

RESEARCH ARTICLE

Editorial Process: Submission:25/01/2026 Acceptance:16/09/2026 Published:28/09/2026

Effect of a PEN-3 Model-Based Motivational Training Programme on Breast Cancer Screening Behaviours Among Female School Teachers

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Abstract

Background: Breast cancer remains a leading cause of morbidity and mortality among women globally, with limited organized screening programs in low- and middle-income countries such as Iraq. Culturally appropriate educational interventions are needed to improve screening behaviors. **Objective:** This study aimed to evaluate the effect of a PEN-3 model-based motivational training program on breast cancer screening behaviors among female school teachers in Erbil city, Iraq. **Methods:** A cluster quasi-experimental controlled study was conducted among 136 female teachers from 18 public girls' high schools. Schools were allocated at the cluster level to either an intervention group (n = 68) or a control group (n = 68). The intervention group received four structured motivational training sessions based on the PEN-3 model, while the control group received no intervention. Data were collected at baseline and two months post-intervention using a researcher-developed questionnaire based on the PEN-3 model, for which content validity and reliability were assessed in this study. Data were analyzed using descriptive statistics and non-parametric tests, including the Wilcoxon signed-rank test, Mann-Whitney U test, and chi-square test. **Result:** At two months post-intervention, the intervention group showed significant improvements in median scores of perception, enablers, and nurturers compared with the control group (all $p < 0.001$), with large effect sizes. The proportion of participants performing breast self-examination increased from 8.8% at baseline to 100% post-intervention in the intervention group, compared to 0% in the control group ($p < 0.001$). Similarly, clinical breast examination (69.1% vs. 0%) and mammography uptake (39.7% vs. 0%) were significantly higher in the intervention group. **Conclusion:** The PEN-3 model-based motivational training programme appears effective in improving breast cancer screening behaviors among female school teachers in the short term. Culturally tailored educational interventions may play an important role in promoting early detection practices in similar settings.

Keywords: Breast Cancer, Cancer Screening, PEN-3 Model, Health Education, Women Educators

Asian Pac J Cancer Prev, 27 (9), 3385-3392

Introduction

Worldwide, breast cancer (BC) represents the most commonly diagnosed form of cancer among women and continues to be one of the most prevalent forms of cancer and cancer-related mortality, creating an important public health issue [1, 2]. In 2022, there were about 2.3 million newly diagnosed BC patients, which contributed to 11.6% of the worldwide cancer burden. BC continues to be the 5th most common cause of cancer-related mortality [2]. Advanced screening programs, despite their proven effectiveness in lowering mortality, are largely inaccessible in low and middle-income nations.

In Iraq, and especially in the Kurdistan region, patterns regarding breast cancer (BC) show great variation. For instance, Kurdish women are diagnosed at a median age

of 47 years, which is a lot younger than women in the United States, for example, where the median age is 62 years [3–7]. Over one-half of these women are diagnosed at stage three, which is problematic and raises concerns about the issue of early detection [3, 8, 9]. Many cases occur in the absence of a BC family history, meaning that a genetic institutional theory is insufficient, and so, the burden of BC and the associated need for effective preventive strategies remain [4].

Despite the proven benefits of early screening through BSE, clinical breast exams (CBE), and mammography (MMG), Iraq lacks formal national screening programmes, and awareness among women remains low [4, 10–13]. Therefore, educational interventions are critical, particularly when tailored to the cultural and social contexts of the target population [14–16].

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The PEN-3 model is a culturally centered framework used in health promotion that emphasizes the role of cultural context in shaping health behaviors [4]. It consists of three interrelated domains: cultural identity (Person, Extended family, Neighborhood), relationships and expectations (Perceptions, Enablers, Nurturers), and cultural empowerment (Positive, Existential, Negative). In the context of breast cancer screening, the model helps identify individual beliefs, social support systems, and environmental factors that influence preventive behaviors, making it particularly suitable for designing culturally appropriate interventions [4].

