

EDUCATIONAL ADVANCES IN EMERGENCY MEDICINE

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# Evaluation of advanced multi-purpose trauma moulage-based training on clinical skills for dealing with trauma-affected individuals in undergraduate nursing students

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## Abstract

**Background** Simulation-based training courses have been developed and widely accepted. The use of simulators can prevent bitter consequences that may sometimes put human lives in danger. Increasing the skill of nursing students in dealing with trauma patients is of great importance. The aim of this study is to evaluate the effectiveness of the simulation-based trauma training program for the management of trauma patients in nursing students.

**Method** It is an observational approach that focuses on improving the learning of trauma care skills. For this study, 6th and 8th semester nursing students were selected by appropriate sampling method. Previously, these students completed the trauma training course without simulation. Training of trauma skills was done using multi-purpose trauma moulage. And we subsequently analyzed the effectiveness of the trauma simulation training program using the OSCE test. In the inferential statistics section, after examining the data distribution (Kolmogorov-Smirnov and Shapiro-Wilk tests), the Wilcoxon test was used to measure significance. SPSS 22 software was used.

**Results** The results indicated that the lowest mean score obtained based on a scale of zero to one hundred was for the movement limitation of the injured long bone and the highest was in the skill of oral-nasal intubation and ventilation. The results of the paired t-test showed that clinical skills for dealing with trauma-affected individuals in undergraduate nursing after simulation training was significantly higher.

**Conclusion** The implementation of the simulation is accompanied by an increase in the skills of the participants, which leads to the application of the acquired knowledge in real-life scenarios and positive changes. In the learning of the participants, the evaluation of conventional trauma training in Iran, like other countries, shows the need for specialized training through simulation. To ensure the continued effectiveness of simulation-based trauma training courses, it is recommended that administrators and policymakers encourage regular faculty participation in the program. Long term effects of trauma simulators training in nursing student requires further study.

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### Key messages

What is already known about the topic supports simulation-based trauma training as an acceptable style of trauma training. Training with the multi-purpose trauma simulator increases the skills of nurses in managing trauma patients. What is expected is that training with simulated models will change nurses' perspective on the reality of trauma patients.

**Keywords** Stress management, Bleeding control in certain conditions, Trauma in pregnant women, Trauma in children, Trauma in the elderly, Glasgow Criterion, Mechanism of injury, The nature of the injury, Knowledge without skills in trauma, Common injuries due to lack of skill

### Introduction

Trauma" refers to various types of penetrating and non-penetrating injuries such as accidents, falls, war, and drowning (One of the most serious problems in the field of individual and public health that threatens various dimensions of human life is the various types of injuries and trauma [1, 2]. One of the issues related to human health that annually causes severe injuries and deaths for human societies, especially in countries with medium and low income levels, is traffic accidents [3]. In 2020, trauma was recognized as the second leading cause of disability in developing countries and the third leading cause of death worldwide [4]. Effective treatment and prevention of financial and life-threatening damages require timely actions and lifesaving measures carried out by the medical staff and emergency ward personnel. The emergency department is as the heart of the hospital and the point of entry for patients to receive health care services [5]. Considering that the emergency nurses play a very vital role in facing with trauma patients alongside the high statistics of accidents, incidents, natural disasters, and man-made disasters in the country, and because of the nature of the services they provide, therefore, they are among the most influential forces in determining the quality of services provided [6]. Therefore, training and preparing nurses to provide therapeutic care are of particular clinical importance [7]. Providing effective clinical experiences for nursing students has always been a perennial challenge in nursing programs [8]. So, in this regard, there is a need for nursing education with technologies such as simulation and the use of simulators that lead to achieving good educational outcomes [9]. Clinical simulation not only enhances students' capability for active participation in the learning experience but also helps bridge the gap between clinical and theoretical knowledge [1]. The emergency nursing curriculum in crises and unexpected incidents, which exists in many universities, is mainly based on traditional principles and methods of trauma education and this results in the presentation of a large volume of information without the necessary efficiency. Therefore, nursing schools in many countries have moved towards simulation-based curriculums that help them to perform their professional roles and activities to

