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Otology

Validity of the Italian adaptation of the Hearing Handicap Inventory for the Elderly (HHIE-It)

Validazione dell'adattamento in lingua italiana dell'Hearing Handicap Inventory for the Elderly (HHIE-It)

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SUMMARY

Objective. The aim of this study was to assess the validity and reliability of the Italian translation of the Hearing Handicap Inventory for the Elderly (HHIE).

Methods. A sample of 275 adults, aged > 65 years, filled out the Italian version of the HHIE (HHIE-It) together with the MOS 36-Item Short Form Health Survey (SF-36). Seventy-one participants answered the questionnaire a second time after six weeks. The internal consistency, test-retest reliability, construct and criterion validity were evaluated.

Results. Cronbach's alpha was 0.94 and suggested a high internal consistency. There was also a significant intraclass correlation coefficient (ICC) between test and retest scores. In addition, Pearson's correlation coefficient between the two scores was high and significant. High and significant correlation coefficients were also found between the HHIE-It score and the pure tone average threshold of the better ear and between the HHIE-It and the subscales Role-emotional, Social Functioning and Vitality of the SF-36. These latter results indicate good construct and criterion validity, respectively.

Conclusions. The HHIE-It maintained the reliability and validity of the English version suggesting its utility for both clinical and research purposes.

KEY WORDS: hearing loss, quality of life, disability, fatigue

RIASSUNTO

Obiettivo. *Lo scopo di questo studio è stato quello di valutare la validità e l'affidabilità della traduzione italiana del questionario Hearing Handicap Inventory for the Elderly (HHIE).*

Metodi. *Un campione di 275 pazienti ambulatoriali di età maggiore di 65 anni ha compilato la versione italiana dell'HHIE (HHIE-It) insieme al questionario MOS 36-Item Short Form Health Survey (SF-36). Settantuno partecipanti hanno risposto al questionario una seconda volta a mezzo di intervista telefonica.*

Risultati. *Il coefficiente alfa di Cronbach è risultato 0,941 suggerendo un'elevata coerenza interna. Il coefficiente di correlazione intraclasse e il coefficiente di Pearson sono risultati statisticamente significativi nel test-retest. Inoltre, si sono evidenziati coefficienti di correlazione significativi tra il punteggio totale dell'HHIE-It e la soglia audiometrica dell'orecchio migliore e tra l'HHIE-It e le sottoscale Ruolo-Emotivo, Funzionamento Sociale e Vitalità del questionario SF-36, quale espressione di buona validità di costrutto e di criterio.*

Conclusioni. *L'HHIE-It ha mantenuto pertanto l'affidabilità e la validità della versione originale in lingua inglese suggerendo il suo utilizzo sia per scopi clinici che di ricerca.*

PAROLE CHIAVE: *ipoacusia, qualità della vita, disabilità, fatica*

Introduction

Population aging is defined as the progressive lengthening of life expectancy associated with an increasing number of elderly persons in any population. The

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economic effects of increased population ageing are considerable and new challenges to health care systems should be considered. In fact, there were 727 million people aged 65 years or above (9.3% of the total world population) in 2020 and this number is expected to consistently increase to about 1.5 billion or approximately 16% of the total world population by the year 2050 according to the United Nations [1]. Age-related hearing loss (ARHL), or presbycusis, is one of the most common conditions affecting older adults and is the third most prevalent chronic condition after hypertension and arthritis. Since population ageing is the most significant predictor of hearing loss, it is not surprising that nearly one of four individuals aged 65 to 74 and one of two of those 75 and older are affected [2,3]. Taken these epidemiological data together, audiological services are expected to be increasingly overwhelmed with older patients with hearing loss in the future. One of the most intriguing questions arising from this scenario is the methodology that should be considered the most appropriate to fully assess hearing loss disability and handicap in older people. Hearing loss is a barrier to communication and easily gives origin to a cascade of relevant consequences such as withdrawal from social interaction, depression and increased risk for cognitive decline [4]. If audiometric measures alone directly reflect the magnitude of sensory deprivation, the difficulties encountered by the listener in daily real-life, their consequences on social attitudes and psychological well-being need more exhaustive tools. Ventry and Weinstein, after investigating and carefully analysing other research on this topic, developed a new, self-assessment tool designed to quantify the effects of hearing impairment on the emotional and social adjustment to hearing loss in elderly people: the Hearing Handicap Inventory for the Elderly (HHIE) [5]. The original English version of this questionnaire was found to be valid and reliable [5,6]. Its translations have been carried out across different countries and cultures [7-11]. To our knowledge, since no study has adapted it to the Italian language, the aim of the present study is to validate an Italian version of the questionnaire (HHIE-It) and test its psychometric properties in a sample of community-dwelling older adults.

