Original Article
Open Access

Archives Of Breast Cancer

DOI: 10.32768/abc.7614502983-374

Effect of an Educational Intervention on Modifiable Risk Factors, Self-Care Behaviors, and Perceived Risk in the Prevention of Breast Cancer Among Menopausal and Postmenopausal Women

Vania Yulisa Abanto Castro*[a], Fiorela Nicoll Bocanegra Cuadros[b], Julio Santiago Cortez García[b], Telmo Agustín Mejia Garcia[a]

[a]e-Health Research Center, University of Sciences and Humanities, Lima, Peru

[b]Nursing Department, Faculty of Health Sciences, University of Sciences and Humanities, Lima, Peru

ARTICLE INFO

Received:
27 November 2025
Revised:
8 March 2026
Accepted:
8 March 2026

Keywords:
breast neoplasms, risk factors, self-care, preventive health services

ABSTRACT

Background: The incidence of breast cancer varies across world regions but continues to rise; it is the most common cancer and the leading cause of cancer-related mortality among women in the Americas. The aim of this study was to evaluate the effect of an educational intervention on modifiable risk factors, self-care behaviors, and perceived risk in the prevention of breast cancer among menopausal and postmenopausal women.

Methodology: A quasi-experimental pretest–posttest study was conducted among 100 women, including 48 in the control group and 52 in the experimental group. Data were collected using 2 instruments: the Modifiable Risk Factors and Self-Care Behaviors Questionnaire and the Perceived Risk Scale.

Results: Baseline characteristics were comparable between the two groups. Post-intervention analyses adjusted for baseline values using analysis of covariance (ANCOVA) showed a statistically significant increase in perceived breast cancer risk in the experimental group compared to the control group. Significant improvements were also observed in breast self-examination and gynecological checkup attendance in the experimental group, whereas no significant differences were found for breast ultrasound.

Conclusion: The educational intervention was associated with significant improvements in perceived breast cancer risk and key self-care behaviors among menopausal and postmenopausal women. These findings support the implementation of structured educational strategies to strengthen preventive behaviors in this population.

INTRODUCTION

Breast cancer is a disease characterized by abnormal breast cells that multiply uncontrollably, forming tumors, which, if left untreated, may spread throughout the body and result in death.[1] According to estimates from the International Agency for Research on Cancer (IARC), approximately 2.3 million new breast cancer cases and 666 000 deaths occurred worldwide in 2022. The global age-standardized incidence rate (ASR) is 46.8 per 100 000, with the highest rates observed in North America (95.1) and the lowest in Asia (34.3).[2] Breast cancer incidence varies across global regions but is steadily increasing. Based on current morbidity and mortality trends, projections estimate that by 2030, breast cancer cases will rise to 2.64 million, with 1.7 million deaths worldwide. The age-standardized incidence rate is 66.4 per 100 000 in developed

***Address for correspondence:**
Vania Yulisa Abanto Castro,
Nurse, e-Health Research Center, University of Sciences and Humanities, Lima, Peru
Email: vabanto@uch.edu.pe

countries compared to 27.3 per 100 000 in developing nations. Globally, breast cancer incidence has escalated rapidly, increasing by 57.8% over the past 3 decades, with an average annual growth rate of 0.5%.[3]

Breast cancer is the most frequently diagnosed malignancy and the leading cause of cancer-related mortality among women in the Americas. In 2022, Latin America and the Caribbean reported over 220 000 new cases and nearly 60 000 deaths. Notably, 31% of women in this region are affected before the age of 50, compared to a substantially lower proportion in North America. Likewise, 21% of breast cancer deaths in Latin America and the Caribbean occur in women under 50, more than double the 10% observed in North America[4]. According to the Ministry of Health, breast cancer is the most prevalent malignancy among women in Peru. Each year, an estimated 7797 new cases and 1951 deaths are attributed to this disease. On a daily basis, approximately 21 women are diagnosed with breast cancer, and 5 women die from it.[5]

Established risk factors include genetic predisposition, hormonal influences, obesity, alcohol consumption, and physical inactivity.[6] Breast cancer incidence rises with age, with approximately 80% of cases occurring in women over 50. Additional risk factors include a history of breast cancer or ductal carcinoma in situ (DCIS), high breast density, prior exposure to thoracic ionizing radiation, hormonal influences (both endogenous and exogenous), and family history of the disease.[7]

The relationship between body mass index (BMI, kg/m²) and breast cancer risk is strongly influenced by menopausal status. Higher BMI in younger women appears to confer a protective effect against breast cancer incidence, whereas after menopause this inverse association shifts, with elevated BMI becoming a positive risk factor.[8] High breast density is a major established risk factor for breast cancer. Additional significant factors include early menarche (before age 15), nulliparity, absence of breastfeeding, premenopausal status, and the use of postmenopausal hormone therapy.[9]

