Title

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Is Outpatient Spine Surgery Associated with New, Persistent Opioid Use in Opioid-Naïve Patients? A Retrospective National Claims Database Analysis

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Abstract

Background Context: Although spine procedures have historically been performed inpatient, there has been a recent shift to the outpatient setting for selected cases due to increased patient satisfaction and reduced cost. Effective postoperative pain management while limiting over-prescribing of opioids, which may lead to persistent opioid use, is critical to performing spine surgery in the outpatient setting.

Purpose: To assess if there is an increased risk for new, persistent opioid use between inpatient and outpatient spine procedures.

Study Design: Retrospective analysis using national administrative claims database.

Patient Sample: 390,049 opioid-naïve patients with a perioperative opioid prescription who underwent an inpatient or outpatient spine surgery.

Outcome Measures: Patients with perioperative opioid prescriptions who filled ≥ 1 opioid prescription between 90- and 180-days following surgery were defined as new, persistent opioid users.

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Ethical Review Committee Statement: This study was performed in accordance with the ethical standards in the 1964 Declaration of Helsinki and was carried out in accordance with relevant regulations of the US Health Insurance Portability and Accountability Act (HIPAA).

Methods: We utilized a claims database to identify opioid-naïve patients who underwent lumbar or cervical fusion, total disc arthroplasty, or decompression procedures. We constructed a multivariable logistic regression to evaluate the association between inpatient versus outpatient surgery and the development of new, persistent opioid use while adjusting for several patient factors.

Results: 19,205 (11.7%) inpatient and 18,546 (8.2%) outpatient patients developed new, persistent opioid use. Outpatient lumbar and cervical spine surgery patients were significantly less likely to develop new, persistent opioid use following surgery compared to inpatient spine Opioid use in spine surgery surgery patients (OR = 0.71 [95% confidence interval (CI): 0.69, 0.73], $p < 0.001$). Average morphine milligram equivalents (MMEs) (inpatient = 1,476 MME +/− 22.7, outpatient = 1,072 MME +/− 18.5, $p < 0.001$) and average MMEs per day (inpatient = 91.6 MME +/− 0.32, outpatient = 77.7 MME +/− 0.28, $p < 0.001$) were lower in the outpatient cohort compared to the inpatient.

Conclusion: Our results support the shift from inpatient to outpatient spine procedures, as outpatient procedures were not associated with an increased risk for new, persistent opioid use. As more patients become candidates for outpatient spine surgery, predictors of new, persistent opioid use should be considered during risk stratification.

Level of Evidence: Level III Prognostic Study.

Mini Abstract:

We utilized a national administrative claims database to identify opioid-naïve patients who underwent common spine procedures. Outpatient lumbar and cervical spine surgery patients were significantly less likely to be new, persistent opioid users following surgery compared to inpatient spine surgery patients. Our results support the shift to outpatient spine procedures.

Keywords

cervical; lumbar; opioids; outpatient surgery; persistent opioid use; spine

Introduction

Back pain is one of the most common reasons for seeking medical care, with population estimates of 70–85% of United States (US) adults experiencing low back pain at some point in their lives.[1–3] The US has the highest incidence of spine procedures in the world, with consistent annual increases in spine procedures since the early 1990s.[4] Particularly, lumbar and cervical spine procedures have been performed increasingly frequently over the last 2 decades and studies estimate further demand for these procedures through 2040.[4–6] Although lumbar and cervical spine procedures have historically been inpatient procedures, there is a growing push to transition these procedures to the outpatient setting due to increased patient satisfaction, reduction in cost, and a shift in patient desire to recover at home.[7–9] In recent years, there has been significant increases in the number of outpatient spine surgeries performed, particularly for lumbar and posterior cervical decompressions.[10] Evidence has shown that outpatient spine procedures such as anterior cervical discectomy and fusion (ACDF), lumbar discectomy, and short segment fusion procedures have higher

patient satisfaction, lower cost, and no significant difference in 90-day readmission or reoperation rates compared to inpatient procedures.[7,11] Despite this evidence, the Centers for Medicare and Medicaid Services (CMS) recently announced that 14 spine procedures, including laminectomies, laminotomies, and discectomies, which were previously covered in either the inpatient or outpatient settings, will be returned to the inpatient-only (IPO) list,[12] which contains procedures that are covered only on an inpatient basis due to extended postoperative hospital stays and recovery.[12]

Although the shift towards an increasing proportion of outpatient procedures allows greater efficiency in surgical care, the safety of outpatient spine surgery is still debated. In the outpatient setting, the push to discharge patients on the same day may lead to an increase in opioid prescriptions, increasing the risk of opioid dependence. Effective postoperative pain management is a critical challenge to safe, same-day discharge after outpatient surgery.[13–16] However, a tentative balance must be struck between addressing patient pain concerns to enable same-day discharge and opioid over-prescribing.[17] Previous studies investigating outpatient total hip arthroplasty have demonstrated success in multimodal opioid-sparing protocols.[18]

