

Racial and Socioeconomic Disparities in the Utilization of TKA Among Patients with Posttraumatic Knee Osteoarthritis

Estimates from the United States National Inpatient Sample, 2011-2018

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Background: Advanced posttraumatic osteoarthritis (PTOA) of the knee is a cause of substantial disability, particularly in younger individuals, and the treatment of choice is total knee arthroplasty (TKA). Racial and socioeconomic disparities exist in the use of TKA, but, to our knowledge, there have been no studies examining these disparities among patients with PTOA.

Methods: We performed chi-square and logistic regression analyses on data from the Nationwide Inpatient Sample (NIS). The outcome of interest was the rate of TKA utilization, and the primary predictors were racial/ethnic group and insurance status. The regression models were adjusted for age, sex, household income, and Charlson Comorbidity Index (CCI).

Results: The odds of receiving TKA for Black patients (odds ratio [OR] = 0.55; 95% confidence interval [CI], 0.48 to 0.62) and Hispanic patients (OR = 0.53; 95% CI, 0.46 to 0.62) were lower compared with White patients. Patients with Medicare (OR = 0.51; 95% CI, 0.46 to 0.57), those with Medicaid (OR = 0.48; 95% CI, 0.42 to 0.55), and those who self-paid (OR = 0.91, 95% CI: 0.14 to 0.25) had significantly lower odds of TKA compared with those with private insurance.

Conclusions: Black and Hispanic patients are less likely than White patients to utilize TKA, and patients with private insurance are more likely to utilize TKA.

Level of Evidence: Prognostic Level III. See Instructions for Authors for a complete description of levels of evidence.

Posttraumatic osteoarthritis (PTOA) is a degenerative joint disease involving the articular cartilage and subchondral bone that develops after structural damage to an articulating joint¹. The precipitating event could be an articular fracture, joint dislocation, or meniscal or ligamentous tear leading to progressive cartilage damage^{1,2}. Up to 75% of patients with a history of substantial joint trauma develop PTOA³. Previous studies have estimated the prevalence of PTOA to represent about 12% of all cases of symptomatic osteoarthritis (OA) of the hip, knee, and ankle^{2,4}. PTOA of the knee is estimated to account for about 12.5% of all cases of OA of the knee and 21% to 44% of all cases of PTOA^{2,3,5}. Treatment of PTOA of the knee depends on disease severity, and total knee arthroplasty (TKA) is the treatment of choice for advanced PTOA^{5,6}.

OA of the knee leads to substantial disability, with an estimated loss of about 0.55 quality-adjusted life years (QALYs)

per person in the United States⁷. Several studies have found TKA to be highly cost-effective for the treatment of advanced knee OA^{8,9}. Debilitating PTOA requiring TKA usually occurs >10 years earlier and progresses faster than primary OA³. As a result, patients with PTOA have a greater number of years lived with disability compared with those with primary OA, thus making TKA vital for improving quality of life and productivity in this subpopulation¹⁰.

There is evidence of racial and socioeconomic disparities in the utilization of services and procedures for different health conditions in the United States^{11,12}. Several studies have reported a disproportionately lower utilization of TKA for the treatment of knee OA among Black individuals as compared with non-Hispanic White individuals, despite Black individuals having a worse baseline functioning level¹³⁻¹⁵. It has been shown that Black individuals lose >70,000 QALYs yearly because of disparities in the utilization of

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TKA¹⁶. These trends persist in studies that have been conducted among subpopulations such as older women (>50 years of age)¹⁷. Although many studies have shown racial and income disparities in utilization of TKA among Medicare patients, few studies have compared TKA utilization across insurance types^{18,19}.

To our knowledge, no study has evaluated the racial and socioeconomic disparities in the utilization of TKA among patients with PTOA. Therefore, we used a large nationwide database (the Nationwide Inpatient Sample [NIS]) to assess for racial and socioeconomic disparities in the utilization of TKA among patients with PTOA.

