

# The Effect of Risk Reduction Intervention on Earthquake Disaster Preparedness of the Elderly People

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## Article info:

Received: 02 Aug. 2015

Accepted: 27 Oct. 2015

## Keywords:

Risk reduction, Disaster Relief planning, Earthquake, Elders

## ABSTRACT

**Background:** Because of vulnerability of the elders in disasters, preparedness of this group is very important in reducing the damages caused by the earthquake. Therefore, the present study designed and conducted with the purpose of developing interventions to increase earthquake preparedness and risk reduction in the elderly people living in Hadishahr Jolfa City, Iran.

**Materials and Methods:** This study was a quasi-experimental study with pretest, posttest design and a control group. Fifty community dwelling elderly people were selected through simple random sampling method from 2 health centers and randomly allocated to intervention and control groups. Intervention program consisted of educational sessions with slideshows, group discussions, and sending reminder materials to their addresses a week later. The data were collected using the researcher developed preparedness questionnaire consisting of 58 items with 4 subscales (communication, environmental, during and after earthquake period). Inferential analyses of data, including analysis of covariance was done by SPSS version 16.

**Results:** The findings showed that scores in all subscales of earthquake preparedness (communication, environment, during and after earthquake) significantly increased after educational intervention ( $P < 0.05$ ).

**Conclusion:** Preparedness programs for disaster risk reduction has a positive effect on the elders' preparedness. Thus, similar multimodal preparedness programs should be used more frequently for this vulnerable community citizens.

## 1. Introduction

Earthquake is the most destructive natural and unexpected accident, which its losses and resultant consequences due to unpreparedness to counteract is so high that deserved to be called a disaster [1]. Earthquake accounts for around 1.87 million deaths in the 20th century with an average of 2052 deaths per each incident between 1990

and 2010 [2]. Out of the 40 different types of natural phenomena recognized in our country, earthquake is the most common cause of death [3].

Iran, because of its special geographical location on the Alp-Himalaya belt, is among the first 10 earthquake-prone countries in the world [3, 4]. Iran vulnerability to earthquake is 1000 times that of the US and 100 times of Japan [5]. More than 20 different types of incidents and disasters,

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which brought about staggering life and financial casualties in Iran, have occurred in Eastern Azerbaijan Province [6].

Each year, millions of earthquakes happen, however, only a tiny portion of the population is prepared for it and thus are less vulnerable [2]. Studies on the age group of victims in natural disasters indicate that the vulnerability of the elderly is considerable in the majority of cases due to their various physical changes, limitations caused by ageing, and chronic diseases [7]. The greatest rate of reported mortality in the earthquake and tsunami in Japan in 2011 and sand storms in 2012 [8], as well as Indonesia tsunami in 2004 belonged to the age group of 60 years and above [9]. In response to the earthquake in 2012 in Arasbaran region, Iran, the mortality number was 300, out of them, 22 were old people, with over 2000 number of wounded. The majority of victims in the Azerbaijan earthquake were old people, children, and women [10].

Population ageing and increased life expectancy, a result of improved health, and better social, and economic conditions, leads to changes in the society's age pyramid [11]. According to WHO, between 2000 and 2050, the share of population over 60 would double, reaching 22% from the current share of 11% [12]. In Iran, the statistical indexes also suggest dramatic growth in the old age population [11]. The census of population and accommodation in 2011 showed that the percentage of elders over 60 years has reached above 8.26% of the total population [13]. In 2020, 25%-30% of the Iran population will be over 50 years old, causing ageing explosion [11].

The reality is that emergency situations around the world are increasing and the elders are a highly vulnerable group in this regard [12]. Experience has shown that prevention and preparedness methods are effective in reducing the damages and losses caused by earthquake. One of the most important principles for realizing the prevention and preparedness methods in minimizing the losses caused by earthquake is public familiarity with earthquake [14].

The measures in 1990 taken by the United Nations around the world, carried out to reverse the increasing trend of incidence of disasters, highlight the preventive activities, i.e. disaster preparedness [15]. In the international conference of reducing natural disasters in Yokohama Japan in 1994, there was a broad consensus emphasizing on the society oriented management programs of disaster risks, involving vulnerable individuals in the planning and implementation [16]. In the world conference of reducing risks caused by disasters, held in January 2005 in Japan, 168 countries enacted the Hyogo

Framework: preparing the people and societies for counteracting disasters to be implemented from 2005 to 2015 [15]. The slogan of WHO in 2012, "health and the elderly" also confirms the significance of caring for the health of the elders to deal with disasters [12].

