

Relationship between health literacy skills and walking behavior to prevent osteoporosis among health volunteers

RAHMAN PANAH¹, NOOSHIN HOSSEINI², SABA YAVARI¹, KEYHAN JAVANMARD³, MOHIADIN AMJADIAN⁴

¹ Research Center for Social Determinants of Health, Research Institute for Endocrine Sciences, Shahid Beheshti University of Medical Sciences, Tehran, Iran; ² MS.C. in Health Education, School of Medical Sciences, Ahvaz University of Medical Science, Ahvaz, Iran;

³ MS.C. in Clinical Psychology, Faculty of Psychology, Kordistan University, Sanandaj, Iran; ⁴ Assistant Professor of English Language Department, School of Medicine, Medical Sciences University of Kurdistan, Sanandaj, Iran

Keywords

Osteoporosis • Walking behavior • Adopting walking behavior • Health literacy skills

Summary

Background. Considering the effect of exercise and health literacy in preventing osteoporosis, the effect of health literacy in adopting preventive behaviors, and the role of health volunteers in transferring health messages to the community, this study aimed to determine the relationship between health literacy skills and adopting walking behavior to prevent osteoporosis in women health volunteers.

Methods. In a cross-sectional study, 290 health volunteers referring to Qazvin health centers in 2020 were selected through Multi-stage random sampling. Data were collected using a health literacy questionnaire (HELIA) and a questionnaire for the adoption of walking behaviors for the prevention of osteoporosis, and they were analyzed using descriptive statistics and logistic regression in SPSS software version 23.

Results. The adoption of walking behaviors to prevent osteoporosis was at an average level. Age ($P = 0.034$, $OR = 1.098$), decision-making and application of health information

($P < 0.001$, $OR = 1.135$), understanding ($P = 0.031$, $OR = 1.054$), and evaluation skills ($P = 0.018$, $OR = 1.049$) were factors affecting the adoption of this behavior so that by increasing one score to these variables, the chance of adopting the behavior increased 1.098, 1.135, 1.054 and 1.049 respectively. Also, the level of education was another effective variable in adopting this behavior, so having a favorable level of adoption of this behavior in health volunteers with a diploma degree ($P = 0.017$, $OR = 0.736$) and below diploma ($P = 0.011$, $OR = 0.960$), were 0.736 and 0.960 times of those with university degrees respectively.

Conclusion. The adoption of walking behaviors to prevent osteoporosis among health volunteers – who have lower age, education, and decision-making skills and the use of health information, understanding, and evaluation – was less. Therefore, it is necessary to pay more attention to them when designing educational health programs.

Background

Osteoporosis is one of the most influential chronic diseases in women's lives in a community [1, 2]. More than 200 million women have osteoporosis worldwide [3, 4], and approximately one in 3 women and one in 12 men have osteoporosis [5, 6]. Epidemiologically about 8 million women and 2 million men have osteoporosis in the United States [3]. According to the Tehran Rheumatology Research Center, over 6 million Iranians have osteoporosis [7, 8]. The main cause of this disease is not yet known. Age, gender, genetic characteristics, smoking, diet, low physical activity, long-term Glucocorticoid intake, inadequate calcium intake, vitamin D deficiency, and estrogen levels are considered factors associated with bone density changes [4, 8]. Although osteoporosis can be prevented and treated, it is irreversible and can disable the patient. In addition to physical problems, it also imposes a lot of costs on these individuals and the health care systems in society [6, 9]. Prevention of osteoporosis has several aspects, including

nutrition, sports, lifestyle, and initial screening. World Health Organization (WHO) believes that women should be aware of a balanced diet such as vitamin D, calcium, and regular exercise exercises to prevent osteoporosis [10].

Although many people are aware of the benefits of physical activity for physical and psychological health, unfortunately, physical activity has decreased in recent years. Physical activity is an effective factor in the incidence of some chronic diseases such as Osteoporosis, Diabetes, Hypertension, Cardiovascular Disease, Obesity, and Overweight [11]. According to the WHO, more than 60 percent of adults do not have enough physical activity to maintain their health [12]. Health literacy can affect levels of physical activity and is also one of the effective factors in preventing osteoporosis among women [13]. Health literacy is a set of skills, abilities, and capacities in various dimensions. These skills and capacities are sometimes manifested in obtaining, sometimes in reading, sometimes in understanding, sometimes in processing and interpreting [14], and sometimes in decision-making and

application of medical and health information, and they can affect the adoption of preventive behaviors in this way [15]. In Panahi et al., decision-making and the use of health information and evaluation skills were associated with the adoption of preventive behaviors [16]. Also, the results of Martin et al., showed that the skills of perception and use of health information were effective in the decision of individuals to adopt healthy and appropriate behavior [17]. One study also showed that the skill of using health information could predict the adoption of osteoporosis-prevention behavior among female adolescents [18].

