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Drill; A Solution to Reduce Mistriage in Prehospital Emergency Setting

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Abstract

Background: Triage is used as one of the main concepts in emergency medicine to differentiate between critically ill patients and those in non-emergency situations. Mistriage (undertriage and overtriage) occurs when the prioritization of patients or injured is not performed correctly for any reason.

Objectives: According to studies, the incidence of mistriage is high worldwide. Exercise is one of the ways to reduce the amount of mistriage.

Methods: This two-group pretest post-test intervention study aimed to investigate the effect of drills on the mistriage of emergency medical service personnel. The follow-up period in this study was 14 days. The participants of the present study included 70 pre-hospital emergency personnel from the selected cities of Isfahan province. After the selection of two cities from Isfahan province by lottery method, all the personnel from these two cities who met the inclusion criteria were involved in the study by census method. The research instruments included: a demographic information form questionnaire, Triage Decision Making Inventory (TDMI), and designed START/jump START triage scenarios. After the collection of the required data, they were analyzed by appropriate parametric and nonparametric statistical tests.

Results: Based on the results, the mistriage rate decreased from 4.74±1.55 out of 12 before the intervention to 1.1±1.4 after the intervention in the intervention group. Moreover, after the drill, the score of triage decision-making power increased from 121±15.72 to 136±15.11.

Conclusion: The findings of the present study pointed out the effectiveness of this exercise method in the reduction of mistriage in participants. Therefore, this method shuld be used in emergency medical service personnel training and preparation programs.

Keywords: Drill, Emergency medical service, Emergency nursing, Operations-based exercises, Triage

1. Background

Most fatal accidents occur in emergency situations following delays in providing services to the injured. Therefore, the provision of prompt and timely health care services to the injured is necessary (1). One of the practical tools for the management of time and resources in emergency medicine is triage, which means prioritizing and categorizing (2). The word "triage" has a French root and was first used in the 18th century by Dr. Jean Larry in the Waterloo War. Triage is used as one of the main concepts in emergency medicine to differentiate between critically ill patients and those in non-emergency situations (3). The correct performance of triage requires the right decision of the nurse and emergency medical technician. Studies have demonstrated the direct effect of triage nurses' clinical decisions on the injured and patients' waiting time in the emergency department and receiving medical services. Proper triage is one of the indicators of emergency medicine performance (4).

Mistriage (undertriage and overtriage) occurs when the prioritization of patients or injured is not conducted correctly for any reason. The occurrence of mistriage is one of the most daunting challenges in emergency medicine since placing the patient on a lower priority or under-triage leads to more waiting for the injured with worse conditions. Other consequences of undertriage include worsening the patient's condition and severe side effects or even death. Putting the patient on a higher level of priority or over-triage may also limit other emergency patients' access to resources, wasting valuable resources and wasting time. The reduction of mistriage is an essential principle worldwide in providing emergency services to save more people affected by accidents and manage resources(3, 5).

Due to the critical importance of triage, various training strategies, such as lectures, workshops, simulation courses, and tabletop exercises (A type of discussion-based exercise), are being used across the world to reduce mistriage. For instance, an increased knowledge level and a decrease in nurses' mistriage have been reported in a study conducted in Iran following an educational lecture (6). In a study performed in Egypt, a reduction in mistriage was reported following a simulation exercise (7). Nevertheless, the incidence of mistriage is much higher than the standard (8, 9). The correct START (Simple Triage And Rapid Treatment) triage was only 36% in a study in the USA(10). In another study in

Iran, the correct triage rate by emergency medical technicians was 48.53% (11).

The effectiveness of exercise in other relief areas has been confirmed in various studies. A study conducted in Kenya in 2021 demonstrated the positive impact of the drill by airport security forces on preparedness to deal with terrorist incidents (12). A study conducted on firefighters in Portugal in 2020 denoted that their performance and readiness improved after playing a simulated game, which is one of the types of exercise (13). Based on the mentioned issues, performing exercises in different relief activities is necessary for these groups.

