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GENDER AND RACIAL DISPARITIES (S EDWARDS, SECTION EDITOR)

Racial Disparities in Total Joint Arthroplasty

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Abstract

Purpose of Review The primary aim of this review was to evaluate recently published total joint arthroplasty (TJA) studies in order to accurately summarize the current concepts regarding racial and ethnic disparities in total joint arthroplasty.

Recent Findings Many studies found that racial and ethnic disparities in TJA are present in all phases of arthroplasty care including access to, utilization of, and postoperative outcomes after TJA.

Summary Factors that limit patient access to TJA—increased patient comorbidities, lower socioeconomic status, and Medicaid/uninsured status—are also disproportionately associated with underrepresented patient populations. Minority patients are more likely to require more intensive postoperative rehabilitation and non-home discharge placement. This in turn potentially adds additional concerns regarding hospital/provider reimbursement in light of the current Medicare/Medicaid model for arthroplasty surgeons, thus creating a recurrent cycle in which disparities in TJA reflect the complex interplay of overall health disparities and access inequalities associated with racial and ethnic biases. Literature demonstrating evidenced-based interventions to minimize these disparities is sparse, but the multifactorial cause of disparities in TJA highlights the need for multifaceted solutions on both a systemic and individual level.

Keywords Racial disparities · Total joint replacement · Total knee replacement · Total hip replacement

Introduction

Osteoarthritis (OA) of the hip and knee is a major cause of disability, pain, and reduced quality of life in the USA. With the aging US population, it is projected that the number of adults diagnosed with osteoarthritis will reach about 78.4 million or 26% of the adult population by 2040 [1]. For patients who have failed conservative management of osteoarthritis, surgical management with total hip arthroplasty (THA) or total knee arthroplasty (TKA) has the potential to significantly improve pain, function, and quality of life.

However, recent changes in the US healthcare reform (e.g., Bundled Payments for Care Improvement; Comprehensive Care for Joint Replacement) aimed at providing cost-effective and equitable high-quality patient care has caused healthcare systems and providers to reassess and evaluate methods of cost saving while continuing to provide quality care in the setting of total joint arthroplasty (TJA). Most of the opportunities for cost savings in hip and knee arthroplasty is focused on postoperative discharge which includes limiting extended length of stay, avoiding preventable readmissions, and optimizing discharge destination [2•, 3]. In light of this, several studies have identified patient risk factors associated with increased healthcare costs. This leads to concern that in order to maintain profitability within the healthcare reimbursement model, hospitals and providers will be incentivized to avoid caring for "high-risk" patient populations [4••].

The purpose of this study was to review the scientific literature from 2015 to 2020 focusing on racial and ethnic disparities in access to, utilization of, and postoperative outcomes after TJA. As racial and ethnic disparities in arthroplasty outcomes often manifest at the intersection of multiple marginalized identities, this review also considers how socioeconomic status and gender potentiates racial and ethnic disparities in total joint arthroplasty.

This article is part of the Topical Collection on *Gender and Racial Disparities*

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Assessment of the Current Literature

A systematic literature search was performed using the PubMed database for articles published in the English language from January 2015 to November 2020 with the following keyword combinations: "joint arthroplasty" OR "total hip arthroplasty" OR "total knee arthroplasty" and one of the following words: "gender disparity" OR "health disparity" OR "racial disparity" OR" socioeconomic disparity" OR "socioeconomic outcomes."

All abstracts from the initial query were then reviewed for inclusion criteria. Inclusion criteria for review were as follows: clinical studies with level of evidence I–III; adult population with minimum age of 18 years; analysis of US patient population; analysis of only total hip and/or knee arthroplasty; and TJA indication for osteoarthritis diagnosis. The authors of this review felt that using this strict inclusion criteria to evaluate the current published literature would result in the most accurate reflection of the current concepts of racial and ethnic disparities in total joint arthroplasty.

Where Do We Find Disparities in Total Joint Arthroplasty?

Based on this review, most published data discussing racial and ethnic disparities in total joint arthroplasty focus on factors that are associated with (1) disparate access to, (2) utilization of, and/or (3) postoperative outcomes after total joint arthroplasty. Many preoperative factors including medical comorbidities, baseline pain and functional well-being scores, and socioeconomic status contribute to disparities in all three of these areas, highlighting that the racial and ethnic disparities in total joint arthroplasty is highly complex and multifaceted.

