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## Clinical Studies

## Growing utilization of ambulatory spine surgery in Medicare patients from 2010–2021

Alex K Miller, MD<sup>a,\*</sup>, Matthew R Cederman, BS<sup>b</sup>, Daniel K Park, MD<sup>a</sup><sup>a</sup> Corewell Health East William Beaumont University Hospital, 3535 W. 13 Mile Road Suite 744, Royal Oak, MI, 48073, United States<sup>b</sup> Oakland University William Beaumont School of Medicine, 3535 W. 13 Mile Road, Royal Oak, MI, 48073, United States

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## ABSTRACT

**Background:** There is growing interest in transitioning various surgical procedures to the outpatient care setting. However, for Medicare patients, the site of service for surgical procedures is influenced by regulations within the Inpatient and Outpatient Prospective Payment Systems. The purpose of this study is to quantify changes in utilization of outpatient spine surgery within the Medicare population, as well as to determine changes in outpatient volume after removal of a procedure from the “inpatient-only” list.

**Methods:** This is a cross-sectional study of Medicare billing database information for selected spine procedures included in the Medicare Physician/Supplier Procedure Summary (PSPS) public use files from 2010–2021. These files include aggregated data from Medicare Part B fee-for-service claims, published yearly. Procedures from Healthcare Common Procedural Coding System (HCPCS) code ranges 22010–22899 and 62380–63103 were selected for analysis, limited to surgical services delivered in the inpatient, hospital outpatient department (HOPD), and ambulatory surgical center (ASC) settings. For each HCPCS code included, estimates of the total number of services and corresponding changes in volume were calculated.

**Results:** Within the range of codes included in the study, the total number of outpatient spine procedures rose approximately 193% from 2010 to 2021, with compound annual growth rate (CAGR) for outpatient procedures per year of 9.9% for HOPDs and 15.7% for ASCs (-2.2% for inpatient procedures). Within this period, the ASC list grew from 12 procedures to 58 procedures. In 2021, the highest volume ASC procedure was HCPCS 63047, at approximately 4970 procedures.

**Conclusions:** This study demonstrates a trend of increasing utilization of HOPDs and ASCs for spine procedures among Medicare beneficiaries from 2010 to 2021. Though HOPDs are currently more widely utilized, the ongoing additions of spine procedures to the ASC covered procedures list may shift this balance.

## Introduction

Improving efficiency is important for controlling healthcare costs. One potential area of cost savings is the transition of surgical care from hospital inpatient departments to hospital outpatient departments (HOPDs) and ambulatory surgical centers (ASCs). This transition has been occurring in multiple surgical specialties, with findings demonstrating care delivered in ASCs and HOPDs may result in lower overall spending for a given procedure, often due to lower administrative costs [1–3].

Utilization of outpatient spine surgery has been increasing since the 1990s, with the advent of outpatient discectomies [4–6]. The safety of performing spine procedures in an outpatient setting depends on appropriately selected patients and procedures. Specific emphasis has been placed on anterior cervical discectomy and fusion (ACDF), lumbar microdiscectomy, and transforaminal lumbar interbody fusion (TLIF) [4,5,7] as prototypical outpatient spine procedures due to relatively shorter duration of procedure and timely postoperative recovery. Yet, the safety and feasibility of outpatient surgery is particularly challenging in the Medicare population, given a relatively older patient age. Previous studies of the safety of outpatient surgery have mostly excluded

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\* Corresponding author. Corewell Health East William Beaumont University Hospital, 3535 W. 13 Mile Road Suite 744, Royal Oak, MI 48073, USA. Tel.: (248) 551-1852.

E-mail address: [alex.miller@corewellhealth.org](mailto:alex.miller@corewellhealth.org) (A.K. Miller).

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this population [8,9]. In a 2019 study of Medicare Standard Analytic Files containing 17,421 patients undergoing ACDF, only 5.9% of Medicare patients underwent an outpatient procedure, with no statistically significant differences in readmission [8].

