



Identifying and mitigating factors contributing to 30-day hospital readmission in high risk patient populations

Michael P. Rogers, Paul C. Kuo

Department of Surgery, University of South Florida Morsani College of Medicine, Tampa, FL, USA

Correspondence to: Paul C. Kuo, MD, MS, MBA. Professor of Surgery Department of Surgery Morsani College of Medicine University of South Florida. Email: paulkuo@usf.edu.

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Unanticipated hospital readmission may significantly impact patient quality of life, hospital system resource utilization, and healthcare expenditure. The cost of unplanned hospital readmission is estimated between \$20–40 billion dollars annually in the United States (1,2). Particular conditions have been identified to contribute disproportionately to readmission and include congestive heart failure (CHF), septicemia, and pneumonia (2). Accordingly, significant attempts have been made to identify and mitigate factors contributing to 30-day hospital readmission. Efforts by the Centers for Medicare and Medicaid Services (CMS) Hospital Readmissions Reduction Program (HRRP), Joint Commission on Accreditation of Healthcare Organizations (JCAHO) performance metrics, and readmission rates as a measure of quality and hospital financial performance have endeavored to reduce unnecessary readmissions to the benefit of patients and hospitals alike (3). Robust national datasets have allowed researchers to identify predictors of hospital readmission unique to individual diagnoses and procedures (4–7). Consequently, readmission rates declined from 21.5% in 2007 to 17.8% in 2015 for conditions targeted by CMS, and from 15.3% to 13.1% for non-targeted conditions (8). As reimbursement and quality metrics are increasingly tied to patient outcome (i.e., mortality, infection, and unplanned 30-day readmission), interest in further identifying contributing factors remains a priority.

Various strategies have been explored to abate unforeseen hospital readmission. Models determining optimal discharge timing, ideal hospital lengths of stay, location of patient discharge, and the temporal influence of

index hospitalization have all been investigated to further reduce this burden (6,7,9–11). While the complete cadre of factors comprising the healthcare macroenvironment and their influence on readmission has yet to be elucidated, several authors have made significant strides in identifying modifiable predictors for individualized disease processes. Kothari and colleagues' utilization of the Healthcare Cost and Utilization Project State Inpatient Database (HCUP SID) for Florida and California to determine the influence of patient discharge location on readmission after liver transplantation represents one such approach (9). The HCUP-SID is developed and maintained by the Agency for Healthcare Research and Quality (AHRQ) to inform nation, State, and community level decision making by providing data elements of inpatient hospital stays (12). Elements including principal diagnoses and procedures, admission and discharge status, patient demographics, expected payment source, total charges, and length of stay allow for thorough investigation and consideration of the various factors associated with hospital readmission. Kothari *et al.*'s analysis revealed similar findings to prior work in patients with a primary diagnosis of congestive heart failure and myocardial infarction. Patients discharged to inpatient rehabilitation and long-term acute care facilities following liver transplantation had lower risk of 30-day readmission when compared to patients discharged to home (9). This and similar analyses may inform decision making when considering discharge planning for individualized patients that may be at risk from unplanned hospital readmission. The strengths of these large datasets in providing

longitudinal follow-up, cost data, and discharge locations offers novel understanding of the patient, surgeon, and hospital-level factors that may influence readmission.

Mitigating hospital readmission in patients with liver cirrhosis is a topic of significant interest. Previous efforts at identifying and understanding knowledge gaps in the care of these patients have explored patient and hospital factors (13-15). Orman and colleagues' recent systematic review found increased model for end-stage liver disease (MELD) score frequently associated with higher readmission (14). Similarly, Wei *et al.* single state analysis identified clinical complexity as well as sociodemographic factors as strong predictors of readmission (13). These studies highlight ongoing work in this cohort with high 30-day readmission. Despite the burden of these admissions however, to date, studies have been limited in the breadth of included factors for analysis. Orman *et al.* comment on the wide heterogeneity of studies included for systematic review, including differences in inclusion/exclusion criteria between studies, cirrhosis-specific and non-specific factors analyzed, and the ability to accurately capture hospital readmission (14). Further, a lack of study of the social determinants of health in this population and the differences in methodology across studies has hindered progress. As a result, a paucity of information currently exists to adequately address readmission in this cohort.

Garg and colleagues' novel investigation of factors contributing to 30-day readmission for liver cirrhosis similarly informs physicians using a large robust dataset and has several important findings (5). Readmission for cirrhosis is high with resultant significant financial impact on healthcare systems (16,17). Indeed, hospitalization costs secondary to cirrhosis and its sequela have been reported to be even greater than that of congestive heart failure or chronic obstructive pulmonary disease (COPD) (18). Garg *et al.* utilized the largest nationally representative inpatient sample, the Nationwide Readmission Database, which provides unique, all-payer information on approximately 49% of all hospitalizations occurring in 27 geographically diverse states in the US (19). Including over 300,000 patients, the authors identified a 31.4% readmission rate, substantially higher than the reported national average readmission rates for any other medical condition (20). Interestingly, though the CMS HRRP does not include cirrhosis currently, this remarkably high readmission rate makes a strong case for including this diagnosis in the future. Perhaps expectantly, the authors found patients with co-morbid conditions including CHF, COPD, peripheral

vascular disease, and diabetes mellitus, a substantial proportion of those readmitted.

Similar to previous analyses, Garg *et al.* observed post-discharge care had a significant impact on hospital readmission in this cohort (5,7,21). In their study, patients with chronic liver disease had significantly less post-discharge care (i.e., skilled nursing facilities, long term acute care hospitals, etc.) than patients admitted for CHF or COPD, despite higher readmission rates. Accordingly, the authors advocate for the development and implementation of strategies to ensure longitudinal support of these at-risk patients (5). Given this influence on readmission, discharge disposition should likely be dictated by individual patient and healthcare system factors, including the status of the patient at discharge, presence of co-morbidities, ability to access to care once discharged, and whether the patient may require ongoing care not available as an outpatient.

The identification of modifiable factors for decreasing the incidence of readmission at the index hospitalization is important in making strides to reduce this burden. Patients undergoing esophagogastroduodenoscopy (EGD) in this study had lower rates of hospital readmission. The authors hypothesize this is consequent to the ability to identify and intervene on high-risk varices, thereby decreasing rates of readmission for bleeding (5). The thorough work-up of patients at the initial hospitalization is thus paramount to identify and appropriately stratify those at risk for complications or need for ongoing medical care. Patients with an increased Charlson comorbidity index, hepatorenal syndrome, hepatic encephalopathy, ascites, esophageal varices, non-alcoholic and biliary cirrhosis, or history of bariatric surgery deserve particular attention (5).

Reducing unplanned 30-day hospital readmission remains a priority for patients, physicians, healthcare systems, and payors alike. It is estimated that approximately one-third of readmissions in this cohort may be preventable (22). These events significantly impact patient quality of life, hospital system resource utilization, and overall healthcare cost. Identifying potential patient and hospital factors that may reduce these readmissions is therefore of significant consequence. Garg and colleagues are to be congratulated on their excellent contribution to the literature and in providing insight on the contributors to readmission in this previously understudied cohort using a large nationally representative database.

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