



Ambulatory versus inpatient shoulder arthroplasty: a population-based analysis of trends, outcomes, and charges

Gabriella E. Ode, MD ^{a,*}, Susan Odum, PhD ^b, Patrick M. Connor, MD ^c, Nady Hamid, MD ^c

^a Department of Orthopaedic Surgery, Prisma Health - Upstate, Greenville, SC, USA

^b Atrium Health Musculoskeletal Institute, Charlotte, NC, USA

^c OrthoCarolina Sports Medicine Center, Charlotte, NC, USA

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Background: The purpose of this study was to evaluate the clinical outcomes and cost of shoulder arthroplasty (SA) performed in ambulatory surgery centers (ASCs) compared with SA performed in hospital-based surgery settings.

Methods: The State Inpatient Databases and the State Ambulatory Surgery Databases were queried for patients undergoing primary or reverse SA between 2010 and 2014 in 5 states in either the inpatient (IP), hospital outpatient department (HOPD), or ASC setting. Outcomes included all-cause readmissions, emergency department visits within the 90-day postoperative period, and charges. Covariates included patient demographic data and procedure details. Risk factors for readmission were calculated using logistic regression analysis.

Results: We identified 795 ASC (2%), 183 HOPD (0.5%), 38,114 (97.5%) SA procedures. The outpatient cohort was overall younger and healthier with a lower percentage of diabetes (14.1% vs. 20.2%), cardiopulmonary disease (11.4% vs. 20.4%), and obesity (10.7% vs. 15.6%). The US state and obesity were factors significantly ($P < .0001$) associated with readmission. The median IP charge was \$62,905 (range, \$41,327–\$87,881) vs. \$37,395 (range, \$21,976–\$61,775) for combined outpatient cases. When outpatient SA was stratified into ASC and HOPD cases, the median charges were \$31,790 for ASC cases vs. \$55,990 for HOPD cases ($P < .0001$). After adjustment for multiple covariates, the charges for combined outpatient SA surgery were 40% lower than those for IP SA surgery ($P < .0001$).

Conclusion: As the current health care climate shifts toward lower-cost and higher-quality care, this study demonstrates that SAs performed in ASCs have a comparable safety profile to and significant financial advantage over SAs performed in the hospital-based setting.

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The rate of shoulder arthroplasty (SA) in the United States is steadily increasing,^{9,15,22,27} with an average annual growth of 12.3%.²¹ The precipitous increase in anatomic total shoulder and reverse total SAs performed over the past 20 years is likely driven by an aging population, expanding surgical indications,²¹ and technologic advances in the procedure. As SA in the United States has become more common with relatively few perioperative and postoperative complications,^{1,9,13,22,25} the average length of stay for SA patients has decreased significantly in the past 20 years.^{4,8,17,22} Concurrently, the proportion of SAs performed in the outpatient setting continues to rise. Cancienne et al⁶ reported a 107% increase in outpatient SAs over a 5-year period. A recent population-based study of the American College of Surgeons (ACS) National Surgical

Quality Improvement Program (NSQIP) database comparing inpatient (IP) SA vs. SA performed in a hospital outpatient setting found no significant difference in 30-day adverse events or readmission rates compared with IP SA.¹⁶ Other clinical and population-based studies have endorsed a similar safety profile compared with the IP setting in the appropriately selected patient.^{5,6}

A recent nationwide emphasis on high-quality, cost-effective care may have ramifications for patient selection and facility selection in SA. Ambulatory surgery centers (ASCs) are freestanding entities that provide outpatient surgical services to patients who do not require hospitalization.¹⁸ From the perspective of Medicare, outpatient surgical procedures performed in ASCs are distinctly different from those performed in a hospital outpatient department (HOPD). Furthermore, the number of Medicare-certified ASCs is growing¹⁹ as more studies have demonstrated comparable safety profiles of procedures performed in ASCs.^{12,26} Broolin et al⁵ reported that SA could be performed safely in an ASC in the appropriately selected patient with no significant difference in short-term

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* Corresponding author: Gabriella E. Ode, MD, 309 E 1st Ave, Easley, SC 29640, USA.

