Research Article

Knowledge, Awareness, and Attitudes Toward Breast Cancer Prevention and Early Detection Among Saudi Pharmacists in Jeddah, Saudi Arabia: A Cross-Sectional Study

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Abstract

Background: Breast cancer remains the most frequently diagnosed cancer among females worldwide. It is the main cause of cancer-related deaths. Early detection using appropriate screening and timely management is among the most effective approaches for reducing mortality. Pharmacists have a unique position to encourage breast cancer prevention and early detection because of their accessibility. However, their readiness for this role in Saudi Arabia is insufficiently examined. Objective: This study aimed to assess the knowledge, awareness, and attitudes related to breast cancer prevention and early detection among Saudi pharmacists, and to examine the relationships between these variables. Methods: A cross-sectional study carried out between October 2025 and March 2026 among Saudi pharmacists in Jeddah. Participants were selected using a stratified convenience method. Data were obtained through a structured, self-administered questionnaire. Data were statistically using SPSS version 26 through independent t-test, one-way ANOVA, Pearson's correlation, and multivariable linear regression. Statistical significance was set at p-value < 0.05. Results: Among the 208 pharmacists who participated in the study, the mean knowledge score was relatively high (79.4%), while the mean awareness score was lower (53.8%). Attitudes were relatively positive, with a mean score of 3.80 out of 5. Previous breast cancer-related training was significantly associated with knowledge, awareness, and attitude scores ($p < 0.001$). Knowledge and awareness were positively correlated ($r = 0.185$, $p = 0.008$) and awareness and attitudes showed moderate positive correlation ($r = 0.474$, $p < 0.001$). In contrast, knowledge and attitudes were not significantly correlated. Several barriers were reported that restrict pharmacists' participation in patient counseling and breast cancer early detection activities, especially lack of time (48.6%), and lack of cultural sensitivity (43.3%). Conclusion: Saudi pharmacists demonstrated sufficient knowledge and positive attitudes toward breast cancer prevention and early detection, whereas their awareness regarding the practical aspects was low. Reported barriers may limit their effective engagement in preventive activities. The significant association between previous breast cancer-related training and knowledge, awareness, and attitudes highlights targeted training as a potentially important strategy for strengthening pharmacists' contribution to preventive health services.

Keywords: Breast Cancer; Early Detection of Cancer; Pharmacists; Health Knowledge; Attitudes of Health Personnel.

1. Introduction

Breast cancer represents the most frequently diagnosed cancer affecting females globally, with 2.3 million new cases recorded annually. Breast cancer is the main cause of cancer-related deaths (Sung et al., 2021). Although diagnostic techniques and therapy methods have been improved considerably, early detection remains the most effective method to reduce cancer-related deaths. Methods of screening such as mammography and clinical breast examination as well as breast awareness contribute to early diagnosis and treatment efficiency when used appropriately (World Health Organization, 2023). However, breast cancer prevention and early detection depend not only on the availability of screening tests but also on the involvement of healthcare providers in preventive measures and patient education.

Healthcare professionals have an essential role in preventive pathways and early diagnosis. Pharmacists have a unique position among healthcare providers capable of facilitating breast cancer prevention and early detection. During the last two decades, pharmacists' role has transformed from solely dispensing medications to conducting health promotion and patient education and participating in disease prevention (Mossialos et al., 2015; Sendall et al., 2018). Thus, pharmacists' position allows them to raise breast cancer awareness and to promote screening examinations

among patients. However, evidence from previous research reported that some healthcare professionals, including pharmacists, may not have sufficient knowledge of breast cancer or may experience challenges in applying their knowledge in routine practice. Earlier studies have reported that pharmacists generally demonstrate adequate understanding of breast cancer risk factors and clinical presentations, although gaps remain regarding awareness of screening recommendations and preventive counseling (Mensah et al., 2018; Momenimovahed & Salehiniya, 2019; Oqal et al., 2022). Moreover, although pharmacists usually display positive attitudes towards participation in health promotion activities, their actual practices may be affected by such factors as lack of training and integration into the healthcare system (Ayoub et al., 2021; Buhl et al., 2023; Shawahna & Awawdeh, 2021).

In the Middle East, the role of pharmacists in breast cancer prevention and early diagnosis is not fully explored. Studies showed generally positive attitudes among pharmacists toward engaging in breast cancer awareness and health promotion. However, significant gaps in knowledge remain, further supporting the need for additional training (El Hajj & Hamid, 2013; Shawahna & Awawdeh, 2021). In Saudi Arabia, the majority of published studies were limited to awareness among women and barriers to screening uptake. Conversely, few studies have examined the extent to which healthcare providers are ready to provide preventive education (Alqahtani et al., 2020; Elobaid et al., 2014). This gap is particularly relevant in the Saudi context, where delayed presentation and limited participation in breast cancer screening remain important public health concerns.

Importantly, previous research frequently evaluated knowledge and attitudes as distinct constructs without adequately examining the role of practical awareness in translating knowledge into professional engagement. The Knowledge–Attitude–Practice (KAP) model hypothesizes that knowledge forms the basis of attitudes, which subsequently influence practice (Launiala, 2009). However, this relationship may be more complex, particularly when practical awareness of healthcare processes is considered. Such awareness may include familiarity with screening guidelines, referral pathways, educational resources, workplace policies, and available preventive services, and may represent an important component of pharmacists' readiness to engage in breast cancer prevention and early detection. However, evidence examining knowledge, awareness, and attitudes together among pharmacists in Saudi Arabia appears to be limited. Furthermore, few studies have examined the relationships among these constructs within a single analytical framework. Therefore, this study was designed to assess the knowledge, awareness and attitudes among Saudi pharmacists regarding breast cancer prevention and early detection, and to examine the relationships among these variables and their associations with the sociodemographic and professional characteristics. The present study extends previous research by exploring awareness as a distinct construct, specifically referring to practical awareness of healthcare processes that may influence the translation of knowledge into professional engagement in breast cancer prevention and early detection.

