

Original Article

Risk factors and prediction model for sub-threshold depression in young and middle-aged breast cancer patients

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Abstract: Objective: To explore the current status of subthreshold depression in young and middle-aged breast cancer patients and its influencing factors, in order to guide early identification and intervention in clinical settings. Methods: The study included 385 young and middle-aged cancer patients treated at the First Affiliated Hospital of Xinjiang Medical University from June 2023 to June 2024. Standardized scales were used to evaluate sub-threshold depression, psychological resilience, and self-perceived burden. Multivariate linear regression analysis was performed to identify risk factors, and ROC analysis was utilized to assess the predictive performance of the model. Results: The sub-threshold depression score for 385 patients was 104.23 ± 19.36 , with an average item score of 3.58 ± 0.59 . Statistically significant differences in sub-threshold depression scores were observed across age groups, family relationships, economic burdens due to the illness, prior contact with patients having the same disease, subjective feelings about the illness, clinical stages, and whether patients had received radiotherapy or chemotherapy (all $P < 0.05$). No statistically significant differences were found in other variables (all $P > 0.05$). Significant risk factors for sub-threshold depression included age ≥ 31 years, poor family relationships, severe subjective perception of the illness, heavy economic burden due to the disease, clinical stage III, psychological resilience, self-perceived burden, and receiving radiotherapy or chemotherapy (all $P < 0.05$). ROC analysis revealed that the area under the curve (AUC) for the predictive model was 0.956. Conclusion: The prediction model developed in this study provides a theoretical basis for screening sub-threshold depression in young and middle-aged breast cancer patients. It also offers a reference for clinical healthcare professionals to adopt preventive measures and care strategies for patients at risk of sub-threshold depression.

Keywords: Breast cancer, young and middle-aged, sub-threshold depression, risk factors, prediction model

Introduction

Breast cancer is one of the most common malignant tumors among women, representing a significant global health burden. Each year, over two million new cases of breast cancer are diagnosed worldwide [1]. Notably, the incidence among young and middle-aged women has been steadily increasing. According to the latest international age classification, women aged 20 to 59 years fall into the young and middle-aged category. In recent years, the prevalence of breast cancer in this demographic

has risen substantially, with rapid growth in diagnosis rates among women aged 30 to 40, who now account for over 40% of women aged 40, compared to just 2% among women aged 20 [2]. In China, the peak incidence of breast cancer occurs between age 45 and 54, approximately 10 years earlier than that in Europe and the United States. Moreover, about 57% of breast cancer patients in China are under 50 years old, a much higher proportion than that in developed countries [3, 4], placing a significant health and socioeconomic burden on patients and their families [5].

Advances in breast cancer treatment and therapeutic protocols have significantly improved patient survival rates. However, breast cancer patients frequently face psychological issues during treatment, with depression being one of the most prevalent issues. Studies show that 20% to 50% of breast cancer patients exhibit depressive symptoms [6]. Particularly concerning is the psychological burden experienced by young and middle-aged patients, who often face numerous challenges after returning home. Research indicates that young patients, unemployed individuals, and those with lower socioeconomic status are at higher risk of developing severe depression following a breast cancer diagnosis [7]. Additionally, young and middle-aged patients are often primary caregivers, responsible for their families and careers, and face greater pressures such as impaired physical integrity, the need for functional rehabilitation, discomfort from chemotherapy, and financial difficulties [8]. These challenges severely impact the physical and mental health of this group. Depression is often characterized by symptoms such as low mood, loss of interest, and sleep disturbances, all of which significantly impair patients' quality of life and mental well-being [9]. Furthermore, depressive symptoms can adversely affect breast cancer treatment and prognosis [10]. Studies have shown that depressive symptoms interfere with treatment adherence, immune function, and metabolic processes, thereby reducing treatment efficacy and negatively impacting patient survival [11].

