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An Examination of Psychometric Characteristics and Factor Structure of Death Anxiety Scale Within a Sample of Iranian Patients With Heart Disease

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Abstract

Background and aims: Despite a substantial body of work examining the role of death anxiety (DA) in an individual's quality of life, there is a lack of valid and standardized instruments that could measure this construct for patients with coronary heart disease (CHD). The objective of this study was to examine the psychometric characteristics and factor structure of the Templer Death Anxiety Scale (TDAS) within a sample of Iranian patients who had experienced acute myocardial infarction (AMI).
Methods: In this study, 584 patients with CHD completed the TDAS. A principal components analysis evaluated dimensionality of the measuring instrument. Reliability and validity were assessed.
Results: Factor analysis found 3 distinct factors (fear of death due to illness, fear of facing death, and distress due to short time of life). Convergent and discriminant validity for the constructs of the TDAS were fulfilled. The internal consistency for the measure was < 0.70.
Conclusion: Findings revealed that the Persian version of the TDAS is a valid and reliable instrument that can be used for the assessment and evaluation of DA in Iranian patients with CHD.
Keywords: Heart disease, Death anxiety, Psychometric properties, Iran

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Introduction

Cardiovascular diseases (CVDs) are the most common cause of death among adults globally.[1] Coronary heart disease (CHD) is the most common CVD, for which acute myocardial infarction (AMI), often referred to as a heart attack, is often a clinical consequence. AMI is a life-threatening event affecting blood flow to the heart muscle. Approximately 1.1 million cases of AMI are reported each year in the United States and the mortality rate has been reported to be 30%.[2] Half of CHD-related deaths are specifically attributed to AMI in Iran.[3]

Research has demonstrated that CHD can have a negative impact on a patient's wellbeing.[4] In most cases, CHD is not only accompanied by physical consequences (e.g., cardiogenic shock, cardiac rupture, ventricular aneurysm, fatal dysrhythmia, ischemia, and stroke), but also psychological consequences (e.g., anxiety and depression) have been observed.[5] Anxiety is one of the most common psychological

sequelae reported by the patients with CHD and it has been shown to have a negative effect on the physical recovery of the patients.[6] Examining psychometric instruments suitable for measuring anxiety related to CHD or other near-death experiences is important for clinical practice.

Anxiety that is specifically concerned with death is referred to as death anxiety (DA). It includes intrusive and negative thoughts and emotions concerned with the end of one's life, which often emerges following a near-death experience or major injury or illness. In other words, DA refers specifically to the anxiety about death in daily life. Moreover, it should not be confused with generalized anxiety that may be felt in circumstances of immediate risk or threat towards one's own life.[7,8] DA is a complex construct that has been found to be influenced by a variety of factors including past experiences (e.g., psycho-educational opportunities concerned with death, perceived threats to life/health, previous injuries), gender, age,

religiosity, culture, environment, and ethical and spiritual beliefs.[9,10]

DA is typically assessed through standardized instruments[11] including Death Anxiety Scale,[12] Revised Death Anxiety Scale,[13] Collett-Lester Fear of Death Scale,[14] Threat Index,[15] Death Attitude Profile-Revised,[16] Multidimensional Orientation toward Dying and Death Inventory,[17] Multidimensional Fear of Death Scale,[18] and Fear of Personal Death Scale.[19] Among these scales, Templer Death Anxiety Scale (TDAS) is the most widely used one in health-related studies which examines chronic health conditions,[20] and has been used by over 60% of the studies that have examined DA more generally.[20,21] Such studies have examined diverse populations including people from health professionals, individuals with substance-related and addictive disorders, psychiatric patients, and healthy individuals.[22-24] There are no studies, to the authors' knowledge, that have assessed the efficacy of the TDAS, or any other DA measuring instrument, in a sample of patients with AMI.

An increased understanding of DA through empirical research supports practitioners to provide interventions and strategies to patients presenting with heart disease.[21] It is therefore essential that practitioners and researchers use valid and reliable tools to measure DA.[25] This is especially relevant to nurses who work with patients who experience a life-threatening illness such as CHD. For nurses, having knowledge and a positive attitude towards death can have an impact on the DA experienced by patients. It is therefore crucial for nurses to develop their skills in assessing and managing the DA in patients and improve practical outcomes.[25]

Considering the broad application of the TDAS, the increasing prevalence of AMI in adult population in Iran, as well as the lack of valid and standardized instruments for this group of patients,[26] it seems necessary to assess the validity and reliability of the scale based on socio-cultural effects within a Persian context.[11] The present study therefore aimed to determine the psychometric properties of the TDAS in Iranian patients with CHD.