Aside from patient characteristics, access to outpatient spine surgery in the Medicare population also depends on specific reimbursement restrictions. For patients under Medicare, the Inpatient Prospective Payment System lists procedures that must be conducted in an inpatient setting. Furthermore, the Outpatient Prospective Payment System (OPPS) Addendum E further denotes procedures that are excluded from payment in ASCs. On a yearly basis (with periodic corrections), Centers for Medicare and Medicaid Services releases updated ambulatory surgical center payment regulations, including additions to the ASC Covered Procedures List (“ASC-list” or ASC CPL). Criteria for addition to the ASC-CPL have varied; currently, procedures are added to this list after a nomination process. Eligible procedures include existing OPPS procedures which do not pose a significant safety risk if performed in an ASC and procedures that would not be typically expected to require monitoring or care at midnight following the procedure [10]. After nomination, CMS regulators adjudicate the addition of procedures to the ASC CPL, with guidance from key stakeholders and consideration of applicable research [11].

Though the success of outpatient procedures in the private market has informed Medicare policy, studies investigating outpatient spine surgery in the Medicare population remain an emerging interest. A growing number of procedures are now available to Medicare beneficiaries in the HOPD and ASC settings, though the utilization of these outpatient venues has not been fully described. This study was intended to demonstrate procedural trends in outpatient spine surgery within the Medicare population, as well as to quantify changes in volume after transition of a procedure from the inpatient-only list to ASC coverage.

## Materials and methods

The Medicare Physician Supplier Procedure Summary public-use files [12] (PSPS) were used for this study. These files are available online and free of charge, including aggregated data from suppliers for Medicare part B fee-for-service claims, published yearly from 2010 through 2021 (current at time of manuscript preparation). Previous studies in the fields of otolaryngology have demonstrated the utility of this database for illustrating practice trends within a surgical subspecialty [13].

Study data was restricted to HCPCS codes for spine procedures commonly performed by both orthopaedic spine surgeons and neurosurgeons (ranges 22010–22899 and 62380–63103). These ranges are inclusive of decompressive procedures and instrumentation; procedures such as intradural or intramedullary spinal cord tumor resection, spinal cord neurostimulator implantation, and rhizotomy procedures were excluded. Procedures chosen were referenced to the Medicare ASC Covered Procedures List (CPL). Database analysis was limited to surgical charges by restricting analysis to services within the database coded and billed as surgery. Locations of care were specified and limited to off-campus hospital outpatient departments, on-campus hospital outpatient departments, hospital inpatient, and ambulatory surgery centers (location of service codes 19, 22, 21, and 24, respectively). For some procedures of interest, analysis was dichotomized by specialty to orthopedic surgery and neurosurgery (provider codes 14 and 20). Total payments corresponding to each HCPCS code were summed for each supplier, according to location of service.

Of note, to protect confidentiality, the Physician Supplier Procedure Summary Data File does not display exact procedure counts for Medicare suppliers with less than 11 services for a given HCPCS code. To estimate the procedure counts of these suppliers, suppressed data was imputed by matching average payments from nonsuppressed suppliers within the same HCPCS code, year, geographic region, 1st HCPCS modifier, and place of service. Estimated procedure volume was calculated by dividing

the “national clearing house (NCH) payment amount” (included for all suppliers) by the corresponding estimated average charge and rounded down to the nearest 10. To comply with the CMS public use file Data Use Agreement, all previously withheld/suppressed data is presented in aggregate form across suppliers and all imputed fields with less than 11 services are reported as “<11.”

Data acquisition and statistical analysis were performed with R version 4.1.2 (The R Foundation for Statistical Computing) and Microsoft Excel software. A significant value of  $\alpha=0.05$  was used. No protected health information or patient identifiers were utilized for this study; IRB approval was not required by our institution.

## Results

A summary of year-to-year additions of HCPCS codes to the ASC list in the analysis range is summarized in Table 1. A total of 12 codes were included on the ASC list from 2010–2012, which expanded to 58 total codes in 2021. A listing of HCPCS codes and descriptions of corresponding procedures is included in Supplementary Table 1 [14].

