



# Evaluation of the Validity and Reliability of the Persian Version of the Nijmegen Cochlear Implantation Questionnaire

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## Abstract

**Objective:** The Nijmegen Cochlear Implant Questionnaire (NCIQ) is designed to evaluate the quality of life of cochlear implant (CI) patients. This questionnaire evaluates basic voice perception, advanced voice perception, talking and speech production, self-confidence, social activity and social interactions. Therefore, the aim of this study was to determine the validity and reliability of the Persian version of the NCIQ Questionnaire.

**Materials and Methods:** The present case-control study included 100 post-lingual patients with severe to profound bilateral hearing loss (case group), who underwent CI surgery and 100 patients (control group), who were on the waiting list. At first, the English version of questionnaire was translated into Persian language. Its validity was confirmed and Pearson correlation analysis was used for its internal reliability in different domains.

**Results:** The validity and reliability of questionnaire was proven. The mean scores of the case group were better than the control group in all questions based on the level of education ( $P_v = 0.000$ ). The differences in mean scores of case group with right ear prosthesis were greater than that of them with left ear, in the areas of activity ( $P$  value = 0.049), social interactions ( $P$  value = 0.039) and self-confidence ( $P = 0.043$ ). Therefore, the NCIQ in Persian language is a valid measure to evaluate health-related quality of life in adult cochlear implant users.

**Conclusion:** The NCIQ is a valid and reliable tool for examining various aspects of the quality of life of Persian-speaking cochlear implant patients.

**Keywords:** Cochlear Implantation; Life; Questionnaire

## Abbreviations

NCIQ: Nijmegen Cochlear Implant Questionnaire; CI: Cochlear Implant; MMSE: Mini Mental State Examination Score; CVR: Content Validity Ratio; I-CVI: Content Validity Index; S-SVI: Scale Content Validity Index.

## Introduction

A CI is an electronic device used to restore hearing to people with severe to profound hearing loss. CI receives sound signals, then processes them and delivers them to the auditory nerve to be interpreted by the patient's auditory

brain [1]. Children with severe to profound hearing loss have a lower level of literacy and educational rank than their peers with normal hearing, and this situation damages their quality of life, learning, educational activities and social interactions [2]. Most adults with hearing loss also experience profound social isolation and reduced quality of life. The stigma of hearing impairment can cause them to refuse treatment and further reduce their self-esteem and self-efficacy [3]. Evidence related to hearing loss in the elderly indicates an increased risk of dementia due to hearing loss [4].

NCIQ was first presented by Hinderink JB, et al. [5] this questionnaire is a quantitative tool for measuring the healthy quality of life of CI users and can be a valid scale to check the condition of a person before and after surgery [5]. So far, the NCIQ has been translated into Spanish, Italian, and Chinese. The use of an internationally valid questionnaire in Farsi is also necessary for the above purposes, because it allows the comparison of different CI populations and provides an opportunity to monitor the impact of CI for treatment evaluation [6,7]. Therefore, the purpose of this research was to determine the validity and reliability of the Persian version of the NCIQ.

## Material and Methods

The present case-control study included 100 patients with severe to profound bilateral postlingual hearing loss as the case group (65 women and 35 men) who underwent CI surgery and another 100 patients with similar conditions as the control group. (57 women and 43 men) and were on the waiting list. The study site was the Cochlear Implantation Center of Ba'ath Hospital in Hamedan.

Inclusion criteria included age over 15 years, severe to profound hearing loss, normal cognitive ability score (MMSE: Mini Mental State Examination Score > 25) [5], absence of other related neurological diseases and completion of consent form by the patient for participation. We're studying Exclusion criteria include speech disorders caused by congenital and acquired abnormalities, speech-motor lesions, voice problems of any origin other than deafness, complications during surgery, incomplete or complete cochlear implantation, and an interval of less than 6 months. They were since the surgery.

### Formal Validity

First, the entire original NCIQ questionnaire (English version) was translated into Farsi by a professional translator. Then, two otolaryngologists who were familiar with the validation process edited the translation from the semantic aspects, terms and concepts of the Persian language. The edited version was translated into English by a professional

translator and its semantic compatibility with the original version was compared by two otolaryngologists.

