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HOT TOPICS IN PAIN AND HEADACHE (N ROSEN, SECTION EDITOR)

Utilization Patterns of Facet Joint Interventions in Managing Spinal Pain: a Retrospective Cohort Study in the US Fee-for-Service Medicare Population

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Abstract

Purpose of Review To assess patterns of utilization and variables of facet joint interventions in managing chronic spinal pain in a fee-for-service (FFS) Medicare population from 2009 to 2016, with a comparative analysis from 2000 to 2009 and 2009 to 2016.

Recent Findings From 2009 to 2016, facet joint interventions increased at an annual rate of 2% per 100,000 Medicare population compared to 10.2% annual rate of increase from 2000 to 2009. Lumbosacral facet joint nerve block episodes decreased at an annual rate of 0.1% from 2009 to 2016, with an increase of 16.2% from 2000 to 2009. In contrast, lumbosacral facet joint neurolysis episodes increased at an annual rate of 7.6% from 2009 to 2016 and the utilization rate also increased at an annual rate of 26% from 2000 to 2009. The ratio of lumbar facet joint block episodes to lumbosacral facet joint neurolysis episodes changed from 6.7 in 2000 to 2.2 in 2016. From 2009 to 2016, cervical and thoracic facet joint injections increased at an annual rate of 0.6% compared to cervicothoracic facet neurolysis episodes of 9.2%. During 2000 to 2009, annual increase of cervical facet joint injections was 18% compared to neurolysis procedures of 26%. The ratio of cervical facet joint injections episodes to neurolysis episodes changed from 8.85 in 2000 to 2.8 in 2016.

Summary In summary, based on available data, utilization patterns of facet joint interventions demonstrated an increase of 2% per 100,000 Medicare population from 2009 to 2016, with an annual decline of lumbar facet joint injection episodes.

Keywords Interventional techniques · Facet joint interventions · Facet joint nerve blocks · Facet joint neurolysis

Introduction

Healthcare seems perennially to be at center stage in the USA since the enactment of the Affordable Care Act (ACA), with its primary goals of increasing the number of insured, improving the quality of care, and controlling healthcare costs [1–15]. With single-party rule of the executive branch and both houses of congress, efforts to repeal and replace the ACA took center

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stage in 2017 [16, 17]. Paradoxically, the ACA has increased the number of individuals who are insured, but may have not increased the access to care [1, 2, 18–20]. The ACA was enacted to solve the longstanding challenges facing the US healthcare system related to access, affordability, and quality of care [1, 3–5, 18–26]. Even though there are clear examples of program success, the effectiveness of ACA in achieving some of the primary goals have been debated [1–5, 27–32]. There is overwhelming literature in support that increase in the number of individuals with insurance, a portion of which is attributed to expansion of Medicaid. However, at the same time, the translation of increased insurance to the access has been questioned by some [1, 18–32]. This has been illustrated in multiple manuscripts specifically about spine care and pain management [27, 28, 31, 32]. Hartman et al. [33] in an assessment of national healthcare spending in 2016 showed slowing of spending and enrollment growth after initial coverage expansions. They showed that total healthcare expenditures in the US reached $3.3 trillion/17.9% GDP in 2016from $2.6 trillion in 2010. In addition, they also showed that Medicare expenditures increased to $672.1 billion and Medicaid expenditures increased to $565.5 billion, from $519.8 billion and $397.2 billion in 2015. At the same time, Dieleman et al. [34, 35] has demonstrated significant increases in health care utilization with $87.6 billion spent on back and neck pain in 2013. During the same period, opioid-related deaths have increased substantially in the USA [36–42] with policies currently being directed towards controlling opioids and improving access to non-opioid modalities [36–44]. However, the burden of low back and neck pain continues to go up [45, 46] with increasing costs and disability, but reduced access to many modalities, including interventional techniques [6, 7, 27, 28, 31, 32, 47, 48••, 49–53], despite significant literature of clinical and cost effectiveness [54, 55, 56••, 57•, 58–63].

Recent analysis of growth patterns of utilization of interventional techniques has shown a reversal of sorts in the growth patterns with an overall decrease of utilization of interventional techniques from 2009 to 2016 at an annual rate of 0.6% per 100,000 Medicare population [47]. However, among the services, epidural and adhesiolysis procedures seem to have shown the most significant decreases in utilization at an annual rate of 1.7%. At the same time, facet joint interventions and sacroiliac joint blocks have shown an annual increase of 0.8% [47].

