500	49,200	50,800	33.1%	3.2%
% ≥ 65 years	83.4%	83.1%	82.8%	83.1%	83.0%	83.4%	83.6%	84.1%	84.7%	85.2%	2.3%	0.2%
< 65 years	7,624	7,923	8,300	8,500	8,800	8,900	9,000	9,000	8,900	8,800	15.4%	1.6%
Epidural Services	F2009	F2010	F2011	F2012	F2013	F2014	F2015	F2016	F2017	F2018	Change	Rate
Services (Allowed)	2,118,840	2,205,160	2,290,740	2,311,880	2,251,720	2,268,300	2,288,520	2,335,000	2,197,300	2,196,100	3.6%	0.4%
Rate	4,626	4,700	4,743	4,596	4,339	4,240	4,169	4,133	3,788	3,685	-20.4%	-2.5%
Episodes	1,727,640	1,793,240	1,866,800	1,894,380	1,849,100	1,836,400	1,851,940	1,895,620	1,785,900	1,798,100	4.1%	0.4%
Rate	3,772	3,822	3,865	3,766	3,563	3,433	3,373	3,355	3,079	3,017	-20.0%	-2.5%
Visits	1,681,200	1,748,660	1,823,380	1,853,120	1,831,420	1,822,260	1,842,720	1,887,260	1,778,580	1,791,200	6.5%	0.7%
Rate	3,671	3,727	3,775	3,684	3,529	3,406	3,357	3,340	3,067	3,005	-18.1%	-2.2%
Patients	856,540	891,640	936,500	967,080	959,520	971,280	993,960	1,027,120	1,001,700	1,013,080	18.3%	1.9%
Rate	1,870	1,901	1,939	1,923	1,849	1,815	1,810	1,818	1,727	1,700	-9.1%	-1.1%
Age groups (Patients)												
≥ 65 Years	686,060	711,020	737,080	756,680	747,640	760,140	783,140	820,060	809,940	832,000	21.3%	2.2%
%	80.1%	79.7%	78.7%	78.2%	77.9%	78.3%	78.8%	79.8%	80.9%	82.1%	2.5%	0.3%
Rate	1,498	1,516	1,526	1,504	1,441	1,421	1,426	1,451	1,396	1,396	-6.8%	-0.8%
< 65 Years	170,480	180,620	199,420	210,400	211,880	211,140	210,820	207,060	191,760	181,080	6.2%	0.7%
Rate	372	385	413	418	408	395	384	366	331	304	-18.4%	-2.2%
Episodes by age												
≥ 65	1,365,840	1,413,080	1,452,280	1,466,500	1,421,500	1,421,960	1,446,800	1,501,960	1,433,840	1,466,960	7.4%	0.8%
Rate	2,982	3,012	3,007	2,916	2,739	2,658	2,635	2,658	2,472	2,461	-17.5%	-2.1%
< 65	361,800	380,160	414,520	427,880	427,600	414,440	405,140	393,660	352,060	331,140	-8.5%	-1.0%
Rate	790	810	858	851	824	775	738	697	607	556	-29.7%	-3.8%
Episodes by PLCR												
HOPD	577,100	591,640	618,400	611,780	586,380	584,120	581,020	587,380	538,880	538,200	-6.7%	-0.8%
Rate	1,260	1,261	1,280	1,216	1,130	1,092	1,058	1,040	929	903	-28.3%	-3.6%
ASC	460,740	469,840	501,920	522,560	498,040	502,180	511,920	542,800	508,100	510,360	10.8%	1.1%
Rate	1,006	1,001	1,039	1,039	960	939	932	961	876	856	-14.9%	-1.8%
Office	689,800	731,760	746,480	760,040	764,680	750,100	759,000	765,440	738,920	749,540	8.7%	0.9%
Rate	1,506	1,560	1,546	1,511	1,473	1,402	1,383	1,355	1,274	1,258	-16.5%	-2.0%

Rate: per 100,000 Medicare beneficiaries; Change: of change from 2009 to 2018, GM – geometric average. PCPY – percentage of change from previous year

zation among these groups. In contrast, surgical groups, radiology groups, and other providers showed a decline of utilization patterns.

Appendix Table 2 shows the utilization of epidural procedures per 100,000 Medicare population, with declines observed in almost all jurisdictions, with an average decline across the United States of 20%, and an annual decline of 2.5%.

For comparative purposes, Appendix Table 3 shows the utilization of lumbar interlaminar and caudal epidural procedure rates in the Medicare population, with declines in all jurisdictions.

Similarly, Appendix Table 4 shows the utilization patterns of lumbar transforaminal epidural procedures, which decreased at a lesser rate than interlaminar epidural procedures, 33.3% versus 6.5%, and 4.4% annual compared to 0.7% annual.

Expenditure Characteristics

Table 4 shows the average allowed charges per service or procedure, which showed, with inflation-adjusted, a decline of 5.5% or 0.6% annually. However, prior to inflation-adjustment, the average allowed charges increased 10.6% and 1.1% from $341.69 in 2009 to $377.94 in 2018. With inflation-adjustment, they were $399.77 to $377.94.

Table 5 shows the average allowed charges per visit, which includes multiple regions only, but not other interventions, which declined after inflation-adjustment by 8% and 0.9% from $503.84 in 2009 to $463.37 in 2018; however, prior to inflation-adjustment, they increased by 7.6% and an annual increase of 0.8% from $430.63 to $463.37.

Table 6 shows the average allowed charges per patient, with an average of $845.24 to $819.27 in 2018, with a decline of 3.1% and 0.3% per year prior to inflation-adjustment. However, the inflation-adjusted rate showed even steeper declines from $988.93 to $819.27, a 17.2% decrease with 0.21% decrease annually.

Table 7 shows the total allowed charges by place of service and type of procedure, which included all services

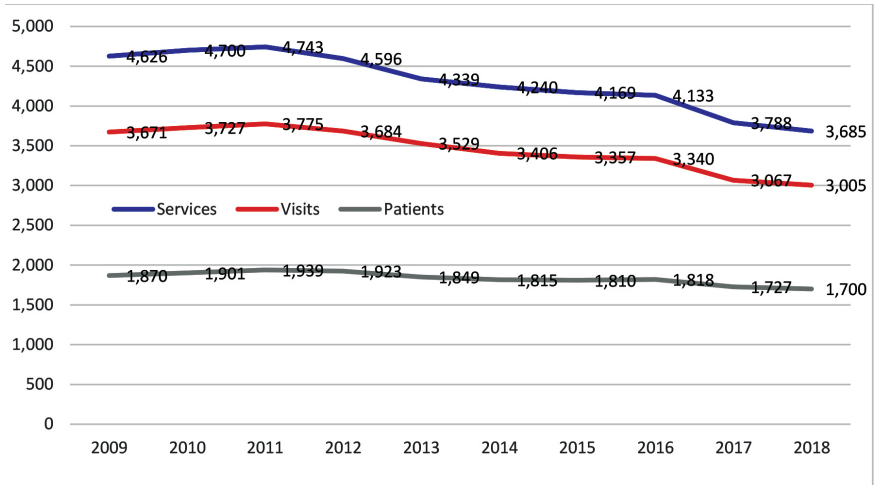


Fig. 1. *Epidural procedures rate per 100,000 FFS Medicare population by services, episodes, and patients from 2009-2018.*

Table 3. *Services and frequency of rates for epidural procedures (interlaminar/caudal vs. transforaminal) in the Medicare population from 2009 to 2018.*

	C/T Interlaminar Epidurals (CPT 62310/62321)		C/T Transforaminal Epidurals (CPT 94479)			C/T Transforaminal Epidurals (64479-64480)		Lumbar Interlaminar and Caudal Epidurals (CPT 62311)		Lumbar Transforaminal Epidurals (64483)			Lumbar Transforaminal Epidurals (64483-64484)	
	Services	Rate	64479	Rate	Ratio	Services	Rate	62311	Rate	64483	Rate	Ratio	Services	Rate
F2009	174,240	380	38,120	83	4.6	68,120	149	876,580	1,914	638,700	1,395	1.4	999,900	2,183
F2010	182,240	388	41,960	89	4.3	74,340	158	885,520	1,888	683,520	1,457	1.3	1,063,060	2,266
F2011	199,700	413	38,780	80	5.1	65,580	136	912,520	1,889	715,800	1,482	1.3	1,112,940	2,304
F2012	209,940	417	35,780	71	5.9	56,840	113	921,120	1,831	727,540	1,446	1.3	1,123,980	2,235
F2013	215,500	415	34,360	66	6.3	54,240	105	896,880	1,728	702,360	1,353	1.3	1,085,100	2,091
F2014	208,140	389	38,900	73	5.4	60,320	113	819,300	1,531	770,060	1,439	1.1	1,180,540	2,207
F2015	218,560	398	39,120	71	5.6	60,560	110	817,300	1,489	776,960	1,415	1.1	1,192,100	2,171
F2016	224,480	397	39,940	71	5.6	60,760	108	829,640	1,468	801,560	1,419	1.0	1,220,120	2,160
F2017	211,520	365	38,720	67	5.5	57,180	99	754,040	1,300	781,620	1,348	1.0	1,174,560	2,025
F2018	221,560	372	38,260	64	5.8	55,580	93	760,920	1,277	777,360	1,304	1.0	1,158,040	1,943
Change	27.2%	-2.3%	0.4%	-22.9%		-18.4%	-37.3%	-13.2%	-33.3%	21.7%	-6.5%		15.8%	-11.0%
GM	2.7%	-0.3%	0.0%	-2.8%		-2.2%	-5.1%	-1.6%	-4.4%	2.2%	-0.7%		1.6%	-1.3%