Materials and methods

Study population

A cohort of 275 subjects was recruited for this study from May 2018 to June 2019. This sample size was adopted in accordance with a predetermined respondent-to-item ratio of 10:1 [12]. The subjects were consecutive outpatients attending the audiological centre at the Audiology Unit, IRCCS Fondazione Policlinico, Mangiagalli e Regina Elena, University of Milan (Italy). The following inclusion criteria were established: both genders, age > 65 years, speaking Italian as their first language and willing to participate in the study. No segregation of cases was made on the basis of type of hearing loss (conductive, sensorineural and mixed). Patients with unilateral or bilateral loss of hearing were both invited to participate. The following exclusion criteria were established. Firstly, the presence of major neurological or psychiatric disorders or any other morbidity that could prevent them from understanding and answering the self-administered questionnaires by paper and pencil. Patients with cultural barriers that could prevent them from understanding the questionnaire items were excluded. Furthermore, subjects with fluctuating hearing loss and balance disorders, or wearing hearing aids/cochlear implants were not included.

Procedures

After otoscopic examination and immittance audiometry, each patient was seated within a double-wall, sound booth that complies with ISO 8253 and in the window view of the examiner but not of the audiometric controls board. Audiological screening of each subject was carried out using a Type 1 two-channel diagnostic audiometer (MADSEN Astera 1066 type, GN Otometrics A/S) and managing data using integrated OTO suite software. The examiners followed the Hughson-Westlake method of obtaining air conduction thresholds for each ear. The four frequency (0.5 KHz, 1 KHz, 2 Khz, 4 KHz) pure tone average threshold (4fPTA) was computed for both ears and then the better ear 4fPTA of each participant was used for statistical analysis. According to the WHO's Grades of hearing impairment [13], a 4fPTA ≤ 25 dB HL means no impairment, 26 dB HL ≤ 4fPTA ≤ 40 dB HL mild impairment, 41 dB HL ≤ 4fPTA ≤ 55 dB HL suggests moderately-severe impairment, 56 dB ≤ 4fPTA ≤ 70 dB indicates severe impairment and a 71 dB HL ≤ 4fPTA < 90 dB HL represents profound impairment.

Questionnaires

As is the original English version of the HHIE, the Italian translation is 25-item questionnaire (HHIE-It) that is comprised of two subscales: a 13-item subscale explores the emotional consequences of hearing impairment (E); a 12-item subscale explores both social and situational effects (S) (Appendix I). A *NO* answer to an item is awarded 0 points, *SOMETIMES* 2 points and *YES* 4 points. The possible scores of E and S are between 0 and 52 and 0 and 48, respectively. Therefore, the total score ranges from 0 to 100 points, with higher scores indicating a greater level of perceived handicap. The original version was translated using a forward and backward technique that complies with the

