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Relationship between neurotic personality traits with symptoms of post-traumatic stress disorder in breast cancer patients: with the mediation of self-efficacy and negative coping

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Abstract

Purpose The present study was conducted to determine the relationship between neurotic personality traits and symptoms of post-traumatic stress disorder (PTSD) in breast cancer patients, with the mediation of self-efficacy and negative coping.

Methods A cross-sectional study design was used. A total of 328 breast cancer patients admitted to two tertiary hospitals in Dali, China, from July 2023 to January 2024 were included. Participants completed the General Information Questionnaire, the PTSD Inventory-Civilian Version, the Social Support Rating Scale, the Brief Coping Styles Questionnaire, the General Self-Efficacy Scale, and the Eysenck Personality Questionnaire-Revised, short Scale for Chinese-Neuroticism. Data were analyzed using SPSS 26.0 and Mplus 8.8 software, binary logistic regression analysis, and weighted least squares estimation. Data were analyzed by SPSS 26.0 and Mplus 8.8 software, using binary logistic regression analysis and weighted least squares estimation.

Results Employment status, time since diagnosis, neurotic personality traits, negative coping, and self-efficacy were correlates of the development of PTSD symptoms in breast cancer patients ($P < 0.05$). Neurotic personality traits in breast cancer patients had significant direct and indirect effects on PTSD symptoms (total effect: 0.625), and self-efficacy and negative coping were also mediated independently or in combination.

Conclusion We suggest that healthcare workers pay close attention to the personality traits of breast cancer patients in their daily work, and take a series of effective targeted measures promptly for patients with neurotic personality traits to help them enhance their sense of self-efficacy and reduce their negative coping styles, to effectively improve the mental health of patients.

Keywords Breast neoplasms, Neurotic personality, Stress disorders, post-traumatic, Negative coping, Self efficacy

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Introduction

Breast cancer ranks as one of the most prevalent malignant tumors globally. According to the Global Cancer Burden 2020 data, it accounts for about 11.7% of all new cancer cases worldwide, ranking first in the global cancer incidence rate [1]. In China alone, there are about 416,000 new cases of breast cancer [2]. In 2022, the number of new breast cancer cases in China reached 357,200 cases. Notably, breast cancer is still one of the most common malignant tumors in Chinese women [3]. After experiencing the diagnosis of a life-threatening disease, breast cancer patients may also face dilemmas such as missing breasts, surgical scars, and frequent vomiting during the course of treatment, and these negative events put heavy psychological pressure on the patients, resulting in a vulnerability to post-traumatic stress disorder (PTSD) symptoms [4, 5]. Previously, a Meta-analysis demonstrated a global prevalence of PTSD symptoms of up to 19% in breast cancer patients [5]. Several studies have also shown that the occurrence of PTSD symptoms in breast cancer patients not only affects an individual's mental health, quality of life, and quality of sleep but also increases their readmission rates and suicide risk [5–7]. Therefore, it is important to explore the symptoms of PTSD to help develop interventions to reduce the incidence of PTSD.

There are many influencing factors associated with PTSD symptoms, and neurotic personality traits are one of the key factors in breast cancer patients [8]. Individuals with neurotic personality traits are more likely to experience PTSD symptoms when exposed to a traumatic event such as a cancer diagnosis [8]. Neurotic personality is a personality trait with a tendency to experience negative emotions, and individuals with this personality type usually have high emotional ups and downs, are prone to experiencing adverse emotions such as anxiety, tension and mood loss, and are poor at coping with external stressors [9]. This can seriously affect patients' quality of life and sleep quality and may increase the risk of death [10]. However, the pathways by which neurotic personality traits influence PTSD symptoms are unclear.

Past research has revealed that groups with neurotic personality traits are more likely to adopt negative coping styles [11]. Bae's research suggests [12] that when patients adopt negative coping styles of avoiding stressors or associated negative emotions, they may increase the perceived severity of their illnesses, amplify negative emotions, and lead to feelings of hopelessness and helplessness, which in turn exacerbate PTSD symptoms. In contrast, a study by Sakamoto and his colleagues found [13] that patients with high self-efficacy not only possessed strong disease self-management confidence and were able to proactively adopt health-promoting behaviors, but also were able to alleviate the individual's psychological stress response and gain post-traumatic growth from psychological stress, and were more able to proactively change their negative psychological state to avoid the PTSD symptoms. Despite these findings, the complex pathways of interactions between neurotic personality traits, negative coping styles, self-efficacy, and PTSD symptoms remain unclear, and more research is urgently needed to validate them.

Therefore, we investigated the factors associated with PTSD symptoms in breast cancer patients and the relationship between PTSD symptoms and neurotic personality traits, negative coping, and self-efficacy. Based on the results of previous studies and our investigation of factors associated with PTSD symptoms in breast cancer patients, we hypothesized that neurotic personality traits would be associated with PTSD symptoms. We also hypothesized that negative coping and self-efficacy would play a key role in moderating the relationship between neurotic personality traits and PTSD symptoms.