Several modalities are available for breast cancer screening. Mammography remains the most widely used tool, while magnetic resonance imaging is recommended for women at elevated risk. The decision to undergo screening and the choice of modality depend on individual risk factors. Additional techniques including breast examination, thermography, tissue sampling, and ultrasound have been explored, with some currently under evaluation in clinical trials.[10] Breast cancer treatment commonly involves surgery, either lumpectomy or mastectomy, sometimes preceded by chemotherapy to reduce tumor size. Lumpectomy removes the tumor and nearby lymph nodes, while mastectomy removes the entire breast, often with reconstruction. Radiotherapy typically follows lumpectomy to eliminate residual disease. Systemic therapies including chemotherapy, hormonal therapy, and biologic agents address microscopic or distant cancer cells, lower recurrence risk, and support immune function. This multimodal approach is essential to improving survival and long-term prognosis.[11]

The cornerstone of breast cancer prevention lies in strategies aimed at reducing the likelihood of disease onset, thereby lowering both incidence and mortality. Effective prevention focuses on minimizing risk factors while enhancing protective determinants associated with breast cancer.[12] Awareness of breast cancer empowers women to recognize warning signs and abnormal symptoms, encouraging preventive practices such as breast self-examination, medical consultation, and diagnostic testing. This knowledge is critical for early detection, which enables timely intervention and improves treatment outcomes.[13]

Another study evaluated the effects of an integrated lifestyle intervention on health-promoting behaviors, depression, body composition, and quality of life among breast cancer survivors with overweight and obesity. Using a quasi-experimental design with a nonequivalent control group (pretest–posttest), 42 participants completed an 8-week program including sessions on nutrition education, physical activity, stress management, and spousal involvement. Outcomes assessed included health-promoting behaviors, depression, marital intimacy, body composition, natural killer cell activity, and quality of life. Compared to controls, the intervention group reported significantly greater improvements in health-promoting behaviors, marital intimacy, and quality of life, alongside lower depression scores. Findings indicate that integrated lifestyle interventions can effectively enhance psychosocial well-being and clinical outcomes in breast cancer survivors. These results support the adoption of such approaches in both community and clinical settings.[14]

A similar study evaluated the impact of a video-based intervention on improving knowledge of breast cancer risk factors, symptoms, attitudes, and screening practices among rural women in Bihar, India. Using a quasi-experimental pretest–posttest design, 267 participants viewed validated Hindi-language YouTube videos as the intervention. Demographic characteristics were assessed and analyzed in relation to knowledge, attitudes, and practices. After three months, there were statistically significant improvements in knowledge of breast cancer risk factors, symptoms, and screening

($P < 0.001$). Attitudes toward breast self-examination improved in 58% of women, while clinical breast examination and mammography attitudes improved by 16.5% and 9.7%, respectively. Breast self-examination practice significantly increased in 60% of participants ($P < 0.001$). Education, age, and occupation were significant predictors of awareness. Findings suggest that video-based interventions delivered via social media may provide a scalable and effective approach for cancer awareness in resource-limited rural settings.[15]

Breast cancer remains the most prevalent malignancy among women worldwide and a leading cause of cancer-related mortality, with incidence and outcomes strongly influenced by modifiable risk factors, awareness, and preventive behaviors. Evidence indicates that many women, particularly those in menopausal and postmenopausal stages, have limited knowledge of breast cancer risk factors, symptoms, and early detection practices, which contributes to delayed diagnosis and poor prognosis.

Educational interventions have demonstrated effectiveness in improving awareness, shaping attitudes, and promoting preventive practices such as breast self-examination, timely medical consultation, and adherence to lifestyle modifications. However, there is a paucity of research specifically addressing the impact of structured educational strategies on modifiable risk factors, perceived risk, and self-care behaviors in menopausal and postmenopausal women, who represent a group at elevated risk of developing breast cancer. Evaluating the effect of such interventions is therefore crucial, as it may inform scalable, evidence-based programs capable of reducing breast cancer incidence and mortality through empowerment, behavioral change, and early detection in this vulnerable population.

The General Objective of the study was to evaluate the effect of an educational intervention on modifiable risk factors, perceived risk, and self-care behaviors in the prevention of breast cancer among menopausal and postmenopausal women. The Specific Objectives were: to determine the effect of the educational intervention on women's knowledge and management of modifiable risk factors for breast cancer, to evaluate the adoption of self-care behaviours after the educational intervention and to assess changes in perceived risk of developing breast cancer following the educational intervention.

METHODS

Study design

A quantitative, quasi-experimental pretest-posttest study was conducted to evaluate the effect of an educational intervention on modifiable risk factors, perceived risk, and self-care behaviors related to breast cancer prevention. This quasi-experimental study was conducted in community settings located in Huaral, Lima, Peru. The selected communities are predominantly rural and have primary healthcare services. Baseline data collection (pretest) was conducted between July and August 2025, followed by the implementation of the educational intervention between August and October 2025. Post-intervention data collection was conducted one month after the intervention's completion.

Population, sample, and sampling

The study population consisted of menopausal and postmenopausal women residing in selected rural communities. Residence was operationally defined as continuous living in the selected community for at least 12 months prior to recruitment, verified through local health center registries. Inclusion criteria were: women aged ≥40 years who were classified as menopausal or postmenopausal and met the residence requirement. Exclusion criteria included severe cognitive impairment, physical limitations preventing attendance at educational sessions, or inability to complete the study questionnaires independently. Written informed consent was obtained from all eligible participants after the screening process and prior to data collection.

