ORIGINAL ARTICLE

Relation between emergency department caseload and transfers from regional to other hospitals

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Objectives: To determine whether higher emergency department volume in regional hospitals generates a larger number of interhospital transfers and whether the referring hospital's resources influence the number of transfers ordered.
Methods: Descriptive, analytic study of a nonprobabilistic sample. The study was carried out in stages in 12 selected hospitals that were members of the regional hospital study group (GEMUHC, an interest section of the Spanish Society of Emergency Medicine ([SEMES]). Information was collected on the number of emergencies attended, the number of transfers, the size of the regional hospital, and the availability of an intensive care unit (ICU) in the regional hospital. Correlations between the studied variables were calculated, with statistical significance set at $P<.05$.
Results: Good correlation was observed between the volume of emergencies attended and the number of transfers carried out in the hospitals inside and outside Galicia. For hospitals without an ICU outside Galicia, the correlation was nearly perfect. When hospitals were grouped by size, there was high correlation between the 2 aforementioned variables and the number of transfers ordered by both small- and medium-sized hospitals.
Conclusions: The volume of interhospital transfers is directly proportional to the number of emergencies attended. The various regional hospitals all behave similarly, according to their size, location, and resources. [Emergencias 2010;22:28-32]

Key words: Interhospital transport services. Emergency health services. Regional hospital.

Introduction

Interhospital transport involves the transfer of patients from one medical centre to another in order to provide complementary diagnostic and therapeutic healthcare resources lacking in the referring centre[1]. Due to limited resources, district or regional hospitals frequently make use of type of transport.

The Regional Hospitals Emergency Medicine Study Group (GEMUHC), part of the Spanish Society of Emergency Medicine (SEMES)[2], was formed to analyze different aspects of the emergency services of regional hospitals. One of these aspects is precisely interhospital transport, which is common to all of them. GEMUHC represents the various regional hospitals participating in this study, which is complementary to another already published study[3] analyzing issues related to human resources for transportation, and uses the same data base.

It seems logical to think that those regional hospitals with a greater number of emergency cases should, in turn, generate a greater volume of transfers, when lacking the resources such as intensive care units (ICU) necessary to treat cases

themselves. However, this deduction may not prove to be true because of the influence of different aspects such as uneven age distribution of the population or heterogeneous patient acceptance protocols in the reference hospital ICUs.

In addition to the previously described heterogeneity of regional hospital emergency services in organization and structure[3-8], the relationship between emergency caseload and transfers from different regional hospitals should also reflect these differences. Based on this, we hypothesized that this relationship did not follow a common pattern. The objectives of this study therefore included: a description of the relationship, or lack thereof, between the number of emergencies attended and transfers from regional to reference hospitals, and an analysis of the variables, if any, which would allow grouping of the different hospitals in terms of similar behaviour.

Method

We performed a descriptive and analytical study, using non-probability convenience sampling by stages, selecting various autonomous communities first and, subsequently, 12 regional hospitals belonging to GEMUHC (Table 1). For a hospital to be included in the GEMUHC database, it had to be a regional hospital with fewer than 200 beds and represented by at least one attending physician. At the time of the study, 2003, GEMUHC was represented in 30 national regional hospitals.

To determine the emergency services level of activity, we recorded the number of ED visits and the number of transfers performed during two months for each centre. By transfer we refer only to medicalized transport involving both a physician and a nurse. Finally, because hospital resources could influence the number of transfers, these were assessed by analyzing two variables: the presence or absence of an ICU and the number of hospital beds.

We used Windows SPSS 12.0 to determine the goodness of fit for the distribution normal interval variables by Kolmogorov-Smirnov test and the correlation between scale variables by Pearson's correlation. We also used a model linear regression analysis with an independent variable to calculate the equations of linear regression. Quantitative variables were expressed as mean ± standard deviation (SD). Differences were considered to be significant when the p value was less than 0.05.

Results

The study included 12 regional hospitals of different sizes, care resources and volume of work from various autonomous communities (Table 1). The mean number of hospital beds was 116 (± 37); 75% of these hospitals did not have an ICU and the average daily number of ED visits was 108 (± 72).