Rate: per 100,000 Medicare beneficiaries; Change: of change from 2009 to 2018; GM – geometric average.

and locations. Overall, the costs increased 4.6% and 1.5% from $723,981,554 to $829,987,636. After inflation-adjustment, they declined 2% or 0.2% annually from $847,058,465 to $829,987,636. Overall, costs per procedure in 2018 were $618.79 in HOPD settings, which essentially recorded an increase of 21.3% and 2.2%, compared to $381.59 in an ASC setting, with an increase of 1% and 0.1%, compared to $218.23 with an increase of 13.5% and 1.4% annually. Similarly, allowed charges per patient were also higher in HOPD, followed by ASC, then followed by office. Further, the average allowed charges per

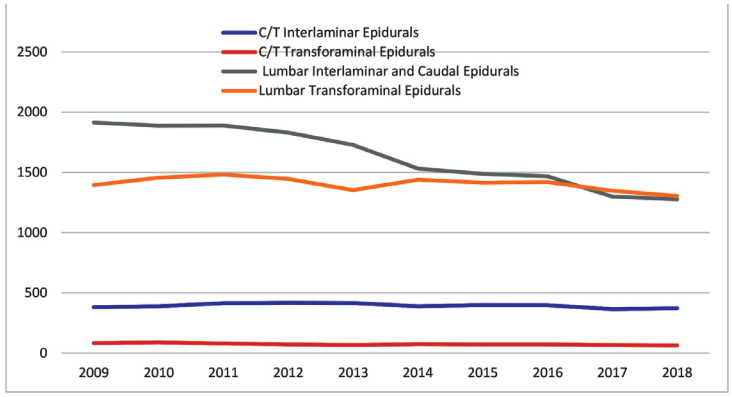


Fig. 2. *Frequency of utilizations of epidural injections in the FFS Medicare population per 100,000 participants from 2009-2018.*

Table 4. *Average allowed charges per service or procedure.*

PLCR	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Change	GM
HOPD	661,140	673,200	708,800	698,260	669,380	670,060	667,320	677,420	618,560	616,560	-6.7%	-0.8%
ASC	572,900	585,860	628,860	660,200	623,960	627,160	642,240	675,660	638,380	635,180	10.9%	1.2%
Office	884,800	946,100	953,080	953,420	958,380	971,080	978,960	981,920	940,360	944,360	6.7%	0.7%
Total	2,118,840	2,205,160	2,290,740	2,311,880	2,251,720	2,268,300	2,288,520	2,335,000	2,197,300	2,196,100	3.6%	0.4%
Average												
Professional												
HOPD	$84.45	$89.62	$88.89	$92.93	$96.30	$85.79	$98.91	$98.89	$104.09	$103.85	23.0%	2.3%
ASC	$86.72	$92.85	$90.82	$95.08	$98.96	$91.87	$102.17	$102.85	$106.05	$106.49	22.8%	2.3%
Office	$85.59	$92.73	$90.60	$95.07	$97.76	$92.94	$100.77	$101.39	$103.68	$104.81	22.5%	2.3%
Total	$85.54	$91.81	$90.13	$94.43	$97.66	$90.53	$100.62	$101.09	$104.48	$105.02	22.8%	2.3%
Facility												
HOPD	$425.85	$430.99	$473.06	$474.05	$513.69	$583.99	$584.92	$507.39	$483.78	$514.94	20.9%	2.1%
ASC	$291.07	$281.43	$273.64	$273.29	$288.16	$316.09	$316.18	$282.22	$268.82	$275.11	-5.5%	-0.6%
Office	$106.73	$112.73	$114.23	$111.60	$110.50	$70.33	$105.46	$106.34	$109.80	$113.42	6.3%	0.7%
Total	$256.15	$254.71	$269.02	$267.24	$279.59	$290.02	$304.41	$273.59	$261.28	$272.91	6.5%	0.7%
Total (Professional + Facility)												
HOPD	$510.30	$520.60	$561.95	$566.98	$609.99	$669.78	$683.83	$606.28	$587.87	$618.79	21.3%	2.2%
ASC	$377.79	$374.28	$364.47	$368.37	$387.12	$407.96	$418.36	$385.08	$374.87	$381.59	1.0%	0.1%
Office	$192.32	$205.46	$204.83	$206.67	$208.25	$163.28	$206.24	$207.74	$213.49	$218.23	13.5%	1.4%
Total	$341.69	$346.52	$359.15	$361.67	$377.24	$380.55	$405.03	$374.68	$365.76	$377.94	10.6%	1.1%
PCPY		1.4%	3.6%	0.7%	4.3%	0.9%	6.4%	-7.5%	-2.4%	3.3%		
Inflation Rate	1.17	1.15	1.12	1.09	1.08	1.06	1.06	1.05	1.02	1	-14.5%	-1.7%
Total* (infl)	$399.77	$398.50	$402.25	$394.22	$407.42	$403.38	$429.33	$393.41	$373.08	$377.94	-5.5%	-0.6%
PCPY		-0.3%	0.9%	-2.0%	3.3%	-1.0%	6.4%	-8.4%	-5.2%	1.3%		

*Inflation-adjusted and converted to the year 2018 values. Change: of change from 2009 to 2018; GM – geometric average
PCPY – percentage of change from previous year
Note: There was about a 16% reduction in payment rates for C/T/L epidural injection in ASC & HOPD settings in 2016 & 2018. In 2014, payments for ASC & HOPD primary codes increased and removed payments for add-on codes.

Table 5. *Average allowed charges per visit.*

PLCR	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Change	GM
No. of Visits												
HOPD	566,460	581,040	607,280	601,380	580,200	578,740	577,500	583,880	536,380	534,880	-5.6%	-0.6%
ASC	445,040	457,520	488,380	509,180	493,140	498,020	508,860	539,480	505,220	507,960	14.1%	1.5%
Office	669,700	710,080	727,720	742,560	758,080	745,500	756,360	763,900	736,980	748,360	11.7%	1.2%
Total	1,681,200	1,748,640	1,823,380	1,853,120	1,831,420	1,822,260	1,842,720	1,887,260	1,778,580	1,791,200	6.5%	0.7%
Average												
Professional												
HOPD	$98.57	$103.83	$103.75	$107.91	$111.10	$99.33	$114.29	$114.73	$120.04	$119.71	21.4%	2.2%
ASC	$111.63	$118.90	$116.95	$123.28	$125.21	$115.69	$128.95	$128.82	$134.00	$133.15	19.3%	2.0%
Office	$113.08	$123.55	$118.66	$122.07	$123.59	$121.07	$130.43	$130.33	$132.29	$132.26	17.0%	1.8%
Total	$107.81	$115.78	$113.23	$117.81	$120.07	$112.69	$124.96	$125.07	$129.08	$128.76	19.4%	2.0%
Facility												
HOPD	$497.03	$499.35	$552.14	$550.41	$592.64	$676.14	$675.89	$588.68	$557.90	$593.57	19.4%	2.0%
ASC	$374.70	$360.37	$352.35	$354.34	$364.61	$398.05	$399.06	$353.47	$339.67	$344.01	-8.2%	-0.9%
Office	$141.02	$150.20	$149.60	$143.29	$139.69	$91.61	$136.50	$136.69	$140.11	$143.13	1.5%	0.2%
Total	$322.83	$321.20	$337.97	$333.40	$343.75	$361.00	$378.05	$338.49	$322.79	$334.60	3.6%	0.4%
Total (Professional + Facility)												
HOPD	$595.59	$603.18	$655.89	$658.32	$703.75	$775.46	$790.19	$703.41	$677.94	$713.28	19.8%	2.0%
ASC	$486.33	$479.27	$469.30	$477.62	$489.81	$513.74	$528.01	$482.28	$473.67	$477.16	-1.9%	-0.2%
Office	$254.09	$273.75	$268.26	$265.35	$263.28	$212.68	$266.93	$267.02	$272.40	$275.38	8.4%	0.9%
Total	$430.63	$436.99	$451.21	$451.21	$463.82	$473.70	$503.01	$463.57	$451.87	$463.37	7.6%	0.8%
PCPY		1.5%	3.3%	0.0%	2.8%	2.1%	6.2%	-7.8%	-2.5%	2.5%		
Inflation Rate	1.17	1.15	1.12	1.09	1.08	1.06	1.06	1.05	1.02	1	-14.5%	-1.7%
Total* (infl)	$503.84	$502.53	$505.35	$491.81	$500.92	$502.12	$533.19	$486.74	$460.91	$463.37	-8.0%	-0.9%
PCPY		-0.3%	0.6%	-2.7%	1.9%	0.2%	6.2%	-8.7%	-5.3%	0.5%		

*Inflation-adjusted and converted to the year 2018 values. Change: of change from 2009 to 2018; GM – geometric average; PCPY – percentage of change from previous year

Note: There was about a 16% reduction in payment rates for C/T/L epidural injection in ASC & HOPD settings in 2016 & 2018. In 2014, payments for ASC & HOPD primary codes increased and removed payments for add-on codes.

patient were $1,174.20 in HOPD setting with a record increase of 8.9% and 1%, compared to ASC at $834.87 with a decline of 11.8% and 1.4%, and in an office setting of $518.01, with an overall decline of 4.1% and an annual decline of 0.5%.

