The Breast 81 (2025) 104441

Contents lists available at ScienceDirect

The Breast

journal homepage: www.journals.elsevier.com/the-breast

Trajectories and predictors of financial toxicity in breast cancer patients: A multicenter longitudinal study in China

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ARTICLE INFO

Keywords:
Financial toxicity
Trajectory
Predictive factors
Growth mixture modeling
Longitudinal study
Breast cancer

ABSTRACT

Background: Patients with breast cancer experience varying levels of financial toxicity (FT), but the factors contributing to sustained financial toxicity remain poorly understood.
Methods: This longitudinal study was conducted from November 2022 to March 2024 in China. Participants were recruited from four Tertiary Level A hospitals using convenient sampling. FT was assessed using the Comprehensive Score for Financial Toxicity (COST) at baseline (T1), 3 months (T2), 6 months (T3), and 12 months (T4) post-surgery. Growth Mixture Modeling was used to identify the different trajectories of the FT. Multivariable logistic regression were employed to explore the predictive factors with different trajectory categories.
Results: Among 378 participants (all women; median [SD] age, 48.9 [9.97] years), the COST score was lowest at T2. Three distinct FT trajectories were identified: 91 patients **(24 %)** in the "Severe FT with Gradual Relief" group (trajectory 1), 190 patients **(50 %)** in the "Persistently Low-Level FT" group (trajectory 2), and 97 patients **(**26 %**)** in the "Moderate FT with Gradual Worsening" group (trajectory 3). Using trajectory 2 as the reference, predictors for trajectory 1 included symptom burden, location, cancer stage, cost-related health literacy, resilience, and difficulty affording basic expenses. For trajectory 3, predictors included monthly household income, symptom burden, location, and cancer stage.
Conclusions: The FT experienced by breast cancer patients changes over time and follows distinct dynamic trajectories, influenced by multiple factors. In future clinical practice, early identification and intervention for high-risk FT groups should be prioritized.

1. Introduction

Advances in cancer diagnosis and treatment have improved survival rates but also led to rising costs [1]. In addition to reduced income resulting from treatment-related work absences and long-term care expenses, patients with breast cancer often face ongoing financial burdens [1]. In 2012, Zafar et al. [2] proposed the term "cancer-related financial toxicity (FT)" to describe the economic side effects of cancer treatment, which encompass both objective financial burdens and subjective financial hardships, along with the resulting psychological, behavioral, and survival outcomes [3]. Studies have shown that patients with breast cancer are at risk of FT worldwide, with rates of 35.3 % in high-income countries and 78.8 % in low- and middle-income countries [4].Therefore, cancer-related FT has been recognized as a global issue that impacts countries with diverse health systems [5].

Extensive research has been conducted on the risk factors of FT in patients with breast cancer [6–11]. However, most of them are cross-sectional and retrospective, limiting our understanding of the

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https://doi.org/10.1016/j.breast.2025.104441
Received 24 December 2024; Received in revised form 22 February 2025; Accepted 12 March 2025
Available online 13 March 2025

occurrence and trajectory of FT throughout the treatment process. FT is a dynamic and individualized phenomenon, as cancer-related expenses fluctuate over time [12,13]. While research on FT trajectories in patients with colorectal and lung cancers exists [14,15], given the differences in treatment modalities and associated costs among cancer types, these findings may not be directly applicable to breast cancer patients. Longitudinal insights within homogeneous patient populations are essential for timely and targeted interventions tailored to specific groups at appropriate stages [16].

Growth mixture modeling (GMM), a trajectory analysis method, captures individual variations and identifies distinct subgroups within a population following different trajectories over time [17,18]. This approach facilitates the exploration of heterogeneity in health status, helps identify vulnerable populations in need of targeted healthcare, and clarifies the trajectories that lead to optimal health outcomes, thereby contributing to our understanding of the development of FT [17,18]. Therefore, this study utilized GMM to investigate the trajectories of FT and their influencing factors among patient with breast cancer. The findings will assist clinicians in identifying high-risk populations early, determining optimal intervention timing, and providing valuable insights for developing localized, dynamic, and personalized intervention strategies to mitigate FT.

