Expenditure Analysis

Spinal Cord Stimulation Trends of Utilization and Expenditures in Fee-For-Service (FFS) Medicare Population from 2009 to 2018

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Background: Spinal cord stimulation has been utilized with increasing frequency in managing chronic intractable spinal pain and complex regional pain syndrome (CRPS) in addition to other neuropathic pain states. The literature has shown the effectiveness of spinal cord stimulation in managing chronic pain with improvement in quality of life and cost utility. There have not been any reviews performed in the fee-for-service (FFS) Medicare population in reference to utilization and expenditure patterns of spinal cord stimulators.

Objectives: This investigation was undertaken to assess the utilization and expenditures for spinal cord stimulation in the FFS Medicare population from 2009 to 2018.

Study Design: The present study was designed to assess the utilization patterns and expenditures in all settings, for all providers in the FFS Medicare population from 2009 to 2018 in the United States.

A standard 5% national sample of the Centers for Medicare and Medicaid Services (CMS) physician outpatient billing claims data. All the expenditures were presented with allowed costs and adjusted to inflation to 2018 US dollars only trials and implants were included.

Results: Utilization patterns showed that spinal cord stimulation trials increased from 12,680 in 2009 to 36,280 in 2018, a 186% increase with an annual increase of 12.4%. The rate of trials per 100,000 population increased from 28 in 2009 to 61 in 2018 with a 120% increase, or an annual increase of 9.1%.

The pulse generator implants increased from 7,640 in 2009 to 22,960 in 2018, an increase of 201%, with an annual increase of 13%. In addition, percutaneous placement with pulse generator implants increased from 4,080 in 2009 to 14,316 in 2018, a 252% increase, or 15% annual increase. In contrast, implantation of neurostimulator electrodes with paddle leads with laminectomy and placement of spinal pulse generator increased from 3,560 in 2009 to 8,600 in 2018, a 142% increase or an annual increase of 10.3%.

Analysis of expenditures showed total inflation-adjusted expenditures increased from $292,153,701 in 2009 to $1,142,434,137 in 2018, a 291% increase from 2009 to 2018 and 16.4% annual increase. These expenditures were 125% higher than facet joint interventions and 138% higher than epidural interventions in 2018. In contrast, these expenditures were 55% below the expenditures of facet joint interventions and 66% lower than epidural injections in 2009.

Trial to implant ratio improved from 42.5% in 2009 to 63.6% in 2018. An overwhelming majority of trials (90%) were performed by nonsurgical physicians, whereas, 56% of implants were performed by non-surgeons.

Limitations: This assessment includes only FFS Medicare population, thus eliminating approximately 30% of the population with Medicare Advantage plans. In addition, this study has not taken into consideration various revisions not included in 3 specific codes.

Conclusions: The analysis of spinal cord stimulators in the FFS Medicare population from 2009 to 2018 showed explosive increases of trials, implants and overall costs.

Key words: Chronic pain, spinal pain, spinal cord stimulation, spinal cord stimulation trial, pulse generator implant, paddle leads with laminectomy, utilization trends of expenditures

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Chronic pain is a prevalent chronic disease with negative impact on the quality of life and function, with impact not only on individuals, but on families, communities, businesses, and health systems (1-9). The impact of chronic pain, of which spinal pain is the leading cause, is not only enormous, but also disproportionate in growth and expenditures (1-10). This has been reinforced in multiple manuscripts and studies of the economic impact on health care in the United States, showing an estimated spending of $134.5 billion in 2016, with a 53.5% increase from 2013 of $87.6 billion spent for managing spinal pain alone. Further, Dieleman et al (6) also showed that low back and neck pain had the highest amount of health care spending among 154 conditions with 57.2% of expenses paid by private insurers, 33.7% paid by public insurance, and 9.2% as out-of-pocket payments (6). National health expenditures (10) are continuing to grow at an average annual rate of 5.4% from 2019 to 2028 and to represent 19.7% of the gross domestic product by the end of the period. Medicare is growing much faster due to the graying of America (1-4,6,10). In addition, health care expenditures have been escalating and the financial impact on the US economy is growing with a perfect storm created by COVID-19, the opioid epidemic and growth in expenditures and utilization patterns often of pain procedures (1-4,11-37). Even though the COVID-19 epidemic resulted in severe access deficits for patients as well as undertreatment and a lack of treatment for elective care in 2020, growth patterns are expected to resume by 2022 (36,37).

Utilization of pharmacological and nonpharmacological modalities including surgical and nonsurgical interventions have been escalating for the treatment of chronic pain, specifically spinal pain including interventional techniques and surgical interventions, despite the decline noted for some interventions (1-4,38-42). Among these, surgical interventions and interventional techniques also have increased with an associated failure rate over the years (1-4,38-42).

Spinal cord stimulation is a neuromodulation technique utilized in managing chronic intractable pain after failure of other modalities of treatments since its first descriptions by Norman Shealy in 1967 (43). From Shealy's original single monopolar electrode, modern spinal cord stimulation has evolved into a complex multi-independent contact utilizing percutaneous and paddle leads, with the mechanism of action moving beyond the central paradigm derived from gate control theory with new therapies that do not rely on paresthesia (44-46).

Multiple theories have emerged to explain how an electrical pulse applied to the spinal cord could alleviate pain, including activation of specific supraspinal pathways, and segmental modulation of neurological interactions (44-46). Given the apparent effectiveness of the treatment, indications have been expanding associated with increased utilization and expenditures for this modality. In a systematic review of clinical effectiveness and mechanisms of action of spinal cord stimulation for treating chronic low back and lower extremity pain, Vallejo et al (45) performed a review of 11 randomized controlled trials (RCTs) and 7 nonrandomized studies, which provided levels of evidence ranging from I to II. Best Practices in Managing Pain, a Department of Health and Human Services (HHS) document, also placed spinal cord stimulation in the management algorithm for chronic pain (29,47). Multiple other reviewers echoed the positive evidence. Positive correlation with cost effectiveness of spinal cord stimulators in improving the quality of life has been described, along with its positive impact (44,46-58). However, this is treatment platform has detractors who cite effectiveness, problematic cost utility, and increasing utilization as issues (59-64). The volume-outcome effect with impact of trial to permanent conversion rates (62), and explantation rates and health care sources of utilization (60), and finally increasing utilization (65) were reported.

Labaran et al (65) in a retrospective review of Medicare and private payer insurance records from 2007 to 2014, showed an overall increase in the annual rate of spinal cord stimulator placements with paddle leads with implantation peaking in 2013. Murphy et al

(62) in a large retrospective analysis using MarketScan database, analyzing adult spinal cord stimulator patients with or without implanted pulse generator implantation from the years 2007 to 2012, showed that high volume providers achieved higher trial to permanent spinal cord stimulator conversion rates than lower volume providers.

There has thus far, to our knowledge, been no analysis of either utilization patterns and expenditure patterns in the fee-for-service (FFS) Medicare population. Consequently, this analysis was undertaken to assess utilization patterns and expenditures in all settings, for all providers in the FFS Medicare population from 2009 to 2018 in the United States.

