Original Article

Knowledge, awareness and attitude towards breast cancer: Risk factors, signs and screening among Health and Allied students: A prospective study

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Abstract

Introduction: Breast cancer (BC) is the second most common cancer in Saudi women. Therefore, understanding BC and its related risk factors, symptoms, and screening is critical for early detection and intervention. The current study was meant to explore the knowledge, awareness, and attitude (KAA) gap in BC: risk factors, symptoms, and screening. **Material and Methods:** This cross-sectional investigation was carried out with Health Professions Students (HPS) using a predesigned and validated study questionnaire to examine HPS knowledge and attitudes concerning BC and associated risk factors, symptoms, and screening. **Results:** A total of 277 female students responded to the survey. The frequency of correct answers for the BC knowledge questions varied from the lowest of 27.8% to the highest of 88.8%, with only 5 out of 15 questions (33.3%) answered correctly by more than 60% of the participants, displaying poor knowledge and awareness of BC. A majority (>60%) of the participants identified only 7 of the 18 risk factors of BC correctly, whereas 11 of the 13 early warning signs of BC were identified correctly by the majority (>60%) of the participants. Among the participants, only 26.4% were aware of the breast cancer screening center, but 94.6% of them agreed that early detection of breast cancer is important and 82.7% agreed to participate in the screening program if offered. **Conclusion:** Participants' knowledge and awareness of BC were found to be relatively low; however, their attitudes towards BC screening were positive. As a result, it is critical to develop effective education programs, curricular activities, and awareness campaigns to address the lack of awareness of BC and to have an appropriate response to screening to reduce disease burden.

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Introduction

Cancer being one of the most significant public health burdens worldwide is the second biggest cause of death. According to the worldwide statistics of 2018, the cancer burden increased to 18.1 million new cases and 9.6 million deaths reported.[1,2] Among females, breast cancer (BC) is one of the most frequent cancers, with 2.1 million new cancer cases diagnosed in 2018, and an estimated 627,000 deaths as a result of BC.[2-4] BC is the second most common malignancy in Saudi women with a prevalence of 21.8%.[5] The incidence rates of BC in Middle Eastern countries and Saudi Arabia have been projected to increase over the next few decades as the population grows and ages.[6,7] In Saudi Arabia, the incidence of BC has increased since 1990, from about 350 cases in 1990 to 3,400 cases in 2016, which is an almost 10-fold increase.[8] BC is a major public health issue in advanced nations and is growing more prevalent in low- and middle-income countries and its incidence will increase fast in the majority of developing countries due to a longer lifespan, expanding development, and adoption of Western lifestyle, especially among younger women.[9] BC incidence and mortality rates have plateaued or even fallen in many developed countries, owing to early detection and proper treatment.[10,11]

The genesis of BC is complex, and the risks linked to it are multivariate in nature, often tied to a community's geographic location and lifestyle-related practices.[12] Age, gender, ethnicity, family history, and genetic background are risk factors for breast cancer, which accounts for around 15% of all cases.[13] The other risk factors also include benign proliferative breast disease, high-fat diet, alcohol, smoked meat, early age at menarche, late age at menopause, late childbirth (after 30 years/nulliparity), late age at first birth,[14] little or no breastfeeding and long-term use of hormone replacement therapy (HRT) and oral contraceptive pills (OCP), high breast density,[15] carcinoma of endometrium or uterus, post-radiation exposure and finally sedentary lifestyle (lack of exercise).[16,17]

Although BC is more common in women over the age of 50 years, but in Saudi Arabia it is identified more frequently in younger women.[18] In younger women, BC is often more aggressive, at a more advanced stage, and is of triple-negative status versus in elderly postmenopausal women.[19] The progression of BC can be halted by better screening methods and diagnosis at advanced stages is associated with the high mortality rate.[20,21] Delays in diagnosis is linked to a number of issues, including lack of awareness about prevalent risk factors, lack of understanding procedures, restricted access to appropriate treatment, and insufficient treatment regimens.[22] Early detection of BC provides favorable prognostic and predictive chances, thereby decreasing the mortality rates and hence increasing survival.[23]

Previous research conducted in various places of Saudi Arabia, such as Al-Qaseem, Riyadh, Buraidah, Jeddah, Dammam and Al Khobar, have explored the knowledge, perception, and attitude towards BC.[24-27] According to previous research, the major barriers and hence the gaps in addressing the problem include a lack of knowledge about the common risk factors of BC, and a lack of understanding of the importance of breast self-examination (BSE) (the most effective approach for internal screening among women of all ages), and insufficient utilization of mammography screening.[27-29]

With the rise in incidence rates and the increase in mortality due to BC, it has become essential to understand the level of cancer literacy. Hence, the current study was conducted to explore health and allied students' knowledge, awareness, and attitude about BC: risk factors, indicators, and screening at King Saud bin Abdulaziz University for Health Science (KSAU-HS) in Jeddah.

Materials and Methods

Study design and setting

A survey questionnaire was used in this prospective descriptive study. The research was conducted between April and June 2022.

Ethical considerations

The study was approved by the Institutional Ethics and Research Board (IRB) of the University (**RJ19/142/J: dated: 13, November 2019**). The study was designed and carried out in accordance with the Declaration of Helsinki, especially in dealing with the participants and the data collected thereof.

Before participating, all participants provided informed consent, and they were told that all responses would be kept anonymous. A survey pilot test was performed among a focal group of students before to its dispensation to ensure its validity, and revisions were made based on the feedback gathered for the final dispensation to all HPS.

Study participants and sampling

The professions students (HPS) were the subjects of this investigation. Using the convenience sample method, all students were chosen randomly. The sample size for this study was computed using the Raosoft® software (website link: www.raosoft.com/samplesize.html), using the following parameters, namely, a 90% confidence level, an assumed 50.0% prevalence of awareness of breast cancer, and a margin of error of 5%. There are 2,000 female students at KSAU-HS, Jeddah Campus. The required determined sample size was 245; however, the final sample size of 275 was targeted to be the best representation of the study population.

Data collection tool and technique

The survey was completed by 277 HPSs who volunteered for their participation and provided electronic informed consent. The information was acquired from the students using an online survey delivered via the Google Forms platform. The questionnaire was sent to all HPS via an official email by the Student Affairs Departments of each college in the Jeddah campus. The questionnaire used for the survey comprised four

sections: Section A contained questions about the demographics of participants, section B contained questions regarding BC, section C contained statements about Risk factors of BC, and Section D contained statements about early warning signs of BC (the questionnaire is available on request). Each survey question had two or three choices: "Yes" (True), "No" (False), and/or "Do Not Know." The survey was carefully designed after a thorough review of the literature.

Statistical analysis

The acquired data were tabulated and analyzed using IBM SPSS Statistics for Windows, version 20.0. For frequencies and percentages, descriptive analyses were performed, and mean values were obtained for continuous data. To compare categorical variables in the questionnaire (degree of education, college), the Chi-square (2) test was utilized. *P* values of 0.05 were considered statistically significant.

Results

Sociodemographic characteristics

A total of 277 female students responded favorably to the distributed survey; of them 262 (94.65%) were single. The mean age of the respondents was 20.7 years (SD = 1.53). The demographic characteristics of the participants are presented in Table 1.

Furthermore, 80 (28.9%) were from the College of Nursing (CON), 79 (28.5%) from the College of Applied Medical Sciences (CAMS), 72 (26%) of the respondents represented the College of Medicine (COM) and 46 (16.6%) were from the College of Health Professions (COSHP). In addition, most students represented second (33.2%) and third (39%) years of academic levels [Table 1]. Based on seniority, 177 (63.9%) students were from clinical phase of their respective programs.

Table 1: Demographic data of participants

n	Mean	SD
Age		
277	20.7	1.53
	***n*=277**	**%**
Marital status		
Single	262	94.6
Married	9	3.2
Divorced	6	2.2
College		
College of Health Professions	46	16.6
College of Applied Medical Sciences	79	28.5
College of Medicine	72	26.0
College of Nursing	80	28.9
Academic level (years)		
First year	8	2.9
Second year	92	33.2
Third year	108	39.0
Fourth year	41	14.8
Fifth year	28	10.1
Academic level (seniority)		
Juniors	100	36.1
Seniors	177	63.9

Knowledge and Awareness about BC

Table 2 displays the frequency distribution of reported knowledge and awareness of the participants about breast cancer. The identification of correct answers for each statement by the participants varied from the lowest of 27.8 to the highest of 88.8%. Out of a total of 15 questions, for only 5 questions (33.3%), more than 60% of the participants identified the correct response, displaying a high level of knowledge and awareness of these questions. For the three questions: "*Breast cancer is more common in 65 years old women than 40 years old women,*" only 27.8% of the participants replied correctly (True), "*The irritation of a tight bra can over time cause breast cancer,*" only 27.1% replied correctly (False) and "*Breast cancer usually presents as a painful lump,*" only 29.6% replied correctly (False).