As imputation was required to calculate the outcomes of interest for suppressed data, overall procedure trends should be interpreted as estimates. Approximately 17.4% of data is derived from imputation. Fig. 1 demonstrates the total number of inpatient and outpatient procedures for the range of years included in the study. The total number of outpatient procedures rose 193% from 2010 to 2021. The total number of inpatient procedures remained relatively stable from 2010 to 2018 (0.5% increase), with decreases in 2020 and 2021 (-15.9% and -22.4% percent from 2019 case volume, respectively). During 2020, outpatient procedures decreased by 4.2% when compared to 2019. In 2021, outpatient procedures increased 28.6% compared to 2019. In 2015, outpatient procedures represented 14.2% of the total volume within the range of procedures in this analysis, compared to 30.1% in 2021.

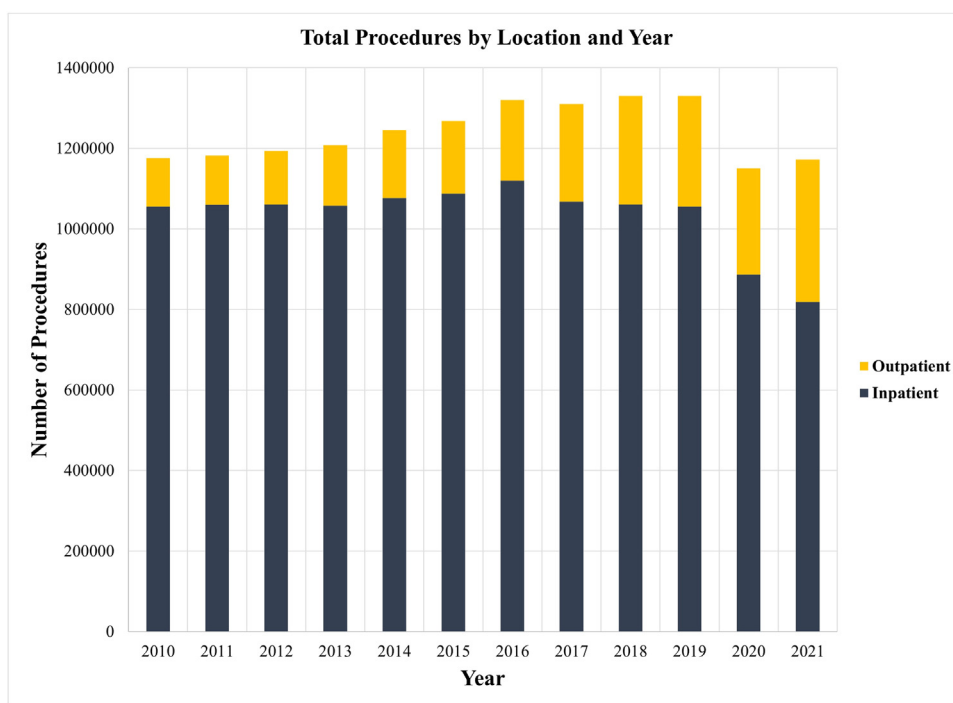
Fig. 2 summarizes outpatient procedures per year, by site of care (HOPD vs. ASC). The compound annual growth rate (CAGR) for outpatient procedures per year was 9.9% for HOPDs and 15.7% for ASCs. Fig. 3A and B summarize the number of procedures per year for neurosurgeons versus orthopedic spine surgeons at ASCs and HOPDs, respectively. From 2010–2014, orthopedic surgeons demonstrated higher utilization of ASCs compared to neurosurgeons (cumulative 10,530 procedures vs. 4580,  $p=.002$ ); there was no significant difference when considering 2015–2021 (cumulative 54,500 procedures vs. 51,190,  $p=.071$ ).

Fig. 4 demonstrates procedural volume trends for a sample of three procedures removed from the “inpatient only” list and added to the ASC payment list in 2015 (HCPCS 22551, 22633, 63047). These represent the primary code for the procedure. For HCPCS 22551, (anterior cervical discectomy and fusion, billing for first interspace), high growth was seen at both HOPDs and ASCs, with 383% and 303% growth, respectively, from 2015–2021. Despite high growth, the total volume of ACDF procedures performed at ASCs represented 4.5% of total volume in 2021. Similarly, for HCPCS 22633 (posterior or posterolateral arthrodesis with posterior interbody fusion, single level), among the total volume of procedures, inpatient procedures represented 77.8%, HOPD 22.0%, and ASC 0.2% of total volume, respectively.

