Evaluation of non-technical skills among emergency medicine residents in the management of severe trauma: a prospective study using simulation

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Abstract

Background: Learning through simulation is not mainly about technical skills. Non-technical skills, which are part of the prerequisite competencies for professionals working in emergency care, can be worked on through simulation as well.

This study aimed to evaluate the learning of non-technical skills in the care of a severe trauma patient and to study the retention of these non-technical skills after one month of simulation sessions.

Methods: We conducted a prospective, observational, descriptive, and single-center study carried out at the Northeast SAMU01 Emergency Care Teaching Center (CESU01) over a period of one year.

The use of a hetero-evaluation score of non-technical skills by the Anesthetists' Non-Technical Skills (ANTS score) was carried out by an observing instructor for all participants during the simulation session and one month later.

Results: We included 30 residents. The average age was 28 years, with a sex ratio of 4. Twenty-one residents (70%) had already benefited from simulation training. Participants significantly improved their situational awareness skills (3.6 vs 3.95, p = 0.026); decision-making (3.41 vs 3.52, p = 0.043); and teamwork (1.72 vs 2.06, p = 0.003) between the first session and one month later. The comparison of the evolution of different non-technical skills in the two groups," prior simulation training" and "no prior simulation training," showed a significant difference concerning the means at 01 month in the group "before training by simulation" (3.42 vs 3.92 with p = 0.002).

Conclusion: Health simulation is therefore a major educational tool in the learning of non-technical skills in emergency medicine

Keywords: Non-Technical skills, Simulation, ANTS, Emergency Medicine, Traumatology

INTRODUCTION

Medical simulation is becoming an increasingly important part of emergency medicine education, enabling the mechanisms involved in understanding clinical situations, reasoning, and decision-making to be analysed and improved (1). In a context of increasing the flow of patients to the emergency room, with its demonstrated impact on the quality of care and mortality (1), the performance of teams becomes a major issue.

The quality of care in terms of safety and effectiveness is directly linked to the non-technical skills (NTCs) of caregivers, which contribute to the efficient and safe realization of technical skills (2). In crises, these NTCs are grouped under the term "Crisis Resource Management" (CRM), defined as "the set of non-technical skills that aim to coordinate and use all available resources to optimize patient care and safety" (3).

Research on the identification of NTCs distinguishes individual (emotion management, fatigue, medical reasoning, communication, decision-making, cognitive load management) and collective (cooperation, conflict management, workload, and synergy with the leader) skills (4). While another approach classifies NTCs in interpersonal (leadership, communication) and cognitive (situational sensitivity, planning) skills (5-6).

Although the importance of NTCs is recognized in the quality of care (7), few studies have been conducted on their simulation learning in emergency medicine. Several rating scales have been developed, such as the Anaesthetist's Non-Technical Skills (ANTS) or the TEAM scale, based on assessment grids assigning an overall score to an observed performance (8-9).

Our study had two main objectives: first, to evaluate the acquisition of NTCs in the management of severe trauma by the ANTS score, and second, to study the retention of these skills one month after the simulation sessions.

METHODS

This was a prospective, descriptive, monocentric study conducted at the Emergency Care Education Center of SAMU 01 North East (CESU01) over a period of one year (January to December 2021).

We included emergency medicine residents who participated in simulation sessions organized as part of the simulation days at CESU01. Recruitment was carried out voluntarily. Participants gave their oral consent to participate and the right to image. Residents who declined to participate were not included, and those who did not participate in the one-month assessment were excluded. The assessment of the non-technical skills was carried out by using the ANTS (Anaesthetists' Non-Technical Skills) score, which was administered by an observing instructor to all the participants during the initial simulation session and one month later. (Appendix)

The ANTS score evaluates 15 competencies according to 4 categories: Task management, teamwork, situational awareness, and decision making.

For each skill, a score of 1 to 4 is assigned: 1 (poor), 2 (marginal), 3 (acceptable), 4 (good).

