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ORIGINAL ARTICLE

Insurance status affects postoperative morbidity and complication rate after shoulder arthroplasty

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Background: Shoulder arthroplasty is an effective procedure for managing patients with shoulder pain secondary to end-stage arthritis. Insurance status has been shown to be a predictor of patient morbidity and mortality. The current study evaluated the effect of patient insurance status on perioperative outcomes after shoulder replacement surgery.

Methods: Data between 2004 and 2011 were obtained from the Nationwide Inpatient Sample. Analysis included patients undergoing shoulder arthroplasty (partial, total, and reverse) procedures determined by International Classification of Disease, 9th Revision procedure codes. The primary outcome was medical and surgical complications occurring during the same hospitalization, with secondary analyses of mortality and hospital charges. Additional analyses using the coarsened exact matching algorithm were performed to assess the influence of insurance type in predicting outcomes.

Results: A data inquiry identified 103,290 shoulder replacement patients (68,578 Medicare, 27,159 private insurance, 3544 Medicaid/uninsured, 4009 other). The overall complication rate was 17.2% (n = 17,810) and the mortality rate was 0.20% (n = 208). Medicare and Medicaid/uninsured patients had a significantly higher rate of medical, surgical, and overall complications compared with private insurance using the controlled match data. Multivariate regression analysis found that having private insurance was associated with fewer overall medical complications.

Conclusion: Private insurance payer status is associated with a lower risk of perioperative medical and surgical complications compared with an age- and sex-matched Medicare and Medicaid/uninsured payer status. Mortality was not statistically associated with payer status. Primary insurance payer status should be considered as an independent risk factor during preoperative risk stratification for shoulder arthroplasty procedures.

This study was deemed not human subjects research by the Boston University Medical Center Institutional Review Board.

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Keywords: shoulder arthroplasty; reverse shoulder arthroplasty; medical complications; surgical complications; insurance status; shoulder arthritis

Shoulder arthroplasty is an effective procedure for managing patients with shoulder pain secondary to end-stage arthritis or degenerative joint disease. When nonoperative treatment is unsuccessful, shoulder arthroplasty can successfully reduce pain and restore function. Since the advent of this surgical procedure in 1893, medical advancements and improvements in implant design have led to the development of both the anatomic and reverse shoulder replacement procedures.¹² The number of shoulder arthroplasties performed annually consequently increased 2.5-fold between 2000 and 2008¹⁹ and continues to rise, due in large part to an aging demographic and surgeons' increasing familiarity with the techniques.

Recent legislative efforts such as the Patient Protection and Affordable Care Act of 2010 extends medical coverage to a previously uninsured population and emphasizes a better understanding of the preoperative factors associated with poor patient outcomes and increased costs. Patients with Medicare insurance are older than age 65 or receive the government-sponsored insurance because of permanent disability or dialysis. Medicaid insurance is a government-subsidized program that provides health care to low-income patients with poor socioeconomic status.

Insurance status has been shown to be an indicator of postoperative success in spine and general surgery because patients with no insurance or government-sponsored insurance (Medicare or Medicaid) are less compliant³¹ and are at greater risk for a postoperative complication.^{2,4,5,21} Understanding the effect of insurance status, limited access to health care, and relevant socioeconomic factors on patient compliance and postoperative results is important for optimizing patient outcomes and utilization of health care resources.

Although several studies have used insurance payer status to highlight differences in postoperative surgical outcomes, to our knowledge, this study is the first to evaluate the influence of insurance status and postoperative morbidity and mortality after shoulder replacement surgery. A large, national administrative database was used to study the effect of payer status on primary medical and surgical complications, and a secondary analysis assessed mortality and hospital charges. Based on previous literature, we hypothesized that uninsured or government-sponsored patients would have worse outcomes after total, partial, or reverse arthroplasty than those with private insurance and that primary insurance payer status would be an independent risk factor to consider during preoperative risk stratification and planning.^{7,10,14,16,21,27}

Materials and methods

The Healthcare Cost and Utilization Project Nationwide Inpatient Sample (NIS) between 2004 and 2011 was used to obtain the data. The NIS is the largest national database of all-payer inpatient discharge information, sampling approximately 20% of all nonfederal United States hospitals, and consists of 9 million hospital admissions annually. Each NIS entry includes International Classification of Diseases, 9th Revision, Clinical Modification diagnosis and procedure codes of activity during the patient's hospitalization at the time of discharge as well as patient demographics, hospital characteristics, and duration of stay. More information about the NIS can be found at: <http://www.hcup-us.ahrq.gov/nisoverview.jsp>.