E-mail address: gabriellaode@gmail.com (G.E. Ode).

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outcomes or complication rates. Although several population-based studies have compared IP SAs with outpatient SAs performed in the hospital setting, the characteristics and cost analysis of outpatient SAs performed in ASCs have not been extensively evaluated.

The purpose of this study was to evaluate the characteristics, clinical outcomes, and associated cost of SA performed in an ASC compared with SA performed in the hospital-based IP and hospital-based outpatient surgery settings. We hypothesized that SAs performed in the ASC setting (1) would have a higher proportion of clinically healthy, low-risk patients, (2) would have similar readmission rates and complication rates, and (3) would incur lower perioperative charges than those performed in hospital-based surgery settings.

Methods

Data sources

Data from the 2010 through 2014 releases of the State Inpatient Databases (SIDs) and the State Ambulatory Surgery Databases (SASDs) were used. These data are obtained from the Healthcare Cost and Utilization Project (HCUP), which is sponsored by the Agency for Healthcare Research and Quality (Rockville, MD, USA). The SIDs and SASDs contain deidentified data.^{10,11} We selected a 5-year range dating back from the most recently available database year (2014) released by the HCUP when access to the database was granted in July 2017. States that participate in the SIDs submit encounter-level data on IP discharges collected by nonfederal community hospitals, including data on demographic information and diagnostic and procedural codes (using the *International Classification of Diseases, Ninth Revision* current modification [ICD-9] and Current Procedural Terminology [CPT] codes), as well as the length of stay, discharge disposition, and hospital charges.¹⁰ States that participate in the SASDs submit encounter-level data on ambulatory surgical procedures performed in both hospital-affiliated and freestanding ASCs, including demographic data, ICD-9 codes, and Current Procedural Terminology 10 codes, as well as encounter charges.¹¹ The specific types of ambulatory surgery and outpatient services included in each SID and SASD vary by state and data year. Furthermore, a small number of states within the SIDs and SASDs are able to track emergency department visits during the same 90-day patient encounter using the State Emergency Department Database to provide additional data on charges, diagnostic codes, and procedural codes, which may have occurred after SID or SASD discharge. Currently, there are 32 states that have databases available for purchase among the SIDs and 21 states with available databases among the SASDs, with 20 states providing access to both the SASD and SID. Of the aforementioned states, only 16 provide linked data on emergency department visits. Ultimately, we selected the SASDs and SIDs from 5 highly populated states that represent different geographic regions of the United States and had complete data sets between 2010 and 2014: California, Florida, Maryland, New York, and Wisconsin.

Cohort definition

Our cohort of patients was established using the ICD-9 procedure codes for SA (81.80 and 81.88). Encounters were included if they contained the ICD-9 diagnostic codes for nontraumatic shoulder arthropathy (715.11, 715.21, 715.91, 716.51, 716.61, 716.81, 716.91, 718.01, or 718.51), post-traumatic shoulder arthropathy including malunion or nonunion (716.11, 733.81, or 733.82), inflammatory shoulder arthropathy (714.0, 714.9, 712.91, 712.81, or 712.11), or avascular necrosis of the shoulder (733.41 or 733.49).

The exclusion criteria were any encounter for revision SA (code 81.97) or hemiarthroplasty (code 81.81) or encounters with additional ICD-9 codes that indicated polytrauma of the upper or lower extremity; prior infection of the shoulder; malignancy; prior shoulder dislocation or shoulder instability; or prior surgery such as hardware removal, arthrodesis, or internal fixation.

For the definitions of the study parameters, patients in the SASDs were classified as those who underwent ambulatory outpatient procedures (ASC) whereas patients in the SIDs were classified as those who underwent either hospital-based outpatient department procedures, based on a hospital length of stay of less than 1 day, or hospital IP procedures, based on a length of stay of 1 day or more. From 2010 to 2014, SA was performed in 38,297 patients in the SIDs and 795 patients in the SASDs. Among the 38,297 patients in the SIDs, 38,114 underwent IP procedures and 183 were treated as hospital-based outpatients.