Methods

This analysis of expenditures and utilization patterns of spinal cord stimulation in the FFS Medicare population was performed utilizing a retrospective cohort analysis with methodology as described by the Strengthening and Reporting of Observational Studies in Epidemiology (STROBE) (66). The data was obtained from the Centers for Medicare and Medicaid Services' (CMS) physician outpatient billing claims for those enrolled in the FFS Medicare program for 2009 through 2018, consisting of the standard 5% national sample (67). The sample data consisting of 5% from CMS, has been reported to be unbiased and unpredictable to avoid divulging any patient characteristics. However, the data does allow appropriate tracking of patients over time and across databases. As a result of the anonymity, Institutional Review Board (IRB) approval was not required for this study.

Study Design

The estimation of expenditures for spinal cord stimulation in FFS Medicare recipients was designed as a retrospective cohort study calculating the trends of costs and utilization patterns from 2009 to 2018 in the United States (67).

Setting

The standard 5% national sample data was obtained from the CMS services physician outpatient billing claims for those enrolled in the FFS Medicare program from 2009 to 2018. Participants included all Medicare FFS recipients receiving epidural procedures. The current procedural terminology (CPT) codes included in this analysis are listed as follows: CPT 63650, 63655, 63685.

Data Sources

CMS physician outpatient billing claims for those enrolled in the FFS Medicare program from 2009 to 2018 provided the appropriate data, facilitating the analysis.

Data Compilation

Data was compiled utilizing Microsoft 365 Access and Microsoft 365 Excel (Microsoft, Redmond, WA). We removed all spinal cord stimulation interventions services with zero allowed payments. One hundred percent data was obtained by multiplication with 20 to scale up from our 5% sample to the full FFS Medicare population. The data were calculated for overall services for each procedure, and the rate of services, based on utilization per 100,000 FFS Medicare beneficiaries. Expenditures were also calculated for physician and facility, which included allowable charges for physician and facility (ambulatory surgery center [ASC], hospital outpatient department [HOPD], office setting). All the expenditures were presented with allowed costs and were adjusted for inflation to 2018 US dollars. HOPD facility allowed charges were estimated based on National Average rates.

Variables

The analysis of trends of utilization and costs patterns of spinal cord stimulation interventions incorporated multiple variables with analysis and costs for all procedures, utilization based on statewide and Medicare Administrative Contractors (MACs) and location of the service provided, either office-, ASC-, or HOPD-based.

Measures

Allowed services were assessed for each procedure. Rates were calculated based on Medicare beneficiaries for the corresponding year and are reported as procedures per 100,000 Medicare beneficiaries. Data was assessed for the total number of spinal cord stimulation interventions performed.

Bias

Data was purchased from the 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. The costs were determined without eliciting any bias. Thus, based on the large size of the dataset derived from a government source, there was no information related to patients' individual identification.

Sample Size

The size of this retrospective cohort study is robust, providing real-world claims data on Medicare patients with inclusion of all Medicare FFS patients undergoing spinal cord stimulation interventions for chronic pain from 2009 to 2018.

Results

Participants and Characteristics

In this analysis, the participants were from the Medicare database undergoing spinal cord stimulation interventions from 2009 to 2018.

Utilization Characteristics

Table 1 and Fig. 1 show the summary of the frequency of utilization of spinal cord stimulator trials and permanent placements in the Medicare population from 2009 to 2018. As shown in this table, Medicare population increased 3% per year with a total increase of 30%. Spinal cord stimulation trials performed percutaneously increased from 12,420 in 2009 to 35,620 in 2018 with an annual increase of 12.4% and overall increase of 187%. All trials increased from 12,680 in 2009 to 36,280 in 2018, a 186% increase with an annual increase of 12.4%. The rate of trials per 100,000 population was 28 in 2009, increasing to 61 in 2018, with a 120% increase or an annual increase of 9.1%.

Implant of pulse generator interventions increased from 7,640 in 2009 to 22,960 in 2018, a 201% increase, with an annual increase of 13%. Further analysis showed that placement of pulse generator with percutaneous lead placement (CPT 63650 and 63685) increased from 4,080 in 2009 to 14,360 in 2018, a 252% increase or 15% annual increase. In contrast, implantation of neurostimulator electrodes with paddle leads with laminectomy and placement of spinal pulse generator increased (CPT 63655 and 63685), increased from 3,560 in 2009 to 8,600 in 2018, a 142% increase or an annual increase of 10.3%. Overall rate of placement of pulse generators increased from 17 in 2009 to 39 in 2018, a 129% increase or 9.6% annual increase per 100,000 population.

Trial to placement of pulse generator ratio also

Table 1. *Summary of the frequency of utilization of spinal cord stimulator trials and permanent pulse generator placements in the Medicare population from 2009 to 2018.*

100%	Y2009	Y2010	Y2011	Y2012	Y2013	Y2014	Y2015	Y2016	Y2017	Y2018	Change	GM
SCS Trials												
Medicare	45,801	46,914	48,300	50,300	51,900	53,500	54,900	56,500	58,000	59,600	30%	3.0%
CPT 63650	12,420	19,760	22,320	23,100	23,880	21,400	21,620	27,920	33,800	35,620	187%	12.4%
CPT 63655	260	440	400	540	500	380	480	460	540	660	154%	10.9%
trials total	12,680	20,200	22,720	23,640	24,380	21,780	22,100	28,380	34,340	36,280	186%	12.4%
Rate	28	43	47	47	47	41	40	50	59	61	120%	9.1%
PCPY		59%	12%	4%	3%	-11%	1%	28%	21%	6%		
Placement of pulse generator												
63650 & 63685	4,080	5,140	5,180	5,520	5,940	6,480	7,660	9,360	13,300	14,360	252%	15.0%
63655 & 63685	3,560	4,440	4,760	5,820	6,500	5,080	5,000	5,900	7,320	8,600	142%	10.3%
Placement	7,640	9,580	9,940	11,340	12,440	11,560	12,660	15,260	20,620	22,960	201%	13.0%
Rate	17	21	22	23	24	22	24	27	36	39	129%	9.6%
PCPY		27%	6%	12%	8%	-7%	11%	19%	34%	11%		
Placement %	42.5%	48.6%	45.8%	49.3%	51.7%	53.6%	58.6%	54.5%	60.5%	63.6%		

63650 - Percutaneous implantation of neurostimulator electrode array, epidural
63655 - Laminectomy for implantation of neurostimulator electrodes, plate/paddle, epidural
63685 - Insertion of spinal neurostimulator pulse generator or receiver, direct or inductive coupling
Rate – per 100,000 Medicare beneficiaries, GM – Annual average change (geometric)
PCPY – Percentage of change from previous year
Change – Change 2018 from 2009
SCS - spinal cord stimulator

showed significant change from 42.5% in 2009 to 63.6% in 2018. The data which is not shown in the table also showed that duration between trial and placement was less than one month in 43% of the patients, one to 2 months in 37%, 2 to 3 months in 10%, 3 to 6 months in 6%, and above 6 months in 4% of the population with average duration between trial and placement of 7.6 weeks.

Table 2 shows the summary of the frequency of utilization of spinal cord stimulation trials by gender, age, and place of service in the Medicare population by place of service. Rate of trials was 38 to 41 male to female ratio per 100,000 Medicare population, which remained similar with 60% in males and 62 in females in 2018.

