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The effect of a virtual educational intervention based on self-efficacy theory on women's skills of breast self- examination

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Abstract

Background Correctly, performing breast self-examination (BSE) has an important role in the early diagnosis of breast cancer and prevention of women's mortality due to it. The present study aimed to investigate the effect of virtual education programs on breast self-examination, self-efficacy, and skills.

Methods This quasi-experimental study was conducted on 146 women who were 18–59 years old (73 in each intervention, and control group) working in Fars Oil Industry. Data collection tools included the researcher-made knowledge questionnaire (10 items), the self-efficacy questionnaire of Champion and Scott (10 item), and Wood's breast self-examination skill questionnaire (23 items). The participants were selected by systematic random sampling and divided into intervention and control groups through Permuted blocks randomization. A four-week virtual educational interventions were conducted for the intervention group through the WhatsApp messenger by sharing educational videos, booklets, and posters. The control group received no education. The questionnaires were completed by both groups, before and two months after the intervention. Data were analyzed in SPSS version 22 using frequency descriptive statistics, independent t-test, and paired t-test.

Results The knowledge mean scores showed no significant differences in participants in the two groups before and after the intervention. The mean score of self-efficacy increased significantly, in both the intervention ($p < 0.001$) and control ($P = 0.025$) groups. After the intervention, the mean scores of BSE skills in the intervention group were significantly ($p < 0.001$) higher than the control group.

Conclusion Virtual education using social networks alone is not able to increase and improve all aspects of BSE skills sufficiently.

Keywords Breast self-examination, BSE skills, Virtual education

Introduction

After cardiovascular diseases, cancers are the second cause of death in developing countries, including Iran) 16% of deaths) [1]. According to the report of the World Health Organization, breast cancer includes about 30% of women's cancers. More than two million women are diagnosed with breast cancer every year worldwide. Breast cancer is the second leading cause of cancer-related deaths among women after lung cancer [2].

In Iran, breast cancer accounts for 21.4% of all cancers among women and is, therefore, one of the most

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common cancers among Iranian women. The death rate caused by this cancer in Iran is 3.3% per 100,000 population, which is the highest rate related to women aged 50 years and older [3]. Iranian women get breast cancer at least a decade earlier than those in developed countries. Evidence shows that Iranian women are less likely to be diagnosed with breast cancer in the early stages of the disease, so that 25% of the diagnosed women were in the advanced stages of the disease at the time of diagnosis [4]. The results of a study in Iran showed that 23% of breast cancer cases were observed in women under 40 years of age and 70% of them died in a short period due to delayed diagnosis [5].

There are three screening methods for early diagnosis of breast cancer: breast self-examination, clinical examination by an expert clinician, and mammography. Among the diagnostic measures, breast self-examination (BSE) is an easy, cost-free, and step-by-step method women can use to examine their breasts [6]. BSE is the most important step in determining breast tumors in the early stages. Although more than 60% of all breast masses are discovered by BSE, the rate of BSE in Iran has been reported from 3 to 17%, and most Iranian women do not have enough knowledge about the warning signs of breast cancer and skills to do BSE correctly [7].

One of the most important measures in the field of screening is health education. Health education plays an important role in changing behavior, preventing diseases, helping people to achieve optimal health, and ultimately improving health [8]. Health education will be effective when the factors affecting the behavior are carefully investigated and it is planned, designed, and implemented based on scientific documentation [9, 10]. In recent years, the effectiveness of face-to-face education for BSE has been proven [11–13]. However due to the Covid-19 pandemic, virtual education received a lot of attention and replaced face-to-face education. Virtual education is a new field of education, which provides learners with the possibility of lifelong learning in any place and at any time [14].

At this time, electronic education through mobile phones shows the positive effect of using these tools, such as sending smart messages and reminders for doing BSE timely and regularly. Also, the dissemination of specialized information on the social and cultural conditions of society in the field of breast diseases through mobile and web-based software is increasing [15]. Considering the cost-effectiveness and feasibility of implementing an e-learning program for breast self-exam training, it is possible to get help in the effective design and implementation of interventions of this type of training, so that more women are encouraged to perform correct breast self-examination [3, 16].

On the other hand, according to Bandura's (1997) self-efficacy theory, the regular and correct implementation of any health behavior, including BSE, requires an understanding of the risk of the disease (risk perception), awareness of the benefits of performing that behavior in disease prevention (outcome expectancies), and self-efficacy to perform behavior correctly. Self-efficacy is also considered the most effective motivational factor, so an individual who does not believe in himself/herself or in his/her ability to perform the behavior will fail to adapt, initiate, and maintain that behavior [17, 18]. Thus, central to Bandura's theory are self-efficacy, knowledge, and skills [19].

