Original Article

Hybrid Simulation in Triage Training

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Abstract

Aim: This study was conducted to evaluate the effectiveness of hybrid simulation in "triage training" for senior nursing students studying emergency nursing.
Method: This descriptive study was conducted with nursing students in their final year of study (n=54) who attended a nursing school in Turkey during the 2016 and 2017 academic years. Within the scope of the study, the triage skills and scenario performance levels of the students were evaluated using video recordings taken during the simulation scenario and the students' opinions about the scenario application.
Results: The students showed the best performance for the yellow triage category during triage practice (3.37±0.44). Student feedback showed that the simulation experience helped them understand the subject better (62.5%). The vast majority of the students reported a favorable opinion regarding simulation-based triage training.
Conclusion: The students' satisfaction scores for simulation-based triage training, awareness, clinical decision making, team communication, staff safety and skills were high. Simulation-based training can be used to improve the triage skills of undergraduate students. In addition, it is thought that this training should be supported in graduate programs because of their lower performance in some triage categories.

Key Words: Triage Nursing, Emergency Department, Human Patient Simulation, Hybrid Simulation, Nursing Education

Introduction

The emergency department is defined as the place where urgent medical care and treatment are provided (Toloo, Aitken, Crilly, & FitzGerald, 2016). Ideally, the emergency department is intended to ensure that each admitted patient is examined and treated in the shortest time possible (Alexander, Abbott, Zhou, & Staff, 2016; Aloyce, Leshabari, & Brysiewicz, 2014; Rabin et al., 2012). Along with the intensity of patient need in the emergency departments, the crowding and chaos created by patients' relatives cause problems related to patient safety (Hasselbalch et al., 2016; van der Linden, Meester, & van der Linden, 2016).

Triage is a dynamic and continuous process used to identify the severity of the illness or injury in individuals referred to the emergency department and to determine which individuals have the greatest vital risk (Iserson & Moskop, 2007). With triage application, the waiting period for patients and the length of hospital stay decreases, and a systemic workflow can be achieved within the emergency department by reducing emergency service traffic (Ataseven Tarhan & Akın, 2016; Gilboy, Tanabe, Travers, & Rosenau, 2012; Karacay & Sevinc, 2007). Incorrect identification of the triage category can cause delays in the care and treatment of the patient (Aloyce et al., 2014). Therefore, providing treatment and care for the patient after he or she is accurately classified according to the priorities of the emergency service environment will ensure patient safety and keep problems under control (Day & Oldroyd, 2010).

A number of triage systems have been developed in many countries for use in emergency departments. Different triage models are described in the literature, such as the Canadian Triage and Acuity Scale, the National Triage Scale, the Australasian Triage Scale, the Manchester Triage System and the Emergency Severity Index (Ataseven Tarhan & Akın, 2016; Christ, Grossmann, Winter, Bingisser, & Platz, 2010; Cristiane Chaves de, Francielli Aparecida, & Tânia Couto Machado, 2015). Each of these models has five triage category levels. The "Mandatory emergency triage instrument" triage model with a triple triage category, developed by Erimsah et al., and the Emergency Severity Index are used in our country (Erimsah, Yaka, Yilmaz, Kama, & Pekdemir, 2015). The triple triage category uses color coding: red (very urgent), yellow (emergency) and green (nonurgent). Triage is usually performed by nurses in emergency services. It is therefore important to provide students with theoretical information and practical courses on triage before graduation. Such actions can decrease any problems caused by triage-level misidentification. The use of innovative approaches to training is recommended to ensure competency in emergency nursing.

Learning in a real-life environment is an effective means of establishing the relationship between learning and real life. Simulation-based training provides participants with safe learning environments where they can develop their skills for specific purposes. Simulation-based training imitates reality safely and efficiently (Kneebone et al., 2006; Stroud & Cavalcanti, 2013). The aim of the simulation is to replicate the clinical practice environment without ignoring reality (Terzioglu et al., 2016). The characteristics of the simulators used in simulation-based training vary from low fidelity to high fidelity. Partial-task trainers with low fidelity characteristics can be used repeatedly to learn, apply and gain proficiency in some simple techniques (intravenous placement, urine catheter placement). High-fidelity simulation uses a high-technology computerized mannequin (Human Patient Simulator, HPS) to provide a structured learning experience. This mannequin can reproduce normal physiological responses as it is anatomically similar to the human body (Hicks, Coke, & Li, 2009; Richardson & Claman, 2014). Hybrid simulation (HS) is another simulation method. It is used in an integrated manner to increase and then evaluate technical and communication skills (Kneebone et al., 2006; Stroud & Cavalcanti, 2013) and has been previously implemented in undergraduate nursing education (Terzioglu et al., 2016). Hybrid simulation combines several simulation modalities during a single teaching or evaluation exercise (Brydges, Carnahan, Dubrowski, Pollex, & Mallette, 2012). It is possible to combine the use of mannequins with desktop simulators and a standardized patient, thereby enabling the use of complex learning activities (Wilson & Rockstraw, 2012). A standardized patient is defined as a person trained to consistently portray a patient or other individual in a scripted scenario for the purposes of instruction, practice, or evaluation (Committee, 2016). In this triage study, high-fidelity mannequins and standardized patient modalities (hybrid) were simultaneously used to evaluate the triage practice skills of senior nursing students. This study is the first to show the effectiveness of hybrid simulations in triage education and aims to share our experience with other educators.

