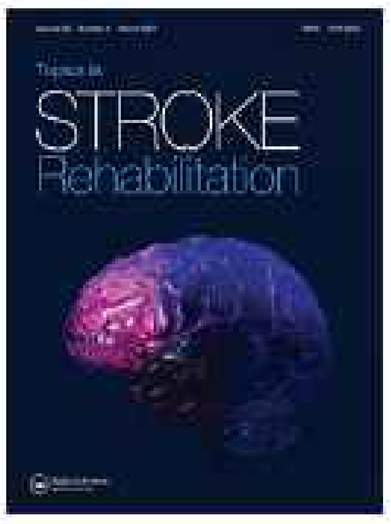

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ARTICLE

Cross-cultural adaptation and validation of the Persian version of the Preparedness Assessment for the Transition Home After Stroke instrument: a methodological study

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ABSTRACT

Background: The successful transition of stroke patients from hospital to home relies on the preparedness of caregivers. Assessing this preparedness is crucial, but existing tools need adaptation and validation for Iranian caregivers.

Objectives: This study aimed to translate, culturally adapt, and validate the Persian version of the "Preparedness Assessment for the Transition Home After Stroke" (PATH-s) for use among Iranian caregivers of stroke survivors. It also assessed the association of patient and caregivers' characteristic association with the final PATH score.

Methods: The PATH-s was translated and culturally adapted using the Backward-Forward translation method and expert consultations. Face and content validity were ensured through input from both caregivers and experts. Participants were recruited from two referral hospitals in Tehran, Iran. The sample consisted of 386 caregivers, 74.4% female with a mean age of 47.18 years (SD = 12.2). Construct validity was assessed using Exploratory and Confirmatory Factor Analyses (EFA and CFA). Convergent validity was evaluated through the correlation with Zarit Burden Interview scores. Reliability was tested through internal consistency (Cronbach's alpha) and test-retest reliability (Intraclass Correlation Coefficient, ICC).

Results: The factor analysis revealed a seven-factor structure with robust fit indices (CFI = 0.92, TLI = 0.90, RMSEA = 0.068, SRMR = 0.074). Convergent validity was supported by a significant negative correlation with the Zarit Burden Interview ($r = -0.27$, $p < 0.001$). Reliability analysis showed good internal consistency (Cronbach's alpha = 0.84) and excellent test-retest reliability (ICC = 0.96).

Conclusions: The Persian version of PATH-s is a valid and reliable tool for assessing caregiver preparedness in Iran. Its use can improve patient outcomes and caregiver support during hospital-to-home transitions.

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Caregivers; stroke; transition home; psychometric; translation

1. Introduction

Stroke is one of the most common neurological diseases in the world, imposing numerous disabilities on patients.[1] The World Health Organization (WHO) reports that the effects of stroke disrupt the structure and function of the body,[2] with impaired mobility, motor problems, and reduced muscle strength being the major clinical manifestations of this disease.[3] According to studies, by 2030, stroke will be recognized as the second leading cause of death in the world and will increase more sharply in developing countries.[4] According to reported statistics, the prevalence of stroke in Iran is higher than in developed countries.[5]

Mobility limitations caused by stroke result in a reduced ability of individuals to perform daily activities such as dressing, bathing, and walking.[6] Given that these patients suffer from physical and functional impairments after a stroke, a caregiver, who can be a spouse, parent, child, etc., often takes on the responsibility of caring of them.[7] Caregivers often face the dual challenge of providing safe care for stroke survivors while managing multiple

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household responsibilities and personal obligations. Assessing these dimensions of caregiving is crucial for identifying gaps and providing targeted support.[8] According to conducted research, it has been shown that family caregivers of stroke survivors not only do not receive adequate support for the transition from hospital to home, but their overall needs, including educational ones, are also not well identified. As a result, the necessary support and training are not provided in a targeted manner, leading to a new crisis for both the caregivers and the stroke patients.[9,10] In a study conducted by Lutz and colleagues in 2017 to identify the needs of caregivers of stroke patients, it was shown that caregivers and stroke survivors face major challenges at three stages: the stroke crisis, recovery expectations, and the discharge crisis.[8] These challenges are especially evident during the discharge process, where caregivers may not fully understand the responsibilities they will undertake, and are often underprepared for the tasks they must perform at home. This is where targeted support becomes critical.[11]

Evaluating the readiness of caregivers at different stages of care necessitates assessing their needs and skills. This assessment can bring about improvements in the care process, reduce secondary risks, and enhance the quality of care.[12] However, many caregivers lack the necessary preparation and understanding of their roles, which can lead to increased stress, burnout, and inadequate care, thereby negatively impacting both the caregiver and the stroke survivor.[13]

