

## RESEARCH ARTICLE

# Self-assessed hearing handicap in the elderly: a pilot study on Iranian population

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## Abstract

**Background and Aim:** Presbycusis is a prevalent chronic condition in the elderly which may have potential adverse effects on social and emotional aspects of their life. There is no one to one relationship between audiogram and the perceived handicap in elderly. A good way to measure hearing handicap are self-assessment tools. This study was aimed to translate, adapt and establish face validity of Short form of Hearing Handicap Inventory for the Elderly (HHIE-S) and the correlation with pure-tone and speech audiometry results as well as score of the other self-assessment tool (Self-Assessment of Communication: SAC) in the Iranian elderly.

**Methods:** HHIE-S was translated into Persian and face validity was established. It was administered in 80 elderly participants. Correlation of their scores with their pure tone averages of 3 and 4 frequencies (PTA<sub>0.5-1-2</sub> and PTA<sub>0.5-1-2-4</sub>), word recognition score (WRS) in quiet, and SAC scores was determined.

**Results:** The experts mean scores to PHHIE-S was 99.63%. There were significant correlations between PHHIE-S with SAC ( $r = 0.89$ ;  $p <$

$0.001$ ), PTA<sub>0.5-1-2</sub> ( $r = 0.4$ ;  $p < 0.001$ ), PTA<sub>0.5-1-2-4</sub> ( $r = 0.6$ ;  $p < 0.001$ ) and WRS ( $r = -0.4$ ;  $p < 0.001$ ). There was no significant gender effect on any of the measures ( $p > 0.05$ ).

**Conclusion:** Simply evaluation of the hearing levels is not adequate in elderly. Self-assessment tools can shed light on the specific disability induced by hearing loss. PHHIE-S appears to be an easy and fast tool that may helpful to distinguish patients who might need rehabilitative services.

**Keywords:** Elderly; presbycusis; self-assessment; handicap

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## Introduction

The population of the elderly is growing in all parts of the world and health care systems and the health care of this population is very important [1]. Presbycusis is a chronic condition in the elderly that can adversely affect their quality of life (QOL) [2,3]. Communication in elderly mostly relies on auditory performance and they do not commonly use modern technological tools

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(e-mail and texting) for communication [4]. Presbycusis has potential effects on physical, cognitive, emotional and social aspects of their life [5]. Hearing loss prevalence has been reported from 30% to 46% in old population. The prevalence reaches 90% in elderly  $\geq 80$  years old [6]. Handicapping hearing loss is a serious issue in the elderly [7] which is known that can result in social isolation, frustration and depression [6]. In addition, many elderly do not accept hearing aid or not gain anticipated satisfaction from it. In general, old adults experience more difficulty than it is expected based on simply their audiograms. This can be attributed to central auditory involvement, peripheral distortion or cognitive involvement and it is clear that reduced audibility of speech secondary to the elevated thresholds is not the only factor contributing to hearing handicap [2,5,8]. The hearing handicap can be measured with the self-assessment tools such as Hearing Handicap Inventory for the Elderly/Adults (HHIE/HHIA) which provides practical information regarding the emotional and social effects of the hearing impairment [2]. Generally, these self-assessment tools can simulate daily conversational environments for patients and are valuable tools for providing beneficial counseling [9] and identifying the elderly who would accept hearing aid [8] and need more rehabilitative services [5,8].

HHIE was first developed by Weinstein and Ventry (1982) to assess the handicap induced by hearing loss [10]. It has two versions: HHIE and its screening form HHIE-S. HHIE-S has been translated and validated in several languages including Japanese [11], Chinese [12], Portuguese [13], Kannada [14], and Spanish [15].

The aim of the present study was translation HHIE-S in Persian (PHHIE-S), establishing face validity and comparing its relation with Self-Assessment of Communication (SAC) questionnaire score and pure tone auditory assessment. Based on previous studies it has been suggested that the relation between self-perceived handicap and hearing thresholds is dependent on ethnic and culture [8]. To the best of our knowledge, it is the first study in Iran conducting on the elderly by using HHIE-S.