2. Methods

2.1. Sample and research design

This prospective longitudinal study was conducted in China from November 2022 to March 2024, which was registered on ClinicalTrials.gov (NCT05964816). A total of 447 patients were recruited from four Tertiary Level A public hospitals across different regions: Shanghai (Eastern China), Shenyang (Northeast China), Wuhan (Central China), and Xi'an (Northwest China) through convenience sampling. Eligible participants were at least 18 years old, diagnosed with breast cancer, had undergone surgery, were scheduled to receive one or more antitumor treatments, and were proficient in Mandarin. This report followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline [19].

2.2. Measures

2.2.1. Demographic characteristics

Sociodemographic data (age, gender, ethnicity, region, marital status, number of children, living arrangements, household size, education level, religious beliefs, medical insurance status, and family savings, etc.) and disease-related data (tumor site, stage, surgical approach, comorbidities, treatment decision preferences, etc.) were collected. Additionally, treatment information and related financial issues, such as ongoing treatments, employment status, and treatment-related expenditures, were also collected. These variables were selected based on previously reported association with FT [11,20–28].

2.2.2. Financial toxicity

FT was assessed using the simplified Chinese version of the Comprehensive Score for Financial Toxicity (COST), which was displayed in eTable 1 [29,30].This 11-item patient-reported outcome measure uses a 7-day time window and a 5-point Likert response scale (ranging from 0, indicating not at all, to 4, very much). Total scores range from 0 to 44, with higher scores indicating better financial well-being. The simplified Chinese version of the COST demonstrated good internal consistency in our study (Cronbach's $\alpha = 0.940–0.946$).

2.2.3. Other covariates

Physical symptom burden was assessed using the Chinese version of the BCPT Eight Symptom Scale [31,32]. Psychological symptom burden was measured using the Chinese version of the Memorial Symptom Assessment Scale – Short Form Psychological [33–35].Socioeconomic status was measured using the Subjective Socioeconomic Status Scale [36,37]. Social support was assessed with the Perceived Social Support Scale [38,39].Resilience was quantified using the Connor-Davidson Resilience Scale 10 [40]. In addition, based on prior literature and relevant definitions, we designed questionnaires to measure cost-related health literacy and adverse outcomes of FT [41,42]. These variables were included as they have been reported as factors associated with FT [20].

2.3. Data collection

Ethical approval was granted by the Clinical Research and Ethics Committee of Shanghai Cancer Center, Fudan University in November 2022 (IRB No. 2211264-24), and subsequently approved by the other three hospitals. All participants provided written informed consent. According to GMM method, at least three measurement time points are required, with four or five being preferable [43]. To capture data across different treatment stages, data were collected at four time points: 1 week (T1), 3 months (T2), 6 months (T3), and 12 months (T4) post-surgery. To minimize the measurement burden on participants, stable variables such as demographic and disease-related characteristics were collected only at T1, while variables expected to change over time, such as symptom burden and treatment costs, were collected at all four time points. Adverse outcomes of FT were measured only at T4. Specific variables collected at each time point were listed in eTable 2. All data were collected by nurses underwent standardized research training.

2.4. Data analysis

Data analysis was performed using Mplus version 8.3 and SPSS version 22.0. Sociodemographic, disease-related characteristics, treatment information and related financial issues were analyzed descriptively. Repeated measures ANOVA was used to compare total FT scores across time points to assess significant differences.

GMM was employed to explore the longitudinal trajectories of FT. We sequentially increased the number of categories from one to five and compared model fit indices to determine the best model. Parameter estimation was performed using robust maximum likelihood estimation, with the variances and covariances of growth factors freely estimated but constrained to be equal across classes. Classification accuracy was assessed using indices such as the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), sample size-adjusted Bayesian Information Criterion (aBIC), Entropy Index, Likelihood Ratio Test (LMR), and Bootstrap Likelihood Ratio Test (BLRT). Lower values of the AIC, BIC and aBIC indicate better model fit. The entropy value ranges between 0 and 1, with values closer to 1 indicating better fit. The LMR and BLRT tests showed statistically significant differences ($p < 0.05$), indicating that the model with n classes fits better than the model with n-1 classes [44,45].