Previous studies revealed that continuous education using new technologies is effective in improving the level of individuals' health behaviors, through increasing knowledge and changing attitudes, but there are few studies that considered the effectiveness of virtual education on self-efficacy and skills of doing BSE correctly [12, 20]. Based on the literature review [8, 21, 22], to the best of our knowledge, most of the studies that have been conducted have emphasized the performance of BSE, and less emphasis has been placed on the skill and quality of BSE. Therefore, the present study aims to investigate the effect of a virtual education program on knowledge about risk perception of breast cancer, outcome expectancies of BSE, and skills of BSE in the population of women covered by a healthcare facility in the oil industry of Fars. The authors hypothesized that virtual education could help increase women's knowledge, self-efficacy, and skills to do BSE correctly.

Materials and method

Study design

In this quasi-experimental educational study with a control group, the study population was 18–59-year-old women who received primary health care at the Fars Oil Industry Health Center, located in Shiraz, Iran. Based on a similar study [23] and considering 95% confidence level ($\alpha = 0.05$), 90% power($1\text{-}\beta = 0.9$), and 5% attrition rate, using the NCSS PASS 15 software, the sample size was computed at least 146 participants (73 participants in each intervention and control groups). The participants were selected through systematic random sampling from 250 eligible women because the samples selected in systematic random sampling are more representative than random sampling. Also, it is usually a bit easier to do than simple random sampling [24, 25]. The sampling framework in this study was a list of women registered in integrated software for registering medical and health services of oil industry employees. The permuted blocks randomization technique (block size = 4) was used to assign the recruited participants to each of the two

intervention and control groups. Despite the systematic random allocation of samples in both groups, there may be some intervening variables that were not easily identified or were ignored during the study design and might affect the results; thus, we considered this study quasi-experimental [26]. We observed that some participants in the control group were familiar with the experimental group and talked about the educational intervention.

Women aged 18–59 years who did not have breast cancer, were interested and consented to participate in the study, had access to a smartphone and the Internet, were not pregnant or lactating, had no breast augmentation, and had no history of breast cancer in first-degree family members were included in the study. The exclusion criteria were getting pregnant, being diagnosed with breast cancer or undergoing breast cosmetic surgery during the study, and being unwilling to continue participating in the study.

Since national guidelines in Iran recommend that all women over 30 years old and under 30 years old women who have risk factors such as a family history of breast cancer or any suspicious signs or symptoms of breast cancer should be screened for breast cancer, so the researchers considered the age range of 18 to 59 years.

Data collection instruments

A) Demographic information form: It includes age, marital status, education level, job status, and the number of children.

B) Knowledge questionnaire: This researcher-made questionnaire consists of 10 questions with a three-point (true/false/ I don't know) scale (e.g. The best time to perform a monthly breast self-examination is 2–3 days after the cessation of menstrual bleeding) in which correct answers receive 1 score and incorrect or I don't know answers receive score 0. The validity of the questionnaire was confirmed by a panel of experts including 10 medical doctors, midwives, and health promotion professionals. The calculated content validity index (CVI > 0.85) and content validity ratio (CVR > 0.75) confirmed the content validity of the questionnaire. Kuder-Richardson Reliability Coefficient was used to determine the internal reliability (KR = 0.892).

C) Self-efficacy questionnaire: For assessing the self-efficacy of participants, we used a 10-item questionnaire with a five-point Likert scale (eg. I can find a breast lump that is the size of a filbert), which was designed and validated by Champion and Scott [27]. The validity and reliability of the Persian version of this questionnaire were assessed and confirmed by Taymoori and Berry [28].

D) Breast self-examination skill: The Breast Self-Examination Proficiency Rating Instrument (BSEPRI) was designed and validated by Wood [29]. It is used for assessing the participants' BSE skills. This instrument includes 23 items in two domains of a) inspection of breasts for size, symmetry, and uniformity in four positions and b) systematic palpation of the right and left breasts. The skills that were performed correctly were scored 1 and those which were not performed or performed incorrectly were scored 0; thus, the total possible scores range from 0 to 23 with higher scores representing better BSE Skills. Each participant demonstrated the BSE herself in a completely private examination room which was located in the Shiraz oil industry health clinic, and one of the research team members who was a female nurse and student of MSc in health education and health promotion scored each subject based on BSEPRI.

