Health Services Research

# Declining Utilization Patterns of Percutaneous Adhesiolysis Procedures in the Fee-For-Service (FFS) Medicare Population

Laxmaiah Manchikanti, MD[1], Radomir Kosanovic, MD[1], Vidyasagar Pampati, MSc[1], and Alan D. Kaye, MD, PhD[2]

From: [1]Pain Management Centers of America, Paducah, KY; [2]LSU School of Medicine, Shreveport, LA and New Orleans, LA and Tulane School of Medicine, New Orleans, LA

Address Correspondence: Laxmaiah Manchikanti, M.D. Pain Management Centers of America 67 Lakeview Drive Paducah, KY 42001 E-mail: drlm@thepainmd.com

Disclaimer: There was no external funding in the preparation of this manuscript.

Conflict of interest: Dr. Kaye is a speaker for Merck

Manuscript received: 12/01/2020
Accepted for publication: 12/09/2020

Free full manuscript: www.painphysicianjournal.com

**Background:** Percutaneous epidural adhesiolysis is a minimally invasive therapeutic modality used in the treatment of patients with chronic low back and lower extremity pain, often recalcitrant to other modalities including epidural injections and surgical interventions. While the initial utilization since its introduction and development of appropriate Current Procedural Terminology (CPT) codes increased up until 2008, but since 2009, there has been a significant decline in utilization of these procedures in the Medicare population. These procedures declined by 53.2% at an annual rate of 10.3% from 2009 to 2016. A recent update analysis on the reversal and decline of growth of utilization of interventional techniques in managing chronic pain in the Medicare population from 2009 to 2018 revealed an even further decline of adhesiolysis procedures.

**Study Design:** An analysis of the utilization patterns of percutaneous adhesiolysis procedures in managing chronic low back and lower extremity pain in the Medicare population from 2000 to 2018, with comparative analysis from 2000 to 2009 and 2009 to 2018.

**Objective:** To assess the utilization patterns of percutaneous adhesiolysis in managing chronic low back pain in the Medicare population.

**Methods:** The Centers for Medicare and Medicaid Services (CMS) Physician Supplier Procedure Summary Master of Fee-For-Service (FFS) Data from 2000 to 2018 was used.

In this analysis, various variables were assessed in reference to usage patterns of percutaneous adhesiolysis procedures with analysis of growth or declining utilization patterns. We also assessed specialty-based utilization, as well as statewide utilization.

**Results:** The decline of percutaneous adhesiolysis procedures began in 2009 and has continued since then. From 2009 to 2018, the overall decline was 69.2%, with an annual decline of 12.3% compared to an overall 62.6% increase from 2000 to 2009, with an annual increase of 5.6%. Compared to multiple other interventions, including epidural injections and facet joint interventions, percutaneous adhesiolysis has declined at a rapid rate.

**Conclusions:** This assessment in the FFS Medicare population in the United States shows an irreversible decline of utilization of percutaneous adhesiolysis procedures, which has been gradually deteriorating with a 69.2% decline from 2009 to 2018 with an annual decline of 12.3% during that same time period.

**Key words:** Epidural injections, percutaneous adhesiolysis, post-surgery syndrome, spinal stenosis, lumbar disc herniation

**Pain Physician 2021: 24:17-29**

Low back pain was rated as number one in causing disability among the 30 leading diseases and injuries contributing to years lived with a disability (1). Health care expenditure overall continues to increase. In fact, assessment of the United States spending on personal and public health care from

1996 to 2016 (2,3), showed the highest estimated spending of $134.5 billion in 2016 for back and neck pain, with a significant increase from 2013 of $87.6 billion (2,3). Related to escalating overall health care costs, together with the opioid epidemic and disability, numerous changes have been made in health care delivery with increased regulations and oversight in the United States (4-20). With escalating regulations and the zeal to control utilization patterns, interventional pain techniques have suffered substantially with declining utilization, often resulting in the inability to provide medically necessary treatments (5,8-15). Even though regulations and utilization patterns have been detrimental to some procedures such as percutaneous adhesiolysis, overall medical procedures continue to stabilize growth patterns, or even decline (5,8-15). However, other modalities continue to increase with the escalation of opioid usage. Further, with extensive regulations to control the opioid epidemic, but to reduce utilization of overall health care, runs in a circular fashion, facilitating illicit drug use and related deaths, as a result of decreasing prescriptions and/or dosage, in spite of declining deaths due to prescription opioids (16,21-24). Interventional pain management has been positioned as one of the essential components of chronic pain management by the Department of Health and Human Services (HHS) (25,26). However, the COVID-19 pandemic resulted in the decimation of elective surgery, thus removing access for pain interventions and curtailing access for opioid therapy. Data revealed that opioid deaths have rebounded with increases of 5% in 2019 (though not related to prescription opioids) and annual increases have been expected for 2020 of 13% (27-35). In addition, the pandemic has caused extensive losses to physicians related to diminished access to patients with an overall impact on the economy and non-COVID-19 patients who are unable to receive appropriate treatment (29-35).

The utilization patterns of interventional techniques have been well studied showing increases until 2009, but an overall decline since 2009 (5,8-15). A recent analysis of utilization patterns in the Medicare population in the United States from 2000 to 2018 (5) demonstrated a decline in utilization of interventional techniques of 6.7% from 2009 to 2018, with an annual decline of 0.8% per 100,000 fee-for-service (FFS) Medicare population, despite an increase of 0.7% per year of population growth with 3.2% of those 65 years or older and a 3% annual increase in Medicare participation from 2009 to 2018 (5). Altogether, there was a decrease in the utilization of epidural, adhesiolysis procedures, and interlaminar epidural injections, while there was a slight increase of transforaminal epidural injections, facet joint interventions, and sacroiliac joint blocks (5,8-15). The most recent analysis of utilization of percutaneous epidural adhesiolysis procedures showed a drastic decline (12). These declines were rapid and appear to be irreversible with a decline of 53.2% and an annual decline of 10.3% from 2009 to 2016 (12).

Consequently, the present retrospective cohort study of utilization patterns of percutaneous adhesiolysis procedures was undertaken to cover the period from 2000 to 2018 in in FFS Medicare population (12).

## Methods

Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidance (36) was utilized in performing the study. The public use files or nonidentifiable data, which is nonattributable and nonconfidential, available through the US Centers for Medicare and Medicaid Services (CMS) database, was utilized (37).

### Study Design

The study was designed to assess usage or utilization patterns and variables of multiple percutaneous adhesiolysis in managing chronic pain from 2000 to 2018 in the Medicare FFS population in the United States.

### Setting

The national database of specialty usage data files from the CMS in the FFS Medicare population in the United States (37).

### Participants

All the participants available from the database, which included all of the FFS Medicare recipients whether they were on Medicare due to Social Security disability, Social Security insurance, or retirement from 2000 to 2018.

### Variables

Variables assessed included not only the usage patterns of percutaneous adhesiolysis procedures in the Medicare population from 2000 to 2018, but multiple characteristics in reference to the Medicare population and the growth of the Medicare population.

Historically, the majority of percutaneous adhesiolysis procedures have been performed by interventional pain physicians represented by the specialties of interventional pain management (-09), pain medicine (-72), anesthesiology (-05), physical medicine and rehabilitation (-25), neurology (-13), and psychiatry (-26). A multitude of other specialties perform interventional procedures infrequently. Based on Medicare designations, specialties grouped into interventional pain management include orthopedic surgery (-20), general surgery (-17), and neurosurgery (-14) as a surgical group; diagnostic radiology (-30), and interventional radiology (-94) as radiological group; all other physicians as a separate group; and all other providers were considered as other providers.

The current procedural terminology (CPT) procedure codes for percutaneous adhesiolysis utilized were those in effect during 2000 to 2018 as follows:

- Adhesiolysis procedures (CPT 62263 and 62264)

The data were also assessed based on the place of service – facility (ambulatory surgery center or hospital outpatient department) or non-facility (office).

### Data Sources

All the analyzed data were obtained from the CMS Physician/Supplier Procedure Summary Master Data from 2000 to 2018 (37). These data included all FFS Medicare participants above the age of 65 and also below the age of 65 receiving percutaneous adhesiolysis irrespective of the type of disability.

