

Health Policy Review

Update on Reversal and Decline of Growth of Utilization of Interventional Techniques In Managing Chronic Pain in the Medicare Population from 2000 to 2018

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Background: The cost of US health care continues to increase, with treatments related to low back and neck pain and other musculoskeletal disorders accounting for the third highest amount of various disease categories. Interventional techniques for managing pain apart from conservative modalities and surgical interventions, have generally been thought to be growing rapidly. However, a recent analysis of utilization of interventional techniques from 2000 to 2016 has shown a modest decline from 2009 to 2016, compared to 2000 to 2009.

Objectives: The objectives of this analysis include providing an update on utilization of interventional techniques in managing chronic pain in the Medicare population from 2009 to 2018 in the fee-for-service (FFS) Medicare population of the United States.

Study Design: Utilization patterns and variables of interventional techniques in managing chronic pain were assessed from 2000 to 2009 and from 2009 to 2018 in the FFS Medicare population of the United States.

Methods: The data for the analysis was obtained from the master database from the Centers for Medicare & Medicaid Services (CMS) physician/supplier procedure summary from 2000 to 2018. The analysis of data showed that there was a decline in utilization of interventional techniques from 2009 to 2018 of 6.7%, with an annual decline of 0.8% per 100,000 FFS Medicare population, despite an increase of 0.7% per year of population growth (3.2% of those 65 years or older) and a 3% annual increase in Medicare participation from 2009 to 2018. Medicare data from 2000 to 2009 showed an increase of 11.8% per year per 100,000 individuals of the Medicare population. The 2009 to 2018 data also showed a 2.6% annual decrease in the rate of utilization of epidural and adhesiolysis procedures per 100,000 population of FFS Medicare, and a 1% decrease for disc procedures and other types of nerve blocks, while there was an increase of 0.9% annually for facet joint interventions and sacroiliac joint blocks.

Limitations: Limitations of this analysis include: only the Medicare population was utilized, and among the Medicare population, only the FFS population was evaluated; utilization patterns in Medicare Advantage Plans, which constitutes almost 30% of the population were not considered. Further, the utilization data for individual states was sparse and may not be accurate.

Conclusion: The decline in utilization of interventional techniques continued from 2009 to 2018 with 6.7% per 100,000 Medicare population, with an annual decline of 0.8%, despite an increase in the population rate and Medicare enrollees of 0.7% and 3% annually.

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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The US Federal Government Actuary estimated that US health care spending reached \$3.65 trillion in 2018 (1). 2018 expenditures increased 4.4% over 2017; however, the national health expenditures survey and estimations forecast an average annual growth rate of 5.5% from 2018 to 2027 (2). The 2018 cost of \$3.65 trillion in spending represents \$11,212 per person. In particular, US spending on personal and public health care from 1996 to 2013 (3), showed an estimated spending of \$87.6 billion in managing low back and neck pain and \$95.5 billion in managing musculoskeletal disorders, yielding a total spending on musculoskeletal disorders and low back and neck pain of approximately \$183 billion. \$183 billion is the third highest amount of the various disease categories (3).

The description of the US Burden of Disease Collaborations and the State of US health care from 1990 to 2010 accounted for nearly half of the US healthcare burden to morbidity and chronic disability (4). Low back pain was rated as number one, other musculoskeletal disorders ranking number 2, with neck pain ranking number 3, and depression and anxiety as number 4 and 5, among the 30 leading diseases and injuries contributing to years lived with a disability, all inter-related with chronic pain.

Based on the current regulations, national health-care spending is projected to grow to nearly \$6 trillion by 2027 (2). Public spending also continues to increase with most of the growth due to higher prices, but with administrative costs increasing rapidly compared to other services (1,2). Apart from increased government spending on health care, faster inflation also attributed to increased costs; however, the focus of policymakers and the public continues to be on reducing the utilization or provider reimbursement rates to reduce health care expenditures. In fact, with the Affordable Care Act (ACA) or Obamacare, the most monumental change in the US health care policy since the passage of Medicare and Medicaid in 1965, was enacted the 3 primary goals were increasing the number of insured, improving the quality of care, and controlling health care costs (5,6). The ACA, while increasing the number of insureds (affordability), does not appear to have increased access to (health care). With increasing regulations, administrative expenses for all sectors, payers, and providers continue to escalate (7-13). Consequently, interventional techniques, which are some of the commonly utilized treatments in managing chronic pain have been under scrutiny, not only for their utilization, but

for clinical and cost utility, medical necessity and indications. Importantly, over the years, all modalities of pain management have shown significant escalation in utilization, including opioids. Prescription opioids have helped result in the creation of the opioid epidemic and escalating deaths, even though in recent years there have been declines in prescriptions as well as prescription opioid related deaths (14-29).

