Health Policy Review

Assessment of the Growth of Epidural Injections in the Medicare Population from 2000 to 2011

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Background: Among the many diagnostic and therapeutic interventions available for the management of chronic pain, epidural steroid injections are one of the most commonly used modalities. The explosive growth of this technique is relevant in light of the high cost of health care in the United States and abroad, the previous literature assessing the effectiveness of epidural injections has been sparse with highly variable outcomes based on technique, outcome measures, patient selection, and methodology. However, the recent assessment of fluoroscopically directed epidural injections has shown improved evidence with proper inclusion criteria, methodology, and outcome measures.

The exponential growth of epidural injections is illustrated in multiple reports. The present report is an update of the analysis of the growth of epidural injections in the Medicare population from 2000 to 2011 in the United States.

Study Design: Analysis of utilization patterns of epidural procedures in the Medicare population in the United States from 2000 to 2011.

Objectives: The primary purpose of this assessment was to evaluate the use of all types of epidural injections (i.e., caudal, interlaminar, and transforaminal in the lumbar, cervical, and thoracic regions) with an assessment of specialty and regional characteristics.

Methods: This assessment was performed utilizing the Centers for Medicare and Medicaid Services (CMS) Physician/Supplier Procedure Summary (PSPS) Master data from 2000 to 2011.

Results: Epidural injections in Medicare beneficiaries increased significantly from 2000 to 2011. Overall, epidural injections increased 130% per 100,000 Medicare beneficiaries with an annual increase of 7.5%. The increases per 100,000 Medicare recipients were 123% for cervical/thoracic interlaminar epidural injections; 25% for lumbar/sacral interlaminar, or caudal epidural injections; 142% for cervical/thoracic transforaminal epidural injections; and 665% for lumbar/sacral transforaminal epidural injections. The use of epidurals increased 224% in the radiologic specialties (interventional radiology and diagnostic radiology) and 145% in psychiatric settings, whereas and physical medicine and rehabilitation physicians' use of epidurals increased 520%.

Limitations: Study limitations include lack of inclusion of Medicare Advantage patients. In addition, the statewide data is based on claims which may include the contiguous or other states.

Conclusions: Epidural injections in Medicare recipients increased significantly. The growth was significant for some specialties (radiology, physical medicine and rehabilitation, and psychiatry) and for certain procedures (lumbosacral transforaminal epidural injections).

Key words: Spinal pain, interventional pain management, epidural injections, caudal epidural, lumbar epidural, cervical epidural, cervical transforaminal, lumbar transforaminal

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The report from the Institute of Medicine (IOM) on relieving pain in America (1) noted that not only is the magnitude of pain in the United States astounding, with more than 100 million Americans experiencing chronic persistent pain, but that the estimated financial costs are enormous. Based on a 2008 Medical Expenditure Survey, Gaskin and Richard (2) estimated the total economic cost of pain in the United States in 2010 to range from $560 to $635 billion. The report of IOM based on Gaskin and Richard's assessment misinterprets the prevalence and costs of chronic pain with inclusion of joint pain, arthritis and functional disability with majority of the costs going to these conditions. However, the cost of moderate and severe pain seems to be less than $100 billion per year. The disability secondary to chronic pain also continues to increase (3). Further, Martin et al (4,5) in assessing the effect of chronic spinal pain on the U.S. economy, found that costs were approximately $86 billion, with an increase of 65% between 1997 and 2005, and a 49% increase in the number of patients seeking spine related care. Similarly, Freburger et al (6), during an assessment of low back pain in North Carolina, showed significant increases from 3.9% in 1992 to 10.2% in 2006. Various reports echoed the increasing prevalence and related disability of spinal pain (6-20).

Over the past decade there have been increases in imaging, drug use, physical therapy, surgery, interventional procedures, and other treatments (19-42). Epidural injections along with other interventional techniques are considered major components contributing to increasing expenditures among patients with chronic spinal pain (34,39-61). The influx of emerging literature addressing the effectiveness of various types of epidural injections in managing spinal pain continuing to emerge, has led to debate regarding their effectiveness, medical necessity, and indications rages on (27,39-65). Thus, epidural injections are the focus of attention among other interventional techniques. In fact, the Office of the Inspector General (OIG) of the U.S. Department of Health and Human Services (HHS) has focused attention on transforaminal epidural injections (34). This investigation from 2003 to 2007 showed increases in expenditures from $57 million in 2003 to $141 million in 2007. Moreover, this investigation showed the ominous findings that 34% of transforaminal epidural injections did not meet the medical necessity criteria, resulting in improper payments of approximately $45 million. Despite these findings and the subsequent increase in regulations, these interventions continue to increase exponentially. Manchikanti et al (22), in a utilization assessment of interventional techniques, showed increases from 2000 to 2011 of 127% per 100,000 Medicare beneficiaries for epidural and adhesiolysis procedures. The geometric average of annual increases was 7.7% for epidural and adhesiolysis procedures. In addition, Manchikanti et al (21), in an assessment of utilization trends in Medicare expenditures from 2000 to 2008, showed spinal interventional techniques increased 186.8%, with an annual average increase of 14.1% per 100,000 beneficiaries. The study results showed explosive increases in spinal interventional techniques from 2000 to 2008, with some slowing of growth in later years. Abbott et al (24), in an assessment of utilization characteristics of spinal interventions, also showed significant increases. In earlier studies, Manchikanti et al (23), assessing the growth of epidural injections separately from 1997 to 2006, showed the prevalence of epidural injections along with an increase of Medicare beneficiaries by 106.3% and office visits per 100,000 population by 102.7%. They also showed that hospital outpatient department payments increased significantly. Since the publication in 2010 utilizing data up to 2006, no reports have been published specifically evaluating the utilization patterns of epidural injections.

Manchikanti et al (21) in assessment of growth of spinal interventional pain management techniques showed total costs of spinal interventional techniques increased from $362,347,025 in 2000 to $1,231,180,420 in 2008 which included all epidural injections and facet joint interventions and sacroiliac joint injections, an increase of 240%.

Thus, we have undertaken this study to evaluate the use of all types of epidural injections (i.e., caudal, interlaminar, and transforaminal in the lumbar, cervical, and thoracic regions).