There are various tools available to assess the needs and readiness of caregivers of patients, one of which is the Caregiver Preparedness Scale (PCS). This tool was designed by Archbold in 1990 to evaluate the readiness of caregivers of elderly patients.[14] The Farsi version of the Caregiver Preparedness Scale has been psychometrically validated in Iran, specifically for family caregivers of older adults undergoing hemodialysis.[15] However, this tool is not specifically designed for stroke patients and does not assess important factors such as the commitment and capacity of caregivers for stroke patients.[10,16]

In 2018, Michelle Camici and colleagues designed a specialized tool for caregivers of stroke patients called the "Preparedness Assessment for the Transition Home After Stroke" (PATH-s). This questionnaire is a clinical self-report tool aimed at assessing the readiness and needs of caregivers of stroke patients before discharge. The PATH-s tool helps caregivers of stroke patients identify potential issues and concerns regarding their caregiving role and provides insights and prompts for addressing these concerns before discharge. Additionally, caregiver-patient interactions provide crucial qualitative data that reflect the dynamics of caregiving relationships. These interactions enrich the evaluation of caregiver preparedness by revealing aspects such as emotional support, commitment, and access to resources, which are critical for tailoring targeted interventions. The items in PATH-s are rated on a four-point ordinal scale, with four indicating the highest level of preparedness. Given the challenges that caregivers often face, particularly the lack of readiness and understanding of their caregiving role, this tool plays a crucial role in identifying gaps in caregiver preparedness and can be used to guide targeted interventions, such as training and educational programs, to improve their readiness.[9,10] There is a need for such a tool while having a psychometrically sound tool would facilitate better assessment and support for these caregivers in the Persian-speaking community.

Considering the crucial role of family caregivers in the recovery of stroke patients through home care, and the importance of ensuring their readiness to provide this care, this study aimed to culturally adapt and evaluate the psychometric properties of the Persian version of the Preparedness Assessment for the Transition Home After Stroke (PATH-s) instrument. If this instrument demonstrates satisfactory psychometric properties, it can be effectively utilized in research and practice within Persian-speaking communities, offering a better understanding of the preparedness of caregivers and improving the quality of care for stroke survivors in the home setting.

2. Methods

2.1. Study design

This methodological study was conducted from January to April 2024. The tool was translated and validated through stages including face

validity, content validity, and construct validity using EFA and CFA. Reliability was assessed through internal consistency and test-retest reliability. The psychometric properties of the PATH-s Instrument were assessed using the criteria COSMIN (Consensus-based Standards for the Selection of Health Measurement Instruments.

2.2. Study population and sampling

Sampling was carried out in two referral hospitals for stroke patients affiliated to two Universities of Medical Sciences in Tehran, capital city of Iran. Family caregivers of patients with a definitive diagnosis of first-time stroke, who were scheduled for discharge and transfer home, were selected through convenience sampling. The inclusion criteria for caregivers were: 1) aged 18 years or older, and 2) literate in reading and writing in Persian. Recruitment continued until the desired sample size was reached. To ensure data integrity, caregivers who submitted incomplete questionnaires were excluded from the analysis. Two general recommendations exist regarding the minimum sample size required for conducting Exploratory Factor Analysis (EFA) as well as Confirmatory Factor Analysis (CFA). The first recommendation underscores the importance of the absolute number of cases (N), while the second focuses on the subject-to-variable ratio (p). According to Guilford,[17] N should not be less than 200. Additionally, MacCallum et al.[18] suggested that the subject-to-variable ratio should be at least 5. In this study, a total of 386 caregivers of stroke patients participated.

2.3. Measurements

The data collection tools included a demographic information questionnaire, the Preparedness Assessment for the Transition Home After Stroke Instrument, and the Zarit Burden Interview questionnaire.

2.3.1. Demographic information questionnaire

This questionnaire consists of two parts: one for caregivers of stroke survivors and the other for stroke patients. The caregiver section collects data on age, gender, marital status, employment status, income adequacy, education level, and the type of relationship with the patient. The patient section gathers information on age, gender, type of stroke, and the duration since the onset of the disease.

2.3.2. Preparedness Assessment for the Transition Home After Stroke Instrument (PATH-s)

This questionnaire was developed in 2018 by Michelle Camicia and colleagues in the United States. The PATH-s was designed to be used as an assessment tool for caregivers of stroke survivors before their discharge from healthcare or rehabilitation centers, before they assume the caregiving role. This questionnaire comprises 25 items, which are presented to caregivers of stroke patients in a four-option format. The items in this tool are rated on a four-point ordinal scale from 1 to 4, with 4 indicating the highest level of caregiver preparedness. The overall score is calculated by summing the responses and dividing by the number of items answered. Scores below two on any item indicate that the caregiver has insufficient information or knowledge in that area, signaling a need for intervention or education. Exploratory factor analysis revealed eight underlying factors including long-term implications: prognosis and insight, commitment: willingness, capacity: formal and informal resources, capacity: pre-stroke caregiver experience, capacity: preexisting health problems, capacity: home and transportation accessibility, social context: commitment (strength of relationship), and capacity (pre-stroke roles/responsibilities and ability to sustain). Its internal consistency reliability using Cronbach's alpha, was found to be 0.90.[10]