standards established by the IQOLA (International Quality of Life Assessment) project [14], for academic use and under license by the original authors. Before starting the present study, the HHIE-It was preliminarily administered in a pilot sample of 28 hearing-impaired patients with varying educational and social status, in a face-to-face interview format. Since few doubts about wording and comprehensiveness occurred, only a minor revision of the items was carried out. In order to provide evidence of criterion-related validity for HHIE-It, all patients were also asked to complete the Italian version [15] of an existing and already validated instrument that measures the psycho-sociological domains of health-related quality of life, the MOS 36-Item Short Form Health Survey (SF-36) [16]. This questionnaire investigates health status in the past four weeks on eight subscales: general health, physical functioning, role-physical, bodily pain, vitality, social functioning, role-emotional and mental health. Each dimension is separately scored using item weighting and additive scaling. Summed data were then transformed into a 0 to 100-point scale with higher score indicating better condition. Similar to a previous validation study of the Hearing Handicap Inventory for Adults [17], we employed the social-functioning (SF) and the role-emotional (RE) subscales as analogues of the correspondent S and E subscales of the HHIE-It. The SF subscale evaluates the impact of physical and emotional problems on social activities (with family, friends, neighbours and groups), while the RE rates the interference of emotional problems (such as feeling depressed or anxious) with regular daily activities. In the framework of this work, we also used the subscale 'vitality' (V) of the SF-36. This subscale is generally accepted to be a valid measure of energy/fatigue [18]. As a fact, increasing evidence from audiological medicine suggests that fatigue, as opposed to vigour and energy, is a relevant factor in the perceived hearing handicap [19].

Data analysis

Epidemiological features of the participants, such as gender, age and 4fPTA, were reported with descriptive statistics and an independent t-test was used to compare the continuous variables between males and females. In addition, the total score of the HHIE-It as well as the scores of its subscales were reported with descriptive statistics (Tab. I). Internal and test-retest consistencies of the HHIE-It were adopted to test reliability. The former was assessed with Cronbach's α [20]. According to this model, the more items in a test are correlated with each other (inter-item correlations), the greater the value of α. Alpha coefficients ≥ 0.70 are generally considered indicative of acceptable reliability of the scale [12], even if the use of cut-off values is debated. In addition, the statistical procedure "Cronbach's α if item is deleted" was adopted. This procedure is intended to verify if the removal of one or more items from the scale improves the overall α coefficient. HHIE-It was administered a second time to 71 selected subjects who responded with no change in their hearing ability after a six weeks interval in a phone-interview format to assess test-retest consistency. This is essential to measure the stability of the scores over time and comparison was made by calculating both the Pearson's correlation between the two surveys and the ICC. In this study, ICC estimates and their 95% confident intervals were calculated based on single measures, absolute-agreement and a 2-way mixed-effects model. The predetermined, minimally acceptable ICC value was set at 0.8. Construct validity of the HHIE-It refers to the ability of a survey to measure an intended hypothetical construct. It was assumed that higher scores of HHIE-It and its subscales should directly correlate to the degree of hearing loss. We used Pearson's correlation coefficient to disclose the presumed correlation between 4fPTA (dB HL) and the total score of HHIE-It and its subscales. As already mentioned, the Italian version of the MOS 36-Item Short Form Health Survey (SF-36) [15] was employed to assess criterion-related validity of the questionnaire and its subscales. The HHIE-It total score was correlated to the vitality (V) subscale score of the SF-36, whereas the S and E subscales scores were correlated to the social functioning (SF) and the role-emotional (RE) subscales of the same questionnaire, respectively. Pearson's correlation coefficient was used. Finally, ceiling and floor effects were computed and considered present if more that 15% of the patients reported the minimum (0) or the maximum (100) score of the scale [21]. Significance was considered if the p-value was < 0.05. Data analysis was performed using the Statistical Package for Social Sciences (SPSS version 23.00) software (SPSS, Inc., Chicago, Il, USA).

Results

Of the 275 outpatients recruited and examined, 160 were males (58.2%) and 115 females (41.8%). The mean age was 74.5 years (SD = 6.6, range: 65-91). Table I shows the demographic characteristics of the sample. According to the WHO's Grades of hearing impairment [13] based on 4fPTA, 15 patients (5.5%) had no impairment, 44 (16.0%) had a slight impairment, 87 (31.6%) had mild impairment, 88 (32.0%) had moderate impairment, 33 (12.0%) had moderately-severe impairment, 6 (2.2%) had severe impairment and 2 (0.7%) profound impairment (Fig. 1). The mean value of 4fPTA was 39.3 dB HL (range: 10-111.3, SD = 16.0). Males were significantly older than females ($t = -3.06$, $df = 273$, $p = 0.002$), but the degree of hearing

Table I. Epidemiological features of the sample.