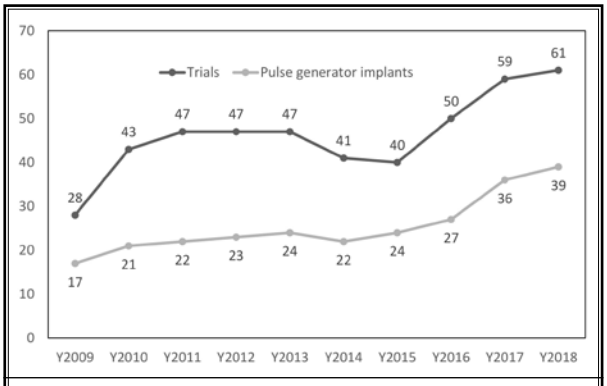

Fig 1. *SCS trials and implant of pulse generator placements rates per 100,000 recipients in the Medicare population from 2009 to 2018*

Table 2. *Summary of the frequency of utilization of spinal cord stimulator TRIALS by gender, age and place of service in the Medicare population by place of service from 2009 to 2018.*

Gender	F2009	F2010	F2011	F2012	F2013	F2014	F2015	F2016	F2017	F2018	Change	GM
Male	5,100	7,840	8,380	9,740	10,260	8,460	9,160	12,660	15,820	15,620	206%	13.2%
Rate	25	38	40	44	45	36	38	50	61	60	134%	9.9%
Female	7,580	12,360	14,340	13,900	14,120	13,320	12,940	15,720	18,520	20,660	173%	11.8%
Rate	29	47	53	49	49	45	42	50	57	62	111%	8.6%
Age	F2009	F2010	F2011	F2012	F2013	F2014	F2015	F2016	F2017	F2018	Change	GM
<65	5,460	8,200	10,060	10,060	10,240	8,740	8,240	8,900	10,500	10,520	93%	7.6%
Rate	72	104	123	119	119	100	94	101	120	122	70%	6.0%
65-74	3,800	6,360	6,720	7,820	8,580	7,620	8,140	11,360	13,860	14,900	292%	16.4%
Rate	19	31	31	34	36	30	31	42	49	51	168%	11.6%
75-84	2,800	4,760	4,920	4,740	4,760	4,580	4,800	6,740	8,420	9,320	233%	14.3%
Rate	22	38	39	37	37	35	36	49	58	62	176%	11.9%
>= 84	620	880	1,020	1,020	800	840	920	1,380	1,560	1,540	148%	10.6%
Rate	11	15	17	16	13	13	14	21	23	23	115%	8.9%
Race	F2009	F2010	F2011	F2012	F2013	F2014	F2015	F2016	F2017	F2018	Change	GM
Caucasian	11,400	18,060	20,340	20,840	21,940	19,120	19,900	25,240	30,520	32,380	184%	12.3%
Rate	32	49	54	54	55	47	48	59	70	72	128%	9.6%
African-American	940	1,360	1,480	1,920	1,520	1,820	1,280	1,980	2,200	2,140	128%	9.6%
Rate	21	30	31	38	29	33	23	34	37	35	66%	5.8%
Others	340	780	900	880	920	840	920	1,160	1,620	1,760	418%	20.0%
Rate	6	14	15	14	14	12	12	14	19	20	222%	13.9%
PLACE	F2009	F2010	F2011	F2012	F2013	F2014	F2015	F2016	F2017	F2018	Change	GM
ASC	2,880	4,720	5,740	4,940	4,880	6,220	7,140	10,080	13,540	14,500	403%	19.7%
Rate	6	10	12	10	9	12	13	18	23	24	287%	16.2%
HOPD	4,180	6,640	6,780	6,840	7,020	6,860	7,260	8,460	10,700	10,640	155%	10.9%
Rate	9	14	14	14	14	13	13	15	18	18	96%	7.7%
Office	5,620	8,840	10,200	11,860	12,480	8,700	7,700	9,840	10,100	11,140	98%	7.9%
Rate	12	19	21	24	24	16	14	17	17	19	52%	4.8%
Total	12,680	20,200	22,720	23,640	24,380	21,780	22,100	28,380	34,340	36,280	186%	12.4%
Rate	28	43	47	47	47	41	40	50	59	61	120%	9.1%

Age characteristics showed a rate of 72 per 100,000 Medicare population in 2009 for those below 65, whereas, it was 52 for those 65 or older, with a change in rate to 122 per 100,000 Medicare population in those below 65 and 136 in those 65 or older. While the change was 70% in those below age of 65, it was higher for all other age groups with a 168% increase for an annual increase of 11.6% in those 65 to 74, 176% for an annual increase of 11.9% in those 75 to 84, and 115% for an annual increase of 8.9% in those who were 85 or older.

Racial statistics showed the rate per 100,000 Medicare population of 32 in 2009 compared to 72 in 2018 in those described as Caucasian, with an increase of 128% or 9.6% annually. Comparing this to African American population, the rate was 21 per 100,000 Medicare population in 2009, which increased to 35 in 2018, an overall increase of 66% and annual increase of 5.8%. However, the most increase was in all others, which was 6 per 100,000 Medicare population in 2009 and increased to 20 in 2018, a 222% increase, with an annual increase of 13.9%.

Table 2 also shows site of service for trials. The overall increase in the rate of performance of the trials was 28 in 2009 and 61 per 100,000 Medicare population in 2018, a 120% increase or 9.1% annual increase. Significant increases were seen in ASC settings with rate of 6 in 2009, increasing to 24 in 2018, for an increase of 287%, or 16.2% annual increase. In contrast, rates increased 96% in HOPD settings, and 52% in office settings. Overall, 40% were performed in ASC settings, 29% in HOPD settings, and 31% in office settings in 2018.

Table 3 shows the frequency of utilization of spi-

Table 3. *Summary of the frequency of utilization of spinal cord stimulator PLACEMENTS by gender, age and place of service in the Medicare population by place of service from 2009 to 2018.*

Gender	**F2009**	**F2010**	**F2011**	**F2012**	**F2013**	**F2014**	**F2015**	**F2016**	**F2017**	**F2018**	**Change**	**Rate**
Male	3,440	3,720	3,660	4,400	5,080	4,240	5,100	6,500	8,700	9,900	188%	12.5%
Rate	17	18	17	20	22	18	21	26	34	38	120%	9.1%
Female	4,200	5,860	6,280	6,940	7,360	7,320	7,560	8,760	11,920	13,060	211%	13.4%
Rate	16	22	23	25	25	25	25	28	37	39	140%	10.2%
Age	F2009	F2010	F2011	F2012	F2013	F2014	F2015	F2016	F2017	F2018	Change	Rate
<65	3,180	3,480	4,560	4,780	5,140	4,620	5,040	4,840	6,140	6,660	109%	8.6%
Rate	42	44	56	57	60	53	57	55	70	77	84%	7.0%
65-74	2,640	3,360	3,040	3,660	4,880	4,260	4,580	6,040	8,520	9,320	253%	15.0%
Rate	13	16	14	16	20	17	18	22	30	32	141%	10.3%
75-84	1,620	2,380	2,000	2,400	2,080	2,220	2,560	3,820	5,060	6,000	270%	15.7%
Rate	13	19	16	19	16	17	19	28	35	40	207%	13.3%
≥ 85	200	360	340	500	340	460	480	560	900	980	390%	19.3%
Rate	3	6	6	8	5	7	7	9	13	15	324%	17.4%
Race	F2009	F2010	F2011	F2012	F2013	F2014	F2015	F2016	F2017	F2018	Change	Rate
Caucasian	6,880	8,660	9,180	10,060	11,160	10,340	11,680	14,080	18,460	20,840	203%	13.1%
Rate	19	24	24	26	28	25	28	33	42	47	143%	10.4%
African-American	580	580	520	860	860	880	600	720	1,120	1,220	110%	8.6%
Rate	13	13	11	17	17	16	11	12	19	20	54%	4.9%
Others	180	340	240	420	420	340	380	460	1,040	900	400%	19.6%
Rate	3	6	4	7	6	5	5	6	12	10	211%	13.4%
Place	F2009	F2010	F2011	F2012	F2013	F2014	F2015	F2016	F2017	F2018	Change	Rate
ASC	840	1,280	1,300	1,420	1,660	1,800	3,380	4,980	7,700	8,640	929%	29.6%
Rate	2	3	3	3	3	3	6	9	13	14	690%	25.8%
HOPD	6,800	8,300	8,640	9,920	10,780	9,760	9,280	10,280	12,920	14,320	111%	8.6%
Rate	15	18	18	20	21	18	17	18	22	24	62%	5.5%
Total	7,640	9,580	9,940	11,340	12,440	11,560	12,660	15,260	20,620	22,960	201%	13.0%
Rate	17	20	21	23	24	22	23	27	36	39	131%	9.7%