Materials and Methods

Database Characteristics

We reviewed NIS data from 2011 to 2018. The NIS is a publicly available database sponsored by the Agency for Healthcare Research and Quality and contains health-care utilization data extracted from about 8 million hospital stays, representing about 20% of U.S. community hospitals²⁰.

Compliance with Ethical Guidelines

The NIS database is a de-identified database that does not directly involve human subjects as defined by federal regulations and guidance²¹. Thus, all procedures performed were in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Inclusion Criteria

Adult patients with International Classification of Diseases (ICD)-9 or ICD-10 Clinical Modification (CM) diagnostic codes for PTOA (ICD-9-CM: 716.16, 715.26, 715.2; ICD-10-CM: M12.569, M17.15, M12.562, M17.30, M17.31, M17.32, M17.4, M17.5)^{22,23} were included in the analysis.

Utilization of TKA was defined using the ICD-9 procedure code of 81.54 and ICD-10 procedure codes of 0SRD0J9, 0SRC0J9, 0SRD0JA, 0SRC0JA, 0SUD09C, 0SUC09C, 0SRC0EZ, 0SRD0EZ, 0SRC0L9, 0SRC0LA, 0SRC0LZ, 0SRD0L9, 0SRD0LZ, 0SRD0LA, 0SRC0M9, 0SRC0MA, 0SRC0MZ, 0SRD0M9, 0SRD0MZ, and 0SRD0MA.

We included the variables age, race, sex, insurance, household income, and Charlson Comorbidity Index (CCI). The CCI is a proxy for comorbidities and is predictive of 1-year mortality.

Outcomes

The primary outcome of this study was the rate of TKA across racial/ethnic groups and insurance types. We defined race/ethnicity as White, Black, Hispanic, and Asian/Pacific Islander and insurance type as Medicare, Medicaid, private insurance, and self-pay (out of pocket) as has been done in previous studies²⁴.

Statistical Analysis

We performed all analyses with STATA (version 14; StataCorp)²⁵. The sampling design of the database was accounted for

by applying appropriate discharge weights to the dataset during analyses. We calculated descriptive statistics to examine the characteristics of the patient population. We used chi-square tests to assess the utilization rates of TKA and to compare the distribution of the variables (e.g., age, sex, race, comorbidities, median household income, and insurance status) between patients who underwent TKA and those who did not (Table I). As the central theme of the study is the effect of race, we also used the chi-square test to evaluate the distribution of the other covariates across the racial groups (Table II).

We compared the rate of TKA utilization by race and insurance type among patients with a diagnosis of PTOA with use of chi-square analysis (Table III). Since White race and private insurance were most common in our patient cohort, they were used as the reference groups during our analysis. Furthermore, in a subgroup analysis, we evaluated the rate of TKA by race among patients with private insurance (Table IV).

We ran 2 separate bivariable logistic regression models to evaluate the relationship between the predictor variables (race and insurance type) and the rates of TKA use (models 1 and 3, respectively). We subsequently included race, age, sex, CCI, and median household income in models 2 and 4 to assess the adjusted disparities in TKA utilization for race and insurance type, respectively.

In addition, we fitted multivariable logistic regression models of TKA by race and insurance type (model 5) and then by race, insurance type, and the other covariates (model 6) to evaluate mutually adjusted disparities in TKA utilization rates. We presented the odds ratios (ORs) and 95% confidence intervals (CIs) in all of the regression analyses. The level of significance was set at $p < 0.05$.

Source of Funding

This research was not supported by any funding.

Results

Demographics and TKA Utilization

Our study identified a total of 17,668 patients with PTOA between 2011 and 2018. About 81% of the patients underwent TKA. The mean age of all patients was 58.7 years, and the mean age did not differ significantly between the patients who underwent TKA and those who did not (58.8 ± 10.8 versus 58.3 ± 15.8 years; $p = 0.117$). Overall, 81.5% of the patients in the study population were White, 45% were women, and 49.5% had private insurance. The mean CCI was lower among patients who received TKA than among patients who did not (0.25 ± 0.67 versus 0.42 ± 1.10 ; $p < 0.001$). The distributions of the demographic characteristics of the patient population are presented in Table I.

