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CLINICAL & BASIC RESEARCH

Inappropriate Hospital Stay of Patients Admitted Under Care of General Medicine Units

A retrospective study

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abstract: ***Objectives:*** This study aimed to assess the incidence of inappropriate hospital stay and to identify the reasons behind inappropriate hospitalisation. ***Methods:*** This retrospective cohort study included patients admitted in the General Internal Medicine Unit, Sultan Qaboos University Hospital, Muscat, Oman, from January to June 2020. The average length of hospital stay for all included patients was calculated. The appropriateness evaluation protocol technique was used to examine admissions that exceeded the average length of hospital stay; subsequently, the reasons for the inappropriate hospital stay were identified. ***Results:*** There were 855 admissions during the study period. In this cohort, 53.1% were male and the median age was 64 years (interquartile range [IQR]: 44–75 years). There was a total of 6,785.4 hospitalisation days and the average length of hospital stay was five days (IQR: 3–9 days). A total of 31.8% of admissions (n = 272) and 9.9% of hospitalisation days (n = 674 days) were classified as inappropriate. Delay in complementary tests (29.0%) and unavailability of extra hospital resources (21.7%) were identified as the most common reasons associated with inappropriate hospital stays. Old age was associated with increase in inappropriate hospital stay. ***Conclusion:*** A significant proportion of hospitalisation days were inappropriate due to hospital-related factors. Therefore, auditing hospital services and investing in home-based care are among the top strategies that are likely to improve early discharge and minimise inappropriate hospital bed occupancy.

Keywords: General Internal Medicine; Length of Stay; Hospitalisation; Patient Discharge; Oman.

Advances in Knowledge

- *A significant proportion of hospital stay is inappropriate primarily due to hospital-related factors.*

Application to Patient Care

- *Auditing health-care services, implementing programmes for lean process of execution of tests and procedure along with investing in subacute health services and home-based care programmes are essential steps towards improving early discharges and minimising inappropriate hospital stay.*

The term 'inappropriate hospital stay' has been used widely in the medical literature to describe any hospital stay with no clinical indication due to the suboptimal use of healthcare services.[1,2] The inappropriate days of hospitalisation may undermine the efforts to improve medical healthcare quality due to increased risk of iatrogenic complications such as healthcare-associated infection, deep vein thrombosis, depression and loss of physical dependence. Consequently, inappropriate length of hospital stay is associated with a substantial increase in morbidity and mortality.[2,3]

Reducing healthcare costs and optimising the utilisation of the current healthcare facilities, including hospital beds, are among the best ways to increase the efficiency of healthcare resources. Nevertheless, studies showed that more than 20% of hospital beds are used inappropriately, resulting in a waste of resources and increased iatrogenic risks for patients.[4,5]

Studies have shown that between 20–40% of hospital days are inappropriate stays.[1,6–8] Delays in performing and reporting diagnostic tests, in consultation and in performing procedures are among the most common causes of inappropriate hospital stay.[1,7,9,10] Old age, prolonged hospital stay and medical admissions were associated with an increase in inappropriate hospital stay.[8,11,12] In general, implementing quality improvement projects including routine auditing of hospital services, a multidisciplinary team approach, engagement of discharge planners early on admission and improving home-based services have been shown to reduce inappropriate hospital stay.[6,13]

Oman's population is rising at more than 9% per year, making it one of the fastest growing populations globally. The latest data from United Nations estimated Oman's current population to be approximately five million, of which more than 1.4

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million people live in the Muscat governorate.[14,15] Socioeconomic growth coupled with a remarkable improvement in the healthcare system in Oman has resulted in a higher birth rate and lower mortality rate, accelerating population expansion that continues to put a tremendous strain on healthcare resources.[16]

One of the indicators of the quality of health service delivery is the number of hospital beds. According to the Ministry of Health's annual report in 2020, there were 15.6 hospital beds available for every 10,000 individuals in Oman.[17] In comparison, hospital beds available for every 10,000 individuals range from 12.5 to 22 in the Gulf Cooperation Countries, while in the United States, there are 28.7 beds for every 10,000 individuals.[16,18]

Studies assessing the factors associated with inappropriate hospital stay in the Middle Eastern region are sparse. Therefore, this study aimed to assess the extent of inappropriate hospital stay and identify the reasons for inappropriate hospital stay. Furthermore, it aimed to guide hospital managers and stakeholders to put strategies in place and implement measures to optimise utilisation of healthcare resources without the need for additional financial investment.