Fig. 5A illustrates top procedures performed in hospital outpatient departments that are included on the ASC list from 2019–2021. In 2021, HCPCS 22853 (insertion of interbody biomechanical device) was the highest volume, representing 41,400 procedures. As a comparison, Fig. 5B illustrates top procedures performed in hospital outpatient departments that are not included on the ASC list from 2019–2021. Of note, HCPCS code 63048 was the highest volume procedure performed in HOPDs in 2019 and 2020. This code was subsequently added to the ASC list in 2021. Fig. 5C illustrates top procedures performed in ASCs from 2019–2021; in 2021, HCPCS code 64047 (single level laminectomy, facetectomy, and/or foraminotomy) represented 4,970 procedures.

**Table 1**  
Summary of year-to-year additions to ASC list.

| Year             | 2010*–<br>2012*                                                                                                     | 2013                      | 2014 | 2015                                                                                    | 2016            | 2017                                                                                                                          | 2018            | 2019 | 2020 | 2021                                                                                                                                                        |
|------------------|---------------------------------------------------------------------------------------------------------------------|---------------------------|------|-----------------------------------------------------------------------------------------|-----------------|-------------------------------------------------------------------------------------------------------------------------------|-----------------|------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Additions</b> |                                                                                                                     |                           |      |                                                                                         |                 |                                                                                                                               |                 |      |      |                                                                                                                                                             |
|                  | 22102,<br>22103,<br>22305,<br>22310,<br>22315,<br>22505,<br>22520,<br>22521,<br>22522,<br>22523,<br>22524,<br>22525 | 63001,<br>63003,<br>63005 | 0    | 22551, 22554,<br>22612, 22614,<br>63020, 63030,<br>63042, 63044,<br>63045, 63047, 63056 | 63046,<br>63055 | 22552,<br>22585,<br>22840,<br>22842,<br>22845,<br>22853,<br>22854,<br>22859,<br>22867,<br>22868,<br>22869,<br>22870,<br>62380 | 22856,<br>22858 | 0    | 0    | 22100,<br>22101,<br>63011,<br>63012,<br>63015,<br>63016,<br>63017,<br>63035,<br>63040,<br>63043,<br>63048,<br>63057,<br>63064,<br>63066,<br>63075,<br>63076 |
| <b>Removals</b>  | 0                                                                                                                   | 0                         |      | 0                                                                                       | 0               | 22305                                                                                                                         | 0               | 0    | 0    | 0                                                                                                                                                           |
| <b>Total</b>     | 12                                                                                                                  | 15                        |      | 26                                                                                      | 28              | 40                                                                                                                            | 42              | 42   | 42   | 58                                                                                                                                                          |



**Fig. 1.** Inpatient and outpatient procedure volume, 2010–2021.

**Discussion**

This study demonstrates a trend of increasing utilization of hospital outpatient departments and ambulatory surgery centers for spine procedures among Medicare beneficiaries from 2010 to 2021. This trend is likely to continue, given the ongoing additions of spine procedures to the ASC list. Similarly, several highly utilized procedures are observed in the HOPD setting that are not yet included on the ASC covered procedures lists. Though there has been growth in both HOPD and ASC utilization, this study demonstrates a substantially greater volume of HOPD procedures compared to ASC procedures for the range of HCPCS codes included in the study.

The disparity between hospital outpatient departments and ASC utilization underscores a critical factor in mitigating risk in outpatient spine surgery—the ability to convert to an inpatient admission without patient transportation [15]. Several strategies appear promising for

minimizing the transition of planned outpatient procedures to inpatient admission, including optimization of postoperative analgesia protocols and providing educational materials at outpatient discharge for recognizing postoperative complications [5,16–18]. A recent systematic review demonstrated that GI-related adverse events and urinary retention were among the most common complications following outpatient spine surgery [18], highlighting the importance of routine postoperative preventive care and counseling on common postoperative complications. Preoperative risk calculators are an emerging tool for patient selection; a recent study demonstrated the utility of preoperative demographic and cardiac characteristics to predict the risk of a new-onset postoperative arrhythmia after lumbar fusion [19]. This study demonstrated significant predictive findings when accounting for age, history of beta blocker use, and levels fused (overall model with AUC 0.742), which may inform patient selection for inpatient versus ambulatory procedures, as a newly observed arrhythmia may necessitate inpatient transfer if first observed

