Original Article

Hospital readmission after an acute admission to internal medicine

Causes and risk factors in a tertiary care center in Saudi Arabia

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ABSTRACT

الأهداف: بحثت العوامل المرتبطة بأسباب إعادة التنويم خلال 30 يوم من الخروج من المستشفى.

المنهجية: أجريت هذه الدراسة بأثر رجعي من عام 2019 في مدينة الملك عبد العزيز الطبية بالرياض، تم حساب عينة عشوائية بنسبة تقديرية 10-20% بالمرضى المعاد تنويمهم وكان حجم العينة 200 مريض. تم تقسيم المرضى الى مجموعتين اما اعادة تنويم مرة واحد او عدة مرات. تم استخدام اختبار ت للمقارنة بين متوسط المجموعتين، تم استخدام تحليل الانحدار اللوجستي لمعرفة العوامل المرتبطة بإعادة التنويم المتكررة.

النتائج: معدل إعادة التنويم 10.18% ولوحظ شيوع بعض الامراض المزمنة مثل ارتفاع ضغط الدم والسكري وضعف عضلة القلب. إعادة التنويم المتكررة عدة مرات وصلت إلى نسبة 18% وعاد ذلك إلى نفس سبب التنويم الأول. لوحظ وجود عوامل أخرى متعلقة بإعادة التنويم مثل العمر (نسبة الارجحية = 1.057، نطاق الثقة 95%: [1.005-1.108] p=0.030)، و معدل كفاءة ضخ عضلة القلب (نسبة الارجحية = 0.925، نطاق الثقة: [0.873-0.980]، p=0.008)، و الاكتئاب (نسبة الارجحية = 1.396، نطاق الثقة: [0.3072-26.957]، p=0.049)، والجلطات الدماغية السابقة (نسبة الارجحية = 0.236، نطاق الثقة: [0.062-0.903]، p=0.035).

الخلاصة: وجدنا أن إعادة التنويم مرة أو أكثر يرتبط بعبء الأمراض المزمنة، العوامل الأخرى التي تزيد من احتمالية إعادة التنويم مثل التقدم بالعمر ضعف عضلة القلب والجلطات الدماغية والاكتئاب.

Objectives: To investigate the risk factors associated with single and multiple hospital readmissions within 30 days of discharge.

Methods: A retrospective study carried out during 2019 at King Abdulaziz Medical City in Riyadh, Saudi Arabia. Using simple random sampling with an estimated prevalence of readmission rates between 10-20%, the calculated sample size was 200 patients. Patients were classified into 2 categories: patients with single or multiple readmissions. For comparison of categorical variables, the Chi-square test and Fisher's exact test were employed as relevant. Means comparisons were carried out using independent samples t-test. Multivariate logistic regression analysis was implemented to identify factors associated with multiple readmissions.

Results: The rate of readmission in hospital patients was 10.18%. A significant burden of comorbidities was observed with diabetes, hypertension, and heart failure being the most prevalent diseases. Multiple readmissions were observed in 18% of the total readmissions, predominantly for conditions related to the initial hospitalization. Age (odds ratio [OR]=1.057, 95% confidence interval [CI]: [1.005-1.108]; p=0.030), ejection fraction (OR=0.925; 95% CI: [0.873-0.980]; p=0.008), depression (OR=1.396; 95% CI: [0.3072-26.957]; p=0.049), and previous stroke (OR=0.236, 95% CI: [0.062-0.903]; p=0.035) were identified as independent predictors of multiple readmissions.

Conclusion: We found a high burden of comorbidities among patients requiring multiple readmissions. Older age, heart failure and ejection fraction, stroke, and depression were identified as risk factors for multiple readmissions. With interventions tailored to at-risk populations, we hypothesize that better utilization of available resources is achievable to reduce readmissions.

