

## Psychometric Evaluation of the Turkish Version of the Atrial Fibrillation Knowledge Scale

### Atrial Fibrilasyon Bilgi Ölçeğinin Türkçe Versiyonunun Psikometrik Değerlendirmesi

#### ABSTRACT

**Objective:** It is important to assess patients' knowledge and learning needs regarding atrial fibrillation (AF) and its management to minimize the risks associated with the disease. To date, the psychometric properties of the Atrial Fibrillation Knowledge Scale (AFKS) have only been tested in a Chinese-speaking sample. However, a validated and comprehensive tool for use among Turkish patients with AF has not yet been developed. This study aimed to determine the validity and reliability of the Turkish version of the AFKS in a Turkish population of patients with AF.

**Method:** This study was a cross-cultural adaptation of the AFKS to evaluate its psychometric properties in a Turkish population diagnosed with AF, in accordance with the methodology and recommendations of the International Commission on Testing.

**Results:** A total of 210 patients were included. The mean age of the patients was  $62.25 \pm 9.30$  years, and the mean duration of the disease was  $2.99 \pm 1.70$  years. Confirmatory factor analysis (CFA) results showed that the four factors identified in the original scale were validated in Turkish patients with AF. The CFA findings demonstrated that the factor loadings of the model indicated strong and significant associations between the items and the relevant factors ( $P < 0.001$  for all items). The Cronbach's alpha reliability coefficient of the scale was 0.88. A positive, moderate correlation ( $r = 0.48$ ,  $P < 0.001$ ) was found between the AFKS and the Atrial Fibrillation Effect on Quality-of-life Questionnaire.

**Conclusion:** The findings of this study indicate that the scale is valid and reliable for use in Turkish patients with AF.

**Keywords:** Atrial fibrillation, knowledge, symptoms, reliability, validity

#### ÖZET

**Amaç:** Hastaların atriyal fibrilasyon (AF) ve yönetimi hakkındaki bilgi ve öğrenme ihtiyaçlarını değerlendirmek, hastalığın risklerini en aza indirmek için önemlidir. Atriyal Fibrilasyon Bilgi Ölçeği'nin (AFKS) psikometrik özellikleri bugüne kadar yalnızca Çince konuşan bir örneklemede test edilmiştir. Ancak, AF'li Türk hastalar arasında kullanılmak üzere doğrulanmış ve kapsamlı bir araç henüz geliştirilmemiştir. Bu çalışmada amacımız, AFKS'nin Türkçe versiyonunun AF'li Türk hasta popülasyonunda geçerlilik ve güvenilirliğini belirlemektir.

**Yöntem:** Bu çalışma, AFKS'nin psikometrik özelliklerini AF tanısı almış Türk popülasyonunda değerlendirmek amacıyla, metodoloji ve Uluslararası Test Komisyonu'nun önerileri doğrultusunda kültürler arası bir uyarlamadır.

**Bulgular:** Toplam 210 hasta çalışmaya dahil edilmiştir. Hastaların ortalama yaşı  $62,25 \pm 9,30$  yıl ve ortalama hastalık süresi  $2,99 \pm 1,70$  yıldır. Çalışmamızdaki doğrulayıcı faktör analizi (DFA) sonuçları, orijinal ölçeğe ortaya çıkan dört faktörün Türk toplumundaki AF hastalarında doğrulandığını göstermiştir. DFA bulguları, modelin faktör yüklerinin, maddelerin ilgili faktörlerle güçlü ve anlamlı ilişkilere sahip olduğunu göstermiştir (tüm maddeler için  $P < 0,001$ ). Ölçeğin Cronbach  $\alpha$  güvenilirlik katsayısı 0,88'dir. AFKS ile Atriyal Fibrilasyonun Yaşam Kalitesine Etkisi Anketi arasında pozitif, orta düzeyde bir korelasyon ( $r = 0,48$ ,  $P < 0,001$ ) bulunmuştur.

**Sonuç:** Bu çalışmanın bulguları, ölçeğin AF'li Türk hastalarda kullanım için geçerli ve güvenilir olduğunu göstermektedir.