nal neurostimulator pulse generator patterns. Figure 2 illustrates characteristic features of place of service for spinal cord stimulator trials and pulse generator implants with changing utilization patterns as shown in Tables 2 and 3.

Gender variations with male to female ratio remained similar with 17/16 in 2009, changing to 38/39, with overall increase in the rate of 120%/140% with annual rate changes of 9.1%/10.2%.

Age variations also showed similar patterns as in trials with pulse generator placement rate of 42 for those below 65, to 29 for those above 84, changing to 77 for those below 65 to 87 for those 65 and above. The highest change was noted in those 85 or over with a 324% increase, followed by those 75 to 84 with 207%. The least change was in those Medicare recipients less than 65 years of age.

Racial distribution showed Caucasian to African American of 32/21 with others at 6 per 100,000 Medicare population in 2009 changing to 72/35 with others increased to 20 from 6 per 100,000 Medicare population. The highest increase was seen for the others category, non-African-American, and non-Caucasian population; however, the numbers were small. This was followed by a significant increase for the Caucasian population, whereas, increases were less significant for the African American population; however, African American population constitute only 13.4% of Medicare population.

Permanent placements based on the location also changed significantly with extensive increases in the rates of 131% from 17 per 100,000 Medicare population to 39 in 2018, a 131% increase and an annual increase of 9.7%. Dramatic increases were noted in ASC settings with an increase from 2 to 14 per 100,000 Medicare population or 690%; however, in actual numbers HOPD utilizations were significantly higher with 15 in 2009 to 24 in 2018, for a 62% increase (Tables 1 and 2 and Fig. 3). Hospitals performed 62% of the implants, while 38% were performed in ASC centers (Fig. 3).

Table 4 and Fig. 3 show the utilization patterns of spinal cord stimulation interventions by various specialty groups from 2009 to 2018 with overall interventional groups, including all non-surgical specialties. Interventional pain management specialties performed about 90% of the total trials and 56% of total pulse generator placements with an increased rate of utilization of 189% for trials and 235% for pulse generator placements among these groups. In

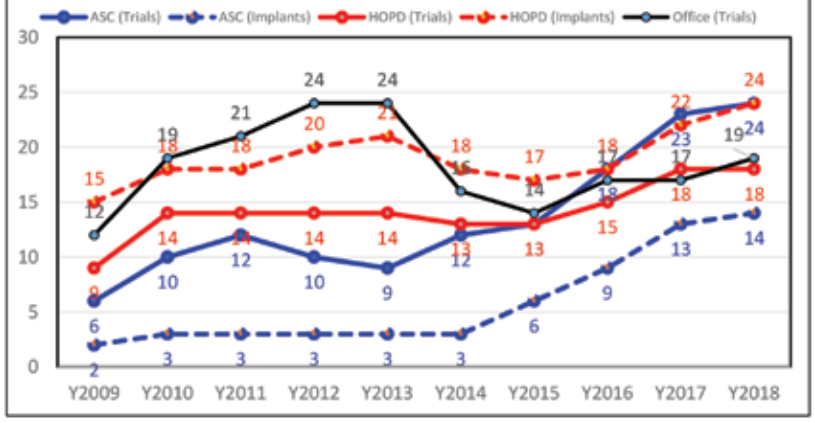

Fig. 2. *Characteristics of place of service for spinal cord stimulator trials and pulse generator implants.*

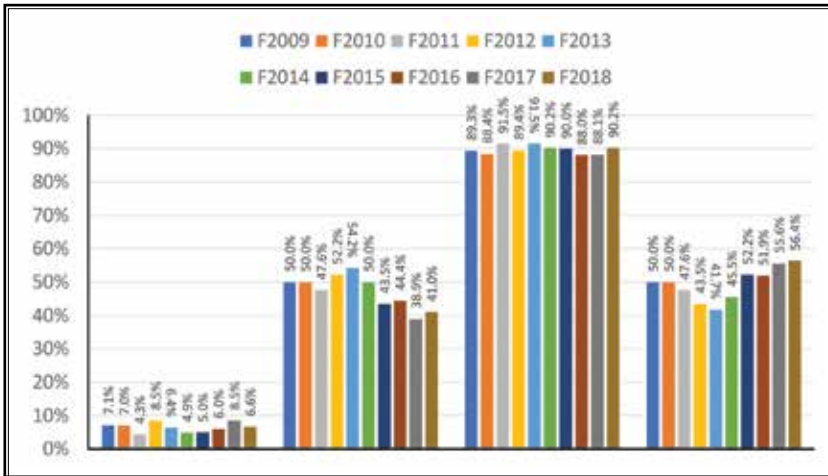

Fig. 3. *Specialty characteristics of spinal cord stimulator trials and pulse generator implants.*

Table 4. *Summary of the frequency of utilization of spinal cord stimulation trials and neurostimulator placements in the Medicare population by specialty from 2009 to 2018.*

Specialty (Trials)	F2009	F2010	F2011	F2012	F2013	F2014	F2015	F2016	F2017	F2018	Change	GM
Surgeons Group	840	1,360	1,160	1,820	1,620	1,240	1,240	1,620	2,620	2,380	183%	12.3%
Rate	2	3	2	4	3	2	2	3	5	4	118%	9.0%
Interventional Pain Management Groups	11,340	18,000	20,780	21,120	22,140	19,580	19,760	24,740	30,320	32,820	189%	12.5%
Percentage to Total	90%	89%	91%	89%	91%	90%	89%	87%	88%	90%		
Rate	25	38	43	42	43	37	36	44	52	55	122%	9.3%
Others	460	840	780	700	620	960	1,100	2,020	1,400	1,080	135%	9.9%
Rate	1	2	2	1	1	2	2	4	2	2	80%	6.8%
Total	12,640	20,200	22,720	23,640	24,380	21,780	22,100	28,380	34,340	36,280	187%	12.4%
Rate	28	43	47	47	47	41	40	50	59	61	121%	9.2%
Specialty Pulse Generators	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**change**	**GM**
Surgeon Groups	3,680	4,660	4,780	5,980	6,800	5,760	5,580	6,700	8,300	9,620	161%	8.4%
% to total	48%	49%	48%	53%	55%	50%	44%	44%	40%	42%	-13%	-1.6%
Rate	8	10	10	12	13	11	10	12	14	16	101%	5.5%
Interventional Pain Management Groups	3,860	4,760	4,900	5,080	5,300	5,580	6,780	8,100	11,500	12,920	235%	11.7%
% to Total	51%	50%	49%	45%	43%	48%	54%	53%	56%	56%	11%	1.40%
Rate	8	10	10	10	10	10	12	14	20	22	157%	8.8%
Others	100	160	260	300	340	220	300	460	840	420	320%	11.3%
Rate	0	0	1	1	1	0	1	1	1	1	223%	8.4%
Total	7,640	9,580	9,940	11,340	12,440	11,560	12,660	15,260	20,620	22,960	201%	10.2%
Rate	17	20	21	23	24	22	23	27	36	39	131%	7.3%

Surgeons (Neurosurgery & Orthopedic Surgery); Pain Management Groups (Anesthesiology, IPM, Pain Management, PM&R and very few cases from Neurology)

contrast, surgical groups showed a 118% increase in trials and a 161% increase in pulse generator implants from 2009 to 2018.