Univariate analysis was performed with FT classifications from the GMM as the dependent variable, and sociodemographic, disease-related characteristics, treatment information, related financial issues and other covariates as independent variables. Variables with $P < 0.1$ in the univariate analysis were further included in the multivariable logistic regression. Variables collected only once were directly incorporated their categories or values, while variables with repeated measurements, such as economic information, were averaged. For symptom burden, which changed over time, GMM was used to categorize data into high and low symptom groups before including them in the regression models. The detailed assignment of variables in multivariable logistic regression is shown in eTable 3.

Finally, chi-square test was used to analyze the association between the trajectory of FT and adverse outcomes.

3. Results

3.1. Participant characteristics

A total of 447 valid questionnaires were collected at baseline, with 378 participants completing all follow-up visits, resulting in a final follow-up rate of 84.56 %. The participant flow diagram is available in eFig. 1(supplemental file 1). The primary reasons for loss to follow-up were patient refusal to continue participation (n = 54) and inability to contact (n = 15). Comparison between the 378 participants and the 69 lost to follow-up revealed no statistically significant differences in demographic characteristics, disease features, or primary outcome variables.

The final analytical sample comprised 378 breast cancer patients (mean [SD] age, 48.92 [9.97] years). All participants were female. By self-reported residence, the majority participants (306 [81.0 %]) resided in urban areas. Regarding education, 39.9 % had primary school education or below. In terms of disease characteristics, 31.7 % were diagnosed with stage 0-I, 46.8 % with stage II, and 21.4 % with stage III-IV. Detailed sociodemographic characteristics and PRO responses are presented in Table 1.

3.2. Descriptive FT

The mean (SD) COST scores at the four time points were 23.5 (10.5), 22.7 (11.4), 24.0 (10.6), and 24.2 (10.5), respectively. At T2, the mean score was the lowest, indicating that FT was the most severe at this time. Repeated measures ANOVA was used to analyze within-group effects. The results revealed significant differences in total FT scores across different time points ($P < 0.05$).

Model Fit Indices of Growth Mixture Models of Presenteeism.

Five latent class models were estimated, with results presented in Table 2. Model fit indices were analyzed to determine the optimal number of classes. As the number of classes increased from 1 to 3, the values of AIC, BIC, and aBIC decreased progressively, and the LMR and BLRT tests were statistically significant ($P < 0.05$). However, as the number of classes increased from 4 to 5, AIC, BIC, and aBIC values began to increase, and the LMR and BLRT tests became non-significant. Considering these fit indices, class probabilities, and model interpretability, the 3-class model was determined to be superior. This model exhibited the smallest AIC, BIC, and aBIC values, significant LMR and BLRT tests, and no group with a class probability below 10 %.

3.3. Trajectories of FT

Fig. 1 illustrates the three identified trajectories of FT. In Class 1, the initial FT scores was low ($I = 11.823$), but the mean FT increased significantly over the follow-up period ($S = 2.785$, $P < 0.001$); this group was designated as the "Severe Financial Toxicity with Gradual Relief Group" and comprised 91 patients. In Class 2, the initial FT scores was high ($I = 31.066$) and showed no significant change over time ($S = 0.360$, $P = 0.090$); this group was labeled the "Persistently Low-Level Financial Toxicity Group" and comprised 190 patients. In Class 3, the initial FT scores was moderate ($I = 17.721$), but the mean FT decreased significantly over the follow-up period ($S = -1.517$, $P = 0.006$); this group was named "Moderate Financial Toxicity with Gradual Worsening Group" and comprised 97 patients.

3.4. Predictors of FT trajectory patterns

The variables included in the regression model were selected through univariate analysis (presented in eTable 4). The results of multivariable logistic regression showed that, using the “Persistently Low-Level FT Group” as the reference group, predictors for the “Severe FT with Gradual Relief Group” were: worsening physical symptom burden (Odds Ratio [*OR*] = 7.921, $P = 0.012$), living in urban areas ($OR = 0.243$, $P =$

Table 1
Characteristics of participants (n = 378).

