J Shoulder Elbow Surg (2024) 33, 2637–2645

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Journal of Shoulder and Elbow Surgery

www.elsevier.com/locate/ymse

Racial and gender disparities in utilization of outpatient total shoulder arthroplasties

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Background: Utilization in outpatient total shoulder arthroplasties (TSAs) has increased significantly in recent years. It remains largely unknown whether utilization of outpatient TSA differs across gender and racial groups. This study aimed to quantify racial and gender disparities both nationally and by geographic regions.

This study was reviewed by the WCG Institutional Review Board, an independent ethical review board, and an exemption was approved.

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https://doi.org/10.1016/j.jse.2024.04.020

Methods: 168,504 TSAs were identified using Medicare fee-for-service inpatient and outpatient claims data and beneficiary enrollment data from 2020 to 2022Q4. The percentage of outpatient cases, defined as cases discharged on the same day of surgery, was evaluated by racial and gender groups and by different census divisions. A multivariate logistics regression model controlling for patient sociodemographic information (White vs. non-White race, age, gender, and dual eligibility for both Medicare and Medicaid), hierarchical condition category (HCC) score, hospital characteristics, year fixed effects, and patient residency state fixed effects was performed.
Results: The TSA volume per 1000 beneficiaries was 2.3 for the White population compared with 0.8, 0.6, and 0.3 for the Black, Hispanic, and Asian population, respectively. A higher percentage of outpatient TSAs were in White patients (25.6%) compared with Black patients (20.4%) ($P < .001$). The Black TSA patients were also younger, more likely to be female, more likely to be dually eligible for Medicaid, and had higher HCC risk scores. After controlling for patient sociodemographic characteristics and hospital characteristics, the odds of receiving outpatient TSAs were 30% less for Black than the White group (odds ratio 0.70). Variations were observed across different census divisions, with South Atlantic (0.67, $P < .01$), East North Central (0.56, $P < .001$), and Middle Atlantic (0.36, $P < .01$) being the 4 regions observed with significant racial disparities. Statistically significant gender disparities were also found nationally and across regions, with an overall odds ratio of 0.75 ($P < .001$).
Discussion: Statistically significant racial and gender disparities were found nationally in outpatient TSAs, with Black patients having 30% ($P < .001$) fewer odds of receiving outpatient TSAs than White patients, and female patients with 25% ($P < .001$) fewer odds than male patients. Racial and gender disparities continue to be an issue for shoulder arthroplasties after the adoption of outpatient TSAs.
Level of evidence: Level III; Cross-Sectional Design; Epidemiology Study

Keywords: Racial disparities; gender disparities; disparities; total shoulder arthroplasty; outpatient; TSA; shoulder

Racial and gender disparities have been well documented throughout the delivery of orthopedic care, including the utilization of total shoulder arthroplasty (TSA).[4,9,10,22,36] Improving overall health and achieving equitable access to care has become a priority for many medical societies, including the American Academy of Orthopaedic Surgeons, and government organizations[33] such as the Center for Medicare and Medicaid Services (CMS). CMS's most recent strategic plan has 6 pillars, of which the first 2 are to advance equity and expand access to quality care.[33] Despite these efforts, previous studies have demonstrated a worsening inequality gap between Whites and non-White individuals in the utilization of TSA between 2012 and 2017.[4]

The coronavirus disease of 2019 (COVID-19) pandemic precipitated major changes in surgeon practice patterns and system resource use including a transition to outpatient care.[28] Policy changes have subsequently ensued including the removal of the *Current Procedural Terminology* codes for shoulder arthroplasty (23472) from the Center for Medicare and Medicaid Services (CMS) inpatient-only list in 2021.[29] These changes have resulted in a significant increase in the rate of patients undergoing outpatient TSA (discharged the same day).[13,17,28]

Outpatient TSA has been shown to be safe for the appropriately selected patient with a low comorbidity burden and an adequate home situation.[1,3,6,7,10,11,18-20,24,25,27,34] Previous studies have shown that minority patients have a higher comorbidity burden, higher complication rates, and higher length of stays following shoulder arthroplasty.[4,5,12,15,21,23,35] Gender differences have also been identified in shoulder arthroplasty patients, with females having surgery at an older age, having longer lengths of stay, and worse patient-reported outcomes.[14,16,26] However, it remains largely unknown whether utilization of outpatient TSA differs across gender and racial groups following the COVID-19 pandemic and removal of shoulder arthroplasty from CMS's inpatient-only list, specifically after accounting for any pre-existing risk factors that these groups may demonstrate.