Analysis included patients undergoing shoulder arthroplasty procedures (International Classification of Diseases, 9th Revision procedural coding: 81.80—total shoulder arthroplasty, 81.81—partial shoulder arthroplasty, and 81.88—reverse shoulder arthroplasty). Patient demographics and comorbidities were analyzed and stratified by insurance type (Medicare, Medicaid/uninsured, private insurance, or other). Comorbidities were scored based on the Charlson Comorbidity Index, a tool used to determine the likelihood of death for a patient during a 10-year period while taking into account possible medical conditions. Descriptive hospital data, including hospital size, location, teaching status, and region were collected.

The primary outcome was medical and surgical complications occurring during the same hospitalization, with secondary analyses of mortality, discharge destination, and hospital charges. Medical complications included an acute cardiac event, pulmonary edema, venous thromboembolic event, cerebrovascular event, acute kidney injury, pneumonia, sepsis, and urinary tract infection. Perioperative surgical complications included wound disruption, hematoma formation, implant failure, fractures, blood transfusions, or any reported adverse surgical events.

Adjusted odds ratios (ORs) were calculated to assess the risk of medical and surgical complications and mortality. The Wald parametric statistical test was similarly used to evaluate the strength of the association between complication risk and patient/hospital variables, including ethnicity, age and insurance type.

A secondary analysis was performed using the coarsened exact matching algorithm as described by Brown et al,⁷ where each Medicaid patient was matched to Medicare and private insurance patients while controlling for age and sex. Likelihood ratios were calculated to validate the adjusted ORs and Wald test results. The Pearson χ^2 test and multivariate regression were performed to assess the influence of insurance type on medical and surgical complications.

Multilevel logistic regression was also performed to determine the natural \log_{10} of the total charges as predicted by payor type and controlling for age and sex. The grouping variable hospital identification was also controlled for using generalized estimating equations and an independent correlation structure. All analysis was performed using R 3.0.3 (R Foundation, www.r-project.org) or STATA/MP 14.0 (StataCorp LP, College Station, TX, USA) statistical software.

Results

Demographics

Of the 103,290 patients who fulfilled study inclusion criteria, 68,578 (66%) had Medicare, 27,159 (26%) private insurance, 3544 (4%) Medicaid/uninsured, and 4009 (4%) were from other programs, including worker's compensation, Civilian Health and Medical Program of the Uniformed Services, Civilian Health and Medical Program of the Department of Veterans Affairs, Maternal and Child Health Services Block Grant (Title V of the Social Security Act), and other governmental programs (Fig. 1). Hemiarthroplasties comprised 44% (45,339) and total shoulder replacements 51% (52,457) of the arthroplasties performed, and reverse total shoulder replacements comprised only 5% (see [Supplementary Table](#); available on the journal's website at www.jshoulderelbow.org). Medicaid/uninsured patients were 61.3% more likely to receive a hemiarthroplasty in contrast to patients with Medicare or private insurance, of whom 50.8% and 53.5%, respectively, received total shoulder replacements.

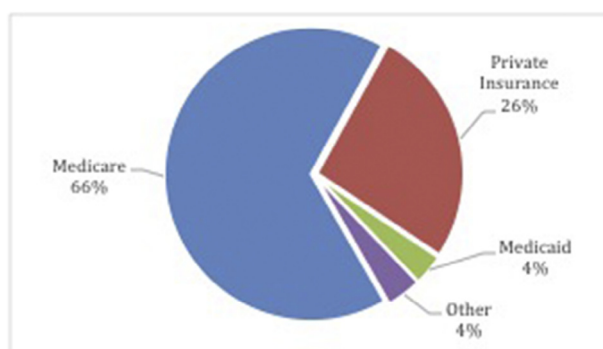


Figure 1 Insurance type for shoulder arthroplasty (2004-2011).