### Measures

The 100% dataset from CMS consists of a CPT code with modifier indicating an additional procedure or bilateral procedure, specialty codes, a place of service, a Medicare carrier number, total services and charges submitted, allowed and denied services, and amounts paid. The usage pattern analysis included all allowed services configured by taking services submitted minus services denied and any services with zero payments. Allowed services were also assessed for each procedure, and rates were calculated based on Medicare beneficiaries for the corresponding year and are reported as procedures per 100,000 Medicare beneficiaries. In this analysis, usage patterns were analyzed only once based on the location rather than duplicating the measurements for physician services and facility services. Assessment measures utilized were of services as well as rate of usage per 100,000 individuals of the Medicare population.

### Bias

The data was purchased from CMS by the American Society of Interventional Pain Physicians (ASIPP). The study was conducted with the internal resources of the primary authors' practice without external funding or grants, either from industry or elsewhere.

In the present analysis, we have utilized all patients enrolled in FFS Medicare, instead of only patients aged 65 or older, due to the finding that a significant proportion of patients below the age of 65 undergo percutaneous adhesiolysis. Medicare represents the second largest health care payer next to Medicaid in the United States, with over 59.6 million beneficiaries in 2018 (36). Consequently, the percutaneous adhesiolysis procedures performed on Medicare beneficiaries increasingly represent a large proportion of the procedures for chronic pain in the United States.

### Study Size

The study size is large with the inclusion of all patients under Medicare FFS undergoing percutaneous adhesiolysis procedures in all settings, for all regions in the United States for chronic spinal pain from 2000 to 2018.

### Data Compilation

The data were compiled using Microsoft Access 2003 and Microsoft Excel 2003 (Microsoft Corporation, Redmond, WA).

## Results

### Participants

All FFS Medicare recipients from 2000 to 2018 were included in this analysis.

### Descriptive Data Population Characteristics

As shown in Table 1, US population older than 65 years of age increased 49.2% at an annual growth rate of 2.2% from 2000 to 2018. During the same period, total US population increased 15.9% at an annual growth rate of 0.8%. From 2009 to 2018, those aged 65 or older grew at an annual rate of 3.2%. At the same time, Medicare participation rate also increased at a rate of 3% with overall increase of 30.1% from 2009 to 2018.

The rate of utilization of percutaneous adhesiolysis showed a significant decline of 69.2% and an annual decline of 12.3% from 2009 to 2018 compared to a decline of 49.9% and an annual decline of 4% from 2000 to 2018.

Table 1. *Characteristics of Medicare beneficiaries and percutaneous adhesiolysis procedures from 2000 to 2018.*

| Year | U.S. Population | | | Fee-for-service Medicare Beneficiaries | | | | Utilization of all Percutaneous Adhesiolysis | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total Population (,000) | ≥ 65 Years (,000) | | Number of individuals participating in Medicare | % to U.S. population | ≥ 65 years (,000) (Percent) | < 65 years (,000) Percent | Services (% in facility) | % of Change from Previous Year | Rate | % of Change from Previous Year |
| | | Number | % of US population | | | | | | | | |
| Y2000 | 282,172 | 35,077 | 12.4% | 39,632 | 14.% | 34,262 (86.5%) | 5,370 (13.5%) | 8,778 (91%) | | 22 | |
| Y2001 | 285,040 | 35,332 | 12.4% | 40,045 | 14.% | 34,478 (86.1%) | 5,567 (13.9%) | 10,966 (89%) | 24.9% | 27 | 24% |
| Y2002 | 288,369 | 35,605 | 12.3% | 40,503 | 14.% | 34,698 (85.7%) | 5,805 (14.3%) | 15,154 (83%) | 38.2% | 37 | 37% |
| Y2003 | 290,211 | 35,952 | 12.4% | 41,126 | 14.2% | 35,050 (85.2%) | 6,078 (14.8%) | 16,916 (81%) | 11.6% | 41 | 1% |
| Y2004 | 292,892 | 36,302 | 12.4% | 41,729 | 14.2% | 35,328 (84.7%) | 6,402 (15.3%) | 16,780 (77%) | -0.8% | 40 | -2% |
| Y2005 | 295,561 | 36,752 | 12.4% | 42,496 | 14.4% | 35,777 (84.2%) | 6,723 (15.8%) | 18,364 (77%) | 9.4% | 43 | 7% |
| Y2006 | 299,395 | 37,264 | 12.4% | 43,339 | 14.5% | 36,317 (83.8%) | 7,022 (16.2%) | 17,903 (74%) | -2.5% | 41 | -4% |
| Y2007 | 301,290 | 37,942 | 12.6% | 44,263 | 14.7% | 36,966 (83.5%) | 7,297 (16.5%) | 17,334 (73%) | -3.2% | 39 | -5% |
| Y2008 | 304,056 | 38,870 | 12.8% | 45,412 | 14.9% | 37,896 (83.4%) | 7,516 (16.6%) | 16,768 (73%) | -3.3% | 37 | -6% |
| Y2009 | 307,006 | 39,570 | 12.9% | 45,801 | 14.9% | 38,177 (83.4%) | 7,624 (16.6%) | 16,496 (73%) | -1.6% | 36 | -2% |
| Y2010 | 308,746 | 40,268 | 13.0% | 46,914 | 15.2% | 38,991 (83.1%) | 7,923 (16.9%) | 15,550 (7%) | -5.7% | 33 | -8% |
| Y2011 | 311,583 | 41,370 | 13.28% | 48,300 | 15.5% | 40,000 (82.8%) | 8,300 (17.2%) | 15,322 (67%) | -1.5% | 32 | -4% |
| Y2012 | 313,874 | 43,144 | 13.75% | 50,300 | 16.% | 41,900 (83.3%) | 8,500 (16.9%) | 14,460 (64%) | -5.6% | 29 | -9% |
| Y2013 | 316,129 | 44,704 | 14.14% | 51,900 | 16.4% | 43,100 (83.%) | 8,800 (17.%) | 13,790 (62%) | -4.6% | 27 | -8% |
| Y2014 | 318,892 | 46,179 | 14.48% | 53,500 | 16.8% | 44,600 (83.4%) | 8,900 (16.5%) | 12,796 (61%) | -7.2% | 24 | -1% |
| y2015 | 320,897 | 47,734 | 14.88% | 54,900 | 17.1% | 46,000 (83.7%) | 9,000 (16.3%) | 10,584 (71%) | -17.3% | 19 | -19% |
| Y2016 | 323,127 | 49,244 | 15.24% | 56,500 | 17.5% | 47,500 (84.1%) | 9,000 (15.9%) | 9,530 (72%) | *-10.%* | 17 | -13% |

Table 1. *Characteristics of Medicare beneficiaries and percutaneous adhesiolysis procedures from 2000 to 2018. (continued)*

| Year | U.S. Population | | | Fee-for-service Medicare Beneficiaries | | | | Utilization of all Percutaneous Adhesiolysis | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total Population (,000) | ≥ 65 Years (,000) | | Number of individuals participating in Medicare | % to U.S. population | ≥ 65 years (,000) (Percent) | < 65 years (,000) Percent | Services (% in facility) | % of Change from Previous Year | Rate | % of Change from Previous Year |
| | | Number | % of US population | | | | | | | | |
| Y2017 | 326,625 | 51,055 | 15.63% | 58,000 | 17.8% | 49,200 (84.83%) | 8,900 (15.34%) | *8,809 (69%)* | *-7.6%* | *15* | *-1%* |
| Y2018 | 327,167 | 52,347 | 16.0% | 59,600 | 18.2% | 50,800 (85.23%) | 8,800 (14.77%) | *6,615 (68%)* | *-24.9%* | *11* | *-27%* |
| Percentage of change from | | | | | | | | | | | |
| 2000-2018 | 15.9% | 49.2% | | 50.4% | | 48.3% | 63.9% | -24.6% | | -49.9% | |
| GM | 0.8% | 2.3% | | 2.3% | | 2.2% | 2.8% | -1.6% | | -4.% | |
| 2000-2009 | 8.8% | 12.8% | | 15.6% | | 11.4% | 42.% | 87.9% | | 62.6% | |
| GM | 0.9% | 1.3% | | 1.6% | | 1.2% | 4.% | 7.3% | | 5.6% | |
| 2009-2018 | 6.6% | 32.3% | | 30.1% | | 33.1% | 15.4% | -59.9% | | -69.2% | |
| GM | 0.7% | 3.2% | | 3.% | | 3.2% | 1.6% | -9.7% | | -12.3% | |

