

Incidence and Risk Factors for 28 Days Hospital Readmission: A Retrospective Study from Oman

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ABSTRACT

Objectives: We sought to evaluate the incidence of 28-day hospital readmission in a tertiary hospital in Oman and identify potential factors associated with increased risk of hospital readmission. **Methods:** We conducted a retrospective study of all adult patients (≥ 18 years) admitted under the care of the General Internal Medicine unit from 1 June to 31 December 2020 at Sultan Qaboos University Hospital. Elective admissions and COVID-19 infection-related admission were excluded from the study. **Results:** There were 200 patients admitted during the study period. The mean age was 58.6 ± 19.3 years, and 106 (53.0%) patients were males. Forty-eight (24.0%) patients had unplanned readmission within 28-days after discharge from the hospital. Patients with 28 days unplanned readmission were older (66.6 vs. 56.0 years, $p < 0.001$) and had a longer length of hospital stay (6.0 vs. 4.0 days, $p < 0.001$). Also, hypertension (77.1% vs. 55.3%, $p = 0.007$), diabetes mellitus (64.6% vs. 48.0%, $p = 0.045$), and comorbidity (≥ 3 comorbidities, [43.8% vs. 23.8%, $p = 0.005$]) were more prevalent in the unplanned readmission group. Patients with poor functional status (43.7% vs. 26.3%, $p < 0.001$), requiring feeding tube (25.0% vs. 5.3%, $p < 0.001$), and with polypharmacy (75.0% vs. 50.0%, $p = 0.003$) were at increased risk of readmission. **Conclusions:** 28-day hospital readmission is prevalent in our health care setting. Old age, polypharmacy, comorbidities, and poor functional status were associated with an increased risk of hospital readmission. Therefore, evidence-based interventions must be implemented in our health care system to minimize the risk of hospital readmission.

Hospital readmission is a frequent health issue associated with increased healthcare costs.¹ In the USA, it has been estimated that the annual cost of 30-day hospital readmission ranges from \$17.4 to \$44 billion.²⁻⁴ Several preventable and unpreventable risk factors are associated with increased hospital readmission, including dementia, which is considered a poor outcome and accounts for 25–27% of the readmission in elderly patients.⁵ Also, heart failure accounts for 18–24% of readmissions, followed by respiratory failure (13.1%) and renal failure (8.9%).^{6,7} Other factors include the length of hospital stay, polypharmacy (≥ 5 medications), the decline in the functional status, and lack of appropriate transition of care.⁷⁻⁹ In addition, lack of patient education and poor understanding of medical issues are also associated with increased risk for hospital readmission.³ Another unpreventable

factor for hospital readmission is the disease progression itself.^{2,3}

The 28-day hospital readmission has numerous financial implications on the health care system,¹⁰ and it is linked with increased short- and long-term mortality regardless of the severity of the patients' underlying diseases.^{11,12} It is associated with 39% mortality compared to 12% in patients with no readmission episodes.¹³

Hospital readmission is an indicator of the quality of a health care system.¹⁴⁻¹⁶ In the Middle Eastern region, expanding population has overstrained health care resources, including increased pressure on hospital beds. As a result, early and poorly planned hospital discharges might worsen the situation by increasing unplanned hospital readmissions. However, studies on hospital readmission from the Middle Eastern region are sparse. Therefore, the study aims to evaluate the incidence of 28-

day hospital readmission in a tertiary hospital in Oman and identify potential factors associated with increased risk of hospital readmission.

METHODS

In this retrospective study, we included all adult patients (≥ 18 years) admitted under the care of the General Internal Medicine Unit from 1 June to 31 December 2020 at Sultan Qaboos University Hospital (SQUH). We excluded patients with elective admissions and patients admitted with COVID-19 infection. We collected the following data from the index admission: age, sex, comorbidities, diagnosis, length of hospital stay, information on the functional status, information related to medications (number, reconciliation), information related to transfer of care upon discharge, and data related to readmission within 28 days after hospital discharge. We classify the functional status of patients into full independence status (able to carry out activities of daily living without the need for assistance), partial dependence status (can feed, limited mobility at home, and needs assistance with some activities of daily living and personal care), and complete dependence status (bed-bound and need assistance with feeding and all personal care needs).