Methods
Design
The cross-cultural adaptation and psychometric validation of the TDAS were used as quantitative approaches to patients (N = 584) who were hospitalized in 2 medical institutions (Boo Ali Sina and Velayat hospitals) in Qazvin (a city in north-central Iran) between August and October, 2015. The inclusion criteria for participant selection included

(1) adequate communication skills; (2) verification of CHD based on ECG and diagnosis by a treating medical practitioner; and (3) stable vital signs. Patients were checked within 24 hours after hospitalization (hemodynamics assessment in heart), as well as after discharge from the cardiac care unit (CCU).

Forward-Backward Translation Process
First, following permission from the scale developer, a standard forward-backward translation was made using the World Health Organization (WHO) protocol.[27] Two English-Persian translators independently translated the TDAS. An expert panel consisting the authors of the present paper and the 2 translators assessed and unified the 2 translations to produce a single Persian translation of the TDAS. Thereafter, a Persian-English translator was asked to back-translate the Persian TDAS into English. This English version of the TDAS was sent to Dr. Templer, the author of the scale, who confirmed that the translated English version was complete and correct when compared with the original version. The TDAS includes 15 items that are scored on a 5-point Likert scale from 1 (completely disagree) to 5 (completely agree). Items 2, 3, 5, 6, 7, and 15 were reverse-scored in the first version.[12]

Construct Validity Assessment
To assess the construct validity, the factor structure of the Persian TDAS was examined by exploratory factor analysis (EFA) by performing a maximum likelihood (ML) estimation followed by a varimax rotation using SPSS, version 22.0 (SPSS Inc., Chicago, IL, USA). The Kaiser-Meyer-Olkin (KMO) test and the Bartlett test of sphericity were used to check the appropriateness of the study sample and the factor structure. The number of factors was determined based on: (*a*) eigenvalues >1, (*b*) items with absolute loading values of 0.3,[28] (*c*) items loaded on more than 1 factor with loadings ≥0.40, (*d*) items loaded on factors with only 1 or 2 items, and (*e*) scree plot (Figure 1).[29]

The factor structure obtained from the EFA was then examined with confirmatory factor analysis (CFA) using AMOS version 19. It should be noted that first, EFA was run with a sample size of 300, then CFA was conducted on a final sample of 284. Jaccard and Wan have recommended that most common indexes of goodness of fit models in CFA are χ2 goodness-of-fit index (CMIN), the root mean square error of approximation (RMSEA), the normed fit index (NFI), the adjusted goodness of fit index (AGFI), the goodness of fit index (GFI), the Tucker-Lewis index (TLI), the parsimonious comparative fit index (PCFI), and the chi-square test divided by the *df* value (CMIN/

Table 1. Cut-off Criteria for Several Fit Indexes

Indexes	Acceptable Fit
Chi-squared *P*-value	
PCFI (Parsimony Normed Comparative Fit Index)	<0.5
PNFI (Parsimonious Normed Fit Index)	
AGFI (Adjusted Goodness of Fit Index)	<0.08
TLI (Tucker-Lewis Index)	<0.9
RMSEA (Root Mean Square Error of Approximation)	Good <0.08, moderate <0.08 to 0.1
CMIN/DF (Minimum Discrepancy Function by Degrees of Freedom divided)	Good <3, acceptable <5

DF).[30] Cut-off criteria for fit indices of latent variable models are shown in Table 1.[31,32]

Convergent and discriminant validity were assessed by estimating average variance extracted (AVE), maximum shared squared variance (MSV), and average shared square variance (ASV). To establish convergent validity, the AVE of constructs should exceed 0.50. For discriminant validity, both MSV and ASV should be less than AVE.[33-35]

