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**Research Article** 

# Evaluation of Inappropriate Admission and Hospitalization According to Appropriateness Evaluation Protocol and Estimation of Direct Financial Burden

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## Abstract

**Background:** Appropriate allocation of resources is an important issue in the delivery of services that can reduce the health system costs. The inappropriateness of healthcare services is one of the problems that increase the pressure on hospitals and patients. **Methods:** In this study, the data were collected using the appropriateness evaluation protocol by a medicine specialist at Rasoul Akram Hospital. In total, 248 participants were selected through systematic sampling. To calculate the financial burden simultaneously with the evaluation of inappropriate hospitalization days, the medicine and facility costs along with the cost of bed-day were estimated. Data were analyzed by SPSS software.

**Results:** The type of treatment was surgery in 56.8% of the patients and 43.2% of them were admitted to the hospital for internal medicine. The mean length of stay was  $4 \pm 6$  days. The inappropriate admission rate was estimated at about 6% and the rate of inappropriate hospital stays was 21.5%. The most important factors influencing the inappropriateness of hospitalization were delayed medical consultations, delayed surgery, conservative practitioner, and the follow-up of clinical test results. The sum of the direct financial burden of inappropriate hospitalization for the patients was estimated at around 1060 dollars.

**Conclusions:** The findings of this study indicated that inappropriate hospitalization and admission imposed a huge financial burden on the health system and community. Hospital authorities by considering issues such as delayed medical consultations and delayed surgery can decrease the financial burden of inappropriate hospitalization to a large extent.

Keywords: Appropriateness Evaluation Protocol (AEP), Inappropriateness, Financial Burden

# 1. Background

The increasing costs of the health system have led to worries about the appropriate management of resource consumption (1). Hospital bed management is one of the issues that contribute to controlling the increasing costs of the health system. The increases in health care costs and patients' age, as well as the presence of acute diseases, duplicate the needs for effective management of hospital beds (2). Inappropriate healthcare services are one of the problems that impose more pressure on hospitals and result in the likelihood of wrong admissions (3). Inappropriate admission is referred to the admission of those patients that may have other potential medical service choices with A lower level of technology than the technology of a hospital. This implies that there is no necessity to admit them in the hospital at the present time (4). In addition, the inappropriate hospitalization day is defined as a day in which the patient receives continuous and active medicalnursing or paramedical services while there is no need for such services for him/his (5). The results of some studies indicate that there is a wide variety of factors effective in inappropriate hospital stay attributed to physicians, demographic, and social characteristics (6-8).

The results of a study by Ghods et al. showed that about 7.4% of admissions and 22.1% of hospital stays were inappropriate (9). The cost of inappropriate admissions and hospitalizations as unnecessary services has considerable importance. In another study by Gupta et al., inappropri-

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ate admission cost was estimated to be 384.45 dollars on average (10). This cost was equal to 202.82 euros in Soria-Aledo et al. study (1). A decline in the length of patients' hospitalization for four hours will increase the capacity of hospital beds by 30 (11). Decreasing inappropriate stays will improve hospital efficiency and shorten the waiting list with no decrease in quality. However, unnecessary hospitalization days increase the cost of hospital stays and expose the hospital to nosocomial infections (12-14). Gardiner et al. in their study demonstrated that the lack of inappropriate admissions and stays could lead to a total saving of 47.5 million pounds for two hospitals per year (15).

# 2. Objectives

The present study was conducted aiming at evaluating the rate, reasons, and direct financial burden of inappropriate admission and hospitalization to patients in a hospital.

