Financial toxicity, family resilience and negative emotions among young and middle-aged breast cancer patients: A multicentre cross-sectional study

Xuelei Chen [a,b,1], Qilin Yan [c,1], Youjuan Tang [b,1], Jianing Zhu [d,1], Wenlu Zhang [a,1], Jingping Zhang [a,*]

[a] Nursing Psychology Research Center, Xiangya School of Nursing, Central South University, Changsha, China
[b] Nursing School, Guilin Medical University, Guilin, China
[c] Guilin Municipal Hospital of Traditional Chinese Medicine, Guilin, China
[d] Nanxishan Hospital of Guangxi Zhuang Autonomous Region, Guilin, China

ARTICLE INFO

ABSTRACT

Purpose: To determine financial toxicity in young and middle-aged women with breast cancer and examine the associations between family resilience and negative emotions.

Methods: A multicentre cross-sectional study was conducted, 538 women with breast cancer were recruited from four hospitals. FT, family resilience, and negative emotions were collected using the Comprehensive Score for FT, the Chinese version of the Family Resilience Assessment in Breast Cancer Patients, Patient Health Questionnaire-9 item, and Generalized Anxiety Disorder-7. This study adhered to the STROBE guidelines.

Results: The valid response rate was 96.8 % (N = 521). Overall, the score for FT was 19.63 ± 10.13. FT was significantly correlated with family resilience ($r = 0.30$, $p < 0.010$) and depression ($r = -0.11$, $p < 0.050$). The hierarchical multiple linear regression analysis showed that career status, monthly income, religion, and family resilience were the main factors influencing FT in patients with breast cancer ($R^2 = 0.37$; $F = 6.83$; $p < 0.001$).

Conclusions: FT was more prevalent among women from low-income career. Women with poor family resilience, no religious also suffer greater financial toxicity. It is necessary to pay more attention of the financial toxicity of female' low-income career, no religious belief and poor family resilience. Developing effective interventions based on family resilience might be helpful in promoting their well-being.

1. Introduction

Breast cancer is women's most common malignancy, according to the International Agency for Research on Cancer [1]. Worldwide, 2.26 million new cases of breast cancer have been reported in the past year, representing 31 % of all female cancers in 2023 [2]. In the same year, the number of new cases of breast cancer in China reached 420,000, first place in terms of new cases among women [3]. With advances in early detection and diagnostic technology, breast cancer patients are experiencing improved health outcomes. A study documented that patients with breast cancer have survival rates of 92.5 % and 83.0 % after 5 and 10 years, respectively [4]. However, breast cancer survivors face significant financial burdens [5].

The term " financial toxicity " (FT) was first proposed by Zafar et al.,

in 2012 [6], and describes financial burdens associated with cancer treatment that cause patients distress or hardship [7]. Financial hardships can contribute to FT because of the high out-of-pocket costs (direct and indirect) incurred after cancer diagnosis and reduced income during chemotherapy and the subsequent rehabilitation [8]. Increasing evidence suggests that FT is a common cancer-related parameter that negatively affects patients who give up treatment and change their original lifestyle, affecting survival outcome and quality of life, with long-term physical, psychological, and social consequences [7,9].

FT is a serious problem for young and middle-aged survivors of breast cancer [10], and there has been a linear increase in breast cancer incidence among young and middle-aged women. Compared to elderly patients in China, they bear the heavy responsibility of working, raising children, and caring for the elderly. They shoulder great social

* Corresponding author. Nursing Psychology Research Center, XiangYa School of Nursing, Central South University, 172 Tongzi Po Road, Changsha, 410013, Hunan, China.
 E-mail address: jpzhang1965@csu.edu.cn (J. Zhang).
[1] These authors contributed equally to this work.

responsibility, experience greater ideological pressure, and are more prone to adverse emotions and negative events [11]. At the same time, chemotherapy often comes with side effects among young and middle-aged breast cancer patients, such as fatigue, weight loss, vomiting, weakness, hair loss, and skin pigmentation [12]. They also need to address body image damage caused by surgery and other related complications [12,13]. In addition, chemotherapy seriously affects ovarian function in young and middle-aged breast cancer patients. Alkylating agents reduces the number of primary follicles and may cause a decline in ovarian function, affecting fertility, especially in women who have not given birth [14]. The decline in ovarian function can also lead to impaired synthesis of estrogen and androgen, and patients will experience hot flashes, night sweats, irritability, sleep disorders, weight gain, and genital tract atrophy, which would affect their quality of sexual life [15]. In young women, most breast cancers has more aggressive, malignancy, and is associated with an unfavorable prognosis in clinical settings [16]. At the same time, they are often an important source of income for the family and suffer greater financial pressure after illness. Therefore, the FT in this group needs to be addressed more closely.

Family resilience plays a significant role in psychological development and physical well-being of family members and is a positive psychological quality experienced in the face of crises [17]. Families with the ability to maintain balance during a crisis can acquire new strengths and social resources from adversity and stress [18]. By improving family resilience and coping with chronic stress, families can better manage future crises [19]. Family resilience in patients with breast cancer affects not only their condition but also their physical well-being [20]. Family is the primary place for disease recovery, and the physical well-being of the members has an important impact on the recovery from disease [20]. Family resilience, a kind of family advantage or successful adaptation after a family encounters adversity, has a positive significance in promoting individual and family health [21]. Young and middle-aged women are the mainstay of family and society, and in the process of recovery, they are under great psychological, familial, and social pressure [20]. Family is a significant source to provide financial resources for patients and is an important social support channel to help patients cope with the disease. A family's resilience may also play a role in alleviating FT, since breast cancer affects the entire family. However, little research has been conducted on the relationship between family resilience and FT.