In reference to overall expenditures, based on the usual procedures for caudal epidural and lumbar interlaminar epidural, there were declines of 2.7% overall and 0.3% annually. In contrast, for lumbar transforaminal epidural procedures, the expenses were higher with a 27% increase and an annual increase of 2.7%.

Discussion

The estimated costs and utilization patterns of epidural procedures from 2009 to 2018 in the Medicare FFS population shows an overall decline in utilization patterns per 100,000 Medicare population, along with inflation-adjusted reductions in the costs, except for transforaminal epidural procedures and low utilized procedures in cervical spine. The number of patients receiving epidural procedures per 100,000 Medicare population declined from 1,870 to 1,700, a 9.1% decline, with an annual decline of 1.1%. At the same time, the Medicare beneficiaries increased 30.1% or 3% annually. Thus, there is a net decline of epidural procedures based on population increases or per 100,000 Medicare population. The 80% of the patients receiving epidural procedures in 2009 and 82% in 2018 were above the

Table 6. *Average allowed annual charges per patient.*

PLCR	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Change	GM
No. of Visits												
HOPD	312,980	319,280	334,440	334,880	326,880	332,300	334,200	344,000	325,920	324,920	3.8%	0.4%
ASC	228,680	237,500	253,040	268,460	261,960	267,260	276,860	295,020	287,400	290,320	27.0%	2.7%
Office	314,880	334,860	349,020	363,740	370,680	371,720	382,900	388,100	388,380	397,840	26.3%	2.6%
Total	856,540	891,640	936,500	967,080	959,520	971,280	993,960	1,027,120	1,001,700	1,013,080	18.3%	1.9%
Average												
Professional												
HOPD	$178.40	$188.96	$188.39	$193.78	$197.20	$172.99	$197.50	$194.74	$197.55	$197.06	10.5%	1.1%
ASC	$217.25	$229.04	$225.72	$233.83	$235.70	$215.59	$237.01	$235.56	$235.56	$232.98	7.2%	0.8%
Office	$240.50	$261.99	$247.40	$249.19	$252.75	$242.81	$257.65	$256.53	$251.04	$248.78	3.4%	0.4%
Total	$211.60	$227.06	$220.47	$225.74	$229.17	$211.43	$231.67	$229.81	$229.19	$227.67	7.6%	0.8%
Facility												
HOPD	$899.56	$908.73	$1,002.59	$988.44	$1,051.92	$1,177.57	$1,167.95	$999.18	$918.16	$977.13	8.6%	0.9%
ASC	$729.21	$694.23	$680.06	$672.07	$686.37	$741.74	$733.46	$646.36	$597.11	$601.90	-17.5%	-2.1%
Office	$299.92	$318.50	$311.92	$292.51	$285.68	$183.74	$269.63	$269.05	$265.86	$269.23	-10.2%	-1.2%
Total	$633.64	$629.93	$658.04	$638.86	$656.11	$677.29	$700.87	$621.96	$573.14	$591.61	-6.6%	-0.8%
Total (Professional + Facility)												
HOPD	$1,077.96	$1,097.69	$1,190.98	$1,182.22	$1,249.12	$1,350.56	$1,365.45	$1,193.92	$1,115.71	$1,174.20	8.9%	1.0%
ASC	$946.46	$923.27	$905.78	$905.90	$922.07	$957.32	$970.47	$881.91	$832.67	$834.87	-11.8%	-1.4%
Office	$540.41	$580.49	$559.33	$541.71	$538.43	$426.54	$527.28	$525.58	$516.90	$518.01	-4.1%	-0.5%
Total	$845.24	$856.99	$878.51	$864.60	$885.28	$888.72	$932.55	$851.77	$802.33	$819.27	-3.1%	-0.3%
PCPY		1.4%	2.5%	-1.6%	2.4%	0.4%	4.9%	-8.7%	-5.8%	2.1%		
Inflation Rate	1.17	1.15	1.12	1.09	1.08	1.06	1.06	1.05	1.02	1	-14.5%	-1.7%
Total* (infl)	$988.93	$985.54	$983.93	$942.41	$956.10	$942.05	$988.50	$894.36	$818.38	$819.27	-17.2%	-2.1%
PCPY		-0.3%	-0.2%	-4.2%	1.5%	-1.5%	4.9%	-9.5%	-8.5%	0.1%		

*Inflation-adjusted and converted to the year 2018 values. Change: of change from 2009 to 2018; GM – geometric average; PCPY – percentage of change from previous year

Note: There was about a 16% reduction in payment rates for C/T/L epidural injection in ASC & HOPD settings in 2016 & 2018. In 2014, payments for ASC & HOPD primary codes increased and removed payments for add-on codes.

age of 65 years, whereas the remaining were younger disabled individuals. The proportion of patient episodes in various settings was 1,258 per 100,000 Medicare population in an office setting, 903 in an HOPD setting, and 856 in an ASC. The data also showed consistently substantial declines of interlaminar epidural procedures compared to very mild decreases for lumbar transforaminal epidural procedures, which essentially is considered as an increase.

As shown in Table 4, average allowed charges per service or procedure after inflation-adjustment decreased 5.5% or 0.6% from $399.77 to $377.94. However, prior to inflation-adjustment, there was an increase of 10.6% and 1.1% from $341.69 in 2009 to $377.94 in 2018. The average charges per visit, included multiple procedures in multiple regions; however, limited to epidural procedures only, showed the total costs after inflation-adjustment to decline 8% or 0.9% from $503.84 in 2009 to $463.37 in 2018. Prior to inflation-adjustment, they showed increases of 7.6% and 0.8% from $430.63 to $463.37 from 2009 to 2018.

Average charges per patient also declined both prior to adjustment of the inflation and after the adjustment of inflation. Prior to adjustment of the inflation, they declined 3.1% or 0.3% from $845.24 to $819.27, whereas after inflation-adjustment, they declined 17.2% and 2.1% from $988.93 to $819.27.

Finally, the total allowed charges by place of ser-

Table 7. *Total allowed charges by place of service, by type of procedures.*

		2009T	2010T	2011T	2012T	2013T	2014T	2015T	2016T	2017T	2018T	Change	GM
HOPD	C/T Epidural	$31,131,829	$32,928,061	$39,685,705	$40,682,055	$41,850,343	$47,454,610	$50,773,324	$47,001,182	$36,854,949	$41,289,652	32.6%	3.2%
	L/C Epidural	$192,894,507	$197,861,340	$221,513,807	$215,692,412	$221,617,276	$241,251,024	$243,323,131	$212,878,318	$170,374,971	$179,685,884	-6.8%	-0.8%
	C/T Transforaminal	$3,763,052	$6,091,920	$6,373,754	$6,452,913	$6,558,167	$7,171,305	$7,291,263	$7,125,935	$6,948,418	$7,074,608	88.0%	7.3%
	L Transforaminal	$109,590,831	$113,589,353	$130,736,451	$133,073,861	$138,287,242	$152,914,498	$154,944,690	$143,702,101	$149,454,300	$153,469,973	40.0%	3.8%
	HOPD Total	$337,380,219	$350,470,675	$398,309,716	$395,901,241	$408,313,028	$448,791,436	$456,332,408	$410,707,535	$363,632,638	$381,520,117	13.1%	1.4%
ASC	C/T Epidural	$20,944,665	$20,554,818	$22,610,188	$24,880,313	$26,015,032	$26,505,218	$30,620,749	$30,150,585	$24,687,122	$26,229,326	25.2%	2.5%
	L/C Epidural	$84,308,507	$81,771,120	$85,708,087	$86,834,948	$86,698,083	$91,754,133	$94,117,042	$88,527,592	$70,065,234	$72,014,734	-14.6%	-1.7%
	C/T Transforaminal	$4,717,886	$5,644,209	$6,311,051	$6,774,534	$6,323,385	$6,600,849	$6,314,067	$6,119,055	$6,922,032	$7,026,096	48.9%	4.5%
	L Transforaminal	$106,464,891	$111,305,376	$114,568,228	$124,706,830	$122,509,658	$130,994,202	$137,632,620	$135,383,957	$137,634,524	$137,110,401	28.8%	2.9%
	ASC Total	$216,435,950	$219,275,523	$229,197,553	$243,196,626	$241,546,158	$255,854,402	$268,684,478	$260,181,189	$239,308,912	$242,380,556	12.0%	1.3%
Office	C/T Epidural	$12,909,374	$15,169,815	$18,346,098	$20,035,732	$22,297,572	$8,938,691	$20,791,348	$20,557,918	$21,048,808	$22,289,523	72.7%	6.3%
	L/C Epidural	$52,650,996	$57,527,144	$64,118,523	$69,612,045	$71,012,127	$29,980,994	$63,683,884	$65,040,149	$66,990,072	$69,191,026	31.4%	3.1%
	C/T Transforaminal	$7,855,386	$9,125,096	$7,159,474	$5,290,552	$5,602,389	$6,794,398	$6,754,783	$6,540,584	$6,046,304	$5,945,542	-24.3%	-3.0%
	L Transforaminal	$96,749,669	$112,561,819	$105,592,099	$102,101,850	$100,673,558	$112,840,227	$110,666,308	$111,840,813	$106,668,313	$108,660,872	12.3%	1.3%
	Office Total	$170,165,425	$194,383,874	$195,216,194	$197,040,180	$199,585,646	$158,554,310	$201,896,324	$203,979,464	$200,753,498	$206,086,963	21.1%	2.2%
Totals	C/T Epidural	$64,985,869	$68,652,695	$80,641,991	$85,598,100	$90,162,947	$82,898,518	$102,185,422	$97,709,685	$82,590,879	$89,808,500	38.2%	3.7%
	L/C Epidural	$329,854,009	$337,159,604	$371,340,417	$372,139,405	$379,327,486	$362,986,151	$401,124,057	$366,446,059	$307,430,278	$320,891,644	-2.7%	-0.3%
	C/T Transforaminal	$16,336,324	$20,861,225	$19,844,279	$18,518,000	$18,483,941	$20,566,552	$20,360,113	$19,785,574	$19,916,754	$20,046,245	22.7%	2.3%
	L Transforaminal	$312,805,391	$337,456,548	$350,896,778	$359,882,542	$361,470,458	$396,748,927	$403,243,618	$390,926,870	$393,757,137	$399,241,246	27.6%	2.7%
	Grand Total	$723,981,594	$764,130,071	$822,723,464	$836,138,047	$849,444,832	$863,200,148	$926,913,210	$874,868,188	$803,695,048	$829,987,636	14.6%	1.5%
	Inflation Rate	1.17	1.15	1.12	1.09	1.08	1.06	1.06	1.05	1.02	1	-14.5%	-1.7%
	Total inflation-adjusted*	$847,058,465	$878,749,582	$921,450,280	$911,390,471	$917,400,419	$914,992,157	$982,528,003	$918,611,597	$819,768,949	$829,987,636	-2.0%	-0.2%
	Medicare	45,801	46,914	48,300	50,300	51,900	53,500	54,900	56,500	58,000	59,600	30.1%	3.0%
	Total Patients	856,540	891,640	936,500	967,080	959,520	971,280	993,960	1,027,120	1,001,700	1,013,080	18.3%	1.9%
	per 100,000 Medicare (Inflation Adjustment)	$1,849,432	$1,873,107	$1,907,765	$1,811,909	$1,767,631	$1,710,266	$1,789,668	$1,625,861	$1,413,395	$1,392,597	-24.7%	-3.1%
	Per Medicare Beneficiaries (Inflation Adjustment)	$18	$19	$19	$18	$18	$17	$18	$16	$14	$14	-24.7%	-3.1%
	Per Epidural patient (Inflation Adjustment)	$988.93	$985.54	$983.93	$942.41	$956.10	$942.05	$988.50	$894.36	$818.38	$819.27	-17.2%	-2.1%

