Health Policy Review

Utilization Patterns of Sacroiliac Joint Injections from 2000 to 2018 in Fee-for-Service Medicare Population

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Background: Sacroiliac joint is one of the proven causes of low back and lower extremity pain. Prevalence estimates of sacroiliac joint pain range from 10% to 25% in patients with persistent axial low back pain without disc herniation, discogenic pain, or radiculitis based on multiple diagnostic studies and systematic reviews. Over the years, utilization patterns of sacroiliac joint injections have been increasing in comparison to other interventional techniques. Further, the development of new current procedural terminology (CPT) codes and coverage policies for sacroiliac joint nerve blocks, sacroiliac joint radiofrequency neurotomy, and evolving evidence for sacroiliac joint fusion will further increase the utilization patterns.

Study Design: Analysis of growth patterns of sacroiliac joint injections from 2000 to 2018 with comparative analysis of 2000 to 2009 and 2009 to 2018.

Objectives: To assess utilization patterns of sacroiliac joint injections from 2000 to 2018.

Methods The Centers for Medicare and Medicaid Services (CMS) Physician/Supplier Procedure Summary (PSPS) Master dataset was utilized in this analysis.

Results: The results of the evaluation from 2009 to 2018 showed an increase of 11.3% and an annual increase of 1.2% per 100,000 Medicare population. However, from 2000 to 2009, an increase of 299.8% from 2000 to 2009 with an annual increase of 16.6% per 100,000 Medicare population.

Limitations: The limitations of this study included a lack of data on the new sacroiliac joint nerve block and radiofrequency neurotomy codes. Further, this data did not include utilization patterns of sacroiliac joint fusions. In addition, Medicare Advantage patients were not included, which constitute approximately 30% of overall Medicare population. Further, there is also a possibility that state claims data may include claims from other states. As with all claims-based data analyses, this study is retrospective and thus potentially limited by bias. Finally, patients who are self or commercially insured are not part of the dataset.

Conclusions: This study shows increases in utilization patterns of sacroiliac joint injections; however, at a significantly lower rate with an annual increase of 16.6% prior to 2009 and only 1.2% from 2009 to 2018 per 100,000 Medicare beneficiaries

Key words: Chronic spinal pain, low back pain, sacroiliac joint arthritis, interventional techniques, sacroiliac joint injections

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Low back pain has been the number one cause of disability with an extensive toll on health care and the economy of the world and the United States (1-9). The US Burden of Disease Collaborators and the state of US health care data from 1990 to 2010 accounted for nearly half of the US health care burden due to morbidity and chronic disability (1). Low back pain was rated as number one, other musculoskeletal disorders ranking number 2, whereas neck pain ranked number 3 among the 30 leading diseases and injuries contributing to years lived with a disability. Dieleman et al (2-4) published health care spending patterns in

the United States from 1996 to 2016. They showed that in 2013, estimated spending in managing low back and neck pain was $87.6 billion (2), which increased to $134.5 billion in 2016. Overall, US health care spending reached $3.65 trillion in 2018 (10) with an annual spending per person of $11,212 (1).

Among the multiple proven causes of low back and lower extremity pain, the sacroiliac joint is one of the common causes in addition to discs, nerve roots, and facet joints (8-12). Consequently, of all the multiple interventional techniques, sacroiliac joint injections, are one of the commonly utilized modalities of treatment in managing pain of sacroiliac joint or low back pain (5-14). Despite significant increases in various modalities managing low back pain, interventional techniques and other modalities, including opioid therapy, have been debated on a regular basis for appropriateness of utilization, treatment effectiveness, and cost utility (5-48). Similar to the decline in opioid prescriptions, there have been declines in the utilization of interventional techniques. However, criticism still continues in reference to the appropriateness of care, medical necessity and indications, and the excessive utilization of interventional techniques, despite extensive literature showing clinical and cost-utility of these interventions (8,34,35,38-47).

The utilization patterns of interventional techniques have shown a continued increase of facet joint interventions and sacroiliac joint injections, though with much slower growth, from 2009 to 2018 at an annual rate of 0.9% increase, compared to an annual increase of 17.6% from 2000 to 2009 (16). Further, analysis of epidural injections and facet joint interventions have shown a decline or significant reduction in growth patterns (12-15). The utilization study of sacroiliac joint injections from 2000 to 2016 showed milder increases than in previous years (14). Further, for sacroiliac joint pain treatment, further modalities have been advanced in recent years with new codes developed for sacroiliac joint nerve blocks and sacroiliac joint radiofrequency and emerging literature and increasing utilization of sacroiliac joint fusion with the potential to significantly increase in the future. The analysis of epidural and facet joint intervention utilization patterns also revealed some interesting patterns with very slow decline of transforaminal epidural injections compared to a steep decline of interlaminar epidural injections, and a decline of facet joint nerve blocks compared to slower increases of radiofrequency neurotomy procedures, with significant reversals of ratios of interlaminar epidural to transforaminal and facet joint nerve blocks to facet joint radiofrequency neurotomy procedures.

This retrospective cohort study of utilization patterns of sacroiliac joint injections evaluates the period covering 2000 to 2018, updating previous publications (14) examining the utilization patterns and fee-for-service (FFS) Medicare population in the United States.

Methods

This retrospective utilization analysis was performed with the public use file available through the Centers for Medicare and Medicaid Services (CMS) database (49). Strengthening the Reporting of Observational Studies (STROBE) in epidemiology guidance (50) was also utilized. Approval from the Institutional Review Board was not required.

Study Design

This assessment was designed to evaluate usage or utilization patterns and variables of sacroiliac joint injections from 2000 to 2018 in the Medicare fee-for-service (FFS) population in the United States.

Participants

The data from all the participants from the database of FFS Medicare recipients were utilized from 2000 to 2018.

Variables

Multiple variables were assessed including usage patterns of sacroiliac joint injections from 2000 to 2018, from 2000 to 2009, and 2009 to 2018.

The Current Procedural Terminology (CPT) code for sacroiliac joint injections CPT 20670 and G20670 for physician, hospital outpatient department (HOPD), and ambulatory surgery center (ASC) was utilized which has been in effect during the entire study period.

