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Investigating the Effect of Education in Reducing Environmental Hazards at Home for the Elderly

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ABSTRACT

Background: Falling is one of the most common and serious health problems, especially at home among the elderly. The purpose of this research is to investigate the effect of education in reducing environmental hazards at home for the elderly.
Methods: In this quasi-experimental study, 200 elderly people were equally divided into intervention and control groups in 2018. The educational intervention was performed in 4 sessions of 45 mins. Data were collected through a standardized home safety checklist during interviews and home visits before and after six months of the training intervention. SPSS software (v19) analyzed the collected data. Chi-squared, Mann Whitney, Wilcoxon, and Exact Tests were used in this study.
Results: The results showed that the mean score of all dimensions of home safety increased in the intervention group compared to the control group after the intervention. Except for the safety dimensions of external stairs and kitchen, this difference was statistically significant (P <0.05). The findings also showed a significant decrease in the percentage of falls in the intervention group compared to the control group after educational interventions (P <0.05).
Conclusion: Educational intervention is useful in reducing home environmental hazards in the elderly and makes the elderly less likely to fall during their daily activities.

1. Introduction

Falling is one of the most serious and common issues facing the elderly. Each year, about one-third to half of the elderly fall and half of them have frequent falls [1]. Related injuries to falls in the elderly consist of 61% of all injuries and they are the leading cause of medical treatment [2]. It is estimated that 20%-30% of falls result in moderate to severe damage [2,3]. Fractures of the limbs, vertebrae, and ribs; trauma to the skull and brain; and damage to soft tissues and internal organs are some of the common causes of injuries that cause dependence, decreased self-efficacy, fear of falling, depression, and immobility. Also limited daily activities include hospitalization or admission to nursing homes and the imposition of costs on the individual and the community [4,5]. Home-related factors are the most common cause of fallings among the elderly, which is responsible for between 30-50% of such accidents [6]. Elderly falling at home is a serious problem that is significantly associated with mortality and morbidity and often leads to decreased physical and mental function [7]. Therefore, the physical environment of the home plays a crucial role in many fallings. Preventing falls at home mainly involves carefully assessing the risks of falling at home and correcting

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them. Dangerous factors that can be changed at home include the design of the building, stairs, corridors and slippery floors, carpets and floors, fences, bathrooms, toilets, stair and bathroom lighting, and home clutter [8]. It only makes sense to modify the home environment to prevent or reduce the number of falls. In addition, in contrast to interventions that target health and behavioral factors, home improvement reduces the potentially reduced risk of falls among the elderly [9]. Home assessment and safety modification is a relatively new component of intervention and prevention programs for fallings. According to the available evidence, interventions can be made to improve home safety in different parts to keep the elderly in a safe home environment [10]. Many studies have shown that home risk assessment is an important part of fall prevention programs for the elderly living at home. In a meta-analysis study, Clemson et al. (2008) found that home-based environmental interventions were associated with a 21% reduction in the risk of falls. The frequency of falls can be reduced by accurate assessment and correction of fall hazards [11]. Bemmel et al. (2005) showed that the risk of falling will be increased by living at home with environmental hazards [12]. Thiamwong et al. (2008) reported that slippery surfaces are one of the risk factors for falls at home [13]. In another study by Chang et al. (2010), it was found that older people living in crowded, dark, and cluttered homes were significantly at risk of falling [14]. Although some studies focus on improving the home environment to prevent falls, they have been largely neglected in Iran. Considering that the prevalence of elderly people falling at home is high, and the consequences of elderly people falling, not only affect their lives, but also lead to complications such as fear of falling again, limitations in activities, social isolation, increase dependence on others, and economic problems. Further, it greatly affects the health-medical and economic systems of society. Also, no study has been conducted in the field of home environment improvement training for the elderly in Iran. This study aimed to investigate the effect of education in reducing environmental hazards at home for the elderly.

2. Materials and Methods

2.1 Design

This study was a quasi-experimental study with a randomized control group and intervention groups in Urmia. It was conducted to investigate the effect of educational intervention on improving the safety of the elderly to prevent falls in 2018.

2.2 Sample

The statistical population of this study was all the elderly over 60 years old in Urmia. In order to reach the target group, we went to Urmia health centers. The total number of health centers in Urmia is 37. Multi-stage random sampling method was used in this study. Thus, 10 centers were randomly selected from 37 health centers in the northern and southern parts for sampling. Health centers were randomly divided into two groups (intervention-control). 20 people from each center were randomly selected based on the list of files. If individuals did not meet the study conditions, sampling would be continued until the desired sample size was reached. The sample size was calculated using the following formula and comparing the ratio before and after the intervention:

$$n = \frac{(Z_{1-\alpha/2} + Z_{1-\beta})^2 (S_1^2 + S_2^2)}{(\mu_1 - \mu_2)^2}$$

$$\beta = 0.20 \rightarrow Z_{1-\beta} = 0.85$$

A proportion of 27% of elderly falls has been shown in the studies [15] and we expect to reduce to 11% of elderly falls after the intervention. The sample size for each group was estimated at 96 people, and at least 100 people were considered for each group.