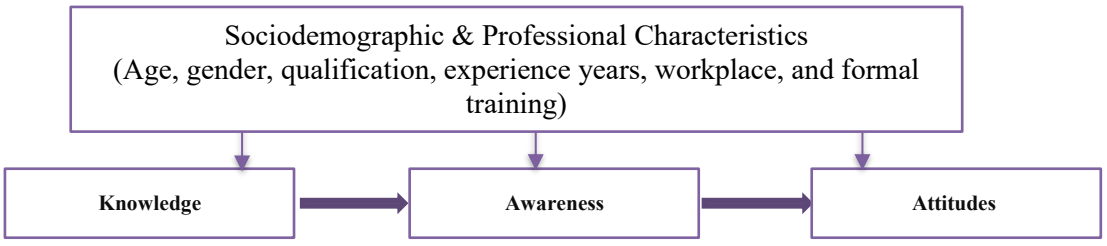

Figure 1. Conceptual framework illustrating the hypothesized associations between pharmacists' characteristics, knowledge, awareness, and attitudes toward breast cancer prevention and early detection.

2. Materials And Methods

Study Design and Setting

A cross-sectional study was conducted among licensed Saudi pharmacists working in community and hospital pharmacy setting in Jeddah city, Saudi Arabia, between October 2025 and March 2026. The study assessed pharmacists' knowledge, awareness, and attitudes regarding breast cancer prevention and early detection and examined their associations with sociodemographic and professional characteristics.

Study Population and Sampling

The study population included licensed Saudi pharmacists working in community and hospital pharmacy settings in Jeddah, Saudi Arabia. The Raosoft sample size calculator was used to calculate sample size based on an estimated population size of 400 pharmacists, a 95% confidence level, a 5% margin of error, and response distribution of 50%. The calculated sample was 197 individuals, a total of 208 pharmacists completed the questionnaire which exceeded the required sample size. A stratified convenience sampling approach was used, with pharmacists stratified by practice setting into hospital and community pharmacies. Participants were then recruited from both groups to include pharmacists from both major pharmacy practice settings.

Inclusion and exclusion criteria

The inclusion criteria were licensed Saudi pharmacists currently working in community or hospital pharmacies in Jeddah, Saudi Arabia. The exclusion criteria were non-Saudi pharmacists and pharmacists who were not currently working in community or hospital pharmacy settings.

Data Collection Tool

A structured, self-administered questionnaire was used for data collection. The questionnaire was developed based on a review of the literature on pharmacists' roles in cancer prevention and health promotion (Al-Shamsi et al., 2023; Egbewande et al., 2022; Ehsan et al., 2021; K. Mensah et al., 2018). The questionnaire was adapted to ensure clarity and cultural relevance to the Saudi context. It was available in both English and Arabic using a forward–backward translation method. The final questionnaire included five sections covering sociodemographic and professional characteristics, knowledge of breast cancer risk factors and early detection (12 items), awareness of screening recommendations and referral pathways (6 items), attitudes toward pharmacists' role in breast cancer prevention and early detection (9 items), as well as barriers and training needs.

Validity and Reliability of Study Tool

Content validity was assessed by experts with prior experience in pharmacy practice and public health research. The experts evaluated the relevance and clarity of the questionnaire items, and revisions were made accordingly. Face validity was assessed through a pilot test involving 10 pharmacists to evaluate the clarity and comprehensibility of the questionnaire. Those who involved in the pilot study were not included in the final study analysis. The internal consistency reliability was assessed using Cronbach's alpha. Values of ≥0.70 were considered satisfactory for internal consistency; however, the knowledge scale was interpreted with caution because its items covered heterogeneous aspects of breast cancer knowledge.

Variables and Scoring

Knowledge, awareness, and attitude scores were treated as the main outcome variables, while sociodemographic and professional characteristics were considered explanatory variables. Items in knowledge questions were coded as ("correct" =1) and ("incorrect" or "don't know" = 0). Total scores range between 0-12 scores and expressed as percentages. Awareness items were coded as "yes" (1) and "no/unsure" (0). Total scores of awareness ranged between 0-6 scores and expressed as percentages. Attitudes items were coded using a 5-point Likert scale (1= strongly disagree) to (5= strongly agree) across 9 items. A total attitudes score was calculated (range: 9–45), and the mean attitude scores were calculated (range:1 -5). For descriptive interpretation, knowledge and awareness scores were grouped under three categories as follows: low (<50%), moderate (50–75%), and high (>75%). For attitude scores, interpretation was made based on the mid-point of the scale (3). Mean attitude scores >3 were considered positive, scores <3 were considered negative, and a score of 3 represented a neutral attitude.

Data Collection

The questionnaire was distributed electronically to eligible pharmacists during the study period. The participation was entirely voluntary, and electronic informed consent was obtained before participation. Responses were collected anonymously, with no identifiable personal information recorded. In addition, the electronic questionnaire was designed to ensure that all questions were answered before submission, so that there were no missing or partially completed responses for analysis.

