Published in final edited form as:

J Shoulder Elbow Surg. 2017 July ; 26(7): e216–e221. doi:10.1016/j.jse.2016.11.044.

Comorbidity effects on shoulder arthroplasty costs analysis of a nationwide private payer insurance data set

Samuel Rosas, MD^{a,b}, Karim G. Sabeh, MD^b, Leonard T. Buller, MD^b, Tsun Yee Law, MD^a, Steven P. Kalandiyak, MD^b, and Jonathan C. Levy, MD^{a,*}

^aOrthopedic Research Institute, Holy Cross Hospital, Fort Lauderdale, FL, USA

^bDepartment of Orthopedics and Rehabilitation, University of Miami, Miami, FL, USA

Abstract

Background: The purpose of this study was to evaluate the effect of common medical comorbidities on the reimbursements of different shoulder arthroplasty procedures.

Methods: We conducted a retrospective query of a single private payer insurance claims database using PearlDiver (Warsaw, IN, USA) from 2010 to 2014. Our search included the *Current Procedural Terminology* codes and *International Classification of Diseases, Ninth Revision* codes for total shoulder arthroplasty (TSA), hemiarthroplasty, and reverse shoulder arthroplasty (RSA). Medical comorbidities were also searched for through *International Classification of Diseases* codes. The comorbidities selected for analysis were obesity, morbid obesity, hypertension, smoking, diabetes mellitus, hyperlipidemia, atrial fibrillation, chronic obstructive pulmonary disease, cirrhosis, depression, and chronic kidney disease (excluding end-stage renal disease). The reimbursement charges of the day of surgery, 90-day global period, and 90-day period excluding the initial surgical day of each comorbidity were analyzed and compared. Statistical analysis was conducted through analyses of variance or Kruskal-Wallis test.

Results: Comorbidities did not have a significant effect on same-day reimbursements but instead caused a significant effect on the subsequent 89-day (interval) and 90-day reimbursements in the TSA and RSA cohorts. For TSA and RSA, the highest reimbursement costs during the 90-day period after surgery were seen with the diagnosis of hepatitis C, followed by atrial fibrillation and later chronic obstructive pulmonary disease. For hemiarthroplasty, the same was true in the following order: hepatitis C, cirrhosis, and atrial fibrillation.

Conclusion: Shoulder arthroplasty reimbursements are significantly affected by comorbidities at time intervals following the initial surgical day.

Level of evidence: Level IV; Large Database Analysis; Economics Study

*Reprint requests: Jonathan C. Levy, MD, Orthopedic Research Institute, Holy Cross Hospital, 5597 N Dixie Highway, Fort Lauderdale, FL 33334, USA. Jonley123@yahoo.com (J.C. Levy).

Disclaimer

The authors, their immediate families, and any research foundations with which they are affiliated have not received any financial payments or other benefits from any commercial entity related to the subject of this article.

Institutional Review Board approval was not required as this was a retrospective review of a large database without the use of private patient information.

Keywords

Shoulder arthroplasty; reverse shoulder arthroplasty; economic analysis; total; reverse; hemiarthroplasty

Shoulder arthroplasty is a commonly performed procedure in the United States, and recent studies have demonstrated that this trend is still on the rise.^{13,17–20} Reasons for this increase include broader indication for use in fracture care,⁹ growing number of patients with degenerative joint disease,⁸ and confidence in the satisfactory outcomes that these procedures achieve.¹⁶

With the recent emphasis on value-based care, greater attention is being directed to understanding the costs associated with surgery as well as the drivers of those costs.² It has been repeatedly demonstrated that medical comorbidities influence the outcomes of all forms of shoulder arthroplasty: total shoulder arthroplasty (TSA), hemiarthroplasty (HA), and reverse shoulder arthroplasty (RSA).^{1–3} The increased costs associated with various comorbidities, however, are not well understood. There is thus a need for clinicians to better understand the economic aspects of a patient's comorbidities and the effects on the cost of care. The purpose of this study was to examine the effect of common medical comorbidities on the initial-day, subsequent 89-day interval period, and 90-day reimbursement costs of shoulder arthroplasty procedures.

