The Effect of Patient Race on Total Joint Replacement Recommendations and Utilization in the Orthopedic Setting

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BACKGROUND: The extent to which treatment recommendations in the orthopedic setting contribute to well-established racial disparities in the utilization of total joint replacement (TJR) in the treatment of advanced knee/hip osteoarthritis has not been explored.

OBJECTIVE: To examine whether orthopedic surgeons are less likely to recommend TJR to African-American patients compared to white patients with similar clinical indications, and whether there are racial differences in the receipt of TJR within six months of study enrollment.

DESIGN: Prospective, observational study.

PARTICIPANTS: African-American (AA; n=120) and white (n=337) patients seeking treatment for knee or hip osteoarthritis in Veterans Affairs orthopedic clinics.

MAIN MEASURES: Patients completed surveys that assessed socio-demographic and clinical variables that could influence osteoarthritis treatment. Orthopedic surgeons' notes were reviewed to determine whether patients had been recommended for TJR and whether they underwent the procedure within 6 months of study enrollment.

RESULTS: Rate of TJR recommendation was 19.5%. Odds of receiving a TJR recommendation were lower for AA than white patients of similar age and disease severity (OR=0.46, 95% CI=0.26–0.83; P=0.01). However, this difference was not significant after adjusting for patient preference for TJR (OR=0.69, 95% CI=0.36–1.31, P=0.25). Overall, 10.3% of patients underwent TJR within 6 months. TJR was less likely for AA patients than for white patients of similar age and disease severity (OR=0.41, 95% CI=0.16–1.05, P=0.06), but this difference was reduced after adjusting for whether patients had received a recommendation for the procedure at the index visit (OR=0.57, 95% CI=0.21–1.54, P=0.27).

CONCLUSIONS: In this study, race differences in patient preferences for TJR appeared to underlie race differences in TJR recommendations, which led to race differences in utilization of the procedure. Our findings suggest that patient treatment preferences play an important role in racial disparities in TJR utilization in the orthopedic setting.

KEY WORDS: healthcare disparities; total joint replacement; orthopedic surgery; osteoarthritis; patient preference.
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INTRODUCTION

Osteoarthritis of the knee or hip is a leading cause of disability in the United States.[1] Given that there is no known cure for osteoarthritis, the goals of therapy are to alleviate symptoms (e.g., pain), improve function, and reduce disability.[2] Although a range of non-surgical treatment options exist (e.g., physical therapy, anti-inflammatory medications), total joint replacement (TJR) is the most effective surgical option available for treating moderate to severe knee or hip osteoarthritis.[3,4] TJR is often considered to be an appropriate treatment option for patients who have radiographic evidence of joint damage and who experience persistent, moderate to severe pain or disability that is not substantially relieved by an extended course of non-surgical management.[2,5–7]

Despite the effectiveness of TJR as a treatment for advanced knee or hip osteoarthritis, numerous studies have documented racial disparities in the utilization of the procedure.[8–15] For example, African-American (AA) patients are markedly less likely than white patients to undergo knee replacement even after adjusting for regional variations and income.[16] This disparity has not only been persistent over time, but has potentially widened.[17]

The underlying causes of disparities in TJR utilization are complex and may involve system-level factors such as access to care, patient-level factors such as preference for treatment, and/or provider-level factors such as differential treatment.

Access to care may not be the only factor that contributes to variation in TJR utilization, given that racial/ethnic differences in TJR in the private sector have also been observed among patients within the Veterans Affairs (VA), a healthcare system with almost equal access to care.[18] Patient preference, on the other hand, may contribute to racial disparities in TJR, as AA and white patients differ in their beliefs and attitudes regarding the procedure.[19–21] For example, studies have found that, compared to white patients, AA patients tend to report a poorer understanding of TJR; expect longer hospital stays, more residual pain, and more difficulty walking after the procedure; are less likely to believe in the efficacy of TJR; and are less willing to consider it as an option for treating knee/hip osteoarthritis.[19–21]

Studies of racial differences in expectations and preferences for TJR have thus far recruited patients from primary care settings or general outpatient populations[19–21], before most patients have likely consulted with an orthopedic specialist who could discuss risks and benefits of the procedure and determine whether TJR is a reasonable option. We are aware of no prior studies that have examined whether a patient's race contributes to providers' decisions to recommend TJR during orthopedic consultations. Therefore, we conducted a prospective, observational study of patients seeking treatment for knee or hip osteoarthritis in VA orthopedic clinics to determine whether orthopedic surgeons are less likely to recommend TJR to AA patients compared to white patients of similar age and with similar disease severity. We also examined whether there were racial differences in the receipt of TJR within six months of study enrollment. We examined these issues in the context of a broad range of socio-demographic and clinical variables that could also influence osteoarthritis treatment.

