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The effect of artificial intelligence literacy and attitudes on breast cancer screening behavior and worry: A cross-sectional study

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Abstract

This study aimed to determine the effects of artificial intelligence (AI) literacy and attitudes on breast cancer screening behavior and worry. This correlational cross-sectional study included 599 women aged 20–65 years. Data were collected using the Personal Information Form, Breast Cancer Worry Scale (BCWC), Artificial Intelligence Literacy Scale (AILS), and General Attitude Toward Artificial Intelligence Scale (GAAIS). Data were analyzed using descriptive statistics, independent samples t-test, one-way analysis of variance (ANOVA), Pearson correlation analysis, and hierarchical regression analysis. In this study, while 22.4% of women reported having undergone breast cancer screening before, 66.6% reported having breast cancer worries. The results showed that marital status, education level, feeling a lump in the breast, previous breast cancer screening, and the awareness, assessment, positive attitude, and negative attitude subscales of AI literacy were significant predictors of breast cancer worry ($p < 0.05$). High artificial intelligence literacy and a positive attitude toward artificial intelligence were associated with increased breast cancer worry. In line with these results, we recommend assessing women's AI literacy and attitudes to determine breast cancer worry.

Keywords: Breast cancer; anxiety; artificial intelligence; literacy; attitude; nursing

Introduction

Breast cancer is the most common cancer among women worldwide and continues to affect their lives daily [1]. GLOBOCAN reported that 2.4 million women worldwide will be diagnosed with breast cancer and 715, 156 women will die from breast cancer in 2025. This report indicates that by 2050, the incidence of breast cancer is expected to increase by 54.7% and breast cancer-related deaths by 70.9% [2]. Breast cancer incidence has been found to be high in low- and middle-income countries, particularly in Burundi, Afghanistan, Ethiopia, Nigeria, Syria, and Uganda [2]. In Türkiye, the breast cancer incidence was 25.249 and breast cancer-related deaths were 7.230 in 2022. By 2050, the incidence of breast cancer in Türkiye is expected to increase by 43.7%, and breast cancer-related deaths by 77.3% [2]. Breast cancer diagnosis and treatment may cause problems for women, such as social isolation, guilt, anger, fear of death, worry, stress, depression, fatigue, alopecia, negative body image, sexual dysfunction, and deterioration in sleep quality [3]. Therefore, early breast cancer detection is of critical importance [4,5]. Methods such as self-breast examination, clinical breast examination, mammography, ultrasound, magnetic resonance imaging, genetic screening, and molecular diagnosis are recommended for the early detection of cancer [6-8]. With early detection methods, the five-year survival rate for breast cancer ranges between 91% and 99% [9]. Women's participation in early detection methods may decrease due to insufficient awareness and knowledge of breast cancer, low education levels, and limited socioeconomic status [10-12]. In addition, excessive information overload about cancer, perceived cancer risk, and lack of previous screening experience may negatively affect participation in screening programs [10-12]. The literature discusses the effect of breast cancer worry on the likelihood

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of undergoing breast cancer screening tests [10-12]. Loft et al. (2024) found that women with low breast cancer worry participated more in screening programs than women with high worry, while Taşhan et al. (2020) determined that breast cancer worry did not affect women's self-breast examination, clinical breast examination, and mammography participation [12,13].

Artificial Intelligence (AI) is a computer program created through the combination of software and hardware, capable of mimicking human intelligence and being updated [14]. AI applications have begun to be used in healthcare systems because of factors such as a shortage of healthcare professionals, insufficient resources, and time constraints [14]. AI applications can be used to identify risk factors for diseases, contribute to early diagnosis processes, support clinical decision-making processes, and obtain information from experts at different centers related to the disease [14,15-17]. AI applications can be used to address several health issues such as cancer [10,16,18,19], vaccine refusal [4], and neurological and cardiological diseases [14,20,21]. An analysis of the use of AI applications in different types of cancer shows that they are used in cancers such as colon cancer [22], thyroid cancer [23], breast cancer [16,24], skin cancer [25], and brain tumors [26].

With advances in technology in recent years, artificial intelligence applications have been used for the diagnosis of breast cancer, identification of risk factors, accurate interpretation of early screening tests, determination of cancer prognosis and risk factors, communication between patients and healthcare personnel, and provision of comprehensive care [2,4,17]. A systematic review and meta-analysis conducted by Nassif et al. (2022) reported that artificial intelligence, machine learning, and deep learning models are effective for the early diagnosis and treatment of breast cancer [24]. Nicolis et al. (2024) found that machine learning models are effective in determining breast cancer risk factors (77%), early diagnosis (80%), and increased survival rates (83%) [16]. The study also indicated that deep learning models are 45% effective in improving the quality of life after mastectomy [16]. Although several studies have reported the positive effects of artificial intelligence in breast cancer, women's approval of the use of artificial intelligence in the fight against breast cancer is influenced by many factors, such as breast cancer worry, attitudes towards artificial intelligence, literacy, awareness, acceptability, and prejudice levels [11, 27, 28]. Erul et al. (2025) stated that the vast majority of women with cancer believe that the use of artificial intelligence in breast cancer is important, but they are concerned that the information may not remain confidential or could lead to misdiagnosis [29].