Most patients in the Medicare and private insurance groups were white (70% and 67%, respectively), followed by Black and Hispanic (<3% for both groups). The Medicaid/uninsured group consisted of 54% white, 9% black, and 9% Hispanic patients. Most operations were elective; however, among the Medicaid/uninsured populations, nearly twice the number of patients underwent arthroplasty as an emergent or urgent procedure (14.4% vs. 6% for private insurance). Patients with government-sponsored insurance demonstrated a higher comorbidity index than those with private insurance, which is a reflection of overall worse health. Privately insured patients were more likely to receive treatment at hospitals with a higher surgical volume ($P < .001$).

Overall complications

The overall complication rate was 17.2% ($n = 17,810$). The overall highest complication rate, irrespective of type of shoulder replacement, occurred in the Medicare population (20.3%), followed by Medicaid/uninsured (16.9%), other insurances (11.1%), and privately insured (10.5%). Cardiac events represented the most common complication ($n = 8165$), occurring in 9.5% of Medicare patients and at more than twice the rate of privately insured patients (Fig. 2). Similar patterns occurred for other complications in regards to insurance type, with private insurance having the lowest rate of complications compared with all other insurance types. Urinary tract infections ($n = 3154$) and pneumonia ($n = 1635$) were the next 2 most frequent medical complications, both of which occurred more commonly in those with government-sponsored insurance. Urinary tract infections occurred in 3% and 3.7% of Medicaid/uninsured and Medicare patients, respectively, compared with only 1.6% of the privately insured patient population. Pneumonia occurred in 2.2% and 1.7% of Medicaid/uninsured and Medicare patients, respectively, compared with 1.2% in the privately insured patient population.

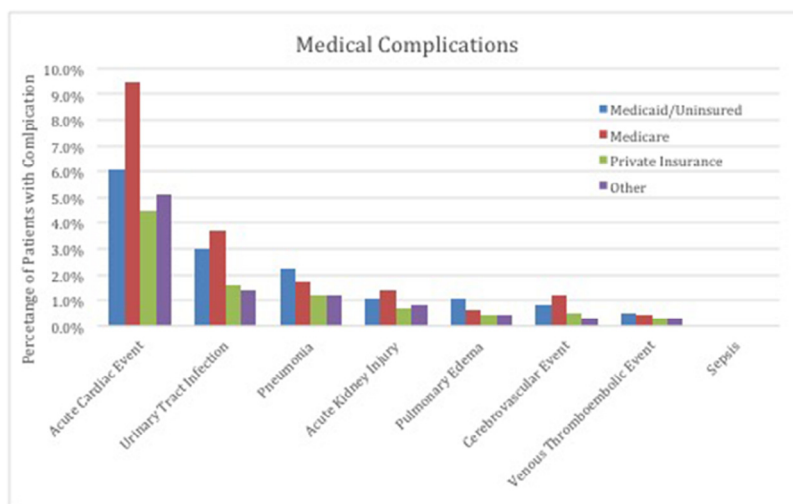


Figure 2 Types of medical complications.

Table I Complication rates of age and sex-matched Medicaid/uninsured patients compared with private insurance patients

Variable*	Medicaid/uninsured (n = 3540)	Private insurance (n = 3540)	Test statistic	P value
Sex				1
Male	1490 (42.2)	1490 (42.2)	<i>t</i> test (7072 <i>df</i>) = 0.53	
Female	2039 (57.8)	2039 (57.8)		
Age, y	54.7 (12.6)	54.9 (12.5)	χ^2 (1 <i>df</i>) 4	.599
Surgical complication?				.045
No	3473 (98.1)	3495 (98.7)	χ^2 (1 <i>df</i>) = 78.68	
Yes	67 (1.9)	45 (1.3)		
Medical complication?				<.001
No	3101 (87.6)	3319 (93.8)	χ^2 (1 <i>df</i>) = 0.57	
Yes	439 (12.4)	221 (6.2)		
Death?				.449
No	3533 (99.9)	3537 (99.9)	χ^2 (1 <i>df</i>) = 74.3	
Yes	5 (0.1)	2 (0.1)		
Any complications?				<.001
No	3051 (86.2)	3277 (92.6)		
Yes	487 (13.8)	263 (7.4)		

* Categorical data are expressed as number (%), and age is expressed as mean and standard deviation.

