

## ORIGINAL ARTICLE / ОРИГИНАЛНИ РАД

# The effects of auditory amplification on subjective assessments of hearing impairment and anxiety in people with presbycusis

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**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 was to examine the impact of hearing amplification on subjective hearing disability assessment and anxiety in people with presbycusis.

**Method** Sample consisted of 120 respondents aged 47–85 with presbycusis, 60 subjects with and 60 subjects with no auditory amplification. The standardized Hearing Handicap Inventory for the Elderly and the Spielberger State Trait Anxiety Inventory were used in the study.

**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 assessment of hearing disability and anxiety in order to preserve health in later life.

**Keywords:** presbycusis; anxiety; hearing impairment; social isolation

**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 [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 affecting 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 suggests the application of audiological assessments with adequate psychometric scales in persons with hearing impairment, in order to define subjective experience of hearing impairment, emotional response to hearing loss, and degree of social functioning as well as anxiety assessment. Hearing Handicap Inventory for Elderly (HHIE) questionnaire confirmed sensitivity, specificity, and reliability and allows assessment of auditory perception disability [14, 15].

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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 with presbycusis of both sexes, 60 examinees with auditory amplification and 60 subjects with no auditory amplification. In subjects with hearing amplification, the average age is 69.4 years (SD 9.86), while in the group with no auditory amplification 67.8 years (SD 6.68). In the group of subjects with hearing amplification 31 (51.7%) respondents were male, female 29 (48.3%), while in the group without amplification 29 (48.3%) respondents were male and female 31 (51.7%).

Pearson's  $\chi^2$  test ( $r = 0.71$ ,  $df = 1$ ) found that there was no statistically significant difference and that both groups of subjects were uniform in terms of sex, and in relation to auditory amplification. In the period of one year in 16 subjects was conducted auditory amplification. The study defined three groups of respondents: with auditory amplification on test and retest ( $N = 60$ ); without auditory amplification on test and with auditory amplification on the retest ( $N = 16$ ); without auditory amplification on the test and the retest ( $N = 44$ ).  $\chi^2$  analysis has confirmed the homogeneity of both groups by sex, age, and hearing 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 and thus are defined independent variables in the research. Applied instruments in research (Hearing Handicap Inventory for the Elderly – HHIE and Spielberg State Anxiety Inventory – STAI) enabled the monitoring of dependent variables: subjective assessment of hearing disability and anxiety in people with presbycusis.

By analyzing the average age of 67.8 years (SD 6.68), Pearson correlation coefficient found that there was no statistically significant correlation between the scores HHIE, STAI and the age of the respondents (statistical significance  $p > 0.01$ ) HHIE ( $r = 0.13$ ,  $p = 0.15$ ), HHIE-S ( $r = 0.1$ ,  $p = 0.26$ ), HHIE-E ( $r = 0.14$ ,  $p = 0.11$ ), STAI ( $r = 0.09$ ,  $p = 0.31$ ), STAI-S ( $r = 0.1$ ,  $p = 0.26$ ), STAI-T ( $r = 0.06$ ,  $p = 0.45$ ).

According to marital status of respondents are married 79 (65.8%), 26 (21.8%) are widowed, eight (6.7%) divorced, five (4%) unmarried, while two (1.7%) live in an extramarital community. The single-factor analysis of the variance (ANOVA) found that the independent variable – marital status was not statistically significant interac-

tion ( $p > 0.05$ ) with a score on the HHIE and STAI scales: HHIE ( $F = 0,339$ ,  $df_1 = 4$ ,  $df = 115$ ,  $p = 0.85$ ,  $\eta^2 = 0.01$ ) HHIE-S ( $F = 0,362$ ,  $df_1 = 1$ ,  $df = 115$ ,  $p = 0.83$ ,  $\eta^2 = 0.01$ ) HHIE-E ( $F = 0,675$ ,  $df_1 = 4$ ,  $df = 115$ ,  $p = 0.61$ ,  $\eta^2 = 0.02$ ); STAI ( $F = 0,699$ ,  $df_1 = 4$ ,  $df = 115$ ,  $p = 0.59$ ,  $\eta^2 = 0.02$ ), STAI-S ( $F = 0,847$ ,  $df_1 = 4$ ,  $df = 115$ ,  $p = 0.49$ ,  $\eta^2 = 0.02$ ), STAI-T ( $F = 0,478$ ,  $df_1 = 4$ ,  $df = 115$ ,  $p = 0.75$ ,  $\eta^2 = 0.01$ ).