The data were also assessed based on the place of service identifying HOPD, ASC, and a non-facility setting or office setting.

Data Sources

The analyzed data were obtained from the CMS Physician/Supplier Procedure Summary Master Data file from 2000 to 2018 (49). These data consisted of all FFS Medicare participants.

Measures

The usage pattern analysis included all allowed services configured by taking services submitted minus

services denied and services with zero payments. The rate was calculated per 100,000 Medicare beneficiaries.

Bias

The American Society of Interventional Pain Physicians (ASIPP) a not-for-profit organization, purchased the data. The study was also conducted with the internal resources of the primary authors' practice without external funding.

Study Size

The database is large. In addition, the data was non-identifiable, which is non-attributable and non-confidential.

Data Compilation

Data were compiled utilizing Microsoft 365 Access and Microsoft 365 Excel (Microsoft, Redmond, WA). The data were calculated for overall services for each procedure, and the rate of services, based on utilization per 100,000 FFS Medicare beneficiaries.

Results

Participants

Participants in this assessment included all FFS Medicare recipients from 2000 to 2018.

Utilization Characteristics

Table 1 shows the frequency of sacroiliac joint injections in the Medicare population from 2000 to 2018 with comparative data from 2000 to 2009 and 2009 to 2018. Comparative analysis showed that sacroiliac joint injections increased 299.8% from 2000 to 2009 with an annual increase of 16.6%, whereas the increases were milder per 100,000 Medicare population from 2009 to 2018 with a total increase of 11.3% and an annual increase of 1.2%.

Figure 1 shows relative declines of various interventional techniques compared to sacroiliac joint blocks with comparison of lumbar facet joint blocks, lumbar epidural injections, disc procedures and other types of nerve blocks, in comparison to all interventional techniques.

Figure 2 shows increasing growth of sacroiliac joint blocks.

Figure 3 shows proportion of sacroiliac joint injections compared to all interventional techniques increasing from 3.3% in 2000 to 5.9% in 2018, an increase of 79%.

Utilization Characteristic by State

Utilization characteristics in various states were analyzed based on Medicare Administrative Contractors (MACs) jurisdictions.

As shown in Table 2, based on MACs jurisdictions from 2009 to 2018, First Coast Services covering Florida and Cahaba covering Alabama, Georgia, Tennessee showed 1.5% and 2.2% reductions in utilization per year with a total of 12.5% and 18.0% decrease overall. All other carriers showed increases ranging from 0.8% for WPS, 1.2% for Palmetto, 1.8% for CGS, 2.2% for Novitas, and for NGS, and, finally, the highest increases noted for Noridian with 4.0% annually or 42% from 2009 to 2018. Noridian led policies removed Local Coverage Determination (LCD) for sacroiliac joint injections (51,52). The data also showed major increases in Noridian states as high as 16.5% for Alaska, 7.1% for Wyoming, 6.8% for North Dakota, 6.8%, 6.7%for Oregon, 6.1% for Utah, and 5.6% for Arizona. Only one Noridian state – Montana, showed a decline of 1.3%. Multiple other states also showed increases in other MACs with over 5% including the states of Oklahoma, Delaware, District of Columbia, Connecticut, Colorado, Idaho, and Massachusetts. The majority of the declines were observed in Tennessee and Rhode Island, with minor declines in Texas, Montana, and Florida. The assessment of usage patterns of sacroiliac joint injections from 2000 to 2009 showed escalating usage with annual increases of 16.6% and an overall increase of 299%, whereas from 2009 to 2018, overall increases were 11.3% with an annual increase of 1.2% per 100,000 Medicare population. Overall, the study showed dampened increase in utilization patterns of sacroiliac joint injections from 2009 to 2018.

Specialty Characteristics

As shown in Table 3, the majority of the sacroiliac joint injections were performed by interventional pain management specialists. However, there was a significant increase of performance by other providers including CRNAs, NPs, and PAs with an annual increase of 5.9% from 2009 to 2018.

Table 1 shows utilization patterns by state per 100,000 Medicare population. In contrast, Appendix Table 2 shows utilization of sacroiliac joint services by MAC with similar results as to rates.

Statewide utilization data showed that while there were declines and milder increases in the majority of the jurisdictions, in Noridian jurisdictions, there was an increase of utilization patterns of 4% on an annual

Table 1. *Characteristics of Medicare beneficiaries and sacroiliac joint injections from 2000 to 2018.*