To improve treatment outcomes and quality of life for young and middle-aged breast cancer patients, it is crucial to explore the factors influencing depressive symptoms in this population. While some domestic and international studies have examined the depressive symptoms of breast cancer patients and their associated factors, research specifically focusing on young and middle-aged patients remains limited. Therefore, this study aims to investigate the factors influencing depressive symptoms in young and middle-aged breast cancer patients and to establish a predictive model. The findings will provide a scientific basis for clinical practice and serve as a reliable reference for psychological interventions and treatment planning for this population.

Materials and methods

Subject selection

A convenience sampling method was used to select young and middle-aged breast cancer patients admitted to the First Affiliated Hospital of Xinjiang Medical University from June 2023 to June 2024.

Inclusion criteria: patients without cognitive or mental disorders, able to communicate effectively, and capable of independently completing the questionnaire; informed consent was obtained, and patients voluntarily participated; women aged 20 to 59; confirmed diagnosis of breast cancer via histopathological examination; no significant organ diseases or complications such as heart or lung diseases.

Exclusion criteria: patients with other malignant tumors, severe physical diseases, or conditions requiring surgery; those with mental disorders, intellectual disabilities, or reading and writing difficulties; a history of alcohol abuse, drug use, or prior use of antidepressants before the survey; and patients not fully informed about their condition.

The sample size was calculated using the formula: $N = Z^2 \times [P \times (1 - P)]/E^2$, where N is the sample size, Z is the statistical value, E is the sampling error, and P is the sample loss probability. A 95% confidence level was chosen, with $Z = 1.96$, an error margin of 5%, and a 50% sample loss probability, yielding a sample size of 385. This study was approved by the First Affiliated Hospital of Xinjiang Medical University.

Methods

General Information Questionnaire: A questionnaire designed by the research team to collect demographic and clinical data of young and middle-aged breast cancer patients, including gender, age, education level, marital status, etc.

Sub-threshold Depression Scale (STDS): The STDS, developed by Liu Yan in 2015 [12], assesses sub-threshold depression. The scale's internal consistency (Cronbach's α) was 0.947, with a retest reliability of 0.802. It consists of four dimensions: depressive mood (5 items), social function decline (10 items), physiological

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function decline (6 items), and low self-concept (8 items), with a total of 29 items. Each item is scored from 1 to 5, ranging from “completely inconsistent” to “completely consistent”, with total scores ranging from 29 to 145. Higher scores indicate more severe sub-threshold depression. In this study, the internal consistency (Cronbach's α) was 0.927, with a content validity of 0.908.

Simplified Chinese Version of the Resilience Scale (RISC): Developed by Connor et al. [13] and translated and modified by Wang et al. [14], the RISC measures psychological resilience. It consists of 10 items, each scored from 0 to 5 on a Likert scale, with total scores ranging from 0 to 50. Higher scores indicate greater resilience. The internal consistency (Cronbach's α) of the RISC in this study was 0.722, with a content validity of 0.914.

Self-Perceived Burden Scale (SPBS): The SPBS, developed by Cousineau et al. [15] in 2003 and translated by Simmons et al. [16], assesses self-perceived burden. The scale has three dimensions: physical (2 items), emotional (3 items), and economic factors (5 items), totaling 10 items. Each item is scored from 0 to 5, ranging from “never” to “always”, with total scores from 0 to 50. Higher scores indicate a more severe self-perceived burden. In this study, the internal consistency (Cronbach's α) was 0.862, and the content validity was 0.907.

Statistical methods

SPSS 27.0 was used for statistical analysis. Descriptive statistics were applied to categorical data (n%), and quantitative data were expressed as mean \pm standard deviation (Mean \pm SD). Pearson correlation analysis was conducted to assess the association between sub-threshold depression and psychological resilience, as well as other characteristics of young and middle-aged breast cancer patients. The t-test and one-way analysis of variance (ANOVA) were used to compare sub-threshold depression scores. Multiple linear regression analysis was used to examine the influencing factors of sub-threshold depression. A multiple linear regression model was established based on the regression results, and internal validation was performed using the Bootstrap method. The predictive performance of the model was evaluated using the Receiver Operating Characteristic

(ROC) curve, while the model's accuracy was assessed using the calibration curve. A significance level of $P < 0.05$ was used to determine statistical significance.