Variables

The outcome variables assessed included readmission and total charges (proxy for cost) for the procedure. Readmission was defined as 90-day postoperative readmission to any hospital for any reason or an emergency department visit within the 90-day postoperative period. Total charges were determined for the ambulatory and hospital-based cohorts and included charges for the procedure, as well as the episode of care. Covariates included outpatient vs. IP, patient demographic data (age, sex, and race), patient comorbidities (obesity, diabetes, and cardiopulmonary disease), and procedure details such as location (state), as well as use of a peripheral nerve block as part of surgical anesthesia. Use of a peripheral nerve block for regional anesthesia was queried under secondary procedure codes during the surgical encounter.

Statistical analysis

Descriptive statistics were calculated including frequency, proportions, measures of central tendency, and variability. We used χ^2 tests to determine differences in proportions for binary and categorical variables. A multivariate logistic regression was used to determine the effect of outpatient surgery on the risk of readmission after controlling for patient and procedure covariates. The distribution for the total charges was evaluated and was not normally distributed. Therefore, a Wilcoxon test was used to determine the difference in total SA charges between cases performed in an IP setting and those performed in an outpatient setting. Charges were log transformed, and a multivariate generalized estimating equation was used to quantify the effect of outpatient surgery on the total charges after controlling for patient and procedure covariates.

Results

Patient demographic data

Demographic data were available for 37,881 IP SAs and 974 combined outpatient SAs (HOPD + ASC). Patient and facility characteristics are outlined in [Table 1](#). The median age of the outpatient SA group was 5 years younger than the IP group (66 years vs. 71 years), and the outpatient SA group had a greater proportion of male patients (53% vs. 42.9%). The outpatient cohort was overall healthier as demonstrated by a lower rate of diabetes (14.1% vs. 20.2%), cardiopulmonary disease (11.4% vs. 20.4%), and obesity (10.7% vs. 15.6%). Medicare was the predominant payer for both groups, representing over two-thirds (72%) of the IP payers and over one-half (51.5%) of the outpatient payers. Private insurance accounted for 38.9% of outpatient SAs compared with only 20.8% of

IP SAs. Peripheral nerve blockade as regional anesthesia was used in 18.2% of outpatient SAs vs. only 10.4% of IP SAs.

Readmission

The factors associated with readmission are outlined in Table II. The state in which the procedure was performed and a patient history of obesity were factors significantly ($P < .0001$) associated with the readmission rate. The readmission rate was highest in New York (8%; 846 of 10,401), followed by Florida (7%; 1081 of 16,553), Maryland (5%; 121 of 2518), Wisconsin (4%; 158 of 3528), and California (4%; 251 of 6092). The readmission rate was 8% among obese patients (452 of 6002) compared with 6% among patients who were not obese (2005 of 33,090).

The readmission rate for SA cases performed in an ASC (8%; 65 of 795) was slightly higher than that for SAs performed in a HOPD (6%; 11 of 183) or on an IP basis (6%; 2381 of 38,114); however, this difference was not statistically significant ($P = .0844$).

The results of the logistic regression model of the readmission risk between IP and combined outpatient (HOPD + ASC) SAs are outlined in Table III. After adjustment for all covariates, the risk of readmission for combined outpatient cases was no longer statistically significant. Compared with the IP setting, the odds of a readmission following combined outpatient surgery was 1.209 (95% confidence interval, 0.95–1.539). The odds of readmission for obese patients was 1.3 (95% confidence interval, 1.166–1.453). Use of regional anesthesia was not associated with readmission (odds ratio, 0.995).

Charges

The charges for SA were significantly ($P < .0001$) higher for IP cases than for cases performed in the combined outpatient setting. The median charge for IP cases was \$62,905 (range, \$41,327–\$87,881) compared with \$37,395 (range, \$21,976–\$61,775) for combined outpatient cases.