Conceptual framework

According to the stress system model [14], multiple factors such as an individual's stressors, personality traits, coping styles, cognitive appraisals, and social support form a dynamic and balanced "system" that interacts to maintain physical and mental health, and when the system is out of balance for some reason, a stress response occurs When the system is out of balance for some reason, a stress reaction occurs. The patient's personality traits, coping styles, cognitive appraisals, and social support may all influence an individual's level of PTSD symptoms. In our study, breast cancer is a stressor that may lead to an imbalance in the individual's systems, resulting in PTSD symptoms, and the independent variables describe the personality traits (neurotic personality traits), coping styles (negative coping), cognitive appraisals (self-efficacy), and social support factors that are associated with PTSD symptoms.

Aim and hypotheses

Guided by the stress system model, we aimed to investigate the factors associated with PTSD symptoms in breast cancer patients and to analyze the relationship between neurotic personality traits and PTSD symptoms.

Based on the results of the analysis of factors associated with PTSD symptoms, the following hypotheses were proposed in this study:

H1 Neurotic personality traits are positively correlated with PTSD symptoms.

H2 Negative coping mediated the correlation between neurotic personality traits and PTSD symptoms.

H3 Self-efficacy mediated the correlation between neurotic personality traits and PTSD symptoms (Fig. 1).

Methods

Study design and participants

This study was a cross-sectional research investigation. Breast cancer patients were recruited for the study from July 2023 to January 2024 at two tertiary hospitals, the First Affiliated Hospital of Dali University and the People's Hospital of Dali Prefecture in Dali, China. A convenience sampling method was used. Inclusion criteria were (1) pathologically confirmed diagnosis of breast cancer; (2) diagnosis ≥ 1 month; (3) age ≥ 18 years; (4) patients were aware of the diagnosis and treatment of their disease; (5) patients' medical records were complete; and (6) they were able to understand the meanings of each entry of the scale. Exclusion criteria were (1) previous history of neurological or psychiatric disorders; (2) comorbidities with other malignancies; (3) severe communication barriers; and (4) Currently involved in psychological intervention or treatment.

Sample size

The sample size was calculated using the cross-sectional study formula: $n=[\ \mu^2_{\alpha}/_2\pi\ (1-\pi)]\ /\delta^2$, $\mu_{\alpha/2}=1.96$, π is the overall rate, which was taken as 22.72% by reviewing the literature [15]; and δ^2 is the permissible error taken as $0.05.n=(1.96^2\times22.72\%\times77.28\%)/0.05^2\approx270$, adding another 10% invalid questionnaires. It was estimated that at least 297 breast cancer patients should have been recruited.

Measures

General information questionnaire

The questionnaire was developed by the researchers themselves after an extensive review of relevant literature [4–8, 15]. We collected general information about breast cancer patients using a self-designed general information questionnaire containing age, height, weight, ethnicity, education, occupation, tumor stage, quality of life, and quality of sleep. General information was obtained by the researcher by reviewing medical records. Quality of life and quality of sleep were self-rated by the patients and measured separately by one question: Overall, how would you say your quality of life/quality of sleep has been over the past four weeks? Responses to this question were rated on a Likert scale from very good (1) to very poor (5).

Post traumatic stress disorder checklist - civilian version (PCL-C)

The PCL-C was developed by Weathers [16] to evaluate the evaluation of the effectiveness of diagnosis, intervention, or treatment of post-traumatic PTSD symptoms in people who experience them in their ordinary lives, and consists of three dimensions of re-experiencing, avoidance, and hypervigilance, with a total of 17 entries. Each entry was rated on a 5-point Likert scale, with 1 to 5 representing "never" to "very severe", and scale scores ranging from 17 to 85. Higher scores indicate that individuals are at higher risk of PTSD, and scores of ≥ 38 are considered to be symptomatic of PTSD. The PCL-C has good reliability and validity [16], with a Cronbach's α of 0.927 in this study.

Eysenck personality questionnaire-revised, short scale for Chinese-neuroticism (EPQ-RSC-N)

The EPQ-RSC-N was developed by Eysenck et al. [17] and introduced to China by Qian Mingyi et al. [18] to measure neurotic personality traits in Chinese individuals aged 16 years and older. The Cronbach's α of the original questionnaire ranged from 0.700 to 0.800, while that of the Chinese version was 0.770, both of which had good reliability and validity [17, 18]. Contains 12 questions with two options, "yes" or "no", with "yes" scoring 1 point and "no" scoring 0 points. The total score is summed to

