

## ORIGINAL ARTICLE

## Triage level assignment and nurse characteristics and experience

Elisenda Gómez-Angelats, Òscar Miró, Ernesto Bragulat Baur, Alberto Antolín Santaliestra, Miquel Sánchez Sánchez

**Objective.** To study the relation between nursing staff demographics and experience and their assignment of triage level in the emergency department.

**Methods.** One-year retrospective observational study in the triage area of a tertiary care urban university hospital that applies the Andorran-Spanish triage model. Variables studied were age, gender, nursing experience, triage experience, shift, usual level of emergency work the nurse undertakes, number of triage decisions made, and percentage of patients assigned to each level.

**Results.** Fifty nurses (5 men, 45 women) with a mean (SD) age of 45 (9) years triaged 67 803 patients during the year. Nurses classified more patients in level 5 on the morning shift (7.9%) than on the afternoon shift (5.5%) ( $P=0.003$ ). The difference in the rate of level-5 triage classification became significant when nurses were older ( $\beta = 0.092$ ,  $P=0.037$ ) and experience was greater ( $\beta = 0.103$ ,  $P=0.017$ ). The number of triages recorded by a nurse was significantly and directly related to the percentage of patients assigned to level 3 ( $\beta = 0.003$ ,  $P=0.006$ ) and inversely related to the percentages assigned to level 4 ( $\beta = -0.002$ ,  $P=0.008$ ) and level 5 ( $\beta = -0.001$ ,  $P=0.017$ ).

**Conclusion.** We found that triage level assignments were related to age, experience, shift, and total number of patients triaged by a nurse.

**Keywords:** Triage. Nursing. Emergency health services.

### *Relación entre la asignación del nivel de triaje y las características y experiencia del personal de enfermería*

**Objetivo.** Investigar la relación entre las características demográficas y experiencia de los enfermeros que realizan triaje y la asignación de pacientes a un determinado nivel de urgencia.

**Método.** Estudio observacional retrospectivo llevado a cabo durante 1 año en el área de triaje de un hospital universitario terciario que usa el Model Andorrà de Triatge/Sistema Español de Triage (MAT/SET). Variables: edad, sexo, experiencia en enfermería, experiencia en triaje, turno de trabajo, nivel asistencial donde trabajaban, número de triajes realizados y porcentaje de pacientes asignados a cada nivel de triaje.

**Resultados.** Se incluyeron 50 enfermeros (5 hombres y 45 mujeres) con una edad de 45 (DE 9) años que efectuaron 67.803 triajes. Los enfermeros del turno mañana clasificaban más pacientes en el nivel 5 que las de turno tarde (7,9% frente a 5,5%,  $p = 0,003$ ). Este mayor porcentaje en el nivel 5 también se registraba de forma significativa cuanto más edad tenía el enfermero ( $\beta = 0,092$ ,  $p = 0,037$ ) y cuanto mayor experiencia acumulaba ( $\beta = 0,103$ ,  $p = 0,017$ ). El número de triajes efectuados por cada enfermero se relacionó, significativa y directamente, con el porcentaje de pacientes clasificados en nivel 3 ( $\beta = 0,003$ ,  $p = 0,006$ ) e, inversamente, con el porcentaje de pacientes clasificados en nivel 4 ( $\beta = -0,002$ ,  $p = 0,008$ ) y en nivel 5 ( $\beta = -0,001$ ,  $p = 0,017$ ).

**Conclusión.** Se ha objetivado una relación entre la edad, la experiencia acumulada, el turno de trabajo y el número total de triajes que efectúa un enfermero con el nivel de triaje asignado.

**Palabras clave:** Triaje. Enfermería. Servicio de Urgencias.

### Introduction

Triage is a process that aims to optimize the waiting time of patients according to their degree of urgency, with the intention of identifying critical patients early and stratifying, at priority visit levels, the rest. In hospital emergency services (HES), where demand and clinical needs often exceed resources<sup>1</sup>, triage is an essential tool to manage clinical risk, allocate resources and guarantee patient safety<sup>2,3</sup>. Indeed, risk identification improves clinical

safety and allows HES to allocate more equitable resources.

