



## Original Article

## Symptom burden, family resilience, and functional exercise adherence among postoperative breast cancer patients

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## ABSTRACT

**Objective:** This study examines the relationships among family resilience, functional exercise adherence, and symptom burden in postoperative breast cancer patients.

**Methods:** In this cross-sectional study, participants consisted of 192 women with breast cancer who had undergone breast cancer surgery in two hospitals in Shandong Province, China. Family resilience, functional exercise adherence, and symptom burden were measured using the 32-item shortened Chinese version of the Family Resilience Assessment Scale (FRAS-C), Postoperative Functional Exercise Compliance Scale for Breast Cancer Patients, and the Chinese version of the M. D. Anderson Symptom Inventory (MDASI-C), respectively. Structural equation modeling was conducted to examine the path relationships among family resilience, functional exercise adherence, and symptom burden.

**Results:** Family resilience and its subscales were significantly negatively correlated with symptom burden ( $r = -0.17$  to  $-0.14$ ,  $P < 0.05$ ), whereas positively correlated with functional exercise adherence ( $r = 0.64$  to  $0.69$ ,  $P < 0.01$ ). Functional exercise adherence was significantly positively correlated with symptom burden ( $r = -0.32$  to  $-0.35$ ,  $P < 0.01$ ). Family resilience indirectly affected symptom burden through functional exercise adherence ( $\beta = -0.319$ , 95% CI:  $-0.491$ ,  $-0.169$ ).

**Conclusions:** Family resilience, as a positive psychological factor, could indirectly impact postoperative breast cancer patients' physical function. Specifically, family resilience can alleviate the patients' symptom burden by strengthening their functional exercise adherence. In addition to improving functional exercise adherence, nurses can also improve family resilience when helping to alleviate the symptom burden of postoperative breast cancer patients. Family resilience-based interventions could be implemented to alleviate the symptom burden among such patients.

## Introduction

Breast cancer is the most commonly diagnosed cancer in women. The latest statistics from the International Agency for Research on Cancer, reported 2.26 million new breast cancer cases worldwide, surpassing lung cancer as the world's leading cancer in 2020.<sup>1</sup> In China, the number of new breast cancer cases increased from 300,000 in 2015 to 420,000 in 2020, accounting for 9.1% of all new cancer cases.<sup>2</sup> As early screening and diagnosis technology has advanced, the five-year and ten-year survival rates of breast cancer patients are 92.5% and 83%, respectively.<sup>3</sup> Although the survival rate of patients has improved, cancer treatment is still a long process and a crisis for them. Currently, surgery remains the

most fundamental therapeutic strategy for most breast cancer patients. However, this can cause different physical symptoms, including reduced range of motion, decreased strength, lymphedema, pain, and numbness.<sup>4</sup> In addition, postoperative breast cancer patients are often treated using radiotherapy, chemotherapy, or other long-term treatments. Therefore, in the treatment and initial recovery phases, patients may experience other psychosomatic symptoms caused by these treatments, such as fatigue, depression, disturbed sleep, and cognitive dysfunction.<sup>5</sup> Furthermore, these symptoms are associated with negative health outcomes, such as reduced survival time, delayed treatment, increased hospital admissions, limited daily activities, heavy financial burden, and reduced quality of life.<sup>6-8</sup>

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### Symptom burden

Symptom burden is defined as “a variety of symptoms that survivors experience, which is reported or measured, including the number of symptoms, frequency of occurrence, severity, physical impairment, and psychological impairment.”<sup>7</sup> Postoperative breast cancer patients have varying levels of symptom burden,<sup>9–12</sup> which have individual differences that are related to many influencing factors. Studies have found that some of the individual factors that influence symptom burden are age, employment status, performance status, income, socioeconomic status, comorbidities, treatment stage, treatment mode, and disease stage.<sup>12–15</sup> Given that the symptom burden is manageable, it is important to identify the characteristics of the symptom burden experienced by postoperative breast cancer patients, understand the influencing factors, and thereby manage the symptom burden.

