Simulation training in the emergency room: experience in a pediatric service
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Abstract
Simulations in the emergency room (SE) aim to reproduce real patients and crisis situations. Since 2013, the pediatric service of the Trás-os-Montes and Alto Douro Hospital Center (CHTMAD) has carried out simulation training. It intends to improve the skills of the health professionals with repeated experiences and feedback in a controlled environment. In 2015, an anonymous survey was carried out with health professionals, and we verified that simulations are an important training tool for developing and improving skills (e.g., usage of ventilator, cardioverter defibrillator and chest drain placement) and behaviors that increase patient’s safety.

Keywords: Simulation, Emergency Treatment, Competency-Based Education, Pediatrics.

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INTRODUCTION

Simulations in the emergency room (ER) consist of reproducing clinical emergencies of real patients and guide their evaluation and treatment in the usual workplace with material and human resources available in the service.

The intention is to improve professionals’ performance as a team, including incorporation of the sequence of evaluation and possible treatments, as well as communication and coordination between the different elements of the medical and nursing staff to achieve the ultimate goal of improving care for critically ill patients.

In this way, medical simulation is a training and learning method that is being increasingly adopted in several centers to the detriment of the traditional “see one, do one, teach one” teaching method.1

Historically, simulations date back to the 1940s when they began to be used in military education.2 Later, in the 1980s, the concept of emergency medicine was born. This innovation was boosted by an increase in the number of trauma centers in the 1990s.3

Alongside the increasing number of trauma centers, there was a gradual reduction in the number of critical patients in hospital emergency rooms, which led to health professionals having less contact with severe and emergency cases. This, simultaneously with major technological developments, led to simulations reaching their development potential.2

The popularity of simulations is related to their characteristics: they are a form of active learning that provides repeated first-person experiences that allow participants to receive immediate feedback on decisions made as well as an opportunity for debriefing to reflect on the benefits or drawbacks of the actions taken and to consider other potential actions. In addition, they create high expectations in relation to previously established goals and encourage collaboration between different professionals, thus favoring the development of multidisciplinary work.1 Performing simulations under the guidance of professionals with appropriate training allows participants to get the full benefit of these drills, identify less correct attitudes, and have the opportunity to reflect and correct errors in a controlled environment.

This popularity has also spread to the field of pediatrics, as is shown in many publications that present an increasing frequency of the use of simulations. This increasing recourse to simulations also correlates with the fact that contact with the ER is increasingly limited during the specific training in pediatrics, resulting in a lack of experience in procedures and resuscitation techniques.4 If, on the one hand, ERs in university hospitals have a high turnover due to the high number of patients directed there by the referral network, on the other hand, ERs in more peripheral non-university hospitals are used less frequently because they only treat local patients. Therefore, use of simulations in a safe environment and reproducing real situations have been a tool in some hospitals to minimize this training gap.5

Across boards and regardless of the type of hospital, it is imperative that professionals be familiar with the ER, its physical space, where materials and medications are located, and that they know how to perform procedures and communicate and collaborate with each other.6

In 2013, the Department of Pediatrics in the Trás-os-Montes and Alto Douro Hospital Center (CHTMAD), a unit of Vila Real, initiated a project involving regular simulations in the ER to promote the acquisition and retention of knowledge and thus optimize the competence of health professionals in the care of critically ill children.

This initiative gradually expanded its activities as seen in the invitation by the São João Hospital Center, in October 2014, to perform a demonstration in an emergency care course, expansion of the Chaves Unit, and collaboration between the Medical Emergency and Resuscitation Vehicle in some scenarios, as well as greater visibility among the general public through a television report in July 2017 on the TVI and Porto channels (see http://portocanal.sapo.pt/noticia/126534).

In this way, the authors consider the sharing of their experience relevant and useful for other pediatric services.

MATERIAL AND METHODS

Between December 2013 and July 2017, 31 simulation trainings were held in the pediatric ER at CHTMAD - Vila Real unit. These drills took place randomly with the cooperation of doctors and nurses present in the ER on the specific day and were organized by a trainer from the European Pediatric Advanced Life Support course, who was certified by the Portuguese Pediatric Resuscitation Group and accredited by the European Resuscitation Council.

Before each simulation, the organizer explained the methodology to be followed, reminding participants of the ABC approach, the need to “put yourself into the role,” and the importance of interactive communication between team members and recommending that direct orders be given sequentially as tasks were completed and that the timeframes of procedures and of the delivery of the results of tests or reassessment therapies were met. The trainer later described the case on hand, based on frequent emergency situations such as respiratory failure, shock, arrhythmia, convulsion, as well as severe trauma and cardiorespiratory arrest.

During each simulation, the leader guided the team as if it were a real situation, addressing the problems as they were identified during the course of the case previously outlined by the organizer, with the case progressing according to the solutions found for each problem, as would be expected in a real case.

At the end of each simulation, a debriefing was held for each team member to ask questions and discuss the evolution of the case. All simulations were filmed from March 2017 onward, which allowed a second debriefing with the participation of other members of the department and provided enrichment for everyone.
In all the scenarios, a resuscitation mannequin was used, which featured a rhythm simulator, a vital signs monitor (oxygen saturation, heart rhythm and rate, and blood pressure), and all the materials needed, including airway adjuvants, manual ventilation bag, mechanical ventilator, intra-osseous puncture needle, monitor and defibrillator pack, and saline and disposable materials depending on how the clinical case developed. Drug dosages were calculated and the time needed for preparation was recorded, although these activities were simulated. Techniques such as ventilator use, chest drainage, defibrillation/cardioversion, and placement of intra-osseous access were practiced as the case developed. Complementary diagnostic tests were ordered by the team leader, although they were not actually performed, the organizer provided results according to the orientations previously mentioned, always maintaining the timeframes usually required to conduct these procedures and for the results of the diagnostic tests to arrive.