After adjustment for the effects of patient demographic characteristics and comorbidities, readmission, regional anesthesia use, and the state in which the case was performed (Table IV), the charges for combined outpatient SA surgery were 40% lower than those for IP SA surgery ($P < .0001$). The state where surgery was performed was an independent driver with a significant effect on the charges regardless of setting. Readmission, comorbidities, race, age, and sex were all independently and significantly associated with charges; however, the effects were minimal. When outpatient SA was stratified into ASC and HOPD cases, the median charges were \$31,790 for ASC cases vs. \$55,990 for HOPD cases, which was significantly different ($P < .0001$) (Table IV).

Discussion

This study analyzes the characteristics, readmission rates, and associated charges of 38,855 patients who underwent SA between 2010 and 2014. Although ASC SA had a slightly higher 90-day readmission rate than SA in the IP setting (8% vs. 6%), this finding was not statistically significant. Furthermore, overall SA performed in the combined outpatient setting did not carry a statistically significantly increased risk of readmission on multivariate analysis. Previous studies that have compared rates of readmission in outpatient and IP SA have reported 30-day readmission rates of 1.74% to 5.7% for outpatient SA and 2.93% to 5.0% for IP SA, with no significant difference between the 2 groups.^{6,16} Cancienne et al⁶ also reported on 90-day readmission rates and reported no significant difference at 90 days between ambulatory and IP SAs (9.3% vs. 9.0%). In a study of over 123,000 Medicare subscribers, IP SA was

found to have a significantly higher readmission rate than outpatient SA at both 30 days (0.83% vs. 0.60%) and 90 days (2.87% vs. 2.04%).² We would argue that our study is in line with these previous studies, which have shown that outpatient SA remains a safe procedure without a significantly increased risk of readmission compared with the IP setting.

An interesting finding within this study was that patients who underwent outpatient SA were more likely to be younger and healthier, which is consistent with findings in previous literature.^{2,16,20} That combined outpatient SA tended to occur in a younger and healthier population likely reflects a selection bias among patients selected to undergo orthopedic surgery in an ASC, which made up the majority of outpatient SAs in the study population. The precision with which orthopedic surgeons select patients appropriately for SA in the ASC setting is believed to be paramount to effectively minimize the risk of adverse events and readmission and to maximize cost benefit. Siow et al²³ reviewed over 4000 patients who underwent outpatient orthopedic surgical procedures in a freestanding ASC within a single hospital system and found that their established comorbidity exclusionary guidelines deemed 20% of their orthopedic patients ineligible for surgery in their ASC. These patients were subsequently treated in the IP setting. The majority of ineligible patients were excluded because of an American Society of Anesthesiologists (ASA) class 3 status, history of coronary artery disease with prior intervention, and history of morbid obesity. Leroux et al¹⁶ examined the rates of adverse events and readmission among IP and outpatient SAs in the ACS NSQIP database and found that their outpatient SA cohort had a significantly lower proportion of patients with ASA scores of class 3

Table I
Patient demographic characteristics of inpatient and outpatient SA

	Inpatient		Outpatient (HOPD + ASC)	
	Data	% of total (n = 37,881)	Data	% of total (n = 974)
Median age (range), yr	71 (64–77)		66 (59–74)	
Sex				
Male	16,248	42.9	519	53.3
Female	21,633	57.1	455	46.7
Payer status				
Medicare	27,562	72.8	502	51.5
Private	7874	20.8	379	38.9
Other	2022	5.3	64	6.6
Medicaid	653	1.7	32	3.3
Race				
White	32,263	85.2	852	87.5
Hispanic	2044	5.4	59	6.1
Black	1516	4.0	34	3.5
Other	1231	3.2	19	2.0
State				
California	5992	15.8	100	10.3
Florida	16,175	42.7	378	38.8
Maryland	2467	6.5	51	5.2
New York	10,108	26.7	293	30.1
Wisconsin	3372	8.9	156	16.0
Diabetes				
Yes	7635	20.2	137	14.1
No	30,479	80.5	841	86.3
Cardiopulmonary disease				
Yes	7717	20.4	111	11.4
No	30,397	80.2	867	89.0
Obese				
Yes	5898	15.6	104	10.7
No	32,216	85.0	874	89.7
Regional anesthesia				
Yes	3923	10.4	181	18.6
No	34,191	90.3	797	81.8

SA, shoulder arthroplasty; HOPD, hospital outpatient department; ASC, ambulatory surgery center.

