The Factors Affecting Length of Stay of the Patients Undergoing Appendectomy Surgery in a Military Teaching Hospital

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The principal objectives of this study were to identify the main predictors of the length of postoperative hospital stay for patients undergoing appendectomy in a military training hospital in Turkey, to examine the effects of each significant predictor, and to justify to hospital health care managers the reasons why an increase in effective use of hospital utilization resources is needed and so important. This study gives the results of a 2-year retrospective study conducted at Gulhane Military Medical Academy between January 2003 and January 2005. The medical files of 417 patients undergoing appendectomy during this 2-year period were reviewed. A number of demographic and clinical patient characteristics were examined to determine their significance in lengthening the postoperative and total hospital stay. After taking all demographic and clinical patient characteristics into account, it was determined that those patients who were temporary or short-term service members and whose medical complications were more severe were more likely to stay in the hospital for longer periods. Despite its limitations, the study reveals that factors affecting variations in resource utilization can be minimized by following very simple administrative procedures. Furthermore, the results could increase awareness among hospital managers of the significant factors involved for health care providers in modifying their behavior concerning resource utilization decisions.

Introduction

Rapid developments in medical knowledge/technology and cost-containment efforts in health care in a rapidly changing and transforming health care environment have triggered a third reassessment in health systems. Initially, previous reassessments seemed to be related to the U.S Health Care System. However, the health care system of nearly every nation, including European Union member states, is affected by these three important developments. The effects of these developments have been leading health systems the world over to place more emphasis on efficiency, effectiveness, and quality in resource utilization.[1]

These developments along with proposed strategies aimed at combating increasing health care costs prompted the re-examination of the role of the public in health care, particularly in industrialized countries. Attention was drawn to an economic appraisal in health services and priority was given to examining and assessing variations in the clinical decision-making process.[2] However, since the studies are expected to provide a basis for cost-containment strategies, it is necessary to place emphasis on certain issues that have been generally neglected. Of these, the first is whether variation in resource utilization among health care providers is due to differences between health care users in such demographic characteristics as severity of illness. The second issue is how various actions of health care providers affect the variation in resource utilization even if the patients have similar characteristics. Third, and perhaps most important, is whether the variations in resource utilization have an impact on patient health outcome or satisfaction level.[3]

In recent years, studies on medical variation have tended to be comparisons among or between individual hospitals or physicians at the microlevel since financial pressures have affected the daily activities at both the micro- and macrolevels.[3,4] It has recently been determined that practice and resource-utilization variations have even more important and interesting implications when the evaluations on the same patients were made at the microlevel rather than macrolevel.[5] Considering the relevant broad literature, it might be concluded that there have been huge differences in the utilization of health care resources measured by length of stay (LOS) and surgical procedures pertaining to geographical area, hospital, and physician, and these differences are important even when the patient groups are comparable.[6–10] Although causal relationship has not been explained completely,[11] studies indicate that the resources used for patients having the same illness vary significantly by hospital,[12] physician, and patient characteristics.[13,14] These variations in medical practice are the rule rather than the exception,[5,15,16] and an intellectual crisis is being witnessed in modern medicine.[17]

Since traditional theories do not explain the variation phenomenon adequately, practice style has been suggested by Wennberg[17] and should be considered as a dominant factor affecting medical decision making. Considerations would include whether nearly every illness should be treated in a hospital or ambulatory care setting surgically or pharmaceutically because consumer or patient characteristics do not adequately explain the majority of differences in utilization. Although Eddy[18] and Eisenberg[19] as well as Wennberg[17] agree that clinical factors are the important predictors of patient resource utilization, they also suggest that the differences are marginal and the main economic and clinical variations occur at the physician level. These authors hold physicians responsible for decreased effectiveness and increased costs in health care. However, physicians' medical decisions are affected by a dozen factors such as working environment, payment method, waiting time, organizational factors, severity of illness, age, marital status, and the existence of secondary disease in patients.[20] For these reasons,

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studies on resource-utilization variability should place emphasis not only on health care providers and settings[21–24] but also on patients.[25]

