



Quality of Life: Hearing Loss and Cancer Treatment

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Abstract

Introduction: One of the negative impacts of hearing loss is communication difficulty, which favors isolation and depression. Cancer patients may also experience hearing loss as a result of antineoplastic treatment. Thus, the impact of hearing loss can be seen as other side effects on patients' quality of life (QOL). Assessing the QOL of cancer patients and those who have hearing loss allows us to understand the difficulties experienced by the subjects affected by both diseases.

Objective: Analyze the audiological findings and the quality of life of cancer and non-cancer patients.

Method: Anamnesis, application the QOL questionnaire (SF-36), meatoscopy and conventional tonal audiological evaluation were carried out in 68 volunteers of both genders. They were divided in two groups: Control Group (CG) (32 participants) and Oncological Group (OG) (36 participants). The CG was composed of subjects without a history of neoplasia and OG must have anatomopathological diagnosis of neoplasia with normal hearing thresholds before cancer treatment. For statistical analysis, the Student T and Mann Whitney tests were used with a fixed critical level of 5% ($P \geq 0.05$). Results: SF-36 analysis, there was a significant positive relationship between the GO and two domains: general health state and mental health. Subjects with hearing loss had worse score at mental health and the presence of tinnitus had had a positive relation to social and emotional aspects beyond pain. CG with hearing loss had a worse score in two domains: vitality and mental health. Furthermore, GO with hearing loss had an emotional limitation as the worst domain.

Conclusion: Hearing loss and cancer treatment affects QOL, and tinnitus is more devastating.

Keywords: Quality of life; Cancer; Hearing Loss; Tinnitus

Introduction

Hearing loss affects approximately 5% of the population worldwide, which is equivalent to 360 million people, many of whom need educational and social support as a result of this type of disability [1].

There are several negative effects related to hearing loss, for example, difficulty in oral communication, which impacts on the emotional and psychosocial contexts. Hearing-impaired people tend to social isolation because they are not able to carry out the communication process with family, friends, and co-workers. It is also known that even at the stage of diagnosis of the disease or rehabilitation, the individual

is stigmatized for having hearing loss or for using a hearing aid. Thus, the attitude of the person with hearing loss is to deny the problem or hide its existence. Thus, it is common to detect changes in the social identity of this population with a decrease in self-esteem [2].

The etiology of hearing loss is diverse, and the antineoplastic treatment is one of the factors that can trigger hearing changes in the oncology population. Besides, other systemic side effects are common to this type of therapy and can interfere negatively in the lives of patients and generate anxiety, depression, and isolation [3-6].

There is a tendency to worsen the quality of life of patients with hearing loss, especially those who do not use hearing aids. Also, some studies elucidate that subjects cured of cancer who presented hearing loss during the antineoplastic treatment showed a worsening in the quality of life regarding their social and physical aspects [7,8].

Therefore, it is known that both hearing loss and cancer can alter the quality of life of patients in social, emotional, educational, and family aspects. However, there is a need for further studies on the quality of life in these conditions, since this is a complex concept term. It depends on the individual perception related to the subject's position in society as well as on the relationship with cultural aspects and value systems regarding one's expectations, objectives, and concerns [4,9,10].

Therefore, the objective of the present study is to analyze the audiological findings and the quality of life of oncology and non-oncology patients.

Materials and Methods

This is a case-control, analytical, and observational study, based on Resolution 466/2012 of the National Health Council of the Ministry of Health for studies with human beings, and all ethical principles were followed. The research was approved by the Research Ethics Committee under the Ordinance number 2.801.792, and all participants signed a free and informed consent form, guaranteeing the right to withdraw from participation, confidentiality, and non-identification.

The convenience sampling had the participation of 68 adult subjects of both genders and was divided into two groups Control Group (CG) and Oncological Group (GO). Both groups were attended in public hospitals at Aracaju-SE (Brazil), in the audiology sector, under demand

Control Group (CG)

32 subjects with no history of neoplasia were included.

Oncological Group (OG)

36 subjects with an anatomopathological diagnosis of neoplasia who underwent radiotherapy and chemotherapy using cisplatin were included. Besides, it was necessary to present normal hearing thresholds before cancer treatment.

