

# Psychometric Evaluation of the Comprehensive Score for Financial Toxicity Scale Among Iranian Cancer Patients

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## Research

**Keywords:** financial toxicity, financial burden, costs and consequences, psychometric, cancer and care

**Posted Date:** February 5th, 2020

**DOI:** <https://doi.org/10.21203/rs.2.22672/v1>

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# Abstract

## Objective

This study aims to evaluate the psychometric properties of the Persian version of financial toxicity (COST) scale in a sample of cancer patients in Iran.

## Methods

A total of 398 cancer patients completed a demographic questionnaire and the 11-item Persian COST. Performing a Maximum likelihood exploratory factor analysis, extracted three factors of financial worry (four items), financial distress (three items) and direct and indirect cost of control (three items) accounting for 65.204% of the variance. The highest load was related to financial distress and the lowest was related to direct and indirect costs concerns.

## Results

The results of conducting confirmatory factor analysis indicated that the three-factor measurement model had a good fit. Moreover, the measurement model showed good items consistency, good construct reliability, as well as good construct validity in terms of convergent and discriminant validity.

## Conclusion

This study highlights the importance of validating the scale in different contexts as the structure and loadings of the factors have appeared differently in various countries. The validated Persian COST can be used in future studies in Iran as a reliable and valid scale to measure financial toxicity among cancer patients.

# Background

Cancer has been identified as a fatal disease, a growing health concern and economic burden worldwide (1–3). During the past decade, with the help of medical advancements in early detection, the survival rate of cancer patients has risen with a concomitant increase in treatment costs (4, 5). As a result of this situation, some insurance systems have changed their policies to limit their coverage and not defray extra costs (5). In developing countries, disproportionate rising price of cancer therapies (6) and diversity of health insurance coverage have given rise to disparities in access to care and treatment among different populations and communities (7).

Due to insufficient insurance coverage, more out-of-pocket expenses required for treatment has escalated financial burden of cancer patients and their family. The negative effect of this is the devastating emotions in the personal and social life of those affected by cancer (Allice, Banegas et al. 2017; Chan, Gordon et al. 2019, Salsman, Bingen et al. 2019) to the extent that some end up in debts (8, 9). Some patients may have perilous reactions such as to discontinue or non-adherence to treatment in order to avoid financial hardships (10). The direct and indirect costs of cancer-related treatment can give rise to what is known as financial toxicity defined as a potential consequence of subjective financial distress experienced by patients (Witte, Mehlis et al., 2019). Past research has supported the impact of financial toxicity on physical burden and mental symptoms such as pain, fatigue, depression, cognitive dysfunction and neuropathy (11). In addition, financial toxicity has been found to be associated with lower probability to survive or an earlier death (12). Such threats brought about by financial toxicity substantially affect the welfare of patients as well as people around them. It is therefore important for care providers to understand the negative impact of financial toxicity. Appropriate intervention is necessary in order to curb such occurrences or to reduce the risk of financial toxicity.

The prevalence of financial toxicity has attracted researchers' attention with a significant rise in research. However, the review of literature shows that despite the importance and prevalence of financial toxicity, there is no conclusive definition in either a broader context or a disease-specific for financial toxicity or financial distress (2, 4). Witte, Mehlis (4) in their systematic review define financial toxicity as a potential consequence of subjective financial distress experienced by patients due to cancer-related (or anticipated) direct and indirect treatment costs. In this definition, financial toxicity is a cognitive or subjective state (internal feeling) that has been induced through perceived distress as a result of objective loads (external and real). Therefore, such patients should cope with both monetary and psychosocial costs of their illness (4).

If there is no conclusive definition for financial toxicity, there is equally an absence of an agreed scale that could adequately capture the dimensions of financial toxicity. Chan, Gordon (8) categorized the instruments to measure financial toxicity into three main groups: monetary, objective and subjective measures. Monetary instruments investigate the currency values of out-of-pocket costs or percentage paid relative to income for direct medical and nonmedical costs as well as indirect costs (2, 8). Objective measures examine real methods or strategies used to manage financial burden such as borrowing money from others or using invested savings and funds, while subjective instruments evaluate perceived financial burden arisen from cancer and its care (2, 4, 8). The results of the review conducted by (4) revealed that more than 88 percent of the studies conducted in developed countries used various designs to assess financial toxicity (4, 8). Researchers have also raised concerns regarding the validity of some of the scales (12, 13). Among the three main approaches to measurement, subjective measures receive widespread interest among researchers.