As stated by Andersen and Mooney,[5] it is important to distinguish between the two variables observed in medical practices: legitimate and illegitimate variations. It is hypothesized that the concerns should be directed to illegitimate variations. For instance, the variations are acceptable if there are many available alternatives for treatment of a disease and determination of the best alternative is scientifically impossible.[26] Additionally, the variation might be due to operational variability stemming from equipment breakdown and/or personnel issues, variability in skill and knowledge level of the personnel, or unexpected occurrences in a patient's condition. Accordingly, health care providers or settings might be held responsible for resource-utilization variability and unnecessary practices if the variations in medical care utilizations cannot be explained by variations in severity of illness and patient expectation level.[27]

In related literature, there are many studies indicating a close and significant relationship between a physician's personal characteristics such as his/her specialization or age, as well as their standard medical practices including hospital admissions, requirements for laboratory tests, or following different diagnosis strategies.[6,8,28–37]

Studies primarily aimed at increasing effectiveness, very common in the Western world, are not given significant credence in the Turkish Health Care System. However, one of the rare studies in Turkey on this issue was carried out in asthma patients by Şahin et al.[38] This study assessed whether medical diagnostic test expenditures for treatment and follow-up procedures varied according to private and normal outpatient status. Although gender, age, treatment time, adaptation, and severity of illness were not significant predictors in affecting resource utilization according to outpatient status, the study revealed that private outpatients had an average of $24.1 more in diagnostic test expenditures when compared to normal outpatients. Another significant finding showed that physicians specializing in the treatment of allergies had requested more diagnostic tests compared to physicians specializing in chest and internal medicine.[38]

Noting these examples, two main questions must be addressed: Why are there differences in treatment of illnesses; and why do health care providers treat patients differently, even if the patients have the same illness and are comparable in terms of other demographic characteristics? The focus of this study is to provide an answer to the first question using a military teaching hospital in Turkey. More specifically, this study attempts to find the most important predictors of LOS in patients undergoing appendectomy surgery and examines the effects of patient as well as physician characteristics on the postoperative and total LOS in appendectomy patients.

Methods

The objectives of this study were to identify the main predictors of postoperative and total length of hospital stay in patients undergoing appendectomy in a military training hospital in Turkey, to examine the effects of each significant predictor, and to explain the reasons to health care managers with the goal of increasing efficiency in their hospitals.

The Study Setting

GATA Training Hospital, a 1,000 patient-bed facility under the Turkish Armed Forces, provides tertiary medical services with an annual bed occupancy of 85.9%. For the year 2004, 1061,085 outpatients were treated along with 29,353 hospitalized patients.

The Sample

The study is composed of 749 patients undergoing appendectomy surgery over a 2-year period (January 2003–January 2005) in the General Surgery Clinic at Gulhane Military Medical Academy, which is a military training hospital. Of the patients in the study, 417 (55.6%) were included in the sample. The remaining 332 patients were excluded because their medical records were either not accessible or were incomplete, and the information on independent patient demographics and clinical characteristics could not be obtained.

The Assumptions

Organizational characteristics and the quality of equipment used in the clinic were assumed to be the same over 2 years and did not change in any way that affected patient outcome. It was also assumed that all information written in the patients' medical records was accurate.

The Limitations

The study results cannot be generalized since this study was carried out in only one clinic and one hospital. Therefore, a greatly expanded study in the near future, covering additional procedures as well as additional sites (additional hospitals) that could be generalized, might be of significant value.

Data Collection Method and Tools

The demographic characteristics (age, gender, marital status, admission date, operation date, discharge date) of the patients in the sample were obtained from the hospital information system.

Clinical patient characteristics (severity of illness, physical examination, ultrasound, primary diagnosis, complication level, diagnosis, surgery team, existence of secondary disease, vital signs, existence of drainage, operative notes, etc.) were obtained by examining the patients' medical records archived in the General Surgery Clinic. In addition, pathology notes were accessed to determine severity of illness. In light of information obtained from medical records and pathology notes, the severity of illness was measured using four different indicators (symptom severity, complication severity, prognosis severity, and curability level) and assessed by a physician specializing in surgical medicine.