Results

Sub-threshold depression scores by demographic characteristics

The sub-threshold depression score for 385 young and middle-aged breast cancer patients was 104.23 ± 19.36 , with an average item score of 3.58 ± 0.59 . Significant differences were found based on age groups ($F = 26.222$, $P < 0.001$), family relationships ($F = 32.775$, $P < 0.001$), economic burden due to the illness ($F = 5.950$, $P = 0.003$), prior contact with patients with the same disease ($t = 3.084$, $P = 0.003$), subjective perception of the disease ($F = 22.232$, $P < 0.001$), clinical stage ($F = 34.277$, $P < 0.001$), and whether patients had received radiotherapy ($t = 3.065$, $P = 0.003$) or chemotherapy ($t = 2.129$, $P = 0.035$). No significant differences were observed for education ($t = 0.636$, $P = 0.526$), location ($t = 1.358$, $P = 0.177$), marital status ($F = 2.274$, $P = 0.107$), occupation ($F = 0.286$, $P = 0.835$), having trusted friends or relatives ($t = 1.672$, $P = 0.097$), average family income ($t = 1.851$, $P = 0.067$), medical expense coverage ($F = 1.760$, $P = 0.177$), identity of primary caregivers ($t = 1.902$, $P = 0.060$), attitude toward the inpatient environment and medical services ($F = 2.343$, $P = 0.100$), or pathological type ($t = 1.555$, $P = 0.123$) (Tables 1, 2).

The results demonstrated that younger individuals, those with poorer family relationships, those facing greater economic burdens, those without prior experience with similar diseases, those perceiving their disease as more severe, and those at advanced clinical stages had higher sub-threshold depression scores. Additionally, patients who had undergone radiotherapy and chemotherapy also exhibited significantly higher scores compared to those who had not received these treatments, suggesting a potential impact of these therapies on patient outcomes.

Psychological resilience and self-perceived burden scores

The study showed significant differences in psychological resilience ($t = 2.967$, $P = 0.004$) and

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Table 1. Demographic characteristics (Mean ± SD, points)

Parameter	Cases	Score	Statistics	P
Age (years)			F = 26.222	< 0.001
20-30	16	57.17±11.15		
31-40	54	77.42±14.21		
41-59	315	96.39±15.11		
Education			t = 0.636	0.526
Junior high school and below	145	71.38±15.88		
High school and above	240	73.21±15.12		
Location			t = 1.358	0.177
Rural	142	82.17±18.08		
Non-rural	243	86.56±16.71		
Marriage			F = 2.274	0.107
No	28	75.46±14.34		
Yes	312	76.81±15.16		
Devoice	45	85.79±15.27		
Family relationships			F = 32.775	< 0.001
Very Poor	32	95.65±14.67		
Poor	47	87.22±16.21		
Fair	85	65.83±15.23		
Good	221	63.79±14.19		
Occupation			F = 0.286	0.835
Farmer	160	73.56±16.42		
Professional/Technical/Administrative staff	101	72.05±15.21		
Business/Service staff	57	70.67±15.15		
Homemaker or Laid-off worker	67	71.47±16.17		
Having the most trusted friends or relatives			t = 1.672	0.097
No	253	82.64±14.15		
Yes	132	78.23±13.22		
Average family income (Yuan)			t = 1.851	0.067
< 5000	340	66.29±17.21		
≥ 5000	45	75.28±16.15		
Medical expense coverage			F = 1.760	0.177
Fully self-funded	54	82.75±12.15		
Publicly funded	51	76.16±13.18		
Medical insurance (New Rural Cooperative Medical System)	280	76.73±14.71		
Economic burdens caused by the disease			F = 5.950	0.003
Mild	19	70.14±10.68		
Moderate	79	80.25±15.15		
Severe	287	89.14±17.02		
Experience of contact with patients with the same disease			t = 3.084	0.003
No	208	68.63±16.35		
Yes	177	77.81±16.42		
Identity of main caregivers			t = 1.902	0.060
Spouse	252	86.15±16.74		
Others	133	92.34±17.25		
Subjective perception of the disease			F = 22.232	< 0.001
Mild	66	61.79±10.17		
Moderate	139	71.58±14.29		
Severe	180	85.56±17.26		