### Content Validity

In order to check the content validity of the questionnaire, seven members of the academic faculty of the university were used under the title of expert panel to give their opinions on "necessity", "relevance", "clarity", "simplicity" and "comprehensiveness". The opinions of the panel members were collected in the form of Content Validity Ratio (CVR), Content Validity Index (I-CVI) and Scale Content Validity Index (S-CVI).

### Content validity ratio (CVR)

To calculate this index, the questions were classified into three ranges: "necessary", "useful but unnecessary" and "unnecessary". The CVR index was calculated based on this formula:  $CVR = (ne - n/2) / (n/2)$ , where n was the total number of experts and ne was the number of people who had chosen the required option.

### Content Validity Index (I-CVI)

This index was obtained by dividing the total number of experts who chose completely favorable or favorable options by their total number.

### Scale Content Validity Index (S-CVI)

This index was obtained by dividing the total number of questions that were rated favorable and completely favorable by all experts by the total number of questions. The minimum acceptable values for CVR, I-CVI and S-CVI indices were considered to be equal to 0.6.

### Comprehensiveness of the Tool

It was calculated by dividing the number of experts who found the comprehensiveness of the tool favorable by the total number of experts.

### Differential Validity

The significant difference obtained in the score of the questionnaire in its different fields indicated its ability to differentiate in different groups and its differential validity. This stage of validity was evaluated after collecting data from two study groups (with cochlear implant prosthesis and waiting for cochlear implant).

### Tool Reliability

The reliability of the NCIQ questionnaire was evaluated after collecting data from all participants.

## Statistical Analysis

Statistical analysis of the data was done after completing the questionnaires by SPSS14 software. Descriptive information of qualitative variables was expressed in the form of tables, graphs, ratios and percentages. Information of quantitative variables was reported based on central and dispersion indicators. Independent t-test and chi-square test were used to compare NCIQ scores in different groups such as gender, age, CI patients and CI candidacy. Post hoc with Tukey's approach was used for pairwise comparisons. Cronbach's alpha coefficient was used to measure the reliability of the

questions, and Pearson's correlation analysis was used for the internal reliability of different areas of NCIQ. Pv less than 0.5 was considered statistically significant.

## Results

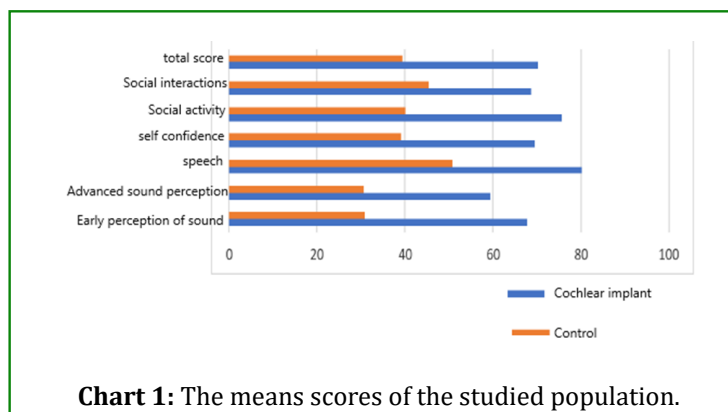
Based on the findings, there was a significant difference between the education levels of the case group compared to the control group (Table 1). Also, the difference between the two groups was significant in terms of age and age of onset of hearing loss.

Demographic Information		Case group	Control group	P value
Age (years mean $\pm$ SD)		33 $\pm$ 14	43 $\pm$ 15	0.001
Age at onset hearing loss (years mean $\pm$ SD)		14 $\pm$ 18	8 $\pm$ 16	0.01
Age at cochlear implantation (years mean $\pm$ SD)		28 $\pm$ 14	-	-
Positive family history (%)		18	24	0.3
Gender (%)	Female	65	57	0.248
	Male	35	43	
Dominant hand (%)	Right handed	90	89	0.891
	Left handed	10	11	
Education level (%)	Illiterate	4	9	0.001
	Primary	20	46	
	High School	61	39	
	Academic	15	6	
CI prosthesis (%)	Advanced Bionics	48	-	-
	MED-EL	39	-	
	Nucleus	13	-	

**Table 1:** Demographic information of all patients with severe to profound bilateral hearing loss (Case group = 100 users of cochlear implant (CI), Control group = 100 waiting patients for cochlear implant).