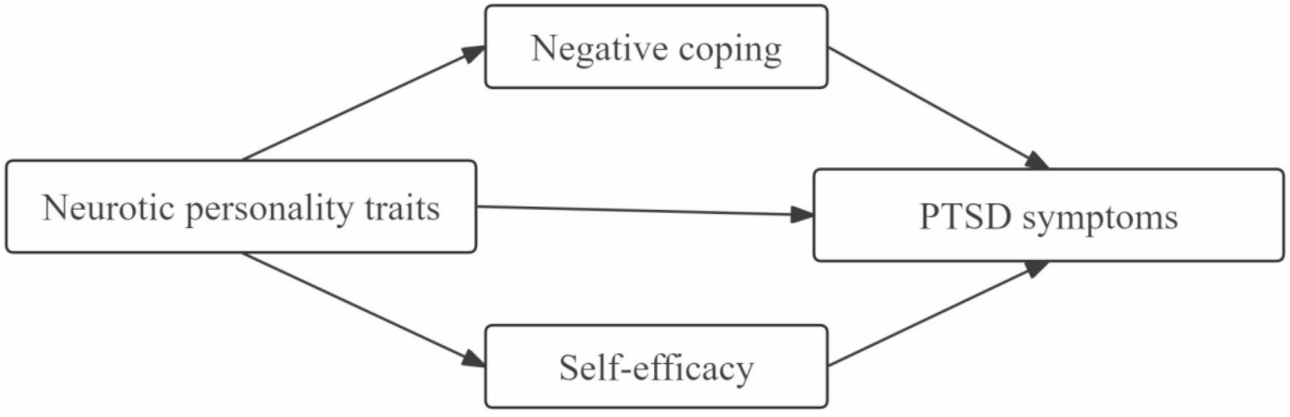

Fig. 1 Hypothesized path of association between neurotic personality traits and PTSD symptoms

the neuroticism raw score, with higher scores indicating a higher level of neuroticism in the individual. An individual with a standardized T-score ≥ 56.7 is classified as having a neurotic personality tendency. T-score formula: T = 50 + 10 × (subject's raw score - mean of the individual's group) / standard deviation of the individual's group. The Cronbach's α for the EPQ-RSC-N in this study was 0.690.

Simple coping style questionnaire (SCSQ)

The SCSQ was developed by Xie [19] to assess the coping styles of individuals or groups. It includes 2 dimensions, positive coping and negative coping, with a total of 20 entries. Each entry is rated on a multi-level scale, with 0 to 3 representing "not used" to "often used". In this study, the negative coping dimension was used to measure patients' negative coping, consisting of questions 13 to 20 of a questionnaire containing eight entries with scores ranging from 0 to 24. Higher scores indicate that individuals are more inclined to adopt negative coping styles. The Cronbach's α for negative coping in the original version of the questionnaire was 0.780 [19], while in this study the value was 0.775.

General self-efficacy scale (GSES)

The GSES was developed by Schwarzer et al. [20] and introduced to China by Wang [21], and is used to measure the overall level of self-efficacy of an individual. It consists of 10 items, each of which is scored on a multiple-point scale, with 1–4 ranging from "not at all true" to Each item is rated on a multi-level scale from 1 to 4, ranging from "not at all true" to "completely true". Scores ranged from 10 to 40, with higher scores indicating higher self-efficacy in individuals. The Cronbach's α of the original questionnaire was 0.800 [20], while the Cronbach's α of the Chinese version of the questionnaire was 0.870 [21], and in this study, the value was 0.841.

Social support rating scale (SSRS)

The SSRS was compiled by Shuiyuan [22] to measure an individual's social support and contains three dimensions, subjective social support, objective social support, and utilization of social support, with a total of 10 entries. Higher scores indicate higher levels of social support for the individual. The Cronbach's α for the original questionnaire was 0.920 [22], while in this study the value was 0.896.

Data collection

Patients who met the study inclusion criteria were recruited at the hospital after obtaining approval from the hospital and relevant authorities. Patients were informed about the purpose and significance of the study and written informed consent was obtained. For patients with low literacy or questions about questionnaire items, we explained the items in neutral, non-suggestive language. A total of 345 questionnaires were distributed in this study and 345 were recalled. After excluding 17 questionnaires with incomplete responses, the final data from 328 participants were analyzed with an effective recall rate of 95.07% (Fig. 2).

Ethical considerations

We adhered to the principles of the Declaration of Helsinki throughout the study.

Data analysis

This study used SPSS 26.0 for descriptive statistical analysis, regression analysis and correlation analysis. Normally distributed continuous variables were described by mean ± standard deviation and comparisons were made using the *t*-test. Non-normally distributed continuous variables were described by median and quartiles, and comparisons were made using the Mann-Whitney rank sum test. The categorical variables were described by frequencies and percentages and compared using chi-square tests. Factors associated with the determination of PTSD symptoms were analyzed using binary logistic regression analysis. Correlation analysis was performed using Spearman's correlation coefficient because the variables were generally non-normally distributed. A two-sided $P < 0.05$ was considered a statistically significant difference.

Mplus 8.8 software was used for path analysis. We performed path analyses on the results of the regression analyses using mean- and variance-adjusted weighted least squares estimates to determine the relationship between neurotic personality traits and PTSD symptoms, which is a dichotomous variable. The model was also corrected according to the modification index (MI), and the root mean square of the error of approximation (RMSEA, ≤ 0.08) and the Comparative Fit Index (CFI, ≥ 0.95) were used to test the fit of the model [23].

Results

Participant characteristics

The age range of the 328 participants was between 25 and 79 years old, with a mean age of 48.89 ± 9.27 years, and most had a body mass index (BMI) between 18.5 and 24.0 kg/m^2 (59.5%), were Han Chinese (54.0%), had elementary school education and below (53.4%), were farmers (67.4%), and had a tumor stage in the ≥ II stages (88.7%). The patients' self-assessed mean quality of life was 2.81 ± 0.81 points, and the mean quality of sleep was 3.28 ± 0.94 points (see Table 1 for details).