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Attitude to Inpatient environment and medical services			F = 2.343	0.100
Not satisfied	19	90.15±16.71		
Fair	85	75.17±19.25		
Satisfied	281	74.79±16.11		
Pathological type			t = 1.555	0.123
Invasive	208	88.79±16.31		
Non-invasive	177	93.58±17.69		
Clinical stage			F = 34.277	< 0.001
Ib	129	61.23±12.71		
II	186	70.94±12.68		
III	44	89.25±15.15		
IV	26	90.51±13.27		
Surgical type			F = 1.755	0.177
Modified radical mastectomy	142	76.14±12.02		
Mastectomy + sentinel lymph node biopsy	192	80.63±12.35		
Breast conserving surgery	51	78.21±12.42		
Radiotherapy			t = 3.065	0.003
No	176	71.21±16.08		
Yes	209	80.51±17.21		
Chemotherapy			t = 2.129	0.035
No	105	75.21±15.75		
Yes	280	82.14±16.05		

Table 2. Assignment of independent variables

Variables	Label	Value
X1	Education	1 = Elementary school, 2 = Junior high school, 3 = High school, 4 = College or above
X2	Location	1 = Rural, 2 = Township, 3 = Non-capital city, 4 = Provincial capital city
X3	Marriage	0 = Unmarried, 1 = Married, 2 = Divorced
X4	Family relationship	1 = Very poor, 2 = Poor, 3 = Fair, 4 = Good
X5	Occupation	1 = Farmer, 2 = Professional/Technical/Administrative staff, 3 = Business/Service staff, 4 = Homemaker or Laid-off worker
X6	Having the most trusted friends or relatives	0 = No, 1 = Yes
X7	Average family income	1 = Low, 1000~, 2 = 1000~, 3 = 2000~, 4 = 3000~, 5 = 5000 and above
X8	Medical expense coverage	1 = Fully self-funded, 2 = Publicly funded, 3 = Medical insurance (New Rural Cooperative Medical System)
X9	Economic burdens caused by the disease	1 = Mild, 2 = Moderate, 3 = Severe
X10	Experience of contact with patients with the same disease	0 = No, 1 = Yes
X11	Identity of main caregivers	1 = Spouse, 2 = Children, 3 = Parents, 4 = Siblings, 5 = Other individuals
X12	Subjective perception of the disease	1 = Mild, 2 = Moderate, 3 = Severe
X13	Attitude to Inpatient environment and medical services	1 = Dissatisfied, 2 = Fair, 3 = Satisfied
X14	Clinical stage	1 = Ib, 2 = II, 3 = III
X15	Psychological resilience	Continuous variable, input original value
X16	Self-perceived burden	Continuous variable, input original value
X17	Age	1 = 20-30, 2 = 31-40, 3 = 41-59
X18	radiotherapy	0 = no, 1 = yes
X19	Chemotherapy	0 = no, 1 = yes