#### 3. Methods

This study was carried out in the first half of the year 2017 at the Iran University of Medical Sciences. The research population included patients admitted to all wards of a hospital (e.g., emergency, internal medicine, surgery, etc.) who were hospitalized for more than one day. This was used as a criterion for patient inclusion in this study. Also, children patients and psychiatric ward patients were excluded from the study. A total of 248 participants were selected for the study through systematic sampling. Data were collected using appropriateness evaluation protocol (AEP), the reliability and validity of which were confirmed by Strumwasser et al. (16). The AEP has four parts. The first part is for gathering the demographic information of patients and their physicians, the second part is a table of appropriate evaluation based on admission and hospitalization protocol criteria, the third one is about the reasons for inappropriate hospitalization and admission, and the fourth part is an appendix of appropriate hospitalization and admission criteria. The AEP considers the appropriateness of the hospitalized patient's conditions with at least one protocol criterion as the appropriateness condition for admission. For calculating the financial burden simultaneously with evaluating the inappropriate hospitalization days, the medicine and facility costs along with the cost of bed-day according to the tariff and cost of medicine and facilities were extracted from the medical records. Direct cost means the patient's out-of-pocket payment at the time of discharge. It includes all hospital costs billed at the discharge time for a patient. Following the extraction of

costs, the sum of the above-mentioned costs was divided by the number of inappropriate hospitalization days, and thus the direct cost of each inappropriate day of stay was obtained per capita to express the imposed direct financial burden of each inappropriate day of stay for each patient.

The appropriateness of the patient's hospitalization was collected by an emergency medicine specialist from the medical records of patients. The sample was determined according to the six-month period of the study and considering the proportion of hospitalized patients in each ward. Regarding the inappropriate hospitalization rate of 18% in a previous study (Z = 1.96, d = 0.05), the sample size was estimated at 248.

In addition to admission days of a patient, each hospitalization day for him/his was evaluated by the AEP protocol.

Data collection was approved by the Ethics Committee of the university. Besides, the validity and accuracy of the data were observed throughout the processes of data collection and analysis.

# 4. Results

According to the findings in Table 1, the average age of the patients was  $49 \pm 21$  (men, 52.4%; married, 80.8%). In terms of treatment, 56.8% of the patients underwent surgery and 68% stayed at the hospital for less than four days (mean, 4 days; standard deviation, 6 days) (Table 1).

During the study, 5.6% of the patients (14 out of 248 patients) were admitted inappropriately. The total bed-day of hospitalization was estimated at 1065 days. Based on the AEP, 228 days of hospitalization were inappropriate. Therefore, the rate of inappropriate hospitalization days was 21.5%.

Table 2 shows the influential factors on the inappropriate admission of patients in a regression model. The length of stay (OR = 1.13; P value = 0.03) was more effective on admission inappropriateness. The full-time presence of physicians increased the inappropriate admission possibility (64%) but this increase was not significant (P value = 0.62).

Table 3 demonstrates the factors affecting the patient's length of stay at the hospital. The length of stay (OR = 1.4; P value < 0.001) and insurance status (OR = 0.07; P value = 0.024) were significantly correlated with inappropriate hospitalization on holidays and non-holidays. Considering the test results, the more the patients' length of stay, the higher the probability of inappropriate hospitalization. With a single-day increase in the length of stay, the risk of inappropriate hospitalization days increased nearly by 1.4 (OR: 1.4; 95% CI: 1.23 - 1.55, P  $\leq$  0.001). Besides, the

Variables/Subgroups	Frequency (%)
Gender	
Male	118 (47.6)
Female	130 (52.4)
Marital status	
Married	185 (80.8)
Single	44 (19.2)
lype of treatment	
Surgical	133 (56.8)
Medical	101 (43.2)
Diagnosis of the disease	
New	160 (66.1)
Old	82 (33.9)
Health insurance	
No	9 (4.1)
Yes	211 (95.9)
Residence	
Tehran	160 (68.4)
Other cities	74 (31.6)
Day of hospitalization	
Holiday	23 (9.5)
Non-holiday	220 (90.5)
Type of referral	
Other hospitals	76 (31)
Urban ambulance	114 (46.5)
Hospital clinic	55 (22.4)
Medical specialty	
Medical	37 (15.3)
Cardiology	33 (13.6)
Emergency medicine	58 (24)
Ophthalmology	23 (9.5)
Gynecology	18 (7.4)
ENT	19 (7.9)
Orthopedic	14 (5.8)
General surgery	27 (11.2)
Urology	6(2.5)
Neurosurgery	7(2.9)
Age range	7 (2.5)
< 20 v	16 (67)
21-40 y	70 (22.1)
41 60 y	(1.65)
41-00 y	03 (20.4)
	81 (33.9)
One d	108 (43.5)
2-3 d	61 (24.6)
4 - 6 d	31 (12.5)
7-10 d	20 (8.1)
≥ 11 d	28 (11.3)