Rate - per 100,000 population; GM - geometric average annual change

## Utilization Characteristics

Table 2 and Figs. 1 and 2 show the utilization characteristics of percutaneous adhesiolysis in the FFS Medicare population from 2000 to 2018. As shown in Table 2 and Fig. 1, an overall decline of interventional techniques from 2000 to 2018 of 49.9% with an annual decrease of 1.5% and from 2009 to 2018 a decline of 69.2% and an annual decline of 12.3% were observed. Further, as shown in Fig. 1, from 2009 to 2018, services declined at an annual rate of 9.7%, whereas utilization rate per 100,000 Medicare population declined at a 12.3% annual rate. Figure 2 also shows a comparative decline of one-day procedures versus 2-day procedures with the essential disappearance of 3-day procedures, which declined dramatically from a utilization rate of 22 to 1 per 100,000 population.

## Specialty Characteristics

Table 3 and Fig. 3 show frequency of utilization based on specialties. The majority of procedures were performed by interventional pain management specialties.

## State Distribution Characteristics

As shown in Table 4, significant decreases were noted in multiple states, with California, North Carolina, South Carolina, and Virginia performing no procedures at all. California residents have not received any procedures from 2016 to 2018, whereas in North Carolina, South Carolina, and Virginia, these procedures were not performed in 2018. Only the states showing an increase from 2009 to 2018 were Arkansas at an annual rate of 9.1%; however, with a low baseline utilization rate of 6 per 100,000 Medicare population in 2009.

# Discussion

The present analysis revealed a significant decline of utilization patterns of percutaneous adhesiolysis showing a rapid irreversible decline of 12.3% per annum and 69.2% from 2009 to 2018. These steep declines also reduced the overall utilization rate from 2000 to 2018 with an overall rate decline of 49.9% and annual decline of 4%. However, from 2000 to 2009, there was an increase of 62.6% with an annual increase of 5.6%. Overall, these declines are in stark contrast to other procedures (5,8-13), even though they are similar to previous publications of adhesiolysis utilization (12). The declines were observed despite continued increasing surgical interventions, increasing

Table 2. *Utilization of 3 days and 1day adhesiolysis procedures in the Medicare population from 2000 to 2018.*

| | 62263 Three days Adhesiolysis Procedures | | | 62264* One day Adhesiolysis Procedures | | | Adhesiolysis Procedures | | |
|---|---|---|---|---|---|---|---|---|---|
| **Year** | **Services** | **Rate** | **PCPY** | **Services** | **Rate** | **PCPY** | **Services** | **Rate** | **PCPY** |
| 2,000 | 8,778 | 22 | NA | - | - | NA | 8,778 | 22 | |
| 2,001 | 10,463 | 26 | 18.% | 503 | 1 | NA | 10,966 | 27 | 23.6% |
| 2,002 | 14,430 | 36 | 36.4% | 724 | 2 | NA | 15,154 | 37 | 36.6% |
| 2,003 | 7,183 | 17 | -51.% | 9,733 | 24 | NA | 16,916 | 41 | 9.9% |
| 2,004 | 2,628 | 6 | -63.9% | 14,152 | 34 | 43.3% | 16,780 | 40 | -2.2% |
| 2,005 | 2,972 | 7 | 11.% | 15,392 | 36 | 6.8% | 18,364 | 43 | 7.5% |
| 2,006 | 2,146 | 5 | -29.2% | 15,757 | 36 | 0.4% | 17,903 | 41 | -4.4% |
| 2,007 | 1,553 | 4 | -29.1% | 15,781 | 36 | -1.9% | 17,334 | 39 | -5.2% |
| 2,008 | 1,269 | 3 | -20.4% | 15,499 | 34 | -4.3% | 16,768 | 37 | -5.7% |
| 2,009 | 1,199 | 3 | -6.3% | 15,294 | 33 | -2.2% | 16,493 | 36 | -2.5% |
| 2,010 | 1,023 | 2 | -16.7% | 14,527 | 31 | -7.3% | 15,550 | 33 | -8.% |
| 2,011 | 948 | 2 | -10.% | 14,374 | 30 | -3.9% | 15,322 | 32 | -4.3% |
| 2,012 | 939 | 2 | -4.9% | 13,521 | 27 | -9.7% | 14,460 | 29 | -9.4% |
| 2,013 | 646 | 1 | -33.3% | 13,144 | 25 | -5.8% | 13,790 | 27 | -7.6% |
| 2,014 | 514 | 1 | -22.8% | 12,282 | 23 | -9.4% | 12,796 | 24 | -10.% |
| 2,015 | 363 | 1 | -31.2% | 10,221 | 19 | -18.9% | 10,584 | 19 | -19.4% |
| 2,016 | 414 | 1 | 10.8% | 9,116 | 16 | -13.3% | 9,530 | 17 | -12.5% |
| 2,016 | 450 | 1 | 5.9% | 8,359 | 14 | -10.7% | 8,809 | 15 | -10.0% |
| 2,018 | 367 | 1 | -20.6% | 6,248 | 10 | -27.3% | 6,615 | 11 | -26.9% |
| Percentage of change from | | | | | | | | | |
| 2000-2018 | -95.8% | -97.2% | | -36% | -56% | | -24.6% | -49.9% | |
| GM | -15.6% | -17.3% | | -3% | -5% | | 0.5% | -1.5% | |
| 2000-2009 | -86.3% | -88.2% | | 59% | 44% | | 87.9% | 62.6% | |
| GM | -17.5% | -18.5% | | 8% | 6% | | 7.9% | 6.5% | |
| 2009-2018 | -69.4% | -76.5% | | -59% | -69% | | -59.9% | -69.2% | |
| GM | -12.3% | -14.9% | | -9.5% | -12.1% | | -9.7% | -12.3% | |

Rate - per 100,000 population; GM - geometric average annual change; PCPY - Percentage of Change from Previous Year
* - for 62264 Change & GM are from 2003 to 2018, from 2003 to 2009 & 2009-2018

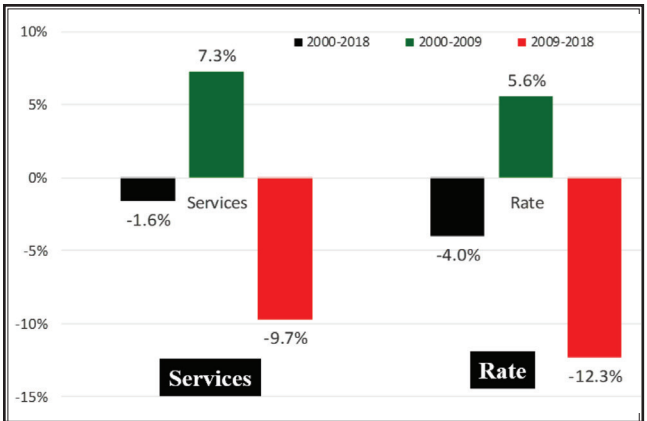


Fig 1. *Annual change in frequency of utilization of adhesiolysis procedures 2000-2018.*

disability secondary to chronic low back pain, and finally, despite an increase in the growth of the Medicare population since 2009 at an annual rate of 3% (5,16,21-23,38-43).