A total of 100 women participated in the study, with 48 in the control group and 52 in the experimental group. The minimum sample size was calculated using the G*Power statistical software with an effect size of 0.8, a power of 80%, and a significance level of $P < 0.05$. Based on these criteria, the minimum required sample size was 26 participants per group. Considering potential dropouts and decreased participation in the posttest, a total of 55 women were initially included in each group. Ultimately, an attrition of 7 participants occurred in the control group and 3 in the experimental group. Due to the community-based nature of the study, participants were assigned to the experimental or control group based on their community of residence to minimize cross-contamination between groups. Community "A," which received the educational program, constituted the experimental group, while community "B," which did not receive the intervention during the study period, served as the control group. Randomization was not performed.

Instruments and variables

Data were collected using three instruments: a sociodemographic questionnaire, a questionnaire assessing modifiable risk factors and self-care behaviors, and a perceived risk scale. Each variable was operationally defined prior to analysis to ensure consistency and clarity. The effectiveness of the variables is determined by the participants' behavioral changes after the intervention. A behavioral change was defined as a transition from non-compliance to compliance with a given self-care practice (e.g., breast self-examination or attendance at screening tests) or an increase in reported frequency between the pretest and posttest assessments.

Data collection instruments

Modifiable risk factors and self-care behaviors questionnaire

A structured questionnaire titled "Modifiable Risk Factors and Self-Care Behaviors for Breast Cancer Prevention" was used to collect data. The instrument comprised three sections: sociodemographic characteristics, modifiable risk factors, and self-care behaviors. Content validity was established through expert judgment by a panel of 10 specialists in oncology, public health, and epidemiology. Aiken's V coefficient was calculated for each item, with all items exceeding 0.90, indicating excellent content validity. Internal consistency reliability for dichotomous and categorical variables was assessed using the Kuder–Richardson Formula 20 (KR-20), yielding a coefficient of 0.81, indicating good reliability. Age was categorized into 3 groups: 40 to 44 years, 45 to 49 years, and ≥50 years. Marital status was classified as single, cohabiting/married, widowed, or divorced. Age at menarche was categorized as: <12 years, 12 to 15 years, and ≥16 years. Age at menopause was categorized as: <45 years, 45 to 55 years, and ≥56 years. Number of children was recorded as a discrete quantitative variable and later categorized for descriptive purposes. Family history of breast cancer was measured as yes, no, or unknown. Personal history of benign breast disease was assessed dichotomously (yes/no). Age at first childbirth was categorized as: <18 years, 18 to 28 years, 29 to 39 years, and ≥40 years. Alcohol consumption was assessed dichotomously (yes/no). Alcohol consumption was initially assessed according to frequency of intake: once per month (sporadic), 2 to 3 times per month (regular), and more than three times per month (frequent). For inferential analyses, alcohol consumption was dichotomized into low consumption (non-consumers and sporadic consumers) and high consumption (regular and frequent consumers) to ensure adequate cell distribution for statistical testing. Physical activity was first evaluated as engagement (yes/no). Participants who reported engaging in physical activity specified the number of hours per week: < 4 hours was categorized as light intensity, 4 hours as moderate intensity, and ≥ 7 hours as vigorous intensity. For inferential analyses, physical activity was dichotomized into inactive (no activity or light intensity) and active (moderate or vigorous intensity). BMI was calculated as weight in kilograms divided by height in meters squared (kg/m²). Preventive mammography was assessed dichotomously (yes/no) based on whether the participant had undergone mammography during the current year. Breast self-examination was assessed as monthly performance during the previous 5 months (yes/no). Attendance at annual gynecological check-ups was recorded dichotomously (yes/no). Breast ultrasound screening behavior was assessed through self-report using a structured questionnaire. Participants were asked how many times they had undergone a breast ultrasound examination during the previous year. Responses were categorized into 3 groups: never, once, and 2 or more times.

Perceived risk scale

A scale was developed to assess participants' perceived risk of developing breast cancer based on non-modifiable and modifiable factors and self-care practices. The scale included 12 items with 5 response options (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree). Construct validity was assessed using Exploratory Factor Analysis, yielding a KMO coefficient of 0.903 and a Bartlett test $P < 0.05$, resulting in a single-factor solution. Reliability analysis using McDonald's ω produced a coefficient of 0.974 and Cronbach's $\alpha = 0.87$. The perceived risk scale consisted of 12 Likert-type items assessing perceived susceptibility based on non-modifiable factors, modifiable factors, and self-care practices. Scores ranged from 12 to 60 and the scale was self-administered during pretest and posttest assessments in a supervised setting.