Table II
Multivariate analysis of factors associated with readmission

	No readmission, n (%)	Readmission, n (%)	Total patients	P value
Location type				
Inpatient	35,733 (94)	2381 (6)	38,114	
Outpatient				
ASC only	730 (92)	65 (8)	795	.0844
HOPD only	172 (94)	11 (6)	183	
Combined (ASC + HOPD)	902 (92)	76 (8)	978	.0525
State				
California	5841 (96)	251 (4)	6092	
Florida	15,472 (93)	1081 (7)	16,553	
Maryland	2397 (95)	121 (5)	2518	
New York	9555 (92)	846 (8)	10,401	<.0001
Wisconsin	3370 (96)	158 (4)	3528	
Patient characteristics				
Race				
Black	1460 (94)	90 (6)	1550	
Hispanic	1996 (95)	107 (5)	2103	
Other	1164 (93)	86 (7)	1250	
White	30,990 (94)	2125 (6)	33,115	.0645
Sex				
Male	15,705 (94)	1062 (6)	16,767	
Female	20,701 (94)	1387 (6)	22,088	.8269
History of obesity				
No	31,085 (94)	2005 (6)	33,090	
Yes	5550 (92)	452 (8)	6002	<.0001
History of diabetes				
No	29,320 (94)	2000 (6)	31,320	
Yes	7315 (94)	457 (6)	7772	.1002
History of cardiopulmonary disease				
No	29,315 (94)	1949 (6)	31,264	
Yes	7320 (94)	508 (6)	7828	.4048
No. of comorbidities				
≤1	14,860 (94)	998 (6)	15,858	
2	9409 (94)	649 (6)	10,058	
>2	12,366 (94)	810 (6)	13,176	.6363
Regional anesthesia				
No	32,781 (94)	2207 (6)	34,988	
Yes	3854 (94)	250 (6)	4104	.5892

ASC, ambulatory surgery center; HOPD, hospital outpatient department.

or higher, significantly lower body mass index scores, and significantly lower rates of pulmonary disease and hypertension than the IP SA cohort. However, they did not quantify the risk of readmission or adverse events based on these patient characteristics.

Multivariate risk stratification among different SA populations can provide stronger evidence for the precise inclusion and exclusion of patients who can safely undergo SA in a freestanding ASC. The majority of studies evaluating risk factors for readmission, an increased length of stay, and adverse events have been in the IP population. Dunn et al⁸ evaluated risk factors for an increased length of stay among IP SA patients and found that the most significant predictors of an increased length of stay were renal insufficiency, cardiac disease, and an ASA class higher than 3, followed by age older than 80 years, female sex, diabetes mellitus, and chronic obstructive pulmonary disease. Singh and Ramachandran²² similarly noted significant age-related differences in mortality rates and length of stay among SA patients, with older patient subgroups having higher rates of mortality and higher proportions of patients with a length of stay greater than 2 days. In our study, we found higher rates of obesity and cardiopulmonary disease within our IP cohort; however, of these variables, only obesity carried an increased risk of readmission on multivariate analysis.

Among database studies that specifically looked at outpatient SA, the study by Cancienne et al⁶ evaluated patients undergoing SA

within the PearlDiver Humana database (PearlDiver, Colorado Springs, CO, USA). They found that obesity and morbid obesity were the only significant independent demographic risk factors for readmission whereas several medical comorbidities, including diabetes mellitus, peripheral vascular disease, cardiopulmonary disease (both congestive heart failure and chronic lung disease), depression, and chronic anemia, were also significant risk factors for readmission for both IP and outpatient SAs. Matsen et al¹⁷ analyzed over 17,000 primary total SAs in the New York State-wide Planning and Research Cooperative System (SPARCS) database and found that patients with a Charlson Comorbidity Index greater than 1 and patients aged 75 years or older had more than a 3-fold increase in the odds of readmission within 90 days compared with patients with no comorbidities and younger patients. Moreover, Basques et al³ found that a history of heart disease or hypertension was significantly associated with readmission in a cohort of over 1500 cases in the NSQIP database. On the basis of conclusions in the current literature as well as in our study, multiple comorbid conditions and morbid obesity may be the most reliable predictors of readmission following SA.

