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Original Article

Financial toxicity and psychological distress in adults with cancer: A treatment-based analysis

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ABSTRACT

Objective: To evaluate disparities in financial toxicity and psychological distress in patients with cancer as a function of treatment and reveal the relationship between financial toxicity and psychological distress.
Methods: This was a multicenter cross-sectional study. Patients were recruited from March 2017 to October 2018, and questionnaires were completed regarding their demographics, financial toxicity, and psychological distress. A multiple linear regression model was used to examine factors associated with financial and psychological distress.
Results: Significant financial toxicity and psychological distress occurred in 47.9% and 56.5% of patients, respectively. Financial toxicity ($P = 0.032$) and psychological distress ($P < 0.001$) were statistically different among the single chemotherapy, adjuvant therapy, and surgery groups. Multivariable analysis revealed that patients aged 50–59 years ($P = 0.035$), 60–69 years ($P = 0.007$), and 70 years or older ($P = 0.002$) had higher the Comprehensive Score for financial Toxicity (COST) scores compared with patients less than 50 years old. Patients with personal annual income > 40,000 CNY reported higher COST scores than those who had < 20,000 CNY ($P < 0.001$). Patients who had Urban Resident Basic Medical Insurance (URBMI) ($P = 0.030$) or New Rural Cooperative Medical Scheme (NRCMS) ($P = 0.006$) compared with Urban Employee Basic Medical Insurance (UEBMI) presented lower COST scores than patients with UEBMI. The multiple analysis model of psychological distress showed that an age of more than 70 years ($P = 0.010$) was significantly associated with low the Distress Thermometer (DT) scores, and patients with colorectal cancer ($P = 0.009$), the surgery group ($P < 0.001$) and adjuvant therapy group ($P < 0.001$) were significantly associated with high DT scores. The correlations between financial toxicity and psychological distress were mild but statistically significant in the chemotherapy-related treatment groups.
Conclusions: The research highlights the high rates of financial and psychological distress in adult patients. Multidimensional distress screening and psychosocial interventions should be provided for patients with cancer according to related factors.

Introduction

An estimated 19.3 million new cancer cases and almost 10.0 million cancer deaths occurred globally in 2020,[1] and the figure is expected to rise over the next 50 years owing to the strong influence of demographic changes, such as population ageing and growth.[2] Cancer is an expensive and stressful disease.[3] Cancer diagnosis and treatment often lead patients to face some level of financial toxicity and psychological distress, regardless of disease stage.[4,5] Financial toxicity has been defined as objective financial burden and subjective financial distress experienced by cancer patients as a result of their treatment.[6] Increasing research attention is being paid to the source and outcome of financial toxicity, and how best to identify and address this problem.[7–10] Psychological distress is conceptualized as a multifactorial, unpleasant experience of a psychological, social, spiritual, or physical nature that may interfere with the ability to cope effectively with the physical symptoms and treatment

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of cancer.[11] It has been considered the sixth vital sign, after pain, in cancer care.[12,13] Financial toxicity and psychological distress in patients with cancer may decrease adherence to treatment, decrease quality of life, and increase cancer-specific mortality.[14–16] Assessment of financial toxicity may play a role in supportive care and help to build a framework for financial counseling interventions on a par with symptom management (eg, for fatigue or pain) across the spectrum of cancer care facilities.[17] Early screening of psychological distress can lead to timely multicomponent intervention, in turn, improving the quality of life of patients with cancer.

The studies of psychological distress have focused on emotional problems (eg, anxiety, depression) and physical problems (eg, fatigue), and studies on financial toxicity are mostly based on demographic factors such as age, with little attention to treatment-related factors.[18–22] The above topics are less frequently researched in China. Approximately 85% of patients choose public hospitals for treatment, and cancer patients prefer high-level public hospitals in China. There are three social health insurance schemes with different target populations, financing, and reimbursement rates: Urban Employee Basic Medical Insurance (UEBMI), Urban Resident Basic Medical Insurance (URBMI), and the New Rural Cooperative Medical Scheme (NRCMS).[23] A previous study showed that public health insurance was associated with cancer-specific mortality, independent of tumor characteristics and primary treatment.[24]

This study was conducted to estimate the financial toxicity and psychological distress in different treatment groups, explore their relationships and identify demographic, clinical, and socioeconomic predictors of distress in cancer patients within the Chinese health system.

Table 1
Characteristics of patients.

Characteristics		*n* (%)
Age (years)	< 50	74 (18.1)
	50–59	137 (33.5)
	60–69	161 (39.4)
	≥ 70	37 (9.0)
Gender	Male	183 (44.7)
	Female	226 (55.3)
Marital status	Married	368 (90.0)
	Unmarried	41 (10.0)
Employment status	Employed	100 (24.4)
	Unemployed	309 (75.6)
Educational background	Primary school	71 (17.4)
	Middle school	172 (42.0)
	High school	94 (23.0)
	University or above	72 (17.6)
Personal annual income (CNY)[a]	< 20,000	264 (64.5)
	20,000–39,999	121 (29.6)
	≥ 40,000	24 (5.9)
Insurance[b]	UEBMI	229 (56.0)
	URBMI	52 (12.7)
	NRCMS	128 (31.3)
Cancer type	Stomach	71 (17.4)
	Lung	127 (31.1)
	Colorectal	99 (24.2)
	Breast	112 (27.4)
Clinical stage	I	65 (15.9)
	II	138 (33.7)
	III	166 (40.6)
	IV	40 (9.8)
Treatment	Chemotherapy	237 (57.9)
	Surgery	103 (25.2)
	Surgery + Chemotherapy	69 (16.9)
First hospitalization	Yes	233 (57.0)
	No	176 (43.0)

[a] CNY, Chinese Yuan. The cutoff values of 20,000 CNY and 40,000 CNY are roughly equivalent to the thresholds for the low-middle-income group and the middle-high-income group according to per capita disposable income in the Liaoning Province bureau of statistics in 2017.