Women's participation is one of the important factors in the success of health programs, which means total involvement of women in decision-making and implementation in health matters relating to the community. Accordingly, the "health volunteers" program was designed and implemented. The purpose of this plan, in addition to teaching the materials and skills necessary, is the transfer of health messages [13]. The health volunteers are housewives or employed women who volunteered to provide a variety of services, including health education, screening, and referral of individuals to health centers at the community level [17]. They have an important role in identifying risk factors, supporting and educating individuals to decrease their risky behaviors, and adopting proper lifestyles [18]. They act as bridges between individuals and health centers, and their knowledge and behavior can affect the health of households and ultimately the whole of society [19]. Despite numerous studies on the impact of health literacy in adopting different levels of exercise, most individuals ignore its role in adopting physical activity, especially walking behavior. Therefore, due to the important role of exercise in preventing osteoporosis, the role of health literacy in adopting different levels of exercise [11, 20, 21], adopting preventive behaviors [19-25] and preventing osteoporosis [26, 24], and the role of health volunteers in the transfer of health messages to the community [13] and the daily increase in of osteoporosis [27], this study aimed to determine the relationship between health literacy skills and adopting walking behavior to prevent osteoporosis in the women health volunteers.

Methods

STUDY DESIGN AND SAMPLING

This was a cross-sectional study conducted among active health volunteers referring to health centers in Qazvin in 2020. Multi-stage random sampling was used so that the list of health centers in Qazvin was prepared and then it was divided into two parts of north and south. Then, two health centers were randomly selected in each section. Finally, health volunteers were randomly selected through a lottery in each health center.

According to the results of the pilot study in 30 health volunteers ($r = 0.15$ for the correlation between the adoption of walking behaviors to prevent osteoporosis and health literacy) as well as the sample size table

for correlation studies, the minimum sample size was estimated to be 175 [28]. The sample size was estimated to be 263 considering *design effect* = 1.5. Finally, considering the possibility of a 10% drop in samples, 290 people were included in the study.

The inclusion criteria of the study were reading and writing literacy, Iranian citizenship, 18 to 65 years old, active as a health volunteer during the study, active presence in weekly or monthly volunteers' meetings in Health Centers, and informed written consent. Exclusion criteria were no unwillingness to continue the study and incomplete questionnaires.

DATA COLLECTION INSTRUMENTS

The data collection instrument consisted of three parts:

- A. demographic and background information questionnaire including items about age, marital status, education level, address, weight, height, number of delivery, number of lactation, number of family members, and monthly family income;
- B. to measure health literacy and its skills, the health literacy questionnaire for the urban population between 18-65 years old (HELIA) was used [28, 29]. This questionnaire included 5 main skills (reading, access, understanding, evaluation, decision-making, and use of health information), and 33 items are used to measure these skills. The scoring scale was based on a 5-score Likert, so that 5, 4, 3, 2, and 1 were given to quite easy, easy, not easy and not hard, hard, and completely hard items about reading skills respectively [29]. In the other four health literacy skills, 5, 4, 3, 2, and 1 were given to always, quite often, sometimes, rarely, and never respectively. To score the questionnaire, the raw score for each individual in each skill was obtained by the sum of his scores. Then, to convert this score to a zero to one hundred range, the raw scores minus the minimum possible raw score were divided by the maximum possible score minus the minimum possible score. Finally, to calculate the total score, scores of all skills (based on a range of zero to 100) were added and it was divided by the number of skills (number 5), so that 0 to 50, 50.1 to 66, 66.1 to 84, 84.1 to 100 were considered as inadequate health literacy, adequate health literacy, sufficient health literacy, and excellent health literacy respectively. The questionnaire had a favorable validity and acceptable reliability (The alpha Cronbach between 72 to 89%) [29]. In the present study, it was first studied as a pilot among 30 health volunteers and the alpha Cronbach coefficients were calculated between 0.76 and 0.85;
- C. part three included measuring the adoption of walking behaviors to prevent osteoporosis. This section included 7 items and it measured the time spent walking over the past week. To score this part, zero, one, two, and three were given to no walking, light walking, average walking, and heavy walking respectively. Thus, the range of scores was between zero and 21. The validity of this part was more than 0.7 in the study of John and colleagues,

and its reliability was above 0.79 by Cronbach's alpha coefficient (30, 27). It was also pilot-studied in 30 of the health volunteers and its alpha Cronbach coefficient was 0.81. The rate of preventive behaviors was classified into three levels: poor (scores less than 50% of the total score), moderate (scores of 75-50% of the total score), and good (scores above 75% of the total score) [31]. Also, the preventive behaviors were classified into two levels: poor (scores less than 50% of the total score) and good (scores between 100-50% of the total score) [25, 32], and they were used in the logistic regression in the study.