Materials and methods

We conducted a retrospective review of the Humana private payers insurance database claims through the PearlDiver supercomputer (Warsaw, IN, USA). All patients undergoing shoulder arthroplasty between 2010 and 2014 were identified by *Current Procedural Terminology* codes and stratified according to arthroplasty type into TSA, HA, and RSA groups. *International Classification of Diseases, Ninth Revision* and *Current Procedural Terminology* codes were used to identify medical comorbidities, including obesity, morbid obesity, hypertension, smoker status, diabetes mellitus, hyperlipidemia, atrial fibrillation, chronic obstructive pulmonary disease (COPD), cirrhosis, hepatitis C, depression, and chronic kidney disease (excluding end-stage renal disease) within the cohort (Table I). Costs were determined on the basis of reimbursement data from the insurance company to the payees, which includes and is not limited to costs of hospitalization, surgical procedure, physical therapy, diagnostic tests, and other charges that the patient might have incurred throughout the 90-day period. Reimbursements have been previously used as markers of costs in cost analysis studies and provide readers the opportunity to observe how payees are currently being reimbursed.¹² By analyzing reimbursements, surgeons, hospitals, and policy makers can observe what payers are actually compensating for in the care provided rather than an inflated estimate of cost elicited by charges. Use of reimbursement as a proxy for cost defines the financial burden to the payer. The same-day, the 89-day interval period, and the 90-day reimbursement costs of each procedure were evaluated on the basis of claims reported from 2010 to 2014.

The Charlson Comorbidity Index (CCI)¹⁰ was extracted from the database and calculated for patients stratified by comorbidity and arthroplasty type, as previously described.²² The CCI was calculated on the day of surgery as well as 90 days after the procedure. Correlations with same-day and 90-day reimbursement costs were evaluated.

Statistics

To compare differences in reimbursement cost between procedure type and comorbidity, analysis of variance for normally distributed data or Kruskal-Wallis comparison for non-normally distributed data was used. Annual mean reimbursements were used for this analysis. Correlations were performed with the use of linear correlations on SPSS version 20 (IBM, Armonk, NY, USA), and an α value of $<.05$ was considered statistically significant.

Results

Between 2010 and 2014, a total of 23,879 patients were identified. This included 13,622 TSA, 5668 RSA, and 4589 HA patients.

Total shoulder arthroplasty

Among patients undergoing TSA, the average initial-day reimbursement cost was \$13,233 (standard deviation [SD], \$728; range, \$12,153–\$16,405) and did not vary significantly among patients with various comorbidities (Kruskal-Wallis, $P = .698$) (Table II).

The average 90-day reimbursement cost among patients undergoing TSA was \$19,589 (SD, \$1410; range, \$15,510–\$23,755) and varied significantly when stratified by comorbidity (Kruskal-Wallis, $P = .001$) (Table III and Fig. 1). The comorbidity with the greatest 90-day reimbursement costs after TSA was hepatitis C (mean, \$21,083; SD, \$3336), followed by atrial fibrillation (mean, \$20,840; SD, \$600) and cirrhosis (mean, \$20,345; SD, \$966).

Evaluation of the 89-day interval reimbursement costs after TSA demonstrated a significant difference in mean reimbursement costs among patients with comorbidities (Kruskal-Wallis, $P < .001$). The comorbidities with the highest impact on the 89-day interval reimbursement cost were atrial fibrillation (mean, \$7915; SD, \$561), COPD (mean, \$7549; SD, \$687), and hepatitis C (mean, \$7111; SD, \$3071). Table IV illustrates the 89-day reimbursement costs stratified by comorbidity.

Reverse shoulder arthroplasty

Among patients undergoing RSA, the average initial-day reimbursement cost was \$15,690 (SD, \$364; range, \$14,522–\$18,349) and was not significantly different when stratified by comorbidity (Kruskal-Wallis, $P = .214$).