Methods

The study was performed utilizing the Centers for Medicare and Medicaid Services (CMS) Physician Supplier Procedure Summary Master Data from 2000 to 2011 (61). The data were purchased from the CMS by the American Society of Interventional Pain Physicians. This study was conducted with internal resources of the primary author's practice without any external funding either from industry or elsewhere. The CMS's 100% data set is therefore unbiased and unpredictable in terms of any patient characteristics. Medicare, with the elderly and disabled, represents the single largest

population of health care payers in the United States, with over 46.9 million beneficiaries in 2011 (66). Thus, procedures performed on Medicare beneficiaries represent a large proportion of the procedures for chronic pain being performed in the United States. Rates were calculated based on Medicare beneficiaries for the corresponding year and are reported as procedures per 100,000 Medicare beneficiaries.

For this analysis, the Current Procedural Terminology (CPT) procedure codes for epidural injections were identified for the years 2000 to 2011. The data was then tabulated based on the place of service – facility (ASC, HOPD) or non-facility (office). The calculated data included the number of epidural injections and rate of services per 100,000 Medicare beneficiaries.

Various specialties were described as those providers: interventional pain management -09, pain medicine -72, anesthesiology -05, physical medicine and rehabilitation -25, neurology -13, and psychiatry -26, constituting interventional pain management; orthopedic surgery -20, neurosurgery -14, and general surgery -02, as a surgical group; radiology specialties as a separate group; all other physicians as another group; and all other providers were considered as other providers.

Statistical Analysis

The data were analyzed using SPSS (9.0) statistical software, Microsoft Access 2003, and Microsoft Excel 2003. The procedure rates were calculated per 100,000 Medicare beneficiaries.

Results

Characteristic Features

Table 1 illustrates the characteristics of Medicare beneficiaries as well as the epidural injections provided to them. Medicare beneficiaries increased 18% from 2000 to 2011 compared to an increase of 130% in the rate (per 100,000 Medicare beneficiaries) of epidural injections with an annual increase of 7.5% compared to a 1.5% annual increase in the number of Medicare beneficiaries which is 5 times the increase of the population rate. However, disabled Medicare beneficiaries below age of 65 years increased 45% with an annual increase of 3.4%.

Table 1. *Characteristics of Medicare beneficiaries and epidural procedures.*

	U.S. Population (,000)			Medicare Beneficiaries (,000)						Utilization of Epidural Injections		
Year	All Ages	≥ 65 years	Percent	< 65 years	Percent	≥ 65 years	Percent	Total Medicare beneficiaries	% to U.S.	Services	% of Change from Previous year	Rate per 100,000 Medicare Beneficiaries
Y2000	**282,172**	35,077	12.4%	5,370	13.5%	34,262	86.5%	**39,632**	14.0%	839,474 (80%)		**2,118**
Y2001	**285,040**	35,332	12.4%	5,567	13.9%	34,478	86.1%	**40,045**	14.0%	989,034 (78%)	17.8%	**2,470**
Y2002	**288,369**	35,605	12.3%	5,805	14.3%	34,698	85.7%	**40,503**	14.0%	1,172,248 (74%)	18.5%	**2,894**
Y2003	**290,211**	35,952	12.4%	6,078	14.8%	35,050	85.2%	**41,126**	14.2%	1,342,829 (71%)	14.6%	**3,265**
Y2004	**292,892**	36,302	12.4%	6,402	15.3%	35.328	84.7%	**41,729**	14.2%	1,611,887 (65%)	20.0%	**3,863**
Y2005	**295,561**	36,752	12.4%	6,723	15.8%	35,777	84.2%	**42,496**	14.4%	1,747,771 (65%)	8.4%	**4,113**
Y2006	**299,395**	37,264	12.4%	7,022	16.2%	36,317	83.8%	**43,339**	14.5%	1,844,182 (63%)	5.5%	**4,255**
Y2007	**301,290**	37,942	12.6%	7,297	16.5%	36,966	83.5%	**44,263**	14.7%	1,915,227 (62%)	3.9%	**4,327**
Y2008	**304,056**	38,870	12.8%	7,516	16.6%	37,896	83.4%	**45,412**	14.9%	2,017,132 (61%)	5.3%	**4,442**
Y2009	**307,006**	39,570	12.9%	7,624	16.6%	38,177	83.3%	**45,801**	14.9%	2,112,511 (59%)	4.7%	**4,612**
Y2010	**308,746**	40,268	13.0%	7,923	16.9%	38,991	83.1%	**46,914**	15.2%	2,205,307 (57%)	4.4%	**4,701**
Y2011	**313,848**	41,122	13.1%	7,786	16.6%	39,132	83.4%	**46,918**	14.9%	2,289,213 (58%)	3.8%	**4,879**
Change	**11%**	17%		45%		14%		**18%**		173%		**130%**
(GM)	**1.0%**	1.5%		3.4%		1.2%		**1.5%**		9.5%		**7.50%**

(GM) : Geometric change.

Epidural Services = 62310- Cervical/Thoracic interlaminar epidural injections; 62311-Lumbar/Sacral interlaminar epidural injections; 64479-Cervical/Thoracic transforaminal epidural injections; 64480- Cervical/Thoracic transforaminal epidural injections add-on; 64483-Lumbar/sacral transforaminal epidural injections; 64484-Lumbar/sacral transforaminal epidural injections add-on

Utilization Characteristics

Table 2 illustrates the utilization characteristics of epidural injections in the Medicare population from 2000 to 2011. Overall epidural injections increased 130% per 100,000 Medicare beneficiaries with an annual increase of 7.5%. However, lumbosacral interlaminar and caudal epidural injections increased 25% per 100,000 Medicare beneficiaries with a 2% annual increase compared to an increase of 123% per 100,000 beneficiaries and a 7.6% annual increase for cervical/thoracic interlaminar epidural injections. In contrast, lumbosacral transforaminal epidural injections increased 665% per 100,000 population with an annual increase of 20.3%, whereas cervical/thoracic transforaminal epidural injections increased 142% with an annual increase of 8.4%. Frequency of Utilization

Specialty Characteristics

Table 3 and Figure 1 illustrates the utilization patten of epidural injections by various specialties. As a group of interventional pain management including anesthesiology, interventional pain management, pain medicine, physical medicine and rehabilitation, neurology, and psychiatry, the rate of increase was 141% per 100,000 Medicare beneficiaries with an overall increase of 186%. However, among these groups, physical medicine and rehabilitation showed an overall increase of 634% and 520% per 100,000 Medicare beneficiaries compared to psychiatry which showed an overall increase of 190% and 145% per 100,000 Medicare population. Radiology consisting of interventional radiology and diagnostic radiology also showed an increasing rate of 224% per 100,000 Medicare beneficiaries. Surgical specialties including neurosurgery, orthopedic surgery, and general surgery showed an increase of 109%.

