

## Health Policy Review

## Reversal of Growth of Utilization of Interventional Techniques in Managing Chronic Pain in Medicare Population Post Affordable Care Act

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**Background:** Over the past 2 decades, the increase in the utilization of interventional techniques has been a cause for concern. Despite multiple regulations to reduce utilization of interventional techniques, growth patterns continued through 2009.

A declining trend was observed in a previous evaluation; however, a comparative analysis of utilization patterns of interventional techniques has not been performed showing utilization before and after the enactment of the Affordable Care Act (ACA).

**Objectives:** Our aim is to assess patterns of utilization and variables of interventional techniques in chronic pain management in the fee-for-service (FFS) Medicare population, with a comparative analysis of pre- and post-ACA.

**Study Design:** Utilization patterns and variables of interventional techniques were assessed from 2000 to 2009 and from 2009 to 2016 in the FFS Medicare population of the United States in managing chronic pain.

**Methods:** The master data from the Centers for Medicare & Medicaid Services (CMS) physician/supplier procedure summary from 2000 to 2016 was utilized to assess overall utilization and comparative utilization at various time periods.

**Results:** The analysis of Medicare data from 2000 to 2016 showed an overall decrease in utilization of interventional techniques 0.6% per year from 2009 to 2016, whereas from 2000 to 2009, there was an increase of 11.8% per year per 100,000 individuals of the Medicare population. In addition, the United States experienced an increase of 0.7% per year of population growth, 3.2% of those 65 years or older and a 3% annual increase in Medicare participation from 2009 to 2016. Further analysis also showed a 1.7% annual decrease in the rate of utilization of epidural and adhesiolysis procedures per 100,000 individuals of the Medicare population, with a 2.2% decrease for disc procedures and other types of nerve blocks, whereas there was an increase of 0.8% annually for facet joint interventions and sacroiliac joint blocks from 2009 to 2016. Epidural and adhesiolysis procedures showed an 8.9% annual increase, facet joint interventions and sacroiliac joint blocks showed a 17.6% increase, and disc procedures and other types of nerve blocks showed a 7.2% increase annually per 100,000 individuals of the Medicare population from 2000 to 2009.

**Limitations:** The limitations of this assessment include lack of analysis of individual procedures. Additional limitations include lack of inclusion of patients from Medicare Advantage plans and lack of complete and accurate data for statewide utilization.

**Conclusion:** From 2009 to 2016, interventional techniques decreased at an annual rate of 0.6% with an overall decrease of 3.9%, compared to an overall increase of 173.6% from 2000 to 2009 with an annual increase of 11.8%. An additional analysis of data with individual procedures is essential to gain further insights into utilization patterns.

**Key words:** Interventional pain management, chronic spinal pain, interventional techniques, epidural injections, adhesiolysis, facet joint interventions, sacroiliac joint injections, disc procedures, other types of nerve blocks

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**T**he Affordable Care Act (ACA), also known as Obamacare, was the most monumental change in US health care policy since the passage of Medicaid and Medicare in 1965 (1-5). The ACA was enacted with 3 primary goals of increasing the number of insured, improving the quality of care, and controlling health care costs (1-5). Apart from its successes and failures, with divergent views often colored by political persuasion, many believe that Obamacare failed to recognize the distinction between affordability and access. Health insurance is a financial mechanism for paying for health care, compared to access, which refers to the process of obtaining that health care. Some scholars believe that the ACA has widened the gap between providing patients the mechanism of paying for health care and actually receiving it. The ACA, the stimulus package that preceded it, and subsequent health care reforms have created an increasing burden on providers, and in fact may have lost the value of increased health insurance affordability without increasing access to care (6-22). Manchikanti et al (1) concluded that the ACA had gained a net increase in the number of individuals with insurance, primarily through Medicaid expansion, with reduction in costs without improvement in the quality of care and diminution in access. As illustrated by numerous reports, the impact of chronic pain on health care and the economy is enormous (22-26).

In a publication describing US spending on personal health care and public health from 1996 to 2013, Dieleman et al (23) showed an estimated spending of \$87.6 billion in managing low back and neck pain, accounting for the third highest amount of various disease categories. They also showed expenditures of \$183.5 billion in managing musculoskeletal disorders, including low back and neck pain. The manuscript describing the US burden of disease collaborations and the state of US health care from 1990 to 2010 accounted for nearly half of the US health care burden to morbidity and chronic disability (24). This manuscript also showed that among the 30 leading diseases and injuries contributing to years lived with disability in 2010 in the United States, low back pain ranked number one, other musculoskeletal disorders ranked number 2, neck pain ranked number 3, with depression and anxiety ranking as numbers 4 and 5 (24-26). When strict definitions and methodology the proportion of patients with chronic pain has been estimated to be around 30 million in the United States. (22).

Interventional techniques are one of the commonly utilized modalities of treatments in managing chronic

pain, with increasing use and debate in reference to the effectiveness (6-8,27-45). However, multiple other modalities, from over-the-counter medications to complex surgical fusions, have also been utilized extensively (22,46-50). Despite these increases in utilization of various modalities and advances in diagnostic therapeutic understanding, the prevalence of and modalities utilized to manage chronic pain, and, more importantly, disability and the adverse economic impact continue to escalate (22-26).

The published literature is replete with reports of increasing utilization of interventional techniques in managing chronic pain (8,27-29,43-45). A recent overall assessment of interventional techniques in managing chronic pain (8), describing the data from 2000 to 2014 in the fee-for-service (FFS) Medicare population in the United States, showed an increase at a rate of 153% and an annual growth rate of 6.9% per 100,000 individuals of the Medicare population. The data also showed an overall increase of epidural injections at a rate of 99%, an annual increase of 5% (29), whereas facet joint interventions and sacroiliac joint blocks increased at a rate of 313% and 317% respectively, at annual increase of 10.7% for both (28).

Over the years, multiple attempts have been made to control the utilization of interventional techniques by coding changes, reimbursement reductions, local coverage determinations (LCDs), and increased oversight from various agencies (6-8,27-29,43-45). In addition, there continues to be discordant opinions and conclusions with lack of agreement between proponents and opponents of the effectiveness and appropriateness of multiple interventional techniques (22,30-42,51-60). The opponents cite the lack of effectiveness, whereas proponents emphasize the significant evidence of conflicts or confluence of interest in assessments leading to inappropriate conclusions as the basis of discordant results (22,31,40-42,51-53).

This retrospective cohort study of utilization patterns of interventional techniques was undertaken in the US FFS Medicare population with data from 2000 to 2016, with a comparative analysis performed from 2000 to 2009 and from 2009 to 2016.

## **METHODS**

The methodology incorporated in this analysis was based on assessment of public use files or non-identifiable data, which is non-attributable and non-confidential, available through the Centers for Medicare & Medicaid Services (CMS) database (61). The study was

performed using Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidance (62). Thus, approval by the Institutional Review Board was not deemed to be necessary for the present analysis.

### Study Design

The study was designed to assess usage or utilization patterns and variables of multiple interventional techniques in managing chronic pain from 2000 to 2016 in the Medicare FFS population in the United States. The study included the majority of the interventional techniques, with exclusion of continuous epidurals, neurolytic procedures, trigger point injections, vertebral augmentation procedures, and implantable devices.

### Setting

The national database of specialty usage data files from CMS in the FFS Medicare population in the United States (61).

### Participants

All of the participants 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 2016.

### Variables

Variables assessed included not only the usage patterns of various procedures in the Medicare population from 2000 to 2016, but multiple characteristics in reference to the Medicare population and the growth of the Medicare population.