Regarding the financial implications of SA in the outpatient setting, combined outpatient SA had significantly lower charges than IP SA in this study. More so, charges for SA performed in ASCs were approximately half those of IP SA. We are unable to report on the specific charges that contribute to the lower charges of ASCs compared with the IP setting. Certain IP services such as nursing care, bed and facility costs, IP medications, and IP therapy services may be substantial contributors to charges during an IP stay, which are eliminated with same-day discharge. Furthermore, the younger and healthier population of patients who undergo SA in the ASC setting may require few services and incur lower charges than patients who are older with more comorbidities who are more commonly seen in the IP setting. Previous studies have outlined some of the cost differences between ambulatory and non-ambulatory SAs. Crawford et al⁷ performed a systematic review of IP and outpatient orthopedic surgery and concluded that outpatient procedures were associated with greater cost savings (up to 60% in mean total cost) than IP procedures. They noted that the greatest contributors to cost reduction in outpatients were lower operating room charges and savings from overnight admission charges and floor charges. Cancienne et al⁶ reported on the reimbursement costs of IP and outpatient SA from a single private insurance payer database and found that outpatient ambulatory total SA cases had significantly lower reimbursement costs than matched controls in several itemized cost categories including lower postanesthesia care unit costs, laboratory costs, occupational and physical therapy costs, and narcotic prescription costs. They also reported that diagnosis-related group-related reimbursed costs were approximately \$3600 less for outpatient SA than for IP SA. Our analysis differs from other studies comparing IP and outpatient SAs because it differentiates between SAs performed in IP settings, HOPDs, and ASCs. HOPDs and ASCs have distinctly different pay models. Medicare currently reimburses payers at much higher rates for equivalent SA procedures performed in HOPDs vs. in freestanding ASCs. Specifically, in 2017, the Medicare reimbursement rate for SAs performed in HOPDs was 85% higher than that for SAs performed in ASCs.¹⁸ From 2010 through 2014, the numbers of outpatient SAs grew in both HOPDs and ASCs but at a slower rate in the latter. It is postulated that this higher growth of SAs in HOPDs relative to ASCs may be a result of the lower Medicare reimbursement rates for SAs performed in ASCs, thus potentially diminishing the financial incentive to provide surgical services for Medicare patients in ASCs.¹⁸ In both the SASDs and SIDs, Medicare was the most common payer for SA, but it made up a smaller proportion of payers in the SASDs compared with the SIDs. This finding supports the

Table III
Logistic regression analysis for factors associated with readmission

Factor	Odds ratio	95% CI
Outpatient surgery		
Yes	1.209	0.95-1.539
No (reference)	—	—
Regional anesthesia		
Yes	0.995	0.867-1.142
No (reference)	—	—
State		
California	0.504	0.435-0.585
Florida	0.822	0.747-0.905
Maryland	0.6	0.486-0.741
Wisconsin	0.503	0.42-0.601
New York (reference)	—	—
Diabetes		
Yes	0.903	0.81-1.006
No (reference)	—	—
Cardiopulmonary disease		
Yes	1.043	0.941-1.156
No (reference)	—	—
Obesity		
Yes	1.302	1.166-1.453
No (reference)	—	—
Race		
Black	0.819	0.657-1.022
Hispanic	0.78	0.638-0.954
Other	0.951	0.758-1.194
White (reference)	—	—
Age	0.986	0.982-0.991
Sex		
Female	1.045	0.959-1.138
Male (reference)	—	—

CI, confidence interval.

argument that the Medicare payment structure affects the proportion of SAs performed in the ASC setting. The slowed growth of outpatient SA performed in ASCs may not be beneficial for ASC-eligible patients undergoing SA. Recent health policy literature has concluded that for outpatient procedures, ASCs provide higher-quality care than hospitals and have lower costs than hospitals.²⁰ Steinhaus et al²⁴ created a cost-savings identification model for IP and outpatient SA and estimated that transitioning an SA patient from the IP setting to the outpatient setting resulted in an estimated cost savings of up to \$15,500 per patient, with substantial cost savings to society of \$51 million to \$5.4 billion over a period of 10 years.