	Total (n = 275)			Male (n = 115)			Female (n = 160)		
	Mean	SD	min-max	Mean	SD	min-max	Mean	SD	min-max
Age (years)	74.5	6.6	65-91	75.9	6.4	65-91	73.5	6.5	65-90
4fPTA (dB HL)	39.3	16.1	10-101	40.8	16.4	10 - 101	37.2	15.3	10-85

SD: standard deviation; min-max: lowest and highest values; 4fPTA: four frequencies (0.5 KHz, 1 KHz, 2 Khz, 4 KHz) pure tone average threshold in the better ear.

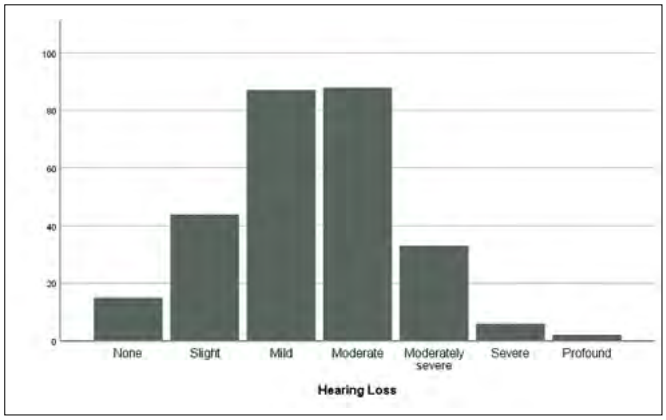

Figure 1. Distribution of hearing loss in the sample cases based on 4fPTA according to the WHO's Grades of hearing impairment. None: normal hearing, from -15 to 15 dB HL (15 subjects, 5.5%); Slight hearing loss: from 16 to 25 dB HL (44 subjects, 16.0%); Mild hearing loss: from 26 to 40 dB HL (87 subjects, 31.6%); Moderate hearing loss: from 41 to 55 dB HL (88 subjects, 32.0%); Moderately-severe hearing loss: from 56 to 70 dB HL (33 subjects, 12.0%); Severe hearing loss: from 71 to 90 dB HL (6 subjects, 2.2%); Profound hearing loss: from 91 dB HL (2 subjects, 0.7%).

loss in the better ear did not differ between gender (t = 1.9, df = 255, p = 0.056). Table II shows the total score of the HHIE-It and the scores of the two subscales, E and S. No significant difference was found between males and females with regards to the HHIE-It total score (t = -0.58, df = 268.4, p = 0.557), the S score (t = -0.231, df = 268.9, p = 0.817) and E score (t = 0.837, df = 266.2, p = 0.403). Cronbach's α coefficient was 0.94 for the total score of the questionnaire, and 0.84 and 0.93 for the S and E subscales, respectively. The procedure 'Cronbach's α if item is deleted' pointed out that removal of item 21 improved overall α coefficient of the scale to 0.957. After its removal, no other item was shown to increase α again. Pearson's correlation coefficient between the total scores of the HHIE-It obtained in the two distinct administrations was 0.392 (2-tails significance = 0.002). ICC resulted 0.888 for HHIE-It total score, 0.828 and 0.884 for the E and S subscales, respectively (Tab. III). Pearson's correlation coefficient between 4fPTA and HHIE-It total score was 0.408 (2-tails significance < 0.001). Highly significant correlations were also found between 4fPTA and the E and S subscales of the HHIE-It (r = 0.358, 2-tails significance < 0.001 and 0.329, 2-tail significance < 0.001). Negative correlations were found between the HHIE-It and its subscales (S, E) scores and the three SF-36 subscales scores (SF, RE and V) (p < 0.001) (Tab. IV). Finally, no ceiling effect was found since no patients scored 100 at HHIE-It and only 8 patients (3%) a minimum score (0).

