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Patient Safety in Emergency Departments: Improvement Is Possible

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Abstract: Emergency services have a high potential risk for adverse events. The working conditions are sometimes conducive to making mistakes. There are few studies that have shown improvements in specific aspects of patient safety in the emergency department, but none in the overall incidence. The general objective is to improve patient safety in our emergency services by implementing improvement actions. This is a quasi-experimental study carried out in 8 hospital emergency services. The methodology is mainly based on the EVADUR and ENEAS studies. We collect data through a face-to-face interview during their stay in the Emergency Department and carry out a telephone review 1 week later. We then inform the departments of the results and initiate improvement activities. 14 improvement measures were implemented in the different emergency services. Two years later, a reassessment was carried out using the same methodology. An initial sample of 382 cases was collected. After the improvement actions, data from 267 patients were collected. No significant differences were found between the 2 groups in terms of age, sex, triage level, hospital, care shift, average length of stay and discharge destination. In the initial evaluation, at least 1 incidence was detected in 46 patients (12.04%), and in the reevaluation, 16 patients with an incident (5.99%) were detected. The differences were statistically significant ($p<0.01$). The emergency services studied were able to reduce the number of patient safety incidents.

Keywords: Safety Patient, Emergency Service, Quality Improvement

1. Introduction

A total of 30.4 million emergencies are treated annually in the emergency departments of Spanish hospitals [1] of which 10,6% require hospitalization. This volume of activity is very high, and both medical and organizational complexity is required to meet this demand for urgent care.

Several authors agree that emergency departments are associated with a high risk potential [2-5]. The working conditions are sometimes conducive to making mistakes.

Occasionally, clinical decisions must be made quickly while lacking all critical information in a high-pressure environment [6, 7].

A Harvard study on the frequency of adverse events (AEs) published by Brennan in 1991 [8] showed that 3.7% of inpatients experienced an AE, of which 3% occurred in the emergency room. These data are consistent with the first national study of adverse effects in Spanish hospitals (ENEAS 2005), [9] in which the cause of AEs in 2.4% of patients was due to emergency care. These data merely reflect a partial reality because only the incidents recorded in the patient care reports are studied (i.e., hospitalized patients previously treated in the emergency room). This situation represents only 10-20% of visits to these departments [10] and disregards the remaining 80-90% of patients who are discharged [2] Other studies have performed retrospective detection of cases of patients who return to the emergency department within 72 hours or 1 week, which account for only 4-9% of the treated patients. These studies have identified AEs at frequencies ranging from 9 to 21% of the study cases. [11, 12] Other authors have relied on questionnaires sent to patients after discharge from the emergency department. The frequency of potential safety issues reported by patients in these questionnaires is 5-8,5% [13, 14]. However, none of the above studies provide us with a complete picture of the magnitude of the problem.

A study of safety incidents in 21 emergency departments (EVADUR) [15] was published in 2010. This study collected information coinciding with care and was complemented by a telephone questionnaire administered to patients 1 week after visiting the emergency department. This study determined the frequency of the occurrence of safety incidents and found that at least 1 incident occurred in 12% of the patients treated in the emergency room with or without damage. This study could be considered the first national study of AEs in the emergency departments of Spanish hospitals.

A recently published systematic review analyzed all studies published from 1990 to 2014 reporting interventions performed to improve patient safety in emergency rooms [16]. The authors of this study concluded that no studies to date had shown an overall improvement in this regard.

The present study was based on the hypothesis that improvement is possible. Therefore, after assessing the safety incident rate, the objective of the study was to show that patient safety might be increased by introducing a series of improvement measures and raising the awareness of professionals.

2. Materials and Methods

2.1. Study Design

This study is a quality improvement study that can be considered within the category of quasi-experimental studies. This study was conducted in 8 hospital emergency departments of the Murcia Health Service (Servicio Murciano de Salud – SMS). This study consisted of the following 4 stages:

a) Training of the group of evaluators.
b) Study of safety incidents.
c) Analysis and communication of the results of the implementation of the improvement measures selected in each center.
d) New cross-sectional analysis of safety incidents 2 years later.

Data on the occurrence of incidents were collected in person during care by the evaluators, and subsequently, all cases were reviewed weekly. The presence of safety incidents, defined by the WHO in 2009 as "any event or circumstance that could have resulted, or did result, in unnecessary harm to a patient", was searched in all cases.

The data collection method is based on the EVADUR and ENEAS studies with a modified data collection questionnaire due to the current taxonomy of the World Health Organization (WHO) on patient safety.

All data collection methods used and documents prepared, including the informed consent form for patient participation in the study, were previously approved by the Ethics Committee on Care of the Morales Meseguer Hospital (Hospital Morales Meseguer).

2.2. Participants

Data collection was performed by the healthcare staff of the emergency department itself (internal evaluation) in both the first assessments and reassessments. All staff members received initial training before the first data collection.