The teaching consisted of two parts:

1. First part: 3 simulation days (3 teams and 3 scenarios per day for the first two days, 4 teams and 4 scenarios for the third)
2. Part 2: One month later, 3 other days were organized according to the same pattern.

Each team consisted of three emergency medicine residents playing their own roles. A facilitator intervened as a nurse. The scenarios covered different clinical situations in the management of a severe trauma:

- Severe head trauma with signs of intracranial hypertension
- Chest trauma with suffocating pneumothorax
- Haemorrhagic shock complicating complex pelvic trauma
- Spinal cord injury

The sessions followed the recommendations of the HAS (10) with a briefing, scenario development, and debriefing.

Statistical analysis

The data was analysed with SPSS version 22.0. For the descriptive study, we calculated absolute and relative frequencies for the qualitative variables, and means, standard deviations, and extreme values for the quantitative variables. For the analytical study, the comparison of averages for paired series was made by the Wilcoxon test, and the relationships between quantitative variables were studied by the Spearman correlation coefficient. The significance level was set at $p<0.05$.

Ethical considerations

The anonymity and security of the participants' personal data were respected. The oral consent of the participants and a request for image rights were collected. The authors state that they have no interest in the content of this study.

RESULTS

The final analysis included 30 residents, with a female-to-male ratio of 4:1. The mean age was 28 years (range: 26-32 years). The breakdown by year of residence was 10 (33%) in the first year, 4 (13%) in the second year, 8 (27%) in the third year, and 8 (27%) in the fourth year.

Twenty-one residents (70%) had already received medical simulation training before the study, but only 19 (63%) had prior knowledge of NTCs.

The vast majority (90%) considered it possible to learn NTCs through medical simulation, and all (100%) considered it possible to learn technical skills. Regarding the percentage of medical errors related to NTCs, 60% of participants estimated it at more than 70%.

The initial means of the ANTS score, as well as those after one month, are mentioned in Table 1.

Table 1: The mean of the ANTS score studied at the initial assessment and after 01 month of training

ANTS SCORE	Averages at initial assessment	Average after 01 month of training	P
Task Management	3.96	4.96	1
Teamwork	1.72	2.06	0.003
Awareness of the situation	3.60	3.95	0.026
Decision-making	3.41	3.52	0.043

At one month, participants significantly improved their situational awareness (3.6 vs 3.95; p=0.026), decision-making (3.41 vs 3.52; p=0.043), and teamwork (1.72 vs 2.06; p=0.003) skills.

Comparison based on previous training by simulation

In the group with previous training (n=21), significant improvement was observed in situational awareness (3.56 vs 3.94; p=0.034), decision-making (3.4 vs 3.57; p=0.039), and teamwork (1.23 vs 1.85; p=0.023). The total score also improved significantly (3.58 vs 3.92; p=0.002).

In the group without prior training (n=9), improvement was significant for teamwork (1.11 vs 1.95; p=0.001) and task management (4.26 vs 4.96; p=0.001). (Table 2)

Table 2: Mean baseline and one-month ANTS scores in the groups with and without prior simulation training

	Previous simulation training (n=21)			No previous simulation training (n=9)		
ANTS score	Initial averages	Mean after 01 month	P	Initial Averages	Mean after 01 month	P
Task Management	4.86	4.96	1	4.26	4.96	0.001
Teamwork	1.23	1.85	0.023	1.11	1.95	0.001
Awareness of the situation	3.56	3.94	0.034	3.67	3.75	0.512
Decision-making	3.4	3.57	0.039	3.33	3.65	0.511
Total	3.58	3.92	0.002	3.36	3.42	0.055

DISCUSSION

Our study included 30 emergency medicine residents, 77.4% of whom were women, with an average age of 28 years. Although 70% had already received simulation training, only 63% knew about NTCs before the study, which is in line with the results of a 2016 French study (11) where almost all participants had no knowledge of NTCs despite prior simulation experience.