Discussion

Cronbach's α coefficient of the Italian version was 0.941 which is very close to that of the original study of Ventry and Weinstein (0.95) [5] and the Swedish adaptation (0.92) [7]. Moreover, Cronbach's α of the E and S subscales (0.84 and 0.93, respectively) closely resemble those of the original version (0.88 and 0.93). Only the removal of item 21 from the scale slightly improved the overall α coefficient of the scale. However, item 21 "Does a hearing problem cause you difficulty when in a restaurant with relatives or friends?" investigates one of the most common complaints among older hearing-impaired patients, namely speech understanding in competing background noise [22]. We decided not to remove it from the scale because it is "necessary and desirable" for audiologists [5] to pinpoint any specific situation that could be detrimental to social adjustment even if

Table II. Total score of the HHIE-It and scores of its subscales Emotional (E) and Socio-Situational (S). Variables are reported as means, standard deviations (SD) and lowest and highest values for the entire population and for both genders separately.

	Total (n = 275)			Male (n = 115)			Female (n = 160)		
	Mean	SD	min-max	Mean	SD	min-max	Mean	SD	min-max
HHIE-IT (total score)	22.4	19.7	(0-92)	21.8	21.3	(0-92)	23.2	17.4	(0-80)
HHIE-IT (E subscale)	11.7	11.3	(0-52)	11.3	12.1	(0-52)	12.4	10.2	(0-38)
HHIE-IT (S subscale)	10.6	9.1	(0-46)	10.5	9.8	(0-44)	10.8	7.9	(0-42)

Table III. Intraclass correlation coefficients of HHIE-It total score and its subscales (E) and (S) computed between the two surveys, administered at a six weeks interval time. Intraclass Correlation Coefficient (ICC) estimates and their 95% confidence intervals were calculated based on single measures, absolute-agreement, 2-way mixed-effects model.

	ICC	95% Confidence interval		F Test with true value 0			
		Lower Bound	Upper Bound	Value	df1	df2	P value
HHIE-IT (total score)	0.888	0.817	0.932	37.3	60	60	< 0.001
HHIE-IT (E subscale)	0.828	0.727	0.894	10.4	60	60	< 0.001
HHIE-IT (S subscale)	0.844	0.751	0.904	11.6	60	60	< 0.001

Table IV. Correlations between the HHIE-It, its subscales scores and the SF-36 subscales scores.

		SF-36		
		SF	RE	V
HHIE-IT (total score)	Pearson's coefficient	-0.333**	-0.254**	-0.330**
	Sig. (2-tails)	p < 0.001	p < 0.001	p < 0.001
HHIE-IT (S subscale)	Pearson's coefficient	-0.327**	-0.241**	-0.313**
	Sig. (2-tails)	p < 0.001	p < 0.001	p < 0.001
HHIE-IT (E subscale)	Pearson's coefficient	-0.320**	-0.250**	-0.325**
	Sig. (2-tails)	p < 0.001	p < 0.001	p < 0.001

*HHIE-It: Italian translation of the Hearing Handicap Inventory for the Elderly; E: emotional subscale of the HHIE-It; S: socio-situational subscale of the HHIE-It; SF-36: MOS 36-Item Short Form Health Survey; RE: role-emotional subscale of the SF-36; SF: social-functioning subscale of the SF-36; V: vitality subscale of the SF-36. * = p < 0.05; ** = p < 0.005.*

