ORIGINAL ARTICLE / KLİNİK ÇALIŞMA

Atrial Fibrillation Impact Questionnaire (AFImpact): Validity and reliability of the Turkish version

Atriyal Fibrilasyon Etki Anketi (AFImpact): Türkçe sürümün geçerlik ve güvenirliği

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ABSTRACT

Objective: Guidelines recommend measuring and addressing health-related quality of life in the management of atrial fibrillation (AF); however, a disease-specific questionnaire is lacking for the Turkish language. Our aim was to translate and adapt the Atrial Fibrillation Impact Questionnaire (AFImpact) into Turkish and to explore its psychometric properties.

Methods: This cross-sectional study was conducted in two phases, including the translation and cultural adaptation of AFImpact into Turkish language and the analysis of psychometric properties of the translated questionnaire. 98 patients diagnosed with AF were evaluated using the Turkish version of AFImpact, Short Form-36 (SF-36) and Pittsburg Sleep Quality Index (PSQI). Reliability, validity, and factor structure of the Turkish version of AFImpact was explored.

Results: Cronbach's alpha coefficients for vitality, emotional distress, and sleep domains of AFImpact was 0.956, 0.955, and 0.819, respectively, indicating good-to-excellent internal consistency. No significant difference was detected between the initial and retest scores, and intraclass correlation coefficients of each domain varied between 0.991 and 0.996, indicating excellent test-retest reliability. Each domain of AFImpact highly correlated with similar domains of SF-36 and PSQI, having correlation coefficients between -0.484 and -0.699. AFImpact was able to discriminate between the patients in different functional classes, confirming know-groups validity. Factor analysis revealed AFImpact had the same factorial structure as the original questionnaire.

Conclusion: The Turkish version of AFImpact is a valid and reliable questionnaire for evaluating health-related quality of life in patients with AF.

ÖZET

Amaç: Kılavuzlar atriyal fibrilasyonun (AF) yönetiminde sağlıkla ilişkili yaşam kalitesini ele almayı önermektedir; ancak, hastalığa özel bir ölçek Türkçe dilinde mevcut değildir. Bu çalışmada amacımız Atriyal Fibrilasyon Etki Anketi'ni (AFImpact) Türkçe'ye tercüme etmek ve anketin psikometrik özelliklerini incelemektir.

Yöntemler: Bu kesitsel çalışma AFImpact'ın Türkçe'ye tercüme edilmesi ve uyarlanması, sonrasında tercüme edilmiş ölçeğin psikometrik özelliklerinin analiz edilmesi olmak üzere iki basamakta gerçekleştirildi. AF tanısına sahip 98 hasta AFImpact Türkçe Versiyon, Kısa Form-36 (KF-36) ve Pittsburg Uyku Kalitesi İndeksi (PUKİ) ile değerlendirildi. AFImpact Türkçe Sürüm'ün geçerlik, güvenirlik ve faktör yapısı incelendi.

Bulgular: AFImpact'ın canlılık, duygusal sıkıntı ve uyku alt grupları için sırasıyla 0.956, 0.955 ve 0.819 olarak saptanan Cronbach alfa katsayıları ölçeğin "iyiden-mükemmele" iç tutarlığa sahip olduğunu gösterdi. Başlangıç ve tekrar-test ölçümleri arasında anlamlı fark yoktu ve her alt grup için 0.991 ile 0.996 arasında hesaplanan korelasyon katsayıları ölçeğin 'mükemmel' test-tekrar test güvenirliğine sahip olduğunu gösterdi. AFImpact'ın her alt grubu, KF-36 ve PUKİ'nin benzer alt grupları ile korelasyon katsayıları -0.484 ve -0.699 arasında değişen kuvvetli ilişkilere sahipti. AFImpact, farklı fonksiyonel sınıfta yer alan hastaları birbirinden ayırt edebildi ve ölçeğin bilinen grup geçerliği doğrulandı. Faktör analizi, AFImpact'ın orijinal ölçek ile aynı faktör yapısına sahip olduğunu gösterdi.

Sonuç: AFImpact Türkçe Sürüm'ü AF'li hastalarda sağlıkla ilişkili yaşam kalitesini değerlendirmek için geçerli ve güvenilir bir ölçektir.