Female school teachers represent a strategic target population for health education interventions due to their educational background, social influence, and role as information disseminators within families and communities. In settings such as Iraq, where awareness of breast cancer screening remains limited, teachers can serve as key agents of change by promoting health knowledge and encouraging preventive practices among students, families, and the wider community [17–19]. Therefore, this study aimed to implement a motivational, PEN-3 model-based educational program to improve the perceptions of breast cancer and screening behaviours among female school teachers in Erbil. By targeting this population, the intervention seeks to enhance individual health behaviours and disseminate knowledge to broader communities, contributing to the early detection and reduction of the BC burden.

Despite increasing attention to breast cancer screening behaviors globally, there is limited evidence on the application of culturally grounded models such as the PEN-3 framework in Iraq and similar settings. In particular, no previous studies in the Kurdistan Region have evaluated the effectiveness of a PEN-3 model-based motivational training programme among female school teachers, a population with potential to influence community health behaviors. Therefore, this study aims to address this gap by assessing the impact of a culturally tailored educational intervention on breast cancer screening practices.

Materials and Methods

Study Design and Participants

This study employed a cluster quasi-experimental controlled design, in which public girls' high schools (clusters) were randomly allocated to either an intervention or control group. Cluster-level allocation was used to minimize contamination between participants within the same school, as teachers frequently interact and share information. Individual-level randomization was therefore not feasible due to the high risk of intervention diffusion across participants within the same setting.

In Erbil city, Kurdistan Region, Iraq, 18 schools were randomly divided into two groups: 9 for intervention and 9 for control. All eligible teachers from these chosen schools were then invited to participate. Due to the cluster-based allocation, potential intra-cluster correlation may influence outcome estimates; however, clustering effects were not adjusted for in the analysis and are acknowledged as a limitation.

Sampling

All eligible female teachers within the selected schools were invited to participate through coordination with school administrations. Information about the study was provided, and those who consented were enrolled. No additional sampling was performed at the individual level beyond eligibility criteria. A multistage sampling approach was used. First, a list of all public girls' high schools in Erbil was obtained from the General Directorate of Education. Schools were randomly selected and then randomly allocated to intervention and control groups at the cluster level.

Within each selected school, purposive sampling was used to recruit eligible female teachers based on predefined inclusion criteria. All teachers who met the criteria and consented were included until the required sample size was achieved.

Although purposive sampling was used at the participant level, the inclusion of multiple schools from different areas of Erbil enhances the representativeness of the sample for female high school teachers in the city. However, generalization beyond similar educational and urban settings should be made with caution.

Data Collection Tool

The researcher used a structured questionnaire based on the PEN - 3 model to gather the data. To assess the validity of the content critical tool, the researcher consulted with ten experts in the fields of health education and oncology. Some theoretical consideration was maintained. Cronbach's alpha was used to assess reliability, which was acceptable for all constructs: Perception ($\alpha = 0.84$), Enablers ($\alpha = 0.78$), Nurturers ($\alpha = 0.81$), and practical steps of breast self-examination (BSE) ($\alpha = 0.87$). Similar reliability values for the PEN-3 constructs were found in the literature [20]. The questionnaire comprised four sections:

1-Sociodemographic Characteristics – 14 items capturing age, marital status, educational level, years of teaching experience, and other relevant demographic information.

2-Clinical Information: Eight questions about personal and family history of breast disease, previous screening actions, and health-related aspects.

3-Relationship and Expectation Factors (PEN-3 Constructs): This section includes three subscales:

Perceptual Factors (Knowledge, attitudes, beliefs)

*Knowledge: 29 single-choice questions assessing understanding of breast cancer and screening methods (BSE, CBE, and MMG). Each correct response was scored as 1, and incorrect responses were scored as 0 (range: 0–29).

*Attitudes: 17 items with five response options (0 = Strongly Disagree to 4 = Strongly Agree), evaluating attitudes toward breast cancer and screening.