Artificial intelligence enables healthcare professionals, such as oncologists, radiologists, and nurses, to devote more time to patient care [17]. However, the effective use of artificial intelligence in breast cancer varies depending on women's attitudes toward artificial intelligence, artificial intelligence literacy, acceptance of technology, and privacy concerns [3]. Nurses play an important role in patient education, counseling, and promotion of participation in breast cancer screening programs, and they increasingly use artificial intelligence applications in diagnosis, treatment, and patient care [3,16,17,27]. To the best of our knowledge, no study has examined the effects of women's AI literacy and attitudes on their participation in breast cancer screening programs and their worry levels. It is crucial for nurses to provide counseling to determine women's attitudes toward AI and literacy levels and to assess their participation in breast cancer screening programs and worry levels. Therefore, this study aimed to determine the effects of women's artificial intelligence (AI) literacy and attitudes on breast cancer screening behavior and worry.

Material and Methods

Research Design

This was a correlational and cross-sectional study. This study was conducted in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

Population and Sample

The study population will consist of women aged 20–65 years who live in Türkiye between July and November 2025. Snowball sampling was used to recruit as many women as possible. G*Power 3.1.9.2 was used to calculate the sample size. Because no similar studies were found in the literature, a medium effect size ($f^2 = 0.15$), significance level of 0.05, and power of 0.95 were used for the calculation of sample size. Hence, the minimum required sample size was determined to be 501. [30]. However, considering the sub-analyses, incomplete data, and sensitivity of the study, 10% more than the sample size was included in the study, and the sample size was determined to be 551 women. Considering possible losses, the study was completed with 599 women who agreed to participate and met the inclusion criteria.

The inclusion criteria were literacy, absence of breast-related disease, and no history of breast cancer. The exclusion criteria were breast cancer diagnosis and presence of a lump (benign or malignant) in the breast.

Data Collection Tools

Data were collected using Google Forms, which included the Personal Information Form, Breast Cancer Worry Scale (BCWC), Artificial Intelligence Literacy Scale (AILS), and General Attitudes Toward Artificial Intelligence Scale (GAAIS).

Personal Information Form

The researchers prepared a Personal Information Form consisting of 15 questions: six questions on women's sociodemographic characteristics (age, employment status, marital status, education level, and income status), two questions on obstetric characteristics (number of living children and use of hormone replacement therapy), and seven questions on breast cancer risk factors (e.g., feeling a lump in the breast, having undergone a breast biopsy, and previous breast cancer screening).

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Breast Cancer Worry Scale (BCWC)

The Turkish validity and reliability of the scale developed by Lerman et al. (1991) were assessed by Taşhan et al. (2018) [13]. The scale consists of six items, responded to on a 5-point Likert scale. Each question on the scale is scored from 0 to 4, with scores to be obtained from the scale ranging between 0 and 24. The cutoff value of the scale is set at 12, with scores below this value indicating low cancer worry and scores above this value indicating high cancer worry [13]. The Cronbach's alpha coefficient for the Turkish validity and reliability of the scale was reported to be 0.78 [13]. In this study, Cronbach's alpha coefficient of the scale was 0.79.

Artificial Intelligence Literacy Scale (AILS)

Çelebi et al. (2023) [31] evaluated the Turkish validity and reliability of the scale developed by Wang et al. (2021) [31]. The scale consists of 12 items responded on a 5-point Likert scale (1 = strongly disagree, 7 = strongly agree). The scale has four subscales: awareness (items 1-3), use (items 4-6), evaluation (items 7-9), and ethics (items 10-12). The total score of the scale is calculated by summing the scores obtained from the subscales. Items 2, 5, and 11 were reverse-coded. The scores ranged from 12 to 84, with higher scores indicating a higher level of artificial intelligence literacy. Cronbach's alpha coefficient for the Turkish version of the scale was 0.85 for the total scale and ranged from 0.72 to 0.76 for the subscales [31]. In this study, Cronbach's alpha coefficients were 0.78 for the total scale and ranged between 0.74 and 0.79 for the subscales.

General Attitude Toward Artificial Intelligence Scale (GAAIS)

The scale was developed by Schepman and Rodway (2020), and its Turkish validity and reliability were assessed by Kaya et al. (2024) [32]. The five-point Likert-type scale consists of 20 items and two subscales: positive attitudes (items 1-12) and negative attitudes (items 13-20). The items in the negative attitude subscale were reverse-coded, with higher scores indicating more positive attitudes. The Cronbach's alpha coefficient of the scale was 0.82 for positive attitudes and 0.84 for negative attitudes [32]. In this study, the Cronbach's alpha coefficient of the scale was 0.89 for positive attitudes and 0.86 for negative attitudes.

Data Collection

Data were collected between July and November 2025. Links to the data collection forms were sent via WhatsApp, Facebook, X, Instagram, and email to women who agreed to participate in the study and who met the inclusion criteria. The participating women were asked to share the link with other women in their circle. To ensure that participants were informed about the study, the beginning of the data collection form included an explanation of the purpose of the study, inclusion criteria, confidentiality procedures, and the option to withdraw from the study at any time. This section also provided a contact number for the responsible researcher so that the women could call if they had any questions about the study or did not understand any of the questions. Before filling out the data collection form, the women were asked to check the "I agree" option to confirm their consent to participate in the study. The data collection process took an average of 10-15 minutes. To prevent duplicate responses, the online survey system was configured to allow only one response per device/account per participant.

