

The Impact of Hearing Impairment in the Expression of Depression in Patients with Tinnitus



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Abstract

Background: Hearing sense is very important for enabling speech and establishing communication. Disabling this function alters the ones personality, limits expression of its capabilities and significantly affects it's psychological, emotional and social aspect of its life. Hearing handicap is a big problem because of disability, comorbidity with mental disorders (depression and anxiety) and significant decrease the quality of life, as important factor in overview of health state. The level of hearing handicap (hearing threshold) is not of crucial relevance as individual perception of damage, which is why it is necessary to determine audiology parameters in function of communication, social contacts and mental health. Usage of tests for self evaluate of hearing and tinnitus disability, psychological-psychiatric scales for evaluating presence and magnitude depressive symptoms, enables adequate overviewing of relevant advantages limitations of certain options for therapeutic treatments or hearing rehabilitation, prevention and in time observation of mental disorders.

Subjects and Methods: Research is the type of clinical, prospective cross-sectional study. During a period of six months a presence of mental disorders was examined at respondents with or without hearing handicap and tinnitus. Research covered 92 respondents both sexes, age 40 to 65 years of life, with normal cochlear, sensorineural damage of hearing and tinnitus in a period of 3 months to 5 years. Leading parameters where results of respondents for self-assessment the level of disability because hearing handicap and tinnitus and their correlations with levels for assessment of presence and severity of depression, anxiety and quality of life.

Results: We notices that lose of hearing function, followed by tinnitus to some extent represents loss of autonomy, loneliness, endangers self-esteem and independence, leads to withdrawal from social and emotional life and over time leads into depression.

Conclusion: Reviewing psychological, social and emotional consequences from loss of hearing function in our research, we try to objectify influence of disrupted hearing sensation on entire life of a man expressing mental disorders and suggest a way for early detection and prevention. It is necessary, on all levels of health care, to overview cause and effect relations between hearing disorder and mental disorders, which will lead to more efficient treatment and higher level of mental health for an individual and whole community in general.

Keywords: Hearing handicap; Tinnitus; Depression

Abbreviations: HHIE: Hearing Handicap Inventory for the Elderly; THI: Tinnitus Handicap Inventory; VAS: Visual Analogue Scale; BDI: Beck's Depression Inventory; HHIE: Hearing Handicap Inventory for the Elderly; THI: Tinnitus Handicap Inventory; NCOA: National Council on the Aging

Introduction

Life in a world of silence evokes a feeling of isolation from the environment, but above all makes it impossible to hear and understand speech. Auditory pathway is the main channel for receiving a number of important information for learning speech and the development of cognitive processes. The degree of depression and mental health are directly dependent on the increase in weight of the psychosocial experience of hearing loss. It is thought that the severity of hearing loss, i.e. threshold of hearing is expressed in decibels does not fully comply with the subjective

experience of hearing loss, which is a significant factor in limiting the social and emotional lives as well as the manifestation of psychiatric disorders.

Hearing aids provide better audibility and speech understanding, improve communication and thus alleviate the conditions that can lead to depression, reduce the symptoms already present depression and significantly improve quality of life. Adjusted hearing loss in the elderly improves interpersonal relationships, including greater intimacy, emotional stability,

cognitive functioning reduces anxiety and a sense of social phobia affecting the overall health and increase their social activities and emotional fulfillment. Audiological untreated hearing loss is closely associated with depression and is a major health problem, especially in the elderly, which speaks of the necessity of consideration of hearing loss from all aspects, especially in terms of mental health and mental disorders [1].

Uncorrected disorder of auditory sensation is often the result of bias, poor socio-economic status, which partly stems from the impossibility of establishing decent communications, participation in business processes, which leads the hearing impaired to social isolation and mental load. Sensorineural hearing loss, according to the site of the lesion may be: Cochlear (damage to Corti's organ), retro cochlear (damage to the auditory nerve and brain pathways) and the Central damage (impaired hearing center in the temporal lobe).

Sensorineural hearing loss does not represent a separate clinical entity, but may be due to different etiopathogenetic factors: inflammation, ototoxic drugs, physical trauma, exposure to noise, presbiakuzis, cerebrovascular disease, diabetes, multiple sclerosis, an autoimmune disease of the inner ear usually within other immune system conditions (polyarteritis nodosa, Cogan's syndrome, systemic lupus erythematosus, Wegener's granulomatosis, ulcerative colitis), hereditary loss as part of the syndrome conditions (associated with abnormalities of the skeletal muscles, sight, the endocrine system, the CNS, pigmentation, etc.) and nonsyndrome disorder (approximately 70% of familial hearing loss is nonsyndromically related to certain location of genes marked - DFN - deafness) [2] tumors in cerebellopontine angle, Meniere's disease.

Frequent accompanying symptom of sensorineural hearing damage is tinnitus, a complex and still insufficiently explained phenomenon which is defined as an abnormal noise (phantom sensations) in the ears (and mind) in the absence of an external sound source [3] Tinnitus is the perception of auditory disturbance due to an altered state of the excitation and inhibition at the level of the neural network, which leads to a mismatch in neuronal signaling [4]. Most of the existing medical and audiological tinnitus research represents the concept of neural plasticity, the theory that neural connections in the brain are in a state of stagnation, but evolving under the influence of internal and external input signals (input), which is the basic concept of the current treatment of tinnitus. Actual concept in the field of audiology neural plasticity - the brain has the potential for change and adaptation and acoustic stimulation, i.e. abstract acoustic stimulation is the result of subcortical and cortical reorganization, i.e. remapping the neural connections [5].

Research results on older people with tinnitus who wear hearing aids are indicated on the adaptive plasticity of the central nervous system, i.e. neurons under the influence of auditory information gain input hearing aids are becoming more successful in coding the stimulus of higher intensity, which affects the reduction of unpleasant subjective perception of phantom auditory sensations [6]. Bartels, Staal and Albers [7] explored the impact of deprivation

on the audio phenomenon tinnitus and the authors hypothesis that early-onset hearing loss, or absence of acoustic stimuli cause dormant, inactive synapses in the central nervous system and auditory amplification affects the activity of the nerve synapse. Neural information can be redirected in the central nervous system, producing hyper excitability or excessive activity of neurons in the auditory system.

