



# Racial Disparities in Total Knee and Hip Arthroplasty in a Medically Underserved Community with a Diverse Population

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## Abstract

**Introduction** Previous studies have demonstrated lower total joint arthroplasty utilization rates and worse postoperative outcomes among non-White patients. Our study examined whether these disparities exist in the setting of a diverse population.

**Methods** This retrospective study included patients with a self-reported race who underwent total knee (TKA) or hip (THA) arthroplasty procedures in a racially diverse county. Patients who did not identify as White or Hispanic/Latino were excluded from the study due to small sample sizes. Demographic, intra and postoperative outcome differences were calculated. A multivariate logistic regression was developed to examine the association between patients' race and undesired postoperative outcomes.

**Results** Five hundred fifty-five patients were included in our study with 490 identifying as non-Hispanic/Latino White (88.8%) and 65 as Hispanic/Latino (11.2%). Hispanic/Latino-identifying patients were significantly younger ( $61.9 \pm 12.79$  versus  $68.58 \pm 9.00$  years), had lower Charlson Comorbidity Index scores, and were more likely to use non-Medicare/Medicaid insurance. We observed no differences between our cohorts in postoperative adverse events, emergency department visits, and hospital readmissions. Patients' self-identified race was not correlated with undesired postoperative outcomes.

**Conclusions** Although Hispanic/Latino-identifying patients constitute 50.2% of the county population of our study cohort, they accounted for only 11.2% of the patients in our study. This is noteworthy considering the lack of evidence suggesting a decreased prevalence of osteoarthritis among individuals of different races and ethnicities. Further, the demographic differences we observed suggest an exclusive Hispanic/Latino patient population utilizing TKA or THA procedures. Future studies controlling for risk factors and less invasive treatment options may explain these disparities.

**Keywords** Arthroplasty · Osteoarthritis · Surgical outcomes · Racial disparities

## Introduction

Osteoarthritis (OA) of the hip and knee joints is the most common arthropathy presentation in adults [1]. The prevalence rate of OA of the knee is estimated to be 12% among adults over 60 years [2] and 16% among those over 70 years [3]. Furthermore, one out of four adults over 85 years are

estimated to have symptomatic hip OA [1]. OA can be debilitating and is the leading cause of lower extremity disability among older adults [4].

While non-surgical treatment options for managing OA are effective for short-term symptomatic relief, total joint arthroplasty (TJA) procedures are recognized as definitive treatment options for end-stage OA [4]. Significant improvements in physical function and pain relief have been reported post total knee arthroplasty (TKA) [5, 6], as well as after total hip arthroplasty (THA) procedures [7].

While the efficacy of TJA is evident in the current literature, there is a variance in patients electing to undergo these interventions, with non-White patients having significantly lower utilization rates [8–11]. The racial disparities in TJA are recognized to extend beyond differences in utilization rates, with reports of poor intraoperative metrics such as

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blood loss [12, 13], and increased postoperative complications and readmission rates for non-White patients [14, 15]. The mechanisms behind these ethnic and racial disparities are multifaceted and include socioeconomics and clinician biases.

In spite of initiatives that have been implemented over the last two decades to help reduce these disparities in orthopedic care, a number of studies have shown that racial disparities persist; a recent study conducted in 2019 suggested that among women undergoing TJA, Black and Hispanic women were significantly less likely to receive the procedure even after adjusting for age and socioeconomic status [16]. One study has even suggested that the racial disparities in joint replacements have worsened [9]. The study, which assessed population-adjusted incidence rates of surgical procedures from 2012 to 2017 among White and Black patients, reported an increase in procedural incidence difference between the two groups by 11.6 per 100,000 persons for total hip arthroplasty and 19.9 per 100,000 persons for TKA.

Our study examined whether these disparities continue to exist. This study is unique in that the surgical cases reviewed are in a diverse and medically underserved community. This is notable as a limitation of some of the studies demonstrating racial disparities in TJA is the use of national databases with limited diversity [17]. Thus, the primary aim of this study was to compare the utilization, intra and postoperative metrics of a diversified group of patients who underwent TJA. Considering the great efforts that have been made in the last decade to combat and eliminate these disparities [18, 19], we hypothesized that our study would demonstrate improved outcomes among non-White patients undergoing TJA.

## Methods

Demographic and surgical information was collected from 580 patients' electronic medical charts. Each patient underwent elective THA or TKA between 2020 and 2021 in the central region of Washington State at a single institution. This study was deemed exempt by the Washington State University Institutional Review Board based on the notion that patient health information was blinded and anonymized. This study did not recruit patients and only reviewed patient charts that met the inclusion criteria.

