

# Surgery and Financial Toxicity are Risk Factors for Distress in Cancer Survivors: A Cross-sectional Study

**Huihui Yu**

Cancer Hospital of China Medical University: Liaoning Cancer Institute and Hospital  
<https://orcid.org/0000-0001-8860-1959>

**Tingting Zuo**

cancer hospital of China medical university

**Xue Bi**

Cancer Hospital of China Medical University: Liaoning Cancer Institute and Hospital

**Hui Li**

Cancer Hospital of China Medical University: Liaoning Cancer Institute and Hospital

**Haiyang Xing**

Cancer Hospital of China Medical University: Liaoning Cancer Institute and Hospital

**Li Cao**

Cancer Hospital of China Medical University: Liaoning Cancer Institute and Hospital

**Lijuan Cai**

Fourth People's Hospital of Fusun

**Jianmin Sun**

Anshan cancer hospital

**Yunyong Liu** (✉ [liuyycancer@sina.com](mailto:liuyycancer@sina.com))

Cancer Hospital of China Medical University: Liaoning Cancer Institute and Hospital

---

## Research article

**Keywords:** surgery, Distress Thermometer, financial toxicity, cancer survivors

**Posted Date:** October 30th, 2020

**DOI:** <https://doi.org/10.21203/rs.3.rs-98521/v1>

**License:**   This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

---

# Abstract

**Background:** Patients with cancer often face some level of distress, regardless of disease stage. Distress in cancer survivors has a negative impact on their quality of life. The goal of this study was to identify risk factors for distress, understand how treatment associated with distress and reveal the relationship between the psychological and financial distress.

**Methods:** This was a multi-center cross-sectional study of patients with cancer requiring surgery or chemotherapy. Patients completed questionnaires regarding their demographics, disease characteristics, psychological distress, and financial toxicity. A multivariable logistic regression model was used to examine factors associated with distress in surgical versus chemotherapy treatment groups.

**Results:** A total of 409 patients participated in the study. Patients treated with surgery ( $n = 172$ ) were more likely to be female, unemployed, early stage compared with patients undergoing chemotherapy ( $n = 237$ ). Multivariable analysis revealed that surgical patients tended to have a higher risk of distress compared with patients receiving chemotherapy (OR, 95% CI: 3.086, 1.854–5.137) due to higher rates of nervousness, pain, and difficulty with bathing/dressing, and patients with high financial toxicity had a higher risk of distress compared with those with low financial toxicity (OR, 95% CI: 2.000, 1.278–3.130). The relationship between financial toxicity and psychological distress was stronger in the chemotherapy group, with the correction coefficient -0.294 and slope -1.196.

**Conclusion:** Patients who underwent surgery and reported higher financial toxicity were more likely to experience distress. Multidimensional distress screening and psychosocial interventions should be provided pre- and post-operatively for patients.

## Introduction

Cancer diagnosis and treatment often lead patients to face some level of distress, regardless of disease stage. [1, 2] Distress is conceptualized as a multifactorial, unpleasant experience of a psychological, social, spiritual, and/or physical nature that may interfere with the ability to cope effectively with the physical symptoms and treatment of cancer,[3] and has been considered the sixth vital sign, after pain, in cancer care. [4] Distress in patients with cancer may reduce adherence to treatment, decrease quality of life, and increase cancer-specific mortality. [5–7] Early screening for distress leads to timely multicomponent intervention, which in turn improves quality of life.

Many studies of distress have focused on the emotional problems (e.g., anxiety, depression) and physical problems (e.g., fatigue) of distress, with little attention to treatment-related and financial factors. [8–10] Financial toxicity has been defined as objective financial burden and subjective financial distress experienced by cancer patients as a result of their treatment. [11] Assessment of financial toxicity may help to build a framework for financial counseling interventions on par with symptom management (e.g., for fatigue or pain). [12] The present study was conducted to identify demographic, clinical, and

socioeconomic predictors of distress, understand how treatment associated with distress and reveal the relationship between the financial toxicity and distress.

## **Methods**

### **Study Design and Procedure**

A cross-sectional observational study was conducted at three public cancer treatment centers: 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 of age 18 years or older; participating in Social Health Insurance (SHI) of China; receiving a new diagnosis of stomach, lung, colorectal, or breast cancer within two months; and undergoing treatment with surgery, chemotherapy, or both. Patients who were illiterate, unable to understand and respond to the study survey, and/or receiving treatments through a clinical trial were excluded from study. This study was approved by the Ethics Committee of Liaoning Cancer Hospital & Institute (No.20170302).

Prior to the survey, the trained researchers, the oncology nurses, explained to the patients the study purpose 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.

## **Measures**

### **Sociodemographic and Clinical Characteristics**

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

### **Psychological Distress Assessments**

Several instruments are available to identify the distress of patients with cancer [13]. 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. [14, 15] 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 various types of cancer patients. [16] A score of 4 or higher on the DT indicates significant distress. The prevalence of distress and specific problems were analyzed in the current study.