The utilization patterns of interventional techniques have been well studied with overall increases until 2009 and an overall decline since 2009 (30-37). These studies also showed a reversal of the utilization ratio of interlaminar epidurals to transforaminal epidurals from 7 in 2000 to one in 2016, the ratio of lumbosacral facet joint injections compared to facet neurolysis procedures decreasing from 6.7% in 2009 to 2.2% in 2016; that is radiofrequency procedures have increased relative to facet medial branch blocks (30-34). Similarly, the ratio of cervicothoracic facet joint injections compared to neurolytic procedures decreased from 8.85% in 2000 to 2.8% in 2016. Similar results were shown for radiofrequency ablation vs facet nerve blocks from 2007 to 2016 (38).

Further, there is an extensive literature demonstrating the clinical and cost utility of various interventional techniques in the form of randomized controlled trials, systematic reviews, cost utility analysis, and evidence for real-world scenarios (39-65). However, discordant opinions and conclusions, with lack of agreement between proponents and opponents of the effectiveness and appropriateness of multiple interventional techniques continues (56-58). While the opponents cite lack of effectiveness, proponents emphasize evidence for conflicts of interest, or confluence of interest in interpretation leading to inappropriate conclusions as the basis of discordant results. In fact, multiple factors have been described in reference to the evidence-based medicine (EBM) and its survival into the future in the era of inappropriate evidence synthesis and application of these standards to the public in general, based on numerous conflicts and confluence of interest (56-58).

There have been attempts to control the utilization of interventional techniques by a variety of means, including reimbursement reductions, coding changes, bundling, local coverage determinations (LCDs), and increased oversight from various agencies. These aspects are augmented by opponents citing the lack of effectiveness.

This retrospective cohort study of utilization patterns of interventional techniques evaluates the period

covering 2000 to 2018, updating previous publications (30-35,38) examining the US FFS Medicare population.

METHODS

Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidance (66) was utilized in performing the study. The public use files or non-identifiable data, which is non-attributable and non-confidential, available through the Centers for Medicare & Medicaid Services (CMS) database was utilized (67).

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 2018 in the Medicare FFS population in the United States, with inclusion of the majority of the interventional techniques. Excluded procedures included 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 (67).

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 2018.

Variables

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

Historically, 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), and 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), and 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 2018 as follows:

- Epidural and adhesiolysis procedures (CPT 62280, 62281, 62282, 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 2018 (67). 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 100% dataset from CMS 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 American 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 (68,69), due to the finding that a significant proportion of patients below the age of 65 undergo interventional techniques (70,71). With emerging affordable insurance under Obamacare, increasing disability, and increasing population over the age of 65, Medicare represents the second largest health care payer next to Medicaid in the United States, with over 59.6 million beneficiaries in 2018 (72). 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 2018.

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 2018.

Descriptive Data of Population Characteristics

As shown in Table 1, from 2000 to 2018, the US population older than 65 years of age increased 49.2% at an annual growth rate of 2.2%, compared to the total US population of 15.9% at an annual growth rate

of 0.8%. The US population grew at an annual rate of 0.9% from 2000 to 2009, compared to 0.7% from 2009 to 2018. 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 2018. The number of individuals participating in Medicare grew at an annual rate of 2.3%, 1.6%, and 3% from 2000 to 2018, 2000 to 2009, and 2009 to 2018 respectively.

The rate of interventional pain management services per 100,000 individuals of the Medicare population declined from 2009 to 2018 at an annual rate of -0.8%, in contrast to an annual growth rate of 5.3% and 11.8%, from 2000 to 2018, and from 2000 to 2009, respectively. Figure 1 shows a comparative analysis of annual US population growth, Medicare participation, and utilization of interventional pain management services.

Utilization Characteristics

Table 2 and Figs. 2 to 4 show the utilization characteristics of interventional techniques in the FFS Medicare population from 2000 to 2018.

Table 2 and Fig. 2 show a decline of overall interventional technique at an annual rate of 0.8% per 100,000 individuals of the Medicare population, with epidural and adhesiolysis procedures declining at 2.6%, disc procedures and other types of nerve blocks declining at 1%, with an increase of 0.9% for facet joint interventions and sacroiliac joint blocks from 2009 to 2018. In contrast, prior years showed significant increases.

Specialty Characteristics

[Appendix Table 1](#) and [Appendix Fig. 1](#) show frequency of utilization of interventional pain management techniques based on specialty designation.

State Distribution Characteristics

[Appendix Table 2](#) shows the rate of utilization of interventional pain management techniques from 2009 to 2018 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 0.3%. This included the highest growth rate states of Alaska and Utah at 5% and 4.2%, with high growth rate states of Arizona at 3.2%. The highest decreases in Noridian states were observed in the state of California at 2.2%, followed by Washington of 1.7% even though their base utilization rate was 8,022 for California and 6,164 for Washington, compared to 10,143 nationwide.

Reversal of Growth of Interventional Techniques In Chronic Pain in the Medicare Population

Table 1. A summary of the frequency of utilization of various categories of interventional procedures in the FFS Medicare population from 2000 to 2018.