Reliability Assessment

The reliability of the Persian TDAS was first assessed

Table 2. Demographic Characteristics of the Study Participants

Demographic Characteristics	EFA (n= 300)	CFA (n= 284)
Gender, No. (%)		
Male	143 (47.7)	138 (48.6)
Female	157 (57.3)	146 (51.4)
Marital status, No. (%)		
Single	5 (1.7)	2 (.7)
Married	244 (81.3)	227 (79.9)
Widowed	51 (17)	55 (19.4)
Educational status, No. (%)		
No formal education	155 (51.7)	149 (52.5)
Primary	69 (33)	64 (22.5)
Intermediate	30 (10)	35 (12.3)
High School	36 (12)	30 (10.6)
Collegiate	10 (3.3)	6 (2.1)
Economic status, No. (%)		
Poor	71 (23.7)	73 (25.7)
Average	213 (71.0)	200 (70.4)
Good	16 (5.3)	11 (3.9)
Main source of income, No. (%)		
Personal	129 (43)	118 (41.5)
Family	26 (8.7)	19 (6.7)
Friends	3 (1)	2 (.7)
Pension from the government	117 (39)	117 (41.2)
Charity	25 (8.3)	28 (9.9)
Death experiences, No. (%)		
Yes	18 (6)	6 (2.1)
No	282 (94)	278 (97.9)
Age , Mean (SD), range	59.89 (11.94), 22-96	61.01 (10.16), 31-88
Social support, Mean (SD), range	6.32 (2.76), 0-10	5.83 (2.54), 1-10
Death Anxiety score (total DAS), Mean (SD), range	44.61 (11.24), 19-75	44.56 (11.80), 19-75

through evaluating its internal consistency (coefficients of Cronbachα, Theta (θ), and McDonald Omega [Ω]).[36] Values of 0.7 or greater show satisfactory internal consistency.[37] Then, the construct reliability (CR) of each factor was assessed. CR of the model was determined whereby values between 0.6 and 0.7 were accepted provided that other indicators are good.[38]

### Multivariate Normality, Outliers, and Missing Data

Univariate distributions were examined for outliers as well as skewness and kurtosis. Multivariate distributions were evaluated for normality and multivariate outliers. Multivariate normality can be evaluated through the use of Mardia's coefficient of multivariate kurtosis. A Mardia's coefficient greater than 8 is an indication of a violation to kurtosis.[39] Multivariate outliers can be evaluated through the evaluation of Mahalanobis distance.[40] Mahalanobis distance is specified typically by a $P < 0.001$.[41] Missing values from individual surveys were excluded.

Results

Table 2 presents the demographic characteristics of respondents in the current study. The respondents were predominately married (81.3%) with a mean age of 59.89 years. Among them, 47.7% were male and 57.3% were female.

The KMO value and the Bartlett test of sphericity were significantly found to be 0.719 ($P < 0.001$) and
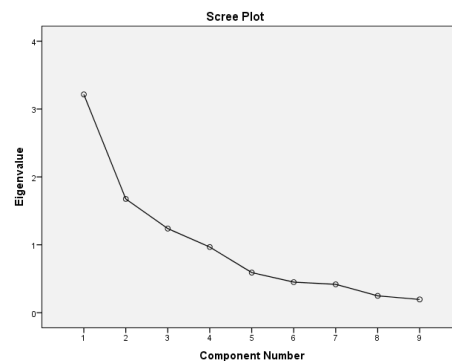
Figure 1. Scree Plot of DAS Based on 300 AMI Patients.
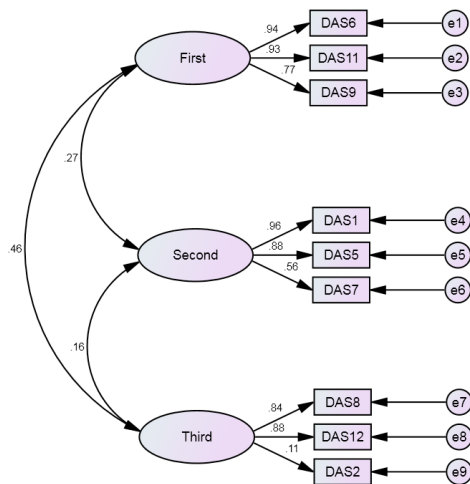
Figure 2. Best Fitting Model, the Structural Model of TDAS Among Patients With Heart Disease. Based on a random sample of 284 questionnaires.

979.47, respectively. Using the eigenvalue greater than 1 criterion, EFA extracted 3 factors each consisting 3 items: factor 1) fear of death due to illness comprised of items 6, 11, 9 (eigenvalue = 2.14), factor 2) fear of facing death comprised of items 1, 5, 7 (eigenvalue = 1.67), and factor 3) distress due to short time of life comprised of items 8, 12, 2 (eigenvalue = 1.58). These 3 factors were together accounted for 68.11% of the variance (Table 3).