Characteristics	n (%)/mean ± standard deviation
Age (years)	
≤ 40 years	81 (21.4)
41–59 years	241 (63.8)
≥60 years	56 (14.8)
Sex	
Female	378 (100.0)
Location	
Northeast of China	92 (24.3)
Eastern of China	118 (31.2)
Central of China	118 (31.2)
Western of China	50 (13.2)
Residential area	
Urban	301 (81.0)
Rural	72 (19.0)
Education attainment	
Primary school or below	151 (39.9)
Secondary school	62 (16.4)
College or above	165 (43.7)
Ethnicity	
Han	351 (92.9)
Minority	27 (7.1)
Marital status	
Married	363 (96.0)
Widowed/divorced/single	15 (4.0)
Living status	
Alone or living with others	25 (6.6)
Living with partner or children	353 (93.4)
Housing type	
Self-purchase	307 (81.2)
Other	71 (18.8)
Whether there is a caregiver	
Yes	335 (88.6)
No	43 (11.4)
Working status before treatment	
Be on the job	85 (22.5)
Sick leave	81 (21.4)
Retire	88 (23.3)
Unemployed/others	124 (32.8)
Occupational type	
Public institutions/civil servants	66 (17.5)
Firm	111 (29.4)
Peasant	66 (17.5)
Others (individual, service)	70 (18.5)
Unemployment	65 (17.2)
Total disposable household savings (Chinese yuan)	
≤ 100,000	237 (62.7)
> 100,000	141 (37.3)
Supplementary commercial insurance	
Yes	54 (14.3)
No	324 (85.7)
Whether it is difficult to pay for basic living expenses	
Not at all	178 (47.1)
A little	101 (26.7)
Some	69 (18.3)
Quite or very	30 (7.9)
How to go to the hospital	
Walk or bike	18 (4.8)
Public transport	135 (35.7)
Take a taxi	40 (10.6)
Private car	185 (48.9)
Which kind of medical institution to choose when you are unwell	
Level III or level II hospital	296 (78.3)
Community health centers or other	82 (21.7)
Type of surgery	
Breast conserving surgery	75 (19.8)
Radical mastectomy	224 (59.3)
Breast reconstruction	22 (5.8)
Others	57 (15.1)
Stage of cancer	
0-I	120 (31.7)
II	177 (46.8)
III-IV	81 (21.4)
Comorbidities	

(continued on next page)

Table 1 (*continued*)

Characteristics	n (%)/mean ± standard deviation
Yes	96 (25.4)
No	282 (74.6)
Most of the medical expenses	
Self-financing	101 (26.7)
Medical insurance	267 (70.6)
Others	10 (2.6)
Had chemotherapy	
Yes	316 (83.6)
No	62 (16.4)
Had Radiotherapy	
Yes	214 (56.6)
No	164 (43.4)
Had Endocrine therapy	
Yes	270 (71.4)
No	108 (28.6)
Had Biological targeted therapy	
Yes	123 (32.5)
No	255 (67.5)
Had Immunotherapy	
Yes	9 (2.4)
No	369 (97.6)
Whether you are still receiving treatment 1 year after surgery	
Yes	333 (88.1)
No	45 (11.9)
Average monthly out-of-pocket direct treatment costs (Chinese yuan)	
<5000	213 (56.3)
≥5000	165 (43.7)
Average monthly indirect treatment cost (Chinese yuan)	
<2000	232 (61.4)
≥2000	146 (38.6)
Whether there were any changes in work during treatment	
Yes	231 (61.1)
No	147 (38.9)
Whether the monthly household income has changed	
Monthly income increase	41 (10.8)
No significant changes have taken place	197 (52.1)
Monthly income had fallen	140 (37.0)
Household monthly income (Chinese yuan)	
< 5000	107 (28.3)
5000–9999	119 (31.5)
10,000–19,999	94 (24.9)
≥ 20,000	58 (15.3)
Subjective socioeconomic status	
Low level	217 (57.4)
High level	161 (42.6)
Social support	
Low level	115 (30.4)
High level	263 (69.6)
Physical symptom burden	
Physical symptom burden relief group	319 (84.4)
Physical symptom burden worsening group	59 (15.6)
Psychological symptom burden	
Low level psychological symptom burden group	330 (87.3)
High level psychological symptom burden group	48 (12.7)
Cost-related health literacy	7.67 ± 2.895
Resilience	25.31 ± 7.352