The exclusion criteria listed for both groups were: age over 60 years old (excluding individuals with hearing loss due to presbycusis), exposure to noise/acoustic trauma; a history of ear surgery and ear diseases prior to the neoplasia; metabolic changes (diabetes mellitus, high blood pressure, and dyslipidemia); performance of antineoplastic treatment

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Received: 11 September, 2020; Accepted: 21 September, 2020 Published: 19 October, 2020

prior to this research and obstruction of the external auditory canal.

The procedures applied in both groups were: audiological anamnesis, meatoscopy, pure tone audiometry, logoaudiometry, and application of the SF-36 Quality of Life questionnaire. In the audiological anamnesis of the CG, the data related to patient identification; main complaint; hearing health; signs and symptoms; past and current conditions (medication, surgery, history of deafness); professional activity and leisure; and use of hearing aids were collected.

The anamnesis of the OG aimed at obtaining data related to patient identification, previous history of the disease (time of the pathology finding, symptoms, type of neoplasia, treatment onset, time of drug use and/or radiotherapy sessions, among others) and hearing health (presence or absence of hearing complaints and previous otological history).

To evaluate the quality of life, the SF-36 questionnaire (Medical Outcomes Study 36 Item Short-Form Health Survey) was used in a reduced, translated, and validated version for Brazil [11]. It is a multidimensional questionnaire, consisting of 36 questions comprised of eight domains: functional capacity, physical aspects, pain, general health, vitality, social aspects, emotional aspects, and mental health. The evaluation of the results was made by assigning scores for each question, which were transformed on a scale from 0 to 100, where 0 corresponded to a worse quality of life and 100 to a better quality of life.

The anamnesis and the SF-36 questionnaire were applied individually in a quiet room. The researcher read the questionnaire aloud and the patient chose the answer that fit his profile. During the procedure, the influence of the researcher on the responses was avoided, with no pre-established time for answering the questions in order not to induce the research participant. The application of the two instruments was completed in approximately 15 minutes.

Meatoscopy was performed to inspect the external auditory canal. When the obstruction was detected, the patient was referred to the otorhinolaryngologist for evaluation and management. The equipment used was the Pocket Junior otoscope (mod 22840, WelchAllyn, USA).

For the auditory evaluation, conventional tonal audiometry and logoaudiometry procedures were performed in an acoustically treated booth with an Interacoustics audiometer (mod AD229b, Denmark, UK) with the use of a TDH 39 headset. The auditory thresholds were investigated in the inter-octave frequencies from 250 Hz to 8 kHz, air-conducted, and from 500 Hz to 4 kHz, bone-conducted. The normality criterion considered normal hearing thresholds when the values were less than or equal to 25 dB [12]. In logoaudiometry, only the Speech Reception Threshold was performed to confirm the tonal findings.

To perform the statistical analysis, the audiometric and quality of life data were processed with the SPSSW software version 20.0. The data classified as parametric were expressed as values of mean \pm standard deviation from the mean. For the comparison between the two groups, under the influence of a single variation factor, Student's t-test was performed. For the results classified as non-parametric, when comparing two groups, under the influence of a single variation factor, the Mann Whitney test was performed. Pearson and Spearman correlation tests were performed to assess the correlation between the dependent variable (quality of life) and the independent variables (hearing loss, study group, gender, and hearing complaints). The fixed critical level is 5% ($P \geq 0.05$) to admit a difference in means as statistically significant.

Results

The CG, composed of 32 subjects without an anatomopathological diagnosis of neoplasia, had a mean age of 51.56 (± 8.61) years, mostly female (81%). The OG counted on the presence of 36 subjects aged on an average of 45.86 (± 9.96) years, 77.5% of whom were female. When comparing ages between groups, it was found that the difference was not statistically significant ($p=0.122$; Student's t-test). For the OG, the most frequent types of cancer were breast (44.4%) followed by head and neck (25%). In the conventional tonal audiometry exam, of the total of participants, it was found that 30.83% presented hearing loss (figure 1). In the OG, 35.2% presented changes in hearing and 27% in the CG.

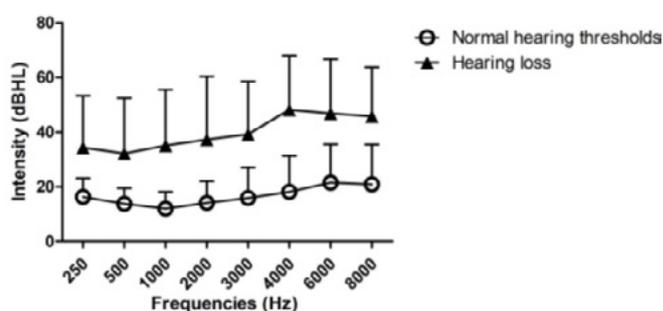


Figure 1: Hearing thresholds of subjects with and without hearing loss (n=92 ears with hearing loss, n=41 ears with normal hearing thresholds). dBHL: Decibel Hearing Level.