not so frequently encountered by the elderly in everyday life. In fact, this study suggested the internal consistency of the HHIA-It to be more than acceptable and all the items of the scale are consistent indicators of hearing handicap. According to George and Mallery [12], α values equal or greater than 0.9 are to be considered excellent. On the other hand, a very high α value could indicate redundancy between items in the scale, but exploring the possibility of a shorter version was beyond the purpose of this validation study. Many factors can affect the score of a questionnaire at different points in time: for instance, patients' responses might be influenced by pathological changes, different moods, or external conditions. Furthermore, the subject's memory of the scale items might contribute to an exceedingly strong correlation between the two surveys. As a rule of thumb, an interval time of at least six weeks between the two administrations adopted in this study is suggested to counteract this latest factor [23]. Thus, both a significant Pearson's correlation coefficient and ICC between the scores of the questionnaire and its subscales suggest that the HHIE-It resists all the other risks. Compared to other adaptations of audiological disease-specific questionnaires into Italian language [23], construct validity of HHIE-It was shown to be more straightforward because a robust and direct correlation between an objective measure of hearing impairment (4fPTA) and perceived hearing handicap was documented. In other words, HHIE-It scores improve as the degree of hearing loss increases in accordance with the predetermined hypothetical concept adopted in this study. Criterion validity was confirmed by significant correlations between HHIE-It overall score and the scores of its subscales E and S with the corresponding RE and SF of the SF-36. These results confirm that hearing handicap is related to both psychological distress and poor social adjustment. Difficulties in taking part in conversation with relatives and friends and subsequent frustration facilitate loneliness and depression. In addition, this study disclosed a negative correlation between the severity of subjective hearing handicap and vitality, as assessed by the V subscale of the SF-36. Indeed, lack of energy, exhaustion and chronic feelings of fatigue could be associated with hearing loss through the increased listening effort [24]. Furthermore, dissipated vigour arising from daily life engagement of cognitive resources for speech perception may be one of the most relevant contributors to hearing loss related disability [25]. Another important factor of this validation study is the exclusion of ceiling and floor effects of the HHIE-It questionnaire, which indicate the percentages of respondents scoring the highest (ceiling) or lowest (floor) extremes of the scale. If a large proportion of patients report the highest or lowest possible score for a questionnaire, then the tool is not adequate to distinguish between respondents at the extreme ends of the scale [21]. Since the floor/ceiling effect was really scarce in this sample of hearing-impaired older adults,

this risk was considered negligible. Some limitations of this study are pertinent. A limitation of this study was the absence of patients wearing hearing aids so that HHIE-It cannot provide any information about the outcome of intervention. To this purpose, a new trial on the benefit of aural rehabilitation in the elderly is ongoing and the HHIE-It is the main tool adopted to detect reduction of perceived handicap after hearing aids fitting. Furthermore, this study did not include any institutionalised older adults with hearing impairment. In view of this, there is a concern about the active ageing process, in which the continuing participation of aged people on daily activities is enhanced with respect to their hospitalised peers.

Conclusions

This study demonstrates that the Italian adaptation of the HHIE is a valid and reliable instrument to investigate the amount of perceived handicap related to hearing impairment in the community-dwelling older adults. The HHIE-It demonstrated favourable psychometric properties overlapping those of the original version and its adoption is justified for both clinical and research purposes in Italy.

Conflict of interest statement

The authors have no personal, financial, and institutional interest in any of the materials and devices described in this article.

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Author contributions

FD: conception and design of the study, drafting the manuscript; RN: methodology, supervision, drafting of manuscript; BA: investigation, acquisition of data; EA: statistical analysis, editing the manuscript; CG: acquisition of data, conception of the study; DM: conception and design of the study, statistical analysis, editing the manuscript, final approval. All Authors contributed to the article and approved the submitted version.

Ethical consideration

The experimental protocol followed the recommendations of the last revision of WMA Declaration of Helsinki for Human experimentation published in October 2013 and written informed consent was obtained from each participant before assessment. The study was approved by the local Ethic Committee (Protocol N. 478-2016bis).

References

1 Department of Economic and Social Affairs, Population Dynamics, The United Nations. World Population Prospects 2019 (https://population.un.org/wpp/Download/Standard/Population/, accessed March 31, 2022).

2 Cruickshanks KJ, Wiley TL, Tweed TS, et al. Prevalence of hearing loss in older adults in Beaver Dam, Wisconsin: the epidemiology of hearing loss study. Am J Epidemiol 1998;148:879-886. https://doi.org/10.1093/oxfordjournals.aje.a009713

3 Lin FR, Niparko JK, Ferrucci L. Hearing loss prevalence in the United States. Arch Intern Med 2011;171:1851-1852. https://doi.org/10.1001/archinternmed.2011.506

4 Ciorba A, Bianchini C, Pelucchi S, et al. The impact of hearing loss on the quality of life of elderly adults. Clin Interv Aging 2012;7:159-163. https://doi.org/10.2147/CIA.S26059

5 Ventry IM, Weinstein BE. The hearing handicap inventory for the elderly: a new tool. Ear Hear 1982;3:128-134. https://doi.org/10.1097/00003446-198205000-00006

6 Weinstein BE, Spitzer JB, Ventry IM. Test-retest reliability of the Hearing Handicap Inventory for the Elderly. Ear Hear 1986;7:295-299. https://doi.org/10.1097/00003446-198610000-00002