2.3 Data collection

First, we referred to 10 selected health centers to start the study. According to the elderly population, 200 elderly people, 100 intervention groups, and 100 control groups were selected by random sampling method in each health center. The elderly were then telephoned. After introducing the researcher and stating the goals and gaining the satisfaction of the elderly, the researcher and an occupational health expert went to the nursing home to assess the safety of the home and a demographic questionnaire (age, sex, education, history of falls) and a home safety checklist (including six locations: bedroom, bathroom/toilet, kitchen, living room, stairs) were completed by interview and observation for both intervention and control groups.

2.4 Measures

Data collection tools in this study are a researcher-made questionnaire that includes demographic characteristics such as age, sex, marital status, history of falls in the elderly in a recent year, and a home safety assessment checklist in 6 positions: bedroom, bathroom/toilet, kitchen, the living room, the stairs, and all the spaces were home security assessment in the form of 45 questions which were prepared as Yes/No and non-applicable options. Score 1 was given to the option "yes", zero scores were given to the option "no" and 1 point was given to the "non-applicable" option. Checklist scores ranged from 0-45. Six questions were about the safety status of an exterior stair and scores ranged from 0-6, eight questions were about the safety status of the interior stair, and scores ranged from 0-8, nine questions were about the safety status of the bathroom/toilet and

Scores ranged from 0-9, four questions were about the safety status of living room safety status (hall) and scores ranged from 0-4, five questions was about the safety status of kitchen and scores ranged from 0-5, five questions were about the safety status of bedroom s and scores ranged from 0-5, and eight questions were about safety ratios of all rooms/spaces and scores ranged from 0-8. Content validity and Cronbach's alpha test. were used for the validity and reliability of the home safety checklist. The checklist was sent to 10 health education and geriatrics specialists to determine its validity. Based on the opinions of experts, the necessary corrections were made to the checklist and the validity of the checklist was higher than 80%. Regarding the reliability of the studied checklist by using the completion of the checklist for a pilot group of 30 elderly using Cronbach's alpha test, the reliability coefficient of the stair questions (internal, external) was calculated at 0.75, for bathroom/toilet 0.72, living room (Hall), 0.71, the kitchen, 0.78, the bedroom, 0.78, and for all spaces was 0.70.

2.5 Intervention

Home safety-based training classes with a 45-minute home safety improvement approach were held for the intervention group in four sessions for one month. The methods of lecturing, group discussion, brainstorming, reminiscence, and question, and answer were used in these classes. No educational intervention was performed in the control group. Table 1 presents a summary of the content of the training classes. Six months after the end of the educational intervention, evaluation (measuring changes in home safety status and the rate of falls) was performed in both groups.

2.6 Data analysis

The collected data were entered into SPSS v19 software and analyzed regarding the statistical tests of chi-squared, Mann Whitney, Wilcoxon, and Exact Tests.

3. Results and Discussion

The mean and standard deviation of the age of the participants in the intervention and control groups were 97/5±42/71 and 75/5±66/70, respectively. The statistical test showed no significant difference between the intervention and control groups in terms of age, sex, level of education, and job (Table 2). The results of the present study showed that the mean score of all dimensions of home safety (stairs, bathroom, living room, kitchen, room, and all spaces) in the intervention group has increased compared to the control group after the intervention. The results of the Wilcoxon test showed that the difference in the mean score of all dimensions of home safety was significant after the intervention in the intervention group except for external stairs and kitchen ($P < 0.05$). As the mean of the home safety scores increased, the results of the same test showed no significant difference in the control group before and after the intervention ($P < 0.05$). The results of the Mann-Whitney test confirmed that there was no significant difference between the intervention and control groups before the intervention, but this difference was significant after the intervention in most aspects of home safety (Table 3). According to the comparison of the results of the number of falls of the elderly before and after the intervention, the results indicated a decrease in the number of falls in the elderly in six months after the educational intervention in the educational intervention group. This difference was statistically significant. However, we observed no noticeable change was observed in the control group after the intervention (Table 4). According to Table 3, before the intervention, 34% of the elderly in the intervention group had a history of falls in the past six months. The results of the present study indicated that in most cases, the home environment improved after the intervention, and this correction, along with education, reduced the frequency of falls among the elderly. Unsafe stairs at homes increase the chances of falling among the elderly. In this study, training to improve the safety of internal stairs include adequate lighting, proper railings, fixing the carpet of stairs, lack of additional equipment on the stairs, etc. Further, the safety status of the stairs was improved before the intervention and after the educational intervention in the intervention group. Results of Stevens et al.′s (2001) and Abolhassani et al.′s (2006) studies revealed that stairs and staircases were a risk factor for the elderly to fall [16,17]. The risk of the elderly falling at home can be reduced by installing railings on stairs and preventing slipping, and providing lighting. Sanitary services (toilets and baths) are among the places where the elderly fall more. Findings of the present study showed that the safety status of toilets and baths in the educational intervention group improved after the intervention and was statistically significant. Sophonratanapokin et al. (2012) reported a greater chance of the elderly falling into bathrooms and toilets, especially in backyards than other physical spaces at home [18]. Camilloni et al. (2011) cited the use of safety devices such as bathroom flooring, non-slip pads in the shower, and auxiliary bars as pre-accident prevention [19]. Promoting a culture of using special, non-slip flooring, placing support bars on the walls of bathrooms and toilets, and using a chair or stool to sit on positively affect preventing the elderly from falling. Moreover, Camilloni et al. (2011) identified the living room as a place where falling occurs [19]. The clutter of furniture in the living room was examined in this study before and after the educational intervention, and the necessary recommendations for improving the safety of the living room were given to the intervention group. The results indicated home safety improvement in this group. Wyman et al. (2007) found that the effectiveness of individual training and counseling in reducing environmental hazards at home was useful in the effect of training on improving the living room [20]. Pi et al. (2015) reported that the bedroom is one of the most common places for indoor falls, especially among women. Older people tend to stay in the bedroom during daily activities, which is why falls more often take place in this place [2].