The proportion of White and Asian patients in the top 3 household income quartiles was significantly higher than that of Black and Hispanic patients, who had their highest population proportion in the lowest-income quartile. Also, more Black and Hispanic patients depended on self-payment to cover the TKA. The distribution of the covariates among the racial groups for patients who underwent TKA is shown in Table II.

TABLE I Patient Demographics for Inpatients with Posttraumatic Osteoarthritis (PTOA) from 2011 to 2018 (N = 17,668)

Variable	All Patients	Patients Who Did Not Receive TKA	Patients Who Received TKA	T-Statistic or Chi-Square	P Value
No. of patients	17,668 (100%)	3,368 (19.1%)	14,300 (80.9%)		
Age* (yr)	58.7 ± 11.9	58.3 ± 15.8	58.8 ± 10.8	-1.57	0.117
Age categories (no. of patients)				473.1	<0.001
<35 yr	488 (2.8%)	247 (7.3%)	241 (1.7%)		
35-44 yr	1,410 (8.0%)	376 (11.2%)	1,034 (7.2%)		
45-54 yr	4,268 (24.2%)	711 (21.1%)	3,557 (24.9%)		
55-64 yr	6,137 (34.7%)	903 (26.8%)	5,234 (36.6%)		
>64 yr	5,365 (30.4%)	1,131 (33.6%)	4,234 (29.6%)		
Female sex† (no. of patients)	7,965 (45.1%)	1,583 (47.0%)	6,382 (44.6%)	6.18	0.013
Household income‡, ** (n = 17,308)				48.6	<0.001
0-25 percentile	4,062 (23.5%)	909 (27.6%)	3,153 (22.5%)		
26-50 percentile	4,462 (25.8%)	822 (25.0%)	3,640 (26.0%)		
51-75 percentile	4,617 (26.7%)	872 (26.5%)	3,745 (26.7%)		
76-100 percentile	4,167 (24.1%)	686 (20.9%)	3,481 (24.8%)		
Charlson Comorbidity Index*	0.30 ± 0.76	0.42 ± 1.1	0.25 ± 0.67	9.18	<0.001
Race (n = 16,097)§				213.1	<0.001
White	13,115 (81.5%)	2,225 (72.5%)	10,890 (83.6%)		
Black	1,565 (9.7%)	463 (15.1%)	1,102 (8.5%)		
Hispanic	1,225 (7.6%)	343 (11.2%)	882 (6.8%)		
Asian/Pacific Islander	192 (1.2%)	38 (1.2%)	154 (1.2%)		
Insurance status (n = 15,349)#				471.1	<0.001
Medicare	5,907 (38.5%)	1,398 (45.3%)	4,509 (36.8%)		
Medicaid	1,592 (10.4%)	497 (16.1%)	1,095 (8.9%)		
Private	7,601 (49.5%)	1,069 (34.6%)	6,532 (53.3%)		
Self-pay	249 (1.6%)	122 (4.0%)	127 (1.0%)		

*The values are given as the mean and the standard deviation. †Data missing for 7 patients (0.04%). **Data missing for 360 patients (2.0%). ‡Median household income quartiles based on patient ZIP code. §Data missing for 1,571 patients (8.9%). #Data missing for 2,319 patients (13.1%).

Overall TKA Utilization

The rate of TKA for White patients (83.0%) was significantly higher than that for Black patients (70.4%; $p < 0.001$) and Hispanic patients (72.0%; $p < 0.001$) but was not significantly higher than that for Asian/Pacific Islander patients (80.2%; $p = 0.310$). Similarly, the rate of TKA for patients with private insurance (85.9%) was significantly higher than that for patients with Medicare (76.3%; $p < 0.001$), those with Medicaid (68.8%; $p < 0.001$), and those who self-paid (51.0%; $p < 0.001$) (Table III).