No correlation was observed between the volume of emergency visits and transfers ($r = 0.3$, $R^2 = 0.09$, $p = 0.33$) on including all the hospitals of the sample. However, inspection of the graph (Figure 1) showed two imaginary straight lines on which the hospitals were grouped, suggesting that there was a relationship. Thus, good correlation was found for the group of hospitals in Galicia on the one hand ($r = 0.99$, $R^2 = 0.99$, $p = 0.02$) and for non-Galician hospitals on the other ($r = 0.78$, $R^2 = 0.62$, $p = 0.01$); and when non-Galician hospitals without ICUs were consid-

Table 1. Group of regional hospitals belonging to the Group for the Study of Emergency Medicine in Regional Hospitals (GEMUHC) that participated in the study

Hospital	Community	Nº beds	Nº emergencies*	ICU	Nº transfers**	% transfers***
San Pau y Santa Tecla	Catalonia	180	128	YES	15	0.4
Melilla	Melilla	172	121	YES	8	0.2
Motril	Andalucía	162	230	YES	14	0.2
Puerta del Rosario	Islands	120	85	YES	6	0.2
San Eloy	Basque Country	104	102	NO	14	0.5
Campo Arañuelo	Extremadura	100	65	NO	12	0.6
Los Arcos	Murcia	104	265	NO	28	0.4
Santiago Apostol	Castilla y León	125	83	NO	13	0.5
do Barbanza	Galicia	80	69	NO	28	1.4
do Salnes	Galicia	80	75	NO	32	1.4
Verin	Galicia	80	33	NO	11	1.1
La Seu d'Urgell	Catalonia	80	38	NO	5	0.4

*Average number of daily emergencies attended during the study period. **Average number of monthly emergency interhospital transfers during the study period. ***Percentage of monthly transfers of each hospital based on the monthly volume of emergencies attended. ICU: intensive care unit.

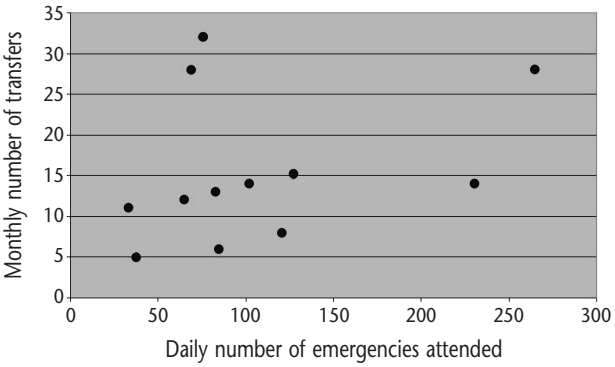

Figure 1. Relationship between the volume of emergencies and transfers.

ered, the correlation was even greater (r = 0.97, R^2 = 0.95, *p* = 0.004) (Figure 2).

On grouping hospitals according to size, there was very good correlation between the two variables, both in hospitals with less than 100 beds (r = 0.96, R^2 = 0.92, p = 0,03) and in those with 100-120 beds (r = 0.93, R^2 = 0.86, *P* = 0.07) although not statistically significant in the latter case. However, no correlation was found in hospitals with more than 120 beds (Figure 3).

Discussion

GEMUHC comprises a heterogeneous group of national hospitals with certain characteristics in common: they are all regional hospitals with fewer than 200 beds and have applied for membership of the Group. At the time of the study 30 hospitals belonged to GEMUHC, of which we selected 12 by means of non-probabilistic sampling, by stages. We chose this system to ensure a national distribution to include special areas such as Melilla or Fuerteventura, with very particular features, and, moreover, ensure representation of communities with greater presence in the Group, which could not be achieved with a system of random selection. We aimed to determine the influence of the number of emergencies attended on the volume of emergency transfers to reference hospitals, and analyze a series of very different hospitals in terms of geographical location, size, volume of emergencies attended and urgent care resources, such as the presence or absence of an ICU.

The number of beds varied considerably; the smallest had 80 and the largest had 180 beds, with a mean of 116 (± 37). A quarter of the sample had an ICU.

The workload of the emergency departments also varied considerably, so that the standard deviation for the average number was high 108 (±72), and the same tendency was observed in the volume of transfers 15 (± 9) per hospital per month.

This was therefore a highly heterogeneous group of hospitals in terms of the above-mentioned characteristics and in terms of the organization of resources for medical transportation, as previously noted by our group[3]. In addition, other authors have also remarked on the excessive heterogeneity of different national hospitals, regional or not, both in organizational aspects and human resources[7,8]. Thus it was possible that each hospital would respond in a very different way and common behaviour patterns would not be detected. Therefore, our study hypothesis involved the null hypothesis that there is no statistical correlation between the numbers of emergencies attended and interhospital transfers.