Method

Design and Participants

The study had a descriptive design. The population was chosen from nursing students in their final year (n=106) who were participating in an internship in Turkey during the 2016 and 2017 academic years.

Students who had taken an emergency nursing course during their internship program and internship students in the emergency department constituted the sample of the study (n = 54). Emergency nursing students who voluntarily participated in triage simulation (n = 40) constituted the sample of the study.

All the students had the same background knowledge and skills. The students participated in the simulation after receiving 4 hours of theoretical training on triage nursing.

Data Collection

After the application of the scenario, the students' feedback was collected, and video assessment checklist were applied.

Student Feedback: To make necessary corrections for the next academic quarter, postdebriefing feedback from the students was collected after each training. In this study, the students' feedback was used. The feedback form was created by the researchers after the literature review (Unver et al., 2013). This form consisted of 12 statements used to evaluate the students' achievements and experience. The students were asked to score each statement from 1 (strongly disagree) to 4 (strongly agree).

Video Assessment Checklist: A checklist was created for the structured review of the students' video recordings. The checklist was created following the review of the literature by researchers (Jonson, Pettersson, Rybing, Nilsson, & Prytz, 2017; Unver et al., 2013), and the video evaluations were conducted by two independent instructors. The checklist included 6 subheadings (situational awareness, clinical decision making, leadership, communication and team working, patient and employee safety and skill implementation) and 20 items. Expert opinion was obtained in the creation of the final version of scaling. The students were evaluated using the following statements: very weak (1), weak (2), acceptable (3), good (4), very good (5), NA (not applicable). Four cases with different triage categories were evaluated separately during the scenario performance evaluation (Table 1).

Scenario Application

In the selection of cases that would be presented for triage application, the current problems in the country and the most frequent reasons for admission to the emergency department were considered. Cardiology emergency and trauma cases were selected as the most common reasons for emergency admissions in Turkey. Scenarios for cases of forensic emergency were represented as women who were subject to violence because violence against women is a current problem in our country, and psychiatric emergency cases were presented because difficulties in the intervention are often experienced in such cases. The students worked in groups of 4 during the presentation of each scenario. The students encountered 4 cases with different triage categories (at approximately a 1-minute interval) in an environment simulating the emergency department. The students were expected to correctly designate red, yellow and green triage coding for 4 separate cases in the same scenario.

Based on the color coding used in our country, the following situations were presented:

Cardiology Emergency (Acute Myocardial Infarction): A high-fidelity mannequin was used. Computer-controlled changes in ECG rhythms were created. Red (Very Urgent) triage category

Trauma (Amputation after Work Accident): A high-fidelity trauma mannequin with a single-leg amputation was used. Red (Very Urgent) triage category

Forensic Emergency (Physical and Sexual Abuse): A standardized patient was used. To create signs of physical violence, ecchymosis and bruises were created by moulage application to the standardized patient's face. She was dressed in torn clothes. Yellow (Urgent) triage category

Psychiatric Emergency (Conversion-Hysteria): A standardized patient was used. Hair design and makeup were applied to make the standardized patient look like a university student. Green (Nonurgent) triage category.