Data Analysis

Data were analyzed using the IBM SPSS Statistics (Statistical Package for Social Science) version 22.0 statistical package program. Descriptive statistics (number, percentage, mean, and standard deviation) were used to analyze the data. The normality of the data was determined using the Kolmogorov-Smirnov test, histogram graphs, Q-Q plots, and skewness-kurtosis values. Independent samples t-tests were used for binary variables showing a normal distribution, and one-way analysis of variance (ANOVA) and Bonferroni tests were used for more than two variables. Mann Whitney U tests were used for binary variables not showing a normal distribution, while Kruskal-Wallis and Bonferroni tests were used for more than two variables. Cohen 's(d) and Eta squared ($\eta 2$) coefficients were calculated to determine the effect size. The relationship between the scales was evaluated using Pearson's correlation analysis. Cases with missing data were excluded from the analyses using listwise deletions. The proportion of missing data was less than 5%; therefore, no imputation procedures were performed. Hierarchical regression analysis was performed to examine the factors determining women's breast cancer worry. Categorical variables were dummy coded for the regression analysis. The categories indicated as "referent" served as reference groups (coded as 0). The remaining categories were compared with the reference category. Positive β coefficients indicate higher outcome scores relative to the reference group, whereas negative β coefficients indicate lower outcome scores. Statistical significance was set at $p < 0.05$.

Ethical Approval

Ethics committee approval was obtained from the Social and Human Ethics Committee (Date: 18.06.2025 No: 2025-SBB-0520) of Bartın University prior to the study. In addition, all women participating in the study were informed about the study, and electronic informed consent was obtained from those who agreed to participate in the study.

Results

The average age of the women was 43.41 ± 12.85 years, and the average number of living children was 2.14 ± 1.52 years. While the majority of women were unemployed (68.8%), 27.5% had a university degree or higher, and 59.6% had an income equal to their expenses (Table 1). The AILS total and subscale scores were higher in employed and single women with a high school education or higher ($p < 0.001$; Table 1). Conversely, marital status had no effect on the AILS evaluation subscale scores ($p > 0.05$; Table 1). Negative GAAIS subscale scores were higher in women with a university degree or higher ($p < 0.001$).

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Positive GAAIS subscale scores were higher in single women and women with a high school degree or higher ($p < 0.001$). The total BCWC score was higher among married women and women whose income exceeded their expenses ($p < 0.001$; Table 1). The total AILS score was higher in premenopausal women than in postmenopausal women ($p < 0.05$). The total BCWC score was higher in women who used Hormone Replacement Therapy (HRT) ($p < 0.001$; Table 1). Women who performed self-breast examinations (SBE) had higher total AILS scores ($p < 0.05$; Table 2). Women who were not worried about breast cancer had higher total AILS and evaluation subscale scores ($p < 0.05$; Table 2). Women with breast cancer who were worried had lower levels of positive attitudes and higher levels of negative attitudes toward artificial intelligence ($p < 0.001$; Table 2). The BCWC total score was higher in women who felt a lump in their breast, had previously undergone a breast biopsy, breast cancer screening, SBE, clinical breast examination, and mammography ($p < 0.001$; Table 2).

Table 1. Examination of women's sociodemographic characteristics with AILS total and subscale scores, GAAIS subscale scores, and BCWC mean scores