It is a common critique applied to all interventional techniques to criticize lack of evidence, medical necessity, and indications (49-54). However, contrary to these claims, significant demonstration of evidence for all interventional techniques, along with percutaneous adhesiolysis with randomized controlled trials (RCTs), systematic reviews, cost utility analysis, and evidence for real world scenarios has been demonstrated (9,53-78). Specifically, the evidence is significant for percutaneous adhesiolysis in managing chronic recalcitrant low back pain

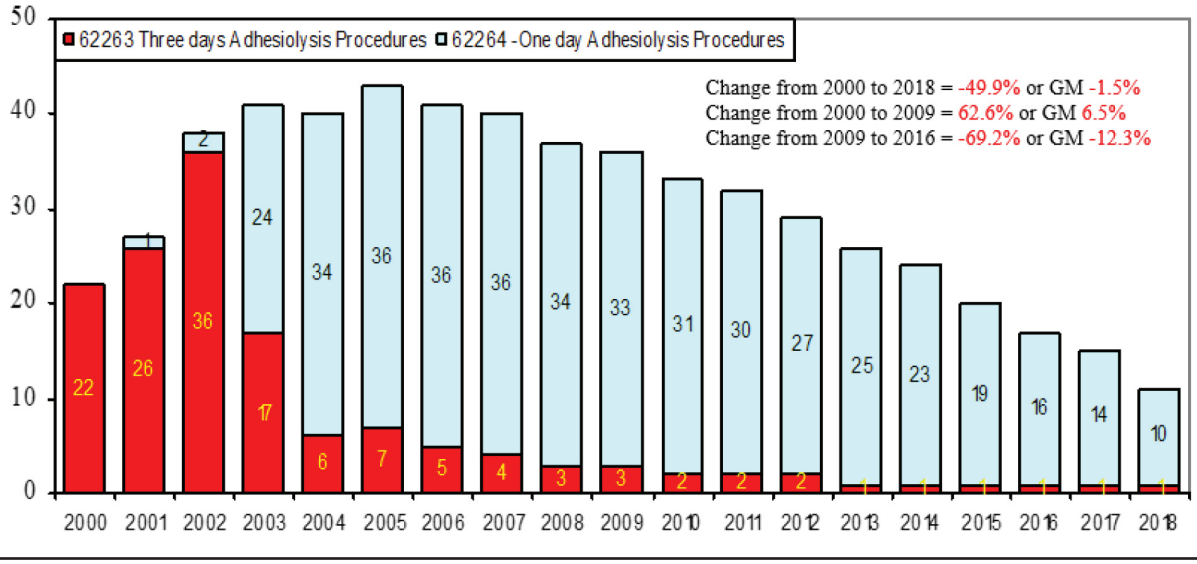


Fig 2. *Frequency of utilization of 3 days and 1 day adhesiolysis procedures by procedures from 2000 to 2018, in Medicare recipients.*

secondary to post-surgery syndrome, spinal stenosis, and disc herniation (63-68,73-76). Even then, percutaneous adhesiolysis continues to face an irreversible decline due to multiple policies, essentially not based on evidence.

The dramatic changes with decline and utilization of percutaneous adhesiolysis have been attributed to the philosophical approach of the Affordable Care Act (ACA), misunderstanding of evidence-based medicine (EBM), and multiple other regulations (49,53,63,64,79-97). Further factors included non-coverage by a multitude of insurers related to lack of local coverage determinations (LCDs) and LCDs without coverage, followed by reduced reimbursement (98,99). As shown, RCTs, systematic reviews, and cost utility analysis have demonstrated appropriate evidence of clinical and cost utility. Clinical outcomes in systematic reviews have shown Level I to II evidence, which is considered as moderate to strong based on relevant high quality RCTs and cost utility with favorable outcomes of $4,426 for one quality-adjusted life year (QALY) compared to multiple other interventions, including spinal cord stimulation and surgical interventions (62,70). In addition, claims of lack of increase in chronic spinal pain, but increases in disability have been exaggerated. As Dieleman et al (2,3) showed, the costs of back and neck pain have substantially increased at a more rapid pace than many other conditions. Additionally, surgical interventions related to spinal pain with microdiscectomies, open discectomies, decompression, and complex fusions continue to increase (42-44).

## Conclusion

This assessment in the FFS Medicare population in the United States shows an irreversible decline of utilization of percutaneous adhesiolysis procedures, which has been gradually deteriorating with a 69.2% decline from 2009 to 2018 with an annual decline of 12.3% during the same period.

### Acknowledgments

The authors wish to thank Bert Fellows, MA, Director Emeritus of Psychological Services at Pain Management Centers of America, for manuscript review, and transcriptionists Tonie M. Hatton and Diane E. Neihoff, transcriptionists, for their assistance in the preparation of this manuscript. We would like to thank the editorial board of Pain Physician for review and criticism in improving the manuscript.

### Author Contributions

The study was designed by LM, and VP. Statistical analysis was performed by VP. All authors contributed to preparation of the manuscript, reviewed, and then approved the content in the final version.

Table 3. *Frequency of utilization of adhesiolysis procedures by specialty from 2000-2018, in Medicare recipients.*

| Specialty/ Year | Anesthesiology (05) | IPM (09) | PM (72) | Interventional Pain Management Specialties | | | Neurosurgery, Orthopedic Surgery & General Surgery | | | Other specialties | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Services | | | Services | Percent | Rate | Services | Percent | Rate | Services | Percent | Rate | Services | Rate |
| 2000 | 7,521 | - | - | 7,853 | 89.5% | 19.8 | 548 | 6.2% | 1.4 | 377 | 1.0% | 1 | 8,778 | 22 |
| 2001 | 9,922 | - | 26 | 10,169 | 92.7% | 25.4 | 228 | 2.1% | 0.6 | 569 | 1.4% | 1.4 | 10,966 | 27 |
| 2002 | 11,845 | - | 1,702 | 14,142 | 93.3% | 34.9 | 672 | 4.4% | 1.7 | 340 | 0.8% | 0.8 | 15,154 | 37 |
| 2003 | 12,069 | 725 | 2,442 | 15,962 | 94.4% | 38.8 | 631 | 3.7% | 1.5 | 323 | 0.8% | 0.8 | 16,916 | 41 |
| 2004 | 9,090 | 2,866 | 3,044 | 16,164 | 96.3% | 38.7 | 505 | 3.0% | 1.2 | 111 | 0.3% | 0.3 | 16,780 | 40 |
| 2005 | 9,893 | 3,067 | 3,385 | 17,597 | 95.8% | 41.4 | 578 | 3.1% | 1.4 | 189 | 0.4% | 0.4 | 18,364 | 43 |
| 2006 | 9,117 | 3,388 | 3,262 | 17,011 | 95.0% | 39.3 | 666 | 3.7% | 1.5 | 226 | 0.5% | 0.5 | 17,903 | 41 |
| 2007 | 8,326 | 4,262 | 2,733 | 16,590 | 95.7% | 37.5 | 573 | 3.3% | 1.3 | 171 | 0.4% | 0.4 | 17,334 | 39 |
| 2008 | 7,975 | 5,110 | 1,703 | 16,086 | 95.9% | 35.4 | 530 | 3.2% | 1.2 | 152 | 0.3% | 0.3 | 16,768 | 37 |
| 2009 | 7,865 | 4,940 | 1,673 | 15,953 | 96.7% | 34.8 | 454 | 2.8% | 1 | 86 | 0.2% | 0.2 | 16,493 | 36 |
| 2010 | 7,083 | 5,160 | 1,429 | 14,836 | 95.4% | 31.6 | 462 | 3.0% | 1 | 252 | 0.5% | 0.5 | 15,550 | 33 |
| 2011 | 6,975 | 4,852 | 1,527 | 14,664 | 95.7% | 30.4 | 538 | 3.5% | 1.1 | 120 | 0.2% | 0.2 | 15,322 | 32 |
| 2012 | 6,358 | 4,535 | 1,953 | 13,802 | 95.4% | 27.4 | 585 | 4.0% | 1.2 | 73 | 0.1% | 0.1 | 14,460 | 29 |
| 2013 | 6,324 | 4,328 | 1,988 | 13,140 | 95.3% | 25.3 | 556 | 4.0% | 1.1 | 94 | 0.2% | 0.2 | 13,790 | 27 |
| 2014 | 5,588 | 4,324 | 1,643 | 12,183 | 95.2% | 22.8 | 552 | 4.3% | 1 | 61 | 0.1% | 0.1 | 12,796 | 24 |
| 2015 | 4,498 | 3,432 | 1,798 | 10,228 | 96.6% | 18.6 | 319 | 3.0% | 0.6 | 37 | 0.1% | 0.1 | 10,584 | 19 |
| 2016 | 4,102 | 3,015 | 1,858 | 9,431 | 99.0% | 16.7 | 57 | 0.6% | 0.1 | 42 | 0.1% | 0.1 | 9,530 | 17 |
| 2017 | 1,802 | 2,893 | 3,672 | 8,702 | 98.8% | 15 | 74 | 0.8% | 0.1 | 33 | 0.1% | 0.1 | 8,809 | 15 |
| 2018 | 1,529 | 2,704 | 2,044 | 6,511 | 98.4% | 10.9 | 71 | 1.1% | 0.1 | 33 | 0.1% | 0.1 | 6,615 | 11 |
| Percentage of change from | | | | | | | | | | | | | | |
| 2000-2018 | -79.7% | | | -17.1% | | -44.9% | -87.% | | -91.4% | -91.2% | | -94.2% | -24.6% | -49.9% |
| GM | -8.5% | | | -1.0% | | -3.3% | -10.7% | | -12.7% | -12.7% | | -14.6% | -1.6% | -3.8% |
| 2000-2009 | 4.6% | | | 103.1% | | 75.8% | -17.2% | | -28.3% | -77.2% | | -80.3% | 87.9% | 62.6% |
| GM | 0.5% | | | 8.2% | | 6.5% | -2.1% | | -3.6% | -15.1% | | -16.5% | 7.3% | 5.5% |
| 2009-2018 | -80.6% | -45.3% | 22.2% | -59.2% | | -68.6% | -84.4% | | -88.0% | -61.6% | | -70.5% | -59.9% | -69.2% |
| GM | -16.6% | -6.5% | 2.3% | -9.5% | | -12.1% | -18.6% | | -21.0% | -10.1% | | -12.7% | -9.7% | -12.3% |

