ORIGINAL RESEARCH

An evaluation of the hierarchical factor structure of the Persian-translated death anxiety scale in nursing students of Iran

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ABSTRACT

Background/Objective: Clinical nurse educators globally have recognized the prominent necessity of evaluating for death anxiety in students, and adopting curriculum that provides education about death and dying. Reliable assessment tools are needed to evaluate death anxiety in the student population. The study evaluates the hierarchical factor structure of the Persian-translated Templer's Death Anxiety Scale (TDAS) in nursing students from Iran.

Methods: A repeated measures standard psychometric analysis was conducted. In total 400 undergraduate and graduate nursing students from a major university campus in Sari, Iran finished the Persian translated 15-item TDAS. Construct validity was assessed. Reliability was tested using Cronbach's Alpha (α), Theta (θ), and McDonald's Omega (Ω) coefficients.

Results: Exploratory factor analysis (N = 200) indicated the TDAS had two factors (Fear of loss of life; Fear to face death). Model fitness indicators confirmed two independent TDAS structure levels. The Cronbach's alpha, Theta, McDonald, and construct reliability were larger than .70.

Conclusions: Study outcomes corroborated acceptable psychometric properties and factor structure for the TDAS in a sample of Iranian nursing students. Findings suggest that the scale can be utilized for reliable and valid educational evaluation of death anxiety in Iranian nursing students.

Key Words: Psychometric, Templer's death anxiety scale, Death, Anxiety, Death education, Nursing students

1. INTRODUCTION

Death anxiety is an aversive psychological occurrence that commonly manifests in relation to the proximity of death or the perceived prospect of dying.[1] Clinical nurses are reminded of death by exposures to the suffering and death of patients they serve.[2] Such exposures often trigger death anxiety which may undermine effective emotional health and adaptive coping with such stressors if not addressed.[2, 3]

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Although a wide expansive literature has described the significance of death anxiety assessment across cultures, there remain challenges in nursing education given the lack of validated tools to evaluate the phenomenon in clinical environments.

Background and significance

Student nurses, recognized to be a group who are vulnerable to stress, have early encounters that may evoke death anxiety during clinical experiences, laboratory simulation, and in course didactic.[2, 3] Studies have indicated that mental health symptoms such as anxiety and depressive symptoms are significant in nursing students, factors that are also associated with stress and the presence of death anxiety.[4–6] Clinical nurse educators have recognized the importance of assessing for death anxiety, and adopting curriculum that provides education about death and dying.[7, 8] There is also an increasing emphasis on burnout and compassion fatigue, emotional exhaustion and reduced work-related motivation that occurs secondary to ongoing exposures to patients who are experiencing trauma and suffering, among clinicians and nursing students in the provision of care for patients facing life threatening illness.[9–11] Such research has recognized the impact of self-awareness and regulation in management of work-related stressors.[12] Although compassion fatigue and burnout are recognized as contributing to lowered professional quality of life and other negative outcomes, these outcomes have not been examined in relation to death anxiety.[13, 14]

Multiple factors may affect nurses' attitudes towards death. Such attitudes are often formed early in life as a result of socialization, cultural values, religious beliefs, personal death-related experiences, and spirituality.[15, 16] Death attitudes and personal attributes including age, gender and health circumstances also impact the development of death anxiety.[15, 16]

Valid and reliable methodologies to quantify death anxiety in global populations of relevance are essential. Templer was an early pioneer in the field of death anxiety research, contributing to a large body of work over the past several decades after development and validation of the Templer Death Anxiety scale (TDAS).[17] Given findings of strong psychometric properties following translation to non-English languages, the TDAS has been translated into Persian and undergone psychometric analysis in both clinical and nonclinical subgroups in the country of Iran.[18, 19] These groups included cancer patients, informal family cancer caregivers, and war veterans.[20, 21] This early psychometric evaluation provides a platform that established the TDAS as a satisfactory measure to examine potential death anxiety.