In Spain<sup>4</sup>, as in many other countries<sup>5</sup>, triage is carried out by nurses. Among the different triage scales with 5 levels of urgency<sup>6-10</sup>, many Spanish HES have adopted the Spanish Triage System (SET), based on the Model Andorrà de Triatge (MAT)<sup>7</sup>. The MAT starts from the theoretical bases of the Canadian scale and evolves towards a model based on symptomatic categories, with discriminants and severity scales<sup>7</sup>. The combination of

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general algorithms, gravity scales, discriminants and specific questions gives rise to the base scale of MAT<sup>8</sup>.

The nurses who perform this work are accredited and have the help of a program called web\_e-PAT, designed to guide and facilitate clinical decision making and minimize the variability in patient prioritization. However, the exact profile that triage nurses should have is not clearly defined, although years of experience and previous knowledge and skills could, at least in theory, influence the outcome of the triage<sup>11</sup>. The objective of present study is to establish, from the analysis of the triages carried out during 1 year, if there is any relationship between the demographic characteristics and years of professional experience of the nurses and the level of triage finally assigned to each patient in a HES.

## Method

Retrospective study based on the triage levels assigned by the nurses, of the morning and afternoon shifts, with the use of the MAT for 1 year (from April 1, 2013 to March 31, 2014). The study was approved by the Clinical Research Ethics Committee of the Hospital Clínic of Barcelona.

The study was carried out in the Emergency Department of a 700-bed high-tech tertiary university hospital located in the city of Barcelona. The centre is a referral hospital of some 550,000 inhabitants, and in its Emergency Department are attended annually more than 90,000 general emergencies, which do not include emergencies of the specialties of obstetrics and gynaecology, paediatrics and ophthalmology, which are resolved in another location. The healthcare levels of the HES, since November 2010 and after a reorganization of the previously published assistance<sup>12</sup>, are consistent with the triage system used: level 1 or resuscitation, level 2 or emergencies, level 3 or emergencies, and level 4-5 or minor emergencies. In the night shift, levels 4-5 are closed and all these emergencies are attended in level 3.

Since February 2009, the triage is done by nurses specially trained in the use and application of MAT distributed in 3 work shifts: morning (from 8 to 15 hours), afternoon (from 15 to 22 hours) and night (from 22 to 8 hours). The nurses are assigned to a specific level of care where they usually develop their work and, on a rotating basis, some of their work shifts are carried out in the triage. The day they are assigned to perform the triage they exclusively do this function. Due to vacations, casualties and unforeseen events, not all nurses trained in triage do the same number of shifts, hence some classify more patients than others during 1 calendar year. Since during the night there are no nurses assigned to level 4-5 and this change in the functioning of the HES supposes different conditions and a possible bias in the allocation of the level of triage, the population finally studied has been the 50 nurses of the morning shifts and afternoon they perform triage. The MAT combines a series of general algorithms, severity scales, discriminants and specific questions to establish the le-

vel of urgency<sup>8</sup>, but the nurse, based on his experience and if he considers it appropriate, can qualify or modify the level of urgency. Also, to be able to compare the triage results of each nurse, the authors have assumed that the group of patients that classifies each of them in the morning and afternoon shifts is very similar, since the arrival of patients is totally random in each of these shifts of job.

Of each nurse who had performed triage during the study period, age, sex, experience in the emergency department (years), experience in triage (years), number of triages performed during the study year, shift of usual work (morning or afternoon) and the level of care to which they were assigned (level 1- 2, level 3 or level 4-5). The triages performed by each nurse were obtained from the triage program itself, since it records the level of triage that is assigned to a specific patient and the nurse who performs the triage. With this data, the percentage of patients assigned by each nurse to each of the 5 levels of triage was calculated.

Quantitative variables are presented as mean and standard deviation (SD) and qualitative variables, as absolute values and percentages. To establish if there was any factor that related to the percentage of patients that was finally assigned to a specific triage level, we used, in the case of the groups created by the qualitative variables (sex, work shift and health care level) of work), the one-way ANOVA for independent data, after checking normality with the Kolmogorov-Smirnov test. In the case of quantitative variables (age, experience in emergency and triage and number of triages performed), Pearson's simple linear regression was applied, establishing the correlation coefficients and their respective 95% confidence intervals (CI). The application of multiple regression did not proceed due to the results obtained. All results were considered statistically significant when the value of  $p < 0.05$ . The statistical analysis was carried out with the statistical package SPSS (SPSS 20.0, SPSS Inc., Chicago, Ill).

