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Utilization of Facet Joint and Sacroiliac Joint Interventions in Medicare Population from 2000 to 2014: Explosive Growth Continues!

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Abstract Increasing utilization of interventional techniques in managing chronic spinal pain, specifically facet joint interventions and sacroiliac joint injections, is a major concern of healthcare policy makers. We analyzed the patterns of utilization of facet and sacroiliac joint interventions in managing chronic spinal pain. The results showed significant increase of facet joint interventions and sacroiliac joint injections from 2000 to 2014 in Medicare FFS service beneficiaries. Overall, the Medicare population increased 35 %, whereas facet joint and sacroiliac joint interventions increased 313.3 % per 100,000 Medicare population with an annual increase of 10.7 %. While the increases were uniform from 2000 to 2014, there were some decreases noted for facet joint interventions in 2007, 2010, and 2013, whereas for sacroiliac joint injections, the decreases were noted in 2007 and 2013. The increases were for cervical and thoracic facet neurolysis at 911.5 % compared to lumbosacral facet neurolysis of 567.8 %, 362.9 % of cervical and thoracic facet joint blocks, 316.9 % of sacroiliac joints injections, and finally 227.3 % of lumbosacral facet joint blocks.

Keywords Facet joint interventions · Sacroiliac joint injections · Chronic spinal pain · Patterns of utilization

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Introduction

In 2014, facet and sacroiliac joint interventions were the second most commonly performed procedures, constituting 47.2 % of all interventional techniques, increasing from 28.9 % in 2000, superseding epidural injections and adhesiolysis procedures, which decreased from 58.6 % in 2000 to 45.2 % in 2014 [1••]. This is occurring with a backdrop of facet and sacroiliac joint interventions being some of the most hotly contested interventional procedures. Areas of challenge include their escalating utilization, diagnostic accuracy, and therapeutic effectiveness in managing chronic spinal pain [2, 4–6, 8, 10, 13–161••, 3•, 7••, 9•, 11•, 12•,]. Moreover, this issue is larger than the interventional management of pain; the prevalence and disability secondary to spinal pain and its resultant costs continue to capture the attention of the public-at-large, physicians, regulators, and payer community [17•, 18–32]. The study by Freburger et al. [23], comparing low back pain in 1992 and 2006, showed an overall increase of 162 %, increasing from 3.9 to 10.2 %. Studies of burden of disease collaborators in the USA and across the globe showed spinal pain occupying three of

the first five categories of disability [17•, 33, 34]. In fact, in the global burden of disease and disability studies [17•, 33], the prevalence of chronic low back pain was shown to be 9.4 % of the overall population, severe chronic low back pain constituting 17 % of these patients. Similarly, the neck pain prevalence was shown to be 4.9 % of the population with a significant proportion suffering with chronic neck pain with high disability [34].

Among the various interventions that are considered as excessive in managing chronic spinal pain, facet joint interventions feature prominently [1••, 2, 4–63•,]. Manchikanti et al. [1••] showed an overall increase in facet and sacroiliac joint interventions of 313 % per 100,000 Medicare population with an annual increase of 10.7 % from 2000 to 2014. Assessing the increase in facet joint interventions, Manchikanti et al. [5] showed a 383 % growth in services and a 308 % growth per 100,000 Medicare population with annual increases of 15.4 or 13.6 % from 2000 to 2011. Among them, the highest increases were observed for cervical and thoracic facet joint neurolysis at a rate of 836 %, an annual increase of 22.5 %, 544 %, with an annual rate of 18.4 % for lumbosacral radiofrequency thermoneurolysis, followed by increase of cervical/thoracic facet joint injections of 359 % with an annual increase of 14.9 % with comparatively lesser increases of lumbosacral facet joint blocks with 228 % and an annual increase of 11.4 %. They also showed sacroiliac joint interventions to increase 331 % from 2000 to 2011 per 100,000 Medicare population with an annual increase of 14.2 % [6].

The explosive growth of facet joint interventions was addressed in various ways including an Office of Inspector General (OIG) investigation [3•, 5, 35–37], multiple local coverage determinations (LCDs), and across the board denials of these procedures by some payers. Questions raised about facet and sacroiliac joint interventions include those related to accuracy of the diagnosis and efficacy of the treatment modalities applied. Despite the evidence derived from multiple diagnostic accuracy studies and systematic reviews of the accuracy of controlled diagnostic blocks, numerous issues have been raised in reference to the value and validity of these techniques [1••, 10, 13–169•, 11•, 12•,]. Similarly, the efficacy and effectiveness of various modalities applied in managing facet joint and sacroiliac joint pain has been vigorously debated [8, 10, 389•, 11•,]. However, the OIG assessment and recommendations, multiple LCDs, and changes in the Current Procedural Terminology (CPT) code definitions appear to have not deterred the growth of facet joint and sacroiliac joint interventions in Medicare population in the USA on a long-term basis [1••, 2, 4–6, 35–37, 39–423•,].

This assessment is undertaken to review the utilization patterns from 2000 to 2014 of facet joint and sacroiliac joint interventions in the USA in the fee-for-service (FFS) Medicare population.

Materials and Methods

This analysis of data of utilization patterns of facet and sacroiliac joint interventions was performed following the reporting standards of Strengthening the Reporting of Observational studies in Epidemiology (STROBE) guidance [43]. Institutional review board (IRB) approval was not required for this assessment and was thus not sought due to public use files (PUF) or non-identifiable data, which is non-attributable and non-confidential, available through the Centers for Medicare and Medicaid Services (CMS) database [44].

Study Design

The analysis of patterns of utilization and variables of facet and sacroiliac joint interventions was designed utilizing STROBE guidance [43], in the FFS Medicare population in the USA from 2000 to 2014.

Setting

The study uses the United States CMS database of specialty utilization from 2000 to 2014 data files of FFS Medicare [44].

Participants

All the FFS Medicare recipients from 2000 to 2014 were included in this analysis. This is a 100 % sample.

Measures

Services were defined as submitted, allowed, denied, and those with zero payments. Allowed services constituted total services after deletion of denied services and services with zero payments

For each procedure, total allowed services and rates per 100,000 were calculated for the corresponding year.

