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Original Article

The Impact of an Educational Program on the Stages of Change for Mammography Screening Among Rural Women with Low Health Literacy

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Abstract

Background: The aim of the study was to investigate the effect of an educational program on the mammography screening stage of change among rural women with low health literacy.

Methods: In general, 52 rural women participated in this experimental study. The samples were selected using a multi-stage cluster sampling method and divided into two intervention (n=26) and control (n=26) groups. An educational program was implemented for the intervention group for one month. The data collection tool was a valid questionnaire based on constructs of the transtheoretical model (TTM) related to mammography screening, which was completed in the pre-test phase and after three and six months. The data were analyzed using SPSS 16 at the significant level of 0.05.

Results: There was no significant difference between the control and intervention groups at the pre-test phase ($P>0.05$). The intervention group demonstrated considerable progress in the stage of change for mammography screening after three- and six-month follow-ups ($P<0.001$, odds ratio [OR]=2.54). The odds ratio of progress in the stages of change in the intervention group compared to the control group significantly increased after three ($P<0.001$, OR=4.29) and six ($P<0.001$, OR=5.45) months of follow-up. In addition, the findings indicated a significant increase in the mean scores of decisional balance, processes of change, and self-efficacy in the intervention group compared to the control group three and six months after the educational intervention ($P<0.005$).

Conclusion: The educational program significantly advanced mammography screening stages among rural women with low health literacy. These results highlight the program's effectiveness in enhancing screening behaviors in this underserved population.

Keywords: Health education, Mammography, Transtheoretical model, Women

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Introduction

The early detection of breast cancer (BC) almost leads to complete recovery and plays a crucial role in reducing mortality and associated complications (1). BC is one of the major leading causes of mortality among women. According to Global Cancer Statistics, in 2020, the age-standardized incidence and mortality rates for this cancer were reported as 13.3 and 7.3, respectively (2). In Iran, the incidence of BC has been rising over the past two decades. According to data from the National Cancer Registry of Iran, the number of cases is projected to increase by 63% by 2025. Furthermore, it is estimated that the number of diagnosed cases will reach 25013 by the mentioned year (3). Considering that there is no definite way to prevent this cancer, screening for early detection is essential (4,5). Screening aims to reduce mortality rates associated with the disease (6,7). BC screening includes breast self-examination, clinical breast examination, and mammography (8). Mammography leads to a greater reduction in mortality rates compared to other screening methods (9). When the disease is confined to the breast, the chance of survival in the next five years is 75%–90%. In the second stage of the disease, the patient's survival probability decreases by 16% (10). It is estimated that 30–35 cases of BC are detected through mammography screening (11). Current guidelines recommend mammography screening starting at the age of 40, yet many women still avoid periodic screenings (8). Although

mammography rates have increased significantly in recent decades, they are still below recommended levels in many communities (12, 13). Generally, the awareness of Iranian women regarding mammography and BC is not high, and they tend to consult a physician only when the disease has progressed to advanced stages (12).

Due to inadequate education and low health literacy levels, especially among rural women, there is little inclination toward undergoing mammography screening (12). Health literacy is one of the factors that influences women's health outcomes and has been identified as a determinant of participation in screening programs in numerous studies (1,14-16). Additionally, it has been reported that other factors such as age, family history, and family support, physician recommendations, perceived sensitivity and severity, self-efficacy, and perceived benefits significantly influence the decision to undergo mammography screening (4).

Increasing knowledge, especially during the early stages of behavior change (e.g., pre-contemplation and contemplation), can be utilized as a strategy or a change process to promote mammography screening (17). Highlighting the risk of BC and understanding the perceived risks of the disease can affect decision-making balance (18).