METHODS

Study Population

Patients were recruited from orthopedic surgery clinics of two large, tertiary care VA hospitals in Pittsburgh, Pennsylvania and Cleveland, Ohio. The clinics were part of teaching hospitals, with most patients being seen by residents who rotated through the clinics in 3- to 4-month cycles. Patients aged 50 or older who were referred to the clinics for the management of chronic knee/hip pain between December 2005 and July 2008 were potentially eligible. Following the study's approval by Institutional Review Boards at each VA, patients meeting these criteria were identified from orthopedic clinic referral files and contacted by study staff to undergo further screening. To be eligible, patients had to have chronic, frequent knee or hip pain based on the Arthritis Supplement of the National Health and Nutrition Examination Survey (NHANES) questions.[22,23] They also had to have significant pain and functional difficulty related to osteoarthritis, defined as a score of 39 or higher (possible range 0–100) on the Western Ontario and McMaster Universities Osteoarthritis (WOMAC) Index.[24] Patients were ineligible if they had previously undergone any major TJR or had ever been diagnosed with an inflammatory arthritis condition. Sixty-four patients who enrolled in the study were later determined not to have radiologic evidence of osteoarthritis and were therefore excluded from analyses.

Data Collection

Data were collected immediately before and after a patient's scheduled orthopedic clinic appointment. Before their appointment, patients completed a baseline survey regarding their preferences for TJR as a treatment option, expectations regarding chronic knee/hip pain management, and socio-demographic characteristics (more details on measures provided below). Patients then met with an orthopedic surgeon. Because this study was part of a larger study on doctor-patient communication, visits were audio-taped with the knowledge and consent of patients and surgeons. Data from the audiotapes were not used in the current analysis. After the visit, patients were surveyed about their impression of the encounter. Patients' medical records were reviewed to determine whether the orthopedic surgeon recommended TJR, identify comorbid conditions, determine whether patients had previous visits to the orthopedic clinic, and identify patients' weight and height. Medical records were reviewed again after six months to determine whether patients had undergone TJR in the VA since enrollment.

Study Outcome Variables

The primary outcome was whether patients received a recommendation for TJR from the orthopedic surgeon. This was ascertained by trained research staff who reviewed the orthopedic visit note in each patient's electronic medical record to determine whether TJR was documented as the recommended treatment for that patient. Four patients did not have an orthopedic visit note in their medical records and were excluded from the analyses. The secondary outcome was actual receipt of TJR at the VA within 6 months of study enrollment, also determined via medical record review.

Primary Predictor Variable

Self-identified patient race was the primary predictor variable. Patients who self-identified as non-Hispanic AA or white while being screened for the study were eligible for enrollment.

Study Covariates

Structured survey instruments were used to examine socio-demographic and clinical covariates that could directly or indirectly influence the treatment of chronic knee/hip osteoarthritis (see Table 1). Basic demographic characteristics included age, gender, education, annual household income, employment status, marital status, and whether participants live alone or with someone. Health literacy,[25,26] social support,[27] trust in physician,[28] and SF-12 quality of life (physical and mental components)[29] were also assessed using validated measures. Clinical characteristics included comorbid conditions that were weighted and summed using the Charlson Comorbidity Index,[13,30] whether patients were being treated primarily for hip or knee osteoarthritis, and osteoarthritis disease severity as measured by the WOMAC Index.[24] The WOMAC is a reliable, valid, and widely used measure of symptoms and disability in patients with osteoarthritis. This

Table 1. Baseline Socio-Demographic and Clinical Characteristics of African American and White Patients with Knee or Hip Osteoarthritis