One month after the initial training, participants significantly improved their situational awareness, decision-making, and teamwork skills. These results confirm those of the literature on the retention of NTC learning. Thomas et al. (12) showed that behavioral changes within teams were retained six months after sessions without the need for a recall. Other studies (13-14) have shown that benefits on patient management persist 18 to 24 months after simulation training with CRM.

However, the study by Miller et al. (15) was inconsistent with previous results: participants had their non-technical skills regain their initial values one week after the simulation training. In light of these results, retention of non-technical skills appears to be variable. It was mostly studied in the medium term. Further studies on this subject would be of interest.

Subgroup analysis revealed that participants with prior simulation experience significantly improved their situational awareness, decision-making, and teamwork, while those without prior experience made particular progress in teamwork and task management. These results

are consistent with a French study (16) showing a significant improvement in teamwork and situational awareness in the previously untrained group.

Crisis Resource Management (CRM), as might be expected, crises in medicine can generate significant stress within a medical team. In the medical field, the same CRM skills as those identified in aeronautics have been recognized as fundamental and as improving the quality of teamwork (17,18).

In the United States, over the past fifteen years, courses have been developed for emergency physicians on communication and coordination of teamwork, "Emergency Team Coordination Course," using high-fidelity simulation as a learning tool (19).

Now more than ever, the medical community recognizes the importance of CRM skills in patient care and quality of care (20).

Thus, according to the recommendations of the High Health Authority (HAS) in 2012, the acquisition and evaluation of CRM skills by practitioners is essential (10). In 2015, the HAS created the "CRM health" sessions as part of the Continuous Improvement Program for Teamwork (PACTE). These sessions aim to raise awareness among practitioners about the principles of CRM in medicine.

Through our study, we show the need to set up training through medical simulation, including the teaching of non-technical skills. Given the concerns of young learners, the teaching of these skills in initial training would probably be more effective when technical skills are acquired. Learning of gestures could be proposed on procedural simulators (task-trainers). A summative evaluation could be carried out at the end. Learning of soft skills could take place in a second stage with the students who have passed this assessment.

CONCLUSION

Simulation learning is not limited to technical skills. NTCs, essential to the quality and safety of emergency care, can also be developed through this means. Our prospective study showed that one month after the initial training, participants significantly improved their situational awareness, decision-making, and teamwork. Subgroup analysis revealed differences in learning based on prior simulation experience. These findings underscore the importance of integrating NTC education into simulation training programs, ideally after the acquisition of technical skills in initial training. The implementation of a CRM-type program could optimize this learning. Further multicentred studies would be needed to assess the learning of NTCs in continuing education, the retention period of the acquired skills, and the optimal time to offer refresher training.

Conflicts of interest: *We declare that we have no conflicts of interest*

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Appendix

Anesthesiologist's Nontechnical Skills (ANTS) Global Rating Scale

Subtopics	Elements	Partial Rating (1-4)	Global Category Rating (1-4)
Task Management			
	Planning and preparing		
	Prioritizing		
	Providing and maintaining standards		
	Identifying and utilizing resources		
Team Working			
	Coordinating activities with team		
	Exchanging information		
	Using authority and assertiveness		
	Assessing capabilities		
	Supporting others		
Situation Awareness			
	Gathering information		
	Recognizing and understanding		
	Anticipating		
Decision-making			
	Identifying options		
	Balancing risks and selecting options		
	Reevaluating		
	TOTAL POINTS (total of global ratings)		

Rating Options		Descriptor
Good	4	Performance was of a consistently high standard, enhancing patient safety; it could be used as a positive example for others
Acceptable	3	Performance was of a satisfactory standard but could be improved
Marginal	2	Performance indicated cause for concern, considerable improvement is needed
Poor	1	Performance endangered or potentially endangered patient safety, serious remediation is required

- Subject Number _____ Date _____