Past reviews have identified three subjective scales specifically used to measure perceived financial toxicity among cancer patients: The Comprehensive Score for financial Toxicity (COST), Breast Cancer Finances Survey Inventory (BCFS), and Socioeconomic Wellbeing scale (SWBS) (4). The COST is the latest instrument developed by de Souza et al. (2014) based on cancer patients' reports and it has been validated using US patients (14). The COST is an 11-item instrument measuring financial toxicity with one item on financial spending, two items on financial resources, and eight items on the psychosocial responses of cancer patients.

Research conducted in the US and Canada to explore causes and effects of financial toxicity using the COST instrument, have recommended it as an effective and feasible measure (4, 15). Review of studies on different instruments for assessing financial toxicity have reported that COST is a valid and most widely

used measure (2, 4, 6). Moreover, the Japanese version (12) and Chinese version (16) of the COST have shown good reliability and validity. However, in less developed societies that are expected to face more difficulties (mortality and costs) among cancer patients and their family, research is relatively scarce (1–3, 17). Besides income, patients from different social, and cultural backgrounds may experience different financial toxicity. The objective of this study is to assess the psychometric properties of the Persian version of the COST in Iran that has specific financial challenges and a healthcare system that differs from other countries (18).

Iran as a middle-income country has the greatest cancer incidence and death attributable to that in the Middle East (19). Meanwhile, various sanctions imposed by the US and the United Nations over the past four decades although not directly targeting pharmaceuticals and medical equipment, they have caused many disturbances in trading and producing essential drugs and medical equipment for more than thirty serious and life-threatening diseases such as cancer (19). Moreover, Gross Domestic Product (GDP) per capita in Iran has declined owing to sanctions which in turn has substantially reduced the purchasing power of Iranians (19). In addition, due to the high inflation in health expenditures (both for the government and consumers), it is estimated that Iranians have to spend almost 60% out of pocket payment to get imported drugs and services which are necessary to treat special diseases such as cancer (19). In this regard, cancer patients and their caregivers (i.e. family and nurses) are under extreme strain and distress with high risk of financial toxicity.

Despite the aggravated circumstances that could cause people to succumb to financial toxicity, little is known about financial toxicity among Iranian patients. Although some studies have been conducted to investigate financial distress of cancer patients using, for example, financial well-being scale (20), no prior research, to the authors' knowledge, has measured financial toxicity or financial burden among cancer patients. Utilizing a standardized and multidimensional instrument such as COST could improve our understanding of this phenomenon and allow us to achieve more robust, consistent and comparable results (4). The results of such studies like the present study will be useful for policy makers to develop intervention strategies to mitigate financial toxicity and improve quality of life of cancer survivors. At the same time, this study will fill a significant gap in the empirical literature of financial toxicity as this study aims to assess psychometric properties of the Persian version of the comprehensive scores for financial toxicity (COST) scale among cancer patients in Iran.

## Methods

This cross-sectional study used the data from the Financial Literacy of Cancer Patients' project collected through two independent surveys (under the same project) in Iran from August 2018 to January 2019. In total, 407 responses from patients who were at least 18 years or older and diagnosed with cancer were collected using a convenience sampling technique in two clinics and research centers in Iran. Nine responses were excluded from the dataset due to missing information which resulted in 398 samples.

## Measures

### Demographic Items

The demographic questionnaire contained items relating to age, gender, marital status, level of education, socioeconomic status, employment status, and whether cancer influenced their work.

### The Comprehensive Score for financial Toxicity (COST)

COST is the general indicator of financial toxicity which captures both economic and financial aspects of burden (21). It provides an overall measure of the cancer patient's perception of financial pressure due to treatment-related costs and loss of income. The COST measure consists of 11 items measured on a 5-point Likert scale that ranges from zero ("not at all") to 5 ("a lot"). A reverse scoring method was used for positive items so that higher scores would show greater financial distress. The original COST measure showed a Cronbach alpha of .9 demonstrating high internal consistency.

The scale was translated into Persian using a forward–backward method. Two English–Persian translators were invited to independently translate the COST from English to Persian language. An expert panel comprised of one of the authors of this study and a translator assessed the two versions and produced a single Persian version. Next, a translator translated the Persian COST into English which was compared with the original scale.

