Quantifying Outpatient Appropriateness For Total Hip and Knee Arthroplasty: A Multi-Institution Risk Prediction Tool

Daniel Ehren Goltz[1], Chelsea Sue Sicat, Jay Micael Levin[2], Joshua Helmkamp[1], David E Attarian[3], William A Jiranek[1], Michael P Bolognesi[4], Ran Schwarzkopf[5], Thorsten M Seyler[6]
[1]Duke University, [2]Duke Health, [3]Duke Orthopaedics, [4]Duke Univ. Med. Ctr. - Duke South, [5]NYU Langone Orthopedic Hospital, Hospital For Joi, [6]Duke University School of Medicine

INTRODUCTION:
Understanding individualized patient appropriateness for outpatient total hip or knee arthroplasty (THA, TKA) is a crucial first step for minimizing patient complications from occurring in an ambulatory setting while also protecting surgeon liability and prioritizing patient outcomes. Same-day discharge is a relatively rare historical event, and short inpatient stay (discharge by post-operative day 1) may serve as a useful historical proxy for true outpatient appropriateness, for which an accurate pre-operative predictive model built for selecting appropriate candidates for accelerated care pathways.
METHODS:
A multi-center cohort of 13,241 primary THAs from two institutions and 5,838 primary TKA's from one institution was created for analysis. The primary outcome was short inpatient length of stay (defined above), and the study period between 2016 and 2020 was targeted as a period when prevalence of short stay arthroplasty was consistently above 40% to minimize changes in practice patterns over time. A multivariable logistic regression model was created for THA from over 50 pre-operative sociodemographic/comorbidity variables. Model accuracy for THA was quantified with area under the receiver operator characteristic curve (AUC), and this model was also tested for accuracy in TKA patients.
RESULTS:
57% of THA patients underwent a short inpatient length of stay (Institution 1: 65%, Institution 2: 53%), with relatively consistent prevalence observed during the study period. Parameter selection was performed, identifying 22 pre-operative variables for their importance in predictive model short inpatient stay after THA, in order of importance: ASA, gender, age, partner status, ethnicity, BMI, insurance type, median county income, electrolyte disorder, diabetes, neurologic disease, patient distance, drug abuse, paralysis, peripheral vascular disease, rheumatoid collagen disease, chronic pulmonary disease, pulmonary circulation disease, liver disease, congestive heart failure, coagulation deficiency, and AIDS/HIV. This model demonstrated very good accuracy using only pre-operative factors (AUC: 0.75). Among the TKA patients from Institution 1, 56% underwent short inpatient stay, and the above model also performed well when tested against this population (AUC: 0.71).
DISCUSSION AND CONCLUSION:
An accurate pre-operative predictive model based on historical short inpatient length of stay may establish a baseline threshold for identifying patients safe for outpatient total joint arthroplasty. This interactive, online model contains only factors that can be automatically populated by electronic medical records, and many factors are potentially modifiable, representing targets for pre-operative optimization strategy.