*Inflation-adjusted and converted to year 2018 values. GM – geometric average

Note: There was about a 16% reduction in payment rates for C/T/L epidural injection in ASC & HOPD settings in 2016 & 2018. In 2014 Payments for ASC & HOPD primary codes increased and removed payments for add-on codes.

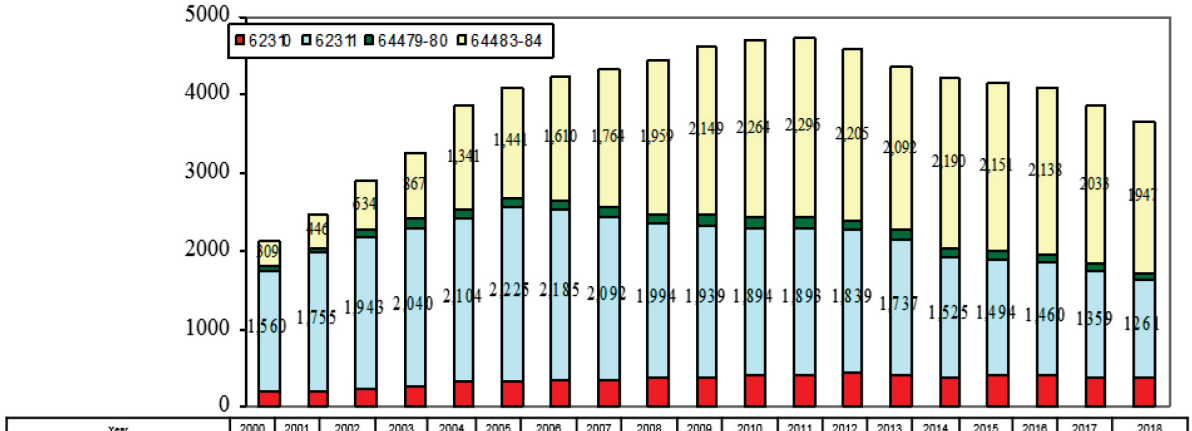
vice and type of procedures showed the total charges of $723,981,594 in 2009 and $829,987,636 in 2018 with a 14.6% and 1.5% increase. The overall allowed charges with inflation-adjusted rates showed a 2% decrease and 0.2% annually, decreasing from $847,058,465 to $829,987,636. Interestingly, the total allowed charges for lumbosacral caudal epidural procedures decreased from $329,854,009 in 2009 to $320,891,064 in 2018, with a decline of 2.7% and 0.3% annually. In contrast, for lumbosacral transforaminal epidural procedures, the increases were 27.6% with an annual increase of 2.7%, changing from $312,805,391 to $399,241,246. In 2009, interlaminar and caudal epidural were the most commonly performed procedures; however, in 2018, the ratios almost reversed with the proportion of transforaminal epidurals decreasing from 1,395 per 100,000 Medicare population in 2009 to 1,304 compared to caudal and interlaminar epidural injections, which declined from 1,914 in 2009 to 1,277 in 2018 as shown in Tables 8, Fig. 3, and Appendix Tables 3 and 4.

Overall, in 2018, 42% of the patients, or 752,980 received lumbar interlaminar and caudal epidural injections, whereas 43.2%, or 773,200 received lumbosacral transforaminal epidural injections (Fig. 3 and Table 8).

Medicare is concerned with utilization patterns and the increasing expenditures of overall interventional techniques, even though they are showing a decline. Epidural procedures compared to overall interventional techniques or facet joint interventions are at a further decline. With the COVID-19 interface, these declines are going to be substantial. Consequently, CMS continues to update Local Coverage Determinations (LCDs) by calling for multijurisdictional Contractor Advisory Committee (CAC) assessment of present LCDs for epidural procedures, and performing enhanced audits, and investigations (9-12,47-56). The philosophy continues towards reducing the utilization and expenditures by not only reducing fraud and abuse, but also by enforcing the appropriate indications and medical necessity criteria. During the enactment of the ACA, or

Table 8. *Proportion of patients and types of epidural procedures.*

	No. of Patients	Percentage
Cervical/Thoracic Transforaminal	37,520	2.1%
Cervical/Thoracic Epidural	218,420	12.2%
Lumbar/Caudal Epidural	752,980	42.0%
Lumbosacral Transforaminal	773,200	43.2%



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%	2.8%	2.7%	2.8%	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%	35.0%	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. 3. *Frequency of utilization of epidural injections by procedures from 2000 to 2018, in Medicare recipients.*

soon after, multiple MACs have enacted LCDs, which were essentially accepted verbatim by all carriers, except for CGS and First Coast Services, which essentially increased the frequency of epidural procedures from 4 to 6 in the therapeutic phase in all jurisdictions (49-54). CGS maintained 2 procedures in the diagnostic phase and 4 procedures in the therapeutic phase per rolling year (53). Thus, multijurisdictional CAC is being called to enact a national coverage policy and to provide uniform guidance (57).

This assessment showed the reversal of transforaminal epidural procedure utilization patterns and the increasing additional costs incurred for transforaminal epidural procedures (Table 7 and Appendix Tables 3 and 4). While multiple causes are considered for the decline in utilization, which is not yet the expected levels, due to overutilization, abuse, and fraud, as described above, which may be attributing to a lack of rapid decline and a growing Medicare population. In addition, the arguments continue in reference to indications and the medical necessity of epidural procedures and interventional techniques in general (7,58-80). Further, the disagreements and criticism continue in reference to the evidence, both positive and negative (7,59-80).

Conclusion

The estimations of expenditures of epidural procedures in the Medicare FFS population from 2009 to 2018 showed declining net costs based on inflation-adjusted estimations. However, the costs increased without adjusting for inflation. Further, the utilization of these procedures was below the growth of the Medicare population, both in terms of net population and rate of population. This analysis of the FFS Medicare population from 2009 to 2018 demonstrated reduction in true utilization patterns of overall epidural injections, except for transforaminal epidural injections, which have increased, and with a change in the ratio of caudal and interlaminar epidural injections versus transforaminal epidural injections. The increases in expenditures also reflected these patterns. Overall, lumbar interlaminar epidural injections decreased from 1,914 per 100,000 Medicare population in 2009 to 1,277, with a 33.3% decrease, or an annual decrease of 4.4%. However, lumbar transforaminal epidural injections showed a much lower decline from 1,395 in 2009 to 1,304 in 2018, with a decline of 6.5% and 0.7% annually. Overall, transforaminal epidural injections increased 27.6% and 2.7% per year, whereas for lumbosacral interlaminar epidural injections, they decreased overall 2.7% and 0.3% annually while total expenditures increased 14.6% with an annual increase of 1.5%. Inflation-adjusted expenses decreased 2% with an annual decline of 0.2%.

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Author Contributions

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

Data collection and analysis was performed by VP.

All authors contributed to the preparation of the manuscript, review, and approval of the content with final version.