Keywords: hospital readmission, acute disease, internal medicine, Saudi Arabia

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Hospital readmissions (HRs) and unplanned hospital admissions are a major concern for healthcare systems and are considered as a quality measure in view of policymakers, with an estimated cost of 15-20 billion dollars annually in the United States.[1-4] Hospital readmissions convey a major impact on the overall well-being and satisfaction of patients as well as patient outcomes. Several studies describe higher mortality rates among patients requiring HR.[5-8] The World Health Organization recommends examining potential interventions to mitigate the burden of unnecessary readmissions.[9] The definition of HR in the literature is equivocal, but the reported readmission rates range from readmission within 30-90 days from the original date of hospital discharge, up to 12 months. However, some studies in the literature defined readmission to the hospital as if it occurred within 30 days from the initial hospital discharge.[10-12] Locally, there is a scarcity of data on HR for medical patients. Alzeer et al[4] established the rate of readmission among cardiac patients as 10%. Another study carried out in the Eastern province of Saudi Arabia from 2000-2008 by Mokhtar et al[13] determined the readmission rate among patients with diabetes mellitus and established that out of 1125 admitted patients, 5.2% were readmitted within 28 days after discharge. Another study carried out in 2016 on 548 patients with stroke who were admitted to King Abdulaziz University Hospital in Jeddah, Saudi Arabia, from 2010-2014 indicated that 20% were readmitted within 30 days, and the most common causes of readmission were due to recurrent stroke, pulmonary embolism, and electrocyte disturbances.[14] Al-Jahdali et al[15] revealed the readmission rate among pulmonary services to be 10%.

Several predictors contribute to HR including older age, male gender, poor socioeconomic status, premature hospital discharge, and patient noncompliance.[15-18] Moreover, frailty and poor nutritional status as well as fall risks have also been identified as risk factors for HRs.[17,19]

Furthermore, shorter length of stay and shortage of available hospital beds have been uncovered as predictors of HR. In some cases, HR rates were associated with higher bed occupancy at time of discharge.[20,21] Lack of adequate discharge planning and insufficient follow-up at the time of discharge have been identified as significant contributors to HR; patients who received comprehensive discharge planning were less likely to be readmitted within 30 days.[22-25] In addition, patients who received transitional care at the time of discharge by follow-up clinics, home health care visits or nurse, and provider phone calls were also less likely to be readmitted.[26] In contrast, poor patient understanding of discharge instructions and poor communication between healthcare providers and patients also contribute to HR.[27-30] Beatty et al[31] emphasized that patients who received clear and concise instructions at the time of discharge were less likely to be readmitted.

Given the paucity of literature on HR in Saudi Arabia, particularly on patient readmission rates, our study objectives were to identify patients who may be at risk of readmission, to examine preventable and unavoidable risk factors that may lead to readmission to our hospital, and to ascertain factors associated with multiple HRs.

Methods. This was a retrospective study carried out at King Abdulaziz Medical City in Riyadh, a tertiary academic hospital, which serves as a primary referral center for patients across the entire country of Saudi Arabia, with a bed capacity of more than 1900.

Patients under medical services who were readmitted within 30 days of their index admission discharge between January 2019 and January 2020 were considered eligible for the study. Using simple random sampling with an estimated prevalence of readmission between 10-20% (worldwide), a midpoint of 15% was defined using statistical power analysis and confidence interval estimation. This analysis yielded a 95% confidence level and 5% margin of error; therefore, the calculated sample size to be achieved was approximately 200 patients.

We excluded patients whose index admission or subsequent hospital admissions were planned (elective procedures), any patient admissions due to psychiatric illness other than acute delirium, patients who were not eligible for treatment at our center and were admitted only for emergency care, any patients discharged to home health care after the index admission, and patients who were discharged against medical advice.

Given the retrospective nature of the study, no written patient consent was required. Ethical approval for the study was obtained from the institutional review board of King Abdulaziz Medical City Hospital in Riyadh.