**Anahtar Kelimeler:** Atriyal fibrilasyon, bilgi, semptom, güvenilirlik, geçerlilik

#### ORIGINAL ARTICLE KLİNİK ÇALIŞMA

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## Introduction

Atrial fibrillation (AF) is a cardiac rhythm disorder with global prevalence.<sup>1,2</sup> It is characterized by an irregular heart rhythm, manifesting as a continuous or intermittent absence of P-wave activity on electrocardiographic tracing.<sup>3</sup> According to the American Heart Association, the prevalence of AF is estimated to be 33 million individuals worldwide, with approximately 5 million new cases identified annually on a global scale.<sup>4</sup> According to data from the Heart Disease and Risk Factors in Turkish Adults study conducted in Türkiye in 2006, the number of cases detected each year is 35,000.<sup>5</sup> The irregular heart rhythm of AF has been associated with an elevated risk of adverse outcomes, including ischemic stroke, heart failure, cognitive impairment, and mortality.<sup>3</sup> As a result, AF contributes to increased health expenditures and burden of care and has a negative impact on patients' quality of life.<sup>6</sup>

Individuals afflicted with AF frequently experience a range of symptoms, including but not limited to palpitations, dizziness, anxiety, restlessness, stress, fatigue, syncope, decreased exercise capacity, chest pain, and shortness of breath.<sup>7</sup> It is noteworthy that asymptomatic patients may be identified only after the emergence of serious AF-related complications, such as stroke, myocardial infarction, or heart failure.<sup>8</sup>

Accurate monitoring of heart rate and detection of heartbeats are crucial for effective treatment and adjustment of treatment as needed. Furthermore, controlling risk factors for AF, such as diabetes mellitus, hypertension, obesity, smoking, and alcohol intake, is essential to reduce the burden of the disease and prevent exacerbations.<sup>9</sup>

International guidelines emphasize a holistic approach to achieve positive outcomes in the treatment of AF. These guidelines state that patients' health outcomes can be improved with modifiable risk factors and dysrhythmia control.<sup>3</sup> In the context of AF, effective treatment and symptom control are crucial for enhancing quality of life. The prevailing challenges in current AF symptom control strategies include the inability to effectively manage and control the rate and rhythm of the heartbeat. This is further compounded by a lack of knowledge surrounding the effective execution and control of oral anticoagulation therapy.<sup>10–13</sup> In conclusion, effective communication with patients, providing education that encourages informed decision-making, and improving patients' self-management skills were identified as important steps.<sup>14</sup> The aforementioned self-management skills encompass self-monitoring and management of signs and symptoms, management of crises related to disease exacerbation and treatment complications, and lifestyle changes.<sup>3</sup>

Recognizing the lack of a comprehensive scale to assess the level of knowledge in patients with AF, Hendriks et al.<sup>15</sup> developed the Atrial Fibrillation Knowledge Scale (AFKS) for patients with AF. In general, the AFKS measures knowledge about recognizing the signs and symptoms of AF and its treatment. To date, the psychometric properties of the AFKS have been tested in a Chinese-speaking sample.<sup>16</sup> In Türkiye, there is no tool to measure AF knowledge that focuses on the disease, symptom recognition, and treatment together. As a result of the increasing

## MAIN POINTS

- This study supports the reliability and validity of the Turkish version of the Atrial Fibrillation Knowledge Scale in patients with atrial fibrillation in Türkiye.
- The Turkish version of the Atrial Fibrillation Knowledge Scale can effectively measure patients' knowledge about the disease, symptom recognition, and treatment.
- Healthcare professionals require a validated tool to assess patients' knowledge of atrial fibrillation and to plan appropriate interventions. The Turkish version of the scale is a psychometrically sound instrument suitable for clinical use.

prevalence of cardiovascular risk factors in our country, the number of individuals predisposed to AF has been rising rapidly in recent years. Therefore, there is a need for a tool that measures the knowledge level of patients with AF. In this study, our aim was to determine the validity and reliability of the AFKS in a Turkish population of patients with AF.

## Methods

### Translation Process

Permission was obtained from the developers of the AFKS for its translation from English to Turkish.<sup>15</sup> The language validity of the scale was assessed at three levels. Translation was performed based on established guidelines.<sup>17–19</sup> First, the translation and back-translation processes were conducted by the authors and a certified linguist who were both fluent in English and Turkish. Subsequently, the finalized Turkish translation was back-translated into English by another certified linguist, a native English speaker who had not seen the original version of the questionnaire. After necessary modifications were made to ensure conceptual equivalence, based on the linguist's recommendations, the scale was independently evaluated by five nursing professors. These experts were fluent in both Turkish and English, and familiar with the languages and cultures involved. This process ensures that the instrument reflects the underlying concept consistently across cultures and yields comparable results in different language populations.<sup>20,21</sup> The experts were also knowledgeable about the scale content and general scale principles, enabling them to perform a professional-quality translation and adaptation of the scale in line with the International Test Commission (ITC) guidelines.<sup>17–19</sup>

### Study Design

This study was methodologically designed to assess the validity and reliability of the Turkish version of the AFKS in Turkish patients with AF. The stages of the study followed the COSMIN methodology and the 2018 guidelines of the ITC.<sup>17–20</sup>

### Study Setting and Participants

The study sample consisted of individuals aged 18 years and older who were hospitalized in the cardiology outpatient clinic and inpatient service of a university hospital in Ankara and had a confirmed diagnosis of AF. Data were collected between May 2023 and November 2024 by a researcher. Participants were required to be of Turkish ethnic origin and able to communicate orally and in written Turkish.