Statistical analysis

The data collected were statistically analyzed by SPSS version 26 using descriptive and inferential analysis. Sociodemographic characteristics of the participants and study variables were summarized descriptively. Means and standard deviations were used for continuous data, and frequencies and percentages were used for categorical data. Normality was assessed using the Shapiro–Wilk test and graphs (histograms and Q–Q plots). Since the sample size was relatively large (n=208) and the distributions were close to normal (checked using skewness, kurtosis, and graphical methods), parametric tests were used. Independent-samples t-tests and one-way ANOVA were used to examine differences in mean scores across categorical participant characteristics.

Multivariable linear regression models were used to reveal independent predictors associated with knowledge, awareness, and attitudes scores. Regression coefficients (B), 95% confidence intervals (CIs), and p-values were reported. The assumptions of multiple regression, normality of the residuals, linearity, homoscedasticity and absence of multicollinearity, were validated before interpretation of the results. Pearson's correlation was applied to examine the correlation between knowledge, awareness, and attitudes. Statistical significance was set at p-value < 0.05.

Ethical considerations

Permission to conduct the study was obtained from Lincoln University College through an official institutional memorandum prior to data collection. The participation was entirely voluntary and electronic informed consent was obtained from all participants at the beginning of the questionnaire. No identifiable personal data was collected, and confidentiality and anonymity were preserved throughout the study.

Results

Characteristics of Participants

The final analysis included 208 Saudi pharmacists. Data completeness was confirmed for all questionnaires, with no missing responses or duplicate records. The majority of study sample were young adults, with 78.9% aged between 20-39 years. Female pharmacists accounted for 57.7% of the sample. Regarding academic qualifications, a Bachelor of Pharmacy (B.Pharm) was the predominant qualification (43.3%), followed by PharmD (36.5%). Community pharmacists represented 66.3% of the participants, and 67.8% of them had five years or less of professional experience. More than half of the pharmacists (52.9%) reported having no formal training related to cancer prevention or early detection (Table 1).

Table 1. Socio-demographic and professional characteristics of the pharmacists (n = 208)

Variables	Category	Number	Percentage %
Age	20-29 years	95	45.7
	30-39 years	69	33.2
	40-49 years	37	17.8
	≥50 years	7	3.4
Gender	Male	88	42.3
	Female	120	57.7
Highest qualification	B. Pharm	90	43.3
	PharmD	76	36.5
	MSc	31	14.9
	PhD	11	5.3
Professional experience period	<2 years	66	31.7
	2-5 years	75	36.1
	6-10 years	27	13.0

	11-15 years	21	10.1
	>15 years	19	9.1
Current primary workplace	Community pharmacy	138	66.3
	Hospital pharmacy	70	33.7
Formal training related to cancer prevention/early detection	No	110	52.9
	Yes	98	47.1

Reliability of Study Tool

The study tool reliability was determined using Cronbach's alpha. The awareness (α = 0.740) and attitudes (α = 0.781) which consider satisfactory internal consistency. While the knowledge scale showed (α= 0.644), this value can be considered acceptable because the questions covered different aspects of breast cancer knowledge rather than a single concept, so the lower internal consistency was expected. Since the questions were in dichotomous form, the use of Cronbach's alpha was considered to be appropriate, and it is equivalent to KR-20.

Pharmacists' Knowledge of Breast Cancer

The mean knowledge score was 9.53 (SD = 1.99) out of 12. Most participants showed moderate to high levels of knowledge of breast cancer (Table 2). Knowledge levels varied across the assessed items. Most of the participants correctly recognized the role of factors like family history (94.2%), physical activity (93.3%), alcohol consumption (91.8%), post-menopausal weight gain (90.4%), and male breast cancer (88.9%). In contrast, there were few participants who could answer correctly regarding the need for breast self-examination as a way for decreasing breast cancer mortality (54.3%) and genetic testing (62.0%) and that early diagnosis ensures recovery (39.9%).

Pharmacists' Awareness of Breast Cancer

The mean awareness score was 3.23 (SD = 1.94) out of 6. Overall, awareness of practical aspects related to breast cancer early detection and preventive measures was lower than the level of knowledge (Table 2). Higher awareness was reported for recommended screening age (64.4%) and national screening recommendations (62.0%). Lowest levels of awareness were seen with regard to mammography referral pathways (42.8%) and availability of Arabic educational materials (40.4%).

Table 2. Reliability, descriptive statistics, and distribution of scores among pharmacists (n = 208)

Variable	Scale structure	Cronbach's α	Mean ± SD	Overall Score	Distribution of score levels, n (%)		
					Low, n (%)	Moderate, n (%)	High, n (%)
Knowledge	12 dichotomous items	0.644	9.53 ± 1.99	79.4%	7 (3.4)	88 (42.3)	113 (54.3)
Awareness	6 dichotomous items	0.740	3.23 ± 1.94	53.8%	82 (39.4)	67 (32.2)	59 (28.4)
Attitudes	9 Likert-type items	0.781	34.19 ± 5.55	3.80 /5	—	—	—

Pharmacists' Attitudes toward Breast Cancer

The mean total attitudes score was 34.19 (SD = 5.55) out of 45. The mean item score was 3.80 out of 5, indicating generally positive attitudes toward prevention and early detection of breast cancer (Table 2). Higher agreement was reported for professional responsibility (mean = 4.03), cultural sensitivity (mean = 4.01), and the role of pharmacists in influencing screening uptake (mean = 3.96). Lower agreement was reported for the availability of sufficient time for patient counseling (mean = 3.23) (Table 3).