Interventional Pain Management Specialties: Interventional Pain Management, Pain Management, Physical Medicine and Rehabilitation, Neurology, and Psychiatry

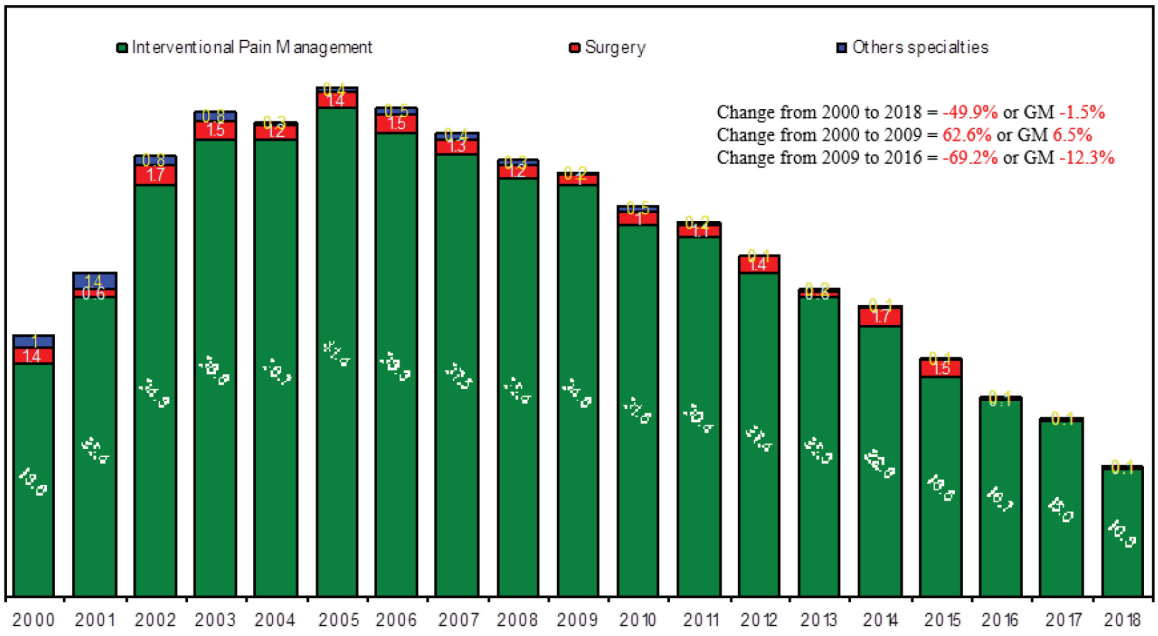


Fig. 3. *Frequency of utilization of adhesiolysis procedures by speciality from 2000 to 2018 in Medicare beneficiaries.*


## Author Information

Dr. Manchikanti is Co-Director, Pain Management Centers of America, Paducah, KY, Clinical Professor, Anesthesiology and Perioperative Medicine, University of Louisville, Louisville, KY, and Professor of Anesthesiology-Research, Department of Anesthesiology, School of Medicine, LSU Health Sciences Center, New Orleans and Shreveport, LA.

drlm@thepainmd.com

Dr. Kosanovic is an Interventional Pain Physician at the Pain Management Centers of America, Paducah, KY, USA.

rkosanovic@pmcoa.us

Vidyasagar Pampati is a Statistician, Pain Management Centers of America

sagar@thepainmd.com

Dr. Kaye is Vice-Chancellor of Academic Affairs, Chief Academic Officer, and Provost, Tenured Professor of Anesthesiology and Pharmacology, Toxicology, and Neurosciences, and Pain Fellowship Program Director, LSU School of Medicine, Shreveport, LA, Professor of Anesthesiology and Pharmacology, LSU School of Medicine, New Orleans, LA, and Professor of Anesthesiology and Pharmacology, Tulane School of Medicine, New Orleans, LA

akaye@lsuhsc.edu, alankaye44@hotmail.com

Table 4. *Frequency of utilization of adhesiolysis procedures rates by state from 2009-2018, in Medicare recipients.*