The authors find that the lateral expansion due to excitatory response of neural plasticity, and possibly the loss of inhibition of the spread, can be the mechanism for the perception of tinnitus [8] The current position is that hyper excitability, abnormal activation of non-classical audio way, related to the emotional centers of the brain in the limbic system, which is considered responsible for the emotional response related to tinnitus. Hyper excitability creates a constant feedback between the audio cortex and the limbic system, which leads to the accompanying mental symptoms such as depression, anxiety and phonophobia [9] Consideration of the plasticity of the nervous system and fluctuations in the level of receptor nerve cells of the auditory system gives a new view of physiological mechanisms of tinnitus [10] All so far known mechanisms are not mutually exclusive, but are mutually complementary, with the proviso that at times, and multiple mechanisms may be present in the observation and diagnosis of an individual's tinnitus, and as the establishment of a methodology of treatment.

The largest number of deaf and hard of hearing people suffer primarily because of difficulties in social contact and understanding of speech, and to a much lesser extent, if any sound they hear or not, therefore, in clinical practice must be examined the frequency-speaking countries, despite the determination of elemental hearing impairment (threshold hearing) to determine understanding of speech and its impact on the mental status of the respondents. The diagnostic audiology and ENT disorders in addition to audiological history have an important place:

- a) tonal audiometry - Psychoacoustic test to determine hearing threshold for tonal stimuli;
- b) speech audiometry - determination of the minimum conversational threshold ;
- c) impedancemetry - testing the functional state of the eardrum and middle ear; and evaluation of acoustic reflex pathways (VII and VIII cranial nerve and brain stem);
- d) auditory evoked potentials of the brainstem - the determination of the functional state of some parts of the auditory system and the topography of lesions of the auditory system;
- e) neuroradiological procedures - computed tomography and magnetic resonance imaging in the evaluation of the temporal bone, mastoid and adjacent intracranial parenchymal structures.

Localization of lesions in the audiological system, the degree and type of hearing loss, presence of tinnitus and the existence

of associated pathological conditions that result in audiological problems will determine the therapeutic approach (medication or surgical therapy). In sensorineural hearing loss (when diagnostic methods eliminated organic causes that require a surgical approach to the treatment) with the present aggravated audio-voice communication require the use of hearing aids. Digital hearing aid technology (artificial intelligence apparatus) allows the automatic changing of electroacoustic characteristics depending on the input signal, which allows listening comfort and speech intelligibility increases.

Tonal audiometry is the basic parameter for audiological observation of the patient and the indications for hearing amplification, but not the only one. Must be taken into account: age, general physical and mental health and cognitive function of the patient, motivation, financial options, cosmetic factors and the patient's needs for communication. Significant impact on the efficiency of amplification is the time that has elapsed since the hearing damage to the determination of the hearing instrument. If the hearing loss developed rapidly, and hearing aid recommended shortly after that, there will be practical difficulties in the use of hearing aids. If the hearing loss incurred gradually or congenital, can expect some difficulties, which implies a longer period of adjustment to the regular counseling [11]. About 70% of people with hearing loss have tinnitus, accompanying, and unpleasant symptom that by their presence exacerbates already present impairment of hearing and interfere with mood (depression) and emotions (anxiety).

Liaison psychiatry in audiological practice gives new possibilities of perception of patients with hearing loss and tinnitus which increases the therapeutic effect, allows the successful rehabilitation, prevention of possible mental disorders (depression, anxiety) as well as increasing the quality of life. The degree of damage is not essential as individual perception of damage. The greater the inaccuracy of individual perception, the greater the degree of frustration because of the subjective experience comes into conflict with reality and makes the adjustment process. Unrealistic perceptions of impaired auditory sensations complicates finding of the adequate roads to meet the dominant needs of the hearing impaired.

Reactions to hearing loss or tinnitus presence are moving in a wide range between two extremes: ignoring the real difficulties that hearing disorder caused and the perception of existing disorders such as tragedies with the withdrawal and resignation as the psychological consequences of the tragedy. The existence of hearing loss starts defense mechanisms aimed at maintaining self-esteem, which affects the formation of a separate pattern of personality depleted identity characterized by: suspicion, distrust, limited control, ego rigidity and impulsivity. Depression is the most common mental disorder in people with hearing loss and tinnitus.

Subjects and Methods

In the cross-section of a prospective clinical study investigated the presence of depression in patients with and without the

impairment and tinnitus, according to predetermined criteria. Views of the respondents were conducted in the afternoon in order to consider the fatigue of hearing after daily activities and intensification of tinnitus as a pathological phenomenon. The sample included 92 patients with tinnitus, of which with the hearing-impairment 25 males (54.3%) and 21 females (45.7%) and in the group with normal hearing 22 (47.8%) males and 24 (52.2%) females. The main criteria for the subjects included in the study: the presence of tinnitus lasting from three months to five years, the age of patients between 40 and 65 years, the existence of sensorineural hearing loss i.e. cochlear sensorineural hearing impairment in a group of hearing-impaired, or neat audiometric findings for a group of patients with normal hearing; the absence of symptoms of cognitive decline, the lack of obvious mental disorders and the use of antidepressant therapy for any reason (quitting smoking, etc.). Criteria for exclusion from the study: conductive hearing loss, hearing loss or tinnitus caused by acoustic or blast trauma, ototoxic drugs, congenital anomalies of the ear, Meniere's disease, tumors of the posterior fossa, acoustic neuroma, glomus tumor, vascular condition after stroke, patients on hemodialysis, diabetes, anemia, and diuretics for more than five year.

Prior research established clinical standards: otorhinolaryngology examination and medical history, audiology and tinnitus history, audiometric (Diagnostic Audiometer AD 229 - Diatec, Interacoustics, Denmark, in the «deaf «room) and tympanometry testing (Impedance audiometer AT 235 - Diatec, Interacoustics, Denmark), determination of hearing and tinnitus disability by standardized questionnaires Hearing Handicap Inventory for the Elderly (HHIE) and the Tinnitus Handicap Inventory (THI), a scale for weighing objectification of hearing loss and tinnitus Visual Analogue Scale (VAS), the use of a standardized psychological test to assess the presence and the severity of depressive disorders Beck's Depression Inventory (BDI). The aim of the study was to determine the impact of state hearing on the occurrence of depression in patients with tinnitus showing the degree of correlation of the subjective experience of hearing disability, tinnitus and depression. This study applied the descriptive methods: absolute and relative numbers, measures of central tendency, measures of dispersion, parametric and non-parametric tests, and analysis of the association. In analyzing the results we consider statistically significant difference or correlation of -0.05 .