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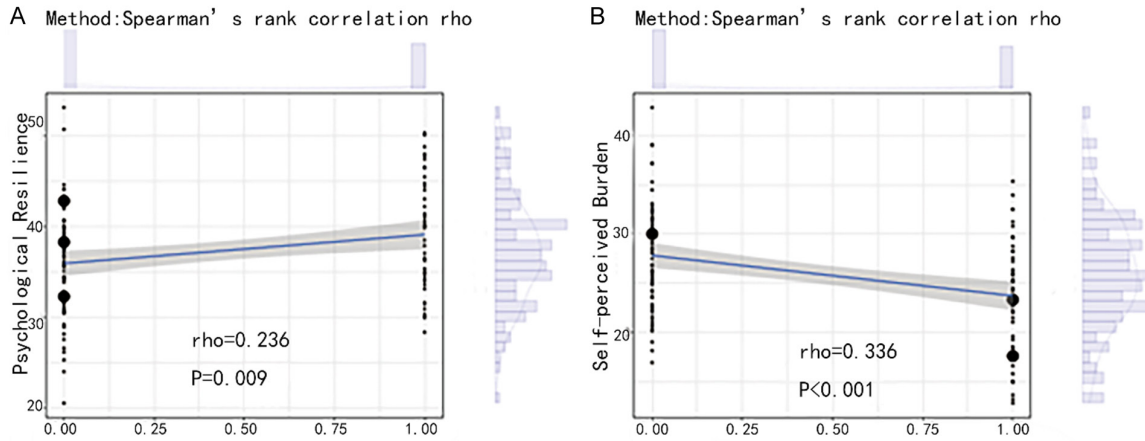


Figure 1. Psychological resilience and self-perceived burden scores. A. Psychological Resilience Score; B. Self-perceived Burden Score.

Table 3. Psychological resilience and self-perceived burden scores (Mean \pm SD, points)

Parameter	Item	Score scale	Subthreshold depression		Non-subthreshold depression		t	p
			Score	Average	Score	Average		
Psychological resilience	10	10-60	35.92 \pm 5.85	3.47 \pm 0.57	39.11 \pm 5.87	3.49 \pm 0.36	2.967	0.004
Self-perceived burden	10	0-40	27.82 \pm 5.28	2.78 \pm 0.46	23.72 \pm 5.44	2.74 \pm 0.47	4.191	< 0.001
Physical	2	0-8	5.57 \pm 1.06	2.87 \pm 0.61	5.68 \pm 1.77	2.96 \pm 0.53	0.418	0.677
Emotional	3	0-12	8.55 \pm 1.61	2.84 \pm 0.52	8.32 \pm 1.54	2.80 \pm 0.48	0.772	0.442
Economical	5	0-20	13.66 \pm 2.75	2.73 \pm 0.51	13.71 \pm 2.65	2.85 \pm 0.34	0.105	0.917

self-perceived burden ($t = 4.191$, $P < 0.001$) between the sub-threshold depression group and the non-sub-threshold depression group (**Figure 1**). No significant differences were observed in the physical ($t = 0.418$, $P = 0.677$), emotional ($t = 0.772$, $P = 0.442$), or economic ($t = 0.105$, $P = 0.917$) dimensions of self-perceived burden. Specifically, individuals with sub-threshold depression had lower psychological resilience scores (35.92 \pm 5.85 vs. 39.11 \pm 5.87) and higher self-perceived burden scores (27.82 \pm 5.28 vs. 23.72 \pm 5.44) compared to those without sub-threshold depression (**Table 3**). These findings suggest that patients with sub-threshold depression exhibit lower resilience and perceive themselves as a greater burden, emphasizing the need to address these factors in clinical interventions.

Influencing factors of sub-threshold depression

Using the sub-threshold depression score as the dependent variable, items with statistically significant differences in univariate analysis,

along with psychological resilience and self-perceived burden, were included as independent variables in a multiple linear regression model. The entry and removal criteria were set at 0.05 and 0.10, respectively. The analysis revealed that age ≥ 31 years, poor family relationships, severe subjective perception of the disease, heavy economic burden, clinical stage III, psychological resilience, self-perceived burden, radiotherapy, and chemotherapy were significant influencing factors of sub-threshold depression ($P < 0.05$) (**Table 4**).