Educational intervention

The educational intervention consisted of 4 structured sessions delivered weekly over a 4-week period. Each session lasted approximately 90 minutes and was conducted in community meeting spaces. Sessions were delivered in small groups (10 to 15 participants) by trained nursing professionals with experience in community health education. The intervention addressed breast cancer risk factors, self-care behaviors, early detection practices, and perceived risk. Educational strategies included interactive lectures, visual materials, group discussions, and practical demonstrations. Attendance was monitored, and reminder messages were used to enhance adherence.

Bias control

Due to the nature of the educational intervention, blinding of participants was not feasible. However, outcome assessment was conducted by personnel who were not involved in the delivery of the educational intervention and who were unaware of the specific content addressed during the sessions. This procedure was implemented to minimize potential assessment bias.

Data analysis

All statistical analyses were conducted using JASP software. Descriptive statistics were calculated for all study variables. Categorical variables were presented as frequencies and percentages, while continuous variables were summarized using means and standard deviations. Baseline comparisons between the intervention and control groups were performed using independent samples t-tests for continuous variables and chi-square or Fisher's exact tests for categorical variables, as appropriate. For categorical outcomes, differences in the distribution of categories between groups were examined using chi-square tests, and the strength of associations was assessed using Cramer's V coefficient. To evaluate the effect of the intervention on continuous outcomes, analysis of covariance (ANCOVA) models were conducted. In each model, the post-intervention value of the outcome variable was entered as the dependent variable, study group (intervention vs control) as the fixed factor, and the corresponding baseline value as a covariate. The assumption of homogeneity of regression slopes was assessed by including an interaction term between group and baseline values in each model. When the interaction term was not statistically significant, the standard ANCOVA model was interpreted. When the interaction term was statistically significant, the interaction was retained in the model, indicating that the intervention effect varied according to baseline levels of the outcome variable. Effect sizes were reported using omega squared (ω^2) with 95% confidence intervals for ANCOVA models. Statistical significance was set at $P < 0.05$.

RESULTS

The sociodemographic characteristics of the participants were considered relevant to the study variables and are presented in Table 1. Most participants were 56 years of age or older (51.92% in the experimental group and 54.17% in the control group). Regarding educational level, the largest proportion had completed secondary education (55.77% in the experimental group and 64.58% in the control group).

Table 1. Baseline Sociodemographic and Clinical Characteristics of Menopausal and Postmenopausal Women in the Experimental and Control Groups Before Matching

Variable		Group			
		Experimental group (N = 52)		Control group (N = 48)	
		n	%	n	%
Age group	<44 years	1	1.92	0	0.00
	45–55 years	24	46.15	22	45.83
	≥56 years	27	51.92	26	54.17
Educational level	No formal education	2	3.85	2	4.17
	Primary	10	19.23	7	14.58
	Secondary	29	55.77	31	64.58
	Higher education	11	21.15	8	16.67
Menopause period	Menopausal	12	23.08	6	12.50
	Postmenopausal	40	76.92	42	87.50
Marital status	Cohabiting	41	78.85	36	75.00
	Married	8	15.38	8	16.66
	Divorced	2	3.85	2	4.17
	Single	1	1.92	2	4.17
Number of children	1 child	3	5.77	2	4.16
	2 children	16	30.77	14	29.17
	3 children	16	30.77	14	29.17
	4 children	13	25.00	12	25.00
	5 children	4	7.69	6	12.50
Family history of breast cancer	Yes	7	13.46	6	12.50
	No	45	86.54	42	87.50
Personal history of nonmalignant breast lesions	Yes	1	1.92	2	4.17
	No	51	98.08	46	95.83

The majority were postmenopausal (76.92% in the experimental group and 87.50% in the control group) and were cohabiting according to marital status (78.85% in the experimental group and 75.00% in the control group). A high proportion reported no family history of breast cancer (86.54% in the experimental group and 87.50% in the control group), and most had no history of nonmalignant breast lesions (98.08% in the control group and 95.83% in the experimental group). No statistically significant differences were found between the 2 groups, indicating that they were comparable at baseline ($P > 0.05$).

According to the results for modifiable risk factors (Table 2), regarding alcohol consumption, the distribution of consumption categories differed significantly between the 2 groups following the intervention ($P < 0.001$). In the experimental group, the proportion of participants reporting low alcohol consumption increased from 38.5% (n = 20) before the intervention to 80.8% (n = 42) after the intervention, while high consumption decreased from 61.6% (n = 32) to 19.2% (n = 10). In contrast, smaller changes were observed in the control group. The magnitude of the association between alcohol consumption and study group was assessed using Cramer's V, indicating a moderate association (V = 0.476). Similarly, significant differences were observed in physical activity levels between the groups after the intervention ($P < 0.001$). In the experimental group, the proportion of inactive participants decreased from 51.9% (n = 27) before the intervention to 17.3% (n = 9) after the intervention, while the proportion of physically active participants increased from 48.1% (n = 25) to 82.7% (n = 43). The effect size for this association was moderate to strong (Cramer's V = 0.572), indicating a substantial association between participation in the educational intervention and improvements in physical activity patterns.