Characteristics	African American (N=120)		White (N=337)		P-value*
Age (n, %)					<0.01
50–64	95	79.2%	209	62.0%	
≥65	25	20.8%	128	38.0%	
Male	114	95.0%	322	95.6%	0.81
Greater than high school education	36	30.0%	90	26.7%	0.49
Annual household income					<0.01
<$20,000	59	49.2%	125	37.1%	
≥$20,000	44	36.7%	179	53.1%	
Missing	17	14.2%	33	9.8%	
Employment status					0.77
Employed	32	26.7%	84	25.0%	
Unemployed	15	12.5%	386	10.7%	
Disabled/retired	73	60.8%	216	64.3%	
Marital status					<0.01
Married/living with partner	53	44.2%	197	58.5%	
Never married/divorced/separated/widowed	67	55.8%	140	41.5%	
Lives alone[a]					
Pittsburgh	24	50.0%	55	23.11%	<0.01
Cleveland	32	34.0%	36	24.8%	0.12
Health literacy level					<0.01
Inadequate/marginal (≤66)	33	29.0%	53	16.7%	
Adequate (67–100)	81	71.0%	265	83.3%	
Social support (mean±sd)[b]	67.0	± 22.8	75.4	± 23.8	<0.01
Trust in physician[b]	43.7	± 5.7	45.7	± 5.4	<0.01
Quality of life (SF-12)					
Physical component summary (PCS)	28.8	± 8.7	28.5	± 8.5	0.77
Mental component summary (MCS)	46.4	± 13.2	49.3	± 12.8	0.04
Charlson Comorbidity Score					0.37
0	44	36.7%	120	35.8%	
1–2	61	50.8%	155	46.3%	
≥3	15	12.5%	60	17.9%	
Hip (vs. knee) OA[a]					
Pittsburgh	4	8.5%	48	21.8%	0.04
Cleveland	21	28.8%	24	20.5%	0.19
WOMAC Index quartiles					0.05
1st quartile (lowest disease severity)	20	16.7%	85	25.2%	
2nd quartile	28	23.3%	96	28.5%	
3rd quartile	33	27.5%	80	23.7%	
4th quartile (highest disease severity)	39	32.5%	76	22.6%	
Body mass index					0.02
<35	85	70.8%	228	68.7%	
35–40	14	11.7%	70	21.1%	
≥40	21	17.5%	34	10.2%	
Prior visit to this clinic (yes)	53	44.2%	130	38.6%	0.28
Expectation on knee surgery[b]	48.4	± 16.1	49.7	± 14.5	0.46
Expectation on hip surgery[b]	46.8	± 15.2	52.5	± 12.8	0.07
Self efficacy for pain[a]					
Pittsburgh[b]	4.4	± 2.0	3.9	± 1.9	0.09
Cleveland	3.5	± 1.6	3.9	± 1.9	0.12
Self efficacy for function[a]					
Pittsburgh[b]	6.5	± 1.8	6.4	± 1.8	0.80
Cleveland	5.7	± 1.8	6.6	± 1.6	<0.01
Preference for TJR					<0.01
Definitely willing	59	49.2%	231	68.5%	
Less than definitely willing	61	50.8%	106	31.5%	
Site					<0.01
Pittsburgh	47	39.2%	220	65.3%	
Cleveland	73	60.8%	117	34.7%	

*P-values compare African Americans and whites

[a]*Stratified by site due to significant interaction between race and site*

[b]*Social support, trust in physician, expectations on knee and hip surgery, and self-efficacy for pain and function were measured on continuous scales with higher scores reflecting more positive responses (e.g., more social support, better expectations). Expectation on knee and hip surgery scores reflect patients' expectations regarding the outcomes of TJR surgery (e.g., degree of pain reduction and functional improvement). Self-efficacy for pain and function scores reflect patients' perceived ability to deal with the pain and functional limitations of arthritis, respectively.*

sd=standard deviation, WOMAC=Western Ontario and McMaster Universities Osteoarthritis Index , OA=osteoarthritis, TJR=Total joint replacement

24-item scale assesses three dimensions of osteoarthritis severity: magnitude of pain, joint stiffness, and disability.[31] For analyses, a composite score was created by summing responses across all items and splitting the scores into quartiles based on the distribution observed in this sample. Body mass index (BMI) and whether patients had visited the clinic within the past 5 years were determined by chart review. Additional clinically-oriented variables that were assessed using validated measures included patients' expectations regarding the outcomes of TJR surgery[32–34] and current levels of self-efficacy in dealing with the pain and functional limitations of arthritis.[35] We also assessed patient preference for TJR using a single item measuring patients' willingness to undergo TJR if their doctor recommended it.[34,36,37] This was measured on a 5-point scale with response options ranging from 'definitely not willing' to 'definitely willing'. Because most patients (63%) were 'definitely willing', responses were categorized as 'definitely willing' or 'less than definitely willing' for analyses.