### Participants

The participants were predominately married ( $n = 299$ , 75.5%) with a mean age of 50.0 (SD = 14.3) years. Among them, 51% ( $n = 203$ ) were male and 46.2% ( $n = 184$ ) were female. The most common education level (65.4%) was higher than a diploma. In terms of employment, 34.4% reported that they were not employed, 38.9% reported that they had a full-time job, 7.8% reported that they had a part-time job, and 14.6% were retired. The majority of the participants (64.6%) reported that cancer had an impact on their employment status. More specifically, 30.7% reported that they reduced their working hours, 7% reported that they changed from full-time job to part-time, 2.3% changed their job, and 24.6% left their job as they were not able to work anymore. The majority (76.9%) of the participants were under treatment, 12.3% had completed the treatment, and 9.5% were diagnosed recently.

### Data Analysis

To evaluate construct validity of the Persian version of COST this study first conducted a maximum likelihood exploratory factor analysis (EFA) with oblique rotation which allows extracted factors to be correlated. To assess appropriateness of the study sample and the factor analysis model, the study used the Kaiser-Meyer-Olkin (KMO) test and Bartlett's sphericity test. Factors were extracted based on the eigenvalue greater than one and scree plot criteria. Items with factor loading of .5 or greater were regarded as appropriate. Next, the factor structure obtained with EFA was validated by conducting a maximum likelihood confirmatory factor analysis (CFA). The model fit was assessed using several model fit indexes. Items with factor loading of .5 or greater remained in the model. Subsequently, internal consistency, construct reliability, convergent validity and discriminant validity of the extracted factors were evaluated. While Cronbach's alpha greater than .7 showed good internal consistency among the items, composite reliability and maximal reliability greater than .7 indicated

good construct validity. To establish convergent validity and discriminant validity, average variance extracted should be greater than .5 and average variance extracted should be greater than maximum shared variance respectively. EFA was conducted using SPSS version 25 and CFA was performed using AMOS version 24.

## Ethical Consideration

The study was approved by the Ethics Committee of Mazandaran University of Medical Sciences, Iran (IR.MAZUMS.REC1398.1634). Written signed informed consent was obtained from the participants after giving information about the objectives of the study and procedures. They were assured that participation was voluntary and it would not affect their medical care. Also, the confidentiality of participants' information was guaranteed.

## Results

The sample was randomly split into two subsamples each consists of 199 samples. EFA was conducted on the first dataset and CFA was performed on the second dataset to avoid overfitting. Table 1 reports the results of conducting EFA with promax oblique rotation and CFA on the Persian version of COST. The KMO value was .791 and Bartlett's sphericity test was significant ( $p < .001$ , 1050.172,  $df = 45$ ) indicating that sampling was adequate. Using the eigenvalue greater than one and scree plot criteria EFA extracted three factors accounting for 65.204% of the variance. The first factor was labelled as financial worry (comprising items 1, 3, 4, and 5; eigenvalue = 3.188), the second factor was labelled as financial control/satisfaction (comprising items 2, 6, and 7; eigenvalue = 2.367), and the third factor was labelled as direct and indirect costs (comprising items 9, 10, and 11; eigenvalue = 2.686). The eighth item of COST was removed due to a high cross-loading. Cronbach's alpha for financial worry (.889), financial control (.819), as well as direct and indirect costs concerns (.815) indicated good internal consistency among the items.

Table 1  
The results of conducting EFA and CFA on the Persian version of COST

Dimensions/items	Exploratory factor analysis					Confirmatory factor analysis				
	Communality (Extraction)	Loading	Variance	Eigenvalue	Cronbach's alpha	Loading	Composite reliability	Maximal reliability	Average variance extracted	Maxin share: varian
Financial worry			35.636	3.188	.889		.886	.930	.661	.212
1. I feel financially stressed	.914	.972				.831				
3. I worry about the financial problems I will have in the future as a result of my illness or treatment	.768	.888				.833				
4. I am frustrated that I cannot work or contribute as much as I usually do	.455	.809				.748				
5. My cancer or treatment has reduced my satisfaction with my present financial situation	.631	.570				.836				
Financial control			19.473	2.367	.819		.814	.947	.595	.216
2. I am satisfied with my current financial situation	.516	.670				.753				
6. I feel in control of my financial situation	.801	.938				.828				
7. I am able to meet my monthly expenses	.563	.712				.729				
Direct and indirect costs concerns			10.096	2.686	.815		.837	.837	.630	.216
9. I am concerned about keeping my job and income, including working at home	.516	.574				.804				
10. I feel I have no choice about the amount of money I spend on care	.777	.924				.786				
11. My out-of-pocket medical expenses are more than I thought they would be	.579	.751				.792				