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

The current procedural terminology procedure codes for interventional techniques utilized were those in effect during 2000 to 2016 as follows:

- Epidural and adhesiolysis procedures (CPT 62310, 62311, 64479, 64480, 64483, 64484, 62263, 62264)
- Facet joint interventions and sacroiliac joint blocks (CPT 64470, 64472, 64475, 64476, 64490, 64491-new, 64492-new, 64493-new, 64494-new, 64495-new, 64622, 64623, 64626, 64627, 64633-new, 64634-new, 64635-new, 64636-new, 27096)
- Discography and disc decompression (CPT 62290, 62291, 62287)
- Other types of nerve blocks (CPT 64400, 64402, 64405, 64408, 64410, 64412, 64413, 64417, 64420, 64421, 64425, 64430, 64445, 64505, 64510, 64520, 64530, 64600, 64605, 64610, 64613, 64620, 64630, 64640, 64680).

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

### Data Sources

All of the analyzed data were obtained from the CMS Physician/Supplier Procedure Summary Master Data from 2000 to 2016 (61). These data included all FFS Medicare participants below the age of 65 and above the age of 65 receiving interventional techniques irrespective of the type of disability.

### Measures

The CMS 100% dataset consists of a CPT code with modifier indicating an additional procedure 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. Allowed services were also assessed for each procedure, and rates were calculated based on Medicare beneficiaries for the corresponding year and are reported as 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.

Assessment measures utilized were of services as well as rate of usage per 100,000 individuals of the Medicare population.

### Bias

The data was purchased from CMS by the Ameri-

can Society of Interventional Pain Physicians (ASIPP). 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 or older as in other evaluations (63,64), due to the finding that a significant proportion of patients below the age of 65 undergo interventional techniques (65,66). With emerging affordable insurance under Obamacare, increasing disability, and increasing population over the age of 65, Medicare represents the single largest health care payer in the United States, with over 56.5 million beneficiaries in 2016 (67). Consequently, the interventional techniques 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 interventional procedures in all settings for all regions in the United States for chronic spinal pain from 2000 to 2016.

### Data Compilation

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

## RESULTS

### Participants

Participants in this assessment included all FFS Medicare recipients from 2000 to 2016.

### Descriptive Data of Population Characteristics

As shown in Table 1, from 2000 to 2016, the US population older than 65 years of age increased 40.4% at an annual growth rate of 2.1%, compared to the growth of the US population of 14.5% and 0.9%. The US population grew at an annual rate of 0.9% from 2000 to 2009, compared to 0.7% from 2009 to 2016. In contrast, those aged 65 or older grew at an annual rate of 1.3% from 2000 to 2009, compared to 3.2% from 2009 to 2016. The number of individuals participating in Medicare grew at an annual rate of 2.2%, 1.6%, and 3% from 2000 to 2016, 2000 to 2009, and 2009 to 2016 respectively.

Interventional pain management services rate per 100,000 individuals of the Medicare popula-

tion declined from 2009 to 2016 at an annual rate of 0.6%, in contrast, the annual rate grew by 6.2% and 11.8% from 2000 to 2016 and from 2000 to 2009 respectively. Figure 1 shows a comparative analysis of annual US population growth, Medicare participation, and utilization of interventional pain management services.

### Utilization Characteristics

Table 2 and Figs. 2 and 3 show the utilization characteristics of interventional techniques in the FFS Medicare population from 2000 to 2016.

Table 2 and Fig. 2 show a decline of overall interventional technique at an annual rate of 0.6% per 100,000 individuals of the Medicare population, with epidural and adhesiolysis procedures declining at 1.7%, disc procedures and other types of nerve blocks declining at 2.2%, with an increase of 0.8% for facet joint interventions and sacroiliac joint blocks from 2009 to 2016. In contrast, prior years showed significant increases.

### Specialty Characteristics

Table 3 and Fig. 4 show frequency of utilization of interventional pain management techniques based on specialty designation.

### State Distribution Characteristics

Table 4 shows the rate of utilization of interventional pain management techniques from 2009 to 2016 based on Medicare carrier contractors. Noridian, the largest and most aggressive carrier regarding the development of specific interventional policies to be utilized across the nation to reduce utilization patterns, showed an overall decrease of 0.2%. This included the highest growth rate states of Alaska and Utah at 6.2% and 5.5%, with high growth rate states of Arizona at 3.2% and Wyoming at 2.6%, with other states showing lower decreases. The highest decreases in Noridian states were observed in the state of Washington at 2.9% even though their base utilization rate was 6,164, compared to 10,143 nationwide.

### Site-of Service Characteristics

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

## Decline of Growth of Interventional Techniques

Table 1. A summary of the frequency of utilization of various categories of interventional procedures in the FFS Medicare population from 2000 to 2016.

Year	US Population			FFS Medicare Beneficiaries				Utilization of FFS Interventional Pain Management Procedures			
	Total Population (,000)	≥ 65 Years (,000)		Number of Individuals Participating in Medicare	% to US Population	≥ 65 Years (,000) (Percent)	< 65 years (,000) Percent	Services	% of Change from Previous Year	Per 100,000 Population	% of Change from Previous Year
Number		% of US Population									
Y2000	282,172	35,077	12.40%	39,632	14.0%	34,262 (86.5%)	5,370 (13.5%)	1,469,495	-	3,708	-
Y2001	285,040	35,332	12.40%	40,045	14.0%	34,478 (86.1%)	5,567 (13.9%)	1,760,456	19.8%	4,396	18.6%
Y2002	288,369	35,605	12.30%	40,503	14.0%	34,698 (85.7%)	5,805 (14.3%)	2,183,052	24.0%	5,390	22.6%
Y2003	290,211	35,952	12.40%	41,126	14.2%	35,050 (85.2%)	6,078 (14.8%)	2,559,323	17.2%	6,223	15.5%
Y2004	292,892	36,302	12.40%	41,729	14.2%	35,328 (84.7%)	6,402 (15.3%)	3,335,047	30.3%	7,992	28.4%
Y2005	295,561	36,752	12.40%	42,496	14.4%	35,777 (84.2%)	6,723 (15.8%)	3,660,699	9.8%	8,614	7.8%
Y2006	299,395	37,264	12.40%	43,339	14.5%	36,317 (83.8%)	7,022 (16.2%)	4,146,124	13.3%	9,567	11.1%
Y2007	301,290	37,942	12.60%	44,263	14.7%	36,966 (83.5%)	7,297 (16.5%)	4,111,127	-0.8%	9,288	-2.9%
Y2008	304,056	38,870	12.80%	45,412	14.9%	37,896 (83.4%)	7,516 (16.6%)	4,433,411	7.8%	9,763	5.1%
Y2009	307,006	39,570	12.90%	45,801	14.9%	38,177 (83.4%)	7,624 (16.6%)	4,645,679	4.8%	10,143	3.9%
Y2010	308,746	40,268	13.00%	46,914	15.2%	38,991 (83.1%)	7,923 (16.9%)	4,578,977	-1.4%	9,760	-3.8%
Y2011	311,583	41,370	13.28%	48,300	15.5%	40,000 (82.8%)	8,300 (17.2%)	4,815,673	5.2%	9,970	2.2%
Y2012	313,874	43,144	13.75%	50,300	16.0%	41,900 (83.3%)	8,500 (16.9%)	4,947,974	2.7%	9,837	-1.3%
Y2013	316,129	44,704	14.14%	51,900	16.4%	43,100 (83.0%)	8,800 (17.0%)	4,932,950	-0.3%	9,505	-3.4%
Y2014	318,892	46,179	14.48%	53,500	16.8%	44,600 (83.4%)	8,900 (16.5%)	5,025,904	1.9%	9,394	-1.2%
y2015	320,897	47,734	14.88%	54,900	17.1%	46,000 (83.7%)	9,000 (16.3%)	5,243,036	4.3%	9,550	1.7%
Y2016	323,127	49,244	15.24%	56,500	17.5%	47,500 (84.1%)	9,000 (15.9%)	5,509,306	5.1%	9,751	2.1%
<b>Percentage of Change from 2000 to 2016</b>											
Change	14.5%	40.4%		42.6%		38.6%	67.6%	274.9%		163.0%	
GM	0.9%	2.1%		2.2%		2.1%	3.3%	8.6%		6.2%	
<b>Percentage of Change from 2000 to 2009</b>											
Change	8.8%	12.8%		15.6%		11.4%	42.0%	216.1%		173.6%	
GM	0.9%	1.3%		1.6%		1.2%	4.0%	13.6%		11.8%	
<b>Percentage of Change from 2009 to 2016</b>											
Change	5.3%	24.4%		23.4%		24.4%	18.0%	18.6%		-3.9%	
GM	0.7%	3.2%		3.0%		3.2%	2.4%	2.5%		-0.6%	