Dr. Manchikanti is Co-Director, Pain Management Centers of America, Paducah, KY, Clinical Professor, Anesthesiology and Perioperative Medicine, University of Louisville, Louisville, KY, and Professor of Anesthesiology-Research, Department of Anesthesiology, School of Medicine, LSU Health Sciences Center, New Orleans and Shreveport, LA.

drlm@thepainmd.com

Vidyasagar Pampati is a Statistician, Pain Management Centers of America

sagar@thepainmd.com

Dr. Soin is Medical Director, Ohio Pain Clinic and Clinical Assistant Professor of Surgery at Wright State University, Dayton, OH Assistant Professor, Ohio University College of Medicine, Athens, OH, and, Clinical Professor of Pain Management and Anesthesiology, University of Pikeville, Pikeville, KY

drsoin@gmail.com

Dr. Sanapati is Co-Director, Pain Management Centers of America, Evansville, IN, and Assistant Professor of Anesthesiology and Research, School of Medicine, LSU Health Sciences Center, New Orleans, LA.

msanapati@gmail.com

Dr. Kaye is Professor, Pain Fellowship Director, Provost, Chief Academic Officer, Vice Chancellor of Academic Affairs, Departments of Anesthesiology and

Pharmacology, Toxicology, and Neurosciences, LSU Health Sciences Center, Shreveport, Oshcher Shreveport Hospital and Pain Clinic Feist-Wieller Cancer Center, Shreveport, LA

akaye@lsuhsc.edu, alankaye44@hotmail.com

Dr. Hirsch is Vice Chair and Service Line Chief of Neurointerventional Radiology, Chief of Neurointerventional Spine, Massachusetts General Hospital and Harvard Medical School, Boston, MA.

jahirsch@mgh.harvard.edu

Appendix tables are available at painphysicianjournal.com

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Appendix Table 1. *Utilization patterns of epidural injections by various specialty groups from 2009 to 2018 in Medicare recipients.*

Specialty	F2009	F2010	F2011	F2012	F2013	F2014	F2015	F2016	F2017	FY2018	change	GM
Anesthesiology – 05	659,740	617,380	601,800	596,980	564,240	545,460	546,420	556,680	509,100	507,600	-23%	-2.9%
IPM – 09	396,300	444,900	472,740	477,060	470,180	444,800	396,420	381,280	364,220	364,240	-8%	-0.9%
Pain Management – 72	126,780	158,100	198,240	220,860	243,300	281,440	331,440	362,160	346,960	359,260	183%	12.3%
PM&R – 25	274,020	298,160	326,620	341,800	335,840	336,960	353,760	376,440	361,460	378,160	38%	3.6%
Neurology – 13	22,560	24,480	23,460	24,280	21,520	19,560	19,800	19,900	17,060	15,360	-32%	-4.2%
Psychiatry – 26	2,940	4,020	3,360	2,600	1,940	1,240	760	800	520	440	-85%	-19.0%
Interventional Pain Management #	1,482,340	1,547,040	1,626,220	1,663,580	1,637,020	1,629,460	1,648,600	1,697,260	1,599,320	1,625,060	10%	1.0%
Rate	3,236	3,298	3,367	3,307	3,154	3,046	3,003	3,004	2,757	2,727	-16%	-1.9%
Percentage to Total	85.8%	86.3%	87.1%	87.8%	88.5%	88.7%	89.0%	89.5%	89.5%	90.4%		
Neurosurgery – 14	30,140	25,740	20,640	21,240	16,240	17,420	18,460	16,240	14,960	13,100	-57%	-8.8%
Orthopedic Surgery – 20	71,060	72,000	73,240	67,880	64,200	64,700	64,200	63,400	59,600	57,080	-20%	-2.4%
General Surgery- 02	2,620	2,900	3,140	1,740	1,100	960	920	680	180	600	-77%	-15.1%
Surgical (neuro, general, & orthopedic)	103,820	100,640	97,020	90,860	81,540	83,080	83,580	80,320	74,740	70,780	-32%	-4.2%
Rate	227	215	201	181	157	155	152	142	129	119	-48%	-6.9%
Percentage to Total	6.0%	5.6%	5.2%	4.8%	4.4%	4.5%	4.5%	4.2%	4.2%	3.9%		
Interventional Radiology – 94	8,120	6,600	6,100	6,520	7,640	8,420	9,700	9,260	9,840	10,280	27%	2.7%
Diagnostic Radiology – 30	72,740	72,520	75,480	75,080	70,040	71,260	67,240	65,080	63,560	57,520	-21%	-2.6%
Radiology	80,860	79,120	81,580	81,600	77,680	79,680	76,940	74,340	73,400	67,800	-16%	-1.9%
Percentage to Total	4.7%	4.4%	4.4%	4.3%	4.2%	4.3%	4.2%	3.9%	4.1%	3.8%		
Rate	177	169	169	162	150	149	140	132	127	114	-36%	-4.8%
Family Practice- 08	11,700	14,220	14,820	12,100	10,400	8,500	8,260	7,620	8,380	7,940	-32%	-4.2%
General Practice – 01	6,320	4,080	2,220	1,840	3,240	3,660	1,960	1,320	1,120	860	-86%	-19.9%
Internal Medicine – 11	11,520	14,240	11,660	10,700	9,820	6,660	7,000	6,740	4,680	4,480	-61%	-10.0%
General Physicians	29,540	32,540	28,700	24,640	23,460	18,820	17,220	15,680	14,180	13,280	-55%	-8.5%
Rate	64	69	59	49	45	35	31	28	24	22	-65%	-11.1%
Percentage to Total	1.7%	1.8%	1.5%	1.3%	1.3%	1.0%	0.9%	0.8%	0.8%	0.7%		
Rheumatology – 66	4,860	4,560	3,820	4,140	2,680	2,420	2,120	1,620	1,560	1,180	-76%	-14.6%
Osteopathic – 12	2,160	1,260	1,880	1,780	1,600	1,600	1,920	1,800	1,080	1,000	-54%	-8.2%
Emergency Medicine – 93	2,960	3,480	3,320	3,280	2,420	2,360	2,220	2,620	1,460	1,880	-36%	-4.9%
Others	4,640	4,860	6,800	8,540	7,240	6,540	5,920	7,400	6,920	4,480	-3%	-0.4%

Appendix Table 1. *Utilization patterns of epidural injections by various specialty groups from 2009 to 2018 in Medicare recipients. (continued)*

Specialty	F2009	F2010	F2011	F2012	F2013	F2014	F2015	F2016	F2017	FY2018	change	GM
Other Physicians	14,620	14,160	15,820	17,740	13,940	12,920	12,180	13,440	11,020	8,540	-42%	-5.8%
Rate	32	30	33	35	27	24	22	24	19	14	-55%	-8.5%
Percentage to Total	0.8%	0.8%	0.9%	0.9%	0.8%	0.7%	0.7%	0.7%	0.6%	0.5%		
CRNA	13,140	16,020	13,820	11,900	11,760	9,460	10,700	10,700	9,340	9,360	-29%	-3.7%
NP	1,140	1,320	1,140	1,180	1,200	940	960	1,780	720	980	-14%	-1.7%
PA	2,180	2,400	2,500	2,880	2,500	2,040	1,760	2,100	3,180	2,080	-5%	-0.5%
Other Providers (CRNA, NP & PA)	16,460	19,740	17,460	15,960	15,460	12,440	13,420	14,580	13,240	12,420	-25%	-3.1%
Rate	36	42	36	32	30	23	24	26	23	21	-42%	-5.9%
Percentage to Total	1.0%	1.1%	0.9%	0.8%	0.8%	0.7%	0.7%	0.8%	0.7%	0.7%		
Total	1,727,640	1,793,240	1,866,800	1,894,380	1,849,100	1,836,400	1,851,940	1,895,620	1,785,900	1,798,100	4%	0.4%
Rate	3,772	3,822	3,865	3,766	3,563	3,433	3,373	3,355	3,079	3,017	-20%	-2.5%

Rate: per 100,000 Medicare beneficiaries; Change: of change from 2009 to 2018; GM – geometric average

Appendix Table 2. *Utilizations of epidural procedures (rate per 100,000) in the Medicare population from 2009 to 2018 (2016 Medicare carrier).*

