***Original article:***

# Investigating the effect of educational intervention based on protection motivation theory on osteoporosis preventive nutritional behaviors in women of reproductive age referring to Healthcare Centers in Sabzevar, Iran

*Maryam Mohammadi[1*], Ali Mehri[2], Masoumeh Hashemian[3], Zahra Seyyed Abadi[4], Shabnam Mohammadi[5]*

**Abstract:**

***Background:*** Osteoporosis is the most common metabolic bone disease, which is greatly reduced by lifestyle modification. The protection motivation theory (PMT) is one of the best theories to understand health behaviors and decisions made by a person to protect him or herself against harmful events and cope with them. ***Aims:*** Therefore, the researchers conducted this study to determine the effect of educational intervention based on PM theory on the osteoporosis preventive nutritional behaviors in women of reproductive age referred to healthcare centers in Sabzevar. ***Methods:*** This quasi-experimental study was performed on 66 women of the reproductive age of Sabzevar who were selected by stratified sampling. Data were collected through questionnaire, the validity and reliability of which were verified and confirmed. The intervention was held within 6 sessions. The evaluation took place three courses. The data analysis was carried out using Stata12 and p-value <0.05 was considered statistically significant.***Results:*** A total of 66 women in the reproductive age of 15-49 participated in the present study. 43% of participants were under 30 years of age. The results showed that the mean score of behavior in the experimental groups changed with time, and there was a significant difference between the two groups at different times ($p \leq 0.0001$).***Conclusion:*** In general, the results of this study showed the positive effect of education on model constructs and eventually increasing the frequency of osteoporosis preventive nutritional behaviors in women of reproductive age. Therefore, the results support the efficacy of this model in promoting osteoporosis preventive behaviors.

**Keywords:** protection motivation theory; osteoporosis; nutritional behaviors; women

*Bangladesh Journal of Medical Science Vol. 19 No. 02 April'20. Page : 254-261*
*DOI: https://doi.org/10.3329/bjms.v19i2.45004*

## Introduction

Osteoporosis is the most common metabolic bone disease that begins with a decrease in bone mass and destruction of bone tissue, resulting in bones becoming thin and fragile. These outcomes are not only attributed to the increase in life expectancy and the rise of age, but also to the adverse changes in lifestyle and diet[1]. About 75 million people are suffering from osteoporosis in Europe, the United States and Japan [2]. There are about 9 million adults with osteoporosis living In the United States and 43

1. Maryam Mohammadi, Assistant professor of Health education& health promotion, Shahid Beheshti University of Medical Sciences, Tehran, Iran
2. Ali Mehri, Assistant professor of Health education& health promotion, Sabzevar University of Medical Sciences, Sabzevar, Iran
3. Masoumeh Hashemian, Assistant professor of Health education& health promotion, Sabzevar University of Medical Sciences, Sabzevar, Iran
4. Zahra Seyyed Abadi, Msc in health education & health promotion, Sabzevar University of Medical Sciences, Sabzevar, Iran.
5. Shabnam Mohammadi, Neurogenic Inflammation Research Center, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran; Department of Anatomy and Cell Biology, School of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran

**Correspondence to:** Maryam Mohammadi, Assistant professor of Health education& health promotion, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

million are also at risk, which is predicted to rise to 68 million by 2030[3]. A total of 61% of osteoporosis-induced fractures occur in women and it is estimated that around 200 million women develop osteoporosis worldwide[4-5]. Epidemiologic studies have shown that bone density is lower in among Asian women than European and American women. It is anticipated that 40% to 70% of total osteoporotic pelvic fractures will occur in these countries as a result of an increase in the aging population of Asia by 2050[6].The overall prevalence of osteoporosis was reported to be13.3% in Iran, with about 50% of men over fifty years old and 70% of women over fifty years old being affected [7-8]. The disease mortality is estimated to 20% [3]. A total of 50% of women over 50 will experience osteoporotic fracture [9]. The total Disability-adjusted-life-years losses of osteoporosis were 36,026 in Iran's population in 2001, of which 18757 and 17270 years belonged to men and women, respectively [10]. Osteoporosis and its associated fractures impose huge economic burdens on societies and its economic burden is comparable to other chronic diseases. It has been even reported that the risk of osteoporosis and its associated fractures require more hospitalization days than stroke and breast cancer[11]. If effective prevention activities are not continuously promoted, the cost of osteoporosis is projected to reach 200 billion dollars by 2040[12]. The most important risk factors for this disease include age, diet, physical activity, low body mass, hormonal factors, smoking, and alcohol consumption[13]. The need for prevention of osteoporosis is obvious for everybody, and this disease has currently been known as a preventable disease [8]. It has been estimated in various studies that 20% to 50% of bone density changes are affected by lifestyle, and on the top of it, nutrition and physical activity [14].Osteoporosis prevention strategies include maximizing bone mass and minimizing bone loss through health education and health promotion programs [15]. Educational planning, especially in the prevention of chronic diseases, requires familiarization and recognition of their nutritional behavior[9]. Various theories and models have been proposed to explain the factors affecting behavior. One of these theories is protection motivation(PM) theory that focuses on understanding and predicting health intent and behaviors that affect the cognitive factors affecting decisions made by individuals to protect him/herself against harmful events or to cope with such events[16].