Private Insurance Subgroup Analysis

In the private insurance subgroup analysis, the rate of TKA for White patients (87.1%) was significantly higher than those for Black patients (81.1%; $p = 0.001$) and Hispanic patients (75.6%; $p < 0.001$) but not that for Asian/Pacific Islander patients (91.9%; $p = 0.293$) (Table IV).

Multivariate Analysis of TKA Across Race and Insurance Groups

Multivariable logistic regression analyses showed that all patients who were members of underrepresented racial groups except

Asian/Pacific Islander patients had lower odds of receiving TKA than White patients. The odds of undergoing TKA for Black patients (OR = 0.55; 95% CI, 0.48 to 0.62; $p < 0.001$) and Hispanic patients (OR = 0.53; 95% CI, 0.46 to 0.62; $p < 0.001$) were significantly lower than those for White patients. The odds of undergoing TKA for Asian/Pacific Islander patients (OR = 0.80; 95% CI, 0.56 to 1.15; $p = 0.384$) were not significantly different from that for White patients.

Also, patients with Medicare (OR = 0.51; 95% CI, 0.46 to 0.57; $p < 0.001$), those with Medicaid (OR = 0.48; 95% CI, 0.42 to 0.55; $p < 0.001$), and those who self-paid (OR = 0.91; 95% CI, 0.14 to 0.25; $p < 0.001$) had significantly lower odds of TKA compared with those with private insurance (Table V).

Discussion

In our analyses of the NIS data from 2011 to 2018 for patients with PTOA in the United States, we found that Black and Hispanic patients had overall lower TKA utilization rates than White patients after adjusting for other covariates. We also found lower rates of TKA utilization among patients with

TABLE II Distribution of Covariates Among Racial Groups for Patients with PTOA Who Underwent TKA From 2011 to 2018 (N = 13,028)

	Race (no. of patients)					T-Statistic or Chi-Square	P Value
	All	White	Black	Hispanic	Asian/Pacific Islander		
Age categories						147.5	<0.001
<35 yr	201 (1.5%)	147 (1.3%)	28 (2.5%)	23 (2.6%)	3 (1.9%)		
35-44 yr	938 (7.2%)	734 (6.7%)	124 (11.3%)	68 (7.7%)	12 (7.8%)		
45-54 yr	3,215 (24.7%)	2,567 (23.6%)	364 (33.0%)	247 (28.0%)	37 (24.0%)		
55-64 yr	4,768 (36.6%)	4,018 (36.9%)	376 (34.1%)	323 (36.6%)	51 (33.1%)		
>64 yr	3,906 (30.0%)	3,424 (31.4%)	210 (19.1%)	221 (25.1%)	51 (33.1%)		
Female sex	5,853 (44.9%)	4,809 (44.2%)	551 (50.1%)	407 (46.2%)	86 (55.8%)	22.4	<0.001
Household income quartile (n = 12,773)*†						455.7	<0.001
0-25 percentile	2,931 (22.9%)	2,139 (20.0%)	500 (46.5%)	259 (30.4%)	33 (22.3%)		
26-50 percentile	3,295 (25.8%)	2,830 (26.5%)	227 (21.1%)	216 (25.4%)	22 (14.9%)		
51-75 percentile	3,370 (26.4%)	2,898 (27.1%)	197 (18.3%)	233 (27.3%)	42 (28.4%)		
76-100 percentile	3,177 (24.9%)	2,830 (26.5%)	152 (14.1%)	144 (16.9%)	51 (34.5%)		
Comorbidity categories						40.7	<0.001
0 comorbidities	10,807 (83.0%)	9,111 (83.7%)	851 (77.2%)	722 (81.9%)	123 (79.9%)		
1 comorbidity	1,548 (11.9%)	1,242 (11.4%)	163 (14.8%)	116 (13.2%)	27 (17.5%)		
≥2 comorbidities	673 (5.2%)	537 (4.9%)	88 (8.0%)	44 (5.0%)	4 (2.6%)		
Insurance status (n = 11,169)‡						280.9	<0.001
Medicare	4,173 (37.4%)	3,556 (37.4%)	315 (36.4%)	257 (38.8%)	45 (35.2%)		
Medicaid	998 (8.9%)	706 (7.4%)	172 (19.9%)	106 (16.0%)	14 (11.0%)		
Private	5,892 (52.8%)	5,188 (54.5%)	351 (40.6%)	285 (43.1%)	68 (53.1%)		
Self-pay	106 (0.95%)	64 (0.67%)	27 (3.1%)	14 (2.1%)	1 (0.78%)		