2.3. Cases

Adults (older than 18 years of age) with no psychiatric or obstetric diseases who signed the informed consent form to participate in this study were enrolled.

2.4. Variables

Data on age, sex, arrival time, assigned triage level, initial care by residents or interns, length of hospital stay and destination at discharge were collected in all cases.

The number of safety incidents per patient, time of detection, impact on the patient, effects caused and potential preventability of the incident were also recorded when an incident was identified.

2.5. Data Source

Data collection on incidents was based on the patient history, discharge report and direct observation by the evaluators during the period of emergency care. The weekly review was performed by telephone questionnaire with discharged patients or in person with inpatients. The reassessment was performed using the same method.

2.6. Sample Size

A minimal population random sample of 254 cases was needed based on a calculation of the sample size using the

12% event incidence and 4% accuracy rates (95% confidence interval of events: 8% to 16%) from the EVADUR study and accepting a 0.05 alpha risk for an accuracy of +/- 0.04 units in a bilateral comparison for an estimated proportion of 0.12.

2.7. Sampling Method

The number of cases treated in the previous year was used as a basis to calculate the sample size for each center. After establishing the sample size needed for each emergency department, the sample was divided between the days of the study. Then, a preliminary systematic random sampling was performed using the mean of cases attended per day in that center as a reference to ensure proportionality between the numbers of cases attended in each shift. As a replacement mechanism, in cases where the patient failed to meet the inclusion criteria or refused to sign the informed consent form, the patient with the subsequent order number was included in the study.

The same sampling method was used in the reassessment during the same month 2 years later.

2.8. Statistical Method

Student's t-test was used as the statistical method to compare the means, and the Chi-square test was used to compare proportions. The level of significance was 95%.

2.9. Intervention

Data on the results from the initial study were provided to each emergency department by the principal investigator. Additionally, some departments provided the information through additional talks. In the general sessions, the attendants were asked to implement improvement measures to control the detected problems. The attendants were allowed to choose the specific intervention independently depending on their results. In total, 25 informative talks and 7 training sessions were held in the departments, and 14 improvement measures (Table 1) were implemented, albeit without a homogenous degree of involvement of the departments (Table 2).

Table 1. *Improvement measures implemented in the different emergency services.*

	Improvement measures
1	Review of emergency protocols
2	Conciliation of medication in emergencies by a presence pharmacy
3	Senior Pharmacy Resident Rotation at the emergency service
4	Systematic measurement of pain at patient reception
5	Change of salbutamol multidosis by single dose
6	Review of albumin use protocol
7	Improvement of indications for urgent radiological tests
8	Improvement of heparin adjustment in patients with renal impairment
9	Improving communication and empathy
10	Improvement of hand hygiene
11	Review of indication of troponin determination
12	Change of potassium concentrates by solutions with dilute potassium
13	Improvement of nephroprotection in patients with iodinated contrast agents
14	Use of personal identification bracelets

Table 2. *Participation of each of the emergency services in the activities that were carried out during this study.*

Hospital	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**
Participation in training sessions	yes	yes	yes	yes	yes	yes	yes	yes
Initial data collection	yes	yes	yes	yes	yes	yes	yes	yes
Medical sessions	yes	yes	yes	yes	yes	yes	yes	no
Nursing sessions	yes	yes	yes	yes	yes	yes	yes	no
Resident sessions	no	no	yes	yes	yes	yes	no	no
Security patients training for other staff	yes	no	yes	yes	yes	yes	no	no
improvement actions	no	no	yes	yes	yes	yes	no	no
Communications or presentations in scientific congresses	no	no	no	yes	yes	yes	no	no
Reevaluation of incidents	yes	yes	yes	yes	yes	yes	yes	yes

3. Results

3.1. Participants

In total, 49 emergency staff physicians and nurses participated in data collection. The evaluation was performed internally in each center.

Regarding the study subjects, complete data on 382 patients who attended the initial assessment and 267 patients who attended the reassessment were collected from all centers.

3.2. Sample Characteristics

The sample parameters collected in each case were analyzed for both samples. No significant differences were noted between the 2 samples and the arrival time (p=0.65), mean age (p=0.26), sex (p=0.61), triage level (p=0.46), initial care by intern or resident (p=0.27), minutes of stay (p=0.84) or destination at discharge (p=0.95).

3.3. Safety Incidents

During the initial assessment, at least 1 safety incident was detected in 46 patients, representing 12.04% of the total patients (confidence interval (CI)=8.8-15.3%). Two incidents occurred in 3 cases, which raised the total number of incidents detected to 49. Incidents during the stay at the emergency department were detected in 24 cases, and the remainder of the incidents was detected by the phone call questionnaire.

During the reassessment, 16 incidents were detected, representing 5.99% of the patients (CI=3.2-8.8%). No patients with more than 1 incident were detected. Eleven of these cases were detected at the Emergency Department, and only 5 incidents were detected during the weekly review. The differences between the 2 results are significant ($p<0.01$).