	U.S. Population			Medicare Beneficiaries				SIJ Injections			
	Total Pop. (,000)	≥ 65 Years (,000) Number	≥ 65 Years (,000) %	Number (,000)	% of U.S. pop.	≥ 65 years (,000) %	< 65 years (,000) %	Services*	% of Change From Previous Year	Rate per 100,000 Medicare Beneficiaries	% of Change From Previous Year
2000	282,172	35,077	12.4%	39,632	14.0%	34,262 (86.5%)	5,370 (13.5%)	49,554 (59%)	NA	125	NA
2001	285,040	35,332	12.4%	40,045	14.0%	34,478 (86.1%)	5,567 (13.9%)	85,664 (41%)	72.9%	214	71.1%
2002	288,369	35,605	12.3%	40,503	14.0%	34,698 (85.7%)	5,805 (14.3%)	101,749 (48%)	18.8%	251	17.4%
2003	290,211	35,952	12.4%	41,126	14.2%	35,050 (85.2%)	6,078 (14.8%)	128,864 (42%)	26.6%	313	24.7%
2004	292,892	36,302	12.4%	41,729	14.2%	35,328 (84.7%)	6,402 (15.3%)	172,704 (41%)	34.0%	414	32.1%
2005	295,561	36,752	12.4%	42,496	14.4%	35,777 (84.2%)	6,723 (15.8%)	188,606 (42%)	9.2%	444	7.2%
2006	299,395	37,264	12.4%	43,339	14.5%	36,317 (83.8%)	7,022 (16.2%)	211,928 (40%)	12.4%	489	10.2%
2007	301,290	37,942	12.6%	44,263	14.7%	36,966 (83.5%)	7,297 (16.5%)	213,489 (41%)	0.7%	482	-1.4%
2008	304,056	38,870	12.8%	45,412	14.9%	37,896 (83.4%)	7,516 (16.6%)	228,687 (42%)	7.1%	504	4.4%
2009	307,006	39,570	12.9%	45,801	14.9%	38,177 (83.4%)	7,624 (16.6%)	228,946 (42%)	0.1%	500	-0.7%
2010	308,746	40,268	13.0%	46,914	15.2%	38,991 (83.1%)	7,923 (16.9%)	237,905 (42%)	3.9%	507	1.4%
2011	311,583	41,370	13.3%	48,300	15.5%	40,000 (82.8%)	8,300 (17.2%)	252,654 (43%)	6.2%	523	3.2%
2012	313,874	43,144	13.8%	50,300	16.0%	41,900 (83.3%)	8,500 (16.9%)	266,764 (45%)	5.6%	530	1.4%
2013	316,129	44,704	14.1%	51,900	16.4%	43,100 (83.0%)	8,800 (17.0%)	266,643 (47%)	0.0%	514	-3.1%
2014	318,892	46,179	14.5%	53,500	16.8%	44,600 (83.4%)	8,900 (16.5%)	278,866 (48%)	4.6%	521	1.5%
Y2015	320,897	47,734	14.88%	54,900	17.1%	46,000 (83.8%)	9,000 (16.4%)	296,997 (49%)	6.5%	541	3.8%
Y2016	323,127	49,244	15.24%	56,500	17.5%	47,500 (84.1%)	9,000 (15.9%)	315,480 (45%)	6.2%	558	3.2%
Y2017	326,625	51,055	15.63%	58,000	17.8%	49,200 (84.8%)	8,900 (15.2%)	325,642 (45%)	3.2%	561	0.6%
Y2018	327,167	52,347	16.00%	59,600	18.2%	50,800 (85.2%)	8,800 (14.8%)	331,537 (46%)	1.8%	556	-0.9%
2000-2018	15.9%	49.2%	29.0%	50.4%		48.3%	63.9%	569.0%		344.9%	
GM	0.8%	2.3%	1.4%	2.3%		2.2%	2.8%	11.1%		8.7%	
2000-2009	8.8%	12.8%	4.0%	15.6%		11.4%	42.0%	362.0%		299.8%	
GM	0.9%	1.3%	0.4%	1.6%		1.2%	4.0%	18.5%		16.6%	
2009-2018	6.6%	32.3%	24.0%	30.1%		33.1%	15.4%	44.8%		11.3%	
GM	0.7%	3.2%	2.4%	3.0%		3.2%	1.6%	4.2%		1.2%	

GM - Geometric average annual change ( ) facility percentage pop - population

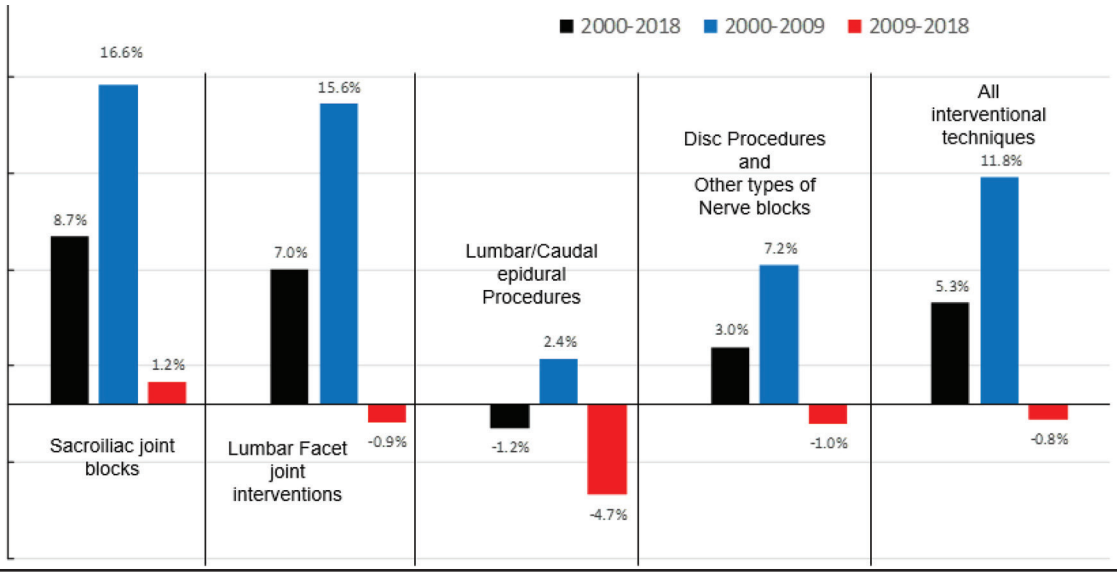
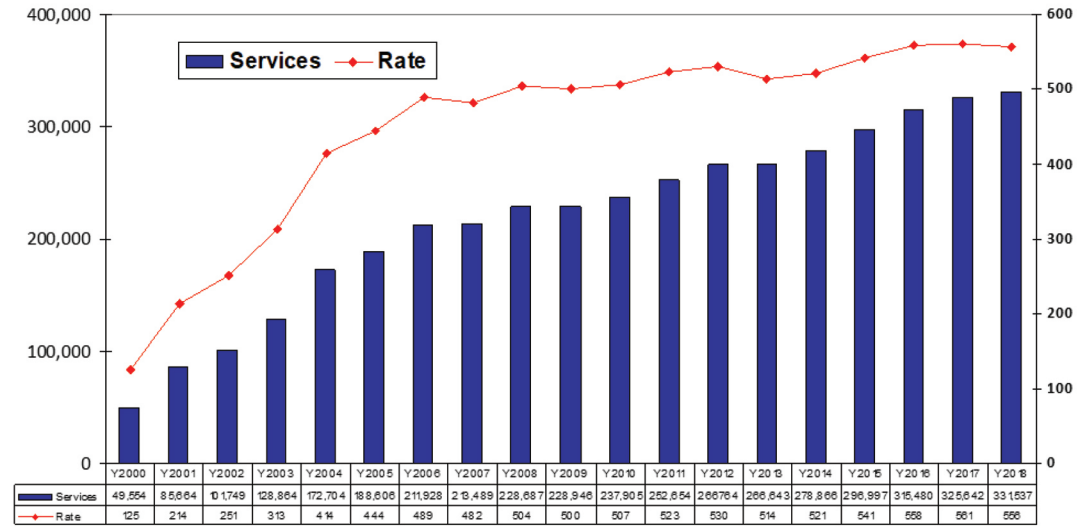


