ORIGINAL ARTICLE

Appropriateness of Hospital Stays in a Pulmonology Department

Francisco Campos Rodríguez,[a] Inés de la Cruz Morón,[a] Araceli Díaz Martínez,[b] Luis López Rodríguez,[c] Francisco Muñoz Lucena,[a] and Martín Tejedor Fernández[b]

[a]Servicio de Neumología, Hospital Universitario de Valme, Sevilla, Spain
[b]Sección de Calidad y Documentación Clínica, Hospital Universitario de Valme, Sevilla, Spain
[c]Unidad de Investigación y Formación, Hospital Universitario de Valme, Sevilla, Spain

OBJECTIVE: To analyze the number of inappropriate stays generated by patients admitted through a pulmonology department over a 1-year period and to identify the causes and predictors of those stays.

PATIENTS AND METHODS: A representative sample of hospital stays corresponding to patients admitted by the pulmonology department at Hospital de Valme, Seville, Spain, in 2004 was analyzed retrospectively using the Appropriateness Evaluation Protocol. The review was conducted by 2 physicians who did not belong to the pulmonology department. Multiple linear regression analysis was performed to identify predictors of inappropriate stay.

RESULTS: Of the 1166 stays analyzed, 1038 (89%) were judged to be appropriate and 128 (11%) inappropriate. The most common reason for inappropriate stay was the delay in performing diagnostic tests and receiving results (64%). The main justification for appropriate stay was the need for respiratory treatment (59.6%) and parenteral treatment (46.1%). The predictive model generated by multiple linear regression analysis identified the following predictors of inappropriate stay: stay on a ward other than the pulmonology ward, diagnosis on admission, and season of the year.

CONCLUSIONS: The rate of inappropriate stay was low in comparison with other studies. The majority of inappropriate stays were attributed to delays in performing diagnostic tests and receiving results. Diagnosis on admission, season of the year, and stay on a ward other than the pulmonology ward were the strongest predictors of inappropriate stay.

Key words: *Appropriateness. Hospital stay. Appropriatenes evaluation protocol.*

Adecuación de las estancias hospitalarias en un servicio de neumología

OBJETIVO: Establecer la tasa de inadecuación de estancias en un servicio de neumología a lo largo de un año, así como conocer las causas que motivan dicha inadecuación y las variables predictoras de ésta.

PACIENTES Y MÉTODOS: Se ha analizado una muestra representativa de las estancias hospitalarias generadas por los pacientes ingresados en el Servicio de Neumología del Hospital de Valme durante el año 2004, utilizando como instrumento de evaluación el Appropriateness Evaluation Protocol (AEP) de forma retrospectiva. Realizaron la evaluación 2 investigadores no neumólogos. Se efectuó una regresión lineal múltiple para determinar qué variables eran predictoras de inadecuación.

RESULTADOS: Se analizó un total de 1.166 estancias, en las que se obtuvo una tasa de adecuación del 89% (n = 1.038) y de inadecuación del 11% (n = 128). La causa principal de inadecuación fue la espera de pruebas diagnósticas o resultados (64%), mientras que los criterios que con mayor frecuencia justificaron la estancia fueron los tratamientos respiratorios (59,6%) y el tratamiento parenteral (46,1%). El modelo predictivo obtenido tras la regresión lineal múltiple incluyó las siguientes variables: estancia en una planta diferente de la de neumología, diagnóstico de ingreso y estación del año.

CONCLUSIONES: La tasa de inadecuación de estancias fue baja en comparación con otros estudios, y debida sobre todo a la espera de resultados o realización de pruebas diagnósticas. Las variables predictoras de inadecuación fueron el diagnóstico de ingreso, la estación del año y que el paciente estuviese ingresado en una planta diferente de la de neumología.

Palabras clave: *Adecuación. Estancias hospitalarias. Protocolo de adecuación de la evaluación.*

Introduction

Concern over the quality of health care has increased in recent years in an attempt to make the utilization of health care resources more efficient. A common strategy for improving efficiency is to reduce medically inappropriate services. Inappropriate utilization of resources not only increases health care costs, but also requires

Correspondence: Dr. F. Campos Rodríguez.
Avda. Emilio Lemos, 19, portal 2, 4.º E. 41020 Sevilla. España.
E-mail: fcamposr@telefonica.net

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patients to undergo unnecessary tests or treatments.[1-4] One of the main aspects evaluated when analyzing quality of care among hospitalized patients is appropriateness of stay. A stay is considered to be appropriate if the reasons for remaining in hospital on any given day are justifiable, and inappropriate if it could have been avoided without compromising quality of care. By identifying the factors that contribute to inappropriate stays, we can modify these factors and help to make hospital management more efficient.