## Methods

### *Participants*

This is a cross-sectional study was conducted on 80 elderly participants with age range of over 60 years old (37 females, 43 males). They were selected from audiology clinic of Tehran University of Medical Sciences and Amir-Alam Hospital. The study was approved by the Ethics Committee of Tehran University of Medical Sciences Code No. 85-02-32-3958. All participants gave written informed consent and then underwent air conduction (AC) and bone conduction (BC) pure tone audiometry (PTA), speech recognition threshold (SRT) and word recognition score (WRS) in quiet at most comfortable loudness (OB822, Madsen audiometer and supra-aural TDH39 headphone in a soundproof room). The pure tone average in frequencies of 500, 1000 and 2000 Hz ( $PTA_{0.5-1-2}$ ) and the average in frequencies of 500, 1000, 2000 and 4000 Hz ( $PTA_{0.5-1-2-4}$ ) were calculated. The  $PTA_{0.5-1-2}$  in the better ear was used to define the degree of the hearing loss for individuals.  $PTA \leq 25$  dB HL was defined as normal,  $26 \leq PTA \leq 40$  dB HL,  $56 \leq PTA \leq 70$  dB HL,  $71 \leq PTA \leq 90$  dB HL, and  $\geq 90$  dB HL were classified as mild, moderately-severe, severe and profound, respectively [16]. WRS was classified into three categories:  $< 50$  very poor, 50-59 poor, 60-74% fair, 75-89% good and 90-100% excellent [17]. Persian version of SAC questionnaires was completed by participants. SAC is a 10-item questionnaire which evaluates disability (Q1-9: activity limitation), handicap (Q1-5: participation restrictions), quality of life (Q9) and hearing aid usage (Q10) [18].

### *Translation procedure*

The permission for developing the Persian version was obtained from the original author. HHIE questionnaire was developed to assess the social and emotional impact of hearing loss on the elderly and includes 13 emotional and 12 social 3-option questions with a maximum score of 100. Answers include Yes (4 points), Sometimes (2 points) and No (zero point). The maximum score for social and emotional parts is 48 and 52,

respectively. Scores from 0% to 16% indicate no handicap, scores of 18%–42% indicate mild-to-moderate handicap, and scores > 44% indicate significant handicap. A shorter screening version of the questionnaire was developed with 10 items known as HHIE-S. It consists of 10 three-choice questions (5 emotional and 5 social questions). Choices included yes (4 points), no (zero point) and sometimes (2 points) with a maximum score of 40. The score > 8 is considered as fail or presence of hearing handicap [10,19]. In addition, final scores of at least 26 indicate an 84% probability of having a hearing impairment and a moderate to severe handicap [5]. The questionnaire was translated into Persian according to the international guidelines for self-reported measures published by the American Association of Orthopedic Surgeons Outcomes Committee [20]. For cross-cultural adaptation, it was handed out to 17 audiologists and psychologists. Based on expert's ratings and comments the questionnaire was revised. Question 10 was replaced by another social question about a telephone communication with permission of the original author. The reason was that the question 10 (social question) was about the hearing complaints in the restaurant. Elderly in Iran do not often go to the restaurant. In addition, the replaced question was designated as question 1 because this condition was more applicable. The Persian version of HHIE-S was finalized as PHHIE-S (Appendix 1).

The HHIE-S may be completed either aided or unaided [21]. In the present study, we investigated the hearing handicap for unaided listening. So, if participants were hearing-aid users they were asked to answer HHIE-S questions based on their performance when the device is off.

Data were expressed as mean (SD). Normality of data was confirmed by Kolmogorov-Smirnov test. We used independent t-test to compare PHHIE-S scores between males and females, and  $PTA_{0.5-1-2}$ ,  $PTA_{0.5-1-2-4}$  and WRS scores between participants with pass and fail PHHIE-S score. Chi-square test was used to compare pass and fail PHHIE-S scores between males and females. We assess correlation between PHHIE-S and SAC scores with Pearson correlation test. Data

analysis was performed by SPSS (Version 17.0, SPSS Inc., Chicago, IL, USA). Significant level was set at 0.05.

