Research Article

Cross-Cultural Validation and Psychometric Assessment of the Persian Version of Hearing Implant Sound Quality Index for Adult Cochlear Implant Users

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Citation: Bagheripour H, Saki N, Saki A, Bayat A. Cross-Cultural Validation and Psychometric Assessment of the Persian Version of Hearing Implant Sound Quality Index for Adult Cochlear Implant Users. Aud Vestib Res. 2026;35(1):85-95.

https://doi.org/10.18502/avr.v35i1.20582

Highlights

- The P HISQUI19 is a reliable tool to measure the auditory benefits of CI adults
- The P HISQUI19 had excellent internal consistency and test–retest reliability
- The duration of deafness and gender had no effect on perceived auditory benefits

Article info:
Received: 16 May 2025
Revised: 29 Jun 2025
Accepted: 07 Jul 2025

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ABSTRACT

Background and Aim: Cochlear Implants (CIs) can successfully improve the speech and auditory perception in patients with a severe to profound hearing loss. This study aimed to assess the psychometric properties of the Persian Hearing Implant Sound Quality Index (P HISQUI19) for measuring the perceived auditory benefits of Iranian adult CI users in everyday listening situations.

Methods: Participants included 70 Iranian CI users with post-lingual deafness aged 18–64 years. After translation and cross-cultural adaptation, the content and construct validity of the P HISQUI19 were examined, followed by internal consistency and test–retest reliability assessments using Cronbach's α and Intra-Class Correlation Coefficient (ICC), respectively.

Results: The mean total P HISQUI19 score was 78.22, indicating a moderate sound quality perception. The P HISQUI19 had excellent internal consistency (Guttman's split-half coefficient=0.912; Cronbach's α=0.956) and test-retest reliability (ICC=0.962). Using factor analysis, the items were loaded on three factors. Age at implantation, duration of deafness, side of implantation, gender, and MED EL implant system (CONCERTO Mi1000 vs. SONATA Ti100) did not significantly affect the sound quality perception.

Conclusion: The P HISQUI19 is a valid and reliable tool to be used in both research and clinical settings for evaluating the auditory benefits of Iranian adults using CI.

Keywords: Adult; cochlear implant; Persian; sound quality

Introduction

Cochlear Implants (CIs) can successfully provide access to auditory information for patients with severe-to-profound hearing loss [1]. The CI recipients usually experience improved speech production and speech comprehension abilities [2, 3]. Despite recent advances in CI technology, there are still major perceptual limitations. Some of these limitations can affect the daily living functions of CI users, including telephone use, auditory discrimination in noisy contexts, sound localization, and music perception [4, 5]. Another important limitation in CI patients is the sound quality, i.e. the perceived richness of an auditory stimulus [4].

It has been shown that CI users may experience limited ability to detect sound quality degradations due to limited high-bandpass and low-bandpass filtering, reduced fine-structure processing, and increased reverberation [6]. In addition to technical limitations, structural changes in central auditory pathways, due to auditory deprivation, may lead to various auditory system dysfunctions that can affect the CI device's performance. Currently, sound quality assessment in the CI recipients is largely carried out using the self-report tools that require the individual to rate the sound pleasantness or likeability in a wide range of listening situations. These instruments can provide insights into CI-mediated sound perception in real-life situations. It seems that the individual's rated sound likability is greatly affected by factors such as the listening situation (room acoustics), the complexity of the stimulus, and the listener's individual characteristics (e.g. musical training or familiarity with the musical piece) [7].

The Hearing Implant Sound Quality Index (HISQUI19) is a quantitative self-assessment instrument for adults with CI. It determines the levels of auditory benefits for implanted patients in everyday listening situations [8-10]. It examines various aspects of sound quality, such as sound localization, music identification, speech perception in competing situations, and differentiation between different talkers [11]. The HISQUI19 was developed by Amann and Anderson [10] and has been validated in other languages, including Spanish [9], Dutch [8], and Turkish [12]. There is a paucity of data to correctly evaluate sound quality in cochlear implanted adults, and no standard tool has been developed to understand the subjective experiences of Persian-speaking CI users. This study aimed to assess the reliability and validity of the Persian HISQUI19 (P-HISQUI19) for Iranian adults with CI, and to investigate the association of subjective auditory benefits with demographic and clinical characteristics of the CI users.

