

## RESEARCH ARTICLE

# Development, validity and reliability of Persian international outcome inventory for hearing aids questionnaire

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### Abstract

**Background and Aim:** Self-assessment questionnaire was developed to judge the success or failure of all aspects of the hearing aid selection and fitting process. The International outcome Inventory for Hearing Aids (IOI-HA) is one of the most common questionnaires to quantify the satisfaction of hearing aid users and its impact on their lives. This study mainly focused on preparing a Persian version of this questionnaire and analyzing its validity and reliability.

**Methods:** First, the original English version of the questionnaire was translated into Persian, then its content and face validity was determined by expert in field and examiners. Persian IOI-HA was presented to 50 hearing aid users twice with two to three weeks interval and, the collected data were analyzed statistically. Finally, in order to evaluate the reliability of the current questionnaire, the correlations of items and paired t-test statistics for total score in test-retest was obtained.

**Results:** The results of face validity assessment revealed that the current questionnaire has a high quality in translation, intelligibility, and cultural adaptation. Mean total score was 26.80 (SD=3.65), and the overall Cronbach's alpha of

this questionnaire was 0.73. Reliability assessment showed that the means of the total scores of the current questionnaire in test-retest have no significant difference, and the scores of the items in test-retest showed a strong correlation.

**Conclusion:** Based on the obtained results, the Persian version of the questionnaire has a satisfactory face validity and reliability and could be used in medical centers.

**Keywords:** International outcome inventory for hearing aids; questionnaire; face validity; reliability

### Introduction

Users' satisfaction in the area of hearing aids refers to the extent to which the effects of hearing impairment on users' lives are reduced. The self-assessment inventory has been designed to judge the success or failure of all aspects of the hearing aid selection and fitting process. It is widely accepted that the successful hearing aid fitting require measurement of hearing impaired subjects satisfaction [1]. Several questionnaires have been developed to measure various dimensions of the results of using hearing aids such as benefit, satisfaction, and activity limitation. Any deficiency in these aspects amounts to not covering the various aspects of the success rate of hearing aids. Researchers sometimes use a set of questionnaires to assess the result of using hearing aids. For example, they use the satisfaction

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with amplification in daily life questionnaire to evaluate the satisfaction rate, the abbreviated profile of hearing aid benefit questionnaire to evaluate the benefit, and the hearing handicap questionnaire to evaluate the changes of functional impact of hearing loss. The use of all these aspects creates difficulty in comparing the studies [2] and is also time-consuming. Therefore, an ideal assessment requires a multidimensional questionnaire and the most commonly used questionnaire for this purpose is the international outcome inventory for hearing aids (IOI-HA). It was developed by Cox and Alexander in 2002 with the aim of preparing a standard and international self-assessment questionnaire to measure users' satisfaction with hearing aids and its impact on their lives [3]. The original version of the questionnaire is in English and has been translated into 27 different languages [4].

The IOI-HA consists of seven items used to subjectively evaluate the results of the hearing aids under the following parameters: 1) daily use, 2) benefit, 3) residual activity limitations, 4) satisfaction, 5) residual participation restrictions, 6) impact on others, and 7) quality of life. Each item investigating a different aspect of the personal impact of a hearing aid fitting on the hearing-impaired person's life [3]. The first item evaluates the daily usage of hearing aids; second item assesses the extent to which hearing has improved after the use of hearing aids; third one (residual activity limitation) evaluates the users' limitations and problems despite their use of hearing aids; fourth item evaluates the users' satisfaction level despite the problems of hearing aids; fifth item (residual participation restriction) evaluates the effect of remaining problems on the users' ability to participate in various activities such as attending a party; the sixth item (impact on others) evaluates the impact of the remaining problems on people around; and finally, the seventh item determines the extent to which the quality of life has improved after using the hearing aid [2]. Each item contains five responses, and they are different from those of other items. However, for each item, the first response from the left (the English version) is the worst result and the last response from the

left is the best result. Each item contains a score between 1 and 5, with 1 representing the weakest result and 5 indicating the best result. The final score (7–35) includes the sum of scores for each item, and a higher score represents a better result [3]. While the total score of the questionnaire indicates the overall result, some studies have identified two subsets for the IOI-HA. The first subset, containing items 1, 2, 4, and 7, relates to the users' perception of the hearing aids, whereas the second subset, containing items 3, 5, and 6, relates to the users' relationship with the environment [5].

The questionnaire has been translated into various languages including Turkish, Portuguese and Danish [1,4,5], but since the Persian version of it is not available, there is a need to design the Persian version of the IOI-HA questionnaire. Accordingly, the present study aimed to translate the IOI-HA questionnaire and determine its validity and reliability in order to make audiologists aware of the importance of hearing aids and the need to measure the success of hearing aids in rehabilitation programs.