Facet joint interventions are one of the common interventional techniques utilized in managing chronic spinal pain, with increasing use and debate in reference to the effectiveness and appropriate utilization [6, 7, 47, 48••, 49, 57•, 58, 59, 63]. However, numerous other modalities ranging from over the counter medications to complex surgical fusions also have been utilized extensively [36, 38, 42, 43, 64–67].

Over the years, multiple attempts have been made to control the utilization of interventional techniques, in particular the facet joint interventions, by coding changes, reimbursement reductions, local coverage determinations (LCDs), regulations, and increased oversight from various agencies [6, 7, 47, 48••, 49–51, 68, 69, 70•]. Further, there is continuous discordance in the opinions and conclusions of practitioners, academicians, public healthcare officials, and content experts with lack of agreement between proponents and opponents of the effectiveness and appropriateness of facet joint interventions [57•, 58, 59, 63, 69, 70•, 71, 72]. Proponents emphasize the significant evidence of effectiveness of the interventions, along with conflicts or confluence of interest in assessments leading to inappropriate conclusions as the basis of discordant results as well as a requirement to understand the nature of placebo effects [54, 55, 56••, 57•, 58, 59, 63, 69, 70•, 71, 72].

Therefore, this retrospective cohort study of utilization patterns of facet joint interventions was undertaken in the US fee-for-service (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 study was performed utilizing the guidance of Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) [73]. The analysis of the data was from public use files (PUF) or non-identifiable data, which is non-attributable and non-confidential and available through the Centers for Medicare & Medicaid Services (CMS) database [74]. Institutional Review Board (IRB) approval was not required. Patients were not involved in this study.

Study Design

This retrospective cohort study was designed to assess utilization patterns of facet joint interventions in managing chronic spinal pain, in the FFS Medicare population in the USA from 2000 to 2016.

Setting

National database of specialty usage data files from CMS, USA, FFS Medicare [74].

Participants

All FFS Medicare recipients from 2000 to 2016 were included in the study.

For purposes of the analysis, the current procedure codes for facet joint interventions were utilized. The CPT codes used included the following: old codes—64470, 64472, 64475, 64476 used until December 31, 2009; new codes—64490-64495; neurolytic codes: old codes—64622, 64623, 64626,

64627 used until December 31, 2009; new codes—64633, 64634, 64635, 64636 (Appendix Table 1). The data were calculated for overall services for each technique, and the rate of services for 100,000 Medicare beneficiaries.

Variables

Multiple variable including the utilization patterns of various procedures, utilization based on region, and statewide utilization were assessed which included usage of facet joint injections.

Data Sources

The data were obtained from the CMS physician/supplier procedure summary master data from 2000 through 2016 [74]. This file provided 100% of the data on all FFS Medicare participants irrespective of their age.

Measures

Allowed services were 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. Allowed services included all the services submitted minus services denied and services with 0 payments.

Bias

Bias was minimized in performance of this assessment. The data were purchased from 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. That dataset from CMS is 100% consisting of usage by CPT codes with modifier usage as an additional procedure or bilateral procedure, specialty codes, place of service, Medicare carrier number, total services, allowed and denied services without identification of individuals denied claims were not included.

Study Size

The study size, with the inclusion of all Medicare FFS patients undergoing facet joint interventions for spinal pain from 2000 to 2016, is considered as large.

Data Compilation

Microsoft Access 2010 and Microsoft Excel 2010, Microsoft, Redmond, WA, USA, were utilized to help compile this data.

Results

Participants

Participants included all Medicare recipients of FFS Medicare from 2000 to 2016.

Descriptive Data of Population Characteristics

Table 1 shows descriptive data from 2000 to 2016. From 2009 to 2016, the US population older than 65 years of age increased at an annual rate of 3.2% compared to an annual growth of 1.3% from 2000 to 2009. The total US population also grew at an annual rate of 0.9% from 2000 to 2009 compared to 0.7% from 2009 to 2016. The number of individuals participating in Medicare also increased at an annual rate of 1.6% from 2000 to 2009 and 3% from 2009 to 2016 with an overall increase of 2.2% from 2000 to 2016.

Facet joint interventions increased for services per 100,000 Medicare population from 2000 to 2016 with an annual rate of 2% compared to 17% annual rate 2000 to 2009.

Utilization Characteristics

Table 2 and Fig. 1 show the usage characteristics of facet joint interventions in the FFS Medicare population from 2000 to 2016. Table 2 shows a minor decline of facet joint interventions episodes in lumbosacral spine at an annual rate of 0.1% from 2009 to 2016 compared to an annual increase of 15.2% from 2000 to 2009. In contrast, facet joint neurolysis episodes increased at an annual rate of 7.6% from 2009 to 2016 compared to 23% from 2000 to 2009. In addition, the ratio of lumbosacral facet joint injections episodes compared to facet neurolysis decreased significantly from 6.7% in 2009 to 2.2% in 2016.