ETHICAL CONSIDERATIONS

The research number was received from the Deputy of Research and Technology of Qazvin University of Medical Sciences (Ethics code: IR.QUMS.REC.1398.380) in coordination with selected health centers. The purpose of the study was explained for the health volunteers to get their written consent. The questionnaires were self-reported, and all health volunteers were asked to complete the questionnaires honestly. They were also assured that all the information requested would be secret and without the names of the individuals.

STATISTICAL ANALYSIS

Data were analyzed using descriptive statistics and logistic regression in SPSS version 23, and the significant level was less than 0.05.

Results

GENERAL CHARACTERISTICS OF PARTICIPANTS

After completing the questionnaire, 10 cases were excluded from the study due to incomplete questionnaires, and 280 were included in the final analysis (response rate of 96.5%). The mean and standard deviation of the participant's age, height, and weight were 41.71 ± 3.57 years, 160.51 ± 6.27 cm, and 65.58 ± 5.89 Kg respectively. 25% (70) had a university education, 55% (154) had diplomas and 20% (56) were under diploma degrees. The monthly income of the participants' families was at an average level. Also, the mean and standard deviation for the number of delivery, the number of lactation, and the number of family members of the participants were 2.32 ± 1.35 and 1.85 ± 1.14 , and 3.55 ± 1.25 respectively. 71.4% (200 people) lived in the city and 28.6% (80) in villages, 20.7% (58) were single and 79.3% (222 people) were married.

ADOPTION OF PREVENTIVE BEHAVIORS

The mean and standard deviation of the adoption of preventive behaviors were 11.57 ± 1.43 out of 21 and it was moderate. The adoption of preventive behaviors was at poor, moderate, and good levels in 41.4% (116), 46.1% (129), and 12.5% (35) respectively. Also, the mean and standard deviation of health literacy score

Tab. 1. Health literacy Total and numerical indicators of its skills among the studied health workers.

Health Literacy Total and its Skills	Mean	Standard Deviation
Access	69.44	14.66
Reading	65.87	14.37
Understanding	75.17	15.14
Evaluation	66.28	13.74
Decision Making and health information Application	54.89	14.55
Health Literacy Total	65.47	12.54

was 65.47 ± 12.54 out of 100 which was at a moderate level. Table I showed the mean and standard deviation of the five skills scores of health literacy and the total health literacy score in the health volunteers. The results showed that among the five skills of health literacy, understanding and accessing had the highest, and decision-making and reading, and applying the health information had the lowest mean scores. (Tab. I).

FACTORS AFFECTING THE ADOPTION OF WALKING BEHAVIORS TO PREVENT OSTEOPOROSIS

Table II showed the results of logistic regression to determine the factors affecting the adoption of walking behaviors to prevent osteoporosis in the health volunteers. The results showed that age, level of education and decision-making skills and use of health information, understanding, and evaluating were the effective factors in adopting walking behaviors.

Moreover, the education level did not have a significant relationship with the adoption of walking behavior; so the chances of having a favorable level of adopting preventive behaviors in health volunteers with diploma ($P = 0.016$, $OR = 0.736$) and below diploma degrees ($P = 0.012$, $OR = 0.960$) were 0.736 and 0.960 respectively which were the same as those with university degrees. Also, the age ($P = 0.034$, 1.098), decision-making and health information application ($P < 0.001$), understanding ($P = 0.031$, $OR = 1.054$), and evaluation ($P = 0.018$, $OR = 1.049$) affected the adoption of walking behaviors to prevent osteoporosis so that by increasing a score to these variables' level, the chances of adopting walking behaviors increased by 1.098, 1.135, 1.054 and 1.049 respectively. Meanwhile, other demographic and background variables and reading and access skills did not affect the adoption of walking behaviors ($P < 0.05$).

Discussion

The study aimed to determine the relationship between health literacy skills and adopting walking behaviors to prevent osteoporosis in health volunteers.

The results showed that among the five skills of health literacy, understanding, and access had the highest mean scores. These results are consistent with the results of Panahi et al. [33]. Also, in the studies of Panahi et al. [16], Khoshravesh et al. [34], and Ansari et al. [35]

Tab. II. Factors affecting the adoption of walking behaviors to prevent osteoporosis in health volunteers in the logistic regression model *.

