Original Article

Relationship between clinical severity and hours of nursing care in an emergency room

Relação entre gravidade clínica e horas de cuidados de enfermagem em um pronto socorro

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ABSTRACT

Objective: to evaluate the relationship between the clinical severity of the patients and the hours of care of nursing professionals in an emergency room. **Methods:** correlational study, which used the Nursing Activities Score and Acute Physiology and Chronic Health Evaluation I instruments. **Results:** we included 338 patients. The highest averages were identified in the group related to deaths, with (22.0%) for Acute Physiology and Chronic Health Evaluation II and (56.8%) for Nursing Activities Score, (p=0.000). We obtained a moderate relationship between these scores. Moreover, the two instruments used proved to be capable of predicting deaths. **Conclusion:** evaluations of the worsening of patients and the demand for care can contribute to the adequacy of the number of personnel, the reduction of the length of stay in the emergency rooms and the high-quality care planning.

Descriptors: Emergency Service, Hospital; Critical Care; Nursing Care; Workload; Severity of Illness Index.

RESUMO

Objetivo: avaliar a relação entre a gravidade clínica de pacientes e as horas de cuidados dos profissionais de enfermagem em um pronto socorro. **Métodos:** estudo correlacional, que se utilizou dos instrumentos *Nursing Activities Score* e *Acute Physiology and Chronic Health Evaluation I*. **Resultados:** incluíram-se 338 pacientes. As médias mais altas foram identificadas no grupo óbitos sendo (22,0%) para *Acute Physiology and Chronic Health Evaluation* II e (56,8%) para *Nursing Activities Score*, (p=0,000). Obteve-se relação moderada entre esses escores. Ademais, os dois instrumentos utilizados se mostraram capazes de predizer o óbito. **Conclusão:** as avaliações do agravamento dos pacientes e da demanda por cuidados, podem contribuir com a adequação do número de pessoal, a redução do tempo de permanência nas salas de emergência e o planejamento assistencial de qualidade elevada.

Descritores: Serviço Hospitalar de Emergência; Cuidados Críticos; Cuidados de Enfermagem; Carga de Trabalho; Índice de Gravidade de Doença.

Introduction

Emergency hospital services have as their main role the rapid assistance to patients suffering from acute diseases. The emergency rooms are spaces for the immediate treatment of stabilization of patients, offering a maximum period of 24 hours of stay[1]. When these services remain saturated, they entail an increase in the workload of the professionals who work with the risk of unwanted incidents and decreased quality of care[2].

The dimensioning of professionals, especially in the area of Nursing, can interfere in the accomplishment of care. The *Nursing Activities Score* (NAS) is one of the instruments that contribute to the appropriate dimensioning of the nursing team. It is used to evaluate the workload spent by a nursing professional with critically ill patients, during 24 hours. This tool is increasingly essential in units for critical patients, in order to ensure safe and qualified care[3]. However, most studies are held in intensive care units, not encompassing urgency and emergency services. Accordingly, we questioned whether there was a relationship between the hours of nursing care and the clinical severity of the patients in an emergency hospital service.

In light of the foregoing, this study can collaborate to adjust the number of nursing professionals, according to the clinical severity of the patients, with a view to ensuring quality care. Accordingly, the objective was to evaluate the relationship between the clinical severity of the patients and the hours of care of nursing professionals in an emergency room.

Methods

Documentary and correlational study, performed in an emergency hospital service, in an emergency room for adults, in a reference hospital in Minas Gerais, Brazil, focused on urgent, emergency and trauma care, integrating the macro-region of Minas Gerais,

with 100.0% care provided by the Brazilian Unified Health System. The emergency room for adults reaches, on average, two thousand visits/month[4]. The emergency room present in the emergency room for adults, where this study was carried out, had, at the time, 20 beds of supportive nursing.

For this study, we selected the medical records of patients admitted to the emergency room, aged over 14 years, according to the care protocol of the studied place, regardless of gender and who remained hospitalized for at least 24 hours, during the period from January to December 2017. During data collection, we considered the information obtained in the first 24 hours of hospitalization.