| State Name | Y2009 | Y2010 | Y2011 | Y2012 | Y2013 | Y2014 | Y2015 | Y2016 | Y2017 | Y2018 | Change | GM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alabama | 313 | 305 | 281 | 267 | 250 | 233 | 219 | 227 | 193 | 28 | -91.0% | -23.5% |
| Arkansas | 6 | 8 | 6 | 7 | 9 | 11 | 7 | 21 | 26 | 14 | 118.6% | 9.1% |
| California | 50 | 61 | 63 | 63 | 61 | 43 | 11 | | | | | |
| Connecticut | 8 | 10 | 9 | 8 | 5 | 5 | 10 | 10 | 17 | 12 | 45.8% | 4.3% |
| Florida | 54 | 45 | 52 | 55 | 55 | 44 | 34 | 34 | 29 | 27 | -50.0% | -7.4% |
| Georgia | 14 | 9 | 6 | 5 | 9 | 7 | 9 | 7 | 8 | 1 | -91.1% | -23.6% |
| Illinois | 25 | 25 | 24 | 19 | 15 | 14 | 15 | 9 | 10 | 12 | -52.6% | -8.0% |
| Indiana | 14 | 9 | 8 | 5 | 6 | 4 | 5 | 2 | 3 | 4 | -69.7% | -12.4% |
| Kansas | 46 | 27 | 13 | 28 | 34 | 20 | 18 | 18 | 19 | 19 | -57.5% | -9.1% |
| Kentucky | 69 | 68 | 70 | 55 | 43 | 31 | 30 | 24 | 15 | 12 | -83.0% | -17.9% |
| Louisiana | 22 | 19 | 12 | 23 | 13 | 10 | 11 | 16 | 6 | 10 | -52.1% | -7.9% |
| Maine | 17 | 10 | 8 | 7 | 7 | 10 | 4 | 4 | 2 | 5 | -72.7% | -13.4% |
| Maryland | 5 | 4 | 2 | 4 | 3 | 2 | 2 | 7 | 9 | 14 | 208.6% | 13.3% |
| Massachusetts | 13 | 9 | 12 | 10 | 10 | 12 | 18 | 18 | 17 | 14 | 7.5% | 0.8% |
| Michigan | 69 | 66 | 53 | 47 | 43 | 42 | 39 | 32 | 29 | 34 | -50.0% | -7.4% |
| Mississippi | 17 | 7 | 7 | 5 | 16 | 23 | 15 | 9 | 6 | 13 | -23.4% | -2.9% |
| Missouri | 7 | 5 | 6 | 7 | 15 | 31 | 27 | 34 | 24 | 35 | 415.5% | 20.0% |
| New Jersey | 39 | 43 | 20 | 10 | 12 | 10 | 11 | 13 | 15 | 11 | -72.8% | -13.5% |
| New York | 31 | 22 | 21 | 17 | 18 | 19 | 20 | 18 | 16 | 13 | -58.1% | -9.2% |
| North Carolina | 15 | 13 | 16 | 15 | 11 | 7 | 4 | 5 | 2 | | | |
| Ohio | 38 | 27 | 30 | 19 | 16 | 12 | 13 | 10 | 10 | 8 | -78.3% | -15.6% |
| Oklahoma | 26 | 22 | 24 | 23 | 20 | 21 | 37 | 38 | 27 | 17 | -32.1% | -4.2% |
| Pennsylvania | 5 | 8 | 7 | 3 | 4 | 2 | 6 | 4 | 5 | 4 | -16.1% | -1.9% |
| South Carolina | 10 | 8 | 8 | 10 | 7 | 11 | 8 | 7 | 2 | | | |
| Tennessee | 4 | 6 | 5 | 4 | 2 | 2 | 2 | 2 | 2 | 0 | -96.3% | -30.7% |
| Texas | 109 | 90 | 88 | 81 | 72 | 78 | 66 | 52 | 47 | 40 | -63.1% | -10.5% |
| Virginia | 9 | 12 | 11 | 7 | 5 | 8 | 7 | 8 | 2 | | | |
| Wisconsin | 9 | 7 | 6 | 4 | 8 | 9 | 6 | 6 | 12 | 4 | -60.5% | -9.8% |
| United States | 36 | 33 | 32 | 29 | 27 | 24 | 19 | 17 | 15 | 11 | -69.2% | -12.3% |

State with 2009 services above 25 were shown in the table. California – There were no services in 2016, 2017 & 2018. North Carolina, South Carolina & Virginia – There were no services in 2018. GM - geometric average annual change

## References


1. US Burden of Disease Collaborators. The state of US health, 1990-2016: Burden of diseases, injuries, and risk factors among US states. *JAMA* 2018; 319:1444-1472.
2. Dieleman JL, Cao J, Chapin A, et al. US health care spending by payer and health condition, 1996-2016. *JAMA* 2020; 323: 863-884.
3. Dieleman JL, Baral R, Birger M, et al. US spending on personal health care and public health, 1996-2013. *JAMA* 2016; 316:2627-2646.
4. Keehan SP, Cuckler GA, Poisal JA, et al. National Health Expenditure Projections, 2019-28: Expected Rebound In Prices Drives Rising Spending Growth. *Health Aff (Millwood)* 2020; 39:704-714.
5. Manchikanti L, Sanapati MR, Pampati V, Boswell MV, Kaye AD, Hirsch JA. Update on reversal and decline of growth of utilization of interventional techniques in managing chronic pain in the Medicare population from 2000 to 2018. *Pain Physician* 2019; 22: 521-536.
6. Alexander JC, Silge J, Jones S, Joshi GP. Evaluation of opioid prescribing habits based on analysis of a state prescription drug monitoring program. *Pain Physician* 2019; 22: E425-E433.
7. Iannaccone F, Nielson P, Adigun H, Kaufman A. What are future pain physicians learning? A survey of opioid prescribing practices among US pain

fellowship programs. *Pain Physician* 2019; 22: 549-554.

8. Manchikanti L, Soin A, Mann DP, Bakshi S, Pampati V, Hirsch JA. Comparative analysis of utilization of epidural procedures in managing chronic pain in the Medicare population: Pre and post Affordable Care Act. *Spine (Phila Pa 1976)* 2019; 44: 220-232.
9. Manchikanti L, Kaye AD, Soin A, et al. Comprehensive evidence-based guidelines for facet joint interventions in the management of chronic spinal pain: American Society of Interventional Pain Physicians (ASIPP) guidelines. *Pain Physician* 2020; 23: S1-S127.
10. Manchikanti L, Soin A, Mann DP, et al. Utilization patterns of facet joint interventions in managing spinal pain: A retrospective cohort study in the US fee-for-service Medicare population. *Curr Pain Headache Rep* 2019; 23: 73.
11. Manchikanti L, Manchikanti MV, Vanaparthy R, Kosanovic R, Pampati V. Usage patterns of sacroiliac joint injections from 2000-2018 in fee-for-service Medicare population. *Pain Physician* 2020; 23:439-450.
12. Manchikanti L, Pampati V, Benyamin R, Hirsch, JA. Declining utilization of percutaneous adhesiolysis in Medicare population: Evidence-based or Over-regulated? *IPM Reports* 2018, 2: 9-17.
13. Manchikanti L, Pampati V, Soin A, et al. Trends of expenditures and utilization of facet joint interventions in fee-for-service (FFS) Medicare population from 2009-2018. *Pain Physician* 2020; 23: S129-S147.
14. Manchikanti L, Sanapati MR, Soin A, et al. An updated analysis of utilization of epidural procedures in managing chronic pain in the Medicare population from 2000 to 2018. *Pain Physician* 2020; 23:111-126.
15. Manchikanti L, Sanapati MR, Pampati V, et al. Update of utilization patterns of facet joint interventions in managing spinal pain from 2000 to 2018 in the US fee-for-service Medicare population. *Pain Physician* 2020; 23:E133-E149.
16. Hopkins RE, Bui T, Magliano D, Arnold C, Dooley M. Prescriber education interventions to optimize opioid prescribing in acute care: A systematic review. *Pain Physician* 2019; 22:E551-E562.
17. Manchikanti L, Helm S 2nd, Benyamin RM, Hirsch JA. A critical analysis of Obamacare: Affordable care or insurance for many and coverage for few? *Pain Physician* 2017; 20:111-138.
18. Manchikanti L, Hirsch JA. Repeal and replace of affordable care: A complex, but not an impossible task. *Pain Physician* 2016; 19:E1109-E1113.
19. Blumenthal D, Collins SR, Fowler EJ. The Affordable Care Act at 10 Years - Its coverage and access provisions. *N Engl J Med* 2020; 382:963-969.
20. Peterson MA. The ACA a decade in: Resilience, impact, and vulnerabilities. *J Health Polit Policy Law* 2020; 45:595-608.
21. Gladden RM, O'Donnell J, Mattson CL, Seth P. Changes in opioid-involved overdose deaths by opioid type and presence of benzodiazepines, cocaine, and methamphetamine - 25 States, July-December 2017 to January-June 2018. *MMWR Morb Mortal Wkly Rep* 2019; 68:737-744.
22. Centers for Disease Control and Prevention (CDC), National Center for Injury Prevention and Control. Drug overdose deaths. Accessed 12/9/2020. www.cdc.gov/drugoverdose/data/statedeaths.html
23. Substance Abuse and Mental Health Services Administration. (2019). Key substance use and mental health indicators in the United States: Results from the 2018 National Survey on Drug Use and Health (HHS Publication No. PEP19-5068, NSDUH Series H-54). Rockville, MD: Center for Behavioral Health Statistics and Quality, Substance Abuse and Mental Health Services Administration. Accessed 12/9/2020. www.samhsa.gov/data/
24. Wilson N, Kariisa M, Seth P, Smith H 4th, Davis NL. Drug and Opioid-Involved Overdose Deaths - United States, 2017-2018. *MMWR Morb Mortal Wkly Rep* 2020; 69:290-297.
25. U.S. Department of Health and Human Services. Pain Management Best Practices Inter-Agency Task Force. Final Report on Pain Management Best Practices: Updates, Gaps, Inconsistencies, and Recommendations. May 9, 2019. Accessed 12/1/2020. www.hhs.gov/ash/advisory-committees/pain/reports/index.html
26. Manchikanti L, Singh V, Kaye AD, Hirsch JA. Lessons for better pain management in the future: Learning from the past. *Pain Ther* 2020; 9:373-391.
27. Kaye AD, Manchikanti L, COVID-19 special issue editorial. *Pain Physician* 2020; 23:S159-S160.
28. Shah S, Diwan S, Soin A, et al. Evidence-Based risk mitigation and stratification during covid-19 for return to interventional pain practice: American Society of Interventional Pain Physicians (ASIPP) Guidelines. *Pain Physician* 2020; 23:S161-S182.
29. Gharibo C, Sharma A, Soin A, et al. Triaging interventional pain procedures during covid-19 or related elective surgery restrictions: evidence-informed guidance from the American Society of Interventional Pain Physicians (ASIPP). *Pain Physician* 2020; 23:S183-S204.
30. Wahezi SE, Duerte RA, Yerra S, et al. Telemedicine during COVID-19 and beyond: A practical guide and best practices multidisciplinary approach for the orthopedic and neurologic pain physical examination. *Pain Physician* 2020; 23:S205-S238.
31. Jha S, Shah S, Calderon MD, Soin A, Manchikanti L. The effect of COVID-19 on interventional pain management practices: A physician burnout survey. *Pain Physician* 2020; 23:S271-S282.
32. Gharaei H, Diwan S. COVID-19 pandemic: Implications on interventional pain practice: A narrative review. *Pain Physician* 2020; 23:S311-S318.
33. Shah S, Diwan S, Kohan L, et al. The Technological Impact of COVID-19 on the Future of Education and Health Care Delivery. *Pain Physician* 2020; 23:S367-S380.
34. The Great Barrington Declaration. Accessed 12/1/2020. https://gbdeclaration.org/
35. Manchikanti L, Vanaparthy R, Atluri S, Sachdeva H, Kaye AD, Hirsch JA. Concurrent public health emergencies in the US: COVID-19 and the opioid epidemic with hampered access to chronic pain management: A review. *Pain Ther* 2020; in press.
36. Vandenbroucke JP, von Elm E, Altman DG, et al; STROBE Initiative. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE): Explanation and elaboration. *Epidemiology* 2007; 18:805-835.
37. Centers for Medicare and Medicaid Services. Accessed 12/9/2020. www.cms.gov/
38. Leavitt SB. NSAID dangers may limit pain-relief options. Pain-Topics News/Research UPDATES, March 14, 2010.
39. Moore A, Wiffen P, Kalso E.

