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

Le conseguenze psico-sociali della perdita uditiva nella popolazione adulta in età lavorativa: validità ed affidabilità della versione italiana dell'Hearing Handicap Inventory

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SUMMARY

Despite increasing demand for questionnaires for assessing hearing handicap and the effectiveness of some tools across different languages, empirical studies to evaluate the reliability and the validity of translations of original English questionnaires into an Italian version have not been reported in the literature, thus making comparisons of Italian experimental and clinical data across cultures and countries impossible. This study tested the global assumption that the Hearing Handicap Inventory for Adults (HHIA), that is one of the most widely used instruments in English-speaking countries, can be adapted to the Italian language maintaining the reliability and clinical validity of the original version. The English version of this 25-item, self-assessment questionnaire was developed by Newman et al. in 1990 and special emphasis was placed on emotional reaction and social limitations perceived by hearing-impaired subjects and scored separately. This tool was translated into the Italian language by a forward and backward technique, as established by the IQOLA (International Quality of Life Assessment) project. Overall, 94 subjects, aged 18-65 years, with acquired hearing impairment and 104 individuals with no hearing problems, well-matched for socio-demographic variables, were enrolled in the study in a case-control design. Reliability of the Italian version of HHIA was tested by measuring internal consistency and test-retest reproducibility. Validity was assessed by using construct, convergent and discriminant methods. A Cronbach's alpha coefficient near 0.90 confirmed a more than acceptable internal consistency and a highly statistically significant Spearman's correlation coefficient (< 0.005) between scores of the two administrations at an interval of one month documented an excellent stability of the questionnaire over time. Construct validity was demonstrated by a correlation between the severity of hearing loss and the score of questionnaire (< 0.005) and convergent validity was supported by a significant correlation between the scores of the emotional and socio/situational subscales of the HHIA to the analogous subscales of a health-related quality of life questionnaire (MOS 36-Item Short Form Health Survey) (< 0.005). Finally, since hearing-impaired subjects scored significantly higher than controls on HHIA (< 0.005), it clearly emerged that also the Italian version of HHIA differentiates the two populations (those with and those without hearing problems) demonstrating a robust discriminant validity. Given the lack of appropriate measures to assess hearing handicap in Italy, the results achieved in this study, confirm that the HHIA, Italian version, is suitable for both experimental and clinical use.

KEY WORDS: Hearing loss • Hearing handicap questionnaire • Validity • Reliability

RIASSUNTO

Nonostante la crescente richiesta di questionari appropriati per misurare l'handicap uditivo e la comprovata efficacia di alcuni di essi in lingue differenti, non sono ancora stati condotti studi sperimentali che documentino l'affidabilità e la validità di una loro traduzione in lingua italiana rendendo così impossibile effettuare il confronto dei risultati sia clinici che sperimentali ottenuti in Italia con quelli di altri Paesi e nelle diverse culture. Questo studio è stato intrapreso con lo scopo primario di verificare se l'Hearing Handicap Inventory, uno dei questionari più diffusi nei Paesi di lingua anglosassone, tradotto ed adattato in lingua italiana, mantiene l'affidabilità e la validità clinica della versione originale. L'Hearing Handicap Inventory for Adults (HHIA) venne sviluppato da Newman et al. nel 1990 ed è un questionario comprendente 25 domande adatto per l'autosomministrazione. Un'enfasi particolare è stata posta dagli Autori sulle reazioni emotive e sulle limitazioni sociali correlate alla perdita uditiva che vengono misurate in due sottoscale separate. La traduzione in lingua italiana è stata eseguita seguendo la procedura indicata dal protocollo dell'IQOLA (International Quality of Life Assessment). Sono stati selezionati 94 soggetti adulti di età compresa tra i 18 e i 65 anni, affetti da sordità acquisita di diversa entità, afferenti ai Servizi di Audiologia delle Aziende Ospedaliero-Universitarie di Modena e Ferrara. Ulteriori 104 soggetti adulti normoudenti e sovrapponibili ai primi per caratteristiche socio-demografiche sono stati reclutati come gruppo di controllo. L'affidabilità del testo italiano è stata verificata esplorando la consistenza interna e la riproducibilità del test-retest. La validità è stata analizzata in termini