In the analysis of auditory thresholds regarding OG and CG, it was found that there was a statistically significant difference for the frequency of 4 kHz for OG, as described in (figure 2).

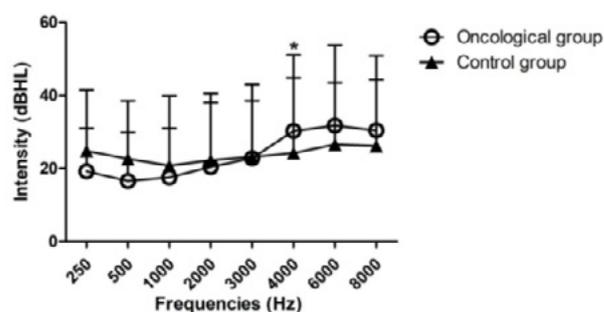


Figure 2: Effect of cancer treatment on hearing thresholds (n=70 oncology, n=63 control). Mann Whitney statistical analysis. Values expressed as mean (°) $p<0.05$ when compared to the CG. dBHL: Decibel Hearing Level

Tables 1 and 2 characterize the findings of the SF36 domains according to the factors: study group, report of the audiometric examination, and tinnitus. It was found that the OG has a worse state of general health and mental health when compared to the CG; that the subjects with hearing loss had more difficulties regarding mental health and that the presence of tinnitus interfered negatively in the aspects: pain, limitation due to emotional and social aspects.

		Fun Cap	p-valor	Lim Pa	p-value	Pain	p-value	Gen Health	p-value
Group	CG	63.47	0.316	43.19	0.209	51.19	0.737	64.72	0.062#
	OG	70.47		56.25		48.91		53.28	
Report	Hearing loss	69.6	0.529	48.2	0.872	49	0.784	60.08	0.857
	Normal hearing thresholds	65.12		50		50.77		58.91	
Tinnitus	Presence	64.23	0.411	46.28	0.499	43.21	0.019**	58	0.613
	Absence	70.17		53.45		59.41		61.14	

Funcional capacity (FunCap), Limitation due to physical aspects (LimPa), General health (GenHealth). (**) p < 0,01, (#) p with a tendency to be significant

Table 1: Characterization of the SF-36 domains according to the study groups, report of the audiometric examination and tinnitus (n=68, Statistical analysis: Student's t-test, values expressed as mean).

		Vital	P-value	Soc Asp	p-value	Lim Ea	p-value	Mental Health	p-value
Group	GC	47.94	0.238	68.89	0.635	58.36	0.397	58.5	0.089#
	GO	40.69		72.13		48.91		49.44	
Report	Hearing loss	40.04	0.263	71.76	0.752	41.32	0.09	46.96	0.025*
	Normal hearing thresholds	47.14		69.63		61.23		58.47	
Tinnitus	Presence	42.62	0.465	64.97	0.056#	43.56	0.027*	52.72	0.503
	Absence	47.1		77.72		67.83		56.28	

Vitality (Vital), Social aspects (SocAsp), Limitation by emocional aspects (LimEa). (°) p < 0,05, (#)p with a tendency to be significant

Table 2: Characterization of the SF-36 domains according to the study groups and report of the audiometric test and tinnitus (n=68, Statistical analysis: Student's t-test, values expressed as mean).

In the analysis of the SF-36 data regarding the quality of life of the OG and CG groups related to hearing loss, a statistically significant relationship was observed for the limitation domain due to emotional aspects of the OG with the presence of hearing loss, as described in table 3, with the other domains having no positive relationship

(functional capacity, limitation due to physical aspects, pain and general condition). For the CG, there was a difference that tended to be statistically significant for the domains of vitality and mental health in subjects with hearing loss (table 3).