Data Analysis

Data were analyzed using bivariate statistical methods (*t* and *F* tests, correlation analysis) and multiple regression analysis to estimate the most important predictors of postoperative and total LOS of patients undergoing appendectomy surgery.

Results

Patient characteristics in the sample are summarized in Table I. Approximately 88% of patients were male, which was not

TABLE I

DEMOGRAPHIC AND CLINICAL CHARACTERISTICS OF PATIENTS

Demographic and Clinical Characteristics	*n*	%
Gender		
Female	50	12.0
Male	367	88.0
Marital status		
Single	237	56.8
Married	88	21.1
Unknown	92	22.1
Patient status		
Officers and noncommission officers	90	21.6
Military servants	281	67.4
Others	46	11.0
Existence of second disease		
No	311	74.6
Yes	106	25.4
Existence of drainage		
No	336	80.6
Yes	81	19.4
Total	417	100.0

surprising for a study population conducted in a military hospital and were relatively younger men (67.4%) serving their compulsory military time, with a mean age of 26.1 years. The second majority (21.6%) were active military officers and noncommissioned officers while the remaining were other military personnel, retired personnel, dependents, and nonmilitary patients. Approximately 25.4% of patients had a second disease in their medical history, and a drainage procedure was required in 19.4% based on exploration findings.

Table II compares the LOS for the patients by their demographic and clinical characteristics. There were statistically significant differences within the patient groups regarding LOS. The results suggest that patients' demographic and clinical characteristics are more likely to affect the LOS. In terms of both postoperative and total LOS, male patients serving temporary military duty stayed in the hospital approximately 1 day longer compared to female patients and others whose status differed from service members ($p < 0.05$). Presence of a drainage procedure was the other significant factor that prolonged the LOS statistically ($p < 0.05$). Those having a drainage procedure had a longer LOS (~2 days) compared to others, suggesting that the clinical characteristics were important factors affecting the LOS in the hospital. The existence of secondary disease did not affect the results significantly ($p > 0.05$).

The following four additional variables were also analyzed: predicting the severity of disease, severity of symptoms, presence of complications, and expected prognosis. The curability level of the case was included to determine whether an appendectomy operation was actually required. All of these variables were evaluated based on patients' medical records and rated on a scale ranging from 1 (lowest) to 4 (highest) by a surgeon. Results for Pearson correlation analysis evaluating the relationship and significance level between the clinical characteristics of the patients and the LOS are reported in Table III. Correlation coefficients that were statistically significant ($p < 0.05$) provide evidence that there was an important relationship between patients' clinical characteristics and their LOS. Those results simply suggest that patients whose severity of illness and curability level were high were more likely to have a longer hospital stay.

A multiple regression analysis was run to determine the significant predictors of postoperative and total LOS of the patients undergoing appendectomy (Table IV). The descriptive statistics on the overall models fitted for postoperative and total LOS showed both models were appropriate and statistically significant (*F* statistics), and the variables used in the models were relatively sound for explaining the variation in postoperative and total LOS of the patients (R^2 statistics). According to the results, service members serving their compulsory military duty were more likely to have longer postoperative and total LOS than

TABLE II

RESULTS OF BIVARIATE ANALYSES COMPARING THE LOS BY PATIENTS DEMOGRAPHIC AND CLINICAL CHARACTERISTICS

	Postoperative LOS (days)			Total LOS (days)		
Demographic and Clinical Characteristics	Mean	SD	*t*/*F*	Mean	SD	*t*/*F*
Gender			2.80[a]			2.04[a]
Male	3.7	2.4		4.3	2.3	
Female	2.7	1.9		3.6	1.8	
Marital status			1.08			0.73
Single	3.6	2.6		4.2	2.5	
Married	3.3	2.1		3.9	1.9	
Unknown	3.8	2.0		4.1	2.0	
Patient status			5.1[a]			3.8[a]
Officers and noncommission officers	3.3	2.1		3.8	1.8	
Military servants	3.8	2.5		4.4	2.4	
Others	2.8	2.1		3.6	2.0	
Existence of second disease			−0.9			−1.2
No	3.5	2.2		4.1	2.2	
Yes	3.8	2.6		4.4	2.5	
Existence of drainage			−6.1[a]			−5.8[a]
No	3.2	1.9		3.8	1.8	
Yes	5.0	3.2		5.4	3.2	
Total	3.6	2.4		4.2	2.3	

[a] $p < 0.05$.