Variables	n (%)	AILS total	AILS awareness	AILS use	AILS evaluation	AILS ethics	GAAIS negative attitude	GAAIS positive attitude	BCWC
		$\bar{X}$ ± SD	$\bar{X}$ ± SD	$\bar{X}$ ± SD	$\bar{X}$ ± SD	$\bar{X}$ ± SD	$\bar{X}$ ± SD	$\bar{X}$ ± SD	$\bar{X}$ ± SD
Employment status									
Employed	187 (31.2)	39.26 ± 6.59	9.75 ± 1.78	9.76 ± 1.98	9.59 ± 2.84	10.16 ± 1.92	20.71 ± 6.93	38.67 ± 7.98	9.50 ± 4.87
Unemployed	412 (68.8)	38.62 ± 6.84	9.61 ± 1.90	9.55 ± 2.12	9.39 ± 2.64	10.07 ± 1.96	21.39 ± 6.51	38.80 ± 7.85	8.91 ± 4.56
Test/p		[&]1.075/ 0.283	[&]0.848/ 0.397	[&]1.113/ 0.266	[&]0.862/ 0.389	[&]0.538/ 0.591	[&]-1.164/ 0.245	[&]-0.176/ 0.860	[&]1.454/ 0.147
Marital status									
Married	392 (65.4)	38.21 ± 6.36	9.52 ± 1.73	9.37 ± 1.98	9.40 ± 2.65	9.92 ± 1.88	20.80 ± 6.53	38.24 ± 7.99	9.50 ± 4.56
Singe	207 (34.6)	39.98 ± 7.34	9.90 ± 2.07	10.09 ± 2.18	9.56 ± 2.80	10.44 ± 2.03	21.90 ± 6.82	39.74 ± 7.59	8.31 ± 4.78
Test/p/d		[#]34249.000/ **< 0.001**	[#]35429.500/ **< 0.05**	[#]34183.000/ **< 0.001**	[&]-0.679/ 0.498	[#]34353.000/ **< 0.05**	[&]-1.927/ 0.055	[&]-2.232/ **< 0.05/** 0.192	[&]2.985/ **< 0.05/** 0.254
Education level									
Literate/primary school graduate[1]	218 (36.4)	36.20 ± 6.42	9.01 ± 1.72	8.83 ± 2.02	8.65 ± 2.65	9.70 ± 1.83	20.51 ± 6.09	36.95 ± 7.71	8.65 ± 4.51
Middle school graduate[2]	125 (20.9)	38.34 ± 5.47	9.40 ± 1.61	9.46 ± 1.60	9.59 ± 2.55	9.89 ± 1.68	20.08 ± 6.68	39.28 ± 7.45	9.64 ± 4.81
High school graduate[3]	91 (15.2)	39.35 ± 5.28	10.01 ± 1.67	9.62 ± 1.77	9.79 ± 2.32	9.93 ± 1.92	21.15 ± 6.58	39.49 ± 7.77	9.84 ± 4.88
University and above[4]	165 (27.5)	42.36 ± 7.22	10.49 ± 1.98	10.78 ± 2.10	10.22 ± 2.82	10.87 ± 2.10	22.91 ± 7.06	40.34 ± 8.09	8.85 ± 4.64
Test/p/η²		[µ]77.295/ **< 0.001 1 < 2,3,4 2,3 < 4**	[µ]63.333/ **< 0.001 1,2 < 3,4**	[µ]73.859/ **< 0.001 1 < 2,3,4 2,3 < 4**	[¥]12.032/ **< 0.001 1 < 2,3,4**	[µ]33.608/ **< 0.001 1 < 2,3,4**	[¥]5.729/ **< 0.001 1,2 < 4**	[¥]6.648/ **< 0.001 1 < 2,4**	[¥]2.162/ 0.091
Income status									
Income less than expenses	115 (19.2)	38.39 ± 7.34	9.83 ± 2.07	9.21 ± 2.65	9.32 ± 2.58	10.03 ± 2.07	20.50 ± 6.14	37.70 ± 8.60	9.00 ± 4.86
Income equal to expenses	357 (59.6)	39.15 ± 6.49	9.69 ± 1.80	9.74 ± 1.90	9.54 ± 2.59	10.19 ± 1.95	21.31 ± 6.67	39.27 ± 7.44	8.66 ± 4.53
Income more than expenses	127 (21.2)	38.28 ± 6.96	9.40 ± 1.84	9.66 ± 1.90	9.32 ± 3.09	9.90 ± 1.80	21.44 ± 7.03	38.27 ± 8.35	10.39 ± 4.64
Test/p/η²		[¥]1.060/ 0.347	[¥]1.710/ 0.182	[µ]3.614/ 0.164	[µ]1.535/ 0.464	[¥]1.111/ 0.330	[¥]0.773/ 0.462	[¥]2.063/ 0.128	[¥]6.633/ **0.001/** 0.022 **3 > 2**

[#]Mann-Whitney U [&]Independent Samples t-test [¥]One Way ANOVA [µ]Kruskal Wallis test d = Cohen d η2 = Eta squared . Average age: 43.41 ± 12.85 Average number of children: 2.14 ± 1.52. Abbreviations: AILS, Artificial Intelligence Literacy Scale; BCWC, Breast Cancer Worry Scale; GAAIS, General Attitude Toward Artificial Intelligence Scale.

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Table 1. Examination of women's sociodemographic characteristics with AILS total and subscale scores, GAAIS subscale scores, and BCWC mean scores

Variables	n (%)	AILS total	AILS awareness	AILS use	AILS evaluation	AILS ethics	GAAIS negative attitude	GAAIS positive attitude	BCWC
		X̄ ± SD	X̄ ± SD	X̄ ± SD	X̄ ± SD	X̄ ± SD	X̄ ± SD	X̄ ± SD	X̄ ± SD
Being in menopause									
Yes	255 (37.6)	30.60 ± 6.26	9.05 ± 1.72	8.98 ± 1.95	8.97 ± 2.71	9.61 ± 1.73	20.56 ± 6.39	37.21 ± 8.25	8.84 ± 4.59
No	374 (62.4)	40.16 ± 6.71	10.02 ± 1.85	10.01 ± 2.05	9.74 ± 2.66	10.39 ± 2.01	21.55 ± 6.78	39.69 ± 7.52	9.24 ± 4.71
Test/p/d		[&]-6.431/ **< 0.001**/ 1.473	[&]-6.345/ **< 0.001/** 0.543	[&]-6.043/ **< 0.001/** 0.514	[&]-3.429/ **0.001/ 0.286**	[#]32516.000/ **< 0.00**1	[&]-1.762/ 0.079	[#]34553.500/ **< 0.001**	[&]0.804/ 0.306
HRT use									
Yes	56 (9.3)	37.73 ± 6.23	9.29 ± 1.55	9.20 ± 1.78	9.45 ± 2.68	9.80 ± 1.88	19.36 ± 6.45	37.89 ± 7.92	10.54 ± 4.42
No	543 (90.7)	38.93 ± 6.81	9.69 ± 1.89	9.66 ± 2.10	9.45 ± 2.71	10.13 ± 1.95	21.37 ± 6.64	38.85 ± 7.88	8.94 ± 4.67
Test/p		[&]-1.267/ 0.206	[&]-1.549/ 0.122	[&]-1.605/ 0.109	[&]-0.017/ 0.986	[&]-1.184/ 0.237	[&]-2.163/ **< 0.05**	[&]-0.862/ 0.389	[&]2.443/ **< 0.05**

[#]Mann-Whitney U [&]Independent Samples t-test [¥]One Way ANOVA [µ]Kruskal Wallis test d = Cohen d η2 = Eta squared . Average age: 43.41 ± 12.85 Average number of children: 2.14 ± 1.52. Abbreviations: AILS, Artificial Intelligence Literacy Scale; BCWC, Breast Cancer Worry Scale; GAAIS, General Attitude Toward Artificial Intelligence Scale.