di struttura, di convergenza e di potere discriminante. Il coefficiente alpha di Cronbach prossimo a 0,9 ha confermato la più che accettabile consistenza interna ed un coefficiente di Spearman altamente significativo (p < 0,005) tra i punteggi ottenuti nel test-retest ha documentato un'ottima stabilità del questionario nel tempo. La validità di costruzione del test è stata provata da una correlazione diretta e statisticamente significativa (p < 0,005) tra il punteggio globale dell'HHIA, versione italiana, ed il grado di perdita uditiva. Per di più, le correlazioni statisticamente significative (p < 0,005), riscontrate tra le sottoscale (emozionale e socio/situazionale) dell'HHIA con le analoghe sottoscale di uno strumento psicometrico per la valutazione della qualità della vita, già ampiamente validato in lingua italiana (MOS 36-Item Short Form Health Survey), hanno confermato la validità in termini di convergenza. Il fatto infine che i punteggi totali dell'HHIA, versione italiana, ottenuti nei due campioni selezionati per sovrapponibili condizioni socio-demografiche, ma differenti per soglia uditiva, siano risultati statisticamente differenti (p < 0,005) è stata un'ulteriore conferma della validità in termini di potere discriminante. Pertanto, data la mancanza di questionari con appropriate qualità psicometriche atte a valutare la percezione dell'handicap uditivo in lingua italiana, il risultato principale di questo studio è stato quello di rendere disponibile sia ai ricercatori che ai clinici uno strumento valido e affidabile e di rendere finalmente possibile il confronto tra le casistiche italiane e quelle di altri Paesi.

PAROLE CHIAVE: *Ipoacusia • Handicap uditivo • Questionario • Validità • Affidabilità*

Introduction

Some important problems in the clinical approach to hearing-impaired patients have been identified on the basis of extensive anecdotal and experimental evidence [1]. One of them is that examination of patients with hearing loss should not be limited to audiometric tests (i.e., appreciation of physical health status), but also evaluate functional adverse effects resulting from hearing disorders (including both physical and role functioning) and psychological well-being [2]. The physical comfort of hearing-impaired individuals may be affected by difficulties in recognition of words and sentences, localization of sounds and hearing speech in noise, that relate directly to auditory disorders. Furthermore, as a result of maladaptive communication strategies, people affected by hearing loss may perceive their psycho-social attitude to be poor due to limitations in their daily activities, such as work, housekeeping and shopping and to a reduced self-esteem if a combination of hearing impairment and psychological distress contributes to failure in their roles [3]. To better appreciate the complexity of these domains, some interesting questionnaires have been developed [4-6] and their application in the clinical approach to patients with hearing loss seems to compensate for the reported low correspondence between self-perceived and audiometrically derived measures of hearing handicap [7]. Despite general agreement concerning the usefulness of questionnaires with adequate psychometric properties in the overall assessment of auditory disability and handicap, most audiological services in Italy do not routinely employ such valuable tools thus underestimating patient's psychosocial adjustment to hearing loss and failing to monitor the overall result of auditory rehabilitation. Probably more than one reason (lack of time, cost, etc.) could explain why self-reported measures are not easily incorporated within audiological decision-making strategies. One of these reasons is that, unfortunately, there are no instruments designed specifically for our Italian population, for this purpose and no research has focused on adapting and re-establishing normative criteria for instruments proven to be useful in other countries.

The present study was, therefore, undertaken to assess the psychometric properties, including validity and reliability, of the Italian version of the Hearing Handicap Inventory for Adults (HHI-A) [5] in a sample population of working adults with normal hearing, as well as in a sample of hearing-impaired individuals (case-comparison design) with the aim of providing our country with an appropriate measure of hearing handicap, for both clinical and research purposes.