Further analysis of the data revealed a considerable variation in knowledge and awareness of the questions across students at various academic levels and colleges [Tables 3 and 4]. For nine out of 15 questions in the BC knowledge and awareness section, there was a significant difference ($P \leq 0.05$) between the junior and senior students in identifying the correct answers. For example, the majority (53.1%) of senior students correctly identified the question "Bearing the first child after the age of 30 increases the risk of breast cancer" to be true, whereas the majority (56.0%) of junior students did not know the answer ($P < 0.001$). Similarly, for the question "*Late menopause may increase the risk of breast cancer*?" most senior students (51.4%) answered in affirmation but the majority (65.0%) of juniors did not know ($P < 0.001$). Additionally, for 10 out of 15 questions in the BC knowledge and awareness section, there was a significant difference between the students at various colleges in identifying the correct answers. For example, majority (66.3% and 68.8%) of college of nursing students correctly identified the two question "*Bearing the first child after the age of 30 increases the risk of breast* cancer" "*Late menopause may increase the risk of breast cancer*" to be true ($P < 0.001$), respectively. Similarly, for the two negative questions - "*Breast cancer is one of the rare cancers affecting women*" and "*Breast cancer usually presents as a painful lump*" college of nursing students failed to identify them as false statements in comparison to other college students ($P < 0.001$).

Knowledge and awareness about BC risk factors

Figure 1 displays the frequency distribution of reported knowledge and awareness of the participants for the various risk factors of breast cancer (please see the supplementary data – Tables S1-S3 for detailed data analysis). Out of 18 choices provided, majority (>60%) of the participants identified only seven risk factors of BC correctly. The top risk factors that the majority of participants identified were family history of breast cancer, having relative with breast cancer, and aging.

Table 2: Frequency distribution of the responses to questions about knowledge and awareness about breast cancer (BC)

	n=277	%
The most frequently occurring cancer in women is breast cancer		
Don't Know	18	6.5
False	13	4.7
True	**246**	**88.8**
Breast cancer is more common in 65 years old women than 40 years old women		
Don't Know	68	24.5
False	132	47.7
True	**77**	**27.8**
Hereditary may play a role in the development of breast cancer		
Don't Know	35	12.6
False	11	4.0
True	**231**	**83.4**
Contraceptive hormones may increase the risk of breast cancer		
Don't Know	102	36.8
False	12	4.3
True	**163**	**58.8**
Being overweight or obese increases the risk of developing breast cancer		
Don't Know	68	24.5
False	68	24.5
True	**141**	**50.9**
Breastfeeding may decrease the risk of breast cancer development		
Don't Know	53	19.1
False	28	10.1
True	**196**	**70.8**
Bearing the first child after the age of 30 increases the risk of breast cancer		
Don't Know	115	41.5
False	38	13.7
True	**124**	**44.8**
Women over the age of 70 rarely get breast cancer*		
Don't Know	133	48.0
False	**92**	**33.2**
True	52	18.8
Late menopause may increase the risk of breast cancer*		
Don't Know	133	48.0
False	34	12.3
True	110	**39.7**
Breast cancer is one of the rare cancer affecting women*		
Don't Know	14	5.1
False	**245**	**88.4**
True	18	6.5
Breast cancer is caused by bacterial infections		
Don't Know	63	22.7
False	**200**	**72.2**
True	14	5.1
Mammography is recommended yearly above the age of 50 years for early detection		
Don't Know	64	23.1
False	60	21.7
True	**153**	**55.2**
The irritation of a tight bra can over time cause breast cancer		
Don't Know	132	47.7
False	**75**	**27.1**
True	70	25.3
Breast cancer usually presents as a painful lump		
Don't Know	45	16.2
False	**82**	**29.6**
True	150	54.2
Women with positive family history of male breast cancer are at higher risk		
Don't Know	81	29.2
False	30	10.8
True	**166**	**59.9**

The choices in bold represent the correct answers to the questions. *Control questions of original intended questions

Knowledge and awareness about BC signs

Figure 2 displays the frequency distribution of reported knowledge and awareness of the participants for the various signs of breast cancer (please see the supplementary data – Table S4-S6 for detailed data analysis). Out of 13 choices provided, the majority (>60%) of the participants correctly identified the 11 signs of BC. The top signs that the majority of participants identified were changes in the shape of the breast or nipple, changes in the size of the breast or nipple and having a breast lump. Family history of breast cancer, having relatives with breast cancer, and aging. Only two breast cancer signs were not identified correctly, that is, bleeding in between menstrual periods (21.7%) and lower back pain (24.9%).

Attitude towards BC screening

Table 5 summarizes the participant's awareness and attitude towards the screening of BC and the availability of treatments for BC. Among the participants, only 26.4% were aware of the breast cancer screening centers, but 94.6% of them agreed that early breast cancer detection to be important, whereas 82.7% agreed to participate in the screening program if offered. Furthermore, 82.3% of the participants agreed to visit the doctor for any breast-related problems, whereas only a minority (12.6%) answered that they already had breast cancer examined by a doctor but contrarily 71.1% of them revealed that they had performed self-examination of breast. For the questions related to the mammogram, 89.8% had knowledge of what it encompasses but only 4.3% had undergone through the test.

Further data analysis revealed a significant difference ($P \leq 0.05$) in awareness and attitude towards BC screening across students from various colleges and levels [Tables 6 and 7]. The significant differences were for the four questions regarding breast cancer screening center, the risk of breast cancer, the age at which

Table 3: Detailed distribution of the responses to questions about knowledge and awareness about breast cancer (BC), based on academic level

	Academic level				*P*
	Juniors		Seniors		
	n=100	%	*n*=177	%	
The most frequently occurring cancer in women is breast cancer					0.071
False	4	4.0%	9	5.1%	
True	85	85.0%	161	91.0%	
Don't Know	11	11.0%	7	4.0%	
Breast cancer is more common in 65 years old women than 40 years old women					0.023
False	55	55.0%	77	43.5%	
True	18	18.0%	59	33.3%	
Don't Know	27	27.0%	41	23.2%	
Hereditary may play a role in the development of breast cancer					0.875
False	4	4.0%	7	4.0%	
True	82	82.0%	149	84.2%	
Don't Know	14	14.0%	21	11.9%	
Contraceptive hormones may increase the risk of breast cancer					0.650
False	3	3.0%	9	5.1%	
True	58	58.0%	105	59.3%	
Don't Know	39	39.0%	63	35.6%	
Being overweight or obese increases the risk of developing breast cancer					0.139
False	29	29.0%	39	22.0%	
True	43	43.0%	98	55.4%	
Don't Know	28	28.0%	40	22.6%	
Breastfeeding may decrease the risk of breast cancer development					0.036
False	15	15.0%	13	7.3%	
True	62	62.0%	134	75.7%	
Don't Know	23	23.0%	30	16.9%	
Bearing the first child after the age of 30 increases the risk of breast cancer					<0.001
False	14	14.0%	24	13.6%	
True	30	30.0%	94	53.1%	
Don't Know	56	56.0%	59	33.3%	
Women over the age of 70 rarely get breast cancer					0.057
False	25	25.0%	67	37.9%	
True	24	24.0%	28	15.8%	
Don't Know	51	51.0%	82	46.3%	
Late menopause may increase the risk of breast cancer					<0.001
False	16	16.0%	18	10.2%	
True	19	19.0%	91	51.4%	
Don't Know	65	65.0%	68	38.4%	
Breast cancer is one of the rare cancer affecting women					0.015
False	95	95.0%	150	84.7%	
True	1	1.0%	17	9.6%	
Don't Know	4	4.0%	10	5.6%	
Breast cancer is caused by bacterial infections					0.222
False	66	66.0%	134	75.7%	
True	6	6.0%	8	4.5%	
Don't Know	28	28.0%	35	19.8%	
Mammography is recommended yearly above the age of 50 years for early detection					0.029
False	13	13.0%	47	26.6%	
True	60	60.0%	93	52.5%	
Don't Know	27	27.0%	37	20.9%	
The irritation of a tight bra can over time cause breast cancer					0.401
False	23	23.0%	52	29.4%	
True	29	29.0%	41	23.2%	
Don't Know	48	48.0%	84	47.5%	
Breast cancer usually presents as a painful lump					0.014

Contd...

Table 3: Contd...