insurance status of patients was another significant factor for the odds of inappropriate hospitalization day (Table 3). Individuals who did not have insurance were more exposed (about 7%) to inappropriate hospitalization days than those who were under the insurance cover (OR: 0.07; 95% CI: 0.01 - 0.7, P = 0.0024).

According to evaluations carried out based on available documents, in 83 of 228 days of inappropriate hospitalization, the reason was medical counseling (36%), surgical operation delay (13%), and physician's conservativeness (13%). In some cases, the evaluation failed to diagnose the main reason for the inappropriateness of the patient's stay. These cases were classified in the class 'other cases' (Table 4).

According to Table 5, the sum of the direct financial burden of inappropriate hospitalizations on patients was estimated at around 1060 dollars (10% tariff). Besides, this amount was about 9537 dollars for the government (90% tariff). The total financial burden was the sum of the costs, which equaled to 10597 dollars.

The loss due to each inappropriate day of hospitalization could be calculated by applying the per capita method. The patients' costs per inappropriate hospital stay were 5 dollars; the rate was nearly 42 dollars for the health system (Table 5). Therefore, the cost of per-day hospital stay was estimated at about 47 dollars by adding up these two figures. Table 6 shows the financial burden of inappropriate days of hospitalization for each ward of the hospital. The orthopedic and internal wards (considering the higher rate of inappropriate hospitalization days) with the costs of 2463 and 1999 dollars had the highest financial burden in this regard, respectively.

#### 5. Discussion

This study aimed to investigate the inappropriate admission and hospitalization days based on AEP and their financial burden. Totally, 14 (6%) out of 248 admissions under investigation did not have appropriate conditions and were determined as inappropriate admissions. Some studies carried out in this field using AEP assessed the rates of inappropriate admissions as 7% - 8.5% (1, 8, 9, 13, 16-19), which are somehow similar to the results of the current study. In another study by Soria-Aledo et al. to estimate inappropriate admissions employing AEP, this rate was equal to 7.4% (1). Several other investigations that did not use AEP for inappropriate admission estimation reported higher rates (14% - 24%) than the current study (15, 20-23). For instance, this rate was reported as 22% in a study by Eriksen et al. in Norway (21). The estimated rate of inappropriate admission in the current study was not very different from the rate in similar studies that used AEP as the tool of estimation. This indicates that there is a conformity between our obtained results and the findings of other similar studies.

Fable 2. Logistic Regression of Variables Affecting Inappropriate Admission				
Components/Groups	P Value	OR 95% Confidence Interval		ence Interval
			Lower Limit	Upper Limit
Type of referral				
Ambulance or other hospitals <sup>a</sup>				
Hospital clinic	0.148	0.132	0.009	2.043
Gender				
Male <sup>a</sup>				
Female	0.956	1.046	0.207	5.3
Health insurance				
No <sup>a</sup>				
Yes	0.99	0.2		-
Marital status				
Married <sup>a</sup>				
Single	0.861	0.789	0.055	11.24
Residence				
Tehran <sup>a</sup>				
Other cities	0.056	0.072	0.005	1.07
Type of treatment				
Surgical <sup>a</sup>				
Medical	0.304	0.261	0.02	3.38
Day of hospitalization				
Holiday <sup>a</sup>				
Non-holiday	0.99	0.6	0	-
Full-time physician				
Yes <sup>a</sup>				
No	0.623	1.641	0.23	11.8
Age	0.52	0.985	0.94	1.03
Hospitalizationday	0.031	1.13	1.01	1.3

Abbreviation: OR, odds ratio.