Material and methods

Study population

Overall 94 patients diagnosed as having hearing loss (41 male, 53 female), age range 18-65 years (mean = 50.7, SD = 10.7) upon audiometric examination were studied. Hearing-impaired subjects (HI) were all outpatients undergoing audiological evaluation at the University Hospitals of Modena and Ferrara, Italy. Patients with fluctuating hearing loss and current hearing aid users were excluded from the study. Other exclusion criteria were not understanding the Italian language and major medical disorders and/or handicap that prevented the participants from regular work. The mean pure tone average (PTA), calculated over 0.5, 1, 2 and 4 kHz across both ears, revealed a hearing threshold ranging from 29 to 71 dB HL with a mean of 48 dB. Based on the better-ear PTA, 10 (10.6%) subjects had normal hearing (< 25 dB HL) unilaterally, 47 (50%) had a mild hearing loss (26-40 dB HL), 31 (32.9%) had a moderate loss (41-55 dB HL) and 6 (6.5%) showed a severe or worse (more than 56 dB HL) hearing loss.

109 subjects with normal bilateral audiometric thresholds (pure tone thresholds for 0.5, 1, 2, 4 KHz < 25 dB HL; 48 males and 61 females), ranging in age between 18 and 65 years (mean = 47.8, SD = 10), selected on the basis of corresponding socio-demographic parameters, served as a control group (NH). The experimental protocol followed the recommendations of the Declaration of Helsinki for Human Experimentation and informed consent was obtained from each participant before examination.

Instruments

The Hearing Handicap Inventory for Adults (HHIA) is a 25-item questionnaire which was derived from the original Hearing Handicap Inventory for the Elderly (HHIE) by Ventry and Weinstein [8] and is composed of a 13-item emotional subscale and a 12-item socio-situational subscale and two replacement questions from the HHIE focus on the occupational effects of hearing loss. Translation of the

HHIA into the Italian language (appendix 1) was carried out independently by two senior audiologists of the University Hospitals of Modena and then agreed in a plenary session. Two independent translators translated back the Italian version into English and compared it to the original version of the questionnaire in order to revisit the Italian one. This forward and backward technique follows the standards established by the IQOLA (International Quality of Life Assessment) project [9].

Finally, to test comprehensiveness, it was first administered in a pilot sample of 15 hearing-impaired patients with varying educational and social status, in a face-to-face interview format. Since wording and questions were clearly understood by all patients, no further revision of the items was made. As in the original version, a *yes* reply to an item was awarded 4 points, a *sometimes* reply 2 points and a *no* response 0 points. Therefore, a score ranging from 0 to 100 points indicated an increasing level of perceived handicap.

Data analysis

To provide a socio-demographic description of NH and HI groups, preliminary χ^2 test was used to compare sex, occupational (professional *vs.* non-professional), marital status (single *vs.* married or cohabiting). Age, duration of education (years) and PTA (dB HL) were compared by the independent t-test procedure.

To test reliability of the HHIA – Italian version –, two parameters were adopted; internal and test-retest consistencies. Internal consistency reliability was measured by Cronbach's alpha coefficient. This procedure is helpful in deciding whether different questions in a questionnaire are measuring the same underlying concept, that is, whether each item of the scale is a consistent indicator of hearing handicap [10]. It is calculated using a one-way analysis of the variance model with items functioning as the repeated measure. A Cronbach's alpha coefficient of 0.70 is the minimally acceptable level for internal consistency reliability [11] [12].

To establish how each item affects the reliability of the scale, Cronbach's alpha was calculated when each item was removed from the scale.

To measure the stability of scores, the HHIA was administered a second time, in the form of a phone interview, to 70 randomly-selected subjects, from the original 94 subjects, after a six-week interval. This time interval was considered acceptable to minimize the subject's memory of the scale items that might contribute to a strong correlation between the two administrations [13]. Comparison was made by calculating a Spearman's correlation coefficient between the first and second testing.

The validity testing of the Italian was studied by adopting construct, convergent and discriminant methods.

Construct validity requires that the employed index behaves in accordance with a predetermined intuitive concept. In this study, construct validity would be supported if the score of the HHIA improves as the severity of hearing loss increases. Therefore, Spearman's correlation coefficient was computed to correlate the two afore-mentioned independent variables.