**Protection Motivation Theory (PMT)**

Protection motivation theory was designed by Rogers in 1975 based on the theory of value expectation. This theory, as a social cognitive model, consists of seven structured constructs as two paths of perception-behavior communication (Fig 1). Threat appraisal refers to individual's assessment of the risk of specific behaviors or diseases, and his/her capabilities to cope with this threat. The threat appraisal path consists of four structures in two groups. One group includes perceived severity and perceived sensitivity, and the other group is composed of perceived rewards assessment including intrinsic and extrinsic rewards. The coping appraisal path is composed of three structures in two groups, one group including assessment of perceived efficiency including the effect of perceived response efficiency and the other response costs [17].The study of literature in Iran shows that there is limited research on the osteoporosis preventive behavior. In addition, there is still no interventional studies that determine role of education in adopting these behaviors using the PM theory in women of reproductive ages. Therefore, the researchers conducted this study with the aim of determining the effect of educational intervention based on PM theory on osteoporosis preventive nutritional behaviors in women of reproductive age referring to healthcare centers in Sabzevar, Iran.

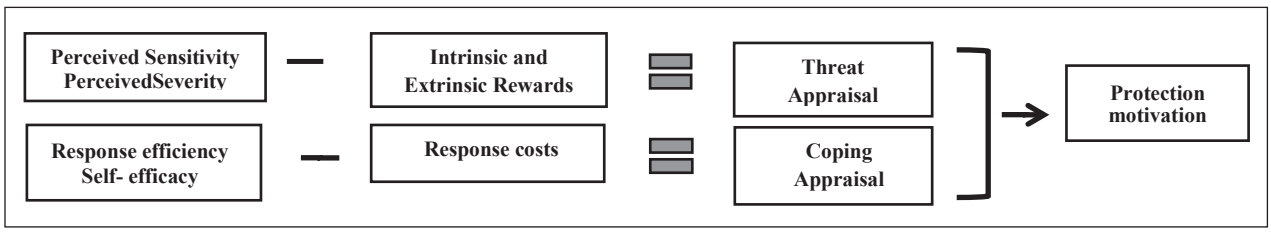


Fig1: Protection motivation theory

## Methods

This quasi-experimental study was conducted to evaluate the osteoporosis preventive nutritional behaviors based on PM theory in women of reproductive age in Sabzevar. The inclusion criteria included women of reproductive age of 15-49 years old, lack of any bone disease and osteoporosis, lack of any mental disease, lack of pregnancy, non-menopause women, and willingness to participate in the study. The sample size was estimated 26 for each group and 52 for the two groups. According to the estimated 20% drop-out in the study, the total sample size was considered 65. Stratified sampling was carried out. So, the researcher after coordinating with Sabzevar University of Medical Sciences, referred to the health center of Sabzevar city, prepared a list of health centers in Sabzevar along with the areas where they were located. Then, the city of Sabzevar was divided into two regions (upper and lower) and then one center was randomly selected from each class. Based on the population of each center, a certain number of samples (n=65) were selected based on the inclusion criteria. The samples were contacted and, if agreed, invited to the health center to participate in the intervention and, if disagreed, replaced by random sampling. After completing the written consent form, samples were randomly assigned to blocks of 33 individuals. Data collection was performed through interviews with the subjects and completion of a questionnaire, the validity and reliability of which were calculated as CVI = 0.88 and α=0.94 and ICC = 0.91.
The questionnaire consisted of two parts:

The first part included demographic characteristics, including age, income, job and marital status, and education level. The second part included questions that evaluated the subscales of PM theory. The questions were responded using 5 options (Completely agree, agree, I do not know, disagree, completely disagree). Each of the questions was rated 1-5.The number of questions and the range of scores to be obtained for these subscales include: The perceived sensitivity subscale, perceived severity subscale, perceived self-efficacy subscale,perceived response efficiency subscale, cost subscale include respectively 6,5,6,4,7 questions and score ranges of 5-30, 5-25, 5-30,5-20,5-35. Also, protection motivation, perceived reward and fear subscale include 5 questions and a score range of 5-25. The questionnaire was distributed before and after the intervention in both the experimental and control groups. The results of the pre-test were analyzed after collecting the questionnaires and entering the data into Stata ver. 12. At this stage, the educational program and the content of the educational setting were developed based on the results of the above questionnaire, which in fact focused on educational needs assessment. The educational program was held six weeks (one session each week) based on the PM theory constructs (Table 1). In this educational program, methods such as lectures along with questions and answers, brainstorming and group discussion, and teaching aids such as pamphlets, posters, Whiteboard and short films were used. The post-test was performed for both the experimental and control groups by redistributing the questionnaire and determining the score of the PM theory constructs on osteoporosis preventive nutritional behaviors one month and three months after the educational intervention. Data analysis was carried out using Stata ver.12 and appropriate statistical tests, and $p<0.05$ was considered as statistically significant.

**Ethical clearance**: This research study was approved **by** Shahid Beheshti University of Medical Sciences, Tehran, Iran.

## Results

A total of 66 women with a reproductive age of 15-49 years old participated in this study, 43% of whom were less than 30 years old and the majority of them (74%) had diploma degree and above. Also, 88% of them were married and 84% of them had no family history of osteoporosis in their first-degree relatives. At the beginning of the study, there was no significant difference between the two groups. The results of Table 2 show that only 7.7% of women consumed milk each day. Spearman correlation test was used to determine the correlation between constructs of PM theory the context of osteoporosis preventive behaviors. The correlation coefficients between the constructs showed a positive and significant correlation between behavior, motivation and self-efficacy (P= 0.005). Also, there is a significant and positive correlation between perceived self-efficacy with all the constructs of the PM theory, with the exception of the reward construct (P= 0.05) (Table 3). To measure the effect of the intervention program on the score of the protection motivation theory constructs over time in the studied groups, repeated measures ANOVA was performed. The hypothesis of this test was approved so that the normal distribution of data was confirmed using Kolmogorov-Smirnov test. The results of repeated measures ANOVA showed that the mean of behavioral scores in the excremental groups changed with time. At different times, there was a significant difference between the two groups ($p\leq0.0001$) (Table 4)