meet the health needs of the people. In this regard, the need for simulation-based nursing education and the role it plays in achieving excellent educational outcomes should be considered [10], because clinical simulation, especially for empowering nursing students for active participation in the learning experience, is beneficial [2]. Using simulations can prevent many bitter outcomes that sometimes can endanger human lives, without the need to consider and spend too much, and it can also save time and money in tasks financially and temporally. Simulation is used in many scientific fields to regulate or optimize the performance of the desired systems. Due to the global competitive market, nowadays, a variety of specialized software and hardware are used for simulation and modeling of different projects [3]. Since a long time ago, simulation methods and anatomical modeling, mannequins, role-playing, and computer-based educational programs have been used for teaching nursing concepts and skills. However, with the advancement of technology and the invention of medical education equipment with maximum proximity and high fidelity to the human body, the attractiveness of education in line with a better understanding in the field of nursing education has made significant progress that the modern PVC (Polyvinyl chloride) (trauma simulator is one of the mentioned cases [4]. The utility of multi-purpose PVC simulators in the field of education can be beneficial today, although cost, lack of IT) information technology( support, and the non-acceptance by universities, absence of structure, and lack of incentive activities for the use of advanced multi-purpose PVC simulators are implementation barriers [11]. Also, it is worth mentioning that no study was found on the use of multi-purpose trauma moulage simulator in nursing skills education in Iran. Experimental studies to determine the use of multi-purpose PVC simulators in nursing education are very necessary. Since the issue of trauma education in nurses is an important issue for improving the provision of services and the health of patients and society as a whole, and given the necessity of patient safety importance and on one hand, the necessity of learning skills in dealing with trauma patients for all undergraduate nursing students, the researchers conducted this study with the aim of investigating the impact of multi-purpose trauma-moulage training on the clinical

skills of dealing with individuals with trauma in nursing bachelor students.

## Methods

### Study design

This study was conducted in October 2023 during 2 consecutive days. In this study, a semi-experimental type of evaluation was conducted with a pre-test-post-test design. This study is an observational research that 2023 with cooperation Gerash Faculty of Medical Sciences, Iran. This study is based on clinical skills assessment tools and specific scenarios and research questions. To achieve the goals of this research, According to the Declaration of Helsinki and after Obtaining ethical approval from the ethics committee Gerash Faculty of Medical Sciences was conducted with the code IR.GERUMS.1402.019. All participants willingly completed the informed consent form.

### Study participants and sampling

This study was conducted on 6th and 8th semester nursing students of the Faculty of Medical Sciences. The nursing students in the Faculty of Medical Sciences, where our study was conducted, take the 6th semester of the trauma course. All students had passed the 8th semester of trauma course and none of them had repeated the course. Participants were selected to enter the study. Lack of previous training in the field of simulating trauma patients is mandatory. Due to the limited number (60 individuals), the whole society participated in the study and eliminated the need for sampling. Therefore, we did not have any cases in the sample size calculation. Except consulting the table of Karjesi and Morgan [12]. As a result, a sample size of 50 people was obtained, which was determined by taking into account 20% dropouts out of 60 people, that is, the total number of students.

### Multi-purpose impact mollapse simulator

In summary, based on the scenario, the following were planned in this model: (1) Crack in the forehead (2) Ulcer on the jaw (3) Clavicle fracture in the chest (4) Abdominal ulcer with small intestine coming out (5) Fracture of the right humerus (6) Rupture in the right hand (7) Open wound on the right thigh (8) Fracture of the hip bone (9) Fracture of the tibia in the right leg (10) An open wound on the sole of the right foot and a cut on the finger (11) Big cut on the left thigh (12) Fracture of the tibia and pressure ulcer on the ankle.

### Objective structured clinical skills evaluation (OSCE)

First, a pre-test was taken, and then trauma training was done with a multi-purpose trauma simulator, and on the second day after the completion of the training, a post-test was taken. And it took a total of 2 days from 8 am to 4 pm. The purpose was to observe and compare the

participants' performance before and after the training-course. The level of skills was assessed by conducting the objective structured clinical examination (OSCE) test in nine stations. To perform the OSCE test, we used nine clinical skill scenarios regarding trauma patients which were developed and validated in Najafi et al.'s study [13]. For data collection and assessment in each station, we utilized a standard trauma clinical assessment checklist which was adapted from Shakeri et al.'s study [14]. This checklist included nine skills focused on the participants' ability to handle traumatized individuals:

- 1) Examining a trauma patient (43 points).
- 2) Restricting spinal movement in a seated patient (12 points).
- 3) Restricting spinal movement in a patient lying down (14 points).
- 4) Restricting movement of an injured long bone (10 points).
- 5) Restricting movement of an injured joint (9 points).
- 6) Utilizing a stretching splint (14 points).
- 7) Controlling bleeding and treating shock (7 points).
- 8) Inserting oral-pharyngeal and nasopharyngeal airways and performing suctioning (13 points).
- 9) Performing oral-tracheal ventilation and intubation (27 points).