Orthopaedic surgery is one of the top 5 opioid prescribing specialties.[17,19,20] Prolonged postoperative opioid use is associated with chronic opioid use, leading to worsened short and long-term outcomes after lumbar and cervical spine procedures.[21,22] Opioid-naïve patients undergoing lumbar fusion surgery with pre-operative opioid use are at risk for long-term opioid use, with 57% maintaining their pre-operative dose and 10% increasing their dosage.[23] Previous studies have indicated that approximately 20% of spine surgery patients are opioid dependent following surgery.[24] Given that the drivers of opioid prescribing may vary between inpatient and outpatient spine procedures, elucidating the risk of new, persistent opioid use after outpatient vs. inpatient spine surgery would inform a safe transition to outpatient procedures. The purpose of this study was to assess if there is an increased risk for new, persistent opioid use between inpatient and outpatient spine procedures.

Materials and Methods

Data Source and Cohort Creation

Data was analyzed from the PearlDiver Mariner Patient Claims Database (PearlDiver Technologies, Colorado Springs, CO, USA), which contains patient-level administrative claims records, including pharmaceutical claims, from over 91 million individuals. The database has diverse geographic and plan representation and provides patient demographic data including age, sex, and comorbidities. This database was chosen for its ability to track patients longitudinally along the spectrum of care and the inclusion of pharmaceutical claims data. Because deidentified data was used, this study was exempt from institutional review board approval.

We included patients 18 years and older who underwent common inpatient and outpatient spine procedures, consisting of single or multilevel lumbar fusion, lumbar total disc arthroplasty, cervical total disc arthroplasty, lumbar decompression, anterior cervical

decompression with fusion (ACDF), cervical posterior decompression with fusion, and cervical decompression. defined using Current Procedural Terminology (CPT) codes (Appendix Table 1). If a patient underwent more than one of these procedures, only the first procedure was included. We required patients to be enrolled in the database for at least 12 months prior to and 6 months after the index procedure. Patients with commercial, Medicare Advantage, or Medicaid managed care plans were included. Patients without complete demographic data were excluded. We defined opioid-naïve patients as those who did not fill an opioid prescription in the period between 12 months and 31 days prior to surgery, as defined in previous opioid naïve study cohorts.[25,26] Patients with a prior diagnosis of opioid dependence or abuse, undergoing revision surgery, undergoing another surgery in the study period, or with metastatic cancer were excluded from the analysis. We defined a perioperative period encompassing 30 days before and 14 days after the index procedure and only included patients who filled an opioid prescription within the perioperative period, consistent with prior studies.[25] Patients were then separated into cohorts depending on site of surgery: inpatient versus outpatient. Outpatient surgery included those performed in the outpatient hospital setting or ambulatory surgical centers. The flow diagram of cohort creation is displayed in Figure 1.

Patients with perioperative opioid prescriptions who filled ≥ 1 opioid prescription between 90- and 180-days following surgery were defined as new, persistent opioid users. Included opioids are shown in Appendix Table 2. Opioids were selected from previous studies to include the most common post-operative medications. Opioids containing brompheniramine, chlorpheniramine, pseudoephedrine, phenylephrine, homatropine, or guaifenesin were excluded because of their use primarily in cough and/or cold medications, rather than for pain control as demonstrated in previous studies.[27] Opioids included are those paid for in full or partially by insurance companies and we assume that most opiates are covered through the given pharmaceutical claims. There was no study funding or conflicts of interest to declare for this study.

Variables

We identified demographic variables for all patients including age, sex, geographic region, and insurance plan (Table 1). The Elixhauser Comorbidity Index (ECI) was included in the analysis to account for baseline comorbidity burden. We also identified patients with a history of chronic pain, defined as the presence of an International Classification of Diseases (ICD) code for generalized chronic pain syndromes, fibromyalgia, or neuropathy (Appendix Table 1) within 12 months prior to surgery. Procedure complexity was approximated using the number of operated vertebral levels, divided into either single level or multi-level procedures. The primary outcome was new, persistent opioid use (filling at least 1 opioid prescription between 90 and 180 days after surgery) in patients who filled an opioid prescription in the perioperative period. The secondary outcome was the amount of opioids filled between 90- and 180-days following surgery, measured as average daily morphine milligram equivalents (MMEs) and total MMEs (Figures 2 and 3). MMEs are contained within the pharmaceutical claims included the database, which is calculated based on the prescription that was filled.