To investigate convergent validity of the HHIA subscales with an existing and already validated instrument that measures the psycho-sociological domains of health-related quality of life, the Italian translation [14] of the MOS 36-Item Short Form Health Survey (SF-36), which demon-

strated a high standard of reliability and validity like the original English version [15] [16], was used. The scale consists of 36 items subdivided into eight health scales, i.e., general health (GH), physical functioning (PF), role-physical (RP), bodily pain (BP), vitality (V), social functioning (SF), role-emotional (RE) and mental health (MH). Each dimension is scored separately using item weighting and additive scaling. Whole data were then converted into a 0 to 100 point scale, where the highest score indicated best well-being. In the framework of this study, we employed the social functioning (SF) and the role-emotional (RE) subscales. The first one measures the impact of physical and emotional problems on social activities (with family, friends, neighbours and groups) while the second measures the interference of emotional problems (such as feeling depressed or anxious) with work and other regular daily activities. Spearman's correlation coefficient was computed to correlate the scores of the HHIA and SF-36 corresponding subscales.

To further assess validity, the sensitivity of the scale in discriminating between groups (patients with hearing loss and subjects with no hearing problems) was tested [17]. To this end, Wilcoxon test was used to compare HHIA mean ranks score of NL and HL groups.

A value of $p < 0.05$ was considered statistically significant in all procedures.

The statistical Package SPSS/PC + version 13 was used.

Results

No significant differences were found between HI and NH groups with respect to sex ($\chi^2 = 0.004$, df = 1, p = 0.95), age (t = -1.7, df = 201, p = 0.09), education (expressed in years of school) (Student's t = 1.4, df = 201, p = 0.15), occupation (professional *vs.* non professional) ($\chi^2 = 0.38$, df = 1, p = 0.84) and marital status (single *vs.* married) ($\chi^2 = 0.06$, df = 1, p = 0.94) (Table I).

As expected, mean PTA was significantly worse in the HI group than in controls (t = - 25.8, df = 201, p < 0.005) (Table I).

Reliability of the Italian version of HHIA

Internal consistency of the HHIA, using Cronbach's alpha in hearing-impaired patients at baseline, was 0.88; the coefficients alpha for the socio/situational and emotional subscales were 0.79 and 0.77, respectively. Spearman's correlation coefficients between the total score of the HHIA and the socio/situational and emotional subscales were 0.914 and 0.408 and both statistically significant (p < 0.001). Moreover, the two subscales resulted significantly correlated between each other (r = 0.422, p < 0.001) (Table III). When each of the 25 items was removed from the scale, Cronbach's alpha varied between 0.87 and 0.88.

The test-retest of the total HHIA scores, calculated on a restricted sample of 70 hearing-impaired patients was found to be correlated at a significant level (test administration: mean = 35.4, SD = 14.7; retest administration; mean = 33.5; SD = 12.4; r = 0.904, p < 0.001).

Validity of the Italian version of the HHIA
Construct validity

The scores of the HHI-A, the socio/situational and the emotional subscales were significantly correlated with mean

Table I. Socio-demographic characteristics of the subjects and audiometric derived measure of hearing thresholds (PTA) in HL and NH groups.

	NH (n = 109)	HI (n = 94)	Statistics	df	p
Sex					
Male	48 (44.0%)	41 (43.6%)	$\chi^2 = 0.004$	1	0.95
Female	61 (56.0%)	53 (56.4%)			
Age (yrs)					
Mean (SD)	47.8 (10.0)	50.7 (10.7)	t = -1.7	201	0.09
Education (yrs)					
Mean (SD)	10.4 (4.1)	9.5 (4.2)	t = 1.4	201	0.15
Occupation					
Professional	53 (48.6%)	47 (50%)	$\chi^2 = 0.038$	1	0.84
Non-professional	56 (51.4%)	47 (50%)			
Marital status					
Married	69 (63.3%)	60 (63.8%)	$\chi^2 = 0.06$	1	0.94
Single	40 (36.7%)	34 (36.2%)			
PTA (dB HL)					
Mean (SD)	15.3 (3.7)	44.1 (10.9)	t = -25.8	201	0.005

PTA (r = 0.332; p < 0.001, r = 0.349 p < 0.001; r = 0.864, p < 0.001) (Table II).

