**Assessment of Inappropriate Hospital Stays in a Cardiology Department**

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**INTRODUCTION**

The increasing demand for hospital care and concern regarding the quality of the services provided justify improving hospital efficiency by determining what constitutes inappropriate use of hospitalization and its possible correction.1 To make this assessment, methods have been developed to measure the appropriateness of hospital stays, the best known of which is the Appropriateness Evaluation Protocol (AEP).2,3 The model is valid and reliable,4 and is useful for identifying inappropriate stays in acute hospitals and the causes.5,6

Inappropriate stays in Spain represent between 15% and 44% of all hospital stays.7 Among the factors that determine appropriateness of stay is the type of department providing the care.8 For this reason, analysis of the factors that cause inappropriate stays for each specialty can provide valuable information for implementing specific corrective measures. This analysis has not been carried out previously in any cardiology department in Spain.

The objective of the present study was to determine the rate of inappropriate stays and associated factors in patients hospitalized in our cardiology department, with the goal of establishing and developing a strategy for decreasing their frequency.

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**Key words:** Inappropriateness. Hospital stays. Cardiology department. Appropriateness Evaluation Protocol. Health management.

Inappropriate stays are defined as those for which none of the criteria for appropriateness are met, in which case the causes of inappropriateness are recorded. Data collection was carried out by 6 researchers, among whom a kappa concordance index was obtained. Explanatory variables considered were: sex, type of admission (emergency or elective), and duration of hospital stay. Quantitative variables were recoded prior to their inclusion in the regression model. The duration of each admission was divided into three thirds and this variable was included in the analysis. Each patient’s time at risk was calculated as well as inappropriate stays for each one of them. From this data the inappropriateness rate (IR) was calculated, which was the outcome variable of interest.

**Statistical Analysis**

A gross analysis was carried out where the null hypothesis of no association between different explanatory variables and the inappropriateness rate was contrasted, with a confidence level of \( \alpha = .05 \). Finally, a multivariate analysis was performed using a generalized linear model assuming a Poisson distribution, obtaining adjusted estimates of the odds ratio for each of the variables and 95% confidence intervals (CI) with an over-dispersion correction factor.

### METHODS

**Study Population**

A retrospective observational analytical study was carried out in our hospital, which is a public entity and comprises 716 beds. The current work is a substudy within the global analysis of the hospital. The study period covered the year 2004, during which time 23,183 admissions were registered, 12% of these corresponding to the cardiology department, which had 35 beds during the year of the study.

**Assessment Tool**

A stratified random sampling was performed with proportionate allocation to the number of admissions in each department. Assuming an alpha error of .05, a statistical power of 80% and 30% expected inappropriate stays in the reference group (quotient \( =2 \)), the necessary size of 800 stays to detect risks >1.25 per stratum was obtained. After taking into account 15% possible losses, a sample size needed of 920 stays corresponding to the cardiology department was estimated. The definition of a case (inappropriate stay) and the data collection model were adjusted to the AEP hospital stay protocol. The appropriateness criteria used in the AEP are listed in Table 1. Inappropriate stays are defined as those for which none of the criteria for appropriateness are met, in which case the causes of inappropriateness are recorded. Data collection was carried out by 6 researchers, among whom a kappa concordance index was obtained. Explanatory variables considered were: sex, type of admission (emergency or elective), and duration of hospital stay. Quantitative variables were recoded prior to their inclusion in the regression model. The duration of each admission was divided into three thirds and this variable was included in the analysis. Each patient’s time at risk was calculated as well as inappropriate stays for each one of them. From this data the inappropriateness rate (IR) was calculated, which was the outcome variable of interest.

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DISCUSSION

Our study highlights a 27% rate of inappropriateness in our cardiology department. Although a priori this may seem high, it is within the range published by other authors in other hospital contexts.9–13 In fact, this rate is low compared with other departments at our center (general rate, 34% [95% CI, 33–35]).8 This is the first study utilizing the AEP for a cardiology department in Spain. Despite its limitations, this is an objective tool that is useful for comparisons between departments and, above all, for comparing a single department against itself at different points in time. We must point out that when cataloguing a stay as inappropriate, neither the appropriateness nor the quality of care given is assessed, but only that this care could have been provided at a lower level of care or in a shorter period of time.