Atrial fibrillation (AF) is the most common cardiac arrhythmia, which has an estimated prevalence of 3% in the general population, with a greater prevalence in older individuals.[1] A recent report states that prevalence of AF is as high as 29% for individuals over 75 years of age in Turkey.[2] Frequent hospitalizations, hemodynamic abnormalities, and thromboembolic events related to AF result in significant morbidity and mortality, including death because of stroke or heart failure.[3] Patients with AF have a poorer health-related quality of life (HRQOL) than their healthy counterparts, experiencing symptoms such as palpitations and chest tightness to various degrees[4-6] and various non-specific symptoms such as dyspnea and fatigue.[7] Depression, anxiety, and sleeping difficulties are also present in these patients, which further impair HRQOL.[4,8] In addition, medical treatment of AF may have an impact on HRQOL. Patients with AF treated with warfarin were shown to exhibit particularly poor HRQOL, resulting from a higher number of bleeding episodes.[9]

It is reported that symptom control is a key factor when determining HRQOL in AF,[10] and improvement of HRQOL is identified as one of the clinical endpoints for pharmacological and interventional therapies of AF.[11] In this context, it is important to measure and address HRQOL for the management of AF, especially in facilities specialized in cardiac diseases, such as cardiology institutes or cardiac rehabilitation centers. Regulatory guidelines recommend that the impact of the disease on HRQOL should be measured using direct reporting from patients themselves using generic or disease-specific HRQOL measures. Generic instruments have the advantage of having been extensively validated such as Short Form-36 (SF-36), which has been used in various studies including patients with AF.[6] However, using such instruments in AF is not recommended as they are deemed not sensitive or specific enough to detect changes in HRQOL.[6,12]

There are several instruments developed specific for AF for measuring HRQOL, including the Atrial Fibrillation Quality of Life (AF-QoL) Questionnaire,[13] QoL in AF (QLAF) Questionnaire,[14] Atrial Fibrillation Effect on QualiTy-of-Life (AFEQT) Questionnaire,[15] and Atrial Fibrillation Impact Questionnaire (AFImpact).[16] However, none of these instruments are validated for Turkish patients

and consequently, such questionnaires are needed in our clinical practice. Previous studies evaluating HRQOL in Turkish patients with AF also stated that an AF-specific questionnaire was needed for the Turkish language,[9,17] supporting the rationale of our study.

It is reported that AF-QoL and QLAF has an uncertain generalizability, and the latter was also found to be relatively time-consuming. AFEQT was initially developed and validated as a 42-item questionnaire and then refined to include 18 items; therefore, the clinical data is limited, and its validity and reproducibility is yet to be analyzed.[6] AFImpact is the most recent questionnaire among the abovementioned instruments. It was developed in accordance with the regulatory guidelines to measure HRQOL in patients with paroxysmal, persistent, and permanent AF. Psychometric analysis demonstrates its validity and reliability, and preliminary results support responsiveness to change in patients undergoing interventional or pharmacological cardioversion. Considering the psychometric properties and practicality of all four instruments, we decided to adapt the AFImpact into Turkish language for using it in our clinical practice. Thus, in this study, we aimed to translate AFImpact into the Turkish language and investigate its psychometric properties in Turkish patients with AF.

METHODS

Study design and subjects

A prospective, cross-sectional study was conducted between August and November 2019, and 98 patients diagnosed with AF who were being followed in the rhythm management clinic of Cardiology Institute of İstanbul University-Cerrahpaşa were included in the study. Inclusion criteria were the di-

Abbreviations:	
AF	Atrial fibrillation
AFEQT	Atrial Fibrillation Effect on QualiTy-of-Life
AFImpact	Atrial Fibrillation Impact Questionnaire
AF-QoL	Atrial Fibrillation Quality of Life
ANOVA	One-way analysis of variance
BP	Bodily pain
GH	General health
HRQOL	Health-related quality of life
ICC	Intraclass correlation coefficients
MCS	Mental component summary
MH	Mental health
NYHA	New York Heart Association
PCS	Physical component summary
PF	Physical function
PSQI	Pittsburgh Sleep Quality Index
QLAF	QoL in AF
RE	Role-emotional
RP	Role-physical
SF	Social functioning
SF-36	Short Form-36

agnosis of paroxysmal, persistent, or permanent AF and to be able to read and understand the Turkish language. To obtain a homogeneous AF sample, patients diagnosed with heart failure, rheumatic valvular heart disease, or any chronic lung diseases were excluded from the study.

The study was approved by the ethics committee of İstanbul University-Cerrahpaşa (approval number: 59491012-604.01.02), prospectively registered to ClinicalTrials.gov website (registration number: NCT04047381) and conducted in accordance with the Helsinki Declaration. Permissions for translating and validating AFImpact into Turkish language was obtained from RWS Life Sciences, AstraZeneca, who owns the rights to the original questionnaire.