Data were collected from electronic medical records, including demographic data, baseline functional status, admitting specialty, known chronic diseases, index admission diagnosis, duration of index admission, requirement of admission to the intensive care

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unit (ICU) and tracheostomy, number of involved specialties during the index admission, number of medications prescribed upon discharge, number of planned outpatient follow-up visits, and discharge diagnosis. Regarding readmissions, data including diagnosis, cause of readmission and its relationship to the index admission diagnosis, length of stay, number of involved specialties, number of medications prescribed at discharge, mortality, ICU admission, and follow-up visits after discharge were collected.

Statistical analysis. Data were entered in a Microsoft Excel® spreadsheet and subsequently transferred to the Statistical Package for the Social Sciences, version 25.0 (IBM Corp., Armonk, NY, USA) for analysis.

Categorical variables were expressed as frequency and percentage, whereas continuous variables were stated as means ± standard deviations (SDs) or, if variables were not normally distributed, as medians (interquartile ranges). Patients were classified into 2 groups: patients with a single readmission and patients with more than one readmission. For comparison of categorical variables, the Chi-square test or Fisher's exact test was employed as the relevant statistical methods. Means comparisons were carried out using the independent samples t-test. Multivariate logistic regression analysis was carried out to identify factors associated with multiple readmissions. Data were expressed by adjusted odds ratios (aOR) and 95% confidence intervals (CIs). All tests were 2-tailed, and a *p*-value of <0.05 was considered significant.

Results. We initially identified 4655 patients admitted to medical wards between January 2019 and January 2020. Of the total number of patients, 1240 patients were readmitted during the same year. Single readmission was required for 727 patients, where as multiple readmissions were necessary for 513 patients. A total of 474 patients were readmitted within 30 days of their discharge, resulting in a 30-day readmission rate of 10.18%. A total of 200 patients were included in the final analysis, 97 (48.5%) were male and 103 (51.5%) were female. The mean age of the patients was 69.56±15.45 years, and the mean body mass index (BMI) was 28.40±8.61. Patients were classified based on their daily activity, and 132 (66%) were dependent and 68 (34%) were independent.

According to Table 1, hypertension was the most prevalent comorbidity, as the condition was present in 160 (80%) patients, followed by diabetes in 142 (71%) patients. A total of 75 (37.5%) patients were affected by heart failure; moreover, patients with heart failure with preserved ejection fraction included 39 (19.5%) patients, and the number of patients with reduced ejection fraction was 36 (18%). Atrial fibrillation was discovered in 24 (12%) patients and ischemic heart disease in 22 (11%) patients. A total of 49 (24.5%) patients were afflicted by a prior stroke and dementia was previously diagnosed in 30 (15%) patients. Chronic renal disease was present in 47 (23.5%) patients, and 16 (8%) patients were on renal replacement therapy. Chronic respiratory illness was reported for 59 (2.5%) patients, bronchial asthma in 29 (14.5%) patients, chronic obstructive pulmonary disease in 19 (9.5%) patients, interstitial lung disease in 6 (3%)patients, and bronchiectasis in 5 (2.5%) patients.

Single readmission within 30 days of index discharge was required for 163 (81.5%) patients, whereas multiple readmissions within 30 days of the first readmission discharge were necessary for 37 (18.5%) patients. All patients had at least one regular follow-up visit scheduled as outpatients prior to their discharge.

Urinary tract infection was the most common cause of admission in 34 (17%) patients, followed by decompensated heart failure in 33 (16.5%) patients and community-acquired pneumonia in 25 (12.5%) patients. Acute kidney injury accounted for the admission of 21 (10.5%) patients, followed by acute stroke in 13 (6.5%) patients. Only 4 (2%) patients were admitted to the ICU during their index admission and none ended up on tracheostomy (Table 1).

The mean length of stay of the primary admission was 7.80±6.70 days and the mean number of medications at discharge was 10.54±4.31. A total of 140 (70%) patients were admitted under the internal medicine specialty, 32 (16%) of patients were admitted under the nephrology department and 7 (3.5%) patients under neurology.