GM= geometric average annual change; \*(Excluding continuous epidurals, intraarticular injections, trigger point and ligament injections, peripheral nerve blocks, vertebral augmentation procedures, and implantables)

The US total included DC, Hawaii/Guam, Puerto Rico/Virgin Islands, and Railroad FFS Medicare data

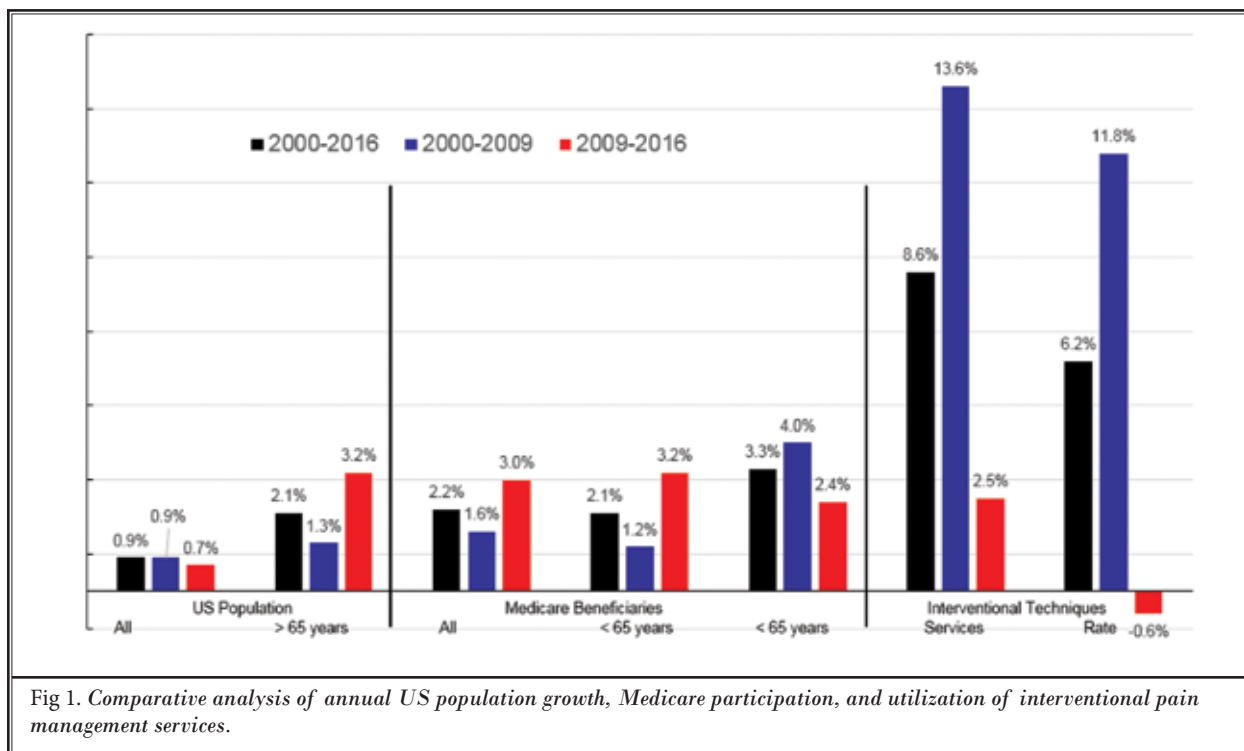


Fig 1. Comparative analysis of annual US population growth, Medicare participation, and utilization of interventional pain management services.

## DISCUSSION

The comparative assessment of utilization data of interventional techniques for chronic pain and the Medicare FFS population from 2000 to 2016 showed dramatic shifts from 2009 to 2016 (post-ACA), compared to 2000 to 2009 (pre-ACA). The important data from this analysis shows that the growth of the US population decreased from an annual rate of 0.9% to 0.7% during the comparison periods of 2000 to 2009 and 2009 to 2016, whereas the US population over the age of 65 years increased at an annual rate of 1.3% and 3.2%. In addition, the number of individuals participating in Medicare has grown significantly at an annual rate of 3% from 2009 to 2016, compared to 1.6% from 2000 to 2009. Contrasting to these trends, the enrollment of those individuals with disabilities below 65 years of age has declined to 2.4% of annual growth from 2009 to 2016, compared to 4% annual growth from 2000 to 2009.

Overall interventional techniques declined at an annual rate of 0.6% from 2009 to 2016 compared to the US population growth increase of 0.7%, elderly of 3.2%, and Medicare population of 3%. This is in stark contrast to an annual increase of 11.8% from 2000 to 2009. Even more impressive is the decline in the rate of epidural and adhesiolysis procedures of an annual rate

of 1.7% from 2009 to 2016, compared to an increase of 8.9% from 2000 to 2009 and a decline of disc procedures and other types of nerve blocks of 2.2% at an annual rate from 2009 to 2016, compared to an annual increase of 7.2% from 2000 to 2009. The only increase was noted for facet joint interventions and sacroiliac joint blocks at an annual rate of 0.8% from 2009 to 2016. This is well below the growth of the Medicare population and well below the growth of the elderly population and Medicare enrollment, compared to the substantial annual increases of 7.6% from 2000 to 2009, which was substantially higher by several multiples of population and Medicare patient growth.

This analysis reaches different conclusions compared to prior analysis performed by some of the authors conducting this study in that analyses of overall utilization without assessing the patterns pre- and post-ACA will show misleading results. There has been an overall increase of 163% and an annual rate of 6.2% from 2000 to 2016 but this must be studied in light of the transitions of 2009. While the majority of the changes are related to the ACA enacted in 2010, the initiation of various regulations and the focus on decreasing utilization, increasing regulatory aspects started in early 2009 with the passage of the stimulus act (68) and expanded with other regulations (10-21).