Results

The average age of our patients with tinnitus in a group with hearing loss was 53.0 ± 7.7 , and for the group of subjects with normal hearing 53.2 ± 7.9 . All demographic factors (age, sex, education level, marital status, offspring, employment, housing status, except bad habits - drinking $p = 0.002$), did not show statistically significant differences for both groups. Given that the subjects included in the study, on the basis of the criteria was not observed statistically significant differences in most parameters ENT and audiological history.

Despite the present difficulties with listening 35.9% of both groups had never examined the hearing; 45.7% with normal hearing and 26.1% in the group with hearing loss. Of the total number of respondents 9.8% is hearing examined 6 months ago, 13.0% a year ago, 41.3% more than two years ago, the difference was statistically significant ($p = 0.004$) (Table 1). Hearing of varying severity was diagnosed in 73.9% of those with hearing impairments, the difference was statistically significant ($p < 0.001$). Treatment, advice or recommendation of the problems in listening did not receive 39.1% of respondents with hearing impairments, 52.2% of subjects with normal hearing and tinnitus, i.e. 45.7% of both

groups. In the group with normal hearing due to tinnitus, 32.6% of respondents have administered the prescribed medications, with 10.9% was performed the toilette of the ear, while 4.3% received advice on diet and lifestyle. Hearing aid was recommended by 54.3% of respondents impaired, while only 4.3% of impaired has administered the prescribed drug therapy for tinnitus. Due to hearing loss, according to audiological standard, hearing aid carries 39.1% of subjects with hearing impairment, while 60.9% of those with hearing impairment does not wear or did not receive a recommendation for a hearing aid, the difference was statistically significant ($p < 0.001$) (Table 2).

Table 1: Diagnosis of hearing loss.

		Hearing loss						P value
		Yes		No		Total		
		N	%	N	%	N	%	
Hearing test	Never	12	26.1%	21	45.7%	33	35.9%	0.004
	6 months ago	2	4.3%	7	15.2%	9	9.8%	
	A year ago	6	13.0%	6	13.0%	12	13.0%	
	More than two years ago	26	56.5%	12	26.1%	38	41.3%	
Diagnosis of hearing loss	No	12	26.1%	46	100.0%	58	63.0%	<0.001
	Yes	34	73.9%	0	.0%	34	37.0%	
The resulting advice or recommendations	Medicaments	2	4.3%	15	32.6%	17	18.5%	-
	Performed ear toilette	1	2.2%	5	10.9%	6	6.5%	
	Advice on diet and lifestyle	0	.0%	2	4.3%	2	2.2%	
	Counseling for a hearing aid	25	54.3%	0	.0%	25	27.2%	
	No advice or recommendations	18	39.1%	24	52.2%	42	45.7%	

Table 2: Hearing amplification and problems related to hearing.

		Hearing loss						P value
		Yes		No		Total		
		N	%	N	%	N	%	
Sudden Hearing Loss	No	42	91.3%	46	100.0%	88	95.7%	0.125
	Yes	4	8.7%	0	.0%	4	4.3%	
Hearing aid	No	28	60.9%	46	100.0%	74	80.4%	<0.001
	Yes	18	39.1%	0	.0%	18	19.6%	
Social limitations	Never	2	4.3%	46	100.0%	48	52.2%	<0.001
	Sometimes	20	43.5%	0	.0%	20	21.7%	
	Constantly	24	52.2%	0	.0%	24	26.1%	
Problem in listening	Never	0	.0%	46	100.0%	46	50.0%	<0.001
	Sometimes	19	41.3%	0	.0%	19	20.7%	
	Constantly	27	58.7%	0	.0%	27	29.3%	
The main problem related to hearing	Lack of understanding speech	29	63.0%	0	.0%	29	31.5%	<0.001
	Tinnitus							
	Unpleasant sound experience							

The subjects with normal hearing did not report limitations in social life and social functioning, while 52.2% of those with hearing impairments has permanent restrictions, temporary 43.5%, without limitation the 4.3% of patients, the difference was statistically significant ($p < 0.001$). Permanent problem in hearing has 58.7%, occasional 41.3% of the impaired, in the group of subjects with normal hearing tinnitus does not cause problems in

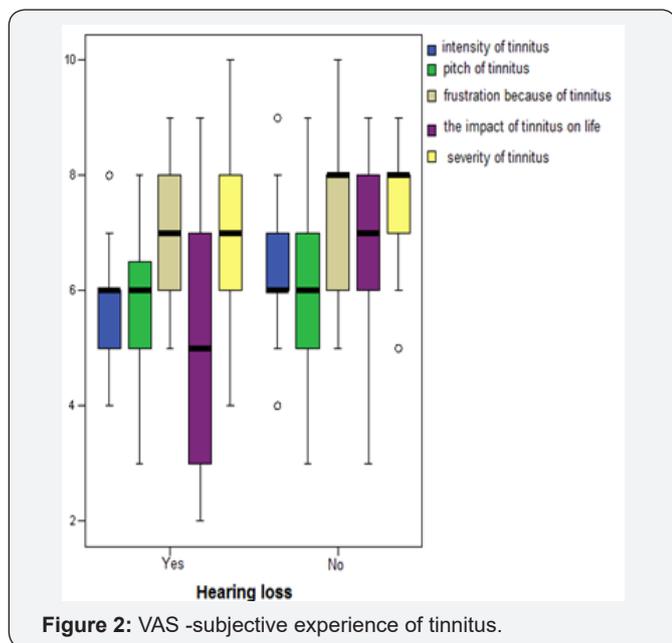
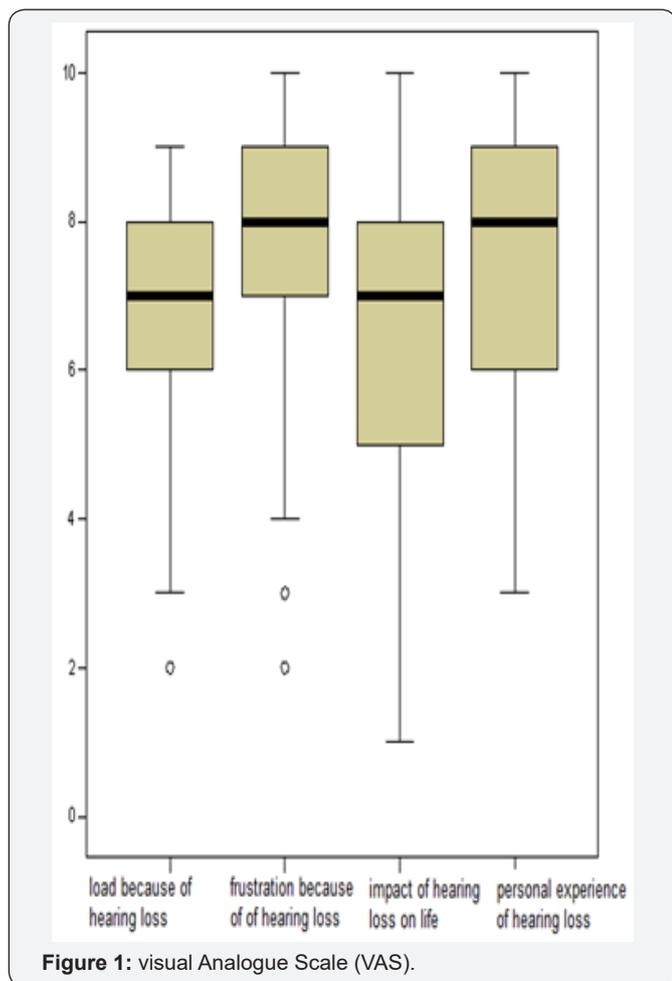
hearing, the difference was statistically significant ($p < 0.001$). The main problem related to hearing that respondents stated is tinnitus in 68.5% of both groups, in the group with hearing loss tinnitus is a major problem in 37.0%, and the inability to understand speech in 63.0%. In the group with normal hearing tinnitus is the main problem, the difference is statistically significant ($p < 0.001$) (Table 3).