### Methods

Initially, the translation of the English version of the IOI-HA questionnaire to Persian was performed in several stages. In the first stage of the translation process, the initial translation of the questionnaire (English into Persian) was performed by two translators (translators 1 and 2) who were native speakers of Persian and had sufficient experience in translating English texts. In fact, the translators were required to have experience in translating questionnaires but not to be familiar with the test. After we explained the translation process to the translators, the translators were asked to provide a list of possible equivalents for some words, phrases, and sentences included in the questionnaire.

Next, the researcher held a meeting with the translators to discuss the preliminary versions of the questionnaire translated by the two translators, and finally, we reached a mutual agreement on the joint Persian translation version considering the items that were difficult to

translate and proposed equivalents for the terms. The joint translation version, provided at the previous stage, was submitted to eight well-known audiologists in the field of hearing aids to score the quality of translation using a five-point Likert scale (1: totally agree; 5: totally disagree). Then, their suggestions for a better translation were used in the questionnaire. Subsequently, the Persian version of the questionnaire was submitted to two other bilingual translators with sufficient expertise in the two languages (Persian and English) to translate this version into English. They had no relationship with each other and were not familiar with the scale under study.

The versions translated by these two translators were converted into a joint translation version in a meeting between the researcher and some professors. Finally, the Persian version was evaluated for face validity by presenting it to eight famous audiologists in the area of hearing aids. They were also asked to score the translated version's cultural adaptation level as well as the extent to which it is simple and comprehensible by selecting a point from the five point Likert scale (1: totally agree; 5: totally disagree).

The final version (Appendix 1) was voluntarily provided to 50 hearing aid users consisting of 41 males and 9 females. They were also instructed regarding the purpose of the research and how to answer the questions. The age range of the participants in this study was between 26 and 77 years with a mean age of 56.26 years and a standard deviation of 11.58 years. Of all, 27 participants were new users of hearing aids while the rest 23 were experienced users of hearing aids (with a mean of 43 months of using hearing aids and a standard deviation of 18 months). The participants' hearing thresholds were at frequencies of 250, 500, 1000, 2000, and 4000 Hz in a mild to severe range (5 dB to 90 dB) with a mean pure tone audiometry threshold of 54 dB and a standard deviation of 17dB.

After ensuring the hearing aids were intact and examining their fitting with the software using the HI-PRO device, we entered the person into the study and provided him/her with a

questionnaire. The questionnaire consisted of seven items with 5 options, and the participants had to select only one option for each question. Each question contained a score between 1 and 5, with 1 representing the weakest result and 5 indicating the best result. In cases where the subjects were illiterate, the researcher raised the questions verbally so that the participant would be able to choose and announce his response from the options.

At the end of this stage, to assess the reliability of the Persian version, all the participants asked to answer the questionnaire again after an interval of two to three weeks.

Prior to performing statistical tests, we used Kolmogorov-Smirnov test to assess normality of the variables. The reliability of the translated version of the present questionnaire was assessed in two ways. In addition to determining the correlation between the scores of the questionnaire that was completed two times during the test-retest evaluation phase, we made a comparison between the total scores of the questionnaire using the paired t-test. In order to examine the internal consistency of the questionnaire, we calculated the correlation between the items, the correlation of each item with the total score of the questionnaire, and the Cronbach's alpha coefficient of the total questionnaire in case of the removal of a certain question. The correlation coefficients of each section with another section, and again, with the whole questionnaire as well as that of each item in the test-retest were determined using the Spearman's correlation coefficient. The data were analyzed using SPSS21 at a significant level of less than 0.05.

## Results

The good/excellent translation quality, intelligibility, and cultural adaption of items 1, 3, 4, 5, and 6 were confirmed by 100% of the experts who assessed the quality and face validity of Persian IOI-HA questioner. 87.5% of the experts confirmed the translation quality of items 2 and 7, and intelligibility of item 2 as good. Changes were made to items 2 and 7 for better translation quality, simplicity, and clarity.

**Table 1. Test-retest mean (standard deviation) scores of international outcome inventory for hearing aids items (n=50)**

Item	Mean (SD) score		Test-retest correlation	p*
	Test	Retest		
1	4.32 (0.76)	4.36 (0.77)	0.93	<0.01
2	3.60 (0.92)	3.78 (0.76)	0.78	<0.01
3	3.82 (0.91)	3.86 (0.80)	0.77	<0.01
4	4.04 (0.63)	4.14 (0.60)	0.59	<0.01
5	3.36 (1.00)	3.38 (0.94)	0.69	<0.01
6	3.92 (0.75)	4.12 (0.65)	0.76	<0.01
7	3.66 (0.79)	3.58 (0.67)	0.72	<0.01
<b>Total score</b>	26.80 (3.65)	27.26 (3.25)	0.86	<0.01

\*Spearman

The score for each item was from 1 to 5, with a higher score representing a better result. The participants mean (SD) scores of each item are presented in Table 1. The mean score of the total questionnaire was 26.80 (3.65), and also the mean score of the first sub-set (questions 1, 2, 4, and 7) was 15.58 (2.4) while the mean score of the second sub-set (questions 3, 5, and 6) was 11.22 (1.88).