Statistical Analysis

Continuous variables were reported as mean +/− standard error and compared using t-tests. Categorical variables were reported as frequencies (percentages) and compared using chi-square tests. The ECI was reported as median (range) and compared using the Mann-Whitney test. We constructed a multivariable logistic regression model to evaluate the association between outpatient versus inpatient surgery and new, persistent opioid use, adjusting for age, sex, geographic region, insurance plan, ECI, single vs. multiple levels operated, procedure type, and history of chronic pain. Consistent with prior studies that adjusted for case complexity by the number of levels operated on, we divided procedures into single versus multiple levels to account for case complexity (Table 2).[28,29]

Sample Size Estimation

Based on a prior study showing new, persistent opioid use in 11.4% of patients undergoing inpatient total joint arthroplasty compared to only 9.0% of patients undergoing outpatient total joint arthroplasty,[26] we estimated that a sample size of at least 2,573 patients in each cohort was required to detect a minimum difference of this magnitude with 80% power and an alpha = 0.05. We defined statistical significance at $p < 0.05$ *a priori.*

Results

Incidence of New, Persistent Postoperative Opioid Use

We included 164,377 opioid-naïve patients with a perioperative opioid prescription who underwent an inpatient spine surgery and 225,213 opioid-naïve patients with a perioperative opioid prescription who underwent an outpatient spine surgery. These cohorts differed by age, sex, insurance type, and geographic region (Table 1). Of these patients, 19,205 (11.7%) and 18,546 (8.2%) developed new, persistent opioid use respectively. In the multivariable analysis, patients undergoing outpatient spine surgery were less likely to develop new, persistent opioid use compared to the inpatient cohort (adjusted odds ratio [OR] = 0.71 [95% confidence interval (CI): 0.69, 0.73], $p < 0.001$). Patients undergoing a lumbar fusion (adjusted OR = 0.83 [95% CI: 0.76, 0.90] $p < 0.001$), lumbar decompression (adjusted OR = 0.79 [95% CI: 0.75, 0.82] $p < 0.001$), cervical total disc arthroplasty (adjusted OR = 0.71 [95% CI: 0.55, 0.94] $p = 0.01$), anterior cervical decompression with fusion (adjusted OR = 0.40 [95% CI: 0.32, 0.49] $p < 0.001$), or cervical decompression (adjusted OR = 0.59 [95% CI: 0.46, 0.75] $p < 0.001$) were all significantly less likely to be new, persistent opioid users (Table 4). Lumbar total disc arthroplasty and cervical posterior decompression and fusion were not analyzed in isolation due to low sample sizes (Table 1). Other independent risk factors for new, persistent opioid use were younger age, female sex, and increasing comorbidity burden (Table 5). Additionally, Medicaid (adjusted OR = 1.50 [95% CI: 1.42, 1.58] $p < 0.001$) or Medicare (adjusted OR = 1.15 [95% CI: 1.12, 1.18], $p < 0.001$) insurance were independent risk factors for new, persistent opioid use compared to private insurance. A history of a chronic pain disorder and multi-level surgery were independent predictors of new, persistent opioid use after surgery (adjusted ORs = 1.09 [95% CI: 1.06, 1.12] and 1.14 [95% CI: 1.12, 1.16] $p < 0.001$ for both) (Table 2).

Amount of Postoperative Opioids Filled

Of patients who developed new, persistent opioid use after spine surgery, the total MMEs and average MMEs per day (in the 90–180 day period after surgery) were lower in the outpatient compared to inpatient cohorts (Table 3). Average total MMEs for the inpatient cohort was 1,476 MME +/− 22.7 ($p < 0.001$) and 1,072 MME +/− 18.5 ($p < 0.001$) for the outpatient cohort. The average MMEs per day for the inpatient cohort was 91.6 +/− 0.32 MMEs compared to the outpatient cohort which was 77.7+/− 0.28 MMEs ($p < 0.001$). When analyzing individual spine procedures within the overall cohort, lumbar fusion, lumbar decompression, and cervical decompression all had significantly fewer average MMEs and average daily MMEs ($p < 0.001$). Anterior cervical decompression with fusion had significantly higher average daily MMEs in the outpatient cohort, although total average MMEs were significantly lower in the outpatient cohort (Table 3).