Table 2. Comparison of Modifiable Risk Factors Before and After the Intervention in the Experimental and Control Groups

Variable		Group								*P* value	χ^2	Cramer's V
		Experimental group				Control group						
		Before the intervention		After the intervention		Before the intervention		After the intervention				
		n	%	n	%	n	%	n	%			
Alcohol consumption	Low	20	38.5	42	80.8	16	33.3	19	39.6	< 0.001	22.660	0.476
	High	32	61.6	10	19.2	32	66.7	29	40.4			
Physical activity	Inactive	27	51.9	9	17.3	48	100	32	66.7	< 0.001	32.770	0.572
	Active	25	48.1	43	82.7	0	0.0	16	33.3			

Values are presented as n (%). *P* values refer to post-intervention comparisons between groups using the χ^2 test (or Fisher's exact test when appropriate). Effect size is reported as Cramer's V.

Sensitivity analyses using dichotomized variables and Fisher's exact test confirmed significant post-intervention differences between groups for alcohol consumption ($P < 0.001$, $\varphi = 0.46$) and physical activity ($P < 0.001$, $\varphi = 0.55$), indicating moderate to large effect sizes. These findings support the robustness of the primary analyses (Table 3).

Due to small expected cell counts in several contingency tables, Fisher's exact test was applied to evaluate group differences in self-care behaviors. At baseline, no statistically significant differences were observed between the groups for gynecological checkup ($P = 0.835$, $\varphi = 0.03$) or breast ultrasound ($P = 1.000$, $\varphi = 0.006$), and breast self-examination and mammography screening showed no variability across the groups. Post-intervention analyses revealed statistically significant differences in breast self-examination ($P < 0.001$, $\varphi = 0.96$) and gynecological checkup ($P < 0.001$, $\varphi = 0.42$), indicating very large and moderate effect sizes, respectively. No statistically significant association was observed for breast ultrasound at post-intervention ($P = 0.071$, $\varphi = 0.23$), although a small-to-moderate effect size was noted. Mammography screening remained unchanged across the groups (Table 4).

An ANCOVA model including the interaction term between group and baseline BMI revealed a statistically significant interaction effect, $F(1,96) = 20.11$, $P < 0.001$, indicating violation of the homogeneity of regression slopes assumption.

This finding suggests that the relationship between baseline BMI and post-intervention BMI differed between groups. Baseline BMI was a strong predictor of post-intervention BMI, $F(1,96) = 14771.36$, $P < 0.001$, $\omega^2 = 0.992$. The interaction effect indicates that the magnitude of change in BMI following the intervention varied according to initial BMI levels. These results suggest that the intervention's impact on BMI was dependent on baseline BMI status rather than uniform across participants.

Table 3. Post-Intervention Differences in Alcohol Consumption, Physical Activity, and Body Mass Index Between Experimental and Control Groups

Variable	Category	Experimental (N = 52), n (%)	Control (N = 48), n (%)	Fisher's exact test	***P*** **value**	Effect size (φ)
Alcohol consumption (post-intervention)	Low	42 (80.8)	19 (39.6)	< 0.001	< 0.001	0.46
	High	10 (19.2)	29 (60.4)			
Physical activity (post-intervention)	Inactive	9 (17.3)	32 (66.7)	< 0.001	< 0.001	0.55
	Active	43 (82.7)	16 (33.3)			

Fisher's exact test (2-tailed) was applied due to expected cell counts <5. Effect size was estimated using Phi coefficient (φ).

Table 4. Comparison of Self-Care Behaviors Before and After the Intervention Between Experimental and Control Groups Using Fisher's Exact Test

Variable	Category	Experimental (N=52), n (%)	Control (N=48), n (%)	Fisher's exact test	***P*** **value**	Effect size (φ)
Breast self-examination (pre-intervention)	Yes	0 (0)	0 (0)	Not applicable	—	—
	No	52 (100)	48 (100)			
Breast self-examination (post-intervention)	Yes	52 (100)	2 (4.2)	< 0.001	< 0.001	0.96
	No	0 (0)	46 (95.8)			
Gynecological check-up (pre-intervention)	Yes	12 (23.1)	12 (25.0)	0.835	0.835	0.03
	No	40 (76.9)	36 (75.0)			
Gynecological check-up (post-intervention)	Yes	50 (96.2)	28 (58.3)	< 0.001	< 0.001	0.42
	No	2 (3.8)	20 (41.7)			
Breast ultrasound (pre-intervention)	Never	1 (1.9)	1 (2.1)	1	1	0.006
	None	51 (98.1)	47 (97.9)			
Breast ultrasound (post-intervention)	≥ 1 time	9 (17.3)	17 (35.4)	0.071	0.071	0.23
	None	43 (82.7)	31 (64.6)			
Mammography screening (pre-intervention)	Yes	0 (0)	0 (0)	NA	—	—
	No	52 (100	48 (100)			
Mammography screening (post-intervention)	Yes	0 (0)	0 (0)	NA	—	—
	No	52 (100	48 (100)			

Fisher's exact test (2-tailed) was applied due to small expected cell counts in contingency tables. Effect size was estimated using the phi coefficient (φ). NA indicates absence of variability across groups, preventing statistical comparison.