Exclusion criteria included patients with dementia or severe psychological illness (excluding depression), patients unable to self-administer the questionnaire, and those with major uncorrected hearing or visual impairments. In line with ITC recommendations, a minimum of 110 participants was required for this study.<sup>17</sup>

Prior to the main study, a pilot study was conducted with 10 patients diagnosed with AF to assess the language validity of the scale. These patients were excluded from the final sample. Ultimately, 210 patients with AF were included in the study.

### Data Collection

Data were collected using the Patient Form, the Turkish Atrial Fibrillation Knowledge Scale, and the Atrial Fibrillation Effect on Quality-of-life Questionnaire for concurrent validity testing. Patients were informed about the study, and it took approximately 15–20 minutes to complete the forms. The researcher was present with the patients during this process and obtained written informed consent from each participant after explaining the study's purpose and procedures. The study was conducted in accordance with the Declaration of Helsinki. All measurement tools were self-administered by the participants. Additionally, stroke risk data (calculated using the CHA<sub>2</sub>DS<sub>2</sub>-VASc score) were obtained from the patients' medical records by the researcher.

### Measures

#### Patient Form

Demographic and clinical data were collected using a form consisting of eleven questions addressing patients' age, disease duration, sex, education level, marital status, employment status, monthly income, comorbidity status, medication use, types of AF, and CHA<sub>2</sub>DS<sub>2</sub>-VASc score.<sup>15,16,22–24</sup>

#### Atrial Fibrillation Knowledge Scale (AFKS)

The AFKS is an 11-item scale developed by Hendriks et al.<sup>15</sup> to assess knowledge of AF, symptom recognition, and treatment modalities. It consists of four dimensions: general (three items), treatment (three items), symptom recognition (three items), and general attitudes (two items). The scale is designed to assess the knowledge, symptoms, and treatment-related understanding experienced by AF patients. Participants are instructed to select one of three options in response to each item. One point is awarded for each correct answer, with no deduction for incorrect responses. The total score is calculated by summing the number of correct responses, with higher scores indicating greater knowledge. The Cronbach's alpha of the original scale was 0.58.<sup>15</sup>

#### Atrial Fibrillation Effect on Quality-of-Life Questionnaire (AFEQT)

The AFEQT was developed by Spertus et al.<sup>25</sup> in 2011, and its Turkish validity and reliability were confirmed by Güneş and Boyraz<sup>24</sup> in 2019. This questionnaire is designed to assess the quality of life in patients with AF. It contains 20 items grouped into four subscales: symptoms, daily activities, treatment concern, and treatment satisfaction. Subscale scores range from 0 to 100, with higher scores indicating better quality of life. The Cronbach's alpha value of the Turkish version of the scale was reported as 0.91.<sup>24</sup> In this study, the Cronbach's alpha value was found to be 0.96.

### Data Analysis

The data obtained in this study were analyzed using IBM SPSS (Version 24.0, Armonk, NY, USA) and IBM SPSS AMOS 24 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize the socio-demographic and clinical characteristics of the participants. Means and standard deviations were calculated for continuous variables, while frequencies and percentages were calculated for categorical variables.

For the AFKS, response frequencies, means, standard deviations, skewness, and kurtosis were calculated for each item to examine score distribution, normality, and ceiling and floor effects. The items were found to show a normal distribution.<sup>26,27</sup>

The Turkish content of each item in the AFKS was independently assessed for language and content validity by five experts, based on the Consensus-based Standards for the Selection of Health Measurement Instruments (COSMIN) guidelines.<sup>17–19</sup> Content validity was evaluated by calculating the item-content validity index (I-CVI) and scale-content validity index (S-CVI).<sup>28</sup>

Confirmatory factor analysis (CFA) was conducted to assess the construct validity of the scale using structural equation modeling (SEM).<sup>28,29</sup> Model fit was evaluated using the goodness-of-fit index (GFI), comparative fit index (CFI), root mean square residual (RMR), root mean square error of approximation (RMSEA), normed fit index (NFI), incremental fit index (IFI), Tucker-Lewis index (TLI), and Chi-square/degrees of freedom ( $\chi^2/df$ ) ratio. Construct validity was further assessed through hypothesis testing using Pearson correlation analysis.<sup>20,25</sup>