The average 90-day reimbursement cost among patients undergoing RSA was \$23,477 (SD, \$1135; range, \$19,121–\$33,088) and varied significantly when stratified by comorbidity ($P < .001$). A diagnosis of hepatitis C was associated with the highest reimbursement cost with a mean value of \$27,136 (SD, \$5164), followed by atrial fibrillation (mean, \$25,379; SD, \$1229) and then COPD (mean, \$24,113; SD, \$1651) (Table III).

Evaluation of the 89-day interval reimbursement costs after RSA demonstrated a significant difference in mean costs among patients with comorbidities ($P < .015$). The comorbidities that incurred the highest mean reimbursement costs were hepatitis C (\$9910; SD, \$5285), atrial fibrillation (\$9713; SD, \$1156), and chronic kidney disease (\$8289; SD, \$157) (Table IV).

Hemiarthroplasty

Among patients undergoing HA, the average initial-day reimbursement cost was \$8368 (SD, \$735; range, \$6756-\$12,270), and the average 90-day cost was \$14,937 (SD, \$1397; range, \$11,037-\$26,058), both of which were not significantly different when stratified by comorbidity ($P = .377$ and $P = .287$). The highest mean reimbursement costs were for patients with a diagnosis of hepatitis C (\$9508; SD, \$3529), followed by those with morbid obesity (\$8990; SD, \$815) and later by COPD (\$8030; SD, \$761) (Table II).

The mean reimbursement cost of all comorbidities was \$14,937 (SD, \$1397) with a range from of \$13,825 for patients with hypertension to \$18,765 for patients with hepatitis C. Table III further demonstrates these costs.

A significant difference was found in examining the cost of the subsequent 89 days (89-day interval costs) after surgery (Kruskal-Wallis, $P = .039$). The patients with hepatitis C, atrial fibrillation, and COPD had the highest reimbursement cost with a mean of \$9257 (SD, \$4196), \$7777 (SD, \$1130), and \$7274 (SD, \$2309), respectively. Table IV demonstrates the complete 89-day reimbursement costs of HA patients.

Charlson Comorbidity Index¹⁰ analysis

Our findings demonstrate that the CCI from the initial day of surgery had a significant positive correlation with the 90-day reimbursement costs for all 3 arthroplasty techniques ($P < .001$ for TSA, $P = .019$ for HA, and $P = .006$ for RSA). Similarly, the CCI at 90 days after surgery also correlated positively significantly with the 90-day reimbursement costs ($P < .01$ for TSA, $P < .01$ for HA, and $P = .003$ for RSA). The CCI score can be found in Table V according to comorbidity.

Discussion

With use of a national database of private payer insurance of 23,879 shoulder arthroplasty patients, comorbidities were found to have no influence on the reimbursement cost of the initial day of care for all forms of shoulder arthroplasty. However, comorbidities were found to have a significant impact on the subsequent 89 days of care and the overall 90-day reimbursement costs of care. This suggests that greater attention must be paid to the subsequent 89-day interval of care in evaluating patients with comorbidities.

There are numerous drivers of costs that may influence the cost of care beyond the initial day of surgery. Extended lengths of stay, readmissions, use of skilled nursing facilities, and surgical revisions are certainly some of the more obvious drivers of cost. Matsen et al reported on the various factors that affect length of stay, readmission, and revision rates for shoulder arthroplasty through the New York State Planning and Research Cooperative

System. They identified specific factors that contributed to longer lengths of stay, 90-day readmission, and revision surgery. These factors included age, sex, race, insurance type, CCI, diagnosis, type of procedure, and surgeon volume.¹¹ The authors found that comorbidities affected the length of stay significantly and included in their analysis comorbidities similar to those evaluated in this study.