[b] Urban Employee Basic Medical Insurance (UEBMI), Urban Resident Basic Medical Insurance (URBMI), New Rural Cooperative Medical Scheme (NRCMS).

Methods

Study design and procedure

A cross-sectional observational study was conducted at three public cancer treatment centers in Northeastern China: Cancer Hospital of China Medical University (Liaoning Cancer Hospital & Institute), Anshan Tumor Hospital, and the Fourth Hospital of Fushun City from March 2017 to October 2018. Patient inclusion criteria included: being aged 18 years or older; participating in Social Health Insurance of China; receiving a new diagnosis of stomach, lung, colorectal, or breast cancer with a clear clinical stage within two months; and undergoing treatment with surgery or chemotherapy. According to the treatment methods adopted by the patients at the end of the investigation, the patients were divided into three groups in the following analysis: chemotherapy (received only chemotherapy), adjuvant therapy (received chemotherapy before or after surgery), and surgery (received only surgical treatment). Patients who were illiterate, unable to understand and respond to the study survey, and/or were receiving treatments through a clinical trial were excluded from the study.

Data collection

Sociodemographic and clinical characteristics

Demographic information and clinical characteristics were solicited in the first part of the questionnaire, including age, gender, marital status, educational background, employment status, personal annual income, medical insurance status, cancer type, clinical stage of cancer, and type of treatment.

Financial toxicity assessments

All patients also completed the Comprehensive Score for financial Toxicity (COST) survey to assess for financial toxicity. The COST measure was previously developed and validated by de Souza et al. to assess financial toxicity in patients with cancer.[25,26] Our team translated and adapted the Chinese version with high reliability ($\alpha = 0.85$) among patients with cancer.[27] Briefly, the COST measure is an 11-item measure of financial toxicity examining one financial item, two resource items, and eight affect items. The patients were asked to respond on a five-point Likert scale, from 0 (not at all) to 4 (very much). The total score ranges from 0 to 44 points. Lower COST values indicate severe financial toxicity. The cut-off score of 17.5 was used to indicate high financial toxicity for the COST measure.[28]

Psychological distress assessments

Several instruments are available to identify the distress of patients with cancer.[29] The Distress Thermometer and Problem List (DT&PL) is widely used as a self-reporting tool for the screening of distress in patients with cancer.[30,31] The DT is a single-item, self-reporting instrument measuring the amount of distress experienced by patients within the last week, with a score ranging from 0 (no distress) to 10 (extreme distress). The PL groups various problems patients with cancer encounter after diagnosis into five problem categories: practical, family, emotional, physical, and spiritual. Problems are selected by checking a corresponding "yes" or "no" on the survey. The Chinese version has been validated in patients with various types of cancer.[32] A score of 4 or higher on the DT indicates clinically meaningful distress. Significant distress and specific problems were analyzed in the current study.

Data analysis

All sociodemographic and clinical characteristics of the patients were summarized using descriptive statistics. Categorical variables were presented as frequencies and percentages. Differences among various groups

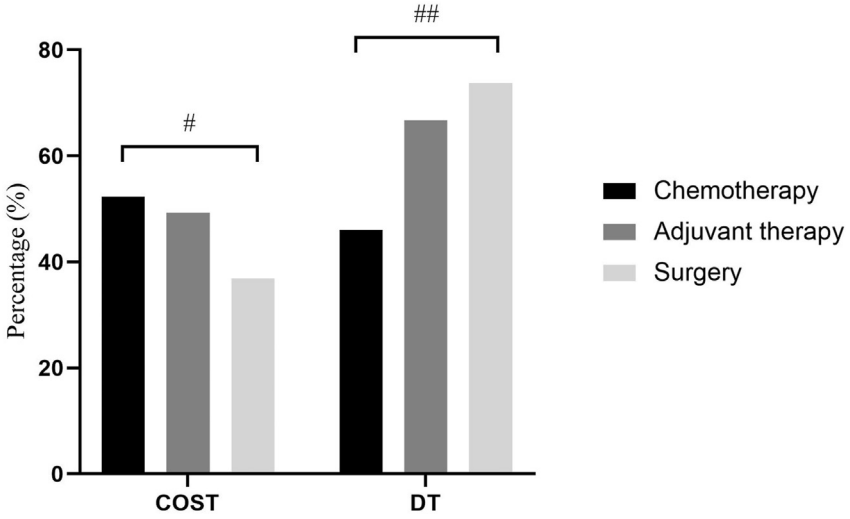

Fig. 1. Comparisons of significant results on financial toxicity (COST) and psychological distress (DT) measures by treatment. COST, Comprehensive Score for financial Toxicity; DT, Distress Thermometer. #: $P < 0.05$; ##: $P < 0.001$.

were tested using χ^2 tests. The related factors of DT or COST were explored by univariate analysis. Variables with a $P < 0.10$ in univariate analysis were included in multiple linear regression analysis. Variables (type of cancer, clinical stage, and type of treatment) that had clinical significance were also included in the final linear regression model. The Pearson correlation coefficient was used to test associations between the COST and DT. The partial correlations with DT were calculated, adjusting for those found to be significantly associated with financial toxicity on multivariable analysis. Statistical analyses were performed with Stata 12 software. All tests were two-sided and *P*-values of 0.05 or less were considered statistically significant.