*Beliefs: 21 items across five response options (0 = Very Untrue to 4 = Very True) gauging culturally shaped belief systems regarding breast cancer and related preventive practices.

Enablers

Seven items measuring environmental, organisational, and social factors that facilitate or impede screening behaviours, scored on a 5-point Likert scale (0 = Strongly Disagree to 4 = Strongly Agree).

Nurturers

Nine items measured the impact of family, friends, and partners on health behaviours of participants, which were also scored using a 5-point Likert scale

4-Breast Cancer Screening Behaviours: This section evaluated the frequency and practical implementation of BSE, CBE, and mammography. As part of the BSE practice, there were 15 items related to performance at home in a stepwise manner, where responses were scored as 2 = Done, 1 = Sometimes Done, and 0 = Not Done. CBE and MMG behaviour were assessed based on adherence to the recommended screening frequency. The tool captured both the behavioural and cognitive dimensions of breast cancer screening, aligned with the PEN-3 framework, and was administered to participants before and two months after the intervention to assess changes in knowledge, beliefs, attitudes, and screening behaviours.

Intervention

Following completion of the baseline questionnaire by both groups, participants in the intervention group received a structured motivational training programme based on the PEN-3 model of health education. The programme comprised four 30-minute sessions delivered over seven months. The programme was implemented a few times in each school because of the school commitment; teachers were not able to participate together, and the group size was between 1 and 12 female teachers. Post-intervention assessment was conducted two months later to evaluate changes in the PEN-3 model factors and breast cancer screening behaviour. The training programme was developed using the PEN-3 model framework, targeting the Person (P) factor, as well as Enablers (E) and Nurturers (N), to address cultural, social, and environmental influences on health behaviours. This model allowed the programme to incorporate perceptions and culturally embedded, ensuring a contextually relevant and motivational approach. Session Structure:

1-Sessions 1–2: Perceptual Factors

***Knowledge:** Participants received lectures, question-and-answer sessions, and group discussions to enhance their understanding of breast cancer, its risk factors, and screening methods, including breast self-examination (BSE), clinical breast examination (CBE), and mammography (MMG).

***Beliefs:** Misconceptions regarding breast cancer and breast cancer screening behaviours were identified and addressed through interactive group discussions. For example, participants were informed that breast cancer risk is not limited to individuals with a family history and that breast cancer, like other chronic diseases, is preventable and manageable through early detection and lifestyle intervention. Teachers were encouraged to share

their personal experiences with disease prevention and screening to reinforce learning.

***Attitudes:** Breast cancer and screening behaviour, positive attitudes were encouraged through group discussions, lectures, and slideshows. Participants who had previous screening practices illustrated the timely and regular breast screening practices and reinforced the early detection benefits.

2-Sessions 3–4: Enablers, Nurturers, Factors, and Behaviours Related to Screening for Breast Cancer

The participants were orientated to local resources, particularly to public and private health facilities in Erbil that offer screening services for breast cancer.

- Guided practice and practical demonstrations of BSE were conducted using breast models.

- To strengthen participants' screening practice, supportive social norms were reinforced using role play and group work.

- Strategies for planning and scheduling CBE and MMG appointments were discussed, including the use of mobile applications for reminders and communication purposes.

At the end of the programme, participants received educational booklets summarising the content and guidance for continued practice of breast cancer screening behaviours. The intervention aimed to enhance knowledge, correct misconceptions, foster positive attitudes, and empower participants to adopt regular screening practices simultaneously, while considering the cultural and social factors that influence behavior.

The training sessions followed a standardized protocol, including PowerPoint presentations, printed educational booklets, breast models for practical training, and structured discussion guides. Educational materials covered breast cancer risk factors, early detection methods, myths and misconceptions, and locally available screening services. Each session followed a consistent format: introduction, interactive lecture, group discussion, practical demonstration (where applicable), and summary. This standardization enhances the reproducibility of the intervention.