Cervicothoracic facet joint injection episodes increased at an annual rate of 0.6% from 2009 to 2016 compared to 18% from 2000 to 2009. Cervicothoracic facet joint neurolytic procedures increased substantially similar to lumbosacral facet joint procedures at an annual rate of 9.2% from 2009 to 2016 compared to 26% from 2000 to 2009. The ratio of cervicothoracic facet joint injections compared to neurolytic procedures decreased significantly from 8.85% in 2000 to 2.8% in 2016.

Figure 2 shows proportional frequency of utilization of facet joint interventions in cervicothoracic and lumbosacral spine from 2000 to 2016.

Statewide Utilization

Table 3 shows statewide utilization data of facet joint interventions showing the number of individuals receiving facet joint interventions. This data showed overall increase

Table 1 Characteristics of FFS Medicare beneficiaries and facet joint interventions from 2000 to 2016

	US Population			Facet Joint Interventions*			
	Total (,000)	≥ 65 years (,000)	Medicare beneficiaries (,000)	Services*	Rate per 100,000	Episodes primary codes	Rate per 100,000
2000	282,172	35,077	39,632	375,242	947	144,157	364
2001	285,040	35,332	40,045	457,845	1143	178,341	445
2002	288,369	35,605	40,503	606,437	1497	228,489	564
2003	290,211	35,952	41,126	755,171	1836	281,413	684
2004	292,892	36,302	41,729	1,181,538	2831	431,758	1035
2005	295,561	36,752	42,496	1,312,616	3089	477,942	1125
2006	299,395	37,264	43,339	1,684,760	3887	585,617	1351
2007	301,290	37,942	44,263	1,607,206	3631	579,233	1309
2008	304,056	38,870	45,412	1746,312	3845	621,323	1368
2009	307,006	39,570	45,801	1,882,754	4111	682,903	1491
2010	308,746	40,268	46,914	1,699,677	3623	645,197	1375
2011	311,583	41,370	48,300	1,811,573	3751	682,472	1413
2012	313,874	43,144	50,300	1892,296	3762	734,514	1460
2013	316,129	44,704	51,900	1,931,123	3721	753,922	1453
2014	318,892	46,179	53,500	2,091,134	3909	825,287	1543
Y2015	320,897	47,734	54,900	2,271,431	4137	897,742	1635
Y2016	323,127	49,244	56,500	2,444,079	4326	967,868	1713
2000–2016	14.5%	40.4%	42.6%	551.3%	356.9%	571.4%	371.0%
GM	0.9%	2.1%	2.2%	12.4%	10.0%	12.6%	10.2%
2000–2009	8.8%	12.8%	15.6%	401.7%	334.2%	373.7%	309.9%
GM	0.9%	1.3%	1.6%	19.6%	17.7%	18.9%	17.0%
2009–2016	5.3%	24.4%	23.4%	29.8%	5.2%	41.7%	14.9%
GM	0.7%	3.2%	3.0%	3.8%	0.7%	5.1%	2.0%

Facet joint blocks: 64470 or 64490, 64472, 64491, or 64492; L/S facet Joint Blocks 64475 or 64493, 64476 or 64494 or 64495; C/T Facet Neurolysis: 64626 or 64633, 64627 or 64634; L/S Facet Neurolysis: 64622 or 64635, 64623 or 64636

GM geometric average annual change

( ) facility percentage

of utilization in all jurisdictions even though some states showed declining utilization. The Noridian jurisdiction noted an annual increase of 1.2%. Overall increases ranged at an annual rate of 0.7% to 4.5% in the jurisdictions adopting Noridian policies. However, two jurisdictions not adopting Noridian policies (CGS and First Coast) showed an increase of 4.2% and 0.3%.

Main Results

The results of the present investigation reveal facet joint injections and neurolytic procedures increased at a rate of 2% per year from 2009 to 2016 per 100,000 Medicare population. In contrast, the utilization increased at an annual rate of 17% from 2000 to 2009 in FFS Medicare beneficiaries.

The proportion of patients undergoing lumbosacral facet joint nerve blocks episodes decreased at an annual rate of 0.1% per 100,000 Medicare population from 2009 to 2016, whereas they increased at a 15.2% annual rate from 2000 to 2009. Lumbosacral radiofrequency neurotomy procedures increased at an annual rate of 7.6% from 2009 to 2016, whereas they increased at an annual rate of 23% from 2000 to 2009. The ratio of lumbosacral facet joint blocks episodes to lumbosacral facet joint neurolysis episodes changed from 6.73 in 2000 to 2.2 in 2016.