## Decline of Growth of Interventional Techniques

Table 2. The frequency of utilization of interventional techniques in the FFS Medicare population from 2000 to 2016

	Epidural and Adhesiolysis Procedures		Facet Joint Interventions and Sacroiliac Joint Blocks		Disc Procedures and Other Types of Nerve Blocks		Utilization of All Interventional Techniques*			
	Services (Facility %)	Rate	Services (Facility %)	Rate	Services (Facility %)	Rate	Services (Facility %)	% of Change in Services	Rate	% of Change in Rate
2000	860,787 (79%)	2,172	424,796 (67%)	1,072	183,912 (87%)	464	1,469,495 (72%)		3,708	
2001	1,013,552 (78%)	2,531	543,509 (62%)	1,357	203,395 (87%)	508	1,760,456 (69%)	19.8%	4,396	18.6%
2002	1,199,324 (74%)	2,961	708,186 (58%)	1,748	275,542 (81%)	680	2,183,052 (64%)	24.0%	5,390	22.6%
2003	1,370,862 (71%)	3,333	884,035 (53%)	2,150	304,426 (80%)	740	2,559,323 (60%)	17.2%	6,223	15.5%
2004	1,637,494 (65%)	3,924	1,354,242 (46%)	3,245	343,311 (79%)	823	3,335,047 (54%)	30.3%	7,992	28.4%
2005	1,776,153 (65%)	4,180	1,501,222 (47%)	3,533	383,324 (78%)	902	3,660,699 (54%)	9.8%	8,614	7.8%
2006	1,870,440 (63%)	4,316	1,896,688 (40%)	4,376	378,996 (75%)	874	4,146,124 (49%)	13.3%	9,567	11.1%
2007	1,940,454 (62%)	4,384	1,820,695 (46%)	4,113	349,978 (73%)	791	4,111,127 (52%)	-0.8%	9,288	-2.9%
2008	2,041,155 (61%)	4,495	1,974,999 (46%)	4,349	417,257 (70%)	919	4,433,411 (51%)	7.8%	9,763	5.1%
2009	2,136,035 (59%)	4,664	2,111,700 (46%)	4,611	397,944 (69%)	869	4,645,679 (49%)	4.8%	10,143	3.9%
2010	2,226,486 (57%)	4,746	1,937,582 (48%)	4,130	414,909 (62%)	884	4,578,977 (52%)	-1.4%	9,760	-3.8%
2011	2,309,906 (58%)	4,782	2,064,227 (50%)	4,274	441,540 (61%)	914	4,815,673 (48%)	5.2%	9,970	2.2%
2012	2,324,563 (58%)	4,621	2,159,057 (50%)	4,292	464,354 (57%)	923	4,947,974 (53%)	2.7%	9,837	-1.3%
2013	2,278,790 (58%)	4,391	2,197,766 (51%)	4,235	456,394 (51%)	879	4,932,950 (53%)	-0.3%	9,505	-3.4%
2014	2,273,104 (57%)	4,249	2,370,000 (50%)	4,430	382,800 (47%)	716	5,025,904 (52%)	1.9%	9,394	-1.2%
2015	2,291,001 (57%)	4,173	2,568,428 (50%)	4,678	383,607 (44%)	699	5,243,036 (53%)	4.3%	9,550	1.7%
2016	2,329,062 (58%)	4,122	2,759,559 (52%)	4,884	420,685 (45%)	745	5,509,306 (54%)	5.1%	9,751	2.1%
<b>Change from 2000 to 2016</b>										
Change	170.6%	89.8%	549.6%	355.7%	128.7%	60.5%	274.9%		163.0%	
GM	6.4%	4.1%	12.4%	9.9%	5.3%	3.0%	8.6%		6.2%	
<b>Change from 2000 to 2009</b>										
Change	148.1%	114.7%	397.1%	330.2%	116.4%	87.2%	216.1%		173.6%	
GM	10.6%	8.9%	19.5%	17.6%	9.0%	7.2%	13.6%		11.8%	
<b>Change from 2009 to 2016</b>										
Change	9.0%	-11.6%	30.7%	5.9%	5.7%	-14.3%	18.6%		-3.9%	
GM	1.2%	-1.7%	3.9%	0.8%	0.8%	-2.2%	2.5%		-0.6%	

Rate= interventional pain management services per 100,000 Medicare Beneficiaries; GM= geometric average annual change;

\*(Excluding continuous epidurals, intraarticular injections, trigger point and ligament injections, peripheral nerve blocks, vertebral augmentation procedures, and implantables)

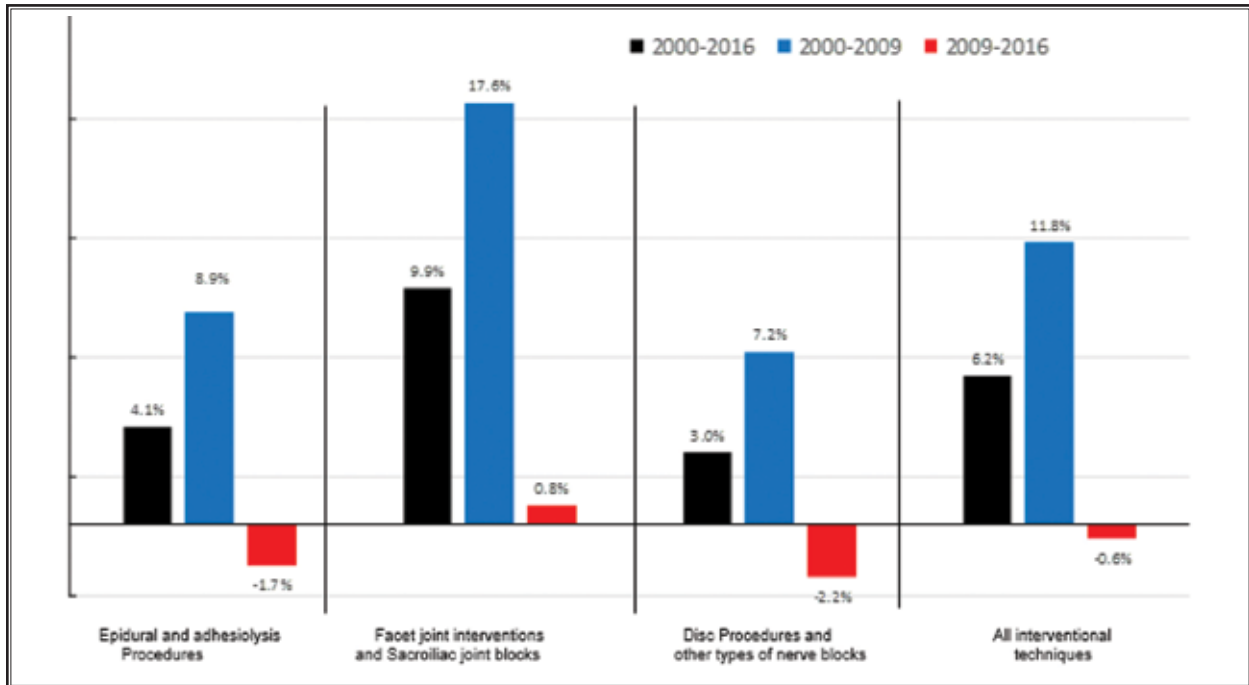


Fig 2. Comparative analysis of epidural and adhesiolysis procedures, facet joint interventions and sacroiliac joint blocks, disc procedures and other types of nerve blocks, and all interventional techniques.