For the reliability of the items, as shown in Table 1, the test-retest correlation was high for all items, and there was no significant difference between them ( $p > 0.05$ ). Test-retest total mean scores were not significantly different (95% CI: -1.00-0.85,  $p > 0.05$ )

To examine the internal consistency, the correlations between the items were calculated (Table 2). The correlation range was between -0.01 and -0.7, and there was a complex inter-item correlation pattern, which means that each item is significantly correlated with some items. However, none of the items were correlated to all other items because each item was related to a part of the fitting results. Cronbach's Alpha coefficient was also calculated to be equal to 0.73. On the other hand, Cronbach's alpha was 0.71 in the test-retest evaluation, which indicates the acceptable internal consistency of the

Persian version of the IOI-HA. Table 3 shows the correlation between each item and the total score of the questionnaire as well as the Cronbach's alpha in case of removing a certain question. The lowest item-total correlation coefficient is related to question 5. Obviously, the correlation between each item and total score of the questionnaire is helpful as it shows the extent to which each item contributes to the total score of the questionnaire. If this correlation is low, the internal consistency of the questionnaire will be reduced, resulting in the increase in the Cronbach's alpha value by removing each item.

### Discussion

The results of the face validity assessment showed that the Persian version of the present questionnaire has high translation quality, comprehensibility, and adaptation to Iranian culture. The mean score of the items in the present study was between 3.36 and 4.24 while that of the original English version was between 3.5 and 4.1, and between 3.19 and 4.34 in the Dutch version [6].

In the present study, the highest score belonged to item 1 (daily use of hearing aids) and item 5 (residual participation restriction), and the same

**Table 2. Inter item correlations for the Persian international outcome inventory for hearing aids (n=50)**

Item	Item					
	2	3	4	5	6	7
1	0.42*	0.24	0.27	0.14	0.09	0.31*
2		0.67**	0.42**	-0.01	0.47**	0.72**
3			0.34*	0.20	0.52*	0.57**
4				-0.06	0.28*	0.46**
5					0.22	0.07
6	2	3	4	5	6	0.53**

p<0.05\*, p<0.01\*\* Spearman correlation

was reported in the original English version [3]. However, the highest score in the Dutch version was obtained for items 1 and 6 (impact on others) [6], and that in the Danish version was reported for items 1 and 4 (satisfaction). The mean score of the total questionnaire was 26.80 with standard deviation 3.65, and also the mean score of the first sub-set (items 1, 2, 4, and 7) was 15.58 (2.4) while the mean score of the second sub-set (items 3, 5, and 6) was 11.22 (1.88) [5]. As well as the mean and standard

**Table 3. Item- total statistics for the Persian international outcome inventory for hearing aids (n=50)**

Item	Corrected item-total correlation*	Cronbach's alpha if item deleted
1	0.55	0.71
2	0.80	0.64
3	0.77	0.64
4	0.52	0.72
5	0.38	0.81
6	0.68	0.69
7	0.78	0.66
<b>Total score</b>	-	0.73

\*Spearman

deviation of score of the total questionnaire in the Dutch version was 28 (4.8), and the mean scores of the first and second sub-sets were 17 (3.2) and 11 (2.5), respectively [6].

The test-retest evaluation showed that the Persian version of the IOI-HA is reliable over time, and the items' correlation range in two administrations was between 0.59 and 0.93. The mean scores of the total questionnaire were compared in two replicates using the paired t-test and had no significant difference (p>0.05). The results is consistent with pervious findings [2,4,5].