Disparities in Access to TJA: Patient Comorbidities

In order to decrease risk of adverse outcomes after total joint arthroplasty, the American Academy of Orthopaedic Surgeons publish a series of evidence-based guidelines for the treatment of hip and knee osteoarthritis. However, several studies have suggested that stringent eligibility criteria for total joint arthroplasty disproportionally excludes underrepresented racial/ethnic populations. Wang et al. examined the odds of lower extremity arthroplasty eligibility based on criteria of BMI, HgbA1c level, and smoking status in racial-ethnic minority groups, women, and those of lower socioeconomic status compared to non-Hispanic Whites, men, and those of higher socioeconomic status. They found that cutoffs of BMI<40, HgbA1c <8%, and nonsmoking status all decreased odds of lower extremity arthroplasty eligibility for non-Hispanic Blacks vs non-Hispanic Whites, women vs men, and patients of lower vs higher socioeconomic status [5••]. Furthermore, other studies have shown that Black and Hispanic patients have a disproportionately higher burden of medical comorbidities including morbid obesity, congestive heart failure, diabetes, positive smoking status, and higher ASA scores [6•, 7••, 8•], all of which can preclude them from being arthroplasty candidates despite meeting diagnostic criteria for surgical treatment of hip or knee osteoarthritis. Warwick et al. showed that patients with increased comorbid conditions (e.g., hypertension, diabetes, obesity) were more than 3-fold more likely to have a delay from OA diagnosis to eventual TKA [9•]. Thus, while cutoffs related to BMI, HbA1c, and smoking status are all important to ensuring safe operative outcomes after total joint arthroplasty, it becomes a concern that these seemingly benign cutoffs are in fact complex issues intertwined with economic, social, and racial biases that can restrict access to total joint arthroplasty in underrepresented populations. These findings emphasize the importance of addressing reversible chronic comorbidities to improve function and quality of life. Venugopal et al. suggested that improving comorbidity profiles in underrepresented populations may lead to an increase in TJA utilization. Their study noted an increase in TKA utilization among Hispanic patients between 2011 and 2017 thought to be attributable to improvement in the clinical status of previously restrictive comorbidity profiles in this patient cohort [10•].

Disparities in Access to TJA: Insurance Status

Another component in determining access to arthroplasty care is a patient's insurance status—which has a significant association with racial and socioeconomic disparities. The majority of Medicaid patients undergoing TJA are likely to be of non-White ethnicity [11•]. A study by Almaguer et al. evaluating the association between insurance status and wait times for initial evaluation for TKA found that Medicaid patients were not only less likely to successfully make an appointment with an arthroplasty surgeon, but if they were able to get an appointment, the wait time was on average 2 weeks longer compared to privately insured Blue Cross Blue Shield patients. Additionally, Medicaid patients were less likely to receive an appointment with private practice providers compared to academic center providers [12••]. The restrictions Medicaid patients face on the types of practices they are able to be evaluated at further limits the overall likelihood of receiving appropriate care in a timely manner. Dy et al. attempted to understand impact of Medicaid insurance status has on demand for TJA. In their study, it was noted that Medicaid expansion under the US Affordable Care Act resulted in decreased wait times from insurance enrollment to TJA relative to other Medicaid plans (e.g., temporary assistance for needy families and for supplemental security income),

potentially demonstrating that the difference in time reflects improved access for Medicaid beneficiaries [13••].

Disparities in Utilization of TJA

Despite recent national efforts to reduce disparities in utilization of total joint arthroplasty by addressing biases in preoperative patient factors, there is still a persistent difference in utilization between Black vs non-Hispanic White patients [14•, 15]. Cavanaugh et al. evaluated the racial and ethnic disparities in utilization of TKA in relation to demographic, health, and socioeconomic status. They found that among women with health indicators for TKA (e.g., arthritis diagnosis, moderate-severe pain, mobility impairment), non-Hispanic White women still demonstrated higher rates of undergoing TKA compared to Black and Hispanic women [16•]. Similarly, Macfarlane et al. showed that despite adjusting for income, comorbidity, and education level, Black patients were less likely to undergo TKA even while reporting worse baseline WOMAC knee pain and function scores [17••]; Collins et al. showed similar trends despite Black patients demonstrating worse radiographic evidence of osteoarthritis [18]. Comparable findings were noted by Hausman et al. in the US veteran population [19]. Thus, while disparities in patient medical comorbidity and socioeconomic status may contribute to the disparate access to TJA, they are clearly not the only factors leading to disparate outcomes in TJA utilization.