Although death anxiety is of strong clinical importance, currently there are few measures to evaluate death anxiety in Iranian nursing students and clinical staff. The availability of death anxiety assessment tools is critical for evaluating the effectiveness of death education curriculum, mental health programs, and targeting interventions.[2] Considering the limited availability of valid and standard instruments in the country of Iran, the focus of the study is to determine the hierarchical factor structure and conceptual underpinnings relative to the Persian version of the TDAS in Iranian nursing students. The hierarchical factor structure refers to the organization of levels including primary, secondary, and tertiary factors of interest that are derived via factor loadings of clustered items and correlation matrices to achieve a coherent interpretation of a construct of interest.

2. METHODS

2.1 Design

We gleaned our sample size determinants from two sources. Plichta and Kelvin[22] suggested that a minimum sample size for factor analysis should be between five to ten times the instrument item numbers. MacCallum and Widaman[23] on the other hand, determined that the sample size should be at least 200 cases. In this study, a total of 400 nursing students from Sari, Iran were thus recruited over a two-month span from April through May 2016. Required inclusion criteria were: (i) ability to read and write in the Persian language, (ii) absence of co-morbid psychiatric problems (such as diagnosis of schizophrenia, post-traumatic stress or other anxiety disorders, dementia, or depression) and (iii) absence of physical problems such as symptoms that could restrict research engagement. Rationales for barring nursing students who reported histories of clinical depression and/or anxiety disorders were to safeguard that participants were free of mental health limitations that potentially would contribute to the manifestation of death anxiety. Participants were also excluded if they reported addiction disorders to substances such as alcohol or other drugs.

The students completed a baseline demographic questionnaire that ascertained information about age, sex, and other factors. The TDAS was completed at baseline and was repeated two weeks later. Before translation of the TDAS into Persian, authorization to conduct this research was derived.[24] The World Health Organization recommendations were utilized for instrument translation.[25] The TDAS incorporates 15 items that are calculated utilizing a five-point Likert format (1 = completely disagree); (5 = completely agree).

2.2 Evaluation of construct validity

The factor structure of the Persian TDAS was evaluated by completing a principal axis factoring exploratory factor analysis (EFA) followed by a Promax rotation with SPSS 22 (SPSS Inc., Chicago, IL, USA) to determine construct validity. The Kaiser-Meyer-Olkin (KMO) test and the Bartlett's test of sphericity were utilized for assessing sample suitability with the factor analytic model. Factor numbers were decided with attention to both eigenvalues with the scree plots. If the absolute loading values of individual items were .3 or greater, they were determined to be appropriate. Any eigenvalues that were less than one remained disregarded.[26]

The factor structure obtained from the EFA were subsequently evaluated by utilizing confirmatory factor analysis (CFA) utilizing AMOS 19. In line with experts' recommendations, the Adjusted Goodness of Fit Index (AGFI), χ^2 goodness-of-fit index (GFI), Normed fit index (NFI), Tucker-Lewis index(TLI), Root Mean Square Error of Approximation (RMSEA), Parsimonious Comparative Fit Index (PCFI), and the chi-square were separated with degrees of freedom values (χ^2/df).[27]

For second-order factor analysis, it is presumed that extracted latent variables in the first stage are indicators of a different conceptual level. Thus, second-order factor analyses can represent concepts that are more general at upper levels.[28] Some studies indicated that the TDAS displays components of the more general concept.[29, 30] Moreover, extracted dimensions of the death anxiety construct express the more common general concepts of this scale. Therefore, a second-order CFA was performed after the first-order factor analysis.