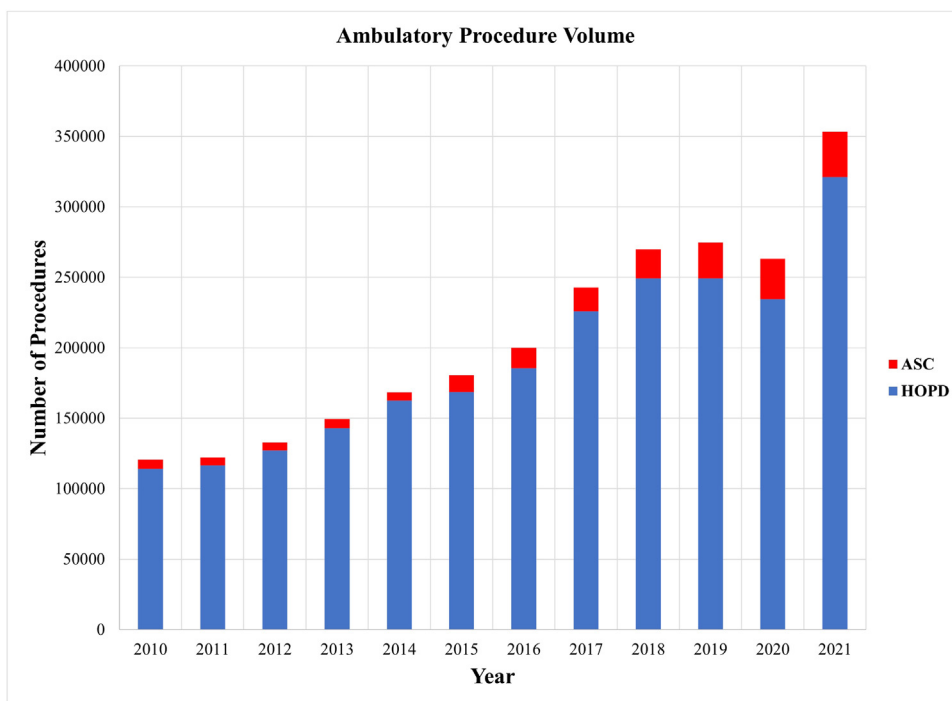


Fig. 2. ASC and HOPD procedure volume, 2010–2021.