0.042), residing in the eastern region ($OR = 0.045$, $P = 0.004$), tumor stage 0–I ($OR = 0.207$, $P = 0.022$), no difficulty in affording basic living expenses ($OR = 0.060$, $P = 0.005$), higher cost-related health literacy scores ($OR = 0.823$, $P = 0.039$), and higher resilience scores ($OR = 0.919$, $P = 0.023$). For the "Moderate FT with Gradual Worsening Group", predictors included: average monthly household income <5000 yuan ($OR = 10.353$, $P = 0.003$), worsening physical symptom burden ($OR = 7.273$, $P = 0.006$), high psychological symptom burden ($OR = 5.350$, $P = 0.019$), residing in the northeastern region ($OR = 0.153$, $P = 0.022$), residing in the eastern region ($OR = 0.099$, $P = 0.003$), tumor stage II ($OR = 0.333$, $P = 0.047$). Using the "Moderate FT with Gradual Worsening Group" as the reference group, predictors for the "Severe Financial Toxicity with Gradual Relief Group" were: high social support levels ($OR = 3.570$, $P = 0.004$), still receiving treatment one year after surgery ($OR = 0.237$, $P = 0.039$), and changes in employment status ($OR = 0.194$, $P = 0.004$). Detailed results of multivariable logistic regression are shown in Table 3.

3.5. Relationship between FT trajectory and subsequent adverse outcomes

The detailed results of the Chi-square are presented in Table 4. The findings revealed the likelihood of experiencing subsequent adverse outcomes varied across different FT trajectory groups. The "Moderate FT with Gradual Worsening Group" exhibited the highest proportion of experiencing subsequent adverse outcomes, while the "Persistently Low-Level FT Group" had a higher proportion of without such outcomes.

4. Discussion

Our study employed a prospective longitudinal design to track the FT levels of breast cancer patients over one year. We identified three distinct FT trajectories and associated unique risk factors with each trajectory. Furthermore, we found significant differences in subsequent outcomes among patients in different FT trajectories, validating the practical significance of the trajectory classification. These findings provide critical evidence for identifying high-risk populations, determining optimal intervention timing, and developing targeted strategies to mitigate FT.

Our results indicate that the FT scores of breast cancer patients were lowest at the T2 time point, with scores increasing at T3 and T4. This suggests that FT was most severe at T2, showing an overall trend of initial worsening and subsequent relief. The continuous worsening of FT from T1 to T2 may be attributed to the heightened negative emotions and concerns following diagnosis, compounded by the intensive treatment phase within the first three months post-surgery, characterized by frequent treatments and a heavy symptom burden. As treatment intensity decreases, FT tends to ease over time. Based on our findings, future interventions to mitigate FT should begin before three months post-surgery to prevent further deterioration. Furthermore, our study utilized GMM to analyze longitudinal FT data and identified three distinct FT trajectory categories. Based on these trajectories, the three categories were labeled as "Severe FT with Gradual Relief Group" (24 %), "Persistently Low-Level FT Group" (50 %), and "Moderate FT with Gradual Worsening Group" (26 %). Overall, most patients experienced

Table 2
Model fit indices of growth mixture models for FT.