Cervicothoracic facet joint injections episodes increased at an annual rate of 0.6% from 2009 to 2016, whereas they increased at an annual rate of 8% from 2000 to 2009. In contrast, cervicothoracic facet joint neurolysis procedure episodes increased at an annual rate of 9.2% from 2009 to 2016 compared to 26% from 2000 to 2009. The ratio of cervicothoracic facet joint injections episodes to neurolysis episodes changed from 8.85 in 2000 to 2.8 in 2016.

Table 2 Frequency of utilizations of facet joint interventions in the FFS Medicare population from 2000 to 2016

	L/S Facet Joint Blocks				L/S Facet Neurolysis				C/T Facet Joint Blocks				C/T Facet Neurolysis			
	Only primary episodes or visits (CPT 64475 or 64493)		All services (CPT 64475, 64493, 64476, 64494, 64495)		Only primary episodes or Visits (CPT 64622 or 64635)		All services (CPT 64622, 64635/64623, 64636)		Only primary episodes or visits (CPT 64470 or 64490)		All services (CPT 64470/64472/64490/ 64491/64492)		Only primary episodes or visits (CPT 64626/ 64633)		All services (CPT 64626/64633, 64627, 64634)	
Year	Services	Rate	Services	Rate	Services	Rate	Services	Rate	Services	Rate	Services	Rate	Services	Rate	Services	Rate
F2000	101,539	256	254,791	643	15,117	38	53,323	135	24,751	62	58,324	147	2750	7	8804	22
F2001	121,234	303	297,088	742	18,792	47	66,424	166	34,500	86	82,184	205	3815	10	12,149	30
F2002	155,620	384	395,863	977	25,744	64	89,266	220	41,935	104	103,916	257	5190	13	17,392	43
F2003	189,263	460	489,065	1189	35,315	86	118,481	288	49,958	121	125,447	305	6877	17	22,178	54
F2004	286,394	686	754,217	1807	57,053	137	189,404	454	77,620	186	203,765	488	10,691	26	34,152	82
F2005	316,158	744	835,847	1967	63,228	149	209,916	494	86,541	204	228,540	538	12,015	28	38,313	90
F2006	370,809	856	1,007,482	2325	79,289	183	305,588	705	121,312	280	325,490	751	14,207	33	46,200	107
F2007	365,372	825	964,940	2180	88,069	199	297,485	672	108,103	244	287,382	649	17,689	40	57,399	130
F2008	385,491	849	1,020,266	2247	100,606	222	340,874	751	114,497	252	316,354	697	20,729	46	68,818	152
F2009	418,036	913	1081,726	2362	112,627	246	376,013	821	126,730	277	341,532	746	25,510	56	83,483	182
F2010	386,897	825	944,469	2013	116,959	249	378,761	807	114,753	245	290,640	620	26,588	57	85,807	183
F2011	402,507	833	990,449	2051	125,630	260	406,378	841	124,431	258	317,220	657	29,904	62	97,526	202
F2012	426,386	848	1,049,496	2086	141,130	281	406,332	808	131,377	261	334,751	666	35,621	71	101,717	202
F2013	423,970	817	1,043,861	2011	155,353	299	434,386	837	135,544	261	343,919	663	39,055	75	108,957	210
F2014	458,539	857	1125,757	2104	178,121	333	480,723	899	144,940	271	364,436	681	43,687	82	120,218	225
F2015	490,685	894	1,205,502	2196	202,460	369	542,154	988	154,275	281	387,042	705	50,322	92	136,733	249
F2016	513,752	909	1,256,525	2224	232,683	412	617,765	1093	163,308	289	412,873	731	58,125	103	156,916	278
2000–2016	406.0%	254.9%	393.2%	245.9%	1439.2%	979.7%	1058.5%	712.7%	559.8%	362.8%	607.9%	396.6%	2013.6%	1382.6%	1682.3%	1150.2%
GM	10.7%	8.2%	10.5%	8.1%	18.6%	16.0%	16.5%	14.0%	12.5%	10.0%	13.0%	10.5%	21.0%	18.4%	19.7%	17.1%
2000–2009	311.7%	256.2%	324.6%	267.4%	645.0%	544.7%	605.2%	510.2%	412.0%	343.1%	485.6%	406.7%	827.6%	702.7%	848.2%	720.5%
GM	17.0%	15.2%	17.4%	15.6%	25.0%	23.0%	24.2%	22.3%	19.9%	18.0%	21.7%	19.8%	28.1%	26.0%	28.4%	26.3%
2009–2016	22.9%	− 0.4%	16.2%	− 5.8%	106.6%	67.5%	64.3%	33.2%	28.9%	4.5%	20.9%	− 2.0%	127.9%	84.7%	88.0%	52.4%
GM	3.0%	− 0.1%	2.2%	− 0.9%	10.9%	7.6%	7.3%	4.2%	3.7%	0.6%	2.7%	− 0.3%	12.5%	9.2%	9.4%	6.2%