Training Focused on Enablers and Nurturers

The interactions focused on enabler and nurturer components of the PEN-3 model during the training aimed to strengthen the breast cancer screening behaviour. Participants were acquainted with the public and private health facilities in Erbil that offer Clinical Breast Examination (CBE) and Mammography (MMG) services. Participants were provided with practical BSE training using the special breast model (Mankin) to facilitate the technique and perform it with guided supervision. The demonstrations were repeated until most of the participants were able to perform the model proficiently.

In addition, teachers received instructions on the procedures and importance of CBE and MMG, including guidance on scheduling and attending appointments. To facilitate adherence, participants were helped to plan regular screening appointments, with reminders provided through mobile applications such as Viber, WhatsApp,

and Telegram. Flexibility can accommodate individual schedules.

At the end of the motivational training sessions, the participants were provided with a comprehensive booklet summarising the educational content, practical steps, and local screening resources. Two months after the intervention, a post-intervention assessment was conducted to evaluate changes in knowledge, perceptions, Enablers, Nurturers, and breast cancer screening behaviours.

Statistical Analysis

Data were analysed using SPSS version 26. The choice of statistical tests was based on data distribution rather than sampling method. As the study used cluster-level allocation, the potential effect of intra-cluster correlation was considered; however, due to sample size limitations and analytical constraints, clustering was not adjusted in the statistical analysis [21]. This may have influenced variance estimates and is acknowledged as a limitation. Normality of continuous variables was assessed using the Shapiro–Wilk test and inspection of histograms and Q–Q plots. As the data were not normally distributed, non-parametric tests were applied.

- Within-group comparisons were conducted using the Wilcoxon signed-rank test to evaluate changes in the PEN-3 constructs and screening behaviours pre- and post-intervention.
- To determine differences in medians between intervention and control groups, between-group comparisons were conducted using the Mann-Whitney U test.
- Chi-square tests of independence were applied to assess the associations between categorical variables, including perceptual, enabler, and nurturer factors, breast cancer screening behaviours, practical BSE steps, and sociodemographic characteristics.

Descriptive statistics were used to summarize the data, including frequencies and percentages for categorical variables and medians with interquartile ranges for continuous variables. A p-value of <0.05 was considered statistically significant [22]. Effect sizes (r) were calculated for non-parametric tests to assess the magnitude of differences.

Ethical Considerationsss

The study was approved by the Ethics Committee of Hawler Medical University (confirmation code: 2531). All participants provided written informed consent after receiving detailed information about the study objectives and the motivational training programme. Participants were promised confidentiality and were informed about the option to withdraw at any stage of the study with no consequences. This study followed the guidelines of the Declaration of Helsinki [23]. After data were collected, control group participants were given booklets and vouchers for free mammography tests, and received delayed access to the educational materials, to assure equitable Gains from the educational materials intervention.

Results

Socio-demographic Characteristics of the Participants

A total of 136 female teachers participated in the study, with 68 in the intervention group and 68 in the control group. Table 1 summaries the comparison of sociodemographic characteristics between groups. There were no statistically significant differences between the groups in terms of age, marital status, socioeconomic status, teaching subject, family history of breast cancer, or history of breast diseases ($p > 0.05$).

However, teaching experience differed significantly between the groups ($p = 0.01$). More than half the teachers in the control group (40, 58.8%) had 10–19 years of teaching experience, while most teachers in the intervention group (35, 51.5%) had 20–29 years of teaching experience. Beyond this, there was a slight imbalance in the distribution of teaching experience when other characteristics were similar.