Regarding the incident impact on the patients, in the first study, the incidents had no effect on the patients due to early detection in 6 cases (13%). The incidents were not detected in time in 16 patients (35%) but caused no damage. The incidents caused damaged in the other 24 cases (52%). During the reassessment, 69% of the incidents caused damage to patients.

The analysis of the causes of safety incidents relative to the total number of cases in the sample showed a decrease in the number of cases in all groups of causes, which was not significant when analyzed separately for each cause (Table 3).

Table 3. *Differences between the initial evaluation and the reevaluation, depending on the factors that have been identified as the cause of the incidents. Results refer to the percentage of patients who have suffered an incident for each of the causes.*

Causal factors	Initial evaluation (cases)	% of total cases	Reevaluation (cases)	% of total cases
Medication	14	3,56%	6	2,25%
Related to care	12	3,05%	7	2,62%
Related to diagnosis	11	2,8%	2	0,75%
Related to communication	9	2,3%	0	0%
Related to management	5	1,27%	1	0,37%
Others	4	1,02%	0	0%

The differences between the emergency departments that only conducted training and informative sessions and the 4 centers that also implemented improvement measures were also analyzed. When we compared the initial incident rate and the reassessment rate in both groups, we found a non-significant ($p>0.05$) decrease in the percentage of patients with incidents from 13.38% in the initial evaluation to 8.03% in the reassessment in the first group and a significant ($p<0.01$) decrease from 11.25% to 4.52% in the group that implemented the improvement measures (Table 4).

Table 4. *Differences between the initial evaluation and the re-evaluation, comparing the group of services that only carried out formative and informative activities with the group that also initiated improvement actions. Results in percentage and confidence interval 95% (c.i.).*

Incidents	initial evaluation (% c.i.)	Re-evaluation (% c.i.)	Absolute difference	p	Significant difference
Total detected	12,04% (8,8-15,3%)	5,99% (3,2-8,8%)	6.05%	< 0,01	significant
Services without improvement actions	13.38% (7.8-18.9%)	8.03% (3-13.7%)	5,35%	>0,05	no
Services with improvement actions	11.25% (7.2-15.25%)	4.52% (1.25-7.8%)	6.73%	< 0,01	significant

4. Discussion

The comparison of data on the number of incidents observed with other studies performed in the emergency room shows that the data source, sample characteristics and analysis method affect the results. [17] The rate of incidents assessed was higher than the rate obtained in studies using patient history as a data source [8, 9] and lower than the rate obtained in studies using only patient reassessment data [11]. As expected, the percentage of patients with AEs assessed in the present study was higher than the percentage in studies using questionnaires sent to patients after discharge [14] because this approach was only part of our data source, although the findings of this part of our study corroborated those from other studies. For example, the percentage of incidents was the same in both our study and the EVADUR [15] study, which used a method similar to that of the present study. All of these findings refer to the initial study and affect the validity of the method used. Furthermore, this phenomenon highlights the difference demonstrated in the reassessment using exactly the same method by the same evaluators.

The improvement measures mostly focused on improving medication use. Accordingly, some interventions have already demonstrated their effectiveness in previous studies, such as the presence of a pharmacist in the emergency room [18].

As expected, the decrease in the number of AEs was more obvious in the group of centers that established improvement measures than in the group of centers that did not implement any improvement measures. This finding supports the relationship between the implemented measures and the observed improvement.

Some studies on this topic have shown improved patient safety in specific subjects, such as a decrease in the number of AEs related to catheters [19] improved medication use by including the pharmacist in the emergency room [20] or an improved safety culture, [21] without a significant overall improvement in the number of AEs. No significant difference in the total number of incidents was shown in the multi-

center study by Hesselink [16] cited in the introduction, wherein all intervention studies on patient safety improvement in emergency departments were analyzed; this finding is in contrast to the present study, which we believe does show a significant difference.

The presence of observers on the data collection day may suggest a bias towards fewer AEs and a higher ratio of prevented events because this sample had a longer follow-up. However, this parameter is a controlled confounding factor for comparability purposes.

Regarding the intervention, all emergency departments had both commonalities (training and general information) and differences (i.e., they were invited to implement improvement measures based on their findings). The implementation of these measures was irregular. Indeed, a group of 4 centers did not implement any type of measure during this period. The results show a decrease in the percentage of patients with safety incidents for the entire set of emergency departments, although the decrease was more significant in the group of centers that implemented improvement measures.

The minimum age for inclusion in the study (18 years) is another study limitation. Therefore, these results are not valid for the pediatric age group.

5. Conclusion

As conclusion, it can be say that the findings show that the studied emergency departments succeeded in decreasing the number of patient safety incidents after the implementation of the improvement actions and this was clearer in the departments that implemented improvement measures compared to those that did not implement any.

Improving patient safety in emergency services is possible.

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