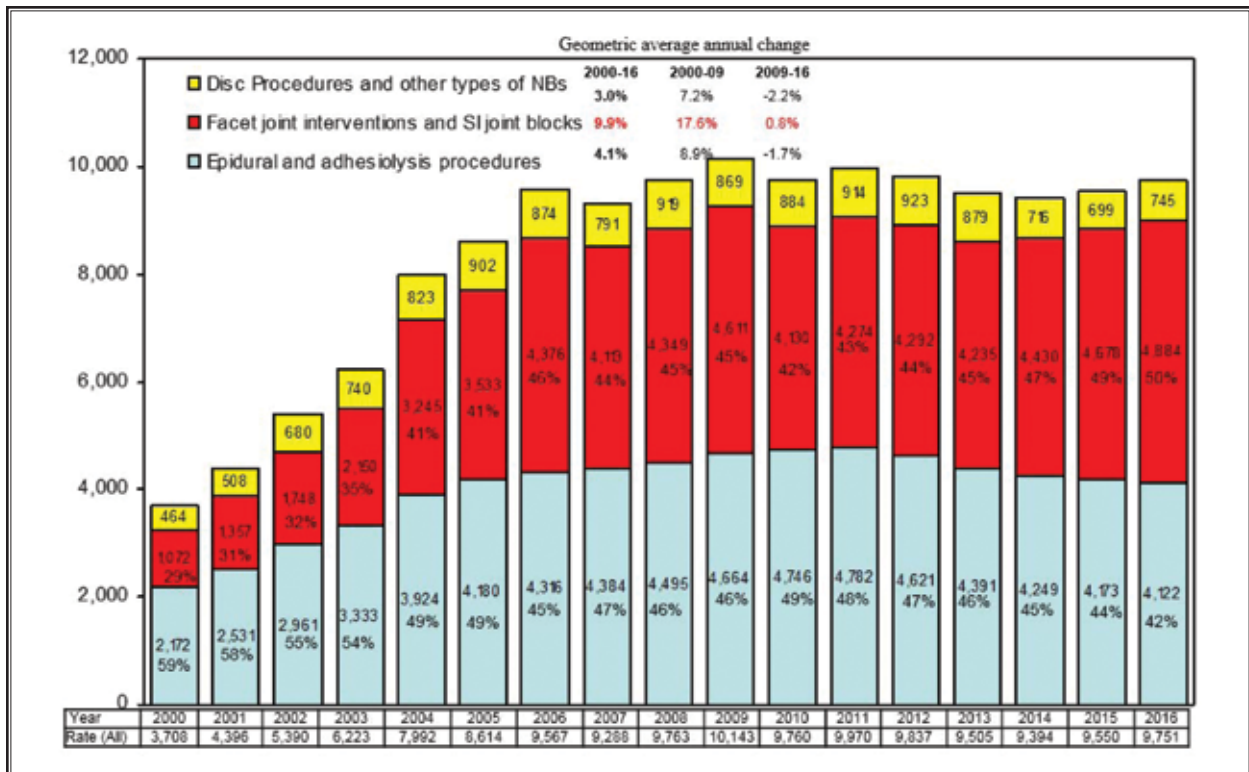


Fig. 3. Distribution of procedural characteristics (rates) by type of procedures from 2000 to 2016.



## Decline of Growth of Interventional Techniques

Table 3. Frequency of utilization of interventional pain management techniques from 2000 to 2016 in FFS Medicare recipients.

Specialty	Interventional Pain Management #		Surgical (Neuro, General, & Orthopedic)		Radiology (Interventional & Diagnostic)		Other Physicians		Other Providers (CRNA, NP, & PA)		Total	
	Services	Rate	Services	Rate	Services	Rate	Services	Rate	Services	Rate	Services*	Rate
2000	1,176,541 (80.1%)	2,969	92,126 (6.3%)	232	40,491 (2.8%)	102	145,100 (9.9%)	366	15,237 (1.0%)	38	1,469,495	3,708
2001	1,389,569 (78.9%)	3,470	105,075 (6.0%)	262	48,978 (2.8%)	122	196,311 (11.2%)	490	20,524 (1.2%)	51	1,760,456	4,396
2002	1,755,521 (80.4%)	4,334	123,403 (5.7%)	305	62,295 (2.9%)	154	218,870 (10.0%)	540	22,963 (1.1%)	57	2,183,052	5,390
2003	2,098,053 (82.0%)	5,102	133,165 (5.2%)	324	77,160 (3.0%)	188	229,010 (8.9%)	557	21,935 (0.9%)	53	2,559,323	6,223
2004	2,718,622 (81.5%)	6,515	168,669 (5.1%)	404	91,892 (2.8%)	220	329,705 (9.9%)	790	26,519 (0.8%)	64	3,335,047	7,992
2005	2,976,908 (81.3%)	7,005	183,972 (5.0%)	433	101,586 (2.8%)	239	367,303 (10.0%)	864	30,930 (0.8%)	73	3,660,699	8,614
2006	3,196,190 (77.1%)	7,375	211,580 (5.1%)	488	110,472 (2.7%)	255	589,835 (14.2%)	1361	38,047 (0.9%)	88	4,146,124	9,567
2007	3,405,892 (82.8%)	7,695	231,170 (5.6%)	522	111,423 (2.7%)	252	323,021 (7.9%)	730	39,621 (1.0%)	90	4,111,127	9,288
2008	3,670,828 (86.9%)	8,083	247,125 (5.6%)	544	117,388 (2.6%)	258	354,877 (8.0%)	781	43,193 (1.0%)	95	4,433,411	9,763
2009	3,879,520 (83.5%)	8,470	273,436 (5.9%)	597	123,228 (2.7%)	269	324,729 (7.0%)	709	44,766 (1.0%)	98	4,645,679	10,143
2010	3,917,426 (85.6%)	8,350	222,784 (4.9%)	475	121,127 (2.6%)	258	265,771 (5.8%)	567	51,869 (1.1%)	111	4,578,977	9,760
2011	4,159,585 (86.4%)	8,612	206,805 (4.3%)	428	127,614 (2.6%)	264	259,177 (5.4%)	537	62,492 (1.3%)	129	4,815,673	9,970
2012	4,302,121 (86.9%)	8,553	197,982 (4.0%)	394	129,823 (2.6%)	258	244,626 (4.9%)	486	73,422 (1.5%)	146	4,947,974	9,837
2013	4,331,789 (87.8%)	8,346	185,630 (3.8%)	358	119,172 (2.4%)	230	231,899 (4.7%)	447	64,460 (1.3%)	124	4,932,950	9,505
2014	4,467,374 (88.9%)	8,350	183,111 (3.6%)	342	119,684 (2.4%)	224	209,379 (4.2%)	391	46,356 (0.9%)	87	5,025,904	9,394
2015	4,693,156 (89.5%)	8,549	181,546 (3.5%)	331	121,344 (2.3%)	221	202,307 (3.9%)	369	44,683 (0.9%)	81	5,243,036	9,550
2016	4,961,640 (90.1%)	8,782	179,880 (3.3%)	318	126,493 (2.3%)	224	189,573 (3.4%)	336	51,720 (0.9%)	92	5,509,306	9,751
Change 2000–2016	322%	196%	95.3%	37.0%	212%	119%	30.6%	-8.4%	239.4%	138%	274.9%	163%
GM change	9.4%	7.0%	4.3%	2.0%	7.4%	5.0%	1.7%	-0.5%	7.9%	5.6%	8.6%	6.2%
Change 2000–2009	230%	185%	196.8%	157%	204.3%	163%	123.8%	94%	193.8%	154%	216.1%	174%
GM	14.2%	12.4%	12.8%	11.0%	13.2%	11.4%	9.4%	7.6%	12.7%	10.9%	13.6%	11.8%
Change 2009–2016	28%	3.7%	-34.2%	-47%	2.6%	-17%	-41.6%	-53%	15.5%	-6.3%	18.6%	-3.9%
GM	3.6%	0.5%	-5.8%	-8.6%	0.4%	-2.6%	-7.4%	-10.1%	2.1%	-0.9%	2.5%	-0.6%

Rate= interventional pain management services per 100,000 Medicare beneficiaries; ( ) percentage of row total; GM= geometric average annual change; # (interventional pain management, pain medicine, anesthesiology, psychiatry, neurology, and psychiatry)

Further analysis would show changes in code definitions, changes in coverage policies by Medicare carriers with substantial alteration in LCDs, and reductions in reimbursement also may have influenced utilization patterns (45,69-71). These indicate potential issues re-

lated to access and reimbursement.