The internal consistency of the scale was measured using Cronbach's alpha reliability coefficient.<sup>30</sup> Acceptable thresholds for item-total and inter-item correlations were greater than 0.30. The scale's discriminative ability was evaluated by comparing the performance of two extreme groups (the lower and upper 27% of scores). Test-retest reliability was assessed using the intraclass correlation coefficient (ICC).<sup>17</sup>

### Ethical Considerations

The original scale owner granted approval for the study via electronic correspondence. Prior to initiating the research, an application was submitted to the Lokman Hekim University Scientific Research Ethics Committee, and approval was obtained (Approval Number: 2023/83, Date: 16.05.2023). The researcher obtained written informed consent from each participant after providing a detailed explanation of the study's purpose and procedures. The study was conducted in accordance with the Declaration of Helsinki. No artificial intelligence programs were used in the data collection or article creation processes.

### Results

#### Sample Characteristics

The study sample consisted of 210 individuals diagnosed with AF. The mean age of patients was 62.25 ± 9.30 years (range: 20 to 82 years), indicating a wide distribution of AF knowledge among participants. The mean disease duration was 2.99 ± 1.70 years.

Among the participants, 60% were male; 36.7% had completed university education; 84.8% were married; 70.0% were not employed; and 87.1% reported that their income was equal to

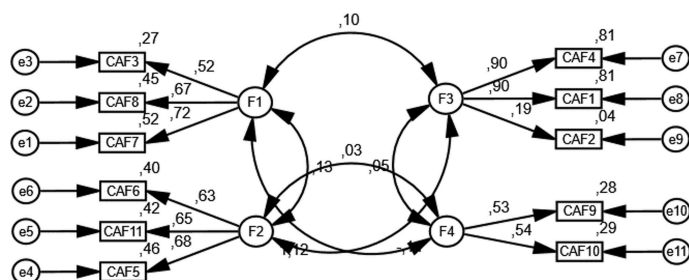
**Table 1. Sample characteristics (n = 210)**

Patients characteristics	n	%
Age, years ( $\bar{x} \pm SD$ )	62.25 $\pm$ 9.3	
Disease duration, ( $\bar{x} \pm SD$ )	2.99 $\pm$ 1.7	
Sex		
Female	84	40
Male	126	60
Graduation level		
Primary school – middle school	74	35.2
High school	59	28.1
University	77	36.7
Marital status		
Single	32	15.2
Married	178	84.8
Employment status		
Working	63	30
Not working	147	70
Monthly income		
Income equal to expenditure	183	87.1
Income more than expenditure	27	12.9
Comorbidities		
Hypertension	102	48.6
Coronary artery disease	66	31.4
Diabetes mellitus	21	10
Stroke	15	7.1
Chronic obstructive pulmonary disease	6	2.9
Medication use		
Anticoagulant	166	79.0
$\beta$ -Blockers	33	15.7
Types of AF		
Paroxysmal	74	35.2
Persistent	7	3.3
Permanent	38	18.1
Undifferentiated	91	43.3
CHA <sub>2</sub> DS <sub>2</sub> -VASc score		
2	84	40
3	56	26.7
4	58	27.6
5	9	4.3
6	3	1.4

SD, Standard deviation; AF, Atrial fibrillation; CHA<sub>2</sub>DS<sub>2</sub>-VASc score, Stroke risk score.

their expenses. Regarding comorbidities, hypertension was the most common (48.6%), followed by coronary artery disease (31.4%) and diabetes (10.0%).

In terms of medication use, 79.0% of participants used anticoagulants, 15.7% used beta blockers, and 5.2% used calcium channel blockers. When analyzing the type of AF, the most

**Figure 1. Path diagram of the Turkish version of the Atrial Fibrillation Knowledge Scale.**

common type was undefined AF (43.3%), followed by paroxysmal (35.2%), permanent (18.1%), and persistent AF (3.3%).

Regarding the CHA<sub>2</sub>DS<sub>2</sub>-VASc score distribution, 40.0% of the participants had a score of 2. The Turkish AFKS total score for participants was 6.94  $\pm$  1.71 (Table 1).