We identified and included all adult patients who underwent THA or TKA during the time frame of January 1, 2020, to December 31, 2021. Patients were excluded from the study if they had fewer than 6 months of postoperative follow-up or were lost to follow-up within their 6-month postoperative period. Our study stratified patients based on their self-identified race and ethnicity. Patients were classified, in accordance with the Standards for the Classification of Federal Data on Race and Ethnicity, as those identifying as non-Hispanic/Latino White ( $n = 490$ , 84.5%) or Hispanic/

Latino ( $n = 65$ , 11.2%). Non-White patients who did not identify as Hispanic/Latino ( $n = 25$ , 4.3%) were excluded from the study due to small sample sizes.

Patient demographics including self-reported race, procedure type, Charlson Comorbidity Index (CCI) score, surgical notes, length of stay (LOS), emergency room visits, hospital readmissions, functional outcomes, and any adverse events were collected from the electronic health records of a single institution. Any of these postoperative findings were also recorded as an undesired outcome. Physical therapy notes including range of motion (ROM) records were recorded if available. Lower extremity functional scale (LEFS) scores and visual analog scale (VAS) pain scores were assessed at 1 week and 3 months postoperatively.

In comparing cohorts, descriptive statistics were used to assess the patients' demographics and comorbidities. To depict the associations between two or more qualitative variables, we used a chi-square test and Fisher's exact test, whereas a *T*-test was used to compare the quantitative data. Frequency (percentage) and mean  $\pm$  SD were used when appropriate for categorical and continuous values. To control for differences in demographics and surgical characteristics, multivariate logistic regression models were developed to analyze the association between a patient's race and the likelihood of experiencing an undesired postoperative outcome. Both adjusted and unadjusted models were performed, and odds ratios were reported with 95% Confidence Intervals (CI).

We used a *p*-value of  $\leq 0.05$  when considering the significance of our results. All statistical analyses were done using statistical packages of SPSS 29.

## Results

A total of 555 patients who underwent TKA or THA were included in our study with 490 (88.3%) identifying as non-Hispanic/Latino White and 65 (11.7%) identifying as Hispanic/Latino. Demographic characteristics for each cohort in our study are summarized in Table 1. The Hispanic/Latino patients were on average younger ( $61.9 \pm 12.79$  versus  $68.58 \pm 9.00$  years;  $p < 0.001$ ). This group also had lower CCI grades, with 98.5% of them having scores less than 5, in contrast to 89.5% of the non-Hispanic/Latino White patients ( $p = 0.019$ ). There was no difference in gender and BMI between the groups ( $p = 0.561$ ;  $p = 0.061$ ). A majority of non-Hispanic/Latino White patients ( $n = 300$ , 61.2%) used Medicare/Medicaid as their insurance while only 18 (27.7%) of Hispanic/Latino patients utilized this insurance model.

Operatively, the proportion of non-Hispanic/Latino White patients undergoing THA and TKA was similar at 45.7% and 54.3% respectively. In contrast, Hispanic/Latino patients had higher TKA rates (73.8%) versus THA (26.2%). A higher percentage of Hispanic/Latino patients (81.5%) had their surgeries

**Table 1** Demographics of patients undergoing total knee or hip arthroplasty

Descriptive	Total ( <i>n</i> =555)	White ( <i>n</i> =490, 88.3%)	Hispanic/Latino ( <i>n</i> =65, 11.7%)	<i>p</i> -value
Age (years: mean, SD)	67.79 (9.75)	68.58 (9.00)	61.9 (12.79)	<0.001
Gender ( <i>n</i> , %)				0.561
Female	292 (52.6%)	260 (53.1%)	32 (49.2%)	
Male	263 (47.4%)	230 (46.9%)	33 (50.8%)	
BMI (kg/m <sup>2</sup> : mean, SD)	31.08 (5.59)	30.92 (5.66)	32.32 (4.87)	0.061
CCI Grade ( <i>n</i> , %)				0.019
≤4	501 (90.4%)	437 (89.4%)	64 (98.5%)	
≥5	53 (9.6%)	52 (10.6%)	1 (1.5%)	
Insurance ( <i>n</i> , %)				<0.001
Medicare/Medicaid	18 (57.3%)	300 (61.2%)	18 (27.7%)	
Other	237 (42.7%)	190 (38.8%)	47 (72.3%)	

in ambulatory surgery outpatient centers ( $p=0.048$ ), compared to 72.0% of non-Hispanic/Latino White patients. A greater portion of non-Hispanic/Latino White patients ( $n=188$ , 38.4%) compared to 13 (20%) of Hispanic/Latino patients utilized SwiftPath Joint camp, a preoperative patient education program recommended to the patients in this study ( $p=0.004$ ). Surgery time and estimated blood loss were significantly lower for the Hispanic/Latino group, averaging 2.19 versus 2.40 h ( $p<0.001$ ) and 267 versus 334 mL ( $p=0.003$ ), respectively. Postoperatively, 83.6% of Hispanic/Latino patients and 69.3% of non-Hispanic/Latino White patients were discharged on the same day as their procedure ( $p=0.021$ ) (Table 2).

