Racial and Ethnic Variation in the Association Between Body Mass Index and Periprosthetic Joint Infection Risk After Total Joint Arthroplasty

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INTRODUCTION: Periprosthetic joint infection (PJI) remains a serious complication after total joint arthroplasty (TJA), with both body mass index (BMI) and race/ethnicity established as independent risk factors. However, these factors have primarily been examined in isolation, and little is known about whether the relationship between BMI and PJI risk varies across racial and ethnic groups. We studied: (1) whether the relationship between BMI and 1-year PJI risk differs by race/ethnicity; (2) whether BMI thresholds for significantly increased risk vary by group; and (3) whether these associations differ for total knee (TKA) versus total hip arthroplasty (THA).

METHODS: We used Optum's de-identified Clinformatics® Data Mart Database to identify adults undergoing primary TKA or THA between January 2016 and June 2021. Using logistic regression models with restricted cubic splines for BMI, we examined whether the association between BMI and one-year PJI risk varied across racial/ethnic groups (White, Black, Hispanic), adjusting for demographics, socioeconomic factors, comorbidities, and procedure type. We assessed the statistical significance of BMI-by-race interactions using likelihood ratio tests. For each racial/ethnic group, we calculated risk differences and numbers needed to harm (NNH) at different BMI thresholds (30-34.9, 35-39.9, ≥40) compared to patients with a BMI <30, and evaluated whether these relationships differed between total knee and hip arthroplasty procedures.

RESULTS: Among our sample of 141,771 patients, the relationship between BMI and PJI risk differed significantly by race/ethnicity, with likelihood ratio tests showing improved model fit when including the BMI-race interaction term ($\chi^2(9) = 21.5$, p=0.011). White patients also exhibited steeper risk increases at BMI >35 compared to Black patients, despite having lower baseline risk at lower BMI levels (Figure 1). The BMI threshold at which PJI risk first became significantly elevated relative to patients with BMI <30 varied across racial/ethnic groups (Figure 2): White patients showed increased risk at BMI 30-34.9 (risk difference 0.29% [95% CI 0.10% to 0.49%]), Black patients at BMI 35-39.9 (risk difference 0.92% [95% CI 0.25% to 1.53%]), and Hispanic patients at BMI ≥40 (risk difference 1.87% [95% CI 0.81% to 3.06%]). The race-specific association between BMI and PJI appeared more pronounced for TKA (p=0.07) than THA (p=0.28).

DISCUSSION AND CONCLUSION:
The relationship between BMI and PJI risk following total joint arthroplasty appears to vary across racial and ethnic groups, which may challenge conventional approaches to surgical eligibility based on uniform BMI thresholds. These differences suggest that such cutoffs may disproportionately limit access to TJA for Black and Hispanic patients, who may not demonstrate significantly elevated infection risk at moderate obesity levels. Clinicians could consider these differential risk patterns when assessing perioperative risk, especially for knee replacements, where the race-specific BMI associations appear more pronounced. Further research is needed to validate these findings in diverse populations and to better understand the potential biological and social mechanisms contributing to these differences, with the goal of informing approaches that appropriately balance surgical safety with equitable access to care.