Descriptive statistics

In this study, PTSD symptoms were detected in 103 out of 328 breast cancer patients with a detection rate of

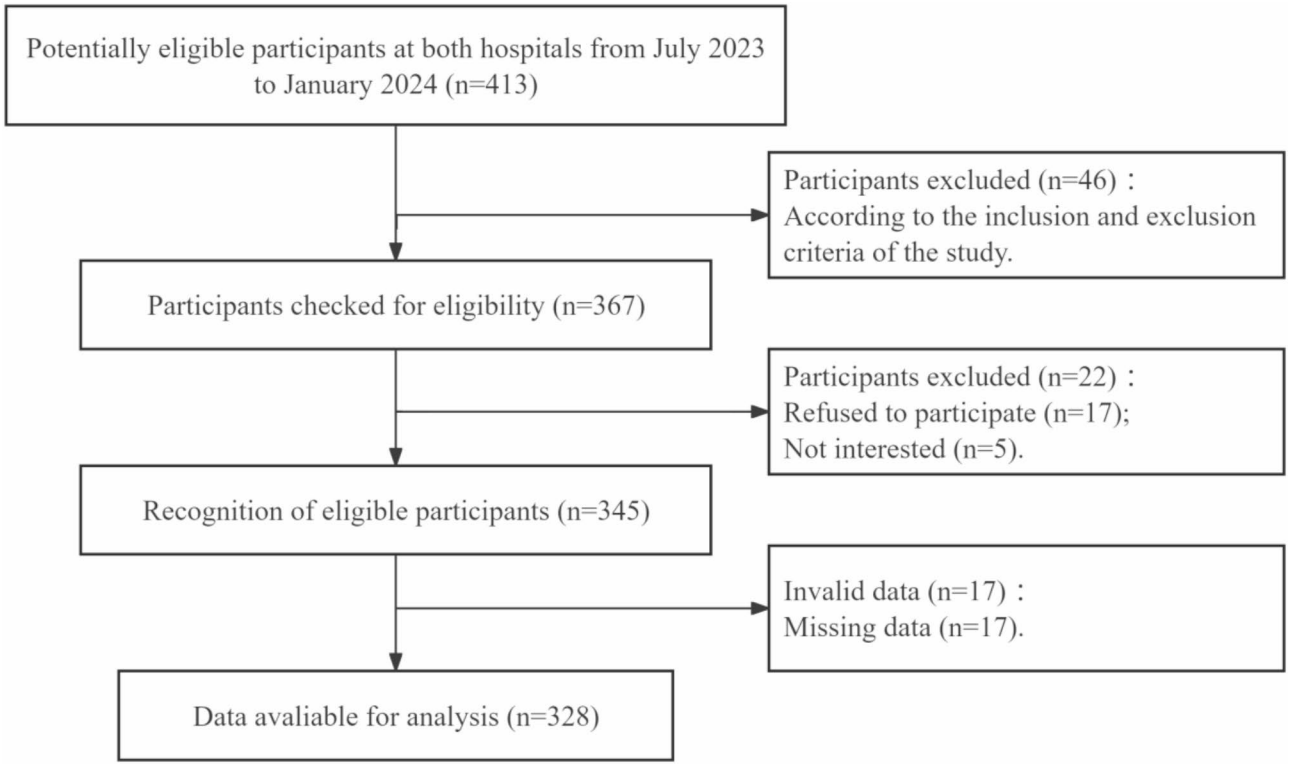

Fig. 2 Flowchart of the study participant screening process

31.4%. The total score of PTSD symptoms in breast cancer patients was 32.42 ± 10.79. The raw score of neurotic personality traits in breast cancer patients was 3.78 ± 2.58 and the T-score was 47.67 ± 8.77, 74 (22.6%) out of 328 breast cancer patients had neurotic personality tendencies. Their negative coping, self-efficacy, and social support scores were (6.40 ± 4.01), (31.30 ± 5.35), and (45.57 ± 5.19), respectively.

Analysis of relevant factors

The results of the univariate analysis in Table 2 showed that there were differences between the PTSD symptom group and the non-PTSD symptom group in terms of employment status, time since diagnosis, tumor stage, degree of chemotherapy side effects, quality of life, quality of sleep, neurotic personality traits, negative coping, self-efficacy, and social support ($P < 0.05$).

Factors associated with PTSD symptoms were determined by further analysis of binary logistic regression analysis. Variables with $P < 0.1$ in the univariate analysis were used as independent variables, and PTSD symptoms were used as the dependent variable in a binary logistic regression analysis. The results showed that employment status (*OR* = 2.521, 95% *CI*: 1.157 ~ 5.497), time since diagnosis (*OR* = 0.942, 95% *CI*: 0.906 ~ 0.980), neurotic personality traits (*OR* = 2.106, 95% *CI*: 1.728 ~ 2.566), negative coping (*OR* = 1.141, 95% *CI*: 1.034 ~ 1.260), and self-efficacy (*OR* = 0.891, 95% *CI*: 0.827 ~ 0.960) were the influencing factors of PTSD symptoms (see Table 3 for details).