Table 4 shows epidural procedures performed in each state with data from 2008 to 2010 based on utilization with high to low. Table 5 shows utilization in states in alphabetical order.

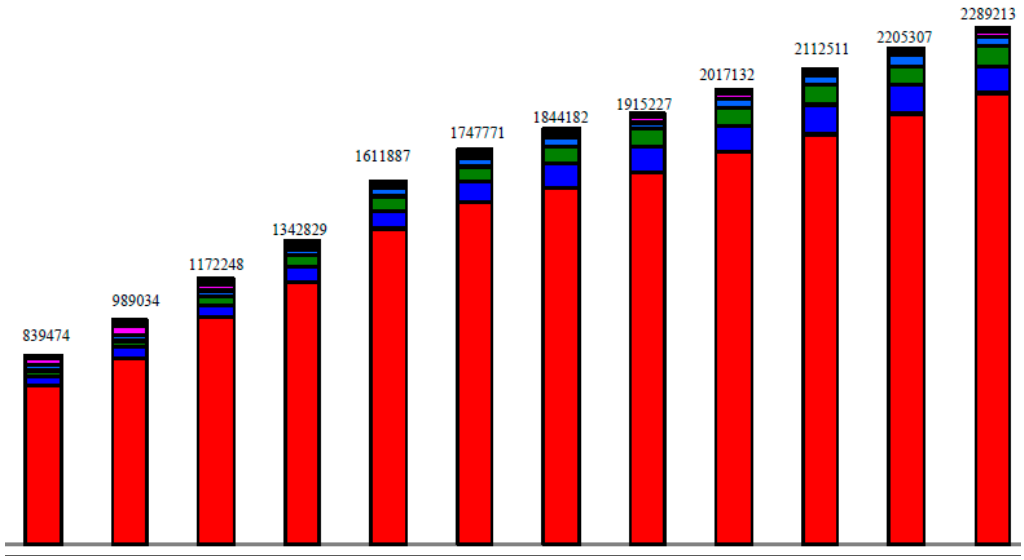
Discussion

Epidural injections for managing chronic spinal pain have increased rather dramatically from 2000 to 2011 with an increase of 130% per 100,000 Medicare beneficiaries and an annual increase of 7.5%. In contrast, Medicare beneficiaries per 100,000 population

Table 2. *Utilization of epidural injections in the Medicare population from 2000 to 2011.*

Year	Interlaminar Epidurals				Transforaminal Epidurals								Total Epidural Injections	
					Cervical/Thoracic				Lumbar/Sacral					
	Cervical/Thoracic CPT 62310		Lumbar/Sacral CPT 62311		CPT 64479	CPT 64480	Total		CPT 64483	CPT 64484	Total			
	Services	Rate	Services	Rate	Services	Services	Services	Rate	Services	Services	Services	Rate	Services	Rate
2000	75,741	191	618,362	1,560	13,454	9,434	22,888	58	85,006	37,477	122,483	309	839,474	2,118
2001	84,385	211	702,713	1,755	14,732	8,537	23,269	58	125,534	53,133	178,667	446	989,034	2,470
2002	99117	245	786919	1,943	18583	10835	29,418	73	177679	79115	256,794	634	1,172,248	2,894
2003	109783	267	838858	2,040	21882	15769	37,651	92	242491	114046	356,537	867	1,342,829	3,265
2004	130,649	313	878,174	2,104	25,182	18,094	43,276	104	363,744	196,044	559,788	1,341	1,611,887	3,863
2005	141,652	333	945,350	2,225	27,844	20,525	48,369	114	395,508	216,892	612,400	1,441	1,747,771	4,113
2006	146,748	339	946,961	2,185	29,822	23,073	52,895	122	452,125	245,453	697,578	1,610	1,844,182	4,255
2007	156,415	353	926,029	2,092	29,938	22,266	52,204	118	506,274	274,305	780,579	1,764	1,915,227	4,327
2008	165,636	365	905,419	1,994	32,286	24,003	56,289	124	572,340	317,448	889,788	1,959	2,017,132	4,442
2009	175,503	383	888,166	1,939	37,012	27,487	64,499	141	632,658	351,685	984,343	2,149	2,112,511	4,612
2010	184,750	394	888,421	1,894	40,003	29,888	69,891	149	679,117	383,128	1,062,245	2,264	2,205,307	4,701
2011	200,134	427	914,324	1,949	38,970	26,628	65,598	140	710,638	398,519	1,109,157	2,364	2,289,213	4,879
Change from 2000 to 2011														
	164%	123%	48%	25%	190%	182%	187%	142%	736%	963%	806%	665%	173%	130%
Geometric average annual change														
	9.2%	7.6%	3.6%	2.0%	10.2%	9.9%	10.0%	8.4%	21.3%	24.0%	22.2%	20.3%	9.5%	7.5%

Rate - Per 100,000 Medicare Beneficiaries



Specialty	F2000	F2001	F2002	F2003	F2004	F2005	F2006	F2007	F2008	F2009	F2010	F2011
IPM	83.7%	83.1%	85.4%	86.9%	86.8%	86.7%	86.1%	86.4%	86.1%	86.1%	86.7%	87.7%
Surgery	5.6%	5.4%	5.4%	5.2%	5.4%	5.3%	5.6%	5.8%	6.0%	6.4%	5.7%	5.1%
Radiology	2.7%	3.0%	3.4%	3.8%	4.0%	4.0%	4.1%	4.0%	4.0%	3.9%	3.8%	3.8%
General Physicians	2.6%	1.9%	1.9%	1.9%	1.9%	1.9%	2.2%	1.8%	1.7%	1.8%	2.1%	1.7%
Other Physicians	3.7%	4.7%	2.2%	1.0%	0.9%	0.9%	0.9%	1.0%	1.3%	0.9%	0.9%	0.9%
CRNA, NP & PA	1.7%	1.9%	1.7%	1.3%	1.0%	1.1%	1.1%	1.0%	0.9%	0.8%	0.8%	0.8%

Fig. 1. Frequency of utilization of epidural injections by various specialties from 2000 to 2011, in Medicare recipients.

increased by only 18% with an annual increase of 1.5% from 2000 to 2011. The increases were present in all settings for all types of epidural injections including lumbar interlaminar or caudal, and cervical/thoracic interlaminar, and cervical/thoracic and lumbar/sacral transforaminal epidural injections. The proportion of nonfacility procedures also increased from 20% to 42% of all procedures. The highest increases were seen for lumbosacral transforaminal epidural injections with an increase of 665% per 100,000 Medicare beneficiaries with an annual increase of 20.3%. In addition, cervical/thoracic transforaminal epidural injections increased 142% with an annual increase of 8.4% per 100,000 Medicare beneficiaries compared to 123% and 7.6% for cervical/thoracic interlaminar epidural injections. In contrast, lumbosacral epidural injections showed increases of 25% with an annual increase of 2% per 100,000 Medicare beneficiaries, only slightly higher than the increase of Medicare beneficiaries.