		Vital	P-value	Soc Asp	p-value	Lim Ea	p-value	Mental Health	p-value
OG	Hearing loss	49.63	0.811	66.09	0.695	33.36	0.040*	52.18	0.289
	Normal hearing thresholds	47.2		70.12		69.36		61.28	
CG	Hearing loss	32.5	0.083#	76.21	0.441	47.57	0.89	42.86	0.087#
	Normal hearing thresholds	47.06		68.94		49.94		54.56	

Vitality (Vital), Social aspects (SocAsp), Limitation by emocional aspects (LimEa). (°) p < 0,01, (#) p with a tendency to be significant

Table 3: Characterization of the SF-36 domains according to the study groups related to the audiological report (normal thresholds and hearing loss), (n=68, Statistical analysis: Student's t-test, values expressed as mean).

Discussion

There was a higher incidence of females in the present study and this data stems from the greater concern of women with health since the active search for care and health services is more common among the female population. There is evidence that women seek health services 1.9 times more when compared to the male population [13].

In the present study, 20.9% of the subjects were male, with a mean age of 50.57 years old. Such data are consistent with the literature since men tend to make regular visits to the doctor less frequently than women, and the demand is greater in the 50-59 age groups [14].

In the OG there was a higher incidence of breast cancer, and this type of cancer in the female population ranks first in all Brazilian regions, without considering non-melanoma skin tumors. INCA estimates 66,280 new cases of breast cancer with a risk of 61.61 cases per 100,000 women for the years 2020/2022. Studies related to the prevalence of breast cancer in women in developed countries also point out this type of tumor as the most common in the female population [15,16].

Head and neck cancer was the most prevalent in the male population. This data is also described in literature since men have a high incidence of this type of tumor. One of the etiological factors reported in the literature is tobacco consumption, which despite the significant reduction in recent years, is still considered one of the main causes of this type of cancer [17,18].

The mean age for cancer patients was 45.86 years, and these data are not consistent with the literature since the most affected age group is 60 years. The elderly are more likely to develop cancer, since increasing age generates a greater predisposition to exposure to endogenous and exogenous agents, with the accumulation of mutations that damage the DNA throughout life. However, studies report that, in the younger population, the appearance may be directly associated with factors such as social, economic, hormonal, reproductive, and dietary effects [19-21].

Hearing loss is common in the oncology population due to the toxic substances present in antineoplastic drugs. In the present study, it was observed that approximately 35% of the oncological population had sensorineural hearing loss, and the literature elucidates the presence of hearing loss in 40 to 80% of patients treated with cisplatin [22].

In the analysis of the auditory thresholds of the OG, it was found a hearing decrease in the frequency of 4 kHz of the sensorineural type. It is also observed that the hearing changes resulting from the use of cisplatin are due to the accumulation of the drug in the vascular streak of the inner ear, which explains the neurosensory alteration [22]. Besides, there is a consensus in the literature that hearing loss due to ototoxicity initially affects high frequencies, starting at 4 KHz, with significant impairment in high frequencies. This fact results from the lesion being initially in the basal portion of the cochlea which, as a result of the evolution of the lesion can affect the apical portion, hinders medium and low frequencies in a lesser proportion than the high ones [5,23]. Such effects are also reported with the combined use of cisplatin and radiation in subjects with head and neck cancer [24,25].

Studies related to the quality of life use questionnaires and this research used the SF-36, which is applied worldwide on a large scale. There are several studied diseases regarding this aspect, but the one that stands out is cancer since the researches show emotional difficulties regarding diagnosis, treatment, and future life prospects. Therefore, it

was observed in the present study that the general health domain had worse scores for OG, when compared to CG, with a tendency for the difference to be statistically significant. Such data are in accordance with the literature since cancer treatment presents side effects such as lack of appetite, vomiting, fatigue, pain, constipation, sleep disorders, and among others that can negatively influence systemic physiological functioning [26-28].

Tinnitus, in the present study, was reported by more than 50% of the participants in both study groups (OG and CG). It is known that this is a complaint, which is not necessarily associated with hearing loss, so it can be present in normal-hearing individuals [29,30]. However, this is also a complaint due to cancer treatment, and it is most often associated with hearing loss in patients undergoing chemotherapy since the drug substances are neurotoxic [31].

It appears that the presence of tinnitus was the factor that presented the worst quality of life regarding other variables of the study, significantly affecting the domains of social, emotional, and pain aspects.

The positive relationship between tinnitus and pain corroborates the findings in the scientific community since subjects with tinnitus reported the presence of neck pain [32]. Studies still report the existence of pain in this population, since the subjects underwent physical therapy and presented significant reports of tinnitus [33]. Furthermore, the authors also report that tinnitus may be present in subjects with dysfunction of the mandibular temporal joint, thus complaining of tinnitus pain, which is known as somatosensory tinnitus [29,34].