Methods

This retrospective cohort study was conducted at Sultan Qaboos University Hospital (SQUH), Muscat, Oman, a 500-bed multispecialty tertiary referral hospital with several unique services and certain specialised medical facilities. SQUH is also a major teaching hospital for medical and nursing students at the College of Medicine & Health Sciences and College of Nursing. Furthermore, it serves as a major training centre for medical interns, general foundation programme trainees and residents of the Oman Medical Speciality Board.

The General Internal Medicine Unit receives approximately 70–80% of medical patients admitted through the Emergency Department. The illnesses of patients range from single organ system diseases (e.g. pneumonia) to complex diseases or undifferentiated illnesses. Besides medical admissions, the General Internal Medicine Unit also receives patients with immunological, genetic and metabolic diseases due to the lack of specialised inpatient services.

There are two main medical wards with a total bed capacity of 45 beds; the high dependency unit contains 10 beds. In addition, general medical patients may be admitted to other non-medical wards during busy periods.

Patients admitted under the care of the General Internal Medicine Unit from January 2020 until June 2020 were included. Patients admitted with COVID-19 infection were excluded from the study. Trained medical doctors collected relevant demographic and clinical data from patients' electronic records. The length of hospital stay was counted as the difference between the time and date of admission and the time and date of discharge. Primary diagnoses were coded and classified according to the tenth revision of the International Statistical Classification of Diseases and Related Health Problems-10.

Appropriateness evaluation protocol (AEP) is the most widely used instrument for evaluating the appropriateness of hospitalisations in various countries. Gertman and Restuccia developed AEP in 1981; the original version contained 27 criteria for use in internal medicine and surgical departments to evaluate the appropriateness of hospital admission and hospitalisation days.[19] Reasons for inappropriate hospital stay, according to AEP, include inappropriate date of discharge; delays related to awaiting complementary tests, the results of complementary tests, surgical procedures and consultations; delays related to poor planning of discharge; delays related to unavailable extra hospital resources (e.g. palliative care and rehabilitation services); and unavailable intensive care bed or delays related to inadequate family support.[20]

AEP has been used across many countries and has been modified many times to adapt to various healthcare settings.[21] In addition, previous studies have shown that AEP is highly reliable and a valid modality to provide an objective assessment for inappropriate hospital stay.[21,22]

A modified version of AEP that includes 27 objective criteria items related to medical and nursing services, extra hospital resources and patient-related factors was used. If one of the criteria is fulfilled, the hospital days are considered appropriate, and if none are met, then the days are considered inappropriate.[20,23]

A team of four trained medical doctors who were not involved directly in patient care reviewed all the included patients' medical records—patient electronic medical records—in detail. Each admission was reviewed independently by at least two medical doctors to assess the appropriateness of hospital stay. The previously reported average length of hospital stay for patients admitted under the care of the General Internal Medicine Unit at SQUH and the calculated average length of hospital stay for the cohort in this study was five days. Hence, any admission that exceeded five days was reviewed to assess the

Table 1: Characteristics and admission data of patients admitted at Sultan Qaboos University Hospital, Muscat, Oman, from January to June 2020 (N = 855)

Characteristic	n (%)
Median age in years (IQR)	64 (44–75)
Female	401 (46.9)
Male	454 (53.1)
Median average length of hospital stays in days (IQR)	5 (3–9)
Total hospitalisation days	6785.4
Admissions with appropriate date of discharge	583 (68.2)
Admissions included inappropriate hospitalisation days	272 (31.8)
Total number of inappropriate hospitalisation days	674
Mortality	29 (3.4)

IQR = interquartile range.

appropriateness of the hospital stay. Any uncertainty regarding the appropriateness of hospital stay was discussed among team members until consensus was achieved.