Discussion

Rates of New, Persistent Opioid Use in Inpatient and Outpatient Spine Surgery

We found that outpatient lumbar and cervical spine surgery patients were significantly less likely to be new, persistent opioid users following surgery compared to inpatient spine surgery patients. Individual spine procedures of lumbar fusion, lumbar decompression, cervical posterior decompression with fusion, anterior cervical decompression with fusion, and cervical decompression all indicated that the outpatient cohort was significantly less likely to be new, persistent opioid users. In addition, total and average MMEs were lower for the outpatient spine surgery group in both our overall analysis and for individual procedures of lumbar fusion, cervical total disc arthroplasty, decompression, and cervical decompression. Despite the variation in complexity and quantity for each individual procedure, our analysis revealed lower opioid use in the outpatient cohort consistently across procedures. The difference in opioid use across procedures likely originates from the differences in operative time and recovery for each procedure. The recent shift towards performing spine procedures in the outpatient setting has been driven by increased patient satisfaction, similar readmission rates as inpatient procedures, and improved cost effectiveness.[8,11,30] Our findings are consistent with previous studies that have investigated opioid use after other major surgical procedures in the inpatient and outpatient settings. For example, a recent retrospective study compared opioid use after inpatient and outpatient total joint arthroplasty (TJA), finding that patients undergoing outpatient TJA procedures were less likely to become persistent opioid users compared to patients undergoing inpatient TJA.[26] Lower rates of opioid use after outpatient spine surgery may point to efficacy of multimodal pain protocols.[31,32] Although our results show that outpatient procedures resulted in relatively lower rates of new, persistent opioid use, there remains a need for pain control protocols that limit opioid use after spine surgery. For example, the implementation of opioid reduction efforts for inpatient procedures may help promote earlier discharge while reducing the risk of persistent opioid use. As outpatient spine procedure volume continues to increase each year in the US,[33] our results suggest that outpatient spine surgeries are safe with respect to new, persistent opioid use.

We also found that Medicare or Medicaid insurance was associated with new, persistent opioid use compared to private insurance, independent of surgery location. Patients enrolled in Medicaid are predominantly low-income adults, who face a multitude of complex social factors (e.g., differential access to care) that could not be accounted for in our models. For example, insurance type has been shown to accurately capture social deprivation in orthopaedic patients.[34] A recent study showed that Medicaid patients undergoing total hip arthroplasties experienced worse postoperative pain compared to private and Medicare patients with higher amounts of opioid use.[35] Similarly, the Medicare population may experience additional medical complexities that are not accounted for such as frailty,[36] leading to higher opioid use. Further research is needed to elucidate modifiable drivers of increased opioid use in Medicaid and Medicare patients after spine surgery.

Amount of New, Persistent Opioids Filled in Inpatient and Outpatient Spine Surgery

For patients with new, persistent opioid use, our study showed high levels of total and average opioid prescriptions after both inpatient and outpatient spine surgery. The CDC guidelines for prescribing opioids for chronic pain urge caution when prescribing opioids ≥50 MMEs/day and advise clinicians to avoid prescriptions of ≥90 MMEs/day.[37] In our study, patients who developed new, persistent opioid use after inpatient spine procedures filled prescriptions averaging over 90 MMEs/day and those with new, persistent opioid use after outpatient spine procedures filled prescriptions averaging over 50 MMEs/day. Thus, better multimodal postoperative pain management protocols are needed. There is a growing body of evidence for the use of multimodal pain control regimens in spine surgery, including the use of NSAIDs, pregabalin, gabapentin, acetaminophen, and/or local anesthesia to reduce opioid consumption and improve pain control.[38,39] In one study, use of a multimodal pain protocol after multilevel instrumented spinal fusions resulted in reduced opioid consumption and improved mobility.[40] These data have resulted in the development of standardized, comprehensive multimodal pain protocols at various institutions.[41,42] There remains a challenge in choosing discharge prescription quantity, especially for outpatient procedures, as clinicians may over-prescribe to limit post-operative pain as the patient recovers at home. This is an area that should be investigated further to understand how to limit excessive post-operative opioid prescribing practices. There are remaining challenges to transitioning greater volumes of spine procedures to outpatient settings. The first is due to gaps in the evidence of what patient factors and physiologic fitness are appropriate for the outpatient setting. Similarly, concerns for patient safety and ensuring patients are not exposed to a greater risk of complications has limited this transition. For example, Medicare was slated to completely remove the inpatient only list (a list of procedures that can only be done in the hospital setting) but chose not to remove this list due to patient safety concerns. However, there is a growing body of evidence supporting the protocols put in place to increase safety in the outpatient setting.[43] Through institutional protocols designating resources and standards for post-operative complications, this barrier can be overcome. Further work is needed to develop and implement standardized postoperative recovery protocols with effective use of multimodal pain control strategies, given the persistence of high levels of opioid use after both inpatient and outpatient spine surgeries. Strategies for identifying patients with persistent postoperative opioid use and subsequent interventions are needed.

