Reducing readmissions in patients with cirrhosis: the time to act is now

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The burden of cirrhosis and cirrhosis-related deaths in the United States (US) has increased significantly over the past two decades, driven largely by climbing rates of alcohol use disorders and obesity (1). Over a similar timeframe, the number of hospitalizations has doubled and costs attributed to inpatient stays have tripled (2). This is even more striking among patients with cirrhosis, as the overall hospitalization trend in the United States slightly declined in the last decade (3). Readmissions are a prime example of low-value care, as they are associated with not only higher costs to payers but also greater psychosocial burden, reduced satisfaction, and increased mortality risk for patients (4). To address this rising healthcare burden, efforts to reduce readmissions in this population have emerged as an important priority for clinicians, health systems, and policymakers (5).

In a recent article, Garg and co-authors perform a nationwide analysis of readmissions for patients with cirrhosis with a focus on assessing modifiable risk factors that may be intervenable to reduce readmission risk (6). Using observational data of cirrhosis-related acute hospitalizations between 2010–2014 from the National Readmissions Database (NRD), this study demonstrated that 31.4% of patients with cirrhosis were readmitted within 30 days of hospitalization.

Orman and colleagues recently published a systematic review of studies reporting readmissions among patients with cirrhosis from 2000 to 2017, finding a total of 21 retrospective studies (7). Their study provides a very nice reference for prior work, and the pooled estimate of 30-day readmissions was 26%, aligning well with the current study. In addition, of the retrospective studies, twenty were single-center studies, highlighting the need for large, multi-center studies in this space.

Describing the context of readmissions is crucial because interventions and healthcare system changes to reduce readmissions should be tailored to the patient's comorbidities, reason for admission, and interventions during the index hospitalization (8). This can vary significantly by the primary reason for index hospitalization, with one study finding as much as 85% related readmissions for joint replacement (9) and another 33% for heart failure (10). Among hospitalized patients with cirrhosis, this can also vary significantly depending on the inclusion and exclusion criteria of the cohort, largely driven by the severity of liver disease. In the study by Garg and colleagues, diagnoses related to liver-related complications and substance use were found in 26% and 17% of readmissions in this cohort, respectively. In another study in an electronic health record study in the national VA, ~60%

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of admissions were related to cirrhosis related conditions (4). Garg and colleagues found that ascites and hepatic encephalopathy were the most common complications related to readmissions, findings that mirror those seen in other analyses of NRD and Department of Veterans Affairs (VA) (4,11).

For readmissions that are potentially preventable, identifying root causes is a critical step. Potential causes should acknowledge not only patient factors, but also variables related to social determinants of health, patient function, and system-level performance (12). In this manuscript, Garg *et al.* identifies the following patient groups with the highest risk of readmissions: men, younger adults, Medicare and Medicaid beneficiaries, and individuals with comorbid conditions. Further analyses in this manuscript revealed that renal disease, chronic obstructive pulmonary disease, and diabetes mellitus were the most common conditions associated with readmissions. Viewing risk factors from a health system level, the authors also found that hospitalizations at metropolitan teaching hospitals carried the highest risk of readmissions; in particular, weekend admissions were associated with higher readmission risk while discharge to a nursing facility or short-term hospitals were protective.

As the authors suggested, understanding such predictors for readmissions can help inform development of risk prediction tools that can be used for quality improvement; however, this does come with caveats. First, when applied at the health system level, scores developed using national administrative data may have less favorable prediction utility, as shown in a study by Koola *et al.*, where they portrayed this phenomenon occurring when prior tools were applied to the Veterans Affairs (VA) population (4). Though models developed utilizing administrative databases provide significantly more patient observations, thereby increasing modeling power and potentially increased generalizability, models derived from single institution and pauci-institution datasets containing granular clinical data such as laboratory tests, medication records, and social context variables may provide improved predictive performance.