Categorical variables (e.g. sex) were reported as numbers and percentages and differences between groups were assessed using the Chi-square test or Fisher's exact, as appropriate. The continuous variables (e.g. age) as mean ± standard deviation for normally distributed values or median (interquartile range [IQR]) for non-normally distributed values were reported in this study. In addition, differences between groups (three or more) were assessed using one-way analysis of variance for normally distributed continuous variables or Kruskal–Wallis rank test for non-normally distributed continuous variables. Finally, a regression analysis was conducted to identify patient-related factors associated with an increased risk of the inappropriate hospital. Stata®, Version 17.0 software package (StataCorp LLC, College Station, Texas, USA) was used to perform statistical calculations and *P* values <0.05 were considered statistically significant.

This study was approved by the Medical Research Ethics Committee (MREC) of the College of Medicine and Health Sciences at SQU (SQU-EC/301/2020; MREC #2336).

Results

There were 855 admissions under the care of the General Internal Medicine Unit during the study period. In this cohort, 53.1% were male and the median

Table 2: Length of hospital stay according to the primary diagnosis classified according to International Statistical Classification of Diseases and Related Health Problems-10 (N = 855)

Classification of primary diagnosis according to ICD-10	n (%)	Median average length of hospital stay (IQR)
Infectious disease (A00–B99)	46 (5.4)	6 (3–10)
Neoplasms (C00–D48)	18 (2.1)	8 (5–14)
Haematological diseases (D50–D89)	29 (3.4)	4 (3–7)
Endocrine, nutritional and metabolic diseases (E00–E90)	70 (8.2)	4.5 (3–6)
Mental and behavioural disorders (F00–F99)	25 (2.9)	4 (2–6)
Diseases of the nervous system (G00–G99)	44 (5.1)	5 (3.5–8)
Diseases of the ear and mastoid process (H60–95)	7 (0.8)	3 (2–5)
Diseases of the circulatory system (I00–I99)	191 (22.3)	6 (4–10)
Diseases of the respiratory system (J00–J99)	188 (22.0)	6 (3–10)
Diseases of the digestive system (K00–K93)	60 (7.0)	4 (3.5–7)
Diseases of the skin and subcutaneous tissue (L00–L99)	20 (2.3)	7 (3.5–11)
Diseases of the musculoskeletal system and connective tissue (M00–M99)	12 (1.4)	6 (3–16)
Diseases of the genitourinary system (N00–N99)	55 (6.4)	6(5–8)
Symptoms, signs and abnormal clinical and laboratory findings not elsewhere classified (R00–R99)	69 (8.1)	6(4–8)
Injury, poisoning and certain other consequences of external causes (S00–T98)	7 (0.8)	5 (2–13)
Factors influencing health status and contact with health services (Z00–Z99)	13 (1.5)	3 (2–5)

ICD-10 = the tenth revision of the International Statistical Classification of Diseases and Related Health Problems; IQR = interquartile range.

Table 3: Patients' characteristics and admission data of the most common diagnoses (N = 855)