This study aimed to quantify racial and gender disparities in the utilization of outpatient (discharged on the same day) shoulder arthroplasty both nationally and by geographic regions in Medicare beneficiaries. As the utilization of outpatient TSA increases, it is important for us to understand whether previously reported disparities in shoulder arthroplasty continue to be present in outpatient arthroplasty. Only once disparities are identified can we work toward providing more equitable care for our patients.

Materials and methods

Data source

This is a retrospective study using the complete 2020-2022 Medicare fee-for-service (FFS) inpatient and outpatient claims, as well as Medicare enrollment data, to examine racial and gender disparities in the use of outpatient TSA. Outpatient was defined as those discharged on the same date of surgery, regardless of whether hospitals submitted them as an inpatient or outpatient claim to the CMS.

We first identified beneficiaries who were continuously enrolled in the Medicare FFS program within each calendar year. A total of 82,401,164 beneficiary-years were identified across the 3-year study span. Of these beneficiaries, we identified inpatient TSA cases using a Diagnosis Related Group code of 483, and outpatient cases using a *Current Procedural Terminology* code of 23472, including both anatomic and reverse shoulder arthroplasty. The *International Classification of Diseases, Tenth Revision* (*ICD-10*), procedure

codes were used to exclude nonshoulder procedures from inpatient cases (n = 1947). The *ICD-10* diagnosis codes were used to exclude cases with fracture as primary diagnosis because these cases were nonelective and were not likely to be candidates for outpatient surgery (n = 17,924). Cases with missing race, age, gender, and residence information were further excluded (n = 4570). As TSA was not approved to be done at an ambulatory surgery center in Medicare patients during the time period of this study, no arthroplasties done at an ambulatory surgery center were included. A total of 168,504 TSAs were included for the analysis.

Patient demographics were collected including age, gender, race, and dual eligibility for both Medicare and Medicaid. We defined race and ethnicity for each beneficiary using the race variable from the Medicare enrollment data. Race and ethnicities include White, Black, Hispanic, Asian, and other. We also compared Black, Asian, Hispanic, and other minority groups with White separately in the analysis. Gender was defined as the biological sex as provided in Medicare claims data. Dual eligibility for Medicare and Medicaid was used as a proxy for socioeconomic status. The CMS hierarchical condition category (HCC) score was calculated for each patient to determine their comorbidity burden. The HCC score is used to risk-adjust capitation payments for Medicare beneficiaries enrolled in a Medicare Advantage plan. In addition to comorbidities, the score incorporates patient demographics, Medicaid eligibility, and the original reason for Medicare entitlement. HCC score is normalized to 1. Patients with an HCC score of <1 are healthier than an average Medicare beneficiary and vice versa. Hospital characteristics including bed size, teaching status, and urban/rural status were also collected. Finally, the patients were grouped into census regions based on their area of residence.

Statistical analysis

The overall TSA volume per 1000 Medicare FFS beneficiaries and the percentage of outpatient cases among TSAs were described by racial and gender groups, as well as by different census divisions. A case-level multivariate logistics regression with receiving an outpatient TSA as outcome variable was performed to quantitatively evaluate the disparities in outpatient TSAs. The covariates included patient sociodemographic information (age, gender, race, and dual eligibility for both Medicare and Medicaid), HCC score, hospital characteristics (bed size, teaching status, and urban/rural status), year-level fixed effects, and patient residence state fixed effects. FFS beneficiary racial distributions were used to weigh the regression to adjust for the racial composition in the Medicare population. The regression was performed nationally and within each census region to study the overall racial and gender disparities in outpatient TSA utilization and variation across regions. Odds ratios (ORs) of receiving an outpatient TSA (ie, discharged on the same day) were then compared across racial and gender groups and census regions. We lowered the P value threshold from .05 to .01 to correct for multiple comparison as 5 null hypothesis tests were conducted in our analyses.