Intervention

Before entering the study, the participant was explained about the study process, especially breast self-examination as one of the conditions of participation in the study, and those who accepted to enter the study signed an informed consent form. Because it was not possible to assess breast self-examination skills virtually, the pre-test skill checklists were completed individually and in person in a safe and private place (family health clinic in Fars Oil Industry Health and Treatment Clinic) by the female researcher. Then, their BSE skills were assessed and scored based on BSEPRI under the above-mentioned conditions.

After that, five educational videos, two pamphlets, and a poster were sent to participants in the intervention group by WhatsApp messenger. The prepared educational contents were at first checked and confirmed in terms of content and scientific validity in consultation with a panel of five health education and promotion experts. Then, their readability, comprehensibility, and cultural adaptation were assessed by 10 women of the target population, and based on their comments, the necessary corrections were made. All of the validations of educational content were done qualitatively. The post-test checklists were completed similarly to the pre-test.

Table 1 represents the intervention schedule. During the study, after sending each educational content in the virtual WhatsApp group, a few questions were asked; they were answered by the participants to ensure that they had learned the content well while receiving feedback. The group discussion created after asking the questions in the virtual group made them understand more about the material and made them feel free to ask

Table 1 Comparison of the frequency distributions of participants in intervention ($n=72$) and control ($n=76$) groups

Variable		Intervention N (%)	Control N (%)	*P*
Education level	Elementary	4(5.6)	4(5.3)	.48
	High school	28(39.4)	23(30.3)	
	University	39(54.9)	49(64.5)	
Job status	Housewife	48(65.8)	48(63.2)	.07
	Employed	18(24.7)	16(21.1)	
	Retired	2(2.7)	4(5.3)	
	Other	5(6.8)	8(10.5)	
Marital status	Single	10(13.9)	11(14.5)	.94
	Married	56(77.8)	60(78.9)	
	Divorced	4(6.5)	4(5.3)	
	Widowed	2(8.2)	1(1.3)	
Number of children	0	1(1.6)	4(3.6)	
	1	12(19)	9(14.3)	.48
	2	30(47.6)	35(55.6)	
	3	10(15.9)	10(15.9)	
	4	7(11.1)	3(4.8)	
	5	2(3.2)	1(1.6)	
	6 and above	1(1.6)	1(1.6)	

their questions without embarrassment. The intervention lasted four weeks. Participants in the control group received routine education and health care during the study period; however, for ethical considerations, at the end of the study, the same educational materials were presented to them. Two months after the intervention, the questionnaires were administered to participants and they were assessed for BSE skills again. All of the participants in both groups were given feedback regarding whether or not they performed BSE correctly after the end of the study.

Session	Content and objective	Educational tools
First	Breast anatomy and its constructs	4-min video clip Poster
Second	Breast cancer, its prevalence symptoms, stages, risk factors, and consequences	5-min video clip Pamphlet
Third	The importance of early diagnosis of breast cancer breast cancer screening methods and their important role in early diagnosis of breast cancer	5-min video clip Pamphlet
Fourth	How to perform BSE	6- minutes video clip Poster
Fifth	Use Role Modeling And Overcoming the barriers of BSE(Self-Efficacy Theoty)	5- minutes video clip Poster

Data analysis

The data were processed and analyzed using SPSS 22 at a significance level of <0.05. The normality assumption of the variables was checked and confirmed by the Kolmogorov–Smirnov normality test ($P>0.05$). We used frequency descriptive statistics (mean, standard deviation, percentage, and frequency) and chi-squareto report and compare the frequency distribution of the participants' demographic characteristics. Independent t-test, paired t-test, and analysis of covariance were used to compare the differences between and within the groups, before and after the intervention. To quantify the effects of intervention, we calculated effect sizes (Cohen's d) using pooled deviations.

Ethical considerations

The present study was approved by the Ethics Committee of Shiraz University of Medical Sciences (ethics code: IR.SUMS.REC.1400.289). Participants were assured that their participation in the study was completely voluntary and their information would remain confidential. The questionnaires were anonymous. All participants completed and signed an informed consent form. All breast examinations were performed in a completely private environment.

Results

The mean age of the intervention (43.53 ± 8.81 yrs.) and control (44.67 ± 9.45yrs.) group participants was not significantly different ($p=0.45$). In terms of the demographic variables in the intervention and control groups, no statistically significant difference was observed ($P>0.05$) (Table 1).