**Table 1:** Educational activities and timetable of educational sessions in the intervention group

| Session | Variables | General purpose | Specific objectives | methods | teaching aids |
|---|---|---|---|---|---|
| 1 | Perceived sensitivity | At the end of the session, learners think that are susceptible to osteoporosis and at risk for osteoporosis. | The learner can define osteoporosis in the presence of other learners.<br>The learner can describe two cases of the importance of considering osteoporosis.<br>The learner can refer to two of the symptoms of osteoporosis.<br>The learner can refer to all groups exposed to osteoporosis.<br>The learner can determine the most vulnerable group based on his own learning.<br>The learner can talk about the lessons learned for 5 minutes.<br>The learner one can ask questions about ways to prevent osteoporosis.<br>The learner can protect women at risk for osteoporosis.<br>The learner can actively participate in the discussion. | lectures<br>Question and answer<br>brainstorming<br>group discussion | Movies<br>Pamphlets<br>posters<br>Whiteboard |
| 2 | Perceived severity | At the end of the session, learners believe that the health threat posed by osteoporosis is serious. | The learner can explain the complications of osteoporosis in group (Knowledge).<br>The learner can ask questions about ways to prevent osteoporosis (emotional).<br>The learner can actively participate in the discussion (emotional-reaction). | | |
| 3 | Perceived self-efficacy | At the end of the session, learners will believe that they can successfully perform the proposed behavior. | The learner believes that (s) he can include foods rich in calcium and vitamin D in his/her diet.<br>The learner believes that (s) he can stop eating foods that prevent the absorption of calcium and vitamin D.<br>The learner believes that (s) he can consume foods containing calcium and vitamin D, even if its price is high.<br>The learner believes (s) he can consume foods rich in calcium and vitamin D even if his/her family does not want to consume these foods. | | |
| 4 | Perceived reward | At the end of the session, learners can understand the rewards received because of doing protective behaviors toward not doing so. | The learner can explain food and calcium-based drinks to other non-nutrients (beverages, tea, coffee, etc.) (Knowledge).<br>The learner can explain to his/her family the importance of using calcium-containing foods (knowledge).<br>The learner can actively participate in the discussion (emotional-reaction). | | |
| 5 | Perceived cost | At the end of the session, learners judge the costs of doing the protecting behavior rather than the non-doing of the protective behavior. | Learners can calculate the cost of buying calcium-rich foods compared with costs imposed by osteoporosis treatment.<br>The learner can explain the importance of a calcium-rich diet.<br>The learner can explain the changes in the diet that contains calcium.<br>The learner can provide solutions regarding access to calcium-containing products. | | |
| 6 | Perceived response efficiency | At the end of the session, learners believe that it is possible to prevent osteoporosis by taking foods containing calcium and vitamin D. | The learner believes that (s) he can prevent osteoporosis by eating foods rich in calcium and vitamin D.<br>The learner believes that consuming foods rich in calcium and vitamin D could lead to better health status in old age.<br>The learner believed that it would be possible to eat good food habits in his family by consuming foods rich in calcium and vitamin D. | | |

**Table 2: Distribution of the Frequency and Percent of the Scale of Behavior in Subjects**

| Items | At all | | once a month | | Once a week | | Every 2-3 days | | everyday | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Frequency | Percent | Frequency | Percent | Frequency | Percent | Frequency | Percent | Frequency | Percent |
| Milk | 8 | 12.3 | 10 | 15.4 | 23 | 35.4 | 19 | 29.2 | 5 | 7.7 |
| yogurt | 0 | 0 | 0 | 0 | 5 | 7.7 | 23 | 35.4 | 37 | 56.9 |
| Cheese | 3 | 4.6 | 6 | 9.2 | 7 | 10.8 | 25 | 38.5 | 24 | 36.9 |
| Greens | 1 | 1.5 | 9 | 13.8 | 19 | 29.2 | 22 | 33.8 | 14 | 21.5 |
| Apple | 3 | 4.6 | 8 | 12.3 | 12 | 18.5 | 28 | 43.1 | 14 | 21.5 |
| pear | 20 | 30.8 | 22 | 33.8 | 11 | 16.9 | 11 | 16.9 | 1 | 1.5 |
| Fish | 26 | 40 | 27 | 41.5 | 9 | 13.9 | 3 | 4.6 | 0 | 0 |
| egg | 1 | 1.5 | 4 | 6.2 | 17 | 26.2 | 32 | 49.2 | 11 | 16.9 |
| Honey | 24 | 36.9 | 17 | 26.2 | 10 | 15.4 | 8 | 12.3 | 6 | 9.2 |
| Raisins | 23 | 35.4 | 17 | 26.2 | 8 | 12.3 | 10 | 15.4 | 7 | 10.8 |
| Almond | 18 | 27.7 | 22 | 33.8 | 12 | 18.5 | 10 | 15.4 | 3 | 4.6 |