Table 2. Examination of the characteristics of women participating in the study regarding breast cancer and their opinions on artificial intelligence, along with AILS total and subscale scores, GAAIS subscale scores, and BCWC mean scores

Variables	n (%)	AILS total	AILS awareness	AILS use	AILS evaluation	AILS ethics	GAAIS negative attitude	GAAIS positive attitude	BCWC
		X̄ ± SD	X̄ ± SD	X̄ ± SD	X̄ ± SD	X̄ ± SD	X̄ ± SD	X̄ ± SD	X̄ ± SD
Family history of breast cancer									
Yes	86 (14.4)	38.23 ± 6.78	9.60 ± 1.76	9.13 ± 2.22	9.40 ± 2.61	10.10 ± 2.11	21.16 ± 6.44	37.53 ± 7.71	9.65 ± 4.45
No	513 (85.6)	38.92 ± 6.76	9.66 ± 1.88	9.70 ± 2.04	9.46 ± 2.72	10.10 ± 1.92	21.18 ± 6.68	38.96 ± 7.90	8.99 ± 4.70
Test/p/d		[&]-0.873/ 0.383	[&]-0.258/ 0.796	[&]-2.383/ **< 0.05/** 0.267	[&]-0.212/ 0.833	[&]0.040/ 0.968	[&]-0.026/ 0.979	[&]-1.556/ 0.120	[&]1.202/ 0.230
Feeling a lump in the breast									
Yes	51 (8.5)	39.69 ± 7.36	9.86 ± 1.94	9.71 ± 2.26	9.71 ± 2.87	10.41 ± 1.98	20.04 ± 6.23	40.43 ± 7.97	12.53 ± 4.42
No	548 (91.5)	38.74 ± 6.70	9.63 ± 1.86	9.61 ± 2.06	9.43 ± 2.69	10.07 ± 1.94	21.29 ± 6.68	38.60 ± 7.86	8.77 ± 4.56
Test/p/d		[&]0.955/ 0.340	[&]0.841/ 0.401	[&]0.311/ 0.756	[&]0.700/ 0.484	[&]1.208/ 0.228	[&]-1.283/ 0.200	[&]1.587/ 0.113	[&]5.642/ **< 0.001/** 0.837
History of a breast biopsy									
Yes	70 (11.7)	39.84 ± 6.50	9.84 ± 1.77	9.63 ± 2.03	9.91 ± 2.73	10.46 ± 2.09	20.44 ± 6.17	40.60 ± 6.90	12.04 ± 4.80
No	529 (88.3)	38.69 ± 6.79	9.63 ± 1.88	9.62 ± 2.08	9.39 ± 2.69	10.05 ± 1.93	21.28 ± 6.70	38.51 ± 7.98	8.70 ± 4.51
Test/p/d		[&]1.346/ 0.179	[&]0.907/ 0.365	[&]0.039/ 0.969	[&]1.524/ 0.128	[&]1.649/ 0.100	[&]-0.988/ 0.324	[&]2.086/ **< 0.05/** 0.280	[&]5.783/ **< 0.001/** 0.717
History of breast cancer screening									
Yes	134 (22.4)	39.97 ± 6.57	9.91 ± 1.75	9.74 ± 1.89	9.96 ± 2.68	10.37 ± 1.96	21.10 ± 6.56	40.27 ± 7.92	10.84 ± 4.80
No	465 (77.6)	38.49 ± 6.79	9.58 ± 1.89	9.58 ± 2.12	9.31 ± 2.69	10.02 ± 1.94	21.20 ± 6.68	38.32 ± 7.83	8.59 ± 4.50
Test/p/d		[&]0.344/ 0.025	[&]1.819/ 0.069	[&]0.756/ 0.450	[&]2.456/ **< 0.05/** 0.242	[&]1.817/ 0.070	[&]-0.150/ 0.881	[&]2.529/ **< 0.05/** 0.247	[&]5.032/ **< 0.001/** 0.483

[#]Mann-Whitney U [&]Independent Samples t-test [¥]One Way ANOVA [µ]Kruskal Wallis test d = Cohen d η2 = Eta squared. Abbreviations: AILS, Artificial Intelligence Literacy Scale; BCWC, Breast Cancer Worry Scale; GAAIS, General Attitude Toward Artificial Intelligence Scale.