Atrial Fibrillation Impact Questionnaire

AFImpact was designed as a disease-specific questionnaire for measuring HRQOL in patients with AF by Coyne et al.[16] It is a recall questionnaire that includes 18 items covering three domains which are vitality (seven items), emotional distress (eight items), and sleep (three items). Each item questions how often AF has affected a specific aspect of the patient's life and is scored on a 7-point Likert scale, with response options ranging from "1" representing "none of the time" to "7" representing "all of the time" (Supplementary File 1). Mean scores are calculated for each domain, and higher scores indicate worse HRQOL. AFImpact demonstrates satisfactory reliability and construct validity, and preliminary results support the responsiveness to change.

Translation of the original questionnaire into the Turkish language was conducted according to the procedure provided by the license holder of the questionnaire. The forward translation from English to Turkish language was independently performed by a blinded certified translator and a researcher who was a health professional. Both of them were native speakers of Turkish and fluent in English. Discrepancies between these two translations were reviewed and resolved between the translators, with the addition of an unbiased researcher who was not involved in the previous translations. A blinded medical doctor who was a native speaker of English and fluent in Turkish then performed the back translation from Turkish to English. The original questionnaire and the back translation were reviewed for any discrepancies by an

expert panel, including all the translators, an expert in instrument development, and a researcher who is working in the cardiopulmonary rehabilitation field; and a pre-final version of the questionnaire was developed. This version of the questionnaire was applied to 10 patients with AF, and each patient was interviewed regarding the intelligibility of each item. All the patients confirmed that they understood each item without any problem. The patients also stated that as the sentences were quite short and straightforward, they were easy to understand. Considering the original questionnaire emphasizes on how often AF affects a specific aspect of the patients' life, it was ensured that the patients clearly understand the adverbs of frequency. The patients were also asked whether they would modify any item or word in the questionnaire to make it more intelligible. They did not recommend any changes to the questionnaire. The expert panel concluded that this version of AFImpact was semantically and conceptually equivalent to the original questionnaire, and culturally appropriate for Turkish patients; and therefore, considered as the final version of the questionnaire (Supplementary File 2).

Short Form-36

SF-36 is a widely used questionnaire for measuring HRQOL in the general population. It evaluates HRQOL over eight domains including physical function (PF), role-physical (RP), role-emotional (RE), vitality, mental health (MH), social functioning (SF), bodily pain (BP), and general health (GH). Each domain is scored between 0 and 100 points, and higher scores indicate better HRQOL. SF-36 also has two summary scores called physical component summary (PCS) and mental component summary (MCS), which require a special algorithm based on country weights to be calculated. PF, RP, and BP contribute most to the physical component, whereas MH, RE, and SF contribute most to the mental component. Vitality, GH, and SF highly correlate with both the components.[18] The Turkish version of SF-36 was used in this study.[19]

Pittsburgh Sleep Quality Index

The Pittsburgh Sleep Quality Index (PSQI) is a self-report questionnaire that evaluates the sleep quality over a one-month time interval. The questionnaire consists of 19 items, creating seven components including sleep quality, sleep latency, sleep duration,

habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction that produce one global score. Each component yields a score ranging from 0 to 3, with 3 indicating the greatest dysfunction. The sum of component scores yields a global score ranging from 0 to 21.[20] The Turkish version of PSQI was used in this study.[21]

Sample size

Literature suggests that 10 participants for each item should be included in the study if Cronbach's alpha coefficient of the original questionnaire is above 0.7 for validation studies.[22] Considering vitality, emotional distress, and sleep domains of AFImpact have Cronbach alpha values of 0.96, 0.96, and 0.90, respectively; and the emotional distress domain has the highest item count with eight items, it was decided that a minimum of 80 patients should be included in the study.

Statistical analysis

Statistical analysis was performed using SPSS v20 for Windows (IBM Corp.; Armonk, NY, USA). Continuous data was expressed as mean±standard deviation and categorical data as n (%). Distribution properties of the data were analyzed using the Kolmogorov-Smirnov test and controlled with Q-Q plot and detrended Q-Q plot. $p < 0.05$ was considered statistically significant.

Floor and ceiling effects

Floor or ceiling effects of the Turkish version of AFImpact were considered present if >15% of the patients in each domain achieved lowest (=1) or highest (=7) score, respectively.