The results of this evaluation of growth patterns are similar to previous evaluations (21-23). This assessment also shows that OIG publications of results in 2010 (34) had no significant effect on performance of lumbosacral transforaminal epidurals which increased dramatically. Surprisingly, the total number of lumbar transforaminal epidural injections exceeded total number of lumbosacral interlaminar or caudal epidural injections in 2009 reversing a trend of higher interlaminar and caudal epidural injections compared to transforaminal epidural injections. It is also surprising to note the utilization rates by physical medicine and rehabilitation specialists (520% per 100,000 Medicare beneficiaries), psychiatry (145% per 100,000 Medicare beneficiaries), and radiologists (224% per 100,000 Medicare beneficiaries) have increased fairly dramatically, though, some of these groups started with a relatively low base number of procedures. Transforaminal epidural injections are reimbursed at a higher rate for both the physician and the facility fee. Of all the statistics, the authors believe the most interesting is related

Table 3. *Frequency of utilization of epidural injections from 2000 to 2011 in Medicare recipients.*

Specialty	F2000	F2001	F2002	F2003	F2004	F2005	F2006	F2007	F2008	F2009	F2010	F2011	Total Change	Annual Change
Anesthesiology -05	634,408	736,863	779,276	797,243	774,843	842,351	827,898	802,821	779,242	779,019	736,653	715,511	13%	1.1%
Interventional Pain Management -09	-	-	-	39,537	163,369	177,767	225,938	331,475	439,182	505,777	564,807	605,651	-	-
Pain Medicine -72	-	1,827	95,438	160,253	230,325	248,938	257,339	214,129	177,773	157,491	203,125	255,031	-	-
PM&R -25	54,047	65,917	99,301	134,970	198,146	211,230	243,389	272,644	307,888	343,094	371,110	396,892	634%	19.9%
Neurology -13	12,981	15,721	23,551	31,379	28,889	30,971	29,691	29,281	28,510	30,935	32,466	31,300	141%	8.3%
Psychiatry -26	1,295	1,957	3,770	3,239	3,236	3,692	4,309	4,877	3,797	3,552	3,601	3,750	190%	10.1%
Interventional Pain Management	**702731**	**822285**	**1001336**	**1166621**	**1398808**	**1514949**	**1588564**	**165,227**	**1736392**	**1819868**	**1911762**	**2008135**	**186%**	**10.0%**
Percent	83.7%	83.1%	85.4%	86.9%	86.8%	86.7%	86.1%	86.4%	86.1%	86.1%	86.7%	87.7%		
Rate	1,773	2,053	2,472	2,837	3,352	3,565	3,665	3,740	3,824	3,973	4,075	4,280	141%	8.3%
Neurosurgery –14	10,674	11,684	15,166	14,694	22,083	24,029	28,314	29,346	36,235	48,532	36,943	24,034	125%	7.7%
Orthopedic Surgery -20	34,810	39,936	45,872	52,846	61,463	65,507	70,726	76,822	80,930	83,893	85,787	89,192	156%	8.9%
General Surgery -02	1,729	1,738	2,773	2,314	3,000	3,354	4,089	4,403	4,085	3,485	3,389	3,775	118%	7.4%
Surgery	**47,213**	**53,358**	**63,811**	**69,854**	**86,546**	**92,890**	**103,129**	**110,571**	**121,250**	**135,910**	**126,119**	**117,001**	**148%**	**8.6%**
Percent	5.6%	5.4%	5.4%	5.2%	5.4%	5.3%	5.6%	5.8%	6.0%	6.4%	5.7%	5.1%		
Rate	119	133	158	170	207	219	238	250	267	297	269	249	109%	6.9%
Interventional Radiology -94	2,051	2,298	2,530	3,035	3,565	3,993	4,709	5,438	7,079	8,555	7,636	6,507	217%	11.1%
Diagnostic Radiology –30	20,743	27,698	37,687	47,777	60,755	66,022	70,121	71,073	72,816	74,310	76,034	80,940	290%	13.2%
Radiology	**22,794**	**29,996**	**40,217**	**50,812**	**64,320**	**70,015**	**74,830**	**76,511**	**79,895**	**82,865**	**83,670**	**87,447**	**284%**	**13.0%**
Percent	2.7%	3.0%	3.4%	3.8%	4.0%	4.0%	4.1%	4.0%	4.0%	3.9%	3.8%	3.8%		
Rate	58	75	99	124	154	165	173	173	176	181	178	186	224%	11.3%
Family Practice -08	5,336	4,615	6,863	9,683	13,065	14,154	13,492	14,234	15,210	16,239	21,723	20,336	281%	12.9%
General Practice -01	8,597	5,860	5,440	6,142	7,343	8,167	14,236	8,157	7,082	6,906	7,357	3,838	-55%	-7.1%
Internal Medicine -11	7,677	8,247	9,733	9,211	10,520	11,674	13,398	11,625	12,003	14,482	16,851	14,049	83%	5.6%
General Physicians	**21,610**	**18,722**	**22,036**	**25,036**	**30,928**	**33,995**	**41,126**	**34,016**	**34,295**	**37,627**	**45,931**	**38,223**	**77%**	**5.3%**
Percent	2.6%	1.9%	1.9%	1.9%	1.9%	1.9%	2.2%	1.8%	1.7%	1.8%	2.1%	1.7%		
Rate	55	47	54	61	74	80	95	77	76	82	98	81	49%	3.7%
Rheumatology -66	6,895	4,907	4,261	4,119	3,528	3,765	3,910	4,518	4,785	4,657	4,995	3,982	-42%	-4.9%
Osteopathic -12	997	1,318	1,169	1,252	1,052	1,166	1,540	2,383	3,298	3,181	2,949	2,640	165%	9.3%
Emergency Medicine-93	994	3,518	2,989	4,827	4,764	5,430	5,203	6,334	5,244	5,254	4,889	5,257	429%	16.3%
Others	21,933	36,532	17,023	3,315	5,130	6,020	6,276	6,665	13,624	6,377	6,846	8,872	-60%	-7.9%
Other Physicians	**30,819**	**46,275**	**25,442**	**13,513**	**14,474**	**16,381**	**16,929**	**19,900**	**26,951**	**19,469**	**19,679**	**20,751**	**-33%**	**-3.5%**
Percent	3.7%	4.7%	2.2%	1.0%	0.9%	0.9%	0.9%	1.0%	1.3%	0.9%	0.9%	0.9%		