Changes in PEN-3 Model Domains

Table 2 presents a comparison of the PEN-3 model domains (Perception, Enablers, and Nurturers) before and after the motivational programme. In the intervention group, there was a highly significant increase in the median scores across all three domains following the training programme ($p < 0.001$). The observed effect sizes were large (Perception: $r = 0.869$; Enablers: $r = 0.871$; Nurturers: $r = 0.870$), showing a strong impact of the intervention on teachers' knowledge, attitudes, beliefs, and supportive social and environmental factors related to breast cancer screening. In contrast, the control group showed only a small, statistically significant increase in the Perception domain ($p = 0.005$; $r = 0.246$), while changes in the enabler ($p = 0.58$; $r = 0.066$) and nurturer ($p = 0.53$; $r = 0.235$) domains were not statistically significant, reflecting the absence of a structured intervention.

Breast Cancer Screening Behaviours

Table 3 illustrates the comparison of breast cancer screening behaviours and the level of BSE practice before and two months after the motivational programme. At baseline, there were no significant differences between the groups in the frequency of BSE ($p = 0.08$), CBE ($p = 0.75$), MMG ($p = 1.00$), or level of BSE practice ($p = 0.05$), showing comparable pre-intervention behaviours.

Two months post-intervention, the intervention group showed significant improvements in all screening behaviours compared to the control group.

- Breast self-examination: 100% of teachers in the intervention group performed BSE, compared with 0% in the control group ($p < 0.001$).
- Clinical breast examination: 69.1% of teachers in the intervention group underwent CBE, compared to 30.9% in the control group ($p < 0.001$).
- Mammography: 39.7% of intervention group teachers had mammograms compared to none in the control group ($p < 0.001$).
- BSE practice level: All teachers in the intervention group demonstrated good practice of BSE steps, while the majority of control group teachers remained at poor

Table 1. Socio-Demographic Characteristics of Teachers in Intervention and Control Groups (n = 136)

Characteristic	Control Group (n = 68)	Intervention Group (n = 68)	P-value
Age (years)			0.83
40–49	53 (77.9%)	52 (76.5%)	
≥50	15 (22.1%)	16 (23.5%)	
Marital Status			0.57
Married	60 (88.2%)	62 (91.2%)	
Single	8 (11.8%)	6 (8.8%)	
Socioeconomic Status			0.86
Low	8 (11.8%)	7 (10.3%)	
Middle	19 (27.9%)	17 (25.0%)	
High	41 (60.3%)	44 (64.7%)	
Teaching Subject			0.99
Sciences	23 (33.8%)	23 (33.8%)	
Languages	23 (33.8%)	24 (35.3%)	
Social	13 (19.1%)	12 (17.6%)	
Others	9 (13.2%)	9 (13.2%)	
Teaching Experience (years)			0.01
10–19	40 (58.8%)	26 (38.2%)	
20–29	18 (26.5%)	35 (51.5%)	
30–39	10 (14.7%)	7 (10.3%)	
Family History of BC			0.81
Yes	10 (14.7%)	11 (16.2%)	
No	58 (85.3%)	57 (83.8%)	
History of Breast Disease			0.78
Yes	7 (10.3%)	8 (11.8%)	
No	61 (89.7%)	60 (88.2%)	

Chi-square test was used to compare categorical variables between groups.

or fair practice levels ($p < 0.001$).

These findings indicate that the motivational programme significantly enhanced both knowledge and practical breast cancer screening behaviour among female teachers.

The motivational training programme based on the PEN-3 model produced large and statistically significant improvements in perceptual, enabler, and nurturer factors, as well as in practical breast cancer screening behaviours, compared with minimal or non-significant changes in the control group. These results show the effectiveness of culturally tailored educational interventions in promoting early detection practices among teachers.

Discussion

This study represents the first investigation in Kurdistan and one of the first in Iraq to evaluate the effectiveness of a motivational training programme based on the PEN-3 model on breast cancer screening behaviours among female school teachers. The PEN-3 models, encompassing Perception, Enablers, and Nurturers, provide a culturally sensitive framework for promoting healthy behaviours, and their application in this context shows substantial benefits.