Hospital readmission rates reported in previous studies ranged between 11% and 24%. Assuming the readmission rate in our health care setting is 15%, then a sample size of 196 patients to study hospital readmission is needed (with a margin error of 5% and 95% CI).

Continuous variables were expressed as mean \pm SD for normally distributed data or median (interquartile range (IQR)) for non-normally distributed data. We used the Shapiro-Wilk test to assess normality. Differences between the two groups (readmission versus no readmission) were compared using the Student's *t*-test for normally distributed variables or Wilcoxon rank-sum for not normally distributed variables. Categorical variables were reported as numbers and percentages, and differences between the two groups were compared using the chi-squared test or Fisher's exact as appropriate. Two-sided *p*-values < 0.05 were considered statistically significant. Statistical calculations were performed using the Stata software (StataCorp. 2021. Stata Statistical Software: Release 17. College Station, TX: StataCorp LLC.).

The study was approved by the Medical Research Ethics Committee (MREC) of the College of Medicine and Health Sciences at Sultan Qaboos University (REF. NO. SQU-EC/ 645/2021 MREC #2656)1.

RESULTS

There were 200 patients admitted during the study period. Clinical characteristics, diagnosis, medications history, and readmission status are summarized in Table 1. The mean age was 58.6 ± 19.3 , and 106 (53.0%) patients were males. Also, 56 (28.0%) patients had ≥ 3 comorbidities. There were 43 (21.5%) patients who required full assistance for care (complete dependence). On average, patients took five medications (IQR: 2–7), and polypharmacy was common among the patients ($n = 112$, 56.0%). Most patients ($n = 175$, 87.5%) had a care plan summary upon discharge from the hospital. Diseases of the circulatory system were the most common class of diagnoses among the hospitalized cohort [Table 2]. The most common diagnoses were as follows: heart failure ($n = 37$, 18.5%), pneumonia ($n = 27$, 13.5%), stroke ($n = 25$, 12.5%), and urinary tract infection ($n = 18$, 9.5%).

Out of the total, 48 (24.0%) patients had unplanned readmission within 28 days after discharge from the hospital. Patients with 28-days unplanned readmission were older (66.6 vs. 56.0 years, $p < 0.001$) and had a longer length of hospital stay (6.0 vs. 4.0 days, $p < 0.001$). Also, hypertension (77.1% vs. 55.3%, $p = 0.007$), diabetes mellitus (64.6% vs. 48.0%, $p = 0.045$), and ≥ 3 comorbidities (43.8% vs. 23.8%, $p = 0.005$) were more prevalent in the unplanned readmission group. Patients with poor functional status (43.7% vs. 26.3%, $p < 0.001$), requiring feeding tube (25.0% vs. 5.3%, $p < 0.001$), and with polypharmacy (75.0% vs. 50.0%, $p = 0.003$) were at increased risk of readmission. Diseases of the respiratory system category (22.9% vs. 10.5%, $p = 0.029$) were common in the unplanned readmission group.

DISCUSSION

This study is one of the few studies from the Middle East region studying hospital readmission.^{17–19} It shows that unplanned hospital readmission rates were high in a tertiary care setting. In addition,

Table 1: Patient's characteristics, functional independence status, comorbidity profile, and medications history classified according to unplanned readmission status.

