



## How to Predict 30-Day Readmission

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### Keywords

• Readmission • Predict • Surgical outcomes

### Key points

- Factors influencing surgical readmissions are multifactorial and can generally be summarized into biologic, social, surgical, and health care factors.
- Surgical readmissions are complex with patient risk profiles largely unique to the surgical procedure performed.
- Surgical readmissions are challenging to predict despite using granular perioperative patient-centered data known to providers at the time of discharge.

## INTRODUCTION

Health care utilization through hospital readmission following hospital discharge within 30 days is publically reported and associated with both clinical and economic implications. According to a 2009 study using Medicare claims data, one-fifth of all hospitalized patients were rehospitalized within 30 days of discharge [1]. Of readmitted patients, 67.1% and 51.5% of medical and surgical patients, respectively, were readmitted or died within the first year of an index hospital discharge, costing an estimated \$17 billion per year. Specifically, one in 7 patients are readmitted within 30 days following major surgery using similar Medicare claims data [2]. It is no surprise that the Affordable Care Act [3] implemented the Hospital Readmission Reduction Program in 2012 to incentivize hospitals with higher than expected 30-day readmission rates to adopt strategies to reduce costly readmissions and improve quality of care. The Centers for Medicare and Medicaid Services (CMS) targeted its first surgical procedure

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with total hip and knee arthroplasty in 2015 and coronary artery bypass grafting in 2017 with plans for other surgical procedures likely to follow in the future. Clinical leaders have urged investigators to respond with a call-to-action for feasible and cost-effective strategies to reduce readmissions [4,5]. It has been long debated whether surgical readmissions are predictable and thereby preventable with intervention. A brief review of previously described predictors, reasons for readmission, and interventions to prevent readmissions are described elsewhere [6]. The purpose of this article is to update discussion on the ensuing challenges in predicting surgical readmission.

## **PREDICTORS OF READMISSION**

Understanding the events that drive surgical readmission remains a constant challenge for policymakers and clinical leaders. Investigators have identified various multifactorial associations with readmission that are used in regression analyses to predict 30-day readmission. Thorough reviews describing unique patient risk profiles for readmission by procedure case-mix have been described [7–9]. Patient readmission risk profiles generally reflect biologic factors such as patient biology and comorbid conditions, social determinants of health, surgical factors including education or acuity of disease and perioperative management, and healthcare system factors involving multidisciplinary care components contributing to readmission. [6,10]

### **Biologic and social factors**

Patient disease and comorbidity are known to place patients at increased risk of surgical readmission [11]. Readmission risk scores using granular data have been developed accounting for patient comorbidity [12,13]. Frail patients and those with dependent functional status are also more likely to experience readmission after surgery [14–17]. The modified frailty index (mFI) is a validated deficit-accumulation frailty tool using 11 preoperative characteristics including comorbidities and functional status tracked by the American College of Surgeons National Surgical Quality Improvement Project (ACS-NSQIP) [18]. Although the mFI has been associated with morbidity and mortality following major surgery across various specialties, its association with readmissions and how the individual components contribute to readmission following surgery were unclear until investigators used a large national retrospective cohort of 118 Veterans Affairs medical centers comprising 236,957 surgeries from 2007 to 2014 [15]. An mFI was calculated based on preoperative patient comorbidities and functional status for veteran patients undergoing general, orthopedic, and vascular surgery having a postoperative length of stay of at least 2 days. The mFI, when measured as a continuous proportional variable, was associated with 30-day readmission with an 11% increase in odds of readmission for each incremental increase in the index. When analyzed using individual components, impaired functional status with dependent status or having any residual deficit from a prior stroke contributed most to the predictive ability of the mFI for readmission. Although there are many measures and

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