## Results

Mean scores of the expert to PHHIE-S was 99.63%. Elderly participants had a mean age of  $70.82 \pm 7.05$  years old (age range of 60 to 95 years old). 64 cases had fail result in PHHIE-S (score > 8) which indicted auditory handicap. All participants with hearing thresholds  $\geq 26$  dB HL showed sensorineural hearing loss. The  $PTA_{0.5-1-2}$ ,  $PTA_{0.5-1-2-4}$ , and WRS of the better ear were compared between participants with fail and pass PHHIE-S result (Table 1).

58 out of 64 (90.6%) participants, who had failed the HHIE-S, failed the auditory screening as well. 11 out of 16 (68.75%) participants who had passed the HHIE-S, passed the auditory screening as well.

The frequency distribution of hearing level categories and WRS in elderly who had failed or passed the PHHIE-S showed most elderly who had failed in PHHIE-S, had moderate hearing loss and there were some cases with normal hearing that showed the fail result in the questionnaire. In general, most cases had normal WRS (Table 2).

There were no significant differences between PHHIE-S score of females ( $22 \pm 12.06$ ) and males ( $21.34 \pm 12.36$ ) and no significant relationship between gender and pass/fail result in PHHIE-S ( $p > 0.05$ ).

There was a significant difference between  $PTA_{0.5-1-2}$  in the elderly who had failed ( $49.51 \pm 19.18$ ) and passed ( $22.10 \pm 17.14$ ) PHHIE-S ( $p < 0.001$ ). PHHIE-S score and  $PTA_{0.5-1-2}$  was significantly related ( $r = 0.4$ ;  $p < 0.001$ ). There was a significant difference between  $PTA_{0.5-1-2-4}$  in elderly who had failed ( $53.67 \pm 18.49$ ) and passed ( $25.02 \pm 15.23$ ) PHHIE-S ( $p < 0.001$ ). Pearson correlation between PHHIE-S score and  $PTA_{0.5-1-2-4}$  was also significant ( $r = 0.6$ ;  $p < 0.001$ ).

There was a significant difference between WRS in elderly who had failed ( $79.12 \pm 30.80$ ) and passed ( $97.06 \pm 3.53$ ) PHHIE-S ( $p < 0.001$ ) and a significant relationship between PHHIE-S

**Table 1. Statistical measures of the word recognition score, and three-frequency- and four-frequency pure tone averages of participants with failed and passed scores based on the Persian version of Hearing handicap inventory for the elderly-short form**

Test	Mean (SD)	Median	Mode	Minimum	Maximum
<b>WRS</b>					
Fail (n = 64)	79.12 (30.80)	92	100	0	100
Pass (n = 16)	97.06 (3.53)	100	100	92	100
<b>PTA<sub>0.5-1-2</sub></b>					
Fail (n = 64)	49.51 (19.18)	48.33	48.33	13.33	110
Pass (n = 16)	22.10 (17.14)	15	8.33	5	65
<b>PTA<sub>0.5-1-2-4</sub></b>					
Fail (n = 64)	53.67 (18.49)	53.12	60	11.25	110
Pass (n = 16)	25.02 (15.23)	20.83	13.75	7.5	65

WRS; word recognition score, PTA<sub>0.5-1-2</sub>; three-frequency pure tone average, PTA<sub>0.5-1-2-4</sub>; four-frequency pure tone average

score and WRS ( $r = -0.4$ ;  $p < 0.001$ ).

There was a significant difference between SAC scores in elderly who had failed ( $67.34 \pm 25.12$ ) and passed ( $15.00 \pm 17.65$ ) PHHIE-S ( $p < 0.001$ ) and a significant relationship between PHHIE-S and SAC score ( $r = 0.89$ ;  $p < 0.001$ ).