The respondents of both groups compared to the level of education: three (2.5%) without education, primary education has nine (7.5%), secondary 67 (55.8%), high 14 (11.7%), faculty education (20.0%) and master's degree 3 (2.5%). Using the Cheffé post hoc test, it was noticed statistical significance on the STAI scale in subjects without education and magister ( $p = 0.041$  for  $p < 0.05$ ), and descriptive statistics showed a more pronounced degree of anxiety in respondents without education ( $M 107.33$ ;  $SD 12.34$ ) compared to respondents with a master's degree ( $M 68.33$ ;  $SD 4.04$ ). The single-factor analysis of variance does not determine statistically significant association (for  $p < 0.05$ ) level of education and HHIE scores.

The highest number of respondents are in status of retiree 74 (61.6%), the permanent job has 22 (18.3%), the occasional work has 16 (13.3%), three (2.5%) were unemployed, while 4.3% of respondents did not answer this question. A single-factor analysis of variance did not establish a statistical significance at the level of  $p < 0.05$  of the working status and scores on the scales: HHIE ( $F = 0.67$ ,  $df_1 = 5$ ,  $df = 114$ ,  $p = 0.64$ ,  $\eta^2 = 0.02$ ), HHIE-S ( $F = 0.38$ ,  $df_1 = 5$ ,  $df = 114$ ,  $p = 0.86$ ,  $\eta^2 = 0.01$ ), HHIE-E ( $F = 0.9$ ,  $df_1 = 5$ ,  $df = 114$ ,  $p = 0.48$ ,  $\eta^2 = 0.38$ ), STAI ( $F = 1.500$ ,  $df_1 = 5$ ,  $df = 114$ ,  $p = 0.19$ ,  $\eta^2 = 0.06$ ), STAI-S ( $F = 0.95$ ,  $df_1 = 5$ ,  $df = 114$ ,  $p = 0.45$ ,  $\eta^2 = 0.04$ ) and STAI-T ( $F = 2.112$ ,  $df_1 = 5$ ,  $df = 114$ ,  $p = 0.07$ ,  $\eta^2 = 0.08$ ).

The largest number of respondents 108 (90%) live in their home / flat, as tenants live 10 (8.3%), while 2 (1.7%) respondents have no answer. The results of a single-factor analysis of variance do not confirm statistical significance for different housing conditions (resolved housing issues) in relation to the scores HHIE and STAI ( $p > 0.05$ ): HHIE ( $F = 0.016$ ,  $df_1 = 2$ ,  $df = 117$ ,  $p = 0.98$ ,  $\eta^2 = 0.00$ ) HHIE-S ( $F = 0.773$ ,  $df_1 = 2$ ,  $df = 117$ ,  $p = 0.46$ ,  $\eta^2 = 0.01$ ) HHIE-E ( $F = 0.444$ ,  $df_1 = 2$ ,  $df = 117$ ,  $p = 0.64$ ,  $\eta^2 = 0.00$ ), STAI ( $F = 1.089$ ,  $df_1 = 2$ ,  $df = 117$ ,  $p = 0.34$ ,  $\eta^2 = 0.01$ ), STAI-S ( $F = 2.661$ ,  $df_1 = 2$ ,  $df = 117$ ,  $p = 0.74$ ,  $\eta^2 = 0.04$ ), STAI-T ( $F = 0.489$ ,  $df_1 = 2$ ,  $df = 117$ ,  $p = 0.61$ ,  $\eta^2 = 0.00$ ).

Distribution of subjects by grade of hearing impairment (mild, moderate, severe, severe to profound) in the group of subjects with hearing amplification: mild hearing loss six (46.2%), moderate 38 (44.2%), severe 14 (73.7%), and severe to profound two (100.0%) subjects. In the group of subjects without amplification: seven (53.8%) subjects had mild hearing impairment, moderate 48 (55.8%), severe five (26.3%); there were no subjects with very severe hearing impairment (0%) (Table 1).

### Study design

The clinical, prospective cross section study, was conducted from April 2016 to April 2017 at the Department

**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	60	100	120	100

of audiology and vestibulology of KBC Zemun, with the approval of the Ethics Committee of this institution in accordance with legal standards.

In all subjects with presbycusis, with and without hearing amplification, at the beginning of the study (test) and after a period of one year (retest), conducted tests of subjective assessment of hearing impairment (HHIE) and anxiety (STAI) in order to evaluate the effects of auditory amplification.