Anxiety and depression have also been documented as negative emotions [22]. The FT includes objective and subjective aspects; objective FT is directly related to clinical treatment and nursing costs, whereas subjective FT refers to patients suffering from depression and other symptoms due to a high self-perceived FT [23]. Due to the loss of normal organ functioning in cancer patients, the consequences of radiotherapy and chemotherapy, the delay of the patient's own future and work, and the heavy pressure on the economy, the general family is often unable to cope with it. These adverse factors often lead to negative emotions in patients [24]. A study showed that 43.4 % of patients with breast cancer surveyed were diagnosed with depression [25]. Another negative emotion is generalized anxiety, and according to reports, over 56.2 % women with breast cancer surveyed had obvious anxiety symptoms [25]. One study in patients with ostomies showed that the level of depression affected the level of FT; a higher depression level indicates a more severe FT, and the depression level has been shown to positively correlate with the FT [26,27]. However, since the mentioned studies did not include young and middle-aged patients, it is unclear whether negative emotions affect FT in patients belonging to this age group with breast cancer.

Many studies exist on FT related to cancer in Western countries; however, the cultural, economic, and medical insurance systems in China and Western countries differ greatly. Therefore, strengthening the study of FT in relation to cancer in the Chinese context, evaluating the FT among young and middle-aged breast cancer survivors, and identifying its influencing factors can lead to effective FT interventions in the country.

This descriptive exploratory study aimed to: (1) describe the current state of FT among young and middle-aged women with breast cancer; (2) examine factors influencing FT, especially in the Chinese medical field, including family resilience, negative emotions, and sociodemographic data.

1.1. Theoretical framework

In this study, Carrera's financial toxicity in cancer treatment framework is used as the theoretical framework, which was published in 2018 [28]. The objective and subjective burdens of financial toxicity are caused by cancer diagnosis and treatment [29]. Previous evidence suggests that demographic and treatment -related factors such as age, race, marital status, monthly income, and negative emotions, such as depression and anxiety, influenced their FT [21,30]. It is also reported that social support is positively correlated with financial toxicity [31]. Families play an important role in social support, so families resilience may be associated with FT. This study was theoretically supported by the model and extant studies, which influenced the choice of predictors. The authors hypothesized that financial toxicity may be related to demographic and treatment-related factors, family resilience, and negative emotions, including depression and anxiety among young and middle-aged breast cancer survivors.

2. Methods

2.1. Design and participants

We conducted an observational cross-sectional study in four public cancer treatment centers on the Chinese mainland between April and September 2022. Kendall's principle of sample size calculation recommends a sample size that is 5–10 times the number of variables in the study [32]. A total of 77 variables were used, 22 of which were related to sociodemographic information, 11 of which were measured by the patient-reported outcome measures (COST-PROM), 28 in the Chinese Family Resilience Assessment in Breast Cancer Patients (FRA-CV), The Patient Health Questionnaire-9 (PHQ-9) has 9 questions, and 7 in the Generalized Anxiety Disorder-7 (GAD-7). Considering 20 % dropout, the target sample size was set at the range 462–924 [i.e., from $77 \times 5 \times (1 + 0.2) = 462$ to $77 \times 10 \times (1 + 0.2) = 924$]. Inclusion criteria: (1) confirmed diagnosis of breast cancer through pathological histology; (2) age 18–59 years; (3) new diagnosis of breast cancer in the previous one month with a clear clinical stage; (4) chemotherapy or surgery performed as part of treatment; and (5) voluntary participation. There were two exclusion criteria: (1) illiterate patients who had difficulty understanding and responding to the questionnaire; and (2) and/or participating in any ongoing clinical trial or psychological program.

2.2. Measurements

Demographics and treatment-related information was assessed by a self-designed questionnaire based on the aims of the study. A total of 22 variables were included: age, BMI, nationality, marital status, childbearing, fertility desire, residence, education level, career, monthly income, medical insurance, caregiver, marital relations, religion, surgery, chemotherapy, neoadjuvant chemotherapy, radiotherapy, endocrine therapy, metastasis and ER.

2.3. Comprehensive score for financial toxicity based on the patient-reported outcome measures (COST-PROM)

The COST-PROM are widely used around the world and have been validated, were used to assess FT [33,34]. The Chinese version translated in 2017 by Huhui et al. [35]. was used. There are 11 items on the COST-PROM scale that measure the perception of patients' seven-day

financial and work pressures. Based on a 5-point Likert scale (0, "Never"; 4, "Very much"), the study used a self-administered questionnaire. "1, 2, 6, 7, 11" are positive entries, while "1", "2, 6, 7, 11" are negative entries. Scores on the scale range from 0 to 44; the lower the total score, the higher the patient's FT score. There are four grades of impact on quality of life, such as >26 for no impact (Grade 1), 14–25 for mild impact (Grade 2), 1–13 for moderate impact (Grade 3), and 0 for high impact (Grade 4) [36]. As a result of this criteria, more than grade 1 FT was considered positive [36]. COST-PROM has proven to be reliable and valid, with Cronbach's α being 0.89. 2 factors explained 68.0 % of the variance in the exploratory factor analysis [35]. Its Cronbach's α was 0.88 in this study.

2.4. The Chinese Family Resilience Assessment in Breast Cancer Patients (FRA-CV)

FRA-CV was used to examine breast cancer survivors' family resilience. In 2017, the FRA was developed by Duncan Lane [37] from the adapted Walsh's Family Resilience Framework [38]; It was translated into Chinese in 2021 by Zhang et al. [39]. The FRA-CV consists of 28 items representing 5 principal factors: positive outlook (7 items), family connectedness (8 items), clarity of emotional expression (4 items), social and economic resources (5 items), and collaborative problem solving (4 items). The questionnaire is self-administered by the participants. A 5-point Likert scale is used (1, "Never"; 5, "Always"). Scale composite score 28 to 140. Higher scores indicate higher levels of family resilience. FRA-CV has demonstrated adequate reliability and validity. The 2-factor model explained 70.9 % of the data variance with Cronbach's α of 0.961 [39], Cronbach's α was 0.95 in this study.

2.5. Patient health Questionnaire-9 (PHQ-9)

PHQ-9 and GAD-7 were used to assess patients' negative emotions of depression and anxiety over the past 14 days. The PHQ-9 was developed by Kroenke et al. based on the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) [40], known to be reliable and valid, it is widely used to measure depression in clinical practice [41]. The questionnaire was translated into Chinese by Xu et al. [42]. The PHQ-9 consists of 9 items. Using a 4-point Likert scale (0 = "rarely" to 3 = "almost every day"), the questionnaire scores the degree to which it is applicable to patients. A score of 0–27 represents the composite score, The higher the score, the more depression. Cronbach's α is 0.83 with the test-retest value of 0.93 [42]. This questionnaire is widely used in China [22,43]. The Cronbach's α for this study was 0.91.