The results of performing CFA on the factor structure obtained with EFA consisting of three dimensions and 10 items indicated a good fit ( $\chi^2$  (df = 32, N = 199) = 64.176,  $p < .01$ ;  $\chi^2/df = 2.006$ , comparative fit index (CFI) = .966, Tucker-Lewis index (TLI) = .953, Incremental Fit Index (IFI) = .967, Relative Fit Index (RFI) = .910, Normed Fit Index (NFI) = .936, Standardized Root Mean Square Residual (SRMR) = .051 and RMSEA = .071 (90% confidence interval = .046–.096)). All item loadings were greater than .7 (varying from .729 to .836) and statistically significant at .001. Both composite reliability (financial worry: .889, financial control: .814, and direct and indirect costs concerns: .837) and maximal reliability (financial worry: .930, financial control: .947, and direct and indirect costs concerns: .837) of the three dimensions were greater than .7 indicating good construct reliability. Also, average variance extracted for financial worry (.661), financial control (.595), and direct and indirect costs concerns (.630) was greater than .5 that established convergent validity of the dimensions. Moreover, average variance extracted of each dimension was greater than its maximum shared variance (financial worry: .212, financial control: .216, and direct and indirect costs concerns: .216) with other dimensions fulfilling the requirements of discriminant validity. Figure 1 shows the measurement model with the results of CFA.

## Discussion

The aim of this study was to assess psychometric properties of the Persian version of COST among Iranian cancer patients. The results of conducting a maximum likelihood EFA with oblique rotation resulted in a three-factor solution labeled as: (i) financial worry; (ii) financial control, and (iii) direct and indirect costs concerns, explaining 65.2% of the variance. The highest load was related to financial distress and the lowest was related to direct and indirect costs concerns. Financial worry ( $r = .46$ ) and financial control ( $r = .47$ ) were both moderately related to direct and indirect costs concerns. Performing CFA on the results obtained from EFA indicated that the three-factor measurement model had a good fit, evidenced by several model fit indices. The study conducted by De Souza, Yap (10) that developed and validated COST among US cancer patients identified one factor explaining 93% of the variance in the data. Another study evaluating psychometric properties of the Chinese version of COST extracted two factors that explained 68% of the variance. This highlights the importance of validating the scale in different contexts.

One factor identified in the current study, consisted of items 1, 3, 4, and 5, was financial worry that reflects being upset for going through financial strain due to losing physical and economic ability and lack of independence. These four items were among the most important items (i.e. four of the top five highest loading items) in the study by De Souza, Yap (10) explained by financial toxicity. Financial worry about having enough funds to support has been reported as one of the main concerns of cancer patients which would have a detrimental effect on their quality of life (22). There is evidence showing negative drastic effects of stress and worry in general (23, 24) and more specifically financial worry (22) on quality of life and psychological well-being of cancer patients. Also, literature has shown that financial distress has a negative impact on self-efficacy, and attitudes toward illness among individuals with cancer (25).

Factor 2, financial control, consisted of items 2, 6, and 7, was associated with financial competence addressing the extent to which an individual is in control of his/her finance and living expenses. Items 6 and 7 had similar factor loadings in the study by De Souza, Yap (10) too. Past studies and reports have shown that loss of control and sense of security are associated with financial concerns and contribute to on-going emotional distress (22). Losing control of finances in cancer patients may hinder them to continue their treatment (26, 27).

The third factor, direct and indirect costs concerns, consisted of three items of 9, 10, and 11, reflects financial burden due to direct (e.g. medical costs) and indirect (e.g. loss of income) costs of the disease. These three items were the lowest loading items in the original study by De Souza, Yap (10) falling next to each other. The past research has documented that cancer patients experience substantial distress related to the direct and indirect costs of the disease (2, 7–9). Empirical studies have revealed the relationship between the distress derived from direct and indirect costs of cancer and psychological symptoms of patients (8). Moreover, educational level, income, and age during the treatment process were found to impact the amount of distress cancer patients experience due to the direct and indirect costs of the disease which is due to their fear of losing income and productivity (7, 28). It has been observed that patients experiencing greater financial hardship related to direct and indirect costs of cancer are more likely to delay or quit their care (29). The measurement model of the Persian COST indicated good items consistency, good construct reliability, as well as good construct validity in terms of convergent (sufficient correlation and shared variances among the items) and discriminant validity (complete separation of the items of different latent factors) (30).

## Limitations

This study has several limitations. Selecting participants through a non-probabilistic sampling approach limits the generalizability of the findings. The data for this study were gathered from multicenter clinics in urban areas. Conducting similar studies using larger sample size by including samples from rural areas would be necessary to approve consistency of our findings and increase the credibility of the present structural model for policymaking and interventions planning (31). Moreover, selecting statements of the questionnaire by researchers on behalf of some patients may bias their responses.