The frequent incidence of destructive earthquakes like Bam earthquake in our country has made a comprehensive view to crisis management inevitable and highlighted preparedness, prevention, and risk reduction before the incidences [17]. Holding short-term workshops for empowering elders to have an active and independent life, development of classes, facilities, and special educational materials for elders, are among the policies of Health Ministry. In the second health program of the country in the Health Week in 2013, the necessity of public education for the elders to fight disasters was emphasized too [18].

Although several studies have been conducted regarding the effects of crises and disasters on people, studies specific to elders have been overlooked [18]. In other words, the focus of the majority of studies has been on the confronting and rehabilitation stages, and no special study has been performed considering preparedness of the elders. Moreover, even in the cases of caring for the elders in crises and their preparedness, the elders themselves have been under-interviewed or undervisited [19]. Indeed, preparedness and counteracting disasters have effects on reducing the rate of mortality and casualties; therefore, the way the people across various classes of society confront unexpected disasters and crises is based on the needs in each stage of the crisis and the agenda of developed countries [16].

Hadishahr-Jolfa City is situated in Eastern Azerbaijan Province, Iran in which the elders account for 11.07% (35452) of the population. This city is on of the border of the Republic of Azerbaijan, by the Aras River (one of the largest rivers in the country), and is an earthquake-prone region in Iran. Therefore, this research is conducted to analyze needs of the special groups under the coverage of rehabilitation area during incidents and disasters (elders, women, addicts, etc.) to enhance the preparedness of the elders of Hadishahr-Jolfa against earthquake and reduce the risk and potential losses and injuries.

## 2. Materials and Methods

This quasi-experimental study was conducted in 2014 on 50 old people (25 control and 25 intervention) who were randomly selected from 2 health centers of Hadishahr City, Eastern Azerbaijan Province, Iran. The sample size calculation by following formula resulted in 25 persons for each group:

where the power analysis was considered 80% and the probability of a type 1 error ( $\alpha=0.05$ ) with the attrition rate of 25% for both groups.

$$n = \frac{2\sigma_a^2 (Z_{1-\alpha/2} + Z_{1-\beta})^2}{\delta^2}$$

To prepare the study sample, at first, a list of the elderly people aged  $\geq 60$  years who had health records in the family health centers was prepared. Then, 25 elders from each center were randomly selected and invited to participate in the study. Participants were unaware of their allocation to the intervention or control groups.

The inclusion criteria were as follows:  $\geq 60$  years, having normal cognitive status based on abbreviated mental test (AMT) scores ( $\geq 7$ ), and getting an acceptable score ( $\geq 90$ ) in activities of daily living (ADL) test. The exclusion criteria were unwillingness to participate in any stages of the study and history of participation in similar training courses.

Data were collected by using the researcher developed earthquake preparedness questionnaire based on other instruments used in similar studies consisting of demographic information and preparedness scale.

### Measurements

Demographic information included age, sex, household status (living alone or with other family members), educational level, residency location (property ownership, rental), having a history of conflicts with family members and previous experiences in disaster relief.

Scale of preparedness included 54 items which were composed under 4 major constructs (subscales): 1) communication, including activities taken to ensure an appropriate response to the impact of hazards associated with their family 2) environmental, including activities and measures to be learned at home to ensure an appropriate response to the impact of hazards, 3) during earthquake period, including activities that should be practiced during the crisis to ensure an appropriate response to the effects of hazards, and 4) after earthquake period, including activities taken in the next stage of the crisis to ensure an appropriate response to recovery.

Eight items were designed to measure communication preparedness. Twenty items were designed to assess environmental preparedness; 13 items were designed to evaluate preparedness during earthquake period and another 13 items to evaluate preparedness after earthquake period.

Responses of the items were based on True or False. One point was given for each true answer. Total scores for each subscale were calculated by adding scores in each section. Total score was achieved by summation of 4 subscales.

### Validity and Reliability

The content validity index was assessed by the literature review of similar studies and a panel of experts, including 11 specialists in Gerontology, Health education, Health in Disaster, and Crisis management. Content validity ratio (CVR) and content validity index (CVI) were used to measure content validity. All CVIs were in the acceptable range of 0.75-1.00.