Methods

Participants

The participants included 70 adult CI users with post-lingual deafness (mean age: 33.87±11.49 years, ranged 18–64 years) recruited from three CI centers affiliated with a public hospital during 2019–2022. These patients were selected from our National Iranian Cochlear Implant Registry [13]. All cases met the inclusion criteria: being native in the Persian language, suffering from bilateral severe to profound sensorineural hearing loss, at least 6 months of CI use, regular attendance at post-surgery mapping and Auditory Verbal Therapy (AVT) sessions (at least 100 sessions), complete insertion of the CI electrodes confirmed by postoperative Computed Tomography (CT) scan, and having normal cochlear anatomy confirmed by postoperative CT scan. The patients were excluded if they had a psychological or neurological disorder diagnosed by an experienced neuropsychologist. All subjects had a unilateral multi-channel MED-EL implant system (CONCERTO Mi1000 or SONATA Ti100 audio processors, MED-EL, Austria).

Data collection instrument

The HISQUI19 has 19 items rated on a seven-point Likert scale, from 1 (never) to 7 (always) [10]. It also includes a "N/A = not applicable" option, if a specific statement/situation is inapplicable, and is considered as a missing value [11]. The total score ranges from 19 to 133. According to the total score, the auditory benefit is classified into five categories: Very poor (<30 points), poor (30–59 points), moderate (60–89 points), good (90–109 points), and very good (110–133 points). The HISQUI19 takes about 10 minutes to complete.

Translation and development

The P-HISQUI19 was developed based on the guidelines of the International Quality of Life Assessment

(IQOLA) for cross-cultural translation [14]. First, two native Persian speakers with advanced English language skills, but without any prior knowledge of the HISQUI19, independently translated the original questionnaire into Persian. Only minor disagreements were found in the translation of the items between the two translators. Then, in a meeting with the authors, the translators approved the first translated draft of the HISQUI19. Afterwards, a native American English speaker (third translator) translated the translated Persian draft back to English. Then, the translated English draft was sent to the developers of the main HISQUI19 to compare it with the original scale. Moreover, a pilot study was carried out with the participation of 10 participants (5 males and 5 females), who were asked to complete the P-HISQUI19 to assess the clarity, relevance, and simplicity of each item on a scale from 1 to 4.

Content validity

The P-HISQUI19 was distributed among 10 experts in the field of cochlear implants (five audiologists and five speech-language pathologists) in order to validate its content. The consensus among the specialists regarding the necessity of a particular item in the questionnaire was determined using the Content Validity Ratio (CVR) determined according to Lawshe formula: CVR=([ne-(N/2)]/(N/2), in which "N" is the total number of panelists and "ne" represents the number of panelists indicating an item as essential [15]. The Content Validity Index (CVI) was also calculated according to the expert's opinions in terms of relevance, simplicity, and clarity on a 4-point Likert scale (e.g. 4=very relevant, 3=quite relevant, 2=somewhat relevant, and 1=not relevant). The CVI for each Item (I-CVI) was calculated as the number of experts giving a relevance rating of 3 or 4 divided by the total number of experts. To calculate the Scale-level CVI (S-CVI), the average I-CVI score was determined for all items. These two content validity indices were considered acceptable if S-CVI and I-CVI values were at least 0.90 and 0.79, respectively. The ceiling and floor effects, indicating the percentage of subjects receiving the highest and lowest total scores, respectively, were also calculated to assess content validity; a value greater than 15% was regarded as significant.

Construct validity

The construct validity was examined by the exploratory factor analysis (orthogonal rotation method). To ensure that the factor analysis is a suitable procedure for our data set, the Keiser–Meyer–Olkin (KMO) test and Bartlett's test of sphericity were employed. The former test assesses the magnitude of the squared correlations between variables, ranging from 0 to 1. Overall, the KMO value is classified as unacceptable (0–0.49), mediocre (0.50–0.69), good (0.70–0.79), great (0.80–0.89), and superb (≥0.9). Bartlett's test measures the null hypothesis that the variables only correlate with themselves.

Reliability

For test-retest reliability assessment, 30 participants were asked to complete the P-HISQUI19. After a 2-week interval, the questionnaire was completed again. Test-retest reliability was evaluated using the Intra-Class Correlation Coefficient (ICC) at a 95% confidence interval; it was considered acceptable if the ICC value was equal to or greater than 0.70. Furthermore, to determine the internal consistency reliability of the items, the Cronbach's α coefficient was measured. The internal consistency was considered satisfactory if Cronbach's α was within the 0.7–0.95 range.