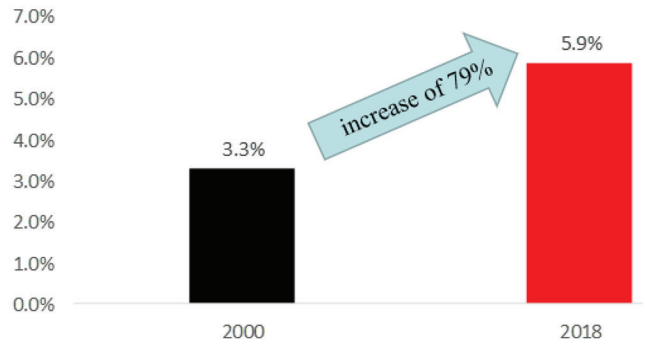
Fig. 1. *Comparative analysis of sacroiliac joint blocks, lumbar facet joint interventions, lumbar/caudal epidural procedures, disc procedures and other types of nerve blocks, all interventional techniques.*



	Y2000	Y2001	Y2002	Y2003	Y2004	Y2005	Y2006	Y2007	Y2008	Y2009	Y2010	Y2011	Y2012	Y2013	Y2014	Y2015	Y2016	Y2017	Y2018
Services	49,554	85,664	101,749	128,864	172,704	188,606	211,928	213,489	228,687	228,946	237,905	252,654	266764	266,643	278,866	296,997	315,480	325,642	331,537
Rate	125	214	251	313	414	444	489	482	504	500	507	523	530	514	521	541	558	561	556

Fig. 2. *Growth of sacroiliac joint blocks*

Fig. 3. *Proportion of sacroiliac joint injections compared to all interventional techniques.*



basis. Further, some of the states showed significant increases as high as 16.5% (with only one state showing a decline of 1.3%) attributed to the Noridian led elimination of sacroiliac joint LCDs for Noridian states and across the United States.

Discussion

The comparative assessment of utilization data of sacroiliac joint injections for low back and lower extremity pain in Medicare FFS population from 2000 to 2018 showed dramatic shifts from 2009 to 2018 after enactment of the Affordable Care Act (ACA) and other regulations as compared with the period of 2000 to 2009. The data shows that there was a significant increase of utilization of sacroiliac joint injections from 2000 to 2009 with 299.8% per 100,000 Medicare population with an annual increase of 16.6%, but with modest growth from 2009 to 2018 with total increase of 11.3% and at an annual increase of only 1.2%. Consequently, while sacroiliac joints still show continuing increase in utilization, it is notably below the annual growth rate for the elderly population of 3.2% and of Medicare participants of 3%.

These growth patterns are similar in earlier years compared to the previous publications; however, there is a significant reversal of growth patterns even though there is no net decline from 2009 to 2018. However, while the increases appear to be similar to lumbar facet joint interventions during these periods they contrast with decreases of lumbar interlaminar epidural procedures (16-20) as shown in Fig. 1.

Over the years, the policymakers and the public continue to be focused on reducing the utilization or provider reimbursement rates to lower health care expenditures. Based on these policies, the Affordable Care Act (ACA) was enacted, which brought the most monumental changes in US health care policy since the passage of Medicare and Medicaid in 1965 with the 3 primary goals of increasing the number of insured, improving the quality of care, and controlling health care costs (53,54). However, the ACA does not appear to have increased access to health care, but only in-

Table 2. *Utilization of sacroiliac joint intervention rates by 2016 Medicare carrier from 2009-2018 in Medicare population.*

State Name	R2009	R2010	R2011	R2012	R2013	R2014	R2015	R2016	R2017	R2018	change	GM
Cahaba												
Alabama	617	836	809	850	745	695	768	805	667	668	8.2%	0.9%
Georgia	716	669	803	812	676	691	735	789	734	723	1.0%	0.1%
Tennessee	895	900	1101	845	568	455	417	448	449	437	-51.1%	-7.6%
Cahaba	750	792	905	833	658	613	637	680	623	615	-18.0%	-2.2%
CGS												
Kentucky	783	865	845	925	948	1071	1017	1139	1162	1093	39.7%	3.8%
Ohio	557	535	513	537	541	574	566	598	608	587	5.4%	0.6%
CGS Total	621	630	608	648	659	717	695	753	765	731	17.7%	1.8%
First Coast												
Florida	867	792	806	789	741	729	772	807	748	759	-12.5%	-1.5%
NGS												
Connecticut	290	287	368	459	504	530	558	570	539	459	58.4%	5.2%
Illinois	386	402	366	427	425	431	482	492	502	487	26.0%	2.6%
Maine	300	337	354	456	541	450	535	471	430	385	28.4%	2.8%
Massachusetts	353	401	453	494	482	491	500	531	541	554	56.9%	5.1%
Minnesota	276	324	315	330	307	284	287	321	313	313	13.4%	1.4%
New Hampshire	637	654	662	720	659	672	610	539	500	456	-28.4%	-3.7%
New York	250	206	223	261	296	315	359	315	309	319	27.6%	2.7%
Rhode Island	1173	1217	1194	1012	852	801	771	689	600	583	-50.3%	-7.5%
Vermont	337	385	400	400	416	454	497	476	455	454	34.5%	3.3%
Wisconsin	438	454	460	501	526	449	465	515	486	480	9.5%	1.0%

Table 2 (cont.). *Utilization of sacroiliac joint intervention rates by 2016 Medicare carrier from 2009-2018 in Medicare population.*