Prediction model for sub-threshold depression

A risk prediction model was developed based on the factors influencing sub-threshold depression in young and middle-aged breast cancer patients. The model equation was:

Logit (P) = 15.471 + 0.648 \times age - 0.515 \times family relationship + 3.354 \times subjective perception of the disease + 0.538 \times economic burden + 4.982 \times clinical stage - 0.629 \times psychological resilience + 0.543 \times self-perceived burden +

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Table 4. The influencing factors of subthreshold depression in young and middle-aged breast cancer patients

	B	SE	β	t	P	95% CI
Constant	15.471	2.158		7.171	< 0.001	7.278-20.799
Age (20-30 years as reference)						
31-40	0.522	0.159	0.448	1.721	0.385	0.245-1.659
41-59	0.648	0.136	0.528	4.721	< 0.001	0.433-0.758
Family relationship (Good as reference)						
Very poor	-0.515	0.218	-0.417	-2.889	0.024	-0.793 - -0.458
Poor	0.221	0.175	0.229	1.738	0.372	0.128-0.549
Fair	0.238	0.192	0.248	1.772	0.352	0.145-0.477
Subjective perception of the disease (Mild as reference)						
Moderate	0.227	0.174	0.235	1.783	0.344	0.117-0.468
Severe	3.354	0.171	0.355	3.121	0.006	0.327-0.651
Economic burdens caused by the disease (Mild as reference)						
Moderate	0.243	0.144	0.229	1.798	0.329	0.126-0.425
Severe	0.538	0.147	0.367	3.489	0.005	0.452-0.958
Clinical stage (Ib as reference)						
II	0.252	0.141	0.228	1.776	0.344	0.127-0.428
III	4.982	0.356	0.418	3.415	0.002	0.305-0.598
Psychological resilience	-0.629	0.222	-0.421	-2.843	0.029	-0.843 - -0.466
Self-perceived burden	0.543	0.155	0.351	3.478	0.007	0.477-0.945
Radiotherapy	1.250	0.300	0.400	4.167	< 0.001	1.050-1.850
Chemotherapy	1.100	0.350	0.350	3.143	0.004	1.004-1.800

$1.250 \times \text{radiotherapy} + 1.100 \times \text{chemotherapy}$.

The area under the ROC curve (AUC) of the prediction model was 0.956, indicating acceptable predictive capability (Figure 2). A calibration curve was used for internal validation, which closely matched the ideal curve (Figure 3). The Hosmer-Lemeshow goodness-of-fit test showed $\chi^2 = 8.550$ ($P = 0.355$), indicating good agreement between the predicted and actual risk.

Discussion

Sub-threshold depression often precedes full-blown depression and can significantly reduce patients' social functioning and quality of life [17]. The physical trauma from breast cancer surgery and chemotherapy can be substantial, and younger patients may experience more stress than their older counterparts, increasing their susceptibility to depressive symptoms. Understanding the current state of sub-threshold depression in young and middle-aged breast cancer patients is critical for reducing the risk of full-blown depression. Our study found that the average sub-threshold depression score

among 385 young and middle-aged breast cancer patients was 104.23 ± 19.36 . The significant influencing factors included age ≥ 31 years, poor family relationships, severe subjective perception of the disease, heavy economic burden, clinical stage III, psychological resilience, and self-perceived burden.

In terms of demographic factors, previous studies have suggested that age, education level, marital status, family burden, cancer stage, and treatment methods are closely related to the occurrence of depressive symptoms [18]. However, other research has found no significant association between sociodemographic factors and negative emotions [19].