L/S lumbosacral, *C/T* cervicothoracic, *GM* geometric average annual change

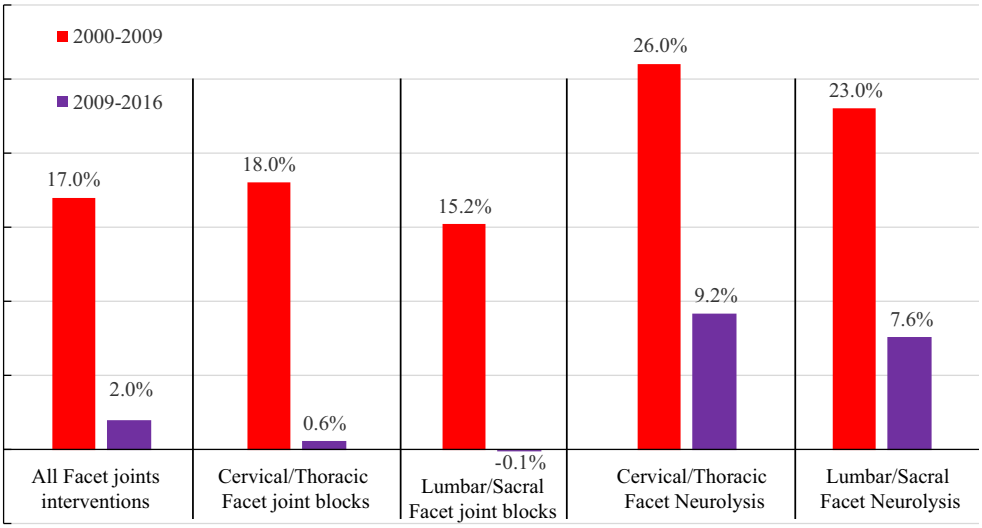
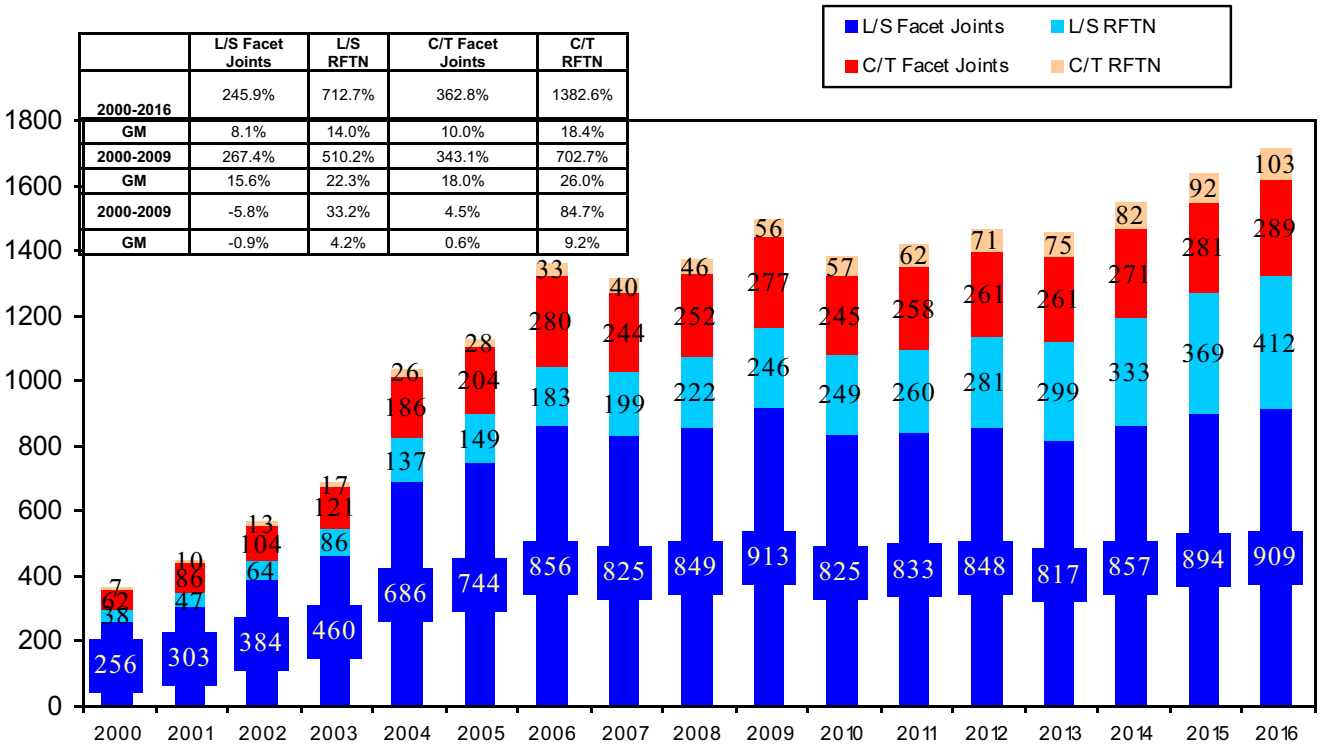