Results

Nationally, 5.1% of TSA cases were performed on non-White patients from 2020 to 2022, with Black, Hispanic, and Asian minorities accounting for 3.0%, 0.6%, and 0.3%, respectively (Table I); the occurrence of TSAs for non-White was lower than the overall non-White beneficiary composition at 14.4%, with Black, Hispanic, and Asian accounting for 8.0%, 2.1%, and 2.1% of the beneficiary population, respectively (Table II). The lower representation of non-White within TSA cases resulted in a lower TSA volume per 1000 FFS beneficiaries. The TSA volume per 1000 beneficiaries was 2.3 for the White population, compared with 0.8, 0.6, and 0.3 for the Black, Hispanic, and Asian population, respectively (Table III). Among the 8 census regions, variations in TSA volume per 1000 beneficiaries within the Black population was observed, with Mountain and West North Central having the highest values at 1.1 and 1.0, respectively, and Middle Atlantic and New England having the lowest at 0.6 (Table III).

Among incurred TSA procedures, 25.4% of the cases were discharged on the same day of surgery, which became smaller (23.8%) when adjusting for the racial compositions of the FFS Medicare population. A higher percentage of outpatient TSAs were observed in White patients at 25.6%, compared with Black (20.4%; $P < .001$), Hispanic (23.2%; $P = .07$), Asian (24.5%; $P = .58$), and other minority groups (21.5%; $P < .001$) (Fig. 1, Tables IV and V). Black TSA patients were also significantly younger, more likely to be female, more likely to be dually eligible for Medicaid, had higher HCC risk scores, and were more likely to receive TSAs in teaching hospitals, larger hospitals in terms of bed size, and those located in an urban area, compared with White patients ($P < .001$; Tables IV and V).

After controlling for patient sociodemographic characteristics, HCC scores, and hospital characteristics, the odds of receiving outpatient TSAs were 30% smaller for Black patients than White patients (OR = 0.70, $P < .001$) nationally. No statistically significant differences were found between White patients and Hispanic or Asian patients in the odds of receiving outpatient TSAs (Fig. 2). Figure 3 shows the variation in the odds of receiving outpatient TSAs across geographic regions for the Black population, with South Atlantic (OR = 0.67, $P < .01$), East North Central (OR = 0.56, $P < .001$), and Middle Atlantic (OR = 0.36, $P < .01$) being the 3 regions observed with significant racial disparities. Estimated regression coefficients by geographic regions and minority groups are listed in Supplementary Table S1.

Gender disparities were also observed between the female and the male population, with 23.2% of females receiving an outpatient TSA vs. 28.2% of males ($P < .001$). Female TSA patients were observed to be slightly older (73 vs. 72.5, $P < .001$), with slightly lower HCC risk score (1.13 vs. 1.17, $P < .001$), more likely to be dually eligible for Medicaid (8.3% vs. 4.5%, $P < .001$), and have smaller presence of White patients (94% vs. 96.2%, $P < .001$) (Table VI). Statistically significant gender disparities were found nationally with an odds ratio of being discharged the same day of 0.75 ($P < .001$), after controlling for patient characteristics, HCCs, and hospital characteristics. The disparity is

Table I TSA volume summary by race, and by census divisions

Region	TSA case volume					
	All, n	White, %	Black, %	Hispanic, %	Asian, %	Other, %
National	168,504	94.9	3.0	0.6	0.3	1.1
East North Central	27,625	96.1	2.7	0.3	0.2	0.7
East South Central	11,241	94.9	4.6	0.0	0.1	0.3
Middle Atlantic	14,800	94.7	3.2	0.7	0.3	1.0
Mountain	17,447	96.6	0.8	0.8	0.2	1.5
New England	7,533	96.9	1.3	0.5	0.3	1.0
Pacific	18,173	93.3	1.8	1.8	1.1	2.0
South Atlantic	37,473	93.2	5.4	0.4	0.3	0.7
West North Central	16,866	97.7	1.1	0.2	0.1	0.9
West South Central	17,346	93.6	3.4	1.0	0.3	1.7

TSA, total shoulder arthroplasty.

