


REVIEW

Racial Disparities in Elective Total Joint Arthroplasty for Osteoarthritis

Ilana Usiskin and Devyani Misra 

Total joint arthroplasty (TJA) is an effective elective surgical procedure for knee and hip osteoarthritis (OA), yet racial disparities in the use of and outcomes from TJA have been recognized. Racial minority individuals are less willing to undergo TJA, demonstrate worse surgical and functional outcomes, and are more likely to undergo surgery at a low-procedure-volume center. In this systematic review, we summarize evidence to date on racial disparities in TJA and discuss potential factors that may underlie this gap in care for patients with OA.

Introduction

Osteoarthritis (OA) is a prevalent and disabling joint disease, with approximately 300 million cases in the United States (1). The most commonly affected joint sites include the knee, hip, hand, and spine (2). There are currently no disease-modifying pharmacologic therapies available for OA; hence, the treatment is targeted at providing symptomatic relief. Surgical intervention is reserved for those with advanced disease when conservative management fails to control symptoms. Total joint arthroplasty (TJA) is an effective elective procedure to reduce pain and disability in those with severe knee or hip OA, with about 90% of total hip arthroplasty (THA) recipients and 80% of total knee arthroplasty (TKA) recipients reporting improved long-term pain postoperatively (3,4). TJA is becoming increasingly common globally, with projections showing continued increases in demand over the next decade (5,6).

Despite the effectiveness of TJA, there is a growing body of evidence showing significant racial disparities in TJA use and outcomes among patients with OA (7,8). The purpose of this article is to review the most recent evidence on racial disparities in TJA and to discuss potential factors that may underlie the gap in TJA use and outcomes by race. Understanding the gaps in the literature on racial disparities in TJA use and outcomes will help guide future research directions, with the ultimate goal of mitigating disparities in the future. In this review, we first examine the current evidence on racial disparities in TJA use, pain and functional outcomes, and complication rates. We then discuss the potential factors underlying these disparities and the gaps in current knowledge.

Racial disparities in TJA use

Racial disparities in the use of TJA are well known. A study by Thirukumaran et al (9) used Medicare claims data from 2009 to 2017 to compare elective TJA rates among Black and White beneficiaries. The authors found that Black beneficiaries were significantly less likely to undergo TJA than White beneficiaries (9). In a study by Hausmann et al (10) using a Veterans Affairs cohort from 2001 to 2013 that included 539,841 veterans with OA, TKA rates were lower for Black veterans than for White veterans, and this difference persisted after adjustment for demographic, socioeconomic, and clinical characteristics. The same study did not find any differences in TKA use in Hispanic versus White veterans. In a large study using the Osteoarthritis Initiative cohort of nearly 2000 participants with knee OA, Collins et al (11) calculated the incidence rates of TKA over 7 years of follow-up and found that compared with white participants, participants of other races had decreased “risk” of TKA, even when stratified by age. An analysis of 1000 patients with knee OA selected from the nationwide Vitamin D and Omega-3 Trial (VITAL) found that Black patients had lower rates of TKA compared with White patients, and this difference persisted across all levels of income and education (12). Cavanaugh et al (13) recently conducted a study of racial disparities in TKA among postmenopausal women using patients enrolled in the Women’s Health Initiative. They followed Medicare claims data to determine the rate of TKA use among women of different races and found that Black and Hispanic women were significantly less likely to undergo TKA compared with White women (13).

Ilana Usiskin, MD, Devyani Misra, MD, MSc: Beth Israel Deaconess Medical Center and Harvard Medical School, Boston, Massachusetts.

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Address correspondence to Devyani Misra, MD, MS, Beth Israel Deaconess Medical Center, Suite 1B, Lowry Building, 110 Francis Street, Boston, MA 02215. Email: Dmisra@bidmc.harvard.edu.

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SIGNIFICANCE & INNOVATIONS

- Racial disparities exist in the use of and outcomes from elective total joint arthroplasty (TJA) in patients with advanced hip and knee osteoarthritis.
- Racial and ethnic minority individuals are less willing to undergo TJA, demonstrate worse surgical and functional outcomes, and are more likely to undergo surgery at a low-procedure-volume hospital.
- Interplay between race and socioeconomic status is complex and may have implications for TJA use, complication rates, and outcomes.

Disparities in TJA use among minority patients has societal and economic implications. Kerman et al (14) used a Markov simulation model to predict the number of quality-adjusted life-years (QALYs) lost by Black patients because of lower TKA use. Assuming 40% lower use of TKA by Black patients compared with White patients, they estimated 72,000 QALYs lost by Black patients (14). Karmarkar et al (15) also used a simulation model to estimate differences in lifetime cost associated with racial differences in TKA use. Assuming treatment rates for Black patients are 60% of those for White patients, they found that the societal costs of disparities in knee OA treatment over 40 years were \$13.3 billion (15).