Table 1: Simulation Scenario Flow Chart

Standardized Patient	High-Fidelity Mannequin	Standardized Patient	High-Fidelity Mannequin
			
Forensic Emergency (Physical and Sexual Abuse)	**Cardiologic Emergency (Acute Myocardial Infarction)**	**Psychiatric Emergency (Conversion-Hysteria)**	**Trauma (Amputation after Work Accident)**
			
Yellow Triage	**Red Triage**	**Green Triage**	**Red Triage**

History: Thirty-five-year-old A.K., married, living with her husband. After she argues with her husband, she is subjected to physical and sexual abuse. Ecchymosis on the face and traces of beating are observed on the body of the patient. Reactions: Fear, shame, guilt, hating her body	**History:** Forty-nine-year-old R.K. presents to the emergency department with pain in the epigastric region. ECG and laboratory tests (CK, CK-MB, troponin T, hemogram, electrolytes) are requested after initial evaluation. Ventricular fibrillation is detected on ECG, and the patient is losing consciousness.	**History:** Nineteen-year-old P.H., university student, afraid of her family's reaction after learning that she has failed her exams. She presents to the emergency service saying she cannot breathe. She faints in the first minute. Reactions: Frequent breathing, cries loudly, is constantly active. His conversation lacks depth and the only aim is to attract attention.	**History:** Thirty-six-year old M.S. works at the shipyard. A crane toppled over onto him at the construction site. His leg became stuck under the crane, and he was brought to the emergency service by ambulance. When he was brought to the emergency service, bleeding had been controlled with a tourniquet and he was conscious. The patient was transferred to the operating room.

Case characteristics are shown in Table 1. Two of the cases were high-fidelity mannequins, and the other two were standardized patients. Short stories were generated for each case. Expert opinion was sought to ensure that the scenarios complied with real life.

Selection of Standardized Patients: Two standardized patients were selected from among professional actors who contracted with the simulation center of the university where the study was implemented. Professional actors who had previously attended more than one training session were preferred when selecting the standardized patients. Moulage application was performed in accordance with the role. Professional support was obtained during moulage applications. Prior to the implementation, approximately 1 hour of training was given to standardized patients about the "cues" they would provide during the scenario, when to give these cues, and characteristics of their role. Rehearsal sessions were conducted with these standardized patients before the implementations.

Each student was told to act as an emergency nurse during the simulation, and an emergency physician was involved as a facilitator. The facilitator maintained the scenario's flow by giving clues during the scenario. Student performances were recorded using a video camera. The students worked together in small groups of 4 during the scenario applications. Each scenario application took 15 minutes, and a total of 10 scenarios were performed. After the implementation of two scenarios (8 students), a 45-minute debriefing session took place.

Ethical Consideration

Prior to simulation training, all the students and standardized patients were informed that videos and pictures could be used as educational material and/or in scientific research. After this information was presented, written approval was obtained from each student and the standardized patient before the simulation was implemented. Approval to conduct the study was obtained from the ethics committee of the university (2016-17/6). Efforts to protect the confidentiality of the students' and standardized patients' personal information were declared to the ethics committee.

Statistical Analysis

The analysis of the study was conducted with SPSS for Windows Ver. 15.0 (SPSS, Inc., Chicago, IL., USA) software. Means and standard deviations were used in the analysis of the students' triage skill performance. Number and percentage data were used to describe the students' feedback.

Results

The triage skills and video performances of the students were evaluated, and their opinions on the scenario implementation were obtained within the scope of the study. The mean triage application performance scores of the groups participating in scenario implementation are presented in Table 2. In the triage practice performance evaluation, the students achieved the best mean score for the yellow triage category (3.37 ± 0.44) and the lowest score for the red triage category (2.99 ± 0.49). When all the subskill groups were examined, the yellow triage category obtained the highest scores for situational awareness, clinical decision-making, leadership, communication and team work, patient and employee safety and skill implementation (Table 2). Student feedback showed that the simulation experience helped the students understand the subject better (62.5%), facilitated reviews of what the students had previously learned (55%) and made it easier to transfer the knowledge gained from the simulation experience to the clinical environment (75%) (Table 3).

Table 2: Video Performance of the Student Groups (n=40)