Each skill was evaluated separately, and the total score ranged from 0 to 149, with a higher score indicating greater proficiency. The checklists' face and content validity were assessed and confirmed by a panel of 10 experts. The tool's reliability was assessed using the Kuder-Richardson 20 criterion, which yielded a coefficient exceeding 0.8. This indicates a high level of reliability for the tool [13, 14]. During the OSCE test, participants were provided with scenarios at each station. Roughly 7 min were dedicated to performing each skill at every station. The research team evaluated participants performance using the trauma clinical assessment checklist with evaluators who were not part of the team.

### Statistical analysis

The Kolmogorov–Smirnov test serves as a valuable tool in examining the normal distribution of variables. To analyze the data, descriptive statistical methods were employed, while the paired t-test was utilized for comparing variables within the same group. The data analysis was conducted using the SPSS V.21 software, renowned for its comprehensive capabilities. A significance level of less than 0.05 is considered significant.

**Table 1** Distribution of frequency of demographic information of operational emergency personnel under study

Demographic information		Frequency	Percent
Gender	Male	28	46.7%
	Female	32	53.3%
	Total sum	60	
Age (year)	21	2	3.3%
	22	55	91.7%
	23	3	5.0%
	Total sum	51	
	Standard deviation ± Mean	22 ± 0.2	
Maximum-Minimum	3 – 1		
Marital status	Married	5	8.3%
	Single	55	91.7%
	Total sum	60	100%
Passing the emergency nursing course	Yes	60	100%
	No	0	0
	Total sum	60	100%
Trauma training	Yes	60	100%
	No	0	0
	Total sum	60	100%
Academic semester	6	27	45.0%
	8	33	55.0%
	Total sum	60	100%

**Table 2** Numerical indices of skills in before and after simulation training

Standard skills for dealing with trauma patients	Before		After		P value
	Mean	SD	Mean	SD	
Examination of trauma patient (0–43)	21.63	2.336	29.15	1.783	0.000
Installation of oral-laryngeal, nasopharyngeal airway and suctioning of ventilation and oral-tracheal intubation (0–14)	7.32	1.295	9.27	0.880	0.000
Controlling bleeding and shock treatment (0–7)	3.20	0.106	4.26	0.739	0.000
Using a traction splint (0–14)	6.18	1.200	9.18	0.792	0.000
Limiting the movement of the spine of a lying patient (0–14)	6.60	1.238	9.15	0.840	0.000
Limiting the movement of the spine of a seated patient (0–12)	6.40	1.196	7.85	0.732	0.000
Limiting the movement of the injured long bone (0–10)	5.20	0.798	6.53	0.791	0.000
Limiting the movement of the injured joint (0–9)	4.55	1.881	6.38	0.555	0.000
Oral-tracheal ventilation and intubation (0–26)	14.53	2.480	19.15	1.313	0.000

**Result**

The aim was Evaluation of advanced multi-purpose trauma moulage-based training on clinical skills for dealing with trauma-affected individuals. In this study, a total of 60nuseing student participated in Evaluation of advanced multi-purpose trauma moulage-based training on clinical skills for dealing with trauma-affected

individuals,. As shown in Table 1, The findings showed that the majority of the research units were 22 years old (91.7%) and all of them had a history of trauma training. As shown in Table 2, the results of the paired t-test demonstrated that the overall clinical skill and also 9 standard skills for dealing with trauma patient nursing student after simulation training were significantly improved compared to before training ( $p < 0.001$ ).

**Discussion**

Hospital care plays a crucial role in enhancing the outcomes of trauma patients. As a result, nursing student must possess exceptional skills to provide optimal hospital care during the critical golden time. To enhance the knowledge and technical proficiency of nursing student, simulation traning are being implemented in various regions worldwide [15]. This study aims to examine the effectiveness of this comprehensivesimulation on nursing skills, utilizing theObjective Structured Clinical Skills Evaluation (OSCE) model.

The training based on multi-purpose trauma trauma had a positive effect on increasing the clinical skills score of dealing with a traumatized person after the training. In relation to the positive effect of this educational intervention against the common training method in increasing the clinical skills of dealing with a traumatized person, it can be pointed out that the simulation of a traumatized person can help to answer some challenges in decision cases. provide clinical assessment of nursing students in the emergency department [16]. Multipurpose trauma-based training and of course such comprehensive evaluations of training courses, which include a high level of learning, help policymakers and educators to identify areas for improvement and strengthening of these training programs.

[17] The comparison of scores in the assessed skills revealed significant improvements in the participants’ skills. When comparing scores before simulation to those taken on after, significant changes were observed. This suggests that the participants’ skill had been positively influenced by simulation. The results demonstrated significant improvements in learning highlighting the effectiveness of the simulation in bringing about meaningful changes.