## Validity

### Language and Content Validity

The experts (nursing professors) involved in the translation process were selected from different institutions to avoid bias. To assess the content validity of the scale, it was distributed via email to these experts, who were then asked to evaluate each item individually. Content validity was assessed using the Davis technique.<sup>28</sup> In this method, expert opinions are rated on a 4-point scale indicating whether an item represents the intended feature or not.

Five experts rated each scale item on a 4-point Likert scale, with 1 representing "not relevant" and 4 representing "highly relevant." Following the collection of expert opinions, the item-content validity index (I-CVI) and scale-content validity index (S-CVI) were calculated to assess content validity.<sup>28–31</sup> The content validity index was determined by dividing the number of experts who rated the item as relevant (ratings of 3 or 4) by the total number of experts. Items with a content validity index lower than 0.80 are typically removed from the scale.<sup>17–19</sup> However, all items in this scale had content validity index values above 0.80. Therefore, no items were removed from the scale.

Experts were also asked to suggest alternative wording for any items they deemed inappropriate. Based on their feedback, minor revisions were made to item 11, which initially had an I-CVI value lower than 1. In the original AFKS, item 11 read, "What is the function of the thrombosis centre?" This item was adapted to: "What is the purpose of regularly monitoring your blood values?" because thrombosis centers are not available in the country or the hospital where the study was conducted. Furthermore, the main function of such centers is to adjust medication doses based on blood test results.

### Construct Validity

In this study, confirmatory factor analysis (CFA), in the form of structural equation modeling (SEM), was used to assess the relationship between observed and latent variables. In addition, goodness-of-fit indices were employed.<sup>29</sup> The CFA results are presented in the diagram (Figure 1).

**Table 2. Confirmatory factor analysis for the Turkish version of the Atrial Fibrillation Knowledge Scale**

Items	Factors	$\beta$	Std. $\beta$	S. Error	t	P
7. Atrial fibrillation is a rare condition	F1	0.719	1.000			
8. It is particularly risky if a person does not feel his/her atrial fibrillation	F1	0.669	0.901	0.115	7.842	< 0.001
3. If atrial fibrillation is identified without complaints, the patient should immediately visit hospital	F1	0.524	0.690	0.108	6.403	< 0.001
5. Why is oral anticoagulation prescribed for some AF patients?	F2	0.681	1.000			
11. What is the purpose of regularly monitoring your blood values?	F2	0.650	0.858	0.147	5.847	< 0.001
6. Why should a person using anticoagulants avoid alcohol?	F2	0.631	0.856	0.146	5.845	< 0.001
4. What is atrial fibrillation?	F3	0.899	1.000			
1. What are the trigger factors for atrial fibrillation?	F3	0.898	1.039	0.202	5.147	< 0.001
2. Why is it important to take my AF medication properly?	F3	0.194	0.223	0.086	2.602	0.009
9. Which statement regarding physical exercise is true for AF patients?	F4	0.533	1.000			
10. Which statement is true?	F4	0.543	1.177	0.193	6.090	< 0.001
Goodness fit	Acceptable value			Found value		
$\chi^2$				57.718		
df				38		
$\chi^2/df$	$0 \leq \chi^2/df \leq 5$			1.519		
CFI	$0.80 \leq CFI \leq 1.00$			0.965		
GFI	$0.80 \leq GFI \leq 0.95$			0.955		
NFI	$0.90 \leq NFI \leq 0.95$			0.906		
IFI	$0.80 \leq IFI \leq 1.00$					
TLI	$0.80 \leq TLI \leq 1.00$			0.949		
RMSEA	$0.05 \leq RMSEA \leq 0.08$			0.034		
RMR	$0.05 \leq RMR \leq 0.08$			0.05		

F1, Atrial fibrillation in general; F2, Atrial fibrillation treatment; F3, Atrial fibrillation symptoms recognition; F4, Atrial fibrillation general attitudes;  $\chi^2$ , Chi square; df, Degrees of freedom; CFI, Comparative Fit Index; GFI, Goodness-of-fit index; NFI, Normed Fit Index; IFI, Improved Fit Index; TLI, Tucker-Lewis Index; RMSEA, Root mean square error of approximation; RMR, Root mean square residual.

The goodness-of-fit criteria used in this study are detailed in Table 2. The resulting  $\chi^2$  value was 57.718 with 38 degrees of freedom. The  $\chi^2/df$  ratio, an essential measure of model fit, was calculated as 1.519, indicating an acceptable model fit. The comparative fit index (CFI) was 0.965, the goodness-of-fit index (GFI) was 0.955, the normed fit index (NFI) was 0.906, and the incremental fit index (IFI) was 0.966. These values exceed the recommended thresholds, indicating good model fit. The Tucker-Lewis index (TLI) was 0.949, which also falls within acceptable limits.