Convergent validity was evaluated by approximating Average Variance Extracted (AVE) and construct reliability. To institute convergent validity, the constructs AVE must surpass .5 and also be lower than the construct reliability.[31–34]

2.3 Reliability evaluation

The reliability of the Persian TDAS was first evaluated by assessment of internal consistency and by computing the Cronbach's alpha (α), McDonald Omega (Ω) and Theta (θ), Cronbach's alpha is a measure of internal consistency, that refers to how closely a set of items are related as a whole. Thus, it is a measure of scale reliability. McDonald's is also a reliability coefficient that is similar to Cronbach's Alpha. However, a main advantage of Omega,compared to Cronbach's alpha, is that it adds the advantage of taking into account the strength of association between items in an instrument when conducting factor analysis. Theta is also essential in the process of determining reliability given an essential role of evaluating factors in descending order given variance

in the specific scale construction. Coefficients for total concurrence of discrete items and domains.[34] It was found that Omega provided the highest estimate of reliability.[35] Reliability of .7 or higher demonstrates internal consistency that is acceptable.[36] Given relevant indicators were satisfactory, construct reliability of the factors were then tested with values between .6 and .7 deemed acceptable.[37, 38] Intra-class correlation coefficients (ICC) were used to determine the test–retest reliability of the TDAS across a period of two weeks using a two-way mixed ICC for complete agreement at the level of individual items. The findings were interpreted as follows: 0-.20 as low, .21-.40 as fair, .41-.60 as moderate, .61-.80 as substantial, and .81-1.0 as excellent.[39]

2.4 Multivariate normality and outliers

We checked for outliers, skewness, and kurtosis utilizing univariate distributions. Multivariate distributions were tested for normality and multivariate outliers.[40] Multivariate normality is often assessed by utilization of Mardia's coefficient for kurtosis. Mardia's coefficients larger than 8 were used as a normal distribution deviation indicator.[27] The Mahalanobis distance was used to assess for multivariate outliers.[41] Such outliers were calculated by distances with a $p < .001$.[42]

2.5 Ethical matters

The study was granted approval by the appropriate Medical Sciences Ethics Committee (Ethics Code: IR.MAZUMS.REC 96.122). All nursing students who participated were educated about the study aims, procedures, and its voluntary nature. Informed signed consent was then obtained from all participants. Confidentiality of survey data was maintained by assignation of a coded number to de-identify volunteers.

3. RESULTS

3.1 Demographic data

Socio-demographic data from the study sample are displayed in Table 1. As depicted, participants were composed of 92 (23%) males, 308 (77%) females, with age means of 21.9 (SD = 3.58), who were mostly Bachelor of Science students (n = 336, 84%). The demographics Omega are reflective of the socio-demographic profile of university nursing students in Iran.

3.2 Construct validity

Table 2 depicts findings from executing the principal axis factoring EFA of the TDAS. The KMO was .853, and the Bartlett's sphericity tests were significant ($p < .001$, 940.312, df = 66) indicating sufficient sampling. A scree plot, depicted in Figure 1 evaluated factors with eigenvalue larger than one,

and EFA extracted two factors entailing 15 items together that explained 60.164% of the variance. All items had factor loadings larger than .4.

Table 1. Socio-demographic profiles of the participants

Characteristic	n (%)
Sex	
Male	92 (23)
Female	308 (77)
Educational Status	
BSN student	336 (84)
Master's student	64 (16)
Marital status	
Single	386 (96.5)
Married	14 (3.5)
Residence	
Urban area	165 (41.2)
Small town	186 (46.5)
Rural	49 (12.3)
Employment status	
Full time	12 (3)
Part time	26 (6.5)
Not employed	362 (90.5)
Characteristic	Mean (SD)
Age	21.9 (3.58)

