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Enhancing breast cancer awareness through a nursing-led training program for Saudi university staff: A quasi-experimental study

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ABSTRACT

Breast cancer is a major health problem worldwide, particularly in Saudi Arabia, where it is often diagnosed in younger women and at more advanced stages than in Western countries. Breast self-examination (BSE) is a low-cost method, but knowledge and practice remain limited. This study aimed to assess the effect of a nursing-led BSE education program on the knowledge and practice of non-medical female staff. A one-group pretest–posttest study was conducted with 60 female staff at Jouf University. The program was based on Roy's Adaptation Model and included structured teaching sessions and practical demonstrations using a silicone breast model. Participants were assessed before the program, immediately afterward, and two months later. A validated knowledge test and a 20-item BSE checklist were used. Mean knowledge scores increased from 5.17 (SD = 1.74) at baseline to 9.18 (SD = 0.43) after the intervention. Mean practice scores increased from 1.53 (SD = 2.46) to 20.0 (SD = 5.6). Improvements remained at follow-up. Both outcomes showed statistical significance (p = 0.001). The findings suggest that nursing-led education may improve BSE knowledge and practical skills among female university staff.

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1. Introduction

From the most common type of cancer in women is the breast cancer and is the top reason for cancer-related fatalities, holding the second position in terms of cancer deaths in women (Mubarik et al., 2022). There has been an increase in the occurrence of breast cancer in both developed and developing countries. Breast cancer impacts more than 2 million women around the world, making it a concern on a global scale. In 2018, there were 2.4 million new cases of breast cancer and 53,000 deaths reported globally; breast cancer accounts for 15 million disability-adjusted life years (DALYs) worldwide (Mekonnen, 2020).

Breast cancer represents a significant global health concern for women in Saudi Arabia (Almohanna et al., 2025). Each woman can perform a

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cost-effective, convenient, painless, easy-to-apply, private, safe, and noninvasive screening method known as breast self-examination for early detection of breast cancer (Ahmed and Shrief, 2019). Regularly conducting Breast Self-Examination (BSE) by women in SSA can lead to the early and convenient detection of any breast changes, as most early breast tumors are found by the individual themselves (Hussein et al., 2023). Healthcare workers must lead by example as role models when advising individuals on positive health behaviors. Female healthcare workers are the top role models for teaching and carrying out tasks such as breast self-examination. Moreover, female healthcare professionals play a significant role in providing beneficial health advice for women, making them effective influencers in their communities (Mekonnen, 2020).

2. Literature review

Nursing professionals, who are often at the forefront of healthcare education, have a key role in addressing this gap. Nursing-led education programs are particularly effective in equipping individuals with the knowledge and skills necessary for early cancer detection (Qurrotunnada and Rochmawati, 2026). Nurses, as healthcare providers with expertise in patient education and communication, can effectively lead such programs by delivering structured, evidence-based content, demonstrating practical techniques, and offering personalized feedback to improve participants' ability to perform BSE (Husna et al., 2019). These programs not only enhance knowledge but also empower women to take control of their health through active participation in early detection practices. Despite the importance of such initiatives, there is limited research on nursing-led BSE education programs targeted at non-medical staff, particularly in university settings. This lack of research underscores the need for targeted studies to assess the feasibility, effectiveness, and sustainability of BSE education within university environments (Alomair et al., 2020). Knowledge of BSE is central to early breast cancer detection, as it enables women to identify potential abnormalities in breast tissue that could indicate the presence of malignancy. However, knowledge alone does not translate into behavior change without appropriate practice (Albeshan et al., 2023). Practice of BSE is influenced by various factors, including the ability to perform the examination correctly, confidence in detecting abnormalities, and regular engagement with the technique. Therefore, this study will also evaluate the practical aspect of BSE, specifically assessing how well the female university staff can perform the examination after receiving the education program.

2.1. Hypotheses

To achieve the aim of the current study, the following hypotheses were postulated to be tested:

H1: There is a statistically significant difference in the pre and post interventional scores of the knowledge of the study group.
H2: There is a statistically significant difference in the pre and post interventional scores of the practice of the experimental group.

3. Methodology

3.1. Design

This study employed a quasi-experimental one group pretest posttest study. This design compares the effectiveness of an intervention on a single non-random sample of students before and after the treatment (Miller et al., 2020).