Reliability

Reliability of the Turkish version of AFImpact was explored by determining internal consistency and test-retest analysis. Cronbach's alpha coefficients for each domain of AFImpact were calculated for assessing internal consistency. Cronbach's alpha coefficients were interpreted as excellent ($\alpha > 0.90$), good ($0.90 > \alpha > 0.70$), acceptable ($0.70 > \alpha > 0.60$), poor ($0.6 > \alpha > 0.5$), or unacceptable ($0.5 > \alpha$). For determining test-retest reliability, the Turkish version of AFImpact was administered to 34 patients again after one-week interval, and test-retest analysis was conducted on the data from these patients. Intraclass correlation coefficients (ICC) were calculated for each domain of AFImpact, and mean scores of each do-

main at first and second evaluations were compared using independent samples t-test.

Validity

Construct validity of the Turkish version of AFImpact was explored on the basis of convergent and discriminant validity. Pearson correlation coefficients were calculated among the domains of AFImpact, SF-36, and PSQI. Convergent validity was confirmed if the magnitude of correlation was higher between the two domains that measured similar concepts, whereas divergent validity was confirmed if the domains that measured theoretically unrelated concepts had a lower magnitude of correlation in between. Known-groups validity of the Turkish version of AFImpact was explored by comparing each domain of AFImpact among the patients with different disease severities that were classified according to the New York Heart Association (NYHA) Functional Classification[23] using one-way analysis of variance (ANOVA). Post-hoc analysis for ANOVA was conducted using Tukey's correction.

Factor analysis

Exploratory factor analysis with maximum likelihood extraction method and Varimax rotation was used to confirm whether the factor structure of the Turkish version of AFImpact were same as the original questionnaire.

RESULTS

A total of 132 patients were assessed for eligibility. Of these, 14 patients with heart failure, 11 patients with valvular disease, and nine patients with chronic lung disease (chronic obstructive pulmonary disease, emphysema, and asthma) were excluded; and 98 patients who met the inclusion criteria were included in the study. The patients were able to answer all three questionnaires, and there were no missing data. Demographic and clinical characteristics of these 98 patients are presented in Table 1.

Floor and ceiling effects

The number of patients with the lowest possible score for vitality, emotional distress, and sleep domains of AFImpact was 12 (12.2%), 27 (27.6%), and 14 (14.3%), respectively, indicating that floor effect was present for the emotional distress domain. The number of patients with the highest possible score for

Table 1. Demographic and clinical characteristics of patients

Variable	Mean±SD or n (%)
Age (years)	64.84±6.57
Sex (n)	
Female	51 (52)
Male	47 (48)
AF type (n)	
Permanent	59 (60)
Persistent	21 (21)
Paroxysmal	18 (19)
AF duration (years)	6.63±6.40
Left ventricular ejection fraction (%)	56.76±7.19
Body mass index (kg/m^2)	30.25±4.97
NYHA class (n)	
Class I	21 (21)
Class II	55 (56)
Class III	22 (23)
Comorbid conditions (n)	
Hypertension	70 (71)
Hyperlipidemia	45 (46)
Diabetes mellitus	35 (36)
AFImpact domains	
Vitality	2.92±1.63
Emotional distress	2.21±1.39
Sleep	2.08±1.22
SF-36 domains	
PF	57.81±25.57
RP	69.13±45.94
RE	87.42±32.99
Vitality	58.98±18.36
MH	64.37±16.61
SF	82.26±25.28
BP	76.48±24.08
GH	56.99±16.71
PSQI	
Global score	4.87±3.40

AF: atrial fibrillation; AFImpact: Atrial Fibrillation Impact Questionnaire; BP: bodily pain; GH: general health; MH: mental health; NYHA: New York Heart Association; PF: physical function; PSQI: Pittsburg Sleep Quality Index; RE: role-emotional; RP: role-physical; SD: standard deviation; SF: social functioning; SF-36: Short Form-36.

vitality, emotional distress, and sleep domains was three (3.1%), two (2.1%), and two (2.1%), respectively, indicating no ceiling effect.

Reliability

Cronbach's alpha coefficients were calculated for vitality, emotional distress, and sleep domains of AFImpact as 0.956, 0.955, and 0.819, respectively. Internal consistency was found to be "excellent" for vitality and emotional distress domains and "good" for sleep domain according to Cronbach's alpha coefficients. Data from 34 patients were analyzed for test-retest reliability. No statistically significant difference was detected between the initial and retest scores for all domains (p>0.05). ICC values were 0.996, 0.994, and 0.991 for vitality, emotional distress, and sleep domains, respectively, indicating that the questionnaire had "excellent" test-retest reliability (Table 2).