Characteristic	Diagnosis, n (%)								*P* value
	Pneumonia	Heart failure	Stroke & TIA	Exacerbation of chronic lung diseases*	Sepsis	Drugs & alcohol	UTI	Others	
Total admission	120 (14.0)	118 (13.8)	68 (8.0)	54 (6.3)	39 (4.6)	36 (4.2)	35 (4.1)	385 (45.0)	
Age in years (IQR)	68 (43.5–75)	70 (61–77)	67 (56–76)	67.5 (53–76)	75 (64–84)	38 (29.5–47.0)	71 (48–79)	57 (35–72)	0.0043†
Female	49 (40.8)	61 (51.7)	28 (41.2)	31 (57.4)	17 (43.6)	7 (19.4)	22 (62.9)	186 (48.3)	0.0034‡
Male	71 (59.2)	57 (48.3)	40 (58.8)	23 (42.6)	22 (56.4)	29 (80.6)	13 (37.1)	199 (51.7)	0.0034‡
Average length of hospital stay in days (IQR)	6 (3–10)	5.5 (4–9)	5.5 (4–8)	6 (3–8)	6 (4–10)	4 (3.0–6.5)	6 (5–8)	5 (3–8)	0.0751†
Admissions with appropriate date of discharge	77 (64.2)	72 (61.0)	39 (57.4)	31 (57.4)	31 (79.5)	28 (77.8)	20 (57.1)	285 (74.0)	0.0023‡
Admissions with inappropriate hospital stay	43 (35.8)	46 (39.0)	29 (42.6)	23 (42.6)	8 (20.5)	8 (22.2)	15 (42.9)	11 (2.9)	0.0023‡
Total number of unnecessary hospital stay days (N = 674 days)	120 (17.8)	103 (15.3)	72 (10.7)	49 (7.3)	12 (1.8)	21 (3.1)	40 (5.9)	257 (38.1)	0.0411‡
Average length of inappropriate hospitalisation in days (IQR)	2 (1–3)	2 (1–3)	3 (1–3)	2 (1–3)	1 (1–2)	2 (1.5–4)	2 (2–3)	2 (1–3.5)	0.0043†
Mortality	2 (1.7)	1 (0.8)	1 (1.5)	0 (0.0)	5 (12.8)	0 (0.0)	0 (0.0)	20 (5.2)	0.0016‡

TIA = transient ischaemic attack; IQR = interquartile range.

**Including chronic obstructive lung disease, interstitial lung disease, bronchiectasis, bronchial asthma. †Using Kruskal–Wallis rank test. ‡Using Chi-squared test.*

Table 4: Reasons for inappropriate hospital stay20 (N = 272)

Reasons for inappropriate hospital stay	n (%)
Awaiting complementary tests	79 (29.0)
Awaiting the results of complementary tests	51 (18.8)
Awaiting surgical procedures	3 (1.1)
Awaiting specialist consultations	48 (17.6)
Awaiting extra hospital care to be arranged and unavailable extra hospital resources, including the availability of long-term or palliative care beds or rehabilitation	59 (21.7)
Awaiting transfer to intensive care or admission to another programme or in-home care or awaiting transfer to other departments within the same hospital	3 (1.1)
Inadequate family support	29 (10.7)

age was 64 years (IQR: 44–75 years). There were 6,785.4 hospitalisation days and the average length of hospital stay was five days (IQR: 3–9 days). A total of 31.8% of admissions (n = 272) were inappropriate hospitalisation days, while 9.9% (n = 674 days) of hospitalisation days were classified as inappropriate. There were 29 mortalities (3.4%) during the study period [Table 1].

Diseases of the circulatory system (22.3%) and respiratory system (22.0%) were the most common class of primary diagnoses for the included patients. In addition, patients with neoplasms and diseases of the skin and subcutaneous tissue had a longer hospital stay than those with other classes of primary diagnoses (i.e. eight and seven, respectively) [Table 2].

Pneumonia (14.0%), heart failure (13.8%), transient ischaemic attack (TIA) and stroke (8.0%), exacerbations of chronic lung diseases (6.3%), sepsis (4.6%), drug- and alcohol-related admissions (4.2%) and urinary tract infection (4.1%) were the most common primary diagnoses. Drug- and alcohol-related admissions occurred mainly in young and male patients. Admissions due to TIA and stroke (42.6%), exacerbations of chronic lung disease (42.6%) and urinary tract infections (42.9%) were likely to result in an inappropriate hospital stay. Also, TIA and stroke diagnoses were associated with prolonged inappropriate hospital stay of an average of three days (IQR: 1–3 days). Sepsis was associated with an increased inpatient mortality rate (12.8%) [Table 3].

Delay in complementary tests (29.0%), unavailability of extra-hospital resources (21.7%) and delay in the results of the complementary tests (18.8%) were the most common reasons associated with inappropriate hospital stay [Table 4].