The determination of the sample of this study considered the medical records of 2,743 patients who were hospitalized in the emergency room of the emergency room for adults in 2017. The number of medical records included was determined randomly, where the sample was stratified considering the period of 12 months. We considered a pilot study carried out to determine the sample size, in the outcome variable, death; adopting the parameters of relative error of 5%, significance level of 5% and prevalence of 80%. With these parameters, we defined a sample of 338 medical records. The program used for the sample calculation was R, version 3.4.1[5]. The collection of information took place between June and October 2018. Data were collected through an active search in the patient's physical records, using a printed model designed for this purpose. This information was also used to calculate the NAS and Acute Physiology and Chronic Health Evaluation II (APACHE II) scores.

The APACHE II instrument was used to evaluate the severity of the patients, which considers clinical data (age, presence of chronic diseases, temperature, average arterial pressure, respiratory and heart rates, PaO_2/FiO_2 ratio, arterial pH, sodium, potassium, creatinine, hematocrit and leukocyte levels, white blood cell count and Glasgow coma scale). The calculation is

based on the worst value of each of the twelve parameters considered, that is, the one that was farthest from the normal parameters, observed during the period of admission until the 24-hour stay, thereby allowing us to evaluate the evolution of the clinical picture of the patient[6]. The APACHE II score varies between 0 and 100 points, the higher the score, the higher percentage of this score that denotes the probability of hospital death[2].

The stratifications of the APACHE II scores take place as follows: 0-4 points: 4.0% non-surgical, 1.0% post-surgical; 5-9 points: 8.0% non-surgical, 3.0% post-surgical; 10-14 points: 15.0% non-surgical, 7.0% post-surgical; 15-19 points: 24.0% non-surgical, 12.0% post-surgical; 20-24 points: 40.0% non-surgical, 30.0% post-surgical; 25-29 points: 55.0% non-surgical, 35.0% post-surgical; 30-34 points: approximately 73.0% both; 35-100 points: 85.0% non-surgical, 88.0% post-surgical[6].

In order to evaluate nursing hours (according to the medical records), we applied the NAS instrument, comprising seven levels (basic activities, cardiovascular, renal, neurological, metabolic and specific interventions), with an evaluation of 23 elements. Each item has a score, and the sum of these scores results in a score assigned to each patient. The result of the NAS score can reach the percentage of up to 176.8% of hours of direct nursing care to patients. Analyzing the concept since the score, a NAS point is equivalent to 14.4 minutes of hours of care[7].

The results obtained were established and displayed in *Microsoft* Excel 2010. For more in-depth analyzes such as mean, minimum and maximum values, univariate and multivariate analyzes, we used the *Statistical Package for the Social Sciences* platform, version 17.0. In this sample, patients were divided according to the outcome of hospitalization – discharge or death. The normality test was applied in order to check the distribution of data in the interest groups. According to the adherence of each variable to the normality test, we applied Student's T or Mann-Whitnney tests to check the degree of adherence of each variable present in the normality test in the groups under study. We also investigated the correlation: score of severity and prognosis of patients/time spent by the nursing team, using the Spearman's coefficient (r_s).

With the purpose of interpreting this measure, we used the classification that considers a correlation up to 0.39, even when statistically significant, without clinical relevance; values between 0.40-0.69 indicate a moderate correlation, while 0.70 or more indicate a strong correlation[8]. In order to analyze the NAS ability to predict death in the emergency hospital service, we designed a Receiver Operator Characteristic (ROC) curve. Statistical significance was defined by a *P* value less than 0.05.

The study project was sent to the competent research ethics committee, opinion number 2,681,678/2018 and presentation certificate for ethical appraisal nº 88588318,6,0000,5393. This investigation was conducted in line with the required standards.

Results

The sample consisted of 338 patients. Patients were classified according to the result, discharge or death, with discharge being the predominant outcome, 272 (80.4%). Women had a higher frequency of deaths, 42 (63.6%), compared to men (p=0.000). The average age of the total number of patients was 60.84 (±16.2) years. For those whose outcome was death, the average age was higher (65.3±15.7) compared to those who obtained discharge, 59.7 (± 16.2) years. Most patients were originated from other towns and admitted to the emergency hospital service for zero vacancy, 254 (75.1%). We should highlight that out of 338 patients, 105 (31.1%) had previously been admitted to other health facilities before entering the emergency room (Table 1).