2.6. Generalized Anxiety Disorder-7 (GAD-7)

Anxiety symptoms in the past 2 weeks were assessed using the GAD-7, a brief self-administered rating scale [44]. Seven items are selected from the scale that describe worry or somatic symptoms. The items are rated on a Likert scale ranging from 0 to 21; higher scores indicate more severe anxiety symptoms. The GAD-7 is an accurate measurement tool with a Cronbach's α of 0.92 [45,46]. Based on this study, the scale had a Cronbach's α of 0.93.

2.7. Data collection

The authors contacted the participating hospitals and obtained approval from their board committees. Three research assistants were trained extensively on the specifics of the study before data collection began. A unified guidance was used to meet with subjects and provide them with questionnaires. In the ward, face-to-face surveys were conducted, which included both an introduction to the project and the main questionnaire. This cross-sectional study's purpose, risks, and benefits were explained to each participant and the hospital director prior to conducting the study. All participants were assured of their confidentiality and informed that they could withdraw at any time. All participants were anonymous and voluntary.

2.8. Data analysis

Excel was used to create the questionnaire database, and data was analyzed using SPSS (version 22.0; IBM, ThinkPad E485). In this study, we used descriptive analysis to analyze the COST-PROM, FRA-CV, PHQ-9, and GAD-7 scores and background characteristics. Using the constant variables, mean, standard deviation, and median have been calculated. Figures and percentages were provided for categorical variables. We conducted multivariate analyses to identify which demographic variables were valuable in regression models. Analyzing variance (ANOVA) and students' t-tests were used to compare scores between groups. Using Pearson's correlation analysis, the associations among financial toxicity, family resilience, and negative emotion scores were assessed. In order to identify important predictors of FT (dependent variable), hierarchical multiple linear regression was conducted. we entered demographics (childbearing, residence, education level, career, monthly income, medical insurance, caregiver, marital relations and religion) as confounders in step 1, treatment-related variables (surgery, chemotherapy, radiotherapy and endocrinotherapy) in step 2, family resilience in step 3, and depression in step 4. The statistical significance level was set at $p < 0.050$.

3. Results

3.1. Demographic characteristics

In total, 538 questionnaires were distributed, however, 17 (3.2 %) of the surveys were disregarded because they had invalid or more than 5 % missing responses; consequently, 521 patients responded validly, with a 96.8 % response rate (521 out of 538). In Table 1, respondents' socio-demographic and treatment-related characteristics are summarized. The age of the patients varied between 18 and 59 years, average age being 43.75 ± 10.13. Among the patients, 92.1 % were married, and 7.9 % did not have children. The majority were of Han nationality (87.4 %), and 88.9 % reported no desire to reproduce. Other details are provided in Table 1.

The FT scores and sociodemographic characteristics of the participants are also presented in Table 1. The results of the analysis showed significant differences among different childbearing groups ($F = 9.20$, $p = 0.001$), residence ($F = 8.53$, $p = 0.001$), education level ($F = 16.88$, $p = 0.001$), career ($F = 12.53$, $p = 0.001$), monthly income ($F = 29.23$, $p = 0.001$), medical insurance ($F = 13.81$, $p = 0.001$), caregiver ($F = 3.09$, $p = 0.006$), marital relations ($F = 5.05$, $p = 0.001$), religion ($F = 11.46$, $p = 0.015$), surgery ($F = 2.43$, $p = 0.015$), chemotherapy ($F = 4.77$, $p = 0.001$), radiotherapy ($F = 2.33$, $p = 0.020$), endocrinotherapy ($F = 2.77$, $p = 0.006$). The other variables did not differ significantly between the groups.

3.2. Financial toxicity, family resilience and negative emotions

As shown in Table 2, descriptive statistics are provided for each of the study variables. The mean FT score was 19.63 (SD = 10.13). A mean score of 117.31 (SD = 20.18) was obtained for family resilience. Table 2 depicts the depression and anxiety scores, the sub-dimensions' total means, standard deviations, minimum and maximum values, and item scores.

3.3. Correlational between financial toxicity, family resilience, and negative emotions

Table 3 shows the Pearson's correlation coefficients between financial toxicity, family resilience, and negative emotions. Family resilience and FT scored significantly positively ($r = 0.30$, $P < .01$). All subscales of

Table 1

Characteristics of the participants and demographic differences in financial toxicity (N = 521).