Correlation analysis

The correlations of PTSD symptoms, neurotic personality, negative coping, and self-efficacy are shown in Table 4, with two significant correlations between the main variables.

Direct paths analysis and model corrections

The results of the direct path analysis of the hypothesized model are shown in Table 5: RMSEA = 0.125, CFI = 0.922, and the current hypothesized model is poorly fitted. The MI of the model showed that the MI of self-efficacy and negative coping was 22.537. Therefore, self-efficacy and negative coping paths were added to correct the hypothesized model, and the corrected path diagram is shown in Fig. 3. The corrected model fit was satisfactory: RMSEA = 0.049; CFI = 0.990. The model showed that neurotic personality traits were associated with higher levels of negative coping [0.284 (0.185, 0.383)], lower levels of self-efficacy [-0.327 (-0.424, -0.231)], and increased chances of experiencing PTSD symptoms [0.532 (0.454, 0.610)]; higher levels of self-efficacy were associated with lower levels of negative coping [-0.258 (-0.358, -0.158)], and lower chances of PTSD symptoms [-0.121 (-0.205, -0.036)]; higher levels of negative coping were associated with increased chances of PTSD symptoms [0.147 (0.061,

Table 1 General information of breast cancer patients ($n=328$)

Variables		*N*	Percentages (%)
BMI(kg/m^2)	< 18.5	12	3.7
	18.5 ~ 24.0	195	59.5
	> 24.0	121	36.9
Ethnicity	Han	177	54.0
	Bai	95	29.0
	Yi	32	9.8
	Others	24	7.3
Educational level	Elementary school education and below	175	53.4
	Middle school	108	32.9
	High school or vocational secondary school	18	5.5
	Junior college	14	4.3
	Bachelor's Degree and above	13	4.0
Careers	Peasants	221	67.4
	Worker	47	14.3
	Teachers	14	4.3
	Self-employed	28	8.5
	Others	18	5.5
Employment status	Employed	202	61.6
	Unemployed	126	38.4
Marital status	Married	299	91.2
	Others (single, divorced, bereaved spouse)	29	8.8
Number of children	0	9	2.7
	1	131	39.9
	2	174	53.0
	3 and above	14	4.3
Residential area	Rural	202	61.6
	Town	126	38.4
Average family income (RMB)	< 1000	107	32.6
	1000 ~ 2999	174	53.0
	3000 ~ 5000	28	8.5
	> 5000	19	5.8
Medical Payment Methods	Self-financed	19	5.8
	Resident medical insurance	253	77.1
	Commercial medical insurance	56	17.1
Time since diagnosis (median and quartiles, months)		4 (2, 7)	
Tumor Stage	I	37	11.3
	≥II	291	88.7
Level of chemotherapy-related side effects	Not have	58	17.7
	Mild	88	26.8
	Moderate	104	31.7
	Severe	78	23.8

0.233)]; and employment status [0.131 (0.053, 0.209)] and time since diagnosis [-0.080 (-0.157, -0.002)] were associated with the occurrence of PTSD symptoms; therefore, hypothesis 1 proposed in this study was valid.

Indirect path analysis

As shown in Table 6, the indirect paths were all significant, including neurotic personality traits → negative coping → PTSD symptoms [0.042 (0.013, 0.070)], neurotic personality traits → self-efficacy → PTSD symptoms [0.040 (0.010, 0.070)], and neurotic personality traits → self-efficacy → negative coping → PTSD symptoms [0.012 (0.003, 0.022)]. Therefore, hypotheses 2 and 3 proposed in this study were valid.

Discussion

We investigated the relationship between PTSD symptoms, neurotic personality traits, negative coping, and self-efficacy. Four major findings emerged from our study. First, we demonstrated that neurotic personality traits are associated with the onset of PTSD symptoms, even after controlling for employment status and the patient's time since diagnosis. Second, we found that negative coping mediated the relationship between neurotic personality and PTSD symptoms. Third, we demonstrated that self-efficacy mediates the relationship between neurotic personality and PTSD symptoms. Finally, somewhat inconsistent with the hypothesized model, we also found a role for self-efficacy and negative coping as chain mediators between neurotic personality traits and PTSD symptoms.