In another study, Sophonratanapokin et al. (2012) found a significant relationship between the prevalence of falls and bedroom floor coverings [18]. As demonstrated in the work by Sadasivam et al. (2014) bed light and a clear path from bed to the bathroom is known as a risk factor for fallings [21].

Table1: Contents and educational materials

Summary of educational content
-Introduction and explanation about the plan, non-mandatory participation in the plan. -Familiarity with old age characters, falling in old age, causes and factors of falling. -Statistics of the prevalence of falls among the elderly at home. -Causes of the elderly falling at home. -Causes and factors that cause the elderly to fall at home. -Feeling of danger and the need to improve the safety of the home. -Expressing the effects of falling in physical, psychological, social, and economic dimensions (fracture, loss of self-confidence, grounding, inability to perform the assigned tasks, treatment and maintenance costs). -How to create complications in the short and long term. -Highlighting the severity of the effects of falling.
Kitchen safety: -Not wet floor. -Not leaving excess objects on the kitchen floor. -Placed at the appropriate height of cooking utensils in the kitchen for easy access. -The use of stepped stools with guards on both sides to access the upper cabinets. Stair safety: -Staircase and footlights are on at night when going up and down stairs. -Adequate light and installation of power switch at the beginning and end of the staircase. -The existence of a fence next to the stairs. -Fixing the floor (carpet or rug) of the stairs with special clamps. -Stairs free of any additional equipment. -Uniformity and appropriate height of stairs.
-Living room safety: how to arrange the furniture, lack of power cord and, fixed carpets, appropriate height of the chair or sofa, non-polished floor. -Bedroom safety: the presence of light in the bedroom, the appropriate height of the bed, the lack of additional equipment on the floor, the availability of a telephone near the bed, adequate space in the room. Bedroom safety: -Being on the light path between the bedroom and the toilet at night. -The presence of a lamp, light to get up at night, near the place of sleep or bed. -No scattered objects left on the floor. -Suitable height of the bed. -Sit for a few moments before getting out of bed to make sure you do not feel dizzy. -Put a phone near the bed. -Available Appropriate storage space (personal belongings).
-Bath/toilet safety: -Using special plastic pads to prevent slipping. -Put the handle on the wall next to the bathtub, next to the toilet, and next to the shower to support the person. -Using the toilet. -Use a short plastic tripod under the shower to sit and wash. -Do not use glass rooms around the shower. -Do not turn suddenly in the bath or tub. -Do not use slippery floor slippers in the bathroom. -Availability of locker room and towel rack. -Availability of hand shower, soap and detergent. All spaces: -Not being Slop and steep of all door entrances (main entrance, room). -No risk of slipping on all floors. -Lack of dazzling light on the floors and lack of light reflection Light Paths (without power cord, furniture without cumbersome and off-road). -Sufficient light in all rooms, corridors, up and down the interior stairs. -Existence of power switch at the entrance of all rooms. -Healthy lamp for night use on the way (bedroom, hall, bathroom, stairs).