## Results

A total of 50 nurses (5 men and 45 women) with an average age of 45 (SD 9) years were included. Of these, 22 (44%) worked on the day shift and 28 (56%) on the afternoon shift. The nurses on the morning shift were older than those on the afternoon shift [(51 (SD 8) years vs. 40 (SD 6) years;  $p < 0.001$ )]. According to the workplace in the emergency area, 25 (50%) belonged to level 1-2, 15 (30%) to level 3 and 10 (20%) to level 4-5. Overall, the group had 21 (SD 9) years of experience in the nursing profession and 4 (SD 1) years of experience in the use of MAT.

During the study period, 67,803 triages were performed, with an average per nurse of 1,359 (SD 902). The nurses of the morning shift performed, on average, 1,579 (SD 1,008) triage, while those of late shift, 1181 (SD 784). The distribution of the triage by shift and place of work is shown in Table 1.

**Table 1.** Number and percentage of triage assigned to each level per shift and place of work of all nurses

Shift	Place of work	Level 1 n (%)	Level 2 n (%)	Level 3 n (%)	Level 4 n (%)	Level 5 n (%)	Level n (%)
Morning (n = 22)	Level 1-2 (n = 9)	76 (0.5)	1.523 (10.5)	8.227 (56.7)	3.833 (26.4)	842 (5.8)	14.501
	Level 3 (n = 6)	71 (0.5)	1.261 (9.7)	6.876 (52.8)	3.871 (29.7)	931 (7.2)	13.010
	Level 4-5 (n = 7)	47 (0.6)	691 (9.6)	3.866 (53.6)	2.081 (28.8)	531 (7.4)	7.216
	Subtotal	194 (0.6)	3.475 (10.0)	18.969 (54.6)	9.785 (28.2)	2.304 (6.6)	34.727
Evening (n = 28)	Level 1-2 (n = 16)	158 (0.9)	1.688 (10.2)	9.072 (54.8)	4.879 (29.5)	750 (4.5)	16.547
	Level 3 (n = 9)	143 (1.0)	1.587 (10.7)	8.313 (56.2)	3.931 (26.6)	825 (5.6)	14.799
	Level 4-5 (n = 3)	7 (0.4)	114 (6.6)	870 (50.3)	629 (36.4)	110 (6.4)	1.730
	Subtotal	308 (0.9)	3.389 (10.2)	18.255 (55.1)	9.439 (28.5)	1.685 (5.1)	33.076
All (n = 50)	Level 1-2 (n = 25)	234 (0.7)	3.211 (10.3)	17.299 (55.7)	8.712 (28.1)	1.592 (5.1)	31.048
	Level 3 (n = 15)	214 (0.8)	2.848 (10.2)	15.189 (54.6)	7.802 (28.1)	1.756 (6.3)	27.809
	Level 4-5 (n = 10)	54 (0.6)	805 (9.0)	4736 (52.9)	2710 (30.)	641 (7.2)	8.946
	Total	502 (0.7)	6.864 (10.1)	37.224 (54.9)	19.224 (28.3)	3.989 (5.9)	67.803

n = number.

When comparing the percentages of distribution of patients between the 5 levels of triage and the variables collected (Tables 2 and 3), it was established that the nurses who Working in the morning shift classified a higher percentage of patients in level 5 than their colleagues in the late shift (7.88% vs. 5.46%,  $p = 0.003$ ). This greater percentage of patients in level 5 was also registered in a significant way when the nurse was older ( $\beta = 0.092$ ,  $p = 0.037$ ) and how much higher nurse experience was accumulated ( $\beta = 0.103$ ,  $p = 0.017$ ).

The number of triages performed by each nurse during the study period was significantly and directly related to the percentage of patients classified at level 3 ( $\beta = 0.003$ ,  $p = 0.006$ ) and, inversely, to the percentage of patients classified at level 4 ( $\beta = -0.002$ ,  $p = 0.008$ ) and level 5 ( $\beta = -0.001$ ,  $p = 0.017$ ). The coefficient of determination ( $R^2$ ) of these relationships was able to explain 14.5%, 13.8% and 11.4% of the variability of the percentage of patients assigned, respectively, to level 3, level 4 and at level 5 (Figure 1).