Antiepileptic drugs for neuropathic pain and fibromyalgia. *JAMA* 2014; 312:182-183.

40. Rajaee SS, Bae HW, Kanim LE, Delamarter RB. Spinal fusion in the United States: Analysis of trends from 1998 to 2008. *Spine (Phila Pa 1976)* 2012; 37:67-76.
41. Deyo RA. Fusion surgery for lumbar degenerative disc disease: Still more questions than answers. *Spine J* 2015; 15: 272-4.
42. Pannell WC, Savin DD, Scott TP, Wang JC, Daubs MD. Trends in the surgical treatment of lumbar spine disease in the United States. *Spine J* 2015; 15:1719-1727.
43. Bae HW, Rajaee SS, Kanim LE. Nationwide trends in the surgical management of lumbar spinal stenosis. *Spine (Phila Pa 1976)* 2013; 38:916-926.
44. Lopez CD, Boddapati V, Lombardi JM, et al. Recent trends in medicare utilization and reimbursement for anterior cervical discectomy and fusion. *Spine J* 2020; 20:1737-1743.
45. Cole T, Veeravagu A, Zhang M, Ratliff JK. Surgeon procedure volume and complication rates in anterior cervical discectomy and fusions: Analysis of a national longitudinal database. *Clin Spine Surg* 2017; 30:E633-E639.
46. Oglesby M, Fineberg SJ, Patel AA, Pelton MA, Singh K. Epidemiological trends in cervical spine surgery for degenerative diseases between 2002 and 2009. *Spine (Phila Pa 1976)* 2013; 38:1226-1232.
47. Belatti DA, Pugely AJ, Phisitkul P, Amendola A, Callaghan JJ. Total joint arthroplasty: Trends in medicare reimbursement and implant prices. *J Arthroplasty* 2014; 29:1539-1544.
48. Curtin BM, Russell RD, Odum SM. Bundled payments for care improvement: Boom or bust? *J Arthroplasty* 2017; 32:2931-2934.
49. Chou R, Hashimoto R, Friedly JL, et al. Epidural corticosteroid injections for radiculopathy and spinal stenosis: A systematic review and meta-analysis. *Ann Intern Med* 2015; 163:373-381.
50. Pinto RZ, Maher CG, Ferreira ML, et al. Epidural corticosteroid injections in the management of sciatica: A systematic review and meta-analysis. *Ann Intern Med* 2012; 157:865-877.
51. Oliveira CB, Maher CG, Ferreira ML, et al. Epidural corticosteroid injections for lumbosacral radicular pain. *Cochrane Database Syst Rev* 2020; 4:CD013577.
52. Boswell MV, Manchikanti L. Appropriate design and methodologic quality assessment, clinically relevant outcomes are essential to determine the role of epidural corticosteroid injections. Commentary RE: Chou R, Hashimoto R, Friedly J, et al. Epidural corticosteroid injections for radiculopathy and spinal stenosis: A systematic review and meta-analysis. Ann Intern Med 2015; 163:373-381. *Evid Based Med* 2016; 21:89.
53. Manchikanti L, Knezevic NN, Boswell MV, Kaye AD, Hirsch JA. Epidural injections for lumbar radiculopathy and spinal stenosis: A comparative systematic review and meta-analysis. *Pain Physician* 2016; 19:E365-E410.
54. Manchikanti L, Knezevic NN, Parr A, Kaye AD, Sanapati M, Hirsch JA. Does epidural bupivacaine with or without steroids provide long-term relief? A systematic review and meta-analysis. *Curr Pain Headache Rep* 2020; 24:26.
55. Lee JH, Shin KS, Park SJ, et al. Comparison of clinical efficacy between transforaminal and interlaminar epidural injections in lumbosacral disc herniation: A systematic review and meta-analysis. *Pain Physician* 2018; 21:433-448.
56. Lee JH, Kim DH, Kim DH, et al. Comparison of clinical efficacy of epidural injection with or without steroid in lumbosacral disc herniation: A systematic review and meta-analysis. *Pain Physician* 2018; 21:449-468.
57. Lee JH, Shin KH, Bahk SJ, et al. Comparison of clinical efficacy of transforaminal and caudal epidural steroid injection in lumbar and lumbosacral disc herniation: A systematic review and meta-analysis. *Spine J* 2018; 18:2343-2353.
58. Sanapati J, Manchikanti L, Atluri S, et al. Do regenerative medicine therapies provide long-term relief in chronic low back pain: A systematic review and meta-analysis. *Pain Physician* 2018; 21:515-540.
59. Mesregah MK, Feng W, Huang WH, et al. Clinical effectiveness of interlaminar epidural injections of local anesthetic with or without steroids for managing chronic neck pain: A systematic review and meta-analysis. *Pain Physician* 2020; 23:335-348.
60. Knezevic N, Manchikanti L, Urits I, et al. Lack of superiority of epidural injections with lidocaine with steroids compared to without steroids in spinal pain: A systematic review and meta-analysis. *Pain Physician* 2020; 23:S239-S270.
61. Zhao W, Wang Y, Wu J, et al. Long-term outcomes of epidurals with lidocaine with or without steroids for lumbar disc herniation and spinal stenosis: A meta-analysis. *Pain Physician* 2020; 23:365-374.
62. Manchikanti L, Pampati V, Parr III A, et al. Cervical interlaminar epidural injections in the treatment of cervical disc herniation, post surgery syndrome, or discogenic pain: Cost utility analysis from randomized trials. *Pain Physician* 2019; 22:421-431.
63. Manchikanti L, Soin A, Boswell MV, Kaye AD, Sanapati M, Hirsch JA. Effectiveness of percutaneous adhesiolysis in post lumbar surgery syndrome: A systematic analysis of findings of systematic reviews. *Pain Physician* 2019; 22:307-322.
64. Cho JH, Lee JH, Song KS, et al. Treatment outcomes for patients with failed back surgery. *Pain Physician* 2017; 20:E29-E43.
65. Manchikanti L, Knezevic NN, Sanapati SP, Sanapati MR, Kaye AD, Hirsch JA. Is percutaneous adhesiolysis effective in managing chronic low back and lower extremity pain in post-surgery syndrome: A systematic review and meta-analysis. *Curr Pain Headache Rep* 2020; 24:30.
66. Manchikanti L, Knezevic NN, Sanapati MR, Boswell MV, Kaye AD, Hirsch JA. Effectiveness of percutaneous adhesiolysis in managing chronic central lumbar spinal stenosis: A systematic review and meta-analysis. *Pain Physician* 2019; 22:E523-E550.
67. Gerdesmeyer L, Wagenpfeil S, Birkenmaier C, et al. Percutaneous epidural lysis of adhesions in chronic lumbar radicular pain: A randomized double-blind placebo controlled trial. *Pain Physician* 2013; 16:185-196.
68. Helm II S, Racz GB, Gerdesmeyer L, et al. Percutaneous and endoscopic adhesiolysis in managing low back and lower extremity pain: A systematic review and meta-analysis. *Pain Physician* 2016; 19:E245-E282.
69. Manchikanti L, Malla Y, Cash KA, Pampati V, Hirsch JA. Comparison of effectiveness for fluoroscopic cervical interlaminar epidural injections with or without steroid in cervical post-surgery syndrome. *Korean J Pain* 2018; 31:277-288.
70. Manchikanti L, Helm S 2nd, Pampati