State name	F2009	F2010	F2011	F2012	F2013	F2014	F2015	F2016	F2017	F2018	Change	GM
Cahaba												
Alabama	5,723	5,496	5,927	5,943	5,775	5,715	5,622	5,814	4,705	4,685	-18.1%	-2.2%
Georgia	5,270	4,988	5,176	5,191	4,437	4,253	4,132	3,922	3,766	3,589	-31.9%	-4.2%
Tennessee	3,840	3,577	3,516	3,401	2,893	2,876	2,825	2,897	2,598	2,552	-33.5%	-4.4%
Cahaba Total	4,910	4,649	4,819	4,791	4,271	4,175	4,084	4,074	3,622	3,527	-28.2%	-3.6%
PCPY		-5.3%	3.6%	-0.6%	-10.9%	-2.3%	-2.2%	-0.2%	-11.1%	-2.6%		
CGS												
Kentucky	4,385	5,108	5,062	5,052	4,690	4,378	4,050	4,165	3,880	3,892	-11.2%	-1.3%
Ohio	3,671	3,524	3,441	3,470	3,296	3,146	2,929	3,195	2,683	2,522	-31.3%	-4.1%
Total	3,874	3,977	3,906	3,924	3,698	3,501	3,251	3,473	3,024	2,912	-24.8%	-3.1%
PCPY		2.6%	-1.8%	0.5%	-5.8%	-5.3%	-7.1%	6.8%	-12.9%	-3.7%		
First Coast												
Florida	4,433	4,445	4,198	4,111	3,760	3,725	3,587	3,622	3,197	3,115	-29.7%	-3.8%
PCPY		0.3%	-5.6%	-2.1%	-8.5%	-0.9%	-3.7%	1.0%	-11.7%	-2.5%		
NGS												
Connecticut	2,928	2,897	3,339	2,953	2,841	2,756	2,569	2,614	2,435	2,189	-25.2%	-3.2%
Illinois	4,262	4,406	4,715	4,605	4,600	4,159	4,040	4,083	3,774	3,585	-15.9%	-1.9%
Maine	3,790	3,383	3,369	3,313	3,014	3,390	2,866	2,683	2,415	1,956	-48.4%	-7.1%
Massachusetts	3,002	3,084	3,363	3,515	3,557	3,315	3,358	3,230	3,059	2,934	-2.3%	-0.3%
Minnesota	2,441	2,222	2,165	2,179	2,241	1,933	1,877	1,609	1,398	1,283	-47.5%	-6.9%
New Hampshire	3,423	3,762	4,166	3,664	3,617	3,733	3,484	3,644	3,239	3,260	-4.8%	-0.5%
New York	2,499	2,346	2,346	2,375	2,528	2,400	2,447	2,339	2,116	2,107	-15.7%	-1.9%
Rhode Island	2,486	2,995	2,521	1,984	1,727	1,979	2,274	1,889	1,550	1,877	-24.5%	-3.1%
Vermont	2,353	2,439	2,390	2,300	2,852	2,474	2,694	2,405	1,968	2,299	-2.3%	-0.3%
Wisconsin	3,411	3,528	3,401	3,218	3,213	2,827	2,643	2,754	2,590	2,507	-26.5%	-3.4%
NGS Total	3,096	3,083	3,189	3,126	3,171	2,950	2,895	2,833	2,596	2,501	-19.2%	-2.3%
PCPY		-0.4%	3.4%	-2.0%	1.4%	-7.0%	-1.8%	-2.2%	-8.4%	-3.6%		
Noridain												
Alaska	3,189	3,532	3,224	3,348	3,359	3,958	4,064	3,744	3,243	3,907	22.5%	2.3%
Arizona	3,593	4,089	4,048	4,487	4,410	4,296	4,288	4,103	3,959	3,984	10.9%	1.2%
California	2,620	2,696	2,770	2,801	2,705	2,619	2,591	2,503	2,182	2,161	-17.5%	-2.1%
Idaho	3,415	3,081	3,788	4,175	3,641	3,614	3,571	3,645	3,055	2,885	-15.5%	-1.9%
Montana	3,596	3,493	3,754	3,509	3,426	3,382	3,336	3,298	2,821	3,031	-15.7%	-1.9%
Nevada	3,766	3,124	3,669	3,844	3,703	3,466	3,493	3,285	2,811	2,755	-26.8%	-3.4%
North Dakota	3,611	4,318	4,451	4,096	4,296	4,420	3,678	3,785	3,078	3,007	-16.7%	-2.0%
Oregon	1,916	1,922	1,970	2,175	2,211	1,701	1,684	1,535	1,295	1,393	-27.3%	-3.5%
South Dakota	4,031	3,456	4,142	3,913	3,425	3,787	4,102	3,715	3,253	3,463	-14.1%	-1.7%
Utah	4,528	4,226	4,562	4,956	5,152	4,880	5,285	4,465	4,426	4,550	0.5%	0.1%
Washington	2,844	3,011	2,635	2,887	2,776	2,568	2,351	2,259	2,038	1,943	-31.7%	-4.1%
Wyoming	3,656	4,271	4,345	4,710	4,284	4,258	3,629	4,902	3,904	4,239	15.9%	1.7%
Noridian Total	2,895	2,971	3,036	3,164	3,076	2,948	2,910	2,788	2,486	2,488	-14.1%	-1.7%
PCPY		2.6%	2.2%	4.2%	-2.8%	-4.2%	-1.3%	-4.2%	-10.8%	0.1%		

Appendix Table 2. *Utilizations of epidural procedures (rate per 100,000) in the Medicare population from 2009 to 2018 (2016 Medicare carrier). (continued)*

State name	F2009	F2010	F2011	F2012	F2013	F2014	F2015	F2016	F2017	F2018	Change	GM
Novitas												
Arkansas	3,855	4,117	4,082	4,153	4,055	4,028	4,169	4,474	4,343	4,617	19.8%	2.0%
Colorado	3,658	3,966	4,058	3,935	3,686	3,634	3,251	3,303	2,697	2,669	-27.0%	-3.4%
Delaware	4,177	4,769	5,062	4,768	5,212	5,189	5,183	5,440	4,515	4,704	12.6%	1.3%
District of Columbia	1,904	2,867	2,708	3,766	4,660	4,593	4,254	3,483	2,548	3,047	60.1%	5.4%
Louisiana	4,502	4,235	4,718	4,445	4,133	3,911	4,244	3,921	3,685	3,350	-25.6%	-3.2%
Maryland	3,863	4,141	4,515	4,578	4,459	4,377	4,906	4,552	4,026	4,353	12.7%	1.3%
Mississippi	5,385	6,014	5,989	5,809	5,184	5,429	5,727	5,332	4,762	4,812	-10.6%	-1.2%
New Jersey	3,387	3,271	3,417	3,393	3,229	3,511	3,325	3,323	3,025	3,044	-10.1%	-1.2%
New Mexico	3,081	2,744	2,859	2,933	2,539	2,390	2,279	2,576	2,167	2,079	-32.5%	-4.3%
Oklahoma	4,846	5,057	5,518	5,627	5,607	5,729	5,786	5,467	5,267	5,445	12.3%	1.3%
Pennsylvania	2,905	3,132	3,180	3,153	3,224	3,157	3,170	3,093	2,899	2,909	0.1%	0.0%
Texas	4,664	4,609	4,795	4,281	4,019	3,874	3,844	3,720	3,282	2,969	-36.3%	-4.9%
Novitas Total	3,941	4,042	4,217	4,054	3,904	3,870	3,896	3,795	3,418	3,358	-14.8%	-1.8%
PCPY		2.6%	4.3%	-3.9%	-3.7%	-0.9%	0.7%	-2.6%	-10.0%	-1.7%		
Palmetto GBA												
North Carolina	4,638	4,489	5,001	5,098	4,733	4,188	4,030	4,288	3,736	3,659	-21.1%	-2.6%
South Carolina	6,102	6,313	6,525	6,607	6,455	5,907	6,185	6,065	5,487	5,419	-11.2%	-1.3%
Virginia	4,163	4,014	3,991	4,007	4,137	4,270	4,163	4,311	4,042	3,932	-5.5%	-0.6%
West Virginia	2,386	2,268	2,362	2,515	2,430	2,141	2,270	2,265	1,730	1,857	-22.2%	-2.7%
Palmetto Total	4,562	4,495	4,748	4,825	4,696	4,379	4,360	4,480	4,019	3,956	-13.3%	-1.6%
PCPY		-1.5%	5.6%	1.6%	-2.7%	-6.8%	-0.4%	2.7%	-10.3%	-1.6%		
WPA												
Indiana	4,326	4,606	4,655	4,706	4,552	4,437	4,391	4,474	3,818	3,787	-12.5%	-1.5%
Iowa	3,725	3,618	3,809	3,720	3,546	3,466	3,660	3,476	3,023	3,135	-15.8%	-1.9%
Kansas	5,782	5,851	6,150	6,363	5,766	6,414	5,636	5,970	5,130	5,046	-12.7%	-1.5%
Michigan	4,306	5,209	4,517	4,496	4,367	3,807	3,643	3,415	3,117	3,076	-28.6%	-3.7%
Missouri	5,700	5,486	5,406	5,497	4,975	5,189	4,856	4,669	4,014	3,906	-31.5%	-4.1%
Nebraska	4,637	4,393	3,885	4,340	4,078	4,245	3,609	2,945	3,223	2,982	-35.7%	-4.8%
WPS Total	4,684	4,984	4,762	4,819	4,549	4,434	4,217	4,095	3,618	3,566	-23.9%	-3.0%
PCPY		6.4%	-4.5%	1.2%	-5.6%	-2.5%	-4.9%	-2.9%	-11.6%	-1.4%		
US TOTAL	3,772	3,822	3,865	3,766	3,563	3,433	3,373	3,355	3,079	3,017	-20.0%	-2.5%
PCPY		1.3%	1.1%	-2.6%	-5.4%	-3.7%	-1.7%	-0.5%	-8.2%	-2.0%		

Rate: per 100,000 Medicare beneficiaries; Change: of change from 2009 to 2018; GM – geometric average; PCPY – percentage of change from previous year

Appendix Table 3. *Utilizations of lumbar interlaminar and caudal epidural rates in the Medicare population from 2009 to 2018 (2016 Medicare carrier).*