7 Öberg M, Lunner T, Andersson G. Psychometric evaluation of hearing specific self-report measures and their associations with psychosocial and demographic variables. Audiol Med 2007;5:188-199. https://doi.org/10.1080/16513860701560214

8 Sogebi OA, Mabifah TO. Validation of hearing handicap inventory for the elderly questionnaire among elderly subjects in Sagamu, Nigeria. Niger Postgrad Med J 2015;22:228-232. https://doi.org/10.4103/1117-1936.173974

9 De Paiva SMM, Simões J, Paiva A, et al. Validity and reliability of the hearing handicap inventory for elderly: version adapted for use on the portuguese population. J Am Acad Audiol 2016;27:677-682. https://doi.org/10.3766/jaaa.15146

10 Laohasiriwong S, Kasemsiri P, Thanavirathananich P, et al. Validity and test-retest reliability of Hearing Handicap Inventory for the Elderly Thai Version (HHIE-Thai). Ann Otolaryngol Rhinol 2018;5:1204. https://doi.org/10.47739/2379-948X/1204

11 Ismail N, Shalaby A, Behairy R, et al. The developed Arabic version of the Hearing Handicap Inventory for the Elderly. Egypt J Otolaryngol 2020;36. https://doi.org/10.1186/s43163-020-00004-6

12 George D, Mallery P. SPSS for Windows step by step: a simple guide and reference. 11.0 update. Fourth edition. Boston: Allyn & Bacon; 2003.

13 The World Health Organisation. Programme for the prevention of deafness and hearing impairment. Report of the Informal Working Group on Prevention of Deafness and Hearing Impairment Programme Planning, Geneva, Switzerland; 18-21 June, 1991. World Health Organisation 1991 https://apps.who.int/iris/handle/10655/58839 (accessed March 31, 2022).

14 Ware J, Gandek B, Keller S. The IQOLA Project Group. Evaluating instruments used across-nationally; methods from the IQOLA Project. In: Pilker B, ed. Quality of life and pharmacoeconomics in clinical trials. Second edition. New York: Raven Press; 1996. pp. 681-692.

15 Apolone G, Mosconi P. The Italian SF-36 Health Survey: translation, validation and norming. J Clin Epidemiol 1998;51:1025-1036. https://doi.org/10.1016/s0895-4356(98)00094-8

16 Ware JE Jr, Sherbourne CD. The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. Med Care 1992;30:473-483.

17 Monzani D, Genovese E, Palma S, et al. Measuring the psychosocial consequences of hearing loss in a working adult population: focus on

validity and reliability of the Italian translation of the hearing handicap inventory. Acta Otorhinolaryngol Ital 2007;27:186-191.

[18] O'Connor PJ. Evaluation of four highly cited energy and fatigue mood measures. J Psychosom Res 2004;57:435-441. https://doi.org/10.1016/j.jpsychores.2003.12.006

[19] Hornsby BW, Kipp AM. Subjective ratings of fatigue and vigor in adults with hearing loss are driven by perceived hearing difficulties not degree of hearing loss. Ear Hear 2016;37:e1-e10. https://doi.org/10.1097/AUD.0000000000000203

[20] Cronbach LJ. Coefficient alpha and the internal structure of tests. Psychometrika 1951;16:297-334. https://doi.org/10.1007/BF02310555

[21] Terwee CB, Bot SD, de Boer MR, et al. Quality criteria were proposed for measurement properties of health status questionnaires. J Clin Epidemiol 2007;60:34-42. https://doi.org/10.1016/j.jclinepi.2006.03.012

[22] Glyde H, Hickson L, Cameron S, et al. Problems hearing in noise in older adults: a review of spatial processing disorder. Trends Amplif 2011;15:116-126. https://doi.org/10.1177/1084713811424885

[23] Demorest M, Walden B. Psychometric principles in the selection, interpretation, and evaluation of communication self-assessment inventories. J Speech Hear Disord 1984;49:226-240. https://doi.org/10.1044/jshd.4903.226

[24] Monzani D, Genovese E, Marrara A, et al. Validity of the italian adaptation of the tinnitus handicap inventory; focus on quality of life and psychological distress in tinnitus-sufferers. Acta Otorhinolaryngol Ital 2008;28:126-134.