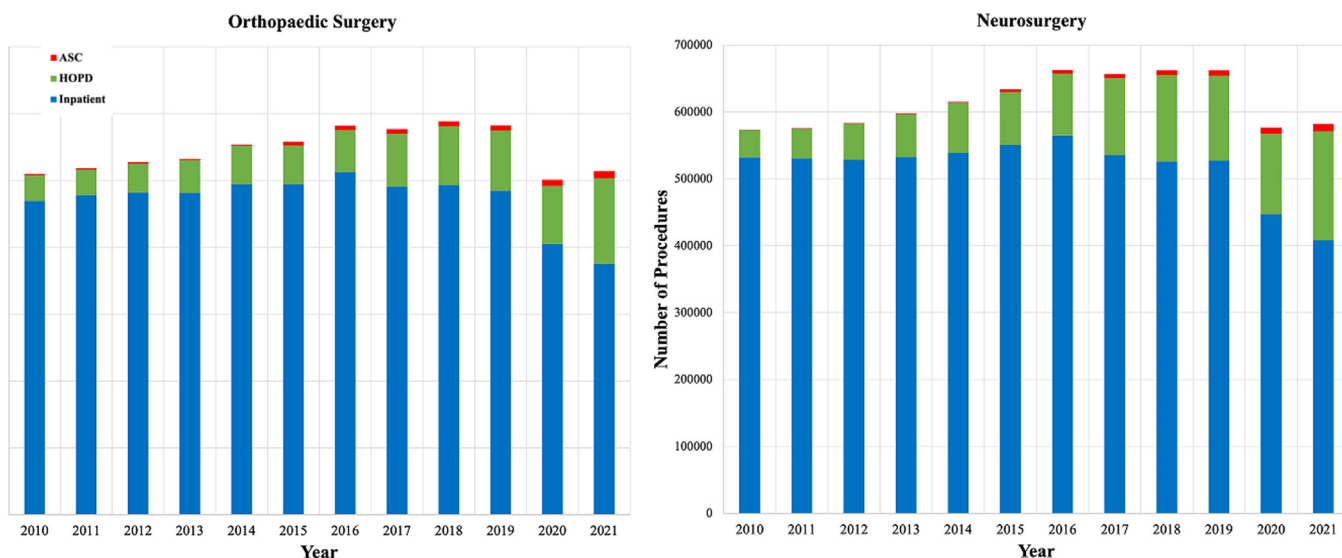


Fig. 3. (A) Neurosurgeon ASC and HOPD utilization, 2010–2021. (B) Orthopaedic spine surgeon ASC and HOPD utilization, 2010–2021.

in the outpatient perioperative setting. Given disparities in age between Medicare patients and the average age of patients included in most existing studies, care must be taken when interpreting the safety in outpatient spine surgery in an older population.

In an early investigation of patient selection for outpatient ACDF by Stieber et al. [20], specific patient characteristics relevant to technical aspects of ACDF were chosen to optimize procedure-specific complications. As such, the authors excluded patients undergoing operations above C4-5, those with myelopathy, large subjective neck size, estimated operative time >2 hours, home living situations not conducive to postoperative care, and living distant from emergency care. With a cohort of 30 outpatients, the authors observed only three patients with minor postoperative dysphagia. Several other studies have attempted to

elucidate risk factors for complications in the outpatient setting, with some studies demonstrating fewer complications in patients undergoing outpatient spine surgery [15,21]. This finding is often attributed to patient selection bias [22,23].

Comparing outcomes between outpatient and inpatient spine procedures is contingent on case complexity and patient selection; ultimately, for some late complications, patient outcomes and management may be unrelated to the initial setting of surgery (ASC vs. HOPD vs. inpatient) [24]. The appropriate duration of monitoring before discharge is also subject to debate. In a prospectively collected study of 390 inpatients undergoing ACDF, time to complication was noted. Of 37 complications, 17 were detected in the first 6 hours after surgery, including 5/5 of the neck hematomas reported. The remaining complications occurred in the