We found patients who were readmitted due to healthcare-associated pneumonia to be 44 (22%) patients and 24 (12%) patients were readmitted due to acute decompensated heart failure, 24 (12%) patients were readmitted due to acute kidney injury, and 20 (10%) patients were readmitted due to urinary tract infection (Table 1).

Patients who were readmitted due to the same cause of their index admission were 73 (36.5%) patients, whereas 72 (36%) patients were readmitted due to a related cause to their index admission, as either a complication from their primary admission or an adverse drug reaction, or adverse side effect.

The majority of patients were readmitted under internal medicine department with 113 (66.5%) patients, followed by 32 (16%) patients that were readmitted under the nephrology service, and 9 (4.5%) patients were readmitted under gastroenterology.

Table 1 - Diagnosis per admission.

Diagnosis	Primary admission (N=200)	First readmission (N=200)	Second readmission (n=37)
Cardiac			
Acute pulmonary embolism	2 (1.0)	3 (1.5)	1 (2.7)
Venous thromboembolism; other than pulmonary embolism	0 (0.0)	2 (1.0)	1 (2.7)
Uncontrolled blood pressure	1 (0.5)	1(0.5)	0 (0.0)
Uncontrolled atrial fibrillation	0 (0.0)	0 (0.0)	1 (2.7)
Acute decompensated heart failure	33 (16.5)	24 (12.0)	6 (16.2)
Cardiac syncope	1 (0.5)	0 (0.0)	0 (0.0)
Pulmonary			
Bronchial asthma exacerbation	4 (2.0)	3 (1.5)	1 (2.7)
Community acquired pneumonia	25 (12.5)	3 (1.5)	0 (0.0)
Hospital acquired pneumonia	2 (1.0)	44 (22.0)	7 (18.9)
Chronic obstructive pulmonary disease exacerbation	8 (4.0)	4 (2.0)	0 (0.0)
Bronchiectasis exacerbation	2 (1.0)	2 (1.0)	1 (2.7)
Aspiration pneumonia	9 (4.5)	4 (2.0)	1 (2.7)
Gastrointestinal			
Upper gastrointestinal bleeding	2 (1.0)	7 (3.5)	2 (5.4)
Lower gastrointestinal bleeding	1 (0.5)	1 (0.5)	0 (0.0)
Gastroenteritis; other than *Clostridium difficile*	2 (1.0)	2 (1.0)	0 (0.0)
Clostridium difficile	2 (1.0)	6 (3.0)	0 (0.0)
Bowel obstruction	1 (0.5)	0 (0.0)	2 (5.4)
Pancreatitis	1 (0.5)	1 (0.5)	0 (0.0)
Colitis	1 (0.5)	1 (0.5)	0 (0.0)
Hepatocellular carcinoma	2 (1.0)	2 (1.0)	0 (0.0)
Deranged liver enzymes	1 (0.5)	1 (0.5)	0 (0.0)
Neurological			
Acute stroke	13 (6.5)	6 (3.0)	0 (0.0)
Meningitis	1 (0.5)	0 (0.0)	0 (0.0)
Myasthenia gravis	1 (0.5)	1 (0.5)	0 (0.0)
Seizure	0 (0.0)	2 (1.0)	0 (0.0)
Myelitis	0 (0.0)	2 (1.0)	0 (0.0)
Hematological			
Vaso-occlusive crises	2 (1.0)	2 (1.0)	0 (0.0)
Pancytopenia	0 (0.0)	1 (0.5)	0 (0.0)
Malignancy related admission	2 (1.0)	2 (1.0)	0 (0.0)
Renal			
Urinary tract infection	34 (17.0)	20 (10.0)	7 (18.9)
Acute kidney injury	21 (10.5)	24 (12.0)	4 (10.8)
Dialysis access related complication	12 (6.0)	8 (4.0)	1 (2.7)
Endocrinological			
Diabetic ketoacidosis	1 (0.5)	1 (0.5)	0 (0.0)
Adrenal insufficiency	0 (0.0)	1 (0.5)	0 (0.0)
Electrolyte's disturbance			
Hyponatremia	6 (3.0)	9 (4.5)	0 (0.0)
Hypernatremia	2 (1.0)	3 (1.5)	0 (0.0)
Hyperkalemia	1 (0.5)	0 (0.0)	0 (0.0)
Hypercalcemia	1 (0.5)	1 (0.5)	0 (0.0)
Feeding related diagnosis	3 (1.5)	6 (3.0)	1 (2.7)