Regarding family relationships, poorer relationships were associated with higher depression scores, suggesting that weak family ties can contribute to depression. Berhili et al. [20] noted that family support plays a crucial role in young female breast cancer patients' ability to cope with the disease. Positive family relationships enable family members to better understand the patient's needs and provide timely support, boosting the patient's confidence in overcoming the illness. Support from relatives,

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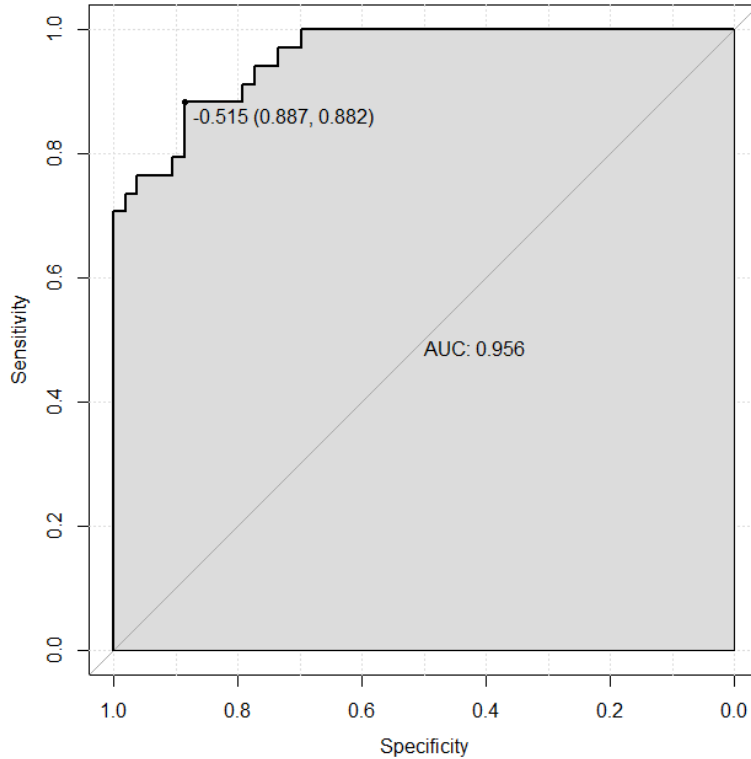


Figure 2. ROC curve of the prediction model for subthreshold depression in young and middle-aged breast cancer patients.

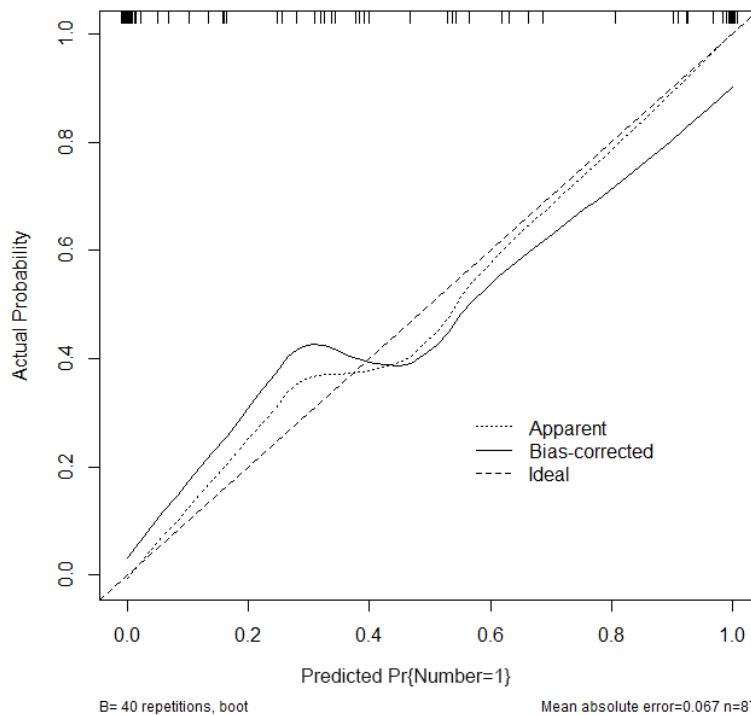


Figure 3. Calibration curve of subthreshold depression prediction model for young and middle-aged breast cancer patients.

particularly spouses, is essential throughout treatment and cannot be replaced by medical staff. Poor family relationships may indicate a lack of emotional support and understanding, which can leave patients feeling isolated and helpless. Frequent family conflicts may also heighten patients' stress and anxiety, increasing their risk of depression [21].