The best known and most widely used instrument designed to evaluate the appropriateness of hospital stays is the Appropriateness Evaluation Protocol (AEP), developed at the end of the 1970s by Gertman and Restuccia[5] and revised in the 1980s. This protocol has been validated in a large number of studies, including some performed in Spain.[6] As it has been demonstrated to have good sensitivity, specificity, and reproducibility, we can consider the AEP a reliable tool for evaluating appropriateness. The protocol consists of 27 criteria that cover medical care, nursing care, and the patient's clinical condition. If just 1 of the criteria is satisfied, stay for the day being analyzed is judged to be appropriate. If none of the criteria is satisfied, however, stay is judged to be inappropriate and the cause must be identified.

Most of the published studies that have used the AEP in Spain were undertaken in internal medicine departments,[4,7-11] while very few involved pulmonology departments.[12,13] Therefore, the aims of this study were to analyze the rate and causes of inappropriate stays in a pulmonology department of an acute care hospital over a 1-year period and to identify variables predictive of inappropriate stay.

TABLE 1.
Causes of Appropriate and Inappropriate Hospital Stays

	No.	%
Reasons for appropriate stays		
Clinical services		
Biopsy of internal organ on same day	26	2.2
New treatment requiring frequent dose adjustment	21	1.8
Monitoring required at least 3 times a day	3	0.2
Invasive procedure in the past 24 hours	49	4.2
Nursing care		
Mechanical ventilation and/or respiratory treatment	693	59.6
Intermittent or continuous parenteral treatment	538	46.1
Intramuscular or subcutaneous injections at least twice a day	50	4.2
Fluid balance	54	4.6
Major surgical wound and drainage care	44	3.7
Clinical situation of the patient		
Transfusion due to blood loss	4	0.3
Fever of at least 38ºC	29	2.4
Symptoms or signs due to acute hematologic disorders	8	0.6
Appearance of new, documented acute myocardial infarction or cerebrovascular accident	13	1.1
Reasons for inappropriate stays		
Test-scheduling problems	2	1.5
Nonworking day	7	5.4
Therapeutic and/or diagnostic decisions pending diagnostic tests, consultations with other departments, or receipt of results	82	64.0
Discharge planned but no written order	1	0.7
Overconservative management by physician	15	11.7
No diagnostic/treatment plan	2	1.5
Diagnostic tests and/or treatment which could have been performed on an outpatient basis	16	12.5
Discharge rejected by patient or family	4	3.1

Patients and Methods

Study Population

The Hospital de Valme in Seville, Spain, is an acute care hospital belonging to the public health service of Andalusia. It serves a reference population of 360 000 inhabitants and has a capacity of 513 hospital beds, 23 of which are allocated to the hospital's pulmonology department. Although the hospital covers most medical and surgical specialties, it does not have a thoracic surgery department. The pulmonology department performs a full range of standard pulmonology tests, including noninvasive procedures (lung function tests, carbon monoxide diffusion, skin tests, etc) and invasive procedures (fiberoptic bronchoscopy, transthoracic fine needle aspiration, blind pleural biopsy, insertion of pleural drainage tubes, chemical pleurodesis, and pleuroscopy). It does not perform tests that require surgical intervention (tumor surgery, surgical treatment of pneumothorax, or open lung biopsies).

To calculate an appropriate sample size, we considered the following parameters: number of stays, 8300 (reference year 2002); sampling error, 3%; 95% confidence interval (CI); and inappropriate stay rate, 20% (based on an earlier pilot study of the same department). The parameters yielded a necessary sample size of 632 stays. To obtain these stays, we chose a sample of 109 patients from the 633 admissions to the pulmonology department in 2004, based on a sampling ratio of 1:6, and analyzed all the stays generated by those patients. The study was approved by the hospital research ethics committee.

