

Original Paper

Comparison of the Effect of Lecturing and Tabletop Exercise Methods on Level of Preparedness of Nurses against Natural Disasters



Samaneh Mirzaei^{1,2}, Adel Eftekhari^{1,2}, Leila Mohammadinia^{3*}, Abbas Ali Dehghani Tafti⁴, Roohangiz Norouzinia^{5,6}, Khadijeh Nasiriani⁷

1. Ph.D. Health in Emergency and Disaster, School of Public Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran.
2. Research Development Center, Shahid Rahmehoon Hospital, Shahid Sadoughi University of Medical Sciences, Yazd, Iran.
3. Department of Health Emergencies and Disasters, Health Human Resources Research Center, School of Management and Information Sciences, Shiraz University of Medical Sciences, Shiraz, Iran.
4. Associate Professor, Department of Health in Emergency and Disaster, School of Public Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran.
5. School of Paramedical Sciences, Alborz University of Medical Sciences, Karaj, Iran.
6. Department of Health in Emergencies and Disaster, School of Management and Medical Information, Esfahan University of Medical Sciences, Esfahan, Iran.
7. Associate Professor, Department of Nursing, School of Nursing and Midwifery, Shahid Sadoughi University of Medical Sciences and Health Services, Yazd, Iran.



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ABSTRACT

Introduction: Hospitals are the first-line care providers in natural disasters. Nurses, as one of the critical health professional groups, require adequate peroration for responding to natural disasters. Due attention has to be paid to various teaching methods to improve the level of nurses' preparedness.

Objective: This study compared the effect of lecturing and lecturing-tabletop exercise methods on the level of nurses' preparedness against natural disasters.

Materials and Methods: In this quasi-experimental study, 74 nurses were randomly selected from different wards at a hospital in Yazd City, Iran, in 2017. Nurses' preparedness level was measured with the 72-item Scale for Nurses' Preparedness against Natural Disasters, including three areas of knowledge, attitude, and performance. The study participants were assigned into group A (lecturing method, n=37) and group B (lecturing-tabletop exercise method, n=37) using a simple random sampling technique. Nurses' level of preparedness was measured three times (pre- and post-intervention, and follow-up) using the Preparedness for Disasters questionnaire. The obtained data were analyzed applying repeated measures Analysis of Variance (ANOVA) and Paired Samples t-test.

Results: The mean scores of nurses' knowledge, attitude, and performance were increased by 4.94, 7.38, and 5.59 in group A as well as 6.56, 11.43, and 6.08 in group B. Additionally, the total score of nurses' preparedness in group B was significantly higher at Pre-test, post-test, and one-month follow-up (107.89 ± 7.50) ($P=0.0001$).

Conclusion: Education (lecturing and lecturing-tabletop exercise methods) positively affected nurses' preparedness. However, it was more effective through lecturing-tabletop exercise methods due to having a scenario and the better participation of nurses in the learning process. This finding emphasizes the positive effect of participants' interactions in the tabletop exercise method on the quality of education, critical skill, and increased level of nurses' preparedness against natural disasters.

* Corresponding Author:

Leila Mohammadinia, PhD.

Address: Department of Health Emergencies and Disasters, Health Human Resources Research Center, School of Management and Information Sciences, Shiraz University of Medical Sciences, Shiraz, Iran.

Tel: +98 (99) 04042940

E-mail: leyla.mohammadinia@gmail.com

Highlights

- Hospitals and health centers are the first units to provide optimal and timely healthcare services in unexpected accidents and natural disasters.
- Education positively affected nurses' preparedness through lecturing and lecturing-tabletop exercise methods. However, it was more effective using the lecturing-tabletop exercise method.
- The quality of the health system response (including nurses) to disasters is directly related to the knowledge level and attitude of nurses. Therefore, by improving the knowledge, attitude, and skills of nurses, we have taken an essential step in providing a proper response to disasters.