Convergent validity

The scores of the HHIA and of its two subscales were significantly correlated with the SF and RE subscales of the SF-36 (r ranging from p < 0.05 to p < 0.001) (Table II).

Discriminant validity

The patient group (HL) scored significantly higher than the healthy group (NL) on the total HHIA (W = 6088, p < 0.005), the socio-situational (W = 6154, p < 0.005) and the emotional (W = 6087, p < 0.005) subscales (Table III).

Discussion

The preliminary analysis of non-auditory issues (age, sex, education, work and marital status) confirmed that the HI

Table II. Spearman's correlation coefficient between HHIA total score and its two subscales (emotional and socio/situational), PTA and SF-36 subscales (role-emotional and social functioning).

	HHIA (total score)	HHIA (socio/situational)	HHIA (emotional)	PTA (dB HL)
PTA (dB HL)	0.332**	0.349**	0.864**	
	0.001	0.001	0.000	
HHIA (total score)	–	0.914**	0.408**	
		0.000	0.000	
HHIA (socio/situational)	0.914**	–	0.422**	
	0.000		0.000	
HHIA (emotional)	0.846**	–	–	–
	0.001			
SF-36 (social functioning)	- 0.245*	-0.300**	-0.738**	-0.843**
	0.017	0.003	0.000	0.000
SF-36 (role emotional)	- 0.225*	-0.285**	-0.685**	-0.808**
	0.029	0.005	0.000	0.000

* p < 0.05, ** p < 0.005

Table III. Mean values and standard deviation of total score of HHIA Italian version and its two subscales (emotional and socio/situational) in patients (NH) and controls (HI).

	NH (n = 109)	HI (n = 94)	Wilcoxon T	p
HHIA (total score)				
Mean (SD)	3.5 (5.6)	37.3 (16.7)	W = 6088	< 0.005
HHIA (socio/situational)				
Mean (SD)	1.7 (2.7)	15.4 (7.8)	W = 6154	< 0.005
HHIA (emotional)				
Mean (SD)	1.8 (2.9)	21.9 (8.9)	W = 6087	< 0.005

and NH groups were frequency well-matched by the aforementioned socio-demographic variables but that the two groups belong to distinct populations as far as the auditory function is concerned.

Cronbach's alpha coefficient near 0.90 proved that the internal consistency of the HHIA, Italian version, was more than acceptable and it was statistically demonstrated that different questions in the questionnaire measure the same underlying concept, that is all the items of the scale are consistent indicators of the hearing handicap. Therefore, none were removed from the Italian version of the scale. Moreover, the Italian version of the HHIA demonstrated its stability over a selected time interval thus possible confounders, such as changes of mood, concentration and mental health of the responder would not affect its reliability.

It emerged that self-perceived hearing handicap, as indicated by the total score of the HHIA, increased as the pure-tone auditory sensitivity worsened (construct validity) and this result indicates an association of the severity of hearing loss with the difficulties experienced in social settings, working activities and emotional life in an industrialized country and confirms similar observations in USA[5 18] and Japan[19].

Significant correlations were also shown between HHIA subscales and the corresponding subscales of the SF-36 (convergent validity) and this result is consistent with a recent observation that identified a significant correlation of a generic health-status instrument, the World Health Organization (WHO) Disability Assessment Scale II (WHO-DAS II), and a specific hearing handicap scale (HHI-E) on interpersonal and limitation domain scores[20].

Hearing-impaired patients reported having reduced ordinary social activities, increased difficulties in the family and with friends, greater emotional limitations, at work and in other daily activities, than subjects with no hearing problems on a disease (hearing loss) specific scale and this result confirmed that HHI-A can differentiate patients with hearing loss from those with no hearing problems with regard to their overall hearing handicap (discriminant validity) as a decisive step in the validation process of the Italian version.

Conclusions

Our findings demonstrate that the HHI-A adapted to the Italian language maintains its original reliability and validity and appears as a useful additional aid to ensure an optimal patient management as it allows an effective determination of non-auditory symptoms while investigating most areas of patient concern. Therefore, it is strongly suggested that audiological services, however busy they might be, should improve their diagnostic equipment with adequate psychometric questionnaires to routinely explore a number of important areas (i.e., emotional reaction to the disease and social context) that could not be highlighted by a more restricted clinical approach.