State Name	R2009	R2010	R2011	R2012	R2013	R2014	R2015	R2016	R2017	R2018	change	GM
NGS Total	345	348	358	400	412	409	440	434	426	419	21.3%	2.2%
Noridian												
Alaska	139	135	180	271	268	270	861	531	522	547	294.0%	16.5%
Arizona	408	441	441	498	577	643	617	657	642	667	63.4%	5.6%
California	285	299	290	293	280	303	327	327	347	342	19.7%	2.0%
Idaho	414	391	419	469	474	568	607	618	623	649	57.0%	5.1%
Montana	343	264	305	284	268	267	244	293	284	304	-11.4%	-1.3%
Nevada	390	401	456	443	485	468	526	537	660	676	73.1%	6.3%
North Dakota	474	547	526	651	773	874	833	861	811	855	80.4%	6.8%
Oregon	215	239	261	283	288	369	402	369	380	386	79.6%	6.7%
South Dakota	1001	997	1074	1152	1127	1179	1203	1290	1420	1435	43.4%	4.1%
Utah	588	660	685	787	708	818	941	1013	968	1002	70.4%	6.1%
Washington	225	217	226	214	266	262	298	309	339	347	54.3%	4.9%
Wyoming	266	262	289	324	434	457	542	511	491	493	85.3%	7.1%
Noridian Total	318	331	335	350	360	393	422	426	446	451	42.0%	4.0%
Novitas												
Arkansas	543	469	449	470	506	530	608	618	705	760	39.9%	3.8%
Colorado	337	352	383	435	464	502	518	556	532	528	56.9%	5.1%
DC	1669	1639	1795	2031	2695	3017	3452	3430	3412	3059	83.3%	7.0%
Delaware	297	289	486	571	704	675	640	548	539	562	89.1%	7.3%
Louisiana	303	281	291	291	345	319	363	386	378	403	33.1%	3.2%
Maryland	404	387	376	442	509	517	545	511	509	512	26.8%	2.7%
Mississippi	592	553	507	507	572	575	677	725	651	699	18.2%	1.9%
New Jersey	345	349	359	379	421	423	437	461	429	441	27.8%	2.8%
New Mexico	304	291	327	374	392	367	364	339	319	295	-3.0%	-0.3%
Oklahoma	341	313	438	499	477	493	620	613	722	695	103.7%	8.2%
Pennsylvania	295	316	316	318	349	377	374	390	411	399	35.0%	3.4%
Texas	566	505	526	520	502	542	574	573	514	510	-9.8%	-1.1%
Novitas Total	424	404	422	439	465	486	520	530	516	516	21.6%	2.2%
Palmetto GBA												
North Carolina	613	618	673	736	716	717	759	795	743	739	20.5%	2.1%
South Carolina	708	803	988	1051	1034	961	809	777	736	711	0.4%	0.0%
Virginia	563	584	650	571	544	607	638	626	615	630	11.7%	1.2%
West Virginia	491	429	428	411	424	400	379	476	495	443	-9.8%	-1.1%
Palmetto Total	605	626	706	719	704	706	699	711	681	674	11.4%	1.2%
WPS												
Indiana	616	707	800	844	735	796	783	814	789	769	24.8%	2.5%
Iowa	394	431	435	507	517	514	507	577	559	588	49.4%	4.6%
Kansas	550	651	660	637	623	643	657	633	575	598	8.6%	0.9%
Michigan	836	1025	891	997	919	789	784	798	888	789	-5.7%	-0.6%
Missouri	865	850	868	885	908	922	909	934	897	900	4.0%	0.4%
Nebraska	563	578	539	610	702	878	627	704	622	752	33.5%	3.3%
WPS Total	709	802	779	838	799	781	761	786	794	765	7.9%	0.8%
US Total	500	507	523	530	514	521	514	558	561	556	11.2%	1.2%

Table 3. *Utilizations of sacroiliac joint injections by specialty the Medicare population from 2000-2018.*

Specialty	Interventional Pain management		Surgery		Radiology		General Physicians		Other Physicians		CRNA, NP & PA		SI joints	
	Services	Rate	**Services**	Rate	**Services**	Rate	**Services**	Rate	**Services**	Rate	**Services**	Rate	**Services**	Rate
F2000	**40,274**	102	**2,778**	7	**2,171**	5	**1,260**	3	**3,050**	8	**21**	0.05	49,554	***125***
F2001	**70,302**	176	**4,316**	11	**1,606**	4	**2,663**	7	**6,606**	16	**171**	0.43	85,664	***214***
F2002	**87,540**	216	**5,101**	13	**2,210**	5	**2,950**	7	**3,589**	9	**359**	0.89	101,749	***251***
F2003	**112,933**	275	**5,925**	14	**3,020**	7	**4,781**	12	**1,584**	4	**621**	2	128,864	***313***
F2004	**147,395**	353	**7,507**	18	**4,155**	10	**9,047**	22	**2,951**	7	**1,649**	4	172,704	***414***
F2005	**160,850**	379	**8,215**	19	**4,566**	11	**9,817**	23	**3,296**	8	**1,862**	4	188,606	***444***
F2006	**176,141**	406	**8,996**	21	**4,880**	11	**16,132**	37	**3,152**	7	**2,627**	6	211,928	***489***
F2007	**182,960**	413	**9,464**	21	**5,582**	13	**9,627**	22	**3,251**	7	**2,605**	6	213,489	***482***
F2008	**194,437**	428	**10,748**	24	**6,187**	14	**10,177**	22	**4,508**	10	**2,630**	6	228,687	***504***
F2009	**194,326**	424	**11,552**	25	**6,563**	14	**10,023**	22	**3,609**	8	**2,873**	6	228,946	***500***
F2010	**202,386**	431	**9,473**	20	**6,570**	14	**11,360**	24	**4,584**	10	**3,532**	8	237,905	***507***
F2011	**215,207**	446	**9,005**	19	**7,288**	15	**11,079**	23	**5,122**	11	**4,953**	10	252,654	***523***
F2012	**228,968**	455	**8,994**	18	**8,253**	16	**10,625**	21	**3,563**	7	**6,361**	13	266764	***530***
F2013	**229,739**	443	**9,361**	18	**8,019**	15	**10,278**	20	**3,380**	7	**5,866**	11	266,643	***514***
F2014	**242,896**	454	**10,619**	20	**8,430**	16	**8,726**	16	**3,361**	6	**4,834**	9	278,866	***521***
F2015	**259,079**	472	**11,233**	20	**9,171**	17	**8,160**	15	**3,477**	6	**5,877**	11	296,997	***541***
F2016	**275,364**	487	**11,118**	20	**10,430**	18	**8,757**	15	**3,402**	6	**6,409**	11	315,480	***558***
F2017	**284,540**	491	**10,616**	18	**10,734**	19	**10,122**	17	**2,770**	5	**6,842**	12	325,642	***561***
F2018	**292,950**	492	**11,551**	19	**11,144**	19	**7,157**	12	**2,496**	4	**6,239**	10	331,537	***556***
2000-18	627.4%	383.7%	315.8%	176.5%	413.3%	241.3%	468.0%	277.7%	-18.2%	-45.6%	29609.5%	19655.8%	569.0%	344.9%
GM	11.7%	9.2%	8.2%	5.8%	9.5%	7.1%	10.1%	7.7%	-1.1%	-3.3%	37.2%	34.2%	11.1%	8.7%
2000-09	382.5%	317.5%	315.8%	259.8%	202.3%	161.6%	695.5%	588.3%	18.3%	2.4%	13581.0%	11738.2%	362.0%	299.8%
GM	19.1%	17.2%	17.2%	15.3%	13.1%	11.3%	25.9%	23.9%	1.9%	0.3%	72.7%	70.0%	18.5%	16.6%
2009-18	50.8%	15.8%	0.0%	-23.2%	69.8%	30.5%	-28.6%	-45.1%	-30.8%	-46.9%	117.2%	66.9%	44.8%	11.3%
GM	4.7%	1.6%	0.0%	-2.9%	6.1%	3.0%	-3.7%	-6.5%	-4.0%	-6.8%	9.0%	5.9%	4.2%	1.2%