Alley et al. investigated the ethnic and cultural barriers leading to difference in TJA in the US-Chinese population. Both Caucasian and Chinese patients of a single, fellowship-trained Caucasian arthroplasty surgeon were given a customized multidisciplinary survey designed to assess the ethnic differences between these 2 patient cohorts that may explain difference in TJA utilization in this particular surgeon's practice. Overall, 269 patients were surveyed, 85 of whom were recommended surgery (42 Caucasian, 26 Chinese). Of the patients offered surgery, 76% of Caucasian patients compared to 35% of Chinese patients elected to pursue TJA. Language, lack of familiarity with surgery, lack of TJA knowledge, family members' role in decision-making, and preference for a doctor with the same race were all factors thought to contribute to this ethnic difference [20]. Other studies illustrated similar factors contributing to Black patients being less willing to undergo TKA compared to non-Hispanic White patients [21, 22]. Furthermore, racially discordant providers were shown to use subjectively poorer communication techniques with minority patients, and patients perceive this racism in preoperative communication as a major factor in patient TJA refusal [23••]. These studies highlight the importance of training arthroplasty surgeons who understand the cultural and ethnic diversity of the patient population they treat, whether it is through diverse surgeon representation in the field of arthroplasty and/or educational training in cultural/ethnic awareness.

Disparities in Postoperative Course: Length of Stay and Discharge Destination

With recent emphasis on cost containment by the Centers for Medicare and Medicaid Services in the transition to bundled payment models, patients at risk of extended length of stay (eLOS) and non-home discharge are vulnerable to increased difficulty of obtaining TJA due to the higher cost risk associated with their increased care needs. Weiner et al. analyzed the Illinois COMPdata administrative database for THA admission between 2016 and 2018 to determine the association between patient variables including age, sex, race/ethnicity, household income, insurance status, and comorbidity and the likelihood of non-home discharges and eLOS. They demonstrated that patients who were female, non-Hispanic Black, obese, Medicaid or uninsured, or with Charlson comorbidity index >3 were associated with increased risk of eLOS and non-home discharges [24••]. These findings have been supported by other studies, showing that minority patients are more likely to discharge to institutional rehabilitation facilities (IRF) or skilled nursing facilities (SNF) instead of home care regardless of age after TJA [14, 25•, 26•, 27•, 28]. Understanding factors that result in increased likelihood of non-home discharges is important as patients discharged to IRF/SNF have higher odds of 30-day and 90-day hospital readmission [26•, 28]. Moreover, Black and Hispanic patients are more likely to have 90-day postoperative ED visit as well as higher rates of readmission at both 30-day and 90-day after TJR [29•, 30, 31].

Disparities in Postoperative Complications

Minority patients (Black, Hispanic, Asian) are more likely to experience higher rates of postoperative complications (e.g., infections, DVTs, above-the-knee amputations, transfusions, persistent post-surgical pain) despite controlling for medical comorbidities via propensity score matching and multivariate analysis [6, 27, 32•, 33•, 34•]. Klemt et al. demonstrated that Black patients experienced increased postoperative infection rate compared to non-Hispanic White patients, although in this study, Black patients also demonstrated significantly higher BMI and ASA scores [7]. George et al. showed that Black men had the highest rates of above-the-knee amputation after both primary, complicated TKA, and septic complication even after adjusting for age and comorbidities [35]. However, Okike et al. found that in a universally insured patient population, minority patients had similar rates of lifetime reoperation and 90-day postoperative events that were generally similar to or lower than those of non-Hispanic White patients [36•].

However, their study still showed Black and Hispanic patients had higher rates of 90-day ED visits.

How Do We Begin to Address the Racial/Ethnic Disparities in TJA?

The literature demonstrated that disparities in race and ethnicity are intimately associated with common patient demographics (e.g., BMI, smoking, socioeconomic status) known to affect preoperative and postoperative TJA outcomes. Inequalities in overall health maintenance, TJA access, and TJA utilization mediate a vast majority of preoperative disparities, while strict exclusion criteria for comorbid status (e.g., BMI, HbA1c, smoking) are important and necessary to ensure optimal outcomes after total joint arthroplasty; if we do not recognize and attempt to address the associated biases of these restrictions, the disparities in TJA access and utilization for underrepresented populations will continue to ensue. A recent survey of AAHKS members reported that 83% of surgeons feel pressure to limit surgical access for patients with limited social support as compensation metrics fail to account for the increased care required to appropriately care for lower SES patients. Surgeons specifically acknowledged that this pressure disproportionately limits access for racial minorities as well as Medicaid and underinsured patients [4].