### Functional exercise adherence

Functional exercise has been shown to be effective and beneficial in improving breast cancer patients' physical and physiological health outcomes after surgery.<sup>16</sup> Specifically, active and effective functional exercise can improve upper limb flap adhesion, limb edema, joint stiffness, and muscle atrophy<sup>17</sup>; enhance the confidence of physical recovery; relieve and prevent discomfort symptoms; and improve quality of life.<sup>18</sup> Postoperative functional exercise is a long-term process that involves physical activity to combat the negative effects caused by cancer treatment, which may improve the well-being of recovering postoperative breast cancer patients.<sup>19</sup> Functional exercise adherence is an important prerequisite for effective functional exercise. Previous studies have reported that, after surgery, breast cancer patients have low to moderate levels of functional exercise adherence,<sup>20–22</sup> and breast cancer patients' functional exercise adherence presented a declining trend from an initial 75%–50% after 105 days.<sup>23</sup> Improving functional exercise adherence could facilitate self-management, alleviate the adverse symptoms, and improve health-related quality of life. Researchers found functional exercise adherence was related to factors, such as age, level of education, disease course, disease severity, adverse reactions to chemotherapy, illness perception, health literacy, and self-efficacy.<sup>17,24–26</sup>

### Family resilience

With the development of family systems theory, researchers began to emphasize the role of family in the treatment and rehabilitation of patients. In regard to family-related factors, family support also plays an important role in improving functional exercise adherence among breast cancer patients.<sup>22</sup> For example, research suggests that if family members are unwilling to accompany breast cancer patients with exercises, the patients' persistence and adherence will be affected to a certain extent.<sup>27</sup> However, studies have examined the effects of family factors on breast cancer patients' adherence to functional exercise, while focusing only on perceived family support. Limited studies have focused on the effects of family functioning in its entirety. As breast cancer is also a family affair, family functioning might also play an important role in alleviating symptom burden and strengthening functional exercise adherence.

### Family resilience and functional exercise adherence

Family resilience is defined as a characteristic that helps people to resist disruption and overcome adversity, prompting them to adapt positively,<sup>28</sup> and it has been confirmed to be associated with breast cancer patients' well-being.<sup>29</sup> It has a positive biopsychosocial meaning, which is conducive to promoting physical and mental development and enhancing the recovery levels of breast cancer patients and their family members.<sup>30</sup> In cancer survivors' perceptions, a high level of family resilience could have a significant impact on medication adherence,

recovery, and social or occupational reintegration.<sup>31</sup> A study showed that high family resilience was associated with high exercise adherence in breast cancer patients undergoing postoperative chemotherapy.<sup>32</sup> A previous study confirmed that family resilience is related to caregiver burden<sup>33</sup>; however, there are currently no studies on family resilience and perceived symptom burden in breast cancer patients.

### Family resilience and symptom burden

Few studies have explored the factors that influence symptom burden from a family perspective. Family is an important place for patients to recover from the disease. Family resilience can promote the level of health of the family and then promote the breast cancer patients' recovery from the disease. It is a family characteristic that helps patients view the physical and emotional symptom burden during the treatment and recovery phases as a challenge or opportunity and actively adapt. Physiological and psychological indicators are not completely independent. Researchers found that a high level of psychological resilience could alleviate the symptom burden of cancer survivors.<sup>34–36</sup> As an important psychological factor that can promote healthy behavior and be intervened, whether family resilience can alleviate physical discomfort symptoms is worth exploring.

### Aim and hypotheses

To date, no studies have investigated the relationships among symptom burden, functional exercise adherence, and family resilience, as well as the underlying mechanisms. Therefore, this study examines the relationships among family resilience, functional exercise adherence, and symptom burden of postoperative breast cancer patients. The proposed hypotheses were as follows: (1) family resilience could have a direct effect on symptom burden, and (2) family resilience could have an indirect effect on symptom burden through functional exercise adherence.

