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Hearing disability and anxiety in people with presbycusis

Слушна онеспособљеност и анксиозност код особа са пресбијакузијом

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SUMMARY

Introduction/Objective Presbycusis, elderly hearing loss is a progressive, bilateral sensoryneural hearing loss characterized by reduced sensitivity of hearing and understanding speech in a noisy environment, thereby impairing communication and inducing anxiety. **The objective.** Examine the presence of hearing impairment and anxiety in people with presbycusis.

Method. Sample consisted of 120 respondents ages 47-85 with presbycusis. The standardized Hearing Handicap Inventory for the Elderly and the Spielberger State Trait Anxiety Inventory were used in the study. The research was conducted at the Department of audiology and vestibulology KBC Zemun.

The results. In subjects with hearing amplification, test / retest has no statistical significance in the STAI and HHIE scales and subscales, except the HHIE-S ($p = 0.004$) with a lower score on the retest. Respondents in whom hearing amplification was performed during the year was statistically significant in HHIE ($p = 0.016$), HHIE-S ($p = 0.004$) and STAI-S ($p = 0.029$) which speaks of favorable effect of hearing amplification. In the group with no hearing amplification, statistical significance was observed in relation to the HHIE scores ($p = 0.002$), HHIE-E ($p = 0.000$), STAI ($p = 0.000$), STAI-S ($p = 0.001$) and STAI-T ($p = 0.001$) and it was noticed that anxiety, loss of emotional contacts, and more pronounced degree of hearing impairment were the result of unassisted hearing rehabilitation.

Conclusion. Audiological practice should include tests for assesment of hearing disability and anxiety in order to preserve health in later life.

Key words: presbycusis, anxiety, hearing impairment, social isolation.

САЖЕТАК

Увод/Циљ. Пресбиакузија, старачка наглувост, је прогресивни, билатерални сензоринеурални губитак слуха који карактерише смањена осетљивост слуха и разумевања говора у бучној средини, чиме нарушава комуникацију, значајно утиче на испољавање анксиозности. Циљ је био испитати присуство слушне онеспособљености и анксиозности код особа са пресбиакузијом.

Метод. Узорак: 120 испитаника оба пола, старости 47–85 година са пресбиакузијом. У истраживању су коришћене стандардизоване скале *Hearing Handicap Inventory for the Elderly (HHIE)* и *Spielberger State Trait Anxiety Inventory (STAI)* за процену присуства анксиозности. Истраживања је спроведено на Одсеку аудиологије и вестибулологије КБЦ Земун.

Резултати. Код испитаника са слушном амплификацијом тест/ретест нема статистичке значајности у скоровању *STAI* и *HHIE* скала и подскала, сем *HHIE-S* ($p = 0.004$) са мањим скором на ретесту. Испитаници код којих је током године спроведена слушна амплификација запажена је статистички значајна разлика у *HHIE* ($p = 0.016$), *HHIE-S* ($p = 0.004$) и *STAI-S* ($p = 0.029$) што говори о повољном утицају слушне амплификације. У групи без слушне амплификације запажена је статистичка значајност у односу на скорове *HHIE* ($p = 0.002$), *HHIE-E* ($p = 0.000$), *STAI* ($p = 0.000$), *STAI-S* ($p = 0.001$) и *STAI-T* ($p = 0.001$) и запажено да су анксиозност, губитак емоционалних контаката и израженији степен слушне онеспособљености последица неспроведене слушне рехабилитације.

Закључак. У аудиолошку праксу увести тестове за процену слушне онеспособљености и анксиозности у циљу очувања здравља у каснијем животном добу.

Кључне речи: пресбиакузија, анксиозност, слушна онеспособљеност, социјална изолација

INTRODUCTION

Old age is a period of reduced physical and mental abilities and increased disability, and demographic aging can be seen as an increase in population dependent on economic, social and health terms [1, 2]. Presbycusis, hearing impairment in elderly, is a physiological phenomenon, which cause hearing loss in adults all over the world [3]. Presbycusis affects

more than half of adults up to 75 years of age, most adults older than 80 years and is usually present in all people over 90 years of age [4]. Presbycusis is the third most common disease besides hypertension and arthritis in the elderly [5]. The gradual hearing loss process lasts for several years, usually affects high frequencies and is accompanied with reduced speech understanding in a noisy environment, a slow acoustic information processing and sound source localization disorder [6]. Hearing loss, accompanied by difficulties in speech comprehension, contributes to the reduction of concentration and memory, leads to isolation, and increases the sense of disability [7]. On the other side, the elderly have a higher prevalence of mental and emotional disorders and are more exposed to neglect of family members and caregivers [8].

The greater hearing loss, the more pronounced are anxiety reactions [9, 10]. Under the influence of external social and economic factors, loss of hearing may be a trigger for the manifestation of anxiety states [11]. Therefore, audiological attitude toward presbycusis is important in hearing amplification [12]. Loss of hearing leads to psychological isolation can cause an identity crisis and lead to the manifestation of anxiety or reactive depression. Social support can alleviate stress and prevent the withdrawal of a person with a presbycusis from social life [13].

This research encourages two clinical recommendations: improving the efficiency of audiological hearing assessment by applying adequate psychometric scales in order to define hearing impairment, emotional response to hearing loss, degree of social functioning and anxiety. Hearing Handicap Inventory for Elderly (HHIE) questionnaire confirmed sensitivity, specificity, and reliability and allows assessment of auditory perception disability [14, 15].

There is a high variability of functional status for any level of hearing loss [16]. Therefore, it is necessary to change the position in audiological practice so that determining the degree of hearing impairment should not be only guideline for recommending a hearing

aid without the perception of communication capabilities in the context of free life activities [17]. One of the most important psychological aspects in elderly refers to human's ability to adapt and maintain activities for that age which is a major challenge for modern health care system [18, 19].