The correlation between the items ranged between -0.01 and 0.7, and there was a complex correlation pattern, which means that each item is significantly correlated with some items, but none of the items were correlated with all of the items because each item is related to one area of the fitting results [3]. This result is consistent with the results of previous studies [4-8]. The comparison between the questionnaire used in the present study and the Dutch version [6] as well as the Danish version [5] showed the highest correlation between the items belonged to item 7 (quality of life),but with that related to item 4 (satisfaction) in the English version [3]. The least correlation of the items in the Persian version is related to item 5, which was also reported in previous studies [3,5,6]. Cronbach's alpha was 0.73 for 7 items in the Persian version of the IOI-HA. If this value increases significantly when an item is removed, it means that the item has no good consistency with the rest of the items. Moreover, the removal of only item 5 in this study increased the Cronbach's alpha by 0.81, and the removal of this item in the original English version also increased the Cronbach's alpha from 0.78 to 0.81 [3]. In the Portuguese version of the IOI-HA, the removal of item 6 increased the total Cronbach's alpha from 0.83 to 0.86 [4]. In 2005, Heuermann et al. also reported an increase of 0.33 in the Cronbach's alpha with the removal of the first question [7]. As shown in Table 3, the lowest item-total correlation coefficient is for item 5, and the rest of the items have a good correlation with the total score. A study conducted by Cox and

Alexander [3] showed that the lowest item-total correlation coefficient belongs to items 1 and 5 while in study of the Thunberg Jespersen et al., belonged to item 1 [5]. In the present study the highest item-total correlation coefficient is belong to item 2, and also in the Danish and Dutch versions [5,6] while in the original English version, it pertains to item 4 [3]. It may be concluded that the IOI-HA is a brief and feasible tool which measures two aspects related to satisfaction of hearing aid users.

### Conclusion

The main purpose of the present study was to develop the Persian version of the IOI-HA and determine its reliability and validity. The results showed that the Persian version of this questionnaire has high reliability and validity, and can be used in clinics and hospitals to determine the success rate of hearing aids.

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### Conflict of Interest

The authors declare that they have no conflict of

interest.

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## Appendix 1

## Persian version of the International outcome Inventory for Hearing Aids

## پرسشنامه بین المللی پیامد استفاده از سمعک (IOI-HA)

۱. میزان استفاده از سمعک (های) فعلی تان را در دو هفته گذشته در نظر بگیرید. به طور معمول در یک روز چند ساعت از سمعک‌هایتان استفاده کرده‌اید؟

اصلاً استفاده نکرده‌ام  کمتر از ۱ ساعت در روز  ۱ تا ۴ ساعت در روز  ۴ تا ۸ ساعت در روز  بیش از ۸ ساعت در روز

۲. موقعیتی را در نظر بگیرید که قبل از تهیه سمعک (های) فعلی تان، بیشترین تمایل به بهتر شنیدن را در آن موقعیت داشته‌اید. در دو هفته گذشته استفاده از سمعک چقدر در آن موقعیت‌ها به شما کمک کرده است؟

اصلاً کمکی نکرده است  کمی کمک کرده است  تا حد متوسطی کمک کرده است  نسبتاً زیاد کمک کرده است  بسیار زیاد کمک کرده است

۳. مجدداً به موقعیتی فکر کنید که بیشترین تمایل به بهتر شنیدن را در آن داشته‌اید. از وقتی که از سمعک‌های فعلی تان استفاده می‌کنید، چقدر کماکان در آن موقعیت مشکل دارید؟

بسیار زیاد مشکل دارم  نسبتاً زیاد مشکل دارم  تا حد متوسط مشکل دارم  کمی مشکل دارم  مشکلی ندارم

۴. با در نظر گرفتن همه جوانب آیا فکر می‌کنید که سمعک‌ها ارزش دردسروشان را دارند؟

اصلاً ارزش آن را ندارد  کمی ارزش آن را دارد  تا حد متوسطی ارزش آن را دارد  نسبتاً زیاد ارزش آن را دارد  بسیار زیاد ارزش آن را دارد

۵. طی دو هفته گذشته، با وجود استفاده از سمعک (های) فعلی تان، تا چه حد مشکلات شنوایی تان بر کارهایی که می‌توانید انجام دهید، تأثیر گذاشته است؟

بسیار زیاد تأثیر گذاشته است  نسبتاً زیاد تأثیر گذاشته است  تأثیر متوسطی گذاشته است  کمی تأثیر گذاشته است  اصلاً تأثیری نگذاشته است

۶. طی دو هفته گذشته، با وجود سمعک (های) فعلی تان، تا چه حد فکر می‌کنید سایر افراد به خاطر مشکلات شنوایی شما دچار اذیت شده‌اند؟

بسیار زیاد اذیت شده‌اند  نسبتاً زیاد اذیت شده‌اند  تا حد متوسطی اذیت شده‌اند  کمی اذیت شده‌اند  اصلاً اذیت نشده‌اند

۷. با در نظر گرفتن همه جوانب، تا چه حد سمعک (های) فعلی تان بهره‌مندی شما را از زندگی تغییر داده است؟

بدتر شده است  تغییری ایجاد نکرده است  کمی بهتر شده است  نسبتاً زیاد بهتر شده است  بسیار زیاد بهتر شده است