V, Racz GB. Cost utility analysis of percutaneous adhesiolysis in managing pain of post-lumbar surgery syndrome and lumbar central spinal stenosis. *Pain Pract* 2015; 15:414-422.

71. Manchikanti L, Pampati V, Sanapati SP, Sanapati MR, Kaye AD, Hirsch JA. Evaluation of cost-utility of thoracic interlaminar epidural injections. *Curr Pain Headache Rep* 2020; 24:5.
72. Manchikanti L, Abdi S, Atluri S, et al. An update of comprehensive evidence-based guidelines for interventional techniques of chronic spinal pain: Part II: Guidance and recommendations. *Pain Physician* 2013; 16:S49-S283.
73. Chun-jing H, Hao-xiong N, Jia-xiang N. The application of percutaneous lysis of epidural adhesions in patients with failed back surgery syndrome. *Acta Cir Bras* 2012; 27:357-362.
74. Manchikanti L, Singh V, Cash KA, Pampati V, Datta S. Assessment of effectiveness of percutaneous adhesiolysis and caudal epidural injections in managing lumbar post surgery syndrome: A 2-year follow-up of randomized, controlled trial. *J Pain Res* 2012; 5:597-608.
75. Heavner JE, Racz GB, Raj P. Percutaneous epidural neuroplasty: Prospective evaluation of 0.9% NaCl versus 10% NaCl with or without hyaluronidase. *Reg Anesth Pain Med* 1999; 24:202-207.
76. Manchikanti L, Rivera JJ, Pampati V, et al. One day lumbar epidural adhesiolysis and hypertonic saline neurolysis in treatment of chronic low back pain: A randomized, double-blind trial. *Pain Physician* 2004; 7:177-186.
77. Shanthanna H, Busse J, Wang L, et al. Addition of corticosteroids to local anaesthetics for chronic non-cancer pain injections: A systematic review and meta-analysis of randomised controlled trials. *Br J Anaesth* 2020; 125:779-801.
78. Manchikanti L, Kosanovic R, Vanaparthy R, et al. Steroid distancing in interventional pain management during COVID-19 and beyond: Safe, effective and practical approach. *Pain Physician* 2020; 23:S319-S352.
79. Ioannidis JPA. The mass production of redundant, misleading, and conflicted systematic reviews and meta-analyses. *Milbank Q* 2016; 94:485-514.
80. Clark W, Bird P, Diamond T, Gonski P, Gebski V. Cochrane vertebroplasty review misrepresented evidence for vertebroplasty with early intervention in severely affected patients. *BMJ Evid Based Med* 2020; 25:85-89.
81. Manchikanti L, Boswell MV, Kaye AD, Helm II S, Hirsch JA. Therapeutic role of placebo: Evolution of a new paradigm in understanding research and clinical practice. *Pain Physician* 2017; 20:363-386.
82. Greenhalgh T, Howick J, Maskrey N; Evidence Based Medicine Renaissance Group. Evidence based medicine: A movement in crisis? *BMJ* 2014; 348:g3725.
83. Prusova K, Churcher L, Tyler A, Lokugamage U. Royal College of Obstetricians and Gynaecologists guidelines: How evidence-based are they? *J Obstet Gynaecol* 2014; 34:706-711.
84. Hickey S, Roberts H. Evidence based medicine: Neither good evidence nor good medicine. *Orthomolecular Medicine News Service*, December 7, 2011. Accessed 12/9/2020.
www.orthomolecular.org/resources/omns/v07n15.shtml
85. Schwartz D. Evidence-based medicine is NOT the Holy Grail (Share) – NEW IMPROVED. July 9, 2016. Accessed 12/9/2020.
www.linkedin.com/pulse/evidence-based-medicine-holy-grail-david-schwartz
86. Every-Palmer S, Howick J. How evidence-based medicine is failing due to biased trials and selective publication. *J Eval Clin Pract* 2014; 20:908-914.
87. Reichman OH, Origitano TC, Anderson DE, Duckworth EA. Lies, damned lies, and statistics: A neurosurgical perspective on the international randomized trial of extracranial to intracranial arterial bypass surgery. *J Stroke Cerebrovasc Dis* 2009; 18:389-397.
88. Cappola AR, FitzGerald GA. Confluence, not conflict of interest: Name change necessary. *JAMA* 2015; 314:1791-1792.
89. David Eddy created the Archimedes model to predict and analyze care. *Health Aff (Millwood)* 2012; 31:2451-2452.
90. Mercuri M, Baigrie B, Upshur REG. Going from evidence to recommendations: Can GRADE get us there? *J Eval Clin Pract* 2018; 24:1232-1239.
91. Howick J. The evidence-based medicine renaissance: Holy grail or poisoned chalice? *BMC Blog Network*, July 3, 2014. Accessed 12/9/2020.
https://blogs.biomedcentral.com/on-medicine/2014/07/03/the-evidence-based-medicine-renaissance-holy-grail-or-poisoned-chalice/
92. Packer M. Are meta-analyses a form of medical fake news? Thoughts about how they should contribute to medical science and practice. *Circulation* 2017; 136:2097-2099.
93. Foroutan F, Guyatt G, Alba AC, Ross H. Meta-analysis: Mistake or milestone in medicine? *Heart* 2018; 104:1559-1561.
94. Mercuri M, Gafni A. The evolution of GRADE (part 2): Still searching for a theoretical and/or empirical basis for the GRADE framework. *J Eval Clin Pract* 2018; 24:1211-1222.
95. Shekelle PG. Clinical practice guidelines: What's next? *JAMA* 2018; 320:757-758.
96. Riado Minguez D, Kowalski M, Vallve Odena M, et al. Methodological and reporting quality of systematic reviews published in the highest ranking journals in the field of pain. *Anesth Analg* 2017; 125:1348-1354.
97. Ross A, Rankin J, Beaman J, et al. Methodological quality of systematic reviews referenced in clinical practice guidelines for the treatment of opioid use disorder. *PLoS One* 2017; 12:e0181927.
98. Noridian Healthcare Solutions, LLC. Local Coverage Determination (LCD). Non-covered services (L36219). Revision Effective Date: Revision Effective Date: 12/01/2019.
99. Palmetto GBA. Local Coverage Determination (LCD): Noncovered services other than CPT® Category III Noncovered Services (L36954). Revision Effective Date 1/29/2018.