Racial disparities in pain and functional outcomes

Although TJA generally results in long-term improvement of pain in more than 80% of patients, a substantial proportion of patients achieve suboptimal pain and functional outcomes (4). Racial minority groups are disproportionately affected by poor outcomes. Rubenstein et al (16) examined social determinants of health in their study of Veterans Health Administration patients undergoing TJA. They evaluated patient-related outcomes (Hip Disability and Osteoarthritis Outcome Score and Knee Injury and Osteoarthritis Outcome Score and their joint replacement subscores) before and 1 year after THA or TKA. They found that Black race was associated with less improvement in knee-related outcomes post-TKA than White race, and that Hispanic ethnicity was associated with less improvement in hip-related outcomes post-THA than White race (16). Given that this study was conducted in Veterans Health Administration patients with equal access, these results indicate that the effect of race on TJA outcomes persists above and beyond access to health care. Goodman et al (17) conducted a systematic literature review of studies that examined race in relation to pain and health-related quality of life outcomes 6 months to 2 years after TKA. They included seven studies in their qualitative review. They found that postoperative pain, function, satisfaction, and quality of life were worse for Black patients compared with White patients (17). Notably, Goodman et al (17) remarked that most studies on TKA

outcomes did not examine race because they ended up with seven studies after initially screening 4781 studies.

Preoperative pain and functional status is correlated with postsurgical pain and function. Using 1649 participants enrolled in a TKA trial in the United Kingdom, Sanchez-Santos et al (18) found that having worse preoperative pain and physical status was a strong predictor of worse TKA outcomes. Several studies have investigated whether racial differences in preoperative symptoms or functional status contribute to disparate outcomes. A recent meta-analysis by Vaughn et al (19) on racial differences in OA pain severity found that overall, Black patients had higher clinical pain severity and self-reported disability compared with non-Hispanic White patients. Cavanaugh et al (20) studied 10,325 community-dwelling women undergoing TKA using the Women's Health Initiative cohort and found that Black women had worse physical function scores than White women during the decades before and also after TKA. Riddle et al (21) conducted a secondary analysis of a randomized clinical trial with 384 participants who underwent TKA. They found that Black patients had worse pain and function prior to TKA and also had worse functional scores following surgery compared with White participants; however, the authors of this study noted that the differences in preoperative measures were significantly attenuated after adjusting for potential confounders such as socioeconomic status and comorbidities (21).

Complication rates

Review of the literature suggests that racial minority patients may have higher surgical complication rates, although recent evidence is not consistent. In a universally insured population that included 129,402 patients who underwent TKAs, Hinman et al (22) found that compared with White patients, Black patients had a higher risk of revision, whereas Hispanic and Asian patients had a lower risk of revision. In contrast, Okike et al (23) conducted a study among THA recipients in the Kaiser Permanente system, a managed health care system, and found similar rates of lifetime revision and 90-day postoperative events among Black patients in comparison with White patients. The authors speculate that similar complication rates among Black and White patients may be attributed to equal access to care provided by a managed care system (23).

Readmissions following TJA may be impacted by race. Aseltine et al (24) conducted a retrospective analysis using a Connecticut TJA registry and found that the rate of 30-day readmissions following TJA from 2005 to 2015 was higher in Black and Hispanic patients compared with White patients, even after controlling for socioeconomic status and medical comorbidities. This study also found that overall 30-day readmission rates decreased over time from 2005 to 2015, with a more pronounced decrease among Black patients; in 2015 Black patients actually had lower rates of readmission following TJA than White patients. In contrast,

Cusano et al (25) used data from the National Surgical Quality Improvement Program to show that Black and Hispanic patients had higher odds of postoperative complications and readmissions as well as longer lengths of stay compared with White patients, after adjusting for medical comorbidities.

Length of hospital stay and discharge to rehab may also differ by race and stand as surrogates for suboptimal surgical outcomes. Discharge to home has been shown to be associated with lower odds of readmission within 30 days (26). A single-center study of 7208 primary TJAs performed between 2013 and 2017 found that Black patients had significantly longer length of stay after TKA compared with White patients, and the difference in length of stay between Hispanic and White patients approached significance (27). Black patients in this study were also discharged to skilled nursing facilities instead of being discharged home at almost twice the rate of White patients. A recent retrospective cohort study by Singh et al (28) of 107,768 TKA recipients in Pennsylvania found that among patients younger than 65 years, Black patients had higher odds of 90-day readmission and a greater risk of discharge to a rehabilitation or skilled nursing facility compared with White patients.