2.3.3. Zarit Burden Interview scale

The Zarit Burden Interview (ZBI) was developed by Zarit and colleagues in 1980 to assess caregiver burden. This scale comprises 22 items and measures physical health, mental health, social activities, financial status of the caregiver, and the relationship between the caregiver and the patient. The construct validity of the items was confirmed through factor analysis. Each question is rated on a 5-point Likert scale ranging from "never" (0) to "almost always,"[4] resulting in a total score ranging from 0 to 88. Higher scores on this tool indicate higher caregiver burden, with scores of 0–21

indicating little or no burden, 22–40 indicating mild to moderate burden, 41–60 indicating moderate to severe burden, and 61–88 indicating severe burden.[19] This instrument has been psychometrically validated in Iran by Haghshenas and colleagues, with an internal consistency reliability (Cronbach's alpha) of 0.88 and an ICC estimate of 0.88 in this study.[20] For our research, the alpha was found to be an impressive 0.89, underscoring the reliability and precision of our findings.

2.4. Translation of the PATH-s

After obtaining permission of Dr. Michelle Camicia, the scale was translated using the standard Backward-Forward method.[21] Initially, two translators proficient in both Persian and English independently and simultaneously translated the scale from English to Persian. In the next step, these translations were compared and integrated into a combined version to identify discrepancies. This integrated version was then reviewed by a group of specialists consisting of two psychometric experts, two nursing professors, and a neurologist based on their feedback.

In the third stage, the resulting Persian version, produced by two different translators proficient in both languages (distinct from the initial phase translators), was translated back into English to complete the Persian to English translation process. In the fourth stage, the two English translations were compared, and any differences were resolved by experts, resulting in the final translation. Following this, the final version was evaluated for formal and content validity.

2.5. Face validity

Face validity evaluates how well a measurement method appears to measure the intended construct.[22] To qualitatively assess face validity, 10 caregivers of stroke survivors were invited to evaluate the clarity of phrases and words, the coherence and relevance of items, and potential ambiguities.

2.6. Content validity

Content validity assesses how well a set of scale items corresponds to the relevant content domain of the intended construct.[22] A qualitative assessment of content validity as well as cultural adaptation of the questionnaire was conducted by a panel consisting of two nursing professors, two statisticians with expertise in psychometric topics, and a neurologist. They provided feedback on item placement, word choice, adherence to grammar, and accuracy of scoring for both the scale and its instructions. This feedback informed any necessary adjustments to ensure the validity of the scale. The panelists also reviewed the items for cultural relevance and appropriateness, making adjustments as needed to align with the cultural context of Iranian caregivers.

2.7. Construct validity

For the following analysis and graphical representations MPLUS (Program Copyright © 1998–2017 Muthén & Muthén Version 8) and SPSS Version 24 were used. To assess the construct validity, both CFA and EFA were employed. Initially, CFA was conducted on the entire sample of 386 participants to test the fit of the hypothesized factor structure. The fit of the model was evaluated using several indices, including Chi-square, Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), and Standardized Root Mean Square Residual (SRMR), with criteria for a good fit set as, among others.

If the CFA results indicated a poor fit, an EFA was conducted[23] on a randomly selected subset of 186 participants. Before conducting EFA, the Kaiser-Meyer-Olkin (KMO) test was conducted to assess the adequacy of sampling for factor analysis, and Bartlett's test was performed to explore if the items of the questionnaires were related to each other. This analysis was carried out using SPSS Version 24. EFA was performed using Principal Component Analysis (PCA) with varimax rotation. Scree plots and parallel analysis were used to determine the number of factors to extract. Factors were retained based on the slope of the scree plot and eigenvalues greater than 1. Items with loadings greater than 0.4 were retained. Data from caregiver-patient interactions, captured through the PATH-s instrument, were utilized in the factor analyses. These interactions provided insights into key domains such as caregiver willingness, prior

experience, and support networks, which were instrumental in confirming the construct validity of the tool. The relationships between these domains, caregiver characteristics, and patient outcomes were also explored to ensure the tool's relevance in the Iranian cultural context. Based on the EFA results, a model of the factors and their associated items was drawn and tested using CFA.

CFA was performed on another sample of 200 participants. The CFA, conducted using MPLUS software, evaluated model fit based on CFI, TLI, SRMR, and RMSEA, with cutoff points of > 0.90, >0.90, <0.08, and < 0.06, respectively. The standardized beta coefficients and a p-value of 0.05 were used for reporting factor loadings. This confirmatory analysis was conducted to ensure that the factor structure identified in the EFA was robust and applicable to the broader population. Associations between patient and caregiver characteristics and the PATH final score were examined using a multivariable linear regression model.