Education is considered one of the important factors in increasing knowledge and the tendency to adapt screening behaviors for BC (19). Earlier studies have emphasized the implementation of interventions to increase knowledge and encourage women in screening programs (7,18,20). The transtheoretical model (TTM) is one of the models of behavior change that is widely used to encourage women to participate in screening programs (18,21). In this model, behavior change is considered to occur in several stages. Individuals progress through these stages by utilizing cognitive and behavioral change processes and balancing the benefits and costs of the change. Typically, these changes are accompanied by the development of self-efficacy in individuals to adopt new behaviors. Given that women's participation in mammography screening requires balanced decision-making and overcoming related barriers and fears, the TTM can be an appropriate choice to assist them in engaging in screening programs (18,22,23). Hence, this study sought to investigate the effect of an educational program on the mammography screening stage of change among rural women with low health literacy.

Materials and Methods

Setting and Sampling

Overall, 52 rural women aged 40 years and above residing in rural areas in Dalahoo county, located in Kermanshah Province, western Iran, participated in this experimental study. The study was conducted from March to October 2023. The sample size was determined based on a similar study (24) and was calculated using the following formula:

$$n = \frac{\left(Z_{1-\alpha/2} + Z_{1-\beta}\right)^2 \left(S_p^2\right)}{\left(\mu_1 - \mu_2\right)^2} = \frac{\left(1.96 + 0.85\right)^2 \left(0.2605\right)}{\left(4.56 - 4.24\right)^2} = \frac{\left(7.84\right)\left(0.2605\right)}{0.1024} = 19.94$$

In this study, $S^2_p = 0.2605$, $\mu 1 = 4.56$, and $\mu 2 = 4.24$ were taken into consideration. Given a confidence level of 0.95 and an error margin of 0.05, the sample size was estimated to be 19.94 participants. Considering a potential 30% dropout rate, the final sample size for each group was determined to be 26 participants.

In addition, a multi-stage cluster sampling framework was used in the sampling process. Initially, two out of six comprehensive rural health centers in Dalahoo county (Kamran and Gahvareh) were randomly selected. Using the lottery method, Gahvareh and Kamran villages were designated as the intervention and control groups, respectively.

Inclusion and Exclusion Criteria

The inclusion criteria for the study were residing in a village, being in the age range of 40–69 years, having at least an elementary level of education and low health literacy level (score of 66 or less from the health literacy for Iranian adults questionnaire) (25), being in the pre-contemplation and contemplation stages of change in the TTM, and completing an informed consent form. On the other hand, the exclusion criteria included undergoing mammography screening in the past two years, having a breast examination by a physician in the past year, performing breast self-examination at least four times (in general) in the past year, and having first-degree relatives with BC. The other exclusion criteria were suffering from or having a history of breast mass, suffering from or having a history of mental illnesses, experiencing pregnancy and lactation, and having a history of participating in BC screening education classes.

Intervention

After establishing telephone contact with eligible women for study participation, they were invited to the rural health center, where further information about the study objectives was provided to them. After completing a written informed consent form, they were enrolled in the study, and in the next step, pre-test data were collected through interviews.

A one-month educational program based on the TTM structures was designed and implemented for the intervention group. Considering that women entered the study at the precontemplation and contemplation stages, the change strategies were initially determined based on these two stages. Subsequently, to help women progress through the remaining stages, change strategies were applied based on the principles of the TTM. Educational sessions were held at the comprehensive rural health center. Educational content was prepared and tailored to the model structures using the principles of health communication. For the intervention group, 12 group

education sessions plus one face-to-face midwifery counseling session were held for each individual. The face-to-face counseling was conducted by a midwife employed at the comprehensive rural health centers. The time of each session was 45 minutes. Educational posters were installed at the comprehensive rural health center hall, and educational pamphlets were distributed during group sessions. Additionally, to maintain continuous access to learning resources, a channel was created on the ITA messaging application (an Iranian messaging application), and intervention group participants were invited to join. Educational podcasts, videos, and animations related to mammography were shared on this channel. It is worth mentioning that to enhance communication with participants and the attractiveness of educational resources, the native language (Kurdish) was used in podcasts, videos, and animations. It is important to note that the educational content and media were approved by the research team prior to their use. During the implementation of the educational program, the control group received no education from the research team. In this study, the control group received the routine care and education provided by the comprehensive health service centers, and the research team imposed no restrictions on the control group's access to these standard services. To assess the impact of the educational program, post-test data were collected three months later, and follow-up data were collected six months later through interviews. The study flow diagram is depicted in Figure 1.