Potential factors underlying the disparities

In this section we discuss three main factors that may underlie the racial disparities in TJA.

Physician bias versus patient willingness. Given that physician referral to TJA is the first step toward undergoing this elective procedure, earlier work has suggested that conscious or unconscious bias by physicians may drive the disparities seen in TJA use (29,30). However, recent evidence suggests that although physician bias exists and certainly influences decision-making, differences in patients' willingness to undergo TJA and perceptions of pain may be larger drivers of racial disparities than physician referral patterns.

A prospective observational study of 457 patients with knee or hip OA seen in the Veterans Affairs system examined differences in referrals for TJA from orthopedic surgeons and found that Black patients were less likely to receive a recommendation for TJA compared with White patients with similar age and disease severity; however, the results were no longer significant after researchers controlled for patient preference for TJA, suggesting that physician referral patterns may be a response to racial differences in willingness to undergo TJA (30). A small study in which 113 orthopedic surgeons were asked to recommend TKA on the basis of standardized patient videos did not find a difference in the recommendation for TKA based on the race (or sex) of the patients in the test scenarios (31). A study by Kwok et al (32) of more than 799 patients with symptomatic knee OA found that Black patients were less willing to undergo TKA than White patients after adjustment for sociodemographic and clinical

factors. This study also highlighted that a good understanding of the procedure, minimal perceptions of pain and difficulties after surgery, and trust in physicians were strong determinants of willingness to undergo TKA among Black patients (32).

Along similar lines, Lavernia et al (33) assessed fear levels and functional outcomes in 331 patients undergoing TJA and found that Black patients had higher fear, higher anxiety scores, and lower perceived general health prior to surgery than White patients. A qualitative study of 18 Black patients with knee OA found that many of these patients described their experience with OA as "bearing the pain," which involved accepting and adjusting to the pain rather than seeking out ways to rid themselves of pain (34). The authors of this study highlight the importance of culturally congruent pain management and communication styles to help facilitate conversations between Black patients and their health care providers.

There have been recent efforts to develop interventions to reduce the disparate rates of TJA use among minority patients aimed at improving willingness to undergo surgery. Ibrahim et al (35) created a 40-minute decision aid video on the risk and benefits of TKA, which was associated with an increased rate of TKA among Black patients in a randomized clinical trial of 336 patients with severe knee OA. Vina et al (36) also developed an intervention involving a video decision aid and motivational interviewing and trialed it in a sample of Black patients with severe knee OA; however, their intervention did not improve referrals for TKA or patient willingness to consider TKA.

Low- versus high-volume hospital. Patients who undergo TJA at low-volume hospitals have been found to have higher complication rates than those undergoing surgery at high-volume centers (37). Dy et al (37) used data from 2,560,314 Medicare patients undergoing TJA and found that Black patients were more likely to undergo surgery at a local low-volume hospital than at a local high-volume hospital, with high-volume hospitals defined as those performing more than 200 TJAs per year. The authors also found that Black patients were less likely than White patients to leave their hospital service area to travel to a high-volume hospital if one was not available locally. Therefore, the centralization of procedures, such as TJAs in high-volume centers, may disproportionately disadvantage racial minority patients, who have historically been distrustful of large academic centers.

Ghomrawi et al (38) used Medicare claims data to perform a network analysis to map physician referral patterns for THA in 2018. They found that service areas with higher concentrations of Black residents had significantly higher within-network clustering and fewer external ties (38). The authors suggest that this more insular referral network for THA may represent less visible barriers within the health care environment that may limit Black patients' access to high-quality care. In contrast, a study by Adelani et al (39) used state inpatient databases from New York and Florida between 2006 and 2013 and found that even after

adjustment for hospital volume, the risk of readmission was higher for Black patients following TKA than for White patients. This study also found an increased risk of emergency department visits after TJA for patients of Black and Hispanic ethnicity. This study highlights the need to investigate factors beyond hospital volume that may underlie TJA disparities. It should be noted that higher surgeon volume has also been shown to be independently associated with better TJA outcomes, and further work should investigate the impact on surgeon volumes and racial disparities (40).

Interplay between race and socioeconomic status.

The interplay between socioeconomic status and race potentially underlies many of the racial differences that exist in terms of willingness to undergo surgery, procedural outcomes, and hospital quality, discussed above. Rahman et al (41) used population-based data to look at variations in primary THA rates by zip code as a proxy for socioeconomic status. They found that THA rates were significantly lower for the most disadvantaged zip codes compared with more affluent areas (41). This difference persisted after adjustment for sex, race, ethnicity, and hospital proximity, suggesting that geographic socioeconomic disadvantage may be an underlying driver of disparities in THA. In an aforementioned study, Thirukumaran et al (9) used Medicare claims data to show that Black patients were less likely than White patients overall to undergo TJA. A key finding from this study is that dual-eligible beneficiaries (a marker of low socioeconomic status) had significantly lower rates of TJA compared with Medicare-only beneficiaries.