As shown in Appendix Table 1, the top 5-principal diagnoses for spinal cord stimulation trial implants included chronic pain, post laminectomy syndrome, radiculopathy, low back pain, and others.

State-wide characteristics based on Medicare carrier jurisdictions (Appendix Table 2) showed overall countrywide increase from 28 per 100,000 Medicare population in 2009 to 61 in 2018 for a 120% overall increase and 9% annual increase. The total increases ranged in various MAC jurisdictions from 52% in the old First Coast jurisdiction to a 249% increase in Palmetto, National Government Services (NGS) with an increase of 182%, Noridian with an increase of 119%, Novitas with an increase of 110%, Palmetto with an increase of 164%, and finally WPS with an increase of 159%.

Expenditure Characteristics

Appendix Table 3 shows Medicare national payment rates. Table 5 shows average allowed charges with inflation-adjusted rates for trials. The total costs of $77,144,859 in 2009 increasing to $247,153,988 for a 220.4% increase and an annual increase of 13.8%. The average costs were $6,084 in 2009 for each trial compared to $6,812 in 2018, with an annual increase of 1.3% or an overall increase of 12%. Inflation adjusted costs showed an increase of 173.8% compared to 220.4% prior to inflation and an annual increase of 11.8% instead of 13.8% prior to inflation. Average costs per trial also showed a pattern of decline with $7,118 in 2009 to $6,812 in 2018 with an overall decrease of 4.3% and an annual decrease of 0.5%.

Major increases in expenditures were seen for ASCs with 773%, whereas, increases were 246% for HOPD settings, followed by a decline of 40% for in-office settings.

Table 6 shows average allowed charges with

Table 5. *Average allowed charges with inflation-adjusted rates for spinal cord stimulator trials.*

HOPD	Y2009	Y2010	Y2011	Y2012	Y2013	Y2014	Y2015	Y2016	Y2017	Y2018	Change	GM
No. of Trials	4,180	6,640	6,780	6,840	7,020	6,860	7,260	8,460	10,700	10,640	154.5%	10.9%
Services	6000	9200	9200	9880	9400	9260	9520	11000	13220	13700	128.3%	9.6%
Professional	$2,115,784	$3,521,579	$3,680,797	$4,005,979	$4,152,926	$4,000,812	$4,182,739	$4,779,693	$5,820,782	$6,253,744	195.6%	12.8%
Facility	$25,910,887	$41,760,056	$43,595,725	$45,601,589	$43,129,379	$44,139,924	$56,327,880	$63,059,500	$84,231,404	$90,676,743	250.0%	14.9%
Total	$28,026,671	$45,281,634	$47,276,521	$49,607,568	$47,282,305	$48,140,736	$60,510,619	$67,839,194	$90,052,186	$96,930,487	245.9%	14.8%
Average	$6,704.95	$6,819.52	$6,972.94	$7,252.57	$6,735.37	$7,017.60	$8,334.80	$8,018.82	$8,416.09	$9,110.01	35.9%	3.5%
ASC	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	0.4%	0.0%
Trials	2,880	4,720	5,740	4,940	4,880	6,220	7,140	10,080	13,540	14,500	403.5%	19.7%
Services	3840	6240	8180	7620	7300	8660	9800	14440	17820	19940	419.3%	20.1%
Prof	$1,349,545	$2,293,771	$3,122,152	$2,868,923	$2,964,364	$3,447,871	$3,900,393	$5,798,608	$7,449,167	$8,265,243	512.4%	22.3%
Facility	$13,512,506	$25,902,326	$34,248,854	$28,612,063	$29,502,272	$35,344,894	$44,287,232	$71,495,075	$107,086,697	$121,460,156	798.9%	27.6%
Total	$14,862,051	$28,196,098	$37,371,005	$31,480,986	$32,466,635	$38,792,765	$48,187,624	$77,293,683	$114,535,864	$129,725,399	772.9%	27.2%
Average	$5,160.43	$5,973.75	$6,510.63	$6,372.67	$6,653.00	$6,236.78	$6,748.97	$7,668.02	$8,459.07	$8,946.58	73.4%	6.3%
Office Setting	Y2009	Y2010	Y2011	Y2012	Y2013	Y2014	Y2015	Y2016	Y2017	Y2018		
Trials	5,620	8,840	10,200	11,860	12,480	8,700	7,700	9,840	10,100	11,140	98.2%	7.9%
Services	8,560	13,240	15,780	18,900	19,180	12,960	10,780	13,140	13,720	14,900	74.1%	6.4%
Prof	$1,228,687	$1,893,147	$2,311,184	$2,695,306	$2,909,184	$5,025,771	$4,371,650	$5,428,254	$5,602,131	$6,665,096	442.5%	20.7%
Over	$33,027,450	$52,457,136	$64,530,057	$78,284,495	$87,231,905	$18,113,172	$9,138,630	$11,276,861	$11,608,828	$13,833,006	-58.1%	-9.2%
Total	$34,256,137	$54,350,283	$66,841,242	$80,979,801	$90,141,089	$23,138,942	$13,510,280	$16,705,114	$17,210,959	$20,498,102	-40.2%	-5.5%
Average	$6,095.40	$6,148.22	$6,553.06	$6,827.98	$7,222.84	$2,659.65	$1,754.58	$1,697.67	$1,704.06	$1,840.05	-69.8%	-12.5%
Total Trials	12,680	20,200	22,720	23,640	24,380	21,780	22,100	28,380	34,340	36,280	186.1%	12.4%
PCPY		59%	12%	4%	3%	-11%	1%	28%	21%	6%		
Services	18,400	28,680	33,160	36,400	35,880	30,880	30,100	38,580	44,760	48,540	163.8%	11.4%
Professional	4,694,016	7,708,497	9,114,133	9,570,208	10,026,474	12,474,454	12,454,782	16,006,555	18,872,080	21,184,083	351.3%	18.2%
Facility	72,450,843	120,119,518	142,374,636	152,498,147	159,863,556	97,597,990	109,753,742	145,831,436	202,926,929	225,969,905	211.9%	13.5%
Total	77,144,859	127,828,015	151,488,768	162,068,355	169,890,029	110,072,443	122,208,523	161,837,991	221,799,009	247,153,988	220.4%	13.8%
Average	$6,084	$6,328	$6,668	$6,856	$6,968	$5,054	$5,530	$5,703	$6,459	$6,812	12.0%	1.3%
Total*	$90,259,485	$147,002,217	$169,667,420	$176,654,507	$183,481,231	$116,676,790	$129,541,034	$169,929,890	$226,234,990	$247,153,988	173.8%	11.8%
PCPY		-263%	-215%	-204%	-204%	-164%	-211%	-231%	-233%	-209%		
Average*	$7,118	$7,277	$7,468	$7,473	$7,526	$5,357	$5,862	$5,988	$6,588	$6,812	-4.3%	-0.5%
PCPY		2.2%	2.6%	0.1%	0.7%	-28.8%	9.4%	2.2%	10.0%	3.4%		