Instruments

The data collection method in this study was the use of a questionnaire completed through interviews with participants. This questionnaire, developed by Khodayarian et al, measures the constructs of the TTM in relation to mammography screening. Its validity and reliability have been confirmed previously. This questionnaire includes an algorithm for assessing mammography screening stages of change (6 items), a decisional balance questionnaire (18 items) using a 4-point Likert-type scale (from not sure to completely sure), a 16-item cognitive and behavioral scale using a 4-point Likert-type scale (from completely agree to completely disagree), and a self-efficacy questionnaire (8 items) using a 4-point Likert-type scale (from not sure to completely sure). Higher scores indicate a better status in the respective construct (22).

Data Analysis

The data were analyzed using SPSS software, version 27. Descriptive statistics such as means, standard deviations, and analytical tests, including independent sample t-test, Fisher's exact test, repeated measures ANOVA, and generalized estimation equation (GEE) (by considering exchangeable for the correlation structure), were used at a significance level of 5% and a confidence interval of 95%. The GEE was utilized to analyze the trend of progression in mammography screening stages of change (ordinal scale) over time in the intervention and control groups.

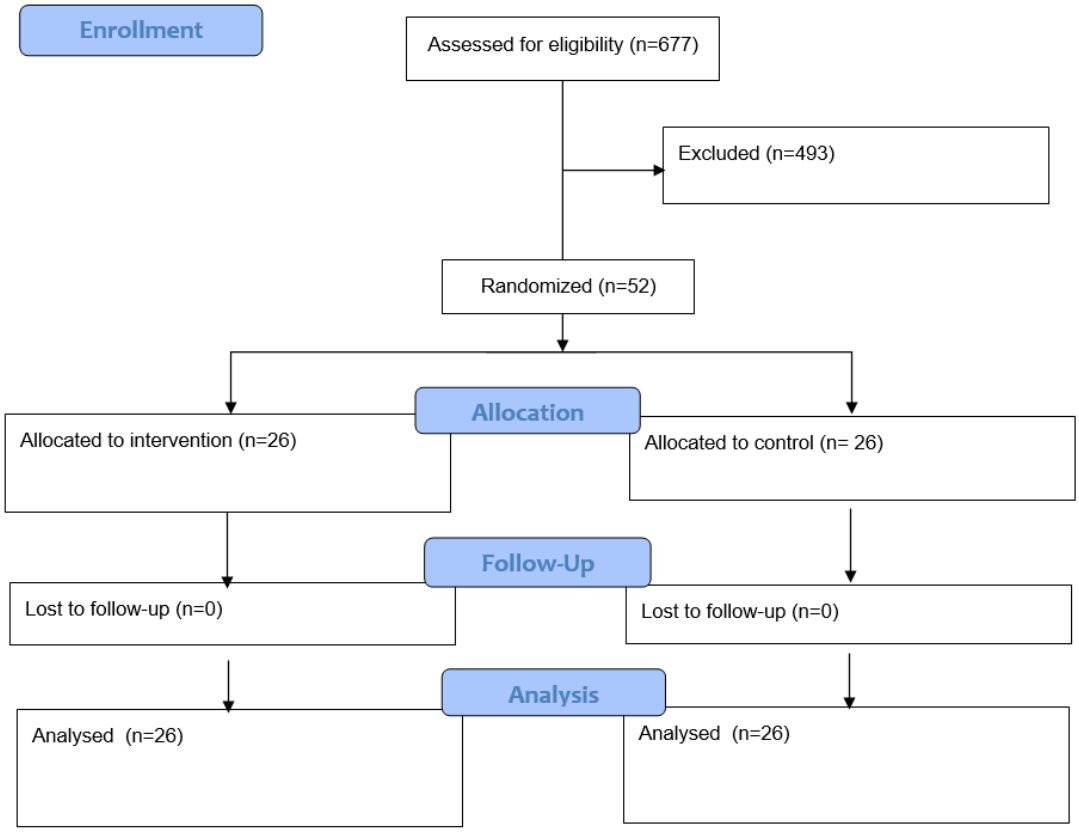

Figure 1. Study Flow Diagram

Results

The mean age of participants in the study was 57.86 ± 78.8 years. The mean age of the control and intervention groups was 56.5 ± 9.10 and 58.23 ± 7.92, respectively. The majority of them had education below the diploma level. More details are provided in Table 1. The homogeneity of the groups was examined using independent sample t-tests and Fisher's exact tests. The groups did not differ significantly in the distribution of demographic variables ($P > .05$).

Table 2 compares the mean scores of the constructs of the TTM in the intervention and control groups at the pre-test stage. The results of the independent sample t-test indicated that the groups did not significantly differ at the pre-test phase ($P > 0.05$).