Table II Medicare FFS beneficiary summary by race and by census divisions

Region	Medicare FFS beneficiary years during the study period					
	All, n	White, %	Black, %	Hispanic, %	Asian, %	Other, %
National	82,401,164	85.6	8.0	2.1	2.1	2.3
East North Central	12,045,241	89.6	7.2	0.9	1.0	1.3
East South Central	5,412,845	86.4	12.5	0.2	0.4	0.5
Middle Atlantic	10,199,773	85.6	8.2	1.9	2.3	2.0
Mountain	6,026,286	90.2	2.2	2.6	1.2	3.8
New England	4,550,074	92.4	3.5	1.5	1.2	1.4
Pacific	10,955,709	77.2	3.9	5.5	7.6	5.8
South Atlantic	18,115,343	82.4	13.6	1.3	1.3	1.3
West North Central	6,293,858	94.3	3.1	0.6	0.6	1.4
West South Central	8,797,436	83.6	9.3	3.2	1.4	2.5

FFS, fee-for-service.

Table III TSA volume per 1000 beneficiaries by race and by census divisions

Region	TSA volume per 1000 beneficiaries					
	All, n	White, n	Black, n	Hispanic, n	Asian, n	Other, n
National	2.0	2.3	0.8	0.6	0.3	1.0
East North Central	2.3	2.5	0.8	0.8	0.5	1.3
East South Central	2.1	2.3	0.8	0.5	0.4	1.4
Middle Atlantic	1.5	1.6	0.6	0.6	0.2	0.7
Mountain	2.9	3.1	1.1	0.9	0.5	1.1
New England	1.7	1.7	0.6	0.5	0.4	1.2
Pacific	1.7	2.0	0.7	0.5	0.2	0.6
South Atlantic	2.1	2.3	0.8	0.7	0.5	1.1
West North Central	2.7	2.8	1.0	0.8	0.5	1.8
West South Central	2.0	2.2	0.7	0.6	0.4	1.3

TSA, total shoulder arthroplasty.

consistently observed across geographic regions, with New England (OR = 0.69, $P < .001$) and Pacific (OR = 0.68, $P < .001$) regions showing the largest gender disparities in receiving outpatient TSAs, and East South Central showing the smallest (OR = 0.85, $P < .001$) (Fig. 4).

Discussion

This study demonstrates significant racial and gender disparities in the use of outpatient shoulder arthroplasty. White Medicare beneficiaries were 30% more likely to be

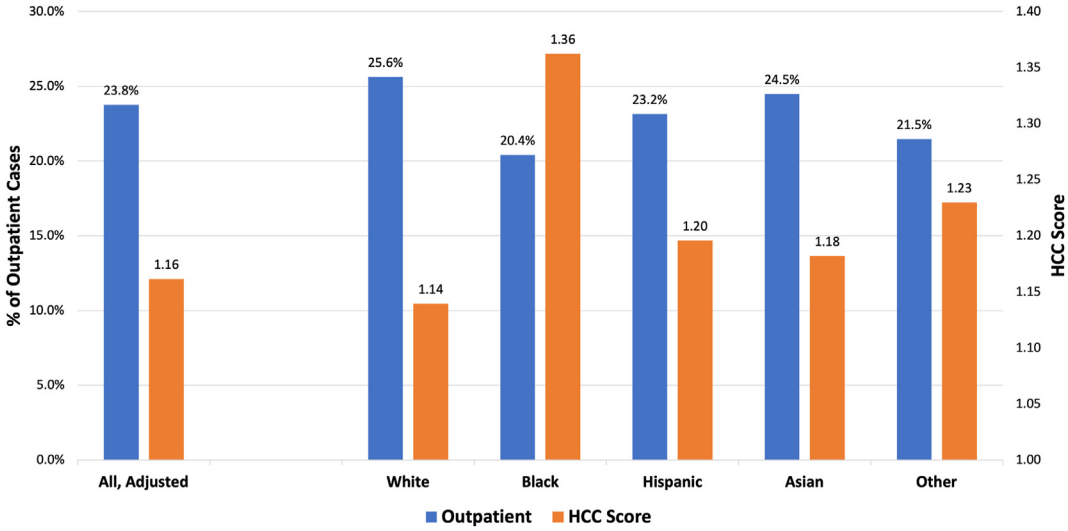

Figure 1 Observed differences in percentage of outpatient total shoulder arthroplasties and mean hierarchical condition category (HCC) score by race groups. Aggregate results were adjusted using national Medicare fee-for-service beneficiary racial distributions within each year.