2.8. Convergent validity

Convergent validity was checked by testing the correlation between the Zarit Burden Interview scale (ZBI) and the PATH-s total scores using the Pearson statistical method. The ZBI total score was calculated by summing all of the items, with a higher score indicating a higher burden of caregiving.

2.9. Reliability

Reliability was tested in terms of internal consistency using Cronbach's alpha coefficients for the total scale and sub-scales. Using test-retest approach to assess the stability of the scores over a two-week period, a group of 20 caregivers of stroke patients were examined. Their scores from both sessions were analyzed to determine test-retest reliability, and the Intraclass Correlation Coefficient (ICC) was calculated to quantify the consistency of the measurements.

2.10. Ethical considerations

The current study emanates from a master's thesis in nursing, which received evaluation and approval from the research ethics committee of Shahid Beheshti University of Medical Sciences under ethics code: IR.SBMU.PHARMACY.REC.1402.107. Permissions were obtained from relevant authorities at the research sites and from the original scale developer. Caregivers were comprehensively informed about the study objectives, their right to withdraw from participation, and the confidentiality of their data. Informed consent was obtained from all participants.

3. Results

3.1. Characteristics of the participants

A total of 420 caregivers were approached, of whom 386 met the inclusion criteria and completed the questionnaires. The caregivers were 74% females, had mean age of 47.18 years (SD = 12.2) and were mostly the children of the patients (63.2). (Table 1).

3.2. Face and content validity

In order to enhance readability and expedite questionnaire completion, we revised the response options to make them shorter and clearer. Specifically, we removed redundant phrases that repeated the content of the question. For example,

Table 1. Population characteristics.

Characteristics of the caregivers and patients		N (%)
Relation with the Patient	Spouse	83 (21.5)
	Child	244 (63.2)
	Sister or Brother	59 (15.3)
Sex	Male	99 (25.6)
	Female	287 (74.4)
Marital status	Single	78 (20.2)
	Married	308 (79.8)
Education	High school	88 (22.8)
	Diploma	159 (41.2)
	2 years College degree	14 (3.6)
	Bachelor	98 (25.4)
	Master	24 (6.2)
	PhD	3 (0.8)
Employment	Unemployed	228 (59.1)
	Employed	158 (40.9)
Perceived family income	Sufficient	201 (52.1)
	Insufficient	185 (47.9)
Patients gender	Male	184 (47.7)
	Female	202 (52.3)
Patients stroke type	Hemorrhagic	59 (15.3)
	Ischemic	327 (84.7)
		Mean (SD)
Age	Caregivers	47.1(12.2)
	Patients	65[11]
Day of onset of illness	In days	8.8 (4.7)

in the question "*How much do you understand about the stroke survivor's expected recovery over the next 6 months?*," the original response options included repetitive text such as "*about the stroke survivor's expected recovery over the next 6 months.*" These were simplified to "No understanding," "little understanding," "Some understanding," and "A lot of understanding." This adjustment preserved the original meaning while improving clarity and conciseness. The revised version was subsequently sent to the original author of the questionnaire, who reviewed and approved the changes. After modification, participants took an average of 8 minutes to complete the questionnaire.

3.3. Construct validity

To evaluate the construct validity of our measurement model, we initially conducted a CFA. The fit indices indicated that the model was unsuitable, with the following results: χ^2 (df = 247) = 1125.22, $p < 0.001$; RMSEA = 0.096; CFI = 0.87; TLI = 0.84; SRMR = 0.10.

Subsequently, we performed an EFA on a randomly selected sample of 186 participants. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.750 and Bartlett's test of sphericity was significant, χ^2 (300) = 3455.908, $p < 0.001$.

The initial EFA, guided by the scree plot and parallel analysis, suggested an eight-factor solution. However, item 18 exhibited a negative relationship with other items and factor 8. Additionally, item 18 was conceptually inconsistent with reverse coding and did not load on any factor. Item 24 also stood alone in factor eight. Therefore, by removing items 18 (*How concerned are you about your ability to continue providing care for the stroke survivor for the next year?*) and 24 (*Thinking over the past year, how much conflict have you had in your relationship with the stroke survivor?*), the EFA revealed a seven-factor solution, accounting for 72.5% of the total variance (Table 2).

The factor loadings revealed a clear structure, with items loading above 0.4 on a single factor. The rotated factor loadings are detailed in Table 3. Items clustered into seven distinct factors, with only two cross-loadings observed. Based on the items loaded on the factors, we named the factors as follows: Factor 1 - Commitment: Willingness; Factor 2 - Post-stroke Financial and Accessibility Preparedness; Factor 3 - Long-term Implications: Prognosis and Insight; Factor 4 - Patient Support Network and Accessibility; Factor 5 - Preexisting Health Problems; Factor 6- Pre-stroke Caregiver Experience; and Factor 7 - Role and responsibility.