Table 3 (cont). *Frequency of utilization of epidural injections from 2000 to 2011 in Medicare recipients.*

Specialty	F2000	F2001	F2002	F2003	F2004	F2005	F2006	F2007	F2008	F2009	F2010	F2011	Total Change	Annual Change
Rate	78	116	63	33	35	39	39	45	59	43	42	44	-43%	-5.0%
CRNA -43	13,995	17,690	18,244	15,462	14,432	16,717	16,001	15,314	14,516	13,352	14,622	13,131	-6%	-0.6%
NP -50	211	479	768	770	1,479	1,681	2,082	2,276	2,219	1,447	1,311	1,821	763%	21.6%
PA -97	101	229	394	761	900	1,143	1,521	1,412	1,614	1,973	2,213	2,704	2577%	34.8%
CRNA, NP & PA	**14,307**	**18,398**	**19,406**	**16,993**	**16,811**	**19,541**	**19,604**	**19,002**	**18,349**	**16,772**	**18,146**	**17,656**	**23%**	**1.9%**
Percent	1.7%	1.9%	1.7%	1.3%	1.0%	1.1%	1.1%	1.0%	0.9%	0.8%	0.8%	0.8%		
Rate	36	46	48	41	40	46	45	43	40	37	39	38	4%	0.4%
Total	839474	989034	1172248	1342829	1611887	1747771	1844182	1915227	2017132	2112511	2205307	2289213	173%	9.5%
Rate	2,118	2,470	2,894	3,265	3,863	4,113	4,255	4,327	4,442	4,612	4,701	4,879	130%	7.9%

Rate - Per 100,000 Medicare Beneficiaries; Change - Change from 2000 to 2011; Annual change = geometric change
Interventional Pain Management: Anesthesiology, Pain Management, PM&R, Neurology, Psychiatry,
Surgery: Neurosurgery, Orthopedic Surgery, General Surgery
Radiology: Interventional Radiology, Diagnostic Radiology
General Physicians: Family Practice, General Practice & Internal Medicine

to cervical/thoracic transforaminal epidural injections which have increased 142% per 100,000 Medicare beneficiaries with a geometric annual change of 8.4%, despite numerous complications reported with cervical transforaminal epidural injections leading to fatalities. However, these results may be different from those published by Abbott et al (24) who, in our opinion, utilized flawed concept and hypothesis.

The increasing utilization of epidural injections adds fuel to claims that these are overused, abused, and used without appropriate medical necessity and indications. Others also claim that there has not been increase in disc herniations or radiculitis over the years (27,33), even though disability and the economic impact of spinal pain continue to increase (1-5). While our understanding of the impact of spinal pain continues to evolve over the years, comorbid disorders, functional limitations, and patient awareness of these issues and their ability to seek relief continue to increase.

The significance of chronic pain, disability, and economic costs have been well illustrated (1,67). Hand in hand with issues related to chronic pain, spinal pain has also been illustrated to be associated with enormous prevalence, economic costs, and disability (3-8). Studies of spinal pain (16,17) showed at least 25% of patients reporting Grade II to IV low back pain with high pain intensity and disability compared to 14% with neck pain. Further, studies evaluating chronic low back pain have shown that the average age-related prevalence of persistent low back pain is approximately 15% in adults, whereas it is 27% in the elderly (15,18,20). Thus, advances in the understanding of the structural basis of chronic spinal pain and evidence-based medicine with comparative effectiveness research have increased utilization (20,21-23,28,39-42,68-71). Consequently, these, with understandings of interventional pain management if performed in contemporary interventional pain management settings with appropriate indications and medical necessity, may be considered appropriate utilization. However, when they do not meet these criteria, they are considered overuse and abuse.

Inappropriate utilization and/or providing these procedures without medical necessity are postulated to be the causes for the increase in the frequency and costs for epidural injections. In fact, the OIG (34) has recommended strengthening program safeguards to prevent improper payments for epidural injections. Consequently, the CMS has established local carrier determinations (LCDs) across the country based on reasonable and necessary criteria (72). However, the establishment

Table 4. *Illustration of epidural Injections performed (claims data) in each state with claims data from 2008 to 2010 in Medicare recipients based on utilization patterns.*