VARIOUS ASPECTS OF THE RESULTS OBTAINED ARE WORTHY OF DISCUSSION. FIRST, THE INAPPROPRIATENESS RATES WERE HIGHER FOR OLDER AGE-GROUPS. THIS MAY BE DUE TO DELAYS IN DISCHARGING ELDERLY PATIENTS FOR SOCIAL REASONS NOT SPECIFIED IN THE CLINICAL HISTORY OR ALSO TO THE HIGHER INCIDENCE OF COMORBIDITIES IN THIS PATIENT GROUP, NOT REFLECTED IN THE AEP CRITERIA. SECOND, THE LIKELIHOOD THAT A DAY OF STAY MAY BE INAPPROPRIATE INCREASES WITH PROLONGED STAYS. IT COULD BE ARGUED THAT PROLONGED STAYS ARE DUE, IN MANY CASES, TO

TABLE 2. Rates of Inappropriateness Based on the Different Study Variables and 95% Confidence Intervals (CI). Gross Analysis and Analysis Adjusted for the Remainder of the Variables of the Odds Ratio, 95% CI, and Statistical Significance. Cardiology Service of the Clinical University Hospital of Valladolid, 2004

<table>
<thead>
<tr>
<th>Group</th>
<th>IR (95% CI)</th>
<th>OR (95% CI)</th>
<th>AOR (95% CI)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>23 (17.7-29.3)</td>
<td>1.27 (0.95-1.7)</td>
<td>1.24 (0.79-1.95)</td>
<td>.349</td>
</tr>
<tr>
<td>Men</td>
<td>29.2 (24.8-34.1)</td>
<td>2.45 (1.89-3.67)</td>
<td>2.84 (1.62-13.1)</td>
<td>.185</td>
</tr>
<tr>
<td>Age, y</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;45</td>
<td>10 (2.7-25.6)</td>
<td>2.94 (1.09-7.93)</td>
<td>2.85 (0.64-12.8)</td>
<td>.174</td>
</tr>
<tr>
<td>45-65</td>
<td>24.5 (18.6-31.6)</td>
<td>2.55 (1.65-3.09)</td>
<td>1.91 (1.15-3.17)</td>
<td>.015</td>
</tr>
<tr>
<td>&gt;65</td>
<td>29.4 (25-34.3)</td>
<td>1.15 (0.88-1.51)</td>
<td>0.86 (0.56-1.33)</td>
<td>.500</td>
</tr>
<tr>
<td>Type</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elective</td>
<td>24.8 (19.7-30.8)</td>
<td>1.15 (0.88-1.51)</td>
<td>0.86 (0.56-1.33)</td>
<td>.500</td>
</tr>
<tr>
<td>Emergency</td>
<td>28.5 (24-33.7)</td>
<td>1.15 (0.88-1.51)</td>
<td>0.86 (0.56-1.33)</td>
<td>.500</td>
</tr>
<tr>
<td>Hospital stay</td>
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<td></td>
<td></td>
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<tr>
<td>Less than 7 days</td>
<td>15.4 (11.7-20.3)</td>
<td>2.03 (1.42-2.9)</td>
<td>1.81 (1.08-3.06)</td>
<td>.028</td>
</tr>
<tr>
<td>More than 7 days</td>
<td>34.7 (29.9-40.3)</td>
<td>2.57 (1.81-3.68)</td>
<td>2.21 (1.31-3.74)</td>
<td>.004</td>
</tr>
<tr>
<td>Thirds</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First</td>
<td>15.6 (11.8-20.2)</td>
<td>2.03 (1.42-2.9)</td>
<td>1.81 (1.08-3.06)</td>
<td>.028</td>
</tr>
<tr>
<td>Second</td>
<td>31.6 (24.9-39.4)</td>
<td>2.57 (1.81-3.68)</td>
<td>2.21 (1.31-3.74)</td>
<td>.004</td>
</tr>
<tr>
<td>Third</td>
<td>40.2 (31.9-50)</td>
<td>1.15 (0.88-1.51)</td>
<td>0.86 (0.56-1.33)</td>
<td>.500</td>
</tr>
<tr>
<td>Total</td>
<td>27 (23.6-30.8)</td>
<td>1.15 (0.88-1.51)</td>
<td>0.86 (0.56-1.33)</td>
<td>.500</td>
</tr>
</tbody>
</table>