Table 2. EFA, exploring the number of factors and total variance explained.

	Initial Eigenvalues			Rotation sums of squared loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.283	25.132	25.132	3.474	13.896	13.896
2	2.992	11.969	37.102	3.017	12.068	25.964
3	2.582	10.327	47.428	2.963	11.854	37.818
4	1.998	7.992	55.420	2.720	10.881	48.698
5	1.871	7.485	62.906	2.141	8.563	57.261
6	1.504	6.016	68.922	2.088	8.353	65.614
7	1.184	4.737	73.659	1.684	6.735	72.349
8	1.065	4.260	77.919	1.392	5.570	77.919
9	.802	3.210	81.129			
10	.616	2.463	83.592			
11	.591	2.365	85.957			
12	.569	2.275	88.232			
13	.463	1.854	90.086			
14	.401	1.605	91.691			
15	.355	1.420	93.111			
16	.292	1.166	94.277			
17	.289	1.155	95.432			
18	.262	1.048	96.480			
19	.228	.912	97.392			
20	.212	.847	98.239			
21	.193	.770	99.009			
22	.134	.537	99.546			
23	.066	.265	99.811			
24	.035	.141	99.952			
25	.012	.048	100.000			

Extraction Method: Principal Component Analysis.

Table 3. EFA rotated component Matrix[a].

	Component							
	1	2	3	4	5	6	7	8
A1: Understand expected recovery			.835					
A2: Understand stroke effect on lives			.799					
A3: Understand things to get ready			.858					
A4: Understand assistance needed			.741					
A5: Experience helping with personal care						.957		
A6: Mentally prepared	.817							
A7: Willing to help with daily activities	.762							
A8: Time to provide personal care	.829							
A9: Physical or mental health problems					.911			
A10: Health problem interfere with caregiver role					.926			
A11: Family/friends capable to help with care				.902				
A12: Family/friends available to help with care				.824				
A13: Other roles and responsibilities							.854	
A14: Other roles impact availability							.859	
A15: Other people to help with responsibilities				.864				
A16: Experience helping with daily activities						.952		
A17: Willing to provide personal care	.736							
A18: Prepared to assist with personal care								−.812
A19: Money for home items not covered		.533				.496		
A20: Accessibility problems in home		.876						
A21: Need to make changes to home		.948						
A22: Money for home modification		.897						
A23: Patient access to transportation					.427			
A24: Existence of conflict with the patient during the last year								.726
A25: Concern with ability to continue caregiver role	.837							

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax without Kaiser Normalization.

a. Rotation converged in 6 iterations.