### Discussion

In the present study, 64 (80%) elderly participants failed and 16 (20%) participants passed PHHIE-S. 58 out of 64 (90.6%) elderly participants, who had failed the PHHIE-S, failed the auditory screening as well and among participants who had passed the PHHIE-S, 11 out of 16 (68.75%) passed the auditory screening too. This shows that only 5 (near 8%) participants who had some degree of hearing loss, passed HHIE-S which means they did not perceive hearing handicap. The finding that people with hearing loss do not feel handicapped has been seen in previous studies [8,12,22,23]. However, the percentage of people who have hearing loss but do not feel handicap varies between several studies. For example, among the 110 Brazilian elderly

with abnormal audiometry, 98 elderly participants (89.10%) showed some degree of perceived handicap, and only 12 of them (10.90%) showed no perception of hearing handicap [22]. However, in a recent study, 21 out of 55 (38.18%) Indonesian elderly participants with some degree of hearing loss did not expressed any handicap and passed HHIE-S [23] which is much higher than the findings of our study.

In addition, although 90.6% of elderly participants with some degree of hearing loss failed HHIE-S, 9.4% of cases with normal hearing sensitivity complained of auditory handicap. This finding have been also reported in previous studies [4,8,22,23]. This suggest that normal hearing is not essentially indicative of normal communication performance and hearing loss is not essentially indicative of auditory handicap. It has been shown that even without hearing loss, listening effort/fatigue increases with age which can be related to the age-related cognitive involvement [5,24]. However, difference is observed between the percentages of people who perceive handicap despite normal hearing in different

**Table 2. Frequency of hearing level and recognition score categories in participants with failed and passed scores based on the Persian version of hearing handicap inventory for the elderly- short form**

PHHIE-S result	Hearing level (n, %)						WRS (n, %)		
	Normal	Mild	Moderate	Moderately sever	Sever	Profound	Poor	Fair	Normal
Pass (n = 16)	13 (68.8)	3 (18.8)	1 (6.2)	1 (6.2)	0 (0)	0 (0)	0 (0)	0 (0)	16 (100)
Fail (n = 64)	6 (9.4)	16 (25)	22 (34.4)	13 (20.3)	5 (7.8)	2 (3.1)	16 (25)	12 (18.75)	36 (56.25)

PHHIE-S; Persian version of Hearing Handicap Inventory for the Elderly- Short form, WRS; word recognition score

countries. For example, among Brazilian 28 individuals with normal hearing, 25% of them expressed some degree of hearing handicap [22] and only 1 out of 5 Indonesian participants with normal hearing reported mild to moderate handicap [23]. Compared with them, the lower percent of people in the present study perceived handicap despite normal hearing sensitivity (9.4%).

It has been suggested that difference in studies reporting hearing impairment and self-perceived hearing handicap seems to be due to the different nations and cultures [8]. As mentioned in a recent study on Indonesian people, 21 out of 55 (38.18%) elderly participants with some degree of hearing loss did not expressed any handicap [23] but in the present study, only about 5 out of 63 (7.94%) of Iranian people with hearing loss passed HHIE-S. This shows that some people in some countries underestimate the hearing problem. For examples, in a Chinese group, majority of the individuals did not report a hearing handicap despite hearing impairment [12]. In Italy, the elderly underestimate the impacts of hearing loss and perceive presbycusis as an integral part of aging process. In other words, using self-assessment tools, they showed that the older patients recognized their dysfunction, but did not consider it as a disability. They suggested that this underestimation of the hearing problem and its' potential effects on the quality of life can be one of the reasons why elderly do not accept the need for hearing aid easily or using it continually [4]. In a cross sectional survey on 1220 Taiwanese elderly people, it has been demonstrated that only 21.4% participants with moderate to profound hearing impairment perceived themselves

as hearing-handicapped (HHIE-S total score 10) and not all elderly persons with hearing impairment perceived a hearing deficit socially or emotionally in everyday life hearing handicap. The authors had selected their samples from a rural place in Taiwan that is not as noisy as the city. Therefore, their elderly might experience less challenging listening conditions than ones who live in the big cities. Several factors other than auditory-related factors and also culture were suggested to contribute to self-perceived handicap. These factors include (but not restricted to) personal characteristics, physical and environmental factors, marital status and general perceived health [8].