Year	U.S. Population			Fee-for-service Medicare Beneficiaries				Utilization of all interventional techniques			
	Total Population (,000)	≥ 65 Years (,000)		Number of individuals participating in Medicare	% to U.S. 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								
2000	282,172	35,077	12.40%	39,632	14.0%	34,262 (86.5%)	5,370 (13.5%)	1,469,495	-	3,708	-
2001	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%
2002	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%
2003	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%
2004	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%
2005	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%
2006	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%
2007	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%
2008	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%
2009	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%
2010	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%
2011	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%
2012	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%
2013	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%
2014	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%
2015	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%
2016	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%
2017	326,625	51,055	15.63%	58,000	17.8%	49,200 (84.8%)	8,900 (15.3%)	5,558,893	0.9%	9,584	-1.7%
2018	327,167	52,347	16.00%	59,600	18.2%	50,800 (85.2%)	8,800 (14.8%)	5,639,608	1.5%	9,462	-1.3%
Percentage of change from 2000 to 2018											
Change	15.9%	49.2%		50.4%		48.3%	63.9%	283.8%		155.2%	
GM	0.8%	2.2%		2.3%		2.2%	2.8%	7.8%		5.3%	
Percentage of change from 2000 to 2009											
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%	

Table 1 (cont.). A summary of the frequency of utilization of various categories of interventional procedures in the FFS Medicare population from 2000 to 2018.

Year	U.S. Population			Fee-for-service Medicare Beneficiaries				Utilization of all interventional techniques			
	Total Population (,000)	≥ 65 Years (,000)		Number of individuals participating in Medicare	% to U.S. 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								
Percentage of change from 2009 to 2018											
Change	6.6%	32.3%		30.1%		33.1%	15.4%	21.4%		-6.7%	
GM	0.7%	3.2%		3.0%		3.2%	1.6%	2.2%		-0.8%	

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

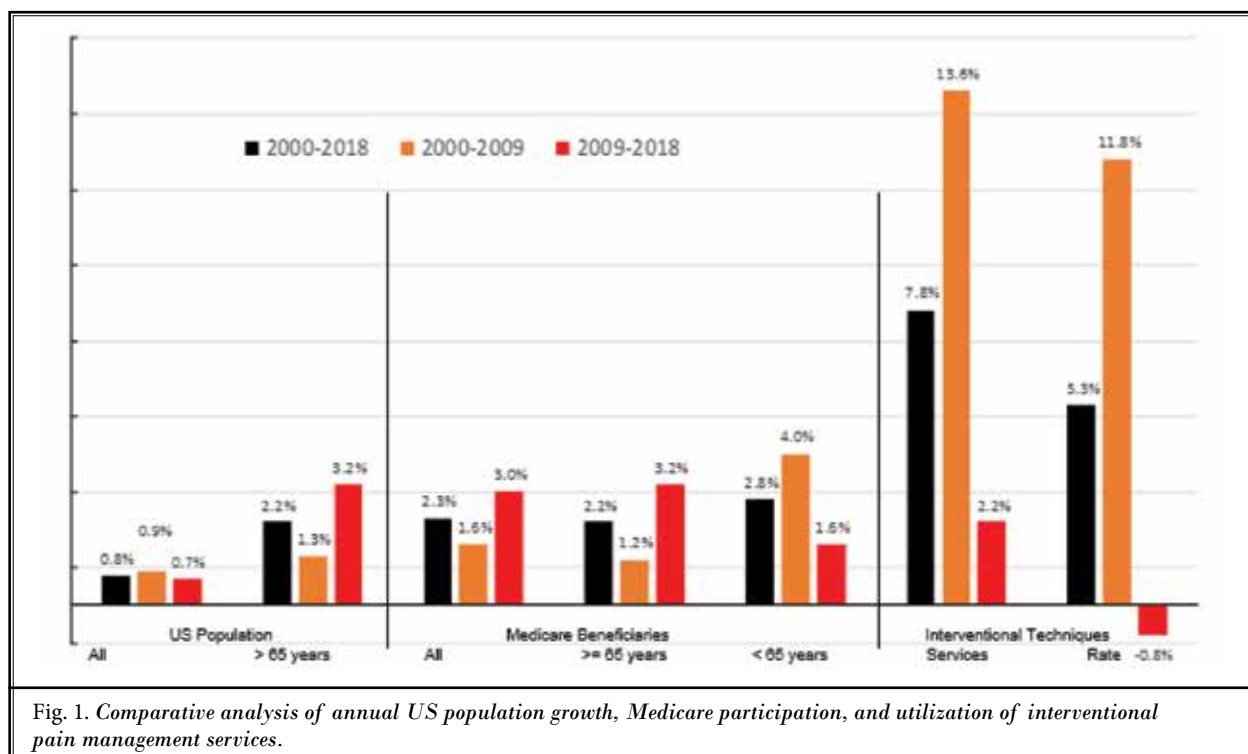


Fig. 1. Comparative analysis of annual US population growth, Medicare participation, and utilization of interventional pain management services.

Table 2. The frequency of utilization of interventional techniques in the FFS Medicare population from 2000 to 2018.