Variables		Total, N = 521	Mean ± SD($\bar{x}$ ±s)	t/F	P
Age (years), n (%)	≤28	11 (2.1)	22.67 ± 5.05	1.73	0.179
	29～39	85 (16.3)	17.84 ± 9.39		
	40～59	425 (81.6)	19.91 ± 10.34		
Age (years),mean ± SD	18～59	43.75 ± 10.13			
BMI, n (%)	<18.5	238 (45.7)	18.97 ± 10.07	0.68	0.510
	18.5～23.9	42 (8.1)	20.11 ± 8.72		
	>23.9	241 (46.3)	20.19 ± 10.44		
Nationality, n (%)	Han	455 (87.4)	19.74 ± 10.26	0.69	0.504
	Zhuang	25 (4.8)	17.63 ± 8.79		
	Others	41 (7.9)	20.93 ± 8.62		
Marital status, n (%)	Unmarried	16 (3.1)	18.60 ± 7.80	0.22	0.805
	Married	480 (92.1)	19.78 ± 10.20		
	Divorced/ separated	25 (4.8)	18.58 ± 10.04		
childbearing, n (%)	No	41 (7.9)	18.76 ± 9.20	9.20	0.001*
	One child	229 (44.0)	22.53 ± 9.76		
	Two children	230 (44.1)	17.46 ± 10.09		
	≥Three	21 (4.0)	13.25 ± 7.08		
Fertility desire, n (%)	Yes	58 (11.1)	20.89 ± 10.13	0.75	0.455
	No	463 (88.9)	19.61 ± 10.11		
Residence, n (%)	Urban	321 (61.6)	22.50 ± 9.54	8.53	0.001*
	Rural	200 (38.4)	14.64 ± 9.20		
Education level, n (%)	≤Junior high school below	255 (49.0)	16.55 ± 10.34	16.88	0.001*
	Senior high school	119 (22.8)	21.19 ± 9.42		
	Junior college	71 (13.6)	22.05 ± 9.27		
	≥Bachelor degree orabove	78 (14.6)	25.03 ± 7.59		
Career, n (%)	Farmer	163 (31.3)	14.62 ± 9.57	12.53	0.001*
	worker	55 (10.6)	22.75 ± 9.69		
	Enterprises employee	102 (19.6)	24.98 ± 8.93		
	Housewife	73 (14.0)	17.03 ± 9.02		
	Others	128 (24.5)	21.52 ± 9.34		
Monthly incom (¥, CNY[a]) , n (%)	< 3000	336 (64.4)	16.64 ± 9.64	29.23	0.001*
	3000–5000	115 (22.1)	22.92 ± 6.89		
	5000–10000	55 (10.6)	29.96 ± 8.92		
	>10000	15 (2.9)	24.07 ± 9.34		
Medical insurance, n (%)	None	20 (3.8)	21.79 ± 9.85	13.81	0.001*
	New rural cooperative medical system (NCMS)	246 (47.2)	16.01 ± 9.32		
	Medical insurance for urban employees	219 (42.0)	23.64 ± 9.47		
	Others	36 (6.9)	17.13 ± 10.92		
Caregiver, n (%)	Spouse	293 (56.2)	19.95 ± 9.76	3.09	0.006*
	Parents	26 (5.0)	16.83 ± 7.78		
	Children	111 (21.3)	21.72 ± 9.86		
	Others	91 (17.5)	16.38 ± 1.44		
Marital relations, n (%)	Very poor	37 (7.1)	17.38 ± 10.53	5.05	0.001*
	Poor	19 (3.6)	16.60 ± 8.019		
	Normal	121 (23.2)	16.65 ± 10.21		
	Good	154 (29.6)	19.27 ± 9.19		
	Excellent	190 (36.5)	22.10 ± 10.46		
Religion, n (%)	Yes	178 (34.2)	26.55 ± 8.91	11.46	0.001*
	No	343 (65.8)	16.14 ± 8.93		
Staging of disease, n (%)	I	99 (19.0)	19.82 ± 9.09	1.43	0.235
	II	266 (51.1)	19.89 ± 9.83		
	III	97 (18.6)	22.13 ± 7.91		
	IV	59 (11.3)	17.81 ± 9.56		
Surgery, n (%)	Yes	290 (55.7)	18.83 ± 9.58	2.43	0.015*
	No	231 (44.3)	21.23 ± 10.79		
Chemotherapy, n (%)	Yes	431 (82.7)	18.39 ± 9.75	4.77	0.001*
	No	90 (17.3)	24.27 ± 10.43		
Neoadjuvant chemotherapy, n (%)	Yes	196 (37.6)	19.83 ± 10.43	0.04	0.965
	No	325 (62.4)	19.88 ± 9.99		

Table 1 (continued)

(continued on next page)

Table 1 (*continued*)

Variables		Total, N = 521	Mean ± SD($\overline{x}$ ±s)	t/F	P
Radiotherapy, n (%)	Yes	154 (29.6)	18.08 ± 8.96	2.33	0.020[b]
	No	367 (70.4)	20.64 ± 10.67		
Endocrinotherapy, n (%)	Yes	200 (38.4)	17.75 ± 9.06	2.77	0.006[b]
	No	321 (61.6)	20.85 ± 1066		
Metastasis, n (%)	Yes	86 (16.5)	16.06 ± 9.26	3.35	0.001
	No	435 (83.5)	20.57 ± 10.22		
ER, n (%)	(+)	413 (79.2)	18.96 ± 9.63	1.06	0.291
	(–)	108 (20.7)	20.43 ± 9.81		

SD: standard deviation.
[a] *p* < .050.
[b] CNY China Yuan, US$ 1.00 = ¥ 7.02.

family resilience were significantly associated with the total scale score for FT (r = 0.11–0.30, *p* < .010). Further, the total FT scale score was negatively associated with depression; however, there were no significant associations with anxiety. A significant negative correlation was noted between family resilience and negative emotions.

3.4. The influence factor of financial toxicity

To examine the predictors of the FT, hierarchical multiple regression was conducted. Results are shown in Table 4. In step 1, demographic variables including childbearing, residence, education level, career,

monthly income, medical insurance, caregiver, marital relations and religion, were entered in the first model. Education level, monthly income, marital relations and religion were found to be a significant predictor of FT(R^2 = 0.30, F = 8.68, *p* < 0.001). In step 2, treatment-related variables including surgery, chemotherapy, radiotherapy and endocrinotherapy were entered into the regression model, and variance explained increased by 2.7 % ($\triangle R^2$ = 0.03, F = 6.65, *p* < 0.001), statistically significant changes in compassion satisfaction were noted. In step 3, compassion satisfaction was also positively impacted by family resilience (F = 7.11, *p* < 0.001) with a growth of 3.3 % ($\triangle R^2$ = 0.03). in Step 4, depression were entered into the regression model, there was an increase of 0.8 % in variance explained ($\triangle R^2$ = 0.01, F = 6.83, *p* < .001), there was no statistical significance to this contribution (β = 0.102, *p* < 0.001) to FT. According to these models, the most important variables for predicting FT were career status, monthly income, religion, and family resilience, particularly monthly income (β = 0.39) and family resilience (β = 0.22), accordingly, Family resilience and low monthly income are associated with a higher FT in breast cancer patients.

4. Discussion

According to this study, the mean FT score was 19.63 (SD = 10.13). It mild impact (Grade 2) to young and middle-aged women with breast cancer [36]. Significant differences were found among childbearing, residence, education level, career, monthly income, medical insurance, caregivers, marital relations, religion, surgery, chemotherapy, radiotherapy, and endocrine therapy regarding the FT of breast cancer patients. Family resilience and depression were significantly correlated with FT. In addition, four variables–career status, monthly income, religion and family resilience were identified as predictive factors for FT.

