ORIGINAL RESEARCH

The beneficial learning by simulation in the acquisition of non-technical skills among medical students

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Abstract

Introduction: Medical simulation is a new learning method recently introduced in medical education and has grown tremendously. "Never the first time on the patient", it is with this objective that medical simulation has become for several years an essential teaching method for health professionals and medical students. It is proven to improve both technical and non-technical skills (NTSs).

Methods: We carried out a pre-experimental study at the simulation center of the emergency medical service of the eastern center of Tunisia and the simulation center of the Faculty of Medicine of Sousse during the academic year 2020-2021. Our target population was students in the third year of the second cycle of medical studies.

We led four days of simulation-based training; it was included the community health program of the Faculty of Medicine of Sousse. NTSs were evaluated by the Anesthesia Non-Technical Skills (ANTS) score, at the start of the training (t0) (Workshop 2), at the end of the training (t1) (Workshop 6-7), and during the practical exam (t2).

Results: Our study population consisted of 67 medical students from the Faculty of Medicine of Sousse. Most students were females (67.7%). The mean age was 23.16 (±0.7).

The mean ANTS score before training at (t0) was 30.85+/- 10.8. At the end of the training, the mean ANTS score (t1) became 44.36+/- 8.8 ($p < 0.001$). At the final assessment, the mean ATNS score at (t2) was 48.99+/-11.8. The difference in mean between the assessment at t0 and t1 and the final assessment (t2) was statistically significant with $p < 0.001$. We compared the means of different items of the ANTS score, during the training to the end, and we found a significant improvement in work organization (10,03,10,94 and 15,79), teamwork (9,96,13,96 and 14,6) situational awareness (4,61, 8,91 and 9,25) and Decision-making (5.34, 7.66 and 9.34) with $p < 0.001$.

Conclusion: Simulation-based training for the medical and paramedical public contributes to patient safety and more effective care provided in critical situations. Our study confirmed the importance of this teaching method in acquiring and strengthening NTS.

Keywords: Crisis Resource Management; High Fidelity simulation training; Medical students

INTRODUCTION

Medical simulation is a new learning method recently introduced in medical education and has grown tremendously.

Simulation-based teaching in the health sciences is defined by the High Authority of Health (HAS) as being “the use of equipment, virtual reality or a standardized patient to reproduce situations or healthcare environments, to teach diagnostic and therapeutic procedures, to repeat processes and medical concepts, or decision-a making by a health professional or team of professionals” [1].

"Never the first time on the patient", it is with this objective that medical simulation has become for several years an essential teaching method for health professionals and medical students. It is proven to improve both technical and non-technical skills.

Medical studies mainly focus on individuals gaining theoretical, procedural, and technical knowledge. Non-technical skills (NTS) are rarely acquired by traditional methods of teaching. Several studies have proven that these skills improve the quality of teamwork, which helps to avoid human errors in patient care [2].

Simulation-based learning offers the possibility to acquire NTS in a psychologically safe environment allowing control of the situation and constructive discussion of errors without negative consequences.

The Cardiopulmonary resuscitation (CPR) training is a simulation-based training recently introduced (in 2020) in the Sousse medical school program for DCEM 3 students.

We can evaluate the impact of simulation in acquiring and improving NTS through different scores: Measurement scale for the evaluation of an emergency team (TEAM scale), OTPA grid (Obstetric Team Performance Assessment) [3], Ottawa CRM score, and the Anesthesiologists’ Non-Technical Skills score (ANTS) which is validated [4].

Our study aimed to study the evolution of the total NTS scale along the study and the score of each item of the ANTS scale by comparing the NTC score before the simulation-based training with that during and after the training.

METHODS

Type of study: We carried out a pre-experimental study at the simulation center of the Emergency Medical Service of the eastern center of Tunisia (CESU 03) and the simulation center of the Faculty of Medicine of Sousse (CESIM) during the academic year 2020-2021.

Study population: Our target population was the third year of the second cycle of medical students, in the faculty of medicine of Sousse. They were divided into four different groups. Students who had or were suspected to have COVID-19 were excluded due to safety measures.

Measurement: We used the «ANTS» score which is validated by the learned societies of emergency and resuscitation which are: SRLF/ SFAR/ SFMU/ SoFra.SimS [4]. The total score is 60 points according to 4 items: task management which was noted on 16 points, teamwork (20 points), situational awareness (12 points), and decision making (12 points).

Program of the training: We led four days of training by simulation "CPR" which is part of the 5.2 community health program of the Faculty of Medicine of Sousse.

The CPR training consisted of different practical workshops. These workshops were led by qualified instructors in simulation teaching. All stages of the simulation session were respected; a briefing, clinical scenario, and constructive debriefing. The workshops were as above:

- Workshop 1: Basic Life Support "BLS" and defibrillation.
- Workshop 2: Management of a critical patient using the ABCDE approach.
- Workshop 3: Airway Management and Intra-Bone Access
- Workshop 4: ECG monitoring and rhythm recognition.
- Plenary session: Advanced Life Support «ALS» algorithm with a demonstration presented by the trainers.
- Workshop 5: Shockable rhythms and post-resuscitation care.
- Workshop 6: Non-shockable rhythms and Decision making.
- Workshop 7: Special circumstances: Anaphylaxis, Asthma, Electrolytic disorders.

During this training, 30 clinical scenarios were carried out. Each student played the role of the team leader in teamwork for the care of a patient in critical condition in at least 5 different scenarios. These CNTs will be evaluated by the ANTS score, at the start of the training (t0) (Workshop 2), at the end of the training (t1) (Workshop 6-7), and during the practical exam (t2). The practical exam was carried out two weeks away from the training days.