Values are presented as numbers and percentages (%).

The mean length of stay of patients during their first readmission was 8.82±9.42 days and 13 (6.5%) of the readmitted patients died.

The number of patients with more than one readmission was 37 (18.5%), and the cause of readmission was due to healthcare-associated pneumonia and urinary tract infection for 7 (18.9%) patients each, and due to decompensated heart failure in 6 (16.2%) patients (Table 1).

Although most of the readmissions were due to the same cause of their index admission diagnosis in 15 (40.5%) patients, in 9 (24.3%) patients, they were

due to a cause related to their index admission (either a complication from their previous hospitalization or an adverse drug reaction or an adverse side effect).

The mean length of stay of the second readmission was 12.51±15.55 days and 6 (16.2%) patients died during their second HR.

As depicted in **Table 2**, when comparing factors associated with single and multiple readmissions in terms of functional status and baseline comorbidities, heart failure, either with reduced (p=0.040) or preserved ejection fraction (p=0.037), was significantly associated with multiple HRs. However, there was no significant association between the number of readmissions and other comorbidities or baseline functional status. Nevertheless, a significant association existed between the mean baseline ejection fraction for patients who required a single readmission as compared to patients with multiple readmissions (52.76±6.14 vs. 48.03±12.07, p≤0.001). There was also a significant correlation between the respective mean ages of patients in the 2 groups (68.44±16.36 years vs. 74.49±9.14 years, p=0.002). However, there was no significant difference between the 2 groups when comparing BMI, primary admission length of stay, and number of discharge medications (**Table 3**).

Multivariate logistic regression analysis, adjusted for demographic and clinical variables was carried out to further analyze factors associated with multiple readmissions. For each additional year of age, the likelihood of multiple readmissions increased by 3.5% (OR=1.057; 95% CI: [1.005-1.108]; p=0.030). Ejection fraction was identified as a predictor of multiple readmissions (OR=0.925; 95% CI: [0.873-0.980]; p=0.008). Depression (OR=1.396; 95% CI: [0.3072-26.957]; p=0.049) and previous stroke (OR=0.236; 95% CI: [0.062-0.903]; p=0.035) were also independent predictors of multiple HRs (**Table 4**).

Discussion. The findings of the current study provide valuable insights into complex factors associated with HRs, as HR is considered an important quality metric that should be a target for decreasing overall mortality, improving utilization of beds and resources, and lowering healthcare costs. The readmission rate of 10.18% in our study is within the range of that reported in the existing published literature. Our study population exhibited a high burden of comorbidities, including diabetes, hypertension, and heart failure as the most prevalent diseases. These conditions likely contributed to HR, with 18% of patients requiring multiple readmissions. Most of the readmissions were related to the diagnosis of the index admission, such as healthcare-associated pneumonia, decompensated heart failure, and acute kidney injury. This outcome suggests that opportunities exist to improve initial identification of patients at risk, to facilitate transition of care, and to follow up with high-risk patients post-discharge. Similar to other studies, we identified patients with cardiac issues to be at high risk of readmission.[10,11] In fact, Hoo et al[11] reported a significant decrease in the rate of readmission after implementing a bundle of interventions at discharge that included multidisciplinary ward rounds, inclusion of treatment checklists in patients' bed head tickets, inpatient cardiac rehabilitation, dietician counseling sessions, medication reconciliation, 30-minute standardized patient education, and heart failure management counseling by the pharmacist.