Following two months of participation in the motivational training programme, the Perception factor

Table 2. Pretest and Post-test Comparison of PEN-3 Model Domains Between Intervention and Control Groups

PEN-3 Domain	Group	Pretest Median (IQR)	Post-test Median (IQR)	Z	P	Effect Size (r)
Perception	Control	110.5 (99–126)	113 (103.5–127)	–2.819	0.005	0.246
	Intervention	113 (98.25–125.75)	173 (170–175)	–7.168	<0.001	0.869
Enablers	Control	16 (14–18)	16 (15–17)	–0.544	0.58	0.066
	Intervention	15 (13–17)	26 (25–27)	–7.183	<0.001	0.871
Nurturers	Control	21.5 (18–24)	21 (19–25)	–1.936	0.53	0.235
	Intervention	20 (18–24)	32 (32–33)	–7.176	<0.001	0.87

Values are presented as median (interquartile range). The Wilcoxon signed-rank test was used for within-group comparisons. Effect size (r) was calculated.

Table 3. Pretest and Post-test Comparison of Breast Cancer Screening Behaviours and BSE Practice Levels between Intervention and Control Groups (n = 136)

Screening Behaviour / BSE Practice	Group	Before Programme	P-value	Two Months After The Programme	P-value
Breast Self-Examination (BSE)	Control	Yes: 13 (19.1%)	0.08	Yes: 0 (0%)	<0.001
		No: 55 (80.9%)		No: 68 (100%)	
	Intervention	Yes: 6 (8.8%)	0.75	Yes: 68 (100%)	<0.001
		No: 62 (91.2%)		No: 0 (0%)	
Clinical Breast Examination (CBE)	Control	Yes: 5 (7.4%)	1	Yes: 0 (0%)	<0.001
		No: 63 (92.6%)		No: 68 (100%)	
	Intervention	Yes: 6 (8.8%)		Yes: 47 (69.1%) No: 21 (30.9%)	
		No: 62 (91.2%)			
Mammography (MMG)	Control	Yes: 2 (2.9%)	1	Yes: 0 (0%)	<0.001
		No: 66 (97.1%)		No: 68 (100%)	
	Intervention	Yes: 2 (2.9%)		Yes: 27 (39.7%) No: 41 (60.3%)	
		No: 66 (97.1%)			
BSE Practice Level	Control	Poor: 60 (88.2%)	0.05	Poor: 57 (83.8%) Fair: 9 (13.2%) Good: 2 (2.9%)	<0.001
		Fair: 7 (10.3%)			
		Good: 1 (1.5%)			
	Intervention	Poor: 67 (98.5%)		Poor: 0 (0%)	
		Fair: 1 (1.5%)		Fair: 0 (0%)	
		Good: 0 (0%)		Good: 68 (100%)	

Chi-square test was used for categorical comparisons. BSE, Breast Self-Examination; CBE, Clinical Breast Examination; MMG, Mammography

in the intervention group showed a highly significant increase, with a large effect size, showing substantial improvement in teachers' knowledge, beliefs, and attitudes toward breast cancer and its screening methods. In contrast, the control group exhibited only slight, non-significant changes in Perception, highlighting the efficacy of the culturally tailored intervention. These findings are consistent with previous research, which reported that Perception scores were significantly higher in intervention groups than in controls following structured health education programmes [17, 24]. Similarly, an Iranian study showed that a 20-week Motivational Interviewing-based programme significantly enhanced women's adherence to all three breast cancer screening behaviours [25].

Also, in the intervention group, the Enablers and Nurturers factors showed great improvement with large effect sizes, and the control group showed no significant changes. This shows the program was successful at increasing external social support and positive reinforcement, so that teachers felt more empowered to do breast cancer screening. Similar results were documented in Iran and Saudi Arabia, where health education interventions of a certain structure increased enabler scores and improved breast cancer knowledge and prevention practices among female teachers [17, 24, 26].