In this study, young and middle-aged women with breast cancer scored lower in FT (19.63 ± 10.13) compared with earlier studies. These include studies from the United States (22.6 ± 11.5 and 26.11 ± 11.14) [1,47], Australia (25.80 ± 10.30) [48], and China in older patients (22.70 ± 8.39) [49]; with lower scores indicating patients' suffering

Table 2
Financial toxicity, family resilience, and negative emotions sub-dimensions' total mean, standard deviation, minimum, maximum and each item score values (N = 521).

Variables	No. of item	Score ranges	Total subscale ($\overline{x}$ ±s)	Minimum	Maximum	Each item ($\overline{x}$ ±s)
Financial toxicity	11	0 ~ 44	19.63 ± 10.13	0.00	44.00	1.78 ± 0.92
Family resilience	28	28 ~ 140	117.31 ± 20.18	28.00	140.00	4.19 ± 0.72
positive outlook	7	7 ~ 35	30.01 ± 5.22	7.00	35.00	4.29 ± 0.75
family connectedness	8	8 ~ 40	35.18 ± 5.87	8.00	40.00	4.40 ± 0.73
social & economic resources	5	5 ~ 25	20.61 ± 4.31	5.00	25.00	4.12 ± 0.86
clarity emotional expression	4	4 ~ 20	15.88 ± 4.09	0.00	20.00	3.97 ± 1.02
collaborative problem solving	4	4 ~ 20	14.06 ± 4.55	0.00	20.00	3.52 ± 1.14
Depression	9	0 ~ 27	10.30 ± 7.00	0.00	25.00	1.14 ± 0.11
Anxiety	7	0 ~ 21	8.79 ± 5.89	0.00	21.00	1.26 ± 0.84

Table 3
Correlations coefficients between financial toxicity, family resilience and negative emotions (N = 521).

	1	2	3	4	5	6	7	8	9
1.Financial toxicity	1								
2.Family resilience	0.30[b]	1							
3.positive outlook	0.24[b]	0.91[b]	1						
4.family connectedness	0.19[b]	0.89[b]	0.79[b]	1					
5.social & economic resources	0.26[b]	0.87[b]	0.75[b]	0.79[b]	1				
6.clarity emotional expression	0.30[b]	0.85[b]	0.75[b]	0.67[b]	0.68[b]	1			
7.collaborative problem solving	0.26[b]	0.77[b]	0.62[b]	0.52[b]	0.63[b]	0.63[b]	1		
8.Depression	−0.11[a]	−0.12[a]	−0.17[b]	−0.10	−0.06	−0.11[a]	−0.04	1	
9.Anxiety	0.03	−0.13[a]	−0.21[b]	−0.11[a]	−0.09	−0.12[a]	−0.01	0.76[b]	1

Note:Pearson test.
[a] *p* < .050.
[b] *p* < .010.

Table 4
Hierarchical regression analysis for predicting financial toxicity (N = 521).

Variables	Step 1		Step 2		Step 3		Step 4	
	b	β	b	β	b	β	b	β
Constant	17.14		14.16		6.37		2.23	
childbearing	0.02	0.01	0.10	0.01	0.10	0.01	0.26	0.02
residence	−1.36	−0.07	−1.46	−0.07	−1.54	−0.08	−1.24	−0.06
education level	−1.46	−0.18[a]	−1.08	−0.13	−1.15	−0.14	−1.16	−0.14
career	0.49	0.11	0.51	0.12	0.61	0.14[a]	0.67	0.15[a]
monthly income	4.53	0.45[b]	4.35	0.44[b]	3.97	0.40[b]	3.89	0.39[b]
medical insurance	−0.34	−0.02	−0.63	−0.05	−0.80	−0.06	−0.61	−0.04
caregiver	−0.33	−0.06	−0.45	−0.08	−0.59	−0.10	−0.56	−0.10
marital relations	1.75	0.18[b]	1.47	0.15[b]	1.08	0.11	1.15	0.12
religion	−2.71	−0.20[b]	−2.45	−0.18[b]	−2.33	−0.17[b]	−2.04	−0.15[a]
surgery			−0.86	−0.05	−1.03	−0.05	−0.91	−0.05
chemotherapy			1.08	0.05	0.73	0.03	0.34	0.02
radiotherapy			0.31	0.02	0.01	0.01	0.01	0.01
endocrinotherapy			2.25	0.12	2.35	0.12	2.11	0.11
family resilience					0.097	0.20[b]	0.11	0.22[b]
depression							0.14	0.10
R^2	0.30		0.33		0.359		0.37	
Adjusted R^2	0.27		0.28		0.308		0.31	
△R^2	0.30		0.03		0.033		0.01	
F	8.68		6.65		7.11		6.83	
p	<0.001		<0.001		<0.001		<0.001	

Notes. b = standardized regression coefficient; β = standardized regression coefficient; Dubin-Watson D: 2.06; Tolerance: 0.55 ~ 0.93; Variance inflation factor: 1.07 ~ 1.84.

[a] $p < .050$ (two-tailed).
[b] $p < .010$ (two-tailed).

higher toxicity. This suggests that the incidence of FT is higher in young and middle-aged breast cancer survivors than in elderly ones. Interestingly, a U-shaped distribution for FT is observed with age. Those under 29 years and over 39 years of age had higher FT scores than those between 29 and 39 years, with higher scores indicating lower toxicity. As per our findings, participants' FT is associated with their demographic and treatment-related characteristics. Significant differences were found in the FT levels according to childbearing, residence, education level, career, monthly income, medical insurance, caregiver, marital relations, religion, surgery, chemotherapy, radiotherapy, and endocrine therapy. All these factors can influence FT in young and middle-aged women with breast cancer.