Variable		Regression Index Estimation	Odds Ratio (OR)	Standard Error (SE)	Wald statistic	P-value	P value (0.95%)	
							The Least Value	The Most Value
Place of Residency	City	-	-	-	-	-	-	-
	Village	0.331	1.39	0.165	4.02	0.359	0.008	0.655
Education Level	University	-	-	-	-	-	-	-
	Diploma	-0.306	0.736	0.344	0.011	0.016	-0.712	0.64
	Below diploma	-0.036	0.96	0.34	0.011	0.012	-0.714	0.64
Marital Status	Single	-	-	-	-	-	-	-
	Married	-0.010	0.99	0.029	0.125	0.654	-0.067	0.047
Monthly Family Income		0.007	1.007	0.006	1.086	0.258	-0.006	0.019
Age		0.094	1.098	0.041	5.055	0.034	0.012	0.176
Number of Deliveries		-0.029	0.971	0.021	1.86	0.152	-0.071	0.013
Height		-0.049	0.95	0.147	0.113	0.687	-0.337	0.239
Weight		-0.010	0.99	0.029	0.125	0.413	-0.067	0.047
Number of lactating		-0.015	0.985	0.05	0.091	0.183	-0.115	0.084
Number of Family members		-0.044	0.956	0.035	1.581	0.254	-0.114	0.025
Reading		0.033	1.033	0.04	0.689	0.186	-0.046	0.112
Access		0.005	1.005	0.034	0.025	0.103	-0.062	0.073
Understanding		0.053	1.054	0.025	4.352	0.031	0.003	0.103
Evaluation		0.048	1.049	0.0218	4.773	0.018	0.005	0.090
Decision-Making and Application		0.127	1.135	0.031	16.514	< 0.001	0.066	0.189

* Independent variables were entered concurrently into the logistic regression model.

understanding had the highest mean score among health literacy skills. Moreover, these results are consistent with the results of the study of Mahmoudi et al. [36] in which access had the highest mean score. Since the participants in this study were health liaisons, it is possible that in addition to access, they also have more understanding of health-related issues than other people. On the other hand, decision-making and use of health information along with reading skills had the lowest scores in our study. These results are consistent with the results of ZiaPour and Kianpour [37], and the study of Panahi et al. [16] in which decision-making and health information applications had the lowest mean scores. However, these results are not consistent with the results of the study of Mahmoudi [36], in which information evaluation skills had the lowest score. The possible reasons for this inconsistency are the participants' low level of health issues evaluation compared to the health volunteers in this study, the health volunteers' low accuracy in answering reading, decision making, and applying health information items, as well as the difference in health literacy level between the two groups.

Also, the results showed that the health literacy level was moderate in the health volunteers. The results of the global study of Eftekhari and colleagues showed that the level of health literacy in health volunteers is low which is not consistent with the results of this study [38]. Considering the direct relationship between education level and health literacy [14, 39], this justification is possible. One of the possible reasons for this inconsistency is that 61.5% of the health volunteers had elementary and upper elementary degrees and had lower health literacy levels compared to the participants of this study. Another reason can be the difference in the instruments used in both studies (HELIA tool in our study and TOFHLA

tool in the study of Eftekhari). Similar to the results of this part of the present study, the study of Dehghankar and colleagues showed that the health literacy level was moderate in female students [40].

The results showed that the adoption of walking behaviors was at a moderate level. In the study of Aligol et al. [41] and Bashiri Moosavi et al. [42], physical activity level was also moderate. Considering the moderate level of health literacy in the present study, as well as the relationship between health literacy and adopting preventive behaviors [24, 32, 43, 44], It was expected that the adoption of preventive behaviors was also at a moderate level.

The moderate level of adopting walking behaviors to prevent osteoporosis could be attributed to the average levels of health literacy among the health volunteers, and also the relationship between health literacy and adopting preventive behaviors.

Moreover, age affected the adoption of walking behavior to prevent osteoporosis. Age also was one of the effective factors in adopting preventive behaviors in the study of Panahi et al. [24]. However, there was no significant relationship between age and adoption of preventive behaviors in Hosseini et al. [45], and Panahi et al. [46]. It seemed that with increasing age and increasing self-efficacy, people would have more successful experiences [47], due to the effect of self-efficacy on calcium intake and exercise [48] and the relationship between self-efficacy and health literacy [49].

Moreover, the results showed that the level of education was effective in adopting walking behaviors. These results were consistent with the results of Hernandez-rauda et al. [50]. Etehad Nezhad and colleagues' study showed that there was a relationship

between the level of women's education and the intake of calcium as preventive behavior of osteoporosis [3]. In the study of Kani Jayhooni and colleagues, there was also a relationship between women's education and adopting preventive behavior [51]. The results of this part were inconsistent with the results of Panahi et al. [2] and Hosseini et al. [46]. One of the possible reasons for this discrepancy could be the younger age and lower health literacy level of the students compared to those of the health volunteers in the present study. It seemed that the higher their level of education, the more likely they are aware of health information and more likely to adopt preventive behaviors.