Data analysis: The results were analyzed using SPSS software, version 23. Qualitative variables were represented by numbers and percentages. Quantitative variables were represented by means and standard deviations. We used the non-parametric "Wilcoxon" test to study correlations of the mean score of ATNS. The significance level was set at a p-value < 0.05.

RESULTS

Our study population consisted of 67 medical students from the Faculty of Medicine of Sousse. Most students were females (67.7%) with a sex ratio of 0.59. The mean age was 23.16 (±0.7) years with extremes ranging from 22 to 26 years.

The mean ANTS score before training at (t0) was 30.85+/- 10.8 with a minimum of 17 and a maximum of 51. At the end of the training, the mean ANTS score (t1) became 44.36+/- 8.8. The maximum score was 59 and the minimum was 30 ($p < 0.001$).

At the final assessment during the exam, the mean ATNS score at (t2) was 48.99+/-11.8 with a minimum of 33 and a maximum of 62. The difference in mean between the assessment at t0 and t1 and the final assessment (t2) was statistically significant ($p < 0.001$).

We compared the means of different items of the ANTS score. The items were work organization, teamwork, situational awareness, and decision-making. During the training to the end, we noted a significant improvement in work organization (10,03,10,94 and 15,79), teamwork (9,96,13,96 and 14,6) situational awareness (4,61, 8,91 and 9,25), and Decision-making (5.34, 7.66 and 9.34) with $p < 0.001$.

Table 1: The mean ANTS score of different items before, during, and at the end of training

Non-technical skills	T0	T1	p	T2	p
Work Organisation l (/16)	10.03	10.94	0.001	15.79	0.001
Teamwork (/20)	9.96	13.96	0.001	14.6	0.001
Situational awareness(/12)	4.61	8.91	0.001	9.25	0.001
Decision-making (/12)	5.34	7.66	0.001	9.34	0.001
Total score (/60)	30.85	44.36	0.001	48.99	0.001

DISCUSSION

Our work aims to evaluate NTS acquisition among medical students of Sousse Medical School during simulation-based training.

We conducted a pre-experimental study. Most students were females (67.7%), with a 23-year mean age.

We found a statistically significant improvement in ANTS scores from the beginning to the end of the training. The mean score at the beginning of training (t0) was 30.85+/- 10.8, 44.36+/-8.8 at the end of training (t1), and 48.99+/-11.8 at the final exam (t2).

It was the same for all the different items of the ANTS score, as we assessed their mean score separately at the beginning, at the end of the training, and during the final exam.

Our results were consistent with various studies that showed medical simulation to be an essential tool in the acquisition of NTS.

In the literature, learning through simulation, allows students to develop the expected behaviors towards critical situations in the professional environment in the most pragmatic way possible. Indeed, simulation helps to develop clinical reflexes and improve them [5].

A meta-analysis including 619 studies did a comparison between traditional learning and simulation and found simulation was systematically associated with the better acquisition of knowledge, and clinical skills NTS [6].

Another meta-analysis published in 2010 [7] demonstrated that simulation-based teaching can improve individual performance in technical tasks and management of critical events [8,9].

In the early 2000s, the committee responsible for the quality of health care in America published a report “To Err is Human” [4] showing the importance of the human factor in medical errors. Over 70% of adverse medical events were reported to be related to communication and coordination problems [10].

In Tunisia, a study conducted at EMS 03 in Sousse evaluating the impact of a simulation training accredited by the European resuscitation council “Immediate Life Support ILS’’ on practical acquisition found a significant improvement in both technical skills (TS) and NTS with a great increase in the ANTS score from the beginning to the end of training [16].

A study carried out in Morocco also confirmed the educational contribution of simulation in the improvement of knowledge and practical acquisitions [17].

A recent study conducted in the USA did a 10-month simulation training program for 231 medical students from Texas. It found a statistically significant improvement in NTS from the 6th session [18].

The General Medical Council of the UK strongly recommends medical simulation be taught in the first year to familiarize all young medical students with this method of learning [15].

In the literature, several studies demonstrated that simulation replicating real critical situations and focusing on teaching verbal and non-verbal communication or leadership has become an essential tool in error reduction strategies [19].

In a study conducted in France with 3 months of simulation training, MOTTIER et al. [20] also confirmed that simulation training allows improvement in NTS, which corresponds to level two of the Kirkpatrick scale. Given these results, other studies would be necessary to assure long-term retention of these new skills [21].

Further, Thomas et al. [22] showed in their study that a combination of theoretical training with simulation improved team-related TLCs compared to those based solely on simulation.

Moreover, a meta-analysis published in 2017 showed that simulation improves skills but not knowledge acquisition [23]. This leads us to conclude that a duality in teaching methods is necessary for better medical learning.

However, an American study revealed in the Journal of the Society for Simulation in Healthcare that the ANTS score was complex, even experienced clinicians and simulation instructors may have difficulty using it, and suggested that BARS '' Behavioral-anchored rating scales would be an alternative to the ANTS scale for NTS assessment [24].

Study Limitation: The sample of our study was small including only 67 students; a study with a larger sample would have yielded more meaningful results.

The evaluation of NTS acquisition in our study was done over a short period; only 4 days of simulation training. A long-term evaluation may also be proposed.

CONCLUSION

Simulation training for the medical and paramedical public contributes to patient safety and more effective care provided in critical situations. Our study confirmed the importance of this teaching method in acquiring and strengthening NTS.

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