*Median household income quartiles based on patient ZIP code. †Data missing for 255 patients (2.0%). ‡Data missing for 1,859 patients (14.3%).

Medicare, Medicaid, and self-payment as compared with those with private insurance during the study period. However, our study showed that the rate of TKA utilization among Asian/Pacific

Islander patients was not significantly different from that among White patients. This finding contrasts with another study, which showed that Asian and Native American patients had lower odds

TABLE III Receipt of TKA Among Patients with a Primary Diagnosis of PTOA*

Variable	No TKA	TKA	P Value
Race (n = 16,097) (no. of patients)			
White	2,225 (17.0%)	10,890 (83.0%)	Ref.
Black	463 (29.6%)	1,102 (70.4%)	<0.001
Hispanic	343 (28.0%)	882 (72.0%)	<0.001
Asian/Pacific Islander	38 (19.8%)	154 (80.2%)	0.310
Insurance status (n = 15,349) (no. of patients)			
Private	1,069 (14.1%)	6,532 (85.9%)	Ref.
Medicare	1,398 (23.7%)	4,509 (76.3%)	<0.001
Medicaid	497 (31.2%)	1,095 (68.8%)	<0.001
Self-Pay	122 (49.0%)	127 (51.0%)	<0.001

*Row percentages are shown. P values are derived from chi-square comparison of the rate of TKA utilization by racial/ethnic group and insurance status.

TABLE IV Receipt of TKA Among Patients with Private Insurance

Variable	No TKA	TKA	P Value*
<i>Race (no. of patients)</i>			
White	766 (12.9%)	5,188 (87.1%)	Ref.
Black	82 (18.9%)	351 (81.1%)	0.001
Hispanic	92 (24.4%)	285 (75.6%)	<0.001
Asian/Pacific Islander	6 (8.1%)	68 (91.9%)	0.293

*Derived from chi-square comparison of the rate of TKA utilization by racial/ethnic group.

of undergoing TKA than White patients; however, that study was not conducted on a nationally representative sample but instead was restricted to 8 states with ethnically diverse populations¹⁵.

The existence of racial disparities in the utilization of TKA in the United States during the 1990s and early 2000s has long been established¹⁹. A more recent study conducted among patients who underwent TKA between 2006 and 2015 found that Black patients received TKA at lower rates than White patients despite national efforts to curb these disparities¹⁴. Subgroup studies also have shown that, in specific patient populations such as older women, Black and Hispanic patients are still less likely than White patients to receive TKA, even after adjusting for differences in age, educational status, and income level¹⁷.

Our findings of lower odds of TKA utilization among Black and Hispanic patients with PTOA are consistent with racial disparities reported in previous studies conducted among patients undergoing arthroplasty¹³⁻¹⁵. However, we found similar odds of TKA utilization between White and Asian/Pacific Islander patients with PTOA, which contrasts with findings from other studies that have been conducted among patients with primary OA¹⁵. This finding may be due to sociocultural differences between the 2 populations. Primary OA affects older individuals as compared with PTOA. Most Asian American elderly patients are immigrants and are less likely to utilize health-care services due to sociocultural factors such as limited English-language proficiency and immigration status²⁶. However, those sociocultural factors are less prevalent among younger Asian American patients, who constitute a substantial proportion of the patients with PTOA²⁷.

The disparities between Black, Hispanic, and White patients identified in our study are likely multifactorial. Several factors could contribute to the racial disparities in the utilization of TKA, including health-care provider bias, health literacy, patient preference, and perceived discrimination.