**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**

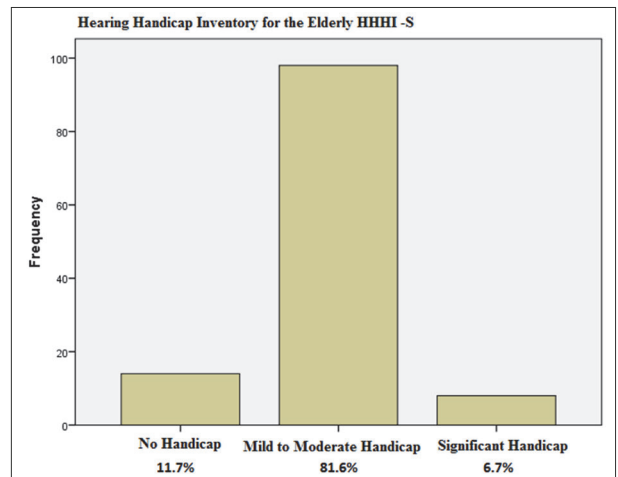
For the analysis of sex, education, marital status and life situations a  $\chi^2$  test was used and t-test for age analysis. The reliability of the applied scale (HHIE and STAI) as well as the subscales was determined by the Kronbach  $\alpha$  coefficient. Reliability for the HHIE scale is 0.886 (test) 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, nonparametric methods for comparing two samples, enabled the testing of the distribution normality in the research. Mann–Whitney 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 analysis. 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**

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.

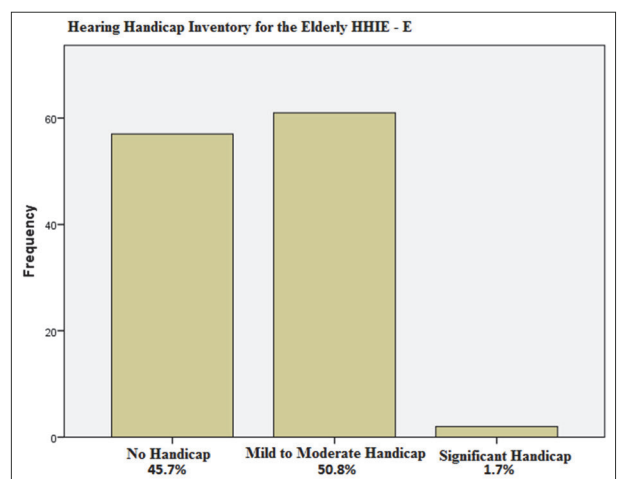
Descriptive statistical analysis of the HHIE-S subscale in all subjects indicated that 11.7% of respondents do not have social and situational consequences of hearing disability, 81.6% mild to moderate, while significant social disability is in 6.7% of respondents (Figure 1).

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



**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

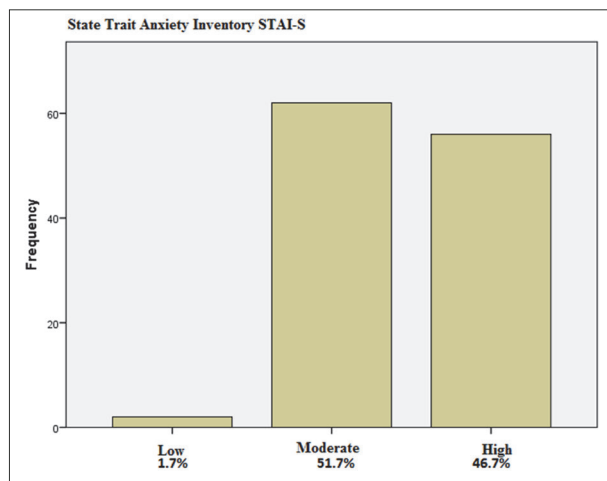


Figure 3. STAI-S of all respondents

\*STAI-S – State Trait Anxiety Inventory "state anxiety";  
 \*\*no or low anxiety (20–37);  
 \*\*\*moderate anxiety (38–44);  
 \*\*\*\*high anxiety (45–80)

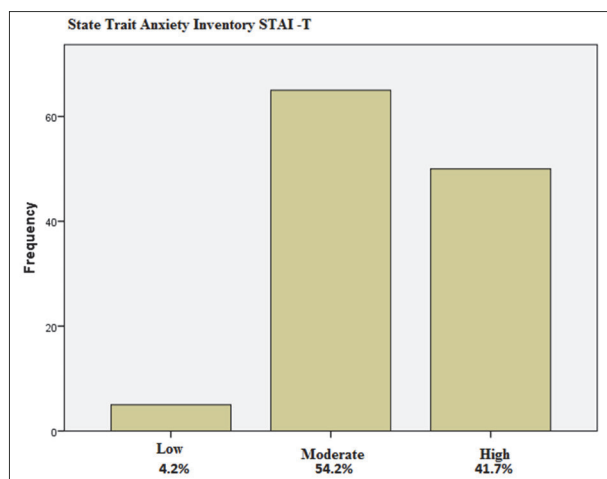


Figure 4. STAI-T of all respondents

\*STAI-T – State Trait Anxiety Inventory "trait anxiety";  
 \*\*no or low anxiety (20–37);  
 \*\*\*moderate anxiety (38–44);  
 \*\*\*\*high anxiety (45–80)

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 time 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, 16 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 ( $N = 60$ ) 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 hearing impairment influence on social life component on the retest. (Table 2 and 3).