	Academic level				*P*
	Juniors		Seniors		
	n=100	%	*n*=177	%	
False	19	19.0%	63	35.6%	
True	63	63.0%	87	49.2%	
Don't Know	18	18.0%	27	15.3%	
Women with positive family history of male breast cancer are at higher risk					0.735
False	10	10.0%	20	11.3%	
True	63	63.0%	103	58.2%	
Don't Know	27	27.0%	54	30.5%	

Chi-squared test

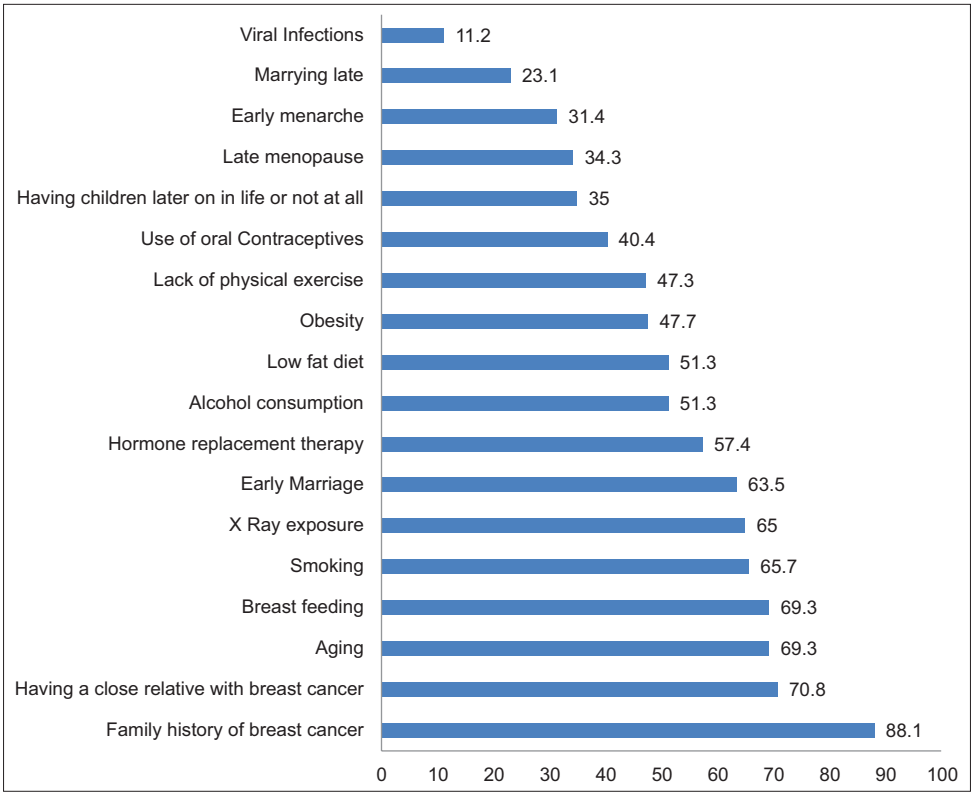

Figure 1: Participants' distribution based on their knowledge and awareness of the risk factor of breast cancer. The numbers on the graph represent the percentage of participants who affirmatively identified the risk factors of breast cancer

mammogram should be performed, and treatment of breast cancer ($P \leq 0.05$) based on the seniority of students. However, the results based on college of education had significant variations for 7 out of 11 questions for the screening of BC.

Discussion

The goal of this retrospective cross-sectional study was to measure Saudi Health Professions Students' (HPS) breast cancer knowledge, awareness, and attitudes *vis a vis* identified risk factors, signs, and screening of BC. The study discovered that the participants had a very low level of knowledge and awareness about BC and its various risk factors, but when it came to identifying the signs, the majority (>60%) of the participants correctly identified 11 of the 13 early warning signs of BC.

Our results are in concordance with the earlier reported studies from Saudi Arabia, where the level of knowledge and awareness of BC was reported to be low.[24-27,30-32] Qedair *et al.*,[30] in their recent nationwide study reported that 71% of the participants had poor knowledge and awareness of BC based on the total awareness score and multiple factors play a role in the awareness regarding BC and its screening, the chief among them were age, educational level, employment status, monthly family income, and the use of oral contraceptives. A recent study by Al-Zalabani *et al.*,[32] also reported that the knowledge of BC among women in Madinah is very poor, with less than 50% of the participants correctly identifying the risk factors of BC and 61.9% of them having a poor knowledge about BC overall. However, the participant's knowledge about the clinical picture, screening and early diagnosis of BC was relatively better much like our results. Amin *et al.*,[26] in their study involving 1,315 Saudi adult

Table 4: Detailed distribution of the responses to questions about knowledge & awareness about Breast Cancer (BC), based on college of education

	College								*P*
	College of Health Professions		College of Applied Medical Sciences		College of Medicine		College of Nursing		
	n=46	%	*n*=79	%	*n*=72	%	*n*=80	%	
The most frequently occurring cancer in women is breast cancer									0.009†
False	0	0.0%	4	5.1%	8	11.1%	1	1.3%	
True	40	87.0%	68	86.1%	62	86.1%	76	95.0%	
Don't Know	6	13.0%	7	8.9%	2	2.8%	3	3.8%	
Breast cancer is more common in 65 years old women than 40 years old women									0.007*
False	22	47.8%	39	49.4%	32	44.4%	39	48.8%	
True	12	26.1%	22	27.8%	12	16.7%	31	38.8%	
Don't Know	12	26.1%	18	22.8%	28	38.9%	10	12.5%	
Hereditary may play a role in the development of breast cancer									0.013†
False	2	4.3%	2	2.5%	2	2.8%	5	6.3%	
True	38	82.6%	68	86.1%	68	94.4%	57	71.3%	
Don't Know	6	13.0%	9	11.4%	2	2.8%	18	22.5%	
Contraceptive hormones may increase the risk of breast cancer									0.617†
False	2	4.3%	2	2.5%	2	2.8%	6	7.5%	
True	26	56.5%	44	55.5%	44	61.1%	49	61.3%	
Don't Know	18	39.1%	33	41.8%	26	36.1%	25	31.3%	
Being overweight or obese increases the risk of developing breast cancer									0.011*
False	14	30.4%	24	30.4%	12	16.7%	18	22.5%	
True	20	43.5%	39	49.4%	32	44.4%	50	62.5%	
Don't Know	12	26.1%	16	20.3%	28	38.9%	12	15.0%	
Breastfeeding may decrease the risk of breast cancer development									0.111*
False	8	17.4%	5	6.3%	6	8.3%	9	11.3%	
True	34	73.9%	58	73.4%	46	63.9%	58	72.5%	
Don't Know	4	8.7%	16	20.3%	20	27.8%	13	16.3%	
Bearing the first child after the age of 30 increases the risk of breast cancer									<0.001*
False	6	13.0%	12	15.2%	2	2.8%	18	22.5%	
True	18	39.1%	17	21.5%	36	50.0%	53	66.3%	
Don't Know	22	47.8%	50	63.3%	34	47.2%	9	11.3%	
Women over the age of 70 rarely get breast cancer									0.011*
False	10	21.7%	29	36.7%	18	25.0%	35	43.8%	
True	16	34.8%	10	12.7%	14	19.4%	12	15.0%	
Don't Know	20	43.5%	40	50.6%	40	55.6%	33	41.3%	
Late menopause may increase the risk of breast cancer									<0.001*
False	8	17.4%	12	15.2%	4	5.6%	10	12.5%	
True	6	13.0%	21	26.6%	28	38.9%	55	68.8%	
Don't Know	32	69.6%	46	58.2%	40	55.6%	15	18.8%	
Breast cancer is one of the rare cancer affecting women									<0.001†
False	44	95.7%	75	94.9%	68	94.4%	58	72.5%	
True	0	0.0%	0	0.0%	2	2.8%	16	20.0%	
Don't Know	2	4.3%	4	5.1%	2	2.8%	6	7.5%	
Breast cancer is caused by bacterial infections									0.035†
False	26	56.5%	55	69.6%	60	83.3%	59	73.8%	
True	4	8.7%	4	5.1%	0	0.0%	6	7.5%	
Don't Know	16	34.8%	20	25.3%	12	16.7%	15	18.8%	
Mammography is recommended yearly above the age of 50 years for early detection									0.008*
False	6	13.0%	23	29.1%	8	11.1%	23	28.8%	
True	24	52.2%	42	53.2%	50	69.4%	37	46.3%	
Don't Know	16	34.8%	14	17.7%	14	19.4%	20	25.0%	

Contd...

Table 4: Contd...