Table 3: Audiometry and tympanometry findings.

		Hearing loss						P value
		Yes		No		Total		
		N	%	N	%	N	%	
Hearing loss	No	0	.0%	46	100.0%	46	50.0%	<0.001
	Mild	15	32.6%	0	.0%	15	16.3%	
	Moderate	15	32.6%	0	.0%	15	16.3%	
	Difficult	15	32.6%	0	.0%	15	16.3%	
	Very difficult	1	2.2%	0	.0%	1	1.1%	
Tympanometry	Valid findings	29	63.0%	42	91.3%	71	77.2%	<0.001
	Type A	8	17.4%	0	.0%	8	8.7%	
	Type B	8	17.4%	4	8.7%	12	13.0%	
	Type C	1	2.2%	0	.0%	1	1.1%	
Stapedius Muscle reflex	Not induced	17	37.0%	0	.0%	17	18.5%	<0.001
	Neat	29	63.0%	46	100.0%	75	81.5%	
		Hearing loss						P value
		Yes		No		Total		
		N	%	N	%	N	%	
Hearing loss	No	0	.0%	46	100.0%	46	50.0%	<0.001
	Mild	15	32.6%	0	.0%	15	16.3%	
	Moderate	15	32.6%	0	.0%	15	16.3%	
	Difficult	15	32.6%	0	.0%	15	16.3%	
	Very difficult	1	2.2%	0	.0%	1	1.1%	
Tympanometry	Valid findings	29	63.0%	42	91.3%	71	77.2%	<0.001
	Type A	8	17.4%	0	.0%	8	8.7%	
	Type B	8	17.4%	4	8.7%	12	13.0%	
	Type C	1	2.2%	0	.0%	1	1.1%	
Stapedius Muscle reflex	Not induced	17	37.0%	0	.0%	17	18.5%	<0.001
	Neat	29	63.0%	46	100.0%	75	81.5%	

Visual Analogue Scale (VAS) - a subjective assessment of the severity of hearing loss in patients with impaired hearing indicates that personal experience of severity of hearing damage is 7.35 with a deviation of 2.046 (MED 8) and the presence of anxiety estimated to severe degree is 7.41 with a deviation of 1.821 (MED 8), while the impact of hearing impairment on the life of 6.63 with a deviation of

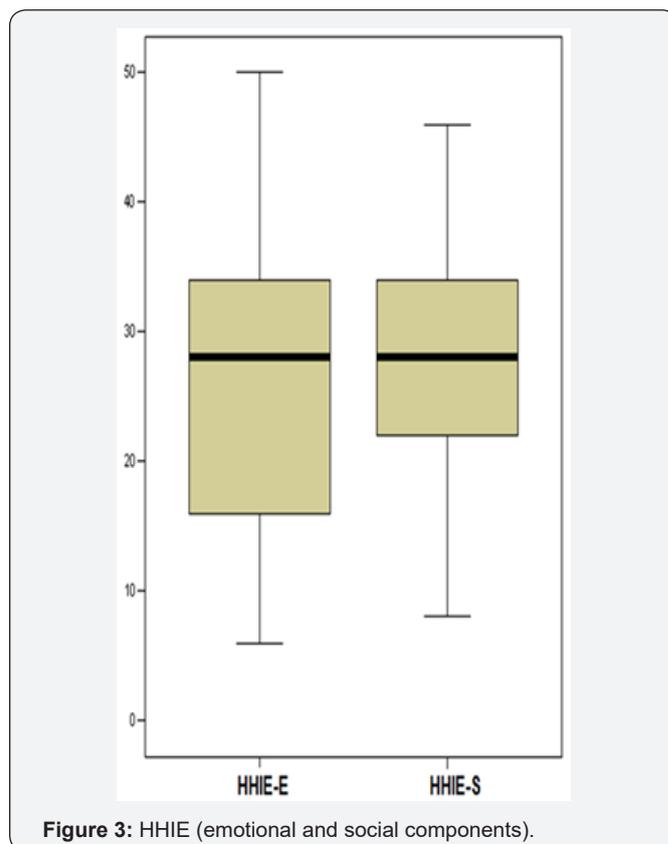
2.274 (MED 7) and the burden of hearing loss due to 6.91 with a deviation of 1.907 (MED 7) corresponds to a moderate level (Figure 1). Comparing the parameters of tinnitus anamnesis in both groups according to the localization, duration and origin of tinnitus is not determined statistically significant difference.



VAS scale parameters of subjective, emotional and mental experience of tinnitus indicate that the average value of the intensity of tinnitus in both study groups is 5.71 with a deviation of 1.022 (MED 6.00). The difference in the subjective assessment

of severity of tinnitus in both groups was statistically significant ($p = 0.001$). It was observed that the average value of estimates of pitch and sense of nervousness because of tinnitus in both groups showed no statistically significant difference ($p = 0.164$, $p = 0.410$) and estimated the moderate level (Figure 2). Assessment of the impact of tinnitus on the lives of all respondents at the average value of 5.01 deviation of 2.171 (MED 5.00), the difference was statistically significant ($p = 0.001$), grading which corresponds to a slight (subjects with normal hearing) and moderate (subjects with impaired hearing) impact on the lives of the respondents.