Examination of the pre-test data revealed that all participants were in the pre-contemplation and contemplation stages of change, and no significant difference was observed between them ($P = 0.48$). The GEE test was utilized to consider the progress trend in the mammography screening stages of change in the two groups over time (Table 3). By considering stages of change as the dependent variable and visit time and group as predictor variables, the results of GEE demonstrated significant progress in the intervention group compared to the control group (OR = 2.54, $P = 0.04$). In other words, the odds ratio (OR) of transition (from the pre-contemplation phase to the preparation phase) in the intervention group was 2.54 times that in the control group. Furthermore, compared to the pre-test phase, the OR for change over the 3-month (OR = 4.29, $P < 0.001$) and 6-month follow-up phases (OR = 5.45, $P < 0.001$) significantly increased in the intervention group. In other words, the odds of transition in the 3- and 6-month follow-up phases were 4.29 and 5.45 times higher than that in the pre-test phase. This result can also be approved by marginal effects, so that the results confirmed a significant increase in the transition phase from pre-test until 6 months after the intervention (the marginal effect of visit = 1.24, $P < 0.001$). However, this transition further happened in the intervention group in comparison to the control group (the marginal effect of group = 1.51, $P = 0.04$).

The repeated measures test indicated a significant increase in the mean scores of the TTM constructs over time in the intervention group compared to the control group ($P < 0.05$, Table 4).

Table 1. Demographic Characteristics of Study Participants

		No. (%)		*P* Value
		Control (n = 26)	Intervention (n = 26)	
Number of children*		3.57 ± 1.83	4.30 ± 2.22	0.20
Education level	Elementary	4 (15.3)	6 (23.06)	0.07
	Secondary	13 (50)	13 (50)	
	Diploma	9 (34.7)	7 (26.94)	
Insurance coverage	Yes	23 (88.5)	25 (96.2)	0.61
	No	3 (11.5)	1 (3.8)	
Job	Housewife	24 (92.3)	26 (100)	0.35
	Employee	2 (7.7)	0 (0)	

Note. * Data presented as means ± standard deviation.

Table 2. Mean Scores of TTM Constructs in the Control and Intervention Groups at the Pre-test

	Group	Number	Mean ± SD	*P* Value
Decisional balance	Control	26	37.46 ± 9.5	0.84
	Intervention	26	38.04 ± 12.12	
Cognitive process of change	Control	26	17.96 ± 5.4	0.84
	Intervention	26	18.27 ± 6.1	
Behavioral process of change	Control	26	23.54 ± 5.91	0.71
	Intervention	26	22.96 ± 5.41	
Self-efficacy	Control	26	14.85 ± 7.57	0.96
	Intervention	26	14.77 ± 5.48	

Note. TTM: Transtheoretical model; SD: Standard deviation.