An analysis of factors associated with PTSD symptoms in breast cancer patients showed that employment status, time since diagnosis, neurotic personality traits, negative coping, and self-efficacy were associated with the occurrence of PTSD symptoms. Relative to being employed, unemployment may increase the risk of PTSD symptom development, which is consistent with the findings of Kazlauskiene et al. [6]. Unemployment may cause patients to lose their sense of identity and value, triggering emotional problems and loneliness and affecting mental health [24]. At the same time, it may reduce family income and increase the financial stress of disease treatment, all of which may contribute to the development of PTSD symptoms [25, 26]. Our study showed that patients who had been diagnosed for a longer period of time were less likely to have PTSD symptoms, contrary to the findings of Mazor et al. [27]. Through long-term health education and psychological counseling, healthcare workers were able to help patients gradually accept the reality of the disease and actively cooperate with treatment, which potentially reduced the incidence of PTSD symptoms. We found a strong association between neurotic personality traits and PTSD symptoms, which is

Table 2 Univariate analysis of PTSD symptoms in breast cancer patients ($n = 328$)

Variables		PTSD symptom group	Non-PTSD symptom group	t/Z/χ^2	*P*
Age		48.81 ± 9.44	48.92 ± 9.22	0.107[a]	0.915
BMI(kg/m^2)	< 18.5	5 (41.7)	7 (58.3)	0.754[b]	0.686
	18.5 ~ 24.0	62 (31.8)	133 (68.2)		
	> 24.0	36 (29.8)	85 (70.2)		
Ethnicity	Han	54 (30.5)	123 (69.5)	1.915[b]	0.590
	Bai	31 (32.6)	64 (67.4)		
	Yi	8 (25.0)	24 (75.0)		
	Others	10 (41.7)	14 (58.3)		
Educational level	Elementary school education and below	53 (30.3)	122 (69.7)	3.567[b]	0.468
	Middle school	33 (30.6)	75 (69.4)		
	High school or vocational secondary school	9 (50.0)	9 (50.0)		
	Junior college	5 (35.7)	9 (64.3)		
	Bachelor's Degree and above	3 (23.1)	10 (76.9)		
Careers	Peasants	64 (29.0)	157 (71.0)	2.861[b]	0.581
	Worker	19 (40.4)	28 (59.6)		
	Teachers	5 (35.7)	9 (64.3)		
	Self-employed	10 (35.7)	18 (64.3)		
	Others	5 (27.8)	13 (72.2)		
Employment status	Employed	45 (22.3)	157 (77.7)	20.327[b]	< 0.001
	Unemployed	58 (46.0)	68 (54.0)		
Marital status	Married	93 (31.1)	206 (68.9)	0.140[b]	0.708
	Others (single, divorced, bereaved spouse)	10 (34.5)	19 (65.5)		
Number of children	0	4 (44.4)	5 (55.6)	1.110[b]	0.796
	1	39 (29.8)	92 (70.2)		
	2	56 (32.2)	118 (67.8)		
	3 and above	4 (28.6)	10 (71.4)		
Residential area	Rural	57 (28.2)	145 (71.8)	2.476[b]	0.116
	Town	46 (36.5)	80 (63.5)		
Average family income (RMB)	< 1000	30 (28.0)	77 (72.0)	4.393[b]	0.222
	1000 ~ 2999	62 (35.6)	112 (64.4)		
	3000 ~ 5000	5 (17.9)	23 (82.1)		
	> 5000	6 (31.6)	13 (68.4)		
Medical Payment Methods	Self-financed	7 (36.8)	12 (63.2)	2.235[b]	0.327
	Resident medical insurance	83 (32.8)	170 (67.2)		
	Commercial medical insurance	13 (23.2)	43 (76.8)		
Time since diagnosis (median and quartiles, months)		2 (2, 5)	4 (2, 7)	-3.597[c]	< 0.001
Tumor Stage	I	4 (10.8)	33 (89.2)	8.209[b]	0.004
	≥II	99 (66.0)	192 (34.0)		
Level of chemotherapy-related side effects	Not have	13 (22.4)	45 (77.6)	10.397[b]	0.015
	Mild	20 (22.7)	68 (77.3)		
	Moderate	37 (35.6)	67 (64.4)		
	Severe	33 (42.3)	45 (57.7)		
Quality of life		3.17 ± 0.85	2.65 ± 0.74	-5.531[a]	< 0.001
Quality of sleep		3.75 ± 1.01	3.22 ± 0.86	-4.895[a]	< 0.001
Neurotic personality traits		6.29 ± 2.38	2.64 ± 1.72	-15.760[a]	< 0.001
Negative coping		8.67 ± 4.06	5.36 ± 3.54	-7.498[a]	< 0.001
Self-efficacy		28.45 ± 4.98	32.61 ± 5.01	7.001[a]	< 0.001
Social support		43.75 ± 5.06	46.40 ± 5.05	4.414[a]	< 0.001

Notes: a: two independent samples t-test; b: chi-square test; c: Mann-Whitney rank sum test

Table 3 Logistic regression analysis of PTSD symptoms in breast cancer patients ($n = 328$)

Variables		β	SE	Wald	*P*	OR	95%CI
Employment status	Employed	1					
	Unemployed	0.925	0.398	5.410	0.020	2.521	1.157 ~ 5.497
time since diagnosis (months)		-0.060	0.020	8.795	0.003	0.942	0.906 ~ 0.980
Tumor Stage	I	1					
	≥II	1.358	0.697	3.801	0.051	3.889	0.993 ~ 15.237
Level of chemotherapy-related side effects				5.177	0.159		
	Not have	1					
	Mild	0.311	0.635	0.241	0.624	1.365	0.393 ~ 4.737
	Moderate	1.139	0.619	3.384	0.066	3.124	0.928 ~ 10.513
	Severe	1.099	0.650	2.858	0.091	3.002	0.839 ~ 10.737
Quality of life		0.249	0.322	0.601	0.438	1.283	0.683 ~ 2.410
Quality of sleep		0.410	0.277	2.191	0.139	1.507	0.875 ~ 2.595
Neurotic personality traits		0.745	0.101	54.394	0.000	2.106	1.728 ~ 2.566
Negative coping		0.132	0.050	6.860	0.009	1.141	1.034 ~ 1.260
Self-efficacy		-0.115	0.038	9.145	0.002	0.891	0.827 ~ 0.960
Social support		-0.005	0.039	0.015	0.902	0.995	0.921 ~ 1.075
Constant		-5.410	2.374	5.193	0.023	0.004	