However, on inspection of the scatter plot relating the number of daily emergencies with the number of monthly transfers, even without evidence of a common pattern for all the hospitals, a clear linear relationship between different groups of hospitals was observed (Figure 1).

A striking feature was the existence of two imaginary lines, almost parallel, excluding the two points corresponding to the hospitals of do Salnés and do Barbanza, with similar slopes but different intersection constants, which showed correlations between these variables in two different groups of hospitals.

Analyzed in terms of different geographical areas, Galician hospitals showed a different pattern from the rest. They manifested a perfectly linear correlation, despite the small number of hospitals analyzed, which was statistically significant (Figure 2). On the other hand, when these Galician hospitals were excluded, we observed good correlation showing a similar pattern in all the other regional hospitals (Figure 2). This means that for the same volume of emergency patients seen, the Galician regional hospitals generated a greater volume of transfers than those of the rest of Spain, calculated by linear equations (Figure 2). The study was not designed to provide possible explanations for this fact.

Hospital resources, referring to the presence or absence of ICU and hospital size, also affected the volume of transfers generated according to the volume of emergencies attended. Thus, the correlation of non-Galician hospitals lacking an ICU was almost perfect (Figure 2). The same could be said of small hospitals with less than 100 beds, regardless of the region concerned, which showed a

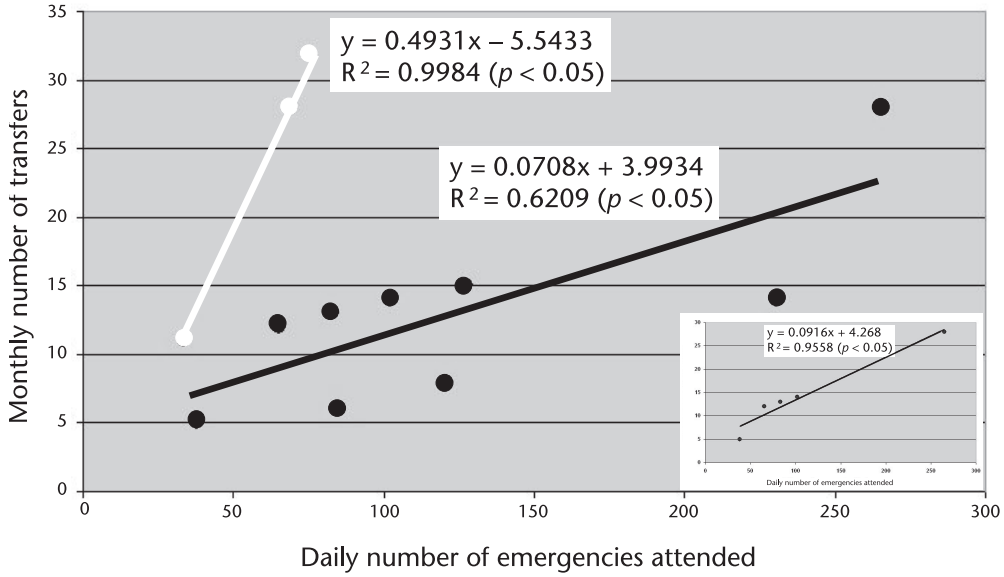

Figure 2. Relationship between the volume of emergencies and transfers according to hospital location: scatter plot points and regression lines (Galician Hospitals in white and non-Galician hospitals in black). For non-Galician hospitals without an intensive care unit, the lower right inset shows the scatter plot of points and regression line.

consistent pattern (Figure 3). Similarly, hospitals with 100-120 beds showed good correlation, although in this case without statistical significance, perhaps because of the reduced number of hospitals in the study (Figure 3).