Table 1 – Representation of the arrangements of patients admitted to the emergency hospital service, according to the result: discharge or death. Uberaba, MG, Brazil, 2017 (n=338)

Variables	Total (n=338)	Discharge (n=272)	Death (n=66)
	n (%)	n (%)	n (%)
Gender			
Female	151 (44.7)	109 (40.1)	42 (63.6)
Male	187 (55.3)	163 (59.9)	24 (36.4)
Origin			
Reference city	143 (42.3)	116 (42.6)	27 (40.9)
Emergency Care Unit	79 (23.4)	62 (22.8)	17 (25.8)
Mobile Urgency and Emergency Care Service	66 (19.5)	51 (18.8)	15 (22.7)
Internal demand	13 (3.8)	12 (4.4)	1 (1.5)
Fire Department	10 (3.0)	10 (3.7)	-
Private network	10 (3.0)	8 (2.9)	2 (3.0)
Rescue	5 (1.5)	5 (1.8)	-
Others	12 (3.6)	8 (2.9)	4 (6.1)
Form of admission			
Zero vacancy	254 (75.1)	206 (75.7)	48 (72.7)
State regulation system	69 (20.4)	55 (20.2)	14 (21.2)
Spontaneous demand	15 (4.4)	11 (4.0)	4 (6.1)

We found 57 different diagnoses, according to the international statistical classification of diseases. The most frequent diagnoses were: acute myocardial infarction, 75 (22.2%); stroke, 68 (20.1%); and traumatic brain injury, 24 (7.1%). In the group of patients with discharge outcome, the main diagnoses were: acute myocardial infarction, 73 (26.8%); and stroke, 58 (21.3%). In the group related to deaths, they were: strokes, 10 (15.2%); and pneumonia, 8 (12.1%). One can note that the specialty that received the highest amount of care services was the medical clinic, 269 (79.6%). The most common diseases were: systemic arterial hypertension, 203 (60.0%); coronary syndromes, 105 (31.0%); diabetes, 80 (26.6%); dyslipidemia, 36 (10.6%); and hypothyroidism, 29 (8.5%).

Table 2 – Characteristics of the patients admitted to the hospital emergency service in relation to risk classification, medical specialty, APACHE II score, Nursing Activities Score and length of hospital stay according to the result: discharge or death. Uberaba, MG, Brazil, 2017

Variables	Total (n=338)	Discharge (n=272)	Death (n=66)	p*
	n(%)	n(%)	n(%)	
Manchester risk rating				
Red	88 (26.0)	51 (18.8)	37 (56.1)	
Orange	232 (68.6)	204 (75.0)	28 (42.4)	
Yellow	18 (5.3)	17 (6.3)	1 (1.5)	
Service by specialty				
Medical clinic	269 (79.5)	217 (79.8)	52 (78.8)	
Neurosurgery	38 (11.2)	29 (10.7)	9 (13.6)	
General surgery	29 (8.5)	24 (8.8)	5 (7.6)	
Orthopedics	2 (0.7)	2 (0.7)	-	
Prognostic score:	Average (minimum-maximum)	Average (minimum-maximum)	Average (minimum-maximum)	
Acute Physiology and Chronic Health Evaluation	13.11(0-44)	10.9(0-36)	22.0 (2-44)	0.000
Nursing Activities Score	45.4 (30-88.9)	42.6 (30-88.9)	56.8(32.2-85.4)	0.000
Length of hospital stay (days)				
Length of stay in the emergency hospital service	1.83 (1-12)	1.79 (1-12)	1.97 (1-5)	
Length of stay in the emergency room for adults	5.19 (1-42)	4.77 (1-42)	6.91 (1-25)	

*Mann–Whitney test

The death estimate, according to APACHE II, was 15.0% for patients whose outcome was discharge and 40.0% for those who progressed to death. In the sample, the application of NAS showed that the time spent by nursing, during the first 24 hours of hospitalization, in the emergency hospital service, was 11 hours, on average. The statistical difference between the average values of NAS and the APACHE II score proved to be statistically significant (p=0.000), which can be associated with the death outcome.