	College								*P*
	College of Health Professions		College of Applied Medical Sciences		College of Medicine		College of Nursing		
	n=46	%	*n*=79	%	*n*=72	%	*n*=80	%	
The irritation of a tight bra can over time cause breast cancer									0.068*
False	8	17.4%	20	25.3%	20	27.8%	27	33.8%	
True	14	30.4%	23	29.1%	10	13.9%	23	28.8%	
Don't Know	24	52.2%	36	45.6%	42	58.3%	30	37.5%	
Breast cancer usually presents as a painful lump									<0.001*
False	8	17.4%	14	17.7%	28	38.9%	32	40.0%	
True	28	60.9%	43	54.4%	38	52.8%	41	51.3%	
Don't Know	10	21.7%	22	27.8%	6	8.3%	7	8.8%	
Women with positive family history of male breast cancer are at higher risk									0.871*
False	6	13.0%	8	10.1%	6	8.3%	10	12.5%	
True	26	56.5%	47	59.5%	42	58.3%	51	63.8%	
Don't Know	14	30.4%	24	30.4%	24	33.3%	19	23.8%	

†Fisher's exact test *Chi-squared test

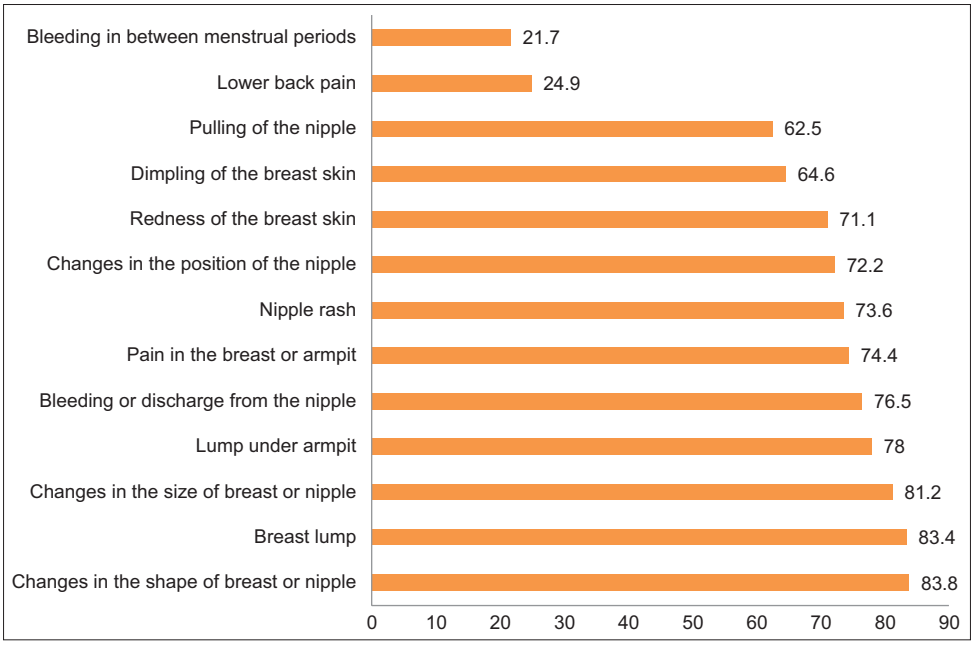

Figure 2: Participants' distribution based on their knowledge and awareness of the signs of breast cancer. The numbers on the graph represent the percentage of participants who affirmatively identified the signs of breast cancer

females reported that the level of knowledge regarding BC risk factors and its appropriate screening was low and dependent upon educational and occupational status. In our study, more than 80% of the participants agreed to the importance of BC screening and their willingness to participate in one if provided, which is similar to the earlier report.[26,32]

In our study, we also found that only 26.4% of the participants were aware of the BC screening center in their vicinity. However, 89.8% of them were aware of mammography as procedure, whereas 71.1% of them had performed a BSE, both of which were significantly dependent upon the level of education of the participants ($P \leq 0.05$). This may be attributed to the facts that our participants were all health profession students with a strong sense of self-preserving attitude. Earlier, Qedair *et al.*,[30] and Al-Mulhim *et al.*[33] have reported a significant correlation between educational level and understanding of the need of BC screening. Qedair *et al.*,[30] reported 60.3% of the women knew how to do BSE, and 84% were aware of Saudi BCS programs. Additionally, we also found that only 4.3% of participants in our study had ever gone through mammography, which was similar to the results reported by an earlier study where only 12.4% of participants performed mammography.[33] Alshahrani *et al.*,[31] 80% of the participants in their study demonstrated a lack of understanding of the significance of mammography in the detection of BC.

Early diagnosis is important in the management of breast cancer as early detection indicates a 5-year survival rate of 92%.[34] BSE,

Table 5: Detailed distribution of the responses to questions about screening of Breast Cancer (BC)

	n=277	%
Do you know any breast cancer screening centre		
Don't Know	43	15.5
No	161	58.1
Yes	73	26.4
Do you think early breast cancer screening is important?		
Don't Know	8	2.9
No	7	2.5
Yes	262	94.6
Would you agree to participate in a Breast Cancer screening Program If offered?		
Don't Know	31	11.2
No	17	6.1
Yes	229	82.7
If you or a family member had any breast problem, would you go to the doctor?		
Don't Know	21	7.6
No	28	10.1
Yes	228	82.3
Have you ever had a breast cancer examination by a doctor?		
Don't Know	17	6.1
No	225	81.2
Yes	35	12.6
What is the percentage do you think is the risk of breast cancer in women, in comparison to other cancers?		
11-20%	37	13.4
21-30%	100	36.1
31-40%	140	50.5
Do you know, what is mammogram? (*n*=274)		
No	28	10.2
Yes	246	89.8
At what age do you think mammogram screening should start?		
<30	85	30.7
30-35	65	23.5
36-40	35	12.6
40-45	49	17.7
>45	43	15.5
Have you ever had a mammogram?		
No	265	95.7
Yes	12	4.3
Have you ever done breast self-examination (BSE)?		
No	80	28.9
Yes	197	71.1
Do you know, what is the treatment of breast cancer?		
Chemotherapy and Radiotherapy	19	6.9
Hormonal therapy	2	0.7
Surgery or Removal of the whole breast	26	9.4
It depends upon the stage	230	83.0

clinical breast examination (CBE), and mammography for women over 40 years are recognized as the most important screening methods for breast cancer.[35,36] These methods allow early detection of breast cancer, significantly increasing the chances of rapid recovery and a decrease in mortality.[37] BC screening methods such as CBE and mammography require hospital visits, highly sophisticated equipment and expertise, whereas BSE is inexpensive and is carried out by women themselves.[38] Mammography, which detects breast cancer in its early stages, is a significant step towards lowering the chance of death from this disease. It was estimated that screening mammography would prevent 20% to 40% of all breast cancer deaths in women.[39] Despite its effectiveness, many women do not have access to mammography due to racial, environmental, financial/insurance hurdles, a lack of information, and, most critically, a lack of medical encouragement.[40] The low use of mammography screening in Saudi Arabia is primarily due to a lack of education and awareness among females.[41] Furthermore, the intervention program on the knowledge, attitude, and practice towards breast cancer screening has led to the improvement in the awareness of the disease.[42]

Advances in knowledge

This study identified health professional education as a critical and trustworthy method for increasing the general public understanding of BC and its many risk factors, signs, and the need for screening in BC. We also underlined the necessity for effective education programs, curricular activities, and awareness campaigns for health profession students to supplement the successful learning process and have a beneficial impact on BC management.

Application to patient care

Because BC is largely avoidable, early intervention and the introduction of appropriate education programs and curricular activities to raise student awareness would be extremely valuable to patient treatment. An assessment of current levels of cancer awareness would continue to be required for the development of comprehensive health programs, initiatives to educate people about early detection techniques, and successful treatment campaigns that effectively engage communities and reduce the societal burden of BC. Knowledge of the identifiable risk factors for BC will enable for early detection and a reduction in disease burden. Awareness campaigns will also assist to reduce negative ideas, beliefs, and taboos around BC, resulting in a more effective and successful healthcare system. Additionally, an increased implementation of BC screening programs among the general masses will augment the decrease in incidence.

Study limitations

1. Because the sample population in this study was health profession students from the KSAUHS Jeddah campus in Saudi Arabia, the results may not be representative of the overall community.
2. Because the data collection questionnaire was self-administered online there was an inherent possibility of recollection bias by the students who participated.