The root mean square error of approximation (RMSEA) value was 0.034, and the root mean square residual (RMR) value was 0.050. Both are below the recommended cut-off values, suggesting a satisfactory error rate. In summary, these findings support a well-fitting, coherent, and valid model structure (Table 2).

As shown in Table 2, the factor loadings demonstrate statistically significant correlations between all items and their corresponding factors ( $P < 0.001$ ). This analysis was conducted to evaluate the construct validity of the scale and to confirm the appropriateness of each item in representing its intended factor. CFA was used to examine the strength and significance of loadings between observed variables and latent constructs, including standardized loadings, standard errors, t-values, and significance levels.

The results showed that all items had significant and high loadings on their respective factors. For example, item 7 loaded onto Factor F1 (atrial fibrillation in general) with a coefficient of 0.719 and was statistically significant ( $P < 0.001$ ). Similarly, other items showed strong and significant loadings on their relevant factors. Notably, item 2 loaded onto Factor F3 (atrial fibrillation symptom recognition) with a coefficient of 0.194 but was still statistically significant ( $P = 0.009$ ).

These collective findings indicate that the factor structure of the scale aligns with the data, thus supporting its construct validity. The statistically significant factor loadings further suggest that the items adequately represent the latent constructs they are intended to measure (Table 2).

### Construct Validity Using Hypothesis Testing

Hypothesis testing was used to confirm construct validity by comparing the AFKS with another validated scale that measures a similar construct. Measurement validity in this context is based on concurrent validity—i.e., comparing the results obtained from the AFKS with those obtained from the AFEQT.<sup>29</sup>

The aim of this analysis was to test hypotheses previously proposed in the literature regarding treatment knowledge, symptom recognition, and awareness of AF. To this end, the AFKS



**Table 3. Correlation between the Turkish Version of the Atrial Fibrillation Knowledge Scale and the Atrial Fibrillation Effect on Quality-of-Life Questionnaire**

	AFKS	
	r*	P
Atrial Fibrillation on Quality-of-Life Questionnaire	0.480 <sup>†</sup>	< 0.0001
Symptoms	0.270 <sup>†</sup>	< 0.0001
Daily activities	0.570 <sup>†</sup>	< 0.0001
Treatment concern	0.413 <sup>†</sup>	< 0.0001
Treatment satisfaction	0.470 <sup>†</sup>	< 0.0001

\*, Pearson Correlation Analysis was applied; †, Statistically significant; AFKS, Atrial Fibrillation Knowledge Scale.

was compared with the Atrial Fibrillation Effect on Quality-of-life Questionnaire (AFEQT).

The analysis revealed a positive and statistically significant correlation between the AFKS total score and the overall AFEQT score, as well as its sub-dimensions. A moderate positive correlation was found between the AFKS total score and the overall AFEQT score ( $r = 0.48$ ,  $P < 0.001$ ). The strongest relationship was observed in the daily activities sub-dimension ( $r = 0.570$ ,  $P < 0.01$ ), while the weakest was in the symptoms sub-dimension ( $r = 0.270$ ,  $P < 0.01$ ). Treatment concern showed a significant positive correlation ( $r = 0.413$ ,  $P < 0.01$ ), and treatment satisfaction also exhibited a significant positive correlation ( $r = 0.470$ ,  $P < 0.01$ ).

These findings support the high validity of the AFKS in Turkish patients with AF and demonstrate its strong correlation with patients' quality of life (Table 3).

## Reliability

### Scale Internal Consistency and Item Analysis

Table 4 presents the item analysis of the scale. The Cronbach's alpha reliability coefficient for the scale was 0.88, indicating

a high degree of reliability. The item analysis results showed that item-total correlations for each item were high, and the Cronbach's alpha value changed minimally when individual items were deleted.

For example, when items 6 and 7 were removed, the Cronbach's alpha values were 0.883 and 0.882, respectively. These findings confirm the strong internal consistency of the scale and demonstrate that each item aligns well with the overall structure. Items 2 (importance of taking medication) and 1 (trigger factors) had the highest item-total correlations, indicating their significant contribution to the scale's overall reliability (Table 4).

### Distinctiveness

The scale is expected to effectively distinguish between two extreme groups (i.e., the lower and upper 27% of scorers). A statistically significant difference between these groups indicates high discriminative power.<sup>17</sup>

The scale demonstrated a significant difference between the lower 27% group ( $n = 62$ ; mean =  $4.491 \pm 1.020$ ) and the upper 27% group ( $n = 62$ ; mean =  $8.667 \pm 0.787$ ). The independent samples t-test yielded a t-value of -24.47 and a p-value of  $< 0.0001$ , indicating a statistically significant difference between the two groups ( $P < 0.001$ ).