There were similar rates with no statistically significant differences between the non-Hispanic/Latino White and

Hispanic/Latino patients in postoperative adverse events including ER visits ( $p=0.946$ ), hospital readmission ( $p=0.646$ ), infection ( $p=0.834$ ), DVT ( $p=0.707$ ), incontinence ( $p=0.707$ ), falls ( $p=0.782$ ), and adverse events ( $p=0.854$ ) (Table 3). Even when adjusting for possible confounding variables such as demographics and different surgical characteristics, there was no difference in having an undesired postoperative outcome in relation to the patient's self-identified race (OR 1.161, 95 CI: 0.569–2.371,  $p=0.681$ ) (Table 4). In terms of postoperative functional outcomes, there were no significant differences between patient groups in terms of LEFS ( $p=0.471$ ), ROM flexion ( $p=0.562$ ), and extension at 1-week ( $p=0.359$ ) and 3-month ( $p=0.265$ ) time points. We did observe a significant

**Table 2** Operative outcomes

Descriptive	Total	White	Hispanic/Latino	<i>p</i> -value
Procedure ( <i>n</i> , %)				0.027
THA	241 (43.4%)	224 (45.7%)	17 (26.2%)	
TKA	314 (56.6%)	266 (54.3%)	48 (73.8%)	
TONNIS ( <i>n</i> , %)				0.023
2	5 (4.5%)	5 (4.8%)	0 (0)	
3	81 (72.3%)	78 (75.0%)	3 (37.5%)	
4	26 (23.2%)	21 (20.2%)	5 (62.5%)	
KL Grade ( <i>n</i> , %)				0.794
3	16 (7.1%)	14 (7.3%)	2 (6.1%)	
4	208 (92.9%)	177 (92.7%)	31 (93.9%)	
Surgery location ( <i>n</i> , %)				0.048
Inpatient	147 (26.5%)	136 (27.8%)	11 (16.9%)	
Outpatient	406 (73.2%)	353 (72.0%)	53 (81.5%)	
SwiftPath Joint Camp ( <i>n</i> , %)				0.004
Yes	201 (36.2%)	188 (38.4%)	13 (20.0%)	
No	354 (63.8%)	302 (61.6%)	52 (80.0%)	
Blood loss (ml: mean, SD)	327.05 (159.26)	333.85 (161.94)	266.51 (117.87)	0.003
Surgery time (hours: mean, SD)	2.38 (0.36)	2.4 (0.36)	2.19 (0.30)	<0.001
Length of stay ( <i>n</i> , %)				0.021
Same day discharge	347 (71.1%)	296 (69.3%)	51 (83.6%)	
Admitted	141 (28.9%)	131 (30.7%)	10 (10.5%)	

**Table 3** Postoperative outcomes

Descriptive	Total	White	Hispanic/Latino	<i>p</i> -value
ER visit ( <i>n</i> , %)				0.946
Yes	33 (6.0%)	29 (5.9%)	4 (6.2%)	
No	520 (94.0%)	459 (94.1%)	61 (93.8%)	
Hospital readmission ( <i>n</i> , %)				0.646
Yes	20 (3.6%)	17 (3.5%)	3 (4.6%)	
No	533 (96.4%)	471 (96.5%)	62 (95.4%)	
Infection ( <i>n</i> , %)				0.834
Yes	7 (1.3%)	6 (1.2%)	1 (1.5%)	
No	546 (98.7%)	482 (98.8%)	64 (98.5%)	
DVT ( <i>n</i> , %)				0.707
Yes	6 (1.1%)	5 (1.0%)	1 (1.5%)	
No	547 (98.9%)	483 (99.0%)	64 (98.5%)	
Incontinence ( <i>n</i> , %)				0.707
Yes	6 (1.1%)	5 (1.0%)	1 (1.5%)	
No	547 (98.9%)	483 (99.0%)	64 (98.5%)	
Fall ( <i>n</i> , %)				0.782
Yes	30 (5.4%)	26 (5.3%)	4 (6.2%)	
No	523 (94.6%)	462 (94.7%)	61 (93.8%)	
Adverse events ( <i>n</i> , %)				0.854
Yes	37 (6.7%)	33 (6.8%)	4 (6.2%)	
No	516 (93.3%)	455 (93.2%)	61 (93.8%)	
Undesired outcomes ( <i>n</i> , %)				0.632
Yes	91 (16.4%)	79 (16.1%)	12 (18.5%)	
No	464 (83.6%)	411 (83.9%)	53 (81.5%)	