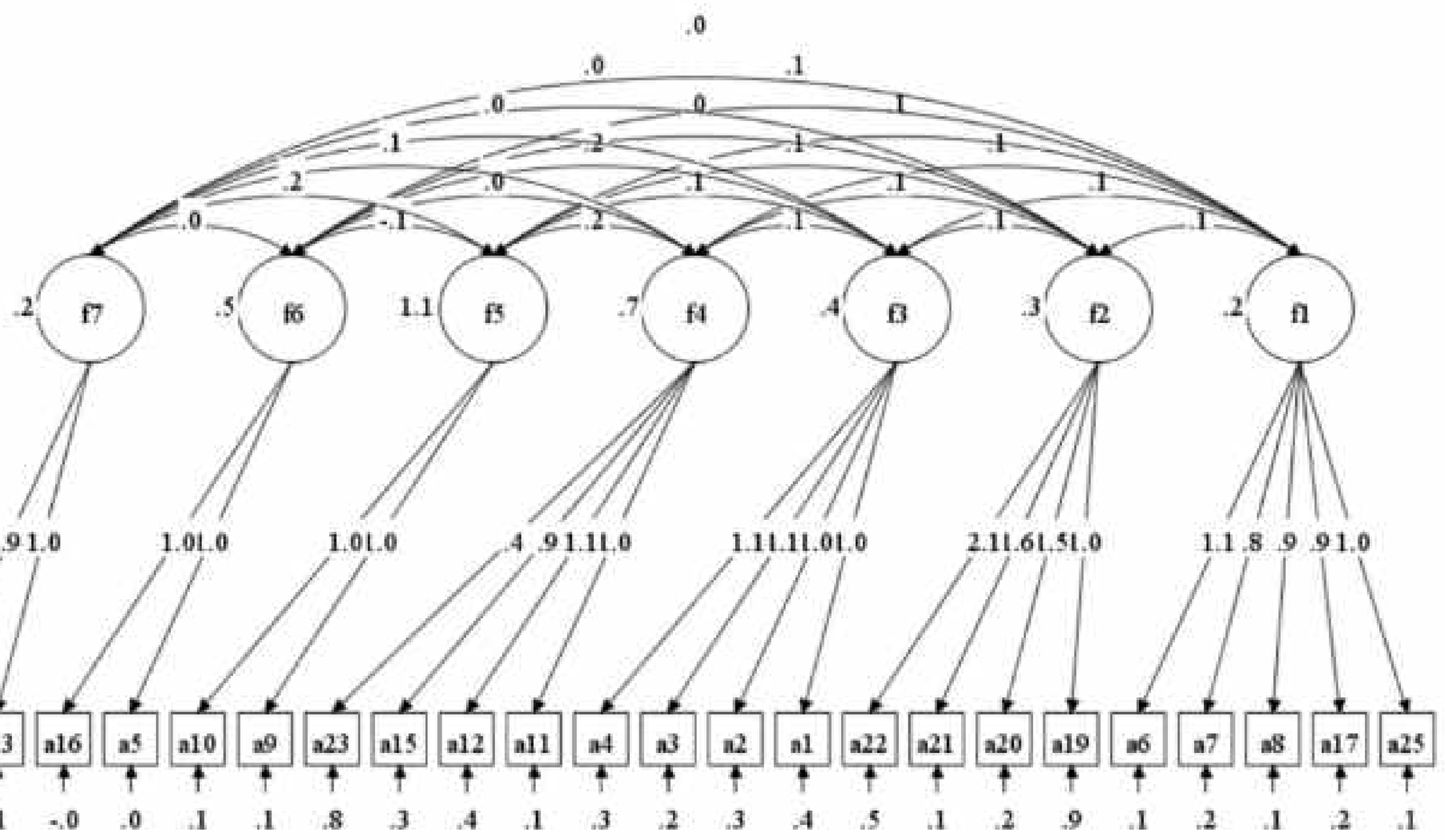

Figure 1. MPLUS diagram output showing the result of the CFA.

Utilizing the factors identified in the EFA, we conducted a subsequent CFA on an additional sample of 200 participants. The CFA results were as follows: χ^2 (df = 209) = 747.69, $p <$ 0.001; RMSEA = 0.068; CFI = 0.92; TLI = 0.90; SRMR = 0.074. Although the chi-square test was significant, other fit indices indicated an acceptable fit to the data. Standardized factor

Table 4. Estimates of fixed effects in multivariable model, assessing association of patient and caregiver characteristics with total PATH score.

					95% Confidence Interval	
Parameter	Estimate	df	t	Sig.	Lower bound	Upper bound
Patient sex: Male Vs. Female	−.089	386	−2.188	**.029**	−.169	−.009
Stroke: Hemorrhagic Vs. Ischemic	.075	386	1.461	.145	−.026	.176
Caregiver sex: Male vs. Female	.029	386	.615	.539	−.063	.120
Single vs Married	.009	386	.188	.851	−.087	.105
Unemployed vs. Employed	−.002	386	−.048	.962	−.086	.082
Income: Insufficient vs. Sufficient	−.209	386	−5.559	**<.001**	−.283	−.135
Education: No-university VS University degree	−.183	386	−4.528	**<.001**	−.263	−.104
Relationship: Spouse vs Sibling	−.032	386.000	−.514	.607	−.153	.090
Relationship: Child vs Sibling	.051	386	.773	.440	−.079	.181
Age caregivers	−.002	386	−.851	.395	−.006	.002
Age patient	.003	386	1.332	.184	−.001	.007

Table 5. The reliability results for the PATH and its subscales.

Dimension of scale	Number of the items	Cronbach's alpha coefficient	ICC (95%CI)
F1: Commitment: Willingness	5	0.85	0.81 (0.69–0.90)
F2: Post-Stroke Financial and Accessibility Preparedness	4	0.86	0.93 (0.88–0.96)
F3: Long-term Implications: prognosis and Insight	4	0.86	0.93 (0.88–0.96)
F4: Patient Support Network and Accessibility	3	0.80	0.82 (0.69–0.91)
F5: Preexisting Health Problems	2	0.96	0.99 (0.98–0.99)
F6: Pre-stroke Caregiver Experience	2	0.99	0.80 (0.65–0.90)
F7: Role and Responsibilities	2	0.71	0.79 (0.64–0.90)
Total	23	0.85	0.96 (0.63–0.99)

loadings, all statistically significant ($p < 0.05$), are presented in Figure 1. These findings further validated the factor structure identified in the EFA.

As part of the construct validity evaluation, the association of caregiver characteristics with the total path score were investigated. Estimates of fixed effects in the multivariable model, assessing the association of patient and caregiver characteristics with the total PATH score, showed that male patients had significantly lower PATH scores compared to female patients ($b = -0.104$, $t = -2.439$, $p = 0.015$). Caregivers with insufficient income had significantly lower PATH scores compared to those with sufficient income ($b = -0.219$, $t = -5.571$, $p < 0.001$). Caregivers with a university degree had significantly higher PATH scores compared to those without a university degree ($b = 0.200$, $t = 4.727$, $p < 0.001$) (Table 4).