Table 3. Distribution of responses according to attitudes statements

No.	Attitudes statement	Strongly disagree n (%)	Disagree n (%)	Neutral n (%)	Agree n (%)	Strongly agree n (%)	Mean ± SD
1	Pharmacists have a professional responsibility to educate patients	2 (1.0)	7 (3.4)	49 (23.6)	74 (35.6)	76 (36.5)	4.03 ± 0.91

No.	Attitudes statement	Strongly disagree n (%)	Disagree n (%)	Neutral n (%)	Agree n (%)	Strongly agree n (%)	Mean ± SD
2	Confident in providing basic breast-health advice	9 (4.3)	29 (13.9)	49 (23.6)	69 (33.2)	52 (25.0)	3.61 ± 1.13
3	Discussing breast cancer requires cultural sensitivity and caution	5 (2.4)	18 (8.7)	31 (14.9)	69 (33.2)	85 (40.9)	4.01 ± 1.06
4	Pharmacists can positively influence uptake of screening	4 (1.9)	9 (4.3)	49 (23.6)	76 (36.5)	70 (33.7)	3.96 ± 0.96
5	Would participate in awareness events if employer supported it	3 (1.4)	10 (4.8)	59 (28.4)	75 (36.1)	61 (29.3)	3.87 ± 0.94
6	There is sufficient time in routine practice to counsel patients	15 (7.2)	46 (22.1)	60 (28.8)	50 (24.0)	37 (17.8)	3.23 ± 1.19
7	Willing to undertake additional training	4 (1.9)	18 (8.7)	56 (26.9)	79 (38.0)	51 (24.5)	3.75 ± 0.99
8	Workplace should include breast cancer awareness in routine public health services	4 (1.9)	8 (3.8)	50 (24.0)	72 (34.6)	74 (35.6)	3.98 ± 0.96
9	Hospital and community pharmacists have different opportunities to contribute	5 (2.4)	19 (9.1)	54 (26.0)	74 (35.6)	56 (26.9)	3.75 ± 1.03
Note. The total attitude score was computed by summing the nine items without reverse coding.							

Perceived Barriers and Training Needs

The most frequently reported barriers that may restrict pharmacists' participation in breast cancer early detection and patient counseling, including lack of time 48.6%, cultural sensitivity 43.3%, patient disinterest 37.5%, and lack of organizational support 35.6%. The most preferred training methods were certification courses 42.8%, online learning modules 38.9%, and short continuing professional development (CPD) workshops 38.5%. The most commonly requested training topics were communication about breast self-examination 56.7%, screening guidelines 46.2%, and breast cancer risk factors 40.9%.

Association Between Participants' Characteristics and Study Variables

Bivariate analyses and multiple regression analyses were used to assess the associations between participants' characteristics and study variables. The assumptions of linear regression were tested and satisfied. No evidence of multicollinearity or influential outliers was observed.

Association with Knowledge

In the bivariate level, formal training was the only variable significantly associated with knowledge scores ($p < 0.001$), with moderate effect size ($d=0.520$). In the multivariable linear regression model ($R^2 = 0.159$; adjusted $R^2 = 0.103$; $p < 0.001$), the adjusted R^2 indicated that the model explained 10.3% of the variance in knowledge scores after adjustment (Table 4). Formal training remained a significant positive predictor of knowledge scores in the adjusted model (B=1.32, [95% CI 0.73-1.91], p<0.001). Pharmacists aged 40-49 years had significantly higher knowledge compared to the reference group (p=0.021), while hospital pharmacists had significantly lower knowledge scores compared to community pharmacists (p = 0.010). Overall, the formal training showed the strongest association with knowledge scores among examined variables.

Table 4. Association between participant characteristics and knowledge scores

Predictor	Category / comparison	B	SE	95% CI	p-value
Age	20 - 29 years (Reference)				
	30-39 years	0.28	0.36	[-0.43, 0.99]	0.439
	40-49 years	1.28	0.55	[0.20, 2.36]	0.021
	≥50 years	0.36	0.99	[-1.59, 2.31]	0.714
Sex	Female (Reference)				
	Male	0.23	0.27	[-0.31, 0.77]	0.400
Qualification	B.Pharm (Reference)				

	PharmD	-0.29	0.32	[-0.92, 0.35]	0.374
	MSc	0.53	0.44	[-0.34, 1.40]	0.229
	PhD	0.26	0.66	[-1.05, 1.57]	0.693
Experience	<2 years (Reference)				
	2-5 years	0.29	0.34	[-0.38, 0.96]	0.393
	6-10 years	0.13	0.54	[-0.93, 1.19]	0.814
	11-15 years	-0.64	0.65	[-1.91, 0.64]	0.325
	>15 years	-0.51	0.80	[-2.09, 1.07]	0.522
Workplace	Community pharmacy (Reference)				
	Hospital pharmacy	-0.98	0.38	[-1.72, -0.24]	0.010
Formal training	No (Reference)				
	Yes	1.32	0.30	[0.73, 1.91]	<0.001
Note. *SE: Standard error, Knowledge score range = 0 - 12. Positive coefficients indicate higher knowledge scores relative to the stated reference group.*					

Association with Awareness

In the bivariate analysis, awareness scores were significantly associated with qualification (p=0.004), experience (p=0.004), workplace (p<0.001), and formal training (p<0.001), with small to moderate effect sizes (η^2 = 0.037-0.073; d = 0.174-0.811). In the multivariable linear regression model (R^2 = 0.231; adjusted R^2 = 0.179; p < 0.001), the adjusted R^2 indicated that the model explained 17.9% of the variance in awareness scores after adjustment (Table 5), formal training remained the only independent predictor of awareness scores (B = 1.35, [95% CI 0.80-1.90], p < 0.001).