METHODS

Research sample

The study included 120 respondents of both sexes, aged 46–85 with presbycusis. One group of respondents use hearing amplification while the other is without amplification.

The general questionnaire enabled the collection of socio-demographic data: sex, age, marital status, place of residence, level of education, employment, general health assessment, which defines independent variables in the research.

Study design

The clinical, prospective study of the intersection was conducted from April 2016 to April 2017 at the Department of audiology and vestibulology of KBC Zemun.

The research was conducted at the Department of audiology and vestibulology of the Clinical Hospital Center Zemun with the approval of the Ethics Committee of this institution in accordance with legal standards.

Instruments

The Hearing Handicap Inventory for the Elderly (HHIE) is a standardized questionnaire that enables the assessment of hearing impairment perceptions and is an objective measure in the planning of rehabilitation interventions [20, 15]. HHIE is a self-

assessment hearing impairment tool and is designed to evaluate the effects of hearing loss on the emotional and social adjustment of older people.

State Trait Anxiety Inventory (STAI) is an instrument that quantifies the anxiety of adults by focusing on areas that include caring, tension, fear, and nervousness. It is designed to assess anxiety as both emotional state (STAI-S) and personality trait (STAI-T) [21, 22].

HHIE and STAI were performed at the beginning of the study and after a year.

Statistical analysis of the data

For the analysis of sex, education, marital status and life situations a chi-square test was used and t-test for age analysis. The reliability of the applied scale (HHIE and STAI) as well as the subscales was determined by the Cronbach α coefficient. Reliability for the HHIE scale is 0,886 (test) and 0,868 (retest), which is good reliability. The reliability of the STAI scale is 0,922 (test) and 0,907 (retest), which is high reliability. Kolmogorov - Smirnov test found that there is no deviation from the normal distribution model in all scales and subclasses, so parametric tests were used in the statistical analysis. Mann-Whitney nonparametric test was used to illustrate the results of the HHIE and STAI scale as well as the multivariate logistic regression in order to explore the influence of various factors on the socio-emotional status in people with presbycusis. The level of statistical significance was taken as $p < 0.05$ for all analyzes. The data collected were processed using a software package for data processing in social sciences (Statistical Package for the Social Sciences-SPSS, version 22.0).

RESULTS

The study involved 120 respondents, 60 males, and 60 females divided into two groups: a group carrying a hearing aid and a group without hearing amplification. The

average age of the respondents is 68.68 years (SD 8.4). Hi-square analysis has determined the homogeneity of both groups by sex, age, and hearing amplification.

The majority of respondents is married, 65.8% (SD 18.6) and live in their home 90% (SD 18.7). Secondary education has 55.8% (SD 18.9) while higher education has 20% respondents (SD 16.2).

Personal attitudes towards general health were assessed as poor, at 6.5% (SD 13.9), neither good nor bad 48.3% (SD 17.1) and good in 40% (SD 15.6) subjects in both groups. The highest number of respondents is in status of retiree 61.1% (SD 17.9), the permanent job has 18.3% (SD 21.6), while the occasional work has 13.3% (SD 19.9) respondents. 48.33% (SD 20.3) of examinees had hearing amplification in period from 2 to 5 years up and 53.3% (SD 18.4) in period more than 5 years.

Eighty percent of the respondents are in the group with no auditory amplification. The hearing aid had 23.3% of those with severe and 3.3% with very severe hearing impairment. 8.3% of those with severe hearing impairment are without hearing amplification (Table 1).

According to the method of purchasing auditory devices of the group with hearing amplification and correlation with the HHIE and STAI scale scores (as well as their subscales), the statistical significance of the difference was not determined.

Descriptive statistical analysis of the HHIE-S subscale in all subjects indicated that 11.7% of respondents do not have social and situational consequences of hearing disability, 81.7% mild to moderate, while significant social disability is in 6.7% of respondents (Figure 1).

The HHIE-E subscale suggests that without the emotional effects of hearing impairment are in 47.5% of subjects, mild to moderate in 50.8%, while the significant emotional component of hearing impairment is observed in 1.7% of respondents (Figure 2).

Low anxiety 1.7% is observed at STAI - S subscale, moderate 51.7%, while it is high in 46.7% of respondents (Figure 3). The STAI - T subscale showed a low degree of anxiety in 4.2% of subjects, moderate 54.2%, and high anxiety in 41.7% of subjects (Figure 4).

For all subjects with presbycusis, using the t-test for dependent samples and using the Pearson coefficient of correlation (r) and Sig ($p < 0.05$), it was found that there was no statistically significant association between the scores of the HHIE and the STAI scale as well as their subscales in relation to age of respondents. One-factor analysis of variance has shown that in relation to the educational level, marital status, the period from the diagnostics to the auditory amplification of the respondents, and in relation to the scores of the HHIE and the STAI scale, there is no statistical significance. The association of the self-assessment of the general health condition and the scores of the HHIE scale and its subscales indicates a statistically significant difference in subjects who considered their health as bad. ANOVA variance determined a statistically significant difference in the scales of the HHIE scale ($p = 0.004$) and its subscales HHIE-S ($p = 0.012$) and HHIE-E ($p = 0.005$) relative to the subjective assessment of the overall health status (poor, bad, good, very good) of respondents for the category of general health assessment as bad for HHIE ($p = 0.018$), HHIE-S ($p = 0.034$) and HHIE-E ($p = 0.040$).