Limitations

This study has several limitations. First, the use of an administrative claims database relies on accurate coding, although prior studies have shown this to be reliably accurate.[44] Any opioid use that did not generate a claim (e.g., patients paying out-of-pocket) is not included in our analysis due to our use of a claims database. The use of this database is also limited by the diagnoses and procedures captured by ICD and CPT codes, as inaccurate coding may occur. Both of these effects are not expected to be differential between the cohorts. Additionally, while we adjusted for several confounding variables, it is possible that other, unobserved confounders were omitted from the analysis, which could alter our results in either direction. While our results showed an association between outpatient spine surgery and decreased rates of new, persistent postoperative opioid use, this is not necessarily causal. The cohort of patients undergoing outpatient surgery is pre-selected based on clinical variables that may not be observed in the data. However, at a minimum, our results suggest that current selection mechanisms for candidates for outpatient spine surgery have not resulted in increased rates of new, persistent opioid use.

Conclusion

As effective pain control is often a barrier to early discharge after spine surgery, opioid over-prescription may occur for outpatient surgeries, leading to an increased risk of persistent opioid use. However, our findings showed that fewer patients developed new, persistent opioid use after outpatient compared to inpatient spine procedures, supporting the relative safety of spine procedures performed in the outpatient setting with respect to risk of persistent opioid use.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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key points:

1. Out of 164,377 and 225,213 patients undergoing inpatient and outpatient spine procedures who filled an opioid prescription in the perioperative period, 11.7% inpatient and 8.2% outpatient patients developed new, persistent opioid use.
2. Outpatient lumbar and cervical spine surgery patients were significantly less likely to be new, persistent opioid users following surgery compared to inpatient spine surgery patients.
3. Our data further support the shift from inpatient to outpatient spine procedures.

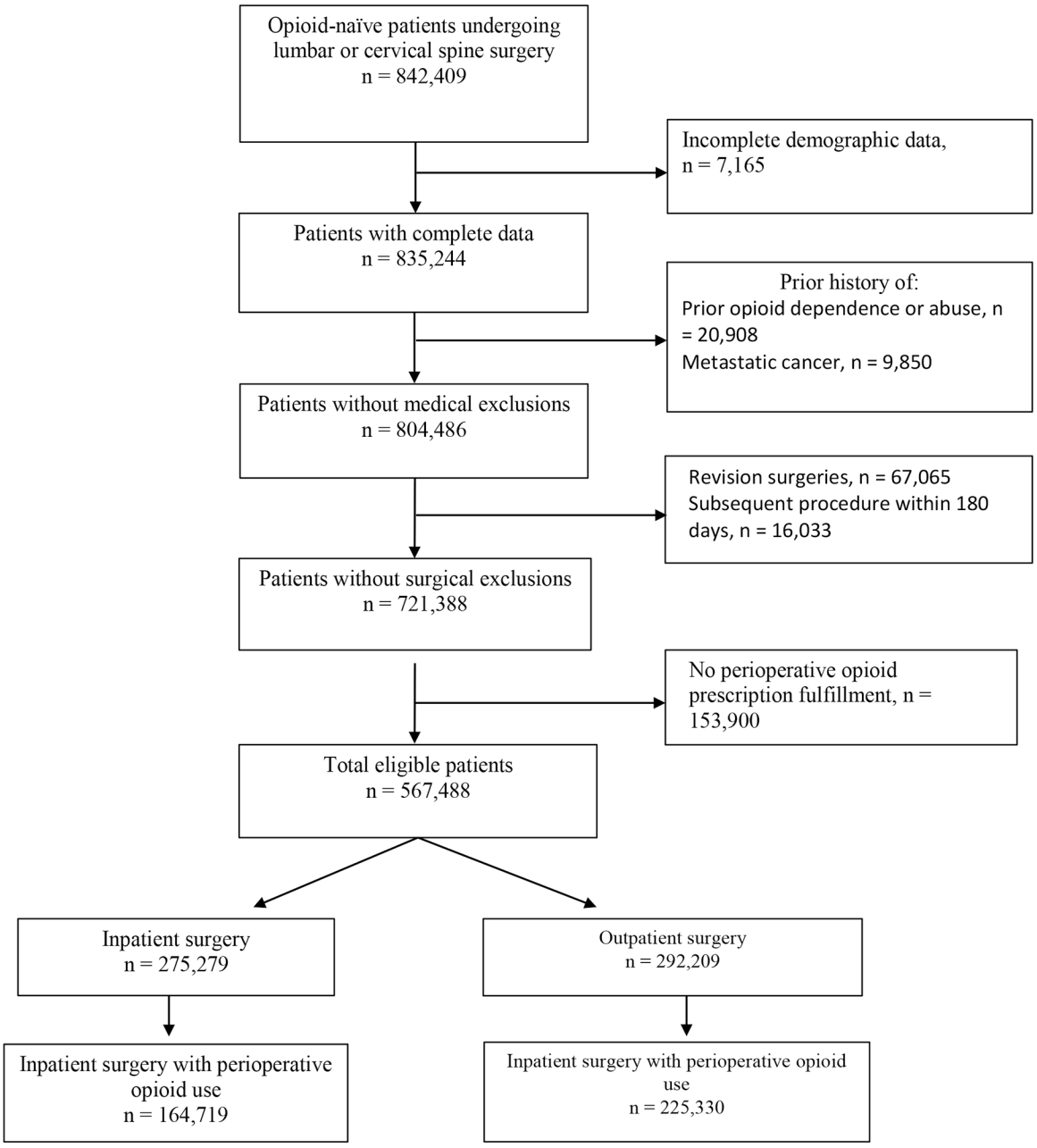

Figure 1.