Table II Complication rates of age and sex-matched Medicare patients compared with private insurance patients

Variable*	Medicare (n = 14,252)	Private insurance (n = 14,252)	Test statistic	P value
Sex			χ^2 (1 <i>df</i>) = 0	1
Male	6161 (43.3)	6161 (43.3)		
Female	8064 (56.7)	8065 (56.7)		
Age, y	64.8 (9.9)	64.6 (9.9)	<i>t</i> test (28,500 <i>df</i>) = 2.32	.02
Surgical complications?			χ^2 (1 <i>df</i>) = 4.61	.032
No	13,995 (98.2)	14,042 (98.5)		
Yes	257 (1.8)	210 (1.5)		
Medical complications?			χ^2 (1 <i>df</i>) = 76.36	<.001
No	12,408 (87.1)	12,876 (90.3)		
Yes	1844 (12.9)	1376 (9.7)		
Death?			χ^2 (1 <i>df</i>) = 4.83	.028
No	14,201 (99.7)	14,223 (99.9)		
Yes	39 (0.3)	21 (0.1)		
Any complications?			χ^2 (1 <i>df</i>) = 76.38	<.001
No	12,198 (85.7)	12,694 (89.1)		
Yes	2042 (14.3)	1552 (10.9)		

df, degrees of freedom.

* Categorical data are expressed as number (%), and age is expressed as mean and standard deviation.

Coarsened exact matching algorithm

Medicaid/uninsured patients were matched one to one with both the Medicare and private insurance patients controlling for age and sex. No difference was found in medical and surgical complications or mortality between the Medicaid/uninsured patients and the Medicare patients. Significant differences existed between the Medicaid/uninsured patients compared with the private insurance patients (Table I): surgical complications were 2% vs. 1% ($P = .045$), medical complications were 13% vs. 6% ($P < .001$), and the overall complications were 14% vs. 6% ($P < .001$). When looking

at Medicare patients compared with the private insurance patients after controlling for age and sex, surgical complications were 1.8% vs. 1.5% ($P = .032$), medical complications were 13% vs 10% ($P < .001$), overall complications were 14% vs 10% ($P < .001$), and mortality was 0.3% vs. 0.1%, respectively ($P = .028$; Table II).

Subtype complication analysis

Multivariate regression analysis also indicated that private insurance was associated with fewer medical complications compared with Medicare insurance (Table III). In addition,

Table III Multivariate analysis of medical complications, surgical complications, and mortality