The motivational training programme significantly improved participants' behaviours regarding breast cancer screenings. For example, participants in the intervention group were more likely than those in the control group to perform breast self-exams (BSE), clinical breast exams (CBE), and mammograms (MMG), as well as to follow BSE practical step guidelines. This is as positive

as past studies showed that the frequency and/or quality of breast cancer screening behaviours improved through educational interventions based on the PEN-3 model [17, 24, 27].

In addition, the practical BSE skills of participants were noticeably improved, as they showed more ability to perform all of the recommended steps. This is similar to previous works of a quasi-experimental nature in Erbil and Saudi Arabia, in which the women's health education programmes positively affected the practical implementation of BSE [26, 28]. This framework demonstrated the positive impact of practical skills and the developed layers of the Perception, Enablers, and Nurturers on the culturally modified, theatrical-based, and preventive health behaviours of the participants.

The motivational training programme based on the PEN-3 model showed that participants at the end had a positive change in the knowledge, attitudes, social support, and behaviours related to breast cancer screening.

A statistically significant difference in teaching experience was observed between groups at baseline. This imbalance may have influenced the outcomes, as more experienced teachers could have greater health awareness or different health-seeking behaviors. However, other key sociodemographic variables were comparable between groups, and the observed intervention effects were large, suggesting that the impact of the programme remains substantial. Future studies should consider stratified randomization or statistical adjustment to control for such baseline differences.

The observed increase in BSE practice to 100% in the intervention group should be interpreted with caution. BSE practice was assessed using a self-reported questionnaire

and practical step checklist, which may be subject to social desirability bias. Additionally, participants received hands-on training and repeated demonstrations using breast models, which may explain the substantial improvement. However, objective verification of long-term behavioral adherence was not conducted. Future studies should incorporate objective measures or longer follow-up periods to validate sustained behavioral change.

In conclusion, the findings of this study show that implementing a motivational educational programme based on the PEN-3 model is highly effective in enhancing breast cancer screening behaviours among female school teachers. The model's strengths explain its multiplicity. It does not treat knowledge, attitudes, and beliefs as isolated factors, but rather considers social beliefs, nurturers, and environmental enablers of the behaviour. By targeting perceptual, enabling, and nurturing constructs, the programme successfully improved both awareness and practical preventive behaviour.

It is therefore recommended that future research consider expanding PEN-3-based educational interventions to evaluate their effectiveness in cascading knowledge and behaviours from teachers to students, amplifying community-wide breast cancer prevention and early detection efforts.

Strengths and Limitations

This study has several strengths, including the use of a culturally grounded PEN-3 model, a structured motivational training programme, and cluster allocation to minimize contamination.

However, several limitations should be considered. First, the study relied on self-reported data, which may be subject to recall and social desirability bias. Second, the short follow-up duration limits the ability to assess the long-term sustainability of behavioral change. Third, the study was conducted in a single city (Erbil), which may limit generalizability. Finally, baseline imbalance in teaching experience may have influenced outcomes. Future research should address these limitations using longitudinal designs and broader geographic sampling.

Another limitation is the short follow-up period of two months, which may not be sufficient to assess sustained behavioral change over time. This timeframe was selected due to academic scheduling constraints and to allow participants time to perform screening behaviors such as CBE and mammography. Longer follow-up periods are recommended in future studies to evaluate the durability of the intervention effects.

Author Contribution Statement

Bekhal Saber Ahmed and Salih Ahmed Abdulla contributed to the study conception and design, data collection, data analysis, and manuscript drafting. All authors reviewed and approved the final version of the manuscript.

Acknowledgements

General

The authors would like to thank the participating schools and all women who generously contributed their time to this study.

Approval

This study was conducted as part of an approved academic research project.

Ethical Declaration

The study protocol was reviewed and approved by the Ethics Committee of Hawler Medical University (Approval No.: 2531). Written informed consent was obtained from all participants before data collection.

Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Conflict of Interest

All authors declare no financial, professional, or personal conflicts of interest that could influence the design, execution, or interpretation of this research.

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