Cohort demographics and exclusion criteria.

STROBE flowchart of cohort selection and breakdown.

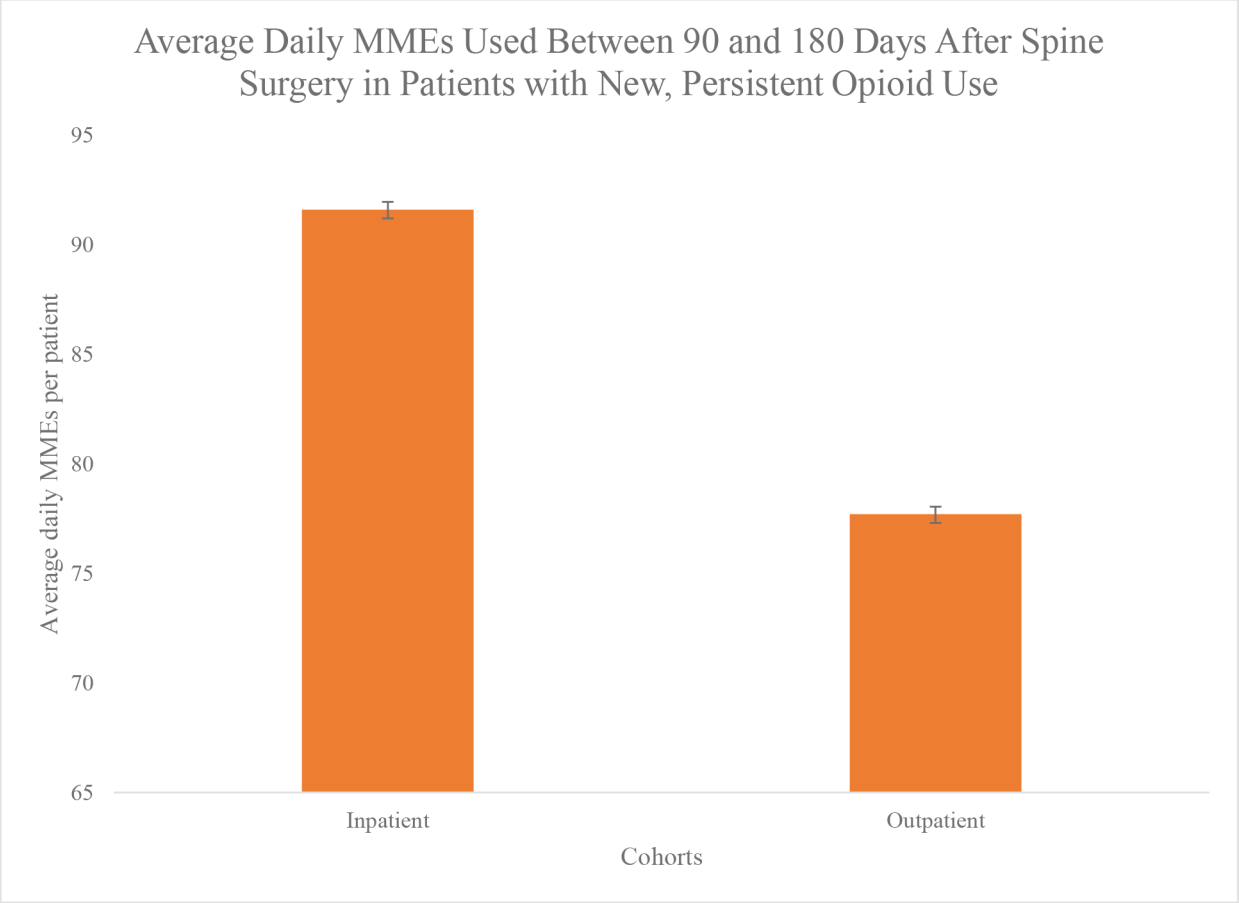

Figure 2.
Average daily MMEs (morphine milligram equivalents) between 90 and 180 days after spine surgery in patients with new, persistent opioid use between inpatient and outpatient cohorts.