Conclusion

In this study, participants' knowledge and awareness of BC were found to be quite inadequate in general, with just 33.3% of questions answered correctly. However, there was a positive

Table 6: Detailed distribution of the responses to questions about screening of Breast Cancer, based on academic level

	Academic Level				*P*
	Juniors		Seniors		
	n=100	%	*n*=177	%	
Do you know any breast cancer screening centre					<0.001
No	80	80.0%	81	45.8%	
Yes	12	12.0%	61	34.5%	
Don't Know	8	8.0%	35	19.8%	
Do you think early breast cancer screening is important?					0.729
No	2	2.0%	5	2.8%	
Yes	96	96.0%	166	93.8%	
Don't Know	2	2.0%	6	3.4%	
Would you agree to participate in a Breast Cancer screening Program If offered?					0.334
No	4	4.0%	13	7.3%	
Yes	87	87.0%	142	80.2%	
Don't Know	9	9.0%	22	12.4%	
If you or a family member had any breast problem would you go to the doctor?					0.234
No	6	6.0%	22	12.4%	
Yes	86	86.0%	142	80.2%	
Don't Know	8	8.0%	13	7.3%	
Have you ever had a breast cancer examination by a doctor?					0.876
No	80	80.0%	145	81.9%	
Yes	14	14.0%	21	11.9%	
Don't Know	6	6.0%	11	6.2%	
What is the percentage do you think is the risk of breast cancer in women, in comparison to other cancers?					0.011
0-20%	6	6.0%	31	17.5%	
21-30%	44	44.0%	56	31.6%	
31-40%	50	50.0%	90	50.8%	
Do you know, what is mammogram?					0.095
No	6	6.0%	22	12.5%	
Yes	92	92.0%	154	87.5%	
At what age do you think mammogram screening should start?					0.002
<30	40	40.0%	45	25.4%	
30-35	29	29.0%	36	20.3%	
36-40	12	12.0%	23	13.0%	
40-45	8	8.0%	41	23.2%	
>45	11	11.0%	32	18.1%	
Have you ever had a mammogram?					0.305
No	94	94.0%	171	96.6%	
Yes	6	6.0%	6	3.4%	
Have you ever done breast self-examination (BSE)?					0.604
No	27	27.0%	53	29.9%	
Yes	73	73.0%	124	70.1%	
Do you know, what is the treatment of breast cancer?					0.051
Chemotherapy & Radiotherapy	2	2.0%	17	9.6%	
Hormonal therapy	0	0.0%	2	1.1%	
Surgery or Removal of the whole breast	8	8.0%	18	10.2%	
It depends upon the stage	90	90.0%	140	79.1%	

Chi-squared test

attitude towards BC screening and the right identification of BC indicators. This emphasizes the significance of adopting a complete and in-depth education program, as well as effective proactive curricular activities, to provide health profession students with the essential knowledge and awareness about the burden of diseases, including cancer. Furthermore, intensive educational awareness initiatives at the grassroots level are required to fill knowledge gaps regarding prevalent human ailments and associated burdens for an effective healthcare system.

Acknowledgments

The Authors would like to express their deep gratitude towards all health profession students who pro-actively participated in this study.

Table 7: Detailed distribution of the responses to questions about screening of BC, based on college of education

	College								*P*
	College of Health Professions		College of Applied Medical Sciences		College of Medicine		College of Nursing		
	n=46	%	*n*=79	%	*n*=72	%	*n*=80	%	
Do you know any breast cancer screening centre									0.001*
No	36	78.3%	49	62.0%	44	61.1%	32	40.0%	
Yes	8	17.4%	22	27.8%	16	22.2%	27	33.8%	
Don't Know	2	4.3%	8	10.1%	12	16.7%	21	26.3%	
Do you think early breast cancer screening is important?									0.004†
No	2	4.3%	0	0.0%	0	0.0%	5	6.3%	
Yes	44	95.7%	79	100%	70	97.2%	69	86.3%	
Don't Know	0	0.0%	0	0.0%	2	2.8%	6	7.5%	
Would you agree to participate in a Breast Cancer screening Program If offered?									0.134†
No	0	0.0%	8	10.1%	2	2.8%	7	8.8%	
Yes	42	91.3%	61	77.2%	64	88.9%	62	77.5%	
Don't Know	4	8.7%	10	12.7%	6	8.3%	11	13.8%	
If you or a family member had any breast problem would you go to the doctor?									0.118*
No	2	4.3%	4	5.1%	8	11.1%	14	17.5%	
Yes	42	91.3%	69	87.3%	58	80.6%	59	73.8%	
Don't Know	2	4.3%	6	7.6%	6	8.3%	7	8.8%	
Have you ever had a breast cancer examination by a doctor?									0.059†
No	38	82.6%	71	89.9%	58	80.6%	58	72.5%	
Yes	4	8.7%	8	10.1%	10	13.9%	13	16.3%	
Don't Know	4	8.7%	0	0.0%	4	5.6%	9	11.3%	
What is the percentage do you think is the risk of breast cancer in women, in comparison to other cancers?									0.487*
0-20%	4	8.7%	8	10.1%	14	19.4%	11	13.8%	
21-30%	18	39.1%	33	41.8%	24	33.3%	25	31.3%	
31-40%	24	52.2%	38	48.1%	34	47.2%	44	55.0%	
Do you know, what is mammogram?									0.007*
No	0	0.0%	10	12.7%	4	5.7%	14	17.7%	
Yes	46	100%	69	87.3%	66	4.3%	65	82.3%	
At what age do you think mammogram screening should start?									0.005*
<30	24	52.2%	16	20.3%	20	27.8%	25	31.3%	
30-35	8	17.4%	18	22.8%	22	30.6%	17	21.3%	
36-40	6	13.0%	16	20.3%	6	8.3%	7	8.8%	
40-45	2	4.3%	12	15.2%	16	22.2%	19	23.8%	
>45	6	13.0%	17	21.5%	8	11.1%	12	15.0%	
Have you ever had a mammogram?									0.110†
No	42	91.3%	79	100%	68	94.4%	76	95.0%	
Yes	4	8.7%	0	0.0%	4	5.6%	4	5.0%	
Have you ever done breast self-examination (BSE)?									0.028*
No	18	39.1%	28	35.4%	20	27.8%	14	17.5%	
Yes	28	60.9%	51	64.6%	52	72.2%	66	82.5%	
Do you know, what is the treatment of breast cancer?									<0.001†
Chemotherapy and radiotherapy	2	4.3%	2	2.5%	2	2.8%	13	16.3%	
Hormonal therapy	0	0.0%	0	0.0%	0	0.0%	2	2.5%	
Surgery or Removal of the whole breast	2	4.3%	4	5.1%	6	8.3%	14	17.5%	
It depends upon the stage	42	91.3%	73	92.4%	64	88.9%	51	63.8%	

†Fisher's exact test *Chi-squared test

Ethical clearance

This study was approved by the Institutional Review Board of King Abdullah International Medical Research Centre (KAIMRC), a research wing of KSAU-HS, Jeddah (*Reference No: RJ19/142/J; Dated: 13/12/2019*).