Validity

Pearson correlation coefficients among the domains of AFImpact, SF-36, and global score of PSQI are presented in Table 3. Correlation coefficients of the vitality domain of AFImpact were relatively higher with the physical component domains of SF-36 (ranging from -0.517 to -0.618), and relatively lower with mental component domains of SF-36 (ranging from -0.433 to -0.512). Similarly, correlation coefficients of the emotional distress domain of AFImpact were relatively higher with mental component domains of SF-36 (ranging from -0.484 to -0.561) and relatively lower with physical component domains of SF-36 (ranging from -0.325 to -0.533). Correlation coefficient of the sleep domain of AFImpact were highest with PSQI global score (0.699) and relatively lower with physical and mental component domains of SF-36 (ranging from -0.292 to -0.567). All the domains of AFImpact significantly differed among the patients in different NYHA classes (Table 4).

Factor structure

Kaiser-Meyer-Olkin value for sampling adequacy was calculated as 0.925, and Bartlett's test for sphericity was statistically significant (p<0.001). Both the tests confirmed that it was appropriate to conduct a factor analysis. Exploratory factor analysis revealed three significant factors for the Turkish version of AFImpact, which explained 79.2% of the total variance, each accounting for 63.6%, 9.1%, and 6.5% of the total variance, respectively. The factor structure of the Turkish version of AFImpact was same as the original questionnaire (Table 5).

Table 2. Test-retest reliability of Turkish version of AFImpact (n=34)

	Initial scores	Retest scores	Difference *p* value	ICC (95% CI)
Vitality	2.85±1.64	2.88±1.62	0.419	0.996 (0.991-0.998)
Emotional distress	2.32±1.29	2.31±1.97	0.647	0.994 (0.988-0.997)
Sleep	2.07±1.31	2.03±1.33	0.211	0.991 (0.981-0.995)

AFImpact: Atrial Fibrillation Impact Questionnaire.
AFImpact scores are reported as mean ± standard deviation.

Table 3. Construct validity of Turkish version of AFImpact

	AFImpact domains		
	Vitality	Emotional distress	Sleep
SF-36 domains			
PF	-0.618*	-0.444*	-0.421*
RP	-0.517*	-0.325*	-0.292†
RE	-0.433*	-0.561*	-0.531*
Vitality	-0.676*	-0.533*	-0.501*
MH	-0.507*	-0.538*	-0.434*
SF	-0.512*	-0.484*	-0.384*
BP	-0.534*	-0.498*	-0.567*
GH	-0.496*	-0.439*	-0.333*
PSQI			
Global score	0.411*	0.410*	0.699*

BP: bodily pain; GH: general health; MH: mental health; PF: physical function; RP: role-physical; PSQI: Pittsburg Sleep Quality Index; RE: role-emotional; SF: social functioning; SF-36: Short Form-36.
Pearson's correlation coefficients (r values) are presented.
*p<0.01.
†p<0.05.

DISCUSSION

In our study, the Turkish version of AFImpact demonstrated satisfactory psychometric properties for measuring HRQOL in patients with AF. In the translation phase, the questionnaire did not require any significant adaptations to Turkish language and socio-cultural structure. In the testing phase, it showed good-to-excellent internal consistency and excellent test-retest reliability. Correlation coefficients between the related domains of AFImpact and SF-36 were higher than those between the unrelated domains, indicating satisfactory convergent and divergent validity, which confirmed the construct validity. The questionnaire was able to differentiate between the disease severities, confirming the known-groups validity, and the factor structure was the same as the original questionnaire.

Management of AF primarily consists of ventricular rate control and antithrombotic therapy to prevent thromboembolism related complications; and generally, HRQOL is not considered as a primary endpoint in routine practice. Guidelines recommend that maintenance of a good HRQOL should be one of the aims of management in all the patients with AF; however they also state that the assessment of HRQOL is constrained by a lack of cross-validation of the several AF-specific quality of life tools.[1] To this date, the Turkish language had no instruments developed specific for AF for assessing HRQOL. Thus, this study was planned considering the importance of including individual patient factors, such as psychological well-being in the management of AF and the need for an instrument to this end in our clinical practice.