Plain Language Summary

The role of hospitals and health centers is very critical in disasters. Moreover, they are among the first units to provide optimal and timely healthcare services. They could help with reducing mortality and increasing the number of survivors, reducing the effects of disabilities, and alleviating physical pain. Preparedness has a vital and decisive role in disaster management. Nurses' training in emergencies and disasters positively impacts their efficacy in care delivery. Although there are various training methods, their effects have not been investigated in many cases. The present study evaluated the effect of two training methods on nurses' preparedness in response to disasters. We used conventional lecturing and practical training by reviewing an earthquake scenario. The study findings suggested that both methods increased nurses' preparedness in disasters. However, the effect of the practical education method is more significant than lecturing education. Nurses comprise the most extensive healthcare team and have a multifaceted role in the treatment; therefore, there is a great need to improve the preparedness of the health care sector. This aim could be achieved by increasing their preparedness, and knowledge, and skills to provide a better response in disasters. This will lead to better disaster management and reduce human casualties and ultimately helps to reduce the risk of disasters.

Introduction

In 2017, of 335 accidents, 136 occurred in Asia, 93 in the US, 42 in Africa, 39 in Europe, and 8 in Oceania [1]. Iran, as an Asian country, is highly exposed to natural disasters due to its specific geographical characteristics [2, 3]. These disasters exert detrimental effects on human health, infrastructures, and facilities [4]. The past and present disasters indicate that communities are not adequately prepared to respond to these disasters [5]. Besides, in the developing countries, insufficient budget allocation for natural disasters has increased vulnerability in hygienic, and socioeconomic social domains [6]. Thus, adequate measures should be taken to save lives and decrease disaster-related damages [7].

The healthcare section, especially hospitals, play the most significant role in the primary stages of emergencies and disasters. Therefore, the increased preparedness of healthcare systems for identifying risks and responding appropriately to disasters is of utmost importance [8]. Preparedness of hospitals against natural disasters influences their performance in the best care provision and

increases their capacity for suitable responding in these conditions [9]. The global reports stated that the approval of plans and policies, designing and building resilient hospitals at the national level, assessment of hospital safety, education, protection of personnel and equipment, and strategic planning for emergency responding are among the facilities and approaches for safe care provision [8]. Moreover, the presence of response policy and standard practical guide for emergency hospital activities in internal and external events are influential in hospital preparedness against natural disasters [7].

Considering the outstanding role of hospitals in caregiving due to frequent patient presentations, their preparedness for appropriate disaster-responding is mandatory [10]. Thus, the level of knowledge, attitude, and performance of the healthcare personnel, especially nurses, as a considerable group of professional caregivers, must be enhanced [9]. The World Health Organization (WHO) has rendered the personnel's preparedness and education as an appropriate strategy in diminishing traumata and damage [11]. Nurses can play a significant role during and after disasters; thus, promoting these

professionals' capabilities is a major management principle in disasters and events [12-14]. Furthermore, considering the wide range of disasters in the health domain, nurses should be sufficiently prepared for correct planning and responding to disasters [6]. They require knowledge and skills to achieve this goal [10]. Nurses should be obligatorily trained in disaster issues to improve their knowledge about natural disasters [10, 15]. Improving nurses' knowledge and attitude before disasters prepares them for better caregiving at disasters [16, 17].

Nurses' education on natural disasters fosters their motivation and positively affects their healthcare provision [18]. Kaplan et al. demonstrated the positive effect of these simulation exercises on nursing students [19]. Despite disaster-related education in recent years, the knowledge of responding to disasters is reported as "inappropriate" in many countries [20]. Exploring the efficacy of many educational programs developed to promote nurses' capability for responding to disasters has been overlooked [21].

Such education is accomplished through various methods. The lecturing method is among the most commonly used approaches in Iran. Lecturing is a passive teaching method used regardless of the differences in learning. However, it is inappropriate for educating operational skills. It facilitates mental skills at high levels of learning. Additionally, there is the possibility of rapid forgetting for presented training programs [22].

Another practical method is field or tabletop exercise approach in which computers, whiteboards, or maps are used for presentation and education. The advantages of tabletop exercise over operational methods include reduced costs, the easier availability of facilities and equipment, as well as the participation of a greater number of learners in education. Positive and dynamic interaction for presentation and the possibility of evaluating all situations before disasters occur are other advantages of this method. Therefore, such training should be implemented and evaluated [23].

Despite the availability of various teaching methods, their efficacy and efficiency still need to be studied [18]. Therefore, given the numerous teaching methods, it is highly important to identify the most effective pedagogic procedure with the highest efficacy for learners. Consequently, this study compared the effects of lecturing and tabletop exercise methods on the level of nurses' preparedness against natural disasters at a hospital in Yazd, City, Iran, in 2017.