The internal consistency (Cronbach  $\alpha$ ) was used to measure reliability and evaluate the correlation between the items which related to the construct or global scale. Reliability coefficients for the communication preparedness scale ( $\alpha=0.76$ ), environmental preparedness scale ( $\alpha=0.80$ ), during earthquake period preparedness scale ( $\alpha=0.88$ ), and after earthquake period preparedness scale ( $\alpha=0.89$ ) suggest high level of internal consistency.

### Abbreviated Mental Test

A modified version of the abbreviated mental test (AMT) scale based on Foroghan et al. (2008), which included 10 items, was used to assess the cognitive performance of the elders. A sample of items were "What is your age?" "When is your date of birth?" and "Who is the Iran's supreme leader?" Reliability coefficients were calculated ( $\alpha=0.76$ ) and demonstrated high internal consistency. Cut-of point established 7 out of 10 point in AMT that indicated the participants' lack of significant cognitive impairment.

### Activities of daily living

A modified 10-item Persian version of Barthel activities of daily living (i.e. eating, bathing, clothing, etc.) based on Soltan Mohammadi study (2008) was used. Its  $\alpha$  coefficient was calculated (0.93) and demonstrated high internal consistency. Inclusion criteria was set at 90 out of 100 points in ADL, which indicated the elderly individual was independent and able to perform activities of daily living.

Data were collected by using self-reported questionnaires completed by the researcher's colleagues. At first, all elders in the intervention and control groups were evaluated by ADL and AMT instruments. Then, a pre-test for each elderly participant was completed by using researcher-developed preparedness questionnaire.

Three persons in the intervention group and 2 persons in the control group were excluded from the study due to failure in achieving the required score in the ADL test. Thus, 5 other old people from the population who were achieved inclusion criteria by using AMT and ADL tools were invited to participate in the study. The developed training program was conducted by inviting the elders to the auditorium of Dr Sajedi Hospital. The community health volunteers who had acceptability and easy access to elders were employed for inviting them. Date of meeting was announced a week earlier by local volunteers. Transportation service were provided exclusively for all elders by the principle researcher. Developed training program which consisted of 2 parts was conducted in a 1-day workshop. The first part included demonstration of educational films and clips, slide presentations, and group discussions. Research objectives and agenda were presented to participants at the beginning of the session. The tutorial film about how to take the necessary measures to be safe in an earthquake was presented for 6 minutes. Three intervention group training sessions were conducted separately, which each session were held in 20 minutes.

Educational slides with additional explanations were presented by the researcher. Then, the necessity of preparing a rescue bag, securing the living environment, accomplishing individual and family preparedness trainings, practicing periodically in the maneuvers with the family and neighbors were emphasized using sample products and equipment. At the end, the group discussion was conducted to use the elders' experiences and interested elderly people to review and comment on the contents of the bags for about 30 minutes.

Educational slides were developed by using relevant literature review, content of public education in Tehran Disaster Management Council, and Passive Defense Organization teaching programs, which were published by the Ministry of Education.

The second part of the training program focused on the enhancing the participation and augmentation of previous learnings in the first part of training program. It was conducted with sending reminder materials, including colored brochures and educational CDs to the elders' addresses 1 week later.

Content validity of the developed training package, including educational slides, film clips, and pamphlets, was confirmed by supervisor advisors and 3 experts in the field of health and disaster management, health education and gerontology. Effectiveness of the program was evaluated 1 month later too.

In this study, 26 codes of medical ethics and the Declaration of Helsinki's National Committee for Clinical Research was considered. Statistical analyses were performed using descriptive statistics (means and frequencies) and inferential analyses (analysis of covariance, the Chi-square tests, independent and paired t test) using SPSS version16 software.

### 3. Results

Based on the results of demographic data, the elders were within the age range of 60-80 years old, whose mean age was 66.80 ( $\pm 5.66$ ) years. About 56% of them were male and 62% had passed elementary education, and the rest had a higher level of education. About 90% of the participants lived with the family, among them, 76% had hardly any dispute with other family members. Furthermore, 56% of the individuals did not have any experience in offering assistance in disasters. The results of the Chi-square test indicated that the investigated groups had similar demographic and background characteristics, and no significant differences were observed between the intervention and control groups in terms of the mentioned variables, suggesting the homogeneity of the study sample ( $P > 0.05$ ).