### **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. [17, 18] Briefly, the COST 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. Our team translated and adapted the Chinese version with high reliability ( $\alpha = 0.89$ ) among patients with cancer. [19] The COST scores were stratified by high and low financial toxicity, and we defined high financial toxicity as lower or equal to the median.[20]

## Statistical Analysis

All sociodemographic and clinical characteristics of patients were summarized using descriptive statistics. Categorical variables were presented as frequencies and percentages. The chi-square test was used for comparing the group differences in categorical variables. Associations between factors were derived by multiple logistic regression models after adjusting for factors including occupation and insurance. Factors examined were age, sex, marital status, educational background, annual household income, type of cancer, type of treatment, and degree of financial toxicity. Pearson correlation coefficient was used to test associations among the COST and DT scores. Statistical analyses were performed with SAS 9.2 software. All tests were two-sided and  $P$  values of 0.05 or less were considered statistically significant.

## Results

### Characteristics of the study population

A total of 409 patients participated in the study. The demographic and clinical characteristics of 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 high school education or more. In addition, 40.6% of patients were diagnosed with stage III cancer, and the most frequently reported type of cancer was lung (31.1%) followed by breast (27.4%). The patients were grouped into two categories for analysis based on treatment methods: chemotherapy alone ( $n = 237$ , 57.9%), and surgery ( $n = 172$ , 40.1%), which included surgery alone or combined with chemotherapy. The two groups were similar in age ( $P = 0.092$ ), marital status ( $P = 0.936$ ), educational background ( $P = 0.218$ ), and household income ( $P = 0.671$ ); the significant variations included sex ( $P < 0.001$ ), employment status ( $P = 0.005$ ), cancer type ( $P < 0.001$ ), and clinical stage ( $P < 0.001$ ).

Table 1  
Characteristics of Patients

		<b>Chemotherapy (n=237)</b>	<b>Surgery (n=172)</b>	<b>P value</b>	<b>Total (n=409)</b>
Median age (range)		58 (34–79)	60 (28–80)	0.092	59 (28–80)
Sex	Male	129 (54.4)	54 (31.4)	< 0.001	183 (44.7)
	Female	108 (45.6)	118 (68.6)		226 (55.3)
Marital status	Married	213 (89.9)	155 (90.1)	0.936	368 (90.0)
	Unmarried	24 (10.1)	17 (9.9)		41 (10.0)
Employment status	Employed	70 (29.5)	30 (17.4)	0.005	100 (24.4)
	Unemployed	167 (70.5)	142 (82.6)		309 (75.6)
Educational background	Primary school	134 (56.5)	109 (63.4)	0.218	243 (59.4)
	Middle school	55 (23.2)	39 (22.7)		94 (23.0)
	High school or above	48 (20.3)	24 (14.0)		72 (17.6)
Household income	< 50 000	168 (70.9)	126 (73.3)	0.671	294 (71.9)
	≥ 50 000	55 (23.2)	34 (19.8)		89 (21.8)
Cancer type	Stomach	51 (21.5)	20 (11.6)	< 0.001	71 (17.4)
	Lung	60 (25.3)	67 (39.0)		127 (31.1)
	Colorectal	79 (33.3)	20 (11.6)		99 (24.2)
	Breast	47 (19.8)	65 (37.8)		112 (27.4)
Clinical stage	I	19 (8.0)	46 (26.7)	< 0.001	65 (15.9)
	II	54 (22.8)	84 (48.8)		138 (33.7)

	Chemotherapy ( <i>n</i> = 237)	Surgery ( <i>n</i> = 172)	<i>P</i> value	Total ( <i>n</i> = 409)
III	127 (53.6)	39 (22.7)		166 (40.6)
IV	37 (15.6)	3 (1.7)		40 (9.8)

## Prevalence of the distress and financial toxicity

Distress was present in 56.5% of the patients, and a total of 231 patients scored  $\geq 4$  on the DT. Physical, emotional, and practical problems were reported as the major sources of distress. Regarding practical problems, financial factors (*n* = 162, 70.1%) were reported the most. Worry (*n* = 145, 62.8%) and fatigue (*n* = 115, 49.8%) were most prevalent among emotional and physical problems. Patients who reported financial toxicity (*n* = 217, 53.1%) had COST scores below or equal to the median of 18. Surgical intervention was associated with a higher degree of patient distress than chemotherapy alone ( $P < 0.001$ ). There was no significant difference regarding financial toxicity. The prevalence of the distress and financial toxicity is presented in Fig. 1.

## Factors Associated With Distress

In the unadjusted analyses, higher income and lower financial toxicity were associated with lower prevalence of distress. A lung cancer diagnosis, early stage of disease, and surgical intervention were associated with higher prevalence of distress. In the final multivariable model, treatment type and financial toxicity were found to be significantly associated with distress when controlling for age, marital status, employment status, and educational background. These findings are demonstrated in Table 2. Patients in the surgery group reported more distress than the chemotherapy group (OR, 95% CI: 3.086, 1.854–5.137). Similarly, patients with a higher degree of financial toxicity, reflected by lower COST scores, had a greater risk of distress than those with a lower degree of financial toxicity (OR, 95% CI: 2.000, 1.278–3.130).