Variable	Medical complications			Surgical complications			Mortality		
	Adj. OR (95% CI)	P (Wald test)	P (LR test)	Adj. OR (95% CI)	P (Wald test)	P (LR test)	Adj. OR (95% CI)	P (Wald test)	P (LR test)
Payor: ref. = Medicare			<.001			.557			.599
Medicaid/uninsured	1.09 (0.96-1.25)	.192		0.98 (0.72-1.32)	.89		1.29 (0.44-3.77)	.638	
Other	0.87 (0.75-1.01)	.066		0.96 (0.7-1.31)	.808		0.95 (0.21-4.31)	.949	
Private insurance	0.78 (0.73-0.84)	<.001		0.89 (0.76-1.05)	.165		0.9 (0.3-2.69)	.856	
Female: female vs. male	0.9 (0.86-0.94)	<.001	<.001	1.08 (0.96-1.21)	.208	.207	0.53 (0.39-0.73)	<.001	<.001
Race: ref. = white			<.001			.014			.646
Black	0.76 (0.67-0.86)	<.001		1.5 (1.15-1.95)	.003		1.0057 (0.406-2.491)	.99	
Hispanic	0.67 (0.58-0.79)	<.001		1.08 (0.76-1.54)	.656		0.41 (0.1-1.67)	.213	
Asian/Pacific Islander	0.64 (0.43-0.94)	.024		1.95 (1.03-3.67)	.039		1.34 (0.18-9.69)	.773	
Native American	0.96 (0.63-1.45)	.833		2.26 (1.06-4.82)	.035		0 (0-1.37e+202)	.963	
Other	0.88 (0.73-1.07)	.211		1.31 (0.86-1.99)	.203		1.64 (0.6-4.47)	.335	
Unknown	0.96 (0.91-1.01)	.103		1.05 (0.92-1.19)	.482		0.91 (0.64-1.3)	.614	
Admission type: ref. = elective			<.001			<.001			<.001
Emergency	2.83 (2.64-3.03)	<.001		1.59 (1.34-1.88)	<.001		0.6 (0.39-0.93)	.023	
Urgent	1.39 (1.29-1.5)	<.001		1.3 (1.09-1.55)	.004		0.19 (0.13-0.27)	<.001	
Age groups: ref. = <40 y			<.001			.722			<.001
40-64 y	3.4 (2.48-4.64)	<.001		0.81 (0.55-1.18)	.27		0.62 (0.14-2.67)	.521	
65-79 y	5.47 (3.99-7.49)	<.001		0.81 (0.55-1.2)	.29		1.12 (0.26-4.88)	.877	
>80 y	9.35 (6.81-12.84)	<.001		0.83 (0.56-1.25)	.384		2.86 (0.66-12.51)	.162	
Procedure type: ref. = total shoulder replacement			<.001			<.001			.124
Partial shoulder replacement	1.15 (1.1-1.21)	<.001		1.32 (1.17-1.48)	<.001		0.92 (0.49-1.75)	.807	
Reverse total shoulder replacement	1.11 (1.01-1.22)	.025		1.07 (0.83-1.38)	.591		0.69 (0.48-0.99)	.045	
Charlson Comorbidity Index: ref. = 0			<.001			<.001			<.001
1	6.01 (5.68-6.36)	<.001		1.02 (0.9-1.16)	.755		1.77 (1.2-2.6)	.004	
2	16.36 (15.32-17.46)	<.001		1.2 (1-1.44)	.048		3.67 (2.41-5.57)	<.001	
>3	26.42 (24.43-28.56)	<.001		1.58 (1.28-1.95)	<.001		6.51 (4.29-9.87)	<.001	

CI, confidence interval; LR, likelihood ratio; Adj. OR, adjusted odds ratio.

white patients had significantly more complications than black, Hispanic or Asian/Pacific Islander patients. Emergency and urgent admissions carried an almost 3-times (OR, 2.83) and 1.5-times (OR, 1.39) greater risk for medical complications, respectively. Increasing age and comorbidity were substantially associated with an increased risk of medical complications. Compared with patients aged <40 years old, patients aged 40 to 64 years, 65 to 79 years, and >80 years were 3-times (OR, 3.40), 5-times (OR, 5.47), and 9-times (OR, 9.35) more likely to have a medical complication. The trend was similar for those with an increasing comorbidity index, in which those with a comorbidity index of >3 were >26-times more likely to have a medical complication compared with those with a comorbidity index of 0.

Surgical complications

The results of the multivariate regression analysis revealed no difference in surgical complications (Table III) between insurance types, including Medicare, Medicaid/uninsured, private, or other insurances. When the incidence of surgical complications was compared with ethnicity, black patients experienced a statistically significant increase in surgical complications ($P = .003$) compared with white patients. The risk for surgical complication was higher in urgently (OR, 1.3) or emergently (OR, 1.59) performed arthroplasties than in those performed electively. Patients with partial shoulder replacements experienced a statistically significantly higher rate of surgical complications (OR, 1.32; $P < .001$) compared with total shoulder replacements. Patients with a Charlson Comorbidity Index >3 experienced an increased number of surgical complications (OR, 1.58; $P < .001$). Age and sex, however, were not statistically significant factors for the development of a surgical complication.

Mortality

The overall mortality rate for patients undergoing shoulder arthroplasty was 0.20% ($n = 208$). Men (OR, 0.53; $P < .001$) and those undergoing reverse total shoulder arthroplasties (OR, 0.69; $P < .045$) were less likely to die (Table III). Similar to surgical complication risk, patients who received a shoulder arthroplasty urgently (OR, 0.19; $P < .001$) or emergently (OR, 0.6; $P < .023$) experienced higher rates of mortality during the hospitalization. Insurance type, ethnicity, and age were not correlated with mortality after shoulder arthroplasty.

