



## Editorials

## Shutting those revolving doors



The “revolving door” phenomenon of early rehospitalizations recognizes complex explanations spanning from severity of CLD, its etiology, its extrahepatic comorbidity, and failures in the health system. All of these are challenging to disentangle and are probably multilayered in the individual patient. The study by Paik *et al.* is a valuable adjunct that integrates and completes previous studies on this topic. Based on this and previous studies, it is concluded that a precision medicine approach keeping in consideration all relevant disease modifiers will likely contribute to reducing hospital readmissions. However, it would probably be illogical and even dangerous to aim at closing all “revolving doors” given that early rehospitalization may also represent a lifesaver in a proportion of CLD cases.

In hospital jargon, readmissions in the first 30 days after a previous hospitalization are sometimes alluded to as the “revolving door” and considered a standard quality metric, indicating increased expenditures, and predicting poor health outcomes [1]. Approximately 1 in 5 Medicare admissions are followed by hospital readmission within 30 days, and these are often assumed to be *prima facie* evidence of poor care given that a quarter of these is reportedly avoidable [2,3]. Therefore, from 2013 to 2015 in the USA, the Hospital Readmissions Reduction Program (HRRP) imposed financial penalties on those hospitals exhibiting higher than expected 30-day readmission rates for acute myocardial infarction, heart failure, pneumonia, total hip or knee replacement and chronic obstructive pulmonary disease [4]. However, the changing policy of hospital readmissions and reimbursement resulting from the HRRP has been met with controversy, with its proponents admitting that it has reduced national readmission rates; its opponents highlighting that it possibly penalizes hospitals for phenomena outside their control, carries the risk of increased mortality and encourages “gaming” the system [5].

In Europe, the number of elderly people requiring hospitalization is increasing and, among the world’s top 20 countries with the largest percentage of individuals aged  $\geq 65$  years, 19 are in Europe. In 2009, Italy, with  $>19\%$  of its population  $>65$  years was the oldest country in the world, a figure which is projected to escalate to 33% by 2050 [6]. A greater demand for hospital care comes in parallel with a greater fraction of elderly people in the population who are competing with other age-group patients for a fixed or even decreasing number of available hospital beds [6]. With this scenario, an improved understanding of the recurrent waves of elderly individuals shifting from community care to hospital care may potentially result in preventing a fraction of hospital readmissions [6,7]. On both sides of the Atlantic, however, the nature and mechanics of hospital readmission are difficult to decipher, given that a variety of medical and non-medical determinants are involved, including factors of individual, social, and health care system-associated origins [7].

In this issue of Annals of Hepatology, Paik *et al.* [8] investigate prevalence, characteristics, and predictors of 30-day readmissions for chronic liver disease (CLD) from 2010–2017 in a US nationwide administrative directory, the Nationwide Readmission Database, an all-payer, all-age, longitudinal index, censoring 35 million hospital discharges annually.

These Authors found that: among those with chronic liver disease (CLD), the readmission rate 30 days after a hospital discharge was 20%; additionally, 30-day readmission rates for patients with nonalcoholic fatty liver disease (NAFLD) increased by 3%, while rates for rehospitalization owing to other types of CLD decreased; among those with NAFLD, the main drivers of readmission were age, sex, disease severity and government sponsored insurance; among those with CLD owing to NAFLD and HCV, 30-day rehospitalization was associated with a high risk of mortality; the most common reasons attributed to rehospitalization were cirrhosis and sepsis; however, extrahepatic conditions also accounted for readmissions, particularly among those with NAFLD.

This study has several findings of major interest:

- Among those with CLD, the readmission rate 30 days after a hospital discharge was 20% (with variable features based on the etiology of CLD), particularly for alcoholic liver disease (ALD) and most cases were readmitted as early as 15 days after discharge (again, with variable figures according to the etiology of disease), particularly for ALD.
- Additionally, over the course of the 2010–2017 study period, 30-day readmission rates for patients with nonalcoholic fatty liver disease (NAFLD) increased by 3%, while rates for rehospitalization owing to other types of CLD decreased. Among those with NAFLD, the main drivers of readmission were age, sex and disease severity (younger males and older females with cirrhosis complications) and government sponsored insurance.
- Of concern, among those with CLD owing to NAFLD and HCV, 30-day rehospitalization was associated with a high risk of mortality after controlling for confounding clinical and social factors.
- The most common reasons accounting for rehospitalization were cirrhosis (and its complications) and sepsis; however, extrahepatic reasons accounted for readmissions particularly among those with NAFLD.

The finding that the 30-day readmission rate was 20% in the study by Paik [8] is well within the 12.9 to 37% range found by previous research (reviewed in 1). It is reasonable to assume that the age of patients, severity of CLD and other extra-hepatic and social variables contribute to determining this wide variability of readmission rates. In this context, the study by Paik *et al.* is innovative in highlighting

the role played by the etiology of CLD and particularly by ALD. Studies have pinpointed that patients' attendance at alcohol rehabilitation institutions may translate into reduced risks of readmission to hospital, alcohol relapse, and death and should, therefore, be regarded as a marker of the quality of treatment of alcoholic hepatitis [9].