Evaluation Procedure

Two researchers trained in the use of the AEP, and who did not belong to the pulmonology department, jointly analyzed the appropriateness of each stay, using as a basis the patients' medical records. Stay for a given day was considered justified if just 1 of the 27 criteria specified by the protocol was satisfied. Patient medical records used to assess appropriateness of stay included progress reports, nursing reports, treatment records, and test results. If no criteria on the AEP were satisfied, the stay was considered inappropriate and the reason was recorded. No additional criteria were considered in this study.

Measures

In addition to assessing compliance with the AEP, the following variables were extracted from patient medical records: age; sex; main diagnosis that led to the admission according to the International Classification of Diseases, Ninth Revision, Clinical Modification; season of the year in which the patient was admitted;

source of the admission order; admitting physician; repeat hospitalization (at least 2 admissions in the previous 12 months, or 3 in the previous 5 years); appropriateness of admission; and stay on a ward other than the pulmonology ward. In all cases, the medical record was the sole source of information for these variables.

Statistical Analysis

The statistical package SPSS Version 13.0 was used for data processing and statistical analysis. The results were expressed either as percentages or means (SD), depending on whether the data were qualitative or quantitative. Means were compared using the Student *t* test if the data were normally distributed; otherwise the nonparametric Mann-Whitney test was used. For the comparison of the qualitative variables the χ^2 test with the Yates correction was used, and when necessary, the 2-tailed Fisher exact test. A *P* value less then .05 was considered significant.

Univariate analysis was performed using the rate of inappropriate stay as the dependent variable and each of the following independent variables: sex; age (older or younger than 65 years); day of stay (working day or nonworking day); season of the year; admission source (emergency or nonemergency department); admitting physician (pulmonologist or emergency department); repeat hospitalization; main reason for admission; appropriateness of admission (appropriate or nonappropriate); and stay on ward other than the pulmonology ward (yes or no). Multiple linear regression analysis was then performed to study the correlation between the dependent variable (rate of inappropriate stay) and various independent numerical variables. Nonnumerical variables were inserted using dummy variables. Goodness-of-fit was quantified using the multiple correlation coefficient.

Results

Series Characteristics

A total of 633 patients were admitted by the pulmonology department in 2004. Mean (SD) stay on discharge was 12.1 (9.5) days. The 109 patients selected for the study had a mean age of 63.8 (17.2) years and 70.3% were men. Admission was urgent in 93.7% of cases and recommended by a pulmonologist in 57.5% of cases. The 109 patients generated a total of 1166 stays, 73.1% of which corresponded to working days and 26.9% to nonworking days. Finally, a ward other than the pulmonology ward received 13.6% of the stays.

Appropriateness of Hospital Stays

A total of 1038 stays (89% of the series) were classified as appropriate and 128 stays (11%) as

TABLE 2.
Univariate Analysis*

Variables	Appropriate Stays	Inappropriate Stays	*P*	OR (95% CI)
Age			.19	0.76 (0.51-1.14)
>65 years	727/809 (89.9%)	82/809 (10.1%)		
<65 years	311/357 (87.2%)	46/357 (12.8%)		
Sex			.08	1.50 (0.95-2.37)
Male	721/820 (88.0%)	99/820 (12.0%)		
Female	317/346 (91.7%)	29/346 (8.3%)		
Type of day			.28	1.27 (0.83-1.92)
Nonworking	274/314 (87.3%)	40/314 (12.7%)		
Working	764/852 (89.7%)	88/852 (10.3%)		
Season			.02	1.56 (1.06-2.29)
Autumn-winter	663/731 (90.7%)	68/731 (9.3%)		
Spring-summer	375/435 (86.3%)	60/435 (13.7%)		
Admission source			.55	1.40 (0.57-3.67)
Emergency	971/1093 (88.9%)	122/1093 (11.1%)		
Scheduled	67/73 (91.8%)	6/73 (8.2%)		
Admitting physician			.59	1.13 (0.76-1.67)
Pulmonologist	594/671 (88.6%)	77/671 (11.4%)		
Nonpulmonologist	444/495 (89.7%)	51/495 (10.3%)		
Stay on nonpulmonology ward			<.0005	2.87 (1.78-4.61)
Yes	104/135 (77.1%)	31/135 (22.9%)		
No	934/1031 (90.6%)	97/1031 (9.4%)		
Repeat hospitalization			.52	0.79 (0.42-1.46)
Yes	145/159 (91.2%)	14/159 (8.8%)		
No	887/995 (89.2%)	108/995 (10.8%)		
Appropriate admission			.33	1.83 (0.63-6.05)
Yes	980/1104 (88.8%)	124/1104 (11.2%)		
No	58/62 (93.6%)	4/62 (6.4%)		
Diagnosis on admission			.04	
COPD	240/282 (85.2%)	42/282 (14.8%)		
Pneumonia	153/166 (92.2%)	13/166 (7.8%)		
Cancer	159/182 (87.4%)	23/182 (12.6%)		
Other	486/536 (90.7%)	50/536 (9.3%)		