## Discussion

The present study reveals for the first time, as far as the authors know, a relationship between the number of triages performed by a nurse and the level of triage

selected. In fact, the more triages you perform, the more likely you are to classify a greater percentage of patients in level 3 and a lower percentage in levels 4 and 5. This finding, if confirmed, would show a non-attributable degree of variability in MAT/SET exclusively at random and that would directly affect the reliability of the model. This would have consequences on patient flows, so that certain circuits could be saturated more than others, with the consequent negative effect on the equity and the degree of resources assigned to each patient.

Reliability refers to the accuracy of an instrument. Its two main components are temporal stability, that is, the results vary little when measured on different occasions, and the internal consistency or the degree to which the items that make up the test measure the same construct. The reliability of the MAT/SET was established based on the degree of agreement that different professionals presented when classifying the levels of urgency of a group of clinical scenarios<sup>13</sup>. Although the degree of agreement was high, this reliability has not been proven in real conditions. This problem, universally recognized in the different scales of triaging of 5 levels, is still to be solved, since there is no "gold standard" for the triage with which to compare the results of the classifications of the different professionals<sup>3</sup>. Nowadays, there are more and more doubts that the

**Table 2.** Comparison of the percentage of patients classified in each level of triage by each nurse according to the categorical variables studied

Variable	Level 1 Mean (SD)	Level 2 Mean (SD)	Level 3 Mean (SD)	Level 4 Mean (SD)	Level 5 Mean (SD)
Sex					
Female (n = 45)	0.77 (0.44)	9.62 (3.78)	53.18 (6.10)	29.77 (4.92)	6.74 (2.94)
Male (n = 5)	0.57 (0.34)	10.51 (5.26)	56.90 (8.02)	27.39 (4.08)	4.63 (2.25)
p value	0.32	0.63	0.22	0.30	0.13
Shift					
Morning (n = 22)	0.55 (0.36)	9.84 (3.76)	52.58 (7.35)	29.33 (5.15)	7.88 (3.20)
Evening (n = 28)	0.91 (0.42)	9.60 (4.06)	54.31 (5.39)	29.69 (4.70)	5.46 (2.23)
p value	0.062	0.83	0.34	0.79	0.003
Number of triages					
Level 1-2 (n = 25)	0.83 (0.51)	10.16 (4.05)	53.95 (6.15)	29.21 (4.27)	5.96 (3.06)
Level 3 (n = 15)	0.79 (0.34)	9.98 (4.05)	54.55 (6.49)	28.19 (4.61)	6.48 (2.35)
Level 4-5 (n = 10)	0.51 (0.22)	8.17 (3.17)	51.07 (6.48)	32.35 (5.88)	8.03 (3.13)
p value	0.12	0.38	0.37	0.10	0.17

**Table 3.** Comparison of the percentage of patients classified in each level of triage by each nurse according to the continuous variables studied

Variable	Level 1	Level 2	Level 3	Level 4	Level 5
Age (years)					
β	-0.006	-0.017	-0.063	0.009	0.092
CI 95% of β	-0.019 to 0.008	-0.137 to 0.104	-0.257 to 0.132	-0.141 to 0.159	0.006 to 0.179
p value	0.399	0.780	0.518	0.904	0.037
Nursing experience (years)					
β	-0.008	-0.021	-0.059	-0.002	0.103
CI 95% of β	-0.021 to 0.005	-0.139 to 0.098	0.251 to 0.133	-0.149 to 0.146	0.019 to 0.187
p value	0.201	0.728	0.539	0.983	0.017
Triage experience (years)					
β	-0.080	0.434	-0.669	0.210	-0.001
CI 95% of β	-0.179 to 0.020	-0.490 to 1.358	-2.159 to 0.821	-0.920 to 1.341	-0.699 to 0.697
p value	0.113	0.349	0.371	0.710	0.999
Number of triages (n)					
β	-2.3E-0.005	0.001	0.003	-0.002	-0.001
CI 95% of β	0.000 to 0.000	-0.001 to 0.002	0.001 to 0.005	-0.003 to -0.001	-0.002 to 0.000
p value	0.734	0.254	0.006	0.008	0.017