Data analysis

The Kolmogorov-Smirnov test was used to assess the normal distribution of numerical data. The relationship between the total score of Persian HISQUI19 with age at cochlear implantation and duration of deafness was measured by Spearman's rho correlation test. In addition, the impact of the side of implantation and gender factors on sound quality perception was measured by the Mann-Whitney U test. The significance level was set at 0.05.

Results

The demographic and clinical characteristics of participants are presented in Table 1. The mean age at cochlear implantation was 33.87 years (ranged 24–70 years). The mean length of deafness before cochlear implantation was 6.5 years (ranged 1–15 years). The cochlear implantation had been conducted in the right ear in 64.3% of the participants (n=45).

Reliability

The P-HISQUI19 showed high internal consistency

Table 1. Demographic and clinical characteristics of cochlear implanted patients

Parameter	n=70, n(%)
Duration of deafness (years)	
<=20	41(58.57)
>20	29(41.43)
Implant side of all subjects	
Left	25(35.7)
Right	45(64.3)
Implant type	
CONCERTO Mi1000	44(62.86)
SONATA Ti100	36(37.14)
Gender of all subjects	
Female	34(48.6)
Male	36(51.4)
Gender of 30 subjects	
Female	18(60.0)
Male	12(40.0)
Etiology of hearing loss	
Unknown	32(45.71)
Middle ear disorders (e.g., otosclerosis)	14(20.0)
Ototoxicity	5(7.14)
Head trauma	2(2.85)
Sudden hearing loss	3(4.29)
Autoimmune disorder	1(1.43)
Meniere's disease	2(2.85)
Hereditary	11(15.71)

CI; cochlear implant

(Guttman's split-half coefficient=0.912; Cronbach's α=0.956) (Table 2). The test–retest reliability was also high and significant (r=0.962, p<0.001).

Content validity

The CVR values for all items were ≥0.8 (Table 3). All items had I-CVI values >0.79 in terms of clarity, relevance, and simplicity. The S-CVI for the overall scale was equal to 0.96. According to the results, all items had satisfactory content validity. Also, none of the participants obtained the floor effect (worst score) of 19 or the ceiling effect (best score) of 133. Therefore, the questionnaire did not show a floor or ceiling effect and was utilized as a valid measurement tool for outcomes reported by the patient.

Construct validity

Table 4 presents the results of the construct validity

Table 2. Reliability analysis of the hearing implant sound quality index questionnaire items

Item number	Corrected correlation	Cronbach's alpha if item deleted
1	0.725	0.958
2	0.745	0.958
3	0.625	0.959
4	0.713	0.958
5	0.727	0.958
6	0.752	0.958
7	0.808	0.957
8	0.722	0.958
9	0.726	0.958
10	0.807	0.957
11	0.721	0.958
12	0.671	0.959
13	0.677	0.959
14	0.775	0.957
15	0.823	0.957
16	0.689	0.959
17	0.788	0.957
18	0.781	0.957
19	0.643	0.959

assessment. The KMO value for sampling adequacy was 0.89, indicating that the calculated sample size was suitable for exploratory factor analysis. The result of Bartlett's test was also statistically significant ($\chi2=1254.43$, $df=171$, $p<0.001$). Therefore, the exploratory factor analysis was suitable for the data, and the variables were correlated and consequently appropriate for structure detection. Based on factor analysis, the items of the scale were loaded on three factors. The categories of "understanding speech in public situations," "watching TV or listening to the radio," and "participating in conversation" were loaded on the first factor. The "sound localization" category, in addition to items 3 and 14 (which were related to sound discrimination skills), loaded on the second factor. The categories of "distinguishing between different voices/ speakers" and "talking on the phone" loaded on the third factor. Except for items 4 and 6, all items were loaded on a similar factor with their group. The three factors could explain 73.85% of the total variance.

Total score calculation

The mean total P-HISQUI19 score was 78.2±21.7, indicating the patients' moderate perception of auditory benefits in everyday listening situations (Table 5). According to the global rating scale, out of 70 participants, 13(18.58%) had poor auditory benefits (30–59 points), 35 (50.0%) had moderate auditory benefits (60–89 points), 18(25.71%) showed good auditory benefits (90–109 points), and four (5.71%) showed very good auditory benefits (110–133 points). None of the patients reported a very poor auditory benefit (i.e.<30 points).