TABLE III

PEARSON CORRELATION COEFFICIENTS BETWEEN THE PATIENTS' CLINICAL CHARACTERISTICS AND LOS

	Postoperative LOS (days)	Total LOS (days)
Severity of symptoms	0.125[a]	0.099[a]
Presence of complications	0.335[a]	0.327[a]
Expected prognoses	0.136[a]	0.129[a]
Curability level	0.111[a]	0.103[a]

[a] $p < 0.05$.

officers and noncommissioned personnel as well as other patients, including retired military members, dependents, and civilian patients. Among the clinical characteristics, only the presence of drainage and high complication rates were found to be statistically significant predictors.

Discussion

There are two main reasons that efforts to control variations in health care resource utilization would continue to accelerate: (1) increase in health care costs and inability to raise more resources and (2) quality and equity issues among health care users in accessing adequate health care resources. The first problem—a universal problem all over the world—should not be a problem as long as marginal benefit exceeds the marginal cost. However, there is a great deal of empirical evidence indicating that health care systems are experiencing serious inefficiency and ineffectiveness issues. Thus, those responsible in health care systems have been focusing on and questioning the allocation and usage of resources, what has been achieved and at what cost. These developments have increased the number of studies on resource utilization patterns and practices and suggest to those in charge that attention should now be focused on increasing the efficient usage of current health care resources rather than simply requesting allocation of more resources. The decisions made at the macrolevel on monetary amounts allocated to health care then begin to affect the decisions made by health care providers at the institutional or individual patient's level. If the resources do not meet expectations, then health care providers would need to make arrangements in accordance with patients' needs and expectations. As mentioned earlier, if the observed variations are legitimate, there is no need to be concerned and efforts for change should be directed elsewhere. However, related literature indicates that many noted variations should be considered improper or irregular and the managers and medical decision makers should pay more attention to these variations by conducting studies aimed at finding the likely predictors of variations in resource utilization.

Based on the relevant literature,[3,10,39–41] the determinants affecting variations in health care resource utilization might be grouped into three broad categories: (1) system-wide or organizational factors, (2) practice style factors stemming from health care provider characteristics, and (3) patients' demographic characteristics and clinical needs.

In this study, we have mainly focused on the second and third categories. Because the study was conducted in a single clinic at a military teaching hospital, we were unable to answer whether system-wide and organizational factors were significant variables in LOS for patients who underwent appendectomy. There were also few differences in terms of health care providers and the quality of equipment used in surgery.

Westert et al.[10] tried to answer the question of whether the difference in length of hospital stay for common surgical procedures is determined by individual differences between doctors in practice style or by systematic differences related to work (hospital) setting. This study, assessing the practices of 23 physicians in five different hospitals, discussed whether physicians conformed to local standards with regard to LOS decisions. These standards differed between hospitals or hospital wards. Another study by Cherkin et al.[14] investigated the relationship between patient characteristics (age, gender, ethnicity, existence of health insurance, functional status, and number of contacts with physicians) and physician characteristics (payment method, specialization area, and solo or group practice) and resource-utilization variation (the most frequently required