Multiple studies on different disease conditions, including breast cancer and acute coronary syndrome, have identified implicit bias among physicians as being responsible for racial differences in treatment recommendations²⁸. Implicit bias also has been documented among physicians treating patients who are potential candidates for TKA²⁹. An online study, which

TABLE V Multivariable Logistic Regression of the Association of Race and Insurance Status with TKA from 2011 to 2018 Controlling for Age, Sex, CCI, and Median Household Income

Independent Variables	Total Knee Arthroplasty					
	Crude Estimate for Race (Model 1)	Estimate for Race Adjusted for Covariates (Model 2)	Crude Estimate for Insurance Status (Model 3)	Estimate for Insurance Status Adjusted for Covariates (Model 4)	Crude Estimate for Race and Insurance Status (Model 5)	Estimate for Race and Insurance Status Adjusted for Covariates (Model 6)
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Race						
White (ref.)	1	1			1	1
Black	0.49*** (0.44-0.55)	0.52*** (0.46-0.59)			0.52*** (0.46-0.60)	0.55*** (0.48-0.62)
Hispanic	0.53*** (0.47-0.61)	0.55*** (0.48-0.63)			0.52*** (0.45-0.61)	0.53*** (0.46-0.62)
Asian/Pacific Islander	0.87 (0.61-1.25)	0.87 (0.61-1.26)			0.85 (0.58-1.22)	0.80 (0.56-1.15)
Insurance status						
Private (ref.)			1	1	1	1
Medicare			0.52*** (0.48-0.57)	0.49*** (0.44-0.55)	0.53*** (0.49-0.58)	0.51*** (0.46-0.57)
Medicaid			0.37*** (0.33-0.42)	0.42*** (0.37-0.48)	0.45*** (0.39-0.51)	0.48*** (0.42-0.55)
Self-pay			0.17*** (0.13-0.22)	0.18*** (0.14-0.23)	0.19*** (0.14-0.25)	0.19*** (0.14-0.25)
Age		1.00 (0.99-1.01)		1.01*** (1.00-1.02)		1.01*** (1.00-1.02)
Female sex		0.92 (0.85-1.00)		0.93 (0.86-1.01)		0.95 (0.87-1.04)
CCI		0.79*** (0.75-0.82)		0.80*** (0.77-0.84)		0.81*** (0.77-0.84)
Income quartile						
0-25 (ref.)		1		1		1
26-50		1.15* (1.02-1.28)		1.17** (1.04-1.31)		1.06 (0.94-1.20)
51-75		1.10 (0.96-1.20)		1.07 (0.95-1.20)		0.95 (0.84-1.08)
76-100		1.22* (1.08-1.37)		1.16* (1.03-1.31)		1.01 (0.89-1.15)

*P < 0.05, **p < 0.01, ***p < 0.001.

involved presenting physicians with different clinical scenarios of patients with severe OA that was refractive to medical treatment, was conducted to assess for racial differences in the recommendations for TKA²⁹. Most physicians in the study reported that White patients were more medically cooperative than Black patients and reported a greater liking for White patients than Black patients. Underestimation of pain among racial minorities by health-care providers has been documented in multiple settings^{30,31}. Another study, conducted among patients undergoing TKA, found that Black and Hispanic patients who were referred for knee surgery had more pain, less function, and worse quality of life compared with non-Hispanic White patients³². These findings may reflect racial differences in the level of physician empathy toward patients' pain. However, other studies on surgeon recommendations for TKA have consistently failed to show any difference in recommendations by race^{28,33}. Those studies were conducted among patients with clear indications for TKA. Among patients in whom the indications for TKA are less clear, health-care provider bias may play a more substantial role in the recommendation for TKA. However, it is unlikely that provider bias alone thoroughly explains the racial disparities in the utilization of TKA in our study.