Several studies have examined the influence of specific individual comorbidities on cost. Obesity has been associated with increased hospital charges, longer hospital stays, greater respiratory complications, and overall higher costs.^{5,14} Using an analysis of the U.S. National Inpatient Sample database between 1993 and 2010, Davis et al reported that multiple comorbidities resulted in higher hospital charges after TSA, and Virani et al demonstrated that lower comorbidity burden correlated with lower costs.^{4,21} Other comorbidities, such as obstructive sleep apnea and diabetes, have been demonstrated not to be associated with increased postoperative charges or hospital costs, respectively.^{6,15}

One of the most influential comorbidities on cost for patients who undergo shoulder arthroplasty was found to be hepatitis C. Using a PearlDiver Medicare database analysis of TSA patients, Cancienne et al similarly demonstrated that patients with hepatitis C have an increased risk for complications, including infection, dislocation, fracture, revisions, systemic complications, and blood transfusions. They demonstrated an odds ratio of 1.7 (95% confidence interval, 1.1–2.6) of infection within the first 3 months after TSA and RSA compared with non-hepatitis C patients.³ These findings are consistent with our analysis, which demonstrates that these complications lead to a significantly increased reimbursement cost per procedure performed compared with other comorbidities.

Similar observations have been reported in other areas of total joint arthroplasty. Issa et al studied the effect of hepatitis C on total joint arthroplasty through analysis of the National Inpatient Sample and found a 30% increased risk of any complication, 15% increased risk of medical complications, 78% increased risk of surgical complications, and increased length of stay for patients with hepatitis C.⁷ Atrial fibrillation has also been shown to be associated with increased costs.^{1,23}

The strength of this study relates to the population-based analysis achieved with a large supercomputer database. Analysis of comorbidities is greatly enhanced by using largescale population analysis and by capturing reimbursement costs from the Humana database; this study is able to provide actual costs of care for patients with various comorbidities. The accuracy of the database is limited by proper reporting. However, high-profile costs, such as readmissions and revisions, are best captured in an insurance database that tracks all costs tagged to a patient. There may be inherent selection bias based on analysis of Humana as a single payer as this population of patients may not be generalizable to the entire country. Nonetheless, use of a single payer provides a valuable representation of the managed care environment that is controlled by negotiated proprietary contracts between hospitals and payers and is not a fixed reimbursement rate, as seen with government payers like Medicare.

With a greater understanding of the increased costs associated with comorbidities, the surgeon can better prepare for shoulder arthroplasty in higher risk patients. Preoperative

screening and medical optimization may one day help control costs in higher risk patients. Improved medical optimization before and after surgery may help lower the costs associated with comorbidities and need to be a focus of future medical care of shoulder arthroplasty patients. These programs will need to identify those factors that can be controlled and improved and separate them from those that cannot. Further studies on the efficacy of such programs will help define the ability to improve the value of care.

Conclusion

Initial-day costs of care are not influenced by comorbidities. However, 90-day and subsequent interval (89-day) costs were significantly affected by comorbidities, with hepatitis C associated with the highest costs for TSA, RSA, and HA.