Table 2  
Factors associated with distress on univariate and multivariate analyses

		Univariate analysis		Multivariate analysis	
		OR (95% CI)	<i>P</i>	OR* (95% CI)	<i>P</i>
Age (years)	< 45	Reference			
	45–59	1.293 (0.633 to 2.642)	0.480		
	≥ 60	0.979 (0.484 to 1.981)	0.954		
Sex	Male	Reference			
	Female	1.344 (0.907 to 1.993)	0.140		
Marital status	Married	Reference			
	Unmarried	1.098 (0.571 to 2.113)	0.779		
Employment status	Employed	Reference			
	Unemployed	1.142 (0.726 to 1.797)	0.565		
Educational background	Primary school	Reference			
	Middle school	1.034 (0.640 to 1.671)	0.891		
	High school or above	1.186 (0.695 to 2.025)	0.531		
Household income	< 50 000	Reference			
	≥ 50 000	0.645 (0.418 to 0.996)	0.048	0.691 (0.371 to 1.032)	0.066
Cancer type	Stomach	Reference			
	Lung	2.196 (1.216 to 3.967)	0.009	1.562 (0.794 to 3.074)	0.196
	Colorectal	1.680 (0.909 to 3.107)	0.098	1.670 (0.840 to 3.318)	0.144
	Breast	1.720 (0.944 to 3.135)	0.076	0.800 (0.351 to 1.825)	0.800
Clinical stage	I	Reference			

\*ORs were adjusted for factors including age, sex, marital status, employment status and educational background in the multivariate regression model.

		Univariate analysis		Multivariate analysis	
	II	0.544 (0.287 to 1.032)	0.063	0.545 (0.270 to 1.099)	0.090
	III	0.374 (0.201 to 0.697)	0.002	0.483 (0.237 to 0.986)	0.046
	IV	0.423 (0.186 to 0.966)	0.041	0.627 (0.245 to 1.603)	0.330
Treatment	Chemotherapy	Reference			
	Surgery	2.865 (1.889 to 4.346)	< 0.001	3.086 (1.854 to 5.137)	< 0.001
Financial toxicity	Low	Reference			
	High	1.937 (1.303 to 2.879)	0.001	2.000 (1.278 to 3.130)	0.002
*ORs were adjusted for factors including age, sex, marital status, employment status and educational background in the multivariate regression model.					

Further analysis was to understand how surgery increased distress. The results showed that patients in the surgery group reported higher rates of nervousness ( $P= 0.001$ ), pain ( $P< 0.001$ ), and difficult with bathing/dressing ( $P= 0.008$ ) compared with the chemotherapy group. Figure 2 outlines the top 10 factors causing distress in the treatment groups.

## Financial Toxicity and Distress in Treatment Groups

The association between overall distress and financial toxicity, respectively measured by the DT and COST, based on treatment is presented in Fig. 3. The correlation coefficient between financial toxicity and distress was  $- 0.188$ , and the COST score decreased by 0.572 points for every 1-point increase in the DT score ( $P= 0.014$ ). This suggests that a higher degree of financial toxicity is associated with greater distress in the surgery group. For patients in the chemotherapy group, the correlation coefficient was  $- 0.294$ , and every 1-point increase in the DT score decreased the COST score by 1.196 points.

## Discussion

In the literature, the prevalence of distress among patients with cancer varies by country, cancer type, sex, age, and other sample characteristics. [21–25] Prior studies identified worry on the DT&PL as the most distressing, possibly as a surrogate for the intensity of distress. [26] McFarland et al. reported that 40% of patients with breast cancer had fatigue, the most common physical problem associated with distress. [27]

Unlike previous studies, [28, 29] in this study financial difficulty was the highest-ranking single item associated with distress. The prevalence of psychological distress and financial toxicity was 56.5% and 53.1%, respectively. Most patients experienced at least one practical, physical, or emotional problem, primarily financial difficulty (70.1%), worry (62.8%), and fatigue (49.8%). In this study, worry was a leading item in the emotional problem domain, but inferior to financial difficulty among all items attributed to distress. The prevalence of financial concerns among patients with cancer may be due to the need to make financially-based decisions throughout cancer treatment. [30] Cancer-related financial problems have been associated with increased risk for depressed mood, a higher frequency of worry, and a significant and frequent source of distress among patients with cancer. [31, 32]

Several studies have examined distress among surgical inpatients. Basak et al. found that approximately half of surgery inpatients had depression and approximately one-quarter had anxiety. [33] Pastore et al. found that patients undergoing surgery for urological cancer had clinical levels of anxiety (9.8%) and depression (3.6%). [34] Furthermore, a significant correlation was observed between distress and esophagectomy among patients with esophageal cancer. [35] In the current study, 70.9% surgical treatment group reported a significantly psychological distress. One potential explanation was that patients underwent surgery were worried about preoperative preparation and postoperative pain. [36]