<sup>a</sup>Reference group.

Investigation of inappropriate hospitalization days in this study revealed that the inappropriate rate of stay in the hospital was 21.5%. In other similar studies, the inappropriate hospitalization days much varied across studies. This rate was 22.7% on average in similar studies that used AEP for the estimation of inappropriate hospitalization days (5, 8, 9, 13, 24-29). In a study in which AEP was the criterion for the rate of appropriateness or inappropriateness of stays, Soria-Aledo et al. found that this rate was 24.6% (8). Conversely, in studies in which the above-mentioned protocol was not the basis of estimation, this rate was reported as 35.3% (2, 20, 30). This may be due to the issue that such a protocol includes stricter criteria for the evaluation of appropriateness. The inappropriateness rate of patients' hospitalization days in Vincitorio et al. study was equal to 30% according to an Italian pediatric appropriateness evaluation protocol (PRUO) in which, they used the records of children from 30 days to 14 years of age (20) while in the current study, patients of various ages were assessed. The results of the current study on the comparison of medical specialties demonstrated that the maximum and minimum rates of inappropriate admission were observed in the urology ward and orthopedic/ophthalmology ward, respectively. However, for inappropriate days of stay, the maximum and minimum rates were related to orthopedic and Ophthalmology Departments, respectively. Probably,

Table 3. Results of Logistic Regression to Determine Variables Affecting Inappropriate Hospitalization				
Components/Groups	P Value	P Value OR	95% Confidence Interval	
			Lower Limit	Upper Limit
Type of referral				
Ambulance or other hospitals <sup>a</sup>				
Hospital clinic	0.85	1.11	0.37	3.31
Gender				
Male <sup>a</sup>				
Female	0.802	1.12	0.46	2.71
Health insurance				
No <sup>a</sup>				
Yes	0.024	0.07	0.01	0.7
Marital status				
Married <sup>a</sup>				
Single	0.882	0.908	0.26	3.23
Residence				
Tehran <sup>a</sup>				
Other cities	0.275	1.722	0.65	4.57
Type of treatment				
Surgical <sup>a</sup>				
Medical	0.801	0.868	0.29	2.6
Day of hospitalization				
Holiday <sup>a</sup>				
Non-holiday	0.151	5.144	0.55	48.05
Age	0.546	0.992	0.97	1.02
Hospitalizationday	$\leq$ 0.001	1.4	1.23	1.55
Abbreviation: OR, odds ratio. <sup>a</sup> Reference group.				
Table 4. Reasons for Inappropriate Hospitalization				
Reasons for Inappropriateness		Number of D	ays	%
Insurance and discharge problems		2		1
Absence of practitioner		2		1
Consultation		83		36
Delayed surgery		30		13
Follow-up of the clinical test results		14		6
Conservative practitioner		29		13
Patient dissatisfaction with surgery		3		1
Others		65		29
Total		228		100

orthopedic patients because of the need for various counseling and tests prior to the surgical operation have more inappropriate hospitalizations. The orthopedic, neurosurgical, and maternity wards showed higher rates of inap-

Table 5. Financial Burden of Inappropriate Hospital				
Туре	of Cost/Hospitalization	Cost of Patients	Cost of Health System	Total
Hoteling				
	Hospital stay days	930	8371	9302
	One day	4	37	41
Medicine and equipment				
	Hospital days	130	1166	1295
	One day	1	5	6
Total				
	Hospital days	1060	9537	10597
	One day	5	42	47

Table 6. Financial Burden of Inappropriate Hospital Days Based on Specialties

Medical Specialties	Number of Inappropriate Hospital Days	Financial Burden of Hoteling, \$	Financial Burden of Equipment, \$	Total Financial Burden, \$
Medical	43	1754.24	244.32	1998.56
Cardiology	12	48956	68.18	557.74
Emergency medicine	32	1305.48	181.82	1487.3
Ophthalmology	1	40.8	5.68	46.48
Gynecology	12	489.56	68.18	557.74
ENT	6	244.78	34.09	278.87
Orthopedic	53	2162.2	301.14	2463.34
General surgery	28	1142.3	159.09	1301.39
Urology	4	163.19	22.73	185.91
Neurosurgery	28	1142.3	159.09	1301.39
Other (unspecified)	9	367.17	51.14	418.3
Total	228	9301.56	1295.46	10597.02

propriate hospitalization. No considerable difference was observed in other specialties. In addition, gender had no significant effect on the inappropriateness of admissions.