An indirect observation is that in a large public healthcare system such as that in Italy, increasing hearing impairment might have not only a progressive negative effect, not only on the individual's health-related quality of life but also on welfare costs and, therefore, allocation of financial resources in prevention, diagnosis and rehabilitation of hearing disorders are largely justified.

Finally, it is suggested that audiological professionals could employ this questionnaire, together with other specific tools, to estimate the extent of the overall benefit obtained from hearing aids. Obviously, further studies examining the usefulness of the HHIA, as an outcome measure for hearing aid intervention, are needed.

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Appendix 1. Italian translation of the original version of the Hearing Handicap Inventory for Adults (aged 18-65). Items nos. 2, 4, 5, 8, 10, 12, 14, 17, 18, 20, 22, 24, 25 correspond to the emotional subscale and items nos. 1, 3, 6, 7, 9, 11, 13, 15, 16, 19, 21, 23 rank the magnitude of socio/situational limitation.

	HEARING HANDICAP INVENTORY PER ADULTI (18-65)	0	2	4
1	Un problema di udito ti obbliga a usare il telefono meno di quello che ti piacerebbe fare?	No	Qualche volta	Sì
2	Un problema di udito ti crea imbarazzo quando conosci nuove persone?	No	Qualche volta	Sì
3	Un problema di udito ti costringe ad evitare la compagnia di altre persone?	No	Qualche volta	Sì
4	Un problema di udito ti rende irritabile?	No	Qualche volta	Sì
5	Un problema di udito ti fa sentire frustrato mentre parli con i tuoi famigliari?	No	Qualche volta	Sì
6	Un problema di udito ti crea difficoltà a partecipare ad una festa?	No	Qualche volta	Sì
7	Un problema di udito rende difficile ascoltare e capire i colleghi, i collaboratori, i clienti?	No	Qualche volta	Sì
8	Ti senti handicappato a causa del problema di udito?	No	Qualche volta	Sì
9	Un problema di udito ti fa sentire frustrato quando ti trovi con gli amici, i parenti, i vicini?	No	Qualche volta	Sì
10	Un problema di udito ti fa sentire frustrato quando parli con colleghi, collaboratori, clienti?	No	Qualche volta	Sì
11	Un problema di udito ti crea problemi al cinema e/o a teatro?	No	Qualche volta	Sì
12	Un problema di udito ti rende nervoso?	No	Qualche volta	Sì
13	Un problema di udito ti costringe a fare meno visite agli amici, ai parenti, ai vicini rispetto a quanto vorresti?	No	Qualche volta	Sì
14	Un problema di udito causa delle discussioni in famiglia?	No	Qualche volta	Sì
15	Un problema di udito ti causa problemi quando ascolti la radio o la televisione?	No	Qualche volta	Sì
16	Un problema di udito ti costringe a visitare meno i negozi di quanto vorresti?	No	Qualche volta	Sì
17	Un qualsiasi problema o difficoltà nell'udito ti sconvolge completamente?	No	Qualche volta	Sì
18	Un problema di udito ti costringe a restare da solo/a?	No	Qualche volta	Sì
19	Un problema di udito ti obbliga a parlare meno con i famigliari rispetto a quanto vorresti?	No	Qualche volta	Sì
20	Ti sembra che qualsiasi difficoltà con il tuo udito limiti od ostacoli la tua vita personale e sociale?	No	Qualche volta	Sì
21	Un problema di udito ti crea difficoltà quando ti trovi in un ristorante con amici o parenti?	No	Qualche volta	Sì
22	Un problema di udito ti fa sentire depresso?	No	Qualche volta	Sì
23	Un problema di udito ti obbliga ad ascoltare meno radio e tv di quello che vorresti?	No	Qualche volta	Sì
24	Un problema di udito ti fa sentire a disagio quando parli con gli amici?	No	Qualche volta	Sì
25	Un problema di udito ti fa sentire escluso quando ti trovi in un gruppo di persone?	No	Qualche volta	Sì

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