Assessment of hearing impairment (HHIE scale) and the presence of anxiety (STAI scale) were conducted at the beginning of the study as well as after a year (test / retest). In the period of one year, 18 examinees conducted hearing amplification so that during the repeated study, three groups of respondents were identified:

Group I: hearing amplification / test - YES; retest - YES

In the group of subjects with hearing amplification performed with the measures of descriptive statistics (SD 19.33) and determined by good correlation of the test / retest scale

($p = 0.000$), the T-test did not determine the statistical significance of the difference for the total score of the HHIE test / retest ($p = 0.288$).

The statistical significance of the difference in the HHIE-S subscale ($p = 0.004$) was observed, with a lower score of the social component of hearing impairment on the retest. Analysis of the HHIE-E subscale did not show a statistically significant difference ($p = 0.064$) on the test and retest (Table 2 and 3).

A statistically significant difference ($p = 0.330$), as well as the STAI-S ($p = 0.132$) and STAI-T ($p = 0.783$) subscales, were not observed by the two-factor analysis of the variance of the scores on the test and the STAI scale retest.

Group II: hearing amplification / test - NO; retest - YES

In 18 subjects who did not have a hearing aid at the beginning of the study, hearing amplification was performed over the next year, as well as analysis of the HHIE and the STAI scores on the test and retest. A statistically significant difference ($p = 0.016$) and a decrease in hearing impairment in the respondents after a year was established by a good correlation between the HHIE scale on the test / retest ($p = 0.000$) and analysis of the HHIE scale scores (Table 3 and 4). A statistical significance of the difference ($p = 0.004$) was observed with the analysis of the HHIE-S subscale scores, with a lower rate of hearing disability at the retest (Table 4 and 5).

The statistical significance of the difference in test and retest in subjects with hearing amplification during the study was not observed by analysis of HHIE-E ($p = 0.526$) and STAI ($p = 0.059$) subscale scores (Table 4, 5).

The statistical significance of the difference of the STAI-S subscale ($p = 0.029$) with a lower rate of anxiety at retest was noticed (Table 4.5), while STAI-T test / retest did not show a statistically significant difference ($p = 0.173$).

Group III: hearing amplification / test - NO; retest – NO

In a group of subjects who did not have hearing aids at the start of the study, as well as after a year, a statistically significant difference ($p = 0.002$) was observed in relation to the scores of the HHIE test / retest, which showed a greater hearing impairment after a year. No statistically significant difference ($p = 1.00$) was observed in HHIE-S subscale analysis of subjects without hearing amplification, as opposed to the HHIE-E subscale where statistically significant ($p = 0.000$) was observed on test and retest. Following the descriptive statistics, we can conclude that the emotional component of hearing impairment is more pronounced when measured after a period of one year (Table 6, 7).

A statistically significant difference ($p = 0.000$) was observed with the analysis of STAI scale scores on the test and retest in patients with no hearing amplification, and following the descriptive statistics we can conclude that the anxiety feeling is more pronounced after one year. The statistical significance of the difference ($p = 0.001$) on the test and retest was observed in the STAI-S subscale, with a more pronounced anxiety feeling as the current state after one year and the STAI-T subscale ($p = 0.001$) with a greater rate of anxiety at the retest (Table 6, 7).

DISCUSSION

Audiological treatment of patients requires the use of valid scales for assessment of hearing impairment, with the aim of planning the rehabilitation of hearing [23].

By comparison of hearing impairment degree in correlation with assessment of hearing impairment (HHIE at the beginning of the study and after a year), a statistically significant difference ($p = 0.004$) was observed. Higher level of hearing disability was in-group with severe hearing impairments who did not carry hearing aid from the beginning to the end of

the study ($p = 0.007$). Our research is in relation to literature regarding hearing impairment and anxiety assessment [24, 25].

The analysis of the HHIE (S and E) scores is in accordance with research data [24, 25] and indicates that the majority of respondents (81.7%) with mild to moderate degree of hearing impairment have social and situational effects of hearing impairment, while the emotional component of hearing impairment in mild to moderate degree is present in 50.8% of subjects. The emotional-social experience of hearing impairment refers to the quality, type and frequency of social interactions, as well as to indicators of emotional status that are probably conditioned by inability to understand speech and establish communication. Research shows that when hearing loss is increased to a moderate level, anxiety is increased. Examination of anxiety as a possible condition in people with presbycusis was determined by STAI-S and T scale. Assessment of the presence of anxiety in the group of subjects with no hearing amplification noted more pronounced anxiety after one year ($p = 0.01$), which is in accordance with the representation of other researchers [26, 27]. Hearing disability has a significant share in assessing the overall health status as poor for HHIE ($p = 0.018$); HHIE-S ($p = 0.034$); HHIE-E ($p = 0.040$), which is significant in the planning of rehabilitation treatment.

Correlation of the HHIE and STAI scales scores at first test and retest is of no statistical significance and is a good indicator of the effects of auditory rehabilitation. This is confirmed by the statistical significance of the correlation of the test / retest scores in HHIE ($p = 0.016$), HHIE-S ($p = 0.09$) and STAI -S ($p = 0.029$) of respondents who received hearing aids during the research. The data are consistent with other researches and indicate the importance of hearing amplification in reducing the sense of disability, impotence, fear, and improvement of communication, emotional and social life [27]. The statistically significant difference in the HHHI test / retest scores ($p = 0.002$), HHHIE-E ($p = 0.000$), STAI

($p = 0.000$), STAI-S ($p = 0.001$) and STAI -T ($p = 0.001$) in which the amplification is not conducted indicates that hearing deficit significantly affects the psychosocial life, leads every day to an even greater isolation, a permanent state of anxiety with a decrease in mental and cognitive abilities.

The process of auditory rehabilitation gives individuals an active role in their lives, which increases self-esteem and well-being [28, 29, 30].