We noted a moderate correlation between NAS and APACHE II (r_s=0,578). The NAS ability to predict death in the emergency hospital service was analyzed using a ROC curve. This analysis showed an area under

the curve of 0.830 (95% confidence period = 0.786-0.869; sensitivity = 74.2%; specificity = 84.19%; p <0.001), with the criterion of score obtainment greater than 50.1 points in the NAS. In addition, we designed a ROC curve to evaluate the APACHE II ability to predict death in the emergency hospital service, thereby obtaining an area under the curve of 0.821 (95% confidence period = 0.776 - 0.861; sensitivity = 74.2%; specificity = 76.8%; p<0.001), with the criterion of score obtainment greater than 14.0 points in APACHE II (Figure 1). Patients who scored more than 50 in the NAS and more than 14 in the APACHE II were more severe and needed more hours of nursing care.
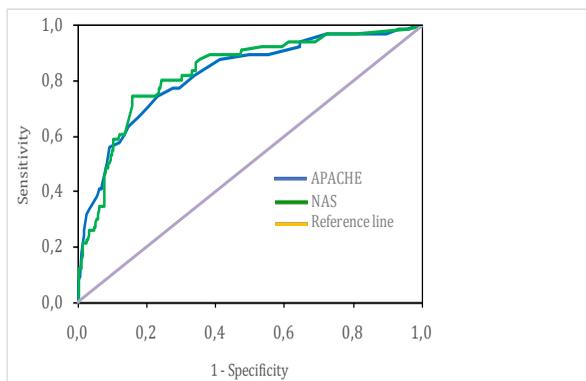
APACHE: Acute Physiology and Chronic Health Evaluation; NAS: Nursing Activities Score

Figure 1 – Prediction of death outcome by NAS and APACHE II scores, in the emergency hospital service, according to the ROC curve. Uberaba, MG, Brazil, 2017

Discussion

The study has the limitations of having been carried out in just one institution. In addition, we should highlight that analytical studies do not allow the analysis of the relationship of results between APACHE and NAS. By using information retrieved from medical records, there is no control over the quality of such information, since they were not prepared for the purpose of providing data for future investigations, the where the documents are the result of human and social production and there is no assurance of the legitimacy of the data.

Nevertheless, we hope that this study will

contribute to the adequacy of the number of nursing professionals in the service where it was performed, considering the NAS as a severity score and the APACHE II for the prognosis of critically ill patients, both validated for these functions. Future studies can be developed with the purpose of obtaining more information and results of the correlation of these and/ or, possibly, other scores in the area of urgency and emergency.

The present study demonstrated that the severity of the patients was related to a greater need for nursing care in an emergency hospital service. In addition, NAS and APACHE II were able to predict death in this sample. The elderly patients, with an average of 60.8 years, were the majority in the emergency service, which can be understood as a consequence of the population aging, which is already part of the Brazilian reality, where the group of people over 60 is growing, with estimates that, by the year 2040, there will be a proportion of approximately 153 elderly people for every 100 young people, that is, 23.8% of the Brazilian population[9].

In this study, women had a higher number of deaths compared to male patients. This can be justified by the new demographic profile of Brazil, where there is a longevity process in women. Data indicate that the total work hours of women is, approximately, eight hours longer than that of men, thereby generating work overload, which brings serious consequences, which can culminate in the worsening of women's health status[10], as well as a greater risk of developing infarction, stroke, among others[11].

Moreover, in this investigation, the main diagnoses identified in the medical records were among the group of cardiovascular diseases, which makes up the ranking of the ten leading causes of death in Brazil and in the world. Data published by the World Health Organization indicate that almost 27.0% of mortality records in the world were derived from these diseases, while, in Brazil, they were responsible for 31.0% of deaths[11].

Regarding the characteristics of the surveyed

care, we noted that the main way for patients to enter the emergency hospital service was through zero vacancy (75.1%). Zero vacancy is a resource that offers direct and quick access to emergency services for patients at imminent risk of death and should be used exclusively for these cases, and not as a routine alternative[1]. Moreover, the medical clinic was the specialty that received the most amount of services, a fact justified by the insufficiency of health services with a focus on health promotion and prevention actions, as well as by the difficulty of these patients to enter the health care network. In Brazil, the majority of hospitalizations that happen in hospital emergency care are originated from clinical cases[1].