The severity of tinnitus in the numerical rights VAS scale, respondents of both groups expressed in the average value of 6.7 with a deviation of 1.539 (MED 7.00), the difference was not statistically significant ($p = 0.687$), as the subjective feeling of severity of tinnitus, grading corresponds to the attitude - in moderation. Audiological hearing tests determined the decline in hearing (dB) and grading is done to: easy to 32.6%, medium heavy 32.6%, 32.6% difficult and very difficult to 2.2% of patients, the difference was statistically significant ($p < 0.001$). Tympanometry findings were normal in 91.3% of subjects with normal hearing and 63.0% of those with impaired hearing at which notes that 17.4% of respondents have tympanometry findings of type A and B. Type C of tympanogram was recorded at 1.1% of the sample (the difference is statistically significant $p < 0.001$) (Table 3).



By analyzing the results of a standardized questionnaire Hearing Handicap Inventory for the Elderly (HHIE), there are two factors in the perception of hearing loss: the emotional HHI-E and

situational (social) HHI-S. Emotional and social components of hearing loss are almost equally represented: emotional average value of 26.87 with a standard deviation of 11.743 (MED 28) and situational (social) 27.76 with a standard deviation of 8.647 (MED 28) (Figure 3). Summarized responses HHIE questionnaire show that 69.6% of those with hearing impairment has a significant, 28.3% mild to moderate, and 2.2% had no disability (Figure 4).

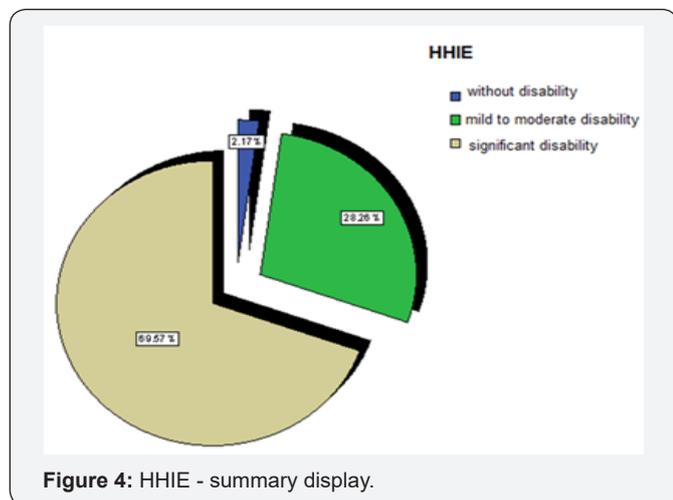


Figure 4: HHIE - summary display.

Correlation of hearing thresholds (dB) and subjective experience of hearing disability hearing impaired subjects showed a high degree of statistically significant ($p = 0.592$, $p < 0.001$), positive direction, solid strength. The respondents in the category of mild hearing loss showed mild to moderate disability, 66.7%, and 26.7% with a significant disability. Respondents with secondary severe 86.7% have a significant disability, while mild, moderate disability is represented in 13.3% of patients. Respondents with severe hearing loss in 93.3% showed severe disability, while one respondent in the category of very severe hearing impairment showed a significant disability. Significant hearing disability correlated with hearing threshold is represented in 69.9%, mild to moderate in 28.3%, easy with 2.2% in hearing impaired subjects (high statistical correlation $p = 0.592$, $p < 0.001$) (Figure 5).

Tinnitus Handicap Inventory (THI), a standardized questionnaire for assessing the psychological aspects of tinnitus, the nature and degree of distress caused by tinnitus enabled quantification of the impact of tinnitus on the psychosocial life of patients with tinnitus. Grading the subjective experience of tinnitus patients, it was observed that dominates the group with severe disability 42.4%, moderate 28.3%, and 13.0% with catastrophic disability (not Statistically significant difference $p = 0.426$) (Figure 6). By analyzing the results of the scale for self-assessment of depressive symptoms, Beck's Depression Inventory-BDI, grading the presence and severity of depression, we observed in the group of patients with hearing loss: a normal finding in 4.3%, mild mood disorder 39.1%, the borderline depression 19.6%, moderate depression 21.7% and major depression in 15.2% of patients.

In the group of subjects with normal hearing: a normal finding 37.0%, mild mood disorder 32.6%, the borderline depression,

17.4%, 10.9% moderate depression and major depression in 2.2% of patients. In both groups dominated by subjects with mild mood disorders 35.9% and borderline clinical depression 18.5%, while 16.3% of those with moderate and 8.7% with severe depression. We observed that 25.0% of the sample showed the presence of clinical depression that requires clinical treatment (with damaged 39.6% and 13.1% with normal hearing), the difference was statistically significant ($p < 0.001$) (Figure 7).

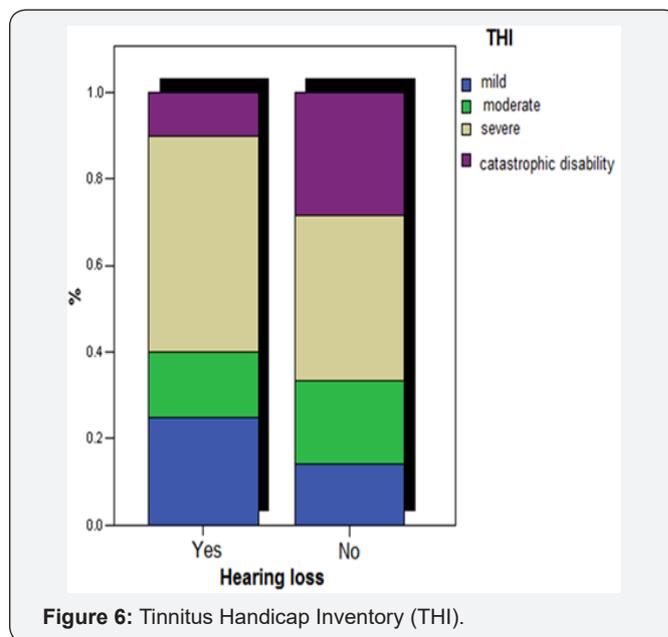


Figure 6: Tinnitus Handicap Inventory (THI).