3.2. Participants and settings

Female university workers employed at Jouf University, Sakaka, Saudi Arabia, were eligible to participate if they were non-medical staff aged between 18 and 59 years and willing to take part voluntarily. The study was publicized to potential participants through email invitations sent by the university's HR department. Once identified, the authors provided potential participants with an information sheet detailing the purpose and procedure of the study. Interested participants were required to provide written consent before participating. Participants were allocated one hour of work time on the main campus to complete the Breast Self-Examination (BSE) education demonstration. The session was scheduled at various times to accommodate different work shifts, either during the morning-to-afternoon shift change or the late-to-night shift change, across weekdays and weekends. An estimated sample size of 60 female university workers was the target for recruitment to ensure sufficient data for analysis. The flow of participants through recruitment, enrollment, and follow-up is presented in Fig. 1.

3.3. Sample size calculation

The sample size for this study was determined using G*Power software (version 3.1.9.7). Based on a quasi-experimental, one-group pretest-posttest design, the calculation was performed for a Wilcoxon signed-rank test (matched pairs) to detect significant differences in knowledge and practice scores across the three evaluation periods. Assuming a medium-to-large effect size of 0.50, an alpha error probability of 0.05, and a desired statistical power of 0.80, the minimum required sample size was calculated to be 52 participants. To account for a potential 15% attrition rate during the two-month follow-up period, the final sample size was increased to 60 female non-medical staff members. This ensured sufficient statistical power to identify meaningful clinical improvements in breast self-examination proficiency following the nursing-led intervention.

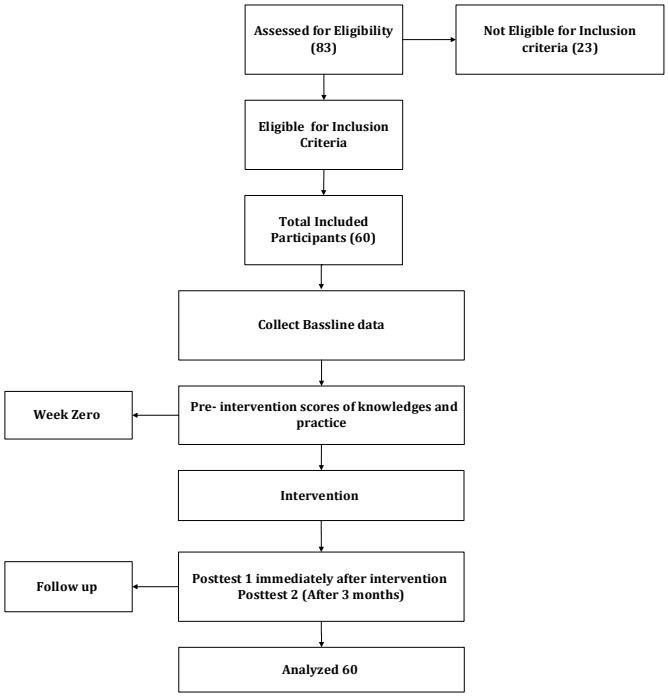


Fig. 1: Participant flow diagram

3.4. Measurements

All measures were translated from English to Arabic using a rigorous back-translation procedure. Two English professors produced an initial Arabic version, which was then back-translated by a certified translator. The original, translated, and back-translated versions were compared to ensure accuracy and cultural relevance. The final Arabic version was pilot tested on six participants not included in the main study. Feedback confirmed clarity, so no revisions were made. This process ensured the tools were appropriate and valid for the target population.

3.4.1. Part 1: Structured socio-demographic and medical background questionnaire

Based on a comprehensive review of relevant literature, a structured assessment tool was developed to collect participant data. The tool included variables such as age, gender, educational level, occupation, marital status, and place of residence. It also included health-related data such as smoking history, past and current medical conditions, surgical history, and family medical history.

3.4.2. Part 2: Knowledge assessment sheet

The knowledge assessment used a structured true/false questionnaire. Each correct answer scored 1 point, and each incorrect answer scored 0. Experts in breast cancer education reviewed the questions to ensure validity. Reliability was established through a structured scoring protocol and multi-phase testing of temporal stability. The instrument was pre-tested on a pilot group comprising 10 percent of the total sample size to check for clarity and cultural appropriateness. Internal consistency and stability were verified using the test-retest method and the Intraclass Correlation Coefficient. The tool successfully captured the significant knowledge increase from a baseline mean of 5.17 with a standard deviation of 1.74 to a post-intervention mean of 9.18 with a standard deviation of 0.43.