References

1. Aggarwal VK, Tischler EH, Post ZD, Kane I, Orozco FR, Ong A. Patients with atrial fibrillation undergoing total joint arthroplasty increase hospital burden. *J Bone Joint Surg Am* 2013;95:1606–11. 10.2106/jbjs.l.00882 [PubMed: 24005202]
2. Black EM, Higgins LD, Warner JJ. Value-based shoulder surgery: practicing outcomes-driven, cost-conscious care. *J Shoulder Elbow Surg* 2013;22:1000–9. 10.1016/j.jse.2013.02.008 [PubMed: 23659804]
3. Cancienne JM, Dempsey IJ, Holzgrefe RE, Brockmeier SF, Werner BC. Is hepatitis C infection associated with a higher risk of complications after total shoulder arthroplasty? *Clin Orthop Relat Res* 2016;474:2664–9. 10.1007/s11999-016-4979-9 [PubMed: 27448222]
4. Davis DE, Paxton ES, Maltenfort M, Abboud J. Factors affecting hospital charges after total shoulder arthroplasty: an evaluation of the National Inpatient Sample database. *J Shoulder Elbow Surg* 2014;23:1860–6. 10.1016/j.jse.2014.04.002 [PubMed: 25156958]
5. Griffin JW, Novicoff WM, Browne JA, Brockmeier SF. Morbid obesity in total shoulder arthroplasty: risk, outcomes, and cost analysis. *J Shoulder Elbow Surg* 2014;23:1444–8. 10.1016/j.jse.2013.12.027 [PubMed: 24725896]
6. Griffin JW, Novicoff WM, Browne JA, Brockmeier SF. Obstructive sleep apnea as a risk factor after shoulder arthroplasty. *J Shoulder Elbow Surg* 2013;22:e6–9. 10.1016/j.jse.2013.06.003
7. Issa K, Boylan MR, Naziri Q, Perfetti DC, Maheshwari AV, Mont MA. The impact of hepatitis C on short-term outcomes of total joint arthroplasty. *J Bone Joint Surg Am* 2015;97:1952–7. 10.2106/jbjs.o.00183 [PubMed: 26631996]
8. Izquierdo R, Voloshin I, Edwards S, Freehill MQ, Stanwood W, Wiater JM, et al. Treatment of glenohumeral osteoarthritis. *J Am Acad Orthop Surg* 2010;18:375–82. [PubMed: 20511443]
9. Jobin CM, Galdi B, Anakwenze OA, Ahmad CS, Levine WN. Reverse shoulder arthroplasty for the management of proximal humerus fractures. *J Am Acad Orthop Surg* 2015;23:190–201. 10.5435/jaaos-d-13-00190 [PubMed: 25630370]
10. Manoli A, Capriccioso CE, Konda SR, Egol KA. Total shoulder arthroplasty for proximal humerus fracture is associated with increased hospital charges despite a shorter length of stay. *Orthop Traumatol Surg Res* 2016;102:19–24. 10.1016/j.otsr.2015.11.003 [PubMed: 26803987]
11. Matsen FA, 3rd, Li N, Gao H, Yuan S, Russ SM, Sampson PD. Factors affecting length of stay, readmission, and revision after shoulder arthroplasty: a population-based study. *J Bone Joint Surg Am* 2015;97:1255–63. 10.2106/jbjs.n.01107 [PubMed: 26246260]
12. Nwachukwu BU, Schairer WW, McCormick F, Dines DM, Craig EV, Gulotta LV. Arthroplasty for the surgical management of complex proximal humerus fractures in the elderly: a cost-utility analysis. *J Shoulder Elbow Surg* 2016;25:704–13. 10.1016/j.jse.2015.12.022 [PubMed: 26968089]
13. Padeigimas EM, Maltenfort M, Lazarus MD, Ramsey ML, Williams GR, Namdari S. Future patient demand for shoulder arthroplasty by younger patients: national projections. *Clin Orthop Relat Res* 2015;473:1860–7. 10.1007/s11999-015-4231-z [PubMed: 25758376]