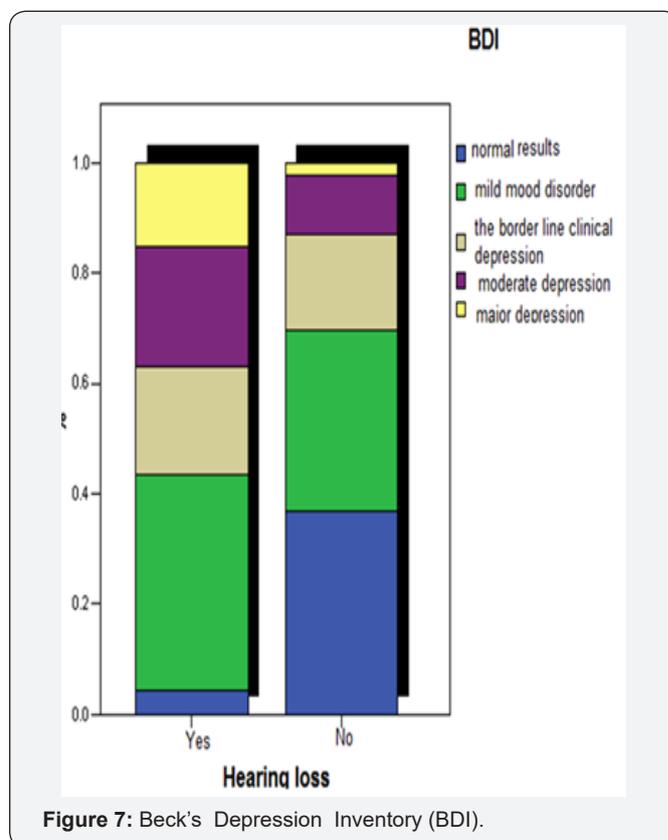


Figure 7: Beck's Depression Inventory (BDI).

By correlating the results HHIE, HHI-E HHI-S and BDI subjects with impaired we observed a significant correlation at the 0.01 level between HHI-E in the perception of hearing and BDI 0574. Significant correlation at the 0.05 level and 0.01 HHI-S in the perception of hearing loss and the aforementioned parameters has not been established. Significant correlation at the 0.01 level of total score HHIE in the perception of hearing and BDI-0442 was found. It can be seen that the correlation HHIE-E and the above parameters in subjects with impaired hearing and tinnitus is highly statistically significant, 0.513 at the 0.01 level, while significant at the 0.05 level for the total score HHIE-0319 (Table 4).

Table 4: HHIE correlation with BDI, BAI subjects hearing impairment and tinnitus Spearman's rho.

	HHIE-E	HHIE-S	HHIE
BDI	.574(**)	.219	.442(**)
BAI	.606(**)	.215	.478(**)

*Correlation significant at 0.05

** Correlation significant at 0.01

By correlating the results of THI and BDI patients with tinnitus showed significant correlation at the 0.01 level between the psychosocial aspects of perception of tinnitus and THI both groups (0.776) in the group of patients with hearing loss 0.798, in the group with normal hearing is 0.840. The correlation of all subjects with tinnitus and tested parameters indicates a statistically significant difference regarding the existence of the two disorders in hearing (hearing loss and tinnitus) and the Hearing Handicap Inventory for the Elderly (HHIE) -0592; HHI-E-0485, HHI-S- 0532, Beck's Depression Inventory (BDI) -0409; The correlation of those with hearing impairment and tinnitus indicates a statistically significant difference regarding the existence of two associated disorders of hearing and Hearing Handicap Inventory for the Elderly (HHIE) -0592; HHI-E-0485, HHI-S-0532, (the correlation is highly statistically significant) (Table 5).

Table 5: Correlation with other parameters of tinnitus.

	All respondents n=92	With hearing Impairments n=46
HHIE-E	.485**	.485**
HHIE-S	.532**	.532**
HHIE	.592**	.592**
BDI	.409**	.213

** Highly statistically significant

Discussion

In the last decades hearing damage is a big problem and in economically developed countries, due to disability and the observed comorbidity with mental disorders. Despite the fact that the sense of hearing impairment significantly affects the social life of man, the fulfillment of social contacts, the expression of emotional experience, the intellectual value of the man, often revealed late when it comes to a serious threat to communication capabilities and the obvious disturbances in various spheres of life. Hearing

impairment is the most common sensory impairment that affects especially older people. In our study, the average age of both groups was 53.0 years, with no differences by age and gender as well as in terms of selected ambulatory care patients.

Socio-demographic data significantly affect expression or deepening of mental disorders, increase the presence of stress, thereby reducing opportunities for persons with chronic disabilities to achieve improvement of their health, social and emotional functioning. The results of our study showed compactness both groups according to socio-demographic characteristics, thus we can exclude their influence on the expression of depression. Evaluation of the general health status of both groups did not differ significantly by group, 57.6% declare good health, while in 38.0% undefined indicating the inability of respondents to define the problem of impaired auditory sensation and its impact on overall health, considering it disorder which is separate from the body and overall health.

Data on the audiological assessment of our patients with disorders of auditory perception is worrisome because 35.9% of all respondents, were not audiometric analyzed and did not receive advice or a recommendation for therapeutic treatment. Subjects with impaired hearing due to probably hindered communication, are often sought help audiologists compared to subjects with normal hearing, while control examinations are very little or not at all represented. Due to the lack of consideration of hearing disorders and tinnitus, their impact on the psychosocial life of man, about half of all respondents did not receive a recommendation for further therapeutic treatment. Data are worrying and are justified by the poor economic situation in the country, but the problem can be solved by reorganizing health services, introducing protocols of diagnosis and treatment, raising health awareness among the population and education of medical personnel.

Audiological evaluation of of the respondents we found that a very small number use or accept hearing aid to correct hearing, dominated by females and younger people and they for a long time are trying to ignore the disruption in communication, as observed by other authors [12] Stigma, fear of rejection in society, conditioned by cultural circumstances, burdened by outdated notions, not informed and lack of education, religious beliefs and poor functioning of the health system, which is very common in developing countries.