Model	AIC	BIC	aBIC	Entropy	LMR	BLRT	Category probability (%)
C = 1	10143.69	10179.11	10150.55	/	/	/	/
C = 2	10119.02	10166.24	10129.17	0.674	0.00	0.00	0.51/0.48
C=3	**10103.09**	**10162.11**	**10114.52**	**0.639**	**0.02**	**0.00**	**0.24/0.026/0.50**
C = 4	10104.96	10175.78	10118.73	0.692	0.85	1.00	0.18/0.29/0.51/0.02
C = 5	10103.58	10186.21	10119.58	0.688	0.30	0.33	0.14/0.37/0.02/0.22/0.24

Abbreviations: AIC, Akaike's information criterion; BIC, Bayesian information criterion; aBIC, sample-size adjusted BIC; LMR, Lo-Mendell-Rubin; BLRT, bootstrapped parametric likelihood ratio test.

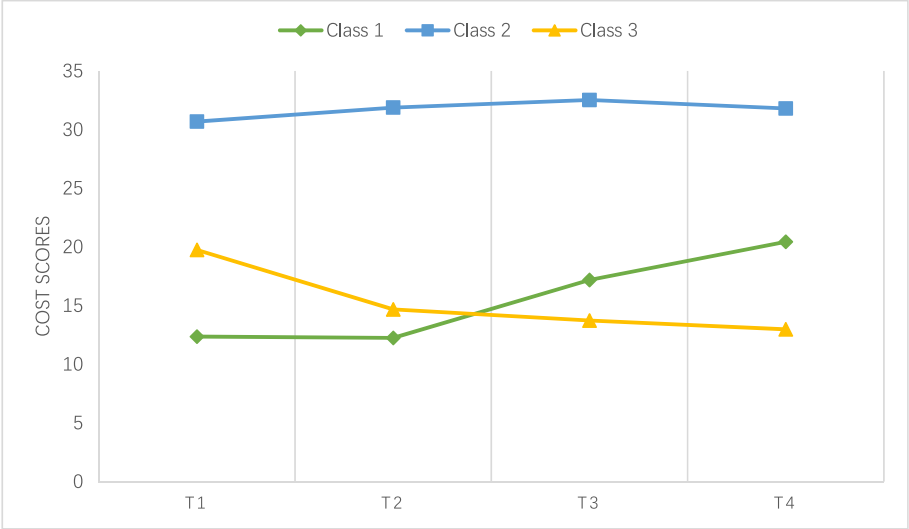

Fig. 1. Trajectories of FT.
Note: Class 1: Severe Financial Toxicity with Gradual Relief Group; Class 2: Persistently Low-Level Financial Toxicity Group; Class 3: Moderate Financial Toxicity with Gradual Worsening Group.

stable or alleviated FT, while a smaller proportion showed worsening FT. Similar findings have been reported in previous studies. Kircher et al. [14] used the COST-PROM tool to assess FT in 132 colorectal cancer patients from diagnosis to one year post-diagnosis, revealing an overall improvement in FT. Similarly, Friedes et al. [15] assessed FT in 112 lung cancer patients at diagnosis and six months later, finding that most patients experienced improvement. These findings align with the trends observed in our study, where FT levels in breast cancer patients improved by T4. Future efforts should focus on identifying and supporting patients in "Severe FT with Gradual Relief Group" and "Moderate FT with Gradual Worsening Group", as these categories represent the most vulnerable groups in terms of FT trajectory.

Consistent with previous studies, this study examined the impact of socioeconomic, demographic, and disease factors such as residence area, family income, and tumor stage on the FT trajectory [10,15,20,46]. Attention should be paid to the identification of these FT risk groups in the early stage, and the corresponding intervention measures should be carried out. In addition, we found some factors influencing FT that clinicians can intervene with. Our findings show that patients with high social support were more likely to receive help from family, friends, and community resources. Previous research suggests that as treatment progresses, patients' support networks tend to shrink. Therefore, fostering cancer support groups and other social initiatives can enhance social support, especially for long-term patients, helping to reduce the psychological burden of financial concerns [47,48]. Furthermore, our study revealed that symptom burden is also a contributing factor to FT. Patients with higher symptom burdens may require more frequent medical interventions and incur additional healthcare costs, intensifying their financial strain [48,49]. Addressing symptom management alongside financial support could help mitigate FT and improve overall patient well-being.