Discussion

Shoulder arthroplasty is an effective treatment option for patients with symptomatic shoulder arthritis and proximal humeral fractures, and the indications have expanded to other shoulder conditions such as symptomatic and irreparable rotator cuff tears. An overall complication rate of between 12% and 15% has been reported for postoperative compli-

cations, including infection (superficial or deep), nerve injuries, instability, and aseptic component loosening.^{3,8,9,33} Many factors, including patient demographics, comorbidities, the surgeon's experience, and hospital volume, have been shown to affect outcomes and complication rates in orthopedic surgery. To our knowledge, however, no study has evaluated how social factors or insurance status affect the medical and surgical complication rates of patients after shoulder arthroplasty. The purpose of this study was to investigate and compare the complication rates of uninsured or government-sponsored patients vs. those with private insurance after shoulder arthroplasty.

Medicaid expansion under the current health care reform has expanded health care coverage to millions of Americans of every age in many states who were previously uninsured because of financial limitations. Information regarding complication rates after shoulder arthroplasty based on patient insurance status is important for the patients and orthopedic surgeons as well as third-party payers. Our multivariate regression analysis showed that postoperative medical complications after shoulder arthroplasty were independently influenced by patient insurance type as well as by a number of other preoperative factors. Medicare and Medicaid/uninsured patients were significantly more likely to have postoperative medical complications, most commonly cardiac complications, urinary tract infections, and pneumonia. This was true for the overall data and also when we matched each patient while controlling for age and sex. Furthermore, the Medicaid/uninsured patients were more than twice as likely to be admitted on an urgent or emergent basis for their shoulder arthroplasty procedures compared with the private insurance patients. However, in both the overall and matched data, we did not find surgical complications or mortality were statistically different between the different payer insurance statuses.

The data also showed that the comorbidity index and age are independent risk factors for medical complications after shoulder arthroplasty, with a higher preoperative comorbidity index seen in the government-sponsored insurance groups. In addition, the increased rate of complications seen in the government-sponsored insurance groups (Medicaid and Medicare) resulted in higher hospital charges after shoulder replacement compared with the private insurance group. Furthermore, privately insured patients were more likely to go to a higher-volume hospital for their elective shoulder replacements than patients with government-sponsored insurance. This finding may reflect that ability of patients with private insurance to select their own physicians. In contrast, Medicaid patients may have difficulty finding orthopaedic surgeons that will accept their insurance type and uninsured patients may have an inability to see an orthopaedic surgeon altogether due to lack of insurance coverage and consequently, exorbitant out of pocket cost.

Factors such as race and insurance status contribute to disparities in general health care and specifically in orthopedic care. Although these differences in care exist, little is known about why they exist, or perhaps more importantly, how to

address health care disparities. Much of the research in this area has focused on the utilization of medical care or access to physicians and care. Previous research in the nonorthopedic literature shows that physicians were less likely to recommend invasive cardiovascular procedures for African American men and women compared with white men and women.²³

Patients with government insurance also have limited and delayed access to specialty care.^{24,25,27,30} In a national survey of orthopedic surgeon's offices that treat pediatric patients, Skaggs et al²⁵ reported that children with Medicaid insurance had limited access to care in 88 of 233 offices (38%) and that 41 of 230 offices (18%) would not see a child with Medicaid under any circumstances. Sood et al²⁷ also reported underinsured patients with bucket-handle meniscus tears experienced significant delays in the time to presentation and overall time to surgery, which may have affected their overall outcome. Shoulder arthroplasty patients with government-sponsored insurance, especially Medicaid or uninsured patients, have very limited options for elective care. Patients with private insurance have the option to search out care at higher-volume hospitals or find private practice surgeons with more experience in shoulder replacement operations. Furthermore, the severity of pathology and associated deformity may be more severe in those with government-sponsored insurance secondary to the delay or inability to readily seek specialist evaluation and care.

Insurance status affects not only utilization of surgery but also surgical outcomes. Studies demonstrate disparities in the outcomes of major surgical operations, thus linking insurance status to mortality.²⁰ Investigations of trauma patients using the National Trauma Data Bank have shown that the uninsured have higher mortality in penetrating trauma,¹⁴ gunshot wounds,¹¹ and motor vehicle collisions.²⁹ Trauma patients with public insurance are also at an increased risk for readmission, with surgical site infection being the most common complication.¹⁸ Haider et al¹⁷ showed that ethnicity and insurance status independently predicted outcome disparities, but insurance status had a stronger correlation than race. Hacquebord et al¹⁶ also reported higher postoperative medical complications in patients with Medicaid status after spine surgery.