The results of this analysis are similar to previous analyses in some aspects (8,28,29), while they differ significantly from other evaluations (63,64). The similarities with recent evaluations (8,28,29) indicate overall

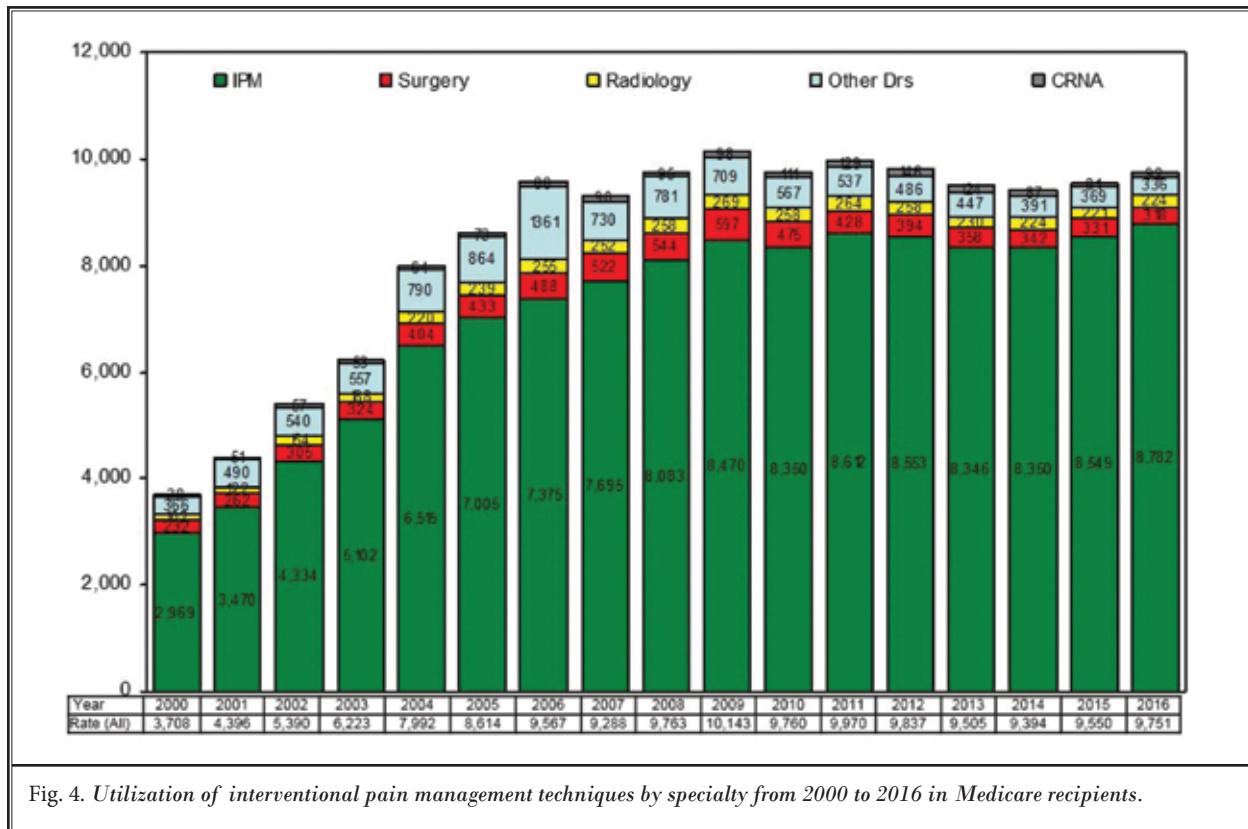


Fig. 4. Utilization of interventional pain management techniques by specialty from 2000 to 2016 in Medicare recipients.

growth or reversal of growth patterns are similar. As illustrated in Tables 1 – 4 and Figs. 1 – 4, the patterns in totality with global analysis are similar, whereas the comparative analysis prior to 2009 and after 2009, coinciding with the enactment of the ACA and multiple other regulations, shows vast differences. The results also differ similar to previous assessments (8,28,29) to assessments performed by Friedly et al (63,64) which were old studies and also focused on the escalating use of injection therapies in chronic low back pain and increases of interventional techniques, but ignoring the available evidence and overall population growth and Medicare population growth. Thus, these results are not only old, but may also not reflect the present atmosphere with the issuance of numerous CPT codes and regulations, including LCDs, with the changing dynamics in health care.

Present data shows rather substantial increases in the elderly and Medicare populations. The only surprise identified in this analysis was the decrease in patients below 65 years of age enrolled in Medicare with disabilities. This bracket showed an annual growth rate of 2.4% from 2009 to 2016, compared to an annual rate of

4% from 2000 to 2009. Considering that the disability has substantially increased in recent years, this finding reflects that these individuals have not been enrolled in Medicare as prior years and are diverted into Medicaid. Another unexpected finding is the overall decrease of epidural and adhesiolysis procedures of 1.7% from 2009 to 2016 at an annual rate, compared to an annual increase of 8.9% from 2000 to 2009. Since 2009, multiple LCDs have been enacted, essentially increasing the number of procedures which can be performed on individual patients in an overwhelming majority of states which followed the Noridian policies (69). These policies increased allowance of these procedures from 5 to 6 during the first year of treatment and from 4 to 6 in subsequent years. However, the previous analysis of usage patterns of epidural injections (29) showed the majority of the increases were with transforaminal epidural injections, whereas interlaminar epidural injections decreased significantly as per the philosophical approach of the Multi-Society Pain Workgroup (MPW) (45,71), promoting that technique. This also has been complicated by the decrease in reimbursement with bundling of fluoroscopy, without increase in the pay-

## Decline of Growth of Interventional Techniques

Table 4. Rate of utilization of interventional pain management techniques from 2009 to 2016 in FFS Medicare recipients by 2016 Medicare carrier contractors.