Statistical Analysis

We compared AA and white patients with respect to socio-demographic and clinical characteristics. Due to the 2-site study design and different racial distributions across sites, racial comparisons for categorical variables were first tested with the Breslow Day test of homogeneity of the odds ratios to see if stratification by study site was necessary. For continuous variables, the need to stratify racial comparisons by study site was determined by testing the interaction between site and race.

We also conducted a series of multiple logistic regression analyses to examine the relationship between race and each outcome. In all models we corrected for a secular trend in TJR recommendation over the course of the study and accounted for clustering of patients under providers using Huber–White sandwich estimators of variance.[38] Our initial multivariable models for each outcome included site, linear time trend, and patient race as fixed effects. The second set of multivariable models tested for the effect of race after further adjusting for age, WOMAC index, and which joint was being treated for osteoarthritis (hip vs. knee). We then constructed final multivariable models for each outcome, first by adding all study covariates that were associated with the outcome at $P \leq 0.15$ in models adjusted for only site and the linear time trend, and then by using backwards stepwise regression to remove those that were not statistically significant at $p < 0.05$ in the full model.

RESULTS

Baseline Sample Characteristics

The sample consisted of 120 AA and 337 white patients who were seen by 81 orthopedic attending surgeons and residents, with each provider seeing a median of six patients (range=1–21). As shown in Table 1, AA and white patients differed on many socio-demographic and clinical characteristics. Specifically, compared to white patients, AA patients were younger, reported lower incomes, were less likely to be married or living with a partner, and were more likely to live alone (see Table 1 for percentages). AA patients were also less likely than white patients to have adequate health literacy and reported less social support, less trust in their orthopedic surgeons, and lower quality of life on the mental component of the SF-12. Fewer AA patients than white patients were being treated for hip (vs. knee) osteoarthritis in one study site but not the other. AA patients tended to have higher WOMAC scores, indicating greater severity of osteoarthritis, and more AA than white patients fell in the highest BMI category. AA patients also reported significantly lower self-efficacy dealing with the functional limitations of arthritis in one study site but not the other. Finally, AA patients were less likely than white patients to express a strong preference for TJR.

Recommendation for TJR

The overall rate of TJR recommendation was 19.5% (n=89). In a model adjusting only for site and the linear effect of time (see Table 2), odds of receiving a recommendation for TJR were lower for AA than white patients (OR=0.55, 95% CI=0.32–0.93; P=0.03). This difference persisted after adjusting for age, WOMAC Index, and whether patients were being treated for hip (vs. knee) osteoarthritis (OR=0.46, 95% CI=0.26–0.83; P=0.01). As shown in Table 2, recommendations for TJR were more likely to be received by older patients and by those being treated primarily for hip (vs. knee) osteoarthritis. Compared to patients with WOMAC scores in the highest quartile (greater disease severity), patients with WOMAC scores in the lowest 2 quartiles were less likely to receive recommendations for TJR.

The set of variables considered for inclusion in the final model because they were associated with receiving a recommendation for TJR in preliminary analyses included BMI, patient preference for TJR, self-efficacy for dealing with arthritis pain, and trust in physician. Only BMI and patient preference remained in the final model after backwards stepwise selection (Table 2). In the final model, race was no longer a significant predictor of receiving a recommendation for TJR (OR=0.78, 95% CI=0.41–1.45; P=0.43). Having a BMI of 35 to 40 was associated with receiving a recommendation for TJR (OR=2.40, 95% CI=1.12–5.13; P=0.02). Patients who were less than definitely willing to undergo TJR were less likely to receive a recommendation for TJR (OR=0.14, 95% CI=0.07–0.29; P<0.01).