As shown in Table 2, between-group comparisons of the knowledge scores showed that there were no significant differences in the knowledge mean scores of the participants in the two groups before and after the intervention. However, in within-group comparisons, after the intervention, the mean score of knowledge increased significantly in both intervention ($p=0.001$) and the control ($p=0.002$) groups compared to before the intervention. Comparing the mean changes of knowledge scores in the intervention and control groups revealed that there was no significant difference ($P=0.575$) between the two groups in this regard, and the effect size was small ($d=0.11$). In the analysis of covariance, after adjusting the pre-test scores, there was no significant differences of changes in knowledge scores between the two groups ($F=0.973$, $P=0.372$, $\eta 2p=0.011$).

According to the results of the paired t-test, the mean score of self-efficacy increased significantly, in both the intervention ($p<0.001$) and control ($P=0.025$) groups,

Table 2 Comparison of the mean scores of the study variables in the intervention and control groups

Variable	Groups	Before intervention	After intervention	*P*	Mean change	ANCOVA		Effect size (Cohen's d)
						P	*η2p*	
Knowledge	Intervention	4.91 ± 2.92	6.84 ± 2.38	0.001	1.57 ± 3.09	0.362	0.011	0.11
	Control	5.05 ± 2.89	6.30 ± 1.82	0.002	1.23 ± 2.76			
P		0.793	0.168	-	0.575			
Self-efficacy	Intervention	25.55 ± 8.83	30.43 ± 9.79	< 0.001	5.39 ± 6.91	0.012	0.052	0.40
	Control	24.42 ± 9.26	25.50 ± 9.79	0.025	2.38 ± 7.98			
P		0.456	0.006	-	0.027			
BSE skills	Intervention	3.88 ± 5.64	12.90 ± 7.54	< 0.001	8.87 ± 7.07	< 0.001	0.209	0.87
	Control	3.93 ± 5.89	6.86 ± 6.80	0.001	2.88 ± 6.64			
P		0.961	< 0.001	-	< 0.001			

after the intervention. However, the results of the independent t-test revealed that the mean score of self-efficacy in the intervention group was significantly more than the control group ($p=0.006$) after the intervention, while there was no significant difference ($P=0.456$) in this respect before the intervention (Table 2). Comparing the mean changes of self-efficacy scores in the intervention and control groups revealed that in the intervention group, self-efficacy increased significantly ($p=0.027$) more than the control group, with a medium effect size (d = 0.0.40). In the analysis of covariance, after adjusting the pre-test scores, there were significant differences in changes in self-efficacy scores between the two groups (F = 6.527, $P=0.012$, $\eta 2p=0.052$).

Between-group comparisons of the mean scores of BSE skills showed that before the intervention there was no difference between the two groups ($P=0.961$), but after the intervention, the mean scores of the intervention group were significantly ($p<0.001$) higher than the control group (Table 2). Within groups comparisons also showed that the mean score of BSE skills in both intervention ($P<0.001$) and control ($P=0.001$) groups increased significantly after the intervention (Table 2). Comparing the mean changes of BSE skill scores in the intervention and control groups revealed that in the intervention group, BSE skill increased significantly ($p=0<001$) more than the control group, with a large effect size (d = 0.87). In the analysis of covariance, after adjusting the pre-test scores, there were no significant differences in changes in mean scores of BSE skills between the two groups (F = 26.621, $P=<0.001$, $\eta 2p=0.209$).

Discussion

The present study was conducted to apply the self-efficacy theory in promoting BSE skills in women in the oil industry, Fars province. The results showed the positive effect of using the model of self-efficacy theory in promoting BSE skills. In this study, the target group consisted of women who did not have breast cancer and had no history of breast cancer in first-degree family members, so these women do not have a correct understanding of self-efficacy about BSE skills. Therefore, focusing on these women to improve self-efficacy and BSE skills is more suitable. Finally, in this study, the focus of education on self-efficacy led to an increase in BSE skills; This finding can most likely express the positive effect of virtual education based on the self-efficacy theory.