Table 5. Association between participant characteristics and awareness scores

Predictor	Category / comparison	B	SE	95% CI	p-value
Age	20 - 29 years (Reference)				
	30-39 years	0.47	0.34	[-0.19, 1.13]	0.162
	40-49 years	0.74	0.51	[-0.26, 1.75]	0.146
	≥50 years	-0.28	0.92	[-2.09, 1.54]	0.764
Sex	Female (Reference)				
	Male	0.22	0.26	[-0.29, 0.72]	0.395
Qualification	B.Pharm (Reference)				
	PharmD	0.47	0.30	[-0.12, 1.06]	0.119
	MSc	0.06	0.41	[-0.75, 0.87]	0.884
	PhD	0.82	0.62	[-0.39, 2.04]	0.184
Experience	<2 years (Reference)				
	2-5 years	0.62	0.32	[-0.01, 1.24]	0.054
	6-10 years	0.38	0.50	[-0.61, 1.37]	0.447
	11-15 years	0.59	0.60	[-0.59, 1.78]	0.326
	>15 years	0.20	0.75	[-1.28, 1.67]	0.792
Workplace	Community pharmacy (Reference)				
	Hospital pharmacy	0.37	0.35	[-0.32, 1.06]	0.295
Formal training	No (Reference)				
	Yes	1.35	0.28	[0.80, 1.90]	<0.001
Note. *Awareness score range = 0 - 6. Positive coefficients indicate higher awareness scores relative to the stated reference group.*					

Association with Attitude Scores

In bivariate analysis, attitude scores were significantly associated with qualification (p=0.002) and formal training (p<0.001), with moderate effect sizes (η^2 = 0.071; d = 0.594). In the multivariable linear regression analysis (R^2 = 0.175; adjusted R^2 = 0.120; p < 0.001), the adjusted R^2 indicated that the model explained 12.0% of the variance in attitude scores after adjustment (Table 6). Formal training remained a significant positive predictor of attitude scores (B = 3.09, [95% CI 1.46-4.72], p < 0.001). Moreover, pharmacists who had PharmD (p=0.025), MSc (p=0.042), and PhD (p=0.015)

qualifications were statistically significantly more likely to have higher attitude scores than those with B.Pharm qualifications.

Table 6. Association between participant characteristics and attitude scores

Predictor	Category / comparison	B	SE	95% CI	p-value
Age	20 - 29 years (Reference)				
	30-39 years	1.55	0.99	[-0.41, 3.51]	0.121
	40-49 years	2.28	1.51	[-0.69, 5.26]	0.132
	≥50 years	-0.35	2.72	[-5.72, 5.02]	0.899
Sex	Female (Reference)				
	Male	1.10	0.75	[-0.39, 2.59]	0.146
Qualification	B.Pharm (Reference)				
	PharmD	2.00	0.88	[0.26, 3.74]	0.025
	MSc	2.48	1.21	[0.09, 4.86]	0.042
	PhD	4.47	1.83	[0.87, 8.07]	0.015
Experience	<2 years (Reference)				
	2-5 years	0.83	0.94	[-1.02, 2.68]	0.378
	6-10 years	-1.37	1.48	[-4.29, 1.54]	0.354
	11-15 years	-1.37	1.78	[-4.88, 2.14]	0.441
	>15 years	-3.51	2.21	[-7.87, 0.84]	0.113
Workplace	Community pharmacy (Reference)				
	Hospital pharmacy	0.23	1.04	[-1.82, 2.28]	0.825
Formal training	No (Reference)				
	Yes	3.09	0.83	[1.46, 4.72]	<0.001

Note. *Attitudes score range = 9 - 45. Positive coefficients indicate more positive attitudes relative to the stated reference group*.

Correlation Between Knowledge, Awareness, and Attitudes

A statistically significant but very weak positive correlation was reported between knowledge and awareness scores (r=0.185, p=0.008). No statistically significant correlation was found between knowledge score and attitudes score (r=0.052, p=0.453). A moderate and statistically significant positive correlation was reported between awareness and attitude scores (r = 0.474, p < 0.001) (Table 7). Overall, awareness was more strongly correlated with attitudes than knowledge.

Table 7. Pearson correlation coefficients between the study variables

Variable pair	Pearson's r	p-value	Direction	Interpretation
Knowledge and awareness	0.185	0.008	Positive	Very weak
Knowledge and attitudes	0.052	0.453	Positive	Very weak / not significant
Awareness and attitudes	0.474	<0.001	Positive	Moderate
Note. Pearson's r values range from -1 to +1. Because the matrix is symmetrical, each pair is reported once only.				

Hypothesis testing

The study hypotheses were partially supported. Formal training was significantly associated with knowledge, awareness, and attitudes. In addition, knowledge was also associated with age and workplace, while attitudes were additionally associated with qualification. Correlation analysis showed significant association between knowledge and awareness, and between awareness and attitudes; but not between knowledge and attitudes.

Discussion

The present study explored a comprehensive evaluation of Saudi pharmacists' readiness regarding breast cancer prevention and early detection in terms of their knowledge, awareness, and attitudes and the correlation between these variables and their associations with sociodemographic and professional characteristics. The results showed relatively good knowledge (79.4%), moderately positive attitudes (3.80/5), whereas awareness was comparatively

lower (53.8%). This suggests a potential gap between theoretical knowledge and preparedness for practical engagement. Delayed diagnosis and low screening uptake may contribute to poorer breast cancer outcomes, particularly where access to early detection is limited (Heer et al., 2020; Hoq et al., 2024). Despite growing awareness of breast cancer in Saudi Arabia, participation in screening programs still poorly utilized(Alotaibi et al., 2018; Alqahtani et al., 2020; Elobaid et al., 2014), indicating the importance of involving pharmacists due to their accessibility.