AF is classified as paroxysmal, persistent, or permanent. Patients with AF may have different symptom patterns; for example, those with permanent AF tend to have a more stable clinical course with fewer episodes which may result in lessening of anxiety regarding their condition.[6] However, those with paroxysmal AF experience a higher number of symptomatic episodes and have higher levels of anxiety associated with the unpredictability of these episodes; and therefore, a greater HRQOL impairment may occur.[17,24] AFImpact was developed including patients with paroxysmal, persistent, and permanent AF; and therefore, we included patients with each type of AF in this study as well to ensure the validity of the instrument.

Floor and ceiling effects are said to occur when the participants' scores cluster toward the high or low end of the instrument. It is reported that these effects frequently occur when a new instrument is applied to patients in medical sciences.[25] In our study, a floor effect was present for the emotional distress domain of the Turkish version of AFImpact, meaning that many of our patients (28%) reported no symptoms

Table 4. Known-group validity of Turkish version of AFImpact

	NYHA Class I (n=21)	NYHA Class II (n=55)	NYHA Class III (n=22)	Difference	Post-hoc		
					Class I vs II	Class I vs III	Class II vs III
Vitality	1.49±0.59	2.79±1.27	4.62±1.64	F=34.179 p<0.001	p<0.001	p<0.001	p<0.001
Emotional Distress	1.39±0.64	2.09±1.10	3.27±1.87	F=12.847 p<0.001	0.048	p<0.001	0.001
Sleep	1.40±0.64	2.04±1.22	2.83±1.54	F=8.765 p=0.001	0.075	0.001	0.017

NYHA: New York Heart Association.
AFImpact scores are reported as mean±standard deviation.

Table 5. Factor structure of Turkish version of AFImpact

	Factors		
	1=Vitality	2=Emotional distress	3=Sleep
17. Not as physically active	0.900*	0.299	0.213
16. Had to rest during the day	0.894*	0.261	0.220
7. Walk slowly	0.797*	0.225	0.290
10. Performed daily activities slowly	0.755*	0.227	0.267
8. Tired	0.717*	0.348	0.424
12. Felt worn out	0.627*	0.447	0.418
4. Less energy	0.527*	0.416	0.367
18. Worried might get worse	0.308	0.806*	0.342
11. Worried about my health	0.354	0.796*	0.320
2. Worried might shorten my life	0.192	0.794*	0.232
3. Felt anxious	0.295	0.630*	0.473
14. Nervous	0.390	0.586*	0.551
15. Depressed	0.454	0.565*	0.558
5. Annoyed	0.195	0.545*	0.520
6. Stressed	0.258	0.515*	0.510
13. Difficulty falling asleep	0.281	0.279	0.714*
9. Woke up during the night	0.213	0.221	0.632*
1. Did not sleep well	0.308	0.170	0.400*

*Highest factor loading.

for emotional aspects of their HRQOL. As the mean AF duration was 6.63 years in our patients, it may be presumed that their disease was in a relatively controlled state, and this may explain the clustering on the lower end of the emotional distress domain. This assumption is also supported by the fact that the man-agement of AF improves the emotional burden of disease by reducing the uncertainty and unpredictability of symptoms.[1,11]

Reliability of an instrument is assessed by means of internal consistency, which is the consistency of responses across the instrument, and test-retest reliability, which is the instrument's ability to replicate the results more than once in the same sample. In our study, the Turkish version of AFImpact had excellent internal consistency for vitality and emotional distress domains, indicated by Cronbach's alpha coefficients of 0.956 and 0.955, respectively; whereas it was relatively lower for the sleep domain (0.819). In the original questionnaire, the Cronbach's alpha coefficient of sleep domain was relatively lower than the vitality and emotional distress domains as well. Cronbach's alpha is highly sensitive to the number of items in the scale,[26] and this may explain the relatively lower coefficients in sleep domain, considering that the sleep domain has only three items compared with seven and eight items of the vitality and emotional distress domains, respectively. Nevertheless, the Turkish version of AFImpact was found to have satisfactory internal consistency, considering the Cronbach's alpha coefficients were above 0.800 for all the domains. Test-retest reliability was also found to be excellent for the Turkish version of AFImpact, same as the original questionnaire. Our subsample for test-retest analysis was similar to the study sample in terms of age, sex, and AF type; and we believe that it ensured the generalizability of test-retest results to the study sample. Reliability of the Turkish version of AFImpact was confirmed by both internal consistency and test-retest reliability.