The current procedure codes for facet joint interventions and sacroiliac joint blocks were utilized. The CPT codes utilized included facet joint interventions and sacroiliac joint blocks (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). These codes were identified for years 2000 to 2014. The utilization data was also assessed based on the place of service, either the facility which included ambulatory surgery centers (ASCs) and hospital outpatient departments (HOPDs) or a non-facility setting—the office. The data was analyzed for overall services for each technique, and rate of services for 100,000 Medicare beneficiaries, and based on the individual primary or specialty.

Table 1 Characteristics of Medicare beneficiaries and facet joint and sacroiliac joint interventions from 2000 to 2014

	US population			Medicare beneficiaries				Facet joint and sacroiliac joint interventions*			
	Total population (,000)	≥65 years (,000)		Number (,000)	% to US population	≥65 years (,000) (percent)	<65 years (,000) (percent)	Services*	% of change from previous year	Per 100,000	% of change from previous year
		Number	Percent								
2000	282,172	35,077	12.4	39,632	14.0	34,262 (86.5 %)	5370 (13.5 %)	424,796 (67 %)	NA	1072	NA
2001	285,040	35,332	12.4	40,045	14.0	34,478 (86.1 %)	5567 (13.9 %)	543,509 (62 %)	17.8	1357	26.6
2002	288,369	35,605	12.3	40,503	14.0	34,698 (85.7 %)	5805 (14.3 %)	708,186 (58 %)	18.5	1748	28.8
2003	290,211	35,952	12.4	41,126	14.2	35,050 (85.2 %)	6078 (14.8 %)	884,035 (53 %)	14.6	2150	22.9
2004	292,892	36,302	12.4	41,729	14.2	35,328 (84.7 %)	6402 (15.3 %)	1,354,242 (46 %)	20.0	3245	51.0
2005	295,561	36,752	12.4	42,496	14.4	35,777 (84.2 %)	6723 (15.8 %)	1,501,222 (47 %)	8.4	3533	8.9
2006	299,395	37,264	12.4	43,339	14.5	36,317 (83.8 %)	7022 (16.2 %)	1,896,688 (40 %)	5.5	4376	23.9
2007	301,290	37,942	12.6	44,263	14.7	36,966 (83.5 %)	7297 (16.5 %)	1,820,695 (46 %)	3.9	4113	−6.0
2008	304,056	38,870	12.8	45,412	14.9	37,896 (83.4 %)	7516 (16.6 %)	1,974,999 (46 %)	5.3	4349	5.7
2009	307,006	39,570	12.9	45,801	14.9	38,177 (83.4 %)	7624 (16.6 %)	2,111,700 (46 %)	4.7	4611	6.0
2010	308,746	40,268	13.0	46,914	15.2	38,991 (83.1 %)	7923 (16.9 %)	1,937,582 (48 %)	4.4	4130	−10.4
2011	311,583	41,370	13.3	48,300	15.5	40,000 (82.8 %)	8300 (17.2 %)	2,064,227 (50 %)	3.8	4274	3.5
2012	313,874	43,144	13.8	50,300	16.0	41,900 (83.3 %)	8500 (16.9 %)	2,159,057 (50 %)	0.7	4292	0.4
2013	316,129	44,704	14.1	51,900	16.4	43,100 (83.0 %)	8800 (17.0 %)	2,197,766 (51 %)	−2.0	4235	−1.3
2014	318,892	46,179	14.5	53,500	16.8	44,600 (83.4 %)	8900 (16.5 %)	2,370,000 (50 %)	−0.2	4430	4.6
Change	13.0 %	31.7 %	16.8	35.0 %	19.8	30.2 %	65.7 %	457.7 %	–	313.3 %	
GM	0.9 %	2.0 %		2.2 %		1.9 %	3.7 %	13.1 %	–	10.7 %	

No significance tests were performed

SI joint interventions: 27096; C/T 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

Change percentage change of change from 2000 to 2014, *GM* geometric average annual change, *()* facility percentage

Table 2 Growth of utilization of facet and sacroiliac joint interventions

Year	Sacroiliac joint interventions				All facet joint interventions			
	Services	% of change from previous year	Rate per 100,000	% of change from previous year	Services	% of change from previous year	Rate per 100,000	% of change from previous year
2000	49,554	NA	125	NA	375,242	NA	947	NA
2001	85,664	72.9	214	71.1	457,845	22.0	1143	20.8
2002	101,749	18.8	251	17.4	606,437	32.5	1497	31.0
2003	128,864	26.6	313	24.7	755,171	24.5	1836	22.6
2004	172,704	34.0	414	32.1	1,181,538	56.5	2831	54.2
2005	188,606	9.2	444	7.2	1,312,616	11.1	3089	9.1
2006	211,928	12.4	489	10.2	1,684,760	28.4	3887	25.9
2007	213,489	0.7	482	−1.4	1,607,206	−4.6	3631	−6.6
2008	228,687	7.1	504	4.4	1,746,312	8.7	3845	5.9
2009	228,946	0.1	500	−0.7	1,882,754	7.8	4111	6.9
2010	237,905	3.9	507	1.4	1,699,677	−9.7	3623	−11.9
2011	252,654	6.2	523	3.2	1,811,573	6.6	3751	3.5
2012	266,764	5.6	530	1.4	1,892,293	4.5	3762	0.3
2013	266,643	0.0	514	−3.1	1,931,123	2.1	3721	−1.1
2014	278,866	4.6	521	1.5	2,091,134	8.3	3909	5.0
Change*	462.8 %		316.9 %		457.3 %	–	312.8 %	–
GM*	13.1 %		10.7 %		13.1 %	–	10.7 %	