[25] Holman JA, Hornsby BWY, Bess FH, et al. Can listening-related fatigue influence well-being? Examining associations between hearing loss, fatigue, activity levels and well-being. Int J Audiol 2021;60(Suppl 2):47-59. https://doi.org/10.1080/14992027.2020.1853261

Appendix I.

The Italian translation of the Hearing Handicap Inventory for Elderly (HHIE-It), aimed at subjects aged over 65. Items number 2, 4, 5, 7, 9, 12, 14, 17, 18, 20, 22, 24, 25 correspond to the emotional subscale and items number 1, 3, 6, 8, 10, 11, 13, 15, 16, 19, 21, 23 rank the magnitude of socio-situational limitation.

The Hearing Handicap Inventory for Elderly – Italian Version (HHIE-IT)		4	2	0
1	Un problema di udito La obbliga a usare il telefono meno di quello che Le piacerebbe fare?	SI	QUALCHE VOLTA	NO
2	Un problema di udito Le crea imbarazzo quando conosce nuove persone?	SI	QUALCHE VOLTA	NO
3	Un problema di udito La costringe a evitare la compagnia di altre persone?	SI	QUALCHE VOLTA	NO
4	Un problema di udito La rende irritabile?	SI	QUALCHE VOLTA	NO
5	Un problema di udito La fa sentire frustrato mentre parla con i familiari?	SI	QUALCHE VOLTA	NO
6	Un problema di udito Le crea difficoltà a partecipare a una festa?	SI	QUALCHE VOLTA	NO
7	Un problema di udito La fa sentire stupido o taciturno?	SI	QUALCHE VOLTA	NO
8	Un problema di udito Le crea difficoltà quando qualcuno parla sussurrando?	SI	QUALCHE VOLTA	NO
9	Si sente handicappato a causa del Suo problema di udito?	SI	QUALCHE VOLTA	NO
10	Un problema di udito Le causa difficoltà quando fa visita agli amici, parenti o vicini di casa?	SI	QUALCHE VOLTA	NO
11	Un problema di udito Le crea problemi al cinema e/o a teatro?	SI	QUALCHE VOLTA	NO
12	Un problema di udito La rende nervoso?	SI	QUALCHE VOLTA	NO
13	Un problema di udito La costringe a fare meno visite agli amici, ai parenti, ai vicini rispetto a quanto vorrebbe?	SI	QUALCHE VOLTA	NO
14	Un problema di udito causa delle discussioni in famiglia?	SI	QUALCHE VOLTA	NO
15	Un problema di udito Le causa problemi quando ascolta la radio o la televisione?	SI	QUALCHE VOLTA	NO
16	Un problema di udito La costringe a visitare meno i negozi di quanto vorrebbe?	SI	QUALCHE VOLTA	NO
17	Un qualsiasi problema o difficoltà nell'udito La sconvolge completamente?	SI	QUALCHE VOLTA	NO
18	Un problema di udito La costringe a restare solo/a?	SI	QUALCHE VOLTA	NO
19	Un problema di udito La obbliga a parlare meno con i familiari rispetto a quanto vorrebbe?	SI	QUALCHE VOLTA	NO
20	Le sembra che qualsiasi difficoltà con il Suo udito limiti o ostacoli la Sua vita personale e sociale?	SI	QUALCHE VOLTA	NO
21	Un problema di udito Le crea difficoltà quando si trova in un ristorante con amici o parenti?	SI	QUALCHE VOLTA	NO
22	Un problema di udito La fa sentire depresso?	SI	QUALCHE VOLTA	NO
23	Un problema di udito La obbliga ad ascoltare meno radio e TV di quello che vorrebbe?	SI	QUALCHE VOLTA	NO
24	Un problema di udito La fa sentire a disagio quando parla con gli amici?	SI	QUALCHE VOLTA	NO
25	Un problema di udito La fa sentire escluso/a quando si trova in un gruppo di persone?	SI	QUALCHE VOLTA	NO