Table 3. Cotent validity of the hearing implant sound quality index questionnaire items

Item number	CVR	CVI		
		Relevancy	Clarity	Simplicity
1	1	1	1	1
2	1	1	0.9	1
3	0.8	0.9	0.9	0.9
4	1	1	1	1
5	1	1	1	1
6	0.8	1	0.8	0.8
7	0.8	1	1	0.9
8	1	1	0.8	0.9
9	1	1	1	1
10	1	1	1	1
11	1	1	1	1
12	1	1	1	1
13	1	1	1	1
14	1	1	1	1
15	1	1	1	1
16	1	0.9	1	0.9
17	1	1	1	1
18	1	1	1	1
19	1	1	1	1

CVR; content validity ratio, CVI; content validity index

Spearman's rho test results showed no significant correlation of the P-HISQUI19 total score with age at implantation (r=–0.164, p=0.893) or duration of deafness (r=0.263, p=0.561). According to the Mann-Whitney U test results, the patients with age at implantation <40 years had slightly, but not significantly, better total P-HISQUI19 scores (mean score: 79.23±22.56) than those with age at implantation >40 years (mean score: 75.85±19.01) (p=0.491). Also, the difference between individuals with a length of deafness ≤20 years (mean score: 79.36±21.30) and a length of >20 years (mean score: 72.66±22.38) was not statistically significant (p=0.494). The total P-HISQUI19 score was not significantly different between females and males, either according to the Mann-Whitney U test results (p=0.51). Regarding the auditory benefits from two MED-EL implant systems, no significant difference was found between CONCERTO Mi1000 and SONATA Ti100 users (p=0.632). Moreover, our analyses also showed that the side of implantation did not significantly affect the patient-reported level of sound quality (p=0.375).

Discussion

The self-rating clinical measures are very common to diagnose or differentiate patients and help to quantify patients' deterioration or improvement over time. In the current study, the psychometric properties of the P-HISQUI19 and the related demographic factors were evaluated among Iranian adult CI users. Our results

Table 4. Factor pattern matrix of the hearing implant sound quality index questionnaire items

Item number	Item description	Factor 1	Factor 2	Factor 3
	Distinguishing between different voices/speakers			
1	Can you effortlessly distinguish between a male and a female voice?			0.629
10	Can you effortlessly distinguish between a female voice and a child's voice (6–10 years of age)?			0.703
14	You are listening to friends or family members talking to each other in quiet surroundings. Can you effortlessly identify the talker?		0.752	
	Identifying music sound			
3	When listening to music, can you effortlessly distinguish whether one or multiple instruments are being played simultaneously?		0.478	
6	Can you effortlessly distinguish single instruments in a familiar piece of music?	0.534		
	Sound localization			
5	Can you effortlessly hear noises such as falling keys, the beeping of the microwave, or the purring of a cat?		0.752	
13	Can you effortlessly hear the ringing of the phone?		0.885	
16	Can you effortlessly allocate background noise to a specific sound source (e.g. toilet flushing or vacuum cleaner) using acoustic help only?		0.818	
	Talking on the phone			
2	When talking on the phone, can you effortlessly understand the voices of familiar people?			0.827
8	When talking on the phone, can you effortlessly understand the voices of unfamiliar people?			0.775
	Watching TV, listening to the radio (speech in noise)			
7	You are watching a movie on TV and music is playing in the background. Provided that the volume of the TV is loud enough, can you effortlessly understand the movie's text?	0.691		
11	At home when other family members are having a conversation and you are listening to the news on the radio, can you effortlessly understand the news?	0.812		
	Understanding speech in public situations (speech in noise)			
9	Can you effortlessly understand a speech/lecture in a hall (e.g. lecture hall, church)?	0.711		
12	Can you effortlessly understand the announcement in a bus terminal, a train station or an airport?	0.781		
15	You are seated on the back seat of a car and the driver in the front is talking to you. Can you effortlessly understand the driver?	0.594		
	Participating in conversations (speech in noise)			
4	When background noise is present, can you effortlessly participate in a conversation with friends or family members (e.g. at a party/in a restaurant)?			0.549
17	When other people in your close surrounding are having a conversation (e.g. talking to a salesperson, a bank clerk at the counter or a waiter in a busy restaurant), can you effortlessly talk to another person?	0.599		
18	When background noise is present (e.g. in the office, printer, copier, air conditioning, fan, traffic noise, in busy restaurants, at parties, noisy children), can you effortlessly participate in a conversation with multiple people?	0.797		
19	When multiple people are talking simultaneously, can you effortlessly follow discussions of friends and family members?	0.738		