Materials and Methods

This was a quasi-experimental study with a Pre-test, Post-test design. It assessed two education groups via holding lecturing workshops for one group and lecturing plus tabletop exercise workshop for the other.

Each group's sample size was estimated as 35, based on the study by Ghanbari et al. with the two-tailed significance of $\alpha=0.05$, test power of %80, and Standard Deviation (SD) of 5, and a subject attrition rate of %10 [11]. Finally, 40 nurses were selected as the sample of each group. Initially, nurses working at a hospital in Yazd, Iran, with BS/MSc. degree in nursing or diploma of paramedics that were inclined to participation and had not participated in similar educational courses were listed. Then, 80 nurses were randomly selected. Next, all study participants (80 nurses) were randomly assigned into groups A or B, using random numbers table. Group A participated in a lecturing workshop; whereas group B participated in a lecturing and tabletop exercise workshop on disaster preparedness. The study participants were excluded from the study if they withdrew from the study, were absent in any part of the workshop, or failed to complete the questionnaire (Figure 1).

In this study, the disaster preparedness program was implemented for the two groups on disaster management, the assessment of possible risks, as well as planning for responding to the probable risks using the two mentioned methods. Group A participated in an 8 h lecturing workshop presented by disaster health specialists. Group B participated in a one-day lecturing-tabletop exercise workshop, including lecturing for 8 h and 2 h tabletop exercises on the same day presented by disaster health specialists. The primary teaching materials included disasters and their effect on health, the stages of disaster management, investigation of risks and possible vulnerability, and planning in disasters approved by the Continuing Education Office of the Ministry of Health and Medical Education.

The intended scenario in the tabletop exercise was the incidence of an earthquake that was explained to the nurses in a room outside of the hospital (Table 1). Then, each participant in group B was requested to assess the scenario, and their opinions were subsequently discussed. This tabletop exercise aimed at familiarizing nurses with the methods of avoiding crowds and pile-ups at the time of earthquake, management of personnel attendance in critical situations (in the case of cutoff of all communication channels), information-giving and code announcement, evacuation of patients from the

damaged parts to safe parts of the hospital, imaging and filming the events and documenting them, identifying strong points, assessment of capabilities, as well as extraction of the present problems and barriers.

To assess nurses' preparedness, the "Preparedness for Disasters Questionnaire", developed and validated by Ghanbari et al. was used. The reliability of this tool was reported by Ghanbari et al. as Cronbach's $\alpha=0.87$ [11]. In this study, the test's reliability was also assessed by internal consistency using Cronbach's alpha coefficient and equaled 0.81. In this 72-item questionnaire, 27 items assess knowledge with a score ranging from 0-27, 20 items assess attitude towards crisis management and planning for coping disasters with a score ranging 20-80, and 25 items related to nurses' performance in planning for coping with disasters with a score ranging 0-25. The total score of the preparedness assessment questionnaire equals to 132. This inventory covers three areas; knowledge (27 items), attitudes (20 items), and performance (25 items). It was completed by nurses at pre-education, immediately post-education, and follow-up (1 month after the education).

The study participants were assured of information confidentiality. Informed written consent was obtained from each nurse, and they were given the right to withdraw at any stage of the study. Subsequently, the questionnaire was provided to the nurses. The obtained data were analyzed in SPSS V. 24 using descriptive statistics, repeated measures Analysis of Variance (ANOVA), and Paired Samples t-test.

Results

This study was conducted on two groups of 40 nurses, as follows: group A received education via lecturing, and group B received education through lecturing-tabletop exercise. Both groups had a subject attrition rate of 3. In group A, 2 nurses left in the middle of the workshop and one nurse failed to complete the questionnaire. In group B, 3 nurses did not participate in the tabletop exercise and were excluded from the study. Eventually, the statistical analysis was performed on 37 nurses in each group. Kolmogorov-Smirnov test results indicated the normal data distribution; thus, parametric tests were used. There was no significant difference between the two groups in demographic variables, including gender, age, work experience, managerial experience, membership in Crisis Committee, and education in disasters.