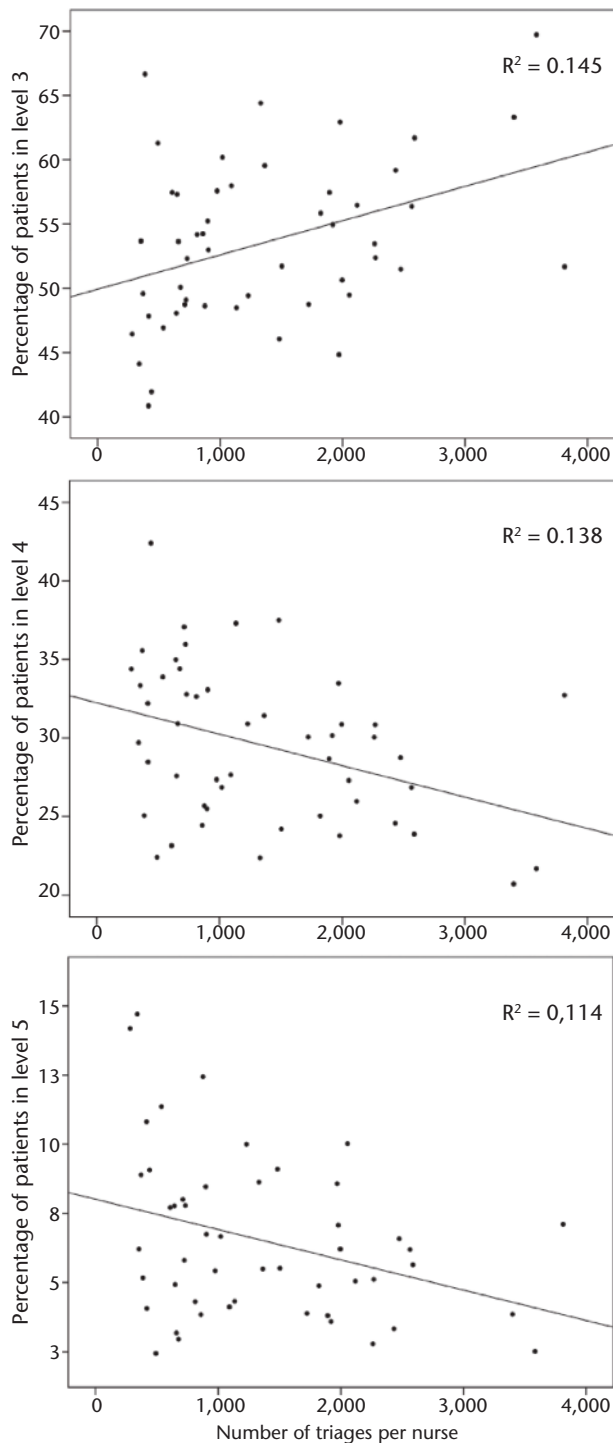
CI: Confidence interval; n= number.

different 5-level triage systems awaken about their reliability and accuracy<sup>14-17</sup>. In fact, in a recent review, Kuriyama et al.<sup>18</sup> found a total of 57 studies that attempt to validate the most universally disseminated triage systems. The authors emphasize that they all end up creating their own reference standard (often a panel of experts) or end up using a combination of gravity and resource utilization that pretends to approximate, without being so, the definition of urgency. Therefore, they conclude that there is no consensus on what should be the way to validate a triage system, and that this difficulty partly explains the variability. And this is not true only for the adult triage scales, but in a review made of the pediatric triage scales, the same conclusion is reached<sup>19</sup>. It is not unreasonable to think, in light of these conclusions, that the MAT/SET is not exempt from variability either. In addition, this variability can be seen even more influenced by the complex interaction of factors that characterize triage in real situations. Part of these factors could be associated with the characteristics and experience of the nurse who performs the triage<sup>11</sup>. Although, the majority of studies carried out to date have not found a significant association between the effectiveness of the triage and the years of experience, either only as an emergency nurse or triage<sup>20-22</sup>. However, there is a general consensus that triage scales pivot around what has been called "experienced nurses". The present study can serve as an argument in favour of this hypothesis. In effect, the most experienced nurses, who are also the oldest and who are mostly assigned to the morning shift, classify a greater percentage of patients in level 5. This finding, difficult to interpret, could highlight the fact that the most experienced nurses they are really able to better discriminate lesser emergencies than their less experienced colleagues. All in all, the distribution of the areas care where it has been done in this study could to some extent justify this association. In effect, levels 4 and 5 are attended in the same physical space, a fact that can lead less experienced nurses to minimize the importance of classifying or discriminating between these two levels. Future investi-

gations in this regard should try to clarify this association.