The results of studies examined the effects of different treatment options on distress among cancer patients are inconsistent. Female patients who underwent chemotherapy were more likely to report fatigue and nausea, whereas surgical patients did not report these physical problems. [27] Patients with breast cancer who underwent mastectomy with reconstruction reported higher levels of distress compared with patients undergoing lumpectomy and mastectomy only.[10] Our data showed that statistically significant differences were noted between the surgery and chemotherapy group for nervousness, pain, and problems with bathing/dressing. Surgical treatment was a significant predictor of psychological distress with 3.09 times risk for psychological distress versus chemotherapy treatment. Further studies are needed regarding preoperative intervention and postoperative management for distress among cancer patients undergoing highly invasive procedures.

The literatures support the relationship between poor socioeconomic status (e.g., a low household income, financial problems) and psychological distress. [37, 38] Approximately 22% of patients with cancer were worried about paying medical bills. [39] Lung and colorectal cancer patients with limited financial reserves reported increased pain.[40] One possible explanation was that cancer patients with poor financial status encountered more barriers to timely diagnosis, optimal treatment, and survivorship care [41, 42]. Carrera et al. suggested that financial toxicity could be coupled with the use of DT&PL in screening for distress.[11]

To our knowledge, this is the first study identifying the relationship between COST and DT in hospitalized patients with cancer. In the current study, COST scores were negatively related to DT scores in two groups, suggesting a higher degree of financial toxicity correlates with a greater severity of distress. Financial toxicity was significantly associated with distress, even after controlling for age, sex, and cancer type.

This study has some limitations. First, the cross-sectional observational 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 radiotherapy treatment were not included in this study, mainly because very few patients receive radiotherapy as first-line or primary treatment. Finally, participations were solicited from three tertiary-level cancer centers from different cities, but all in Northeast China. Therefore, the application of the study findings is limited to patients with cancer in China.

Patients with cancer experience distress caused by physical, emotional and financial problems. Frequently, these problems overlap and exacerbate one another. This study demonstrates that a significant proportion of cancer survivors above the threshold for psychological and financial distress, provides preliminary evidence for an association between treatment and financial toxicity and distress, and evaluates predictors of distress in adults with cancer. The findings confirm that surgical treatment and severe financial toxicity are significant predictors of distress.

## **Declarations**

### **Authors' contributions**

**Huihui Yu** participated in study conducting, data analysis and interpretation, drafting the manuscript and approval of final manuscript. **Tingting Zuo** participated in data interpretation and approval of final manuscript. **Xue Bi, Hui Li, Haiyang Xing, Li Cao, Lijuan Cai, Zhen Zhang** participated in collection and assembly of data and approval of final manuscript. **Yunyong Liu** participated in study designing, critically revising the manuscript, approval of final manuscript and is the guarantor of the study.

### **Acknowledgments**

There are no potential conflicts of interest or disclosures to report pertaining to this submission.

### **Funding**

This work was supported by Key Research and Development Program of Liaoning Province (Grant No.2019JH2/10300013)

### **Compliance with ethical standards**

### **Conflict of interest**

The authors declare no conflicts of interest.

### **Ethics approval**

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

## References

1. Hollingworth W, Metcalfe C, Mancero S, Harris S, Campbell R, Biddle L, McKell-Redwood D, Brennan J: **Are needs assessments cost effective in reducing distress among patients with cancer? A randomized controlled trial using the Distress Thermometer and Problem List.** *Journal of clinical oncology : official journal of the American Society of Clinical Oncology* 2013, **31**(29):3631-3638.
2. Riba MB, Donovan KA, Andersen B, Braun I, Breitbart WS, Brewer BW, Buchmann LO, Clark MM, Collins M, Corbett C *et al.*: **Distress Management, Version 3.2019, NCCN Clinical Practice Guidelines in Oncology.** *Journal of the National Comprehensive Cancer Network : JNCCN* 2019, **17**(10):1229-1249.
3. **Distress management. Clinical practice guidelines.** *Journal of the National Comprehensive Cancer Network : JNCCN* 2003, **1**(3):344-374.
4. Bultz BD, Carlson LE: **Emotional distress: the sixth vital sign—future directions in cancer care.** *Psychology* 2006, **15**(2):93-95.
5. Lin C, Clark R, Tu P, Bosworth HB, Zullig LL: **Breast cancer oral anti-cancer medication adherence: a systematic review of psychosocial motivators and barriers.** *Breast cancer research and treatment* 2017, **165**(2):247-260.
6. Batty GD, Russ TC, Stamatakis E, Kivimaki M: **Psychological distress in relation to site specific cancer mortality: pooling of unpublished data from 16 prospective cohort studies.** *BMJ (Clinical research ed)* 2017, **356**:j108.
7. Yang L, Zhao M, Magnussen CG, Veeranki SP, Xi B: **Psychological distress and mortality among US adults: prospective cohort study of 330 367 individuals.** *Journal of epidemiology and community health* 2020.
8. Bjerkeset E, Rohrl K, Schou-Bredal I: **Symptom cluster of pain, fatigue, and psychological distress in breast cancer survivors: prevalence and characteristics.** *Breast cancer research and treatment* 2020.
9. Chan A, Poon E, Goh WL, Gan Y, Tan CJ, Yeo K, Chua A, Chee M, Law YC, Somasundaram N *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**(9):3257-3266.
10. Fayanju OM, Yenokyan K, Ren Y, Goldstein BA, Stashko I, Power S, Thornton MJ, Marcom PK, Hwang ES: **The effect of treatment on patient-reported distress after breast cancer diagnosis.** *Cancer* 2019, **125**(17):3040-3049.
11. 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 journal for clinicians* 2018, **68**(2):153-165.
12. Carlson LE, Waller A, Mitchell AJ: **Screening for distress and unmet needs in patients with cancer: review and recommendations.** *Journal of clinical oncology : official journal of the American Society of Clinical Oncology* 2012, **30**(11):1160-1177.