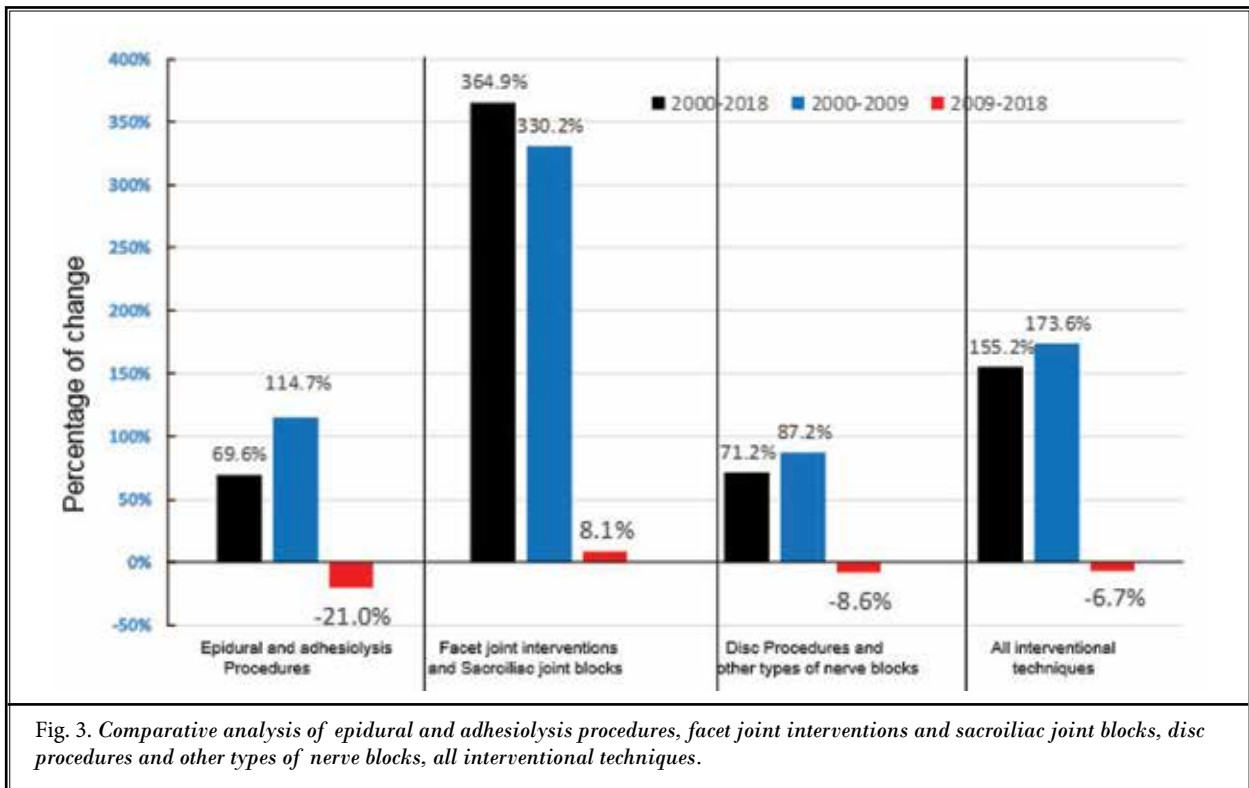
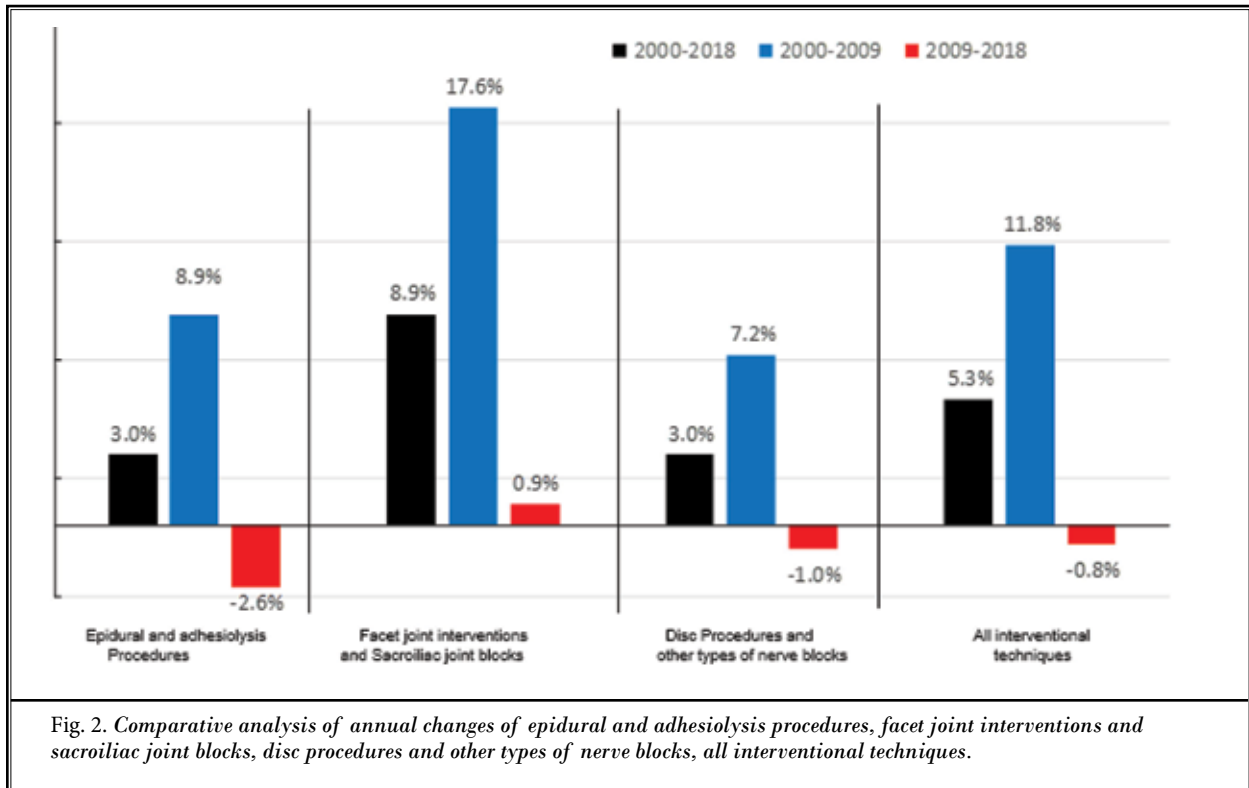
	Epidural and adhesiolysis procedures		Facet joint interventions and Sacroiliac joint blocks		Disc Procedures and other types of nerve blocks		Utilization of all interventional techniques*			
	Services (Facility %)	Rate	Services (Facility %)	Rate	Services (Facility%)	Rate	Services (Facility%)	% of Change 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%