In this study, the total FT score positively correlated with family resilience and negatively correlated with depression. This finding suggests that the better the family's resilience was, the less FT the patients suffered. The more career stability, higher income, and religious status of the patient, the lower the FT. An important reason for this is the strong correlation between social support and family resilience among young cancer patients [50]. Patients with better family resilience received more support from their families. They can face the disease together and solve problems, including finance related, during the illness; therefore, they suffer less economic toxicity. At the same time, family resilience also affects patients' psychological adaptation. Families with low resilience are more likely to have negative emotions, especially those related to depression [50], when dealing with challenges such as cancer and treatment and find it harder to make rational decisions, thus increasing their economic burden, which in turn can affect their quality of life [51]. This study confirms the findings of previous studies conducted in Western countries [1]. Developing effective interventions based on family resilience might be helpful in promoting their well-being. Therefore, it is possible to prevent and alleviate various negative emotions related to cancer and treatment by improving the resilience of patients' families, conducting various forms of cancer group activities to enhance the psychological adaptation of cancer survivors, reducing their subjective feelings of economic toxicity, and assisting cancer survivors and their families in improving their quality of life.

The hierarchical multiple regression analyses showed that career, monthly income, religion, and family resilience were predictors of FT in patients with breast cancer. In terms of career, farmers scored the lowest, whereas workers in enterprises and public institutions scored the highest. Patients who earn more than 10,000 yuan per month are often small-business owners. Although they have a high monthly income when healthy, once they fall ill, they are unable to work, and their income is seriously affected. Therefore, the FT of such patients is more serious than that of unit workers. This study showed that monthly income is significantly correlated with FT. Contrary to our expectations that FT would decrease with an increase in monthly income, patients with a monthly income of 5000-10,000 had the lowest FT. The reason for this analysis is that most patients with income in this range are government employees or employees of enterprises and public institutions with income stability and high medical insurance coverage, which is consistent with the career scores in this study. Low-income cancer survivors are more likely to enter a vicious cycle of cancer, low income, unemployment, and economic toxicity [1,7]. One study found that patients with a low income face a 5.86-fold higher financial burden than those with a high income [7,51]. Other studies from the United States and Japan also found that low income was also associated with more severe FT [52,53]. Low income is the most important barrier limiting early screening, diagnosis and timely treatment of breast cancer in women. The effects of FT can occur even before cancer is diagnosed, with low-income women suffering delayed diagnosis and treatment due to a lack of regular screening. Consequently, the stage of cancer diagnosed is late and the optimal treatment period is missed, leading to a poor prognosis and higher expenditure [54]. Therefore, the government's efforts to establish adequate social insurance are crucial in reducing financial toxicity. Religion and coping with FT correlated positively, as religion may assist nurses in accepting illnesses and decreasing their negative emotions, as documented an earlier study [55].

Several limitations of this study should be addressed in future research. Firstly, the convenience sample of breast cancer patients recruited from four tertiary hospitals may not represent the whole population of mainland Chinese women with breast cancer. Further, all participants reported their data, not objective measurements. Therefore,

the respondents' attitudes and interests may have affected the accuracy of the results. Thus, the verification of the results will require larger sample sizes from different geographical areas.

5. Clinical implication

This study has several implications. First, understanding the FT state among young and middle-aged breast cancer patients remains a developing discipline not only in mainland China but worldwide. Researchers must examine the FT in patients with breast cancer based on their demographics and clinical characteristics. Since family resilience and negative emotions influence FT, a need to focus on the relationship between them arises. Second, as with respect to different childbearing, residence, educational level, career, monthly income, medical insurance, caregiver, marital relationship, and clinical characteristics, breast cancer survivors had different levels of FT, and questions arise regarding the quality and nature of their interventions. Therefore, intervention projects based on these influencing factors should be designed to equip young and middle-aged women with breast cancer against FT. Moreover, the screening, development, and implementation of interventions may enhance the resilience of families based on the results, reduce their negative emotions and subjective perception of FT, and assist surviving breast cancer patients who are young and middle-aged as well as their families in improving their quality of life.

6. Conclusions

Breast cancer survivors' FT was assessed via a multi-centre cross-sectional survey in their early and middle years and to identify the key factors contributing to this toxicity. The findings indicate that FT was widespread in this population, with a larger impact than in older females. In addition to the general influencing factors of a childbearing, residence, education level, career, monthly income, medical insurance, caregiver, marital relations, surgery, chemotherapy, radiotherapy, endocrine therapy, family resilience, and negative emotions were found to be associated with FT. This study provides a theoretical basis for FT prevention and intervention. In the future, caregivers can be encouraged intervention plans to enhance family resilience and minimize negative emotions to reduce FT.

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Consent to participate

Informed consent was obtained from all individual participants included in the study.

Ethical consideration

IRB approval was granted for this study by the institution review board of Xiangya School of Nursing, Central South University (IRB No. E202225, approved 08/April/2022). Prior to data collection, verbal or written approval was obtained from the management or ward supervisor of each sample hospital. Participants freely completed the questions after signing an informed consent form, ensuring their right to withdraw at any time. All data collected from participants was treated with complete privacy and anonymity.

Funding

In this study, funding was provided by the Innovation-driven project of Central South University (Grant No: 2023ZZTS0236).

CRediT authorship contribution statement

Xuelei Chen: Writing – original draft, Methodology, Investigation, Data curation. **Qilin Yan:** Resources, Investigation, Data curation. **Youjuan Tang:** Data curation. **Jianing Zhu:** Resources, Investigation, Data curation. **Wenlu Zhang:** Writing – review & editing, Project administration, Formal analysis. **Jingping Zhang:** Writing – review & editing, Supervision, Methodology.

Declaration of interest statement

The authors declare that there is no conflict of interest.

Acknowledgments

We thank the participants of this study for their time and dedication, as well as the hospitals for supplying their Support for data extraction.