We conducted additional analyses to determine whether the reduced effect of race on TJR recommendation in the final model was due to the inclusion of BMI or patient preference. The effect of race on TJR recommendation remained significant when the final model included BMI but not patient preference (OR=0.51, 95% CI=0.28–0.91, P=0.02). However, the effect of race was reduced to non-significance when the final model included patient preference but not BMI (OR=0.69, 95% CI=0.36–1.31, P=0.25). These results suggest that the race difference in TJR recommendations was largely driven by patient treatment preferences.

Receipt of TJR within 6 Months

Overall, 47 (10.3%) patients underwent hip or knee TJR at the VA within 6 months of study enrollment. In a model adjusting only for site and the linear effect of time (see Table 3), the odds

Table 2. Adjusted Odds of Receiving a Recommendation for TJR

Variable	Adjusted Model 1 OR (95% CI)	Adjusted Model 2 OR (95% CI)	Final Adjusted Model OR (95% CI)
African American race	0.55 (0.32–0.93)	0.46 (0.26–0.83)	0.78 (0.41–1.45)
Age ≥65		1.72 (1.04–2.85)	2.30 (1.32–4.00)
WOMAC Index quartiles			
1st quartile		0.11 (0.04–0.29)	0.10 (0.04–0.28)
2nd quartile		0.38 (0.19–0.73)	0.47 (0.22–0.99)
3rd quartile		0.69 (0.36–1.31)	0.75 (0.37–1.51)
4th quartile		1.00	1.00
Hip (vs. knee) OA		1.95 (1.09–3.47)	2.12 (1.10–4.07)
Body mass index			
<35			1.00
35–40			2.40 (1.12–5.13)
≥40			0.49 (0.18–1.31)
Preference for TJR			
Less than definitely willing			0.14 (0.07–0.29)

Note: All models were adjusted for site, a linear effect of time, and clustering by provider. Adjusted Model 2 examined the effect of race while controlling for age, disease severity (WOMAC), and whether patients were being evaluated for knee or hip osteoarthritis. The final adjusted model examined the effect of race after controlling for variables in Model 2 in addition to other variables found to be associated with the outcome through a process of backwards stepwise selection.
OA=osteoarthritis, TJR=Total joint replacement

of AA patients receiving TJR was 0.43 (95% CI=0.18–1.05; P=0.06). Adjusting for age, WOMAC index, and whether patients were being treated for hip (vs. knee) osteoarthritis did not alter the effect of race (OR=0.41, 95% CI=0.16–1.05, P=0.06).

Additional variables considered for inclusion in the final model because they were associated with undergoing TJR in preliminary analyses included: living alone, patient preference for TJR, trust in physician, self-rated physical quality of life, self-efficacy for dealing with arthritis pain, and whether patients had received a recommendation for TJR during their initial visit. Only receiving a recommendation for TJR (OR=30.39, 95% CI=13.89–66.48, P<0.01) was retained after backwards stepwise selection (see Table 3). The relationship between race and receipt of TJR was not significant in the final model (OR=0.57, 95% CI=0.21–1.54, P=0.27).

We conducted additional analyses to examine whether race was associated with undergoing joint replacement in the subsample of 89 patients who were recommended for joint replacement. Of those patients who received a recommendation for joint replacement, 22% (n=5) of African Americans had undergone the procedure at the VA within 6 months, compared to 45% (n=30) of whites (Fisher's exact test p=0.05). In a logistic regression model adjusting for site and the linear effect of time, AA patients had a lower odds of undergoing joint replacement than white patients, although the race difference was not statistically significant (OR=0.57, 95% CI=0.14–2.30, P=0.43). The small number of patients in this subsample did not allow for the adjustment of additional covariates in this analysis.

DISCUSSION

To our knowledge, this is the first study to explore whether treatment recommendations and procedure utilization in the orthopedic setting contribute to racial disparities in TJR. We found that AA patients being treated for knee/hip osteoarthritis at VA orthopedic clinics were less likely to receive a recommendation for TJR than white patients of similar age and disease severity. However, controlling for patients' pre-existing willingness to undergo TJR decreased the race difference in TJR recommendations. This suggests that race differences in TJR recommendations may result from orthopedic surgeons being responsive to patient preferences regarding the procedure.