Next, in the first-order confirmatory factor analysis, the factor structure derived with EFA was tested for validation utilizing maximum likelihood CFA. Given modification indexes, one pair of measurement errors (items 9; 11) were permitted to

co-vary. Figure 2 depicts the final model following studying modification parameters for sources of model misfits. The findings from performing CFA on the TDAS specified as a two factors comprising of 15 items suggesting a good fit (χ^2 (179, N = 200) = 111.387, $p < .001$; χ^2/df = 2.652, GFI = .906, AGFI = .852, NFI = .877, Comparative Fit Index = .919, TLI = .894, Incremental Fit Index = .920, Root Mean Square Residual = .093 and RMSEA = .091(90% CI= .071–.112)).
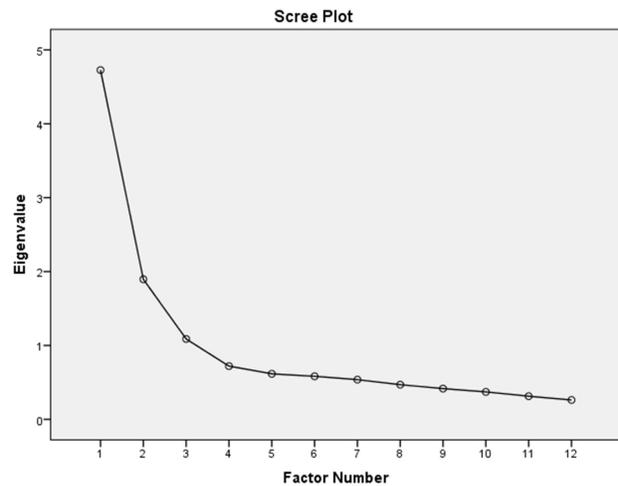

Figure 1. Scree plot for the exploratory factor analysis (EFA) of the death anxiety scale (DAS)

Table 2. Factor analysis for the Persian version of death anxiety scale in Iranian nursing students

Factors name	Items	Loading	*h^2	% of Variance	Eigenvalues
Fear of loss of life	Q10. The subject of life after death troubles me greatly	.842	.642	32.583	3.854
	Q9. I fear dying a painful death	.837	.630		
	Q12. I often think about how short life really is	.756	.506		
	Q11. I am really scared of having a heart attack	.703	.499		
	Q15. I feel that the future holds nothing for me to fear	.588	.498		
	Q7. The thought of death never bothers me	.500	.554		
	Q8. I am often distressed by the way time flies so rapidly	.461	.371		
Fear to face death	Q5. I am not at all afraid to die	-.763	.494	27.581	3.034
	Q1. I am too afraid to die	.694	.639		
	Q3. It doesn't make me nervous when people talk about death	.660	.602		
	Q4. I dread to think about being compelled to have an operation	.646	.310		

* h^2: Communalities

The factors of TDAS were assessed separately after completing the first-order CFA. The second-order CFA was used to assess whether all the factors are placed in the general context of the TDAS. The fitness indexes of the second-order CFA in comparison with the pre and after modification of the first-order CFA are shown in Table 3. Figure 3 shows the structural model of TDAS with the standardized coefficients loading factor.

3.3 Reliability

Cronbach's alpha, Theta, McDonald Omega, and construct reliability of Factor 1 and Factor 2 demonstrated good reliability and internal consistency for both factors (see Table 4). The average measure ICC was .785 with a 95% confidence interval between .739 to .826 (F (200) = 17.722, $p < .001$). Further, the findings demonstrated that the construct AVE surpassed .5 and the construct reliability was larger than