Ethical considerations

Prior to the survey, trained researchers explained to the patients the purpose of the study and that participation was voluntary. All participating patients provided informed consent. The patients completed the entire questionnaire except for the clinical information section, which was pre-populated from the electronic health record. This study was approved by the Ethics Committee of the Liaoning Cancer Hospital and Institute (Approval No. 20170302).

Results

Characteristics of the study population

Five hundred eligible patients were approached, and 450 (90.0%) patients agreed to participate. After excluding patients who did not meet the inclusion criteria or had incomplete data, a total of 409 patients were included in the study. The demographic and clinical characteristics of the patients are presented in Table 1. The median age was 59 years, and more patients identified as female (55.3%) than male. Approximately 90.0% of patients identified as married, 24.4% as employed, and 17.6% as having a university education or above. In addition, 40.6% of patients were diagnosed with stage III cancer, and the most frequently diagnosed type of cancer was lung (31.1%), followed by breast (27.4%). Detailed information on the cancer type and the stage is presented in Supplementary Table S1. The patients were grouped into three categories for analysis

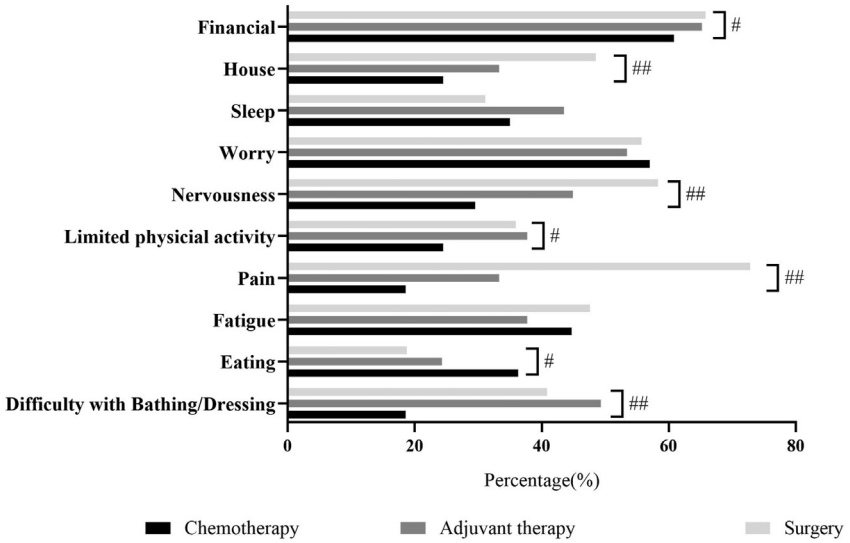

Fig. 2. Frequency distribution of top ten items of psychological distress by treatment. Patients undergoing surgery-related treatment were more likely to have a higher rates of pain nervousness, difficulty with bathing/dressing and house than those undergoing chemotherapy. #: $P < 0.05$; ##: $P < 0.001$.

Table 2
Factors associated with financial toxicity on unavailable and multivariable analyses.

Variables	COST			
	Univariate analysis		Multivariable analysis	
	Coefficient (95% CI)	Significant	Coefficient (95% CI)	Significant
Age (years)				
< 50	Reference		Reference	
50-59	2.959 (0.720–5.197)	0.010*	2.329 (0.167–4.491)	0.035*
60-69	3.652 (1.473–5.831)	0.001**	3.124 (0.859–5.388)	0.007**
≥ 70	5.419 (2.295–8.543)	0.001**	4.933 (1.787–8.080)	0.002**
Gender				
Male	Reference		Reference	
Female	−1.563 (−3.123 to −0.003)	0.050*	–1.801 (−3.637 to 0.036)	0.055
Marital status				
Married	Reference			
Unmarried	−0.693 (−3.288 to 1.901)	0.600		
Employment status				
Employed	Reference		Reference	
Unemployed	−3.944 (−5.716 to −2.172)	0.000**	−1.205 (–3.230 to 0.819)	0.243
Educational background				
Primary school	Reference		Reference	
Middle school	2.694 (0.551–4.837)	0.014*	1.567 (–0.668 to 3.800)	0.169
High school	5.332 (2.943–7.720)	0.000**	1.484 (–1.303 to 4.270)	0.296
University or above	6.580 (4.039–9.121)	0.000**	2.150 (–0.975 to 5.274)	0.177
Personal annual income[a] (CNY)				
< 20,000	Reference		Reference	
20,000–39,999	4.541 (2.919–6.164)	0.000**	2.500 (0.709–4.290)	0.006**
≥ 40,000	9.594 (6.443–12.746)	0.000**	7.003 (3.398–10.307)	0.000**
Insurance				
UEBMI	Reference		Reference	
URBMI	−3.731 (–6.012 to −1.449)	0.001**	−2.518 (−4.793 to −0.244)	0.030*
NRCMS	−5.916 (–7.556 to −4.277)	0.000**	−2.954 (–5.050 to −0.858)	0.006**
Cancer type				
Stomach	Reference		Reference	
Lung	0.466 (−1.874 to 2.806)	0.695	−0.208 (−2.459 to 2.044)	0.858
Colorectal	−0.226 (−2.682 to 2.230)	0.856	0.634 (−1.705 to 2.973)	0.594
Breast	0.477 (−1.918 to 2.873)	0.695	1.784 (−1.241 to 4.809)	0.247
Clinical stage				
I	Reference		Reference	
II	−0.917 (−3.282 to 1.447)	0.446	−1.275 (−3.505 to 0.955)	0.262
III	−1.958 (−4.263 to 0.346)	0.096	−1.662 (−3.942 to 0.659)	0.163
IV	−1.937 (−5.099 to 1.226)	0.229	−1.617 (−4.774 to 1.540)	0.315
Treatment				
Chemotherapy	Reference		Reference	
Surgery + Chemotherapy	0.626 (–1.437 to 2.690)	0.551	1.350 (–0.901 to 3.598)	0.239
Surgery	1.591 (−0.319 to 3.501)	0.102	1.213 (−0.842 to 3.267)	0.247