The SF-36, regarding the domain of emotional aspects, presented a significant relationship with the presence of tinnitus. Studies in the area report the presence of depression and anxiety in subjects with tinnitus, which is in line with the findings of the present study [35]. Tinnitus is characterized by an abnormality of the central nervous system, with a high rate of spontaneous neural firing as well as increased neural synchronism. It has no treatment or a curative effect for this disease and only 20% of the population seeks health services to treat this condition [36]. There are reports in the literature of the intimate relationship between tinnitus and psychiatric disorders, which can lead one to commit suicide [37].

The data related to hearing loss showed that the subjects with hearing loss presented a worse performance for the mental health domain when compared to the group with normal hearing thresholds. Such findings are corroborated by the literature since subjects with hearing loss report a greater chance of having confusion and memory loss, as well as general worsening in health [38]. Accordingly, there are reports of depression and anxiety, as well as decreased quality of life in subjects with hearing loss [39]. The literature reports that there is a relationship between the degree of hearing loss and the worsening of quality of life, however, in the present study, the hearing loss occurred predominantly in high frequencies, which do not affect human communication. Perhaps this was a factor that explains good health in general [40,41]. However, some authors report that hearing loss self-perception does not depend on the degree of hearing loss, and the quality of life does not depend on the degree of hearing impairment [42].

The present study investigated the relationship between hearing loss and two study groups (OG and CG). It was found that the subjects of the OG with hearing loss presented a worse quality of life regarding emotional aspects, and these data are in line with the literature since

cancer patients and those with hearing loss suffer from depression and anxiety [26, 39]. On the other hand, studies related only to the oncological group have elucidated that the stress related to the disease negatively affects the patient's mental health and not the emotional aspects [43].

In the CG, the data tend to be significant for the domains of vitality and mental health in subjects who presented hearing loss. The literature reports that the association of mental problems with hearing loss is common, and the subject may develop psychiatric problems, which requires intervention to improve the quality of life of patients with hearing loss. Besides, studies still report that hearing loss acquired in childhood can lead to a decline in mental health in adulthood, which is accompanied by depression, anxiety, and decreased self-esteem [44,45]. Regarding vitality, the literature corroborates the findings of the present research, which is a domain that has lower scores when compared to the control group [46]. However, studies with the same theme elucidate that the vitality domain, focused on the emotional issue, is reduced in the elderly population [47].

Quality of life is a complex term that needs more study. Therefore, the present research has some limitations, such as focusing on findings related to hearing loss and even in its relationship in individuals undergoing antineoplastic treatment. Furthermore, there are also difficulties in the size of the sample, since the subjects with hearing loss have a hard time accepting their own disease – the same for the oncology population, which often hinders the research possibilities of this population, limiting the number of researched subjects.

Conclusion

It was concluded that the OG had a worse performance in the domains of general and mental health and that subjects with hearing loss presented worse scores for mental health. It was also observed that the presence of tinnitus was the factor that most negatively interfered with the quality of life of patients, relating to the pain, limitation by emotional and social aspects domains. Besides, it was found that hearing loss in the CG had a worse score for the vitality and mental health domains. In OG with hearing impairment, we observed a positive relationship for limitation due to emotional aspects.