* inflation adjusted rates

Table 6. *Average allowed charges with inflation-adjusted rates for spinal cord stimulator pulse generator implants.*

HOPD	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Change	GM
Placements	6800	8300	8640	9920	10780	9760	9280	10280	12920	14320	111%	8.6%
63650	5,320	6,440	6,400	7,000	7,260	7,180	7,160	7,400	9,240	10,000	88%	7.3%
63655	3,620	4,380	4,400	5,780	6,400	5,000	4,360	5,040	5,720	6,800	88%	7.3%
63685	6,800	8,140	8,080	9,960	10,940	9,720	9,260	10,340	12,380	14,320	111%	8.6%
Profe.	$5,881,289	$7,697,025	$7,991,367	$9,192,718	$10,195,827	$9,034,023	$8,434,750	$9,327,707	$11,678,505	$12,890,579	119%	9.1%
Facility	$148,131,620	$167,660,297	$176,052,795	$218,742,671	$255,354,166	$238,349,880	$355,130,554	$403,087,750	$490,084,527	$585,459,008	295%	16.5%
Total	$154,012,909	$175,357,322	$184,044,162	$227,935,389	$265,549,993	$247,383,903	$363,565,304	$412,415,457	$501,763,032	$598,349,587	289%	16.3%
Average	$22,649	$21,127	$21,301	$22,977	$24,634	$25,347	$39,177	$40,118	$38,836	$41,784	84%	7.0%
ASC	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	0%	0.0%
Placements	840	1280	1300	1420	1660	1800	3380	4980	7700	8640	929%	29.6%
63650	1320	2100	1900	2140	2100	2480	4220	6280	9060	9760	639%	24.9%
		20	100	140	280	140	620	820	1220	1660		
63685	840	1080	1180	1280	1480	1560	3060	4660	6800	8280	886%	28.9%
Prof.	$630,637	$931,597	$1,060,264	$1,150,537	$1,346,469	$1,394,933	$2,737,271	$4,077,199	$6,108,309	$7,199,072	1042%	31.1%
Facility	$17,915,613	$27,013,473	$26,220,750	$30,339,994	$34,582,954	$40,083,414	$98,087,052	$137,649,365	$222,981,439	$289,731,490	1517%	36.2%
Total	$18,546,250	$27,945,070	$27,281,014	$31,490,531	$35,929,423	$41,478,347	$100,824,323	$141,726,564	$229,089,747	$296,930,562	1501%	36.1%
Average	$22,079	$21,832	$20,985	$22,176	$21,644	$23,044	$29,830	$28,459	$29,752	$34,367	56%	5.0%
Total Placements	7,640	9,580	9,940	11,340	12,440	11,560	12,660	15,260	20,620	22,960	201%	13.0%
Prof.	$6,511,926	$8,628,621	$9,051,631	$10,343,255	$11,542,296	$10,428,955	$11,172,021	$13,404,907	$17,786,814	$20,089,651	209%	13.3%
PCPY		33%	5%	14%	12%	-10%	7%	20%	33%	13%		
Overhead	$166,047,233	$194,673,770	$202,273,545	$249,082,665	$289,937,120	$278,433,294	$453,217,606	$540,737,115	$713,065,966	$875,190,498	427%	20.3%
		17%	4%	23%	16%	-4%	63%	19%	32%	23%		
Total	$172,559,159	$203,302,391	$211,325,176	$259,425,920	$301,479,416	$288,862,249	$464,389,627	$554,142,022	$730,852,780	$895,280,149	419%	20.1%
PCPY		18%	4%	23%	16%	-4%	61%	19%	32%	22%		
Total*	$201,894,216	$233,797,750	$236,684,197	$282,774,253	$325,597,769	$306,193,984	$492,253,005	$581,849,123	$745,469,835	$895,280,149	343%	18.0%
PCPY		16%	1%	19%	15%	-6%	61%	18%	28%	20%		
Average	$22,586	$21,222	$21,260	$22,877	$24,235	$24,988	$36,682	$36,313	$35,444	$38,993	73%	6.3%
Average*	$26,426	$24,405	$23,811	$24,936	$26,173	$26,487	$38,883	$38,129	$36,153	$38,993	48%	4.4%

inflation-adjusted rates for neurostimulator implants. Total expenditures for neurostimulator implants were $172,559,159 to $895,280,149 in 2009 and in 2018, for a 419% increase or an annual increase of 20.1%. The inflation-adjusted costs also showed significant increases with a 343% increase overall and an 18% increase per year.

Figure 4 shows increasing expenditures with inflation-adjusted rates in a graphic display of spinal cord stimulator trials and pulse generator implants from 2009 to 2018, showing total costs increasing from $292,153,701 to $1,142,434,137, with an increase of 291% or 16.4% annual increase.

Average cost per procedure increased from $22,586 in 2009 to $38,993 in 2018, for a 73% overall increase or annual increase of 6.3%. However, inflation-adjusted costs showed increases of 48% with an annual increase of 4.4%. Similar to trials, dramatic increases in utilization and expenditures were seen in ASC settings with an increase of 1,501% overall and 36.1% annually, with an average procedure increase of 56% and 5% annually compared to HOPD increases of 289%, or 16.3% annually with an average procedural increase of 84% total or 7% per year.

Comparative expenditures with facet joint interventions and epidural procedures, based on our previous evaluations (3,4) were assessed. Table 7 and Fig. 5 show total comparative expenditures of facet joint interventions, epidural injections, and spinal cord stimulation trials and placements combined, including number of patients receiving these services. Based on this assessment, it appears that expenditures for spinal cord stimulation for a small number of patients have rapidly exceeded the total costs for either facet joint interventions or epidural procedures, with 125% higher expenditures than facet joint interventions and 138% higher than for epidural interventions in 2018. In 2009, spinal cord stimulator expenditures were 55% below the expenditures of facet joint interventions and 66% lower than epidural injections.