*$P < 0.05$, **$P < 0.01$.
CNY, Chinese Yuan; COST, Comprehensive Score for financial Toxicity; NRCMS, New Rural Cooperative Medical Scheme; UEBMI, Urban Employee Basic Medical Insurance; URBMI, Urban Resident Basic Medical Insurance.
[a] The cutoff values of 20,000 CNY and 40,000 CNY are roughly equivalent to the thresholds for the low-middle-income group and the middle-high-income group according to per capita disposable income in Liaoning Province bureau of statistics in 2017.

based on treatment methods: surgery alone ($n = 103$, 25.2%), chemotherapy alone ($n = 237$, 57.9%) and adjuvant therapy ($n = 69$, 16.9%).

Financial toxicity in the treatment groups

Patients with COST scores ≤ 17.5 reported meaningful financial toxicity ($n = 196$, 47.9%). The rates of clinically meaningful financial toxicity in the chemotherapy, adjuvant therapy, and surgery groups, were 52.3%, 49.3%, and 36.9%, respectively. There was a significant difference between the three groups (Fig. 1). Stratified analysis was carried out by cancer types and clinical stages (Supplementary Table S2), and the results showed that the level of financial toxicity was statistically significantly different between the different treatment groups among lung cancer patients.

Psychological distress in the treatment groups

Psychological distress was present in 56.5% of the patients, and a total of 231 patients scored ≥ 4 on the DT. There were significant differences in rates among the chemotherapy group (46.0%), adjuvant therapy group (66.7%), and surgical treatment group (73.8%) ($P < 0.001$) (Fig. 1). A stratified analysis based on cancer type demonstrated that after excluding patients with colorectal cancer, the psychological distress in the other three types of patients was significantly different among the three treatment groups. The stratification by clinical stage showed that psychological distress was significantly different among the different treatment groups in stage-II patients (Supplementary Table S3).

The top ten problems on the PL in the DT&PL were financial factors ($n = 269$, 65.8%), worry ($n = 228$, 55.7%), fatigue ($n = 181$, 44.3%), nervousness ($n = 161$, 39.4%), sleep ($n = 145$, 35.5%), pain ($n = 142$, 34.7%), house ($n = 131$, 32.0%), eating (n = 124, 30.3%), limited physical activity ($n = 121$, 29.5%), and difficulty with bathing/dressing ($n = 121$, 29.5%). The problem of pain was reported by 75 patients undergoing surgery (72.8%), and 23 who underwent adjuvant therapy (33.3%), compared with only 18.6% of the chemotherapy group ($n = 44$, $P < 0.001$). There were also significant differences in nervousness, financial factors, house, limited physical activity, and difficulty with bathing/dressing among the three treatment groups. Fig. 2 outlines the top ten factors causing distress in the various treatment groups.

Table 3
Factors associated with psychological distress on unavailable and multivariable analyses.

Variables	DT			
	Univariate analysis		Multivariable analysis	
	Coefficient (95% CI)	Significant	Coefficient (95% CI)	Significant
Age (years)				
< 50	Reference		Reference	
50-59	−0.350 (–0.990 to 0.291)	0.284	−0.269 (−0.887 to 0.348)	0.391
60-69	−0.212 (−0.836 to 0.411)	0.503	−0.218 (−0.838 to 0.403)	0.4791
≥ 70	−1.095 (–1.989 to −0.201)	0.017*	−1.177 (–2.071 to −0.290)	0.010*
Gender				
Male	Reference		Reference	
Female	0.539 (0.099–0.980)	0.017*	−0.024 (−0.564 to 0.515)	0.929
Marital status				
Married	Reference			
Unmarried	−0.066 (–0.800 to 0.669)	0.860		
Employment status				
Employed	Reference		Reference	
Unemployed	0.482 (–0.029 to 0.993)	0.064	0.347 (−0.170 to 0.865)	0.188
Educational background				
Primary school	Reference			
Middle school	−0.229 (–0.859 to 0.401)	0.475		
High school	−0.458 (–1.159 to 0.244)	0.201		
University or above	−0.132 (–0.878 to 0.615)	0.729		
Personal annual income[a] (CNY)				
< 20,000	Reference			
20,000–39,999	−0.306 (–0.795 to 0.184)	0.220		
≥ 40,000	−0.322 (–1.273 to 0.629)	0.506		
Insurance				
UEBMI	Reference			
URBMI	0.440 (–0.245 to 1.124)	0.207		
NRCMS	0.257 (–0.235 to 0.749)	0.305		
Cancer typerowhead				
Stomach	Reference		Reference	
Lung	0.778 (0.123–1.433)	0.020*	0.351 (–0.311 to 1.014)	0.298
Colorectal	0.812 (0.125–1.499)	0.021*	0.924 (0.233–1.641)	0.009**
Breast	1.077 (0.407–1.747)	0.002*	0.445 (−0.440 to 1.331)	0.323
Clinical stage				
I	Reference		Reference	
II	−0.735 (–1.398 to −0.071)	0.030*	−0.634 (–1.309 to 0.040)	0.065
III	−1.070 (–1.717 to −0.423)	0.001**	−0.439 (–1.130 to 0.251)	0.212
IV	−0.815 (–1.703 to 0.072)	0.012*	0.030 (−0.919 to 0.944)	0.979
Treatment				
Chemotherapy	Reference		Reference	
Surgery + Chemotherapy	1.503 (0.942–2.065)	0.000**	1.537 (0.872–2.202)	0.000**
Surgery	1.093 (0.573–1.613)	0.000**	1.297 (0.690–1.904)	0.000**

*$P < 0.05$, **$P < 0.01$.
CNY, Chinese Yuan; DT, Distress Thermometer; NRCMS, New Rural Cooperative Medical Scheme; UEBMI, Urban Employee Basic Medical Insurance; URBMI, Urban Resident Basic Medical Insurance.
[a] The cutoff values of 20,000 CNY and 40,000 CNY are roughly equivalent to the thresholds for the low-middle-income group and the middle-high-income group according to per capita disposable income in Liaoning Province bureau of statistics in 2017.