14. Pappou I, Virani NA, Clark R, Cottrell BJ, Frankle MA. Outcomes and costs of reverse shoulder arthroplasty in the morbidly obese: a case control study. *J Bone Joint Surg Am* 2014;96:1169–76. 10.2106/jbjs.m.00735 [PubMed: 25031371]
15. Ponce BA, Menendez ME, Oladeji LO, Soldado F. Diabetes as a risk factor for poorer early postoperative outcomes after shoulder arthroplasty. *J Shoulder Elbow Surg* 2014;23:671–8. 10.1016/j.jse.2014.01.046 [PubMed: 24745315]
16. Rasmussen JV, Polk A, Brorson S, Sorensen AK, Olsen BS. Patient-reported outcome and risk of revision after shoulder replacement for osteoarthritis. 1209 cases from the Danish Shoulder Arthroplasty Registry, 2006–2010. *Acta Orthop* 2014;85:117–22. 10.3109/17453674.2014.893497 [PubMed: 24650020]
17. Rosas S, Law TY, Kurowicki J, Formaini N, Kalandiak SP, Levy JC. Trends in surgical management of proximal humeral fractures in the Medicare population: a nationwide study of records from 2009 to 2012. *J Shoulder Elbow Surg* 2016;25:608–13. 10.1016/j.jse.2015.08.011 [PubMed: 26475637]
18. Schairer WW, Nwachukwu BU, Lyman S, Craig EV, Gulotta LV. National utilization of reverse total shoulder arthroplasty in the United States. *J Shoulder Elbow Surg* 2015;24:91–7. 10.1016/j.jse.2014.08.026 [PubMed: 25440519]
19. Trofa D, Rajae SS, Smith EL. Nationwide trends in total shoulder arthroplasty and hemiarthroplasty for osteoarthritis. *Am J Orthop* 2014;43:166–72. [PubMed: 24730001]
20. Virani NA, Williams CD, Clark R, Polikandriotis J, Downes KL, Frankle MA. Preparing for the bundled-payment initiative: the cost and clinical outcomes of reverse shoulder arthroplasty for the surgical treatment of advanced rotator cuff deficiency at an average 4-year follow-up. *J Shoulder Elbow Surg* 2013;22:1612–22. 10.1016/j.jse.2013.01.003 [PubMed: 23566674]
21. Virani NA, Williams CD, Clark R, Polikandriotis J, Downes KL, Frankle MA. Preparing for the bundled-payment initiative: the cost and clinical outcomes of total shoulder arthroplasty for the surgical treatment of glenohumeral arthritis at an average 4-year follow-up. *J Shoulder Elbow Surg* 2013;22:1601–11. 10.1016/j.jse.2012.12.028 [PubMed: 23510749]
22. Voskuijl T, Hageman M, Ring D. Higher Charlson Comorbidity Index scores are associated with readmission after orthopaedic surgery. *Clin Orthop Relat Res* 2014;472:1638–44. 10.1007/s11990013-3394-8 [PubMed: 24276857]
23. Wu EQ, Birnbaum HG, Mareva M, Tuttle E, Castor AR, Jackman W, et al. Economic burden and co-morbidities of atrial fibrillation in a privately insured population. *Curr Med Res Opin* 2005;21:1693–9. 10.1185/030079905x65475 [PubMed: 16238910]

Figure 1.

Graphic depiction of the 90-day costs per comorbidity. *TSA*, total shoulder arthroplasty; *RSA*, reverse shoulder arthroplasty; *HA*, hemiarthroplasty; *DM*, diabetes mellitus; *Afib*, atrial fibrillation; *COPD*, chronic obstructive pulmonary disease; *CKD*, chronic kidney disease.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Table 1

International Classification of Diseases codes used for data extraction

Entity	Code
Total shoulder arthroplasty	ICD-9 81.80, CPT 23472
Reverse shoulder arthroplasty	ICD-9 81.88
Hemiarthroplasty	ICD-9 81.81, CPT 23470
Hepatitis C	ICD-9 07051, 07054, 07070
Obesity	ICD-9 27800
Morbid obesity	ICD-9 27801
Hypertension	ICD-9 4019, 7962
Smoking	ICD-9 3051
Diabetes mellitus	ICD-9 25000, 25001, 25002, 25003
Hyperlipidemia	ICD-9 2720, 2722, 2729, 2721
Atrial fibrillation	ICD-9 42731
Chronic obstructive pulmonary disease	ICD-9 4910, 4911, 49120, 49121, 49122
Cirrhosis	ICD-9 5712, 5715, 5718
Depression	ICD-9 2962, 2963, 311
Chronic kidney disease (excluding end-stage renal disease)	ICD-9 D-5851, 5852, 5853, 5854, 5855, 5859

ICD-9, International Classification of Diseases, Ninth Revision; CPT, Current Procedural Terminology.