Table IV TSA sample characteristics by race groups

Characteristics	All, unadjusted	All, adjusted*	White	Black	Hispanic	Asian	Other
Volume, n	168,504	168,504	159,991	5093	1071	547	1802
Outpatient, %	25.4	23.8	25.6	20.4	23.2	24.5	21.5
Age, yr	72.8	72.6	72.9	70.0	69.6	73.3	72.7
Female, %	56.4	57.6	55.9	72.0	66.1	68.6	53.0
HCC risk score, mean	1.15	1.16	1.14	1.36	1.20	1.18	1.23
Medicaid dual status, %	6.6	8.8	5.6	23.8	55.7	28.9	14.8
Teaching hospital, %	51.2	52.0	50.8	62.3	55.9	53.7	49.2
Hospital bed size, n	314	320	311	395	356	354	301
Urban hospital, %	90.2	90.7	90.0	95.3	95.1	96.3	88.8

TSA, total shoulder arthroplasty; *HCC*, hierarchical condition category.
* Aggregate TSA results were adjusted using national Medicare FFS beneficiary racial distributions within each year.

Table V *P* values observed when comparing each minority and the White population

Characteristics	Black	Hispanic	Asian	Other
Volume	NA	NA	NA	NA
Outpatient	<.001	.070	.580	<.001
Age, yr	<.001	<.001	.230	.300
Female	<.001	<.001	<.001	.020
HCC risk score	<.001	.120	.400	<.001
Medicaid dual status	<.001	<.001	<.001	<.001
Teaching hospital	<.001	<.001	.180	.170
Hospital bed size	<.001	<.001	<.001	.130
Urban hospital	<.001	<.001	<.001	.130

NA, not available; *HCC*, hierarchical condition category.

discharged the same day compared with Black patients, and men were 25% more likely to be discharged home the same day compared with women. Further, the geographic region where a patient was treated significantly affected the degree of inequity observed. Racial and gender inequity is not new to orthopedics, and unfortunately, recent literature specific to shoulder arthroplasty has demonstrated worsening rather than improving disparities. Best et al[4] reported a worsening gap in utilization of TSA between 2012 and 2017, with a widening of procedure rates by 12.5 per 100,000 beneficiaries between White and Black patients, supporting previous reports.[4,8,9,22,30,36] The current study demonstrates that the rapid transition to outpatient shoulder arthroplasty has failed to eliminate barriers to equitable care.

With a significantly increased number of patients undergoing outpatient TSA,[13,17,28] it was unclear how race and gender disparities would evolve. Outpatient TSA has been shown to be safe in patients with a low medical comorbidity burden as well as an appropriate living situation at home.[1,3,6,7,10,11,18,19,24,25,27,34] Unfortunately, race can influence these factors, with minority patients demonstrating a higher rate of medical comorbidities, leading to

