Risk Assessment Tools Used to Predict Outcomes of Total Hip and Total Knee Arthroplasty

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KEY POINTS

- Clinical tools have been developed to help predict outcomes in total joint arthroplasty (TJA) patients to aid efficient care delivery as demand for TJA increases.
- The Risk Assessment and Prediction Tool (RAPT) uses preoperative patient factors to predict patient need for an extended care facility after TJA. Our experience shows that length of stay and percentage of patients discharged home can be improved.
- The Predicting Location after Arthroplasty Nomogram (PLAN) is an alternative tool for predicting patient discharge needs.
- The Morbidity and Mortality Acute Predictor (arthro-MAP) uses patient characteristics and intraoperative factors to predict a patient's probability of significant postoperative complications.
- The Penn Arthroplasty Risk Score predicts a patient's need for postoperative intensive care unit monitoring.

INTRODUCTION

The demand for total knee arthroplasty (TKA) and total hip arthroplasty (THA) in the United States is growing rapidly. Kurtz and colleagues[1] projected the demand for primary THA to grow 174% to 572,000, and primary TKA to grow by 673% to 3.48 million procedures per year by 2030. Demand for THA and TKA revision procedures is likewise expected to experience a large increase in demand of 147% and 601% by 2030, respectively.[1] Hospital costs associated with total joint arthroplasty (TJA) were estimated at $30 billion in 2004, and are expected to increase as demand increases.[1]

TKA and THA are considered safe, long-term, cost-effective treatments for osteoarthritis[2–4] and it is therefore desirable that the growing demand be met. The predicted shortage of qualified arthroplasty surgeons in relation to the increasing demand represents an additional challenge.[5] The United States health care system's ability to meet the rapidly growing demand will be predicated on safe and efficient delivery.

The capacity to predict patient outcomes and needs preoperatively allows more efficient delivery of care, which increases the ability of joint replacement surgeons to meet this demand. Numerous clinical tools have been developed to predict a variety of TJA patient outcomes (**Table 1**). Such

Table 1
Select risk assessment tools for total hip and knee arthroplasty patients

Study	Study Design	Patients (n)	Tool Name	Predicts	Variables Measured	Internal C-Statistic	Notes
Oldmeadow et al,[13] 2003	Prospective	520	RAPT	Postoperative rehabilitation need	(6) Age, gender, preoperative walking distance, gait aid, community support, home caregiver	0.75	Based on Australian population
Barsoum et al,[17] 2010	Retrospective	517	PLAN	Postoperative rehabilitation need	(17) Type of surgery, age, gender, BMI, comorbidities, preoperative ambulation status, predicted postoperative ambulation status, home environment variables (no. of steps, bedroom on first or second floor, bathroom on first or second floor), baseline caregiver assistance, home distance relative to the OR	0.867	Externally Validated
Wuerz et al,[21] 2014	Retrospective	3511	arthro-MAP	Postoperative complications	(8) Lowest intraoperative HR, EBL, preoperative BUN, procedure type, race, ASA score, comorbidities, presence of fracture	0.76	Awaiting external validation
Courtney et al,[30] 2014	Retrospective	1594	PARS	Postoperative ICU care need	(5) COPD, CHF, CAD, EBL >1000, intraoperative vasopressor use	0.822	7-point scale, with postoperative ICU care recommended if ≥3 points
Sabry et al,[34] 2014	Retrospective	314	Unnamed nomogram	Reinfection after 2-stage TKA revision for infection	(12) BMI, time from index surgery, duration of symptoms, number of previous surgeries, preoperative hemoglobin, soft tissue coverage required, prior infection in the same joint, previous 2-stage revision, type of organism, diabetes, immunocompromise, and heart disease	0.773	Not externally validated

Abbreviations: arthro-MAP, Morbidity and Mortality Acute Predictor; ASA, American Society of Anesthesiologists; BMI, body mass index; BUN, blood urea nitrogen; CAD, coronary artery disease; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; EBL, estimated blood loss; HR, heart rate; ICU, intensive care unit; OR, operating room; PARS, Penn Arthroplasty Risk Score; PLAN, Predicting Location After Arthroplasty Nomogram; RAPT, Risk Assessment and Prediction Tool; TKA, total knee arthroplasty.