In similar studies, According to Chen et al., A simulation-based emergency and intensive care nursing curriculum was created and well received by third-year nursing students and associated with decreased response time in a resuscitation simulation [18]. According to Cherry et al., The integration of simulators into student curriculum, training, and continuing medical education has been strongly recommended by the American College of Surgeons as an innovative means of enhancing patient safety, reducing medical errors, and performing a systematic

evaluation of various competencies [19]. However, The integration of simulators into student curriculum, training, and continuing medical education have been a subject of debate among Cherry et al. [19]. In this study, we also assessed the skills for pre test post test but The control group was not considered. It appears that simulation should be repeated through continuous a training programs and integrated into the curriculum. in this study To assess the effectiveness of the trauma simulation course. Only clinical skill learning of nursing students was evaluated, but the change in their behavior was not investigated and Although the control group was not considered, but trauma simulation are associated with Increase skill within a short period of time and In a similar study by Park et al., which was only pre-test and post-test, these things were seen, So Future investigations are warranted in the effect of simulation on short-term and long-term patient outcomes [20]. The disparity in these results may be attributed to the different organizational indicators examined and the varying duration of follow-up to assess the effects of the trauma simulation course, For example, Park et al.'s study was prospective observational between July 2018 and February 2019 at a large trauma center [20]. Although simulation-based trauma training is not thought to improve trauma care in the clinical setting, there is strong evidence to support the impact of trauma simulation on clinical practice. In a study by Fernandez et al., which evaluated the clinical impact of simulation-based trauma training on team leadership and patient care during real trauma resuscitations, it was shown that simulation training led to the transfer of complex skills to the clinical setting and may Indirect impact on patient care through better team leadership [21].

### Strengths and limitations

This study was conducted by a special lecturer during two days in the form of a training workshop for sixth semester and eighth semester undergraduate nursing students who had seen the normal training of trauma in the emergency nursing course, but the present study, like many others, had limitations. The two-day training course may not have an acceptable effect on training. One of the reasons for the lack of willingness of colleges to simulate and use simulators is that they are expensive, which is perhaps the most important issue. Also, the existence of a gap of one year between the participants of the eighth semester and the participants of the sixth semester may have negative effects on the results of the study, although the criteria for the inclusion of the participants in the study was not participating in any simulated trauma training. It is better to conduct this study in the students of a same incoming entrance. Due to the limitation of admission of nursing students in the faculty, therefore, we were only able to include all the participants in the study so that

the significance is closer to the reality. Also, the scope of this study was limited to one faculty and this study can be conducted among sixth or eighth semester students in several faculties. Therefore, our sampling process was limited to convenience sampling and we were unable to collect data from a wider range of students or in different geographical areas. It is important to acknowledge these limitations as they may affect the generalizability of our results. However, despite these limitations, we believe that our study still provides valuable insights into the field of simulation in trauma and contributes to the existing body of knowledge.

### Conclusion

The present study has revealed that the trauma simulation successfully enhances various skills taught in trauma education, leading to improved learning. However, to ensure the continued effectiveness of the trauma simulation, it is advisable for managers and policymakers to encourage nursing student to regularly participate in the course. Additionally, it is recommended to conduct further studies to evaluate the effectiveness of this course, as well as similar courses, in managing trauma patients. These studies should consider a wider range of indicators related to learning, for example, changes in behavior, rather than focusing solely on the amount of learning. Overall, this research emphasizes the importance of developing training with simulators and the need for simulation-based training to increase the quality of trauma patient care. By implementing these recommendations, healthcare organizations can further improve outcomes and overall management of trauma patients.

### Acknowledgements

The research team expresses their utmost gratitude and appreciation to all Participants of this study, especially all colleagues who assisted us in conducting this research, in accordance with scientific writing standards.

### Author contributions

PN and EP designed the project. PN, EP, EY and BS managed the project And collected all data. ZK and EP analyzed the data. EY, PN and PN were Responsible for manuscript preparation. All authors contributed to reviewing The paper before submission.

### Funding

This research has been supported by the Gerash University of Medical Sciences and Health Services.

### Data availability

The datasets generated during and/or analyzed during the current study are Available from the corresponding author on reasonable request.

### Declarations

#### Ethics approval and consent to participate

Participants were assured about the confidentiality of their answers, voluntary Participation, and no effect on students' performance evaluation. The ethics approval was issued by the Research Ethics Committee of Gerash University of Medical Sciences and Health Services of Institutional Review Board (IRB) (code of ethics: IR.GERUMS.1402.019). The authors certify that the study was

performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. Written informed consent was obtained from all participants. Written informed consent was obtained from all participants.

#### Consent for publication

Not required.

#### Competing interests

The authors declare no competing interests.

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Received: 8 February 2024 / Accepted: 27 August 2024

Published online: 06 September 2024

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