**Table 4** Predictors of an undesired outcome after discharge

	Unadjusted				Adjusted			
	OR	95% CI (Lower)	95% CI (Upper)	<i>p</i> -value	OR	95% CI (Lower)	95% CI (Upper)	<i>p</i> -value
Age (Ref: 64 or younger 65 or older)	0.825	0.517	1.315	0.418	0.919	0.520	1.624	0.770
Gender (Ref: Female Male)	0.994	0.633	1.558	0.978	0.875	0.550	1.392	0.574
BMI (Ref: Under 30 Greater than 30)	0.985	0.625	1.551	0.947	0.896	0.562	1.428	0.643
Charlson Comorbidity Index Grade (Ref: Score of 4 or less Score of 5 or greater)	1.563	0.787	3.107	0.202	1.759	0.847	3.652	0.130
Insurance (Ref: Medicare/Medicaid Non-Medicare/Medicaid)	1.386	0.883	2.175	0.156	1.629	0.941	2.820	0.081
Procedure (Ref: Total Knee Arthro- plasty) Total Hip Arthroplasty Procedure	0.973	0.618	1.532	0.905	0.985	0.616	1.574	0.948
Location of Procedure (Ref: Outpa- tient) Inpatient	1.737	1.078	2.798	0.023	1.754	1.069	2.878	0.026
Race (Ref: White) Hispanic/Latino	1.178	0.602	2.305	0.633	1.161	0.569	2.371	0.681

*Ref*, reference; *OR*, odds ratio; *CI*, confidence interval

Logistic regression models were used to estimate OR and 95% CI. Adjusted estimates were produced using the listed variables

difference between VAS pain scores at the 3-month time point with the Hispanic/Latino group having increased pain ( $p = 0.002$ ) (Table 5).

## Discussion

The findings of this study suggest that lower rates of TJA among non-White patients have persisted and exist even in diverse populations. Contrary to their representation in the region, non-Hispanic/Latino White patients accounted for the majority of the participants in our study. Meanwhile, the Hispanic/Latino patients in the study comprised 11.2% of the patients even though they constituted 50.2% of the population in the county where our study was conducted.

Considering the current literature that suggests similar or even increased prevalence rates of OA among patients of different races and ethnicities [20], the difference observed in this study between the rate of the Hispanic/Latino patients undergoing TJA and their representation within the study population suggests a possible decreased rate of TJA utilization. One possibility for these differences could be that fewer non-White patients present to orthopedic clinics with symptoms of OA. These patients could be living longer with joint pain and only presenting in advanced stages. This hypothesis is supported by previous studies which have shown that non-White patients are more likely to have radiographic and symptomatic knee/hip OA with increased severity when presenting for TJA [21].

While this could be one explanation, another possibility might be an increased aversion to surgical intervention among Hispanic/Latino patients. Several factors could contribute to this hypothesis; differences in socioeconomic status might limit time off from work to recover as well as a lack of trust in the healthcare system as has been suggested in other studies [22]. Examining the limited Hispanic/Latino patients who underwent TJA in our study reveals

characteristic differences between this group and their non-Hispanic/Latino White counterparts. These patients were younger, had fewer comorbidities, and were more likely to use non-Medicare/Medicaid insurance. This may be suggestive of a selective Hispanic/Latino patient subpopulation that is willing to undergo these procedures.

Furthermore, an important possibility regarding the differences seen in our surgical population might be explained by evaluating procedure selection among patients of different races despite prevalence rates for OA being similar among them. Since our study focused on patients undergoing these surgical procedures, patients who are electing other treatment options such as less invasive ones were excluded, and therefore the disparity suggested by our study might be explained by differences in treatment selection [23]. One possibility is that this exclusive population electing to undergo these surgeries had an earlier onset of debilitating osteoarthritis that failed other interventions and motivated them to undergo TJA in order to continue working and perform activities they enjoy. On the other hand, older patients who may not be as active at baseline may opt to forgo any invasive procedures. The demographic descriptions of the Hispanic/Latino patients might also indicate selectivity by patients who are healthier and younger that are seeking a quick recovery as further supported by their increased utilization of outpatient centers and decreased length of stay.