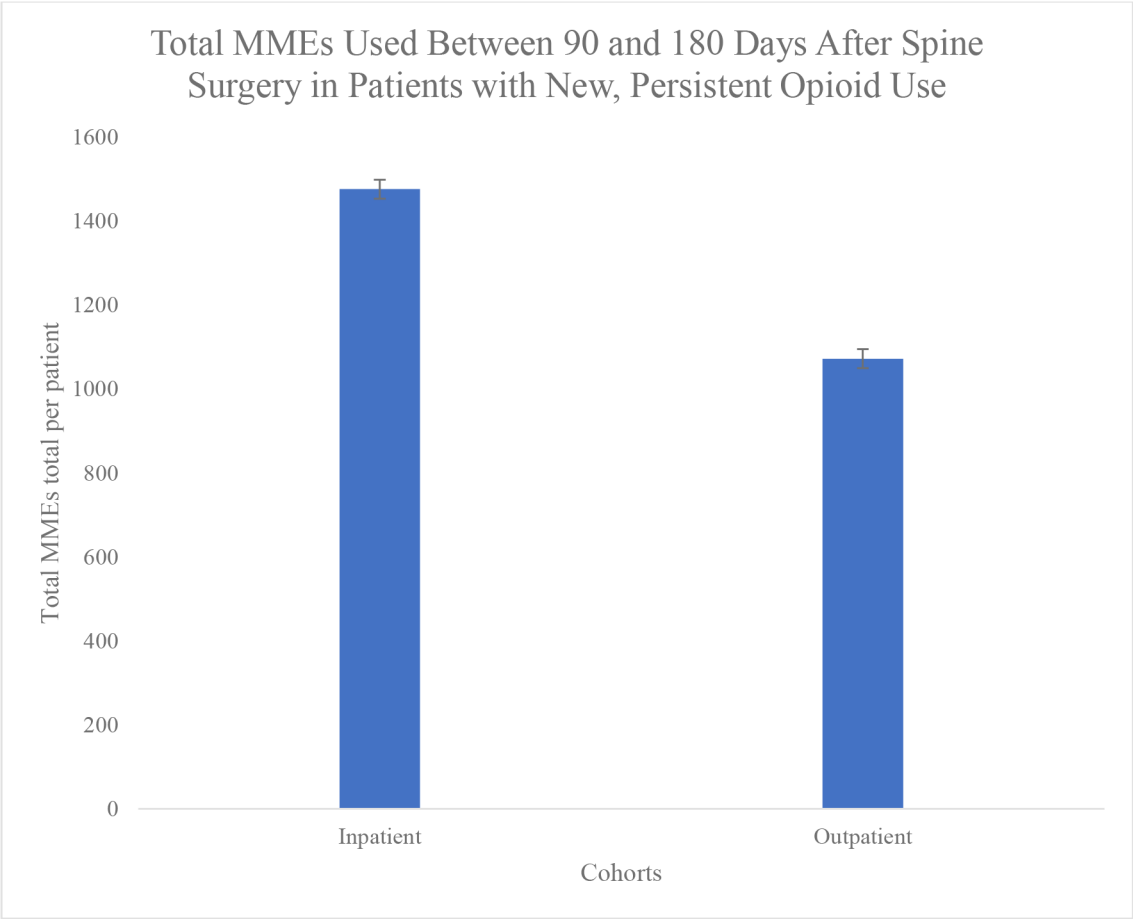

Figure 3.

Total MMEs (morphine milligram equivalents) between 90 and 180 days after spine surgery in patients with new, persistent opioid use compared between inpatient and outpatient cohorts.

Table 1.

Cohort Demographics.

Variable	Inpatient (n = 164,719)	Outpatient (n = 225,330)	P-value
Age, n (%)			< 0.001
<25 years	1,107 (0.7)	4,065 (1.8)	
25–44 years	15,492 (9.4)	45,066 (20.0)	
45–64 years	63,827 (38.7)	93,736 (41.6)	
≥65 years	84,293 (51.2)	82,463 (36.6)	
Sex, n (%)			< 0.001
Female	82,868 (50.3)	101,237 (44.9)	
Male	81,851 (49.7)	124,093 (55.1)	
Insurance type, n (%)			< 0.001
Commercial	109,326 (66.4)	175,379 (77.8)	
Medicare Advantage	50,155 (30.4)	42,802 (19.0)	
Medicaid managed care	5,238 (3.2)	7,149 (3.2)	
Region, n (%)			< 0.001
Midwest	45,677 (27.7)	61,239 (27.2)	
Northeast	32,279 (19.6)	40,311 (17.9)	
South	63,633 (38.6)	91,267 (40.5)	
West	23,130 (14.0)	32,513 (14.4)	
ECI, median (range)	3 (0–24)	3 (0–22)	< 0.001
Levels operated, n (%)			< 0.001
Single level	145,492 (88.3)	221,326 (98.2)	
Multi-level	19,227 (11.7)	4,004 (1.8)	
Procedure			< 0.001
Lumbar decompression	63,063 (38.3)	201,508 (89.4)	
Lumbar fusion	86,547 (52.5)	7,427 (3.3)	
Cervical decompression	4,028 (2.4)	7,358 (3.3)	
Cervical total disc arthroplasty	2,123 (1.3)	6,918 (3.0)	
Cervical posterior decompression with fusion	5,041 (3.1)	246 (0.1)	
Anterior cervical decompression with fusion	3,575 (2.2)	1,756 (0.8)	
Lumbar total disc arthroplasty	342 (0.2)	117 (0.1)	

Data presented at n (%).