State	R2009	R2010	R2011	R2012	R2013	R2014	R2015	R2016	Change	RGM
<b>Cahaba</b>										
Alabama	13,026	13,278	13,704	14,007	12,666	12,494	12,513	12,971	-0.4%	-0.1%
Georgia	14,447	12,889	13,799	13,786	12,574	12,459	12,965	12,940	-10.4%	-1.6%
Tennessee	12,482	12,030	12,844	12,987	10,165	8,548	8,541	8,996	-27.9%	-4.6%
<b>Cahaba Total</b>	<b>13,398</b>	<b>12,704</b>	<b>13,452</b>	<b>13,577</b>	<b>11,788</b>	<b>11,157</b>	<b>11,369</b>	<b>11,639</b>	<b>-13.1%</b>	<b>-2.0%</b>
<b>CGS</b>										
Kentucky	10,683	10,602	11,199	12,197	12,302	11,590	11,870	12,287	15.0%	2.0%
Ohio	9,420	9,176	9,156	9,364	9,138	8,806	8,462	9,282	-1.5%	-0.2%
<b>CGS Total</b>	<b>9,779</b>	<b>9,583</b>	<b>9,741</b>	<b>10,177</b>	<b>10,050</b>	<b>9,608</b>	<b>9,443</b>	<b>10,142</b>	<b>3.7%</b>	<b>0.5%</b>
<b>First Coast</b>										
Florida	16,071	14,175	14,188	14,104	13,237	13,194	13,264	13,612	-15.3%	-2.3%
<b>NGS</b>										
Connecticut	6,392	6,503	6,955	7,100	7,124	7,326	7,230	7,440	16.4%	2.2%
Illinois	9,607	8,807	8,898	9,308	9,044	8,715	8,844	8,992	-6.4%	-0.9%
Massachusetts	7,379	7,891	8,828	9,423	9,420	9,172	9,186	9,314	26.2%	3.4%
Maine	6,186	6,055	6,570	6,920	6,823	7,488	7,570	6,811	10.1%	1.4%
Minnesota	5,561	5,381	5,453	5,504	5,173	4,826	4,837	4,903	-11.8%	-1.8%
New Hampshire	10,014	11,096	11,853	11,846	11,027	10,092	9,613	9,104	-9.1%	-1.4%
New York	5,866	5,929	5,993	6,080	6,498	6,745	7,012	6,933	18.2%	2.4%
Rhode Island	7,021	7,665	7,471	6,502	5,420	5,392	5,562	5,309	-24.4%	-3.9%
Vermont	6,258	6,080	6,066	5,839	6,119	6,246	6,638	6,429	2.7%	0.4%
Wisconsin	7,697	7,593	7,944	8,151	7,889	7,459	7,236	7,328	-4.8%	-0.7%
<b>NGS Total</b>	<b>7,151</b>	<b>7,082</b>	<b>7,335</b>	<b>7,542</b>	<b>7,529</b>	<b>7,447</b>	<b>7,531</b>	<b>7,543</b>	<b>5.5%</b>	<b>0.8%</b>
<b>Noridian</b>										
Alaska	5,342	5,686	5,627	5,478	6,389	6,721	8,809	8,117	51.9%	6.2%
Arizona	11,267	11,906	12,627	12,950	13,152	13,414	13,525	14,077	24.9%	3.2%
California	8,022	7,733	7,826	7,824	7,711	7,173	7,109	6,989	-12.9%	-1.9%
Idaho	7,407	7,187	7,829	7,599	7,537	7,839	8,239	7,807	5.4%	0.8%
Montana	7,600	6,647	7,276	7,050	6,979	6,842	7,047	6,955	-8.5%	-1.3%
North Dakota	8,124	7,681	6,961	7,110	7,452	7,603	7,378	7,639	-6.0%	-0.9%
Nevada	10,506	11,541	12,062	12,761	12,451	12,004	12,857	12,276	16.8%	2.2%
Oregon	4,228	4,271	4,448	4,587	4,804	4,612	4,755	4,822	14.0%	1.9%
South Dakota	11,980	10,233	10,006	9,106	9,220	8,843	9,007	9,111	-23.9%	-3.8%
Utah	11,133	11,430	11,897	13,446	13,843	14,834	15,914	16,177	45.3%	5.5%
Washington	6,164	5,958	5,787	5,318	5,341	4,985	4,926	5,009	-18.7%	-2.9%
Wyoming	7,071	7,423	6,569	6,687	7,557	8,016	8,047	8,452	19.5%	2.6%
<b>Noridian Total</b>	<b>8,104</b>	<b>7,994</b>	<b>8,163</b>	<b>8,209</b>	<b>8,211</b>	<b>7,923</b>	<b>8,014</b>	<b>7,992</b>	<b>-1.4%</b>	<b>-0.2%</b>
<b>Novitas</b>										
Arkansas	12,978	12,319	11,130	11,269	11,654	12,246	13,462	15,005	15.6%	2.1%
Colorado	7,218	7,465	7,800	8,439	8,469	8,655	8,778	9,420	30.5%	3.9%
DC	50,647	52,070	57,626	57,006	71,556	75,143	81,035	76,031	50.1%	6.0%

Table 4 (cont.). Rate of utilization of interventional pain management techniques from 2009 to 2016 in FFS Medicare recipients by 2016 Medicare carrier contractors.

State	R2009	R2010	R2011	R2012	R2013	R2014	R2015	R2016	Change	RGM
Delaware	9,341	9,169	9,479	9,741	10,457	11,203	12,217	12,635	35.3%	4.4%
Louisiana	10,800	10,654	11,289	11,701	12,175	12,161	12,195	12,244	13.4%	1.8%
Maryland	9,213	8,798	9,619	9,639	10,384	10,941	11,391	10,767	16.9%	2.3%
Mississippi	12,668	11,957	12,422	12,799	12,545	11,760	12,492	12,952	2.2%	0.3%
New Jersey	7,446	7,577	7,924	7,841	8,580	8,635	9,115	9,415	26.4%	3.4%
New Mexico	6,420	6,525	6,886	7,039	6,761	6,579	6,726	6,548	2.0%	0.3%
Oklahoma	9,923	9,862	10,561	11,055	11,356	12,511	14,052	13,671	37.8%	4.7%
Pennsylvania	6,878	7,075	7,298	7,409	7,791	7,868	7,776	7,911	15.0%	2.0%
Texas	16,025	13,916	13,839	12,916	12,214	12,291	12,607	12,957	-19.1%	-3.0%
Novitas Total	10,952	10,366	10,622	10,502	10,654	10,834	11,237	11,497	5.0%	0.7%
<b>Palmetto GBA</b>										
North Carolina	10,677	10,265	10,448	10,613	9,977	9,274	9,618	10,150	-4.9%	-0.7%
South Carolina	12,800	13,018	13,756	14,276	14,423	14,399	14,622	14,348	12.1%	1.6%
Virginia	7,259	6,873	7,307	7,361	7,837	8,335	8,729	8,971	23.6%	3.1%
West Virginia	6,475	6,747	7,115	7,742	8,082	7,886	7,384	8,118	25.4%	3.3%
Palmetto Total	9,648	9,451	9,850	10,103	10,098	9,947	10,209	10,488	8.7%	1.2%
<b>WPS</b>										
Iowa	6,025	6,061	6,405	6,415	6,317	6,027	6,440	6,866	14.0%	1.9%
Indiana	11,191	11,484	12,158	12,278	11,607	11,819	12,202	12,232	9.3%	1.3%
Kansas	10,747	10,819	11,306	11,113	11,013	10,968	11,092	10,882	1.3%	0.2%
Michigan	14,822	14,915	14,751	14,660	14,309	14,332	13,898	12,899	-13.0%	-2.0%
Missouri	12,001	11,874	12,112	12,205	11,581	11,767	11,211	10,920	-9.0%	-1.3%
Nebraska	8,013	7,535	7,471	7,770	7,624	7,786	7,965	8,452	5.5%	0.8%
WPS Total	11,806	11,864	12,083	12,103	11,711	11,778	11,658	11,307	-4.2%	-0.6%
<b>US Total</b>	<b>10,143</b>	<b>9,760</b>	<b>9,970</b>	<b>9837</b>	<b>9,505</b>	<b>9,394</b>	<b>9,550</b>	<b>9,751</b>	<b>-3.9%</b>	<b>-0.6%</b>