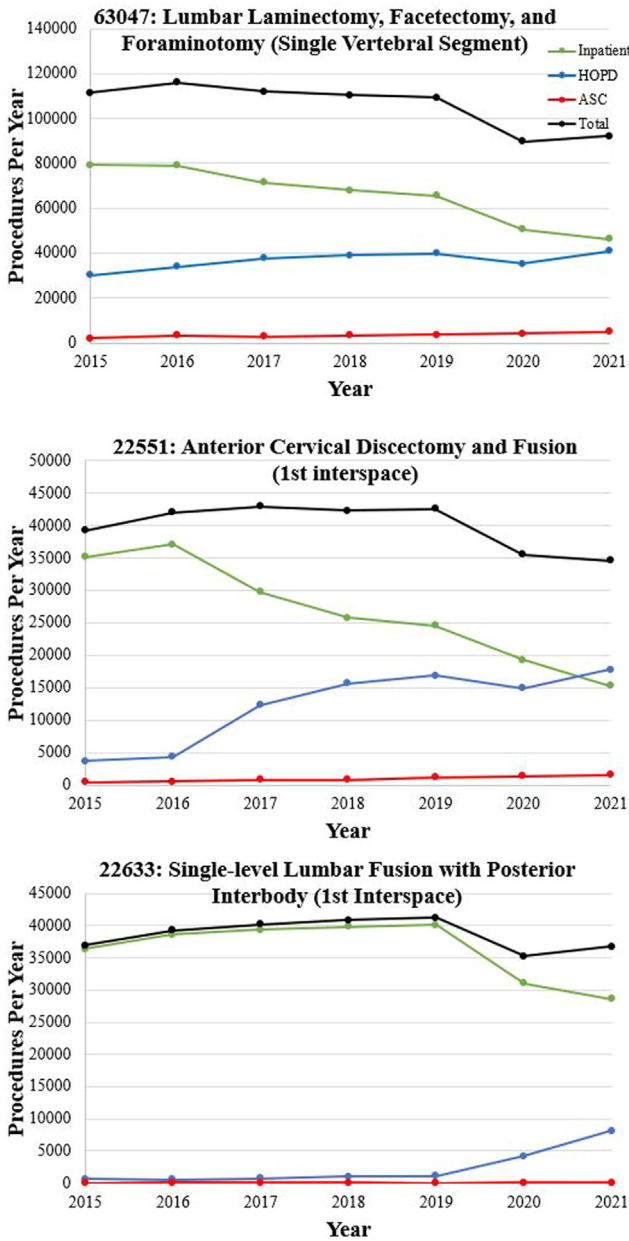


Fig. 4. Procedural volume changes after addition to ASC list (HCPCS codes 63047, 22551, 22633).

late period (>72 hours), except for one complication occurring between 6–72 hours [25]. Carlson et al. [22] investigated rapid-response team activations after inpatient ACDF and CDA. This study noted the timing of hematomas, with two hematomas within 6 hours and one at 8.8 hours. As a result, the authors recommend monitoring a patient for at least 9 hours before discharge. This requirement may not be feasible given the limited working hours at many ASCs.

A prominent driving factor for the transition to outpatient spine surgery is a perception of lowered overall cost [20,26]. However, price reduction depends on the specific procedure and the site of care (ASC vs. HOPD). For posterior lumbar interbody fusion (including CPTs 22630, 22633, 22851, and 22840), Jain et al. investigated average hospital reimbursement utilizing the PearlDiver database [27]. From 2007–2015, the average hospital reimbursement with Medicare Advantage was \$20,251 versus \$16,846 for inpatient and outpatient procedures, respectively. A recent study encompassing a variety of outpatient or-