Note: 1 is the reference variable

Table 4 Correlation analysis between the main variables ($n = 328$)

Variables	PTSD symptoms	Neurotic personality traits	Negative coping	Self-efficacy
PTSD symptoms	1			
Neurotic personality traits	0.606**	1		
Negative coping	0.411**	0.388**	1	
Self-efficacy	-0.399**	-0.355**	-0.412**	1

Note: **: $P < 0.01$, all coefficients are Spearman correlation coefficients

Table 5 Direct effects of hypothetical pathways

Direct effects	Point estimate	SE	t	*P*	95%CI
Neurotic personality traits → negative coping	0.368	0.048	7.718	< 0.001	0.275 ~ 0.462
Neurotic personality traits → self-efficacy	-0.327	0.049	-6.641	0.000	-0.424~-0.231
Negative coping → PTSD symptoms	0.147	0.044	3.333	0.001	0.061 ~ 0.234
Self-efficacy → PTSD symptoms	-0.121	0.043	-2.797	0.005	-0.206~-0.036
Neurotic personality traits → PTSD symptoms	0.534	0.040	13.509	< 0.001	0.457 ~ 0.611
Employment status → PTSD symptoms	0.132	0.040	3.284	0.001	0.053 ~ 0.210
Time since diagnosis → PTSD symptoms	-0.080	0.040	-2.003	0.045	-0.158~-0.002

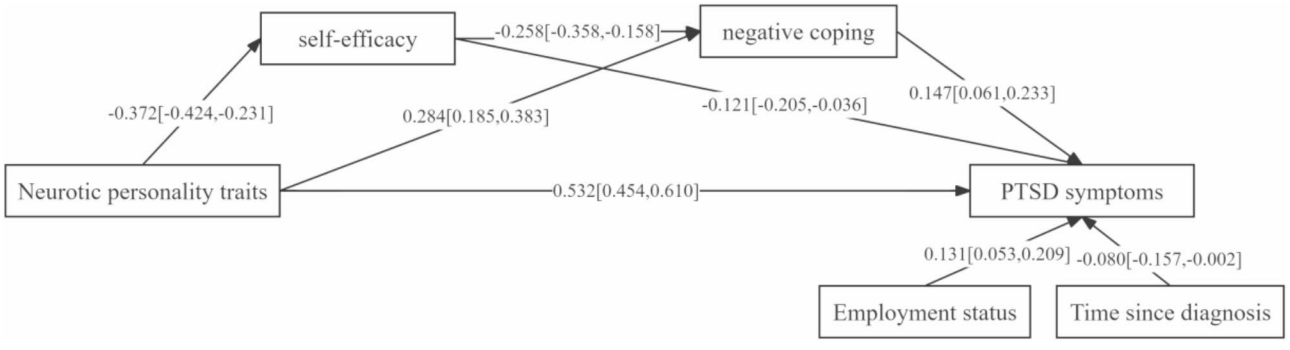

Fig. 3 Path diagram of the association between modified neurotic personality traits and PTSD symptoms

Table 6 Indirect path of association between neurotic personality traits and PTSD symptoms

Path	Point estimate	SE	t	*P*	95%CI
Total effect	0.625	0.033	18.784	< 0.001	0.560 ~ 0.691
Indirect effect	0.094	0.021	4.497	< 0.001	0.053 ~ 0.134
Neurotic personality traits → negative coping → PTSD symptoms	0.042	0.015	2.872	0.004	0.013 ~ 0.070
Neurotic personality traits → self-efficacy → PTSD symptoms	0.040	0.015	2.585	0.010	0.010 ~ 0.070
Neurotic personality traits → self-efficacy → negative coping → PTSD symptoms	0.012	0.005	2.555	0.011	0.003 ~ 0.022
Direct effect	0.532	0.040	13.316	< 0.001	0.454 ~ 0.610

consistent with previous studies [9, 28]. Those individuals with high neurotic personality traits showed extreme sensitivity to negative events and were prone to strong emotional reactions [28]. Recent studies have revealed that cancer patients with neurotic personality traits tend to have lower life satisfaction [29, 30]. Their attitudes and worldviews tend to be more negative, which makes them more susceptible to psychological distress and more likely to develop PTSD symptoms. Similar to Elklit et al.'s [31] study, our study revealed that the higher the individual's level of negative coping the more likely they were to develop PTSD symptoms. Consistent with the findings of Koopman et al. [32], we found that self-efficacy was a protective factor for the occurrence of PTSD symptoms.