State name	F2009	F2010	F2011	F2012	F2013	F2014	F2015	F2016	F2017	F2018	Change	Rate
Cahaba												
Alabama	3,330	3,395	3,527	3,468	3,393	2,989	2,894	3,060	2,408	2,374	-28.7%	-3.7%
Georgia	2,290	2,132	2,168	2,050	1,686	1,527	1,403	1,318	1,207	1,107	-51.6%	-7.7%
Tennessee	2,362	2,155	2,001	1,899	1,568	1,540	1,504	1,397	1,342	1,219	-48.4%	-7.1%
Total	2,596	2,480	2,475	2,377	2,097	1,915	1,826	1,797	1,560	1,467	-43.5%	-6.1%
PCPY		-4.5%	-0.2%	-4.0%	-11.8%	-8.7%	-4.7%	-1.6%	-13.2%	-5.9%		
CGS												
Kentucky	3,134	3,705	3,489	3,489	3,243	2,964	2,709	2,719	2,431	2,334	-25.5%	-3.2%
Ohio	1,999	1,825	1,765	1,838	1,706	1,547	1,366	1,444	1,220	1,150	-42.5%	-5.9%
Total	2,322	2,362	2,259	2,312	2,149	1,955	1,752	1,808	1,565	1,487	-36.0%	-4.8%
PCPY		1.7%	-4.4%	2.4%	-7.1%	-9.0%	-10.4%	3.2%	-13.5%	-5.0%		
First Coast												
Florida	2,302	2,217	2,038	1,971	1,887	1,682	1,545	1,599	1,385	1,325	-42.4%	-5.9%
PCPY		-3.7%	-8.1%	-3.3%	-4.2%	-10.9%	-8.2%	3.5%	-13.4%	-4.3%		
NGS												
Connecticut	1,573	1,663	1,914	1,582	1,529	1,359	1,472	1,447	1,155	1,045	-33.6%	-4.4%
Illinois	2,073	2,089	2,241	2,200	2,240	1,841	1,735	1,726	1,553	1,412	-31.9%	-4.2%
Maine	2,300	2,099	2,246	2,127	2,207	2,263	1,839	1,671	1,447	1,081	-53.0%	-8.0%
Massachusetts	1,705	1,657	1,807	1,778	1,952	1,774	1,778	1,782	1,682	1,583	-7.1%	-0.8%
Minnesota	1,155	1,066	1,030	1,034	1,074	856	825	704	571	466	-59.7%	-9.6%
New Hampshire	2,300	2,401	2,629	2,152	2,369	1,994	1,894	2,074	1,594	1,792	-22.1%	-2.7%
New York	1,139	1,099	1,143	1,127	1,121	1,006	1,054	1,018	891	920	-19.3%	-2.3%
Rhode Island	1,487	1,629	1,444	1,369	1,111	1,398	1,411	1,190	841	1,193	-19.8%	-2.4%
Vermont	1,427	1,417	1,274	1,278	1,651	1,439	1,623	1,294	1,178	1,184	-17.0%	-2.0%
Wisconsin	1,913	1,803	1,689	1,636	1,528	1,319	1,137	1,293	1,144	1,115	-41.7%	-5.8%
Total	1,580	1,551	1,620	1,560	1,584	1,386	1,353	1,336	1,173	1,123	-28.9%	-3.7%
PCPY		-1.9%	4.5%	-3.7%	1.5%	-12.5%	-2.4%	-1.3%	-12.2%	-4.2%		
Noridain												
Alaska	1,595	1,614	1,481	1,818	1,242	1,871	1,993	1,502	1,154	1,663	4.3%	0.5%
Arizona	1,721	1,881	1,702	1,913	1,957	1,469	1,437	1,331	1,189	1,170	-32.0%	-4.2%
California	1,134	1,110	1,120	1,188	1,184	1,059	1,066	994	839	828	-27.0%	-3.4%
Idaho	1,928	1,462	1,616	1,729	1,683	1,630	1,313	1,284	1,247	1,124	-41.7%	-5.8%
Montana	2,077	2,006	2,027	1,856	1,724	1,502	1,668	1,788	1,392	1,497	-27.9%	-3.6%
Nevada	1,475	1,211	1,560	1,564	1,621	1,225	1,202	1,095	930	875	-40.7%	-5.6%
North Dakota	2,611	3,202	3,307	3,086	3,433	3,554	2,758	2,860	2,498	2,115	-19.0%	-2.3%
Oregon	687	670	662	691	539	447	480	406	369	385	-44.0%	-6.2%
South Dakota	2,082	2,006	2,338	1,971	1,894	1,812	2,248	2,088	1,644	1,638	-21.3%	-2.6%
Utah	2,176	2,092	2,366	2,151	2,536	2,052	2,143	1,830	1,710	1,729	-20.6%	-2.5%
Washington	1,398	1,415	1,270	1,298	1,124	1,030	929	889	719	766	-45.2%	-6.5%
Wyoming	2,071	2,173	1,782	2,165	1,750	1,605	1,491	2,125	1,511	1,696	-18.1%	-2.2%
Total	1,327	1,312	1,310	1,365	1,346	1,172	1,157	1,083	924	921	-30.6%	-4.0%
PCPY		-1.1%	-0.1%	4.2%	-1.4%	-12.9%	-1.3%	-6.4%	-14.7%	-0.3%		

Appendix Table 3. *Utilizations of lumbar interlaminar and caudal epidural rates in the Medicare population from 2009 to 2018 (2016 Medicare carrier). (continued)*

State name	F2009	F2010	F2011	F2012	F2013	F2014	F2015	F2016	F2017	F2018	Change	Rate
Novitas												
Arkansas	2,306	2,525	2,606	2,781	2,652	2,451	2,538	2,688	2,493	2,715	17.7%	1.8%
Colorado	2,007	2,071	2,072	1,840	1,637	1,623	1,373	1,480	991	1,012	-49.6%	-7.3%
Delaware	3,416	3,763	4,187	3,692	4,801	3,768	3,958	3,642	3,405	3,803	11.3%	1.2%
District of Columbia	400	402	390	725	860	615	638	831	527	438	9.4%	1.0%
Louisiana	1,820	1,672	1,833	1,643	1,754	1,570	1,773	1,644	1,243	1,201	-34.0%	-4.5%
Maryland	1,696	1,600	1,841	1,885	1,621	1,571	1,762	1,656	1,378	1,562	-7.9%	-0.9%
Mississippi	2,808	2,828	2,977	3,038	2,765	2,818	2,853	2,641	2,148	2,403	-14.4%	-1.7%
New Jersey	1,555	1,322	1,429	1,442	1,335	1,324	1,159	1,146	1,007	989	-36.4%	-4.9%
New Mexico	1,507	1,180	1,141	1,345	1,146	1,014	1,123	1,309	947	878	-41.7%	-5.8%
Oklahoma	2,376	2,506	2,798	2,805	2,637	2,480	2,522	2,405	2,090	2,261	-4.8%	-0.5%
Pennsylvania	1,663	1,745	1,777	1,738	1,742	1,523	1,577	1,473	1,382	1,391	-16.3%	-2.0%
Texas	1,788	1,638	1,746	1,594	1,491	1,283	1,326	1,278	1,060	1,019	-43.0%	-6.0%
Total	1,830	1,777	1,882	1,830	1,740	1,587	1,613	1,568	1,321	1,349	-26.3%	-3.3%
PCPY		-2.9%	5.9%	-2.8%	-4.9%	-8.8%	1.6%	-2.8%	-15.7%	2.1%		
Palmetto GBA												
North Carolina	2,338	2,267	2,375	2,553	2,234	1,809	1,714	1,794	1,511	1,417	-39.4%	-5.4%
South Carolina	3,305	3,415	3,320	3,345	3,218	2,658	2,878	2,754	2,444	2,445	-26.0%	-3.3%
Virginia	1,995	1,850	1,861	1,652	1,684	1,502	1,466	1,463	1,373	1,310	-34.3%	-4.6%
West Virginia	1,177	1,116	1,212	1,189	1,225	856	960	988	776	760	-35.4%	-4.7%
Total	2,312	2,260	2,299	2,310	2,181	1,807	1,817	1,821	1,601	1,546	-33.2%	-4.4%
PCPY		-2.3%	1.7%	0.5%	-5.6%	-17.2%	0.6%	0.2%	-12.1%	-3.5%		
WPS												
Indiana	2,509	2,645	2,579	2,564	2,453	2,314	2,090	2,095	1,831	1,882	-25.0%	-3.1%
Iowa	2,647	2,636	2,792	2,635	2,504	2,355	2,424	2,185	1,799	1,959	-26.0%	-3.3%
Kansas	3,333	3,277	3,642	3,588	3,414	3,528	3,027	3,199	2,922	2,837	-14.9%	-1.8%
Michigan	2,262	2,600	2,283	2,363	2,170	1,648	1,648	1,536	1,401	1,401	-38.1%	-5.2%
Missouri	3,325	3,152	3,119	3,083	2,928	2,701	2,542	2,411	2,022	1,937	-41.7%	-5.8%
Nebraska	2,736	2,738	2,392	2,420	2,288	2,258	1,745	1,218	1,269	1,384	-49.4%	-7.3%
Total	2,694	2,794	2,695	2,691	2,532	2,270	2,127	2,025	1,784	1,793	-33.5%	-4.4%
PCPY			-3.6%	-0.1%	-5.9%	-10.4%	-6.3%	-4.8%	-11.9%	0.5%		
US Total	1,914	1,888	1,889	1,831	1,728	1,531	1,489	1,468	1,300	1,277	-33.3%	-4.4%
PCPY		-1.4%	0.1%	-3.1%	-5.6%	-11.4%	-2.8%	-1.4%	-11.5%	-1.8%		

Rate: per 100,000 Medicare beneficiaries; Change: of change from 2009 to 2018; GM – geometric average; PCPY – percentage of change from previous year

Appendix Table 4. *Utilizations of lumbar transforaminal epidurals rates in the Medicare population from 2009 to 2018 (2016 Medicare carrier).*