According to the Emergency Nurses Association (ENA), practice exercises are one way to reduce mistriage. Exercises are categorized based on various criteria. Federal Emergency Management Agency (FEMA) categorization is the most common one, and it divides exercises into two types: discussion-based and performance-based. Discussion-based exercises are mainly theoretical, while operations-based exercises are practical tasks (14, 15). There are different types of operations-based exercises, one of which is the drill which is used to examine a specific operation in an organization. It covers limited achievement goals, such as teaching a skill, examining a method, or preparing for more complex exercises. The results of this exercise revealed the level of knowledge or skills of personnel in a field.

Some of the features of the drill are cost-effectiveness, limited focus, realistic view, strong feedback, and the possibility of its application to exercise on a larger scale. These unique features make the drill a popular and convenient way to improve preparedness and build capacity in different groups, especially relief groups (16-18). The lack of facilities in the ambulance compared to the hospital and the lack of resources in the pre-hospital emergency necessitate the correct performance of triage (19).

Triage algorithms are very diverse around the world. In Iran, according to the order of the Ministry of Health and Medical Education, the Emergency Severity Index (ESI) triage algorithm is used under normal circumstances, which is a 5-level number-based triage. Moreover, according to the ministry's instruction, following disasters and multiple casualty incidents, the Simple Triage And Rapid Treatment (START/Jump START) system, a 4-level, color-based rapid triage, should be used in hospitals and pre-hospital emergencies (20).

2. Objectives

In Iran, various traffic or industrial accidents occur daily. Therefore, the health system needs to properly manage such resources as time, medical equipment, and the number of hospital beds to provide medical services to more injured people. In light of the aforementioned issues, the present study aimed to investigate the effect of drills on the mistriage rate of emergency medical service personnel in Iran.

3. Methods

3.1. Design

This prospective pre-post-intervention study was performed on 70 emergency medical service personnel in Isfahan province (35 in the intervention group and 35 in the control group) from August to September 2021. The research sample was emergency medical service personnel of selected cities of Isfahan province. To conduct research, after the selection of two cities from Isfahan province by the census method, all the personnel from these two cities who met the inclusion criteria were involved in the study via the census method. These two cities are almost similar in size and population, and according to the personnel pyramid and the pre-hospital emergency structure in these two cities, the number of official personnel is equal.

The inclusion criteria entailed emergency medical service personnel of selected cities, six months of experience in a pre-hospital emergency in the country, having a degree in nursing, emergency medical technician, disaster relief, or Anesthesiology. On the other hand, the exclusion criteria were as follows: leaving the exercise before completing the exercise process due to the need to attend the mission (Figure 1).

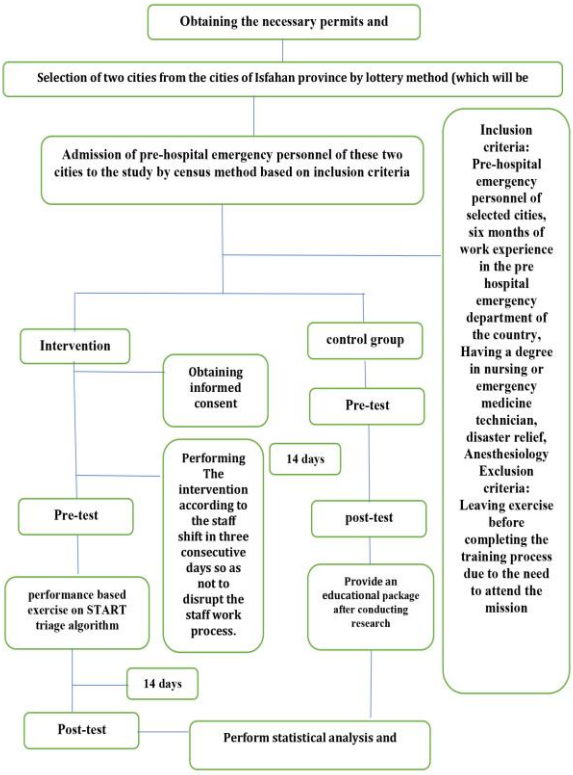

Figure 1. Study Flowchart

3.2. Intervention

The intervention in the present study was a drill in the field of START/jump START triage. The drill is an intermediate-level performance-based exercise that focuses only on one area. The intervention in this study includes 1. Having a public meeting and explaining the rules in a place outside the drill site 2. Performing triage for 12 hypothetical patients in a specific scenario for a period of 6-12 minutes in a simulated environment 3. Discussing the scenarios used in exercise after the completion of practice in the formal educational environment.