In this study, the environmental hazards of the bedroom were reduced before and after the intervention in the educational group. It seems that using a bed with a suitable height, access to the phone next to the bed, and using the night light affect the elderly falling. Furthermore, Tüzün et al. (2010), in their study, showed that multidisciplinary interventions reduce the number of falls in the elderly and that home safety improvement plays a key role in falls, especially in the elderly [22]. Coimbra et al. (2011), in an interventional study to prevent falls in the elderly, reported that fall prevention programs must be multifactorial to reduce falls in the elderly [23]. Taylor (2019) and Schepens et al. (2011) in their study on the elderly following home safety training and suggestions showed that the elderly receiving special fall prevention training significantly causes to improve fall prevention [1,18]. On the other hand, Tiefenbachová et al. (2019) found that the elderly after the intervention made their home environment safer than in the past after the intervention of individual education about home hazards, including the preparation of a free training sheet and emergency contact tags and advice on home remediation and safety devices [8]. There were two obvious limitations in this study. First, the follow-up period after the training was short. In other words, if the follow-up period was longer, the number of home safety modifications would have been higher. Second, the cost-effectiveness of modifying the basic environmental hazards of the home should be considered in future interventions on how to combine financial and practical assistance [24].

Table 2: Comparison of research units according to demographic characteristics in the two groups of intervention and control

variables		control group Number (percent)	Intervention group Number (percent)	p-value*
Age	60-65	22(22)	14(14)	0.33
	65-70	26(26)	28(28)	
	70-75	18(18)	26(26)	
	75-80	34(34)	32(32)	
Sex	Male	58(58)	46(46)	0.1
	Female	42(42)	54(54)	
Job	homewife	36(36)	48(48)	0.13
	Self employed	22(22)	18(18)	
	Retired	8(8)	12(12)	
	Out of work	34(34)	22(22)	
Education	illiterate	26(26)	32(32)	0.1
	Elementary	40(40)	26(26)	
	The Junior	16(16)	26(26)	
	Diploma and more	18(18)	16(16)	

Table 3: Comparison of mean scores of different dimensions of home safety in the two groups of intervention and control before and after the educational intervention

Environmental hazards	Study groups	before intervention Mean(SD)	after intervention Mean(SD)	**P-value
External stairs	Control	5.24(1.29)	5.34(1.13)	0.32
	Intervention (study)	5.16(1.46)	5.19(1.43)	0.8
	*P-vale	P=0.68	P=0.41	
Interior stairs	Control	5.6(1.56)	5.68(1.48)	<0.001
	Intervention (study)	5.58(1.33)	6.51(1.1)	0.01
		P=0.92	P>0.001	
Bathroom	Control	5.52(1.82)	5.85(2.32)	0.13
	Intervention (study)	5.57(1.94)	7.22(1.8)	>0.001
		P=0.19	P>0.001	
living room	Control	2.54(1.02)	2.64(1.04)	0.15
	Intervention (study)	2.42(1.06)	3.28(1.03)	>0.001
		P=0.41	P>0.0001	
kitchen	Control	3.12(1.2)	3.22(1.11)	0.29
	Intervention (study)	3.47(1.14)	3.66(1.01)	0.08
		P=0.36	P=0.06	
bedroom	Control	2.92(1.13)	3.16(1.16)	0.05
	Intervention (study)	3.08(1.06)	4(1.83)	>0.001
		P=0.3*	P>0.001	
All spaces	Control	5.0(1.77)	5.57(2.34)	0.012
	Intervention (study)	6.51(1.38)	5.48(1.65)	>0.001
		P=0.06*	P>0.001	

*P-value in column-wise based on T-test, ** P-value in row-wise based on Paired t-test

Table 4: Comparison of fall rates in experimental and control groups in the study population before and after six months of intervention

Variable	control group Number (percent)	control group Number (percent)	intervention group Number (percent)	p.value*
Falling before the intervention	has	26(26)	34(34)	0.06
	Doesn't have	74(74)	66(66)	
	total	100(100)	100(100)	
Falling after the intervention	has	32(32)	16(16)	0.004
	Doesn't have	68(68)	84(84)	
	total	100(100)	100(100)	
p.value		0.28	0.006	

*Exact Tests

4. Conclusion

The results of the present study prove that environmental risk factors of falling can be avoided at home. Home remodeling keeps older people from the hidden dangers of falling during their daily activities. Assessing environmental risk factors at home can be a key intervention in preventing falls among older people living in their home environment. If we do home improvement training, the environmental risks of the home can be reduced. It is recommended that older people being treated in the hospital after a fall, should receive training in home risk assessment and safety interventions/changes by a health professional. Normally, this should be part of the discharge plan and it should be done within a period that will be agreed upon by the patient or caregiver.

Authors' Contributions

Morad Ali Zareipour: Design ideas; working methods; writing articles. Ehsan Movahed: Implementation of the plan; submit. Mohammad Saeed Jadgal and Mehdi Haghi: Writing the article; implementing a plan.

Conflicts of Interest

There are no conflicts of interest.

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