The Mean $\pm$ SD age and work experience of nurses were 31.38 ± 5.62 and 6.57 ± 5.24 years in group A, and

31.62 ± 4.78 and 7.14 ± 5.17 years in group B, respectively. Most study units (64.8%) of both groups were female with a BS degree in nursing (87.8%).

The results of repeated measures ANOVA demonstrated that education significantly increased the Post-test and follow-up mean scores of knowledge, attitude, and performance and follow-up (Appendix 1) ($P=0.0001$). In group A (education with lecturing), the Mean $\pm$ SD scores of knowledge increased from 13.92 ± 3.02 to 18.86 ± 2.41 , the mean scores of attitude increased from 62.24 ± 6.08 to 69.62 ± 6.34 , and the mean scores of performance increased from 7.00 ± 3.66 to 12.59 ± 4.04 . Totally, the general preparedness scores increased from 83.16 ± 8.85 to 101.08 ± 9.37 in the follow-up. In group B, the mean scores of knowledge increased from 14.03 ± 3.32 to 20.59 ± 2.38 , the Mean $\pm$ SD scores of attitude increased from 62.03 ± 5.99 to 73.46 ± 4.75 , and the Mean $\pm$ SD scores of performance increased from 7.76 ± 3.28 to 13.84 ± 3.91 . Totally, the general preparedness increased from 83.81 ± 9.14 to 107.89 ± 7.50 from pre-test to the follow-up. Thus, the scores of nurses' preparedness were greater in group B, compared to group A with the difference being significant in knowledge ($P=0.003$), attitude ($P=0.005$), performance ($P=0.680$), and total preparedness ($P=0.0001$).

The achieved results revealed that the knowledge scores decreased in group A by 2.25 at follow-up, compared to immediately post-education, whereas it decreased in group B by 1.46 at follow-up education, compared to immediately post-education. Moreover, the attitude scores decreased in group A by 2.06 at follow-up, compared to immediately post-education, whereas it decreased in group B by 0.27 at follow-up, compared to immediately post-education. However, the performance scores increased in group A by 1.08 immediately post-education, compared to follow-up, whereas it increased in group B by 1.25 immediately post-education, compared to follow-up stage (Table 1). Given the changes in scores at different times, the results of the Bonferroni posthoc test demonstrated that the scores significantly increased at post-education and follow-up stages compared to the pre-education phase ($P=0.0001$). Additionally, the scores were significantly different between immediately post-education and follow-up stages ($P=0.0001$).

The pair-wise comparison of mean scores of the two groups using Paired Samples t-test at different times suggested a significant difference in the scores of group A at all times ($P=0.0001$); the scores of group B were also significantly different at all times ($P=0.0001$), except for the attitude scores at immediately post-education, compared to the follow-up stage ($P=0.250$). However, the total score of preparedness was not significantly different