The results showed that decision-making skills and the use of health information, understanding, and evaluation skills were effective factors in adopting walking behaviors to prevent osteoporosis. In the studies of Panahi et al. [33] and Martin et al. [52], decision-making skills and health information and evaluation were related to the adoption of preventive behaviors which is in line with these results. Martin et al. showed that perception and the use of information in decision-making were effective in treating behavior [52]. It can be concluded that health literacy is a set of skills, capabilities, and capacities in various dimensions. These skills and capacities emerge occasionally in obtaining medical and health information, reading, understanding, processing and interpretation, and decision-making and the use of health information [14], and they can affect the adoption of preventive behaviors [15]. In other words, in the present study, probably these skills and capacities were able to appear only in the three skills of decision-making and the use of health information, understanding and evaluation, and they had an impact on the adoption of preventive behaviors. Also, regarding the impact of decision-making skills and the use of health information on adopting behavior, it can be added that this skill is somehow the same as behavior. Meanwhile, understanding and assessment were effective in the adoption of preventive behaviors due to the activities of the health volunteers and their presence in educational meetings in the health centers, and their transferring of these pieces of training to the households.

Conclusion

The adoption of walking behaviors to prevent osteoporosis was less among health volunteers who had lower age, education, decision-making skills, and the use of health information, understanding, and evaluation. Therefore, it is necessary to pay more attention to them when designing educational health programs.

It seemed that the present study was the first study to determine the relationship between health literacy skills and adopting walking behaviors. The findings of this study should be used to design interventions to prevent osteoporosis among health professionals. Also, the target group in this study was active health workers living in Qazvin city. Therefore, the results of this study cannot be generalized to other groups of health

professionals. Therefore, it is recommended to conduct this study among the health liaisons of other cities as well as among different groups of women (in terms of education, age, and residential area).

Limitation

The most important limitation of this study was the lack of a specific instrument for measuring health literacy in osteoporosis. Moreover, ignoring other health skills related to health literacy such as self-efficacy, communication, and calculation was another limitation of this study which could study a wider and more comprehensive relationship between health literacy skills and adopting walking behaviors in osteoporosis. Ignoring cultural backgrounds and skills such as speaking, listening, and understanding basic and cultural knowledge of individuals was also another limitation of this study that should be paid attention to when measuring health literacy. They were also neglected in other instruments and studies. In addition, a relatively low number of samples, sampling at the level of health centers, a low number of related studies, and self-reported data collection were other limitations of this study.

Ethics approval and consent to participate

The ethical principles observed by the researchers included obtaining permission from the Ethics Committee of Qazvin University of Medical Sciences (Ethics code: ir.qums.rec.1398.380). In addition, written informed consent from all the participants was obtained and they were granted the right to withdraw from the study at any time. The principles of anonymity and confidentiality were applied and the participants were provided with the results upon their request.

Consent for publication

Consent was given to the participants so that their anonymity was not endangered.

Availability of data and materials

The data that support the findings of this study are available from Rahman Panahi but restrictions apply to the availability of this data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of Rahman Panahi.

Acknowledgments

This study was supported by the Department of Science and Technology of the University of Medical Sciences

(project code: 28.6.35261 dated 25.12.1398). We sincerely appreciate all Health officials and managers of health centers in Qazvin, and all the volunteers who helped us in this study.

Conflict of interest statement

The authors declare no competing interests regarding the present study.

Funding

The researchers consider it necessary to express their gratitude to the Deputy of Research and Technology and the School of Nursing and Midwifery of Qazvin University of Medical Sciences which supported this research in the form of an approved plan.

Authors' contributions

This study was designed by RP, MA, and NH. SY, LD, KJ, RP wrote the proposal, and MA and RP reviewed and modified it. MA and SY performed the simulations of blindness. All authors have read and approved the manuscript.