The average scores of the case group in all sub-areas of the questionnaire (initial understanding of voice, advanced understanding of voice, speech and speech production, self-

confidence, social activity, social interactions) were better than the control group (Pv = 0.000) (Chart 1).

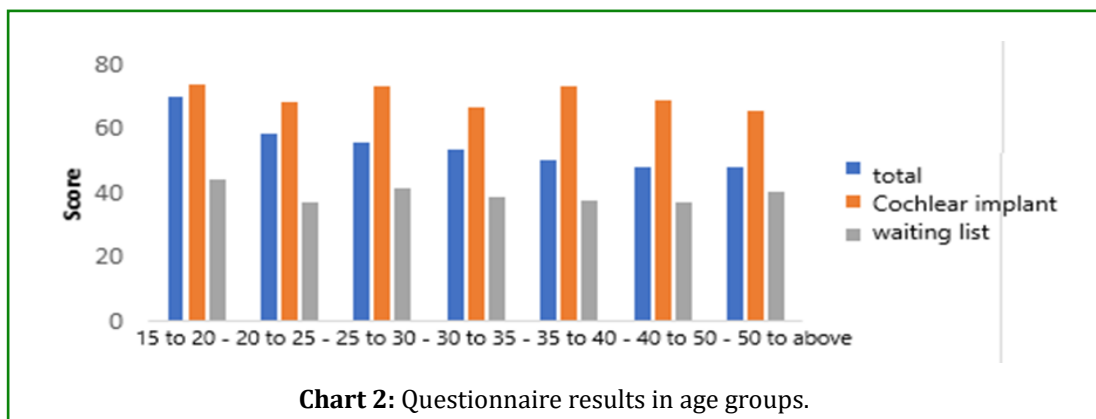


**Chart 1:** The means scores of the studied population.

The results of one-way analysis of variance between the average scores of education level and quality of life showed that the education level has a significant relationship with the average scores obtained in the questionnaire ( $P_v = 0.000$ ). However, no significant difference was observed between high school and university groups ( $P_v = 0.700$ ). In fact, with the increase in the level of education to the university level, the quality of life scores did not increase significantly

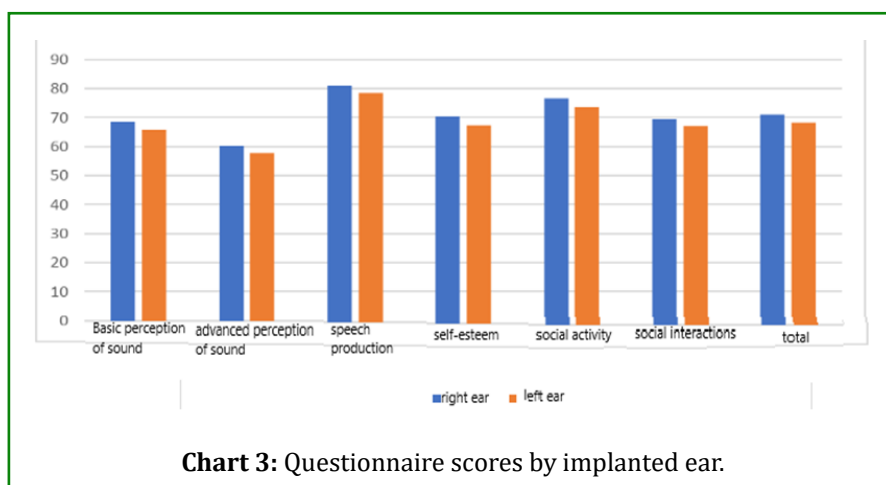
compared to the high school level.

The results of one-way analysis of variance between age groups and questionnaire scores showed that there is a significant difference between the implanted groups and the biggest difference was related to patients over 50 years old ( $P_v = 0.004$ ) (Chart 2).