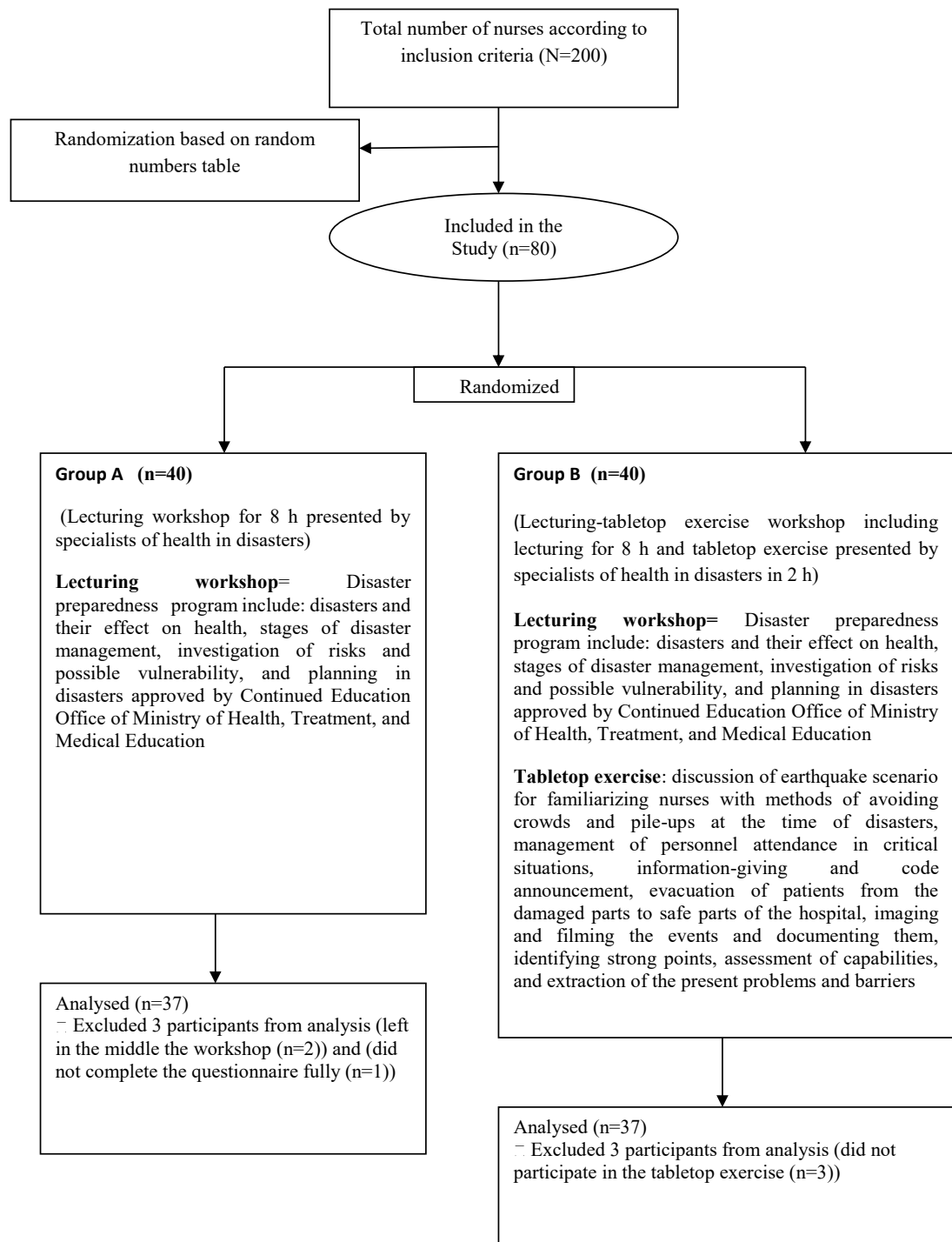


Figure 1. Randomized subject assignment and the details of two groups' education program

at immediately post-education, compared to the follow-up stage ($P=0.878$) (Table 2). The study findings indicated that education increased the scores of knowledge, attitude, and performance in both groups (Figure 2).

Discussion

Nurses are important in the response phase of disasters. Their preparedness improves performance and response. This study explored the effect of education by lecturing and lecturing-tabletop exercise methods on nurses' performance at Shahid Rahnemoon Hospital in Yazd City,

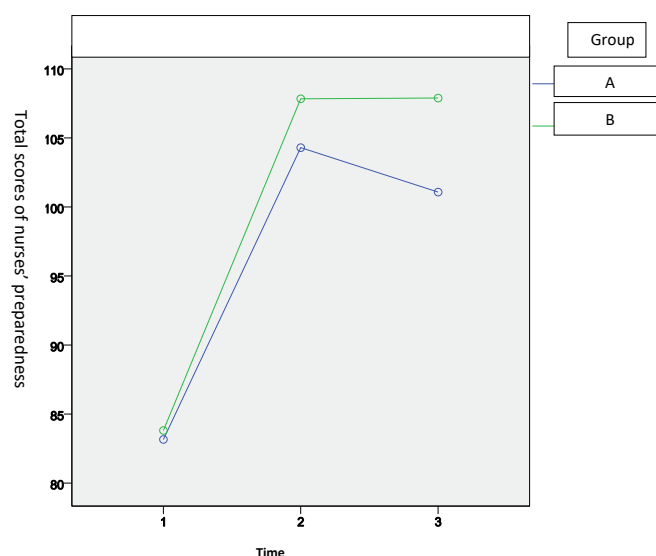


Figure 2. The effect of education on the scores of knowledge, attitude, and performance in both groups

central Iran. The study findings suggested that the majority of nurses failed to participate in disaster management courses or received insufficient education in this regard. This finding indicates that either education in this field is unimportant in nurses' perspectives or its importance has not been highlighted for them. Our findings were in line with Diab's study; most of their study participants had no experience of participating in such classes [10]. These findings indicate that nurses have been inadequately trained in responding to emergencies and disasters and insufficient attention is paid to hospitals. Therefore, some

programs for nursing education should be planned, and the importance of this field should be emphasized.