13. Mitchell AJ: **Short screening tools for cancer-related distress: a review and diagnostic validity meta-analysis.** *Journal of the National Comprehensive Cancer Network : JNCCN* 2010, **8**(4):487-494.
14. Chung IY, Jung M, Park YR, Cho D, Chung H, Min YH, Park HJ, Lee M, Lee SB, Chung S *et al.*: **Exercise Promotion and Distress Reduction Using a Mobile App-Based Community in Breast Cancer Survivors.** *Frontiers in oncology* 2019, **9**:1505.
15. 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**(5):871-874.
16. 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**(1):54-58.
17. de Souza JA, Yap BJ, Hlubocky FJ, Wroblewski K, Ratain MJ, Cella D, Daugherty CK: **The development of a financial toxicity patient-reported outcome in cancer: The COST measure.** *Cancer* 2014, **120**(20):3245-3253.
18. de Souza JA, Yap BJ, Wroblewski K, Blinder V, Araujo FS, Hlubocky FJ, Nicholas LH, O'Connor JM, Brockstein B, Ratain MJ *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**(3):476-484.
19. Yu HH, Bi X, Liu YY: **[Reliability and validity of the Chinese version on Comprehensive Scores for Financial Toxicity based on the patient-reported outcome measures].** *Zhonghua liu xing bing xue za zhi = Zhonghua liuxingbingxue zazhi* 2017, **38**(8):1118-1120.
20. Huntington SF, Weiss BM, Vogl DT: **Financial toxicity in insured patients with multiple myeloma: a cross-sectional pilot study.** *The Lancet Haematology* 2015, **2**:e408-e416.
21. Shim EJ, Shin YW, Jeon HJ, Hahm BJ: **Distress and its correlates in Korean cancer patients: pilot use of the distress thermometer and the problem list.** *Psycho-oncology* 2008, **17**(6):548-555.
22. Ghazali N, Roe B, Lowe D, Tandon S, Jones T, Brown J, Shaw R, Risk J, Rogers SN: **Screening for distress using the distress thermometer and the University of Washington Quality of Life in post-treatment head and neck cancer survivors.** *European archives of oto-rhino-laryngology : official journal of the European Federation of Oto-Rhino-Laryngological Societies* 2017, **274**(5):2253-2260.
23. Hurria A, Li D, Hansen K, Patil S, Gupta R, Nelson C, Lichtman SM, Tew WP, Hamlin P, Zuckerman E *et al.*: **Distress in older patients with cancer.** *Journal of clinical oncology : official journal of the American Society of Clinical Oncology* 2009, **27**(26):4346-4351.
24. Xie J, Ding S, He S, Duan Y, Yi K, Zhou J: **A Prevalence Study of Psychosocial Distress in Adolescents and Young Adults With Cancer.** *Cancer nursing* 2017, **40**(3):217-223.
25. Guan B, Wang K, Shao Y, Cheng X, Hao J, Tian C, Chen L, Ji K, Liu W: **The use of distress thermometer in advanced cancer inpatients with pain.** *Psycho-oncology* 2019, **28**(5):1004-1010.
26. Clover KA, Oldmeadow C, Nelson L, Rogers K, Mitchell AJ, Carter G: **Which items on the distress thermometer problem list are the most distressing?** *Supportive care in cancer : official journal of the*