3.3. Measurements Methods

A questionnaire consisting of three sections was used to collect the needed data. The first part was a demographic information form consisting of five questions, including age, education, work experience, study discipline, and a history of participating in the triage course in the last year. The second part was Triage Decision Making Inventory (TDMI) questionnaire used to assess the decision-making power. It consists of 27 items(cognitive abilities=14 items, the field of experience=6 items, and insight=7 items) (21).

The items are rated on a 6-point Likert scale ranging between strongly agree (6) to strongly disagree (1), yielding a score of 27-162. In this tool, obtaining a higher score is indicative of one's higher decision-making power in the field of triage. The third part of the questionnaire was the standard cards of the START/Jump START triage, routinely used in the pre-hospital emergency department of the country according to the instructions of the Ministry of Health and Medical Education of Iran. These cards are used to collect answers to scenario questions; thereafter, they are evaluated by the researcher, and the answers are recorded as correct or incorrect.

Permission to use the TDMI tool was obtained from its designer, and the translation-re-translation process was performed since it was used for the first time in Persian and in Iran. Finally, its validity was determined by the content validity method and the Lawshe index (mean CVR = 0.66 and CVI = 0.86 for all questions). The reliability of this scale was determined using the test-retest method and correlation coefficient (r = 0.82).

It is worth noting that seven scenario packages, including event description and 12 event-based questions for different patient age groups and different triage levels, were designed to perform drill and evaluate the level of mistriage by participants before and after the intervention. The above scenarios were designed based on the scientific literature and field experiences of the research team. The content validity of the above scenario packages was performed with the cooperation of 12 experts in the pre-hospital emergency and START/Jump START triage. Of the seven packages of the above scenario, six ones were tested during the exercise and one for pre-test-post-test.

3.4. Data Collection Procedure

Necessary coordination was made with the pre-hospital emergency heads of the two cities of Isfahan province; subsequently, after explaining the study objectives, they were invited to assist in the study. In the control group, the pretest was performed. In this group, the post-test was performed after 14 days. After conducting the pretest, the intervention consisting of a START/Jump START triage drill was performed in the intervention group. According to the work schedule of emergency medical service personnel in Iran, participants attended the exercise for three consecutive days following their work shifts. Out of six designed scenario packages, two scenarios for each day were selected by lottery method, based on which the drill site was designed and prepared.

Mannequins and balloons were used on which hypothetical injury conditions were described, placed in different places, such as the street floor, inside the car, and among the bushes. The researcher first explained the exercise rules and methods to the participants in an environment away from the drill site every day. The subjects then entered the site in pairs, and it took 6-12 min to complete triage and record on the triage cards provided to them. To better manage time and perform triage, the researcher enlisted the help of three individuals who had been trained before the study.

Participants would gather in another room, separated from those who had not yet entered the drill site. The scenarios used that day were discussed with the help of a meeting facilitator who was an expert in triage. Following that, 14 days after the drill, the post-test was administered to the participants. All participants in the study had necessary cooperation with the research team until the end of the study, and no sample was eliminated.

3.5. Ethical considerations

Ethical considerations in this study were as follows: Obtaining the code of ethics (IR.TUMS.FNM.REC.1400.073) from Tehran University of Medical Sciences, obtaining a written permit and submitting it to the pre-hospital emergency organization of the studied cities, obtaining informed consent from research participants, maintaining the confidentiality of participants' information, presenting a package of scenarios used in the experimental group along with the correct answer of each of them to the control group after the study, observing ethical principles throughout the study, deleting the names of the participants and assigning an identification code to enter the pretest and post-test data.