Factors associated with financial and psychological distress

In the financial toxicity models, after adjusting for possible confounding variables, when compared with patients less than 50 years old, patients aged 50–59 years, 60–69 years, and 70 years or older scored on average 2.3 points (95% Confidence Interval [CI]: 0.2–4.5, $P = 0.035$), 3.1 points (95% CI: 0.9–5.4, $P = 0.007$), and 4.9 points (95% CI: 1.8–8.1, $P = 0.002$) higher on the COST, respectively. Additionally, patients with a personal annual income of > 40,000 CNY scored on average 7.0 points (95% CI: 3.4–10.3, $P < 0.001$) higher on the COST than those who had a personal annual income < 20,000 CNY. Finally, patients who had URBMI or NRCMS compared with UEBMI scored on average 2.5 points (95% CI: −4.8 to 0.2, $P = 0.030$) and 3.0 points (95% CI: −5.1 to −0.9, $P = 0.006$) lower on the COST, respectively. See Table 2 for the univariable and multivariable analysis of factors associated with financial toxicity.

In the psychological distress models, multiple linear regression analysis showed that age greater than 70 years (−1.2; 95% CI: −2.1 to −0.3; $P = 0.010$) was significantly associated with low DT scores, and colorectal cancer (0.9; 95% CI: 0.2–1.6; $P = 0.009$), surgery (1.3; 95% CI: 0.7–1.9; $P < 0.001$) and surgery combined with chemotherapy (1.5; 95% CI: 0.9–2.2; $P < 0.001$) were significantly associated with high DT scores. See Table 3 for the univariable and multivariable analysis of factors associated with psychological distress.

Correlation between financial toxicity and psychological distress in the treatment groups

The median COST score was 18 (range, 0–44; mean ± SD, 17.77 ± 8.01). The median DT score was 4 (range, 1–9; mean ± SD, 4.25 ± 2.27). The Pearson correlation coefficients for COST and DT in the chemotherapy, adjuvant therapy, and surgery groups were −0.280 ($P < 0.001$), −0.233 ($P = 0.054$), and −0.081 ($P = 0.148$), respectively. When controlled for age, personal income, and medical insurance, the partial correlation coefficients remained statistically significant in the chemotherapy and adjuvant therapy groups, at −0.275 ($P < 0.001$) and −0.314 ($P = 0.010$), respectively. The coefficient was not significant in the surgery group ($P = 0.423$). The association between financial toxicity and psychological distress based on treatment is presented in Fig. 3.

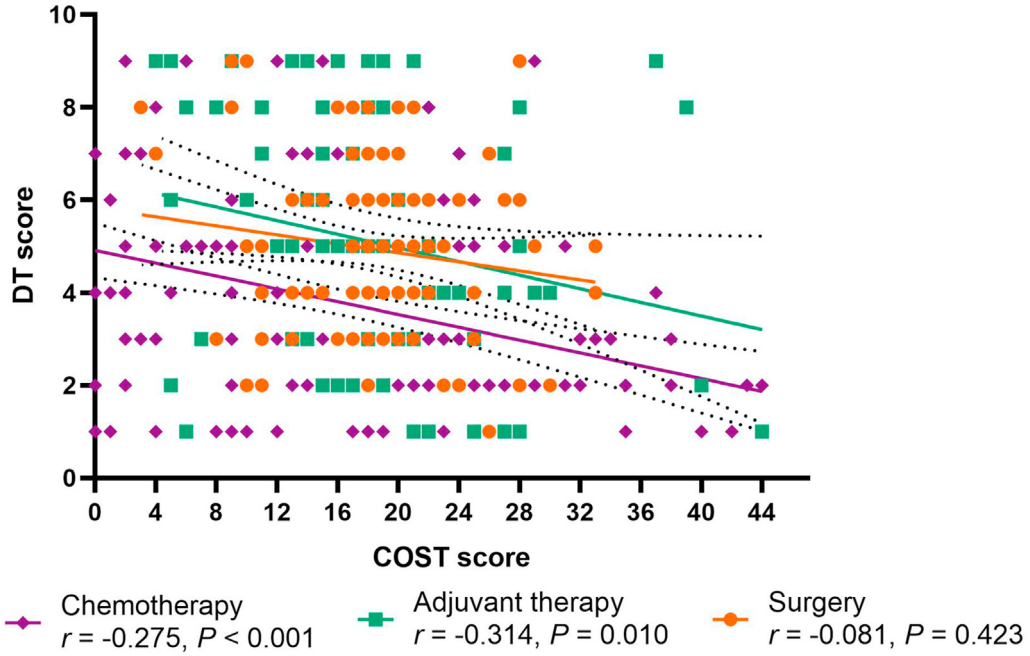

Fig. 3. Correlation between financial toxicity (COST) and distress (DT) by treatment. Worse financial toxicity (lower COST score) is mild correlated with increased psychological distress (higher DT score) in chemotherapy and adjuvant therapy groups with the partial correction coefficients were -0.275 and -0.341, respectively. COST, Comprehensive Score for financial Toxicity; DT, Distress Thermometer.