Although it appears that the PTA alone is insufficient to describe the amount of perceived handicap, however, several studies have shown a significant relationship between HHIES and pure tone average [8,23,25,26]. Accordingly, a significant relation between PHHIE-S score and  $PTA_{0.5-1-2}$  as well as  $PTA_{0.5-1-2-4}$  of the better ear have been found in the present study that is in agreement with previous studies [23,25]. The  $PTA_{0.5-1-2-4}$  in the better ear was most strongly correlated with the HHIE-S ( $r = 0.6$ ,  $p < 0.001$ ) compared with the  $PTA_{0.5-1-2}$  ( $r = 0.4$ ,  $p < 0.001$ ). So, it seems that excluding 0.5 kHz increased the correlation that is in agreement with some studies that suggest perceived hearing handicap correlated most with the formulas using higher frequencies (1 kHz and above) excluding 0.5 kHz [8]. Other studies have also found the relationship between HHIE-S and PTA in the better ear [23, 25,26]. However, it seems that there is difference between studies in degree of correlation. For

example, Purnami et al. also found a significant relationship between HHIE-S score with the degree of hearing loss based on the pure-tone threshold average of 0.5, 1, 2, and 4 kHz ( $r = 0.691$ ,  $p = 0.001$ ) that is in best agreement with the present study [23]. However, Everett et al. observed a significant relationship between HHIE-S and pure-tone threshold average of 1, 2, and 4 kHz in the better ear but with lower correlation coefficient ( $r = 0.42$ ,  $p < 0.001$ ) [26]. Chang et al. also found moderate association between pure-tone threshold average of 1, 2, and 4 kHz and self-perceived handicap using HHIE-S but the strongest correlation was between the pure-tone threshold average of 0.5, 1, 2, and 4 kHz for both ears (binaural PTA) rather than the better ear ( $r = 0.52$ ) [8]. Taken together, the finding of only a relatively moderate correlation between hearing impairment and hearing handicap in elderly persons as measured by HHIE-S in the present study as well as other studies indicate that although hearing impairment is quite common among elderly people, but not all perceive handicap by the hearing impairment. This is an important finding and suggest the effects of several factors in self-perceived handicap. Identifying these factors associated with self-perceived hearing handicap in elderly participants in every country will help in identifying high risk people and thereby providing hearing rehabilitation services [8].

In addition, in the present study, there was a significant reciprocal relationship between WRS and PHHIE-S score. Higher WRS was related to lower PHHIE-S score which means lower auditory handicap ( $r = 0.4$ ). Weinstein and Ventry showed the same correlation coefficient between WRS and HHIE [10]. Wiley et al. showed that WRS in the competition was correlated with the HHIE-S score after compensating for hearing loss (odds ratio = 0.95) [27].

They also found that HHIE-S score is more affected by the degree of hearing loss, and gender does not have any significant effects on the perceived handicap and showed that if the degree of hearing loss was matched, auditory handicap indicated by failed HHIE-S was comparable in both genders [27]. This is in agreement with the

present study. The present study showed no significant difference of PHHIE-S scores between females and males. In general, gender seems to have no significant effect on hearing handicap. No significant effect of gender on HHIE-S have been also found in other studies [8,25]. For example, the study of Wang et al. revealed that with the same degree of hearing impairment, the handicap as measured by HHIE-S is in the same level for males and female [25].