Discussion

The estimated costs and utilization patterns of spinal cord stimulation interventions from 2009 to 2018 in the Medicare FFS population shows significant increases in utilization patterns per 100,000 Medicare popula-

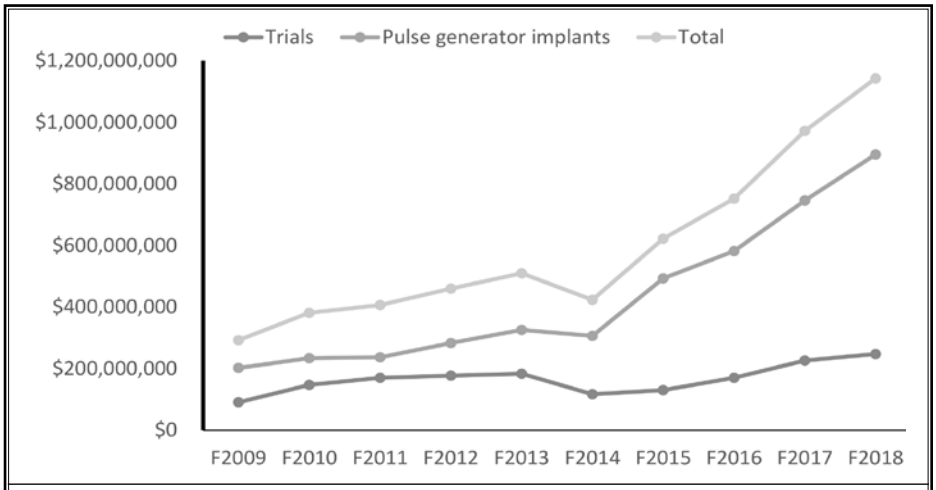

Fig. 4. *Increasing expenditures of spinal cord stimulator trials and pulse generator implants.*

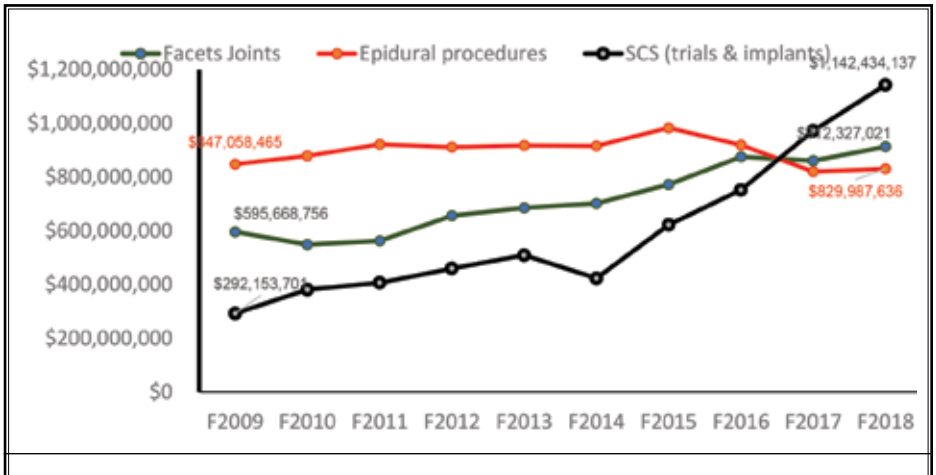

Fig 5. *Total cost for facet joints interventions, epidural services, spinal cord stimulators.*

Table 7. *Total cost for facet joints interventions, epidural services, spinal cord stimulators.*

	F2009	F2010	F2011	F2012	F2013	F2014	F2015	F2016	F2017	F2018
Epidural Services										
Patients	856,540	891,640	936,500	967,080	959,520	971,280	993,960	1,027,120	1,001,700	1,013,080
Total Cost*	$847,058,465	$878,749,582	$921,450,280	$911,390,471	$917,400,419	$914,992,157	$982,528,003	$918,611,597	$819,768,949	$829,987,636
Per Patient	$989	$986	$984	$942	$956	$942	$988	$894	$818	$819
Facets Joints										
Patients	309,440	312,940	330,660	356,220	366,860	396,040	433,520	463,900	489,320	511,020
Total cost*	$595,668,756	$548,183,220	$562,602,189	$655,649,594	$685,356,524	$701,726,706	$771,820,485	$875,301,195	$860,710,496	$912,327,021
Per Patient	$1,925	$1,752	$1,701	$1,841	$1,868	$1,772	$1,780	$1,887	$1,759	$1,785
SCS										
Total cost*	$292,153,701	$380,799,967	$406,351,617	$459,428,760	$509,079,000	$422,870,774	$621,794,039	$751,779,013	$971,704,825	$1,142,434,137
Patients	12440	19300	21800	22720	23620	20520	20980	26420	32720	35240
Per Patient	$34,032	$31,522	$30,942	$32,322	$33,899	$32,219	$44,996	$44,511	$43,601	$46,384

* inflation-adjusted
SCS – spinal cord stimulator

tion, along with inflation-adjusted costs. The number of patients receiving spinal cord stimulation interventions per 100,000 Medicare population increased from 12,680 in 2009 at a rate of 28 per 100,000 population to 36,280 in 2018 at a rate of 61, a 99% increase, with an annual increase of 9.1% based on 100,000 Medicare population (Table 2). At the same time, the Medicare beneficiaries increased 30.1% or 3% annually. Thus, there is a net increase of spinal cord stimulation interventions based on population increases or per 100,000 Medicare population. The proportion of the patients receiving spinal cord stimulation interventions in the age group of less than 65 years of age on Medicare (disabled population) increased 70% at an annual rate of 6.6%.

As shown in Table 5, average allowed charges per spinal cord stimulator trial increased from $6,084 in 2009 to $6,812, for a 12% increase of 1.3% annually. Inflation-adjusted cost of trials decreased 4.3% or annually 0.5%.

Spinal cord stimulator pulse generator implant costs (Table 6) showed an increase of 73% overall per implant, increasing from $22,586 to $38,993, with an annual increase of 6.3%; however, inflation-adjusted costs showed lower increases of 48% overall and 4.4% annually. Overall, costs of implants increased from $172,559,159 in 2009 to $895,280,149, for a 419% increase or 20.1% increase on an annual basis. The inflation adjusted costs increased 343% with an annual increase of 18%. Table 6 and Fig. 4 show increasing expenditures per year of spinal cord stimulator trials and pulse generator implants from $292,153,701 in 2009 to $1,142,434,137 in 2018, a 291% increase from 2009 to 2018 and 16.4% annual increase.

In this assessment we also compared trends in expenditures in the Medicare population with facet joint interventions and epidural interventions during the same periods (3,4), which showed higher expenditures for spinal cord stimulator trials and implants combined of more than 125% above facet joint interventions and 138% above epidural procedures in 2018, whereas in 2009, it was only 34% above facet joint interventions and 29% above epidural procedures.

The results of this investigation indicate significant increases in utilization patterns, as well as expenditures of spinal cord stimulation trials and implants. In contrast to epidural injections, which showed declines, and facet joint interventions, which showed minor increases, spinal cord stimulation showed consistent increases in utilization and expenditures; however, the number of patients receiving spinal cord stimulation, in comparison, is low. The number of patients receiving epidural injections is over a million/year or 1,700 per 100,000 Medicare population and over 511,000 or at a rate of 857 for facet joint interventions,

whereas over 36,000, or at a rate of 61 per 100,000 Medicare population for spinal cord stimulator interventions in 2018. Further, of the number of patients receiving spinal cord stimulation procedures, only 64% received permanent implants in 2018.

Medicare is concerned with utilization patterns and increasing expenditure overall for services provided, specifically of low back and neck pain and those of interventional techniques and spinal cord stimulation, along with surgical interventions. Epidural procedures have been shown to be in decline, whereas facet joint interventions showed very mild increases but with flattening. While the proportion of patients receiving these services is very small, the proportion of expenditures is high being 38% above epidural interventions and 25% over facet joint interventions in 2018. This is in contrast to the proportion of expenditures in 2009, which were 51% below the expenditures of facet joint interventions or 66% below that of epidural injections.