## Methods

### Study design and sampling

This cross-sectional study adopted a convenience sampling method. A paper questionnaire survey was conducted with postoperative breast cancer patients who met the research criteria in two public hospitals in Shandong province, China. The inclusion criteria were as follows: (1) the pathological diagnosis was breast cancer, and patients had undergone breast cancer surgery; (2) age  $\geq 18$  years; (3) clear consciousness; and (4) informed consent indicating willingness to participate in the study. The exclusion criteria were as follows: (1) patients diagnosed with other malignant tumors and recurrences; (2) patients diagnosed with other severe physical illnesses; and (3) persons diagnosed with a mental disorder or language communication disorder. After collecting 239 questionnaires, 47 were invalid and excluded because they had one or more missing data. The final number of valid questionnaires was 192, with a valid response rate of 80.3%.

### Data collection procedure

We recruited breast cancer patients who had undergone surgery through convenience sampling from April to July 2021 in the breast surgery ward in two public hospitals. The participants signed an informed consent form and then completed the paper questionnaire. For patients who could not complete the questionnaire independently, the investigator would read the questions and fill in the patient's answers. Family members were not allowed to assist in this aspect. The investigators were two trained graduate students who are responsible for distributing and checking the questionnaires. It took approximately 10 to 30 min for participants to complete the paper questionnaire.

## Measurements

### Family resilience

Family resilience was assessed using the 32-item shortened Chinese version of the Family Resilience Assessment Scale (FRAS-C),<sup>37</sup> which is a self-report scale, and each item is scored on a four-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = agree, and 4 = strongly agree). The scale has three subscales: Family Communication and Problem Solving (FCPS), Utilizing Social Resources (USR), and Maintaining a Positive Outlook (MPO). The total score can range from 32 to 128, with higher scores indicating higher family resilience. This scale has demonstrated good reliability and validity. In this study, Cronbach's  $\alpha$  of the total scale was 0.97, and Cronbach's  $\alpha$  for the three subscales were 0.96, 0.76, and 0.89 for FCPS, USR, and MPO, respectively.

### Functional exercise adherence

Functional exercise adherence was measured using the Postoperative Functional Exercise Compliance Scale for Breast Cancer Patients, which is a self-report scale with 18 items compiled by Chinese scholars.<sup>38</sup> Each item is rated on a four-point Likert scale, ranging from "simply not able to accomplish" to "have no difficulty accomplishing," with a total score ranging from 18 to 72. The scale has three dimensions: physical exercise compliance (9 items), postoperative attention compliance (5 items), and actively seeking compliance (4 items). A higher total score indicates higher functional exercise adherence. The adherence rate was the actual score/total score  $\times$  100%. An adherence rate  $>$  75% indicated a high adherence rate, 50.0%–74.9% indicated a moderate adherence rate, and  $<$  50% indicated a low adherence rate. In this study, Cronbach's  $\alpha$  for the total scale was 0.97, and the Cronbach's  $\alpha$  for the three dimensions were 0.94, 0.91, and 0.89 for physical exercise compliance, postoperative attention compliance, and actively seeking compliance, respectively.

### Symptom burden

Symptom burden was assessed using the Chinese version of the M. D. Anderson Symptom Inventory (MDASI-C),<sup>39</sup> which is a self-report scale consisting of two domains. The first domain is named "core symptom severity items" and has 13 symptoms. Each symptom is rated on an 11-point scale (0–10) to indicate the presence and severity of the symptom, with 0 indicating "not present" and 10 indicating "as bad as you can imagine." Each symptom is rated based on the severity of the symptom, at its worst, in the last 24 h. The second domain is named "six symptoms interference items" and includes ratings of how much symptoms interfered with different aspects of the survivor's life in the last 24 h. The interference items are also rated on a scale of 0–10, with 0 indicating "did not interfere" and 10 indicating "interfered completely." A score of 0–3 indicated a mild level, 4–6 indicated a moderate level, and 7–10 indicated a severe level of symptom severity or interference. The Chinese version of the MDASI has demonstrated good reliability and validity. In this study, the Cronbach's  $\alpha$  of the total scale was 0.97, and the Cronbach's  $\alpha$  of the two domains was 0.96 for core symptom severity and 0.95 for 6 symptoms interference.