In conclusion, significant differences were observed in all dimensions between the lower and upper 27% groups, supporting the scale's ability to effectively discriminate between individuals with low and high knowledge scores. This finding provides further evidence that the scale is a valid measurement tool (Table 5).

### Test-Retest Reliability

As shown in Table 6, the test and retest mean scores for each sub-measure were highly correlated, with no statistically significant differences observed. For the AFKS total score, the test mean was 6.941 and the retest mean was 7.020. The t-test result yielded a t-value of -1.661 and a p-value of 0.103, indicating no significant difference between the two measurements.

**Table 4. Item Descriptive Statistics and Cronbach's Alpha if Item Deleted for the Turkish Version of the Atrial Fibrillation Knowledge Scale**

Item	Item-total correlation	Cronbach $\alpha$ if item deleted
1. What are the trigger factors for atrial fibrillation?	0.735	0.869
2. Why is it important to take my medication for atrial fibrillation properly?	0.752	0.869
3. If atrial fibrillation is identified without the patient experiencing any complaints, the patient should immediately visit the hospital.	0.677	0.872
4. What is atrial fibrillation?	0.657	0.873
5. Why is oral anticoagulation medication prescribed in certain patients with atrial fibrillation?	0.730	0.869
6. Why should a person using anticoagulation medication be careful with the use of alcohol?	0.641	0.883
7. Atrial fibrillation is a rare condition.	0.625	0.882
8. It is particularly risky if a person does not feel his/her atrial fibrillation.	0.606	0.876
9. Which statement regarding physical exercise is true for patients with atrial fibrillation?	0.610	0.876
10. Which statement is true?	0.720	0.870
11. What is the purpose of regularly monitoring your blood values?	0.590	0.881

**Table 5. Comparison of lower and upper 27% Groups on the Turkish Version of the Atrial Fibrillation Knowledge Scale**

Groups	Lower 27% (n = 62)		Upper 27% (n = 62)		t <sup>a</sup>	SD	p
	$\bar{X}$	SD	$\bar{X}$	SD			
AFKS	4.491	1.020	8.667	0.787	-24.474	112	0.000

SD, Standard deviation; AFKS, Atrial Fibrillation Knowledge Scale; a, Independent Groups T-Test.

**Table 6. Test-retest reliability of the Turkish Version of the Atrial Fibrillation Knowledge Scale**

Measurement	Test (n = 51)		Retest (n = 51)		t	P <sup>a</sup>	ICC	P <sup>b</sup>
	$\bar{X}$	SD	$\bar{X}$	SD				
AFKS	6.941	1.714	7.020	1.726	-1.661	0.103	0.903	0.000

SD, Standard deviation; AFKS, Atrial Fibrillation Knowledge Scale; a, Dependent Group T-Test; b, Intraclass correlation coefficient (ICC).

The intraclass correlation coefficient (ICC) was 0.903 ( $P < 0.001$ ), reflecting a high level of consistency between test and retest scores. These results indicate that the scale demonstrates strong temporal stability, with consistent measurements over time (Table 6).

## Discussion

This study had two primary aims: first, to translate and culturally adapt the original Atrial Fibrillation Knowledge Scale (AFKS) from English to Turkish; second, to evaluate its psychometric properties in patients with atrial fibrillation (AF) in Türkiye. To ensure the accuracy and reliability of the translated scale items, it is essential to conduct a language validity assessment involving experts with language proficiency and professionals from various fields.<sup>17,19,20</sup> This approach helps minimize discrepancies and ensures that the translated items accurately and meaningfully reflect the original content.

In this study, the translation and back-translation method was employed, and content validity was assessed using the Davis technique. In scale adaptation and development studies, the number of consulted experts can vary between three and twenty.<sup>32</sup> To ensure content validity of the AFKS, both the item-content validity index (I-CVI) and the scale-content validity index (S-CVI) should exceed 0.80.<sup>17,19,28,33</sup> Based on the evaluations of five experts, values for the scale items ranged from 0.80 to 1.0. Following the pilot study, it was concluded that the scale demonstrated content validity and was culturally appropriate for use in Türkiye.