Category	Factors	Red Mean±SD*	Yellow Mean±SD*	Green Mean±SD*
Situational Awareness	Collecting information	3.33±0.50	4.00±0.50	3.44±0.73
	Interpreting information	2.89±1.05	3.33±0.50	3.11±0.78
	Predicting and considering the future	2.89±1.17	3.67±0.71	3.11±0.78
	Total	**3.03±0.74**	**3.66±0.48**	**3.22±0.66**
Clinical Decision-making	Assessing the options	3.22±0.84	3.56±0.53	3.22±0.66
	Identifying the priorities	3.33±0.87	3.44±0.88	3.00±0.71
	Making the right decision among the options	2.89±1.05	3.11±0.60	3.00±0.71
	Implementing the selected decisions at the right time	3.0±0.87	3.22±0.44	3.11±0.60
	Reviewing the decision	3.11±0.78	3.33±0.71	3.22±0.67
	Using critical thinking skills	2.78±0.67	3.33±0.71	2.78±0.67
	Total	**3.07±0.70**	**3.33±0.41**	**3.05±0.51**
Leadership	Ability to assign tasks	3.22±0.83	3.44±0.73	3.22±0.67
Communication and Team	Communication skills among team members	2.89±0.60	3.56±0.53	3.67±0.50
	Communication skills with patient	2.78±0.67	3.78±0.44	3.44±0.73
	If available, communication skills with patient's relative	0.00±0.00	0.00±0.00	0.00±0.00
	Ability to work as a team	3.67±0.71	3.56±0.73	3.56±0.53
	Total	**2.20±0.32**	**2.73±0.33**	**2.66±0.27**
Patient and Employee Safety	Compliance with patient safety principles	3.44±0.73	3.78±0.83	3.89±0.78
	Identity confirmation	2.78±0.67	3.89±0.33	3.44±0.53
	Explaining the procedure and providing information	2.78±0.67	3.44±0.73	3.22±0.67
	Taking standard precautions	3.56±0.88	3.22±0.97	3.56±0.73
	Total	**3.08±0.46**	**3.58±0.60**	**3.52±0.52**
Skill	Performing all the skills required during this simulation	3.45±0.88	3.44±0.88	2.89±0.79
	The skill is performed in accordance with the technique	3.33±0.71	3.56±0.73	3.11±0.78
	Total	**3.38±0.75**	**3.50±0.72**	**3.00±0.72**
Total score		**2.99±0.49**	**3.37±0.44**	**3.11±0.44**

The order of intervention based on triage category: Correct identification of priority as red-yellow-green.
*** Min:1- Max:5**

Table 3. Student Feedback

	Student Feedback	Definitely Disagree		Disagree		Agree		Definitely agree	
		n	%	n	%	n	%	n	%
1.	The simulation experience helped me understand the subject better			1	2.5	14	35	25	62.5
2.	Reviewing what I learned before the simulation helped me during the simulation			2	5	16	40	22	55
3.	Simulation is a valuable learning method			1	2.5	8	20	31	77.5
4.	Simulation enabled the development of my critical thinking skills			1	2.5	14	35	25	62.5
5.	The simulation was realistic			2	5	16	40	22	55
6.	The transfer of the knowledge acquired from the simulation experience to the clinical environment could be easier			1	2.5	9	22.5	30	75
7.	I was nervous during the simulation experience			4	10	21	52.5	15	37.5
8.	I will feel less nervous if I encounter a similar situation in the clinic			2	5	25	62.5	13	32.5
9.	The simulation experience can partially replace true clinical experience	2	5	1	2.5	29	72.5	8	20
10.	Simulation experiences should be integrated into the curriculum			1	2.5	10	25	29	72.5
11.	I had the opportunity to discuss my and my friends' performance during the analysis phase			1	2.5	12	30	27	67.5
12.	The analysis phase reinforced my learning			1	2.5	13	32.5	26	65

Discussion

Triage by experienced and trained personnel in emergency services ensures the provision of rapid treatment and care to individuals with life-threatening problems (Christ et al., 2010). Simulation-based training is widely used to provide the knowledge, skills and experience required in emergency care management. Simulation-based training courses have been shown to develop the self-efficacy, self-confidence and management skills of emergency nurses (Abelsson, Rystedt, Suserud, & Lindwall, 2016; Jonson et al., 2017) and to improve their clinical performance in the psychomotor skills and affective domains (Kung, Ok, Soo, Won, & Yon, 2012).

Video recordings were made during simulation-based training courses to evaluate the students' performances. Educators used checklists when evaluating these video recordings (Jeffries,