Discussion

The current study examined the impact of different treatment approaches on financial toxicity and psychological distress among adult Chinese patients with cancer, analyzed the association between financial and psychological distress, and identified the factors associated with both types of distress. The rates of meaningful financial toxicity and psychological distress in this study were 47.9% and 56.5%, respectively. Different treatments produce various effects on financial and psychological distress and the relationship between them. Surgery-related treatments were associated with high psychological distress in patients; however, chemotherapy-related treatments were linked to high financial toxicity. Age was linked with both financial toxicity and psychological distress. Patients who were younger than 50 years old reported significantly worse financial toxicity, and age greater than 70 years old was significantly associated with low psychological distress. In addition, the participants with a personal annual income of less than 20,000 CNY and UEBMI were more likely to report high financial toxicity. The correlations between financial toxicity and psychological distress were mild but statistically significant in the chemotherapy-related treatment groups.

We used a cut-off score of 17.5 for the COST to predict clinical implications of a high level of financial toxicity,[28] instead of 26 as used in a previous study.[33] The patients in the latter study with stage IV cancer in the United States reported higher COST scores than Chinese patients. The ranges of median COST scores were large, from 10 to 29, in the various studies.[10,34–36] It is necessary to calculate the clinically significant cut-off value for financial toxicity in the various medical and health systems.

Several studies have examined the effects of different treatment options on financial toxicity among cancer patients, and the results are inconsistent. The latest study found that 55% of surgical patients and 29% of nonsurgical patients reported financial toxicity in a National Health Interview Survey (NHIS) in the United States.[37] Patients with localized prostate cancer undergoing external beam radiotherapy reported the highest financial toxicity, whereas those undergoing radical prostatectomy and active surveillance had similar rates of financial toxicity.[38] The choice of breast-conserving therapy or mastectomy was not associated with financial toxicity in early-stage cancer.[39] An analysis of US national sample demonstrated that over 9 out of 10 uninsured and 1 out of 10 privately insured individuals were at risk of financial toxicity after surgery.[40] In the current study, surgical treatment was not associated with worse financial toxicity than chemotherapy, even in the subgroup analysis of cancer types and clinical stages. The main factors related to financial toxicity were associated with personal wealth, such as personal income and medical insurance, which is supported by most studies.

Treatment has curative effects on cancer but also brings different forms of psychological distress. Patients who underwent chemotherapy were more likely to report fatigue and nausea, whereas surgical patients did not report these physical problems.[41] Patients undergoing surgery were worried about preoperative preparation and postoperative pain.[42] In addition, approximately half of surgery inpatients had depression, and approximately one-quarter had anxiety in one study.[43] Furthermore, different surgical procedures are linked to various degrees of psychological distress. Patients with breast cancer who underwent mastectomy with reconstruction reported higher levels of distress than patients undergoing lumpectomy and mastectomy only.[19] Compared with nonsurgical treatments, surgery was significantly associated with high DT scores in this study, especially in patients with stomach, lung, or breast cancer. A study related to esophageal cancer also showed a significant correlation between distress and esophagectomy.[44] Significant differences were noted between the surgery group and the nonsurgical group for nervousness, pain, and problems with bathing/dressing. Further studies are needed regarding preoperative intervention and postoperative management for distress among cancer patients undergoing highly invasive procedures.

To our knowledge, this is the first study that takes different treatment approaches into account in the link between COST and DT in hospitalized patients with cancer in China. Research is limited on the financial toxicity of cancer patients in China; it mainly involves sociodemographic and clinical factors and the impact on health-related quality of life. In this study, COST scores were negatively related to DT scores in different groups, suggesting a higher degree of financial toxicity related to greater severity of distress. The literature supports a relationship between financial strain and psychological distress.[45,46] Lung and colorectal

cancer patients with limited financial reserves reported increased pain.[47] Furthermore, cancer-related financial problems have been associated with increased risk for depressed mood, a higher frequency of worry, and are a significant and frequent source of distress among patients with cancer.[48,49]

Limitations

This study has limitations. First, the cross-sectional design could not evaluate dynamic changes of DT and COST with treatment and did not provide interventions to patients with significant distress. Second, patients undergoing surgery combined with chemotherapy did not specify whether they were given adjuvant chemotherapy or neoadjuvant chemotherapy. This clinical characteristic may be important in understanding financial toxicity and distress. Third, there was no matching among treatment groups to optimize comparability. Despite the limitations, the study recruited a large sample of respondents from three tertiary-level cancer centers in different cities and a clinically representative sample of Chinese patients, including those with the four most common cancers.

Conclusions

This study identified a high prevalence of financial toxicity and psychological distress among adult patients with cancer in Northeast China. There were mild correlations between financial toxicity and psychological distress in the two treatment groups. Patients who underwent surgical treatment were more likely to experience distress. Multidimensional distress screening and psychosocial interventions should be provided preoperatively and postoperatively for patients with cancer.

Authors' contributions

Conceived and designed the analysis: Huihui Yu, Hui Li, and Yunyong Liu. **Collected the data:** Huihui Yu, Tingting Zuo, Li Cao, Xue Bi, Haiyang Xing, Lijuan Cai, and Jianmin Sun. **Contributed data or analysis tools:** Huihui Yu, Hui Li, Tingting Zuo, and Yunyong Liu. **Performed the analysis:** Huihui Yu, Tingting Zuo, and Yunyong Liu. **Wrote the paper:** Huihui Yu, Hui Li, Tingting Zuo, Li Cao, Xue Bi, Haiyang Xing, Lijuan Cai, Jianmin Sun, and Yunyong Liu.