### Demographic and clinical characteristics

Demographic and clinical characteristics included age, nationality, level of education, residence, occupation status, marital status, number of children, principal caregiver, family history of breast cancer, age at diagnosis, time since diagnosis, stage of breast cancer, the operation type, treatment method after surgery, payment method, and perceived medical burden. These observational variables might directly and indirectly influence the symptom burden.<sup>13,40</sup> Hence, we considered them as potential confounders and explored their differences in symptom burden.

### Data analysis

We conducted a normality test and a homogeneity of variance test. Means, standard deviations (SD), and percentages were used to describe

the participants' sociodemographic characteristics and the main study variables (family resilience, functional exercise adherence, and symptom burden). The one-way analyses of variance (ANOVAs) and the independent samples *t*-tests were used to analyze the factors that influence the symptom burden. The Pearson correlations were used to explore the correlation relationships between family resilience, functional exercise adherence, and symptom burden. IBM SPSS (version 22.0; IBM Corp., Armonk, NY, USA) was used for the statistical analyses. Structural equation modeling was used to examine the path relationships among the main study variables, using IBM SPSS AMOS 22.0 (IBM Corp., Armonk, NY, USA). The maximum likelihood method was used to fit the model several times. The model fit indices included  $\chi^2/df$ , root mean square error of approximation (RMSEA), goodness of fit index (GFI), Tucker–Lewis index (TLI), incremental fit index (IFI), comparative fit index (CFI), and normed fit index (NFI). The following values indicated a good model fit: RMSEA  $<$  0.08, GFI  $>$  0.90, TLI  $>$  0.90, CFI  $>$  0.90, and NFI  $>$  0.90.<sup>41</sup> All statistical tests were bilateral tests, and statistical significance was set at  $P <$  0.05.

### Ethical considerations

The study was conducted in accordance with the Declaration of Helsinki. Ethics approval was granted by the Institutional Review Board at the School of Nursing, Shandong University (Approval No. 2021-R-031). Before the investigation began, the purpose and significance of the study were explained to breast cancer patients. The patients who were willing to participate in the study gave informed consent. The paper questionnaires were completed anonymously, and the data were held in strict confidence. If a participant dropped out, we respected their wishes.

## Results

### Demographic and clinical characteristics of the participants

Participants' sociodemographic and clinical characteristics are shown in Table 1. The mean age was  $50.0 \pm 10.8$  years. Ninety-nine percent of the participants were Han Chinese, and slightly more than half (54.2%) had completed a high school education or more. The mean age at diagnosis was 49, and the average time since diagnosis was  $12.6 \pm 19.2$  months. Only 12.5% had a family history of breast cancer. About 76% of the participants perceived a medical burden. For almost all of the participants (96.6%), the payment method was medical insurance.

### Status of family resilience, functional exercise adherence, and symptom burden

The average total score for family resilience was  $97.1 \pm 20.3$ . The proportions of patients with high, moderate, and low levels of functional exercise adherence were 57.3%, 34.9%, and 7.8%, respectively. The average total score of symptom burden, symptom severity, and symptom interference were  $3.7 \pm 2.8$ ,  $3.7 \pm 2.8$ , and  $3.6 \pm 2.8$ , respectively. The most common symptoms were disturbed sleep (94.8%), pain (92.7%), and fatigue (91.7%). The most common interference symptoms were mood (91.7%), general activity (89.6%), and work (86.6%).

### Correlations between family resilience, functional exercise adherence, and symptom burden

Pearson correlations between family resilience, functional exercise adherence, and symptom burden are shown in Table 2. The results indicated that family resilience total scores and the subscale scores were negatively correlated with symptom burden ( $r = -0.17$  to  $-0.14$ ,  $P <$  0.05), and positively correlated with functional exercise adherence ( $r = 0.64$  to  $0.69$ ,  $P <$  0.01). Functional exercise adherence and its three dimensions were negatively correlated with symptom burden ( $r = -0.32$  to  $-0.35$ ,  $P <$  0.01).