AOR indicates adjusted odds ratio; IR, inappropriateness rate each 100 patient-days; OR, odds ratio.

The data analysis was performed using the R 2.5.0® program. The percentages of the principal causes of inappropriateness were calculated in each of the thirds of the hospital stay.

RESULTS

During the study period 202 admissions to the cardiology department were assessed, which corresponded to a total of 818 days of stay. The mean (standard deviation) age of the patients was 65 (10.5) years and 127 (63%) were men. Seventy percent of the admissions were elective (n=142). The mean admission stay was 4.5 (5.4) (median, 2) days and 1.1 (3) (median, 0) days were inappropriate. The mean general kappa concordance index was 0.71, with a maximum agreement level of 0.76 (0.23) and a minimum agreement level of 0.67 (0.15).

The general inappropriateness rate in the study period was 27 (95% CI, 23.6-30.8) inappropriate stays each 100 patient-days. Multivariate analysis (Table 2) shows that the main risk factors of inappropriate stays were older age-groups, stays of more than 7 days and days during the last third of the hospital stay. Sex and type of admission (emergency or elective) did not influence inappropriateness of stay. The main causes of inappropriateness are shown in Figure.
waiting for results of tests that have already been performed. It is also possible that the patient’s daily progress report does not reliably reflect the reason for continued hospitalization. This is more frequent in prolonged stays, where daily progress notes refer to previous days’ progress notes. As we have already demonstrated, the absence of an ongoing record of patient progress increases the risk of inappropriate stay by 36%. In a strict sense, those stays are not truly inappropriate, but by not specifying the reason for continued hospitalization they are catalogued as such.

Our results indicate that inappropriate stays are more frequent in the final third of the stay, independently of total stay duration. Again, this may be related to daily progress reports that initially reflect appropriateness criteria but fail to do so in later reports. Furthermore, it is more probable that social reasons as much as comorbidities in the elderly cause inappropriate stays in the final days of hospitalization, and that in the first days severity criteria that deem the stay appropriate predominate.

To accurately assess the effect of other potential confounders on appropriateness of stays, such as care pressure, psychosocial factors, clinical and comorbidity aspects, would require additional research. This is not a simultaneous review, and inappropriateness may therefore be slightly overestimated, since the AEP can lead to such overestimation when the stay is not sufficiently justified. Other inherent limitations in the use of the AEP as the measuring instrument have been extensively described. It is unlikely that seasonal variations in the inappropriateness rates are a limitation in this study, since random sampling was performed over one year. One limitation that could have affected the results is the loss of statistical power derived from the fact that the number of stays analyzed was lower than expected and gave excessively broad CI results. Nonetheless, the magnitude of the risk and the CI range indicate that the results were not affected.

Finally, with regard to causes of inappropriateness, two of the most frequent causes (Figure) are closely related (pending tests and scheduling problems), and would be resolved by performing diagnostic tests more quickly once ordered, fundamentally catheterization and echocardiograms. Identifying measures for improvement with this objective and putting them into practice would most likely reduce the rate of inappropriate stays. Another frequent cause of inappropriate stays is that the diagnostic or therapeutic process could be carried out in an outpatient setting. In this respect, performing invasive procedures without hospital admission and starting up short-term care units should improve the rate of inappropriate stays.

REFERENCES