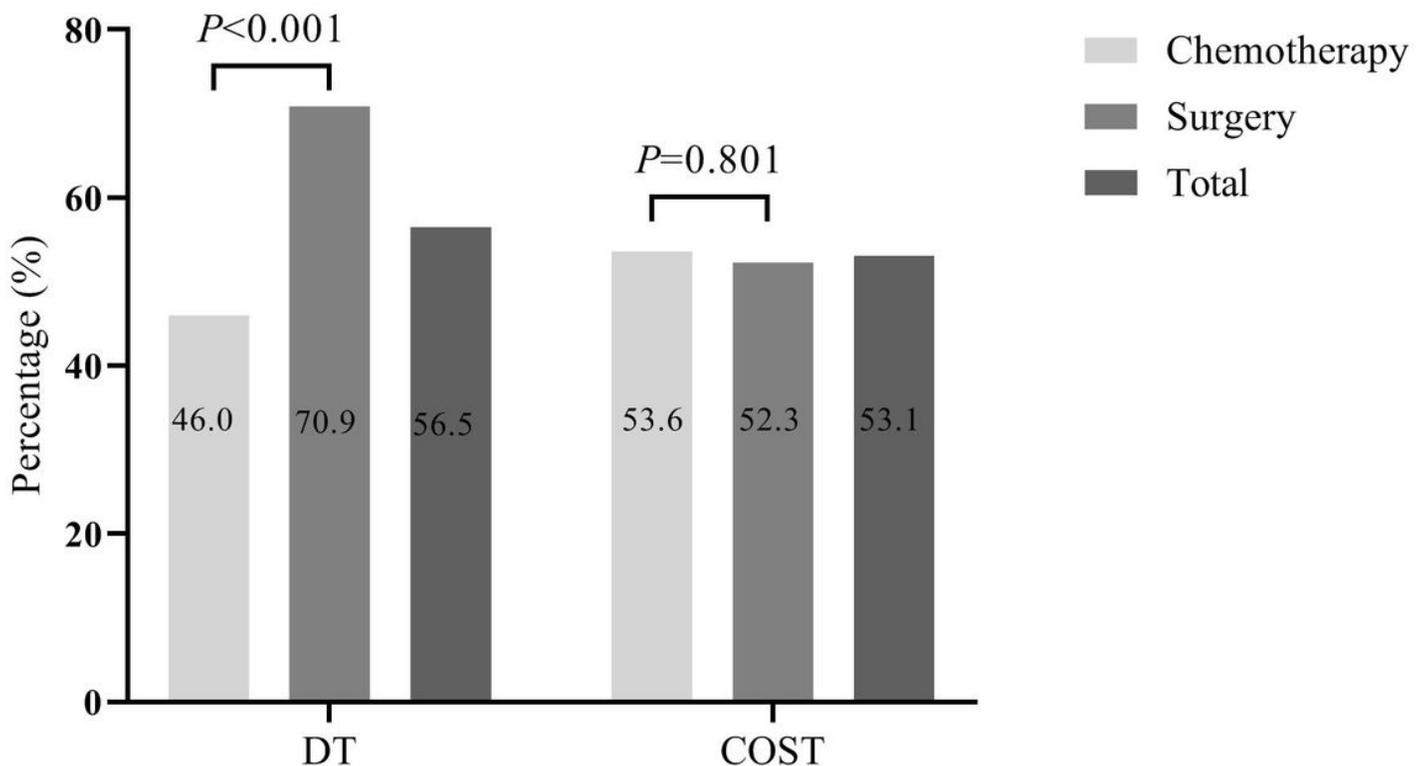
*Multinational Association of Supportive Care in Cancer* 2016, **24**(11):4549-4557.

27. 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-oncology* 2018, **27**(5):1394-1403.
28. Ciambella CC, Taneja C, Dizon DS, Wiggins DL, Emmick CM, Leonard KL, Lopresti ML, Witherby S, Cabral D, Snow S *et al*: **Distress: Characterizing What Causes the Thermometer to Shift in Patients with Newly Diagnosed Breast Cancer Attending a Multidisciplinary Clinic.** *Annals of surgical oncology* 2019, **26**(10):3204-3209.
29. Klingenstein A, Samel C, Garip-Kuebler A, Miller C, Liegl RG, Priglinger SG, Foerster PI: **The national comprehensive cancer network distress thermometer as a screening tool for the evaluation of quality of life in uveal melanoma patients.** *Acta ophthalmologica* 2019.
30. Barbaret C, Delgado-Guay MO, Sanchez S, Brosse C, Ruer M, Rhondali W, Monsarrat L, Michaud P, Schott AM, Bruera E *et al*: **Inequalities in Financial Distress, Symptoms, and Quality of Life Among Patients with Advanced Cancer in France and the U.S.** *The oncologist* 2019, **24**(8):1121-1127.
31. 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-oncology* 2011, **20**(6):594-600.
32. 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**(8):283-289.
33. Basak F, Hasbahceci M, Guner S, Sisik A, Acar A, Yucel M, Kilic A, Bas G: **Prediction of anxiety and depression in general surgery inpatients: A prospective cohort study of 200 consecutive patients.** *International journal of surgery (London, England)* 2015, **23**(Pt A):18-22.
34. Pastore AL, Mir A, Maruccia S, Palleschi G, Carbone A, Lopez C, Camps N, Palou J: **Psychological distress in patients undergoing surgery for urological cancer: A single centre cross-sectional study.** *Urologic oncology* 2017, **35**(12):673.e671-673.e677.
35. 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.
36. 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.** *The Journal of surgical research* 2018, **226**:140-149.
37. Berhili S, Kadiri S, Bouziane A, Aissa A, Marnouche E, Ogandaga E, Echchikhi Y, Touil A, Loughlimi H, Lahdiri I *et al*: **Associated factors with psychological distress in Moroccan breast cancer patients: A cross-sectional study.** *Breast (Edinburgh, Scotland)* 2017, **31**:26-33.
38. **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 medicine* 2017, **15**(1):10.
39. Yabroff KR, Dowling EC, Guy GP, Jr., Banegas MP, Davidoff A, Han X, Virgo KS, McNeel TS, Chawla N, Blanch-Hartigan D *et al*: **Financial Hardship Associated With Cancer in the United States: Findings**