**Table 1**  
Characteristics of the participants and demographic differences in symptom burden ( $n = 192$ ).

Variable	$n$ (%)	$t/F$	$P$
<b>Educational level</b>		4.195	0.003
Elementary school or less	37 (19.3)		
Junior high school	51 (26.6)		
High school/high vocational school	52 (27.1)		
College education or higher	52 (27.1)		
<b>Residence</b>		6.817	0.001
City	76 (39.6)		
Suburban	59 (30.7)		
Rural	57 (29.7)		
<b>Occupation</b>		5.124	0.007
In employment	68 (35.4)		
Unemployed	78 (40.6)		
Retired	46 (24.0)		
<b>Marital status</b>		-3.658	< 0.001
Married	170 (88.5)		
Unmarried/divorced/widowed	22 (11.5)		
<b>Children</b>		0.767	0.514
None	12 (6.3)		
One	91 (47.4)		
Two	80 (41.7)		
Three or more	9 (4.7)		
<b>Principal caregiver</b>		1.823	0.144
Spouse	136 (70.8)		
Parent	11 (5.7)		
Child	32 (16.7)		
Others	13 (6.8)		
<b>Time since diagnosis (months)</b>		5.893	0.003
≤ 6	113 (58.9)		
7–11	27 (14.1)		
≥ 12	52 (27.1)		
<b>Stage of breast cancer</b>		7.283	< 0.001
Stage I	30 (15.6)		
Stage II	84 (43.8)		
Stage III	71 (37.0)		
Stage IV	7 (3.6)		
<b>The operation type</b>		2.578	0.079
Modified radical operation	148 (77.1)		
Breast-conserving surgery	21 (10.9)		
Modified radical operation +breast reconstruction	23 (12.0)		
<b>Treatment method after surgery</b>		4.833	0.003
None	29 (15.1)		
Chemotherapy	119 (62.0)		
Radiotherapy	3 (1.6)		
Chemotherapy and radiotherapy	41 (21.4)		
<b>Perceived medical burden</b>		12.54	< 0.001
No burden at all	6 (3.1)		
Almost no burden	40 (20.8)		
Have some burden	104 (54.2)		
Have a lost burden	42 (21.9)		

### Model test

The path relationship among family resilience, functional exercise adherence, and symptom burden were tested in the structural equation modeling, while controlling for medical burden and the treatment method post-operation (Fig. 1). The initial model did not reach the ideal fit indices:  $\chi^2/df = 2.267$ , RMSEA = 0.081, GFI = 0.923, TLI = 0.962, IFI = 0.973, CFI = 0.973, and NFI = 0.953. The initial model was modified. The final model had better fit indices:  $\chi^2/df = 1.928$ , RMSEA = 0.070, GFI = 0.937, TLI = 0.972, IFI = 0.981, CFI = 0.981, and NFI = 0.961. Family resilience had a significant positive effect on functional exercise adherence ( $\beta = 0.738$ ,  $P = 0.002$ ). Functional exercise adherence had a negative effect on symptom burden ( $\beta = -0.433$ ,  $P = 0.001$ ). There was no significant direct effect of family resilience on symptom burden ( $\beta = 0.176$ ,  $P = 0.063$ ). Family resilience had an indirect effect on symptom burden through functional exercise adherence ( $\beta = -0.319$ , 95% CI:  $-0.491$ ,  $-0.169$ ).

### Discussion

This study examined the relationships between family resilience, functional exercise adherence, and symptom burden in postoperative breast cancer patients. As hypothesized, the findings indicated that family resilience could indirectly affect symptom burden through functional exercise adherence, indicating that higher family resilience was associated with higher functional exercise adherence, which in turn was associated with a lower symptom burden. This finding expands the knowledge on the effects of family resilience on the postoperative health outcomes of postoperative breast cancer patients and enriches the research on the positive psychological and social significance of family resilience.