No significance tests were performed

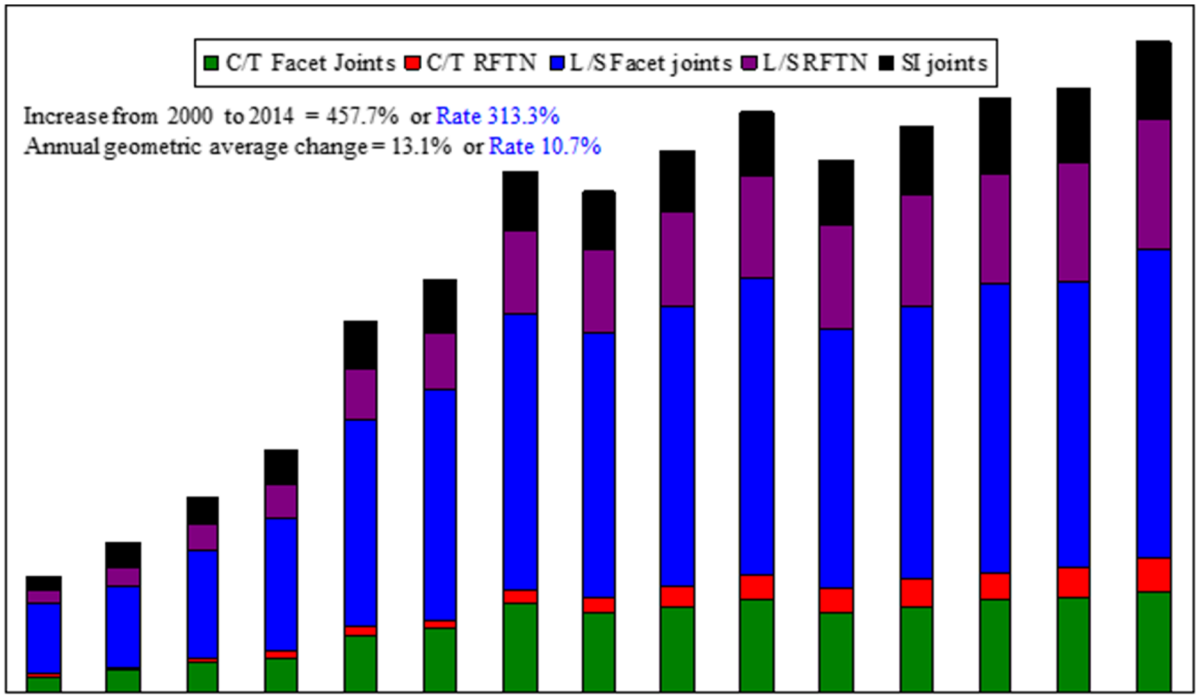
Change percentage change of change from 2000 to 2014, *GM* geometric average annual change

Table 3 Utilizations of facet joint blocks in the Medicare population from 2000 to 2014

Year	Cervical/thoracic facet joint blocks						Lumbar/sacral facet joint blocks					
	Total services rate per 100,000						Total services rate per 100,000					
	64470/64490	64472/64491/64492	Services	% of change from previous year	Rate	% of change from previous year	64475 64493	64476/64494/64495	Services	% of change from previous year	Rate	% of change from previous year
2000	24,751	33,573	58,324	NA	147	NA	101,539	153,252	254,791	NA	643	NA
2001	34,500	47,684	82,184	40.9	205	39.5	121,234	175,854	297,088	16.6	742	15.4
2002	41,935	61,981	103,916	26.4	257	25.0	155,620	240,243	395,863	33.2	977	31.7
2003	49,958	75,489	125,447	20.7	305	18.9	189,263	299,802	489,065	23.5	1189	21.7
2004	77,620	126,145	203,765	62.4	488	60.1	286,394	467,823	754,217	54.2	1807	52.0
2005	86,541	141,999	228,540	12.2	538	10.1	316,158	519,689	835,847	10.8	1967	8.8
2006	121,312	204,178	325,490	42.4	751	39.7	370,809	636,673	1,007,482	20.5	2325	18.2
2007	108,103	179,279	287,382	−11.7	649	−13.6	365,372	599,568	964,940	−4.2	2180	−6.2
2008	114,497	201,857	316,354	10.1	697	7.3	385,491	634,775	1,020,266	5.7	2247	3.1
2009	126,730	214,802	341,532	8.0	746	7.0	418,036	663,690	1,081,726	6.0	2362	5.1
2010	114,753	175,887	290,640	−14.9	620	−16.9	386,897	557,572	944,469	−12.7	2013	−14.8
2011	124,431	192,789	317,220	9.1	657	6.0	402,507	587,942	990,449	4.9	2051	1.9
2012	131,377	203,374	334,751	5.5	666	1.3	426,386	623,110	1,049,496	6.0	2086	1.7
2013	135,544	208,375	343,919	2.7	663	−0.4	423,970	619,891	1,043,861	−0.5	2011	−3.6
2014	144,940	219496	364,436	6.0	681	2.8	458,539	667,218	1,125,757	7.8	2104	4.6
Change	485.6 %	553.8 %	524.8 %		362.9 %		351.6 %	335.4 %	341.8 %		227.3 %	
GM	13.5 %	14.4 %	14.0 %		11.6 %		11.4 %	11.1 %	11.2 %		8.8 %	

C/T facet joint blocks: 64470 or 64490, 64472 64491 or 64492; L/S facet joint blocks 64475 or 64493, 64476 or 64494 or 64495

Change percentage change of change from 2000 to 2014, *GM* geometric average annual change



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
SI Joints	11.7%	15.8%	14.4%	14.6%	12.8%	12.6%	11.2%	11.7%	11.6%	10.8%	12.3%	12.2%	12.4%	12.1%	11.8%
L/S RFTN	12.6%	12.2%	12.6%	13.4%	14.0%	14.0%	16.1%	16.3%	17.3%	17.8%	19.5%	19.7%	18.8%	19.8%	20.3%
L/S Facets	60.0%	54.7%	55.9%	55.3%	55.7%	55.7%	53.1%	53.0%	51.7%	51.2%	48.7%	48.0%	48.6%	47.5%	47.5%
C/T RFTN	2.1%	2.2%	2.5%	2.5%	2.5%	2.6%	2.4%	3.2%	3.5%	4.0%	4.4%	4.7%	4.7%	5.0%	5.1%
C/T Facets	13.7%	15.1%	14.7%	14.2%	15.0%	15.2%	17.2%	15.8%	16.0%	16.2%	15.0%	15.4%	15.5%	15.6%	15.4%
Services	424,796	543,509	708,186	884,035	1,354,242	1,501,222	1,896,688	1,820,695	1,974,999	2,111,700	1,937,582	2,064,227	2,159,057	2,197,766	2,370,000

Fig. 1 Illustration of the increase of various facet joint interventions and sacroiliac joint interventions and interventional pain management services from 2000 to 2014

Variables

Variables assessed in this evaluation included the assessment of the Medicare population and increase in Medicare population from 2000 to 2014, utilization of facet and sacroiliac joint interventions procedures in the various regions of the spine including cervical, thoracic, lumbar, sacral spine, and sacroiliac joint. Specialty characteristics and the settings in which the procedures were performed, influence of bundling of codes, and newly implemented LCDs were also assessed as additional variables.