*OR indicates odds ratio; CI, confidence interval; COPD, chronic obstructive pulmonary disease.

TABLE 3.
Multiple Linear Regression Model*

Variables	Slope	95% CI	*P*
Stay on nonpulmonology ward	13.8	9.42-18.22	<.0005
Admission season			
Summer	1		
Spring	11.26	6.81-15.70	<.0005
Winter	4.48	0.48-8.47	.02
Autumn	–3.85	–8.18-0.46	.08
Admission diagnosis			
COPD	1		
Pneumonia	–17.46	–22.14 to –12.77	<.0005
Cancer	–6.07	–10.58 to –1.56	.008
Other	–10.16	–13.55 to –6.77	<.0005

*CI indicates confidence interval; COPD, chronic obstructive pulmonary disease.

inappropriate. The main justification for appropriate stay was the need for respiratory treatment (59.6%) and parenteral treatment (46.1%) (Table 1). The most common reason for inappropriate stay was the delay in performing diagnostic tests, receiving results, or conducting consultations with other hospital departments (64%). Other reasons included tests that could have been done on an outpatient basis (12.5%), conservative management by the physician (11.7%), and stays on a nonworking day (5.4%) (Table 1).

Univariate Analysis

The results of the univariate analysis are shown in Table 2. Appropriateness of stay was independent of sex, age, admitting physician, working or nonworking day, source of admission, repeat hospitalization, and appropriateness or inappropriateness of admission. The highest rates of inappropriate stay were found for diagnosis on admission (*P*=.04), season of the year (*P*=.02), and stay on a ward other than the pulmonology ward (*P*<.0005).

Multiple Linear Regression

The following variables were included in the final multiple linear regression model (Table 3): *a)* stay on a ward other than the pulmonology ward, *b)* diagnosis of chronic obstructive pulmonary disease (COPD) as reason for admission, and *c)* admission in spring or winter. The multiple correlation coefficient for the model was 0.84.

Discussion

The results of this study indicate that the rate of inappropriate hospital stays for our department during 2004 (11%) was lower than that observed in other studies. The main cause of inappropriate stay was the delay in performing diagnostic tests, receiving results, and conducting consultations with other hospital departments. The following variables were independently associated with inappropriate stay: diagnosis of COPD as main reason for admission, admission in spring or winter, and stay on a ward other than the pulmonology ward.

This study analyzed the appropriateness of hospital stays in the pulmonology department of an acute care hospital. We decided to analyze a full year to avoid seasonal bias, and to use a larger-than-necessary sample size to ensure sufficient statistical power. Rather than analyze just 1 stay for each patient, we decided to analyze all the stays they generated. This approach has proven useful in other studies[7,9,12] and facilitates compilation of the data as it involves the processing of fewer medical records. Finally, the fact that all the stays were analyzed by 2 reviewers who did not belong to the pulmonology department ensured both impartiality and objectivity of the results.

Certain limitations that are inherent to the AEP and faced by all studies that use the protocol should be considered. Firstly, the AEP does not address the question of whether the actual diagnostic or therapeutic procedures the patient undergoes while in hospital are or are not appropriate. Rather, it assumes that they are always appropriate and clinically indicated. The AEP is designed to assess the level and timing of care provided, and as such, it might underestimate the rate of inappropriate stay.[2,14,15] Secondly, some of the criteria used to justify a stay might have become obsolete since the questionnaire was designed 25 years ago.[7] Finally, the AEP does not analyze alternative solutions to hospitalization or take patient preferences into account, and as a result, it could underestimate the rate of inappropriate stay.[2] Despite these limitations, however, the AEP is considered to be a relevant and valuable tool as it has been widely used and validated. It offers a simple, reproducible means of measuring appropriateness and performs well in terms of sensitivity and specificity. Consequently, it is practically the only tool used to analyze appropriateness in our setting.[6]