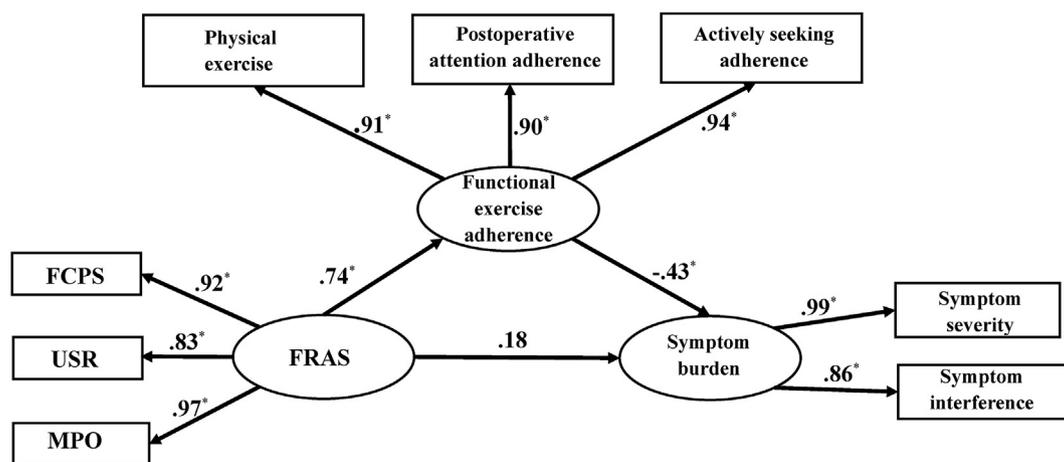
In the current study, postoperative breast cancer patients experienced mild to moderate symptom burden, which is lower than what has been found in other studies.<sup>10,42</sup> This might be because, for patients with early breast cancer, as was the case for most participants in this study, the perceived symptom burden might be relatively mild. Previous studies showed that symptom burden was related to the cancer stage; patients of advanced stage cancer tended to have a higher symptom burden.<sup>10,43</sup> Moreover, the symptom burden could have been influenced by other factors. The path analysis results in this study indicated that the medical burden and post-operation treatment method were the influencing factors for symptom burden. Survivors perceived that the higher the medical burden, the more severe the symptom burden. This is consistent with a prior study that found financial strain was associated with more severe symptoms of depression, anxiety, and a worse physical symptom burden.<sup>44</sup> It is possible that patients thought that treatment would result in a heavy financial burden and mental stress to their families. Meanwhile, they had a stronger desire to live and receive better treatment. This ambivalent psychology led to physical and psychological symptoms, such as anxiety and sleep disturbances. Another reason may be that patients who perceived a high medical burden will feel financially constrained and pay less for expensive medical treatments. The study showed that patients who did not receive chemotherapy or radiotherapy after surgery had the lowest symptom burden, and those who only accepted radiotherapy had the highest symptom burden. Similarly, a recent study indicated that radiotherapy was an important predictor of symptom burden<sup>45</sup>; it causes many complications, including cardiac and lung damage, lymphedema, brachial plexopathy, impaired shoulder mobility, and second malignancies. These symptoms could increase the symptom burden, have an impact on the quality of life, and affect survival.<sup>46</sup>

In this study, the path analysis showed that functional exercise adherence was significantly negatively correlated with symptom burden, which indicates that patients with higher functional exercise adherence would have less symptom burden. Clinically, functional exercise is a regular rehabilitation strategy for postoperative breast cancer patients, and previous studies have demonstrated that adhering to a regular plan of exercise could promote physical rehabilitation; prevent complications; improve physical, physiological, and psychological health; and improve quality of life.<sup>47,48</sup> Hence, this study enriches the research on functional exercise outcomes. Furthermore, the overall functional exercise adherence rate in our study was higher than that found in other studies,<sup>17,38</sup> with more than half of the patients (57.3%) having a high adherence rate. These results provide a possible explanation for why the participants' symptom burden was relatively low in this study (mild to moderate), because they indicated that, generally, they had good functional exercise adherence. More specifically, in the current study, the score for postoperative attention adherence was the highest among the three dimensions of the Postoperative Functional Exercise Compliance Scale for Breast Cancer Patients. This might be because education on postoperative precautions is included in the routine nursing work with patients in China, such as avoiding compression of the affected limb and avoiding