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Declaration of competing interest

None declared.

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Ethics statement

This study was approved by the Ethics Committee of the Liaoning Cancer Hospital and Institute (Approval No. 20170302).

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.apjon.2022.04.008.

References

1. Sung H, Ferlay J, Siegel RL, et al. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA A Cancer J Clin*. 2021;71:209–249.
2. Soerjomataram I, Bray F. Planning for tomorrow: global cancer incidence and the role of prevention 2020-2070. *Nat Rev Clin Oncol*. 2021;18:663–672.
3. Meeker CR, Wong YN, Egleston BL, et al. Distress and financial distress in adults with cancer: an age-based analysis. *J Natl Compr Cancer Netw : J Natl Compr Cancer Netw*. 2017;15:1224–1233.
4. Hollingworth W, Metcalfe C, Mancero S, et al. Are needs assessments cost effective in reducing distress among patients with cancer? A randomized controlled trial using the distress thermometer and problem list. *J Clin Oncol : official journal of the American Society of Clinical Oncology*. 2013;31:3631–3638.
5. Riba MB, Donovan KA, Andersen B, et al. Distress management, version 3.2019, NCCN clinical practice guidelines in oncology. *J Natl Compr Cancer Netw : J Natl Compr Cancer Netw*. 2019;17:1229–1249.
6. 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 A Cancer J Clin*. 2018;68:153–165.
7. Xu T, Xu L, Xi H, et al. Assessment of Financial Toxicity Among Patients with Advanced Lung Cancer in Western China. *Front Public Health*. 2021;9:754199.
8. Xu RH, Wang LL, Zhou LM, Wong EL, Wang D. Urban-rural differences in financial toxicity and its effect on cancer survivors' health-related quality of life and emotional status: a latent class analysis. Supportive care in cancer. *official journal of the Multinational Association of Supportive Care in Cancer*. 2022;30:4219–4229.
9. Watabayashi K, Steelquist J, Overstreet KA, Leahy A, Bradshaw E, Gallagher KD, et al. A Pilot Study of a Comprehensive Financial Navigation Program in Patients with Cancer and Caregivers. *J Natl Compr Cancer Netw : J Natl Compr Cancer Netw*. 2020;18:1366–1373.
10. Hazell SZ, Fu W, Hu C, et al. Financial toxicity in lung cancer: an assessment of magnitude, perception, and impact on quality of life. *Ann oncol: official journal of the European Society for Medical Oncology*. 2020;31:96–102.
11. Distress management. Clinical practice guidelines. *J Natl Compr Cancer Netw : J Natl Compr Cancer Netw*. 2003;1:344–374.
12. Bultz BD, Carlson LE. Emotional distress: the sixth vital sign–future directions in cancer care. *Psycho Oncol*. 2006;15:93–95.
13. Holland JC, Bultz BD. The NCCN guideline for distress management: a case for making distress the sixth vital sign. *J Natl Compr Cancer Netw: J Natl Compr Cancer Netw*. 2007;5:3–7.
14. Smith GL, Lopez-Olivo MA, Advani PG, et al. Financial burdens of cancer treatment: a systematic review of risk factors and outcomes. *J Natl Compr Cancer Netw: J Natl Compr Cancer Netw*. 2019;17:1184–1192.
15. Yang L, Zhao M, Magnussen CG, Veeranki SP, Xi B. Psychological distress and mortality among US adults: prospective cohort study of 330 367 individuals. *J Epidemiol Community Health*. 2020;74:384–390.
16. Ramsey SD, Bansal A, Fedorenko CR, et al. Financial insolvency as a risk factor for early mortality among patients with cancer. *J Clin Oncol*. 2016;34:980–986.
17. Carlson LE, Waller A, Mitchell AJ. Screening for distress and unmet needs in patients with cancer: review and recommendations. *J Clin Oncol: official journal of the American Society of Clinical Oncology*. 2012;30:1160–1177.
18. Chan A, Poon E, Goh WL, et al. Assessment of psychological distress among Asian adolescents and young adults (AYA) cancer patients using the distress thermometer: a prospective, longitudinal study. *Supportive care in cancer: official journal of the Multinational Association of Supportive Care in Cancer*. 2018;26:3257–3266.
19. Fayanju OM, Yenokyan K, Ren Y, et al. The effect of treatment on patient-reported distress after breast cancer diagnosis. *Cancer*. 2019;125:3040–3049.
20. Huey RW, George GC, Phillips P, et al. Patient-reported out-of-pocket costs and financial toxicity during early-phase oncology clinical trials. *Oncologist*. 2021;26:588–596.
21. Arastu A, Patel A, Mohile SG, et al. Assessment of financial toxicity among older adults with advanced cancer. *JAMA Netw Open*. 2020;3, e2025810.
22. Bjerkeset E, Röhrl K, Schou-Bredal I. Symptom cluster of pain, fatigue, and psychological distress in breast cancer survivors: prevalence and characteristics. *Breast Cancer Res Treat*. 2020;180:63–71.
23. Fang W, Xu X, Zhu Y, Dai H, Shang L, Li X. Impact of the national health insurance coverage policy on the utilisation and accessibility of innovative anti-cancer medicines in China: an interrupted time-series study. *Front Public Health*. 2021;9:714127.
24. Xie Y, Valdimarsdóttir UA, Wang C, et al. Public health insurance and cancer-specific mortality risk among patients with breast cancer: a prospective cohort study in China. *Int J Cancer*. 2020;148:28–37.
25. de Souza JA, Yap BJ, Hlubocky FJ, et al. The development of a financial toxicity patient-reported outcome in cancer: the COST measure. *Cancer*. 2014;120:3245–3253.
26. de Souza JA, Yap BJ, Wroblewski K, et al. Measuring financial toxicity as a clinically relevant patient-reported outcome: the validation of the COmprehensive Score for financial Toxicity (COST). *Cancer*. 2017;123:476–484.
27. Yu H-H, Yu Z-F, Li H, Zhao H, Sun J-M, Liu Y-Y. The COmprehensive score for financial toxicity in China: validation and responsiveness. *J Pain Symptom Manag*. 2021;61:1297–1304. e1291.
28. Ng MSN, Choi KC, Chan DNS, et al. Identifying a cut-off score for the COST measure to indicate high financial toxicity and low quality of life among cancer patients. *Support Care Cancer*. 2021;29:6109–6117.
29. Mitchell AJ. Short screening tools for cancer-related distress: a review and diagnostic validity meta-analysis. *J Natl Compr Cancer Netw : J Natl Compr Cancer Netw*. 2010;8:487–494.