The description of various specialities included in this analysis incorporated multiple specialties representing interventional pain physicians and others, interventional pain management −09, pain management −72, anesthesiology −05, physical medicine and rehabilitation −25, neurology −13, and psychiatry −26, were described as interventional pain management. Orthopedic surgery −20, general surgery −17, and neurosurgery −14 were incorporated into surgical specialities. Diagnostic radiology −30 and interventional radiology −94 encompassed radiologic specialties. Finally, other physicians were grouped into a single separate group as general physicians, whereas all non-physician providers were grouped as other providers.

Data Sources

The data for years 2000 to 2014 obtained from the CMS physician supplier procedure summary master data files provides data of all FFS Medicare participants, above and below the age of 65, receiving facet and sacroiliac joint interventions. This sample does not include medicare advantage patients.

Bias

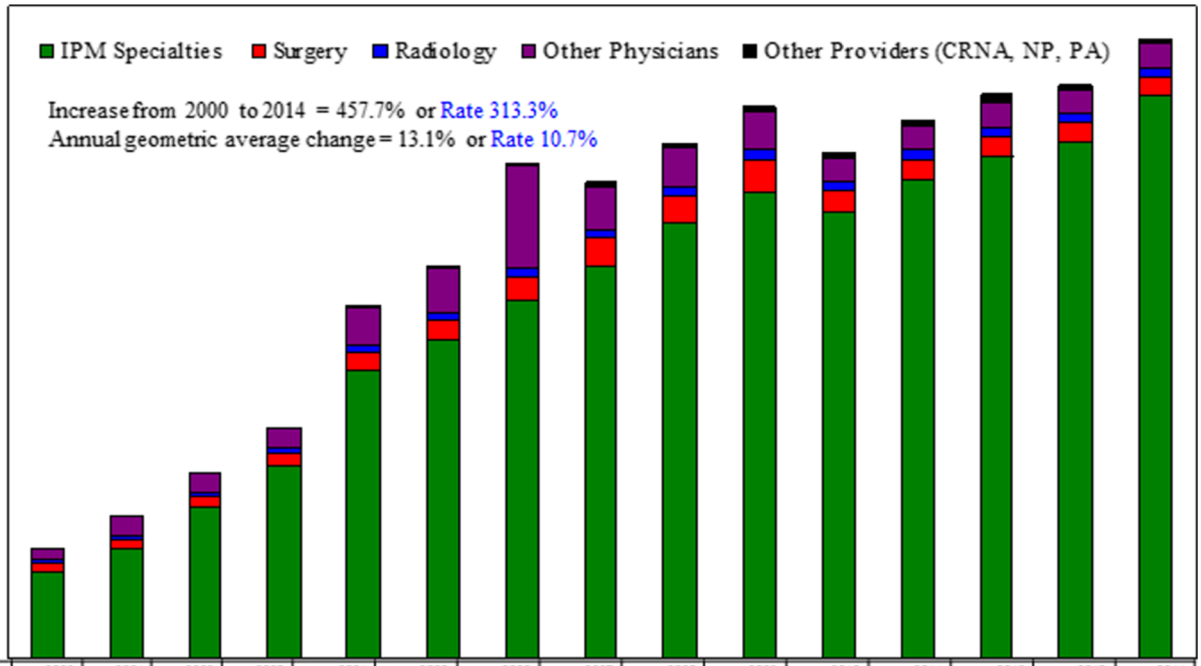
This analysis was conducted with the internal resources of the primary author's practice. There was no external funding. The American Society of Interventional Pain Physicians (ASIPP) purchased the data from CMS. These data files were 100 % data sets, providing data of utilization by CPT code with modifier usage, speciality codes, place of service, Medicare carrier number, total services, and charges submitted, allowed, and denied, and amount paid, are expected to be unbiased and also unpredictable in terms of identification of any patient characteristics.

Table 4 Utilizations of facet neurolysis interventions in the Medicare population from 2000 to 2014

Year	Cervical/thoracic facet neurolysis						Lumbar/sacral facet neurolysis					
	Total services rate per 100,000						Total services rate per 100,000					
	64626/64633	64627/64634	Services	% of change from previous year	Rate	% of change from previous year	64622/64635	64623/64636	Services	% of change from previous year	Rate	% of change from previous year
2000	2750	6054	8804	NA	22	NA	15,117	38,206	53,323	NA	135	NA
2001	3815	8334	12,149	38.0	30	36.6	18,792	47,632	66,424	24.6	166	23.3
2002	5190	12,202	17,392	43.2	43	41.5	25,744	63,522	89,266	34.4	220	32.9
2003	6877	15,301	22,178	27.5	54	25.6	35,315	83,166	118,481	32.7	288	30.7
2004	10,691	23,461	34,152	54.0	82	51.8	57,053	132,351	189,404	59.9	454	57.6
2005	12,015	26,298	38,313	12.2	90	10.2	63,228	146,688	209,916	10.8	494	8.8
2006	14,207	31,993	46,200	20.6	107	18.2	79,289	226,299	305,588	45.6	705	42.7
2007	17,689	39,710	57,399	24.2	130	21.6	88,069	209,416	297,485	−2.7	672	−4.7
2008	20,729	48,089	68,818	19.9	152	16.9	100,606	240,268	340,874	14.6	751	11.7
2009	25,510	57,973	83,483	21.3	182	20.3	112,627	263,386	376,013	10.3	821	9.4
2010	26,588	59,219	85,807	2.8	183	0.3	116,959	261,802	378,761	0.7	807	−1.7
2011	29,904	67,622	97,526	13.7	202	10.4	125,630	280,748	406,378	7.3	841	4.2
2012	35,621	66,096	101,717	4.3	202	0.2	141,130	265,202	406,332	0.0	808	−4.0
2013	39,055	69,902	108,957	7.1	210	3.8	155,353	279,033	434,386	6.9	837	3.6
2014	43,687	76,531	120,218	10.3	225	7.0	178,121	302,602	480,723	10.7	899	7.4
Change	1488.6 %	1164.1 %	1265.5 %		911.5 %		1078.3 %	692.0 %	801.5 %		567.8 %	
GM	21.8 %	19.9 %	20.5 %		18.0 %		19.3 %	15.9 %	17.0 %		14.5 %	