Respondents with hearing loss, 60.9%, do not wear a hearing aid that fits the data in the literature about the low representation of auditory amplification. National Center on Hearing Assessment and Management states that 32 million people in the U.S. have hearing loss, 75.0% do not wear a hearing aid while the average period before amplification is seven years (National Council on the Aging, 1999). Numerous research works and epidemiological prevention programs in developed and less developed countries advocate the position that the loss of hearing is medical problem associated with the physical, emotional, mental and social well-being, and depression, anxiety, mental instability, phobias,

withdrawal, isolation, and decreased self-esteem accompany the greater or lesser extent, uncorrected hearing loss [13,14]

A large percentage (63.0%) of the patients with unadjusted hearing impairment has a problem of intelligibility of speech and communication, while 37.0% emphasizes tinnitus as sensation which are more burdened by than hearing disorders. Impaired hearing and tinnitus are the cause of impaired communication and social restrictions in 52.2% of full-time and 43.5% occasionally. The subjects with normal hearing and tinnitus are considered to have limitations in social life which indicates a significant effect of hearing in social functioning.

Undetermined clinical standards or guidelines for the therapeutic approach, ignorance of the problems of hearing loss and tinnitus, negative messages to the patient by the physician can influence the overall social, emotional, social and mental status of persons with hearing impairment when they cease to seek help, they become agitated, anxious or depressive [15] The therapeutic approach to tinnitus is not unique, but the number of multidisciplinary interventions that are now successfully implemented in large audiological centers: strategies stress management, therapeutic use of music, lifestyle modification and other, with the aim of helping patients to change their reaction to tinnitus or rehabilitate hearing loss [16].

According to our data disturbed auditory function has 67.74% of the respondents, in interaction with social constraints, temporary and permanent 95.7% of respondents indicating a significant impact of impaired social relations and a number of consequences of emotional, cognitive and social functioning of these individuals. Difficult or impossible communication hinders their participation in important aspects of social life and play important social roles which with greater severity and duration of damage affect the formation of specific psychological characteristics of personality. In many works, the most commonly cited are the following personal characteristics of people with impaired auditory sensation: the emotional and social maladjustment (emotional immaturity, dependency, increased affective reactions), disturbed self-concept (problem of adequate identification, feelings of inferiority, dissatisfaction with oneself), self-centeredness and lack of empathy, impulsivity (anger, aggression), restricted interests, and poor motivation as well as severe mental stress and disorders [17].

There are different experiences of our respondents in terms of experience tinnitus as unpleasant auditory sensations which causes unpredictable mental experience and has different effects on emotional and social relations. We observed significant information about high loads due to tinnitus (37.0%) in patients with varying degrees of hearing loss. Personal perception of tinnitus burden of stress, fatigue, fear, the patient is introduced into a vicious circle of depression, and when tinnitus itself sometimes becomes a major cause depression, anxiety and sleep disorders. Many authors believe that the causal link between tinnitus, hearing impairment and mental disorders is bidirectional because tinnitus reinforces the fear at patient that will eventually cause loss of hearing what

causes depression and change their emotional, social functioning with the consequences of the economic sphere [18].

There is a significant difference between the hearing threshold and the subjective experience of hearing impairment that represents the attitude of the respondents about negative effects on almost every dimension of human experience: physical health, emotional and mental health, intellectual and social functioning, success in work, family relationships and self-esteem. The main direction in the implementation of appropriate therapy is the overall assessment of personality of the person with hearing loss, with special emphasis on mental status, so that hearing rehabilitation would be timely and successful [19].

According to VAS scale parameters of subjective, emotional and mental experience of tinnitus of subjects with tinnitus we observed that the impact of tinnitus is greater on life in patients with impaired hearing, which is similar to other researchers [20]. The use of VAS scale for self-assessment of hearing and tinnitus enabled us to better clarify the complex relationship between hearing loss (audiological component), perception of hearing impairment (subjective experience of deficits), tinnitus, social functioning and psychopathological dimensions unrest. We found that hearing deficit affects the occurrence of many limitations in an individual's life discourages them and exposes them to uncomfortable social situations, leading to the isolation that leads to depression, irritability, feelings of inferiority. The same psychological symptoms in individuals with hearing impairment exacerbated by the presence of tinnitus, decreased social integration, the cause of withdrawal from social life, and eventually lead to a deterioration of the economic status of introducing them into a vicious cycle of hopelessness in which they need help of an expert team for overcoming [16].=

Assessment of emotional and social limitations of the subjective experience of hearing loss, we observed almost the same limitations in both areas of life of the patients regardless of the severity of hearing loss, i.e. that there is no significant difference between the degree of hearing loss and the degree of limitation in the emotional and social spheres of life. It's the same attitude of other authors Araújo [21] that perceived auditory disorder is not correlated with the degree of hearing loss. Menegotto [22] point out that the questionnaire HHIE is highly sensitive, specific and useful screening method for the detection and treatment of hearing loss as it confirms the link between subjective experience and audiological parameters of hearing loss, and we observed a statistically significant correlation to any degree of hearing loss and the degree of restriction in operation. We observed similar data in the group of patients with light and medium-severe hearing impairment (65.2% of respondents) is correlated with the results HHIE is showing that 69.6% of those with hearing impairment have a significant disability, 28.3% mild to moderate, while 2.2% have no disability.

Respondents, who did not report a limit, people with impaired auditory sensation, which belongs to the category of light damage, or in terms of respondents who wear hearing aids and have not

been able to give a realistic account of the functioning without a hearing aid due to its good adaptation to amplification. This result we have complemented with a precise correlation between the degree of hearing threshold (according to audiological findings in dB) and the weight of the subjective experience of hearing disability in patients with impaired hearing, which showed a high degree of statistically significant correlation ($p = 0.592$, $p < 0.001$), associated solid direction and strength. The respondents in the category of mild hearing loss to a greater extent show mild to moderate disability, 66.7%, and 26.7% with a significant disability. Respondents with secondary severe 86.7% have a favorable outcome, while mild, moderate disability present in 13.3% of patients.

Correlation of positive direction and solid strength in this correlation indicates that with the greater hearing loss disability significantly increases and therefore we own assessment of auditory disability perceive as the main parameter of hearing loss. Research results [23] suggest that audiometric data correlate with demographic data and HHIE allows assessment of hearing impairment in the context of life functioning, which is of great clinical importance in planning therapeutic interventions. They point out that the audiometry certainly is the gold standard for the evaluation of hearing threshold, but the correlation with the results of tests for self-assessment can be an alternative in the prevention of mental disorders that are usually on the rise in the elderly, improving the quality of life and achieve better therapeutic results.