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		X̄ ± SD	X̄ ± SD	X̄ ± SD	X̄ ± SD	X̄ ± SD	X̄ ± SD	X̄ ± SD	X̄ ± SD
Performing a self-breast examination									
Yes	264 (44.1)	39.67 ± 6.76	9.82 ± 1.89	9.84 ± 2.08	9.82 ± 2.58	10.19 ± 1.92	20.88 ± 6.73	39.54 ± 8.05	9.56 ± 4.71
No	335 (55.9)	38.16 ± 6.70	9.52 ± 1.84	9.44 ± 2.05	9.16 ± 2.76	10.03 ± 1.97	21.42 ± 6.58	38.14 ± 7.71	8.72 ± 4.60
Test/p/d		&2.731/ **< 0.001/** 0.224	&1.976/ **< 0.05/** 0.160	&2.329/ **< 0.05/** 0.193	&2.961/ **< 0.05/** 0.247	&0.990/ 0.322	&-0.998/ 0.319	&2.156/ **< 0.05**	&2.208/ **< 0.05/** 0.180
Having undergone a clinical breast examination									
Yes	110 (18.4)	39.46 ± 6.90	9.75 ± 1.78	9.64 ± 1.97	9.85 ± 2.94	10.24 ± 1.84	20.77 ± 6.28	40.34 ± 8.55	10.95 ± 4.85
No	489 (81.6)	38.68 ± 6.73	9.63 ± 1.88	9.62 ± 2.10	9.36 ± 2.64	10.07 ± 1.97	21.27 ± 6.73	38.40 ± 7.69	8.67 ± 4.52
Test/p/d		&1.103/ 0.271	&0.577/ 0.564	&0.095/ 0.924	&1.692/ 0.091	&0.831/ 0.406	&-0.712/ 0.477	&2.333/ **< 0.05**	&4.693/ **< 0.001/** 0.486
Having undergone mammography									
Yes	92 (15.4)	39.08 ± 7.55	9.64 ± 1.91	9.52 ± 2.08	9.60 ± 3.10	10.34 ± 2.03	21.32 ± 6.53	39.64 ± 8.33	10.79 ± 5.04
No	507 (84.6)	38.77 ± 6.61	9.65 ± 1.86	9.64 ± 2.07	9.43 ± 2.62	10.05 ± 1.93	21.16 ± 6.67	38.60 ± 7.80	8.78 ± 4.53
Test/p/d		&0.426/ 0.670	&-0.064/ 0.949	#22956.000/ 0.808	&0.561/ 0.575	&1.286/ 0.199	&0.211/ 0.833	&1.169/ 0.243	&3.847/ **< 0.001/** 0.419
BCWC									
Yes	399 (66.6)	38.31 ± 7.06	9.60 ± 1.95	9.54 ± 2.15	9.15 ± 2.79	10.02 ± 1.96	21.89 ± 6.82	37.73 ± 8.00	6.58 ± 3.32
No	200 (33.4)	39.85 ± 6.01	9.76 ± 1.68	9.78 ± 1.91	10.07 ± 2.41	10.25 ± 1.91	19.76 ± 6.05	40.82 ± 7.24	14.11 ± 2.34
Test/p/d		#35134.500/ **< 0.05**	#38438.500/ 0.457	&-1.301/ 0.194	#32754.500/ **< 0.001**	&-1.364/ 0.173	#32342.000/ **< 0.001**	&-4.597/ **< 0.001/** 0.405	&-28.708/ **< 0.001/** 2.621

#Mann-Whitney U &Independent Samples t-test ¥One Way ANOVA ¤Kruskal Wallis test d = Cohen d η2 = Eta squared. Abbreviations: AILS, Artificial Intelligence Literacy Scale; BCWC, Breast Cancer Worry Scale; GAAIS, General Attitude Toward Artificial Intelligence Scale.

A positive correlation was detected between the BCWC and AILS total scores ($r = 0.146$, $p < 0.001$) and between the AILS use ($r = 0.095$, $p < 0.05$) and evaluation ($r = 0.204$, $p < 0.001$) subscales (Table 3). A positive correlation was found between the BCWC total score and the negative attitude subscale of the GAAIS ($r = 0.190$, $p < 0.001$). A positive correlation was found between the BCWC total score and the positive attitude subscale of the GAAIS ($r = 0.218$, $p < 0.001$; Table 4).

Hierarchical regression analysis was performed to determine the predictors of breast cancer worry among women. Model 1, which included women's personal characteristics, was statistically significant and explained 11.1% of the total variance ($F = 6.119$, $p < 0.001$). In Model 1, marital status, education level, feeling a lump in the breast, having undergone a breast biopsy, and having undergone breast cancer screening were found to predict breast cancer worry. Artificial intelligence literacy was included in Model 2. This model significantly explained breast cancer worry ($F = 6.210$, $p < 0.001$) and accounted for 14.6% of the total variance in breast cancer worry. In this model, the AILS evaluation subscale effectively predicted breast cancer-related worries. In Model 3, AI attitude was added, and the model was found to be significant ($F = 7.352$, $p < 0.001$). The model explained 18.6% of the total variance. In the final model, significant predictors of breast cancer worry were marital status ($\beta = -0.112$, $p < 0.05$), education level ($\beta = 0.092$, $p < 0.05$), feeling a lump in the breast ($\beta = -0.114$, $p < 0.05$), previous breast cancer screening status ($\beta = -0.102$, $p < 0.05$), AILS awareness subscale ($\beta = -0.103$, $p < 0.05$), AILS evaluation subscale ($\beta = 0.133$, $p < 0.05$), GAAIS positive attitudes subscale ($\beta = 0.138$, $p < 0.05$), and GAAIS negative attitudes subscale ($\beta = -0.163$, $p < 0.001$) (Table 3).