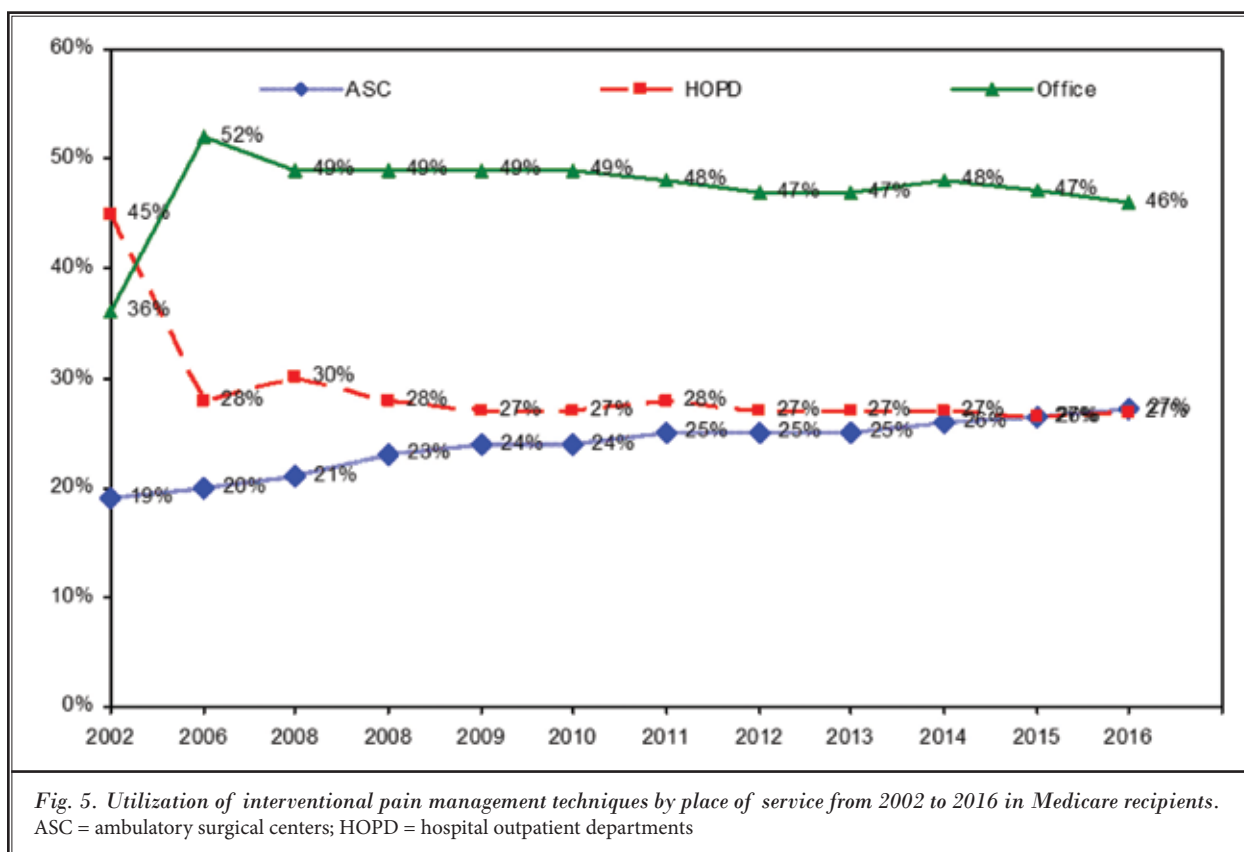
The US total included DC, Hawaii/Guam, Puerto Rico/Virgin Islands, and Railroad FFS Medicare data, but the state data included only FFS Medicare

ment rate for physicians in 2014 (6,72). It is also conceivable that 2017 and beyond may demonstrate such declines due to 25% reductions in reimbursements for interlaminar epidural injections in ambulatory surgery center and hospital settings (7,73). Other factors for epidural injections may include non-coverage policies by Noridian for percutaneous adhesiolysis procedures, which have declined significantly since 2009 (74,75). The next group of procedures with a decline in usage patterns includes disc procedures and other types of nerve blocks. These procedures are performed infrequently. However, their usage has increased from a proportion of 1.5% of all interventional techniques in 2000 to 7.6% in 2016.

Disc procedures continue to decline because of noncoverage policies. The exception to the epidural

and adhesiolysis procedures and disc procedures and other nerve blocks is a slight annual increase of facet joint interventions and sacroiliac joint injections of 0.8% from 2009 to 2016, compared to annual increase of 17.6% from 2000 to 2009. The decline may have been subdued because of various factors including those of LCDs from Noridian, which have been adapted by multiple other states (70). These LCDs essentially increased the number of facet joint nerve blocks to be performed per year from a total of 4 to 5 in the therapeutic phase. In addition, LCDs for sacroiliac joints continue to lack, which may have attributed to increases. Further, major increases have been shown to be due to the increasing utilization of radiofrequency neurotomy procedures, as shown in previous assessments (28).

## Decline of Growth of Interventional Techniques



We also assessed state utilization patterns of interventional techniques based on Medicare carriers from 2009 to 2016, as shown in Table 4. We expected to see a major decline in utilization in the Noridian states based on restrictive LCDs (65,69,70,74), noncoverage policies (74), and lack of LCDs for some procedures. However, this analysis has not confirmed these assumptions, as the highest increases were observed in Alaska, followed by Utah, with rates of 6.2% and 5.5% respectively. A few Noridian states also showed minor decreases with an overall decrease of 0.2%, compared to an overall national decrease of 0.6%. The highest decline was observed in the Cahaba coverage areas of Alabama, Georgia, and Tennessee with a 2% decline. Major carriers covering a large proportion of the United States, namely NGS and Novitas, showed a small increase of 0.8% and 0.7% respectively.

Multiple limitations of this study include its retrospective nature, the lack of differentiation of individual procedures in each category and the lack of inclusion of Medicare Advantage enrollees which constitutes approximately 30% of the population. Further, Medicare Advantage is also riddled with numerous disadvantages

of lack of coverage for various interventional techniques not covered by Medicare with a LCD or noncovered by Noridian, such as percutaneous adhesiolysis.

This study does not differentiate the type of individual procedures within each category such as transforaminal epidural injections versus interlaminar epidural injections or radiofrequency neurolysis versus facet joint blocks. Analyses of such factors will yield further understanding as shown in previous assessments. Further, such an analysis may also yield even more decreases in utilization patterns for certain procedures and increases in utilization for others.

Overall, we have discussed various issues related to the assessment of the utilization and misconceptions in previous manuscripts (8,28,29). Increased utilization was based on allegations that physicians simply overused these procedures in the face of lack of evidence. However, these arguments were counteracted by increasing prevalence and its impact on the health of chronic pain and the opioid epidemic (22,76-80). Nevertheless, these allegations do not explain the declines in usage patterns from 2009 to 2016. The same arguments of the lack of evidence and the lack of increase in chronic pain

continue to be incorporated in their arguments; however, this analysis clearly shows a decline in utilization despite the increase in the Medicare population and effectiveness literature. Thus, the changes in utilization patterns may not be based on LCDs, which occasionally promote higher utilization, but at the same time limit with other stricter regulations. However, the decrease in coverage, despite the increase in insurance rates as per the ACA, may have influenced the Medicare population even though this has been to a greater extent with Medicaid, commercial insurance, those insured under the ACA, and, finally, Medicare Advantage plans.

In summary, what has been described as an explosive growth of interventional techniques has shown a reversal with an overall decline which may be based on factors outside of the focus on medical necessity and proper indications, which include reduced coverage despite the increasing insured population and Medicare population. While this data is limited to the FFS Medicare population, we expect that these patterns are more severe with decline in coverage for Medicaid, commercial insurers, Medicare Advantage Plans, and those insured under the ACA with special policies. Overall, a decline is refreshing compared to increases, but a decline must not be due to a decline in coverage or a shift of coverage to expensive procedures and must be based on increased access to insurance and coverage. Further analyses of data of individual procedures will shed light onto these factors as previously analyzed data (28,29).

## **CONCLUSION**

From 2009 to 2016, interventional techniques decreased at an annual rate of 0.6% with an overall decrease of 3.9%, compared to an overall increase of 173.6% from 2000 to 2009 with an annual increase of 11.8%. These changes in utilization patterns from 2009 to 2016 are significant in that they are lower than the increase of the US total population of 0.7%, the increase in US population of > 65 years of age of 3.2% annual

increase, and, finally, an annual increase of 3% of the number of individuals participating in FFS Medicare. Further analyses of the data into individual procedures will yield further insights into utilization patterns.

## **Author Contribution**

LM, VP, and JH conceived the concept and design, VP performed statistical analysis, and LM and JH coordinated the preparation of the manuscript.

AS, DM, and SB approved the concept and design and participated in the preparation of the manuscript and review.

All authors unanimously approved the final manuscript.

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