Few studies have analyzed appropriateness of stay in a pulmonology department. Bañeres et al[12] analyzed patients with COPD and cancer and found an inappropriate stay rate of 15.5% for the former and 40% for the latter. The main causes were social factors (34%) and tests that could have been performed on an outpatient basis (46%). Antolín-García et al[13] found a rate of inappropriate stay of 21.67% for 286 pulmonology stays. The highest rate was in patients with cancer (36.11%) and the lowest in patients with COPD (10.44%). The main cause was delay in performing tests or receiving results (55% of cases). Finally, a number of personal communications have reported results for specific diseases and much smaller samples.[16,17] Our inappropriate stay rate of 11% is substantially lower than those reported by the above studies, particularly considering that we did not use additional criteria.

The main reason for inappropriate stay in our study was delay in performing diagnostic tests and receiving results (64% of all cases). Given that the pulmonology department is responsible for managing standard pulmonology tests, inappropriate stays are usually due to delays in performing radiological tests (particularly computed tomography scans), receiving pathology results,

and conducting consultations with other hospital departments. This problem could be resolved with improved organization and coordination between different hospital areas in order to minimize the time taken to perform tests and receive results. If patients had been managed on an outpatient basis, 12.5% of the inappropriate stays we detected could have been avoided. Physicians' reluctance to treat patients on an outpatient basis is probably a reflection of their belief that diagnosis would be delayed if tests were ordered through an outpatient department. They, therefore, prefer to perform the tests while the patient is in hospital, even though this results in an increased rate of inappropriate stay. Finally, 11.7% of the inappropriate stays we detected were the direct result of the conservative approach of the attending physician, who considered that the patients should stay in hospital even though none of the AEP criteria was satisfied.

Stay on a ward other than the pulmonology ward, diagnosis on admission, and season of the year were the strongest predictors of inappropriate stay according to multiple linear regression analysis. Patients were basically admitted to other wards when there were not enough beds available in the pulmonology department. This occurred in months when pulmonology admissions were highest. The allocation of pulmonology patients to beds in other departments presents a series of additional difficulties as far as the management of these patients is concerned. Firstly, nursing staff and assistants are not generally familiar with relevant treatment procedures or specific care requirements (respiratory treatments, noninvasive ventilation, pleural drains, respiratory physiotherapy, etc), and secondly, the frequent transfers of the patients from one location to another and the physical distance between them and the attending physician mean that diagnostic tests and sometimes even discharge procedures are delayed. In our opinion, this is why pulmonology patients allocated to other wards had a significantly higher rate of inappropriate stay than those on the pulmonology ward. The solution would be to discontinue this practice.

Season of the year also influenced the rate of inappropriate stay, with the highest rates being recorded in spring and winter. The increased pressure on departmental resources due to the high number of patients admitted during these months, combined with the predominance of diseases that we found generated higher rates of inappropriate stay (such as COPD) explain this effect.

Finally, we found that the main diagnosis on admission also influenced the rate of inappropriate stay. Specifically, the diagnosis most consistently associated with inappropriate stay was COPD. We believe that our low overall inappropriate stay rate may have led us to overestimate the importance of this group, which was also the largest. The data, however, may also have been influenced by the individual characteristics of some of the patients, or the manner in which they were managed. Given that a high percentage of patients with COPD have severe or very severe airflow obstruction on admission, this subgroup generated a considerable proportion of inappropriate stays, particularly in the case of patients who were managed conservatively or who could have been managed on an outpatient basis.

In conclusion, although our rate of inappropriate stay was lower than that of other studies, we believe that it can be improved by implementing measures to reduce delays in performing and receiving the results of certain diagnostic tests and conducting consultations with other hospital departments. We also believe that it is essential to eliminate, or at least minimize, stays on other wards, and that physicians should pay greater attention to the early discharge of COPD patients. Finally, we believe that the problem of inappropriate stay during certain periods of the year, caused in our opinion by increased pressure on resources, can be resolved by allocating more health care staff at these times of the year.

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