In November 2015, all health professionals from the department were invited to fill out an anonymous survey about the simulations.

RESULTS

Twenty-three health professionals filled out the survey. It is important to note that the respondents did not answer all the questions, so the authors obtained different absolute numbers for all the answers.

Of the 23 professionals who responded, 14 were specialists, 1 was a specialist intern, and 8 were nurses. With respect to experience (n = 22): 4 had <5 years of experience, 6 had 5–10 years, and 12 had >10 years.

Among the 23 professionals, 6 participated in one simulation, 4 participated in 2, 6 participated in 3, 1 participated in 4, 1 participated in 6, and 5 did not participate in any simulation.

Approximately 90% of the respondents participated in the last course in advanced life support for patients aged 1–5 years; 14/16 and 15/19 attended the neonatal and pediatric advanced life support courses.

The average number of simulations led by each medical specialist was 1.3 (minimum 0, maximum 3).

The explanation and information given prior to the simulations (briefing) were considered useful (11/18). The degree of confidence concerning general ER knowledge improved after the simulations (18/18), and the majority of respondents considered the location of the ER in urgent care units to be correct (10/17) and the location of materials in the ER to be correct as well (12/18) (Figure 1).

With respect to the simulation, 8/17 respondents felt that the scenarios were well-adjusted to real situations, 14/18 found that the environments of the simulations were appropriate without too many interruptions and that understanding was easy among participants (Figure 1), and the majority felt that the simulations allowed them to improve their mastery of techniques, with special emphasis on the use of the ventilator and cardioverter/defibrillator and placement of the chest tube (Figure 2).

As for the individual assessment of behaviors and attitudes during the simulation, the majority of the respondents considered that these reduced anxiety (11/17) and increased organizational capacity within the ER (9/17) and the leadership capacity of the team (9/17). On the other hand, they reported finding no significant differences between before and after

![Figure 1. Opinions on the course of the simulations](image-url)

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the simulations in relation to prescription/preparation of medication (12/17), ability to participate in patient care (10/17), doctor/nurse feedback (8/17), and communication of indications (14/17). The respondents reported feeling comfortable in all circumstances.

The protocols and information available in the ER were considered productive (7/17) but insufficient. A similar assessment was made in relation to the scenarios used (Figure 3).

During the debriefing, majority (10/18) reported feeling very comfortable asking questions and 7/17 acknowledged that it was easy to recognize errors (Figure 1). The debriefing was considered very useful (9/17) (Figure 3).

The overall assessment was the following: 10/17 considered the simulations beneficial in improving child safety in the ER and 9/17 deemed the simulations very useful in assessing the competence of professionals caring for critically ill children.

**DISCUSSION**

The authors were able to ascertain that simulations performed systematically and regularly, with a high level of expectations, produce a significant degree of anxiety that motivates participants to achieve previously set goals. Briefing is essential to control this anxiety and consequently to be able to glean as much as possible from the exercise. In this way, professionals are allowed to operate without the fear of making mistakes (if they were dealing with a real patient). Moreover, repeated and controlled training allows achieving more consolidated learning and more consistent and solid
performance in future situations\textsuperscript{2}. Furthermore, simulations also facilitate the establishment of training programs related to the implementation of procedures and techniques, handling of devices, and preparation and administration of drugs used in emergency situations because pediatric patients belong to the group that is at a greater risk of medication errors\textsuperscript{6}.

Debriefing provides an opportunity to conduct a formative evaluation to improve individualized and team action plans.

It is also important to emphasize that although few institutions are able to acquire advanced medical simulators, scenarios based on actual emergencies that use less expensive materials can be organized\textsuperscript{2}.

The analysis performed herein corroborates the literature and emphasizes the importance and relevance of simulations for health professionals\textsuperscript{4}.

However, because the development of problem-based learning in simulations implies a high degree of commitment by professionals, particularly in reconciling their professional activity with this exercise, we believe that further efforts should be made to increase the frequency and diversity of simulations. Additionally, because this activity is still not nationally widespread and having professionals “perform” in front of their peers generates some anxiety, adherence to this type of training requires motivation and commitment by everyone. In our department, we observed a growing popularity and acceptance of training simulations among the participants.

Both the literature and this study identified some aspects for improvement, notably more participative involvement of pediatric interns, improvement and optimization of support posters available in the ER, and the need to conduct more training simulations and create a greater variety of scenarios.

By sharing our experience, we want to motivate others to follow our example, and this study demonstrates that advanced simulation mannequins are not absolutely essential to conduct training simulations. What is indispensable and irreplaceable is the creation and organization of appropriate scenarios with the guidance of accredited trainers and that everyone who works in the ER feel involved in this project.

Because regular study and training are key to strengthening and maintaining competencies (whether cognitive or practical), the authors believe that by sharing their experience, these trainings can be implemented in a sustained manner in other departments and will productively contribute to the training of health professionals. Therefore, a more rapid, accurate, and coordinated response between the elements of the emergency care team is achieved, with the ultimate aim of a more effective approach toward the safe care of critically ill children.

“New contributions of this study”

- Simulations improve professionals’ performance as a team through the incorporation of the evaluation sequence and possible treatments as well as communication and coordination between the different elements of the medical and nursing staff.
- Scenarios can be set up based on actual emergencies using less expensive materials, if appropriate scenarios are created and organized with the guidance of accredited trainers and if everyone who works in the ER feels involved in the project.
- The implementation of these training sessions productively contributes to the training of health professionals, particularly specialist interns, and promotes contact with the ER and the implementation of resuscitation procedures and techniques.

BIBLIOGRAPHY