2012). Checklists can be used to evaluate both technical and nontechnical skills during team performances (Spanager et al., 2013). The highest scores obtained during the triage practice performance evaluation in this study were observed in the yellow triage (emergency) category (3.37 ± 0.44). The students' mean scores for situational awareness, decision-making and intrateam communication skills in the scenarios involving red triage category (very urgent) patients were lower than those obtained for the other triage categories. It is thought that students could not manage the crisis effectively in very urgent situations and that the stress negatively affected their performance. Confusion of nonurgent situations with emergency situations increases the wait time for patients with real emergencies. In another study, while a high percentage of nurses could generally successfully distinguish betwen very urgent and nonurgent patient categories, they were be more indecisive when identifying emergency situations (Alexander et al., 2016). The reason for the students' low performance for high-urgency triage categories can be explained as poor crisis management due to the lack of professional experience and competence. In similar studies, the ability of emergency nurses to correctly determine triage categories was low, an outcome explained by the nurses' short working time and limited competence (Considine, Botti, & Thomas, 2007; Mirhaghi & Roudbari, 2011). The literature shows that as professional experience increases, nurses can more accurately determine the triage category (Considine et al., 2007; Rahmati, Azmoon, Meibodi, & Zare, 2013). The inadequate knowledge and skill levels of emergency nurses for determining triage levels is reported to be due to their lack of training in triage nursing (Azhough et al., 2015; Ebrahimi, N., Gorgich, Darban, & Shirzadi, 2016; Sardar, Taverner, Ghani, Kussor, & Naz, 2013). Similarly, the low mean performance scores during the evaluation of the patients in the green triage (nonurgent) category indicated that the students did not show the necessary consideration of these patients and ignored certain conditions.

All the students who participated in the study stated that simulation-based education facilitated their learning. Studies have provided support for the notion that simulation-based training facilitates learning by integrating theory and practice prior to clinical practice (Aebersold & Tschannen, 2012; Lapkin, Levett-Jones, Bellchambers, & Fernandez, 2010). This facilitation contributes to the development of a more positive attitude towards the course among students. Simulation-based training is valuable in terms of facilitating the transition to clinical training and increasing motivation by allowing the student to communicate with the patient (Aebersold & Tschannen, 2012; Boling & Hardin-Pierce, 2016; Lapkin et al., 2010; Shin, Park, & Kim, 2015). Simulation-based training is reported to enable the development of students' skills and to contribute to maintaining these skills (Motola, Devine, Chung, Sullivan, & Issenberg, 2013). The literature has shown that simulation is a robust method in nursing education and should be integrated into the curriculum (Motola et al., 2013; Najjar, Lyman, & Miehl, 2015). The use of a standardized patient is an effective method for improving students' experience and performance (Schram & Mudd, 2015). Research indicates that in clinical skills training, students who learn through standardized patient scenarios make more accurate diagnoses than students who learn by the traditional method (Yoo & Yoo, 2003). Moreover, students who learn to communicate with standardized patients will provide better service in real patient care (Shankar & Dwivedi, 2016). In scenario applications involving mannequins, students forget to communicate with the patient and focus more on the application of techniques (McCaughey & Traynor, 2010; Yuan, Williams, Fang, & Ye, 2012). Mannequins and standardized patients have been shown to be more effective for improving students' cognitive development and learning of practical skills (Abelsson et al., 2016; Davis et al., 2007; Wyatt, Archer, & Fallows, 2015). Studies have shown that the use of a standardized patient increases students' awareness of communication skills, positively affects patient outcomes, and contributes to patient safety, including patient care and discharge (Defenbaugh & Chikotas, 2016; MacLean, Kelly, Geddes, & Della, 2017; Ryan et al., 2010). In this study, high-fidelity mannequins and standardized patients were simultaneously used to present frequently encountered cases with different triage categories in Turkey, thereby developing nursing students' practical skills as well as their situational awareness, clinical decision making, leadership, communication, and patient and employee safety practices.

Conclusion

Nursing students' performance was evaluated using hybrid simulation in triage training. The students gave positive feedback in this study, which aimed to promote their competence in triage. Nearly all of the students mentioned that this method was a valuable learning method. It is worth noting that this method is effective in triage training. The students showed the best performance for the yellow triage category during triage practice. The students' decreased performance for the red (very urgent) triage category is believed to be due to their inadequate professional experience and competence. Similarly, it was determined that students did not show the necessary consideration during the evaluation of patients in the green triage (nonurgent) category.

The training and improvement of health care team members who apply triage should be closely monitored. The knowledge and experience of the personnel responsible for triage are the basic criteria for the rapid evaluation and diagnosis of emergency patients and successful triage. Because knowledge and experience affect whether the correct right triage decision is made, institutions should support and prioritize the education of those responsible for triage and their development in this area. The use of hybrid simulation methods is recommended to improve nurses' learning of triage practices during undergraduate training.

Limitations

The fact that this study was conducted at only one nursing school limits the generalization of the results. The country and cultural characteristics were taken into consideration during the selection of triage cases. The scenario was limited to four case characteristics that apply to the emergency department. It was conducted with a limited number of students.

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