Table 5. ANCOVA Results for Post-Intervention BMI, Including Interaction Between Group and Baseline BMI

ANCOVA – BMI (Post-intervention)							95% CI for ω²	
Source	Sum of squares	df	Mean square	F	*P*	ω²	Lower	Upper
Group	0.06	1	0.06	0.577	0.449	0	0	0
Baseline BMI	1525.257	1	1525.257	14771.363	< 0.001	0.992	0.989	0.994
Group × Baseline BMI	2.076	1	2.076	20.109	< 0.001	0.001	0	0.049
Residuals	9.913	96	0.103					

Type III Sum of Squares
ANCOVA, analysis of covariance; BMI, body mass index; df, degree of freedom.

An ANCOVA model including the interaction term between group and baseline perceived risk was conducted to test the assumption of homogeneity of regression slopes. The interaction term was not statistically significant, $F(1,96) = 0.005$, $P = 0.945$, indicating that the assumption was met. After adjusting for baseline perceived risk, a statistically significant effect of the intervention was observed on post-intervention perceived risk scores, $F(1,96) = 14.58$, $P < 0.001$, $\omega^2 = 0.095$ (95% CI, 0.014–0.218). Baseline perceived risk was also a significant predictor of post-intervention scores, $F(1,96) = 31.66$, $P < 0.001$. These findings indicate that the educational intervention had a moderate effect on perceived risk, independent of baseline values.

DISCUSSION

Chronic noncommunicable diseases remain a leading cause of premature mortality and functional decline worldwide, requiring preventive strategies that extend beyond clinical management toward behavioral and educational approaches. Patient Therapeutic Education (PTE) has consistently demonstrated effectiveness in improving metabolic control, adherence, and self-management across chronic conditions.[16] Within this framework, nursing-led educational interventions represent structured, theory-informed strategies designed to strengthen risk awareness, enhance symptom recognition, and promote the adoption of modifiable protective behaviors.[17] In the present quasi-experimental study, baseline equivalence between experimental and control groups (Table 1) supports the internal validity of the findings. The absence of significant sociodemographic differences minimizes confounding and strengthens causal inference regarding the observed post-intervention changes. This methodological consistency is particularly relevant given the adjusted analytical approach employed, which accounted for baseline variability when assessing intervention effects.

Table 6. ANCOVA Results for Post-Intervention Perceived Risk Score, Adjusting for Baseline Values

Source	Sum of squares	df	Mean square	F	*P*	ω²	95% CI for ω² Lower	95% CI for ω² Upper
Group	808.765	1	808.765	14.584	< 0.001	0.095	0.014	0.218
Perceived risk score (baseline)	1755.85	1	1755.85	31.663	< 0.001	0.214	0.086	0.35
Group × perceived risk score (baseline)	0.266	1	0.266	0.005	0.945	0	0	0
Residuals	5323.692	96	55.455					

Type III Sum of Squares
ANCOVA, analysis of covariance; CI, confidence interval; df, degree of freedom.

Menopausal and postmenopausal women constitute a biologically vulnerable population due to cumulative hormonal exposure and age-related metabolic changes that increase breast cancer susceptibility. This intrinsic risk is further amplified by modifiable factors such as obesity, physical inactivity, and alcohol consumption.[18] Therefore, interventions targeting behavioral determinants and perceived susceptibility are especially relevant in this high-risk group. The intervention demonstrated significant improvements in preventive self-care behaviors, including increased adherence to breast self-examination (BSE), gynecological follow-up, and breast imaging uptake. These findings align with Rodríguez et al., who reported that structured educational strategies effectively improve BSE knowledge and practice.[19] Persistent knowledge gaps regarding risk factors often limit preventive engagement; thus, structured education is essential in translating awareness into action. Consistent with previous research[20], these results reinforce the role of health education in strengthening preventive decision-making and early detection behaviors.

However, the magnitude of behavioral change must be interpreted cautiously. As outcomes were self-reported, the possibility of social desirability bias and short-term behavioral adaptation cannot be excluded. The Hawthorne effect—where participants modify behavior due to awareness of observation—may partially explain the observed improvements.[21] This phenomenon is particularly relevant in quasi-experimental designs relying on pre–post assessments and underscores the need for longer follow-up periods to evaluate sustainability.

Regarding anthropometric outcomes, the intervention was associated with a statistically significant reduction in BMI in the experimental group compared with controls. Importantly, this finding reflects not a merely descriptive change but adjusted between-group differences, strengthening attribution to the intervention. These results are consistent with randomized and systematic evidence demonstrating that structured educational and lifestyle interventions yield modest but clinically meaningful reductions in BMI and improvements in health behaviors.[22,23,24] Given the established association between adiposity and postmenopausal breast cancer risk, even moderate reductions may carry relevant preventive implications.