Despite the lack of apparent progress in lowering the difference in TJA utilization rates among patients of different races, the operative and postoperative outcome findings are encouraging. The Hispanic/Latino patients in our study had significantly decreased operative blood loss, surgical time, and hospital length of stay compared to the non-Hispanic/Latino White patients. Further, contrary to the current literature, these patients did not have worse postoperative outcomes including ER visits, hospital readmissions, infections, DVT, incontinence, falls, or any adverse events. Even when controlling for demographic

**Table 5** Postoperative functional and clinical outcomes

Descriptive	Total	White	Hispanic/Latino	<i>p</i> -value
LEFS ( <i>n</i> , %)				
1 week PO	10.67 (6.13)	10.83 (6.35)	9.17 (3.16)	0.121
3 months PO	46.90 (13.39)	47.26 (13.65)	45.00 (12.03)	0.471
VAS pain ( <i>n</i> , %)				
1 week PO	3.46 (2.39)	3.40 (2.38)	4.05 (2.42)	0.093
3 months PO	1.61 (2.20)	1.48 (2.14)	2.70 (2.41)	0.002
ROM flexion ( <i>n</i> , %)				
1 week PO	86.67 (10.53)	86.50 (10.47)	87.97 (11.03)	0.419
3 months PO	119.85 (12.30)	120.05 (12.52)	118.54 (10.94)	0.562
ROM extension ( <i>n</i> , %)				
1 week PO	-3.30 (8.61)	-3.13 (9.00)	-4.50 (4.63)	0.359
3 months PO	-0.02 (1.46)	0.04 (1.39)	-0.38 (1.84)	0.265

and surgical characteristic differences between our two groups, there was no association between patients' identified race and undesired postoperative outcomes. In addition, patients were able to achieve similar 3-month postoperative functional outcomes as evidenced in the similar knee flexion and extension among all patients. Although these findings might suggest some progress in decreased racial disparities in TJA outcomes, the better outcomes in the Hispanic/Latino patients might be attributed to the younger and healthier patients identified in this study. Future studies examining cohorts with similar demographics are needed to validate these initial findings.

Limitations of this study include the non-random patient representation in our study from a single institution in one region of Washington state limiting the generalizability of our results to a larger population. Further, the study period which coincided with the COVID-19 pandemic could have exacerbated this situation with patients being less likely to seek out healthcare facilities with non-emergent cases. It is evident that racial disparities were amplified during the pandemic with numerous studies reporting increased overall morbidity and mortality among non-White patients [24]. Specialty care that already had accessibility limitations was also affected by these findings [25]. Stronach et al. have suggested that arthroplasty procedure-related racial disparities have persisted during the pandemic [26]. Their study reported a decrease during the COVID-19 pandemic in overall arthroplasty utilization in the Hispanic population by 34% compared to 19% in White patients. These findings in other studies might explain the differences we report in this study. However, while the pandemic might have been a confounding factor in our results, it is difficult to determine its role as our study duration was within the COVID-19 period.

Another limitation of our study is our small sample size. A larger study population including all patients presenting to the clinic with symptoms of OA of the knee and hip would allow an examination of patients' selection of treatment options and examine any differences between patients of various races. Further, an increased sample size would allow the examination of the differences we have observed in our study across patients of other races beyond those included in our study.

Despite our study's limitations, its strength lies in the study population. The difference in utilization rates of various procedures has been difficult to assess due to differences that already exist in population representations. The setting of our study population included a more diverse population, allowing us to assess whether differences observed in previous studies of larger populations held true in settings with higher rates of non-White patients. Although our study was limited to only include patients identifying as non-Hispanic/Latino White or Hispanic/Latino due to our small sample size, it represents a unique population that is not predominantly non-Hispanic/Latino White.

## Conclusion

This study highlights the persistence of racial disparities in patients utilizing TJA. It is difficult to determine if the disparity lies in patients presenting with OA or in those deciding to ultimately undergo a joint replacement. Future studies should examine all patients presenting with symptoms of OA to assess a more comprehensive rate of utilization of TJA among patients of various races. It is critical that we examine these differences considering the debilitating nature of OA and its impact on the quality of life of individuals.

**Author Contribution** All authors read and approved the final manuscript.

**Data Availability** Available upon request.

**Code Availability** Available upon request.

## Declarations

**Ethics Approval** This is an observational study. The Washington State University Institutional Review Board has confirmed that no ethical approval is required.

**Consent to Participate** Not applicable.

**Consent for Publication** Not applicable.

**Competing Interests** The authors declare no competing interests.

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