Table 5. Descriptive statistics of hearing implant sound quality index questionnaire items

Item number	Item description	Mean±SD
1	Can you effortlessly distinguish between a male and a female voice?	4.6±1.5
2	When talking on the phone, can you effortlessly understand the voices of familiar people?	3.9±1.5
3	When listening to music, can you effortlessly distinguish whether one or multiple instruments are being played simultaneously?	3.9±1.4
4	When background noise is present, can you effortlessly participate in a conversation with friends or family members (e.g., at a party/in a restaurant)?	3.9±1.2
5	Can you effortlessly hear noises such as falling keys, the beeping of the microwave, or the purring of a cat?	5.0±1.4
6	Can you effortlessly distinguish single instruments in a familiar piece of music?	4.0±1.4
7	You are watching a movie on TV and music is playing in the background. Provided that the volume of the TV is loud enough, can you effortlessly understand the movie's text?	3.5±1.4
8	When talking on the phone, can you effortlessly understand the voices of unfamiliar people?	3.5±1.5
9	Can you effortlessly understand a speech/lecture in a hall (e.g., lecture hall, church)?	3.4±1.4
10	Can you effortlessly distinguish between a female voice and a child's voice (6–10 years of age)?	4.5±1.4
11	At home when other family members are having a conversation and you are listening to the news on the radio, can you effortlessly understand the news?	3.4±1.4
12	Can you effortlessly understand the announcement in a bus terminal, a train station or an airport?	3.6±1.5
13	Can you effortlessly hear the ringing of the phone?	5.2±1.4
14	You are listening to friends or family members talking to each other in quiet surroundings. Can you effortlessly identify the talker?	4.2±1.4
15	You are seated on the back seat of a car and the driver in the front is talking to you. Can you effortlessly understand the driver?	3.9±1.5
16	Can you effortlessly allocate background noise to a specific sound source (e.g., toilet flushing or vacuum cleaner) using acoustic help only?	4.8±1.5
17	When other people in your close surrounding are having a conversation (e.g., talking to a salesperson, a bank clerk at the counter or a waiter in a busy restaurant), can you effortlessly talk to another person?	4.1±1.5
18	When background noise is present (e.g., in the office, printer, copier, air conditioning, fan, traffic noise, in busy restaurants, at parties, noisy children), can you effortlessly participate in a conversation with multiple people?	4.0±1.5
19	When multiple people are talking simultaneously, can you effortlessly follow discussions of friends and family members?	4.0±1.5
Total		78.22±21.4

demonstrated that the P-HISQUI19 had acceptable reliability and validity, indicating that the P-HISQUI19 is a reliable tool to determine the benefit of cochlear implantation.

The excellent internal consistency (α=0.96) and acceptable test-retest reliability (ICC=0.91) for P-HISQUI19 reported in the present study are in line with those of HISQUI19 versions in German (α=0.95, ICC=0.94) [10], Spanish (α=0.93, ICC=0.91) [9], Dutch (α=0.93) [8], and Turkish (α=0.94, ICC=0.91) [12] languages. The P-HISQUI19 also had excellent content and construct validity to evaluate Persian-speaking CI users' sound quality perception in everyday listening situations. Amann and Anderson [10] and Calvino et al. [9] also indicated that German and Spanish versions of the HISQUI19 were valid tools, respectively. Similar to the original version of HISQUI19 [10], no ceiling or floor effects were found for the Persian HISQUI19. Therefore, it is applicable as a valid measurement tool for outcomes reported by the patient.

The patients' mean total P-HISQUI19 score in our study was 78.2, indicating a moderate perception of sound quality. The score is close to that in Calvino et al.'s [9] study (mean=79.9). However, Amann and Anderson (mean=75.7) and Mertens et al. (mean=64.9) reported a lower score of the HISQUI19 for the CI adults [8, 10].