References

- [1] Dehghankar L, Panahi R, Hasannia E, Hemmati F, Samiei Siboni F. The Effect of an Educational Intervention on Health Literacy and the Adoption of Nutritional Preventive Behaviors Related to Osteoporosis Among Iranian Health Volunteers. *J Prev Med Public Health* 2021;54:404-11. <https://doi.org/10.3961/jpmph.21.183>
- [2] Panahi R, Dehghankar L, Hosseini N, Hasania E. Factors Related to Adoption of Osteoporosis Preventive Behaviors among Females' High School Students; a Case Study of Qazvin City. *J Educ Community Health* 2020;7:105-12. <https://doi.org/10.29252/jech.7.2.105>
- [3] Etehadnezhad S, Moradi Z, Kashfi M, Khani-jeihooni A, Khiyali Z. Predictors of Osteoporosis Preventive Behaviors among Women: An Application of the Transtheoretical Model. *J Educ Community Health* 2018;5:48-56. <https://doi.org/10.21859/jech.5.3.48>
- [4] Karimiankakolaki Z, Eslami A, Gerayllo S, Heidari F, Safari Hajataghaie S, Behzadi Goudari S. Effect of Education Using the Virtual Social Networks on Promoting Women's Self-Efficacy in Preventing Osteoporosis. *J Educ Community Health* 2018;5:57-62. <https://doi.org/10.21859/jech.5.3.57>
- [5] Shobeiri F, Hesami E, Khodakarami B, Soltanian A. Effect of Counseling on Preventive Behaviors of Osteoporosis in Women Referred to Health Centers in Hamedan, Iran in 2015. *J Educ Community Health* 2015;2:51-7. <https://doi.org/10.20286/jech-02037>
- [6] Mohammadi S, Ghofranipour F, Gholami-Fesharaki M. The Effect of Osteoporosis Prevention Education on Knowledge, Attitude and Behavior of Adolescent Female Students in Kerman-shah, Iran. *J Educ Community Health* 2015;2:47-55.
- [7] Mousaviasl S, Renani HA, Gheibizadeh M, Malehi AS. The Effect of Education Based on the Health Belief Model on Osteoporosis Prevention Behaviors in Female High School Students. *Jundishapur J Chronic Dis Care* 2016;5:e34852. <https://doi.org/10.17795/jjcd-c-34852>
- [8] Malekzadeh J, Fararoei M. Preventing of osteoporosis: Applying the health belief model. *Adv Nurs Midwifery* 2015;25:15-22.
- [9] Ghaffari M, Niazi S, Ramezankhani A, Soori H. Knowledge of Female Students of Kalaleh city about Osteoporosis, calcium intake, and physical activity: An Unacceptable Status. *Iran J Nutr Sci Food Technol* 2013;7:319-27.
- [10] Panahi R, Samiei Siboni F, Kheiri M, Jahangasht Ghoozlu KH, Shafaei M, Dehghankar L. Promoting the adoption of behaviors to prevent osteoporosis using the Health Belief Model integrated with Health Literacy: a quasi-experimental intervention study. *BMC Public Health* 2021;21:2221. <https://doi.org/10.1186/s12889-021-1230>
- [11] Fathi F, Rezaei Sofi M. The Relationship between Health Literacy and Physical Activity Level of Elderly Women in the City of Urmia. *J Health Lit* 2017;2:12-21. <https://doi.org/10.22038/jhl.2017.10947>
- [12] World Health Organization. Health Education and Health Promotion Unit. Annual global move for health initiative: a concept paper. World Health Organization 2003. Available at: <https://apps.who.int/iris/handle/10665/67795> (Accessed on: 2012-06-17T00:50:38Z).
- [13] Bayat B, Mohebbi B, Tol A, Sadeghi R, Yekaninejad MS. Quality of Life Predictors Among Health Volunteers in South Tehran Health Centers. *J Sch Publ Health Inst Publ Health Res* 2018;15:377-88.
- [14] Tavousi M, Haeri Mehrizi AA, Rafiefar SH, Solimani A, Sarbandi F, Ardestani M, Hashemi A, Montazeri A. Health literacy in Iran: findings from a national study. *Payesh* 2016;15:95-102.
- [15] Mahdavi ZH, Ramezankhani A, Ghanbari SH, Khodakarim L. [Relationship between health literacy and female cancers preventive behaviors]. *Payesh* 2017;5:613-25.
- [16] Panahi R, Dehghankar L, Abdollahi F, Anbari M, Hosseini N. Health Literacy and Breast Cancer Preventive Behaviors among Students. *Payesh* 2019;18:547-57.
- [17] Bayati A, Ghanbari F, Shamsi M. Exploration of the educational needs of health educators and volunteer health care communicators: A qualitative study. *J Arak Med Univ* 2013;15:21-32.
- [18] Shojaezadeh D, Sadeghi R, Tarrahi MJ, Asadi M, Lashgarara B. Application of Health Belief Model in Prevention of Osteoporosis in Volunteers of Khorramabad City Health Centers, Iran. *J Health Syst Res* 2012;2(8).
- [19] Jorvand R, Karami B, Panahi R. The effect of healthy nutrition education on the behavior of health volunteers in Ilam Province in terms of consuming fast food. *J Health Field* 2020;8:10-6.
- [20] Geboers B, de Winter AF, Luten KA, Jansen CJ, Reijneveld SA. The association of health literacy with physical activity and nutritional behavior in older adults, and its social cognitive mediators. *J Health Commun* 2014;19(Suppl 2):61-76. <https://doi.org/10.1080/10810730.2014.934933>
- [21] Lim ML, van Schooten KS, Radford K, Delbaere K. Association between health literacy and physical activity in older people: a systematic review and meta-analysis. *Health Promot Int* 2021;1-16. <https://doi.org/10.1093/heapro/daaa072>
- [22] Panahi R, Namdar P, Siboni FS, Fallah S, Anbari M, Dehghankar L, et al. Association between health literacy and adopting preventive behaviors of breast cancer in Iran. *J Edu Health Promot* 2020;9:241. https://doi.org/10.4103/jehp.jehp_313_20
- [23] Panahi R, Ramezankhani A, Tavousi M. Health literacy and preventive behaviors. *J Res Health* 2018;8:93-4. <https://doi.org/10.29252/jrh.8.2.93>
- [24] Panahi R, Osmani F, Javanmardi K, Ramezankhani A, Dehghankar L, Amini RA, et al. The relationship between different levels of Health Literacy and smoking prevention among Medical sciences students. *Int J Prev Med* 2021;12:124. https://doi.org/10.4103/ijpvm.IJPVM_460_20. eCollection 2021
- [25] Panahi R, Ramezankhani A, Tavousi M, Niknami SH. Adding health literacy to the health belief model: effectiveness of an educational intervention on smoking preventive behaviors among university students. *Iran Red Crescent Med J* 2018;20:e13773. <https://doi.org/10.5812/ircmj.13773>