Discussion

This study examined the impact of an educational intervention based on the TTM on the stages of change for mammography screening in rural women with low health literacy. Significant progress was observed in the stages of mammography screening behavior change in the intervention group over time. This progress was evident in a significantly increased odds ratio of change over time after 3 and 6 months in this group and was positively correlated with an increase in the number of individuals in the preparation stage for mammography screening. Considering the significant difference between the control and intervention groups in the progress of change stages, it appears that the educational program succeeded in targeting enabling and reinforcing factors of change and guiding individuals to the preparation stage. Overall, our findings align with those of previous research

Table 3. The Trend of Mammography Screening Stages of Change in Intervention and Control Groups

Stage of Change	Control Group (n = 26)			Intervention Group (n = 26)			Time Effect (Baseline=Pre-test)				Group Effect (Baseline = Control)		Marginal Effect	
							3 Months		6 Months					
	Pre-test	3 Months	6 Months	Pre-test	3 Months	6 Months	OR (95% CI)	P-value	OR (95% CI)	P-value	OR (95% CI)	P-value	Group	Visit
PC	20 (76.9)	17 (65.4)	17 (65.4)	22 (84.6)	12 (46.2)	6 (23.1)	4.29 (2.09 to 8.78)	<0.001	5.45 (2.33 to 12.74)	<0.001	2.54 (1.02 to 6.31)	0.044	1.51 (p:0.042)	1.24 (p<0.001)
C	6 23.1)	7 (26.9)	8 (30.8)	4 (15.4)	7 (26.9)	15 (57.7)								
P	0 (0)	2 (7.7)	1 (3.8)	0 (0)	7 (26.9)	5 (19.2)								

PC: Pre-contemplation; C: Contemplation; P: Preparation

Table 4. Mean Scores of the TTM Constructs in the Control and Intervention Groups at Pre-test, 3 Months, and 6 Months

	Group	Number	Pre-test	3 Months	6 Months	Within-subject	Between-subject	Interaction
Decisional balance	Control	26	37.46±9.5	40.85±8.35	41.65±7.76	F=122.75; df=1.35/67.67; *P*<0.001	F=10.45; df=1/50; *P*=0.002	F=43.512; df=1.35/67.67; *P*<0.001
	Intervention	26	38.04±12.12	49±7.97	55.04±4.95			
Cognitive process of change	Control	26	17.96±5.4	19.08±3.7	19.88±3.75	F=77.27; df=1.31/65.68; *P*<0.001	F=19.12 df=1/50 *P*<0.001	F=34.48; df=1.31/65.68; *P*<0.001
	Intervention	26	18.27±6.1	25.12±3.18	27.42±2.28			
Behavioral process of change	Control	26	23.54±5.91	23.62±4.92	23.85±4.57	F=18.62; df=1.21/60.67; *P*<0.001	F=0.62 df=1/50 *P*=0.43	F=12.96; df=1.21/60.67; *P*<0.001
	Intervention	26	22.96±5.41	24.92±4.27	26.19±3.58			
Self-efficacy	Control	26	14.85±7.57	16.54±6.78	15.96±5.65	F=63.89; df=1.49/74.41; *P*<0.001	F=5.65; df=1/50; *P*=0.02	F=35.73; df=1.49/74.41; *P*<0.001
	Intervention	26	14.77±5.48	19.81±3.39	23.23±3.27			

in this area. For instance, Khodayarian et al reported that a TTM-based intervention could effectively promote Pap smear testing among women aged 18–65 years, facilitating their progression from the pre-contemplation and contemplation stages to the preparation stage (22). Additionally, Pirzadeh et al documented a 97% progress rate in the stages of Pap smear screening in married women (26). Furthermore, Lee-in et al concluded that an educational intervention significantly improved the stage of change in mammography screening 3 and 6 months post-intervention in mammography non-adherent Chinese women (27).