CMS continues to update Local Coverage Determinations (LCDs) by calling for multijurisdictional Contractor Advisory Committee (CAC) assessment of present LCDs for facet joint interventions, epidural interventions, and is performing enhanced audits, and investigations (67-70). The philosophy and emphasis continues towards reducing utilization and expenditures by not only reducing fraud and abuse, but also by enforcing the appropriate indications and medical necessity criteria. This is reinforced by initiation of precertification requirements for spinal cord stimulation in hospital settings (71).

Conclusion

The estimations of expenditures of spinal cord stimulation interventions in the Medicare FFS population from 2009 to 2018 showed significant increases in the costs from $292,153,701 in 2009 to $1,142,434,137 in 2018, a 291% increase from 2009 to 2018 and a 16.4% annual increase.

From 2009 to 2018, spinal cord stimulation trials increased 186% with an annual increase of 12.5%. Pulse generator implants increased 201% with an annual increase of 13%. Total inflation-adjusted expenditures for spinal cord stimulation, including trials and implants, increased from $292,153,701 in 2009 to $1,142,434,137 with an overall increase of 291% and an annual increase of 16.4%.

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Author Contributions

The study was designed by LM, VP, BV, and JAH.

Data collection and analysis was performed by VP.

All authors contributed to the preparation of the manuscript, review, and approval of the content with final version.

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Appendix Table 1. *Top 5 principal diagnosis for spinal cord stimulator trial patients*

	F2009	F2010	F2011	F2012	F2013	F2014	F2015	F2016	F2017	F2018
Chronic pain (G89.21, G89.28, G89.29. G89.4)	2,420	4,720	6,480	8,640	8,620	7,540	8,040	10,780	12,320	13,780
Percent	19%	23%	29%	37%	35%	35%	36%	38%	36%	38%
Post laminectomy syndrome (M96.1)	3,720	5,080	5,140	5,140	4,660	4,740	4,240	5,160	7,380	8,400
Percent	29%	25%	23%	22%	19%	22%	19%	18%	21%	23%
Radiculopathy, lumbar region (M54.16 or M54.17)	2,440	3,280	4,220	4,040	4,100	3,280	3,500	4,800	6,500	6,160
Percent	19%	16%	19%	17%	17%	15%	16%	17%	19%	17%
Low back pain (M54.5)	740	1,300	1,480	1,060	1,140	1,200	860	1,280	840	780
Percent	6%	6%	7%	4%	5%	6%	4%	5%	2%	2%
Others	3,330	2640	2360	1720	3120	1980	2020	1500	2320	2380
Percent	27%	13%	10%	7%	13%	9%	9%	5%	7%	7%
Total	12,680	20,200	22,720	23,640	24,380	21,780	22,100	28,380	34,340	36,280

Appendix Table 2. *Summary of the frequency of utilization of spinal cord stimulator trials in the Medicare population by state and 2016 Medicare carrier from 2009 to 2018.*

State Name	F2009	F2010	F2011	F2012	F2013	F2014	F2015	F2016	F2017	F2018	Change	GM
Cahaba	1,120	1,360	1,820	1,700	1,520	1,380	1,200	2,440	2,260	2,740	145%	10%
Rate	37	43	56	51	44	39	33	66	58	68	85%	7%
PCPY	18%	30%	-9%	-14%	-12%	-15%	99%	-12%	18%			
CGS	880	1,440	1,780	1,720	1,620	1,160	1,500	1,260	1,640	2,180	148%	11%
Rate	34	54	66	62	58	40	51	42	52	68	102%	8%
PCPY		61%	21%	-5%	-7%	-30%	27%	-18%	25%	30%		
First Coast	1,080	1,520	1,740	2,260	2,180	1,620	1,740	1,900	2,460	2,200	104%	8%
Rate	33	45	50	64	59	42	44	47	57	50	52%	5%
PCPY		37%	11%	28%	-8%	-28%	4%	7%	21%	-13%		
NGS	1,320	1,660	2,400	2,140	2,760	2,460	3,080	2,740	4,260	4,600	248%	15%
Rate	15	19	26	23	30	26	32	27	40	42	182%	12%
PCPY		23%	42%	-12%	30%	-13%	23%	-15%	49%	5%		
Noridian	2,340	3,380	3,680	3,700	2,320	3,640	2,020	5,680	3,280	6,980	198%	13%
Rate	28	39	41	41	25	38	21	55	30	61	119%	9%
PCPY		40%	6%	-1%	-38%	51%	-46%	167%	-46%	106%		
Novitas	3,420	5,780	6,060	6,640	8,260	6,060	7,620	7,740	12,300	9,240	170%	12%
Rate	32	53	54	58	72	51	63	61	92	68	110%	9%
PCPY		65%	2%	7%	23%	-29%	23%	-3%	52%	-27%		
Palmetto	1,020	2,100	2,320	2,180	2,480	2,200	2,040	2,780	3,380	3,560	249%	15%
Rate	28	55	60	55	60	52	47	62	71	73	164%	11%
PCPY		100%	7%	-8%	10%	-14%	-10%	33%	15%	2%		
WPS	1,480	2,900	2,800	3,220	3,180	3,200	2,880	3,800	4,620	4,740	220%	14%
Rate	31	59	56	63	61	60	53	68	80	80	159%	11%
PCPY		92%	-5%	13%	-4%	-2%	-12%	30%	16%	0%		
US Total	12,680	20,200	22,720	23,640	24,380	21,780	22,100	28,380	34,340	36,280	186%	12%
Rate	28	43	47	47	47	41	40	50	59	61	120%	9%
PCPY		56%	9%	0%	0%	-13%	-1%	25%	18%	3%		

Appendix Table 3. ***Medicare national payment rates***.

Professional Rates										
CPT	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
63650	$379.06	$393.68	$414.85	$427.17	$437.20	$427.37	$425.45	$429.93	$424.20	$425.88
63655	$773.63	$802.85	$855.53	$832.90	$841.73	$847.21	$857.37	$859.87	$864.56	$866.51
63685	$370.40	$373.48	$396.50	$363.18	$370.17	$373.27	$378.74	$381.21	$378.27	$376.92
HOPD Rate										
CPT	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
63650	$4,206.45	$4,429.21	$4,553.02	$4,437.12	$4,399.77	$4,626.50	$5,288.58	$5,244.37	$5,742.69	$6,055.19
63655	$5,476.61	$5,831.77	$6,201.79	$6,203.77	$6,792.04	$7,424.49	$17,099.35	$17,359.37	$17,795.86	$18,367.62
63685	$15,566.65	$13,892.45	$14,743.58	$15,188.78	$16,394.73	$17,232.90	$26,152.16	$26,728.39	$27,035.69	$27,889.86
ASC Rates										
CPT	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
63650	$3,495.96	$3,495.96	$3,707.45	$3,593.57	$3,550.55	$3,691.78	$3,836.95	$3,993.90	$4,421.66	$4,594.66
63655	$4,969.87	$4,969.87	$5,223.67	$5,264.08	$5,860.83	$6,295.98	$15,854.21	$14,797.32	$14,674.55	$15,005.88
63685	$12,877.21	$12,877.21	$13,816.04	$14,283.97	$15,431.30	$16,172.35	$20,806.60	$21,258.56	$23,148.41	$22,891.80
Office Overhead										
CPT	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
63650						$922.07	$929.24	$940.49	$912.30	$927.35
63655										
63685										

From 2009 to 2014 – L0860 payments were separate