Reversal of Growth of Interventional Techniques In Chronic Pain in the Medicare Population

Table 2 (cont.). *The frequency of utilization of interventional techniques in the FFS Medicare population from 2000 to 2018.*

	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
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%
2017	2,258,726 (54%)	3,894	2,862,876 (49%)	4,936	437,289 (43%)	754	5,558,893 (51%)	0.9%	9,584	-1.7%
2018	2,196,060 (54%)	3,685	2,970,100 (50%)	4,983	473,448 (44%)	794	5,639,608 (51%)	1.5%	9,462	-1.3%
Change from 2000 to 2018										
Change	155.1%	69.6%	599.2%	364.9%	157.4%	71.2%	283.8%		155.2%	
GM	5.3%	3.0%	11.4%	8.9%	5.4%	3.0%	7.8%		5.3%	
Change from 2000 to 2009										
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%	
Change from 2009 to 2018										
Change	2.8%	-21.0%	40.6%	8.1%	19.0%	-8.6%	21.4%		-6.7%	
GM	0.3%	-2.6%	3.9%	0.9%	1.9%	-1.0%	2.2%		-0.8%	

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)



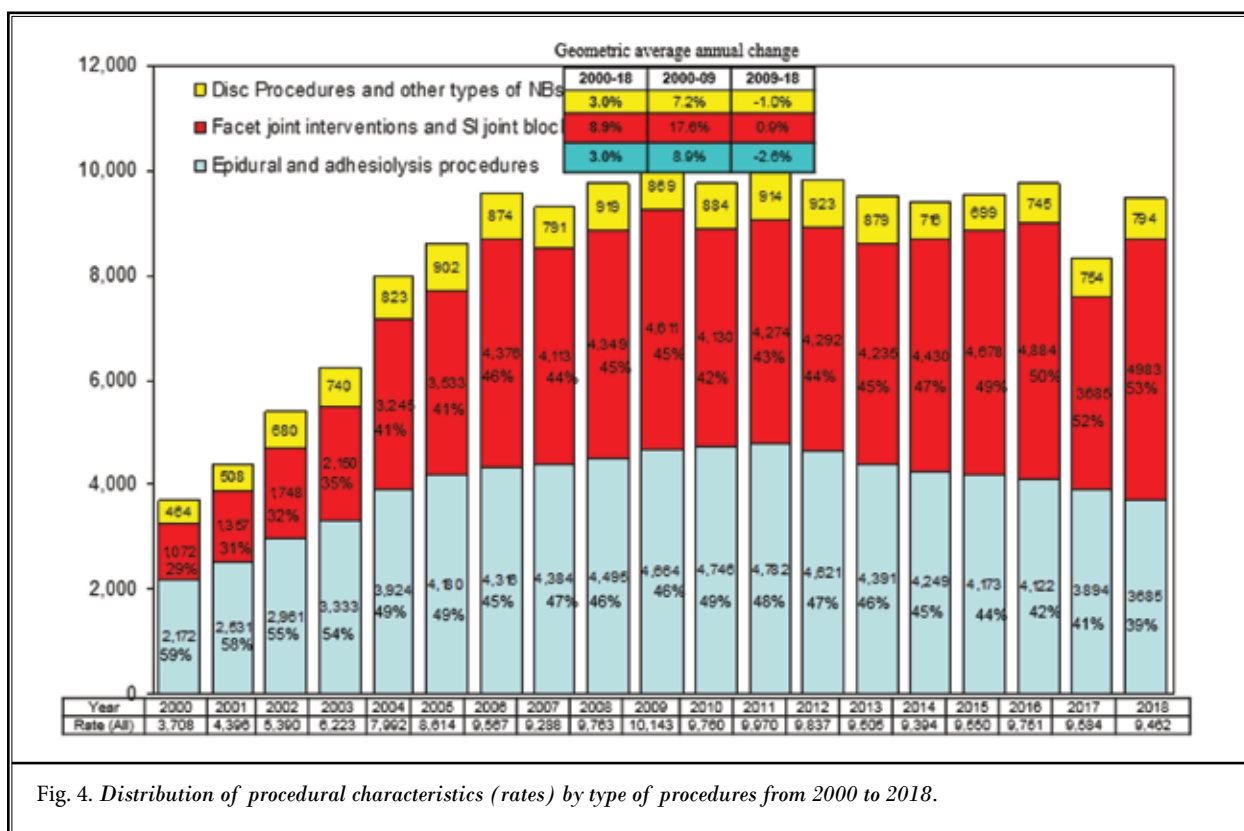


Fig. 4. Distribution of procedural characteristics (rates) by type of procedures from 2000 to 2018.

We also assessed the rate of utilization of interventional pain management techniques from 2009 to 2018 based on the rates of highest to lowest utilization as shown in [Appendix Table 3](#). In addition, [Appendix Table 4](#) shows highest to lowest based on proportion of change from 2009 to 2018 with Alaska showing the most increases, followed by Oklahoma, Utah, Delaware, whereas Rhode Island, followed by Tennessee, Michigan, Texas, and Alabama showing the most declines. [Appendix Table 5](#) also shows percent of change in the services from 2009 to 2018 based on alphabetical order.

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.

Services Compared to Rate

This manuscript provides both total number of

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

DISCUSSION

This updated assessment of utilization data of interventional techniques for chronic pain and the Medicare FFS population from 2000 to 2018 shows shifts from 2009 to 2018, compared to 2000 to 2009. These periods may be described as pre-ACA from 2000 to 2009 and post ACA from 2009 to 2018. Overall, interventional techniques declined at an annual rate of -0.8% from 2009 to 2018 compared to the US population growth increase of 0.7%, elderly of 3.2%, and Medicare population of 3%. The decline accelerated from -0.6% from 2009 to 2016 to -0.8% annual rate from 2009 to 2018 showing further declines in 2017 and 2018 compared to mild increases in 2015 and 2016 as shown in Table 1. This is in stark contrast to an annual increase of 11.8% from 2000 to 2009. However, of significant importance is the decline in the rate of epidural and ad-

