

A Validated Pre-Operative Risk Prediction Tool For Extended Inpatient Length of Stay Following Primary Total Hip or Knee Arthroplasty

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INTRODUCTION: As value-based reimbursement models mature, understanding the potential trade-off between inpatient length of stay and complications or need for costly post-acute care becomes more pressing. Predicting a patient's natural baseline length of stay may help providers understand how best to decide optimal discharge timing for high-risk hip/knee arthroplasty patients as part of efforts to minimize 90-day adverse events.

METHODS:

A retrospective review was conducted of 42,099 primary total hip and knee arthroplasties performed at two high-volume, geographically diverse tertiary health systems (Southeast: 07/2013-09/2020; Northeast: 01/2014-03/2021). Patients were stratified based on 3 binary outcomes for extended inpatient length of stay: 72+ hours, 4+ days, or 5+ days. The predictive ability of over 50 sociodemographic/comorbidity variables was tested. Multivariable logistic regression models were created for each outcome using the cohort from Institution #1 (derivation), with accuracy tested using the cohort from Institution #2 (validation).

RESULTS:

37,406 primary total hip (17,134, 46%) and knee (20,272, 54%) arthroplasties were performed during the study period, of which 29%, 11%, and 5% experienced an extended length of stay of 72+ hours, 4+ days, and 5+ days, respectively. 15% overall were discharged to rehabilitation or skilled nursing facility. Multivariable logistic regression models created from the training cohort demonstrated excellent accuracy (AUC: 72+ hours 0.755, 4+ days 0.783, 5+ days 0.810), and performed very well under external validation (AUC: 72+ hours 0.719, 4+ days 0.743, 5+ days 0.763). Parameter selection for variable importance showed substantial commonality between the 3 models: age, gender, ASA, body mass index, marital status, bilateral case, insurance type, deficiency anemia, cardiac arrhythmia, rheumatoid collagen disease, congestive heart failure, chronic pulmonary disease, diabetes, liver disease, electrolyte disorder, neurologic disease, paralysis, psychoses, pulmonary circulation disease, and weight loss.

DISCUSSION AND CONCLUSION:

An online, freely-available, pre-operative clinical decision tool accurately predicts risk of extended inpatient length of stay after total joint arthroplasty. Many risk factors are potentially modifiable, and these validated tools may help guide clinicians in pre-operative patient counseling, medical optimization, and understanding optimal discharge timing.

Factors Common To All 3 Models

Age	Congestive Heart Failure
ASA Score	Chronic Pulmonary Disease
BMI	Diabetes
Gender	Liver Disease
Partner Status	Electrolyte Disorder
Bilateral Case	Neurologic Disease
Insurance Type	Paralysis
Deficiency Anemia	Psychoses
Cardiac Arrhythmia	Pulmonary Circulation Disease
Rheumatoid Collagen Disease	Weight Loss

Predictive Model:	Derivation (Institution 1)	Validation (Institution 2)
72+ Hours	0.755	0.719
4+ Days	0.783	0.743
5+ Days	0.810	0.763