**Table 3. Coefficient relation matrices of parts of the protection motivation theory**

| Behavior | Motivation | Fear | Perceived reward | Perceived cost | Perceived response efficiency | Perceived self-efficacy | Perceived severity | Perceived sensitivity | variable | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 1 | R<br>P | Perceived sensitivity |
| | | | | | | | 1 | 0.440<br>0.000 | R<br>P | Perceived severity |
| | | | | | | 1 | 0.386<br>0.002 | 0.308<br>0.012 | R<br>P | Perceived self-efficacy |
| | | | | | 1 | 0.336<br>0.006 | 0.419<br>0.001 | 0.308<br>0.012 | R<br>P | Perceived response efficiency |
| | | | | 1 | 0.443<br>0.000 | 0.354<br>0.004 | 0.271<br>0.029 | 0.351<br>0.004 | R<br>P | Perceived cost |
| | | | 1 | 0.195<br>0.120 | 0.127<br>0.315 | 0.086<br>0.497 | 0.156<br>0.216 | 0.108<br>0.392 | R<br>P | Perceived reward |
| | | 1 | 0.269<br>0.030 | 0.369<br>0.002 | 0.306<br>0.013 | 0.336<br>0.006 | 0.323<br>0.009 | 0.437<br>0.000 | R<br>P | Fear |
| | 1 | 0.053<br>0.676 | 0.055<br>0.665 | 0.363<br>0.003 | 0.267<br>0.032 | 0.606<br>0.000 | 0.201<br>0.108 | 0.165<br>0.188 | R<br>P | Motivation |
| 1 | 0.419<br>0.001 | 0.138<br>0.274 | 0.114<br>0.365 | 0.225<br>0.072 | 0.184<br>0.142 | 0.357<br>0.004 | 0.233<br>0.061 | 0.067<br>0.593 | R<br>P | behavior |

**Table 4: Comparison of the effect of the intervention program based on the protection motivation theory**

| Groups / variable | Before intervention | | | | One month from the intervention | | | | 3 months after intervention | | | | One Way ANOVA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | experimental | | control | | experimental | | control | | experimental | | control | | |
| | Mean | SD | Mean | SD | Mean | SD | Mean | SD | Mean | SD | Mean | SD | |
| Perceived sensitivity | 24.09 | 4.15 | 22.06 | 2.61 | 26.81 | 2.5 | 22 | 3.16 | 26.70 | 2.33 | 22.16 | 2.64 | p≤0.001 |
| Perceived severity | 20.34 | 2.78 | 19.90 | 2.7 | 23.85 | 1.6 | 19.32 | 2.6 | 23.55 | 1.69 | 19.92 | 2.36 | p≤0.001 |
| Perceived reward | 18.67 | 2.92 | 19 | 2.68 | 22 | 2.3 | 17.39 | 2.6 | 21.18 | 2.13 | 18.36 | 1.93 | p≤0.001 |
| Perceived self-efficacy | 24.4 | 3.66 | 24.25 | 2.32 | 27.77 | 2.48 | 23.85 | 2.6 | 27.7 | 2.47 | 23.2 | 2.66 | p≤0.001 |
| Perceived response efficiency | 16.12 | 2.15 | 15.61 | 1.47 | 17.5 | 2.22 | 14.85 | 1.6 | 16.92 | 1.95 | 14.6 | 1.32 | p≤0.001 |
| Perceived cost | 26.96 | 4.88 | 26.45 | 2.77 | 25.1 | 1.21 | 26.85 | 2.53 | 24.09 | 2.20 | 26.80 | 2.03 | p≤0.001 |
| Motivation | 21.40 | 3.88 | 19.96 | 2.28 | 23.88 | 1.7 | 20.25 | 2.38 | 23.51 | 1.94 | 19.48 | 1.73 | p≤0.001 |
| Fear | 21.5 | 3.03 | 21.38 | 2.59 | 24.88 | 2.7 | 20.64 | 2.51 | 24.44 | 2.39 | 21.72 | 1.72 | p≤0.001 |
| Behavior | 34 | 6.16 | 33.32 | 6.7 | 41.42 | 4.47 | 31.25 | 4.46 | 40.40 | 4.14 | 29.32 | 4.05 | p≤0.001 |

## Discussion

The main purpose of this study was to determine the effect of PM theory-based program on the osteoporosis preventive nutritional behaviors in the population under study.The results of Table3 show that only 7.7% of women consumed milk each day. As pointed out in the research by Nickpour et al., although various dairy products including milk, yogurt, cheese and dough, etc., are abundantly found in Iran because the occupation of the majority of people is husbandry in rural areas, there is no standard per capita consumption of dairy products in our country due to lack of proper infrastructure in the field of consumption pattern of these products, especially in urban areas that may be rooted in the livelihood and cultural status. Health ministry reports indicate that per capita milk consumption in Europe is 300 to 400 kilograms per year, but per capita milk consumption is 90 kilograms per person in Iran, which shows low per capita consumption of milk and dairy products in the country[9].