Fig. 1 Comparative utilization patterns based on an annual rate from 2000 to 2009 and 2009 to 2016

Discussion

Comparative utilization of facet joint interventions for chronic spinal pain have dramatically changed from 2000 to 2009 compared to 2009 to 2016 in the FFS Medicare population in the USA. Facet joint injection and neurolytic procedures increased at a rate of 2.2% per year from 2000 to 2016 per 100,000 Medicare population, with increases observed in 3 of the 4 types of interventions with a decline of 0.1% per year from 2009 to 2016. However, radiofrequency neurotomy procedures increased significantly at an annual rate of 7.6% from 2009 to 2016 compared to 23% from 2000 to 2009. Similarly, episodes of cervicothoracic facet joint neurolysis procedures increased at an annual rate of 9.2% from 2009 to 2016 compared to 26% from 2000 to 2009. The ratio of lumbar facet joint blocks episodes to lumbosacral facet joint neurolysis episodes changed from 6.73 in 2000 to 2.2 in 2016. Similarly, the ratio of cervical and thoracic facet joint injection episodes to neurolysis episodes changed from 8.85 in 2000 to 2.8 in 2016. Thus, except for lumbar facet joint injections, growth continued at a slower pace for cervical and thoracic facet joint injections and neurolytic procedures, as well as



	L/S Facet Joints	L/S RFTN	C/T Facet Joints	C/T RFTN
2000-2016	245.9%	712.7%	362.8%	1382.6%
GM	8.1%	14.0%	10.0%	18.4%
2000-2009	267.4%	510.2%	343.1%	702.7%
GM	15.6%	22.3%	18.0%	26.0%
2000-2009	-5.8%	33.2%	4.5%	84.7%
GM	-0.9%	4.2%	0.6%	9.2%

Fig. 2 Proportional frequency of utilizations facet joint interventions episodes for primary codes (per 100,000 Medicare beneficiaries) from 2000 to 2016

Table 3 Utilizations of facet injections (rates per 100,000) in the FFS Medicare population from 2009 to 2016 based on Medicare Administrative Contractor (MAC) jurisdictions of 2016