For all these reasons, the study conclusions below are only applicable to GEMUHC hospitals, and can not be extrapolated to all Spanish regional hospitals: (1) the number of interhospital transfers from regional hospitals was directly proportional to the volume of emergencies attended, and this pattern was consistent for all except for Galician hospitals, which showed a greater number of transfers for the same volume of emergen-

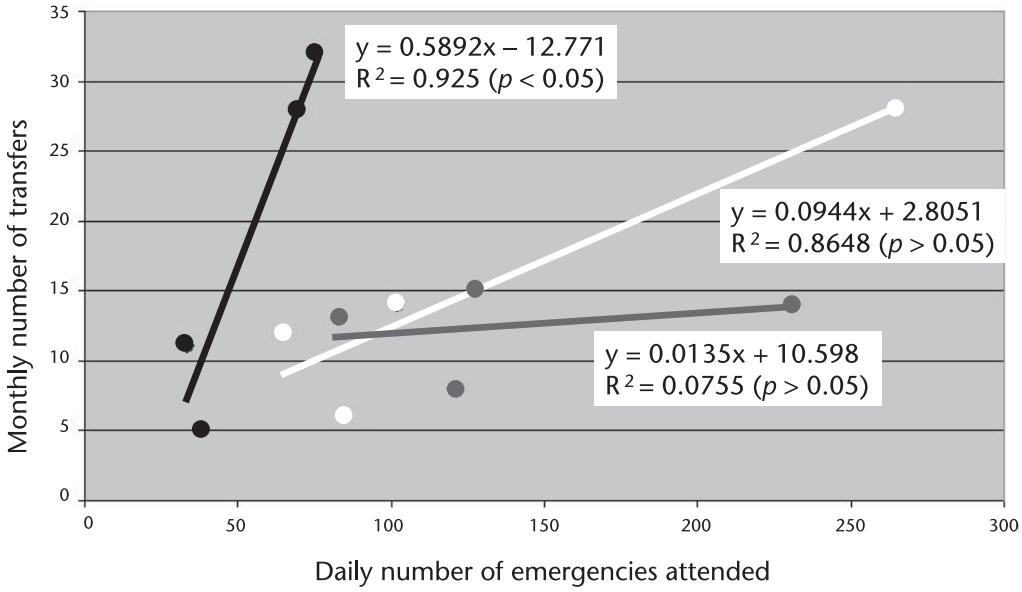

Figure 3. Relationship between the volume of transfers according to daily emergencies attended and hospital size: scatter plot of points and regression lines (small regional hospitals with less than 100 beds are shown in white, medium-size regional hospitals with 100-120 beds in black, and large regional hospitals with more than 120 beds are shown in grey).

cies attended; and (2) this pattern was even more homogeneous when resources were similar, so that the absence of an ICU, in non-Galician hospitals, generates a volume of transfers that is proportional to the number of emergencies attended, and that hospital size exerts a decisive influence, especially in the small ones, generating a volume of transfers that is proportional to the number of emergencies attended. In conclusion, the study hypothesis that that there is no statistical correlation between the two variables was rejected.

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Relación entre el volumen de urgencias y el de transportes interhospitalarios desde los hospitales comarcales.

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Objetivos: Determinar si un mayor volumen de urgencias atendidas en los hospitales comarcales genera un mayor número de transportes interhospitalarios, inquiriendo si el tamaño o los recursos de los hospitales emisores pudieran influir.

Método: Estudio descriptivo y analítico, mediante un muestreo "no probabilístico" por etapas, seleccionando 12 hospitales comarcales pertenecientes al Grupo de Estudio de la Medicina de Urgencias y de los Hospitales Comarcales (GEMUHC). Se determinó el número de urgencias atendidas, el número de traslados realizados, el tamaño del hospital comarcal y la disponibilidad de unidad de cuidados intensivos (UCI) en el propio centro. Se realizó un análisis de correlación entre las diferentes variables.

Resultados: Se demostró una buena correlación entre el volumen de urgencias y de traslados en el grupo de hospitales gallegos por un lado y en los no gallegos por el otro, y se apreció que cuando los hospitales no gallegos carecían de UCI la correlación era casi perfecta. Cuando los hospitales se agruparon en función de su tamaño se demostró una muy buena correlación estadística entre las dos variables antes comentadas tanto en los hospitales pequeños como en los de mediano tamaño.

Conclusiones: El volumen de transportes interhospitalarios es directamente proporcional al número de urgencias atendidas, en el que se observa homogeneidad en el comportamiento de los diferentes hospitales comarcales en función de su tamaño, de su localización y de sus recursos. [Emergencias 2010;22:28-32]

Palabras clave: Transportes interhospitalarios. Urgencias. Hospitales comarcales.