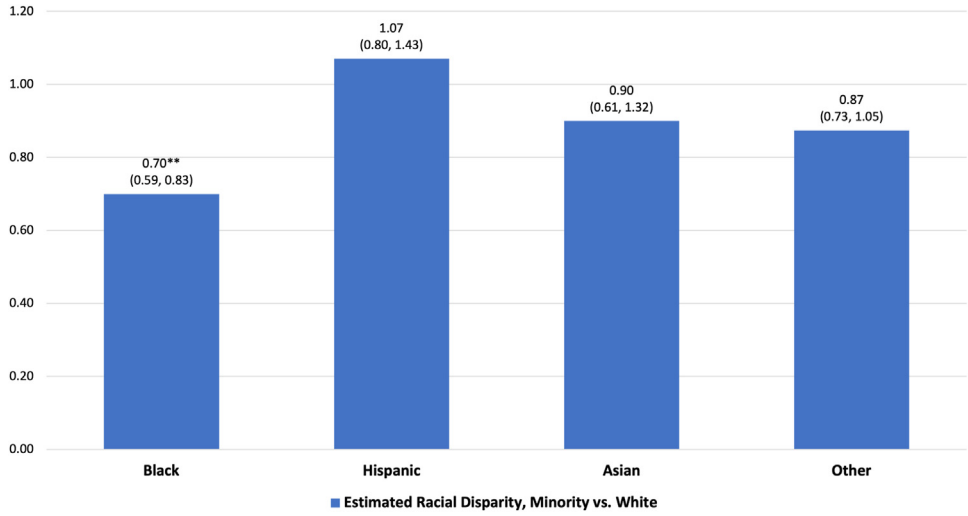

Figure 2 Estimated racial disparity in odds ratios for receiving outpatient total shoulder arthroplasties by minority groups. All analyses controlled for patient age, gender, interaction term between race and gender, dual status for Medicaid, hierarchical condition category (HCC) score, hospital teaching status, urban status, bed size, year fixed effects, and state fixed effects. Fee-for-service beneficiary racial distributions were used to weight the regression. $*P < .01$, $**P < .001$.

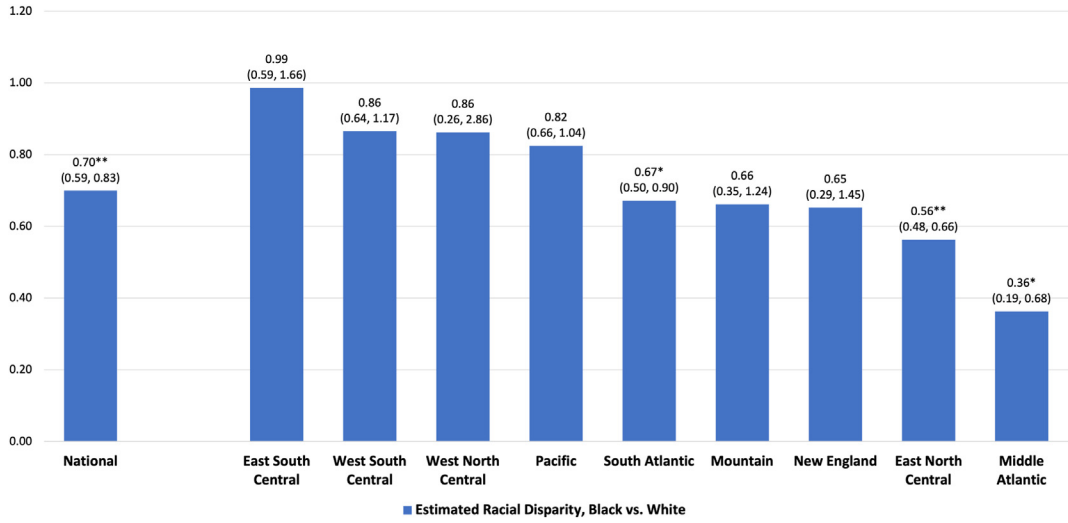

Figure 3 Estimated racial disparity for Blacks in odds ratios for receiving outpatient TSAs, nationally and by census divisions. All analyses controlled for patient age, gender, interaction term between race (Black) and gender, dual status for Medicaid, hierarchical condition category (HCC) score, hospital teaching status, urban status, bed size, year fixed effects, and state fixed effects. Fee-for-service beneficiary racial distributions were used to weight the regression. $*P < .01$, $**P < .001$.

increased risk for complication, readmission, and delayed discharge in non-White patients.[4,5,12,15,21,22,35] However, in the current study, significant racial differences in the rates of outpatient shoulder arthroplasty were observed even after controlling for comorbidities through the HCC score. Further research is therefore required to determine the reason for this disparity.