The CFA results confirmed the four-factor structure of the scale—atrial fibrillation in general, treatment, symptom recognition, and general attitudes—as originally developed by Hendriks et al.<sup>15</sup> These factors were validated in Turkish patients with AF. The confirmatory factor analysis showed that the model's fit indices were within acceptable limits, and the error values were below the recommended thresholds, indicating a robust model fit. Consequently, the results support the validity and compatibility of the model.

Unlike the original study, structured training was not provided to the participants in this study. However, the high education level and disease awareness among participants may have influenced the factor structure. In the Chinese version of the scale, items 9 and 10 loaded on a single factor, resulting in a three-factor structure. The authors attributed this difference to variations in the sample.<sup>16</sup>

In this study, factor loadings showed statistically significant relationships between items and their corresponding factors. For example, item 7 had a factor loading of 0.719 on Factor 1 (atrial fibrillation in general), and item 5 loaded 0.194 on Factor 2. Additionally, item 2 loaded 0.194 on Factor 3 (symptom recognition), and although this was a lower value, it was still statistically significant. In the original scale's four-factor structure, item 7 loaded on Factor 1 and item 5 on Factor 2.<sup>15</sup> In the Chinese version's three-factor structure, item loadings exceeded 0.30, which is considered acceptable and indicates that common factors strongly influence the item.<sup>26</sup>

To test the hypotheses proposed in earlier studies, this study examined construct validity by assessing the relationship between AFKS and AFEQT scores. Significant positive correlations were found between the total AFKS score and the total and subscale scores of the AFEQT (daily activities, symptoms, treatment concern, and treatment satisfaction). These findings support the criterion validity of the scale and indicate that higher AF knowledge is associated with better quality of life.

The original scale's developers also proposed evaluating whether knowledge and self-management reduce hospital visits by examining related variables, such as quality of life, anxiety, and depression. In the Chinese version, the hypothesis tested was that patients with an established AF diagnosis possess better knowledge than newly diagnosed patients.<sup>16</sup>

It is crucial for psychometric testing to be reproducible in new language contexts.<sup>17–19</sup> Internal consistency, typically evaluated using Cronbach's alpha, should approach 1.0. Values above 0.90 are considered acceptable for physiological measurements, and values above 0.70 are acceptable for attitude scales.<sup>28,32</sup> In this study, the Cronbach's alpha for the Turkish AFKS was 0.88, supporting the scale's reliability in measuring the intended construct. In comparison, the Cronbach's alpha values were 0.58 in the original version and 0.60 in the Chinese version.<sup>16</sup>

Our study also showed that the Turkish AFKS provides sensitive and valid measurements of distinctiveness. This parameter, recommended in adaptation guidelines, supports the scale's reliability by demonstrating significant score differences between low and high scorers.<sup>21</sup> The distinctiveness analysis further confirmed the scale's measurement validity. Notably, the Chinese version of the scale did not include distinctiveness testing.<sup>16</sup>

A test–retest procedure was conducted with 51 patients at a two-week interval, as recommended in psychometric guidelines.<sup>32</sup> The intraclass correlation coefficient (ICC), commonly used in quantitative research, reflects the proportion of variance not due to measurement error. ICC values below 0 indicate poor reliability, while values above 0.81 suggest almost perfect reliability.<sup>32</sup> High ICC values observed in this study indicate strong measurement consistency over time. Similar test–retest results were reported for the Chinese version.<sup>16</sup> In the original scale's recommendations, test–retesting was encouraged for future adaptation and psychometric studies.

### Strengths and Limitations

A key strength of this study is its ability to assess the construct validity and internal consistency of the AFKS in Turkish using a sufficiently large sample size. Additionally, the mean total score of the scale was  $6.94 \pm 1.71$ , and participants' ages ranged from 20 to 82 years, indicating a wide range of knowledge levels among individuals. These findings underscore the variability in patients' understanding of atrial fibrillation and highlight the importance of individualized disease management.

A potential limitation of the study is that it was conducted in a university hospital located in an urban setting, using a sample of patients diagnosed with AF. Therefore, the findings may not be generalizable to the entire population of patients with AF in Türkiye.

### Conclusion

The Turkish version of the AFKS is a straightforward and effective tool for assessing the knowledge levels of patients with atrial fibrillation. The results demonstrated that the Turkish version possesses satisfactory reliability and validity for use with Turkish AF patients. The scale's strong reliability coefficients, test–retest stability, and high criterion validity indicate that it can reliably measure knowledge in this patient group. These findings suggest that the scale is a tool that can be safely used by healthcare providers and researchers in Türkiye in clinical and educational settings for patients with AF.

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**Informed Consent:** The researcher obtained written informed consent from each participant after providing a detailed explanation of the study's purpose and procedures.

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