Patients with higher depression scores tend to have a more negative perception of their condition, influenced by their cognitive and emotional state [22]. Helping these patients correct negative thought patterns and enhance their understanding of the disease may alleviate depressive symptoms. Comprehensive interventions, including psychological counseling and medication, coupled with family support, have been shown to improve outcomes [23, 24].

Patients who focus excessively on their symptoms and emotions tend to emphasize the negative aspects while overlooking the positive, which can impair their ability to accurately assess disease progression and prognosis. Assisting these patients in correcting cognitive distortions and improving their judgment may help manage depressive symptoms and enhance psychological resilience. Young and middle-aged breast cancer patients facing heavy economic burdens scored higher on subthreshold depression measures [18]. High medical costs can increase anxiety, lower self-esteem, and adversely affect mental health. A holistic approach that includes both

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economic assistance and psychological support is crucial in mitigating these effects.

Advanced clinical stages were also associated with higher depression scores [25]. More intensive treatments required at advanced stages can foster feelings of hopelessness and fear. Early intervention and comprehensive support are essential for managing these symptoms effectively. Therefore, it is crucial to help patients identify depressive symptoms early and provide comprehensive support and treatment, including psychological therapy, medication, and social support.

Numerous studies underscore the influence of age, family support, and financial burden on depression. For instance, older age is often linked to a higher risk of depression due to declining physical health and reduced social support [26, 27]. While family support is widely recognized as an important factor in mitigating depression [28], negative family dynamics can still have a detrimental impact. Psychological resilience serves as a protective factor against depression, contrasting with findings that suggest negative emotions weaken psychological adaptability [28, 29]. Radiotherapy and chemotherapy are also associated with an increased risk of depression due to the physical discomfort and psychological stress they induce [30, 31]. The side effects of radiotherapy, combined with the uncertainty surrounding the treatment, can further escalate the emotional burden on patients.

The prediction curve developed in this study achieved an AUC of 0.956, demonstrating good predictive ability. Unlike many existing models that focus primarily on biomedical factors, this model incorporates a broader range of psychological and social elements, addressing the unique psychological needs of young and middle-aged patients. Our findings align with existing literature, confirming that sub-threshold depression in young and middle-aged breast cancer patients is influenced by multidimensional factors encompassing physiological, psychological, and social aspects. Future research should consider larger sample sizes and explore targeted interventions to alleviate depressive symptoms and improve the quality of life for these patients. Additionally, it is crucial to translate these findings into clinical practice to better support the mental health of young and middle-aged breast cancer patients.

This study has several limitations. The use of convenience sampling may compromise the representativeness of the sample and limit the generalizability of the results. Additionally, all data were collected from a single medical institution, which may not reflect the broader experiences of young and middle-aged breast cancer patients across different regions or hospitals. Although validated scales were used, the self-report nature of the data may introduce biases, as patients' perceptions of their psychological states may not always be accurate. Furthermore, the cross-sectional design of this study precludes the establishment of causal relationships, so caution is needed when interpreting the influencing factors. Lastly, the relatively small sample size may affect the stability of the model and the reliability of external validation. Future studies should adopt multi-center and larger sample designs to enhance the representativeness and external validity of the findings.

In conclusion, the predictive model constructed in this study provides a theoretical basis for screening sub-threshold depression in young and middle-aged breast cancer patients and offers a reference for clinical staff to implement timely preventive care and treatment for these patients. Future research should focus on gathering more data and conducting multi-center studies to further verify the model's sensitivity and specificity. This model can enable medical staff to adjust and implement appropriate diagnostic and treatment strategies, providing more precise and personalized care for patients, improving prognosis, alleviating depressive symptoms, and promoting recovery in young and middle-aged breast cancer patients.

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Disclosure of conflict of interest

None.

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