3.4.3. Part 3: Breast self-examination re-demonstration checklist

The BSE re-demonstration checklist assessed participants' ability to perform inspection and palpation steps. Each correct action scored 1 point, and incorrect or missed actions scored 0. Validity was ensured by aligning with National Breast Cancer Institute guidelines and expert input. Reliability and reproducibility were established through a standardized scoring protocol and expert review. Temporal stability was confirmed via repeated application. The tool captured the significant practice improvement from a baseline mean of 1.53 with a standard deviation of 2.46 to a post-intervention mean of 20.0 with a standard deviation of 5.6.

3.5. Procedure

Once official approval was obtained from the Local Committee of Bioethics (LCBE), Jouf University, an initial interview was conducted with the female who agreed to participate in the study and met the inclusion criteria. She was informed about the nature and purpose of the study, and written informed consent was obtained from those who agreed to participate; privacy and confidentiality were assured. The proposed study was conducted in four phases: assessment, planning, implementation, and evaluation.

3.5.1. Initial assessment and feasibility

The intervention began with a collaborative assessment involving the Jouf University Human Resources Department to identify eligible female non-medical staff. Feasibility was established by evaluating the readiness of potential participants through a survey assessing attitudes toward breast health education. This phase ensured that the final cohort was both available and motivated to engage in the training program.

3.5.2. Planning and instructional design

The study population was refined to include non-medical workers aged 18–59 years, excluding those with a history of breast cancer or prior specialized BSE training. Based on a literature review and Roy's Adaptation Model, a structured educational program was designed to improve knowledge and practice. Standardized tools, including a validated knowledge test and a 20-item practice checklist, were selected to ensure scientific rigor and data reliability.

3.5.3. Program implementation and delivery

Eligible participants were enrolled through an informed consent process and a private interview to collect demographic and medical data. The core intervention consisted of a nursing-led session using a professional silicone breast model. The training, which was performed by the researchers' team leader, covered visual inspection in multiple positions and palpation techniques for the breast, axillary, and supraclavicular regions. To ensure mastery, participants performed a supervised re-demonstration on the model and received real-time corrective feedback.

3.5.4. Follow-up and longitudinal evaluation

Immediate post-education evaluations were conducted to measure peak knowledge and skill acquisition. To evaluate the sustainability of these behaviors, a follow-up assessment was performed two months later. The data were analyzed using paired t-tests to determine the statistical significance of the intervention's impact, ensuring that the final conclusions were substantiated by objective evidence of long-term behavior change.

3.6. Statistical analysis of the data

The data were analyzed using IBM SPSS Statistics version 26.0. Descriptive statistics summarized both qualitative and quantitative variables. Categorical variables were reported as frequencies and percentages. Normality was checked using the Kolmogorov-Smirnov test. For normally distributed data, measures like range, mean, and standard deviation (SD) were calculated. A significance level of 0.05 was used. Pearson's correlation was used for normally distributed continuous data to assess the linear relationship between two variables. For non-parametric data, Cochran's Q test was applied for binary variables, and Dunn's post hoc test was used after ANOVA with repeated measures for pairwise comparisons across multiple related groups.

4. Results

Table 1 shows the demographic and clinical characteristics of the 60 participants. The majority (56.7 percent) were aged 31 to 43 years, followed by 44 to 56 years (36.7 percent), while the youngest group aged 18 to 30 made up only 6.7 percent. All participants resided in Sakaka. Most were married (83.3 percent), and 68.3 percent held a university degree. Employees constituted 91.7 percent of the sample. All participants were non-smokers, but nearly half (48.3 percent) reported chronic conditions. A family history of breast cancer was reported by 10 percent, with 3.3 percent specifically noting maternal history. Despite this, only 1.7 percent had ever undergone mammography.

Table 2 demonstrates a significant enhancement in theoretical knowledge following the intervention. The mean knowledge score rose from a baseline of 5.17 ± 1.74 to 9.18 ± 0.43 immediately post-test ($p < 0.001$). Although a slight attrition in knowledge was observed at the two-month follow-up (Mean = 8.53 ± 1.03), scores remained significantly higher than pre-intervention levels ($p < 0.001$).