C/T facet neurolysis: 64626 or 64633, 64627 or 64634; L/S facet neurolysis: 64622 or 64635, 64623 or 64636

Change percentage change of change from 2000 to 2014, *GM* geometric average annual change



Specialty	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
IPM Specialties	78.5%	77.0%	81.2%	83.4%	81.6%	81.5%	72.0%	82.6%	84.4%	84.5%	88.2%	88.7%	88.9%	90.2%	91.0%
Surgery	7.6%	7.2%	6.4%	5.5%	5.1%	5.1%	5.0%	5.9%	5.7%	5.9%	4.4%	3.8%	3.5%	3.2%	3.0%
Radiology	2.9%	2.4%	2.3%	2.2%	1.6%	1.6%	1.5%	1.6%	1.6%	1.6%	1.7%	1.7%	1.7%	1.5%	1.4%
Other Physicians	10.9%	13.2%	9.8%	8.5%	11.2%	11.4%	20.9%	9.2%	7.5%	7.0%	4.6%	4.5%	4.4%	4.1%	4.0%
Other Providers (CRNA, NP, PA)	0.04%	0.15%	0.28%	0.36%	0.48%	0.49%	0.57%	0.72%	0.86%	0.90%	1.14%	1.27%	1.52%	0.97%	0.57%
Facets & SI joints	424,796	543,509	708,186	884,035	1,354,242	1,501,222	1,896,668	1,820,695	1,974,999	2,111,700	1,937,582	2,064,227	2,159,057	2,197,766	2,370,000

Fig. 2 Frequency of utilization of facet joint and sacroiliac joint interventions from 2000 to 2014 in Medicare beneficiaries

Study Size

This is a large analysis with inclusion of all patients in the Medicare FFS system receiving facet and sacroiliac joint interventions for spinal pain from 2000 to 2014.

Data Compilation

Microsoft Access 2003 and Microsoft Excel 2003 (Microsoft, Redmond, WA) were utilized for data compilation.

Results

Population Characteristics

As shown in Table 1, the number of Medicare beneficiaries increased from 39.632 million in 2000 to 53,500 million in 2014, an increase of 35 % compared to an increase of 13 % in the US population. The disabled population on Medicare below age 65 increased at an annual rate of 3.7 % with a total increase of 65.7 %, compared to those over 65 with an annual increase of 1.9 % and total increase of 30.2 %.

Facet joint and sacroiliac joint interventions (services) in Medicare recipients increased 457.7 % from 2000 to 2014. Facet joint and sacroiliac joint interventions increased from 1072 per 100,000 in 2000 to 4430 per 100,000 in 2014, a 313.3 % increase. In 2000, 67 % of procedures were performed in facility settings, whereas in 2014, only 50 % were performed in facility settings. As shown in Table 2, sacroiliac joint injections in FFS Medicare recipients increased 462.8 % from 2000 to 2014. Rate per 100,000 Medicare beneficiaries of sacroiliac joint injections increased from 125 in 2000 to 521 in 2014, a total increase of 316.9 %, with an annual increase of 10.7 %. In addition, Table 2 also showed the utilization rate for facet joint interventions increased 457.3 % with a rate of 312.8 % per 100,000 Medicare population from 2000 to 2014 and an annual increase rate of 10.7 % per 100,000 Medicare population, similar to sacroiliac joint injections.

Utilization Characteristics

The majority of the procedures and rate per 100,000 Medicare beneficiaries (84.3 % in 2000 and 79.6 % in 2014) were performed in the lumbosacral region, with cervical and thoracic procedures constituting 15.8 % in 2000 and 20.5 % in 2014.

Table 5 Utilization of facet and sacroiliac joint interventions (rates per 100,000) in the Medicare population from 2008 to 2014 based on Medicare carrier of 2014