One intervention suggested by the survey to improve access for minority patients was to improve reimbursement models to better account for the increased patient medical complexity. The Comprehensive Care for Joint Replacement model introduced by Medicare aimed to increase hospital accountability for patients undergoing TJA by imposing penalties if episode spending exceeded the spending benchmark [37••]. However, it does not account for patient medical complexity and once again potentially disincentivizes healthcare systems and healthcare providers from treating certain patient groups.

Throughout the review, it was clear that a number overarching structural factors contribute to patient outcomes preoperatively and postoperatively. One of these factors was undoubtedly the concept of structural racism, which was pervasive in many of the discussions. Structural racism refers to the ways in which societies reinforce discrimination through mutually reinforcing inequitable systems such as housing, education, employment, earnings, and criminal justice [38]. These systems adversely impact physical health, social, and economic opportunities and status and can contribute to the development of maladaptive coping behaviors that can accumulate across both a person's lifetime and generationally (same cite). It is not coincidental that throughout this review, economically disadvantaged patient populations had lower educational levels and were more likely to belong to underrepresented groups [39, 40]. Our review of the literature found multiple studies that demonstrated that despite worse reported preoperative and postoperative outcome metrics, patients of lower SES were still less likely to utilize TJA [39, 40, 41•]. Furthermore, discriminatory and/or disadvantageous housing policies are known to be associated with increased rates of poverty and chronic disease which ultimately impacts health and systematically influences healthcare access and utilization [38].

Tools that help identify and develop interventions to reduce the burden of racial and socioeconomic factors on health outcomes would be useful to help address the disparities in healthcare. Using trends in 30-day outcomes, Trivedi et al. developed a preoperative risk stratification model to help predict operative risk and guide optimization of modifiable patient factors to improve postoperative outcomes in their Black patient population. They noticed that Black patients experienced a significant reduction in postoperative hospital length of stay and rates of 30-day adverse events (AE) after TKA upon improvement of modifiable factors (anemia, operative time, smoking status) [42••].

While the answer to solve the racial and ethnic disparities seen in total joint arthroplasty is neither simple nor straightforward, if we start by acknowledging the issue, educating the public, and recognizing the multifaceted and complex societal implications of this topic, we are one step closer to creating an equitable and accessible healthcare environment for all US patients.

Conclusion

Disparities in total joint arthroplasty are multidimensional, encompassing patient factors like medical comorbidities in addition to overarching systemic disparities affecting race/ethnicity, socioeconomic status (SES), and gender. Moreover, many marginalized patients lie at the intersection of these identities which further complicates how to effectively address these disparities. This review demonstrated that racial/ethnic factors in addition to gender and SES contribute to disparate (1) access to, (2) utilization of, and/or (3) postoperative outcomes after total joint arthroplasty. Without fully acknowledging the myriad ways in which these disparities occur, interventions and solutions to address the problem will continue to fall short. To start addressing inequalities in arthroplasty, we must encourage change to healthcare at an individual and systemic level.

Declarations

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any other the authors.

Conflict of Interest The authors declare no competing interests.

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Papers of particular interest, published recently, have been highlighted as:
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- •• Of major importance

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likely to receive a bonus for spending cuts in the current Medicare Compreehensive Care for Joint Replacement model.

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42. >•• Trivedi A, Ezomo OT, Gronbeck C, Harrington MA, Halawi MJ. Time trends and risk factors for 30-day adverse events in Black patients undergoing primary total knee Arthroplasty. J Arthroplasty. 2020;35(11):3145–9. https://doi.org/10.1016/j.arth.2020.06.013 **Authors examined trends in disparities of arthroplasty care for Black patients and used this data to create a preoperative risk stratification model. They found that risk factors for deveoping adverse effets included male gender, smoking, functional status among others. The goal of this model was to identify modifiable factors, namely anemia, tobacco smoking, bilateral surgery, and operative time and optimize those at the preoperative level.**