In terms of patient-related factors, a regression analysis showed that old age was associated with an increased risk of inappropriate stay (P = 0.007; odds ratio = 0.020 per 10-year increase in age, 95% confidence interval: 0.006–0.036).

Discussion

This study assessed inappropriate hospital stay in a region where a rapidly expanding population has overstrained the healthcare resources. The analysis showed that approximately 10% of hospital bed-days were wasted. Waiting for complementary tests to be conducted and then for their results and lack of extra hospital resources were the most common causes of inappropriate hospital stay. In addition, old age and specific diagnoses such as those of stroke and chronic respiratory diseases are major factors contributing to an inappropriate hospital stay.

The overall average length of hospital stay for patients admitted to the General Internal Medicine Unit was observed to be five days, which is higher than the average length of stay (3.9 days) in a similar healthcare setting in Oman but is below the average length of stay reported in different Asian and European countries (6.4–7.8 days).[17,24] A study from Thailand reported a length of hospital stay of 25.9 days for patients admitted under the care of the General Medicine department.[25] This is probably due to the inclusion of subacute admissions (e.g. palliative care, rehabilitation services) in the Internal Medicine department. In contrast, a study from Australia reported the length of hospital stay of patients admitted under the care of the General Medicine department as 3.7 days.[26] The variations in the reported length of hospital stay could be explained by multiple factors, including accessibility to diagnostic and therapeutic services and availability of subacute medical services and home-based services.

According to AEP criteria, 31.8% of hospitalisation (n = 272) included inappropriate hospital days, causing a waste of around 9.9% of total hospital bed days (n = 674 days). The rate of inappropriateness reported in various international studies displayed significant variation across countries, hospitals and clinical departments. However, studies conducted to assess the utilisation of beds in internal medicine departments over the past 20 years concluded that the rate of inappropriateness ranged between 20–41%.[27–30] A study from the Netherlands found more than 20% of hospital stay to be inappropriate and reported that old age and lack of home-based care and specialised medical services were associated with an increased risk of inappropriate hospital stay.[28]

The disparity in the rates of inappropriate hospitalisation between these studies is notable, which could be due to differences in admission and discharge protocols, geographic areas or bed occupancy rates of different hospitals. In addition, differences in methodology, including sampling methods, AEP modifications, options used to justify hospitalisation days and the quality of medical records, are important factors that might have contributed to the differences in the previously reported rate of inappropriate hospital stay.[28,31] The rate in this study is lower than the reported rate in a similar setting, probably because only those admissions that exceeded the calculated average length of hospital stay (i.e. five days) have been included.

The most common reasons for the inappropriate hospital stay in the current study were mainly related to the hospital system factors, including delay in complementary tests or waiting for the test results.

In the authors' institution, a routine imaging request is usually carried out in 1–3 days; the official report may be available two days after the procedure. As a tertiary and university hospital receiving many undiagnosed cases from different regional hospitals for expert opinion, diagnostic workup represents a significant part of patient's hospitalisation period. Hence, institutional arrangements should be initiated, including the execution of a programme for request justification, scheduling and reporting procedures.[9]

In addition, extra hospital care, including the availability of long-term or palliative care beds and rehabilitation services, accounted for approximately 22% of inappropriate hospital stay. This result highlights the lack of adequate rehabilitation services, home-based care and nursing homes, resulting in inappropriate hospitalisation and utilisation of acute health resources in Oman.

Approximately 18% of inappropriate hospital stays were due to a waiting period for specialist consultation. The General Internal Medicine Unit routinely admits patients with multiple complex issues; hence, consultation in other specialities is vital. Creating an efficient consultation process and improving communication between teams may decrease inappropriate hospital stays.[32,33]

In terms of patients' related factors, previous studies have shown that elderly patients and patients with multiple comorbidities including chronic heart failure, stroke and soft tissue infection are at an increased risk of prolonged length of hospital stay.[34,35]

This study has shown that the majority of patients were hospitalised with circulatory and respiratory system diseases. Pneumonia and exacerbations of chronic lung disease were among the most common diagnoses, with a median length of hospital stay of six days, which is higher than the reported length of hospital stay in similar health settings (i.e. five days).[36] This could be explained by the fact that the cohort of patients in this study had advanced chronic pulmonary diseases and many were on long-term oxygen therapy and mechanical ventilatory support.