There was a positive and significant correlation between behavior, motivation and self-efficacy (P = 0.005) in this research. This correlation shows this the stronger the person's intention to do the behavior is, the more likely it will be in the future and individuals' motivation and intentions have a positive impact on health-related behaviors [18]. In Mcleod's review study, motivation was one of the most effective and important factors for performing osteoporosis preventive behaviors [19]. Milne et al., also showed that variables of the PM theory where the relationship between intent and behavior is stronger, are significantly related with current behaviors. They also stated that health care intentions are significantly related with future behaviors [16].Self-efficacy is a person's judgment of the confidence of his ability to perform a particular act. Individuals with more self-efficacy consider higher goals and become more committed and, as a result, their behavior is more desirable [19].

Also, various studies have shown that self-efficacy is one of the most important factors in performing health behaviors. Lendz et al. in their study titled 'Social support, knowledge and self-efficacy'' as factors related to the osteoporosis preventive behavior among girls, showed a positive correlation between self-efficacy and consumption of calcium-based foods. The higher the self-efficacy of higher individuals, the better their nutritional status is [20].The main objective of this study was to determine the effect of a PM theory-based program on the osteoporosis preventive behaviors in the population under study. Table 4 shows comparison of the means of PM theory components before the implementation of the educational program. After the implementation of the educational program, the means of PM theory components (perceived sensitivity, perceived severity, perceived self-efficacy, perceived response efficiency, reward, fear, motivation and behavior) in the excremental group were better than the pre-intervention stage; while there was no significant difference between the mean components of the examined model in the control group. In the present study, there was a significant difference between the experimental and control groups in terms of post-intervention perceived susceptibility so that the mean perceived susceptibility in the experimental group increased from 24.09 ± 4.15 to 26.81 ± 2.5 ($p \leq 0.0001$). This showed the effect of educational intervention on the increase in perceived susceptibility of women in reproductive age, meaning that most women believed that they might have a risk of osteoporosis after the intervention. The results of this study are consistent with Khorsandi et al., Ebadi Fard Azar et al and Ghaffari et al. [21-23]. In the pre-intervention stage, the mean perceived severity score of both groups was moderate and there was no significant difference between the two groups. However, this mean significantly increased in the experimental group in the post-intervention stage so that the mean of perceived severity in the experimental group increased from 20.34 ± 2.78 to 23.85 ± 1.6 ($p \leq 0.0001$). Hazavehi et al. study also suggests an increase in students' perceived severity of osteoporosis after intervention [24].After the intervention, self-efficacy was significantly increased in the experimental group. In this study, the mean perceived self-efficacy in the experimental group increased from 24.4 ± 3.66 to 27.7 ± 2.48 ($p \leq 0.0001$). The results of the present research were consistent with the Sedlock' and Tussing's study [25-26]. In a 8-week educational class, Tussing examined

the effect of osteoporosis preventive educational program based on the Health Belief Model and the theory of reasoned action on calcium intake of 42 women. She showed that significant changes were achieved in the field osteoporosis prevention and understanding the benefits of increasing calcium intake after intervention [25].

## Conclusion

In general, the results of this study indicated the positive effect of education on perceived susceptibility, perceived severity, perceived self-efficacy, perceived response efficiency, cost, reward, fear, motivation and ultimately increased osteoporosis preventive nutritional behaviors in women of reproductive age after implementation of PM theory-based educational intervention. Therefore, the project executives support the effectiveness of this model on promoting the osteoporosis preventive functions. Hence, implementation of interventional programs is an easy solution to promote osteoporosis preventive nutritional behaviors in women of reproductive age.

**Acknowledgment**

The authors grate fully acknowledges the cooperation of the participating patients.

**Funding**

This study was supported by Sabzevar University of Medical Sciences, Iran.

**Conflict of interest statement**

None declared.

**Contribution of Authors:**

Data gathering and idea owner of this study: Mohammadi M, Mehri A, Hashemian M, Abadi ZS

Study design: Maryam Mohammadi, Ali Mehri, Masoumeh Hashemian

Data gathering: Mohammadi M, Mehri A, Hashemian M, Abadi ZS, Mohammadi S

Writing and submitting manuscript: Mohammadi M, Mehri A, Hashemian M, Abadi ZS, Mohammadi S

Editing and approval of final draft: All authors

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