The relatively high knowledge levels shown in this study are similar to findings of other regional studies in which pharmacists had adequate knowledge of breast cancer risk factors and preventive methods (Alzahrani et al., 2025; Shawahna & Awawdeh, 2021). Item level analysis further shows that there is significant variance. In particular, pharmacists have shown good knowledge of common risk factors; but their knowledge decreases in more specialized items like breast self-examination (54.3%), early detection and treatment (39.9%) and genetic testing (62.0%). This variation suggests that pharmacists were more familiar with general concepts than with specific aspects of screening practice. Similar patterns have been reported in previous studies which showed that health professionals are generally aware but poorly understand screening guidelines and preventive counseling practices (Mensah et al., 2018; Momenimovahed & Salehiniya, 2019). Thus, general knowledge assessments may present an inaccurate picture of professional readiness because there is a need for a distinction between having information and using it appropriately in clinical practice.

The awareness was found to be the most limited variable. Pharmacists showed lower awareness regarding the practical elements of breast cancer prevention including referral of patients for mammography (42.8%) and patient education tools (40.4%). Such outcomes may reflect low involvement of professionals in the routine preventive care rather than lack of relevant factual knowledge. Moreover, they may be related to organizational features of pharmacy practices since pharmacists are not included in the formal process of breast cancer screening programs. Thus, it limits their involvement in the process of experiential learning. Distinguishing between knowledge and awareness helps explain these findings. Knowledge represents the theoretical information about diseases while awareness stands for familiarity with the practical context of this knowledge. The differentiation between the terms may help to explain the observed gap between pharmacists' knowledge and attitudes and support awareness as a meaningful construct in pharmacy practice. Findings from regional studies support that the attitudes of pharmacists towards their roles in general cancer prevention are generally consistent in various geographic settings. Their involvement depends on training, integration, availability of resources, and cultural aspects, especially within sensitive healthcare settings. Participation in preventive activities requires an understanding of the processes involved in healthcare and professional opportunities. Previous research reported that those who understand the healthcare processes and structures are more likely to become actively involved in preventive and screening programs (Anderson et al., 2019; Mossialos et al., 2015). These findings suggest that higher knowledge alone may not necessarily be accompanied by more positive attitudes.

Regarding attitudes, pharmacists showed generally positive attitudes toward their role in breast cancer preventive practices. However, it seemed that the positive attitudes were based on problems faced in practice. Specifically, only 41.8% of participants reported sufficient time for patient counseling, highlighting a major barrier that may limit their involvement in preventive activities and health promotion. This suggests that the positive attitudes of pharmacists may reflect professional commitment despite practical barriers. Such situations have been observed in other areas of healthcare practice, whereby positive attitudes towards participation in preventive practices exist along with barriers like workload, insufficient time, and absence of organization support (Rosenthal et al., 2010).

The important finding of this study was the significant association between formal training and all three study outcomes: knowledge, awareness, and attitudes. Nevertheless, the relatively small proportion of variance explained by the regression models suggests that even though training is an important determinant, it might not be the sole factor that influences the preparedness of pharmacists for participation in the preventive actions and early detection. Other factors such as support from the organization, workload, work environment, and integration into the healthcare system may also contribute. Pharmacists who had undergone training were more knowledgeable, aware of the processes within healthcare, and had more positive attitudes. This is similar to findings from previous studies where training was related to increased involvement in cancer prevention and health promotion activities (El Hajj & Hamid, 2013; Gharaibeh et al., 2024; K. Mensah et al., 2018). The novelty of the current research lies in the demonstration of a relationship between training and all three outcomes.

The correlation between knowledge, awareness, and attitudes score have important implications for understanding pharmacists' professional readiness. The lack of correlation between knowledge and attitudes scores does not support the assumption that indicate an increased knowledge leads to more positive attitudes. Instead, the results indicate the possibility of the knowledge-action gap – situations when knowledge does not lead to changes in attitudes and behavior. According to behavioral and implementation theories, the practices of healthcare workers are affected by various factors, including contextual and individual factors and the ability of individuals to apply recommended actions (Ajzen, 1991; Eccles et al., 2006; Godin et al., 2008). These findings are consistent with the Eades et al who demonstrated that even if pharmacists have enough knowledge concerning public health, they are less involved in practices(Eades et al., 2011). A weak but statistically significant positive correlation was observed between knowledge and awareness ($r = 0.185$, $p = 0.008$). This finding suggests that greater knowledge of breast cancer was associated with slightly higher practical awareness; however, the weak magnitude of the correlation indicates that knowledge alone may not be sufficient to ensure awareness of practical preventive and early-detection processes. In contrast, awareness score was significantly positively correlated with attitudes score ($r = 0.474$) indicates that higher practical awareness was associated with more positive attitudes. Pharmacists who are more familiar with screening pathways and healthcare processes are more likely to view their role in the situation as feasible and thus form more positive attitudes. These findings suggest that the traditional interpretation of the KAP model may not fully capture the complexity of translating knowledge into professional attitudes. This study suggest that awareness of practical aspects may represent as an intermediate construct in in the knowledge-attitude relationship. Therefore, further research using mediation analysis is warranted to understand the effect of awareness in the transition from knowledge to practice among pharmacists.