The results of the present study showed that after the intervention, there was no significant difference in knowledge scores between the intervention and control groups. Howover, the mean scores of knowledge in both groups increased significantly, but the increase in the knowledge score in the intervention group was slightly more than the control group. These findings are not consistent with the studies Karimian et al. (2022), Absavaran et al. (2015), Pirzadeh et al. (2021),and Ghaffari et al. (2019) in Iran, showing significant increases in knowledge about SBE using video-based multimedia training [12, 20, 30, 31]. Kissal and Kartal (2019) in Turkey [23], Kang et al. (2020) in South Korea [32], and Anggraeni et al. (2023) in Indonesia [33] observed an increase in knowledge in the control group which caused a nonsignificant difference between groups, which can be attributed to increasing the dissemination of educational contents in various health subjects during the Covid-19 pandemic which may exposed the control group to educational materials.

In the present study, after the intervention, the virtual education led to an increase in self-efficacy in the intervention group compared to the control group; this finding is consistent with the results of the studies by Golzarifard et al. (2022) in Iran [11], Pirzadeh et al. in Iran (2021) [30], Shakery et al. (2021) in Iran [34], Kirag et al. (2019) in Turkey [35], Olii and Abdul (2021) in Indonesia [36], and Mahmoud et al. (2018) in Egypt [37].

Since in this study we used some strategies for enhancing self-efficacy proposed by self-efficacy theory, such as setting achievable goals, breaking tasks into smaller manageable steps, visualizing the successful performance of participants verbal persuasion, introducing successful models, and providing constructive feedback to refine and improve performance [38], obtaining such results was not far from expected.

The results of this study showed that the intervention led to an increase in the average BSE skills of women in the intervention group compared to the control group; this finding is consistent with those of Çelik et al. (2023) [39], Karimian et al. (2020) [12], Ayran et al. (2017), and [40] Mahboobighazaani [41]. Also, similar to the results obtained from the present study, Olii and Abdu (2021) in Indonesia [36] reported that educational videos caused a significant increase in BSE skills. In another study, Blajda et al. [42] in Poland reported that educational intervention using a mobile-based medical app caused a significant increase in BSE skills [42]. In all of these studies, researchers have emphasized the effectiveness of interventions in BSE skills. The effectiveness of virtualtraining can be credited to its ability to enhance engagement and accessibility, cater to diverse learning styles, and improve the retention of educational content. However, it should be noted that despite the increase in the score of BSE skill in the intervention group and the effect size of 0.87, which demonstrate the considerable impact of the intervention in enhancing the BSE skill score, the skill mean score in the intervention group was 12.9 after the intervention, which is far from the 32 as the maximum possible score. That is to say, our educational intervention succeeded in increasing the BSE skill score, but probably not sufficient to diagnose breast cancer cases correctly and timely.

Strengths and limitations

While most of the previous interventional studies in this area have focused on doing BSE, this study is one of the few studies which focused on educating skills of doing BSE correctly, especially through virtual education using different educational materials, including videos, pamphlets, and posters. Despite these strong points, the study suffers from some limitations which should be considered when interpreting the findings. First, the generalizability of our results may be limited due to the specific context of our study conducted at the Fars Oil Industry Health Center in Shiraz, whose members have a relatively high socioeconomic status. Therefore, caution should be exercised when applying these findings to other populations or settings. Second, while the BSE skills were assessed and scored by the researcher, which should be considered as a strong point, other variables in the study were assessed through self-reporting questionnaires which increases the risk of social desirability bias. Finally, the short follow-up period was another study limitation.

Conclusion

The results of the present study showed that virtual training using social networks alone was relatively effective in improving BSE skills. However, since accurate breast self-examinations are very important for early detection of breast cancers, it seems essential to investigate the effectiveness of combining face-to-face and virtual training to achieve the goal of performing a correct BSE.

Abbreviations

BSE	Breast Self- Examination
CVI	Content Validity Index
CVR	Content Validity Ratio
BSEPRI	Breast Self-Examination Proficiency Rating Instrument
KR	Kuder-Richardson

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Authors' contributions

Maryam Kucheki: investigation, data curation, resources, conceptualization, methodology, writing, original draft. Mahin Nazari: investigation, data curation, resources, conceptualization, methodology. Roohollah Arshadinejad:conceptualization, review and editing. Masoud Karimi: supervision, literature searching, writing and editing.

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Data availability

Data used in the analysis as well as all programs used for the analysis can be obtained from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

The present study was approved by the Ethics Committee of Shiraz University of Medical Sciences (ethics code: IR.SUMS.REC.1400.289),) and was conducted in accordance with the declaration of Helsinki. Participants were assured that their participation in the study was completely voluntary and their information would remain confidential. The questionnaires were anonymous. All participants completed and signed an informed consent form.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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