Paik *et al.* report that, confronted with decreasing rates of rehospitalization owing to other CLD, readmission rates for patients with NAFLD increased by 3% [8]. This finding likely reflects the changing epidemiological scenario of CLD, where forms owing to viral infections have decreased thanks to effective prevention and treatment strategies, in parallel with increasing CLD forms occurring due to the metabolic syndrome and its individual components [10]. However, an additional intriguing explanation could also be that, compared to other causes of CLD, NAFLD might specifically be prone to rehospitalizations owing to its high rate of comorbidities [11–13]. Data on the interaction of age and sex with disease severity in concurring with the risk of readmission among those with NAFLD further expand on seminal studies on sex differences in this arena [14–17] while also indirectly highlighting the importance of acknowledging liver fibrosis severity as a determinant of disease course [18,19].

The finding that NAFLD, particularly when complicated by advanced cirrhosis, was an independent risk factor for 30-day readmission illustrates the complexity of a disease associated with older age and multiple metabolic comorbidities. Indeed, in the study by Paik *et al.* [8] compared to CLD owing to other etiologies, those with NAFLD had a higher comorbidity index, were less likely to be discharged home, more often required home health care and were more likely to be readmitted even if discharged to a skilled nursing facility (rather than home). Collectively, these data render a picture of extreme frailty, defined as a complex cluster of the multisystemic impaired physiological reserve, and vulnerability to stressors, associated with reduced life expectancy via increased disability and morbidity [20].

The HRRP did not include CLD in general, and cirrhosis and its complications within the area of intervention to tackle hospital readmissions, although they account for a substantial clinical workload and a major financial burden. However, in a nationwide USA survey, 25% of those 58,954 patients with cirrhosis-related complications admitted to hospitals were readmitted within 90 days [21]. Moreover, early rehospitalization strongly predicts decreased overall survival of patients with cirrhosis [22,23]. Collectively, the above data describe a significant economic burden and call for interventions and resource allocations to reduce readmission rates.

Over the last few years, studies have identified several factors affecting the risk of readmissions (Table 1) [22,24–30]. These factors may be considered when planning hospital discharges of patients at a high risk of readmission.

Interestingly, although physicians are sometimes blamed for the allegation that rapid discharge from the hospital may inherently lead to an increased risk of rehospitalization, a study conducted in Europe and the USA found that hospital readmissions were not produced by premature hospital discharges [31].

The scenario lying behind early hospital readmission is even more complex than illustrated above while some early rehospitalizations are unavoidable, particularly among patients with advanced, decompensated cirrhosis; a fraction of readmissions might be prevented by addressing provider and system failures. Patients should be prescribed drug schedules of proven efficacy and be instructed on how to take them correctly while avoiding instances of “missing” information when the patient is delivered from the hospital team to outpatient healthcare providers [32]. It has been argued that rehospitalizations are not “hard outcomes” *per se* and that, rather, they serve as a “canary in the coal mine” indicating systemic coordination issues in care delivery [32]. Undoubtedly, the only radical intervention to effectively prevent early readmissions would be... “to never discharge any patients!” while, in a proportion of cases,

**Table 1**

Factors associated with variations in the risk of early hospital readmission.

Increased risk of early hospital readmission
female sex
history of bariatric surgery
higher comorbidity
ascites
renal disease (acute, chronic, and end-stage)
increased MELD score CRP >10 mg/l at discharge
disability
poor social support
leaving against medical advice
Decreased hazards of early rehospitalization
older age
long-term administration (>3 months) of albumin
payer type (private vs. others)
patients' attendance of alcohol rehabilitation institutions
discharge to nursing facilities
standardized, team-based transitional care management services

Legend to Table 1. CRP C-reactive Protein; MELD – model of end-stage liver disease

readmission to the hospital is both necessary and beneficial, in as much as it saves lives by permitting intensive treatment [32]. Moreover, some cases of hospital readmissions may also configure undue therapeutic persistence. This suggests that hospital professionals should be able to identify suitable patients for inpatient palliative care consultation. This, when offered to patients with more advanced hepatocellular carcinoma, defined with higher MELD-Na, receipt of sorafenib, and higher pain scores, is indeed associated with reduced hospital readmission rates [33].

In conclusion, the “revolving door” phenomenon of early rehospitalizations recognizes complex explanations spanning from severity of CLD, its etiology, its extrahepatic comorbidity, and failures in the health system that appear difficult to disentangle and are probably multilayered in the individual patient. The study by Paik *et al.* [8], although exhibiting some acknowledged limitations, such as missing certain detailed clinical, physiological, and laboratory parameters beyond ICD codes, as well as cause-specific death, used a nationally representative sample of patients and robust statistical methods to enhance the generalizability of their findings while decreasing any potential bias. Therefore, it is a valuable adjunct that integrates and completes previous studies on this topic. Based on this [8] and previously cited studies, it is concluded that a precision medicine approach keeping in consideration all relevant information [34–36] will likely contribute to reducing hospital readmissions. However, it would probably be illogical and even dangerous to aim at closing all “revolving doors” given that early rehospitalization may also represent a life-saver in a proportion of CLD cases. Therefore, future studies will build and validate prediction rules that identify, among CLD populations, those cohorts in whom readmission is both probable and preventable compared to those individuals who should be diverted to palliative care. The former should be submitted to intensive medical management and offered as much social support as possible.

## Declaration of Competing Interest

None.

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