creased the number of insureds' affordability, without a significant effect on quality. Further, with increasing regulations, administrative expenses for all sectors, payers, and providers continues to escalate (53-57), with no significant improvement in quality or long-term cost controls (55). These measures have led to a decline in utilization patterns of interventional techniques, and at the same time, may have contributed to the opioid epidemic with reducing prescriptions, but a continued increase in the death rate.

There is moderate literature demonstrating the diagnostic value of sacroiliac joint injections (11) with limited evidence of therapeutic facet joint injections. Due to lack of appropriate coding patterns for sacroiliac joint nerve blocks and radiofrequency neurotomy, these data are not available. Thus, based on insufficient literature compared to other modalities, such as epidural injections and facet joint interventions, discordant opinions and conclusions continue with lack of agreement between opponents and proponents of the effectiveness and appropriateness of sacroiliac joint injections, or in future interventions, including fusion.

In the peak of regulatory escalation, multiple LCDs were spearheaded by Noridian, presumably to discourage performance of interventional techniques and reduce their utilization. During these changes, Noridian policies were adapted by all MACs. At the same time, specific policies were omitted for sacroiliac joint injections, cervical epidural injections, and percutane-

ous adhesiolysis. However, Noridian also went further by issuing a non-coverage policy for percutaneous adhesiolysis, which was also adapted by Palmetto, which resulted in significant reductions in its utilization (33,40). With lack of LCD, sacroiliac joint injection utilization increased significantly in Noridian states with an annual rate of 4.3% per 100,000 Medicare population compared to a national rate of 1.2%. Further, statewide data also showed extensive increases at an annual rate of 21.1% for Alaska, 9.8% for Wyoming, 8.9% for North Dakota, 8.1% for Utah, 8% for Oregon, 7% for Arizona, 5.9% for Idaho, and 4.7% for Nevada.

The declining rate of utilization of interventional pain management procedures may be considered as a contributing factor to the escalating opioid epidemic (11,13,22,37,38,66). Multiple attempts have been made from administration officials to curtail the opioid epidemic with promotion of non-opioid interventional techniques (5,11,22,66-68); however, in contrast to the public perceptions and perceived policies, we believe that the present policies continue to promote the decline of non-opioid techniques (5,11,22,32,39,41,44,46,64,70-72).

Limitations of this assessment include lack of inclusion of Medicare Advantage Plans, which constitute approximately 30% of the population, as well as self and commercially insured plans. However, the present assessment also is expected to apply to Medicare Advantage Plans and other carriers with enhanced implementation of reduction strategies. As with all claims based data reviews, this analysis is retrospective and thus could be influenced by reviewer bias.

Conclusion

The assessment of usage patterns of sacroiliac joint blocks from 2000 to 2018 showed a trend with decrease in the rate of increase of utilization from 2009 to 2018. From 2009-2018 there was an annual increase of 1.6% per 100,000 Medicare population, compared to an annual increase of 16.6% from 2000 to 2009. Multiple factors have been attributed to changes in utilization patterns.

Author Contributions

The study was designed by LM, VSP, AND MVM.

Statistical analysis was performed by VSP.

All authors contributed to preparation to the manuscript, reviewed, and approved the content with final version.

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Appendix Table 1. *Utilization of sacroiliac joint injections rates by state*