The difference between the case group in the mean total score of NCIQ based on cochlear implanted ear was not significant ( $P_v = 0.780$ ), social interactions ( $P_v = 0.039$ ) and self-confidence ( $P_v = 0.043$ ) more than people with ear

prosthesis. It was left (Chart 3). The average quality of life scores of patients in all NCIQ subdomains, based on gender, did not differ significantly between the case and control groups ( $P_v < 0.05$ ).



## Discussion

This study was conducted to determine the validity and reliability of the Persian version of the NCIQ questionnaire and to evaluate the quality of life of Iranian CI users. So far, several studies have been conducted in Persian to evaluate the quality of life of CI patients, such as Soltani R, et al. [6], who confirmed the validity and reliability of Anderson and Brook's quality of life questionnaire for Iranian CI users [6]. Attar Kar NK, et al. [7] also confirmed that CI user children have higher academic achievement than children without

prosthesis [7]. Hashemi SB, et al. [8] also reported that CI has increased the quality of life of its users in the areas of activity and social interactions [8]. The aforementioned studies have mainly focused on measuring auditory functions and evaluating social activities of cochlear implant users [6-8]. Therefore, it is difficult to consider them as accurate tools to check the quality of healthy life. While, NCIQ is designed as a valid measure to evaluate the measurable and healthy quality of life of CI users and has been translated into several living languages of the world. Also, its validity and reliability have been confirmed in those different languages [5-7]. In the

present study, NCIQ was translated into Farsi and its validity and reliability were confirmed, and also, NCIQ scores in the case group were significantly higher than the control group.

In Sanchez's study, the validity and reliability of the NCIQ questionnaire in Spanish was confirmed, and all the research participants obtained better scores in the fields of the questionnaire after receiving the CI prosthesis [6]. In Ottaviani's study, which was conducted with the aim of cultural adaptation of the NCIQ in Italian, the participants in the research had better scores after surgery and receiving CI prosthesis in all subdomains of the questionnaire [7]. In the study of Hinderink JB, et al. [5] and his colleagues, the quality of life of CI users was reported to be better than patients without CI in all sub-domains of the questionnaire [5]. In the present study, the scores of CI users were better in all sub-domains of NCIQ, and by comparing the level of education with the average scores of the questionnaire; we found that the increase in the level of education up to the high school level had a direct relationship with the increase in quality of life scores.

In Spencer LJ, et al. [9] study, the level of life satisfaction in CI users increased with increasing education level [9]. Also, Klop WMC, et al. [10] reported that in adults, a high level of education was one of the important reasons for increasing the quality of life of patients [10]. In our study, there was a significant difference between the age of the patients and the average NCIQ scores, and the biggest difference was related to patients aged 15 to 20 years. Also, young patients had higher mean scores than older patients. In Vermeire K, et al. [11] study, it was observed that elderly patients benefited from CI, but scores were higher in younger patients and quality of life was at a higher level [11]. Klop WMC, et al. [10] compared the quality of life of CI users before and after receiving the prosthesis and found that the quality of life was improved based on the NCIQ and there was a significant increase in the dimensions of self-confidence, activity and social interactions [10]. Also, Mo B, et al. [12] reported that CI users had significantly better quality of life and ability to communicate in social relationships, had lower levels of isolation and stress, and improved all levels of personal/social communication [12]. In our study, the Cronbach's alpha coefficient was 0.97 and considering that the reliable Cronbach's alpha coefficient is  $\geq 0.70$  (Reliable Cronbach's alpha coefficient), the validity of the NCIQ questionnaire in Persian language for evaluating the healthy quality of life of adult CI users was confirmed.

## Conclusion

The Nijmegen Cochlear Implant Questionnaire (NCIQ) is a valid and reliable tool for examining various aspects of the quality of life of adult cochlear implant users and is a valid

measure to evaluate their healthy quality of life and can determine the well-being and benefits of cochlear implant over time.

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## Ethical Considerations

This study was approved by the Research Ethics Committee of Hamedan University of Medical Sciences (code: IR.UMSHA.REC.1401.161).

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