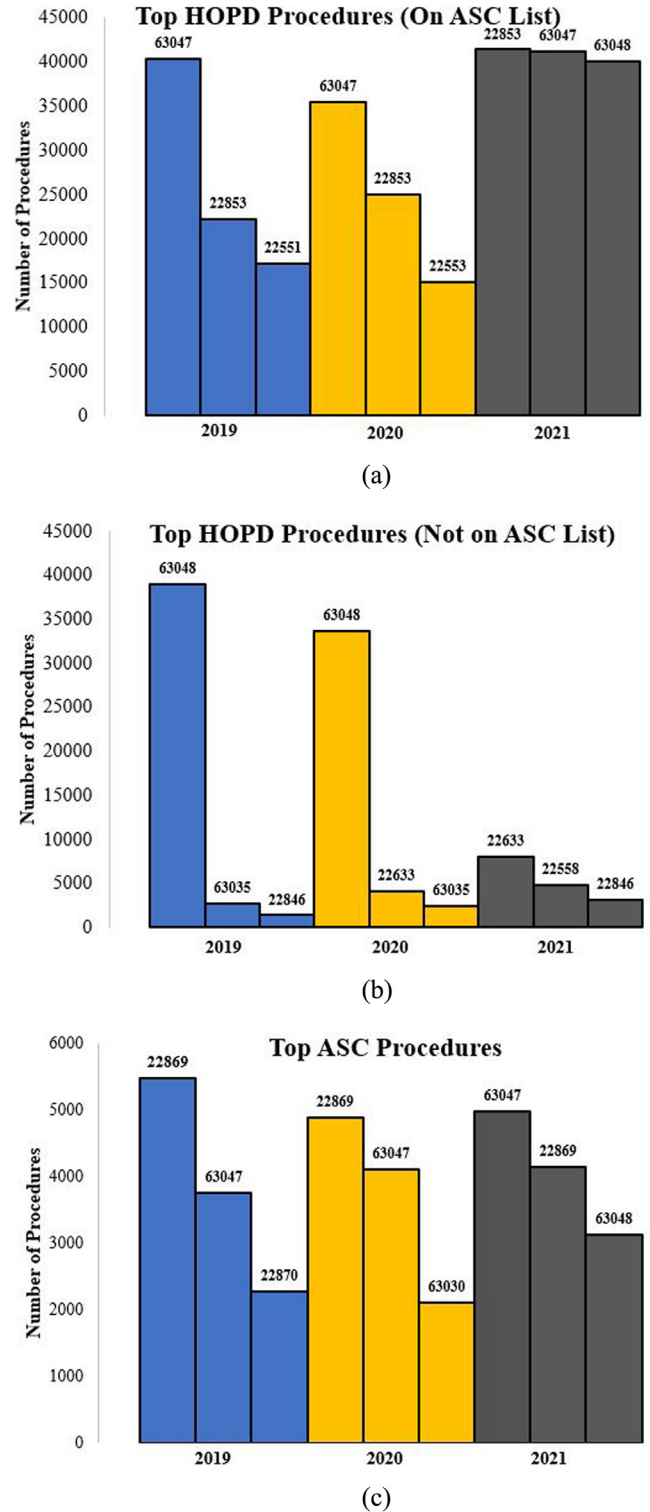


Fig. 5. (A) Top procedures performed in HOPDs (included on ASC list), 2019–2021. (B) Top procedures performed in HOPDs (not included on ASC list), 2019–2021. (C) Top ASC procedures, 2019–2021.

thopedic procedures (including lumbar microdiscectomy) found that the average total costs were 26% lower at ASCs than HOPDs [28]. For single-level lumbar microdiscectomy, Malik et al. reported a cost of approximately \$7829 at HOPDs and \$5814 at ASCs for Medicare advantage patients, without statistically significant differences in complications and readmissions [29]. For patients undergoing ACDF, Khalid et al. [8] show



a marginal reduction in the cost of ACDF in the ASC setting compared to HOPD (\$7774.80 vs. 7956.75, respectively).

Though the actual procedure may be less expensive when performed in the outpatient setting, readmissions or other unanticipated postoperative charges increase the overall cost of care [30]. In a study by Alvi et al. [23], Healthcare Cost and Utilization Project Data was analyzed for outpatient lumbar decompression (including CPTs 63005, 63012, 63030, 63042, and 63047) for ASC and HOPD patients. They found higher 7-, 30-, and 90-day readmission charges in ASC patients and approximately \$4000 higher bills to Medicare patients undergoing surgery at an ASC compared to hospital outpatient departments (\$37,457.75 vs. 33,408.00). Patients with anxiety/depression or severe mental illness tend to have significantly increased rates of ED visits at 30 days without corresponding increases in reoperation, suggesting the importance of targeted follow-up in this population [31].

Surgeon practice patterns are another possible explanation for the increased popularity of HOPDs over ASCs. In a survey study of orthopedic and neurosurgery-trained spine surgeons, 84.2% performed some degree of ambulatory spine surgery; 94.3% of surgeons in private practice performed ambulatory surgery. Among these surgeons, 39.6% performed ambulatory surgery in the hospital setting, 20.8% utilized an ASC, and 39.6% used both [32]. In a study of the New York Statewide Planning and Research Cooperative System, 96 surgeons performed outpatient ACDF or cervical disc arthroplasty in 2010, compared to 376 surgeons in 2018 [33]. Given the efficiency of the ambulatory environment, a surgeon may have the incentive to utilize the ASC or HOPD setting to maximize procedures performed in a given amount of time [28]. Surgeon ownership of ASCs may be a financial factor influencing place of care [32,34], though the PSPS data used in this study does not include information to further investigate this influence.

Several important limitations of this study must be acknowledged. Public-access Medicare files used in this study suppressed information that was deemed identifiable. As such, imputation was used to account for this missing data. An imputation strategy deriving estimates of procedure costs based on higher-volume suppliers was utilized; given the established price-volume relationships, this likely underestimates the charge per procedure for smaller-volume providers. The lack of patient-level data, including comorbidities and age, limits the use of this study for risk assessment. Finally, for 2020 and 2021 data, the impact of the Coronavirus-19 pandemic on inpatient and outpatient procedure volumes has not been fully characterized. Given widespread suspensions of elective procedures and careful adjudication of hospital resources resulting from the pandemic, there may be a disparity in volume changes observed for inpatient and outpatient procedures during and after these years.

## Conclusions

An overall trend of increasing utilization of outpatient spine surgery is seen in the Medicare population, particularly after substantial additions to the ASC list in 2015. Though procedural volume in ASCs is rising, the majority of outpatient spine procedures are still performed in the HOPD setting.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.nxj.2024.100314](https://doi.org/10.1016/j.nxj.2024.100314).

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