Table 1: Demographic and medical data distribution of the studied cases (n = 60)

Variable	n	%
Age (year)		
18 – 30	4	6.7
31 – 43	34	56.7
44 – 56	22	36.7
Min – Max	25.0 – 53.0	
Mean ± SD	40.82 ± 6.15	
Residence [Sakaka]	60	100.0
Marital status		
Married	50	83.3
Single	6	10.0
Widow	1	1.7
Divorced	3	5.0
Education		
Cannot read and write	1	1.7
Can only read and write	4	6.7
Primary education	2	3.3
Lower secondary education	1	1.7
Secondary education	11	18.3
University education	41	68.3
Occupation		
Employee	55	91.7
A worker	5	8.3
Smoking		
Yes	0	0.0
No	60	100.0
Chronic diseases		
Yes	29	48.3
No	31	51.7
Family history of breast cancer		
Yes	6	10.0
No	54	90.0
Previous breast examinations		
Yes [mammogram]	13	21.7
No	47	78.3

Table 3 shows a significant surge in mean practice scores from 1.53 ± 2.46 at baseline to 20.0 ± 5.6 post-intervention ($p < 0.001$). While a minor

decline in proficiency was noted at the two-month follow-up (Post 2), particularly in nipple discharge inspection (6.7% "not done") and post-exam covering (11.7% "not done"), the overall practice mean remained high at 19.13 ± 0.85 ($p < 0.001$).

Table 2: Distribution of the studied cases according to score for knowledge (n = 60)

Measure/statistic	Pre-test	Immediately post-test	2-month follow-up	F	Overall p-value
Total score (0–10): Min–max	2.0–9.0	8.0–10.0	5.0–10.0	—	—
Total score (0–10): Mean ± SD	5.17 ± 1.74	9.18 ± 0.43	8.53 ± 1.03	167.183*	<0.001*
Average score (0–1): Mean ± SD	0.52 ± 0.17	0.92 ± 0.04	0.85 ± 0.10	—	—
Post hoc p-value vs. pre-test	—	0.001*	0.001*	—	—

SD: Standard deviation; F: Repeated-measures ANOVA F-statistic; Post hoc comparisons were conducted using the Bonferroni test; The post hoc p-values are presented for comparisons of the pre-test with each subsequent assessment; *: Statistically significant at $p \leq 0.05$

Table 3: Distribution of the cases studied according to breast self-examination re-demonstration checklist (n = 60)

Measure/statistic	Pre-test	Immediately post-test	2-month follow-up	F	Overall p-value
Total score (0–20): Min–max	0.0–8.0	20.0–20.0	17.0–20.0	—	—
Total score (0–20): Mean ± SD	1.53 ± 2.46	20.0 ± 5.6	19.13 ± 0.85	2971.160*	<0.001*
Average score (0–1): Mean ± SD	0.08 ± 0.12	1.0 ± 0.2	0.96 ± 0.04	—	—
Post hoc p-value vs. pre-test	—	< 0.001*	< 0.001*	—	—

*: Statistically significant at $p \leq 0.05$

5. Discussion

This study validates that a structured BSE demonstration is effective in enhancing knowledge and practice among female employees. One remarkable thing that emerged from the study was that 91.7% of participants had a previous awareness of the effectiveness of BSE in detecting breast cancer; however, no one had tried it previously. This is a significant awareness-practice gap that needs to be explored more deeply than being mentioned superficially. There are several possible reasons. Firstly, the value of BSE is a passive piece of knowledge which may not give a woman the procedural expertise, or knowledge of how to perform it effectively, and our pre-intervention data, which revealed low technique scores, bears this out. Second, psychological and cultural barriers could exist even when the knowledge is present, reducing practice: discomfort with touching one's own breasts, embarrassment, or fear of finding an abnormality or what it means could all act as barriers to practice independently of knowledge. Third, the lack of a habit routine (the other health programs have monthly cues or reminders, for example, to remind women to take their medication) could be the reason that even women who are motivated never follow through with the behavior and thus never get their medications taken. This study has not incorporated the qualitative interviews nor the structured barriers questionnaire, meaning that we are unable to establish which of these mechanisms prevails in this population, which is an explicit limitation of this study.

Similar to the results of Akhtari-Zavare et al. (2014) and Somdatta and Baridalyne (2008), who also found high awareness but low actual practice of BSE. It is not just a knowledge gap, as psychological factors like not wanting to touch the breast or fear of finding an abnormality appear to have more influence on not getting low-risk screening than knowledge, and were not specifically explored in this study but warrant further qualitative research.