3.4. Convergent validity

The PATH-s and ZBI total scores showed normally distributed scores. A negative statistically significant correlation was observed between the two scores ($r = -0.27$, $p < 0.001$).

3.5. Reliability

Reliability checks showed a Cronbach Alpha of 0.84 for the total score and for the factors the reliability test showed a Cronbach Alpha between 0.71 to 0.99. Additionally, the scale exhibited excellent test-retest reliability, as evidenced by an Intraclass Correlation Coefficient (ICC) of 0.96, with a 95% confidence interval ranging from 0.63 to 0.99 (Table 5).

4. Discussion

The objective of this study was to culturally adapt and validate the Persian version of the PATH instrument.

Our study confirmed the high face validity of the Persian PATH-s, aligning with similar research emphasizing the importance of adapting instruments for cultural and linguistic contexts. The tool demonstrated appropriate face validity and comprehension of the statements, indicating its practicality for clinical use. This is supported by recent studies that underscore the significance of face validity in the adaptation process.[24,25]

Content validity was established through the input of a panel of experts. Their evaluation ensured that the translated PATH-s accurately

covered all relevant content domains of caregiver preparedness. This aligns with the findings of Boateng et al.,[26] who emphasized the critical role of expert panels in establishing the content validity of research instruments. The comprehensive feedback provided by these specialists led to refinements that enhanced the instrument's clarity, appropriateness, and comprehensiveness.

Construct validity of the Persian PATH-s was rigorously assessed through both EFA and CFA, ensuring a robust examination of the underlying structure of the tool. The initial CFA indicated a poor fit, which necessitated the EFA to refine the factor structure. This stepwise approach is crucial in validating the construct in a new cultural context, as it allows for the identification and modification of items that may not align well with the population's characteristics.[26,27]

The EFA revealed a seven-factor solution after removing items that did not contribute meaningfully to the construct, demonstrating that the Persian PATH-s possesses a slightly different factor structure compared to the original PATH-s, which identified eight factors.[10] This variation can be attributed to cultural differences influencing caregivers' perceptions and experiences. For instance, the removal of items 18 and 24 might reflect specific cultural nuances in how Iranian caregivers perceive long-term care concerns and relational conflicts, which may differ from their counterparts in the original study. The high factor loadings observed in the Persian PATH-s suggest that the remaining items have a strong correlation with their respective factors, indicating that the adapted tool is effective in measuring caregiver preparedness within the Iranian context.

Moreover, the satisfactory fit indices in the final CFA support the construct validity of the Persian PATH-s. These results are consistent with the findings from the original PATH-s validation, where high factor loadings and satisfactory model fit indices were also reported.[10] The study also highlighted that caregiver-patient interactions play a significant role in understanding the domains of caregiver preparedness. These interactions not only supported the identification of meaningful factors but also provided deeper insights into the contextual and relational dynamics shaping caregiver readiness. This underscores the importance of integrating relational data into psychometric analyses to ensure the tool's applicability across different cultural contexts. This similarity underscores the robustness of the PATH-s construct across different cultural settings, albeit with minor modifications to better suit specific populations.

This validation process not only confirms the utility of the PATH-s in a new context but also contributes to the broader understanding of how caregiver preparedness can be universally measured and supported across diverse populations.[26]

The multivariable linear regression analysis identified key demographic and socioeconomic factors influencing caregiver preparedness as measured by the PATH-s final scores. Caregivers of male patients had significantly lower PATH-s scores compared to those of female patients. This suggests that caregiving roles and expectations may vary by the patient's gender. In the cultural context of Iran, it is traditionally the responsibility of women to care for sick family members. This aligns with recent research indicating differing caregiving demands based on gender roles, highlighting the cultural expectation that women primarily assume caregiving duties.[28,29]

Caregivers with insufficient family income reported significantly lower PATH scores. Financial constraints are known to increase caregiver stress and reduce preparedness, highlighting the need for financial support programs.[30,31] Caregivers with a university degree had higher PATH scores. Higher education levels are associated with better problem-solving skills and access to resources, enhancing caregiver preparedness.[32]

The findings of this study highlight the potential of the PATH-s instrument to identify caregivers at risk of burnout due to continuous caregiving demands. For instance, the tool's ability to assess caregivers willingness (e.g. Question 7), experience (e.g. Question 16), and access to social support (e.g. Questions 11 and 15) provides actionable insights that can inform interventions such as respite care, skill-building workshops, and professional support services. These measures can help reduce caregiver fatigue and ensure patient safety.