State name	F2009	F2010	F2011	F2012	F2013	F2014	F2015	F2016	F2017	F2018	Change	Rate
Cahaba												
Alabama	1,506	1,292	1,606	1,556	1,507	1,763	1,664	1,798	1,545	1,508	0.2%	0.0%
Georgia	2,211	2,170	2,251	2,290	1,999	2,006	1,991	1,924	1,910	1,822	-17.6%	-2.1%
Tennessee	1,100	1,036	1,132	1,085	947	990	978	1,124	941	986	-10.4%	-1.2%
Total	1,644	1,551	1,702	1,691	1,515	1,601	1,567	1,626	1,497	1,467	-10.8%	-1.3%
PCPY		-5.7%	9.7%	-0.7%	-10.4%	5.7%	-2.2%	3.8%	-7.9%	-2.0%		
CGS												
Kentucky	517	703	718	736	652	664	725	728	846	947	83.3%	7.0%
Ohio	1,277	1,300	1,265	1,231	1,151	1,189	1,198	1,324	1,130	1,046	-18.1%	-2.2%
Total	1,061	1,129	1,108	1,089	1,007	1,038	1,062	1,153	1,049	1,017	-4.1%	-0.5%
PCPY		6.5%	-1.8%	-1.8%	-7.5%	3.0%	2.3%	8.6%	-9.0%	-3.0%		
First Coast												
Florida	1,625	1,634	1,555	1,549	1,346	1,575	1,522	1,527	1,355	1,360	-16.3%	-2.0%
PCPY		0.5%	-4.8%	-0.4%	-13.1%	17.0%	-3.3%	0.3%	-11.2%	0.4%		
NGS												
Connecticut	1,089	937	1,234	1,098	1,050	1,129	915	926	1,048	910	-16.4%	-2.0%
Illinois	1,749	1,866	1,919	1,862	1,857	1,838	1,795	1,902	1,765	1,707	-2.4%	-0.3%
Maine	1,073	815	768	796	502	729	752	685	633	610	-43.2%	-6.1%
Massachusetts	1,062	1,133	1,210	1,362	1,210	1,191	1,179	1,110	1,018	973	-8.4%	-1.0%
Minnesota	981	934	876	834	879	814	733	673	608	620	-36.8%	-5.0%
New Hampshire	819	878	1,039	1,158	872	1,327	1,271	1,142	1,367	1,096	33.8%	3.3%
New York	1,119	1,036	999	1,045	1,109	1,114	1,130	1,041	954	922	-17.6%	-2.1%
Rhode Island	843	1,137	797	530	429	495	632	472	586	527	-37.5%	-5.1%
Vermont	723	789	838	733	934	808	835	837	646	822	13.8%	1.4%
Wisconsin	1,137	1,276	1,263	1,206	1,288	1,155	1,149	1,110	1,095	1,080	-5.0%	-0.6%
Total	1,211	1,216	1,232	1,233	1,228	1,226	1,202	1,170	1,105	1,061	-12.4%	-1.5%
PCPY		0.4%	1.3%	0.1%	-0.4%	-0.1%	-2.0%	-2.6%	-5.5%	-4.0%		
Noridain												
Alaska	1,116	1,187	1,278	1,212	1,157	1,627	1,398	1,789	1,437	1,663	48.9%	4.5%
Arizona	1,463	1,632	1,791	2,015	1,852	2,254	2,258	2,152	2,097	2,122	45.0%	4.2%
California	1,185	1,289	1,317	1,244	1,147	1,233	1,159	1,156	1,047	1,028	-13.3%	-1.6%
Idaho	1,054	1,201	1,692	2,067	1,394	1,570	1,594	1,737	1,325	1,355	28.6%	2.8%
Montana	1,215	1,215	1,347	1,136	1,279	1,271	1,047	1,152	1,151	1,175	-3.3%	-0.4%
Nevada	1,650	1,340	1,501	1,722	1,601	1,752	1,742	1,784	1,418	1,454	-11.9%	-1.4%
North Dakota	796	750	527	632	395	513	538	555	451	376	-52.8%	-8.0%
Oregon	1,026	1,082	1,155	1,199	1,379	1,050	962	864	681	796	-22.5%	-2.8%
South Dakota	1,651	1,172	1,357	1,403	1,295	1,420	1,249	1,204	1,185	1,404	-15.0%	-1.8%
Utah	1,884	1,760	1,676	2,117	1,942	2,294	2,492	1,969	2,070	2,127	12.9%	1.4%
Washington	1,226	1,255	1,178	1,292	1,306	1,218	1,145	1,077	1,052	909	-25.9%	-3.3%
Wyoming	1,151	1,698	2,075	1,927	1,843	1,895	1,793	2,272	1,923	2,016	75.2%	6.4%
Total	1,248	1,315	1,368	1,397	1,314	1,401	1,345	1,313	1,203	1,199	-4.0%	-0.4%
PCPY		5.3%	4.0%	2.1%	-6.0%	6.6%	-4.0%	-2.4%	-8.3%	-0.4%		

Appendix Table 4. *Utilizations of lumbar transforaminal epidurals rates in the Medicare population from 2009 to 2018 (2016 Medicare carrier). (continued)*

State name	F2009	F2010	F2011	F2012	F2013	F2014	F2015	F2016	F2017	F2018	Change	Rate
Novitas												
Arkansas	846	900	808	688	801	962	918	942	1,087	1,080	27.7%	2.8%
Colorado	1,186	1,492	1,469	1,613	1,591	1,526	1,560	1,457	1,331	1,326	11.8%	1.2%
Delaware	3,208	4,428	4,412	4,824	5,250	6,848	6,651	6,175	5,030	4,711	46.9%	4.4%
District of Columbia	565	978	924	1,157	1,106	1,217	1,071	787	589	845	49.5%	4.6%
Louisiana	2,127	1,934	2,117	1,989	1,648	1,645	1,859	1,750	1,798	1,578	-25.8%	-3.3%
Maryland	1,691	2,057	2,260	2,209	2,311	2,282	2,518	2,368	2,150	2,153	27.3%	2.7%
Mississippi	1,721	2,152	2,088	1,981	1,634	1,716	1,895	1,703	1,783	1,577	-8.4%	-1.0%
New Jersey	1,449	1,599	1,617	1,569	1,499	1,712	1,787	1,779	1,652	1,715	18.3%	1.9%
New Mexico	1,251	995	1,284	1,273	1,037	1,084	903	987	917	912	-27.0%	-3.4%
Oklahoma	1,690	1,813	1,939	2,003	2,066	2,295	2,301	2,182	2,274	2,195	29.9%	2.9%
Pennsylvania	949	1,032	1,083	1,083	1,135	1,258	1,235	1,221	1,179	1,157	21.8%	2.2%
Texas	2,055	2,188	2,281	2,024	1,865	1,913	1,900	1,823	1,698	1,452	-29.3%	-3.8%
Total	1,545	1,688	1,761	1,680	1,608	1,704	1,735	1,676	1,596	1,501	-2.9%	-0.3%
PCPY		9.2%	4.4%	-4.6%	-4.3%	5.9%	1.8%	-3.4%	-4.8%	-5.9%		
Palmetto GBA												
North Carolina	1,757	1,682	1,974	1,914	1,880	1,873	1,713	1,857	1,675	1,674	-4.7%	-0.5%
South Carolina	2,041	2,032	2,219	2,310	2,274	2,415	2,365	2,365	2,244	2,216	8.6%	0.9%
Virginia	1,860	1,868	1,786	1,991	1,963	2,316	2,230	2,330	2,212	2,139	15.0%	1.6%
West Virginia	938	922	767	995	955	1,004	989	945	767	825	-12.1%	-1.4%
Total	1,762	1,733	1,848	1,928	1,897	2,034	1,935	2,022	1,875	1,854	5.2%	0.6%
PCPY		-1.6%	6.6%	4.4%	-1.6%	7.2%	-4.9%	4.5%	-7.2%	-1.1%		
WPS												
Indiana	1,368	1,485	1,527	1,549	1,498	1,621	1,712	1,858	1,426	1,360	-0.6%	-0.1%
Iowa	727	700	723	730	790	734	852	895	863	836	15.0%	1.6%
Kansas	1,655	1,682	1,607	1,807	1,420	1,818	1,773	1,840	1,436	1,495	-9.7%	-1.1%
Michigan	1,404	1,865	1,583	1,495	1,566	1,604	1,423	1,393	1,296	1,237	-11.9%	-1.4%
Missouri	1,494	1,547	1,430	1,599	1,369	1,767	1,648	1,521	1,425	1,376	-7.9%	-0.9%
Nebraska	1,379	1,283	1,238	1,516	1,438	1,589	1,475	1,345	1,566	1,160	-15.9%	-1.9%
Total	1,364	1,549	1,432	1,476	1,412	1,569	1,503	1,501	1,332	1,268	-7.0%	-0.8%
PCPY		13.6%	-7.5%	3.1%	-4.4%	11.1%	-4.2%	-0.2%	-11.2%	-4.8%		
US Total	1,395	1,457	1,482	1,446	1,353	1,439	1,415	1,419	1,348	1,304	-6.5%	-0.7%
PCPY		4.5%	1.7%	-2.4%	-6.4%	6.4%	-1.7%	0.2%	-5.0%	-3.2%		

Rate: per 100,000 Medicare beneficiaries; Change: of change from 2009 to 2018; GM – geometric average; PCPY – percentage of change from previous year