3.6. Statistical Analysis

The collected data were entered in SPSS software (version 20) and statistically analyzed after testing their normal distribution using the Kolmogorov-Smirnov test. Parametric and nonparametric tests, including mean and standard deviation, independent t-test, paired t-test, Chi-squared, Fisher, and Mann-Whitney, were used. A p-value less than 0.05 was considered statistically significant.

4. Results

A total of 70 individuals (35 in the intervention group and 35 in the experimental group) participated in this study. No subject was eliminated. The mean age scores were 36.71± 8.83 and 36.7± 6.72 years in the intervention and control groups, respectively. The mean scores of work experience in the intervention and control groups were obtained at 12.86±8.29 and 12.11±6.31 years, respectively. In terms of education, most subjects had a bachelor's degree in emergency medicine and nursing in both groups. There was no statistically significant difference between the two groups in demographic data (Table 1).

Based on the findings, before the drill, the mean mistriage rates were 4.74±1.55 and 4.1±1.87 out of 12 in the intervention and control groups, respectively. Furthermore, the results indicated that the mean triage decision-making power in both groups (control 113±15.53 and intervention 121±15.72) was low. Following the independent t-test, there was no statistically significant difference between the intervention and control groups before the intervention in terms of mean mistriage rate (P=0.890) and triage decision-making power (P=0.207).

After drilling, the mean mistriage rates were 1.1±1.4 and 4.1±1.97 out of 12 in the intervention and control groups, respectively. The results indicated that after the drill, the mean scores of triage decision-making power were 136±15.11 and 109±15.53 in the intervention and control groups, respectively. According to this, the mistriage rate decreased, and decision-making power increased significantly (P<0.001). Nevertheless, no significant difference was observed in the control group for the mistriage rate (P=0.244) and decision-making power (P= 0.496). Table 2 displays the mistriage rate and decision-making power score in the control and intervention groups before and after the drill.

Table 1. Demographic data of participants

Group	Variable	Control group Number (%)	Intervention group Number (%)	P value
Education	Associate	9 (25.7)	8 (22.9)	0.208*
	Bachelor	26 (74.3)	24 (68.6)	
	Masters	0 (0)	3 (6.8)	
Study Discipline	Emergency Medical Technician	16 (45.7)	17 (48.6)	0.171*
	Nursing	13(45.7)	16 (37.1)	
	Anesthesiology	0(0)	2 (5.7)	
	Disaster Relief	1(2.9)	5 (14.3)	
History of participating in the triage course in the last year	Have participated	7 (20)	9 (25.7)	0.589*
	Have not participated	28 (80)	26 (74.3)	

*Chi-square test

Table 2. Miss-triage rate and decision-making power in the control and intervention groups before and after the drill

Variable	Time / Group	Before intervention	After intervention	P value
		Mean ± SD		
Miss-triage	Intervention group	4.74±1.55	1.1± 1.4	<0.001*
	Control group	4.1±1.87	4.1±1.97	0.244*
	P value	0.890**	<0.001**	-
Decision-making power	Intervention group	121±15.72	136±15.11	<0.001*
	Control group	113±15.53	109±15.53	0.496*
	P value	0.207**	<0.001**	-

* Paired t-test
**Independent t-test

5. Discussion

The hypothesis of the present study indicated the existence of a relationship between performing drills and reducing mistriage among pre-hospital emergency personnel. The results of the study, in line with the hypothesis of the research, pointed out that conducting drills reduced mistriage among pre-hospital emergency personnel. As illustrated by the results, the mean mistriage rate decreased, and the mean triage decision-making power increased after drilling, signifying a statistically significant difference. Therefore, the results denoted that drilling can reduce the mistriage rate and increase triage decision-making power. Consistent with the findings of the present research, in the studies conducted by Sedaghat et al. (2012) and Mirhaghi et al. (2010), the mean age scores of participants were reported 31.32±3.94 and 29.46±4.09, respectively (22, 23). The mean work experience of all participants was

12.48±7.3. Javadi et al. (2016) reported the mean work experience of nurses participating in the study as 10.07±6.89, slightly less than the present study (24).