In this study, provided educations increased the mean scores of knowledge, attitude, and performance of nurses in both groups immediately after the intervention and at follow-up stage; however, the increase was more considerable in the lecturing-tabletop exercise group (group B). This indicates that lecturing can positively affect nurses' preparedness level. Applying various other teaching methods combined with lecturing can promote the level of nurses' preparedness; therefore, we

Table 1. Comparing the scores of nurses' preparedness at the hospital in groups A and B

Variable	Group	Mean±SD			Sig.*	
		Pre-test	Post-test	Follow-up test	Intergroup	
Knowledge	A	13.92±3.02	21.11±2.8	18.86±2.41	0.0001	0.003
	B	14.03±3.32	22.05±2.71	20.59±2.38		
Attitude	A	62.24±6.08	71.68±6.09	69.62±6.34	0.0001	0.005
	B	62.03±5.99	73.19±4.64	73.46±4.75		
Performance	A	7.00±3.66	11.51±4.58	12.59±4.04	0.0001	0.68
	B	7.76±3.28	12.59±3.84	13.84±3.91		
Total	A	83.16±8.85	104.30±9.72	101.08±9.37	0.0001	0.0001
	B	83.81±9.14	107.84±7.9	107.89±7.50		

* Repeated measures ANOVA;

** Group A=lecturing;

*** Group B=lecturing-tabletop exercise

Table 2. The pair-wise comparisons of scores at different times between groups A and B

Variable	Comparable Pairs at Different Times	Group A		Group B	
		Difference in Mean±SD	Sig.*	Difference in Mean±SD	Sig.*
Knowledge score	Pre-test	7.18±1.76	0.0001	8.02±2.03	0.0001
	Pre-follow up	4.94±1.88	0.0001	6.56±2.41	0.0001
	Post-follow up	2.24±1.11	0.0001	1.45±1.09	0.0001
Attitude score	Pre-test	9.43±5.89	0.0001	11.16±4.36	0.0001
	Pre-follow up	7.37±6.11	0.0001	11.43±4.40	0.0001
	Post-follow up	2.05±1.53	0.0001	0.27±1.40	0.250
Performance score	Pre-test	4.51±3.54	0.0001	4.83±4.22	0.0001
	Pre-follow up	5.59±3.50	0.0001	6.08±4.39	0.0001
	Post-follow up	1.08±1.29	0.0001	1.24±1.21	0.0001
Total score	Pre-test	21.13±6.63	0.0001	24.02±5.56	0.0001
	Pre-follow up	17.91±6.63	0.0001	24.08±5.61	0.0001
	Post-follow up	3.21±1.90	0.0001	0.05±2.21	0.878

* Paired samples t-test

can use such combined methods to improve the efficacy of education. Lecturing is a common procedure used to increase knowledge; other studies have also confirmed its efficacy, approving our findings [9, 11]. Using handbooks for nurses has successfully enabled them to achieve considerable awareness in coping with disasters and modifying their attitudes [10]. The tabletop exercise is among the best methods of preparing for responding to disasters. It dramatically influences nurses' attitudes and performance [24].

In addition, increased knowledge can affect nurses' attitudes, leading to improved performance. Our findings are also in consistent with other studies; nurses can provide a proper response to disasters through education and awareness about their role in disasters [10, 25]. To increase and perpetuate learning, educational courses should apply suitable teaching methods. Exercises provide an opportunity for increasing healthcare personnel's preparedness for a more suitable response to disasters [26]. Moreover, teaching through teamwork is more effective in acquiring new knowledge on disaster exercise. The participants may play a specific role in a team and directly practice disaster exercises [27]. The higher efficacy and efficiency of the two methods of lecturing and advanced training are due to their longer-lasting effects; since they increase the efficiency of education.

Re-education courses and repeated educational programs have been effective in increasing knowledge [23]. Our findings also suggested that the mean scores of knowledge decreased in both groups one month after conducting the education, compared to immediately after the education. These findings indicate the necessity of continuing educational courses to improve nurses' efficacy. The significant difference in knowledge scores at different time intervals supports this finding.