In terms of construct validity, correlation coefficients between the domains of the original question-

naire and SF-36 were reported above -0.400. Similarly, in our study, vitality and emotional distress domains of the Turkish version of AFImpact highly correlated with similar domains of SF-36, having correlation coefficients between -0.484 and -0.618, with domains measuring dissimilar concepts having relatively lower coefficients. Sleep domain of the original questionnaire significantly correlated to the Medical Outcomes Study-Sleep Scale scores, having correlation coefficients between 0.220 and 0.780. In our study, we used another sleep-specific instrument, which was PSQI, for exploring the convergent validity of sleep domain of the Turkish version of AFImpact. Similar to the original questionnaire, sleep domain of the Turkish version of AFImpact highly correlated with the PSQI global score (r=0.699). The Turkish version of AFImpact was found to have satisfactory convergent and discriminant validity, confirming the construct validity of the questionnaire on patients with all three types of AF. Besides construct validity, we also explored the factor structure of the Turkish version of AFImpact. The aim of the factor analysis is to reduce the items of the instrument into smaller groups, that is, factors containing correlated items that are conceptually similar. Factor analysis for the Turkish version of AFImpact revealed three significant factors, with same factor structure as the original questionnaire. The same items appeared in the same factors in both questionnaires.

Majority of patients with AF experience exercise intolerance. It is reported that exercise tolerance in patients with AF is reduced by 15%-20% compared with individuals with sinus rhythm.[27] Therefore, it is recommended to measure functional status in patients with AF, both as a means of measuring symptom burden and as an outcome measure for rehabilitative interventions.[6] NYHA classification is one of the frequently used subjective instruments to measure functional status in patients with AF and is associated with HRQOL.[24] Thus, we used NYHA classification to explore know-groups validity of the Turkish version of AFImpact in this study. All three domains of the Turkish version of AFImpact differed among patients in different NYHA classes, and know-groups validity of the questionnaire was confirmed.

Limitations

Guidelines recommend that HRQOL should be considered as one of the primary endpoints in the treatment of AF. It means reliable, disease-specific instruments are needed to assess the change in HRQOL in clinical practice. The original AFImpact questionnaire supports the responsiveness to change after cardioversion with preliminary results. Responsiveness to change after pharmacological therapy is yet to be explored. Similarly, the main limitation of our study was the lack of responsiveness analysis for AFImpact. Another limitation was that the original questionnaire has not yet been validated for another language; therefore, we were unable to compare the psychometric properties of the Turkish version of AFImpact with different languages or cultures. Nonetheless, the Turkish version of AFImpact was found to be consistent with the original questionnaire regarding psychometric properties.

Conclusion

The Turkish version of AFImpact is a valid and reliable questionnaire for evaluating HRQOL in patients with AF. To the best of our knowledge, this is the first AF-specific HRQOL instrument available in the Turkish language. Guidelines recommend including assessment of HRQOL in the management of AF, and the Turkish version of AFImpact answers the need for such an instrument in clinical practice including Turkish patients.

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Supplementary File 1. Atrial Fibrillation Impact Questionnaire

Atrial Fibrillation Impact Questionnaire (AFI)

The following questions ask about how often your atrial fibrillation or irregular heartbeat might have affected your life over the **past 7 days**. Through the questionnaire we refer to atrial fibrillation or irregular heartbeat as 'your heart condition'.
Please mark with an "X" how you were affected. Please choose only one box per question.

IN THE PAST 7 DAYS…	All of the time	Most of the time	A good bit of the time	Some of the time	A little of the time	Hardly any of the time	None of the time
1. I did not sleep well because of my heart condition	☐	☐	☐	☐	☐	☐	☐
2. I was worried that my heart condition might shorten my life	☐	☐	☐	☐	☐	☐	☐
3. I felt anxious because of my heart condition	☐	☐	☐	☐	☐	☐	☐
4. I had less energy because of my heart condition	☐	☐	☐	☐	☐	☐	☐
5. I felt annoyed because of my heart condition	☐	☐	☐	☐	☐	☐	☐
6. I felt stressed because of my heart condition	☐	☐	☐	☐	☐	☐	☐
7. I had to walk slowly because of my heart condition	☐	☐	☐	☐	☐	☐	☐
8. I felt tired because of my heart condition	☐	☐	☐	☐	☐	☐	☐
9. I woke up during the night because of my heart condition	☐	☐	☐	☐	☐	☐	☐
10. I performed daily activities slowly because of my heart condition	☐	☐	☐	☐	☐	☐	☐
11. I worried about my health because of my heart condition	☐	☐	☐	☐	☐	☐	☐
12. I felt worn out because of my heart condition	☐	☐	☐	☐	☐	☐	☐
13. I had difficulty falling asleep at night because of my heart condition	☐	☐	☐	☐	☐	☐	☐