References

[1] Benedict C, Fisher S, Schapira L, Chao S, Sackeyfio S, Sullivan T, et al. Greater financial toxicity relates to greater distress and worse quality of life among breast and gynecologic cancer survivors. Psycho Oncol 2022;31:9–20.
[2] Siegel RL, Miller KD, Wagle NS, Jemal A. Cancer statistics, 2023. CA A Cancer J Clin 2023;73:17–48.
[3] Changming Z, Zezhou W, Ying Z. Interpretation of US cancer statistics 2023 and its implications for cancer prevention and treatment in China. China Oncology 2023;33:117–25.
[4] Miao M, Jing Y, Cm Z, J S, Zz W, al e. Changing long-term survival of Chinese breast cancer patients-experience from a large single institution hospital-based cancer registry with 35 thousand patients. China Oncology 2020;30:90–7.
[5] Shi JF, Shi CL, Yue XP, Huang HY, Wang L, Li J, et al. Economic burden of cancer in China during 1996-2014: a systematic review. Zhonghua Zhongliu Zazhi 2016;38:929–41.
[6] Zafar SY, Abernethy AP. Financial toxicity, Part I: a new name for a growing problem. Oncology (Williston Park) 2012;27(80–1):149.
[7] Ehsan AN, Wu CA, Minasian A, Singh T, Bass M, Pace L, et al. Financial toxicity among patients with breast cancer worldwide: a systematic review and meta-analysis. JAMA Netw Open 2023;6:e2255388.
[8] Neilson T, Huynh V, Macdonald A, Romandetti K, Ahrendt G, Hampanda K, et al. Financial toxicity of breast cancer care: the patient perspective through surveys and interviews. J Surg Res 2023;281:122–9.
[9] Cheng H, Lin L, Liu T, Wang S, Zhang Y, Tian L. Financial toxicity of breast cancer over the last 30 years: a bibliometrics study and visualization analysis via CiteSpace. Medicine (Baltim) 2023;102:e33239.
[10] Miller KD, Fidler-Benaoudia M, Keegan TH, Hipp HS, Jemal A, Siegel RL. Cancer statistics for adolescents and young adults, 2020. CA Cancer J Clin 2020;70:443–59.
[11] Iddrisu M, Aziato L, Dedey F. Psychological and physical effects of breast cancer diagnosis and treatment on young Ghanaian women: a qualitative study. BMC Psychiatr 2020;20:353.
[12] Kim SD, Kwag EB, Yang MX, Yoo HS. Efficacy and safety of ginger on the side effects of chemotherapy in breast cancer patients: systematic review and meta-analysis. Int J Mol Sci 2022;23:1–12.
[13] Versluis A, van Alphen K, Dercksen W, de Haas H, van den Hurk C, Kaptein AA. "Dear hair loss"-illness perceptions of female patients with chemother apy-induced alopecia. Support Care Cancer : official journal of the Multinational Asso ciation of Supportive Care in Cancer. 2022;30:3955–63.
[14] Qiu J, Tang L, Li P, Fu J. An investigation into the reproductive concerns of young women with breast cancer. Asia Pac J Oncol Nurs 2022;9:100055.
[15] Mejia-Rojas ME, Contreras-Rengifo A, Hernandez-Carrillo M. Quality of life in women treated with chemotherapy for breast cancer in Cali, Colombia. Biomedica 2020;40:349–61.
[16] Yehia L, Eng C. One size does not fit all: breast cancer in young women. Clin Cancer Res 2022;28(11):2209–10.
[17] Chang L, Zhang S, Yan Z, Li C, Zhang Q, Li Y. Symptom burden, family resilience, and functional exercise adherence among postoperative breast cancer patients. Asia Pac J Oncol Nurs 2022;9:100129.
[18] Hawley DR, DeHaan L. Toward a definition of family resilience: integrating life-span and fa mily perspectives. Fam Process 1996;35:283–98.
[19] Li Y, Li-mei S, Wei-ye Q, Yu-li L. The relationships among family resilience, posttraumatic growth, and quality of life in breast cancer survivors. Chin J Clin Psychol 2018;26:800–3.
[20] Jin X, Liu X, Xie H, Yu J, Gu D. Effect of narrative nursing on family resilience and psychosocial adap tation of middle-aged patients with breast cancer. Evidence-Based complementary and alternative medicine. eCAM 2022;2022:5499298.
[21] Zhang J, Yang Z, Wang X, Li J, Dong L, Wang F, et al. The relationship between resilience, anxiety and depression among patients with mild symptoms of COVID-19 in China: a cross-sectional study. J Clin Nurs 2020;29:4020–9.

[22] Yanhong C. The relationship between negative emotion and emotion regulation strategies in breast cancer patients with metastasis [Master]. Shandong University; 2020.

[23] Thaduri A, Garg PK, Malhotra M, Singh MP, Poonia DR, Priya M, et al. Financial toxicity and mental well-being of the oral cancer survivors residing in a developing country in the era of COVID 19 pandemic - a cross-sectional study. Psycho Oncol 2023;32:58–67.

[24] Perez-Tejada J, Labaka A, Vegas O, Larraioz A, Pescador A, Arregi A. Anxiety and depression after breast cancer: the predictive role of Mon oamine levels. Eur J Oncol Nurs : the official journal of Europea n Oncology Nursing Society 2021;52:101953.

[25] Hajj A, Hachem R, Khoury R, Hallit S, ElJebbawi B, Nasr F, et al. Clinical and genetic factors associated with anxiety and depression in breast cancer patients: a cross-sectional study. BMC Cancer 2021;21:872.

[26] Mo M, Jia P, Zhu K, Huang W, Han L, Liu C, et al. Financial toxicity following surgical treatment for colorectal cancer: a cross-sectional study. Support Care Cancer 2023;31:110.

[27] Yalin S, Liping T, Ying C, Baozhen Z, Zhufeng X, Min W. Financial toxicity status and its influencing factors among patients undergoing cutaneous ureterostomy. Journal of Nursing Science. 2022;37:26–9.

[28] Carrera PM, Kantarjian HM, Blinder VS. The financial burden and distress of patients with cancer: understanding and stepping-up action on the financial toxicity of cancer treatment. CA Cancer J Clin 2018;68:153–65.

[29] Kemp EB, Geerse OP, Knowles R, Woodman R, Mohammadi L, Nekhlyudov L, et al. Mapping systematic reviews of breast cancer survivorship interventions: a network analysis. J Clin Oncol 2022;40:2083–93.