However, according to the authors, the most relevant finding of this study, from a clinical point of view, is the direct relationship between the number of triage performed by each nurse and the percentage of patients classified as level 3. Some years, Considine et al.<sup>23</sup> already pointed out this possibility, but, certainly and despite its importance, it has gone largely unnoticed, possibly because it is a study carried out with simulated clinical scenarios. It established a positive and significant correlation between the over-triage and the number of shifts performed by the nurses in triage, although the correlation coefficient was not specified. In the present study, the correlation coefficient found ends up explaining that approximately 15% of the variability that exists in the assignment or not of a level of triage 3, 4 or 5 to a specific patient depends on the number of triages performed by a certain nurse. Although the figure obtained may seem modest, it should not be underestimated, since it indicates that 15 of every 100 patients that a nurse classifies of level 3 could be overstretched. And in some HES where congestion and saturation are frequently experienced in their care circuits, this misallocation of the level of triage may have important consequences on the flow of patients and, ultimately, on the equity of care that, Paradoxically, triage guarantees. Since, as has been stated so far, there is no "gold standard" for the triage, the present results are difficult to interpret. In the study by Considine et al.<sup>23</sup> it was pointed out that the fact that the nurses were repeatedly exposed to forms of presentation of certain very similar pathologies would establish a certain familiarity with them, which would end up classifying in the same level of triage. A certain degree of "exhaustion or routine" could also be adduced that, in one way or another, would lead to contemplate the different presentations as similar and end, therefore, assigning them an average level of triage which, in this case, would be level 3.

Whether true or not, these findings justify future studies that should clarify whether, really and in spite of



**Figure 1.** Diagram of correlation-dispersion points between the number of triages performed and the percentage of patients that are classified as level 3 (above), level 4 (center) and level 5 (below).

being accredited, nurses tend to discriminate less the more triages they perform.

The present study presents some limitations that should be noted. In the first place, it is a retrospective study, which has been carried out in a single centre, a fact that can always call into question its external vali-

dity. Secondly, the most widespread triage scale in the Spanish State has been analysed and, therefore, the findings can only refer to it, without knowing if they are generalizable to the rest of the scales. Third, there has not been a random assignment of patients to each nurse. The time spent in each triage by each nurse, the reasons for consultation, the clinical status and the age of the patients have not been recorded either. This fact, however, should be compensated for by the randomness with which they attend the HES and that would imply that all the nurses would have a percentage of patients in each level of urgency significantly similar. Finally, the interpretation of the results is complicated since there is no "gold standard" for the triage and, therefore, it is difficult to know if all the triages were well performed by each and every one of the nurses.

Although it is necessary to emphasize the importance of triage in HES<sup>24</sup>, there is a need to professionalize and standardize it using tools that do not depend exclusively on the intuition and experience of the nursing staff<sup>25</sup>. As a conclusion of this study it can be said that there has been a relationship between age, accumulated experience, work shift and the total number of triages performed by a nurse with the assigned triage level. In light of these results, it would be pertinent to propose prospective studies with trained observers and taking into account also the clinical status of the patient that deepens in this line, especially taking into account that the triage has been an area of Emergency Medicine and scarcely studied in recent years by Spanish emergency physicians<sup>26-28</sup>.

## Conflicting interests

The authors declare no conflict of interest in relation to this article.

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The authors declare the non-existence of external financing of this article.

## Ethical Responsibilities

The study was evaluated and approved for its realization by the Ethics and Clinical Research Committee of the Hospital Clínic of Barcelona. The consent of the participants was obtained to join the study. All authors have confirmed the maintenance of confidentiality and respect for the rights of patients in the author's responsibilities document, publication agreement and assignment of rights to EMERGENCIAS.

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