There is no standardized and objective audiometric test to detect the presence and characteristics of tinnitus, a lack of correlation between the physical intensity of tinnitus, its acoustic characteristics and inconvenience caused led to the use of a questionnaire based on the method of self-evaluation, Tinnitus Handicap Inventory, which provides the opportunity to objectify perception of disability and better quantify the impact of tinnitus and its effects, which are to a great extent subjective. Epidemiological studies have shown that depression exacerbates problems caused by tinnitus because patients develop a conditioned reflex, emotional response, focusing on tinnitus [24]. By using THI, we made an assessment of the psychosocial aspects of tinnitus i.e. quantifying the impact of tinnitus on the daily lives of the respondents, managed to perceive the emotional changes in participants: anger, frustration, irritability, anxiety, uncertainty, changes in the more social sphere: stress, loss of concentration and sleep, changes in work, family, changes in terms of accountability and social activities. Summarized data on feelings of despair, anxiety, lack of control, unable to escape or cope with tinnitus, the perception that it is a dangerous disease, we expressed according to the proposed degree (mild, moderate, heavy and catastrophic), which allowed us to compare with other studies parameters.

Catastrophic and pronounced disability were significantly more frequent in the patients with impaired hearing indicating more severe perception of tinnitus and its impact on the emotional and social aspects of life. Moderate disability prevalent in the group of subjects with normal hearing, indicating that the subjects with impaired hearing and tinnitus are difficult to change in the social,

emotional and mental functioning, change in physical health, self-esteem and family relationships. Similar data research Lim [25] who emphasize the importance of this test in the clinical assessment of the complexity of the problem in order to comprehend the mental health of patients and started a multidisciplinary approach treatment.

In our study, following the occurrence of depression in patients, results analysis, BDI, we have achieved a grading of the severity of depressive symptoms according to established criteria. Respondents with hearing loss showed a significant degree of expressed symptoms of depression. We concluded that hearing loss and tinnitus often correlated with depression in both groups mild mood disorder is represented by 35.9%, while at the borderline of clinical depression, 18.5% of respondents. Important data for this study is that the symptoms of moderate to severe depression requiring clinical treatment, present in 36.9% of subjects with impaired hearing and tinnitus, and 13.1% with normal hearing. Tambs [26] makes the same point, that the presence of depression and loss of self-esteem are more represented in the moderate decline in impairment in the younger population, significant in males, probably due to shattered dominant role of men in society, increasing expectations of career, social and family life. Langenbach [27] noted that the presence of depression may be a predisposing factor for a severe disability due to tinnitus experience and to long-lasting tinnitus - cure uncertainty leads to depressed mood. They concluded that patients with psychological disorders and sleep disorders soon after the onset of tinnitus have a higher risk of developing tinnitus anxiety that leads to depression.

The effect of tinnitus on the mental status of an individual depends on several variables: character, tinnitus, hearing impairment, vertigo, hyperacusis, severity of depression or anxiety, the presence of somatic illness and personality structure. An additional factor in the subjective experience of tinnitus is age of the respondents and time of onset of tinnitus (subjects with a manifestation of tinnitus in later years reported more distress than patients with tinnitus in early adulthood and middle age), which explains the decline in neuroplasticity of the brain in old age Schlee [28]. Also, older age, due to lifestyle changes, physiological loss of energy, reduced social contacts, changes in the family setting, the presence of chronic disease, the cumulative effect of bad experiences and social stressors in life, is burdened by the higher rate of the disorder in terms of phobias and depression.

The impact of hearing loss on an individual cannot be easily measured in decibels, it is an individual experience that each individual faces depends on a number of factors: an early or late start of damage, gradual or sudden occurrence, severity of hearing loss, communication requirements, as well as characteristics of the persons Kaland and Salvatore [29]. Regardless of the combination of these factors it is indisputable bond of hearing loss with feelings of depression, anxiety, frustration, social isolation and stress. The problem with hearing in our patients with hearing loss were more likely related to the inability to understand speech and disrupted communication, which has a direct impact on adequate social

integration, while subjects with normal hearing emphasized the inability to concentrate, sleep disturbance, and withdrawal from social and emotional life. Negative emotional reactions and socio-situational constraints in subjects with hearing impairment noticed Monzani with his associates in 2008th, whose data match our work results, emphasizing greater incidence of mental disorders in persons with impaired hearing [30].

Our study showed that 70.7% of both groups reported symptoms of depression (mild, borderline, moderate depression) while dominating the group of patients with hearing loss. The principal methodological parameters and their correlation we have noticed that the categories of those with severe and profound hearing impairment are more prone to symptoms of depression than those with mild hearing loss, a trend of increased depressive symptoms according to increasing severity of tinnitus on a scale of self-assessment. Close relationship between tinnitus and comorbid psychological disorders noted by many authors, particularly high prevalence of depression, as well as the tendency of frequent manifestation of depressive disorders in persons with impaired hearing and tinnitus Martines [3] Depression in association with hearing loss and tinnitus is an entity of significant clinical severity.

Identification of the severity of the auditory sensations disorder, perception of psychological and mental status, preventing the possibility of overlooked diagnosis of depressive disorder and allows the selection of appropriate treatment methods. The best form of prevention of depression is its early detection, but it is in practice difficult primarily due to the incorrect evaluation of depression as "normal reactions to somatic disease", a superficial approach to the problems of the patient and the lack of knowledge of the impact of combining behavioral therapy in the treatment of the underlying disease. Patients' behavior in terms of symptoms that are disproportionate in relation to somatic illness, permanent focus on bodily symptoms may indicate the possible presence of mental disorder.

Conclusion

Proper therapeutic approach requires hearing evaluation of the respondents to determine audiometric parameters in the function of communication, social contacts and mental health, which should allow for proper consideration of the relative advantages and limitations of a particular therapeutic treatment options, or auditory rehabilitation. In order to maintain and improve the health of patients with disorders of auditory sensations (hearing loss, tinnitus), it is necessary for estimation of the subjective experience of hearing and tinnitus disability to be a leading parameter in the planning and monitoring of therapeutic treatment, prevention and early detection of mental disorders, which should introduce tests for the self-assessment of hearing loss and depression into clinical practice. The introduction of protocols of diagnosis and treatment of hearing loss and tinnitus with the aim of early detection, diagnosis, timely and continuous re / habilitation of hearing, educating people with hearing impairment to auditory function in order to overcome the stigma, increase well-being, emotional satisfaction and integration into society will enable the prevention

of depressive disorders and reducing disability.

Conflict of Interest

This study is part of a Ph.D. dissertation, which was defended in June 2013. Name Ph.D. dissertation: The impact of hearing impairment in the expression of depression, anxiety and quality of life of patients with tinnitus.

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