Characteristics	Total cohort N = 200 n (%)	No-readmission n = 152 n (%)	Readmission n = 48 n (%)	p-value
Age, mean ± SD, years	58.6 (19.3)	56.0 (19.8)	66.6 (15.1)	< 0.001
Male	106 (53.0)	83 (54.6)	23 (47.9)	0.418
Length of hospital stay (IQR), days	4.0 (3–7)	4.0 (2–6)	6.0 (4–10)	< 0.001
Comorbidities				
Hypertension	121 (60.5)	84 (55.3)	37 (77.1)	0.007
Diabetes mellitus	104 (52.0)	73 (48.0)	31 (64.6)	0.045
Stroke	34 (17.0)	24 (15.8)	10 (20.8)	0.417
Other neurological diseases	15 (7.5)	11 (7.2)	4 (8.3)	0.760
Chronic heart failure	27 (13.5)	17 (11.2)	10 (20.8)	0.088
End-stage kidney disease	5 (2.5)	3 (2.0)	2 (4.2)	0.595
Dementia	7 (3.5)	3 (2.0)	4 (8.3)	0.058
Chronic liver disease	7 (3.5)	3 (2.0)	4 (8.3)	0.058
Chronic pulmonology disease	16 (8.0)	11 (7.2)	5 (10.4)	0.542
Comorbidities (≥ 3 Comorbidities)	56 (28.0)	35 (23.0)	21 (43.8)	0.005
Functional independence				
Fully independent	139 (69.5)	112 (73.7)	27 (56.3)	< 0.001
Partially dependent	18 (9.0)	17 (11.2)	1 (2.1)	< 0.001
Complete dependence	43 (21.5)	23 (15.1)	20 (41.7)	< 0.001
Tracheostomy	8 (4.0)	4 (2.6)	4 (8.3)	0.096
Feeding tube	20 (10.0)	8 (5.3)	12 (25.0)	< 0.001
Medications				
Number of medications	5.0 (2–7)	4.5 (1–7)	5.0 (4.5–7)	0.0233
Polypharmacy (≥ 5 medications)	112 (56.0)	76 (50.0)	36 (75.0)	0.003
Change in medications	114 (57.0)	87 (57.2)	27 (56.3)	0.904
Care plan summary	175 (87.5)	135 (88.8)	40 (83.3)	0.317

IQR: interquartile range.

Table 2: Patient's category of diagnosis and the most common diagnosis and the readmission status.

Characteristics	Total cohort N = 200 n (%)	No-readmission n = 152 n (%)	Readmission n = 48 n (%)	p-value
Classification of Primary diagnosis of hospitalization according to ICD-10				
Diseases of the circulatory system	67 (33.50)	49 (32.2)	18 (37.5)	0.500
Diseases of the respiratory system	27 (13.50)	16 (10.5)	11 (22.9)	0.029
Endocrine diseases	21 (10.50)	18 (11.8)	3 (6.3)	0.418
Diseases of the digestive system	18 (9.00)	14 (9.2)	4 (8.3)	1.000
Diseases of the genitourinary system	18 (9.00)	14 (9.2)	4 (8.3)	1.000
Diseases of the nervous system	12 (6.00)	9 (5.9)	3 (6.3)	1.000
Mental and behavioral disorders	9 (4.50)	9 (5.9)	0 (0.0)	0.118
Blood disorders	8 (4.00)	6 (3.9)	2 (4.2)	1.000
Infectious diseases	2 (1.00)	2 (1.3)	0 (0.0)	1.000
Others	18 (9.00)	15 (9.9)	3 (6.3)	0.571
The most common diagnoses				
Heart failure	37 (18.5)	27 (17.8)	10 (20.8)	0.633
Pneumonia	27 (13.5)	16 (10.5)	11 (22.9)	0.029
Stroke	25 (12.5)	18 (11.8)	7 (14.6)	0.617
Urinary tract infection	18 (9.0)	14 (9.2)	4 (8.3)	1.000
Others	93 (46.5)	77 (50.7)	16 (33.3)	

this study identified several factors significantly associated with an increased 28-day readmission rate, including old age, length of hospital stay, hypertension, diabetes mellitus, the presence of ≥ 3 comorbidities, poor functional status, need for a feeding tube, polypharmacy, and patients diagnosed with respiratory system diseases.

We found the 28-days readmission rate was high ($n = 48$, 24.0%), which is on the higher side of the previously reported readmission rate (11% to 24%).^{20–24} Different hospital settings could explain the differences in the readmission rate in the previous studies, the use of different definitions of readmission (within 28 days, 30 days, or 90 days, etc.), different patients' clinical profiles (e.g., oncology patients were excluded from some studies, variable sociodemographic profiles of patients), variable post-discharge health care and follow-up processes (e.g., availability of early follow-up clinics).^{24,25}