In addition to race, gender differences have been observed in shoulder arthroplasty. Female patients undergo arthroplasty at an older age, have longer lengths of stay, and also report worse patient-reported outcomes than their male counterparts.[14,16,26] In the current study, female patients demonstrated significantly lower rates of outpatient shoulder arthroplasty as compared to their male counterparts, despite controlling for HCC scores. One potential explanation may be that older patients, especially in North America and Europe, are more likely to live alone.[2] However, the age difference in this study was only 6 months (72.5 years for males vs. 73 years for females). Unfortunately, a patient's living situation and/or reasons for why females undergo outpatient shoulder arthroplasty at a lower rate cannot be fully evaluated in this database study. Further

Table VI TSA sample characteristics by gender

Characteristics	Male	Female	*P* value
Volume	73,400	95,104	NA
Outpatient, %	28.2	23.2	<.001
Age, yr	72.5	73.0	<.001
HCC risk score	1.17	1.13	<.001
Medicaid dual status, %	4.5	8.3	<.001
White, %	96.2	94.0	<.001
Teaching hospital, %	50.6	51.6	<.001
Hospital bed size	312	315	.040
Urban hospital, %	89.9	90.4	.002

TSA, total shoulder arthroplasty; *HCC*, hierarchical condition category; *NA*, not available.

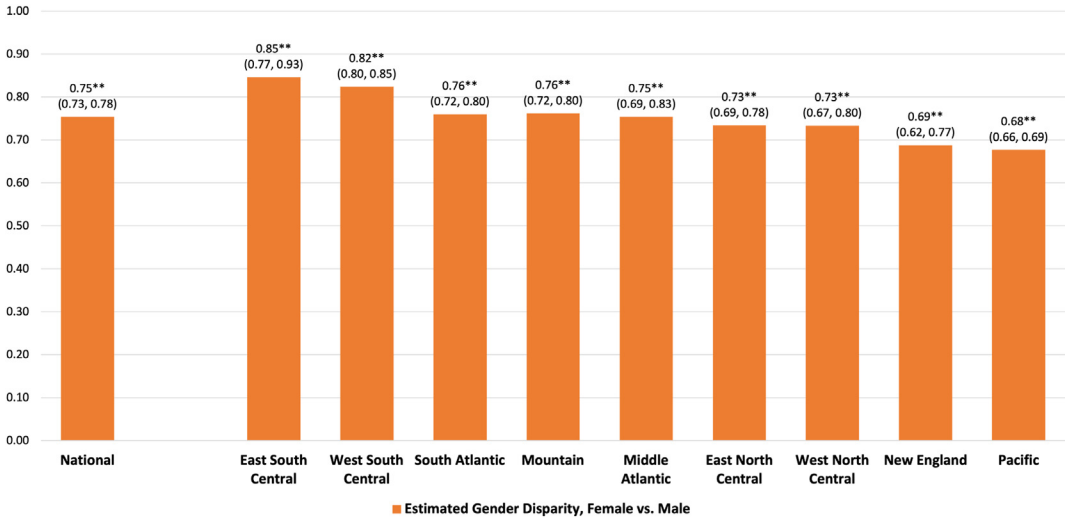

Figure 4 Estimated gender disparity in odds ratios for receiving outpatient total shoulder arthroplasties, nationally and by census divisions. All analyses controlled for patient age, race (White vs. non-White), interaction term between race (non-White) and gender, dual status for Medicaid, hierarchical condition category (HCC) score, hospital teaching status, urban status, bed size, year fixed effects, and state fixed effects. Fee-for-service beneficiary racial distributions were used to weight the regression. $*P < .01$, $**P < .001$.

research is necessary to evaluate this disparity to identify and address barriers faced by female patients.

The rates of outpatient TSA for both race and gender varied by geographic region. Blacks had lower rates of outpatient TSA in the South Atlantic, East North Central, and Middle Atlantic regions whereas females had lower rates in the New England and Pacific regions. Eichinger et al[9] previously reported no difference in racial disparities across census regions using the Healthcare Cost and Utilization Project Nationwide Inpatient Sample. Sudah et al[32] evaluated CMS claims in 2019-2020 and found differences between geographic regions in length of stay with the West having the lowest and the Northeast having the highest, but they did not evaluate gender or racial disparities between regions. Meanwhile, Somerson et al[31] evaluated the variation in high-volume shoulder arthroplasty surgeons in 2012 by metropolitan area and found the lowest numbers in the West, and the highest in some of the areas where we found the most disparities (New England, Mid-Atlantic, West Coast, and South Atlantic). To our knowledge, no other studies have reported on the geographic variation in racial or gender disparity. It is difficult to discern the cause of the increased disparities noticed within these regions, but we believe it is important to recognize these differences to encourage practitioners to take a closer look at their own practices to evaluate for bias.