Next, the factor structure obtained from EFA was assessed using a CFA. The fit of the final CFA was acceptable (Figure 2) (χ^2 [24, N = 284] = 69.33, $P < 0.001$; AGFI = 0.909, PCFI = 0.645, PNFI = 0.635, NFI = 0.952, GFI = 0.951, TLI = 0.952, CMIN/DF = 2.88, RMSEA = 0.072]). As shown in Table 4, the AVE, MSV, and ASV of the constructs fulfilled the requirements of convergent and discriminant validity. Although AVE of the third factor was not suitable and convergent validity of the third factor was not confirmed.

According to Table 4, the internal reliability of the first and second factors of TDAS were calculated as

a good reliability (<0.7), but the third factor showed low reliability. CR of the first and the second factors were more than .8, which indicates good reliability. CR of the third factor was less than 0.7, which shows low reliability.

Discussion

The purpose of this study was to evaluate the psychometric properties of the Persian version of the TDAS among patients with CHD. The findings of the present study demonstrated that the TDAS reports 3 factors: fear of death due to illness, fear of facing death, and distress due to short time of life. Other studies in this field have reported conflicting results.[25] For example, Conte et al extracted 4 factors (fear of the unknown, fear of suffering, fear of loneliness, and fear of personal extinction) in participants which included students, senior-citizen-center attendees, and nursing home residents.[42] In another study, Tavakoli and Ahmadzadeh reported that the scale consisted of 5 factors: absolute DA, fear of pain, death-related thoughts, shortness of life, and fear of the future in university students.[11] Abdel-Khalek et al also reported 5 factors associated with the TDAS, however these were death-related thoughts, death-related pain, preoccupation with death, life shortness, and fear of the future among Egyptian students.[43] Similar to the present study, 2 other studies conducted on cancer patients and their caregivers found 3 factors: fear of death, worry and stress, and general concern about negative things (and fear to face death, bodily preoccupation with death, and fear of loss of life.[25,44] While most of these studies reported common factors consistent with the present findings (e.g., fear of death due to illness, fear of facing death, and distress due to short time of life), the differences noted between studies and specifically, the extracted latent factors, may be accounted for by the populations examined. Individuals' perceptions of death are expressed

Table 3. Three-Factor Solution by Exploratory Factor Analysis for the Persian Version of TDAS (n = 300)

Factor Name	Items	Loading	h^2	% Of Variance	Eigenvalues
Fear of death due to illness	Q_6: I am not particularly afraid of getting cancer	0.886	0.824		
	Q_{11}: I am really scared of having a heart attack	0.872	0.824	26.62	2.39
	Q_9: I fear dying a painful death	0.836	0.714		
Fear of facing death	Q_1: I am very much afraid to die	0.901	0.823		
	Q_5: I am not at all afraid to die	0.890	0.793	23.87	2.14
	Q_7: The thought of death never bothers me	0.644	0.543		
Distress due to short time of life	Q_8: I am often distressed by the way time flies so very rapidly	0.865	0.770		
	Q_{12}: I often think about how short life really is	0.806	0.704	17.61	1.58
	Q_2: The thought of death seldom enters my mine	0.328	0.137		

Items sorted according to loadings by factors and sizes for easier comprehension.
h^2: Extraction (final) communalities, Eigenvalues: prerotation column sums of squared loadings.

Table 4. Convergent and Discriminant Validity, Reliability Results (Fornell Larcker Criterion Table) of TDAS Factors

Factor	α	θ	Ω	CR	AVE	MSV	ASV
1. Fear of death due to illness	0.864	0.88	0.94	0.869	0.691	0.162	0.124
2. Fear of facing death	0.747	0.81	0.90	0.806	0.590	0.085	0.057
3. Distress due to short time of life	0.494	0.55	0.81	0.568	0.362	0.162	0.096

Mean (SD) of Cronbach α for overall scale scores: 44.61(11.24)
Abbreviations: CR, construct reliability; AVE, average variance extracted; MSV, maximum shared squared variance; ASV: average shared square variance.

consciously or unconsciously and are deeply influenced by the environment and past experiences as well as socio-cultural and philosophical belief systems.[21]

The first factor, fear of death due to illness, was best represented by the item Q_{11}, which reported a loading of 0.87. Lo et al also found that fear of death was one of the factors related to DA among patients with advanced terminal cancers. They stated that 45% of cancer patients had experienced fear of death.[45] In some cases, fear of death can be due to a limited understanding about the illness.[46] This fear may be due to the perceived possibility of experiencing a painful death.[47] In a health care context, DA is a central consideration for practice, including psychiatric care, community cancer screenings of healthy individuals, trauma care, acute and chronic care, and in individuals facing diagnosis of a life-threatening illness.[21] Moreover, factors such as the severity of disease, witnessing death of others, and separation from loved ones can heighten patients' death-related fear and anxiety.[48]