The results of the current study pointed to a high rate of mistriage rate: 4.74 out of 12 (39.5%) in control group and 4.1 out of 12 (34.1%) in the intervention group before the intervention. Kamrani et al. (2013) reported a mistriage rate of 35.4%, which is in agreement with our results, although the triage pattern and the location of the study were different from the present study (3). In line with the findings of the present research, Mirhaghi et al. (2010) reported a mistriage rate of 56.57% in a hospital emergency room (22).

The high mistriage rate in the pre-hospital emergency personnel group can be caused by the gap between knowledge and practice, lack of performance-based exercise, and non-use of triage patterns in daily missions. In this context, drills can communicate knowledge and performance and reduce mistriage in emergency teams, especially pre-hospital emergencies. In accordance with the results of the current study, Abbasi Dolatabadi et al. (2022) reported seven categories in the challenges of the triage field around the world and suggested performance-based exercise especially drill, as a solution to overcome some of these challenges (25). Another result achieved in the present study was the low decision-making power in the triage among pre-hospital emergency personnel before drilling. Esmaeilzadeh et al. (2019) reported the low clinical decision-making power of pre-hospital emergency personnel in Iran before the trauma patient training program (26).

The results pointed out that the drill reduced the mistriage rate and increased the decision-making power of pre-hospital emergency personnel. In this regard, the findings of Khan (2018) revealed that a tabletop exercise increased triage accuracy and reduced the mistriage rate (27). In the same context, Arshad et al. (2015) stated that a simulated exercise reduced mistriage (28). Both studies were different from the present research in terms of the type of exercise performed; nonetheless, the results of the exercise intervention were consistent with our findings. In their study, Knight et al. (2010) investigated the effect of playing computer games on miscarriage. According to the findings of this study, playing games can reduce the mistriage rate. Although the type of exercise in this study is different from the current research, its results are consistent with our study (29).

The study performed by Faraji et al. (2015) demonstrated that a workshop, one of the discussion-based exercises, could reduce mistriage (30). Risavi et al. (2001) conducted a study on emergency medical service personnel and concluded that a multimedia educational intervention could reduce mistriage (31). These two studies are different from the present research in terms of the type of exercise used; however, the results and the effect of exercise on reducing mistriage are consistent with our findings. Chih Chen et al. (2003) found that the tabletop exercise on START triage increased the ability to perform triage and reduced mistriage (32). This study was also different from the present research regarding the type of exercise; nonetheless, the triage algorithm and the result obtained were consistent with our findings.

In another study conducted by Fathoni et al. (2013) in Jakarta, Indonesia, the relationship between the knowledge and skill of triage and exercise was measured. Based on the results of the referred study, there is a positive relationship between exercise and triage knowledge and skills. The results of this study are in line with the present study in terms of the positive effect between exercise and implementation of correct triage, while in the study by Fathouni et al., there is no mention of the type of exercise and the type of triage algorithm (33).

5.1. limitations

Among the notable limitations of this study, we can refer to the absence of women mainly due to the structure of the pre-hospital emergency in Iran and their absence in pre-hospital emergency stations. Furthermore, sampling and intervention in one day were not possible due to the shift work of pre-hospital emergency personnel; accordingly, information leakage may have affected the results.

6. Conclusion

In general, the results of this study demonstrated that the drill could significantly reduce mistriage and increase the decision-making power of emergency medical service personnel. As evidenced by the findings of this study, emergency medical service managers and policymakers are advised to include operations-based exercises, such as the drill, in their schedules. It is also suggested that more extensive studies be performed to examine operations-based exercises, particularly drills, in different relief groups. It is recommended to use operations-based exercises, especially the drill, for education in other triage algorithms. Conducting research with more samples is essential to ensure and make a definite statement.

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Footnotes

Conflicts of Interest: The authors report no conflict of interest.

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