Our study found that neurotic personality traits were not only directly associated with the development of PTSD symptoms, but also indirectly associated with PTSD symptoms through negative coping, which is consistent with the findings of Cohen-Louck et al. [28]. When patients adopt negative coping styles that avoid stressors or negative emotions, such as keeping themselves busy to get rid of stress or traumatic events, it may not alleviate post-traumatic psychological shock. Instead, it may exacerbate illness perceptions and negative emotions, leading to despair and helplessness, and even exacerbating PTSD symptoms [33, 34]. Patients who possess neurotic personality traits usually tend to adopt negative coping strategies of avoidance and escapism, which makes them more prone to PTSD symptoms [28]. Therefore, the key to improving patients' PTSD symptoms is to reduce negative coping and foster positive coping styles to improve their mental health. Our study also suggests that self-efficacy in breast cancer patients mediates the relationship between neurotic personality traits and PTSD symptoms. Possibly because neurotic personality traits predict a patient's sense of self-efficacy, patients with highly neurotic personalities are prone to perceive themselves as lacking in disease management competence when confronted with the stressors of a disease diagnosis and adverse reactions to treatment, experiencing self-doubt, anxiety, and other emotional responses that result in individuals being more susceptible to the development of PTSD symptoms [35]. Whereas, patients with high self-efficacy have strong confidence in disease management, can take the initiative to adopt healthy behaviors, and can also self-regulate to reduce psychological stress and actively improve their psychological state, thus preventing PTSD symptoms [36]. Therefore, the important impact of self-efficacy in reducing neurotic personality traits and PTSD symptoms should be valued. Furthermore, we noted that neurotic personality traits can also influence PTSD symptoms through the chain-mediated effects of self-efficacy and negative coping. This chain mediator suggests that individuals with higher levels of neurotic personality tend to perceive themselves as lacking confidence in disease management and will exhibit self-doubt and worry, which in turn leads to negative coping styles of reality avoidance, diagnosis avoidance, and over-reliance on others, thereby increasing the probability of PTSD symptoms [33, 37]. These shed light on the internal mechanisms of action of how neurotic personality traits have an impact on PTSD symptoms. Personality is a relatively stable and enduring trait that cannot be altered by interventions in a short period [9], and therefore enhancing patients' self-efficacy and decreasing their negative coping can be an important target when intervening in the mental health of patients with neurotic personality tendencies.

Our study validates the idea that the variables in the stress system model interact and are causative of each other through an empirical study of the relationship between personality traits, cognitive appraisals, coping styles, and PTSD symptoms, elucidates the influences affecting the PTSD symptoms of patients, and further suggests that the stress system model can be used to explain the level of PTSD in individuals [14]. Therefore, researchers can intervene with personality, cognitive appraisal, and coping styles, focusing on self-efficacy and negative coping styles, as well as keeping an eye on neurotic personality traits, which will in turn enhance patients' psychological well-being and reduce the incidence of PTSD symptoms. Meanwhile, we suggest that healthcare workers should focus on cultivating patients' confidence in disease management, improving their sense of self-efficacy, strengthening the guidance of coping styles, helping patients abandon negative coping patterns such as avoidance and dependence, and guiding patients to face life with a positive and optimistic attitude in the follow-up health education.

Limitations

Our study also has some limitations. First, the study was cross-sectional and we were unable to determine any causal relationship between the variables studied. Suggesting that future longitudinal studies be conducted to identify these relationships. Second, due to the use of a convenience sampling method, we cannot claim that the participants are representative of all Chinese breast cancer patients, as these participants came from only two hospitals in China. Future studies should expand the sample to verify the generalizability of the results. Finally, the assessment tools used in our study were all scales. Subsequent studies may consider adding objective indicators, such as C-reactive protein, albumin, and neutrophils, and further exploring the mechanisms associated with the development of PTSD symptoms in breast cancer patients.

Conclusion

Our findings suggest that employment status, time since diagnosis, negative coping, self-efficacy, and neurotic personality traits are correlates of PTSD symptom development in breast cancer patients. Neurotic personality traits are directly associated with the development of PTSD symptoms and can also be indirectly associated with PTSD symptoms through negative coping and self-efficacy. The key to preventing and improving PTSD symptoms in breast cancer patients lies in focusing on breast cancer patients with neurotic personality traits, who can be expected to improve their mental health by promptly correcting negative coping styles and improving self-efficacy.

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Author contributions

Q Z was involved in research design, data compilation and analysis, and writing the original manuscript; Sx Z and Jb H were involved in interpreting the data and guiding the project; Xc L, Jh W, F S, and Q T were involved in data collection and presenting the results; and Yf F guided and supervised the process of research and revised the paper. All authors read and approved the final manuscript.

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Data availability

The datasets used and/or analyzed during the current study available from the corresponding author on reasonable request. Email: yanfen1998@hotmail.com.

Declarations

Ethics approval and consent to participate

Our study was approved by the Ethics Committee of the First Affiliated Hospital of Dali University (DFY20230629001). All participants provided written informed consent.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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