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Table 3. Model for predicting BCWC scores based on women's sociodemographic and AI use characteristics and AILS and GAAIS total and subscale scores

Variables	Model 1				Model 2				Model 3			
	B	SE	β	p	B	SE	β	p	B	SE	β	p
Employment status (referent: employed)	0.373	0.429	0.037	0.385	0.276	0.422	0.027	0.514	0.349	0.414	0.035	0.400
Marital status (referent: married)	-1.105	0.440	-0.113	**< 0.05**	-1.009	0.437	-0.103	**< 0.05**	-1.097	0.429	-0.112	**< 0.05**
Education level (referent = literate/ primary school graduate)	0.294	0.126	0.104	**< 0.05**	0.193	0.133	0.068	0.148	0.259	0.131	0.092	**< 0.05**
Income level (referent: Income less than expenses)	0.385	0.301	0.052	0.201	0.336	0.301	0.046	0.265	0.366	0.295	0.050	0.215
HRT use (referent: Yes)	-1.155	0.634	-0.072	0.069	-1.060	0.625	-0.066	0.090	-0.949	0.613	-0.059	0.122
Family history of breast cancer (referent: Yes)	-0.086	0.530	-0.006	0.871	-0.199	0.525	-0.015	0.705	-0.347	0.515	-0.026	0.501
Feeling a lump in the breast (referent: Yes)	-1.996	0.773	-0.120	**< 0.05**	-2.089	0.762	-0.125	**< 0.05**	-1.900	0.746	-0.114	**< 0.05**
Previous history of a breast biopsy (referent: Yes)	-1.546	0.715	-0.107	**< 0.05**	-1.433	0.704	-0.099	**< 0.05**	-1.335	0.689	-0.092	0.053
Previous history of breast cancer screening (referent: Yes)	-1.296	0.507	-0.116	**< 0.05**	-1.152	0.502	-0.103	**< 0.05**	-1.141	0.491	-0.102	**< 0.05**
Performing self-breast examination (referent: Yes)	-0.197	0.396	-0.021	0.619	-0.021	0.392	-0.002	0.956	0.029	0.383	0.003	0.939
Having undergone a clinical breast examination (referent: Yes)	-0.516	0.621	-0.043	0.406	-0.450	0.611	-0.037	0.462	-0.319	0.599	-0.026	0.595
Having undergone mammography (referent: Yes)	0.145	0.646	0.011	0.823	0.017	0.637	0.001	0.978	-0.110	0.624	-0.009	0.860
AILS awareness subscale					-0.251	0.128	-0.100	0.051	-0.257	0.126	-0.103	**< 0.05**
AILS use subscale					0.133	0.114	0.059	0.243	0.100	0.112	0.045	0.371
AILS evaluation subscale					0.377	0.088	0.218	**< 0.001**	0.229	0.093	0.133	**< 0.05**
AILS ethics subscale					-0.109	0.112	-0.046	0.332	-0.063	0.110	-0.026	0.569
GAAIS negative attitudes									0.081	0.027	0.138	**< 0.05**
GAAIS positive attitudes									-0.114	0.027	-0.163	**< 0.001**
F(p)		6.119 (0.000)				6.210 (0.000)				7.352 (0.000)		
R^2		0.111				0.146				0.186		
Adj. R^2		0.093				0.122				0.161		
R^2 change		-				0.35				0.40		
Durbin- Watson										2.126		

B Unstandardized coefficients, β Standardized coefficient, SE Standard error Predictors had a statistically significant association with the outcome variable in univariate analysis ($p < 0$ .05). Abbreviations: AILS, Artificial Intelligence Literacy Scale; BCWC, Breast Cancer Worry Scale; GAAIS, General Attitude Toward Artificial Intelligence Scale; SE, standart error.

Table 4. Correlation analysis of women's BCWC, AILS, and GAAIS total and subscale scores

Scales	X ± SD	1	2	3	4	5	6	7	8
1. BCWC	9.09 ± 4.66	1							
2. AILS total	38.82 ± 6.76	**0.146****	1						
3. AILS awareness subscale	9.65 ± 1.86	0.051	**0.775****	1					
4. AILS use subscale	9.62 ± 2.07	**0.095***	**0.773****	**0.564****	1				
5. AILS evaluation subscale	9.45 ± 2.70	**0.204****	**0.843****	**0.531****	**0.473****	1			
6. AILS ethics subscale	10.10 ± 1.95	0.073	**0.737****	**0.395****	**0.423****	**0.527****	1		
7. GAAIS negative attitudes	21.18 ± 6.65	**-0.190****	0.021	0.041	0.043	-0.053	0.061	1	
8. GAAIS positive attitudes	38.76 ± 7.88	**0.218****	**0.504****	**0.366****	**0.363****	**0.522****	**0.290****	-0.052	1

Pearson Correlation Analysis *$p < 0.05$ **$p < 0.001$. Abbreviations: AILS, Artificial Intelligence Literacy Scale; BCWC, Breast Cancer Worry Scale; GAAIS, General Attitude Toward Artificial Intelligence Scale.

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Discussion

This study found that higher levels of AI literacy and more positive attitudes toward AI were associated with greater worry about breast cancer. Women who performed self-breast examinations had high levels of artificial intelligence literacy, awareness, and use, as well as positive attitudes toward artificial intelligence. Additionally, women who underwent clinical breast examinations had positive attitudes toward AI. However, mammography participation was not associated with AI literacy or attitudes. These findings may indicate that women with greater awareness of AI technologies and stronger perceptions of AI use in healthcare may also have increased sensitivity and worry about breast cancer.