**Table 2**  
Correlations between family resilience, functional exercise adherence, and symptom burden (n = 192).

	Mean ± SD	1	2	3	4	5	6	7	8	9	10	11
1.FRAS-C	97.1 ± 20.3	1										
2.FCPS	68.7 ± 14.9	0.99**	1									
3.USR	9.5 ± 2.0	0.82**	0.75**	1								
4.MPO	18.9 ± 4.1	0.94**	0.89**	0.80**	1							
5.Postoperative Functional Exercise Compliance Scale for Breast Cancer Patients	55.7 ± 12.8	0.68**	0.65**	0.64**	0.69**	1						
6.Adherence to physical exercise	26.8 ± 6.5	0.64**	0.61**	0.61**	0.64**	0.97**	1					
7.Adherence to following the precautions	16.4 ± 3.9	0.66**	0.63**	0.56**	0.68**	0.92**	0.82**	1				
8.Adherence to actively seeking advice	12.4 ± 3.1	0.64**	0.60**	0.64**	0.65**	0.94**	0.86**	0.84**	1			
9.MDASI-C	70.2 ± 43.4	-0.17*	-0.17*	-0.14*	-0.16*	-0.35**	-0.33**	-0.32**	-0.35**	1		
10.Symptom severity	48.6 ± 29.9	-0.15*	-0.14** <sup>a</sup>	-0.15*	-0.15*	-0.35**	-0.33**	-0.32**	-0.35**	0.98**	1	
11.Symptom distress	21.6 ± 15.0	-0.19**	-0.20**	-0.12	-0.17*	-0.32**	-0.31**	-0.30**	-0.32**	0.94**	0.86**	1

\*P < 0.05, \*\*P < 0.01. FCPS, Family Communication and Problem Solving; FRAS-C, Shortened Chinese Version of Family Resilience Assessment Scale; M, mean; MDASI-C, Chinese version of the M. D. Anderson Symptom Inventory; SD, standard deviation; USR, Utilizing Social Resource.



**Fig. 1.** Model of the relationship among family resilience, functional exercise adherence, and symptom burden of patients. \*P < 0.001. Values on paths are path coefficients (standardized βs). FCPS, Family Communication and Problem Solving; FRAS, Family resilience; MPO, Maintaining a Positive Outlook; USR, Utilizing Social Resource.

wearing tight clothing. Possibly because these instructions do not require extra time and experience, and medical staff repeatedly teach these instructions and precautions after surgery, it is easier for patients to accept the education and adhere to it.

Contrary to postoperative attention adherence, the score for physical exercise adherence was the lowest. This might be because the participants feared experiencing pain or were busy with life and work, which may have resulted in simplified exercise, in terms of time, frequency, and type. However, the majority of the patients' postoperative exercise adherence was rated as high, which might also be related to some protective factors. Moreover, in this study, a higher level of family resilience was associated with higher functional exercise adherence. This finding is not only consistent with another study showing that family resilience could affect the adaptability of family members to cancer<sup>49</sup> but also reveals a new meaning for the behavioral changes of patients facing treatment-related challenges. Resilient families have a flexible structure that allows them to adapt to changes and help their family members overcome crisis or adversity. Moreover, under the influence of traditional Chinese Confucianism, the family concept is very important for the Chinese people. Family members face illnesses together, mobilize existing resources, activate new resources, understand each other, and discuss problem-solving strategies. Family members could also strengthen their belief in overcoming the disease and establish a positive attitude toward life.