14. I felt nervous because of my heart condition ☐ ☐ ☐ ☐ ☐ ☐ ☐

15. I felt depressed because of my heart condition ☐ ☐ ☐ ☐ ☐ ☐ ☐

16. I had to rest during the day because of my heart condition ☐ ☐ ☐ ☐ ☐ ☐ ☐

17. I could not be as physically active as I wanted to be because of my heart condition ☐ ☐ ☐ ☐ ☐ ☐ ☐

18. I worried that my heart condition might get worse ☐ ☐ ☐ ☐ ☐ ☐ ☐

Supplementary File 2. Turkish version of the Atrial Fibrillation Impact Questionnaire

Atriyal Fibrilasyon Etki Anketi

Aşağıdaki sorular **geçtiğimiz 7 günde** atriyal fibrilasyonunuzun ya da düzensiz kalp atımınızın hayatınızı ne sıklıkla etkilediğini sormaktadır. Sorularda 'sizin kalp rahatsızlığınız' ile atriyal fibrilasyonu ya da düzensiz kalp atımını kastetmekteyiz.
Lütfen nasıl etkilendiğinizi 'X' ile işaretleyin. Lütfen her soru için sadece bir kutu seçin.

GEÇTİĞİMİZ 7 GÜNDE…	Her zaman	Çoğu zaman	Epeyce bir zaman	Bazı zamanlar	Çok az bir zaman	Neredeyse hiçbir zaman	Hiçbir zaman
1. Kalp rahatsızlığımdan dolayı iyi uyumadım	☐	☐	☐	☐	☐	☐	☐
2. Kalp rahatsızlığımın hayatımı kısaltabileceğinden endişelendim	☐	☐	☐	☐	☐	☐	☐
3. Kalp rahatsızlığımdan dolayı huzursuz hissettim	☐	☐	☐	☐	☐	☐	☐
4. Kalp rahatsızlığımdan dolayı daha az enerjiye sahiptim	☐	☐	☐	☐	☐	☐	☐
5. Kalp rahatsızlığımdan dolayı kızgın hissettim	☐	☐	☐	☐	☐	☐	☐
6. Kalp rahatsızlığımdan dolayı stresli hissettim	☐	☐	☐	☐	☐	☐	☐
7. Kalp rahatsızlığımdan dolayı yavaş yürümek zorunda kaldım	☐	☐	☐	☐	☐	☐	☐
8. Kalp rahatsızlığımdan dolayı yorgun hissettim	☐	☐	☐	☐	☐	☐	☐
9. Kalp rahatsızlığımdan dolayı gece uyandım	☐	☐	☐	☐	☐	☐	☐
10. Kalp rahatsızlığımdan dolayı günlük aktivitelerimi yavaşça gerçekleştirdim	☐	☐	☐	☐	☐	☐	☐
11. Kalp rahatsızlığımdan dolayı sağlığım hakkında endişelendim	☐	☐	☐	☐	☐	☐	☐
12. Kalp rahatsızlığımdan dolayı yıpranmış hissettim	☐	☐	☐	☐	☐	☐	☐
13. Kalp rahatsızlığımdan dolayı gece uykuya dalmakta zorluk çektim	☐	☐	☐	☐	☐	☐	☐

GEÇTİĞİMİZ 7 GÜNDE…	Her zaman	Çoğu zaman	Epeyce bir zaman	Bazı zamanlar	Çok az bir zaman	Neredeyse hiçbir zaman	Hiçbir zaman
14. Kalp rahatsızlığımdan dolayı gergin hissettim	☐	☐	☐	☐	☐	☐	☐
15. Kalp rahatsızlığımdan dolayı moralim bozuk hissettim	☐	☐	☐	☐	☐	☐	☐
16. Kalp rahatsızlığımdan dolayı gün içinde dinlenmek zorunda kaldım	☐	☐	☐	☐	☐	☐	☐
17. Kalp rahatsızlığımdan dolayı fiziksel olarak istediğim kadar aktif olamadım	☐	☐	☐	☐	☐	☐	☐
18. Kalp rahatsızlığımın kötüleşebileceğinden endişelendim	☐	☐	☐	☐	☐	☐	☐