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Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. International Agency for Research on Cancer (IARC). (2018). The Grants Register 2018, 412–413. Available from: https://www.iarc.who.int/wp-content/uploads/2018/09/pr263_E.pdf. [Last accessed on 2023 Jan 15].
2. Ferlay J, Soerjomataram I, Dikshit R, Eser S, Mathers C, Rebelo M, *et al*. Cancer incidence and mortality worldwide: Sources, methods and major patterns in GLOBOCAN 2012. Int J Cancer 2015;136:E359-86. doi: 10.1002/ijc.29210.
3. Breast cancer. [2018, Sep 12]. Available from: https://www.who.int/news-room/fact-sheets/detail/breast-cancer. [Last accessed on 2023 Jan 15].
4. Zaidi Z, Dib HA. The worldwide female breast cancer incidence and survival, 2018. [abstract]. In: Proceedings of the American Association for Cancer Research Annual Meeting 2019; 2019 Mar 29-Apr 3; Atlanta, GA. Philadelphia (PA): AACR; Cancer Res 2019;79 (13 Suppl): Abstract nr 4191.
5. Alotaibi RM, Rezk HR, Juliana CI, Guure C. Breast cancer mortality in Saudi Arabia: Modelling observed and unobserved factors. PLoS One 2018;13:e0206148. doi: 10.1371/journal.pone.0206148.
6. Al-Qahtani MS. Gut metastasis from breast carcinoma. Saudi Med J 2007;28:1590-2.
7. Ibrahim EM, Zeeneldin AA, Sadiq BB, Ezzat AA. The present and the future of breast cancer burden in the Kingdom of Saudi Arabia. Med Oncol 2008;25:387-93.
8. Althubiti MA, Nour Eldein MM. Trends in the incidence and mortality of cancer in Saudi Arabia. Saudi Med J 2018;39:1259-62.
9. Adibe MO, Uchenna N, Aluh DO. Knowledge, attitude and perception of breast cancer among female staff of Nigerian University. J Basic Clin Pharm 2018;9:10.
10. Jemal A, Siegel R, Ward E, Hao Y, Xu J, Thun MJ. Cancer statistics, 2009. CA Cancer J Clin 2009;59:225-49.
11. Agarwal G, Pradeep PV, Aggarwal V, Yip CH, Cheung PS. Spectrum of breast cancer in Asian women. World J Surg 2007;31:1031-40.
12. Tazhibi M, Feizi A. Awareness levels about breast cancer risk factors, early warning signs, and screening and therapeutic approaches among Iranian adult women: A large population based study using latent class analysis. Biomed Res Int 2014;2014:306352.
13. Martin AM, Weber BL. Genetic and hormonal risk factors in breast cancer. J Natl Cancer Inst 2000;92:1126-35.
14. Gupta A, Shridhar K, Dhillon PK. A review of breast cancer awareness among women in India: Cancer literate or awareness deficit? Eur J Cancer 2015;51:2058-66.
15. Kerlikowske K, Shepherd J, Creasman J, Tice JA, Ziv E, Cummings SR. Are breast density and bone mineral density independent risk factors for breast cancer? J Natl Cancer Inst 2005;97:368-74.
16. Lee MS, 'Azmiyaty Amar Ma' Ruf C, Nadhirah Izhar DP, Nafisah Ishak S, Wan Jamaluddin WS, Ya'acob SNM, *et al*. Awareness on breast cancer screening in Malaysia: A cross sectional study. Biomedicine (Taipei) 2019;9:18.
17. Abulkhair OA, Al Tahan FM, Young SE, Musaad SM, Jazieh AR. The first national public breast cancer screening program in Saudi Arabia. Ann Saudi Med 2010;30:350-7.
18. Ramakant P, Singh KR, Jaiswal S, Singh S, Ranjan P, Rana C, *et al*. A survey on breast cancer awareness among medical, paramedical, and general population in North India using self-designed questionnaire: A prospective study. Indian J Surg Oncol 2018;9:323-7.
19. Chiedozi LC, El-Hag IA, Kollur SM. Breast diseases in the Northern region of Saudi Arabia. Saudi Med J 2003;24:623-7.
20. Hofvind S, Holen Å, Román M, Sebuødegård S, Puig-Vives M, Akslen L. Mode of detection: An independent prognostic factor for women with breast cancer. J Med Screen 2016;23:89-97.
21. Jones SC, Johnson K. Women's awareness of cancer symptoms: A review of the literature. Womens Health (Lond) 2012;8:579-91.
22. Sharma K, Costas A, Shulman LN, Meara JG. A systematic review of barriers to breast cancer care in developing countries resulting in delayed patient presentation. J Oncol 2012;2012:121873.
23. Olsson A, Borgquist S, Butt S, Zackrisson S, Landberg G, Manjer J. Tumour-related factors and prognosis in breast cancer detected by screening. Br J Surg 2012;99:78-87.
24. Alomair AN, Felemban DG, Felemban MS, Awadain JA, Altowargi AS, Alfawzan NF. Knowledge, attitude, and practice of breast self-examination toward breast cancer among female students at King Saud University in Riyadh, Saudi Arabia. International Journal of Medicine in Developing Countries 2020;4:429-34.
25. Radi SM. Breast cancer awareness among Saudi females in Jeddah. Asian Pac J Cancer Prev 2013;14:4307-12.
26. Amin TT, Al Mulhim AR, Al Meqihwi A. Breast cancer knowledge, risk factors and screening among adult Saudi women in a primary health care setting. Asian Pac J Cancer Prev 2009;10:133-8.
27. Hussein DM, Alorf SH, Al-Sogaih YS, Alorf SH, Alaskar RS, Al-Mahana AM, *et al*. Breast cancer awareness and breast self-examination in Northern Saudi Arabia. A preliminary survey. Saudi Med J 2013;34:681-8.
28. Habib F, Salman S, Safwat M, Shalaby S. Awareness and knowledge of breast cancer among university students in Al Madina Al Munawara Region. Middle East J Cancer 2010;1:159–66.
29. Jahan S, Al-Saigul AM, Abdelgadir MH. Breast cancer. Knowledge, attitudes and practices of breast self examination among women in Qassim region of Saudi Arabia. Saudi Med J 2006;27:1737-41.
30. Qedair JT, Al Qurashi AA, Alfayea T, Mortada H, Alsudais A, Almuntashiri S, *et al*. Level and predictors of breast cancer awareness among Saudi women: A nationwide study. Womens Health (Lond) 2022;18:17455057221133835. doi: 10.1177/17455057221133835.
31. Alshahrani M, Alhammam SYM, Al Munyif HAS, Alwadei AMA, Alwadei AMA, Alzamanan SSM, *et al*. Knowledge, attitudes, and practices of breast cancer screening methods among female patients in primary healthcare centers in Najran, Saudi Arabia. J Cancer Educ 2019;34:1167-72.
32. Al-Zalabani AH, Alharbi KD, Fallatah NI, Alqabshawi RI, Al-Zalabani AA, Alghamdi SM. Breast cancer knowledge and screening practice and barriers among women in Madinah, Saudi Arabia. J Cancer Educ 2018;33:201-7.
33. Al-Mulhim F, Bakr R, Almedallah D, Alkaltham N, Alotaibi A, Alnoaim S. Screening mammography and breast self-examination: Attitudes and practices of women in the Eastern Province of Saudi Arabia. Saudi J Health Sci 2018;7:89-100.

34. Mutalib AMA, Moey SF, Kamarudin NNA. Awareness, knowledge and breast cancer screening practices among IIUM non-academic staff. Int J Allied Health Sci 2019;3:616-24.
35. Ibrahim NA, Odusanya OO. Knowledge of risk factors, beliefs and practices of female healthcare professionals towards breast cancer in a tertiary institution in Lagos, Nigeria. BMC Cancer 2009;9:76.
36. Takkar N, Kochhar S, Garg P, Pandey AK, Dalal UR, Handa U. Screening methods (clinical breast examination and mammography) to detect breast cancer in women aged 40-49 years. J Midlife Health 2017;8:2-10.
37. Secginli S, Nahcivan NO. Factors associated with breast cancer screening behaviours in a sample of Turkish women: A questionnaire survey. Int J Nurs Stud 2006;43:161-71.
38. Al-Sakkaf KA, Basaleem HO. Breast cancer knowledge, perception and breast self- examination practices among Yemeni Women: An application of the Health Belief Model. Asian Pac J Cancer Prev 2016;17:1463-7.
39. Chalkidou K, Marquez P, Dhillon PK, Teerawattananon Y, Anothaisintawee T, Gadelha CA, *et al.* Evidence-informed frameworks for cost-effective cancer care and prevention in low, middle, and high-income countries. Lancet Oncol 2014;15:e119-31. doi: 10.1016/S1470-2045 (13) 70547-3.
40. O'Malley MS, Earp JA, Hawley ST, Schell MJ, Mathews HF, Mitchell J. The association of race/ethnicity, socioeconomic status, and physician recommendation for mammography: who gets the message about breast cancer screening? Am J Public Health 2001;91:49-54.
41. Dandash KF, Al-Mohaimeed A. Knowledge, attitudes, and practices surrounding breast cancer and screening in female teachers of Buraidah, Saudi Arabia. Int J Health Sci (Qassim) 2007;1:61-71.
42. Rakhshani T, Dada M, Kashfi SM, Kamyab A, Jeihooni AK. The effect of educational intervention on knowledge, attitude, and practice of women towards breast cancer screening. Int J Breast Cancer 2022;2022:5697739.

Table S1: Detailed distribution of the responses to questions about risk factor of Breast Cancer (BC)

Parameter	N	%
Aging		
Don't Know	38	13.7
No	47	17.0
Yes	192	69.3
Family history of breast cancer		
Don't Know	9	3.2
No	24	8.7
Yes	244	88.1
Having a close relative with breast cancer		
Don't Know	25	9.0
No	56	20.2
Yes	196	70.8
Hormone replacement therapy		
Don't Know	87	31.4
No	31	11.2
Yes	159	57.4
Alcohol consumption		
Don't Know	79	28.5
No	56	20.2
Yes	142	51.3
X Ray exposure		
Don't Know	45	16.2
No	52	18.8
Yes	180	65.0
Smoking		
Don't Know	45	16.2
No	50	18.1
Yes	182	65.7
Obesity		
Don't Know	75	27.1
No	70	25.3
Yes	132	47.7
Low fat diet		
Don't Know	108	39.0
No	142	51.3
Yes	27	9.7
Marrying late		
Don't Know	85	30.7
No	128	46.2
Yes	64	23.1
Early menarche		
Don't Know	122	44.0
No	68	24.5
Yes	87	31.4
Late menopause		
Don't Know	109	39.4
No	73	26.4
Yes	95	34.3
Having children later on in life or not at all		
Don't Know	95	34.3
No	85	30.7
Yes	97	35.0
Lack of physical exercise		
Don't Know	71	25.6
No	75	27.1
Yes	131	47.3
Use of oral Contraceptives		
Don't Know	126	45.5
No	39	14.1
Yes	112	40.4
Breast feeding		
Don't Know	47	17.0
No	192	69.3
Yes	38	13.7
Early Marriage		
Don't Know	74	26.7
No	176	63.5
Yes	27	9.7
Viral Infections		
Don't Know	125	45.1
No	121	43.7
Yes	31	11.2

Contd...