Overall, although studies on HR rates are relatively abundant, there are fewer studies, both locally and internationally, designed to evaluate recurrent readmissions and their causes and risk factors. Multiple readmissions were associated with chronic diseases, depressive symptoms, patient underweight, and were also linked to a higher rate of mortality as compared to a single readmission.[32,33] The paucity of research on recurrent admissions to medical wards in the western literature may be due to lesser occurrences with a rate of 1% at 30 days in patients with cardiac percutaneous intervention, according to Kwok et al.[34] However, patients with recurrent readmissions may likely have their overall care addressed by transitioning to hospice care and have advanced medical directives initiated at earlier stages. Some studies have reported that hospice care residents have lower HR rates, granting insight into how this type of transition provides clinical, emotional, and spiritual support.[35,36] However, this issue is approached differently in Saudi Arabia, and certainly in many Muslim countries, where advanced healthcare directives are not widely practiced.[37]

Saudi Arabia has a current population of over 32 million with an elderly population expected to grow from 1.96 million in 2018 to 4.63 million by 2030.[38] Currently there are 22.6 beds per 10,000 members of the population with a bed occupancy rate of 57.2%. It is proposed that to be able to meet the demands of the growing population, the number of hospital beds needs to be increased by 20,000 beds by 2035.[38,39] With the current numbers, a bed crisis might occur and may lead to premature patient discharges and subsequent unplanned readmissions. An example of such a bed crisis was evident during the COVID-19 pandemic.

Our current study revealed a complex, multi-faceted situation, with socioeconomic, demographic, and

Table 2 - Comparing numbers of readmissions with demographics, comorbidities, and functional status.

Variables	Single readmission (n=163)	Multiple readmissions (n=37)	*P*-values
Gender			
Male	81 (49.7)	16 (43.2)	0.300
Female	82 (50.3)	21 (56.7)	
Diabetes mellitus			
Yes	113 (69.3)	29 (78.4)	0.186
No	50 (30.7)	8 (21.6)	
Hypertension			
Yes	131 (80.4)	29 (78.4)	0.470
No	32 (19.6)	8 (21.6)	
Heart failure with reduced ejection fraction			
Yes	25 (15.3)	11 (29.7)	0.040
No	138 (84.7)	26 (70.3)	
Heart failure with preserved ejection fraction			
Yes	36 (22.1)	3 (8.1)	0.037
No	127 (77.9)	34 (91.9)	
Stroke			
Yes	42 (25.8)	7 (18.9)	0.258
No	121 (74.2)	30 (81.1)	
Atrial fibrillation			
Yes	20 (12.3)	4 (10.8)	0.532
No	143 (87.7)	33 (89.2)	
Chronic kidney disease is not on Renal replacement therapy			
Yes	40 (24.5)	7 (18.9)	0.311
No	123 (75.5)	30 (81.1)	
End stage renal disease on Renal replacement therapy			
Yes	15 (9.2)	1 (2.7)	0.164
No	148 (90.8)	36 (97.3)	
Interstitial lung disease			
Yes	5 (3.1)	1 (2.7)	0.693
No	158 (96.9)	36 (97.3)	
Bronchial asthma			
Yes	24 (14.7)	5 (13.5)	0.543
No	139 (85.3)	32 (86.5)	
Chronic obstructive pulmonary disease			
Yes	13 (8.0)	6 (16.2)	0.112
No	150 (92.0)	31 (83.8)	
Thyroid disease			
Yes	12 (7.4)	5 (13.5)	0.184
No	151 92.6)	32 (86.5)	
Dementia			
Yes	24 (14.7)	6 (16.2)	0.495
No	139 (85.3)	31 (83.8)	
Connective tissue disease			
Yes	5 (3.1)	1 (2.7)	0.693
No	158 (96.9)	36 (97.3)	
Ischemic heart disease			
Yes	17 10.4)	5 (13.5)	0.384
No	146 (89.6)	32 (86.5)	
Renal transplant			
Yes	8 (4.9)	1 (2.7)	0.479
No	155 (95.1)	36 (97.3)	
Bronchiectasis			
Yes	4 (2.4)	1 (2.7)	0.645
No	159 97.5)	36 (97.3)	
Venous thromboembolism			
Yes	5 (3.1)	2 (5.4)	0.382
No	158 (96.9)	35 (94.6)	
Malignancy			
Yes	11 (6.7)	3 (8.1)	0.498
No	152 (93.2)	34 (91.9)	
Depression			
Yes	2 (1.2)	1 (2.7)	0.505
No	161 (98.8)	36 (97.3)	