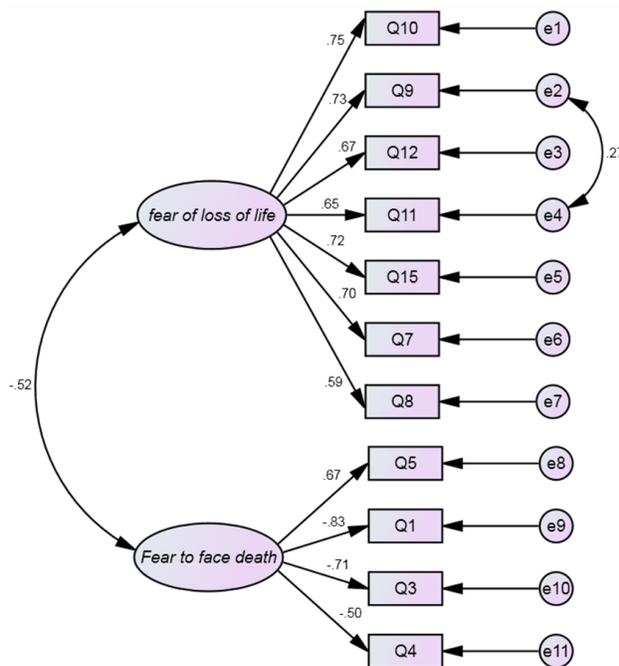its AVE, satisfying the necessary parameters of convergent
validity.

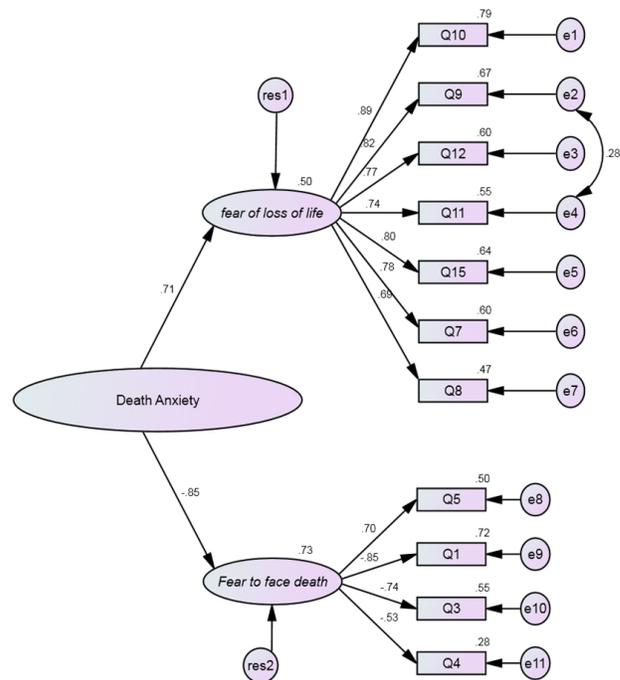**Figure 2.** The final model of the first order death anxiety
factor model

Figure 3. The final model of the second order death anxiety
factor model

Table 3. Model Fitness Indices of the first and second order CFA

Index CFA	χ^2	df	p-value	CMIN/DF	RMSEA	PCFI	PNFI	AGFI	IFI	CFI
First order	111.387	42	< .001	2.652	.091	.694	.660	.852	.920	.919
Second order	97.986	41	< .001	2.390	.083	.696	.665	.873	.934	.933

Note. Acceptable Index: Root Mean Square Error of Approximation (RMSEA) (>.08); Parsimonious Comparative Fit Index (PCFI), PNFI (>.5);
Adjusted Goodness of Fit Index (AGFI), Incremental Fit Index (IFI), Comparative Fit Index [CFI (>.9)]; and Comparative Minimum/Degrees of
Freedom [CMIN/DF (>3 = good, >5 = acceptable)].

Table 4. Construct validity and reliability results and the
fornell larcker criterion

	α	θ	Ω	CR	AVE
Factor 1: fear of loss of life	.865	.888	.788	.883	.678
Factor 2: Fear to face death	.605	.893	.758	768	.698

Note. α: Cronbach's alpha coefficients, θ: Theta Coefficient, Ω: McDonald's
Omega Coefficient, CR: Construct reliability, AVE: Average variance extracted