- [26] Panahi R, Kazemi SS. Health literacy: an Effective Component in Prevention of Osteoporosis in Women. *Int J Musculoskeletal Pain Prev* 2018;3:69-71.
- [27] Jeihooni AK, Hidarnia A, Kaveh MH, Hajizadeh E, Askari A. The effect of an educational program based on health belief model on preventing osteoporosis in women. *Int J Prev Med* 2015;6:115. <https://doi.org/10.4103/2008-7802.170429>
- [28] Sharifi Rad Gh, Baghani Moghaddam MH, Shamsi, Rezaian M. *Research in Health Education*. 1st Edition. Tehran, Iran: Sobhan Works Publications 2009, pp. 178-180.
- [29] Montazeri A, Tavousi M, Rakhshani F, Azin SA, Jahangiri K, Ebadi M. Health Literacy for Iranian Adults (HELIA): development and psychometric Properties. *Payesh* 2014;13:589-99.
- [30] Khani-Jeihooni A, Manouchehri M, Bahmadoost M, Khyali Z. Effect of Educational Intervention Based on the Health Belief Model on Preventive Behaviors Against Influenza A (H1N1) among Students. *J Educ Community Health* 2020;7:97-103. <https://doi.org/10.29252/jech.7.2.97>
- [31] Panahi R, Ramezankhani A, Tavousi M, Osmani F, Niknami S. Predictors of Adoption of Smoking Preventive Behaviors among University Students: Application of Health Belief Model. *J Educ Community Health* 2017;4:35-42. <https://doi.org/10.21859/jech.4.1.35>
- [32] Panahi R, Namdar P, Siboni FS, Fallah S, Anbari M, Dehghankar L, et al. Association between health literacy and adopting preventive behaviors of breast cancer in Iran. *J Edu Health Promot* 2020;9:241. https://doi.org/10.4103/jehp.jehp_313_20
- [33] Panahi R, Ramezankhani A, Tavousi M, Osmani F, Niknami SH. Relationship between health literacy skills and adoption of smoking preventive behaviors. *J Ilam Univ Med Sci* 2019;27:11-20. <https://doi.org/10.29252/sjimu.27.2.11>
- [34] Khoshravesh S, Moeini B, Rezapur-Shahkolai F, Taheri-Kharameh Z, Bandehelahi K. Health Literacy of Employees of Hamadan University of Medical Sciences and Related Demographic Factors. *J Educ Community Health* 2018;5:19-26. <https://doi.org/10.21859/jech.5.1.19>
- [35] Ansari M, Shahdadneghad E, Khaledian M, Salajegheh M. Survey of Health Literacy of People Referred to the Libraries of Public Libraries Foundation. *Health Inf Manag* 2017;14:224-7.
- [36] Mahmoudi H, Taheri A. [Relation between Information Literacy and Health Literacy of Students in the Ferdowsi University of Mashhad]. *Hum Inf Interact* 2015; 2: 31-41.
- [37] Ziapoor A, Kianpoor N. [Predicting health literacy of students in Kermanshah University of Medical Sciences in 2016: The role of demographic variables]. *J Health Lit* 2016;1:182-90.
- [38] Jahani Eftekhari M, Peyman N, Doosti H. Health Literacy and Health-promoting Lifestyle among Health Volunteers in Neyshabour. *J Ilam Univ Med Sci* 2018;26:7-15. <https://doi.org/10.29252/sjimu.26.3.7>
- [39] Sajadi FA, Sajadi HS, Panahi R. Health Literacy of University Students and its Influential Factors: A Case Study at Isfahan University. *J Educ Community Health* 2020;7:23-8. <https://doi.org/10.29252/jech.7.1.23>
- [40] Dehghankar L, Hajikarimbaba M, Panahi R. Health Literacy and Factors Related to It Among Female Students of Imam Khomeini International University in Qazvin, Iran. *sjsph* 2019;17:295-306.
- [41] Aligol M, Kazemi S S, Salim Abadi Y, Nasirzadeh M, Tayyebi Z. A Survey on Physical Activity Determinants as Osteoporosis Preventive Behavior Among Pre-university Female Students of Rafsanjan in 2017: A Descriptive Study. *J Rafsanjan Univ Med Sci* 2019;18:455-68.