Acute decompensated heart failure was the second most common diagnosis in this study, with a median length of hospital stay of 5.5 days (IQR: 4–9), consistent with international studies, which reported a median of six days (IQR: 4–9).[34,37] This is due to the nature and complexity of managing heart failure leading to an increased rate of admission and readmission, the need for intravenous diuretics and the possible development of complications such as renal injury.[38] Heart failure was also associated with increased length of inappropriate hospital stay, which might be due to the delay in performance of cardiac-specific imaging, the interpretation of these investigations and lack of multidisciplinary heart failure service.

Patients diagnosed with neoplasm had the most extended length of hospital stay and the highest total number of inappropriate hospitalisation days, which is likely due to the time needed to perform diagnostic investigations to confirm the diagnosis and arrange the appropriate transfer of care to oncological specialities. Diseases of the skin and subcutaneous tissue had an increased length of inappropriate hospital stay, possibly due to delayed diagnosis and specialist consultation.

Approximately 43% of admissions due to stroke and TIA accounted for inappropriate hospital days. This was mainly due to delays in performing relevant investigations such as magnetic resonance imaging, Holter monitoring and echocardiography. In addition, the absence of a dedicated stroke unit and inpatient rehabilitation service contributed to inappropriate hospitalisation of patients with acute stroke.

Logistic regression analysis demonstrated that old age was associated with an increased inappropriate hospital stay. This could be explained by the increased burden of comorbidity and high prevalence of geriatric syndromes in elderly patients.[39] Dementia and poor pre-morbid functional status were found to be associated with prolonged length of hospital stay in elderly patients in previous studies.[40]

Many earlier studies have identified strategies and interventions to promote early discharge and reduce inappropriate hospital stay of patients. Auditing clinical and procedural services, holding physicians' accountable, coordinating patient care early on admission, establishing a discharge planning unit and investing in home-based care and nursing home and rehabilitation services were effective strategies to minimise inappropriate hospital stay.[5,9,41,42]

Also, implementing geriatric assessment for elderly patients, clinical pathways for management of common diagnoses such as heart failure, medications for patients with polypharmacy and case management could reduce the length of hospital stay.[34,43]

This study has many strengths. It is one of the few studies from the Middle East, a place where the expanding population has put extreme pressure on healthcare systems. This study identified several hospital-related factors causing the prolongation of inappropriate hospital stay. In addition, it provides stakeholders and hospital managers with insights about the waste in acute hospital beds and potential services so as to reduce inappropriate hospital stays.

The limitations of the study include the retrospective nature of the study that reports data from a single centre. Also, only those admissions that exceeded the average length of hospital stay were

reviewed, which could underestimate the wasted hospital beds. Due to the study's retrospective nature and lack of billing information—free-of-cost healthcare system for citizens—the financial implication of inappropriate hospital stay could not be estimated.

Conclusion

A significant proportion of hospital stays are deemed inappropriate primarily due to hospital-related factors, including in-hospital delayed procedures and the inability to discharge patients in subacute hospital care settings. Therefore, auditing hospital services to minimise the time between complementary test request and completion of the test (performance and reporting), monitoring the quality of consultation services, establishing rehabilitation services and investing in home-based care are among the top strategies that are likely to improve early discharge and minimise inappropriate hospital bed occupancy.

AUTHORS' CONTRIBUTION

AY, AA, KZ and HF were involved in conceptualisation and design of the study. AY, HB, KH and RY collected the data and drafted the manuscript. AA analysed and interpreted the results as well as revised the manuscript. All authors approved the final version of the manuscript.

CONFLICT OF INTEREST

The authors declare no conflict of interests.

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