Among the possible factors affecting the inappropriate stay, an 83-day delay in medical counseling (36%), surgical operation delay and conservative decisions of physicians (13%), the follow-up test results (6%), and other causes (29%) had higher effects on inappropriate stays of the patients. Tavakoli et al. reported factors such as the time for operation (30%), other factors (27%), the physician's conservativeness (21%), and medical counseling (11%) (4). Similarly, Meidani et al. (29)mentioned the lack of the physician's presence (17%) and delay in counseling (12%), as well as insurance problems, discharge, and clearance (8%), as the most important factors. Due to the generality of the hospital, the presence of various specialties, and the inter-ward relationships, problems with medical counseling and delays are common. In another study by Barisonzo et al. conserand counseling services (18%) were the contributory factors in inappropriateness of admissions or hospital days (2). The results of the study showed that the likelihood of inappropriateness of hospitalization days increased with the prolonged patients' length of hospital stay. According to some studies, a single-day increase in the length of hospital stay would increase the risk of inappropriateness of hospitalization days by about 1.4%. Besides, the more the patients stay in the hospital, the more the likelihood of inappropriateness of the stay (9, 31-33). This implies that the probability of inappropriate stay was more in patients with more length of hospital stay. In addition, the results of the study indicated that gender had no effect on the rate of inappropriate admission and days of hospital stay. Some studies also showed similar results (23, 31); however, some other studies reported opposite results in this respect (25, 32). The insurance state of patients had no effect on the prob-

vative performance (39%), results of diagnostic tests (21%),

ability of inappropriate admission but had effects on inappropriate hospitalization. It is possible that the hospital's interest in gaining cash form patients rather than gaining from insurance has effects on this matter because insurance payments to the hospital have several months of delay. However, in some studies, insurance and inappropriateness of the stay were found to be significantly related (29, 31, 32). It seems that physicians in the hospital under investigation prescribed medical procedures regardless of the insurance state of the patient and that no demand was induced due to the insurance coverage. Similar to the results of the present study, the findings of a study by Masoompour et al. showed no relationship between insurance and inappropriateness of hospitalization days (23). Several studies have found a direct association between the higher age of the patients and the likelihood of inappropriate hospitalization day (25, 29, 33, 34) while in the present study, this relationship was not approved. The results of a study by Masoompour et al. indicated the lack of any statistically significant correlation between the age and inappropriate hospitalization (23).

Inappropriate admission or stay caused the waste of health system resources and decreased the efficiency of the hospital. Various costs are wasted for each inappropriate admission or stay. This rate in a hospital results in a massive financial loss to the health system per year. Obtaining information on contributing factors in inappropriate admission or stay can save money in the health system and community (1, 8, 10, 35). In the current study, 228 days of stay were inappropriate which caused a cost equal to 10597 dollars. The generalization of this rate to a year and all the admitted patients revealed that many financial resources were lost due to these issues, which could be reduced with appropriate plans in the above-mentioned areas.

## 5.1. Conclusions

In general, the findings of this study indicated that 6% of the admissions and 21.5% of the stays were inappropriate, indicating a huge financial burden imposed on the health system and community. Through appropriate identification of influential factors on inappropriateness of admissions and hospital stays, a considerable rate of these costs could be prevented annually. The most significant predictors of inappropriate hospitalization in the present study included delay in medical counseling and surgical operation, medical practitioner's conservativeness, and the follow-up test results. As a result, hospital authorities by considering these areas can decrease the financial burden of inappropriate costs to a large extent.

# Footnotes

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