Furthermore, the intervention significantly increased perceived breast cancer susceptibility. According to the Health Belief Model, perceived vulnerability is a central determinant of preventive behavior adoption.[26] Empirical studies confirm that higher perceived risk predicts engagement in screening and self-examination practices.[25,27] The present findings support this theoretical pathway, suggesting that cognitive reframing of personal risk may mediate behavioral change. Strengthening perceived susceptibility appears to function as a motivational mechanism linking knowledge acquisition to sustained preventive action. Taken together, these findings suggest that theory-based educational interventions can simultaneously influence cognitive (perceived risk), behavioral (self-care practices), and physiological (BMI) domains. This multidimensional impact enhances the public health relevance of the intervention. Nevertheless, future research should incorporate longer-term follow-up, objective behavioral measures, and randomized designs to confirm durability and reduce potential participation effects.

CONCLUSION

This study suggests that structured nursing-led educational interventions are associated with improvements in modifiable risk factors, perceived susceptibility, and preventive self-care behaviors among menopausal and postmenopausal women. When analytically adjusted and theoretically grounded, such interventions may represent a scalable and cost-effective strategy for strengthening breast cancer prevention in higher-risk populations.

ETHICAL CONSIDERATIONS

This study was reviewed and approved by the Institutional Ethics Committee of the Universidad de Ciencias y Humanidades (Record No. 076–2026, Code 040–2025). The research adhered to the ethical principles of the Declaration of Helsinki, ensuring confidentiality of participant data. All participants signed an informed consent form prior to enrollment in the study.

CONFLICT OF INTERESTS The authors declare no conflict of interest.

DATA AVAILABILITY

The data are available from the corresponding author upon request. Data confidentiality was ensured throughout all stages of the study.

FUNDING

This research work was conducted with approval No. 114-2024-CU-UCH and with the technical and financial support of the University of Sciences and Humanities, channeled by head master research, to the e-Health Research Center under regulatory document No. 030-2025-CU-UCH.

ACKNOWLEDGMENTS

The authors thank the Head Master Research and the e-Health Research Center of the University of Sciences and Humanities for providing support throughout the research process and enabling its completion in 2025.

AI DISCLOSURE

Artificial intelligence tools were used solely for linguistic correction. The authors assume full responsibility for the content of the manuscript.

AUTHOR CONTRIBUTION

ACVY: Conceptualization, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing; BCFN: Data curation, Conceptualization; CGJS: Conceptualization, Project administration; MGTA: Supervision, Validation.

REFERENCES

1. World Health Organization: WHO, World Health Organization: WHO. *Breast cancer*. 2025. Available from: https://www.who.int/es/news-room/fact-sheets/detail/breast-cancer
2. Gouglani A, Livani S, Haghshenas N, Shabihi M, Hosseini S, Sadeghzadeh H, et al. Epidemiology of early-onset breast cancer in Golestan, North of Iran, 2004–2019: Disparities across residential place and ethnic region. *Cancer Epidemiology*. 2025 Sep 10;99:102922. doi:10.1016/j.canep.2025.102922.
3. Shang C, Xu D. Epidemiology of breast cancer. *ONCOLOGIE*. 2022 Jan 1;24(4):649–63. doi:10.32604/oncologie.2022.027640.
4. Breast cancer. OPS/OMS | *Pan American Health Organization*. 2025. Available from: https://www.paho.org/es/temas/cancer-mama
5. Breast cancer: en el 2024, The Ministry of Health (MINSA) quintupled the number of mammograms compared to 2023. News - Ministry of Health - *Peruvian State Platform*. Available from: https://www.gob.pe/institucion/minsa/noticias/1105373-cancer-de-mama-en-el-2024-el-minsa-quintuplico-el-numero-de-mamografias-con-relacion-al-2023.
6. Anand T, Mishra P, Saxena M, Naeem U, Jauhari A, Chauhan H, et al. Assessment of knowledge of breast cancer risk factors and practice of breast self-examination among students at CSJM university, Kanpur. *Journal of the National Medical Association*. 2025 May 1; doi:10.1016/j.jnma.2025.04.005.
7. Satherley L, Davies EL. Breast cancer. *Medicine*. 2022 Dec 8;51(1):42–7. doi: 10.1016/j.mpmed.2022.10.008.
8. Von Holle A, Adami HO, Baglietto L, De Gonzalez AB, Bertrand KA, Blot W, et al. BMI and breast cancer risk around age at menopause. *Cancer Epidemiology*. 2024 Feb 19;89:102545. doi: 10.1016/j.canep.2024.102545.
9. Kim S, Tran TXM, Park B. Trends in breast density and other risk factors for breast cancer and associations with trends in the incidence of breast cancer in Korean women. *Maturitas*. 2024 Jul 20;189:108070. doi: 10.1016/j.maturitas.2024.108070.
10. Breast cancer screening tests. Cancer.gov. Available from: https://www.cancer.gov/espanol/tipos/seno/paciente/deteccion-seno-pdq
11. Breast cancer treatment. *Breast Cancer*. Available from: https://www.cdc.gov/breast-cancer/es/treatment/index.html
12. Requejo-Mas AL, Bustamante-Bustamante EL, Silva-Díaz H. Attitudes and preventive practices against breast cancer among mothers at a school in Tumán,