Values are presented as numbers and percentages (%).

Table 3 - Comparing numbers of readmissions with continuous variables.

Variables	Single	Multiple	*P*-values
Age	68.44±16.36	74.49±9.14	0.002
Ejection fraction	52.76±6.14	48.03±12.07	<0.001
Body mass index	28.83±8.84	26.4±7.34	0.068
Admission length of stay	7.8±6.9	7.7±5.8	0.459
Number of discharge medications	10.56±4.43	10.43±3.76	0.434

Values are presented as means ± standard deviation (SD).

Table 4 - Multivariate regression analysis for demographic and clinical parameters associated with multiple readmissions.

Parameters	*P*-values	ORs	95% CIs
Age	0.030	1.057	1.005-1.108
Gender	0.213	2.052	0.663-6.357
Body mass index	0.578	0.959	0.826-1.112
Weight	0.643	0.985	0.924-1.050
Functional status	0.571	0.699	0.202-2.411
Diabetes mellitus	0.094	3.133	0.824-11.912
Hypertension	0.409	0.409	0.162-2.100
Ejection fraction	0.008	0.925	0.873-0.980
Old stroke	0.035	0.236	0.062-0.903
Atrial fibrillation	0.293	0.395	0.070-2.232
Chronic kidney disease	0.907	0.925	0.248-3.449
End-stage renal disease	0.393	0.322	0.024-4.346
Interstitial lung disease	0.556	0.250	0.002-25.390
Bronchial asthma	0.737	1.290	0.292-5.708
Chronic obstructive pulmonary disease	0.247	2.663	0.507-13.999
Neurological disease	0.903	1.111	0.206-5.994
Connective tissue disease	0.729	0.590	0.030-11.668
Thyroid disease	0.520	1.622	0.372-7.084
Dementia	0.347	0.480	0.104-2.214
Ischemic heart disease	0.214	2.784	0.553-14.002
Kidney transplant	0.823	0.729	0.046-11.569
Bronchiectasis	0.681	0.572	0.040-8.154
Venous thromboembolism	0.189	5.565	0.431-71.886
Malignancy	0.300	2.586	0.429-15.599
Depression	0.049	1.396	0.072-26.957

ORs: odds ratios, CI: confidence interval

clinical predictors of recurrent HR. Old age and patients with heart failure were at higher risk of HR, with ejection fraction as a significant predictor of recurrent readmission. Depression and prior stroke were also identified as predictors of readmission, which is likely due to the poor performance status for those patients and overall dependence. In addition, there is limited perception, awareness, and knowledge of hospice care within the Muslim society as demonstrated in several

studies, which might complicate discharge planning and patient care transition.[40] If the interventions are tailored to at-risk populations identified in our study with an emphasis on predictors associated with multiple readmissions, we believe that better utilization of available resources and cost cutting is achievable.

Study limitations. The current work is not without limitations, as the retrospective nature of the study and the small sample size might have affected the study results. Future studies should focus on a larger inclusion of patient data from multiple centers, providing potential solutions, and implementing strategic interventions tailored to decreasing avoidable readmissions for at-risk patients.

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