CONCLUSION

Presbycusis in the elderly is a common but not enough reported and perceived problem. Questionnaires for self-evaluation of hearing disability and anxiety are useful for assessing emotional and social/situational consequences and it is necessary to use them in clinical practice, during audiological examination, first interview, counseling, qualification, and evaluation of hearing rehabilitation program effectiveness. Proper approach to audiological rehabilitation of people with presbycusis is the right path in improving life quality and process of humane aging.

NOTE

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REFERENCES

1. Rent PD, Kumar S, Dmello MK, Purushotham J. Psychosocial status and economic dependence for healthcare and nonhealthcare among elderly population in rural coastal Karnataka. *J Mid-life Health* 2017; 8:174-8. DOI: 10.4103/jmh.JMH_46_17
2. Hosseinpoor AR, Stewart Williams JA, Gautam J, Posarac A, Officer A, Verdes E et al. Socioeconomic inequality in disability among adults: a multicountry study using the World Health Survey. *Am J Public Health*. 2013; 103: 1278–1286 DOI: 10.2105/AJPH.2012.301115
3. Olusanya BO, Neumann KJ, Saunders JE. The global burden of disabling hearing impairment: a call to action. *Bulletin of the World Health Organization*. 2014; 92 (5): 367–373. DOI: <http://dx.doi.org/10.2471/BLT.13.128728>
4. Wattamwar K, Qian ZJ, Otter J, Leskowitz MJ, Caruana FF, Siedlecki B, et al. Increases in the Rate of Age-Related Hearing Loss in the Older Old. *JAMA Otolaryngol Head Neck Surg* 2017; 143(1):41-45. DOI: 10.1001/jamaoto.2016.2661.
5. Nilforoush MH, Sepehrnejad M, Habibi Z. Beck depression Inventory-II in hearing impaired elderly patients: A presbycusis study. *Indian J Otol*. 2017; 23(3): 168-170. DOI: 10.4103/indianjotol.INDIANJOTOL_63_16
6. Fetoni AR, Picciotti PM, Paludetti G, Troiani D. Pathogenesis of presbycusis in animal models: a review. *Exp Gerontol*. 2011; 46 (6): 413-425. DOI: 10.1016/j.exger.2010.12.003.
7. Hsu W-T, Hsu C-C, Wen M-H, Lin H-C, Tsai H-T, Su P, et al. Increased risk of depression in patients with acquired sensory hearing loss: A 12-year follow-up study. *Medicine (Baltimore)*. 2016; 95 (44): 5312. DOI:10.1097/MD.0000000000005312
8. Mener DJ, Betz J, Genther DJ, Chen D, Lin FR. Hearing loss and depression in older adults. *J Am Geriatr Soc*. 2013; 61(9): 1627-1629. DOI: 10.1111/jgs.12429
9. Carmen R, Uram S. Hearing loss and anxiety in adults. *Hearing loss and anxiety*.2002; 55(4): 48-54.
10. Hughes ME, Nkyekyer J, Innes-Brown H, Rossell SL, Sly D, Bhar S, et al. Hearing Aid Use in Older Adults With Postlingual Sensorineural Hearing Loss: Protocol for a Prospective Cohort Study. *JMIR Res Protoc*. 2018; 7(10):174. DOI: 10.2196/resprot.9916
11. Bernabei V, Morini V, Moretti F, Marchiori A, Ferrari B, Dalmonte E, et al. Vision and hearing impairments are associated with depressive—anxiety syndrome in Italian elderly. *Aging Ment Health*. 2011; 15(4): 467–474. DOI: 10.1080/13607863.2011.562483.
12. Gonçalves DC, Byrne GJ. Interventions for generalized anxiety disorder in older adults: Systematic review and meta-analysis. *Journal of Anxiety Disorders*. 2012; 26 (1): 1-11. DOI: 10.1016/j.janxdis.2011.08.010.
13. Pichora-Fuller MK. How Social Psychological Factors May Modulate Auditory and Cognitive Functioning During Listening. *Ear Hear*. 2016; 37 (1): 92-100. DOI:10.1097/AUD.0000000000000323
14. Paglialonga A, Grandori F. Introduction to the AJA research forum on intervention and rehabilitation strategies for adults and older adults. *Am J Audiol*. 2013; 22 (2): 321-2. DOI:10.1044/1059-0889(2013/13-0004)
15. Ventry IM, Weinstein BE. The hearing handicap inventory for the elderly: a new tool. *Ear Hear*. 1982 ; 3(3): 128–134
16. National Research Council (US) Committee on Disability Determination for Individuals with Hearing Impairments; Dobie RA, Van Hemel S, editors. *Hearing Loss: Determining Eligibility for Social Security Benefits*. Washington (DC): National Academies Press (US); 2004. ISBN-10: 0-309-09296-5
17. Eadie TL, Yorkston KM, Klasner ER, Dudgeon BJ, Deitz JC, Baylor CR, et al. Measuring communicative participation: a review of self-report instruments in speech-language pathology. *Am J Speech Lang Pathol*. 2006;15(4):307-20. DOI: 10.1044/1058-0360(2006/030)
18. Cox RM, Johnson JA, Xu J. Impact of advanced hearing aid technology on speech understanding for older listeners with mild to moderate, adult-onset, sensorineural hearing loss. *Gerontology*. 2014; 60 (6): 557-68. DOI: 10.1159/000362547
19. World Health Organization. *Global Health and Aging*. National Institute on Aging. U.S. Department of Health and Human Services. October 2011; NIH Publication no. 11-7737.