Several studies have specifically looked at the relationship between race, socioeconomic status, and TJA outcomes. Goodman et al (42) investigated patient-reported outcomes following TKA using a hospital-based registry and found that Black race and census tract poverty were not individually significantly associated with worse patient-reported outcomes. However, within communities with higher levels of poverty, they did find that Black patients had worse pain and function 2 years after TKA compared with White patients. The study by Sanchez-Santos et al (18) on patients undergoing TKA in the United Kingdom, described previously, also found that greater socioeconomic deprivation, defined by residential area, was associated with significantly worse patient-reported pain and function 12 months after TKA.

Insurance status has been used as a proxy for socioeconomic status in multiple studies investigating the impact of poverty on TJA outcomes. A study by D'Apuzzo et al (43) found that economically disadvantaged patients, defined by enrollment in Medicaid, had worse function and quality of life both before and after TJA compared with non-economically disadvantaged patients. They noted additionally that a higher proportion of patients in the economically disadvantaged group were Black and Hispanic. Veltre et al (44) used the Nationwide Inpatient Sample to look at all patients who underwent elective THA from

1998 to 2011 and found lower surgical complication rates and lower mortality following THA for privately insured patients compared with patients with government-sponsored insurance.

A study conducted by Bass et al (45) sought to answer the question of whether racial disparities in TKA are explained by poverty. Using a single-institution TKA registry in New York, they found a trend toward higher TKA revision rates in Black patients but, overall, did not find an association between race, poverty, and TKA failure, which was defined as either undergoing a revision or having poor knee-related quality of life scores following surgery (45). Overall, there is a complex relationship between socioeconomic and race that underlies TJA disparities. All of the aforementioned studies adjusted for socioeconomic status in the analysis, suggesting that socioeconomic status alone does not explain the racial differences in TJA use and outcomes but rather is directly related to other confounding factors.

Recent advances

Encouragingly, recent work shows that some progress has been made regarding narrowing the gap in TJA use among minority patients. Gwam et al (46) showed that the proportion of patients who undergo TKA belonging to minority groups increased between 2009 and 2015, with Black patients experiencing the largest proportional increase in TKA use. Etcheson et al (47) found that there was an increased percentage of primary THA recipients who were Black, American Indian, and Asian in the United States between 2008 and 2016.

Trivedi et al (48) recently published on the trends in adverse events experienced by Black patients following TKA, and they found nearly a 40% decline in 30-day adverse outcomes following TKA between 2011 and 2017 for Black patients. Some of this progress in reducing disparities in TJA care may be due to deliberate efforts on the part of policy makers and professional societies to increase awareness of the existing disparities. For example, the Musculoskeletal Healthcare Disparities Research Symposium organized by the American Academy of Orthopaedic Surgeons included a "call to arms" to reduce racial disparities with measures such as promoting research on health care disparities, diversifying the orthopedic physician workforce, and educating health care providers on disparities (49).

Despite these advances, there is still much room for improvement, as evidenced by the fact that Gwam et al (46) found that Black and Hispanic patients composed 7.7% and 5.5% of all patients undergoing TKAs, respectively, whereas in a study of the burden of knee OA in the US population, Black patients composed 11.8% of all patients with advanced symptomatic knee OA and Hispanics composed 10.4% (50). Amen et al (51) looked at trends in TJA care from 2006 to 2015 in the United States using the National Inpatient Sample and found that racial disparities in TJA use and outcomes defined by length of stay, discharge

disposition, and inpatient complications actually worsened over the course of those years.

Conclusions

Our review of the current literature finds that despite improvements in recent years regarding the use of TJA among minority patients, there still exists a significant gap in care. We describe the existent racial disparities in TJA use, outcomes, and complication rates. Research on TJA outcomes should include information on race because it is notable that many published studies do not (17). In this review, we also describe potential underlying factors for the disparities, including patient willingness to undergo TJA, access to high-volume surgical centers, and socioeconomic factors.

There is a complex interplay between race and socioeconomic status that underlies disparities in TJA use that is not well understood, and future studies should further investigate this relationship. Future studies should also investigate the potential impact of implicit bias and systemic racism on Total Joint Replacement disparities.

AUTHOR CONTRIBUTIONS

Drs. Usiskin and Misra drafted the article, revised it critically for important intellectual content, and approved the final version to be published.

Study conception and design. Misra.

Acquisition of data. Usiskin, Misra.

Analysis and interpretation of data. Usiskin, Misra.

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