With regard to the risk stratification performed in the phase of welcoming, as shown in Table 2, we noted a higher frequency of admissions in patients with orange classification and a higher number of deaths among patients with red classification in the group related to deaths (p=0.000). The emergency hospital service, where the study was conducted, is a reference for patients with orange and red classification, a fact that explains the predominance of these classifications in the sample. In addition, the association of the red classification with death is an indication that these patients were properly classified[12].

The value found for length of stay in the emergency hospital service was 1.83 days and in the adult emergency room, 5.19 days. In Brazil, in another study, the average hospital stay was 3.6 days in the emergency room[13]. A prolonged length of stay, found in the present study, may have contributed to the increased demand for nursing care in the group related to deaths, where the NAS was higher, that is, the prolonged length of stay may have resulted in an increased number of hours of nursing care for each patient[14].

When considering the analysis of the APACHE II score and the NAS instrument, we found that the severity of the patient was related to the higher demand for work hours of the nursing staff in the emergency hospital service. These scores were also able to pre-

dict deaths in this sample. The ROC curve was designed to evaluate this ability.

To that end, when analyzing the ROC curve, there is a perception of the relationship between sensitivity and specificity of the test, where the sensitivity is demonstrated by the abscissa axis (y axis) and the test specificity by the ordinate axis (x axis). Accordingly, the test that passes through the upper left corner is called a test with perfect discrimination, since this location indicates the 100.0% value curve, both for sensitivity and specificity. In this sense, the accuracy of the test is clear when performing the visual analysis of the curve, since the most accurate test is the test that shows the curve closest to the upper left corner[15].

However, this study showed a difference relative to other scientific findings, with regard to the absence of a significant relationship between the severity of the patients and the hours of care provided, that is, patients with a high chance of dying do not always require a high degree of care of nursing, those who demand high dependence on care are not necessarily the ones that evolve to death[16]. Conversely, in another study, the correlation identified between the severity of the patients and the workload was moderate, as in the study performed. Nevertheless, these findings are not similar to the results of this investigation and reflect only the environment of intensive care units[14].

We should emphasize that the intensive care unit concentrates a highly trained team and material resources to offer continuous assistance to the patient, using first-line technology aimed at immediately identifying organic changes that support decisions and interventions in situations of decompensating. In addition, the environment has advanced technological support for the admission of patients, who often come from the urgency and emergency unit or from the surgery room and have invasive devices installed[17].

The emergency unit has characteristics of nursing care very similar to those found in intensive care centers, but the emergency condition is often close to contingency and limiting situations. This factor is as-

sociated with the stress of the moment, the unpredictability of the environment, the lack of physical and material structure and the occurrence of unpredictable and immediate changes in the clinical picture of patients who are acutely ill, who have a complex clinical profile, whose deterioration of health entails an increased risk of death or suffering, thereby requiring immediate intervention, with a focus on prioritizing life and preventing the worsening of symptoms, before the appropriate therapeutic resource can be established[18].

Several scores are available in the medical literature, but few meet the needs of patients in emergency hospital care. Although APACHE II is designed for patients admitted to intensive care units, the application of this score could contribute to achieving a better follow-up and therapy in emergency services, due to the similarity of environments and severity of patients. Moreover, in this context, the results of this study demonstrate the lack of characterization of the emergency room as a place for stabilization and initial treatment, becoming an intensive care center; however, without the numerically adequate physical and personnel structure, thereby resulting in the overload of the nursing staff[19].

Conclusion

This study has shown the characteristics of an emergency hospital service and a moderate relationship between the clinical severity of the patients who entered these services and the hours of nursing care. In addition, the evidence showed that the Nursing Activities Score instrument and the Acute Physiology and Chronic Health Evaluation II score can be used as predictors of death in these patients. The severity evaluations and the need of the nursing team for care can contribute to the adequacy of the number of personnel, the reduction of the length of stay in the emergency rooms and the quality care planning, thereby providing improvement in the health care of the patients and in the work environment for emergency room workers.

Collaborations

Sabino SS contributed to the idealization and design, development, check and writing of the paper. Silveira LM collaborated through the appraisal of data and critical analysis of the content. Stabile AM helped in all stages of the research, mainly in the finalization for publication.

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