The mean scores of nurses' attitudes decreased in group A one month after providing the education, compared to immediately post-education; however, it increased in group B. Such data suggest that education with tabletop exercise can exert a more significant positive effect on learning with more extended durability. The mean scores of performance increased in both groups one month after the education, compared to immediately after it. The scores have changed significantly with time. Therefore, education and modifying attitudes can positively impact performance, influencing positively personnel's preparedness [28, 29]. Besides, nurses' positive attitude towards preparedness against disasters indicate their improper knowledge and performance; thus, preparing the personnel by providing theoretical and practical programs along with holding operational exercises with an emphasis on repetition could be useful [30]. Other stud-

ies reported that nurses' attitudes positively changed after receiving educational programs, and their attitude scores increased as well [10, 19, 31]. These studies support the findings of our study. This indicates that studies on different methods of education had a positive effect on attitude. However, the extent of the positive impact on attitude in practical and operational teaching methods is more than that of lecturing alone.

Higher effects of education in teaching methods involving interaction between trainers and learners have been demonstrated. Additionally, the more significant effect of the combination of interactive teaching methods on improving learning has been highlighted [32]. In the present study, teaching with a tabletop exercise method has created a suitable background for interactive learning by nurses. This was due to various suggested scenarios and discussing them. This confirms the greater effects of interactive and contributory methods compared to the lecturing method.

This study revealed the positive effect of educational programs on increasing knowledge, attitudes, and performance of nurses, using lecturing and lecturing-tabletop exercise methods. Education positively impacted nurses' preparedness through both methods; however, it was more effective with lecturing-tabletop exercise method, due to having a scenario and the greater participation of nurses in the learning process. This finding highlights the positive effect of participants' interactions in the tabletop exercise method on the quality of education, critical skills, and the increased level of nurses' preparedness against natural disasters. Nurses' preparedness for responding to disasters and emergencies could be enhanced by holding educational courses. This goal is also achievable by their participation in tabletop exercises predisposing to proper responding in emergency cases.

In this study, the training program included a one-day 8-hour course. The short period of the educational course was a limitation of the study. Thus, future study courses should be presented for more days and hours. Furthermore, more discussions for various scenarios in tabletop exercise should be offered in future studies.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the Clinical Research Development Center at Shahid Rahnemoon Hospital, Yazd (Code: IR.SSU.REC.1396.193). The research objectives and procedures were explained to the study participants before collecting the data. Moreover, they were assured of

the confidentiality of their information and were allowed to discontinue participation in the study at any time. Next, they provided a signed informed consent form.

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This study was approved by Clinical Research Development Center at Shahid Rahnemoon Hospital, Yazd, Iran.

Authors contributions

Concepts, design, data analysis, manuscript preparation, and editing: Samaneh Mirzaei, Adel Eftekhari, and Leila Mohammadinia; Definition of intellectual content, data acquisition, literature review, and statistical analysis: Khadijeh Nasiriani and Abasali Dehghani; and manuscript review was done by all of authors.

Conflict of interest

There are no conflicts of interest to be declared.

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Appendix 1. Scenario intended for tabletop exercise

An earthquake with 6 Richter in magnitude occurred in Yazd City on 23rd, March 2018 damaging several urban and rural areas. Primary observation reports indicate that 30 people have been killed in the first two hours post-earthquake, and 200 have been injured. Moreover, more than 100000 people require emergency care. The geophysical earthquake station has announced several post-quakes. Many buildings have been destroyed. Wreckage and fallen trees and lamp-posts have blocked most streets and avenues. Dozens of people have presented to the ambulatory emergency of hospitals. There is a crowd of victims in the emergency ward. Prehospital care ambulances are transporting many victims to this hospital. The out-of-shift personnel are called in; the in-shift personnel is very anxious. The phone lines are busy, and nobody can make a phone call. The emergency room and hospital ramp are so fully crowded that nobody can enter the hospital. Since this is the only 200-bed hospital and the only trauma center of Yazd, most critically ill patients have been transported to this center. There is an emergency medicine specialist in the morning shift, and the shortage of physicians and specialists have caused a crisis.