20. Eckert MA, Matthews LJ, Dubno JR. Self-Assessed Hearing Handicap in Older Adults with Poorer-Than-Predicted Speech Recognition in Noise. *J Speech Lang Hear Res.* 2017; 60 (1): 251-262.
21. Spielberger CD. *Manual for the State-Trait Anxiety Inventory (STAI)*. Palo Alto, CA: Consulting Psychologists Press 1983.
22. Vujović M, Sovilj M, Jeličić L, Stokić M, Plećaš D, Plešinac S, et al. Correlation between maternal anxiety, reactivity of fetal cerebral circulation to auditory stimulation, and birth outcome in normotensive and gestational hypertensive women. *Dev Psychobiol.* 2018;60(1):15–29. PMID: 29091282, DOI: 10.1002/dev.21589.
23. Phan NT, McKenzie JL, Huang L, Whitfield B, Chang A. Diagnosis and management of hearing loss in elderly patients. *Aust Fam Physician.* 2016; 45(6): 366-369. PMID: 27622223
24. Menegotto IH, Soldera CLC, Anderle P, Anhaia TC. Correlation between hearing loss and the results of the following questionnaires: Hearing Handicap Inventory for the Adults – Screening Version HHIA-S and Hearing Handicap Inventory for the Elderly – Screening Version - HHIE-S. *Int Arch Otorhinolaryngol.* 2011;15 (3): 319–326. DOI: 10.1590/S1809-48722011000300009
25. Servidoni AB, Conterno LO. Hearing Loss in the Elderly: Is the Hearing Handicap Inventory for the Elderly - Screening Version Effective in Diagnosis When Compared to the Audiometric Test?. *Int Arch Otorhinolaryngol.* 2017; 22 (1): 1-8. DOI: 10.1055/s-0037-1601427
26. Kvam MH, Loeb M, Tambs K. Mental health in deaf adults: symptoms of anxiety and depression among hearing and deaf individuals. *J Deaf Stud Deaf Educ.* 2007;12 (1): 1-7. DOI: 10.1093/deafed/enl015 }
27. Humes LE, Wilson DL, Barlow NN, Garner C. Changes in Hearing-Aid Benefit Following 1 or 2 Years of Hearing-Aid Use by Older Adults. *Journal of Speech, Language, and Hearing Research* . 2002; 45: 772-782.
28. Kozłowski L, Ribas A, Almeida G, Luz I. Satisfaction of Elderly Hearing Aid Users. *Int Arch Otorhinolaryngol.* 2016; 21(1):92-96. DOI:10.1055/s-0036-1579744
29. Silva DP, Silva VB, Aurélio FS. Auditory satisfaction of patients fitted with hearing aids in the Brazilian Public Health Service and benefits offered by the hearing aids. *Brazilian Journal of Otorhinolaryngology.* 2013; 79(5):538-545. DOI:10.5935/1808-8694.20130098
30. Servidoni AB, Conterno LO. Hearing Loss in the Elderly: Is the Hearing Handicap Inventory for the Elderly - Screening Version Effective in Diagnosis When Compared to the Audiometric Test? *Int Arch Otorhinolaryngol.* 2018; 22(01): 1-8 DOI: 10.1055/s-0037-1601427

Table 1. Distribution according to degree of hearing impairment and amplification

Hearing Loss	Hearing amplification					
	Yes		No		Total	
	N	%	N	%	N	%
Mild	6	10	7	11.7	13	10.8
Moderate	38	63.3	48	80.0	86	71.7
Severe	14	23.3	5	8.3	19	15.8
Severe-to-Profound	2	3.3	0	0.0	2	1.7
Total	60	100.0	60	100.0	120	100.0

Table 2. HHIE - S patients with hearing amplification *

Scales	Mean	N	Std. Deviation	Std. Error Mean
HHIE– S test	30.03	60	10.730	1.374
HHIE– S retest	26.98	60	10.749	1.376

* amplification /test - Yes; amplification /retest – Yes

** HHIE-S - Hearing handicap inventory for the Elderly - social and situational effects

Paper accepted

Table 3. HHIE - S patients with hearing amplification *

	Paired Differences	t	df	Sig. (2-tailed)
	95% Confidence Interval of the Difference			
	Upper			
HHIE– S test / retest	5.078	3.006	59	.004

* **amplification /test - Yes; amplification /retest – Yes**

** HHIE-S - Hearing handicap inventory for the Elderly - social and situational effects

*** statistical significance ($p < 0.05$)

Paper accepted

Table 4. Scales of respondents with aural amplification at test and retest *

Scales	Mean	N	Std. Deviation	Std. Error Mean
HHIE test	43.12	16	22.192	5.382
HHIE retest	37.18	16	21.119	5.122
HHIE– S test	26.71	16	12.864	3.120
HHIE – S retest	21.65	16	9.956	2.415
STAI– S test	43.59	16	6.727	1.632
STAI– S retest	40.47	16	5.456	1.323

* **amplification /test - No; amplification /retest – Yes**

** HHIE – Hearing handicap inventory for the Elderly

*** HHIE-S – Hearing handicap inventory for the Elderly - social and situational effects

**** STAI-S – State Trait Anxiety Inventory "state anxiety"

***** statistical significance ($p < 0.05$)

Table 5. Scales of respondents with aural amplification at test and retest *

	Paired Differences	t	df	Sig. (2-tailed)
	95% Confidence Interval of the Difference			
	Upper			
HHIE test/ retest	10.599	2.704	15	.016
HHIE – S test/ retest	8.678	2.963	15	.009
STAI– S test/ retest	5.868	2.403	15	.029