Our study also underscored the importance of psychological and cognitive factors in mitigating FT. The results indicated that patients with higher cost-related health literacy were more likely to experience lower FT. Previous research suggests that FT levels may decrease over time as patients acquire financial knowledge, including understanding insurance reimbursement processes, reimbursement rates, and monthly medical expenses [15,50]. To address this issue, future interventions should provide patients with comprehensive, evidence-based, and accessible financial information, such as insurance-related knowledge on reimbursement procedures, coverage percentages, and eligible medications. Furthermore, patients with higher psychological resilience were also more likely to experience lower FT, consistent with findings by Yuan et al.'s[48]research. Future interventions should incorporate psychological counseling and positive interventions to enhance psychological resilience. By improving resilience, patients may better cope with the emotional and financial challenges of cancer treatment, ultimately reducing FT severity and improving overall well-being.

5. Implications for research and practice

These findings underscore the importance of early identification of high-risk groups for FT, enabling timely interventions and follow-ups to mitigate its long-term impact on subsequent treatment outcomes and quality of life. Addressing FT at an early stage can significantly reduce the risk of adverse financial outcomes in the future. Developing FT risk prediction tools in clinical practice is essential for promptly identifying high-risk groups and enabling early interventions. FT intervention programs should integrate symptom burden management, positive psychological interventions, and comprehensive financial information and counseling. Although this study was conducted in China, it holds significant potential for global application, particularly in low- and middle-income countries (LMICs), which share common challenges such as high out-of-pocket expenses for cancer treatment. Furthermore, the symptom burden, psychological and cognitive factors uncovered in this research have broad contextual relevance, providing new perspectives for advancing efforts to mitigate the financial burden of cancer treatment worldwide.

6. Limitations

Our study has several limitations. First, the study sample was limited to hospitals in four cities, with most participants coming from urban areas, potentially limiting the generalization of the findings. Moreover, the one-year follow-up period may fail to capture the dynamic changes in FT experienced by breast cancer patients throughout their extended treatment journeys. Finally, as the study commenced one week after surgery, it does not account for patients' financial status prior to their breast cancer diagnosis, which could provide critical context for understanding financial changes over time.

7. Conclusions

FT is prevalent among breast cancer patients, exhibiting an initial

Table 3
Multivariable logistic model of Factors Associated With Trajectories of FT(n = 378).

Trajectory comparison	Predictors	*β*	*S.E*	*Wald*χ [2]	*P*	*OR*	95 %*CI*
Class 1 vs Class 2(Reference)	Residential area						
	Urban	−1.416	0.697	4.124	0.042*	0.243	0.062–0.952
	Rural						
	Location						
	Northeast of China	−1.242	0.885	1.971	0.160	0.289	0.051–1.635
	Eastern of China	−2.872	0.996	8.307	0.004**	0.045	0.008–0.399
	Central of China	−1.214	0.787	2.378	0.123	0.297	0.064–1.389
	Western of China						
	Whether it is difficult to pay for basic living expenses						
	Not at all	−2.810	0.995	7.969	0.005**	0.060	0.009–0.424
	A little	−0.253	0.914	0.076	0.782	0.777	0.129–4.659
	Some	0.987	1.002	0.969	0.325	2.682	0.376–19.127
	Quite or very						
	Stage of cancer						
	0-I	−1.574	0.686	5.262	0.022*	0.207	0.054–0.795
	II	−0.687	0.626	1.205	0.272	0.503	0.148–1.715
	III-IV						
	Resilience	−0.084	0.037	5.172	0.023*	0.919	0.855–0.988
	Cost-related health literacy	−0.195	0.095	4.248	0.039*	0.823	0.683–0.990
	Physical symptom burden						
	Physical symptom burden worsening group	2.069	0.826	6.284	0.012*	7.921	1.571–39.945
	Physical symptom burden relief group						
Class 3 vs Class 2(Reference)	Location						
	Northeast of China	−1.877	0.821	5.228	0.022*	0.153	0.031–0.765
	Eastern of China	−2.310	0.790	8.559	0.003**	0.099	0.021–0.467
	Central of China	−1.643	0.726	5.119	0.024*	0.193	0.047–0.803
	Western of China						
	Household monthly income (Chinese yuan)						
	<5000	2.337	0.794	8.668	0.003**	10.353	2.184–49.064
	5000–9999	1.387	0.760	3.327	0.068	4.003	0.902–17.765
	10,000–19,999	0.026	0.744	0.001	0.972	1.026	0.239–4.414
	10,000–19,999						
	Stage of cancer						
	0-I	−1.089	0.620	3.081	0.079	0.337	0.100–1.135
	II	−1.101	0.554	3.947	0.047*	0.333	0.112–0.985
	III-IV						
	Physical symptom burden						
	Physical symptom burden worsening group	1.984	0.729	7.409	0.006**	7.273	1.743–30.350
	Physical symptom burden relief group						
	Psychological symptom burden						
	High level psychological symptom burden group	1.677	0.714	5.512	0.019*	5.350	1.319–21.697
	Low level psychological symptom burden group						
Class 1 vs Class 3(Reference)	Whether there were any changes in work during treatment						
	Yes	−1.642	0.568	8.362	0.004**	0.194	0.064–0.589
	No						
	Whether you are still receiving treatment 1 year after surgery						
	Yes	−1.439	0.695	4.281	0.039*	0.237	0.061–0.589
	No						
	Social support						
	High level	1.273	0.445	8.194	0.004**	3.570	1.494–8.533
	Low level						