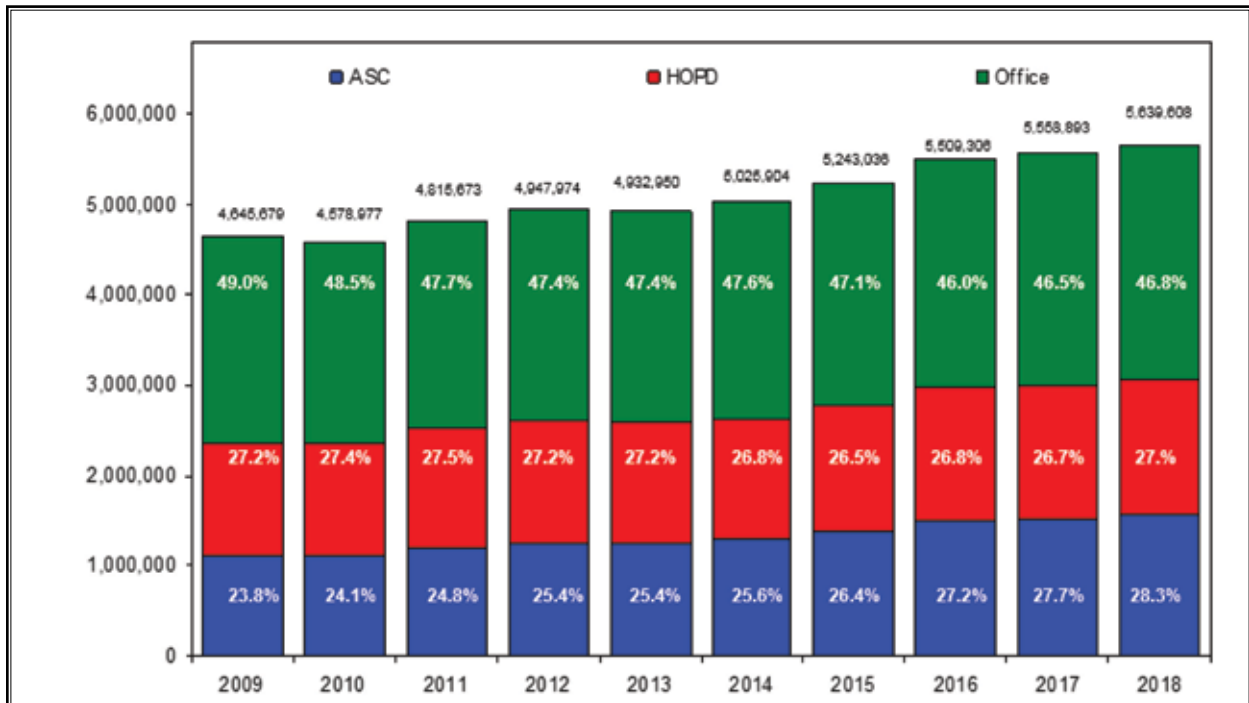


Fig. 5. Utilization of interventional pain management techniques by place of service from 2009 to 2018, in Medicare recipients.

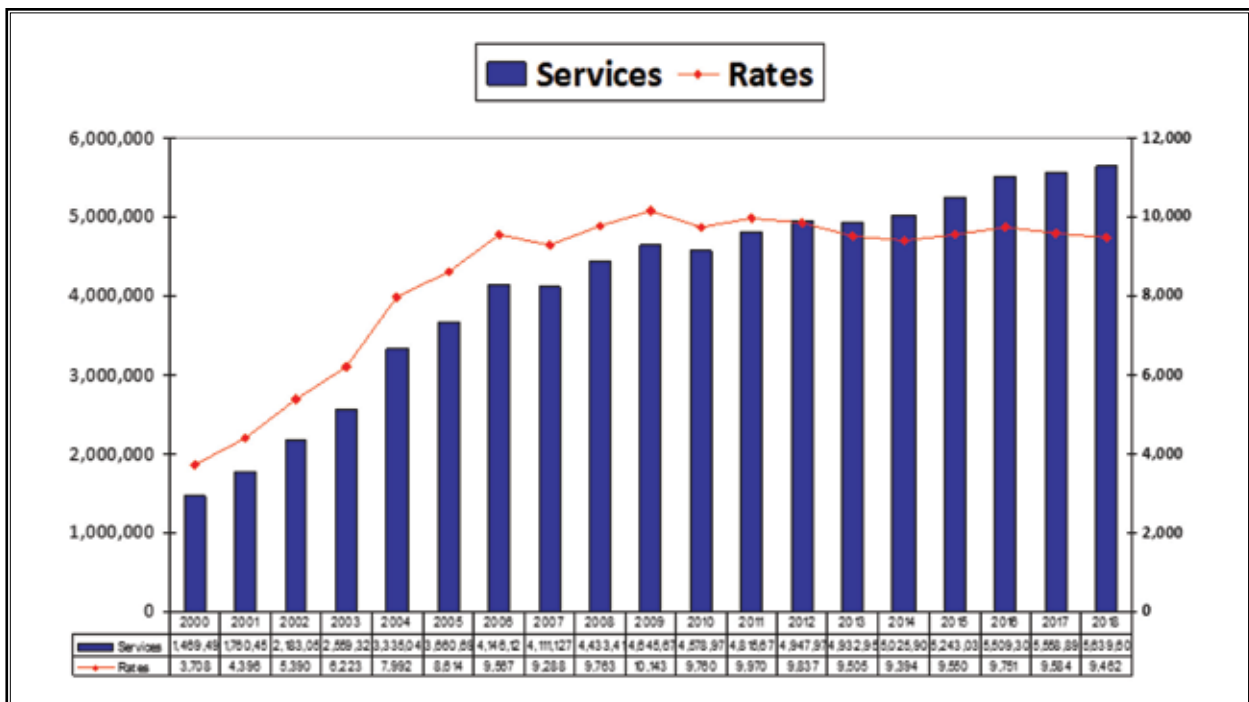


Fig. 6. Utilization of interventional pain management techniques services & rates, in Medicare recipients.

hesiolysis procedures of -2.6% annual rate compared to an annual increase of 8.9% from 2000 to 2009. Similar declines were also observed with disc procedures and other types of nerve blocks with an annual decline of -1% from 2009 to 2018 compared to a 7.2% increase from 2000 to 2009. Facet joint and sacroiliac joint interventions, in fact, was the only category with increases in utilization patterns of 0.9% annual rate from 2009 to 2018, whereas this annual rate of increase was 17.6% from 2000 to 2009. Overall, these findings confirm our findings from our previous publications (30-35) with continued decline and reversal of growth patterns.