Although this study has identified significant racial and gender disparities in the utilization of outpatient TSA, given the limitations of the CMS database, it does not provide insight into the underlying causes of these disparities. The first step is to identify the problem, but future research is required to try to determine the underlying cause of these disparities in order to develop practices that provide more equitable care to our patients.

The current study is not without limitations. First, this database study is inherently limited by the accuracy of data entry and coding. Second, this study includes only Medicare beneficiaries that may have a biased representation of

race and gender distribution when compared to patients with private insurance. Also, we could not include patients done at an ambulatory surgery center as this was not approved during this time period for this patient cohort. Third, this study does not address the underlying reasons for the racial and gender disparities that were found in outpatient TSA. However, this is the largest database study evaluating the effect of race and gender on the utilization of outpatient TSA. The first step in correcting disparity is recognizing and reporting its presence.[35] The continuous promotion of equity, diversity, and inclusion is crucial to improve patient outcomes and the overall quality of care delivered.

Conclusion

Racial and gender disparities were found nationally in outpatient TSAs, with Black patients having 30% ($P < .01$) fewer odds of receiving outpatient TSAs than White patients, and female patients with 25% ($P < .01$) fewer odds than male patients. Racial and gender disparities varied by region and continue to be an issue for shoulder arthroplasties after the adoption of outpatient TSAs. Further research is required to identify the underlying causes of these disparities in order to develop better practices for more equitable care.

Disclaimers:

Funding: No funding was disclosed by the authors.
Conflicts of interest: Catherine J. Fedorka reports personal fees from Stryker. Michael B. Gottschalk reports research support from Konica Minolta and Stryker. Joseph A. Abboud reports ownership of stock in Aevumed; research support from Arthrex, Lima, OREF, Orthofix, and the Department of Defense; personal fees from Bioventus; intellectual property (IP) royalties from OsteoCentric Technologies, Smith & Nephew, DJ Orthopaedics, Globus Medical, Stryker, and Zimmer; personal fees from DJ Orthopaedics, Globus Medical, Stryker, and Zimmer; membership on the editorial or governing board of *Journal of Shoulder and Elbow Surgery* and Lima; ownership of stock in Marlin Medical Alliance, in OBERD, OTS Medical, and Shoulder JAM; financial or material support from SLACK Incorporated; and publishing royalties and financial or material support from Wolters Kluwer Health–Lippincott Williams & Wilkins. Joseph A. Abboud reports ownership of stock in Aevumed; research support from Arthrex, Lima, OREF, Orthofix, and the Department of Defense; intellectual property (IP) royalties from OsteoCentric Technologies, Smith & Nephew, DJ Orthopaedics, Globus Medical, Stryker, and Zimmer; personal fees from Bioventus, DJ Orthopaedics, Globus Medical, Stryker, and Zimmer; membership on the editorial or governing board of *Journal of Shoulder and Elbow Surgery* and Lima; ownership of stock in Marlin Medical Alliance, in OBERD, OTS Medical, and Shoulder JAM; financial or material support from SLACK Incorporated; and publishing royalties and financial or material support from Wolters Kluwer Health–Lippincott Williams & Wilkins. Jon J.P. Warner reports membership on the editorial or governing board of *Journal of Shoulder and Elbow Surgery*, other financial or material support from Smith & Nephew, personal fees from Stryker, and IP royalties and personal fees from Wright Medical Technology. John Costouros reports IP royalties and personal fees from Arthrex, Inc., Medacta, and Stryker; IP royalties, personal fees, and stock or stock options with Catalyst Orthoscience, Inc.; IP royalties, personal fees, and research support from FX Shoulder; other financial or material support from United Healthcare; and IP royalties from Wright Medical Technology, Inc. Matthew J. Best reports other financial or material support from Arthrex, Inc., and Smith & Nephew. April D. Armstrong reports personal fees from Globus Medical, IP royalties from Zimmer, and membership on the editorial or governing board of *Journal of Shoulder and Elbow Surgery*. Derek A. Haas reports ownership of stock in Avant-Garde Health and personal fees from Medacta. The other 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.

Supplementary Data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jse.2024.04.020.

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