References

1. Privado J, Carrasco L, Durán R (2019) Hearing loss: Stigma consciousness, quality of life and social identity. *Span J Psychol* 22:22.
2. Barker AB, Leighton P, Ferguson MA (2017) Coping together with hearing loss: A qualitative meta-synthesis of the psychosocial experiences of people with hearing loss and their communication partners. *Int J Audiol* 297-305.
3. Coolbrandt A, Dierckx de Casterlé B, Wildiers H, Aertgeerts B, Van der Elst E, et al. (2016) Dealing with chemotherapy-related symptoms at home: A qualitative study in adult patients with cancer. *Eur J Cancer Care* 25:79-92.
4. Gil F, Costa G, Hilker I, Benito L (2012) First anxiety, afterwards depression: Psychological distress in cancer patients at diagnosis and after medical treatment. *Stress Heal* 28:362-7.
5. Landier W (2016) Ototoxicity and cancer therapy. *Cancer*. 122:1647-58.
6. Waissbluth S, Del Valle Á, Chuang A, Becker A (2018) Incidence and associated risk factors for platinum-induced ototoxicity in pediatric patients. *Int J Pediatr Otorhinolaryngol* 111:174-9.
7. Weiss A, Sommer G, Schindera C, Wengenroth L, Karow A, et al. (2019) Hearing loss and quality of life in survivors of paediatric CNS tumours and other cancers. *Qual Life Res* 28:515-21.
8. Hyams AV, Hay-McCutcheon M, Scogin F (2018) Hearing and quality of life in older adults. *J Clin Psychol* 74:1874-83.
9. Haraldstad K, Wahl A, Andenæs R, Andersen JR, Andersen MH, et al. (2019) A systematic review of quality of life research in medicine and health sciences. *Qual Life Res* 28:2641-50.
10. Roland L, Fischer C, Tran K, Rachakonda T, Kallogjeri D (2016) Quality of Life in Children with Hearing Impairment. *Otolaryngol Head Neck Surg* 208-19.
11. Ciconelli RM, Ferraz MB, Santos W, Meinão I, Quaresma MR (1999) Brazilian-Portuguese version of the SF-36. A reliable and valid quality of life outcome measure. *Rev Bras. Reum.* 39:143-50.
12. Silman S, Silverman C Basic (1997) *Audiology Testing In: Silman S, Silverman C Auditory Diagnosis: Principles and Applications*. San Diego: Singular Publishing Group 10-65.
13. Levorato CD, Mello LM, Silva AS, Nunes AA (2014) Fatores associados à procura por serviços de saúde numa perspectiva relacional de gênero. *Ciênc Saúde Colet* 19:1263-74.
14. Arruda GO, Mathias TAF, Marcon SS (2017) Prevalência e fatores associados à utilização de serviços públicos de saúde por homens adultos. *Ciênc Saúde Colet* 22:279-90.
15. Instituto Nacional de Câncer José Alencar Gomes da Silva. *Estimativa 2020: Incidência de câncer no Brasil*. Instituto. Rio de Janeiro: Ministério da Saúde; 2019.
16. Bray F, Jemal A, Grey N, Ferlay J, Forman D (2012) Global cancer transitions according to the Human Development Index (2008-2030): A population-based study. *Lancet Oncol* 13:790-801.
17. Galbiatti ALS, Padovani-Junior JA, Maníglia JV, Rodrigues CDS, Pavarino ÉC, (2013) Head and neck cancer: Causes, prevention and treatment. *Braz J Otorhinolaryngol* 79:239-47.
18. Malta DC, Stopa SR, Santos MAS, Andrade SSCA, Oliveira TP, et al. (2017) Evolução de indicadores do tabagismo segundo inquéritos de telefone, 2006-2014. *Cad. Saude Publica.* 33:S162-73.
19. Fidler MM, Gupta S, Soerjomataram I, Ferlay J, Steliarova-Foucher E, et al. (2017) Cancer incidence and mortality among young adults aged 20-39 years worldwide in 2012: A population-based study. *Lancet Oncol* 18:1579-89.
20. DePinho RA (2009) The age of cancer. *Nature* 408:248-54.
21. Lin HN, Gu XY, Zhang SW, Zeng HM, Wei WW, et al. (2018) Analysis on incidence and mean age at diagnosis for Global Cancer. *Zhonghua Zhong Liu Za Zhi* 40:543-9.
22. Breglio AM, Rusheen AE, Shide ED, Fernandez KA, Spielbauer KK, et al. (2017) Cisplatin is retained in the cochlea indefinitely following chemotherapy. *Nat Commun* 8:1654.
23. Paken J, Govender CD, Pillay M, Sewram V (2016) Cisplatin-Associated Ototoxicity: A Review for the Health Professional. *J*