Among the other data of this assessment, the US population growth decreased from an annual rate of 0.9% to 0.7% during the comparison periods of 2000 to 2009 and 2009 to 2018, whereas the US population over the age of 65 years increased at an annual rate of 1.3% and 3.2%, respectively. In addition, the number of individuals participating in Medicare also showed significant growth at an annual rate of 3% from 2009 to 2018, compared to 1.6% from 2000 to 2009. However, the enrollment of those individuals with disabilities below 65 years of age has declined to 1.6% of annual growth from 2009 to 2018, compared to 4% annual growth from 2000 to 2009.

This analysis once again reaches discordant conclusions compared to our own prior publications and publications by other authors (30-35,38,68,73), which continue to show increases. However, continuous data collection from prior years to the present will show increases as in this manuscript, due to extensive increases in earlier years. Consequently, separation of these 2 groups to pre and post-ACA before and after 2009 appropriately analyzes the results and removes the misconceptions. Overall, there have been significant increases of utilization of interventional techniques from 2000 to 2018 with 155.2% with an annual rate of 5.3%. However, all the increases were from 2000 to 2009 of 173.6% with an annual rate of 11.8%. The decline or reversal of growth patterns may be attributed to ACA enacted in 2010; a multitude of regulations focusing on decreasing utilization, increasing regulatory aspects that started in early 2009 with the passage of the Stimulus Act (74) and expanded with other regulations (5-8). In addition, as described in the above tables, the changes in coverage policies by Medicare carriers with modifications in LCDs, and reductions in reimbursement also have influenced utilization patterns (7,8,30-35,75-79). Thus, the changes may be related to reduced reimbursement and decreased access.

This updated analysis shows very similar results to our previous publications (30-35,70,80). However, they differ significantly from other evaluations (38,68,69,73). However, our results are in contrast to more recent publication by Starr et al (38). In that manuscript, the authors described trends in lumbar radiofrequency ablation utilization from 2007 to 2016 with inclusion of an explosive era of increase until 2009.

The present data continue to show increases in the elderly and Medicare populations. However, the population below the age of 65 appears to have been increasing at higher rates than in the elderly. There were no surprises in reference to utilization by states despite differences in policies developed by Noridian and notwithstanding allowed increased utilization rates in all states except Kentucky, Ohio, and Florida. Similar to interventional techniques, many other services also have seen changes in utilization. As an example, beginning in 2004, CMS implemented a series of reductions (81,82) in the physician fees for inpatient and outpatient testing and facility fees for cardiovascular diagnostic testing, due to significant geographic variations in use and expenses of these tests, and concern for potential overuse of these tests (83,84). In the face of these reimbursement changes, the overall rate of testing has modestly declined (85-87). Further, a recent analysis of trends in high- and low-value cardiovascular diagnostic testing from 2000 to 2016 showed considerable decline of overall and low-value diagnostic cardiovascular testing, whereas rates of high-value testing have increased slightly. Thus, payment changes intended to reduce spending on overall testing may not have adversely affected testing recommended by guidelines. However, analysis did not show the costs of the testing and shifting of services from office practices to hospital settings.

Limitations of the current 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 constitute approximately 30% of the Medicare population. Further, this analysis does not identify specific approaches with each modality of treatment in the various categories, such as facet joint nerve blocks versus radiofrequency neurotomy, and interlaminar epidural versus transforaminal epidural injections. We have analyzed these data elsewhere and showed significant differences in the growth patterns, with increases in utilization of transforaminal and facet joint neurolysis procedures (31-33).

Overall, since the previous publications, further literature has been accumulating and the credibility of EBM, specifically its applications in dietary guidelines have brought various issues into focus, creating questions about the evidence synthesized by some authors with negative reviews on interventional pain management (40-45,47,48,50-60,88). Indeed, we believe that the literature shows that differences in conclusions may be based on investigator preference, lack of understanding of the basis of procedural aspects, lack of clinical experience, and conflicts of interest, and confluence of interest (89-95). The overall mass production of redundant, often misleading, and conflicted systematic reviews and meta-analyses (96), as well as the value and sustainability of EBM has been questioned (94,95). Consequently, RCTs, systematic reviews and guidelines may vary, and none of these manuscripts considered highly methodological do not guarantee corresponding methodological and reporting rigor (96-101).

The issues related to multiple publications on pain were highlighted by Riado Minguez et al (97), whereas Manchikanti et al (56) highlighted the effectiveness of percutaneous adhesiolysis in post lumbar surgery syndrome in a systematic analysis of findings of systematic reviews. Declines are not related to clinical effectiveness or cost effectiveness. Indeed, issues with EBM presented in numerous trials, systematic reviews, meta-analysis, as well as bias in reporting with inappropriate assessments have been noted by multiple authors, including Guyatt's group (96-110).

CONCLUSION

This analysis shows that from 2009 to 2018, not only was there a reversal of growth patterns of interventional pain procedures, but also actual declines in procedures, despite increases in the total US population, elderly population, and number of Medicare recipients.

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[Appendix Figure](#)

[Appendix Table 1](#)

[Appendix Table 2](#)

[Appendix Table 3](#)

[Appendix Table 4](#)

[Appendix Table 5](#)

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