Similar to other studies, the readmitted patients in our cohort were older. Old age is associated with poor health, increased comorbidities, polypharmacy, and reduced functional dependence.^{8,26,27} Continuity of care interventions, multidisciplinary team approach, medication reconciliation, and a proper transition of care are associated with reduced risk of hospital readmission in old patients.^{1,28,29}

Our study found that a longer length of hospital stay and the presence of ≥ 3 comorbidities were associated with an increased risk of hospital readmission, which is similar to previous studies finding.^{4,8,30} Longer hospital stay is usually related to patient's complex medical issues due to comorbidities and lack of social support.^{31,32} Improving discharge planning, patients and family education, management of comorbidity by targeting the high-risk group, and follow-up arrangements might reduce hospital readmission in patients with a high burden of comorbidities.^{33–35}

Polypharmacy, defined as the use of ≥ 5 medications regularly, was associated with an increased risk of hospital readmission in our cohort. This finding is similar to other studies' findings, which concluded that poor compliance with medications is linked to the increase in the number of medications patients are getting, increasing the likelihood of adverse drug reactions.^{9,20,23,36} Additionally, a large-scale cohort study of intensive care unit survivors revealed that polypharmacy is an independent risk factor for hospital readmission.³⁷ A

study from the Middle East region showed that lack of patient education is associated with poor compliance to treatment of acute coronary syndrome. Therefore, it was associated with more cardiovascular events and readmissions within one year.³⁸ Old patients with anticipated low health literacy require specialized education during admission and upon discharge to encourage treatment satisfaction and medication adherence. Moreover, medications reconciliation is highly recommended upon discharge,³⁹ along with an early follow-up review to minimize the risk of readmission associated with polypharmacy.³⁶

Among the readmitted patients, 22.9% had a pneumonia diagnosis, which is in line with another study that showed a similar range of readmission (17%–29%).^{40–42} Patients with multiple comorbidities, including heart failure, chronic obstructive pulmonary disease, diabetes mellitus, and malignancy, are at an increased risk of hospital readmission due to pneumonia.^{24,43} We believe that careful assessment of the antibiotic treatment, the need for feeding tubes, and annual influenza and pneumococcal vaccinations are the top preventable measures for preventing pneumonia.^{40,44} Likewise, providing a management plan of the patient's comorbidities to control their disease significantly reduces the readmission rate.⁴⁵

Our hospital readmission rate was high, and we have identified several factors associated with an increased risk of unplanned hospital readmission. Implementing a hospital readmission reduction program based on evidence-based approaches is vital to improve the quality of delivered health services and minimize the wastage of healthcare resources associated with unplanned hospital readmission.^{2–4} Also, the hospital readmission rate should be included as a key performance indicator for all hospital admission services to monitor performance and guide hospital managers on the need to take the necessary intervention.

Evidence-based interventions that have been shown to reduce unplanned hospital readmission include patient education, medication reconciliation, discharge planning, multidisciplinary team approach, scheduling follow-up appointments/telephone calls, and post-discharge home visits.^{46,47}

This study provides important data for health care system managers and stakeholders about the incidence of early hospital discharge in a tertiary hospital in the Middle East, where the

expanding population has overstrained the health care resources. Also, the study provides important insight into the depth of readmission rate and factors associated with increased readmission rate. Overall, this new insight can be used as a base for healthcare planners to intervene to minimize the readmission rate. In addition, it provides evidence-based solutions based on previous medical literature in similar health settings. Also, it represents a starting point to conduct more research work, including interventional trials to explore further solutions appropriate for our health care setting.

Our study is limited by its retrospective nature. It is from a single center for which we have not evaluated the relationship between the financial and quality of health care and hospital readmission. Also, we have not assessed the relationship between readmission and important factors such as patients' socioeconomic status.

CONCLUSION

28-day hospital readmission is prevalent in our health care setting. Old age, polypharmacy, comorbidities poor functional status were associated with an increased risk of hospital readmission. Therefore, we recommend adopting evidence-based interventions to minimize the risk of hospital readmission. These evidence-based interventions include comprehensive discharge planning for high-risk patients, medication reconciliation, multidisciplinary management of patients with comorbidities, post-discharge follow-up, and appropriate transfer of care upon discharge.

Disclosure

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