State Name	R2009	R2010	R2011	R2012	R2013	R2014	R2015	R2016	R2017	R2018	change	GM
Alabama	617	836	809	850	745	695	768	805	667	668	8.2%	0.9%
Alaska	139	135	180	271	268	270	861	531	522	547	294.0%	16.5%
Arizona	408	441	441	498	577	643	617	657	642	667	63.4%	5.6%
Arkansas	543	469	449	470	506	530	608	618	705	760	39.9%	3.8%
California	285	299	290	293	280	303	327	327	347	342	19.7%	2.0%
Colorado	337	352	383	435	464	502	518	556	532	528	56.9%	5.1%
Connecticut	290	287	368	459	504	530	558	570	539	459	58.4%	5.2%
DC	1669	1639	1795	2031	2695	3017	3452	3430	3412	3059	83.3%	7.0%
Delaware	297	289	486	571	704	675	640	548	539	562	89.1%	7.3%
Florida	867	792	806	789	741	729	772	807	748	759	-12.5%	-1.5%
Georgia	716	669	803	812	676	691	735	789	734	723	1.0%	0.1%
Idaho	414	391	419	469	474	568	607	618	623	649	57.0%	5.1%
Illinois	386	402	366	427	425	431	482	492	502	487	26.0%	2.6%
Indiana	616	707	800	844	735	796	783	814	789	769	24.8%	2.5%
Iowa	394	431	435	507	517	514	507	577	559	588	49.4%	4.6%
Kansas	550	651	660	637	623	643	657	633	575	598	8.6%	0.9%
Kentucky	783	865	845	925	948	1071	1017	1139	1162	1093	39.7%	3.8%
Louisiana	303	281	291	291	345	319	363	386	378	403	33.1%	3.2%
Maine	300	337	354	456	541	450	535	471	430	385	28.4%	2.8%
Maryland	404	387	376	442	509	517	545	511	509	512	26.8%	2.7%
Massachusetts	353	401	453	494	482	491	500	531	541	554	56.9%	5.1%
Michigan	836	1025	891	997	919	789	784	798	888	789	-5.7%	-0.6%
Minnesota	276	324	315	330	307	284	287	321	313	313	13.4%	1.4%
Mississippi	592	553	507	507	572	575	677	725	651	699	18.2%	1.9%
Missouri	865	850	868	885	908	922	909	934	897	900	4.0%	0.4%
Montana	343	264	305	284	268	267	244	293	284	304	-11.4%	-1.3%
Nebraska	563	578	539	610	702	878	627	704	622	752	33.5%	3.3%
Nevada	390	401	456	443	485	468	526	537	660	676	73.1%	6.3%
New Hampshire	637	654	662	720	659	672	610	539	500	456	-28.4%	-3.7%
New Jersey	345	349	359	379	421	423	437	461	429	441	27.8%	2.8%
New Mexico	304	291	327	374	392	367	364	339	319	295	-3.0%	-0.3%
New York	250	206	223	261	296	315	359	315	309	319	27.6%	2.7%
North Carolina	613	618	673	736	716	717	759	795	743	739	20.5%	2.1%
North Dakota	474	547	526	651	773	874	833	861	811	855	80.4%	6.8%
Ohio	557	535	513	537	541	574	566	598	608	587	5.4%	0.6%
Oklahoma	341	313	438	499	477	493	620	613	722	695	103.7%	8.2%
Oregon	215	239	261	283	288	369	402	369	380	386	79.6%	6.7%
Pennsylvania	295	316	316	318	349	377	374	390	411	399	35.0%	3.4%
Rhode Island	1173	1217	1194	1012	852	801	771	689	600	583	-50.3%	-7.5%
South Carolina	708	803	988	1051	1034	961	809	777	736	711	0.4%	0.0%
South Dakota	1001	997	1074	1152	1127	1179	1203	1290	1420	1435	43.4%	4.1%
Tennessee	895	900	1101	845	568	455	417	448	449	437	-51.1%	-7.6%
Texas	566	505	526	520	502	542	574	573	514	510	-9.8%	-1.1%
Utah	588	660	685	787	708	818	941	1013	968	1002	70.4%	6.1%
Vermont	337	385	400	400	416	454	497	476	455	454	34.5%	3.3%
Virginia	563	584	650	571	544	607	638	626	615	630	11.7%	1.2%
Washington	225	217	226	214	266	262	298	309	339	347	54.3%	4.9%
West Virginia	491	429	428	411	424	400	379	476	495	443	-9.8%	-1.1%
Wisconsin	438	454	460	501	526	449	465	515	486	480	9.5%	1.0%
Wyoming	266	262	289	324	434	457	542	511	491	493	85.3%	7.1%
US Total	500	507	523	530	514	521	514	558	561	556	11.2%	1.2%

Appendix Table 2. *Utilization of sacroiliac joint intervention Services by 2016 Medicare carrier from 2009-2018 in Medicare population.*