Table II

Initial day of surgery costs per comorbidity

Mean initial-day costs	TSA	RSA	HA
Hepatitis C	\$13,972	\$17,226	\$9508
Obesity	\$13,116	\$15,481	\$8833
Morbid obesity	\$13,133	\$15,546	\$8990
Hypertension	\$13,083	\$15,280	\$8155
Smoking	\$13,308	\$15,804	\$8516
Diabetes mellitus	\$13,068	\$15,434	\$7985
Hyperlipidemia	\$13,068	\$15,347	\$8275
Atrial fibrillation	\$12,925	\$15,666	\$7819
COPD	\$13,071	\$15,863	\$8030
Cirrhosis	\$13,792	\$15,538	\$8558
Depression	\$13,090	\$15,409	\$8169
CKD	\$13,045	\$15,689	\$7581
Mean	\$13,154	\$15,551	\$8265
<i>P</i> value	.698	.214	.287

TSA, total shoulder arthroplasty; *RSA*, reverse shoulder arthroplasty; *HA*, hemiarthroplasty; *COPD*, chronic obstructive pulmonary disease; *CKD*, chronic kidney disease.

Table III

Mean 90-day costs per comorbidity for the first 90 days after TSA, RSA, and HA

Mean 90-day costs	TSA	RSA	HA
Hepatitis C	\$21,083	\$27,136	\$18,765
Obesity	\$18,522	\$22,078	\$14,628
Morbid obesity	\$19,445	\$23,807	\$15,251
Hypertension	\$18,391	\$21,844	\$13,455
Smoking	\$18,875	\$22,060	\$14,087
Diabetes mellitus	\$19,093	\$22,801	\$13,825
Hyperlipidemia	\$18,399	\$22,065	\$13,551
Atrial fibrillation	\$20,840	\$25,379	\$15,597
COPD	\$20,620	\$24,113	\$15,305
Cirrhosis	\$20,345	\$23,091	\$15,781
Depression	\$19,531	\$23,370	\$14,633
CKD	\$19,926	\$23,979	\$14,368
Average	\$19,589	\$23,477	\$14,937
<i>P</i> value	.001	<.001	.287

TSA, total shoulder arthroplasty; *RSA*, reverse shoulder arthroplasty; *HA*, hemiarthroplasty; *COPD*, chronic obstructive pulmonary disease; *CKD*, chronic kidney disease.

Table IV

Mean 89-day costs per comorbidity (without day of surgery) for TSA, RSA, and HA

Mean 89-day costs	TSA	RSA	HA
Hepatitis C	\$7111	\$9910	\$9257
Obesity	\$5406	\$6596	\$5795
Morbid obesity	\$6312	\$8260	\$6261
Hypertension	\$5308	\$6564	\$5300
Smoking	\$5567	\$6256	\$5572
Diabetes mellitus	\$6025	\$7367	\$5840
Hyperlipidemia	\$5331	\$6718	\$5276
Atrial fibrillation	\$7915	\$9713	\$7777
COPD	\$7549	\$8250	\$7274
Cirrhosis	\$6553	\$7553	\$7223
Depression	\$6441	\$7961	\$6464
CKD	\$6882	\$8289	\$6787
Average	\$6367	\$7787	\$6569
<i>P</i> value	<.001	.015	.039

TSA, total shoulder arthroplasty; *RSA*, reverse shoulder arthroplasty; *HA*, hemiarthroplasty; *COPD*, chronic obstructive pulmonary disease; *CKD*, chronic kidney disease.

Table V

Charlson Comorbidity Index (CCI)

Same-day CCI	TSA	HA	RSA
Hepatitis C	9	7	10
Obesity	6	6	7
Morbid obesity	6	7	8
Hypertension	5	5	6
Smoking	6	6	7
Diabetes mellitus	7	7	9
Hyperlipidemia	5	5	7
Atrial fibrillation	7	7	9
COPD	9	9	11
Cirrhosis	8	8	10
Depression	6	6	7
Chronic kidney disease	9	9	11

TSA, total shoulder arthroplasty; *RSA*, reverse shoulder arthroplasty; *HA*, hemiarthroplasty; *COPD*, chronic obstructive pulmonary disease.