**From a Population-Based Sample of Adult Cancer Survivors.** *Journal of clinical oncology : official journal of the American Society of Clinical Oncology* 2016, **34**(3):259-267.

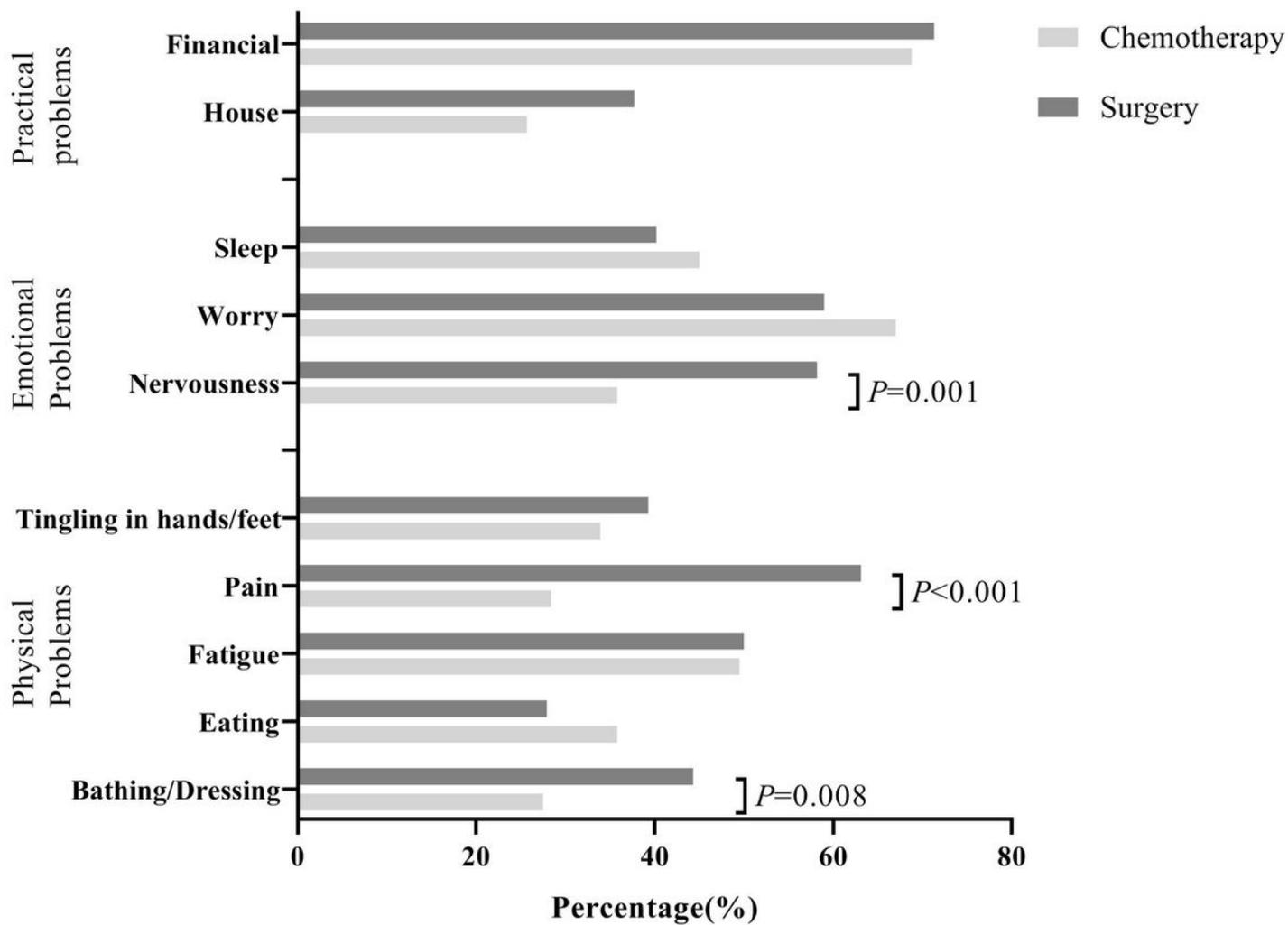
40. Lathan CS, Cronin A, Tucker-Seeley R, Zafar SY, Ayanian JZ, Schrag D: **Association of Financial Strain With Symptom Burden and Quality of Life for Patients With Lung or Colorectal Cancer.** *Journal of clinical oncology : official journal of the American Society of Clinical Oncology* 2016, **34**(15):1732-1740.
41. Alfonsso S, Olsson E, Hursti T, Lundh MH, Johansson B: **Socio-demographic and clinical variables associated with psychological distress 1 and 3 years after breast cancer diagnosis.** *Supportive care in cancer : official journal of the Multinational Association of Supportive Care in Cancer* 2016, **24**(9):4017-4023.
42. Niksic M, Rachet B, Warburton FG, Wardle J, Ramirez AJ, Forbes LJ: **Cancer symptom awareness and barriers to symptomatic presentation in England—are we clear on cancer?** *British journal of cancer* 2015, **113**(3):533-542.