State	R2009	R2010	R2011	R2012	R2013	R2014	R2015	R2016	Change	GM
Cahaba										
Alabama	1410	1653	1670	1745	1572	1648	1694	1803	28%	3.6%
Georgia	2340	1964	2088	2163	2036	2197	2364	2446	5%	0.6%
Tennessee	1935	2010	1962	2124	1640	1517	1601	1752	− 9%	− 1.4%
Cahaba total	1951	1896	1934	2038	1780	1825	1934	2049	5%	0.7%
PCPY		− 2.8%	2.0%	5.4%	− 12.7%	2.5%	6.0%	5.9%		
CGS										
Kentucky	1793	1642	1746	2024	2136	2015	2223	2315	29%	3.7%
Ohio	1280	1292	1320	1484	1504	1520	1528	1745	36%	4.5%
CGS total	1426	1392	1442	1639	1686	1663	1728	1908	34%	4.2%
PCPY		− 2.4%	3.6%	13.7%	2.9%	− 1.4%	3.9%	10.4%		
FirstCoast										
Florida	2544	2253	2267	2371	2231	2351	2463	2591	2%	0.3%
PCPY		− 11.4%	0.6%	4.6%	− 5.9%	5.4%	4.8%	5.2%		
NGS										
Connecticut	872	834	883	960	1001	1134	1159	1216	39%	4.9%
Illinois	1200	953	998	1132	1112	1142	1210	1286	7%	1.0%
Maine	819	831	1036	1140	1104	1309	1384	1287	57%	6.7%
Massachusetts	1264	1377	1603	1738	1715	1722	1752	1768	40%	4.9%
Minnesota	739	741	783	878	862	876	893	932	26%	3.4%
New Hampshire	1385	1677	1834	2020	1956	1927	1758	1665	20%	2.7%
New York	803	743	763	789	888	1011	1081	1130	41%	5.0%
Rhode Island	1224	1295	1291	1195	1082	1084	1161	1077	− 12%	− 1.8%
Vermont	1094	1110	1124	1119	1275	1385	1552	1525	39%	4.9%
Wisconsin	1176	1208	1286	1434	1430	1474	1482	1484	26%	3.4%
NGS total	1003	956	1024	1111	1136	1206	1252	1286	28%	3.6%
PCPY		− 4.7%	7.1%	8.4%	2.3%	6.1%	3.8%	2.7%		
Noridian										
Alaska	872	958	741	545	752	1057	1565	1429	64%	7.3%
Arizona	1859	1982	2004	2090	2184	2378	2436	2589	39%	4.8%
California	1218	1054	1074	1090	1074	1066	1099	1099	− 10%	− 1.5%
Idaho	902	936	1050	952	971	1177	1303	1157	28%	3.6%
Montana	1150	948	1085	1045	1046	1055	1145	1125	− 2%	− 0.3%
Nevada	1635	1904	1964	2249	2229	2279	2491	2470	51%	6.1%
North Dakota	813	693	509	490	678	739	730	768	− 6%	− 0.8%
Oregon	770	780	745	727	822	880	987	1074	39%	4.9%
South Dakota	1838	1705	1481	1069	1113	1242	1316	1435	− 22%	− 3.5%
Utah	1629	1741	1758	2072	2234	2551	2891	3032	86%	9.3%
Washington	1030	930	828	687	704	754	800	863	− 16%	− 2.5%
Wyoming	1485	1595	1238	1142	1400	1591	1525	1503	1%	0.2%
Noridian total	1259	1182	1180	1190	1214	1267	1336	1365	8%	1.2%
PCPY		− 6.1%	− 0.2%	0.9%	2.1%	4.4%	5.4%	2.1%		
Palmetto GBA										
North Carolina	1336	1288	1278	1355	1307	1285	1403	1497	12%	1.6%
South Carolina	1682	1575	1690	1922	2132	2319	2470	2401	43%	5.2%
Virginia	952	850	888	964	1183	1322	1431	1503	58%	6.7%
West Virginia	1161	1224	1283	1429	1573	1659	1691	1915	65%	7.4%
Palmetto total	1273	1208	1246	1361	1469	1550	1665	1728	36%	4.5%

Table 3 (continued)

State	R2009	R2010	R2011	R2012	R2013	R2014	R2015	R2016	Change	GM
PCPY		− 5.1%	3.1%	9.3%	7.9%	5.5%	7.4%	3.8%		
Novitas										
Arkansas	2495	2306	1927	1956	2167	2436	2816	3218	29%	3.7%
Colorado	913	906	959	1162	1202	1411	1504	1704	87%	9.3%
DC	6489	6247	7029	6789	9182	10,554	12,118	12,306	90%	9.6%
Delaware	1375	1194	1208	1193	1533	1878	2102	2367	72%	8.1%
Louisiana	1343	1400	1491	1640	1855	2001	2061	2136	59%	6.9%
Maryland	1439	1303	1475	1540	1744	1949	2065	1898	32%	4.0%
Mississippi	1875	1646	1795	2024	2130	1991	2107	2285	22%	2.9%
New Jersey	967	1013	1100	1143	1280	1469	1621	1679	74%	8.2%
New Mexico	1064	1095	1201	1418	1264	1356	1506	1518	43%	5.2%
Oklahoma	1235	1191	1270	1379	1483	1845	2303	2374	92%	9.8%
Pennsylvania	978	931	937	950	1033	1112	1183	1308	34%	4.3%
Texas	2431	1914	1941	1912	1921	1980	2103	2265	− 7%	− 1.0%
Novitas total	1603	1428	1472	1521	1623	1757	1909	2038	27%	3.5%
PCPY		− 10.9%	3.1%	3.3%	6.7%	8.3%	8.6%	6.7%		
WPS										
Indiana	1572	1686	1792	1892	1704	1920	2142	2212	41%	5.0%
Iowa	605	694	800	813	826	856	1016	1151	90%	9.6%
Kansas	1056	1030	1077	1021	1149	1226	1345	1385	31%	4.0%
Michigan	2644	2057	2239	2463	2457	2810	2823	2528	− 4%	− 0.6%
Missouri	1571	1532	1577	1672	1618	1792	1725	1659	6%	0.8%
Nebraska	727	689	708	787	754	904	1087	1297	78%	8.6%
WPS total	1735	1560	1671	1789	1754	1974	2048	1973	14%	1.9%
PCPY		− 10.1%	7.1%	7.1%	− 2.0%	12.5%	3.7%	− 3.6%		

PCPY percent of change from previous year, *GM* geometric average annual change

lumbosacral facet joint neurolytic procedures, with ratios of facet joint neurolysis procedures exceeding the injection procedures.