Table S2: Detailed distribution of the responses to questions about risk factor of Breast Cancer (BC), based on academic level

	Academic Level				*P*
	Preclinical		Clinical		
	n=100	%	*n*=177	%	
Aging					0.304
No	21	21.0%	26	14.7%	
Yes	68	68.0%	124	70.1%	
Don't Know	11	11.0%	27	15.3%	
Family history of breast cancer					0.445
No	6	6.0%	18	10.2%	
Yes	90	90.0%	154	87.0%	
Don't Know	4	4.0%	5	2.8%	
Having a close relative with breast cancer					0.266
No	25	25.0%	31	17.5%	
Yes	68	68.0%	128	72.3%	
Don't Know	7	7.0%	18	10.2%	
Hormone replacement therapy					0.001
No	6	6.0%	25	14.1%	
Yes	50	50.0%	109	61.6%	
Don't Know	44	44.0%	43	24.3%	
Alcohol consumption					<0.001
No	23	23.0%	33	18.6%	
Yes	36	36.0%	106	59.9%	
Don't Know	41	41.0%	38	21.5%	
X Ray exposure					0.044
No	12	12.0%	40	22.6%	
Yes	74	74.0%	106	59.9%	
Don't Know	14	14.0%	31	17.5%	
Smoking					0.204
No	21	21.0%	29	16.4%	
Yes	59	59.0%	123	69.5%	
Don't Know	20	20.0%	25	14.1%	
Obesity					0.008
No	34	34.0%	36	20.3%	
Yes	36	36.0%	96	54.2%	
Don't Know	30	30.0%	45	25.4%	
Low fat diet					0.053
No	55	55.0%	87	49.2%	
Yes	4	4.0%	23	13.0%	
Don't Know	41	41.0%	67	37.9%	
Marrying late					<0.001
No	56	56.0%	72	40.7%	
Yes	10	10.0%	54	30.5%	
Don't Know	34	34.0%	51	28.8%	
Early menarche					<0.001
No	30	30.0%	38	21.5%	
Yes	10	10.0%	77	43.5%	
Don't Know	60	60.0%	62	35.0%	
Late menopause					<0.001
No	39	39.0%	34	19.2%	
Yes	10	10.0%	85	48.0%	
Don't Know	51	51.0%	58	32.8%	
Having children later on in life or not at all					<0.001
No	44	44.0%	41	23.2%	
Yes	16	16.0%	81	45.8%	
Don't Know	40	40.0%	55	31.1%	

Contd...

Table S2: Contd...

	Academic Level				*P*
	Preclinical		Clinical		
	n=100	%	*n*=177	%	
Lack of physical exercise					0.343
No	28	28.0%	47	26.6%	
Yes	42	42.0%	89	50.3%	
Don't Know	30	30.0%	41	23.2%	
Use of oral Contraceptives					<0.001
No	12	12.0%	27	15.3%	
Yes	22	22.0%	90	50.8%	
Don't Know	66	66.0%	60	33.9%	
Breast feeding					0.019
No	75	75.0%	117	66.1%	
Yes	6	6.0%	32	18.1%	
Don't Know	19	19.0%	28	15.8%	
Early Marriage					0.622
No	60	60.0%	116	65.5%	
Yes	10	10.0%	17	9.6%	
Don't Know	30	30.0%	44	24.9%	
Viral Infections					0.047
No	34	34.0%	87	49.2%	
Yes	14	14.0%	17	9.6%	
Don't Know	52	52.0%	73	41.2%	

Chi-squared test

Table S3: Detailed distribution of the responses to questions about risk factor of Breast Cancer (BC), based on college of education

	College								*P*
	College of Health Professions		College of Applied Medical Sciences		College of Medicine		College of Nursing		
	n=46	%	*n*=79	%	*n*=72	%	*n*=80	%	
Aging									0.147*
No	14	30.4%	12	15.2%	10	13.9%	11	13.8%	
Yes	28	60.9%	56	70.9%	54	75.0%	54	67.5%	
Don't Know	4	8.7%	11	13.9%	8	11.1%	15	18.8%	
Family history of breast cancer									0.060†
No	4	8.7%	10	12.7%	0	0.0%	10	12.5%	
Yes	40	87.0%	65	82.3%	70	97.2%	69	86.3%	
Don't Know	2	4.3%	4	5.1%	2	2.8%	1	1.3%	
Having a close relative with breast cancer									<0.001*
No	8	17.4%	25	31.6%	2	2.8%	21	26.3%	
Yes	38	82.6%	46	58.2%	62	86.1%	50	62.5%	
Don't Know	0	0.0%	8	10.1%	8	11.1%	9	11.3%	
Hormone replacement therapy									<0.001*
No	4	8.7%	10	12.7%	2	2.8%	15	18.8%	
Yes	24	52.2%	34	43.0%	48	66.7%	53	66.3%	
Don't Know	18	39.1%	35	44.3%	22	30.6%	12	15.0%	
Alcohol consumption									<0.001*
No	10	21.7%	25	31.6%	4	5.6%	17	21.3%	
Yes	20	43.5%	42	53.2%	34	47.2%	46	57.5%	
Don't Know	16	34.8%	12	15.2%	34	47.2%	17	21.3%	
X Ray exposure									<0.001*
No	6	13.0%	18	22.8%	2	2.8%	26	32.5%	
Yes	34	73.9%	51	64.6%	58	80.6%	37	46.3%	
Don't Know	6	13.0%	10	12.7%	12	16.7%	17	21.3%	
Smoking									0.378*
No	4	8.7%	17	21.5%	10	13.9%	19	23.8%	
Yes	34	73.9%	50	63.3%	48	66.7%	50	62.5%	
Don't Know	8	17.4%	12	15.2%	14	19.4%	11	13.8%	
Obesity									0.001*
No	12	26.1%	25	31.6%	12	16.7%	21	26.3%	
Yes	22	47.8%	30	38.0%	30	41.7%	50	62.5%	
Don't Know	12	26.1%	24	30.4%	30	41.7%	9	11.3%	
Low fat diet									0.001*
No	24	52.2%	36	45.6%	26	36.1%	56	70.0%	
Yes	4	8.7%	10	12.7%	6	8.3%	7	8.8%	
Don't Know	18	39.1%	33	41.8%	40	55.6%	17	21.3%	
Marrying late									<0.001*
No	20	43.5%	38	48.1%	30	41.7%	40	50.0%	
Yes	6	13.0%	13	16.5%	14	19.4%	31	38.8%	
Don't Know	20	43.5%	28	35.4%	28	38.9%	9	11.3%	
Early menarche									<0.001*
No	14	30.4%	20	25.3%	14	19.4%	20	25.0%	
Yes	4	8.7%	12	15.2%	20	27.8%	51	63.8%	
Don't Know	28	60.9%	47	59.5%	38	52.8%	9	11.3%	
Late menopause									<0.001*
No	20	43.5%	29	36.7%	10	13.9%	14	17.5%	
Yes	2	4.3%	10	12.7%	26	36.1%	57	71.3%	
Don't Know	24	52.2%	40	50.6%	36	50.0%	9	11.3%	
Having children later on in life or not at all									0.001*
No	16	34.8%	27	34.2%	16	22.2%	26	32.5%	
Yes	10	21.7%	22	27.8%	24	33.3%	41	51.3%	
Don't Know	20	43.5%	30	38.0%	32	44.4%	13	16.3%	

Contd...

Table S3: Contd...