* **amplification /test - No; amplification /retest – Yes**

** HHIE - Hearing handicap inventory for the Elderly

*** HHIE-S - Hearing handicap inventory for the Elderly - social and situational effects

**** STAI-S – State Trait Anxiety Inventory "state anxiety"

***** statistical significance ($p < 0.05$)

Table 6. Scales of respondents without aural amplification at test and retest*

Scales	Mean	N	Std. Deviation	Std. Error Mean
HHIE test	44.29	44	15.733	2.428
HHIE retest	49.29	44	15.735	2.428
HHIE – E test	16.38	44	9.205	1.420
HHIE – E retest	21.38	44	9.239	1.426
STAI test	85.43	44	13.012	2.008
STAI retest	90.14	44	12.417	1.916
STAI – S test	43.57	44	6.145	.948
STAI – S retest	45.83	44	5.938	.916
STAI – T test	41.86	44	7.700	1.188
STAI – T retest	44.31	44	7.192	1.110

* **amplification /test - No; amplification /retest – No**

** HHIE - Hearing handicap inventory for the Elderly

*** HHIE-E - Hearing handicap inventory for the Elderly - emotional effects

**** STAI – State Trait Anxiety Inventory

***** STAI-S – State Trait Anxiety Inventory "state anxiety"

***** STAI-T – State Trait Anxiety Inventory "trait anxiety"

Table 7. Scales of respondents without aural amplification at test and retest*

	Paired Differences	t	df	Sig. (2-tailed)
	95% Confidence Interval of the Difference			
	Upper			
HHIE test/ retest	-1.888	-3.244	43	.002
HHIE – E test/ retest	-3.188	-5.573	43	.000
STAI test/ retest	-2.237	-3.844	43	.000
STAI – S test/ retest	-1.046	-3.757	43	.001
STAI – T test/ retest	-1.010	-3.434	43	.001

* **amplification /test - No; amplification /retest – No**

** HHIE - Hearing handicap inventory for the Elderly

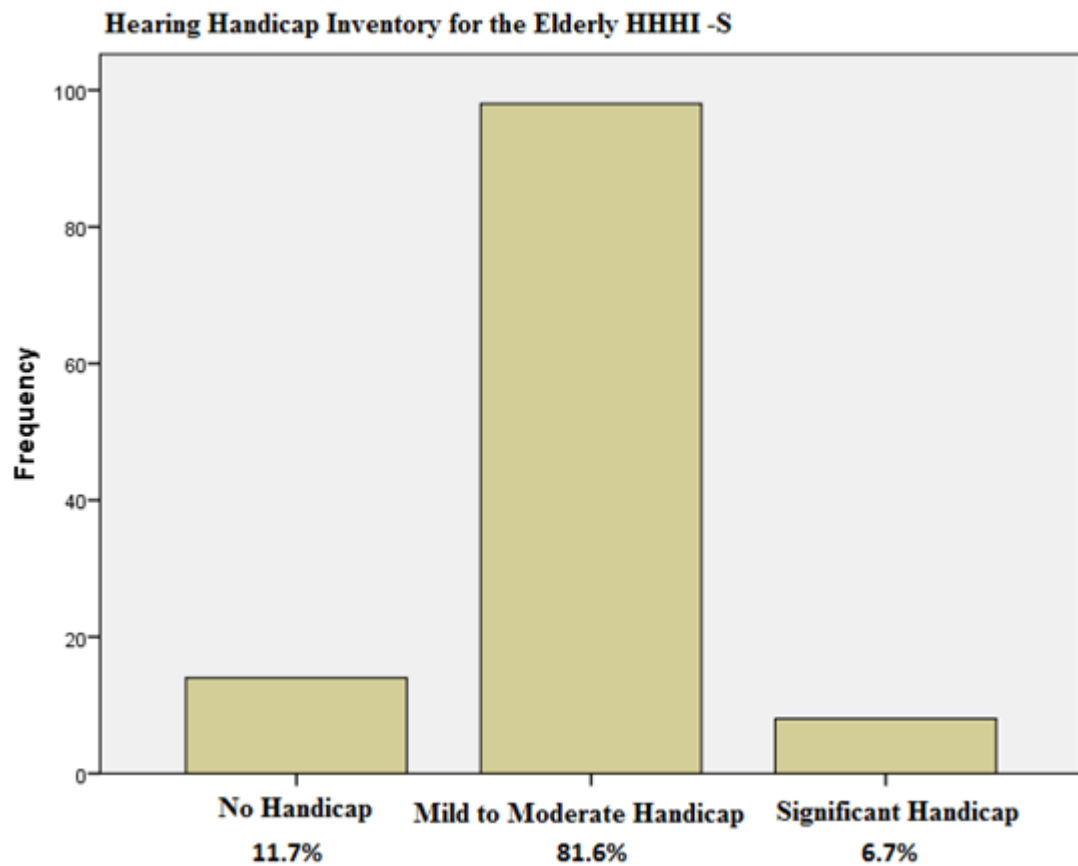
*** HHIE-E - Hearing handicap inventory for the Elderly - emotional effects