State Name	R2008	R2009	R2010	R2011	R2012	R2013	R2014	Change	GM
Alabama	3,995	4,808	5,304	5,309	5,399	4,671	4,814	20.5 %	3.2 %
Georgia	5,996	7,122	5,948	6,509	6,499	5,892	6,207	3.5 %	0.6 %
Tennessee	6,173	6,276	6,324	6,470	6,493	4,903	4,343	−29.7 %	−5.7 %
Cahaba	5,510	6,209	5,901	6,175	6,204	5,237	5,216	−5.3 %	−0.9 %
CFPY		12.7 %	−5.0 %	4.6 %	0.5 %	−15.6 %	−0.4 %		
Kentucky	5,168	5,300	4,954	5,433	6,148	6,646	6,451	24.8 %	3.8 %
Ohio	3,680	4,076	4,084	4,114	4,489	4,509	4,495	22.2 %	3.4 %
CGS	**4,102**	**4,424**	**4,333**	**4,492**	**4,965**	**5,125**	**5,058**	**23.3 %**	**3.6 %**
CFPY		**7.9 %**	**−2.1 %**	**3.7 %**	**10.5 %**	**3.2 %**	**−1.3 %**		
Florida	9,118	8,766	7,101	7,229	7,344	6,862	7,183	−21.2 %	−3.9 %
First Coast	**9,118**	**8,766**	**7,101**	**7,229**	**7,344**	**6,862**	**7,183**	**−21.2 %**	**−3.9 %**
CFPY		**−3.9 %**	**−19.0 %**	**1.8 %**	**1.6 %**	**−6.6 %**	**4.7 %**		
Connecticut	2,459	2,360	2,431	2,670	2,876	3,014	3,429	39.4 %	5.7 %
Illinois	3,664	4,147	3,097	3,192	3,522	3,373	3,397	−7.3 %	−1.3 %
Massachusetts	3,078	3,456	3,756	4,380	4,697	4,665	4,644	50.9 %	7.1 %
Maine	2,138	2,329	2,370	2,851	3,120	3,165	3,903	82.5 %	10.5 %
Minnesota	2,042	2,219	2,088	2,195	2,345	2,252	2,302	12.7 %	2.0 %
New Hampshire	3,955	4,397	4,959	5,464	5,709	5,339	4,971	25.7 %	3.9 %
New York	2,484	2,133	2,115	2,183	2,224	2,522	2,802	12.8 %	2.0 %
Rhode Island	4,402	4,090	4,119	4,021	3,382	2,720	2,661	−39.5 %	−8.0 %
Vermont	2,461	2,760	2,763	2,810	2,758	3,136	3,423	39.1 %	5.7 %
Wisconsin	3,185	3,238	3,245	3,462	3,652	3,701	3,694	16.0 %	2.5 %
NGS	**2,894**	**2,949**	**2,772**	**2,962**	**3,128**	**3,184**	**3,325**	**14.9 %**	**2.3 %**
CFPY		**1.9 %**	**−6.0 %**	**6.8 %**	**5.6 %**	**1.8 %**	**4.4 %**		
Alaska	2,698	2,178	2,315	2,068	1,564	2,181	2,768	2.6 %	0.4 %
Arizona	4,531	5,784	5,949	6,117	6,056	6,314	6,691	47.7 %	6.7 %
California	3,322	3,639	3,109	3,168	3,118	2,997	2,921	−12.1 %	−2.1 %
Idaho	2,005	2,636	2,630	2,971	2,611	2,619	3,217	60.5 %	8.2 %
Montana	3,085	3,175	2,380	2,700	2,551	2,479	2,357	−23.6 %	−4.4 %
North Dakota	2,001	2,367	2,197	1,739	1,747	2,308	2,608	30.4 %	4.5 %
Nevada	4,059	4,599	5,250	5,546	6,186	6,169	6,366	56.8 %	7.8 %
Oregon	1,678	1,885	1,951	1,902	1,794	2,032	2,223	32.4 %	4.8 %
South Dakota	5,958	6,403	4,875	4,498	3,447	3,614	3,901	−34.5 %	−6.8 %
Utah	4,541	5,019	5,167	5,391	5,885	6,154	7,191	58.4 %	8.0 %
Washington	2,170	2,576	2,255	2,079	1,615	1,709	1,800	−17.0 %	−3.1 %
Wyoming	2,369	2,869	3,119	2,566	2,340	3,055	3,445	45.4 %	6.4 %
Noridian	**3,248**	**3,682**	**3,372**	**3,418**	**3,331**	**3,354**	**3,454**	**6.4 %**	**1.0 %**
CFPY		**13.4 %**	**−8.4 %**	**1.3 %**	**−2.5 %**	**0.7 %**	**3.0 %**		
Arkansas	8,229	7,651	7,076	5,901	5,974	6,538	7,278	−11.6 %	−2.0 %
Colorado	2,182	2,373	2,407	2,605	3,152	3,261	3,778	73.1 %	9.6 %
DC	17,348	18,151	17,003	19,332	18,592	26,127	30,455	75.5 %	9.8 %
Delaware	4,333	3,424	2,983	3,158	3,193	4,042	4,688	8.2 %	1.3 %
Louisiana	4,382	3,901	3,915	4,311	4,558	5,257	5,626	28.4 %	4.3 %
Maryland	4,672	4,370	3,891	4,363	4,548	5,058	5,550	18.8 %	2.9 %
Mississippi	4,657	6,071	5,063	5,483	5,952	6,168	5,487	17.8 %	2.8 %
New Jersey	2,691	2,597	2,665	2,972	3,100	3,689	3,789	40.8 %	5.9 %
New Mexico	2,916	2,925	2,923	3,226	3,556	3,479	3,567	22.3 %	3.4 %
Oklahoma	2,933	3,501	3,326	3,755	4,195	4,355	5,286	80.2 %	10.3 %

Table 5 (continued)

State Name	R2008	R2009	R2010	R2011	R2012	R2013	R2014	Change	GM
Pennsylvania	3,075	2,808	2,690	2,699	2,694	2,946	3,174	3.2 %	0.5 %
Texas	7,399	7,814	5,879	5,986	5,717	5,699	5,881	−20.5 %	−3.8 %
Novitas	**4,778**	**4,854**	**4,186**	**4,345**	**4,402**	**4,709**	**5,005**	**4.7 %**	**0.8 %**
CFPY		**1.6 %**	**−13.8 %**	**3.8 %**	**1.3 %**	**7.0 %**	**6.3 %**		
North Carolina	4,308	4,473	3,927	3,867	3,979	3,803	3,790	−12.0 %	−2.1 %
South Carolina	4,539	5,062	5,001	5,426	5,819	6,302	6,589	45.2 %	6.4 %
Virginia	2,843	3,062	2,754	2,946	2,918	3,424	3,888	36.8 %	5.4 %
West Virginia	3,260	3,777	3,944	4,144	4,500	4,891	5,106	56.6 %	7.8 %
Palmetto GBA	**3,804**	**4,096**	**3,795**	**3,937**	**4,088**	**4,321**	**4,534**	**19.2 %**	**3.0 %**
CFPY		**7.7 %**	**−7.4 %**	**3.8 %**	**3.8 %**	**5.7 %**	**4.9 %**		
Iowa	2,197	2,124	2,172	2,427	2,461	2,511	2,595	18.1 %	2.8 %
Indiana	4,647	4,663	4,872	5,313	5,566	4,988	5,558	19.6 %	3.0 %
Kansas	2,986	3,355	3,219	3,453	3,171	3,416	3,617	21.1 %	3.2 %
Michigan	7,794	8,184	6,633	6,958	7,586	7,549	8,317	6.7 %	1.1 %
Missouri	4,515	4,740	4,556	4,780	4,876	4,673	5,150	14.1 %	2.2 %
Nebraska	2,077	2,530	2,257	2,289	2,520	2,468	2,945	41.8 %	6.0 %
WPS	**5,117**	**5,354**	**4,820**	**5,123**	**5,404**	**5,273**	**5,806**	**13.5 %**	**2.1 %**
CFPY		**5 %**	**−10 %**	**6 %**	**5 %**	**−2 %**	**10 %**		
Total	**4,349**	**4,611**	**4,130**	**4,274**	**4,292**	**4,235**	**4,430**	**1.9 %**	**0.3 %**
CFPY		**6.0 %**	**−10.4 %**	**3.5 %**	**0.4 %**	**−1.3 %**	**4.6 %**		