Other patient-specific factors that have been found to contribute to the underutilization of TKA by Black and Hispanic patients include a lack of familiarity with the procedure and a lower perception of its benefit, leading to a lower preference for TKA²⁸. A study conducted in the orthopaedic clinics of 2 large tertiary institutions showed that TKA recommendations were largely driven by patient preferences³³. In that study, Black patients had a lower preference for TKA and were less likely than White patients to receive TKA. After adjusting for preference for TKA and other confounders, the authors found no difference in the likelihood of receiving TKA by race³³. A similar study conducted among middle-aged and elderly patients with hip and knee OA showed that Black patients had lower health literacy levels and far lower post-operative outcome expectations than White patients, which may explain their low preference for surgical interventions³⁴.

Distrust of health-care professionals and perceived racial discrimination within the health-care system are essential factors in health-care utilization disparities. The reasons for this distrust have been extensively studied. The most common reasons cited for the mistrust include fear of experimentation, the perceived quest for profit by the hospitals and physicians, and a lack of trust in the competency levels of the health-care providers³⁵. Although distrust of health-care providers may in part account for the lower TKA utilization rates in our study, previous studies among candidates for hip and knee replacement have had mixed findings. While some authors have reported that Black patients are less likely to trust their orthopaedic surgeons³³, others have reported no racial difference in physician trust levels³⁴.

Many studies have evaluated racial disparities in the utilization of TKA overall and among Medicare patients, but we are not aware of any recent studies that have compared TKA utilization between Medicare, Medicaid, private insurance, and self-pay patients^{18,19}. Disparities in the utilization of expensive inpatient

procedures such as spinal cord stimulation therapy (SCST) by type of insurance were described in a previous study¹². The investigators found that the odds of SCST utilization were highest among patients with private insurance and lowest among Medicaid and self-pay patients¹². In the present study, the odds of TKA utilization were highest among patients with private insurance and lowest among self-pay patients. The odds of TKA utilization among Medicaid and Medicare patients also were significantly lower than those for privately insured patients in our study. Several factors, including provider preference, transportation, wait times, and insurance plan design, could be responsible for the observed disparities in TKA utilization by health insurance status.

Insurance payout is a factor that is substantially responsible for disparities in the utilization of various inpatient and outpatient services and has been extensively studied. A study comparing differences in the utilization of rehabilitation services after reverse shoulder arthroplasty found higher utilization rates among patients with private insurance compared with Medicare users³⁶. Private insurers have higher reimbursement rates than Medicare or Medicaid, and physicians and hospitals will likely be more willing to undertake a procedure if it is financially acceptable¹². Some health-care providers only accept private insurance, and this restricts the options of both Medicare and Medicaid users.

Because of the limited number of providers who accept Medicare and Medicaid insurance, their beneficiaries often must travel considerable distances to clinics and hospitals that accept their insurance³⁷. These facilities often have long appointment wait times³⁷, which serve as barriers to care access that can contribute to disparities in the utilization of health-care services.

Insurance providers offer different insurance plans with different designs and varying levels of copayments and deductibles. Studies have shown that users of insurance plans with high out-of-pocket payments are less likely to utilize health-care services³⁷. This may explain why self-pay patients had the lowest odds of TKA utilization in our study.

Limitations

Our study had several limitations. First, the severity of PTOA is likely a predictor of TKA utilization, but the absence of a variable for disease severity in the NIS database precluded us from adjusting for it. Second, no information on racial and socioeconomic differences in diagnosing PTOA is provided by the NIS database, and this could have affected the inclusion of participants in our study, which could also affect the interpretation of our results. Additionally, employment and knowledge about available health insurance plans could affect access to different types of health insurance. Last, the accuracy of our study conclusions is subject to potential inaccuracies in the ICD billing records (e.g., PTOA miscoded as primary OA, particularly in older individuals), patient data transfer from medical records, and exclusion of missing cases from the NIS database.

Conclusions

Despite these limitations, our study provides nationally representative information on racial and socioeconomic disparities

in utilizing a cost-effective procedure for treating a disabling condition. It also provides evidence on the relationship between sex, age, income level, comorbidities, and TKA in the context of PTOA. ■

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