[30] Coroneos CJ, Lin YL, Sidey-Gibbons C, Asaad M, Chin B, Boukovalas S, et al. Correlation between financial toxicity, quality of life, and patient satisfaction in an insured population of breast cancer surgical patients: a single-institution retrospective study. J Am Coll Surg 2021;232:253–63.

[31] Nguyen NH, Khera R, Ohno-Machado L, Sandborn WJ, Singh S. Prevalence and effects of food insecurity and social support on financial toxicity in and healthcare use by patients with inflammatory bowel diseases. Clin Gastroenterol Hepatol 2021;19:1377. 86.e5.

[32] Lewis S. Sample size calculations in clinical research. Appl Stat 2009;36:469.

[33] de Souza JA, Yap BJ, Hlubocky FJ, Wroblewski K, Ratain MJ, Cella D, et al. The development of a financial toxicity patient-reported outcome in cancer: the COST measure. Cancer 2014;120:3245–53.

[34] de Souza JA, Yap BJ, Wroblewski K, Blinder V, Araujo FS, Hlubocky FJ, et al. Measuring financial toxicity as a clinically relevant patient-reported outcome: the validation of the COmprehensive Score for financial Toxicity (COST). Cancer 2017;123:476–84.

[35] Huihui Y, Xue B, Yunyong L. Reliability and validity of the Chinese version on comprehensive scores for financial toxicity based on the patient-reported outcome measures. Chin J Epidemiol 2017;38:1118–20.

[36] De Souza JA, Aschebrook-Kilfoy B, Grogan R, Yap BJ, Daugherty C, Cella D. Grading financial toxicity based upon its impact on health-related quality of life (HRQol). American Society of Clinical Oncology; 2016. p. 16.

[37] Duncan Lane C, Meszaros PS, Savla J. Measuring Walsh's family resilience framework: reliability and validity of the family resilience assessment among women with a history of breast cancer. Marriage Fam Rev 2017;53:667–82.

[38] Walsh F. Applying a family resilience framework in training, practice, and research: mastering the art of the possible. Fam Process 2016;55:616–32.

[39] Shan-shan Z, Hui-ping L, Jiang-yan S, Meng-ke Z, Jie G, Jia-xin L. Reliability and validity of the Chinese version of family resilience assessment in breast cancer patients. J Nurs 2021;28:1–5.

[40] Kroenke K, Spitzer RL. The PHQ-9: a new depression diagnostic and severity measure. Psychiatr Ann 2002;32:509–21.

[41] Mufson L, Morrison C, Shea E, Kluisza L, Robbins R, Chen Y, et al. Screening for depression with the PHQ-9 in young adults affected by HIV. J Affect Disord 2022;297:276–82.

[42] Xu Y, Wu H, Xu Y. The reliblility and validity of patient health questionnaire depression module(PHQ-9) in Chinese elderly Shanghai psychiatric. Medicine 2007:257–76.

[43] Peng Z. The effect of marital satisfaction on depression in breast cancer patients and self-help intervention study [Master]. Hebei Medical University; 2020.

[44] Spitzer RL, Kroenke K, Williams JBW, Löwe B. A brief measure for assessing generalized anxiety disorder: the GAD-7. Arch Intern Med 2006;166:1092–7.

[45] Ip H, Suen YN, Hui CLM, Wong SMY, Chan SKW, Lee EHM, et al. Assessing anxiety among adolescents in Hong Kong: psychometric properties and validity of the Generalised Anxiety Disorder-7 (GAD-7) in an epidemiological community sample. BMC Psychiatr 2022;22:703.

[46] Romano I, Ferro MA, Patte KA, Leatherdale ST. Measurement Invariance of the GAD-7 and CESD-R-10 among adolescents in Canada. J Pediatr Psychol 2022;47:585–94.

[47] Rosenzweig M, West M, Matthews J, Stokan M, Yoojin Kook YK, Gallups S, et al. Financial toxicity among women with metastatic breast cancer. Oncol Nurs Forum 2019;46:83–91.

[48] Durber K, Halkett GK, McMullen M, Nowak AK. Measuring financial toxicity in Australian cancer patients - validation of the COmprehensive Score for financial Toxicity (FACT COST) measuring financial toxicity in Australian cancer patients. Asia Pac J Clin Oncol 2021;17:377–87.

[49] Xiaoyi Y, Yanling S, Yi K, Jing Z, Haiyan G, Weijie X. Status and influencing factors of cancer-related financial toxicity of breast cancer survivors. Chinese Nursing Management 2022;22:830–5.

[50] Ruiqin Z, Cuiyong S, Huimin Z, Min G, Lanqing G. Correlation between family resilience, social support and psychosocial adjustment for young breast cancer patients. Nursing and rehabilitation 2021;20:10–5.

[51] Dar MA, Chauhan R, Trivedi V, Kumar R, Dhingra S. Assessing the prevalence of financial toxicity, its predictors and association with health- related quality of life among radiation oncology patients in India: a cross-sectional patient reported outcome study. Int J Radiat Oncol Biol Phys 2022;116:157-165.

[52] Ver Hoeve ES, Ali-Akbarian L, Price SN, Lothfi NM, Hamann HA. Patient-reported financial toxicity, quality of life, and health behav iors in insured US cancer survivors. Support Care Cancer : official journal of the Multinational Asso ciation of Supportive Care in Cancer 2020;29:349–58.

[53] Honda K, Gyawali B, Ando M, Kumanishi R, Kato K, Sugiyama K, et al. Prospective survey of financial toxicity measured by the comprehensive score for financial toxicity in Japanese patients with cancer. J Glob Oncol 2019;5:1–8.

[54] Donkor A, Atuwo-Ampoh VD, Yakanu F, Torgbenu E, Ameyaw EK, Kitson-Mills D, et al. Financial toxicity of cancer care in low- and middle-income countries: a systematic review and meta-analysis. Support Care Cancer : official journal of the Multinational Asso ciation of Supportive Care in Cancer 2022;30:7159–90.

[55] Tsaras K, Papathanasiou IV, Mitsi D, Veneti A, Kelesi M, Zyga S, et al. Assessment of depression and anxiety in breast cancer patients: preval ence and associated factors. Asian Pac J Cancer Prev APJCP 2018;19:1661–9.