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

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	0.004

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

\*\* HHIE-S – hearing handicap inventory for the elderly – social and situational effects

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

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 16 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 (Table 4). A statisti-

cally significant difference ( $p = 0.016$ ) in the respondents after a year was established by a good correlation between the HHIE scale on the test/retest which confirms that the subjective experience of hearing impairment is lower after the period of auditory amplification (Table 5). A statistical significance of the difference ( $p = 0.009$ ) was observed with the analysis of the HHIE-S subscale scores, with a lower rate of hearing disability at the retest, which indicates a significant impact of hearing amplification on the social component of subjective assessment of hearing impairment (Table 5). The statistical significance of the difference in test and retest in subjects with hearing amplification during the study was also observed on STAI-S subscale score with a lower rate of anxiety at the retest ( $p = 0.029$ ) (Table 5).

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

Scales	Mean	n	Standard Deviation	Standard 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	0.016
HHIE-S test/retest	8.678	2.963	15	0.009
STAI-S test/retest	5.868	2.403	15	0.029

\*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 ( $p < 0.05$ )

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 ( $N = 44$ ), 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 subjective hearing disability assessment after a year (Table 7).

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).

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

Scales	Mean	n	Standard Deviation	Standard 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	0.948
STAI-S retest	45.83	44	5.938	0.916
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	0.002
HHIE - E test/retest	-3.188	-5.573	43	0.000
STAI test/retest	-2.237	-3.844	43	0.000
STAI - S test/retest	-1.046	-3.757	43	0.001
STAI - T test/retest	-1.010	-3.434	43	0.001

\* 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 ( $p < 0.05$ )

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 analysis of hearing impairment in correlation with assessment of hearing disability and sense of handicap (HHIE at the beginning of the study and after a year), it is noticed that higher level of subjective hearing disability assessment was in group of patients who did not carry hearing aid from the beginning to the end of the study ( $p = 0.002$ ). 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 (81.6%) 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.

By comparing the average of the score and determining the statistically significant difference in the score HHIE and STAI scales at test and retest is a good indicator of the effects of auditory rehabilitation. This is confirmed by the statistical significance of the test/retest scores in HHIE ( $p = 0.016$ ), HHIE-S ( $p = 0.09$ ) and STAI-S ( $p = 0.029$ ) of respondents who started aural amplification over a period of one year. 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 HHI test/retest scores ( $p = 0.002$ ), HHIE-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, leading to an even greater isolation every day, 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

Hearing amplification in persons with presbycusis influences the improvement of communication, reduction of subjective assessment of hearing disability and anxiety.

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.

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## Ефекти слушне амплификације на субјективну процену слушне онеспособљености и анксиозност код особа са пресбиакузијом

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### САЖЕТАК

**Увод/Циљ** Пресбиакузија, старачка наглувост, јесте прогресивни, билатерални сензоринеурални губитак слуха који карактерише смањена осетљивост слуха и разумевања говора у бучној средини, чиме нарушава комуникацију и значајно утиче на испољавање анксиозности.

Циљ рада је био испитати утицај слушне амплификације на испољавање слушне онеспособљености и анксиозности код особа са пресбиакузијом.

**Метод**е Узорок су чинила 120 испитаника оба пола, старости 47–85 година са пресбиакузијом, 60 испитаника са слушном амплификацијом и 60 без спроведене амплификације. У истраживању су коришћене стандардизоване скале *Hearing Handicap Inventory for the Elderly* и *Spielberger State Trait Anxiety Inventory* за процену присуства анксиозности.

**Резултати** Код испитаника са слушном амплификацијом тест/ретест нема статистичке значајности у резултати-

ма скала и подскала *STAI* и *HHIE*, сем *HHIE-S* ( $p = 0,004$ ) са мањим резултатом на ретесту. Код испитаника 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 резултате *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 је да су анксиозност, губитак емоционалних контаката и израженији степен слушне онеспособљености последица неспроведене слушне рехабилитације.

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

**Кључне речи:** пресбиакузија; анксиозност; слушна онеспособљеност; социјална изолација