State Name	F2009	F2010	F2011	F2012	F2013	F2014	F2015	F2016	F2017	F2018	change	GM
Cahaba												
Alabama	5,108	7,069	6,994	7,495	6,758	6,465	7,301	7,795	6,717	6,865	34.4%	3.3%
Georgia	8,544	8,267	10,284	10,714	9,257	9,846	10,835	11,993	11,920	12,118	41.8%	4.0%
Tennessee	9,229	9,525	11,965	9,374	6,549	5,410	5,071	5,533	5,815	5,795	-37.2%	-5.0%
Cahaba	**22,881**	**24,861**	**29,243**	**27,583**	**22,564**	**21,721**	**23,207**	**25,321**	**24,452**	**24,778**	**8.3%**	**0.9%**
CGS												
Kentucky	5,818	6,573	6,564	7,334	7,677	8,868	8,585	9,826	10,408	9,978	71.5%	6.2%
Ohio	10,420	10,177	9,911	10,581	10,824	11,756	11,822	12,892	13,664	13,482	29.4%	2.9%
CGS Total	**16,238**	**16,750**	**16,475**	**17,915**	**18,501**	**20,624**	**20,407**	**22,718**	**24,072**	**23,460**	**44.5%**	**4.2%**
First Coast												
Florida	**28,531**	**26,725**	**27,995**	**27,845**	**27,307**	**27,861**	**30,587**	**32,495**	**32,140**	**33,510**	**17.5%**	**1.8%**
NGS												
Connecticut	1,617	1,627	2,123	2,695	2,882	3,089	3,305	3,591	3,526	3,065	89.5%	7.4%
Illinois	6,980	7,395	6,850	8,151	8,005	8,301	9,469	10,158	10,792	10,677	53.0%	4.8%
Maine	777	893	958	1,262	1,529	1,310	1,595	1,442	1,385	1,276	64.2%	5.7%
Massachusetts	3,668	4,251	4,910	5,451	5,251	5,489	5,719	6,463	6,904	7,227	97.0%	7.8%
Minnesota	2,118	2,543	2,531	2,708	2,576	2,457	2,555	2,930	3,025	3,121	47.4%	4.4%
New Hampshire	1,384	1,460	1,516	1,667	1,541	1,631	1,527	1,435	1,405	1,322	-4.5%	-0.5%
New York	7,348	6,169	6,775	8,065	8,972	9,756	11,341	10,534	10,764	11,362	54.6%	5.0%
Rhode Island	2,114	2,227	2,216	1,907	1,550	1,490	1,464	1,401	1,271	1,262	-40.3%	-5.6%
Vermont	364	429	458	469	499	561	631	625	633	651	78.8%	6.7%
Wisconsin	3,910	4,132	4,284	4,749	5,169	4,541	4,826	5,411	5,396	5,483	40.2%	3.8%
NGS Total	**30,280**	**31,126**	**32,621**	**37,124**	**37,974**	**38,625**	**42,432**	**43,990**	**45,101**	**45,446**	**50.1%**	**4.6%**
Noridian												
Alaska	87	89	124	188	190	199	665	445	480	526	504.6%	22.1%
Arizona	3,671	4,102	4,245	4,869	5,813	6,752	6,744	7,453	7,874	8,478	130.9%	9.7%
California	13,186	14,236	14,215	14,665	13,822	15,510	17,247	18,430	20,686	20,932	58.7%	5.3%
Idaho	918	898	996	1,139	1,210	1,513	1,683	1,743	1,910	2,079	126.5%	9.5%
Montana	564	447	530	505	494	509	479	590	613	677	20.0%	2.0%
Nevada	1,339	1,429	1,695	1,684	1,896	1,919	2,258	2,431	3,251	3,458	158.3%	11.1%
North Dakota	512	598	579	722	860	989	960	1,024	1,006	1,092	113.3%	8.8%
Oregon	1,295	1,484	1,673	1,853	1,952	2,607	2,949	2,786	3,065	3,232	149.6%	10.7%
South Dakota	1,346	1,362	1,489	1,625	1,619	1,743	1,830	2,014	2,348	2,454	82.3%	6.9%
Utah	1,610	1,868	2,003	2,357	2,143	2,576	3,074	3,500	3,602	3,871	140.4%	10.2%
Washington	2,110	2,109	2,267	2,208	2,806	2,883	3,409	3,678	4,326	4,584	117.3%	9.0%
Wyoming	208	210	237	272	377	410	502	486	500	523	151.4%	10.8%
Noridian Total	**26,846**	**28,832**	**30,053**	**32,087**	**33,182**	**37,610**	**41,800**	**44,580**	**49,661**	**51,906**	**93.3%**	**7.6%**
Novitas												
Arkansas	2,827	2,490	2,434	2,598	2,856	3,053	3,563	3,674	4,343	4,772	68.8%	6.0%
Colorado	2,027	2,198	2,491	2,901	3,183	3,600	3,874	4,365	4,510	4,654	129.6%	9.7%
DC	1,280	1,281	1,432	1,650	1,920	2,194	2,564	3,033	3,107	2,831	121.2%	9.2%
Delaware	431	432	747	898	1,146	1,142	1,123	990	1,043	1,130	162.2%	11.3%
Louisiana	2,033	1,931	2,043	2,091	2,531	2,401	2,804	3,058	3,135	3,423	68.4%	6.0%
Maryland	3,085	3,036	3,036	3,659	4,111	4,301	4,672	4,750	5,009	5,179	67.9%	5.9%
Mississippi	2,887	2,749	2,568	2,620	3,044	3,130	3,758	4,065	3,776	4,134	43.2%	4.1%
New Jersey	4,500	4,629	4,848	5,218	5,662	5,803	6,109	6,877	6,666	6,986	55.2%	5.0%
New Mexico	923	913	1,055	1,235	1,300	1,258	1,290	1,262	1,268	1,208	30.9%	3.0%
Oklahoma	2,020	1,886	2,694	3,125	3,026	3,191	4,093	4,622	5,099	5,023	148.7%	10.7%
Pennsylvania	6,649	7,211	7,295	7,480	8,232	9,074	9,160	9,876	10,805	10,700	60.9%	5.4%
Texas	16,413	15,163	16,341	16,590	16,418	18,357	20,085	20,819	19,965	20,513	25.0%	2.5%

Novitas Total	**45,075**	**43,919**	**46,984**	**50,065**	**53,429**	**57,504**	**63,095**	**67,391**	**68,726**	**70,553**	**56.5%**	**5.1%**
Palmetto GBA												
North Carolina	8,883	9,212	10,320	11,544	11,814	12,213	13,322	14,070	13,955	14,286	60.8%	5.4%
South Carolina	5,300	6,212	7,895	8,632	8,935	8,609	7,515	7,314	7,406	7,396	39.5%	3.8%
Virginia	6,253	6,656	7,628	6,869	6,575	7,565	8,176	8,442	8,787	9,255	48.0%	4.5%
West Virginia	1,853	1,636	1,652	1,611	1,697	1,627	1,563	1,983	2,116	1,922	3.7%	0.4%
Palmetto Total	**22,289**	**23,716**	**27,495**	**28,656**	**29,021**	**30,014**	**30,576**	**31,809**	**32,264**	**32,859**	**47.4%**	**4.4%**
WPS												
Indiana	6,069	7,107	8,212	8,850	7,932	8,807	8,871	9,361	9,505	9,483	56.3%	5.1%
Iowa	2,015	2,229	2,276	2,694	2,801	2,843	2,859	3,299	3,341	3,603	78.8%	6.7%
Kansas	2,341	2,817	2,899	2,853	2,826	2,986	3,113	3,084	2,934	3,126	33.5%	3.3%
Michigan	13,501	16,928	15,043	17,232	16,529	14,535	14,748	15,120	17,587	15,972	18.3%	1.9%
Missouri	8,527	8,538	8,870	9,212	9,640	10,026	10,109	10,612	10,614	10,842	27.1%	2.7%
Nebraska	1,552	1,614	1,522	1,753	2,031	2,597	1,904	2,208	2,048	2,541	63.7%	5.6%
WPS Total	**34,005**	**39,233**	**38,822**	**42,594**	**41,759**	**41,794**	**41,604**	**43,684**	**46,029**	**45,567**	**34.0%**	**3.3%**
US Total	**228,946**	**237,905**	**252,654**	**266,764**	**266,643**	**278,866**	**296,997**	**315,480**	**325,642**	**331,537**	44.8%	4.2%