Statewide utilization data based on Medicare Administrative Contractor (MAC) jurisdictions showed similar changes in overall utilization in Noridian MAC and other MACS utilizing Noridian policies, compared to jurisdictions without adoption of Noridian policies. However, analysis of lumbosacral facet joint injections episodes showed greater annual increase for Noridian jurisdiction of 2% compared to national rate of 0.1% decline. Utilization of radiofrequency neurolytic procedures was also higher in Noridian jurisdictions with an annual increase of 8.6% compared to 7.6% nationwide.

The results of this assessment are comparable to the previous evaluations which [47, 48••, 49, 50] showed significant declines in the utilization of epidural injections with continued increase in facet joint interventions. It is reflected in this manuscript. Overall utilization has been reduced for all health care services resulting in decline in utilization of facet joint interventions which may be secondary to reduced access [1, 20].

Limitations of our assessment include lack of inclusion of patients participating in Medicare Advantage plans constituting approximately 30% of the Medicare population. However, the advantages of this utilization assessment include utilization of 100% Medicare data without extrapolation and inclusion of all of the FFS population instead of only those 65 or older. We also believe that the slow increase patterns are observed all across the USA in all types of populations with all types of insurers.

As discussions continue on health care expenses and methods to restrain the healthcare expenses, the prevalence, disability, as well as healthcare costs and human toll of spinal pain continues to increase with significant utilization of various modalities with some declines observed from 2009 to 2016, specifically of facet joint interventions. However, the facet joint interventions continue to incite significant debate, along with controversy, and provide a basis for the claims that facet joint injections are inappropriately utilized, along with overuse, misuse, abuse, and fraud [68, 69, 70•]. Further, there have been claims of lack of evidence of effectiveness, medical necessity, and indications, despite extensive literature of

clinical and cost effectiveness, as well as recommended caution for appropriate use with determination of medical necessity and indications [57•, 58, 59, 63]. The evidence, though it continues to be debated, is derived from multiple randomized controlled trials (RCTs) for facet joint nerve blocks and radiofrequency neurotomy, whereas there is a significant lack of evidence for intraarticular injections [57•, 58, 59, 63, 75, 76, 77••]. However, opponents claim there is a lack of evidence and lack of validity in arriving at the diagnosis of facet joint pain with claims that facet joint pain is nothing but nonspecific low back pain [78, 79]. Recent literature has demonstrated difficulties in performing appropriate RCTs [78–80] and also the value of pragmatic trials performed in practical settings [81, 82]. This type of evidence has been utilized by the Food and Drug Administration (FDA), known as real-world evidence [81, 82]. There also has been significant literature in reference to conflicts of interest, as well as confluence of interest, in assessing placebo reactions and inappropriate conversions of local anesthetic injections into placebos, thus arriving at rather erroneous conclusions and recommendations [56••, 72, 75, 76, 77••, 83, 84].

Overall, this assessment of utilization of facet joint interventions showed a different pattern of usage compared to previous evaluations with some declines and some muted increases and others with continued increase from 2009 to 2016 compared to 2000 to 2009. The evidence from this assessment also shows that significant increases in utilization patterns of radiofrequency neurotomy procedures in the face of decline of facet joint injections may be related to various reimbursement issues, LCDs, and bundling of codes [6, 7, 52, 53, 68, 69, 70•]. There is a net increase of radiofrequency neurotomy procedures.

Conclusion

The use of facet joint injections showed a modest increase of an annual rate of 2% from 2009 to 2016, compared to explosive increases at an annual rate of 17% from 2000 to 2009. Significant increases continue to be observed for radiofrequency neurotomy procedures, whereas there was decline of lumbosacral facet joint injections and modest increase of cervicothoracic facet joint injections.

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Compliance with Ethical Standards

Conflict of Interest Amol Soin, Dharam P. Mann, Sanjay Bakshi, and Vidyasagar Pampati declare no conflict of interest. Dr. Manchikanti has provided limited consulting services to Semnur Pharmaceuticals, Incorporated, which is developing nonparticulate steroids. Dr. Kaye is on the Speakers Bureau for Merck Pharmaceuticals. Dr. Hirsch is a consultant for Medtronic.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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- •• Of major importance

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