Numbers in "bold" were totals by Medicare carriers

CFPY change from previous year

The most commonly performed procedures were subsequent lumbar facet joint/nerve blocks CPT 64475 or 64493 and 64476 or 64494 or 64495, with 60 % in 2000 and 47.5 % in 2014. Cervical/thoracic facet joint/nerve blocks (CPT 64470 or 64490, 64472, 64491, or 64492) increased 362.9 % and lumbar facet joint injection/nerve blocks increased 227.3 % per 100,000 Medicare beneficiaries from 2000 to 2014 (Table 3 and Fig. 1). Cervical/thoracic facet neurolysis increased 911.5 %, and lumbar facet neurolysis increased 567.8 % per 100,000 Medicare beneficiaries from 2000 to 2014 (Table 4 and Fig. 1). The rate of lumbar/sacral and cervical/thoracic facet joint injections declined 16.9 and 14.8 % in 2010 and 0.4 and 3.6 % in 2013.

Figure 1 illustrates the increase of various facet joint interventions and sacroiliac joint interventions and interventional pain management services from 2000 to 2014.

Specialty Characteristics

Figure 2 and Appendices 1 and 2 illustrate the increase in the utilization of facet and sacroiliac joint interventions by various specialty groups assigned as interventional pain management, surgery, radiology, general physicians, and others from 2000 to 2014. Across the country, 78.5 % of combined facet and sacroiliac joint interventions were performed by interventional pain management physicians in 2000 and 91.0 % in 2014.

State Utilization Characteristics

Table 5 and Appendices 3–6 show the frequency of utilization of facet and sacroiliac joint interventions from 2008 to 2014 based on Medicare part B carrier data for 2014 per 100,000 Medicare population. The utilization of facet and sacroiliac joint interventions varied from a reduction of 5.3 and 21.2 % in Cahaba and First Coast Services jurisdictions to an increase of 4.7 % to 23.3 % for other carriers. Noridian, with extensive regulations, showed a 6.4 % increase, with a 3.8 % increase for facet joint interventions. Appendices 3, 5, and 6 show utilization patterns by state based on highest utilization to lowest utilization in descending order.

Site of Service Utilization

Facet and sacroiliac joint interventions are provided in multiple settings including HOPDs, ASCs, and in physician's offices (in-office). There has been a significant shift over the years in the facet joint interventions based on the location of the performance. In 2002, HOPD services constituted 40 %, with ASCs providing 18.3 % of the service, and in-office was 41.7 %. Since then, the HOPD share decreased to 23.1 %, with

the ASC share increasing to 26.9 % and in-office share dramatically increasing to 50 % from 2002 to 2014 as shown in Appendices 7 and 8.

Discussion

The assessment of utilization patterns of facet and sacroiliac joint interventions in the FFS Medicare population continued to show alarming growth patterns from 2000 through 2014, with an increase of 313.3 % per 100,000 Medicare population from 2000 to 2014 similar to our previous reports [2, 4–6, 45]. The growth patterns are centered with overall growth of facet joint interventions with significant decreases in facet joint injections in 2010 of 14.8 % in the lumbar/sacral and 16.9 % in the cervical and thoracic spine per 100,000 Medicare recipients, with negligible decreases compared to 2011 for 2012 and 2013 with re-establishing increases in 2014 for facet joint interventions, whereas a small decrease was observed for sacroiliac joint interventions from 2012 to 2013 with an increase in 2014.

This analysis of claims of utilization essentially illustrates larger growth patterns of facet neurolysis with 911.5 % for cervical and thoracic, 567.8 % for lumbosacral, radiofrequency neurotomy from 2000 through 2014 compared to growth rate of 362.9 % for cervical/thoracic facet joint nerve blocks, 227.3 % of lumbosacral facet joint injections, and 316.9 % for sacroiliac joint injections. Overall the growth patterns have shown an increase of 312.8 % per 100,000 Medicare recipients with an annual increase of 10.7 % for facet joint interventions. However, sacroiliac joint interventions continued to increase with utilization with a rate of 316.9 or 10.7 % per year.

The results show similar patterns across the regions and specialties as shown in our previous evaluations [2, 4–6]. While explosive growth of facet joint interventions, specifically of radiofrequency neurotomy and lumbar transforaminal epidural injections, has been illustrated in the past [1••, 2 ,4-6] by proponents and opponents of the procedures, the methodology used to curb these increases without affecting the access has been variable. Some insurers have attempted to completely eliminate therapeutic facet joint interventions and encouraged radiofrequency neurotomy, and some CMS LCD policies have increased the limits in the therapeutic phase of facet joint injections from 4 to 5 per year with all of them seeming to either affect the access or increase the utilization [35, 36, 45]. These activities are very similar to the controls established in the early stages of opioid usage stating that they were utilizing guidance from boards of medical licensure, the Joint Commission Accreditation on Health care Organizations (JCAHO), and others, only to see increases of 400 % and escalating deaths [25, 46, 47]. Finally, with opioids escalating growth, adverse factors have been recognized and certain steps have been taken by multiple states to regulate opioid usage and by the Food and Drug Administration (FDA) changing hydrocodone from schedule III to II [25, 46, 47]. Paradoxically, the FDA also has encouraged increased utilization by approving Zohydro and multiple other long-acting opioids [47] with misinterpretation of essential evidence of prevalence of chronic persistent pain and disability. Bodies as auspicious as The Institute of Medicine (IOM) [18] have misinterpreted the data originally published by Gaskin and Richard [19]. Essentially, IOM has estimated the prevalence and cost of chronic pain based on prevalence and costs of not only moderate and severe pain 21 % but also joint pain 33 %, arthritis 25 %, and functional disability 12 %, leading to overblown estimations of disease burden. In fact, based on this study, the population suffering with moderate and severe pain was approximately 44 million, instead of 100 million, with a cost of $100 billion instead of $650 billion [47].