It is noteworthy that although CI devices can improve sound quality in hearing-impaired patients, the sound quality in CI users is poorer than in normal-hearing individuals due to the degradation of multiple auditory fine structures [4]. Despite technological advances in surgical methods, sound processors, electrode placement designs, and programming approaches, the ability to perceive speech and music sounds remains limited for many CI users. It seems that the spectral (frequency) aspect of sound is highly influenced by electrical stimulation. Frequency resolution is important for the perception of complex types of acoustical stimuli such as music or speech prosody. Restrictions in CI-mediated frequency perception can be manifested as reduced detection of change in pitch direction, decreased harmony/timbre perception, and reduced perception of cues and pitch-driven emotional voice [14-18]. This degraded pitch quality may seriously affect the sound quality and speech intelligibility of CI users in everyday listening situations. Roy et al. [19] indicated that CI users (mean age=51.8 years, n=11) exhibited more difficulties than those with normal hearing (mean age=30.5 years, n=10) in recognizing sound quality differences among high-pass filtered musical stimuli with cutoff frequencies of 200–1000 Hz. Their results demonstrated that CI users were not able to recognize sound quality differences among musical stimuli missing at frequencies up to 400 Hz. This decreased ability at low cutoff frequencies (200 Hz and 400 Hz) represents the deterioration of bass frequency perception that contributes to reduced sound quality perception while listening to a piece of music. Information at low frequencies is crucial for processing complex sounds, such as music. Caldwell et al. [4] suggested that presenting low-frequency stimuli to the CI users can be an effective procedure to enhance sound quality. The improved perception at low frequencies can be achieved through deeper electrode insertion, electric-acoustic stimulation of low-frequency areas, or bass-enhanced processing strategies.

Our results also indicated that younger CI adults had greater subjective functioning, although no statistically significant difference was detected in the P-HISQUI19 score between adults with <40 and >40 years of age at implantation. This finding supports previous results for the Spanish [9] and German [10] versions of the HISQUI19. Contrary to our findings, Mertens et al. [8] demonstrated that the age at implantation was moderately correlated with the mean HISQUI19 score.

The patients with shorter length of hearing loss in our study perceived slightly better, but not significantly, hearing benefits compared to patients with longer length of hearing loss. Amann and Anderson [10] and Calvino et al. [9] also reported that the length of hearing impairment had no significant impact on the perceived auditory benefits from CI. In our study, the gender factor had no effect on the sound quality perception, consistent with the results of Caporali et al. [11], Amann and Anderson [10], and Calvino et al. [9]. All adults in our study were provided with a multi-channel MED-EL system. However, Caporali et al. [11] indicated that the type of CI prosthesis had no significant effect on the sound quality experienced by the CI users.

According to our results, the side of implantation had no significant influence on the perceived auditory benefit. This finding is in line with the results of Amann and Anderson [10] and Calvino et al. [9] who also indicated that the side of implantation in post-lingual adult users did not affect the sound quality. Furthermore, our findings suggested that the type of CI processor (CONCERTO Mi1000 vs. SONATA Ti100) did not influence sound quality perception. Caporali et al. [11] also showed that the type of CI prosthesis (MED-EL, Advanced Bionics, or Cochlear) has no statistically significant impact on sound quality experienced by the CI users.

The present study had some limitations. Since the participation in the study was contingent on returning the HISQUI19 questionnaire, there was a risk of self-selection bias. Patients who are satisfied with the CI benefits are often more motivated to participate in the study. All included CI users underwent unilateral implantation; therefore, their sound localization and speech perception abilities may be negatively affected in both noisy and quiet environments. The etiology of deafness may contribute to the association of subjective assessments with speech perception, which was not analyzed in our study because too many patients had an unknown etiology. In the present study, only MED-EL implants were utilized. Then, using different CI instruments for evaluating the criterion validity and convergent validity of the P-HISQUI19 is highly recommended.

Conclusion

The P-HISQUI19 is a reliable and valid measure for quantifying perceived auditory benefit that Persian-speaking adult CI users experience in everyday listening situations. The good internal consistency and ease of scoring suggest that P-HISQUI19 is a beneficial tool for assessing the subjective outcomes of CIs.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the local Ethics Committee (registration number: IR.AJUMS.REC.1395.433). Written informed consent forms were signed by all the participants.

Funding

This study financially supported by the Vice-Chancellor for Research of the Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran (Registration number: HRC-9502).

Authors' contributions

HB: Study design, interpretation of the results, and drafting the manuscript; NS: Study design, interpretation of the results and drafting the manuscript; AS: Statistical analysis, and drafting the manuscript; AB: Study design, acquisition of data, interpretation of the results, and drafting the manuscript.

Conflict of interest

No potential conflict of interest was reported by the authors.

Acknowledgments

This study was the result of the final thesis registered in Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.

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