The second manifested factor was fear of facing death such as that represented in question number 1, which reported a loading of .90. Other studies have also reported fear of facing death.[49,50] Azaiza et al reported that fear of death is often due to a lack of knowledge.[46] Confronting death, mostly due to its inevitability, poses a unique psychological quandary for most individuals.[25] DA can be related to environmental factors and unpredictable situations, which affect death-related experiences. Life-threatening disease may also provoke death-related thoughts and fears, as the experience may consolidate the imminence of death, which can have a profound effect at a psychological level.[51]

The third factor of the TDAS found in the present study was distress due to short time of life, best represented by question number 12, which reported a loading of 0.80. Given the other items loaded on this factor, patients' worry and stress mostly appeared to relate to the rapid passage of time, shortness of life, imminent painful death, fear of the unknown, and despair. Lonetto et al also found time awareness to be one of the components of DA among Irish and Canadian students.[47] Tavakoli and Ahmadzadehand

Templer also reported that passage of time and shortness of life were among the dimensions of DA.[11,12]

A CFA model was used in order to determine the validity of the Persian version of the TDAS. It confirmed the final factor construct of the present scale. Chi-square goodness of fit test was almost significant in the sample size with more than 200 participants.[41] Thorson and Powell confirmed 4 factors using CFA.[13]

The present study used AVE, MSV, and ASV for assessment of convergent and discriminant validity. Convergent and discriminant validity were shown with construct fulfilled for the first and the second latent factors (fear of death due to illness, fear of facing death), however the results did not support the convergent and discriminant validity for the third latent factor. This result may be due to the low loading of one of the items in the third factor. Moreover, high measurement errors may be another explanation. The measurement model did not show how measurement items logically and systematically contribute to latent constructs.[52]

The study findings also indicated that the Cronbach α coefficient for the overall TDAS was acceptable. While Cronbach α and CR values for factors 1 and 2 were good, factor 3 showed a low composite reliability and internal consistency. Templer reported a test-retest correlation coefficient and an internal consistency coefficient of 0.83 and 0.76 for the scale.[12] Other studies reported reliability between 0.57 and 0.89.[11,21,53] Many factors can affect the reliability of a measurement instrument. For example, Cronbach α has been associated with the number of items and length of the test on a tool.[54]

The present study was subject to a number of limitations associated with the nature of self-report measurements. Common limitations such as whether participants answered questions truthfully or whether there was adequate understanding of items are common issues that are difficult to control in studies of this type. In addition, as with other studies that focus on one geographical region, generalizability of the findings may not be possible and these results should be interpreted with caution. Conducting future

studies that may assess and confirm the validity and the reliability of the TDAS in diverse and varied patient populations is recommended.

Implications for Practice

Principal components analysis found a 3-factor solution associated with the TDAS (labelled: fear of death due to illness, fear of facing death, and distress due to short time of life) which was supported by confirmatory analysis;

Reliability (using internal consistency and construct reliability) of the TDAS was greater than 0.70;

The overall findings of the study demonstrated that the TDAS is a valid and reliable instrument in patients with heart disease; and

According to the results of the present study, the researcher who may carry out a study on determining the psycometric properties of the TDAS in Iranian patients with CHD, can use it with confidence.

Conclusion

The present study found that the Persian version of the TDAS has a 3-factor structure and reports acceptable validity and reliability. It is believed that the Persian version of TDAS can contribute to research and practice in the fields of medicine and social sciences in improving how DA is assessed and managed across different clinical populations within Iran. Global contribution of this study is the offer of using the world literature and researchers in the other countries. Results found using Persian version of TDAS are available for use by other researchers. Researchers in other countries who study on the psycometric properties of TDAS will be able to compare their results with those of iranian patients.

Conflict of Interest Disclosures

The authors declare no potential conflict of interests with respect to the research, authorship, and/or publication of this article.

Ethical Approval

The study was approved by the Ethics Committee of Qazvin University of Medical Sciences (QUMS. REC.1394.11). Before signing an informed consent form, participants were informed on the aims and procedures of the study , and that participation was voluntary and would not affect their medical care. Patient confidentiality was assured through the de-identification of all personal data and the completion of study procedures in a quiet treatment area. To ensure that a broad cross-section of patients were able to participate in the study, a trained research assistant who was part of the study team provided support as needed.

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