30. Chung IY, Jung M, Park YR, et al. Exercise promotion and distress reduction using a mobile app-based community in breast cancer survivors. *Front Oncol*. 2019;9:1505.
31. van der Geest IMM, van Dorp W, Pluijm SMF, van den Heuvel-Eibrink MM. The distress thermometer provides a simple screening tool for selecting distressed childhood cancer survivors. *Acta paediatrica (Oslo, Norway : 1992*. 2018;107:871–874.
32. Tang LL, Zhang YN, Pang Y, Zhang HW, Song LL. Validation and reliability of distress thermometer in Chinese cancer patients. *Chinese journal of cancer research = Chung-kuo yen cheng yen chiu*. 2011;23:54–58.
33. de Souza J, Wroblewski K, Proussaloglou E, Nicholson L, Hantel A, Wang Y. Validation of a financial toxicity (FT) grading system. *J Clin Oncol*. 2017;35:6615, 6615.
34. Williams CP, Gallagher KD, Deehr K, et al. Quantifying treatment preferences and their association with financial toxicity in women with breast cancer. *Cancer*. 2021;127:449–457.
35. Bouberhan S, Shea M, Kennedy A, et al. Financial toxicity in gynecologic oncology. *Gynecol Oncol*. 2019;154:8–12.
36. Jing J, Feng R, Zhang X, Li M, Gao J. Financial toxicity and its associated patient and cancer factors among women with breast cancer: a single-center analysis of low-middle income region in China. *Breast Cancer Res Treat*. 2020;181:435–443.
37. Taylor KK, Neiman Pu Fau - Liu C, Liu C Fau - Sheetz K, Sheetz K Fau - Sinco B, Sinco B Fau - Scott JW, Scott JW: Financial toxicity among surgical patients varies by income and insurance: A Cross-Sectional Analysis of the National Health Interview Survey. Ann Surg 2022.
38. Stone BV, Laviana AA, Luckenbaugh AN, et al. Patient-reported financial toxicity associated with contemporary treatment for localized prostate cancer. *J Urol*. 2021;205:761–768.
39. Boukovalas S, Liu J, Asaad M, et al. Relationship between financial toxicity and surgical treatment for early-stage breast cancer: a propensity score-matched comparison of breast-conserving therapy and mastectomy. *J Am Coll Surg*. 2021;233:445–456. e442.
40. Farooq A, Merath K, Hyer JM, et al. Financial toxicity risk among adult patients undergoing cancer surgery in the United States: an analysis of the National Inpatient Sample. *J Surg Oncol*. 2019;120:397–406.
41. McFarland DC, Shaffer KM, Tiersten A, Holland J. Prevalence of physical problems detected by the distress thermometer and problem list in patients with breast cancer. *Psycho Oncol*. 2018;27:1394–1403.
42. Abelson JS, Chait A, Shen MJ, Charlson M, Dickerman A, Yeo HL. Sources of distress among patients undergoing surgery for colorectal cancer: a qualitative study. *J Surg Res*. 2018;226:140–149.
43. Basak F, Hasbahceci M, Guner S, et al. Prediction of anxiety and depression in general surgery inpatients: a prospective cohort study of 200 consecutive patients. *Int J Surg*. 2015;23:18–22.
44. Ohkura Y, Ichikura K, Shindoh J, Ueno M, Udagawa H, Matsushima E. Relationship between psychological distress and health-related quality of life at each point of the treatment of esophageal cancer. *Esophagus : official journal of the Japan Esophageal Society*. 2020;17:312–322.
45. Berhili S, Kadiri S, Bouziane A, et al. Associated factors with psychological distress in Moroccan breast cancer patients: a cross-sectional study. *Breast*. 2017;31:26–33.
46. Health-related quality of life and psychological distress among cancer survivors in Southeast Asia: results from a longitudinal study in eight low- and middle-income countries. *BMC Med*. 2017;15:10.
47. Lathan CS, Cronin A, Tucker-Seeley R, Zafar SY, Ayanian JZ, Schrag D. Association of financial strain with symptom burden and quality of life for patients with lung or colorectal cancer. *J Clin Oncol: official journal of the American Society of Clinical Oncology*. 2016;34:1732–1740.
48. Kendall J, Glaze K, Oakland S, Hansen J, Parry C. What do 1281 distress screeners tell us about cancer patients in a community cancer center? *Psycho Oncol*. 2011;20:594–600.
49. Kale HP, Carroll NV. Self-reported financial burden of cancer care and its effect on physical and mental health-related quality of life among US cancer survivors. *Cancer*. 2016;122:283–289.