## Clinical Implications

The results have several implications. Healthcare professionals should be aware of the detrimental effects of financial toxicity characterized by concerns about direct and indirect costs, financial worry, and perceived lack of financial control among cancer patients. Informing cancer patients about the financial challenges that they may face, providing consultations on how to manage their cancer related financial issues, and providing them a list of different financial support resources (22) will have a positive impact as it enhances patients' quality of life and may encourage them to complete treatment. As for some patients there may be some limitations in overcoming their financial challenges, assessing perceived financial toxicity of cancer patients regularly at different points of time is recommended.

## Conclusions

This study assessed psychometric properties of the Persian version of the COST scale among cancer patients in Iran. The results of conducting EFA and CFA suggested a three-factor solution with ten items consisting of financial worry; financial control, and direct and indirect costs concerns. The measurement model showed good internal consistency, high reliability and good construct validity. Based on the results, the Persian version of COST, validated by this study, can be used for assessing financial toxicity among cancer patients.

## Declarations

### Acknowledgments

The authors would like to thank all the participants of the study and authorities of the cancer care centers.

### Funding

There is no funding for this research paper.

### Availability of data and materials

The data that support the findings of this study are available on request from the corresponding author. The corresponding author has full control of all primary data and will agree to allow the journal to review the data if requested.

### Authors' contributions

Pahleven Sharif, S participated in the design of the study and played a leadership role in analysis and interpretation of data and drafting the manuscript. Sim Ong, F played a leadership role in critical revision of the article for important intellectual. Moshtagh, M conceived of the overall study concept, design and writing the manuscript. Naghavi, N participated in drafting the discussion section, critical revision and final approval. Sharif Nia, H participated in data collection, analysis and interpretation of data.

### Ethics approval and consent to participate

All study activities were approved by Ethics Committee of Mazandaran University of Medical Sciences, Iran (IR.MAZUMS.REC1398.1634). Informed, written consent was obtained from all individual participants included in the study.

### Competing interests

The authors declare that they have no competing interests.

### Consent for publication

Not applicable in this section.

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## Figures

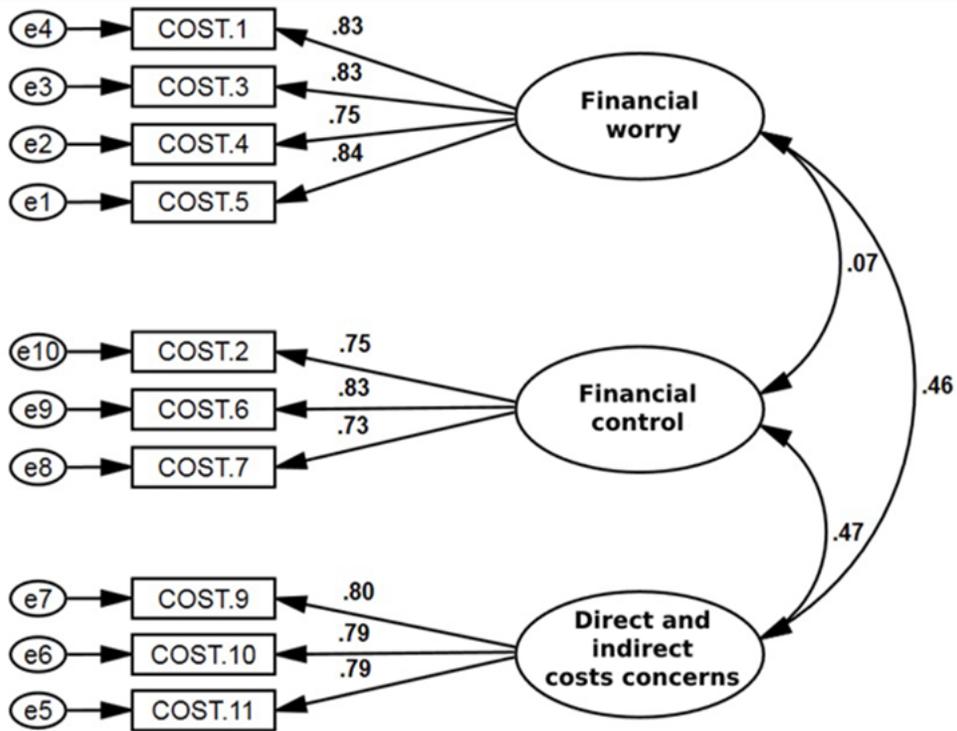


Figure 1

The measurement model