TABLE IV

MULTIPLE REGRESSION RESULTS ON THE MAIN DETERMINANTS OF POSTOPERATIVE AND TOTAL LOS OF THE PATIENTS

	Postoperative LOS			Total LOS		
Demographic and Clinical Characteristics	B	SE	*t*	B	SE	*t*
Constant	2.49	0.64	3.87[a]	3.56	0.63	5.67[a]
Age of the patients	0.02	0.01	1.26	0.01	0.01	0.98
Gender of the patients (male)	0.67	0.38	1.76	0.43	0.37	1.17
Patients' status						
Officers and noncommission officers	−0.74	0.30	−2.43[a]	−0.71	0.30	−2.41[a]
Others	−1.34	0.41	−3.29[a]	−1.16	0.40	−2.93[a]
Military servants	Reference			Reference		
Existence of second disease (yes)	0.41	0.26	1.62	0.47	0.25	1.88
Existence of drainage (yes)	0.84	0.42	1.99[a]	0.67	0.41	1.63
Symptom severity	−0.03	0.19	−0.16	−0.11	0.19	−0.57
Complication severity	1.40	0.48	2.92[a]	1.48	0.47	3.16[a]
Prognoses severity	2.06	1.60	1.29	2.08	1.56	1.33
Curability level	−2.07	1.70	−1.22	−2.28	1.65	−1.38
R^2	0.42			0.39		
F	8.53*			7.53[a]		

[a] $p < 0.05$.

15 diagnostic tests and expenditures per patient). Based on their findings, the authors concluded that physicians specializing in internal medicine had two times higher diagnostic test expenditures and devoted as much as 25% more time to their patients compared to family practice physicians. However, the authors also concluded that those physicians using more resources should not be labeled as ineffective in resource utilization since the outcome level of the patients, including improved health status and satisfaction level, was not measured in their study. A study by Feinglass et al.[42] assessed hospital resources used for patients with 12 different illnesses and found severity of illness was the most important factor affecting resource utilization, while patient demographic characteristics such as age, gender, and ethnicity were insignificant variables in hospital resource utilization.

As these relevant studies suggested, practice styles of health care providers in treating their patients were affected by their personal characteristics as well as professional backgrounds. Our study attempted to examine the effects of two other important provider characteristics that we collected during the study period: working experience in years and the academic title of the responsible surgeon. The initial analyses showed that the postoperative and total LOS for the patients were not related to and affected significantly by these characteristics, which was consistent with the findings of Westert et al.[10] It could be concluded that the decisions surgeons made about LOS for patients with the same illness were similar, and the surgeons were more likely to follow the informally set standards in the clinic to feel free from the criticism of their colleagues.

The results of this study suggest that postoperative and total LOS of the patients undergoing appendectomy are more likely to be affected by patients' demographic characteristics and clinical needs. Being male and temporary service members are patients' demographic characteristics lengthening both postoperative and total LOS. Actually, this finding is not surprising for those familiar with the Turkish military system because 16 months of military service is compulsory for males over age 20 and health care is provided by the government during this period. The study hospital is the only facility providing tertiary health care to service members as well as commissioned and noncommissioned military members and their dependents. The reason for longer hospital stays of male service members might be explained by the fact that these soldiers are kept in the hospital on purpose because they cannot be discharged until the decision is made that they have completely recovered without complications or infection. Their readmission might be compromised by circumstances in their duty places. However, discharge decisions for the patients in other categories might be more easily given since they are more likely to have access to good quality care in their own homes. Also, if a complication or infection develops, they can easily receive the needed care from military as well as other hospitals.

LOS for patients with a drainage procedure was two days longer than those without drainage. The findings also showed that those patients whose clinical needs were more severe measured by symptom, complication and prognoses severity, and curability level were more likely to stay in the hospital longer than other patients. However, the multiple regression results, taking all demographic and clinical characteristics of the patients into account, revealed that those patients who were temporary service members and whose complication level was more severe were more likely to stay longer in the hospital. Our study revealed consistent findings with those studies investigating the relationship between variation resources utilization and demographic characteristics of the patients[43–46] and the clinical needs of the patients.[47–49]

This study was conducted with the aim of providing information on using health care resources in a more effective manner to health care managers at the microlevel in a single hospital by determining the more significant predictors of postoperative and total LOS in patients undergoing appendectomy. Our results cannot be generalized to other clinics and hospitals because this study carried some limitations. However, overall the study provides significant evidence that some of the factors affecting variations in resource utilization can be avoided by following very simple administrative actions or, at the very least, the results of this study should make hospital managers more aware of the significant factors causing health care providers to act differently in their resource utilization decisions.

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