The comparison of the mean of the total score of the intervention and control group's preparedness before and after the treatment using paired samples t test (Table 1) indicates that the mean of the total score of preparedness ( $P = 0.001$ ) as well as the subscales of communication preparedness ( $P = 0.001$ ), environmental preparedness ( $P = 0.012$ ), during earthquake period preparedness ( $P = 0.004$ ), and recovery after the crisis ( $P = 0.017$ ) after the intervention has increased significantly in the intervention group. This suggests the effectiveness of the intervention program.

Moreover, to examine the effectiveness of the intervention program, independent t test was conducted upon the intervention and control groups. As table 1 shows, no significant difference exists between the intervention and control group with regard to the preparedness scale and its different subscales before the intervention, implying that the studied population was homogeneous ( $P > 0.05$ ). However, following the intervention, a significant difference was observed between the mean total scores of the preparedness of the elders before the earthquake as well as its subscales (communication preparedness, environmental preparedness, before earthquake period preparedness, and during earthquake period preparedness) between the 2 groups ( $P < 0.05$ ), suggesting the effectiveness of the intervention program in reducing risk.

**Table 1.** Comparison of the mean of preparedness score against earthquake and its subscales in the elders in intervention and control groups before and after the educational program.

Variable	Sample, Frequency (%)	The mean (SD)		t	95%		T-test
		Before the intervention	After the intervention		Lower limit	Upper limit	P-Value
Preparation Scale	Intervention group, 25 (100%)	33.44 (9.42)	42.24 (8.29)	-5.43	-12.14	-5.45	0.001
	Control group, 25 (100%)	32.44 (10.25)	31.04 (6.21)	0.92	-1.73	4.53	0.36
Communication Preparation	Intervention group, 25 (100%)	3.84 (1.70)	7.32 (1.40)	-8.04	-4.37	-2.58	0.001
	Control group, 25 (100%)	3.80 (1.84)	3.40 (1.22)	1.08	-0.36	1.16	0.29
Environmental preparation	Intervention group, 25 (100%)	10.24 (4.13)	12.52 (3.61)	-2.72	-4.00	-0.55	0.012
	Control group, 25 (100%)	9.4 (4.48)	8.48 (3.24)	0.85	-1.29	3.13	0.40
Preparation time response to earthquake crisis	Intervention group, 25 (100%)	9.28 (3.34)	11.12 (2.96)	-3.16	-3.04	-0.63	0.004
	Control group, 25 (100%)	9.24 (3.13)	9.28 (2.52)	-0.13	-0.66	0.58	0.89
Recovery next from earthquake	Intervention group, 25 (100%)	10.08 (3.08)	11.28 (2.28)	-2.5	-2.16	-0.23	0.017
	Control group, 25 (100%)	10.00 (2.91)	9.88 (2.47)	0.54	-0.33	0.57	0.58

To compare the mean total score of the preparedness of intervention and control groups in posttest, by removing the effect of pretest, covariance analysis was conducted. This test revealed that by controlling the effect of the

pretest means, there is a significant difference between the mean of the preparedness scores across elders in the intervention and control group in the posttest ( $F(47.1)$ ,  $P<0.001$ ), i.e. the effect of the intervention has been sig-

**Table 2.** The results of independent t test for comparing the mean of the preparedness scores as well as its subscales in the intervention and control group before and after the educational program.

Variable	Variable status	Levene's test		T-test		
		F	P-Value	t	df	P-Value
Preparation scale	Before the intervention	0.000	1.00	0.35	48	0.72
	After the intervention	3.8	0.06	5.40	48	<0.001
Communication preparation	Before the intervention	0.370	0.546	0.08	48	0.93
	After the intervention	0.78	0.38	10.51	48	<0.001
Environmental preparation	Before the intervention	1.51	0.225	0.68	48	0.494
	After the intervention	2.34	0.132	4.15	48	<0.001
Preparation time response To earthquake crisis	Before the intervention	0.56	0.45	0.44	48	0.96
	After the intervention	0.09	0.76	2.36	48	0.02
Recovery next from earthquake	Before the intervention	0.23	0.62	0.09	48	0.92
	After the intervention	0.62	0.43	2.08	48	0.04

**Table 3.** The results of covariance analysis of the comparison of the mean total score of preparedness scale of individuals in the intervention and control group by modifying the pretest effect.