Collectively, the findings indicate that pharmacists' professional readiness may depend on several interrelated factors. While knowledge provides an important theoretical foundation, practical awareness was more strongly associated with attitudes than knowledge itself. These findings suggest that improving pharmacists' involvement in breast cancer prevention and early detection may require a multidimensional approach that extends beyond knowledge acquisition and includes targeted training and improved integration into preventive healthcare pathways.

Limitations

However, this study has several drawbacks. First, the cross-sectional design limits the ability to establish causal relationships between pharmacists' knowledge, awareness, and attitudes. The observed associations reflect correlations at a narrow period and are non-directional. Second, using of self-administered questionnaire and convenience sampling method may lead to response and selection biases, limiting the ability to generalize the results to the larger population of pharmacists in Saudi Arabia. finally, the study was performed only among Saudi pharmacists in one city, restricting the applicability of the findings to other regions with different healthcare systems where the role of pharmacists may be different. Even so these limitations, the study provides insights into pharmacists' preparedness for participation in the preventive actions and early detection of breast cancer and highlights important areas for future study and potential intervention.

Conclusion

This study found that Saudi pharmacists demonstrated relatively high knowledge and positive attitudes toward breast cancer prevention and early detection, whereas awareness of practical aspects was comparatively lower. Previous breast cancer-related training was significantly associated with higher knowledge, awareness, and attitude scores, highlighting training as a potentially important strategy for strengthening pharmacists' preparedness for preventive health services. The significant positive association between awareness and attitudes, together with the absence of a significant association between knowledge and attitudes, suggests that practical awareness may be an important component of pharmacists' professional readiness. However, these findings do not establish a mediating or causal role for awareness. Further research using longitudinal or mediation-based designs is warranted to clarify the relationships among knowledge, practical awareness, attitudes, and professional practice. Increased training and integration of pharmacists into preventive healthcare pathways may enhance their contribution to breast cancer prevention and early detection.

References

1. Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes*, *50*, 179–211. https://doi.org/10.1016/0749-5978(91)90020-T
2. Alotaibi, R. M., Rezk, H. R., Juliana, C. I., & Guure, C. (2018). Breast cancer mortality in Saudi Arabia: Modelling observed and unobserved factors. *PLoS ONE*, *13*(10). https://doi.org/10.1371/journal.pone.0206148
3. Alqahtani, W. S., Almufareh, N. A., Domiaty, D. M., Albasher, G., Alduwish, M. A., Alkhalaf, H., Almuzzaini, B., AL-Marshidy, S. S., Alfraihi, R., Elasbali, A. M., Ahmed, H. G., & Almutlaq, B. A. (2020). Epidemiology of cancer in Saudi Arabia thru 2010–2019: A systematic review with constrained meta-analysis. *AIMS Public Health*, *7*(3). https://doi.org/10.3934/publichealth.2020053
4. Al-Shamsi, S., Al-Shamsi, A., Al-Shamsi, M., Sajwani, A., Alzaabi, M. S., Al Hammadi, O., Iqbal, F., & Al-Shamsi, H. O. (2023). The Perception and Awareness of the Public about Cancer and Cancer Screening in the United Arab Emirates, a Population-Based Survey. *Clinics and Practice*, *13*(3), 701–714. https://doi.org/10.3390/clinpract13030064
5. Alzahrani, F., Alotaibi, N. S., Albishi, S. A., Alnefaie, N. M., Alharbi, A. A., Maash, S. A., Alosaimi, H. T., Fadil, H. A., & Alnezary, F. S. (2025). Pharmacists at the frontline: A cross-sectional study of knowledge, attitudes, and barriers to breast cancer screening promotion in Saudi Arabia. *Journal of Oncology Pharmacy Practice*. https://doi.org/10.1177/10781552251360206
6. Anderson, C., Zhan, K., Boyd, M., & Mann, C. (2019). The role of pharmacists in general practice: A realist review. *Research in Social and Administrative Pharmacy*, *15*(4). https://doi.org/10.1016/j.sapharm.2018.06.001
7. Ayoub, N. M., Al-Taani, G. M., Almomani, B. A., Tahaineh, L., Nuseir, K., Othman, A., & Mensah, K. B. (2021). Knowledge and Practice of Breast Cancer Screening Methods among Female Community Pharmacists in Jordan: A Cross-Sectional Study. *International Journal of Breast Cancer*, *2021*. https://doi.org/10.1155/2021/9292768
8. Buhl, C., Olsen, N. L., Nørgaard, L. S., Thomsen, L. A., & Jacobsen, R. (2023). Community Pharmacy Staff's Knowledge, Educational Needs, and Barriers Related to Counseling Cancer Patients and Cancer Survivors in Denmark. *International Journal of Environmental Research and Public Health*, *20*(3). https://doi.org/10.3390/ijerph20032287
9. Eades, C. E., Ferguson, J. S., & O'Carroll, R. E. (2011). Public health in community pharmacy: A systematic review of pharmacist and consumer views. *BMC Public Health*, *11*. https://doi.org/10.1186/1471-2458-11-582
10. Eccles, M. P., Hrisos, S., Francis, J., Kaner, E. F., Dickinson, H. O., Beyer, F., & Johnston, M. (2006). Do self- reported intentions predict clinicians' behaviour: A systematic review. *Implementation Science*, *1*(1). https://doi.org/10.1186/1748-5908-1-28
11. Egbewande, O., Abdulwasiu, M., Yusuf, R., Durojaye, A., & Ashimiyu-Abdusalam, Z. (2022). Roles of Community Pharmacists in Cancer Management. *INNOVATIONS in Pharmacy*, *13*, 6. https://doi.org/10.24926/iip.v13i3.4946
12. Ehsan, S., Aris, M., Md Nor, A., Arisha, A., Azhar, A., & Ramlee, N. A. (2021). Knowledge, Attitude and Practice of Public on Breast Cancer Screening: A Systematic Review. *Borneo Journal of Medical Sciences (BJMS)*, *15*. https://doi.org/10.51200/bjms.vi.2839
13. El Hajj, M. S., & Hamid, Y. (2013). Breast cancer health promotion in Qatar: A survey of community pharmacists' interests and needs. *International Journal of Clinical Pharmacy*, *35*(3), 376–385. https://doi.org/10.1007/s11096-010-9449-y
14. Elobaid, Y. E., Aw, T. C., Grivna, M., & Nagelkerke, N. (2014). Breast cancer screening awareness, knowledge, and practice among arab women in the United Arab Emirates: A cross-sectional survey. *PloS One*, *9*(9), e105783. https://doi.org/10.1371/journal.pone.0105783
15. Gharaibeh, L., Liswi, M., Al-Ajlouni, R., Shafei, D., & Fakheraldeen, R. E. (2024). Community Pharmacists' Readiness for Breast Cancer Mammogram Promotion: A National Survey from Jordan. *Journal of Multidisciplinary Healthcare*, *17*, 4475–4489. https://doi.org/10.2147/JMDH.S471151
16. Godin, G., Bélanger-Gravel, A., Eccles, M., & Grimshaw, J. (2008). Healthcare professionals' intentions and behaviours: A systematic review of studies based on social cognitive theories. *Implementation Science*, *3*(1). https://doi.org/10.1186/1748-5908-3-36
17. Heer, E., Harper, A., Escandor, N., Sung, H., McCormack, V., & Fidler-Benaoudia, M. M. (2020). Global burden and trends in premenopausal and postmenopausal breast cancer: A population-based study. *The Lancet Global Health*, *8*(8). https://doi.org/10.1016/S2214-109X(20)30215-1