Our findings demonstrated a significant increase in decisional balance regarding mammography screening in the intervention group compared to the control group. It seems that adopting educational strategies to introduce the benefits of mammography and its future advantages could shift individuals' mental balance toward the decision to undergo mammography. Additionally, providing strategies to overcome barriers was effective in facilitating this change. Correcting misconceptions, as one of the major barriers to participation in mammography screening programs, also contributed to the success of the intervention group. This finding is consistent with the results of previous studies. For example, Duarte found that encouragement and motivational messages significantly reduced barriers to free mammography screening among women (28). Conversely, Hajian et al reported that a health belief model-based intervention did not successfully address barriers related to mammography screening behavior (29). The difference in findings may stem from attention to individuals' stages of change and the use of stage-specific processes of change in the current study.

The adaptation of cognitive and behavioral processes of change increased over time among women in the intervention group. This progression was consistent with advances in the stages of change. Cognitive and behavioral processes of change facilitated the transition through stages of change and enhanced women's movement toward the decision to undergo mammography screening, which aligns with those of some earlier studies (30-32). In the educational session, details of each change process were provided to the intervention group, aiming to familiarize women with change strategies and empower them to make decisions regarding mammography screening. Overall, it is presumed that, in this study, special attention to providing educational content tailored to the details of processes of change improved these constructs in women in the intervention group compared to the control group.

In general, the effectiveness of the educational approach used in this study on the self-efficacy of women in the intervention group in deciding to undergo mammography screening was evident. Implemented strategies included breaking behavior into smaller steps, introducing individuals who had previously undergone mammography screening, and providing verbal encouragement for mammography screening. Secginli and Nahcivan reported increased confidence in breast self-examination six months after a health promotion program related to BC screening behaviors among Turkish women (33). Davis et al also demonstrated increased self-efficacy in mammography screening among women aged 40 and above after an educational intervention (34). Similarly, Tuzcu et al found increased self-efficacy among immigrant women in Turkey regarding BC screening in the intervention group compared to the control group 3 and 6 months post-intervention (35). On the other hand, these results are not consistent with the findings of some other studies.

A study on cancer screening behaviors in women revealed that a specific educational intervention did not significantly enhance self-efficacy in the participants, despite other positive outcomes related to knowledge and attitudes toward screening.

The consistency of our findings with previous studies confirms the effectiveness of the strategies used to increase self-efficacy in women in the intervention group.

Conclusion

The results of the present study revealed that interventions based on the TTM can have a positive impact on women's stage of change to undergo mammography screening. Activating change processes appropriate to the stage of change has significantly encouraged rural women with low health literacy to effectively participate in mammography

screening programs. Moreover, assisting these individuals in creating a suitable balance between the pros and cons of mammography screening and reinforcing their self-efficacy led to significant progress in the stages of change in the intervention group compared to the control group 3 and 6 months post-intervention.

Strengths and Limitations

The strength of this study was providing intervention to rural women with low health literacy and in inactive stages of change to mammography screening. Additionally, the processes of change strategies, especially cognitive processes, were utilized to assist women in the upward stage of change. Changes in the structures of the theoretical model 3 and 6 months after the educational program for the long-term evaluation of intervention effects were another strength. Conversely, the limitation was the lack of sufficient resources, such as financial support and time for continued study and assessment of long-term effects over at least one year.

Although the control group in this study exhibited no significant improvement in the variables under investigation, it is important to acknowledge that the nature of education-focused intervention studies inherently carries the risk of information transfer from the intervention group to the control group. As a result, the inability to fully control conditions to prevent the potential spillover of intervention effects to the control group represents a notable limitation of this study.

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Authors' Contribution

Conceptualization: Mohsen Jalilian, Nasrin Ghiasi.
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Writing–original draft: Mohsen Jalilian, Nasrin Ghiasi, Reza Pakzad.
Writing–review & editing: Mohsen Jalilian, Reza Pakzad.

Competing Interests

There was no conflict of interests.

Ethical Approval

This study was approved by the Ethics Committee of Ilam University of Medical Sciences (IR.MEDILAM.REC.1401.102). Its code of ethics is available from: https://ethics.research.ac.ir/IR.MEDILAM.REC.1401.102.

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