	Services					Rate per 100,000 Medicare Beneficiaries				
State	2008	2009	2010	Overall Change	Annual Change	2008	2009	2010	Overall Change	Annual Change
DC	20,014	21,632	24,211	21%	6.6%	26,641	28,206	30,987	16%	5%
South Carolina	69,074	73,648	76,625	11%	3.5%	9,544	9,837	9,904	4%	1%
Texas	188,029	204,170	208,216	11%	3.5%	6,711	7,041	6,938	3%	1%
Kansas	27,008	27,058	28,637	6%	2.0%	6,461	6360	6,617	2%	1%
Missouri	59,547	64,045	66,245	11%	3.6%	6,164	6,500	6,596	7%	2%
Alabama	55,577	53,873	53,297	-4%	-1.4%	6,868	6,510	6,305	-8%	-3%
Michigan	76,498	84,431	103,458	35%	10.6%	4,843	5,230	6,266	29%	9%
Georgia	68,942	76,431	75,633	10%	3.1%	5,982	6,402	6,121	2%	1%
Louisiana	34,861	41,842	41,947	9%	2.9%	5,859	6,233	6,108	4%	1%
Mississippi	25,334	28,065	29,538	17%	5.3%	5,286	5,751	5,941	12%	4%
Florida	201,171	194,604	195,475	-3%	-1.0%	6,263	5,917	5,793	-8%	-3%
Nevada	16,447	18,059	19,423	18%	5.7%	4,984	5,265	5,446	9%	3%
Indiana	52,135	53,012	54,422	4%	1.4%	5,407	5,381	5,411	0%	0%
Delaware	7,329	7301	8,058	10%	3.2%	5,195	5,033	5,398	4%	1%
Arizona	40,666	44,249	49,704	22%	6.9%	4,676	4,919	5,343	14%	5%
Oklahoma	29,056	31,026	32,236	11%	3.5%	5,023	5,243	5,342	6%	2%
Utah	13,268	14,062	14,888	12%	3.9%	5,024	5,135	5,260	5%	2%
North Carolina	70,143	74,156	77,550	11%	3.4%	4,993	5,121	5,205	4%	1%
North Dakota	5,504	5,639	5,537	1%	0.2%	5,160	5,221	5,066	-2%	-1%
New Hampshire	8,838	10,005	11,162	26%	8.1%	4,176	4,603	5,000	20%	6%
Illinois	78,063	83,272	90,979	17%	5.2%	4,399	4,610	4,946	12%	4%
Kentucky	32,697	33,726	36,171	11%	3.4%	4,490	4,537	4,760	6%	2%
South Dakota	5,746	6,456	6,342	10%	3.3%	4,352	4,801	4,644	7%	2%
Nebraska	12,395	12,518	12,236	-1%	-0.4%	4,568	4,542	4,385	-4%	-1%
Colorado	23,966	25,162	27,204	14%	4.3%	4,137	4,180	4,354	5%	2%
Arkansas	21,476	22,526	22,922	7%	2.2%	4,221	4,329	4,313	2%	1%
Ohio	78,533	83,862	81,001	3%	1.0%	4,266	4,484	4,262	0%	0%
Tennessee	45,312	47,027	44,480	-2%	-0.6%	4,512	4,560	4,205	-7%	-2%
Maryland	28,925	31,110	32,696	13%	4.2%	3,885	4,071	4,166	7%	2%
New Jersey	51,144	52,646	54,839	7%	2.4%	3,987	4,036	4,133	4%	1%
Idaho	9,439	9,361	9,192	-3%	-0.9%	4,406	4,217	4,000	-9%	-3%
Montana	6,448	6,633	6,469	0%	0.1%	4,019	4,029	3,816	-5%	-2%
Wisconsin	34,718	34,826	34,089	-2%	-0.6%	3,973	3,905	3,742	-6%	-2%
Wyoming	3,023	2,848	2,943	-3%	-0.9%	3,971	3,641	3,675	-7%	-3%
California	152,011	158,595	174,349	15%	4.7%	3,384	3,433	3,665	8%	3%
Pennsylvania	75,599	75,415	82,985	10%	3.2%	3,403	3,349	3,635	7%	2%
Virginia	37,262	40,357	40,648	9%	2.9%	3,455	3,636	3,564	3%	1%
Iowa	18,234	18,103	18,198	0%	-0.1%	3,602	3,538	3,517	-2%	-1%
Massachusetts	32,463	34,758	37,148	14%	4.6%	3,187	3,344	3,501	10%	3%
Connecticut	18,018	18,836	19,544	8%	2.7%	3,284	3,375	3,444	5%	2%
Maine	8,405	8,665	8,664	3%	1.0%	3,320	3,344	3,271	-1%	0%
Rhode Island	7,059	4,733	5,777	-18%	-6.5%	3,969	2,626	3,157	-20%	-7%

Table 4 (cont.). *Illustration of epidural Injections performed (claims data) in each state with claims data from 2008 to 2010 in Medicare recipients based on utilization patterns.*

	Services					Rate per 100,000 Medicare Beneficiaries				
State	2008	2009	2010	Overall Change	Annual Change	2008	2009	2010	Overall Change	Annual Change
Washington	28,010	28,688	30,354	8%	2.7%	3,101	3,058	3,122	1%	0%
New Mexico	8,463	8,956	9,738	15%	4.8%	2,876	2,948	3,107	8%	3%
New York	81,344	86,042	89,030	9%	3.1%	2,814	2,930	2,979	6%	2%
Alaska	1,648	1,779	1,956	19%	5.9%	2,757	2,837	2,978	8%	3%
Vermont	2,989	3,157	3,001	0%	0.1%	2,849	2,925	2,691	-6%	-2%
Minnesota	19,383	20,031	19,851	2%	0.8%	2,588	2,612	2,526	-2%	-1%
West Virginia	8,104	8,392	8,635	7%	2.1%	2,173	2,225	2,262	4%	1%
Oregon	11,653	12,370	12,459	7%	2.3%	1,995	2,054	2,006	1%	0%
Hawaii/Guam *	1,561	1,681	2,339	–	–	804	839	1,133	–	–
Medicare Total	2,017,132	2,112,511	2,205,307	9%	3.0%	4,442	4,612	4,700	6%	2%

*Hawaii and Guam were combined in 2010.
Annual change = geometric change

of LCDs has not deterred the utilization patterns of epidural injections. To the contrary, despite the OIG report, transforaminal epidural injections explosively increased more than any other modality. Furthermore, despite substantial complications related to cervical and thoracic transforaminal epidural injections, they also have increased substantially. Thus, in providing value based interventional pain management, LCDs if inappropriately prepared, could function as a hindrance. Thus, it is crucial to apply available evidence as dictated in the Program Integrity Manual (73) of … with reasonable and necessary provisions utilizing appropriate evidence supporting the LCDs. Thus, LCDs should be based on:

- Published authoritative evidence derived from definitive randomized clinical trials or other definitive studies, and
- General acceptance by the medical community (standard of practice), as supported by sound medical evidence based on:
- Scientific data or research studies published in peer-reviewed medical journals
- Consensus of expert medical opinion (i.e., recognized authorities in the field)
- Medical opinion derived from consultations with medical associations or other health care experts.

Epidural injections also have been considered for a national coverage determination (NCD). NCDs (72) are developed by the CMS to describe the circumstances for Medicare coverage nationwide for an item or service. NCDs generally outline the condition for which an item or service is considered to be covered and are usually issued as program instructions. However, once published in the CMS program instruction, an NCD is binding on all Medicare carriers and other related organizations (74). The CMS makes relatively few NCDs (75) because:

- Most decisions to cover services are not controversial
- Most services do not meet the criteria for the CMS to initiate an NCD
- Limited resources may affect the CMS's ability to initiate more NCDs
- Manufacturers and providers of a medical service may be apprehensive about requesting an NCD because they perceive that the decision could result in an all or nothing scenario in terms of their ability to obtain Medicare reimbursement.