	College								*P*
	College of Health Professions		College of Applied Medical Sciences		College of Medicine		College of Nursing		
	n=46	%	*n*=79	%	*n*=72	%	*n*=80	%	
Lack of physical exercise									<0.001*
No	6	13.0%	25	31.6%	10	13.9%	34	42.5%	
Yes	22	47.8%	38	48.1%	42	58.3%	29	36.3%	
Don't Know	18	39.1%	16	20.3%	20	27.8%	17	21.3%	
Use of oral Contraceptives									<0.001*
No	6	13.0%	6	7.6%	8	11.1%	19	23.8%	
Yes	10	21.7%	32	40.5%	30	41.7%	40	50.0%	
Don't Know	30	65.2%	41	51.9%	34	47.2%	21	26.3%	
Breast feeding									0.011*
No	36	78.3%	51	64.6%	52	72.2%	53	66.3%	
Yes	4	8.7%	16	20.3%	2	2.8%	16	20.0%	
Don't Know	6	13.0%	12	15.2%	18	25.0%	11	13.8%	
Early Marriage									0.001*
No	24	52.2%	49	62.0%	42	58.3%	61	76.3%	
Yes	6	13.0%	2	2.5%	8	11.1%	11	13.8%	
Don't Know	16	34.8%	28	35.4%	22	30.6%	8	10.0%	
Viral Infections									<0.001*
No	12	26.1%	26	32.9%	34	47.2%	49	61.3%	
Yes	8	17.4%	8	10.1%	4	5.6%	11	13.8%	
Don't Know	26	56.5%	45	57.0%	34	47.2%	20	25.0%	

†Fisher's exact test *Chi-squared test

Table S4: Detailed distribution of the responses to questions about various warning signs of BC

	n=277	%
Breast lump		
Don't Know	28	10.1
No	18	6.5
Yes	231	83.4
Lump under armpit		
Don't Know	36	13.0
No	25	9.0
Yes	216	78.0
Nipple rash		
Don't Know	40	14.4
No	33	11.9
Yes	204	73.6
Pulling of the nipple		
Don't Know	65	23.5
No	39	14.1
Yes	173	62.5
Bleeding or discharge from the nipple		
Don't Know	36	13.0
No	29	10.5
Yes	212	76.5
Changes in the position of the nipple		
Don't Know	37	13.4
No	40	14.4
Yes	200	72.2
Redness of the breast skin		
Don't Know	42	15.2
No	38	13.7
Yes	197	71.1
Changes in the size of breast or nipple		
Don't Know	22	7.9
No	30	10.8
Yes	225	81.2
Changes in the shape of breast or nipple		
Don't Know	23	8.3
No	22	7.9
Yes	232	83.8
Pain in the breast or armpit		
Don't Know	25	9.0
No	46	16.6
Yes	206	74.4
Dimpling of the breast skin		
Don't Know	66	23.8
No	32	11.6
Yes	179	64.6
Bleeding in between menstrual periods		
Don't Know	139	50.2
No	78	28.2
Yes	60	21.7
Lower back pain		
Don't Know	114	41.2
No	94	33.9
Yes	69	24.9

Table S5: Detailed distribution of the responses to questions about various warning signs of breast cancer (BC), based on academic level

	Academic Level				*P*
	Preclinical		Clinical		
	n=100	%	*n*=177	%	
Breast lump					0.433
No	4	4.0%	14	7.9%	
Yes	85	85.0%	146	82.5%	
Don't Know	11	11.0%	17	9.6%	
Lump under armpit					0.717
No	10	10.0%	15	8.5%	
Yes	79	79.0%	137	77.4%	
Don't Know	11	11.0%	25	14.1%	
Nipple rash					0.056
No	11	11.0%	22	12.4%	
Yes	81	81.0%	123	69.3%	
Don't Know	8	8.0%	32	18.1%	
Pulling of the nipple					0.756
No	12	12.0%	27	15.3%	
Yes	64	64.0%	109	61.6%	
Don't Know	24	24.0%	41	23.2%	
Bleeding or discharge from the nipple					0.082
No	10	10.0%	19	10.7%	
Yes	71	71.0%	141	79.7%	
Don't Know	19	19.0%	17	9.6%	
Changes in the position of the nipple					0.612
No	17	17.0%	23	13.0%	
Yes	69	69.0%	131	74.0%	
Don't Know	14	14.0%	23	13.0%	
Redness of the breast skin					0.223
No	14	14.0%	24	13.6%	
Yes	66	66.0%	131	74.0%	
Don't Know	20	20.0%	22	12.4%	
Changes in the size of breast or nipple					0.149
No	13	13.0%	17	9.6%	
Yes	83	83.0%	142	80.2%	
Don't Know	4	4.0%	18	10.2%	
Changes in the shape of breast or nipple					0.091
No	4	4.0%	18	10.2%	
Yes	90	90.0%	142	80.2%	
Don't Know	6	6.0%	17	9.6%	
Pain in the breast or armpit					0.008
No	11	11.0%	35	19.8%	
Yes	85	85.0%	121	68.4%	
Don't Know	4	4.0%	21	11.9%	
Dimpling of the breast skin					0.020
No	12	12.0%	20	11.3%	
Yes	55	55.0%	124	70.1%	
Don't Know	33	33.0%	33	18.6%	
Bleeding in between menstrual periods					0.955
No	29	29.0%	49	27.7%	
Yes	22	22.0%	38	21.5%	
Don't Know	49	49.0%	90	50.8%	
Lower back pain					0.182
No	39	39.0%	55	31.1%	
Yes	19	19.0%	50	28.2%	
Don't Know	42	42.0%	72	40.7%	

Table S6: Detailed distribution of the responses to questions about various warning signs of breast cancer (BC), based on college of education

	College								*P*
	College of Health Professions		College of Applied Medical Sciences		College of Medicine		College of Nursing		
	n=46	%	*n*=79	%	*n*=72	%	*n*=80	%	
Breast lump									<0.001
No	4	8.7%	6	7.6%	0	0.0%	8	10.0%	
Yes	40	87.0%	55	69.6%	68	94.4%	68	85.0%	
Don't Know	2	4.3%	18	22.8%	4	5.6%	4	5.0%	
Lump under armpit									0.005
No	8	17.4%	8	10.1%	2	2.8%	7	8.8%	
Yes	32	69.6%	53	67.1%	64	88.9%	67	83.8%	
Don't Know	6	13.0%	18	22.8%	6	8.3%	6	7.5%	
Nipple rash									0.023
No	4	8.7%	9	11.4%	6	8.3%	14	17.5%	
Yes	36	78.3%	58	73.4%	48	66.7%	62	75.5%	
Don't Know	6	13.0%	12	15.2%	18	25.0%	4	5.0%	
Pulling of the nipple									0.002
No	6	13.0%	7	8.9%	4	5.6%	22	27.5%	
Yes	28	60.9%	48	60.8%	50	69.4%	47	58.8%	
Don't Know	12	26.1%	24	30.4%	18	25.0%	11	13.8%	
Bleeding or discharge from the nipple									0.051
No	6	13.0%	10	12.7%	2	2.8%	11	13.8%	
Yes	34	73.9%	57	72.2%	56	77.8%	65	81.3%	
Don't Know	6	13.0%	12	15.2%	14	19.4%	4	5.0%	
Changes in the position of the nipple									0.020
No	8	17.4%	17	21.5%	4	5.6%	11	13.8%	
Yes	34	73.9%	46	58.2%	58	80.6%	62	77.5%	
Don't Know	4	8.7%	16	20.3%	10	13.9%	7	8.8%	
Redness of the breast skin									0.006
No	8	17.4%	16	20.3%	6	8.3%	8	10.0%	
Yes	32	69.6%	47	59.5%	50	69.4%	68	85.0%	
Don't Know	6	13.0%	16	20.3%	16	22.2%	4	5.0%	
Changes in the size of breast or nipple									0.002
No	8	17.4%	11	13.9%	2	2.8%	9	11.3%	
Yes	38	82.6%	60	75.9%	58	80.6%	69	86.3%	
Don't Know	0	0.0%	8	10.1%	12	16.7%	2	2.5%	
Changes in the shape of breast or nipple									0.018
No	4	8.7%	6	7.6%	2	2.8%	10	12.5%	
Yes	42	91.3%	63	79.7%	60	83.3%	67	83.8%	
Don't Know	0	0.0%	10	12.7%	10	13.9%	3	3.8%	
Pain in the breast or armpit									0.033
No	6	13.0%	16	20.3%	8	11.1%	16	20.0%	
Yes	40	87.0%	55	69.6%	52	72.2%	59	73.8%	
Don't Know	0	0.0%	8	10.1%	12	16.7%	5	6.3%	
Dimpling of the breast skin									0.001
No	8	17.4%	12	15.2%	2	2.8%	10	12.5%	
Yes	24	52.2%	48	60.8%	44	61.1%	63	78.8%	
Don't Know	14	30.4%	19	24.1%	26	36.1%	7	8.8%	
Bleeding in between menstrual periods									<0.001*
No	12	26.1%	27	34.2%	12	16.7%	27	33.8%	
Yes	18	39.1%	10	12.7%	4	5.6%	28	35.0%	
Don't Know	16	34.8%	42	53.2%	56	77.8%	25	31.3%	
Lower back pain									<0.001*
No	18	39.1%	27	34.2%	12	16.7%	37	46.3%	
Yes	10	21.7%	22	27.8%	14	19.4%	23	28.8%	
Don't Know	18	39.1%	30	38.0%	46	63.9%	20	25.0%	