

Identifying Racial Disparity in Utilization and Outcomes of Hip Arthroscopy using Machine Learning

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INTRODUCTION: Diagnosis and arthroscopic treatment of femoroacetabular pathology has been increasing in the past thirty years with interventions resulting in improved hip function and delay of the progression to hip arthroplasty. Unfortunately, previous investigations have observed decreased rates of access, utilization of, and outcomes following orthopaedic interventions such as hip arthroplasty in underrepresented patients. The purpose of this study is to examine racial differences in procedural rates, outcomes, and complications in patients undergoing hip arthroscopy to see if trends observed in other orthopaedic procedures exist for hip arthroscopy.

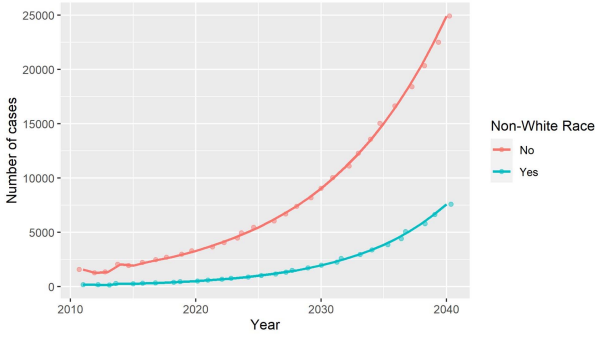
METHODS: The State Ambulatory Surgery and Services Database (SASD) and State Emergency Department Database (SEDD) of New York were queried for patients undergoing hip arthroscopy from 2011 to 2017. The primary outcomes investigated were utilization over time, total charges billed per encounter, 90-day emergency department visits, and revision hip arthroscopy. Patients were stratified into White and non-White race, and intergroup differences were evaluated with descriptive statistics. Subgroup analysis was performed with linear mixed-effects models to identify significant interactions between race and individual variables that contributed to any differences in the outcomes of interest. Temporal trends in utilization of hip arthroscopy and concomitant procedures between the two groups were analyzed with Poisson regression modeling. Finally, targeted maximum likelihood estimation (TMLE) was performed to provide nonparametric estimates of the specific differences in the outcomes studied using machine learning ensembles while controlling for patient risk factors.

RESULTS:

A total of 9,745 patients underwent hip arthroscopy during the study period, with 1,081 patients of non-White race (11.9%). Results of Poisson regression demonstrated an annual increase of 1.11 in the incidence rate of hip arthroscopy among White patients, compared to 1.03 for non-White patients ($p < 0.001$), with this disparity projected to increase by 2040 (Figure 1). Based on TMLE utilizing an ensemble of machine learning models, non-White patients were significantly more likely to incur higher costs (OR: 1.30, 95% CI: 1.24-1.37, $p < 0.001$) and visit the emergency department within 90-days after surgery (OR: 1.09, 95% CI: 1.01, 1.18, $p = 0.05$), but had negligible differences in reoperation rates at 90 days to 2 years (OR: 1.13, 95% CI: 0.78-1.63, $p = 0.53$). Subgroup analysis identified higher likelihood for 90-day emergency department admissions among non-White patients compared to White patients, which were significantly compounded by Medicare insurance (OR: 2.95, 95% CI 1.46-5.95, $p = 0.002$), median income in the lowest quartile (OR: 1.84, 95% CI: 1.2-2.61, $p = 0.012$), and residence in low-income neighborhoods (OR: 2.05, 95% CI: 1.31-3.2, $p = 0.006$). Subgroup analysis for charges billed and reoperation did not identify significant findings.

DISCUSSION AND CONCLUSION: Hip arthroscopy remains an increasingly utilized surgical technique for the treatment of myriad hip disorders. Unfortunately, racial disparities exist and are worsening over time. Irrespective of insurance status, non-White patients undergo hip arthroscopy at a lower rate, incur higher costs, and more frequently experience unexpected returns to the emergency department. Improved initiatives to improve the disparity in access to and outcomes following hip arthroscopy must be addressed to further its utility for all patients.

Hip arthroscopy volume projections through 2040



Subgroup analysis of 90-day emergency department admissions in non-White patients compared to White patients

