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Multivariate Analysis of Risk Factors Applied to the Study of Induced Hearing Loss due to Occupational Noise in the Industry

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Abstract

Background: Noise-induced hearing loss (NIHL) impacts on about 20

Index terms— perception; noise; exposure; nihl; risk; hearing loss.

1 Introduction

pproximately 30 million workers are exposed daily to high levels of sound pressure in the United States only, with the potential for real damage to health. ?? Loss hearing induced by high levels of sound pressure is the second cause of occupational disease. 2 In 2006, only in Norway, of 3392 cases of occupational diseases reported to the government, about 59% were related to noise-induced hearing loss. 3 Checking occupational diseases most incident in Mongolia was observed the predominance of noiseinduced hearing loss, a phenomenon associated with the rapid industrialization that occurred in that country. 4 The magnitude of hearing loss would be a direct result of excessive exposure to noise, thus being dependent on several factors, among them those associated with exposure and related to the characteristics of the individual: sound pressure level (SPL), duration of exposure, type and frequency of the noise, susceptibility to damage by noise, age, history of hearing loss. 5 Models relating labor hearing loss to the behavioral of workers, named Health Promotion Model, analyze modifying factors (behavioral characteristics) and cognitive-perceptual factors (such as perceived benefits and self-efficacy). 6 The authors indicate that this and other developed models, allow them to infer that workers must be aware of the risk of noise-induced hearing loss (NIHL), and that they can do something to prevent of this disease.

In a survey that took as sample a group of researchers in this area of occupational health and safety, noted that the notion of risk perception is socially constructed variable, being influenced by the nature of labor relations; valuesin society and individual events. 7 Although there are some publications on occupational noise exposure, the analysis of the individual perception of the worker and its implications on his behavior remains a poorly discussed subject. Moreover, the approaches verified relating the understanding of the behavioral phenomenon to the exposure to occupational noise, need more analysis and the support of quantitative approaches of main humans factors relacteds to NIHL. This paper aims to use the technique of factor analysis as a tool for examining the variable noise-induced hearing loss, to propose actions that may contribute to the prevention and anticipation of mitigating the risk of the exposed worker.

2 a) Theoretical Research

For development of the theoretical research, there was conducted a literature search of indexed journals, seeking to identify main studies conducted in the identification of variables related to the development of noise-induced hearing loss.

The research showed that the variables related to the development of NIHL would be influenced by a lot of factors related to the individual, as well as by the social and cultural organizational system, as shown in Table 1.

Source: The author. For this research, a sustained quantitative methodology for factor analysis technique was developed, and a statistical model was adjusted to support the conceptual model.The proposed conceptual model, as shown in Figure1, is structured on the adaptation of similar models of other authors who also researched on this topic. 10,39,40 The self-administered questionnaires comprise the most frequently indicated version. 41 During filling, someone was available to assist in understanding the instrument, ensuring that no questions were left blank.X X X X X X X X X 9 X X X X X 10 X X X X X X X X X X 11 X X X X X X X 12 X X 13 X X X X X X X X 14 X X X X X X X X X X 15 X X X X X X X X X X X X X X 16 X X X X X X X X X X X 17 X X X

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In research on the influence of the perception of employees on the effects of occupational health hazards was also used as an instrument of data collection a questionnaire then generating similar analysis, with the objective of further reducing the dimensionality of the data. The analysis was useful for the planning of health promotion campaigns and prioritization of other interventions. 42 The initial questionnaire aimed to characterize the individual risk perception, consisting of questions divided into the following sections: worker´s identification (name, workplace, age, sex, marital status and education), individual risk perception and perception of noise effects, expectation and appreciation of the results of use of PPE, barriers, safety culture and risk behavior.

The second questionnaire intended to characterize the noise exposure and the use of PPE, having questions grouped into the following sections: risk exposure, exposure to ototoxic chemicals, family history of hearing loss, training in occupational health and safety/hearing loss/use of PPE, comfort, and use of PPE and audiometry.

The evaluation instrument used the Likert fivelevel scale, from ”strongly agree” to ”strongly disagree.” After filling in all the 278 questionnaires, responses were converted into numbers, according to the scale, and tabulated in a spreadsheet. The answers were coded on scales from 1 (strongly disagree) to 5 (strongly agree). In some cases, the use of inverted scale was necessary, for example, for questions about barriers, physical load, and risk behavior.

In a second stage, through the environmental noise assessment of each work micro-area of all evaluated employees, was possible the characterization of daily personal exposure level. The evaluated employees were still undergoing tonal audiometric examination by ISO 8253.1 standard.