SAC is also another self-assessment tool for identifying problems that hearing impaired people may experience. In the present study, there was a significant a strong correlation between PHHIE-S and SAC score ( $r = 0.89$ ;  $p < 0.001$ ). The present study found a high correlation coefficient between PHHIE-S and Persian SAC which is in agreement with the findings reported by American Speech-Language Association (ASHA). According to ASHA, characteristics of the SAC and HHIE-S for the identification of hearing impairment are comparable for individuals  $\geq 65$  years old (correlation coefficient was 0.9) [28]. Based on a survey at 1990, it was shown that 14% of audiologists used SAC and 36% used HHIE in elderly. Both inventories cover speech communication, special communication, non-speech communication, and personal reactions [29]. It has been shown that the SAC and HHIE-S are useful tools for evaluation of hearing aid benefits [30]. Therefore, according to the findings the correlation between HHIE-S with other self-assessment tools are higher than pure tone average.

This is a pilot study, and one of the limitations of the present study was to establish the content validity of PHHIE-S. It is recommended that future studies measure the content validity of the PHHIE-S version.

### Conclusion

The present study showed that simply evaluation of the hearing levels is not adequate in elderly and self-assessment tools can shed light on the whole picture. Combining both evaluations can provide both functional and physiological information about the auditory status of the elderly. Among self-assessment tools, HHIE-S has been

proven universally to be an easy, fast, reliable and valid tool for determining patients who might actually use their hearing aid, have a good satisfaction from using it and would benefit from rehabilitative services. This study showed that Persian Short form of Hearing Handicap Inventory for the Elderly (PHHIE-S) has significant correlation with PTA especially at higher frequencies and Self-Assessment of Communication (SAC) questionnaire, so it is recommended that PHHIE-S be a part of auditory evaluations for Iranian elderlies.

### Conflict of interest

The authors state that there was no conflict of interest.

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## Appendix 1 Persian version of Hearing Handicap Inventory for the Elderly- Short form (PHHIE-S)

پرسشنامه غربالگری معلولیت شنوایی سالمندان فارسی زبان (PHHIE-S)

نام و نام خانوادگی: سن: تاریخ:

لطفاً به سؤالات پرسشنامه زیر به صورت «بله»، «گاهی اوقات» یا «خیر» پاسخ دهید. اگر به سؤالی برخورد کردید که به خاطر وجود کم‌شنوایی از آن شرایط دوری می‌کنید، لطفاً خود را در آن شرایط قرار داده و پاسخ دهید. اگر در حال حاضر سمعک دارید لطفاً هنگام پاسخ دادن به سؤالات، شرایطی را در نظر بگیرید که از سمعک استفاده نمی‌کنید.

بله (۴)	خیر (۰)	گاهی اوقات (۲)	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	۱- آیا مشکل شنوایی شما باعث می‌شود کمتر از تلفن استفاده کنید؟
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	۲- آیا مشکل شنوایی شما باعث می‌شود وقتی با افراد غریبه مواجه می‌شوید، احساس خجالت و دستپاچی کنید؟
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	۳- آیا مشکل شنوایی شما باعث می‌شود زمانی که با اعضای خانواده‌تان صحبت می‌کنید احساس درماندگی کنید؟
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	۴- آیا در شنیدن صحبت‌های آهسته مشکل دارید؟
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	۵- آیا به دلیل مشکل شنوایی احساس ناتوانی می‌کنید؟
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	۶- آیا زمانیکه به دیدن دوستان، همسایگان یا خویشاوندان خود می‌روید، کم‌شنوایی شما مشکل ایجاد می‌کند؟
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	۷- آیا مشکل شنوایی شما سبب می‌شود در مراسمی که در محیط‌های بسته مانند مسجد، تالار و غیره برگزار می‌شود کمتر شرکت کنید؟
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	۸- آیا مشکل شنوایی شما باعث بحث و جدل بین شما و اعضای خانواده‌تان شده است؟
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	۹- آیا مشکل شنوایی شما سبب می‌شود که هنگام گوش کردن به رادیو و تلویزیون دچار مشکل شوید؟
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	۱۰- آیا فکر می‌کنید مشکل شنوایی شما به زندگی شخصی یا اجتماعی شما لطمه‌ای وارد می‌کند و یا محدودیت‌هایی برای شما ایجاد می‌نماید؟