The use of artificial intelligence applications in breast cancer screening raises technological concerns, trust issues regarding artificial intelligence, ethical issues, and possible uncertainty after the adoption of artificial intelligence in breast cancer [33]. Ayaad et al. (2025) indicated that 70% of women in Middle Eastern countries had moderate to low awareness of breast cancer [34]. The study identified emotional factors, economic problems, and barriers related to a lack of information as obstacles to early breast cancer screening. Education aimed at increasing awareness and knowledge and encouraging help-seeking behavior has been reported to increase positive attitudes toward breast cancer screening [34]. A study found that participation in mammography screening is influenced by a lack of information, cultural beliefs, and religious factors [35]. Although artificial intelligence is used in the health field, attitudes toward artificial intelligence are influenced by individuals' health status, demographic factors, previous use of artificial intelligence in their lives, and artificial intelligence literacy levels [28]. A cross-sectional study conducted by Busch et al. (2025) with 13.806 patients in 43 countries found that healthy women had a more positive attitude towards artificial intelligence than women with health conditions [28]. Ekaterina et al. (2025) found that standard education supported by AI-generated visual texts improved women's understanding of their Pap smear test results and increased their participation in follow-up programs [36].

Similar to several types of cancer, artificial intelligence has been reported to be useful in the early detection and treatment of breast cancer [24]. Artificial intelligence achieves this by identifying cancerous tissue, determining the volume of cancer cells, determining the cancer phenotype, and risk assessment [37]. This study found that women who were afraid of using artificial intelligence and were unsure about its reliability in medicine had higher breast cancer worry [37]. Wu et al. (2022) evaluated breast ultrasound results using a deep learning model and reported that the joint evaluation of breast ultrasound by the deep learning model and physicians was better than that of senior physicians [21]. It was also found that the deep learning model alone performed better than young physicians [21]. Dembrower et al. (2023) stated that mammography results evaluated by artificial intelligence were more effective in detecting breast cancer than those evaluated by two radiologists compared to those evaluated by artificial intelligence alone. The study also found that evaluating mammography results using one radiologist and one artificial intelligence tool was more effective in detecting breast cancer than using two radiologists [33]. A randomized controlled trial conducted by Lang et al. (2023) involving 80.033 women at risk of breast cancer and with a history of breast cancer determined that AI-assisted mammogram reading by a radiologist increased the detection rate and reliability of breast cancer compared to double reading by the same radiologist. Additionally, the use of artificial intelligence reduces screen reading time, thereby decreasing the workload of radiologists [38].

Cancer symptoms and signs, along with suspicious, uncertain, or positive cancer screening results, increase cancer worry [8,12]. This study found that women who used HRT, felt a lump in their breast, and underwent breast biopsy, breast cancer screening, self-breast examination, clinical breast examination, and mammography had higher breast cancer worry. These findings suggest that women with higher breast cancer worry tend to participate more in screenings.

In a systematic review conducted in Middle Eastern countries, Alduraidi et al. (2025) stated that insufficient knowledge about breast cancer, difficulty in making appointments, lack of female doctors in health centers, long waiting times, and difficulty in accessing centers reduced participation in screening tests [39]. In contrast to the present study, that study found that women with low breast cancer awareness, fear of the procedures involved in breast cancer, and embarrassment in asking questions about breast cancer participated less in breast cancer screenings [39]. Özkan et al. (2024) found that women aged 50 and over, who had previously been diagnosed with cancer, knew they should undergo cancer screening, were referred for mammography by health professionals, found mammography painful, and did not know that early screening tests were free at health centers had low participation in screening programs [10]. In addition, the study found that women with breast cancer worry had lower participation rates in breast cancer screening programs than those without such worries [10]. Breast cancer worry was found to be more prevalent among women at risk of breast cancer, who exhibited negative attitudes. Zhuang and Guan (2022) stated that moderate breast cancer worry increases information-seeking behavior about breast cancer and participation in early breast cancer detection methods [40].

This study had several limitations. First, the data for this study were collected online using a questionnaire. Second, although we achieved a large sample size, we did not include an equal number of women from different regions of Türkiye. Future studies should consider these limitations in their study design.

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Conclusion

AI literacy and attitudes vary among women of different generations in our country, necessitating an evaluation across generations. It is also recommended that education on the benefits of using AI in healthcare be provided according to the educational levels and ages of the respondents. It is important for nurses, who have a counseling and educational role, to raise awareness among women regarding the use of artificial intelligence in breast cancer screening. Menopause is associated with an increased risk of breast cancer. In the present study, menopausal women had lower AI literacy levels and less positive attitudes toward AI than non-menopausal women. Therefore, nurses should provide counseling specifically to women during this period.

This study found that women with high artificial intelligence literacy and positive attitudes toward artificial intelligence had high breast cancer-related worries. Women at risk of breast cancer had higher breast cancer worry. These findings suggest that breast cancer worry is related to AI literacy; therefore, AI literacy should be assessed in women who apply for screening programs.

Ethical Approval

Ethical committee approval was obtained from the Bartın University Social and Human Ethics Committee (Date: 18.06.2025 No: 2025-SBB-0520) before starting the research.

Patient Consent

All women participating in the research were informed about the research and written and/or verbal consent forms were obtained stating that they voluntarily participated.

Conflict of Interest

The authors confirm the absence of any conflicts associated with this work.

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