Another important trend to note is the changing patient case-mix and outcome rates among patients with moderate to advanced liver disease. Orman and colleagues evaluated an Indiana statewide cohort of patients with a new diagnosis of cirrhosis and found a number of important trends. First, the rates of diagnosis were rising, the proportion of patients with alcoholic and nonalcoholic steatohepatitis were increasing, rates of viral hepatitis and hepatocellular carcinoma were declining, and overall mortality rates were declining (13). Davis and colleagues found among a national VA hospitalized population, across multiple outcomes, patient characteristics and healthcare delivery trends created information changes over time and led to risk modeling degradation (14). This highlights the need for continued evaluation of patients with cirrhosis in recent data to understand the ever-shifting trends and which characteristics that may be preventable could be good targets for intervention.

In addition, many studies evaluating cirrhosis are in the U.S. International Classification of Diseases (ICD)-9 era, including the study by Garg and colleagues. Since the switch to ICD-10, sustaining coding accuracy in both the inpatient and outpatient domains have been challenging, with a 2019 report showing only ~60% accuracy for primary diagnoses and ~40% for secondary diagnoses. Conditions such as opioid use disorders demonstrate an abrupt 14% increase in coding, whereas alcohol and tobacco dependence disorders saw a significant increase (15). Potential causes include that only 5% of ICD-10 codes have a 1-to-1 correspondence to semantically similar ICD-9 codes, a gradual learning curve as healthcare providers and coding/billing professionals acclimate to the ICD-10 system, and limitations to serial temporal assessments for data overlapping the ICD-9 to ICD-10 transition (15). This introduces further challenges and opportunities when using administrative data for population health tracking and interventions.

Understanding root causes can also be used to craft novel quality improvement and policy initiatives towards reducing readmissions. In general, such interventions should target high-risk groups identified in this study, as mentioned above. At the hospital level, ensuring the delivery of high-quality cirrhosis care can be an effective intervention strategy. Tapper *et al.* reduced readmissions by 40% after applying a discharge checklist and electronic decision support tools (16). Similarly, presence of gastroenterology consultation during inpatient stays have been associated with reduced readmissions (17). The present study suggests that interventions that optimize care coordination and safe discharge plans may be an effective solution. In fact, several recent studies, including one randomized controlled trial, have highlighted the effect of specialty palliative care consultation in reducing readmissions for patients with cirrhosis, consistent with this concept (18-20). In the outpatient and community settings, only one intervention, incorporating multidisciplinary care management and same day hospitals for procedures in hepatology clinics,

effectively reduced both readmissions and mortality in a cohort of patients with cirrhosis (21).

In the manuscript, Garg and co-authors call for policy-level interventions to help with reducing readmissions, similar to how the Hospital Readmissions Reduction Program (HRRP) has been implemented for comparable serious illnesses such as congestive heart failure (CHF) (22). However, endorsing such solutions for readmissions may not lead to desired outcomes. For instance, though HRRP has been associated with reduced readmissions for CHF, 1-year mortality increased over the timeframe of implementation (23). Interestingly, HRRP was not associated with reduced rates of readmissions in patients who had a comorbid diagnosis of cirrhosis (24).

The problem of addressing readmissions in patients with cirrhosis is at a critical crossroads. Garg and authors offer some unique insights that further understanding of high-risk populations and the types of solutions that can be offered to them. However, with the mounting burden of illness and healthcare utilization, the time to act is now. Clinicians and health systems must invest in developing and testing tools that predict readmission risk for this population within their health systems, ideally capturing a more granular context of readmissions. In tandem, planned interventions, including those that support care coordination and high quality cirrhosis care in the inpatient and outpatient settings, should be tested. Policymakers should consider supporting such interventions, recognizing that Medicare and Medicaid beneficiaries are at higher risk of readmissions. As described in Garg *et al.* and similar studies, we have made significant strides over the past decade in understanding readmissions for patients with cirrhosis. In the next decade, let us strive to act on these changes to finally meet the needs of this vulnerable population and their communities.

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