4. DISCUSSION

Although death anxiety is recognized to be an important con-
cept that affects nurses who are faced with death encounters
in the workplace, there are limited assessment strategies to
measure this phenomenon in Iranian nursing students. Thus,
the current inquiry focused on evaluating validity and relia-
bility of the TDAS with a sample of Iranian nursing students.
The results revealed the TDAS to have a two-factor structure

that included 'fear of loss of life' and 'fear of facing death'.
These two factors explained a significant share (47.59%) of
the total variance. Psychometric methodology researchers
have stated that the extraction of factors is suitable when the
explained variance falls within the range of 50% to 60% in
psychometric analysis.[37] Our study differs from previous
studies in terms of the number of factors extracted, the dis-
tinctive nature of the sample selection, and the unique study
environment.[19, 21]

Researchers have reported that fear of loss of life amongst
the factors affecting death anxiety in other samples including
caregivers of cancer patients.[21] Such fears relative to loss of
life are often activated by personal encounters with patients
facing life threatening illnesses. Cognitions associated with
death and the anxious preoccupations that follow are com-
mon in all societies and cultures, but culturally diverse social

and religious institutions manage this awareness in varied modes.[6] Further, it is recognized that cultural, cognitive, and emotional factors contribute to an individual's attitude towards death.[3] Unique personal and environmental factors may stimulate thoughts of death, and fear and anxiety can arise from the psychological impact.[20]

In this study, after the removal of outlier data, weak markers, and evaluation of the natural data distribution, the fitness of structural factors of the TDAS were assessed and the most common indicators of the model fit were evaluated. The model fit results were tested for all indicators and the item factor loadings were larger than 0.4 ranges, indicating that they had a minimum of acceptable loading factors. Therefore, conferring findings from the confirmatory factor analysis, the observed indices were corroborated and fit indices had solid standard levels. Although many studies used EFA for validating TDAS, this research used CFA in validating the scale. In the final TDAS model, there were correlations noted between the measurement errors of items 9 and 11. Correlated measurement errors may occur in circumstances where variables cannot be identified plainly or measured exactly, which in turn affects item responses. The type of measurement, such as self-reported assessment, may contribute to such error.[43] For example, measurement errors can result from similar meanings of words and phrases in positively and negatively toned declarations.[41] Based on feedback attained from the participants in this study, the structure of these two TDAS items may have similar meaning and/or underlying concepts contributing to the considerable measurement error.

A second-order confirmatory factor analysis was done utilizing structural equation modeling to achieve accuracy by extracting the meaningful data.[42] With this methodology it is assumed that latent variables in the shared variance are due to one or higher order factors and the construct contains two levels.[28] Structural equation modeling is the most appropriate approach to investigate this structure due to its ability to

represent and introduce the first-level structures as latent variables. Final model TDAS structures had suitable convergent and divergent validity. With convergent validity, the items of the intended structure are proximal sharing variance with each other. With divergent validity, intended structure or hidden factor items are removed entirely.[37] In the current study, the TDAS instrument reliability was suitable as evidenced by the high Cronbach's alpha demonstrating scale internal consistency. TDAS reliabilities using Cronbach's alpha has been reported in several studies from 0.73 to 0.89.[44–46] Other research[45] tested the reliability of this scale utilizing ICC and "split-half" methodology which were reported to be 0.87 and 0.59, and 0.57.[47] Construct reliability was also demonstrated to be satisfactory in the study.

5. CONCLUSIONS

In Iran, there are distinct geographical areas that vary significantly in sociocultural norms. Hence, it is essential that studies evaluating the Persian version of TDAS are replicated in other Iranian nursing student samples. It is recognized that death anxiety can be a significant factor that impacts mental health in nursing students and practicing nurses. The study determined satisfactory measurement properties with the TDAS factor structure for a sample composed of nursing students from Iran. Although continuing research is recommended, the scale can be utilized as an effective dependable instrument for assessing nursing student death anxiety in Iranian samples. The TDAS is recognized to be a valid instrument in other international nursing groups.[46] This study adds to a growing body of nursing literature that has evaluated this measure in global populations.

CONFLICTS OF INTEREST DISCLOSURE

The author declares that there is no conflict of interest.

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