**** STAI – State Trait Anxiety Inventory

***** STAI-S – State Trait Anxiety Inventory "state anxiety"

***** STAI-T – State Trait Anxiety Inventory "trait anxiety"

***** statistical significance (p<0.05)

Figure 1. HHIE-S of all respondents

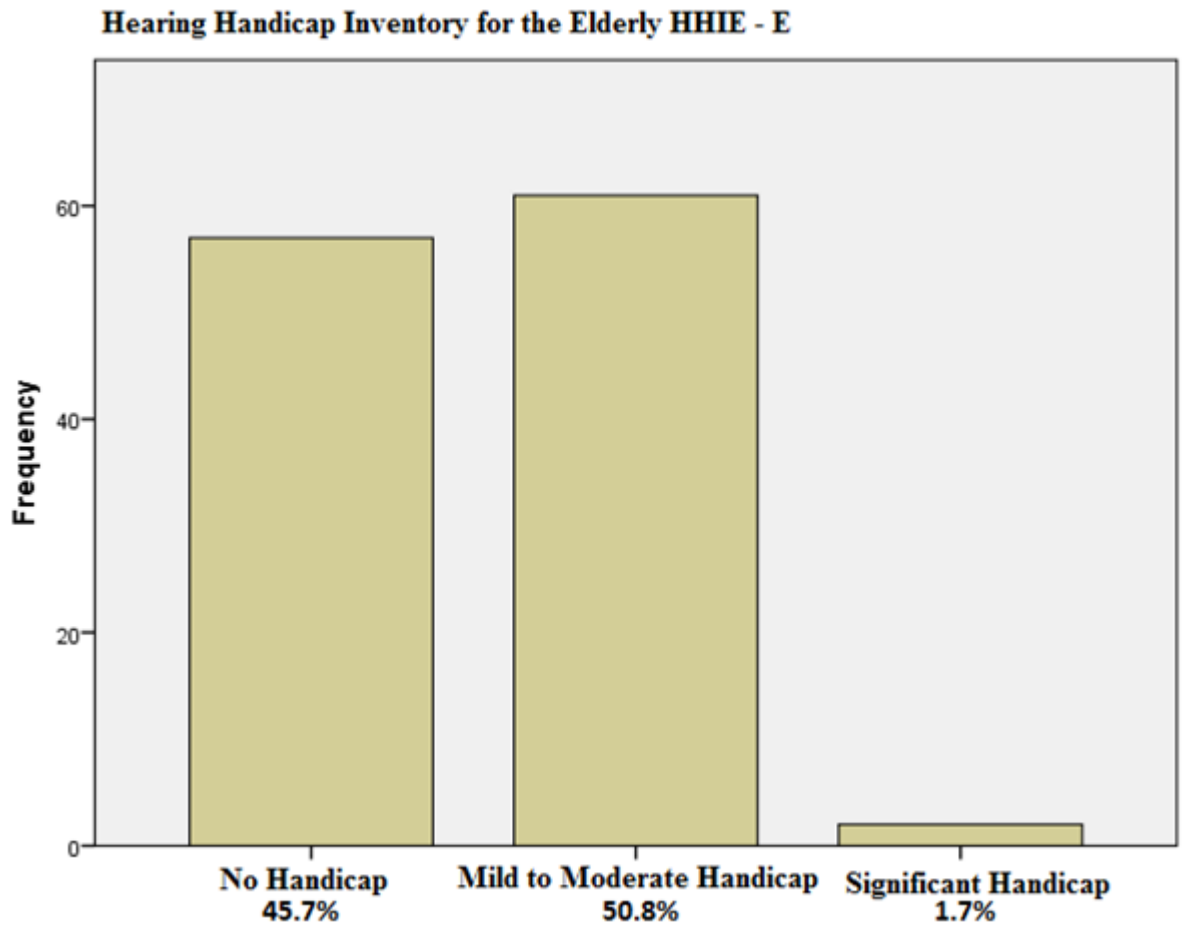
* HHIE-S - Hearing handicap inventory for the Elderly - social and situational effects

** No Handicap 0 to 8 - 13% probability of hearing impairment

*** Mild to Moderate Handicap 10 to 24 - 50% probability of hearing impairment

**** Significant (severe) Handicap 26 to 40 - 84% probability of hearing impairment

Figure 2. HHIE-E of all respondents



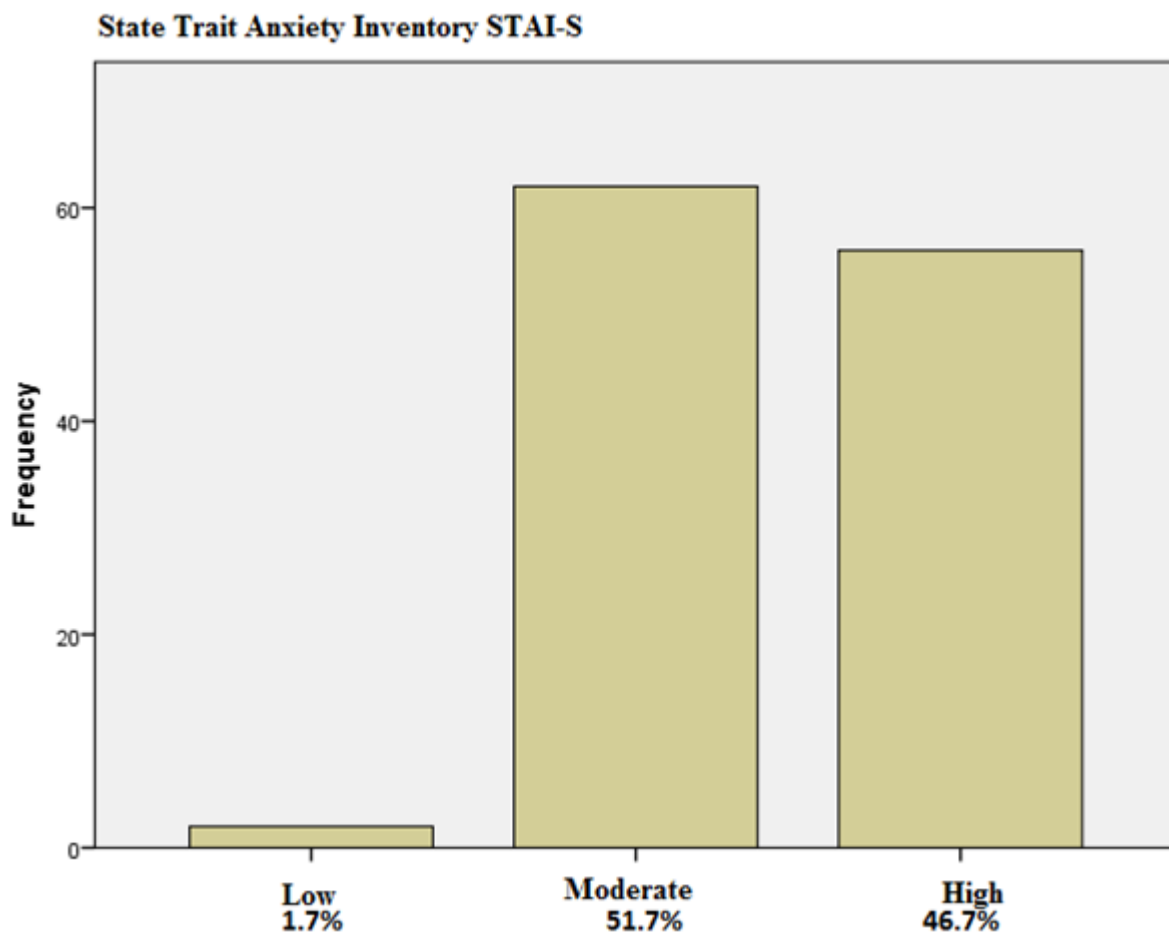
* HHIE-E - Hearing handicap inventory for the Elderly - emotional effects