- [42] Bashiri Moosavi F, Farmanbar R, Taghdisi MH, AtrkarRoshan Z. [Level of physical activity among girl high school students in Tarom county and relevant factors]. *Iran J Health Educ Health Promot* 2015;3:133-40.
- [43] Fernandez MD, Larson JL, Zikmund-Fisher BJ. Associations between health literacy and preventive health behaviors among older adults: findings from the health and retirement study. *BMC Public Health* 2016;16:596. <https://doi.org/10.1186/s12889-016-3267-7>
- [44] Izadirad H, Zareban I. The Relationship of Health Literacy with Health Status, Preventive Behaviors and Health Services Utilization in Baluchistan, Iran. *J Educ Community Health* 2016;2:43-50. <https://doi.org/10.20286/jech-02036>
- [45] Panahi R, Ramezankhani A, Anbari M, Javanmardi K. Adoption of smoking preventive behaviors and its related factors among dormitory students of Shahid Beheshti University of Medical Sciences in Tehran-2016. *J Health Field* 2020;8:22-31.
- [46] Hosseini Z, Karimi Z, Mohebi S, Sharifirad G, Rahbar A, Gharlipour Z. Nutritional preventive behavior of osteoporosis in female students: applying Health Belief Model (HBM). *Int J Pediatr* 2017;5:413744. <https://doi.org/10.22038/ijp.2016.7560>
- [47] Ozturk A, Sendir M. Evaluation of knowledge of osteoporosis and self-efficacy perception of female orthopedic patients in Turkey. *Journal of Nursing and Healthcare of Chronic Illness* 2011;3:319-28. <https://doi.org/10.1111/j.1752-9824.2011.01106.x>
- [48] Chan CY, Mohamed N, Ima-Nirwana S, Chin KY. A Review of Knowledge, Belief and Practice Regarding Osteoporosis among Adolescents and Young Adults. *Int J Environ Res Public Health* 2018;15:1727. <https://doi.org/10.3390/ijerph15081727>
- [49] Ghanbari S, Ramezankhani A, Montazeri A, Mehrabi Y. Health literacy measure for adolescents (HELMA): development and psychometric properties. *PloS One* 2016;11:e0149202. <https://doi.org/10.1371/journal.pone.0149202>
- [50] Hernandez-Rauda R, Martinez-Garcia S. Osteoporosis-related life habits and knowledge about osteoporosis among women in El Salvador: a cross-sectional study. *BMC Musculoskeletal Disord*. 2004;5:29. <https://doi.org/10.1186/1471-2474-5-29>
- [51] Khani Jeihooni A, Heidarnia AR, Kaveh MH, Hajizadeh E, Gholami T. Survey of osteoporosis preventive behaviors among women in Fasa: The application of the health belief model and social cognitive theory. *Iran South Med J* 2016;19:4862.
- [52] Martin LT, Haas A, Schonlau M, Pitkin Derosé K, Rosenfeld L, Rudd R, Buka SL. Which literacy skills are associated with smoking? *J Epidemiol Community Health* 2012;66:189-92. <https://doi.org/10.1136/jech.2011.136341>

Received on August 16, 2022. Accepted on March, 1, 2023.

Correspondence: Mohiadin Amjadian, Kurdistan University of Medical Sciences, Sanandaj, Iran. Tel. 0989183778545 - Fax: 08733664645 - E-mail: Mohiadin72@yahoo.com

How to cite this article: Panahi R, Hosseini N, Yavari S, Javanmardi K, Amjadian M. Relationship between health literacy skills and walking behavior to prevent osteoporosis among health volunteers. *J Prev Med Hyg* 2022;63:E48-E54. <https://doi.org/10.15167/2421-4248/jpmh2023.64.1.2685>

© Copyright by Pacini Editore Srl, Pisa, Italy

This is an open access article distributed in accordance with the CC-BY-NC-ND (Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International) license. The article can be used by giving appropriate credit and mentioning the license, but only for non-commercial purposes and only in the original version. For further information: <https://creativecommons.org/licenses/by-nc-nd/4.0/deed.en>