18. Hoq, M. I., Jahan, S., Mahmud, M. H., Hasan, M. M. U., & Jakaria, M. (2024). Breast cancer screening awareness, practice, and perceived barriers: A community-based cross-sectional study among women in south-eastern Bangladesh. *Health Science Reports*, *7*(1). https://doi.org/10.1002/hsr2.1799

19. Launiala, A. (2009). How much can a KAP survey tell us about people's knowledge, attitudes and practices? Some observations from medical anthropology research on malaria in pregnancy in Malawi. *Anthropol Matters*, *11*, 1–13. https://doi.org/10.22582/am.v11i1.31

20. Mensah, K. B., Oosthuizen, F., & Bonsu, A. B. (2018). Cancer awareness among community pharmacist: A systematic review. *BMC Cancer*, *18*(1). https://doi.org/10.1186/s12885-018-4195-y

21. Mensah, K., Oosthuizen, F., & BOAMAH MENSAH, A. B. (2018). Attitude and Barriers of Community Pharmacists towards Cancer Health Promotion: A Systematic Review. *Asian Pacific Journal of Cancer Care*, *3*, 13. https://doi.org/10.31557/apjcc.2018.3.1.13

22. Momenimovahed, Z., & Salehiniya, H. (2019). Epidemiological characteristics of and risk factors for breast cancer in the world. *Breast Cancer: Targets and Therapy*, *11*. https://doi.org/10.2147/BCTT.S176070

23. Mossialos, E., Courtin, E., Naci, H., Benrimoj, S., Bouvy, M., Farris, K., Noyce, P., & Sketris, I. (2015). From "retailers" to health care providers: Transforming the role of community pharmacists in chronic disease management. *Health Policy*, *119*(5), 628–639. https://doi.org/10.1016/j.healthpol.2015.02.007

24. Oqal, M., Odeh, M., Abudalu, R., Alqudah, A., Alnajjar, R., Younes, Y. B., Al-Shawabkeh, M., & Taha, L. (2022). Assessing the knowledge, attitudes and barriers regarding health promotion of breast cancer among community pharmacists. *Future Science OA*, *8*(10). https://doi.org/10.2144/fsoa-2022-0051

25. Rosenthal, M., Austin, Z., & Tsuyuki, R. T. (2010). Are pharmacists the ultimate barrier to pharmacy practice change? *Canadian Pharmacists Journal*, *143*(1). https://doi.org/10.3821/1913-701X-143.1.37

26. Sendall, M. C., Ostermann, L., Brown, C., & McCosker, L. (2018). Health promotion of bowel cancer and breast cancer screening in community pharmacies: Pharmacists' perceptions of their role, knowledge and confidence. *Pharmacy Practice*, *16*(4). https://doi.org/10.18549/PharmPract.2018.04.1275

27. Shawahna, R., & Awawdeh, H. (2021). Pharmacists' knowledge, attitudes, beliefs, and barriers toward breast cancer health promotion: A cross-sectional study in the Palestinian territories. *BMC Health Services Research*, *21*(1). https://doi.org/10.1186/s12913-021-06458-5

28. Sung, H., Ferlay, J., Siegel, R. L., Laversanne, M., Soerjomataram, I., Jemal, A., & Bray, F. (2021). Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. *CA: A Cancer Journal for Clinicians*, *71*(3). https://doi.org/10.3322/caac.21660

29. World Health Organization. (2023). *Breast Cancer*. https://www.who.int/news-room/fact-sheets/detail/breast-cancer