** No Handicap 0 to 8- 13% probability of hearing impairment

*** Mild to Moderate Handicap 10 to 24 - 50% probability of hearing impairment

**** Significant (severe) Handicap 26 to 40 - 84% probability of hearing impairment

Figure 3. STAI - S of all respondents



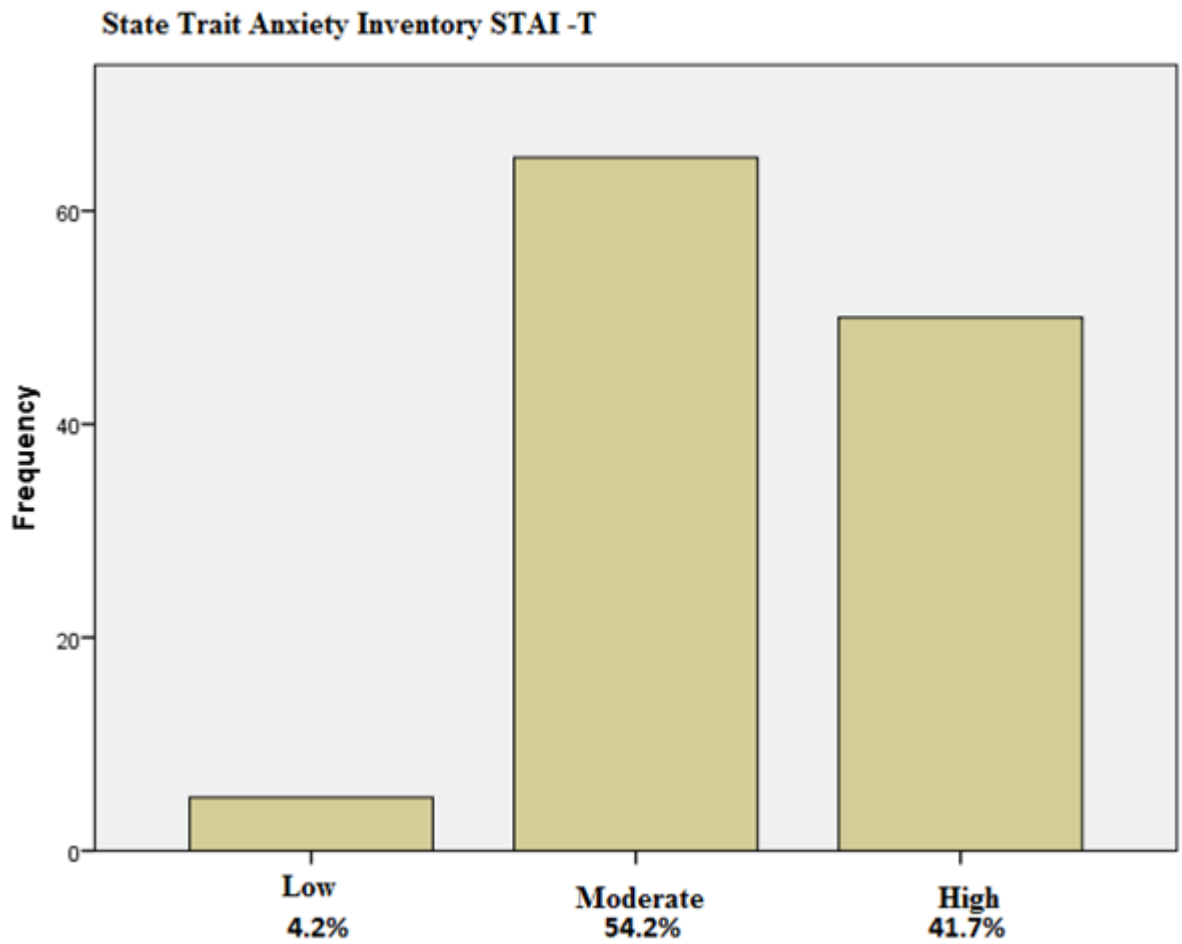
* STAI-S – State Trait Anxiety Inventory "state anxiety"

** No or low anxiety (20-37)

*** Moderate anxiety (38-44)

**** High anxiety (45-80)

Figure 4. STAI - T of all respondents



*STAI-T – State Trait Anxiety Inventory "trait anxiety"
** No or low anxiety (20-37)
*** Moderate anxiety (38-44)
**** High anxiety (45-80)