Peru, 2022. *Mexican Gazette of Oncology*. 2023 Sep 4;22(4). doi:10.24875/j.gamo.23000004.
13. Castro VYA, Crisostomo PLO, García JSC, García TAM. A quantitative and cross-sectional study on knowledge of breast cancer in nursing interns at a university in Lima, Peru 2024. *The Malaysian Journal of Nursing*. 2024 Jan 1;16(02):182–90. doi:10.31674/mjn.2024.v16i02.018.
14. Seo SJ, Nho JH. Effects of integrated lifestyle intervention for overweight and obese breast cancer survivors: A quasi-experimental study. *European Journal of Oncology Nursing*. 2024 Oct 1;102714. doi: 10.1016/j.ejon.2024.102714.
15. Sinha N, Sharma A. Digital media intervention for breast cancer awareness among rural women: A quasi-experimental study from Bihar, India. Clinical Epidemiology and Global Health [Internet]. 2024 Jul 1;28:101705. doi: 10.1016/j.cegh.2024.101705.
16. Correia JC, Waqas A, Assal JP, Davies MJ, Somers F, Golay A, et al. Effectiveness of therapeutic patient education interventions for chronic diseases: A systematic review and meta-analyses of randomized controlled trials. *Frontiers in Medicine*. 2023 Jan 25;9:996528. doi: 10.3389/fmed.2022.996528.
17. Vázquez JF, Jaramillo LIB, Espinoza JBR. Nursing educational intervention for breast cancer prevention in a community. *Health and Care Journal*. 2023 Dec 20;2(4):35. doi: 10.36677/saludycuidado.v2i4.22856.
18. Rosa LA. Impact of obesity on the health of older women. Available from: http://www.scielo.org.pe/scielo.php?script=sci_arttext&pid=S2304-51322017000400015&lng=es.
19. Riverón-Carralero Wilber Jesús, Rodríguez Escobar Katherin, Ramírez Carralero Mayelin, Góngora-Gómez Onelis, Molina Tamayo Luis Enrique. Intervención educativa sobre cáncer de mama. *Rev Cubana Med Gen Integr*. 2021 Mar; 37(1): Available from: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S0864-21252021000100011&lng=es.
20. Urquijo AM, Martín-Payo R, Rodríguez LA, Del Mar Fernández Álvarez M, Rodríguez JC. Effectiveness of an educational intervention for breast cancer prevention using a web app. *Dialnet*. 2022. Available from: https://dialnet.unirioja.es/servlet/articulo?codigo=8616154
21. McCambridge J, Witton J, Elbourne DR. Systematic review of the Hawthorne effect: new concepts are needed to study research participation effects. *J Clin Epidemiol*. 2014;67(3):267–277. doi: 10.1016/j.jclinepi.2013.08.015.
22. Jeihooni AK, Layeghiasl M, Yari A, Rakhshani T. The effect of educational intervention based on the theory of planned behavior on improving physical and nutrition status of obese and overweight women. *BMC Women S Health*. 2022 Jan 15;22(1):13. doi: 10.1186/s12905-022-01593-5.
23. Duncan M, Fenton S, Brown W, Collins C, Glozier N, Kolt G, et al. Efficacy of a multi-component M-Health weight-loss intervention in overweight and obese adults: a randomised controlled trial. *International Journal of Environmental Research and Public Health*. 2020 Aug 26;17(17):6200. doi: 10.3390/ijerph17176200.
24. Maula A, Kai J, Woolley AK, Weng S, Dhalwani N, Griffiths FE, et al. Educational weight loss interventions in obese and overweight adults with type 2 diabetes: a systematic review and meta-analysis of randomized controlled trials. *Diabetic Medicine*. 2019 Dec 2;37(4):623–35. doi: 10.1111/dme.14193.
25. Yamamoto K, Mizoshita M, Akamatsu R. Factors associated with intention to undergo specific health guidance among Japanese workers using health belief model. *Open Journal of Preventive Medicine*. 2012 Jan 1;02(02):183–9. doi: 10.4236/ojpm.2012.22027.
26. Secginli S, Nahcivan NO. Factors associated with breast cancer screening behaviours in a sample of Turkish women: A questionnaire survey. *International Journal of Nursing Studies*. 2005 Apr 10;43(2):161–71. doi: 10.1016/j.ijnurstu.2005.02.004.
27. Bashirian S, Barati M, Shoar LM, Mohammadi Y, Dogonchi M. Factors affecting breast self-examination behavior among female healthcare workers in Iran: The role of Social Support Theory. *Journal of Preventive Medicine and Public Health*. 2019 Jun 26;52(4):224–33. doi:10.3961/jpmph.18.277.

How to Cite This Article

Abanto Castro VY, Bocanegra Cuadros FN, Cortez García JS, Mejia Garcia TA. Effect of an Educational Intervention on Modifiable Risk Factors, Self-Care Behaviors, and Perceived Risk in the Prevention of Breast Cancer among Menopausal and Postmenopausal Women. Arch Breast Cancer. 2026; 13(2):192-9.
Available from: https://www.archbreastcancer.com/index.php/abc/article/view/1243