Consequently, a negative NCD can be especially problematic for patients and providers of a service for which Medicare constitutes a large share of the market. Furthermore, it also stops access to these procedures for all Medicare beneficiaries which also will be followed by all other insurers. However, sometimes NCDs are written for a specific clinical indication of an item or service and can be modified once new clinical information is available.

Patient-Centered Outcomes Research Institute (PCORI) (35) by its founding legislation is not allowed to use, cost effectiveness or cost utility evidence. However, experience suggests that CMS might use these thresholds implicitly or explicitly (72). Multiple cost effectiveness analysis studies have been performed

Table 5. *Illustration of epidural procedures performed (claims data) in each state with data from 2008 to 2010 in alphabetical order.*

	Services					Rate per 100,000 Medicare Beneficiaries				
State	2008	2009	2010	Overall Change	Annual Change	2008	2009	2010	Overall Change	Annual Change
Alabama	55,577	53,873	53,297	-4%	-1.4%	6,868	6,510	6,305	-8%	-3%
Alaska	1,648	1,779	1,956	19%	5.9%	2,757	2,837	2,978	8%	3%
Arizona	40,666	44,249	49,704	22%	6.9%	4,676	4,919	5,343	14%	5%
Arkansas	21,476	22,526	22,922	7%	2.2%	4,221	4,329	4,313	2%	1%
California	152,011	158,595	174,349	15%	4.7%	3,384	3,433	3,665	8%	3%
Colorado	23,966	25,162	27,204	14%	4.3%	4,137	4,180	4,354	5%	2%
Connecticut	18,018	18,836	19,544	8%	2.7%	3,284	3,375	3,444	5%	2%
DC	20,014	21,632	24,211	21%	6.6%	26,641	28,206	30,987	16%	5%
Delaware	7,329	7301	8,058	10%	3.2%	5,195	5,033	5,398	4%	1%
Florida	201,171	194,604	195,475	-3%	-1.0%	6,263	5,917	5,793	-8%	-3%
Georgia	68,942	76,431	75,633	10%	3.1%	5,982	6,402	6,121	2%	1%
Hawaii/Guam *	1,561	1,681	2,339	–	–	804	839	1,133	–	–
Idaho	9,439	9,361	9,192	-3%	-0.9%	4,406	4,217	4,000	-9%	-3%
Illinois	78,063	83,272	90,979	17%	5.2%	4,399	4,610	4,946	12%	4%
Indiana	52,135	53,012	54,422	4%	1.4%	5,407	5,381	5,411	0%	0%
Iowa	18,234	18,103	18,198	0%	-0.1%	3,602	3,538	3,517	-2%	-1%
Kansas	27,008	27,058	28,637	6%	2.0%	6,461	6360	6,617	2%	1%
Kentucky	32,697	33,726	36,171	11%	3.4%	4,490	4,537	4,760	6%	2%
Louisiana	34,861	41,842	41,947	9%	2.9%	5,859	6,233	6,108	4%	1%
Maine	8,405	8,665	8,664	3%	1.0%	3,320	3,344	3,271	-1%	0%
Maryland	28,925	31,110	32,696	13%	4.2%	3,885	4,071	4,166	7%	2%
Massachusetts	32,463	34,758	37,148	14%	4.6%	3,187	3,344	3,501	10%	3%
Michigan	76,498	84,431	103,458	35%	10.6%	4,843	5,230	6,266	29%	9%
Minnesota	19,383	20,031	19,851	2%	0.8%	2,588	2,612	2,526	-2%	-1%
Mississippi	25,334	28,065	29,538	17%	5.3%	5,286	5,751	5,941	12%	4%
Missouri	59,547	64,045	66,245	11%	3.6%	6,164	6,500	6,596	7%	2%
Montana	6,448	6,633	6,469	0%	0.1%	4,019	4,029	3,816	-5%	-2%
Nebraska	12,395	12,518	12,236	-1%	-0.4%	4,568	4,542	4,385	-4%	-1%
Nevada	16,447	18,059	19,423	18%	5.7%	4,984	5,265	5,446	9%	3%
New Hampshire	8,838	10,005	11,162	26%	8.1%	4,176	4,603	5,000	20%	6%
New Jersey	51,144	52,646	54,839	7%	2.4%	3,987	4,036	4,133	4%	1%
New Mexico	8,463	8,956	9,738	15%	4.8%	2,876	2,948	3,107	8%	3%
New York	81,344	86,042	89,030	9%	3.1%	2,814	2,930	2,979	6%	2%
North Carolina	70,143	74,156	77,550	11%	3.4%	4,993	5,121	5,205	4%	1%
North Dakota	5,504	5,639	5,537	1%	0.2%	5,160	5,221	5,066	-2%	-1%
Ohio	78,533	83,862	81,001	3%	1.0%	4,266	4,484	4,262	0%	0%
Oklahoma	29,056	31,026	32,236	11%	3.5%	5,023	5,243	5,342	6%	2%
Oregon	11,653	12,370	12,459	7%	2.3%	1,995	2,054	2,006	1%	0%
Pennsylvania	75,599	75,415	82,985	10%	3.2%	3,403	3,349	3,635	7%	2%
Rhode Island	7,059	4,733	5,777	-18%	-6.5%	3,969	2,626	3,157	-20%	-7%
South Carolina	69,074	73,648	76,625	11%	3.5%	9,544	9,837	9,904	4%	1%
South Dakota	5,746	6,456	6,342	10%	3.3%	4,352	4,801	4,644	7%	2%

Table 5 (cont.). *Illustration of epidural procedures performed (claims data) in each state with data from 2008 to 2010 in alphabetical order.*

	Services					Rate per 100,000 Medicare Beneficiaries				
State	2008	2009	2010	Overall Change	Annual Change	2008	2009	2010	Overall Change	Annual Change
Tennessee	45,312	47,027	44,480	-2%	-0.6%	4,512	4,560	4,205	-7%	-2%
Texas	188,029	204,170	208,216	11%	3.5%	6,711	7,041	6,938	3%	1%
Utah	13,268	14,062	14,888	12%	3.9%	5,024	5,135	5,260	5%	2%
Vermont	2,989	3,157	3,001	0%	0.1%	2,849	2,925	2,691	-6%	-2%
Virginia	37,262	40,357	40,648	9%	2.9%	3,455	3,636	3,564	3%	1%
Washington	28,010	28,688	30,354	8%	2.7%	3,101	3,058	3,122	1%	0%
West Virginia	8,104	8,392	8,635	7%	2.1%	2,173	2,225	2,262	4%	1%
Wisconsin	34,718	34,826	34,089	-2%	-0.6%	3,973	3,905	3,742	-6%	-2%
Wyoming	3,023	2,848	2,943	-3%	-0.9%	3,971	3,641	3,675	-7%	-3%
Medicare Total	2,017,132	2,112,511	2,205,307	9%	3.0%	4,442	4,612	4,700	6%	2%