An interesting finding of our study was that the state where surgery was performed had a significant effect on readmission rates and charges regardless of setting. New York had significantly higher readmission rates and charges than the other states. In a recent HCUP report on geographic variation in hospital IP charges in the United States, it was reported that hospitals within the geographic region that includes New York had IP charges that were 16% higher than the national average.¹⁴ Alternatively, IP charges in the region that includes Wisconsin were 16% lower than the national average. Although this geographic variation is of interest, it is important to note that charges reported within HCUP databases such as the SIDs and SASDs reflect hospital list prices for the hospital stay. Hospital

list prices (charges) vary across hospitals and markets and are different from the final costs that are negotiated and paid by the primary payer. Numerous other factors may contribute to the geographic variations in charges, such as physician practice patterns, primary payer mix, access and availability of services in a given state, wages, and cost of living. Furthermore, the reason behind the significantly higher readmission rate for the state of New York is also unclear. New York patients may have more risk factors for readmission than patients in other states. Alternatively, there may be more New York hospitals and emergency departments that participate in the HCUP and, therefore, the capture rate of readmissions in this state may be influenced by selection bias. Unfortunately, we have no clear evidence to support either explanation, and the literature on geographic variations in readmission for orthopedic surgery is limited. Overall, the significance of these state-related findings, particularly regarding SA outcomes, remains unclear and represents a future area of study.

This study is not without limitations. This was a large database study; thus, similarly to previous studies, it is subject to granular data acquisition and coding errors at the encounter level that limit the ability to analyze the clinical outcomes of SA in greater detail. Furthermore, we were unable to provide reimbursement and cost data, and our results are reported as charges, which have wide variations at different institutions and in different locations in the country. Although cost-to-charge ratio data were available for the SIDs, they were not available for the SASDs, which limited our ability to perform a thorough cost analysis between the 2 cohorts. In addition, we cannot delineate the charges in the SASDs and SIDs, so we are unable to definitively report on which specific charges may contribute to the higher charges in the IP setting vs. the ambulatory setting. Finally, although there was no statistically significant difference in readmissions for ASC and outpatient cases on multivariate analysis and logistic regression, the ASC and outpatient cohorts had substantially smaller sample sizes than the IP cohort. It is possible that the smaller sample sizes may predispose our study to a type II error. Ultimately, although the statistical significance of the difference in readmission rates between IP and ASC cases is not supported, this finding may warrant a larger, prospective comparative study to help draw stronger conclusions on its clinical significance. The strength of our study is that the large patient numbers can better capture patient characteristics and outcomes among outpatient and IP SAs and their associated financial implications. Furthermore, this study is distinct in its ability to differentiate characteristics and outcomes of SAs performed in ASCs compared with those performed in hospital-based facilities, which may provide some insight on the impact of health policy regulating SAs performed in ASCs.

Conclusion

Outpatient SA incurred lower perioperative charges and similar readmission rates to IP SA. A history of morbid obesity was the only consistent risk factor for readmission. The charges for SAs performed specifically in ASCs were substantially lower than those for

Table IV
Patient charges

	Patients		Median charges, \$	Lower quartile, \$	Upper quartile, \$	P value
	Observed	Charges available				
Inpatient	38,114	37,175	62,905	41,327	87,881	>.0001
HOPD	183	181	55,990	39,446	63,043	
ASC	795	693	31,790	19,842	59,916	

HOPD, hospital outpatient department; ASC, ambulatory surgery center.

SAs performed in both IP and hospital-based outpatient facilities. As the current health care climate shifts toward lower-cost and higher-quality care, this study demonstrates that SAs performed in ASCs have a comparable safety profile to and significant financial advantage over SAs performed in the hospital-based setting.

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