Table 3. Adjusted Odds of Undergoing TJR at the VA within 6 Months

Variable	Adjusted Model 1 OR (95% CI)	Adjusted Model 2 OR (95% CI)	Final Adjusted Model OR (95% CI)
African American race	0.43 (0.18–1.05)	0.41 (0.16–1.05)	0.57 (0.21–1.54)
Age ≥65		1.30 (0.69–2.45)	1.04 (0.49–2.21)
WOMAC Index quartiles			
1st quartile		0.37 (0.14–0.98)	1.52 (0.47–4.92)
2nd quartile		0.61 (0.24–1.55)	1.45 (0.44–4.77)
3rd quartile		1.03 (0.50–2.16)	1.77 (0.72–4.34)
4th quartile		1.00	1.00
Hip (vs. knee) OA		1.77 (0.93–3.38)	1.02 (0.49–2.15)
TJR recommended			30.39 (13.89–66.48)

Note: All models were adjusted for site, a linear effect of time, and clustering by provider. Adjusted Model 2 examined the effect of race while controlling for age, disease severity (WOMAC), and whether patients were being evaluated for knee or hip osteoarthritis. The final adjusted model examined the effect of race after controlling for variables in Model 2 in addition to other variables found to be associated with the outcome through a process of backwards stepwise selection.
OA=osteoarthritis, TJR=Total joint replacement

We also examined the secondary outcome of whether AA patients were less likely than white patients to undergo TJR at the VA within 6 months of study enrollment. Despite the small number of patients who underwent TJR (n=47), we detected a marginally significant difference between AA and white patients, with AA patients being less than half as likely to undergo TJR compared to white patients. This difference was reduced by taking into account whether patients had received a recommendation for TJR, which was the dominant predictor of whether patients underwent TJR.

Our findings add to the growing literature on the role of patient preferences in race disparities in the utilization of knee/hip TJR. Prior studies using a variety of research methodologies (e.g., observational surveys, focus groups, willingness-to-pay measures) have consistently found that AA patients are less likely than white patients to prefer TJR as a treatment option.[19–21,39–41] Our study demonstrates that such differences exist even among patients whose osteoarthritis has progressed to the point where they seek specialized care in the orthopedic setting. Moreover, out of all the socio-demographic and clinical variables examined in this study, patient preferences had the most substantial impact on recommendations patients received from orthopedic surgeons, which in turn largely determined whether or not patients underwent TJR. These findings underscore the unique importance of patient preference in shaping decision-making about TJR.

Given the consistent race differences found in patient preferences for TJR, coupled with the strong impact of patient preferences on TJR recommendations in the orthopedic setting, reducing TJR disparities may require efforts to understand and influence patient treatment preferences. Towards this end, existing studies have identified multiple determinants of preferences for TJR, including beliefs about the efficacy of the procedure, expectations about post-operative recovery and potential complications, overall familiarity with the procedure, and the use of non-surgical coping strategies such as prayer and natural pain remedies.[21,39,42–45] Studies of interventions that target patient preference for TJR have shown that patient expectations about TJR outcomes can be modified through education.[46,47] It remains to be seen, however, whether such interventions affect patient preference for, and actual utilization of, TJR. If deeper issues such as general distrust of the medical system underlie some patients' negative expectations for TJR as well as their reluctance to undergo the procedure, a change in expectations may not be sufficient to influence utilization.

There are important limitations to consider in interpreting our results. Given that our sample was recruited from 2 VA facilities, our findings may not generalize to women, to those from higher socioeconomic strata, to the private sector, or to orthopedic practices across the US. This study also included only AA and white patients and does not address potential disparities in other racial and ethnic groups. Lastly, the outcomes in this study were recommendations and treatments that were documented in patient medical records, which may have resulted in the misclassification of some patients due to imperfect documentation.

In conclusion, we found AA patients to be less likely than white patients to receive a recommendation for TJR from orthopedic surgeons, and that this difference was largely explained by lower preference for TJR among AA patients. Moreover, we found that there was a trend for AA patients to be less likely than white patients to undergo TJR within 6 months, and that this trend was mainly due to differences in treatment recommendations. Although our findings need to be replicated in more representative samples, this study highlights the important role of patient preferences in the AA-white racial disparity in TJR utilization.

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