In this shoulder arthroplasty patient population, we found patients with Medicaid or no health insurance had an overall complication rate of 17% compared with 11% among privately insured patients. The Medicare and Medicaid patient population both had almost double the complication rate in cardiac and urinary tract infections compared with the privately insured patients, controlling for age and sex. This discrepancy in the overall and medical complication rates after shoulder replacement surgery may be a result of the poor socioeconomic status or education level of patients that have government-sponsored insurance that results in the lack of access to both preoperative and postoperative care. Butler et al¹ found that patient demographic factors of ethnicity, education level, poverty level, and income were more predictive

of clinical outcome after total hip replacement compared with implant-related factors.

Understanding that disparities in patient care exist is an important first step; however, the next logical question to ask is why does it happen, and subsequently, what can be done to eliminate its occurrence. In a statewide study of trauma patients in Massachusetts, Haas and Goldman¹⁵ found that uninsured patients were less likely to undergo physical therapy and had increased mortality compared with those with private insurance. In a study of orthopedic trauma patients, Whiting et al³¹ found that patients with no or government insurance were more likely to be noncompliant with the initial postoperative clinic appointment. Time and distance (as well as the means to get to the clinic appointment) have also been looked at as a contributing factor in adhering to medical guidance in a number of specialties.^{13,22,28}

Studies have looked at patient understanding of financial costs associated with surgery and have found that patients typically overestimate costs, perhaps leading to nonadherence to postoperative care and subsequent rehabilitation.^{6,26} In addition, poor health literacy is common, particularly among poor and elderly patients, who make up a large proportion of the Medicare/Medicaid community. These patients pose unique challenges in order to gain compliance and avoid complications.³² How these various social factors that are more prevalent in the uninsured or government sponsored insurance programs affect the complication rates and outcomes in shoulder arthroplasty is not well understood.

The strength of this study was that it was drawn from a large number of patient records to find statistical trends that were not discernible in smaller retrospective single or multisite studies. The database was a nationwide sampling of all shoulder arthroplasties, so it can be seen as broadly applicable.

Despite the generalizability of our study, we were limited in our ability to analyze causality. Comparing Medicare and privately insured patients does have an inherent bias based on the patient population that comprises each group: Medicare patients are aged older than 65 or, if insured at a younger age, are permanently disabled. Private insurance patients may be younger with a lower number of medical comorbidities. Understanding this relationship should be considered when interpreting these study findings.

Another limitation was that the data only provide information from a single hospital stay and discharge encounter and do not capture information on follow-up rates, readmissions, functional outcomes, or delayed complications occurring after discharge. In addition, although we were able to demonstrate that additional covariables such as comorbidity, age, and acuity of admission, affect complication rates, we did not specifically control for them in our statistical analysis. Furthermore, the type of implants used in the shoulder replacements (hemiarthroplasty, total shoulder arthroplasty, or reverse shoulder) are not reported with this database, which also presents another set of limitations when evaluating for the complication rates.

Conclusion

Our matched data controlling for age and sex show that patients with government-sponsored insurance (Medicaid and Medicare) have increased medical comorbidities after shoulder replacement surgery as well as medical and surgical complications and are more likely to be treated emergently (vs, electively) compared with private insurance. In addition, private insurance patients are more likely to go to higher-volume hospitals for their shoulder replacement surgery. Other similar studies in primary hip and knee arthroplasty also found that Medicaid insurance payer status is an independent risk factor for increased complications.⁷ As pay-for-performance and bundled care initiatives become more prevalent in the future, understanding what risk factors contribute to increased morbidity and cost is important for the hospital and surgeon. The development of risk-adjustment models may need to include factors such as insurance status to account for variations in outcomes and cost. Our study found that insurance status is an independent risk factor for increased medical and surgical complications after shoulder replacement surgery and that future research focused on both clinical and socioeconomic factors is warranted to determine the reason for possible differences in the postoperative complications and outcomes between government sponsored (Medicaid and Medicare) and private insurance.

Disclaimer

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Supplementary data

Supplementary data to this article can be found online at <http://dx.doi.org/10.1016/j.jse.2016.12.071>

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