Note: Class 1: Severe Financial Toxicity with Gradual Relief Group; Class 2: Persistently Low-Level Financial Toxicity Group; Class 3: Moderate Financial Toxicity with Gradual Worsening Group; *$P < 0.05$,**$P < 0.01$; OR, Odds Ratio; CI, confidence interval.

Table 4
The relationship between FT trajectories and the occurrence of adverse outcomes.

Trajectories	Whether subsequent adverse outcomes of FT occurred		χ [2]	P
	Yes	No		
FT Trajectories			40.929	<0.001**
Class 1	30(34.5 %)	61(21.0 %)		
Class 2	18(20.7 %)	172(59.1 %)		
Class 3	39(44.8 %)	58(19.9 %)		

Note: Class 1: Severe Financial Toxicity with Gradual Relief Group; Class 2: Persistently Low-Level Financial Toxicity Group; Class 3: Moderate Financial Toxicity with Gradual Worsening Group; **$P < 0.01$.

worsening trend followed by gradual alleviation. The severity of FT peaks three months post-surgery. Three distinct trajectories of FT were identified, influenced by sociodemographic, economic, disease- and treatment-related, as well as psychological and cognitive factors. Early identification of high-risk groups for FT should be a prioritized in future clinical practice. Targeted interventions should be actively implemented to address FT, incorporating psychological, social, and informational support alongside symptom management to alleviate its adverse effects on patients' well-being.

CRediT authorship contribution statement

Yi Kuang: Writing – review & editing, Writing – original draft, Investigation, Formal analysis, Data curation, Conceptualization. **Jiajia Qiu:** Project administration, Investigation, Data curation, Conceptualization. **Ye Liu:** Project administration, Investigation, Data curation, Conceptualization. **Sijin Guo:** Project administration, Investigation,

Data curation, Conceptualization. **Ting Chen:** Project administration, Investigation, Data curation, Conceptualization. **Lichen Tang:** Resources, Project administration, Conceptualization. **Winnie K.W. So:** Methodology, Conceptualization. **Weijie Xing:** Writing – review & editing, Writing – original draft, Supervision, Resources, Project administration, Methodology, Formal analysis, Conceptualization.

Data sharing statement

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

Role of the funder/sponsor

The funder had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

Funding/support

Dr Xing received financial support from the Natural Science Foundation of China project (72004034) and China Medical Board Open Competition Program (20–371).

Declaration of competing interest

All authors declare that they do not have any actual or potential conflicts of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.breast.2025.104441.

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