The results of this assessment show an overwhelming increase in utilization patterns of facet joint interventions and sacroiliac joint injections in general and cervical/thoracic and lumbar/sacral radiofrequency neurotomy in particular, ranging from a 227 % increase for lumbosacral facet joint blocks to 912 % for cervical/thoracic facet joint neurolysis. Comparatively, the population of the USA increased 13 % from 2000 to 2014, whereas the elderly population over 65 years of age increased 31.7 %. During this period, the elderly population increased to 16.8 % of the population, but Medicare beneficiaries constituted 19.8 %, increasing from 14 % in 2000.

Among the Medicare beneficiaries, the increases were 30.2 % for those aged over 65, whereas for those disabled individuals younger than 65 years of age, the growth rate was 65.7 %. Comparatively, epidural injections increased 99 % from 2000 to 2014 per 100,000 Medicare population with interlaminar epidural injections increasing 9 % with an annual rate of 0.6 %. Further, the growth patterns of facet joint and sacroiliac joint interventions reversed the long-standing dominance of epidural procedures, transforming facet and sacroiliac joint interventions into the number one place of most commonly performed interventional techniques. It is of major concern that while lumbosacral facet joint injections increased 277.3 % and cervical/thoracic facet joint blocks increased 362.9 %, lumbosacral facet joint facet neurolysis increased 567.8 % and finally cervical and thoracic facet neurolysis increased a whopping 911.5 %. Even then, the numbers of services performed were predominantly lumbosacral facet joint blocks (47.5 %), followed by lumbosacral radiofrequency neurotomy (20.3 %) and cervical and thoracic facet joint blocks (15.4 %). However, radiofrequency neurotomy procedures are twice as expensive as facet joint blocks, even though the relief patterns are also double that of facet joint blocks, but, in cervical region due to the

avoidance of bilateral facet joint radiofrequency neurotomy in the same setting, the costs of radiofrequency neurotomy may be even higher.

While these patterns of increase show an exponential growth, these patterns are similar to our previous assessments [2, 4–63•,]. In the past, some evaluations [48, 49] focused on the lumbar spine assessment and lack of evidence; however, with numerous developments in evidence synthesis and explosive utilization patterns in cervicothoracic as well, the previous assessments may no longer be valid. Among the more recent assessments, Beckworth et al. [39] also showed significant increases in utilization; however, their analysis artificially inflated the number of procedures performed [40] by utilizing duplicate services, thus increasing the number of services utilized by one third. They also concluded that the changes in the CPT coding were uniquely responsible for decreases in 2010. While this is a possibility, we believe that the OIG assessment and its warnings had a significant effect on the utilization patterns [35]. Interestingly, multiple measures with LCDs [3•, 36, 37, 45] and multiple negative publications [38] seem to have no significant effect on utilization patterns. We would therefore posit that future strategies to restrain the growth include appropriate understanding of the literature, accuracy of diagnostic interventions with controlled diagnostic blocks and 80 % pain relief as the criterion standard, proper assessment of therapeutic interventions utilizing unbiased methodological quality criteria assessment in systematic reviews, appropriate determination of indications and medical necessity, and finally development of clinically relevant, evidence-based guidelines and coverage policies [1••, 2, 4–6, 8, 10, 50–653•, 7••, 9•, 11•, 12•,].

Beyond the particulars described above, various researchers have indicated that there has in fact not been an increase in chronic pain [22, 23]. While the IOM indicated that the prevalence of chronic persistent pain to be affecting one third of the US population, other data has focused on the approximately 30 million individuals with significant disability. Freburger et al. [23] also have shown increases in the low back pain in North Carolina from 3.9 to 10.2 % in 1992 and 2006 showing an overall increase of 162 %. These assumptions are important as perception feeds into the reality of increases in the utilization of various management strategies designed to treat chronic pain [50–61]. Thus, proponents argue that the prevalence of chronic pain is increasing along with the evidence for diagnostic and therapeutic strategies. Utilizing appropriate quality assessment measures in systematic reviews, there has been significant evidence of the value and validity of diagnostic and therapeutic facet joint interventions, even though the evidence is only moderate for diagnostic sacroiliac joint interventions and limited for therapeutic sacroiliac joint interventions [7••, 8, 10, 13–16, 50–619•, 11•, 12•,]. Thus, facet and sacroiliac joint interventions performed in contemporary interventional pain management settings with proper indications and medical necessity may be the key to obtaining appropriate utilization. The discordant evidence illustrated may be dependent on interpretation of the placebo, long-term/short-term, and statistical analysis utilized by different groups due to lack of standardization and variable interpretation of methodologists and clinicians [7••, 8, 10, 13, 14, 62–72, 74–78, 809•, 11•, 12•, 73••, 79•,].

Multiple limitations of assessment include lack of inclusion of Medicare Advantage participants constituting approximately 20 to 30 % of Medicare patients, potential coding errors, and lack of appropriate and identifiable coding patterns for sacroiliac joint interventions other than sacroiliac joint injections. However, the major advantage of this assessment is that we have included all patients in the FFS Medicare which included both the elderly population as well as the disabled population. This inclusion often is crucial as the disabled population tends to be higher utilizers [81].

In summary, the growth of facet and sacroiliac joint interventions continues. Thus, appropriate evidence synthesis and application of principles demonstrating medical necessity are crucial in managing the growth patterns into the future.

Conclusion

This assessment showed significant increases in facet joint and sacroiliac joint intervention utilization patterns of 313.3 % per 100,000 Medicare population from 2000 to 2014 compared to an overall Medicare beneficiary increase of 35 %. Further analysis also showed that lumbosacral facet joint blocks increased 227.3 %, compared to cervical and thoracic facet joint blocks of 362.9 %; however, increases of lumbosacral neurolysis were shown to be more dramatic with 567.8 % for lumbosacral facet neurolysis and 911.5 % for cervical and thoracic facet neurolysis. Sacroiliac joint injections increased 316.9 %.

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Compliance with Ethical Standards

Conflict of Interest Laxmaiah Manchikanti declares to have provided limited consulting services to Semnur Pharmaceuticals, Incorporated, which is developing nonparticulate steroids.

Joshua A. Hirsch declares he is a consultant for Medtronic and declares personal fees for teaching a single course for Carefusion.

Vidyasagar Pampati and Mark V. Boswell declare no conflict of interest.

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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