Source Changes	The sum of squares	df	Average of squares	F	P-Value	Chi Eta
Source	1828.99	1	1828.99	3.91	<0.001	0.534
Pre-exam	983.02	1	983.02	28.97	<0.001	0.381
Grouping	1438.15	1	1438.15	42.39	<0.001	0.474
Error	1594.49	47	3392			
Total	4145.52	49				

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nificant and it has had a positive influence on enhancing the preparedness of elders in the intervention group. Furthermore, according to the eta coefficient of 0.474, it can be concluded that around 47% of the developed difference is related to the treatment educational program (Table 3).

#### 4. Discussion

Increased overall preparedness score as well as its subscales in the findings of the data analysis showed that the study elders had less preparedness before the intervention. In the research conducted by Rossan et al. in US, around two-thirds of studied individuals had absolutely no plan for crisis conditions and also no previous background in participating in crisis preparedness educational programs [8]. Ghanbari et al. aimed to determine the effect of implementing the disaster preparedness management programs in enhancing the preparedness of nurses in potential disasters. They found that a large number of nurses had not been educated enough to be prepared for disasters and thus those individuals had no preparedness to respond in potential incidents [22]. A similar result was also obtained by Dong [23] in his study.

In addition, the findings of this study indicated that the educational program has resulted in a significant increase in the score of communication preparedness in the intervention group compared to the control group ( $P=0.001$ ). Heydari and Arabshahi investigated the effect of implementing simulated maneuver on the knowledge of nursery students. The researchers observed that the educational processes have been effective in promoting the preparedness of medical staff [24]. Bartelli et al. also implemented an educational program and maneuver in Jilang, Australia, to report an absolute increase in the scores of knowledge of dealing with crisis in the intervention group [25].

Preparing short-term educational programs to empower elders to have an active and independent life together

with holding classes in educational facilities specific to elders are among the policies of the health ministry. To this end, the slogan of WHO in 2012, “health and the elderly” also confirms the significance of caring for the health of the elders in incidents and disasters. This also highlights the necessity of the elders’ public education to face disasters [26]. Communications is absolutely essential to enhance awareness, reducing the risk before the occurrence of disasters to achieve flexibility in the elders during disasters [19]. Since disasters are unexpected, application of before crisis preparedness approaches for all individuals, even the elders decreases the risk of confronting future potential earthquakes and their unfavorable outcomes [27].

The findings of this study confirm the effect of educational program on the subscale of during earthquake period preparedness in the intervention group after the intervention ( $P=0.001$ ). In the study by Piapung et al. the trainings received through mass media, including television together with educational workshops to prevent fire, had a great impact in preparedness of the elders in fighting fire hazards [4]. Idrus et al. investigated the effect of training in the form of classrooms and simulated maneuvers. They reported a significant increase in the mean of the preparedness scores in responding to disasters [28], congruent with the findings of Ghanbari et al. [22] and Bartelli et al. [14].

The comparison of the mean of the elders’ preparedness score in the recovery stage after the crisis in fighting earthquake across the intervention and control groups before and after the intervention, confirms the effectiveness of the educational program, which is in line with the results of a case study by Ahmad Foadi et al. [29].

As crisis can occur at anytime and anywhere, and mostly without warning, preparedness programs and assisting individuals with physical and mental disabilities, highly contribute to decrease the negative outcomes of disasters [30].

## 5. Conclusion

In conclusion, preparedness of the elders can be enhanced through using a combination of crisis preparedness education methods, including workshops, around-table maneuvers, and participation in local crisis management programs, which should be held and repeated to preserve preparedness, as experience has shown that the outcomes of the education will fade over time. Therefore, such trainings would be effective provided that they had continuity and were not forgotten. In this regard, national media and the centers that offer services to the elders can have a key role.

Lack of similar research background in the elderly group, together with age, physical, and physiological limitations of elders were the limitations of this research. As this research has dealt with examining the effect of educational programs on the preparedness of the elders, it is suggested that in addition to conducting similar studies, the effect of in absentia educational programs as well as the effect of trainings presented to families on the elderly be implemented in other regions of the country. Moreover, investigation of the factors affecting the extent of disaster preparedness in the elders, examination of their concerns, and the information required by the elders during responding to disasters also seem to be necessary.

## Acknowledgements

This article is extracted from a thesis supported by the Department of Science and Technology of the University of Social Welfare and Rehabilitation Sciences, Tehran, Iran.

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