This difference is influenced by social factors in various ways in different groups of people. BSE information was found to be dominated by peers and media by Manisha and Kaphle (2023), but the source was found to be healthcare providers by Conte et al. (2023). The contrast may be because of access to health care or because of cultural norms related to discussing breast health; it suggests that family and community networks have an impact on encouraging breast self-examination, which may indicate that informal, peer-level education is a channel that could be utilized.

A particularly unexpected finding was that despite roughly two-thirds of participants holding a university education, baseline knowledge of correct BSE technique remained poor. This contrasts with the general assumption, supported by Mihret et al. (2021), that higher education predicts better health knowledge. A plausible explanation is that general educational attainment does not necessarily include exposure to specific reproductive or breast health curricula; formal schooling in this context may not substitute for targeted health education. This points to a need for embedding BSE-specific content into broader health curricula rather than assuming that general literacy will translate into practical health skills.

The marked improvement in correct technique after a single demonstration aligns with similar pre/post intervention studies (Abo Al-Shiekh et al., 2021; Almeshari et al., 2023), reinforcing that skills-based, hands-on demonstration is more effective than awareness campaigns alone. However, the decline in performance scores at follow-up was an unexpected finding worth highlighting: it suggests that a single training session, while effective short-term, may not be sufficient for skill retention, and that periodic reinforcement may be necessary a consideration not always addressed in comparable intervention studies. It is also possible that performance during supervised demonstration on a silicone model overestimated participants' true competence, since being observed may have encouraged more careful technique than would occur during unsupervised, real-life self-examination. In the study group, over half of the female participants showed an increase in knowledge following the intervention. Additionally,

the women's performance in BSE improved following the intervention. Yeshitila et al. (2021) found comparable results in their meta-analysis on Breast self-examination practice and factors influencing it among Ethiopian women. Numerous studies have found that teaching young women about health promotion increases their knowledge and improves their performance in performing breast self-exams (Ahmed and Shrief, 2019).

5.1. Limitations

This study offers valuable insights into the impact of breast self-examination (BSE) demonstrations on knowledge and practice among female university workers; however, several limitations should be acknowledged. The quasi-experimental, one-group pretest-posttest design, without a control group, limits the ability to establish causal relationships and introduces potential threats to internal validity, such as testing effects and participant maturation; other concurrent influences cannot be ruled out, and causal claims should be interpreted with caution. This needs to be studied in the future using a randomized controlled design or at least a non-equivalent control group. The use of a convenience sample from a single university in Sakaka, Saudi Arabia, may also limit the generalizability of the findings to broader populations, including women from different cultural backgrounds, age groups, or occupational settings.

The relatively short follow-up period of two months constrains the ability to assess long-term retention of knowledge and sustained behavioral change. Additionally, the reliance on self-reported adherence and observed re-demonstration may be subject to social desirability bias, particularly due to the individualized, researcher-administered format. The study exclusively targeted non-medical female employees, excluding participants with prior exposure to BSE education or clinical training. While this provided a more uniform sample, it restricts the ability to compare outcomes across groups with varying baseline knowledge or health literacy levels. Future research incorporating a control group, longer follow-up, and validation of skills beyond a simulated model is needed to strengthen these conclusions.

6. Conclusions

The research found that educating women on BSE results in improved understanding and implementation of related practices. University females have the ability to carry out this straightforward, budget-friendly, and successful method on their own. Similar training programs should be put in place in comparable environments. Increasing awareness about breast cancer, early diagnosis, and BSE practice, as well as utilizing media platforms like television, magazines, and newspapers are crucial in educating the public and promoting information about breast cancer and BSE practice.

List of abbreviations

ANOVA	Analysis of variance
BSE	Breast self-examination
DALYs	Disability-adjusted life years
F	F-statistic (repeated-measures ANOVA)
HR	Human resources
IBM	International Business Machines
LCBE	Local Committee of Bioethics
p	Probability value
SD	Standard deviation
SPSS	Statistical Package for the Social Sciences
SSA	Sub-Saharan Africa

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Compliance with ethical standards

Ethical considerations

Ethical approval was btained from The Local Committee of Bioethics (LCBE), Jouf University NO (6-04-45). All procedures involving human participants were conducted in accordance with the ethical standards of the institutional and/or national research committee, and with the 1964 Helsinki Declaration and its later amendments.

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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