Convergent validity was assessed by examining the correlation between the PATH-s and the ZBI scores. The negative correlation between the two instruments suggests that higher preparedness is

associated with lower caregiver burden. This finding aligns with theoretical expectations and supports the construct validity of the PATH-s, as seen in similar studies, who reported the impact of caregiver preparedness on reducing burden.[33,34]

The reliability analysis demonstrated good internal consistency for the total PATH-s score and acceptable reliability for the seven factors, with Cronbach's alpha ranging from 0.71 to 0.99. These results are comparable to those reported by Camicia et al.[10] for the original PATH-s, where high reliability was also observed. The test-retest reliability and intraclass correlation coefficients (ICCs) confirmed the stability of the PATH-s over time, ensuring its reliability for repeated measurements in clinical and research settings.

4.1. Limitation

This study has a few limitations that should be considered. Firstly, the study relied on self-reported data from caregivers, which may be subject to response bias or inaccuracies in reporting their preparedness and experiences. Secondly, while the study's translation and adaptation process was rigorous, it may not fully capture all cultural nuances and variations within the broader Persian-speaking population. Although the samples were selected from two referral hospitals that serve as major centers for patient referrals from across the country, they may not be fully representative of the entire Iranian population. Therefore, it is recommended to reassess the tool in diverse Iranian populations. Despite these limitations, the study provides valuable insights and a robust tool for assessing caregiver preparedness in the Iranian context. Future studies may consider cognitive interviews into their validation process. Cognitive interviews can enhance the robustness of the tool by identifying acceptable interpretations, providing evidence for item revisions, distinguishing fixable issues from fundamental flaws, and minimizing missing data. The direct interaction and support provided by the data collectors in this study helped mitigate potential issues with item interpretation and response accuracy, contributing to the overall reliability and validity of the collected data.

4.2. Practical implications

The validated Persian version of the PATH-s instrument offers several practical benefits. Healthcare providers can use this tool to assess the readiness and needs of caregivers of stroke survivors before discharge, ensuring that caregivers receive tailored support and education. This can potentially reduce caregiver burden and improve patient outcomes by addressing gaps in preparedness. Specifically, the PATH-s can help identify areas where caregivers need additional resources or training, such as financial planning, accessibility modifications, emotional support, managing daily care tasks, and understanding the long-term implications of stroke. By implementing this tool in clinical settings, hospitals can facilitate smoother transitions from hospital to home, ultimately enhancing the quality of care for stroke survivors. By identifying areas of caregiver strain, the PATH-s instrument enables the design of tailored interventions to support caregivers in managing the demands of continuous caregiving. Such interventions may include respite care, access to community resources, and educational programs to enhance caregiving skills and reduce stress.

Moreover, the PATH-s instrument offers a versatile framework that can be culturally adapted to improve health policy, education, and healthcare delivery across diverse contexts. In cultures where community and family values play a significant role, PATH-s assessments can guide the creation of supportive policies, such as financial assistance programs or community caregiving networks, aligning resources with cultural priorities. Additionally, societies with well-established educational systems can leverage PATH-s insights to develop caregiver training programs that address emotional readiness and resource access gaps. Advanced healthcare systems can also integrate PATH-s into digital health platforms for real-time caregiver feedback, while traditional caregiving practices in other regions can benefit from its structured framework. Finally, international collaborations in adapting PATH-s can foster mutual learning, enabling cultures to share best practices and enhance caregiver preparedness globally. This adaptability underscores the instrument's potential to not only serve Iranian

caregivers, but also transform caregiver support across diverse cultural settings.

5. Conclusion

The study successfully adapted and validated the Persian version of the PATH-s instrument, confirming its reliability and validity for use with Iranian caregivers of stroke survivors. The PATH-s demonstrated good psychometric properties, including face, content, construct validity, as well as reliability. The seven-factor structure identified provides a comprehensive framework for understanding caregiver preparedness. This instrument is a valuable tool for assessing and addressing the preparedness of caregivers, which is crucial for improving the transition of stroke patients from hospital to home. Future research should focus on conducting psychometric evaluations in larger samples of different cultural contexts of Iranian population.

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Author contributions

HBD, AA and VZ was involved in the conception and organization of the study. KP were involved in the execution and data collection of the study; ZR and MR participated in statistical analysis design and/or execution. HBD prepared the first draft of the manuscript. AA and MR edited the manuscript. All authors contributed to the preparation, critical review and all of them approved the final manuscript.

Data availability statement

The datasets generated and/or analyzed during the current study are not publicly available due to the necessity to ensure participant confidentiality policies and laws of the country but are available from the corresponding author on reasonable request.

Ethical considerations

The current study emanates from a master's thesis in nursing, which received evaluation and approval from the research ethics committee of Shahid Beheshti University of Medical Sciences under ethics code: IR.SBMU.PHARMACY.REC.1402.107. Permissions were obtained from relevant authorities at the research sites and from the original scale developer. Caregivers were comprehensively informed about the study objectives, their right to withdraw from participation, and the confidentiality of their data. Informed consent was obtained from all participants.

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