However, inconsistent with the research hypothesis, family resilience did not directly affect the symptom burden experienced by patients in this study. This suggests that patients may have overcome the disease through individual efforts, and that family was only a positive motivator. Symptom burden is a multidimensional concept that includes the severity of physical and psychological symptoms, as well as the degree of distress in various aspects of life. Family resilience is a form of psychological support for patients that may primarily be a key factor in alleviating the symptom burden. Symptom burden can be influenced by other factors. As hypothesized, family resilience affected symptom burden through functional exercise adherence. Family resilience, as a feature that enables families to recover from adversity, encourages individuals to actively use family resources and obtain encouragement or supervision from one's family to exercise actively. The findings suggest that family members helped patients perform functional exercises and provided them with moral support, urging them to exercise and ensuring the continuity of exercise. Through active family communication with family members, patients build confidence to overcome the disease and consequently improved their functional exercise adherence. Prolonged functional exercise can improve treatment-related symptoms, which is consistent with other studies,<sup>50</sup> and could reduce the risk of death from this disease.<sup>51</sup> These findings support the view that family resilience promotes positive change and a better quality of life for breast cancer patients.<sup>29</sup>

This study is among the first to evaluate how family resilience may alleviate the symptom burden by strengthening functional exercise adherence in postoperative breast cancer patients. It not only focused on factors that directly affect the symptom burden but also considered the pathway in which these factors affected it.

### Limitations

There are some limitations to the current study. First, as this study only investigated two hospitals in Jinan, the generalizability of the findings is limited. In the future, the sample size should be expanded to explore whether different hospitals in different regions validate our conclusions. Second, although our study indicates that family resilience affects the symptom burden through functional exercise adherence, as a cross-sectional study, it is not possible to make conclusions about causal relationships among the variables, or the effects of improvement in functional exercise adherence over time. Future research should investigate causation and the effects of exercise adherence by conducting a longitudinal assessment of symptom relief after improvement of functional exercise adherence. A longitudinal study design is recommended to explore the path relationship, and latent variables should be used to analyze individual change levels. Third, all data were self-reported and may have been affected by self-report bias. Symptom burden assessment can be used as a biological indicator, or the MDASI module specific to breast cancer (MDASI-Br) may be used.<sup>52</sup> In the future, family caregivers may be involved in reporting relevant data. Family resilience can be measured from family members to reflect overall family functioning. Moreover, the disease characteristics of postoperative breast cancer patients vary greatly, and therefore cannot represent the specificity of the sample. Specificity research can be conducted in the future to explore whether there are differences in relationship changes among individuals with different demographic characteristics and disease characteristics.

### Clinical implications

The study has some clinical implications for nurses. When the symptom burden of postoperative breast cancer patients is serious, nurses should investigate the postoperative exercise adherence and family resilience of patients and identify families with poor family resilience. Families have different family resilience levels and family uniqueness; thus, care guidance should be provided accordingly. Family-based intervention programs should be implemented to improve family resilience and postoperative breast cancer patients' well-being. Several studies have shown that couples or family interventions can improve fatigue, depressive symptoms, sleep disorders, and recovery of physical function.<sup>53-55</sup> These interventions include yoga, ballroom dancing, psycho-education, and developing exercise prescriptions for couples to participate in. These also verify the effectiveness of couple and family coping. In the face of the disease, the spouses and patients can undertake positive coping methods to jointly endure and help each other, and the spouses can give more emotional and substantive support to the patients. When providing postoperative exercise guidance to patients, nurses should make full use of family resources. In the continuity of care after discharge, family members should be encouraged to participate in exercise activities and play a supervisory and maintenance role. Therefore, in the future, we can develop some programs focusing on couples or family members participating in functional exercise together, which can not only improve patients' functional exercise adherence but also thereby enhance the family resilience in the process.

### Conclusions

The results of the present study indicated that postoperative breast cancer patients had a higher level of family resilience and functional exercise adherence, as well as mild to moderate symptom burden. Family resilience, as a positive psychological factor, could indirectly impact

breast cancer patients' physical functioning. Our findings suggest that family resilience, symptom burden, and functional exercise adherence should be improved.

### Author contributions

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### Ethics statement

This study was approved by the Institutional Review Board at the School of Nursing, Shandong University (Approval No. 2021-R-031).

### Declaration of competing interest

None declared.

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