Lumbar total disc arthroplasty and cervical posterior decompression with fusion were not analyzed in isolation due to low sample sizes.

Table 2.

Multivariable Analysis of Association Between Location of Surgery and New, Persistent Opioid Use After Spine Surgery.

Variable	Parameter Estimate [95% CI]	p-value
Location of surgery		
Inpatient	Reference	
Outpatient	0.71 [0.69, 0.73]	<0.001
Age	0.99 [0.98, 0.99]	<0.001
Sex		
Female	Reference	
Male	0.92 [0.91, 0.95]	<0.001
Insurance type		
Commercial	Reference	
Medicare Advantage	1.15 [1.12, 1.18]	<0.001
Medicaid managed care	1.50 [1.42, 1.58]	<0.001
Region		
Midwest	Reference	
Northeast	0.87 [0.84, 0.90]	<0.001
South	1.10 [1.08, 1.13]	<0.001
West	1.06 [1.03, 1.10]	<0.001
ECI	1.01 [1.01, 1.02]	<0.001
History of chronic pain disorder	1.09 [1.06, 1.12]	<0.001
Levels operated		
Single level	Reference	
Multi-level	1.14 [1.12, 1.16]	<0.001

Data presented as OR [95% CI].

Table 3.

Amounts of Opioids Used Between 90 and 180 Days After Spine Surgery in Patients with New, Persistent Opioid Use.

Variable	Inpatient	Outpatient	p-value
Total MMEs per patient, mean (SEM)	1,476 (22.67)	1,072 (18.53)	<0.001
Lumbar fusion	1,490 (30.27)	1,258 (123.47)	<0.001
Lumbar decompression	1,426 (37.84)	1,063 (19.29)	<0.001
Cervical total disc arthroplasty	1,131.4 (153.43)	845.8 (37.49)	0.104
Anterior Cervical Decompression and Fusion (ACDF)	1,439 (134.26)	1,413 (158.76)	<0.001
Cervical Decompression	1,758.2 (157.38)	1,110 (101.37)	<0.001
Average MMEs per day (per patient), mean (SEM)	91.6 (0.32)	77.7 (0.28)	<0.001
Lumbar fusion	92.8 (0.43)	82.1 (1.55)	<0.001
Lumbar decompression	86.5 (0.53)	77.6 (0.29)	0.001
Cervical total disc arthroplasty	81.1 (3.00)	70.4 (1.65)	0.075
Anterior Cervical Decompression and Fusion (ACDF)	92.1 (2.03)	98.7 (3.10)	<0.001
Cervical Decompression	96.1 (1.89)	73.7 (1.54)	0.003

Table IV.

New, Persistent Opioid Use for each Spine Procedure.

Inpatient Procedure	Inpatient n, % new, persistent opioid use (n = 164,377)	Outpatient Procedure	Outpatient n, % new, persistent opioid use (n = 225,213)
Lumbar fusion (n = 86,547)	10,759 (12.4%)	Lumbar fusion (n = 7,427)	750 (10.1%)
Lumbar decompression (n = 63,063)	6,737 (10.7%)	Lumbar decompression (n = 201,508)	16,640 (8.3%)
Anterior cervical decompression with fusion (ACDF) (n = 3,575)	485 (13.6%)	Anterior cervical decompression with fusion (ACDF) (n = 1,756)	195 (11.1%)
Cervical total disc arthroplasty (n = 2,123)	210 (9.9%)	Cervical total disc arthroplasty (n = 6,918)	515 (7.4%)
Cervical Decompression (n = 4,028)	450 (11.2%)	Cervical Decompression (n = 4,028)	546 (7.4%)

Table V.

Multivariable Analysis of Individual Outpatient Spine Procedures Compared to Inpatient Spine Procedures.

Procedure	Parameter Estimate [95% CI]	p-value
Lumbar fusion	0.83 [0.76, 0.90]	<0.001
Lumbar decompression	0.79 [0.75, 0.82]	<0.001
Cervical total disc arthroplasty	0.71 [0.55, 0.94]	0.01
Anterior cervical decompression with fusion	0.40 [0.32, 0.49]	<0.001
Cervical decompression	0.59 [0.46, 0.75]	<0.001

Data presented as OR [CI 95%].