Annual change = geometric change

over the years about managing spinal pain, along with multiple systematic reviews (72,76-91). Thus, due to escalating health care costs and the questionable effectiveness of multiple interventions, cost effectiveness or cost utility analysis has become an important part of evidence-based medicine, clinical practice, and health policy (72). The purpose of a cost utility analysis is to estimate the ratio between the cost of a health related intervention and the benefit it produces in terms of the number of years lived in full health by the patient receiving the intervention in health economics. Thus, it is considered as a type of cost effectiveness analysis. In fact, cost effectiveness analysis and cost utility analysis are used interchangeably measuring the cost in monetary units, in contrast to a cost-benefit analysis in which the benefits do not have to be expressed in monetary terms. Kepler et al (77), in a systematic review and cost utility analysis in spine care analyzing 33 studies with 60 cost utility ratios, showed that 27 of 60 or 45% of the cost utility assessments were less than $100,000 per quality-adjusted life year (QALY) gained, and 23.3% were greater than 100,000 – QALY gain. Indrakanti et al (78), in another systematic review assessing cost utility of value-based care in the management of spinal disorders, demonstrated greater value for nonoperative treatments with graded activity over physical therapy and pain management; spinal manipulation over exercise; behavioral therapy and physiotherapy over advice; and acupuncture and exercise over usual practitioner care. Furlan et al (79), in a systematic review and meta-analysis of the efficacy, cost effectiveness, and safety of selected complementary and alternative medicines for neck and low back pain, showed that complementary and alternative therapies did not significantly reduce disability compared to sham therapies. Dagenais et al (83) showed that cost per QALY ranged from $304 to $579,527, with a median cost of $13,015. For surgery, Tosteson et al (85,86) showed, based on the 2 year results of Spine Patient Outcomes Research Trial (SPORT) observational and randomized cohort participants, cost per QALY gained for surgery was $69,403 or $52,746 (74% of total cost) as direct medical cost using general adult surgery costs and $34,355 or $23,017 (67% of total cost) as direct medical cost, using Medicare population surgery costs for disc herniation; and a cost of $77,600 or $48,112 as direct medical cost per QALY for spinal stenosis surgery, whereas they showed a cost of $115,600 or $71,672 direct medical cost per QALY gained for degenerative spondylolisthesis surgery.

None of the systematic reviews included epidural injections in their cost effectiveness or cost utility analysis. Further, very few studies have been published evaluating any interventional techniques, specifically epidural injections (72,76,84). In reference to cost utility analysis, the earlier data was very sparse and ineffectively performed. Recent analysis of caudal epidural injections administered for lumbar disc herniation, lumbar discogenic or axial low back pain, lumbar central spinal stenosis, and lumbar post surgery syndrome utilizing a robust outcome measure of 50% improvement in pain reduction and disability status in 480 patients with a 2 year follow-up showed an average cost per one year QALY of $2,172.50 (76).

Clinical effectiveness of epidural injections has been demonstrated with differential evidence for various conditions with randomized trials, systematic reviews, and

guidelines (20,39-50,68-71). As shown in these assessments, the evidence for disc herniations in the lumbar, thoracic, and cervical spine is fair to good when epidural injections are performed under fluoroscopic visualization either with caudal, cervical, thoracic, or lumbar interlaminar, or lumbosacral transforaminal epidural injections. The evidence is fair for lumbar and cervical spinal stenosis with interlaminar epidural injections; however, it is limited to fair for lumbar transforaminal epidural injections. For axial or discogenic pain the evidence is fair for caudal, fluoroscopic lumbar interlaminar, and cervical interlaminar epidural injections; however, it is limited with transforaminal epidural injections. For lumbar post surgery syndrome the preferred modality appears to be caudal epidural injection with fair evidence, or approaching the epidural space above or below the scar with an interlaminar approach (even though there is no published evidence), or in highly select cases transforaminal epidural injections with limited evidence. Evidence for cervical interlaminar epidural injections in post surgery syndrome is fair.

There is criticism of spine care providers with claims spanning that decisions are neither informed, nor consensual (92). Further, it has been claimed that informed consent in spine care often ignores the key details in reference the patient's diagnosis, risks and benefits of proposed treatments and procedures, the risks and benefits of alternative approaches (regardless of their cost or availability under insurance policies), and the risks and benefits of not having the proposed procedure(s). It is claimed that patients with back and neck problems often don't receive accurate information about their condition (92). As an example, they illustrate not only the facet syndrome, but also the discogenic pain where disc prosthesis, fusion surgery, and epidural injections are provided. Consequently, claims are made that patients are diagnosed with unvalidated diagnosis and obviously the prescribed treatments targeting these hypothetical disease entities are provided. Obviously they criticize that many spine care providers play up the potential benefits of suggested treatments while playing down their risks. This is a common phenomenon in the medical profession. However, we believe that in contemporary interventional pain management, appropriate information is provided while it may not be provided in some settings and by some physicians.

There are several limitations to our study including the lack of inclusion of participants in Medicare Advantage Plans and potential coding errors; however, this study included all fee-for-service Medicare patients, rather than only the ones above the age of 65. Another limitation includes the lack of availability of state data from 2000 to 2007, as well as facility and cost data which have been published elsewhere (21). In addition, the statewide data is based on claims which may include the contiguous or other states.

Overall, epidural injections are increasing at an explosive rate specifically in reference to lumbosacral transforaminal epidural injections. Appropriate evidence development utilizing proper methodologic criteria development of LCDs with limitations on indications and medical necessity, frequency, mandating fluoroscopy, may reduce these explosive increases substantially.

Conclusion

The use of epidural injections grew significantly. The growth was significant for some specialties (radiology, physical medicine and rehabilitation, and psychiatry) and for certain procedures (lumbosacral transforaminal epidural injections).

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