- Toxicol 1-13.
24. Niemensivu R, Saarilahti K, Ylikoski J, Aarnisalo A, Mäkitie AA (2016) Hearing and tinnitus in head and neck cancer patients after chemoradiotherapy. *Eur Arch Otorhinolaryngol* 273:2509-14.
 25. Shorter P, Harden F, Owen R, Panizza B, Burmeister B, et al. (2017) Risk profiles for sensorineural hearing loss in patients with head and neck cancer receiving cisplatin-based chemoradiation. *J Med Imaging Radiat Sci* 48:61-7.
 26. Linden W, Vodermaier A, MacKenzie R, Greig D (2012) Anxiety and depression after cancer diagnosis: Prevalence rates by cancer type, gender, and age. *J Affect Disord* 141:343-51.
 27. Haraldstad K, Wahl A, Andenæs R, Andersen JR, Andersen MH, et al. (2019) A systematic review of quality of life research in medicine and health sciences. *Qual Life Res* 28:2641-50.
 28. Rha SY, Lee J (2017) Symptom clusters during palliative chemotherapy and their influence on functioning and quality of life. *Support Care Cancer* 25:1519-27.
 29. Ralli M, Altissimi G, Turchetta R, Mazzei F, Salviati M, et al. (2016) Somatosensory tinnitus: Correlation between cranio-cervico-mandibular disorder history and somatic modulation. *Audiol Neurotol* 21:372-82.
 30. Mores JT, Bozza A, Magni C, Casali RL, Amaral MIR. (2019) Perfil clínico e implicações do zumbido em indivíduos com e sem perda auditiva. *CoDAS*. 31:e20180029.
 31. Miaskowski C, Paul SM, Mastick J, Schumacher M, Conley YP, et al. (2018) Hearing loss and tinnitus in survivors with chemotherapy-induced neuropathy. *Eur J Oncol Nurs* 32:1-11.
 32. Lee HY, Kim SJ, Chang DS, Shin SA (2019) Tinnitus in the side with better hearing. *Am J Otolaryngol* 40:400-3.
 33. Michiels S, Van de Heyning P, Truijten S, Halleman A, De Hertogh W (2016) Does multi-modal cervical physical therapy improve tinnitus in patients with cervicogenic somatic tinnitus? *Man Ther* 26:125-31.
 34. Ralli M, Greco A, Turchetta R, Altissimi G, de Vincentiis M, et al. (2017) Somatosensory tinnitus: Current evidence and future perspectives. *J Int Med Res* 45:933-47.
 35. Kehrlé HM, Sampaio ALL, Granjeiro RC, de Oliveira TS, Oliveira CACP. (2016) Tinnitus Annoyance in Normal-Hearing Individuals. *Ann Otol Rhinol Laryngol* 125:185-94.
 36. Tang D, Li H, Chen L (2019) Advances in understanding, diagnosis, and treatment of tinnitus. *Adv Exp Med Biol* 1130:109-28.
 37. Szibor A, Mäkitie A, Aarnisalo AA (2019) Tinnitus and suicide: An unresolved relation. *Audiol Res* 9:222.
 38. Marrone N, Ingram M, Bischoff K, Burgen E, Carvajal SC, et al. (2019) Self-reported hearing difficulty and its association with general, cognitive, and psychosocial health in the state of Arizona. *BMC Public Health* 19:875.
 39. Cieśla K, Lewandowska M, Skarżyński H (2016) Health-related quality of life and mental distress in patients with partial deafness: Preliminary findings. *Eur Arch Otorhinolaryngol* 273:767-76.
 40. Simpson A, Simpson K, Dubno JR (2015) Health-related quality of life in older adults: Effects of hearing loss and common chronic conditions. *Heal Aging Res* 4:1-11.
 41. Tsimpida D, Kaitelidou D, Galanis P (2018) Determinants of health-related quality of life (HRQoL) among deaf and hard of hearing adults in Greece: A cross-sectional study. *Arch Public Heal* 76:1-11.
 42. Pugh K, Crandell C (2002) Hearing loss, hearing handicap, and functional health status between african american and caucasian american seniors. *J Am Acad Audiol* 13:493-502.
 43. Bouskill K, Kramer M (2016) The impact of cancer and quality of life among long-term survivors of breast cancer in Austria. *Support Care Cancer* 24:4705-12.
 44. Idstad M, Tambs K, Aarhus L, Engdahl BL (2019) Childhood sensorineural hearing loss and adult mental health up to 43 years later: Results from the HUNT study. *BMC Public Health* 19:168.
 45. Blazer DG, Tucci DL (2019) Hearing loss and psychiatric disorders: A review. *Psychol Med* 49:891-7.
 46. Sano H, Okamoto M, Ohhashi K, Iwasaki S, Ogawa K (2013) Quality of life reported by patients with idiopathic sudden sensorineural hearing loss. *Otol Neurotol* 36-40.
 47. Contrera KJ, Betz J, Deal JA, Choi JS, Ayonayon HN, et al. (2016) Association of hearing impairment and emotional vitality in older adults. *J Gerontol B Psychol Sci Soc Sci* 400-4.

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