## Figures



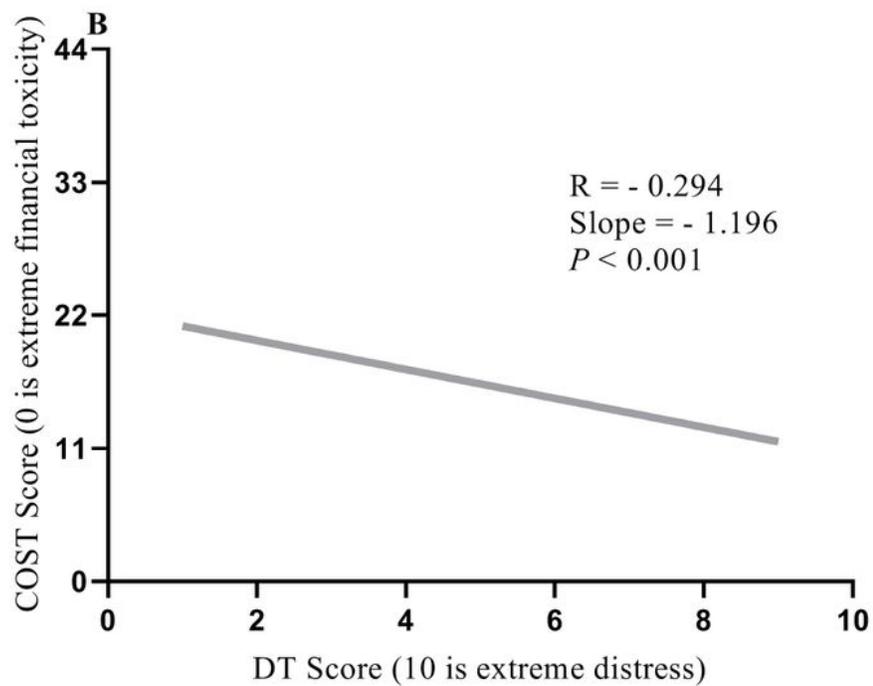
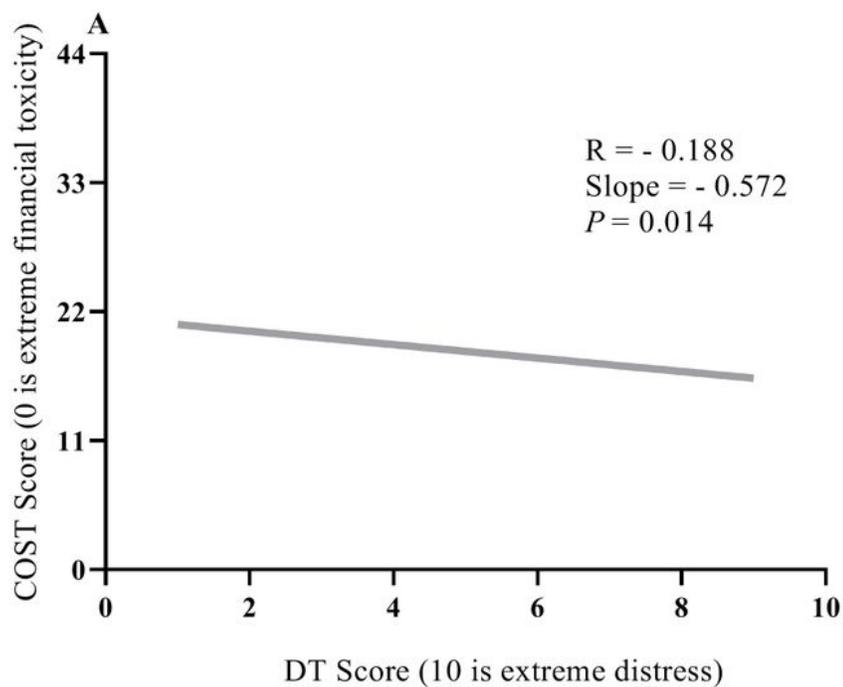
**Figure 1**

The prevalence of the distress and financial toxicity



**Figure 2**

Outlines the top 10 factors causing distress in the treatment groups.



**Figure 3**

The association between overall distress and financial toxicity, respectively measured by the DT and COST, based on treatment