In a third stage, the model was tested and validated through multivariate statistical analysis which took into account, in addition to the construct (the development of NIHL), dependent subconstructs: risk perception; perception of effects; risk behavior and use of PPE.

Because of this study include more than two dependents subconstructs, will be used the technique of multiple regression analysis (MRA), which, using dependent subconstructs whose values are known, allows predicting a single subconstruct independently Source: The author. Year 2019 G selected. 43 Equation 1 presents the MRA adopted in this article, which aimed to: 1) maximize the overall power prediction of a group of independent subconstructs as representatives of a composition;

2) to compare two or more groups of independent subconstructs regarding the predictive power of each factor.Y 1 =? 0 + ? 1 X 1 + ? 2 X 2 + ?+? m X m +? Equation 1

where Y1: Dependent subconstruct or criterion; Xi: Independent subconstructs or predictor; ? i : Regression coefficients; ?: Associated error;

The path analysis is an essential resource of multivariate statistics, allowing correlations between characters are split into direct and indirect effects, measuring the influence of a variable, independent of the other, on the other.

Path analysis was used to proof the conceptual model. Following the results of this analysis, the corresponding path diagram was established, as the summary presented in Figure 3. Statistical analysis was performed using IBM SPSS.

3 III.

4 Results

Using the alpha (?) of Cronbach, it was possible to test the internal reliability, allowing a decrease up to 37,5% of the items. Thus, from the starting 74 questions, the technique applied in this questionnaire allowed to shorten it down to only 61 questions.

223 of the 278 employees evaluated in the sample were male and 55 were female, 147 had completed high school, 73 had incomplete graduation, and 44 had completed graduation. The estimated average hearing losses versus age, in the sample, may be observed in Figure 2, where the increase of hearing loss due to the aging of the population, by presbycusis, can be evidenced. The questionnaire also asked about the period of use and comfort of hearing protection equipment, aiming to quantify the subconstruct Use of PPE, in this case particularly the hearing protector was considereddue to the focus of the study on NIHL. As provided in table 5, of 278 evaluated employees, the vast majority -261 -reported using such equipment, and on average used their hearing protectors around 90% of the journey. The standard deviation was close to 18 points, featuring a small oscillation of the answers.

From 261 people who reported using hearing protection, there was a divergence of habits between the sexes of 4% of usage time and 6% in the proportion. Chi-square test for equality has the value of 0,0976. Threshold for rejecting the hypothesis of equality at the 5% value is 3,84, one cannot drop the hypothesis of no difference between men and women in the PPE use.

5 a) Statistical Analysis

6 G

Through the Pearson correlation coefficient matrix, shown in Table **??**, it was possible to analyze the correlation between the subconstructs inspect.

The correlation shows the linear relationship between two variables, where values will always be between -1 and +1. The sign indicates the direction and the size of the variable specify the strength of the correlation. An amount above 0,7 module is a strong correlation. Thus, variables with a rejected hypothesis of null relation at 5% level were considered significantly correlated.

Source: The author.

Table **??**: Matrix of Pearson correlation coefficients between subconstructs Thus, considering the above, the research screen in this study uses the multivariate analysis of multiple regression analysis (MRA) data, using the data generated by the questionnaires. Five equations of multiple linear regressions were adjusted, with the After, the technique of path analysis was used, as the summary presented in Figure 3. This diagram symbolizes paths for subconstructs evaluated. Source: The author. IV.

7 Discussion

8 Table 4 shows the following results: a) Risk Behavior

The study of the factor related to Risk Behavior of the sample has small effect on the development of hearing loss (0,013), where this parameter totally contemplates the indirect consequence arising from the interaction with the subconstruct Perception of Effects. This parameter may be positive, i.e., the higher the irresponsible behavior that puts the employee at risk of acquiring irreversible lesion in his auditory system, more significant these attenuations are. The Safety Culture, which contains only the direct component (0,099), presents a significant contribution to the construct parameter. As a positive value, it oddly reflects that the higher the presence of safe work procedures, the higher the level of hearing loss encountered. Perhaps this positive effect is justified by the conjuncture of the companies evaluated, which hada history of compromising workers' hearing and therefore implemented hearing conservation policies, such as HCP (Hearing Conservation Program).

9 c) Formation

The study of formation did not contribute to the model since it presented no direct or indirect components in this evaluation.

As for the characterization of this factor, we used questions to prior knowledge of the interviewee in areas such as safety and hygiene, as well as any previous training in the prevention of noise-induced hearing loss and about the correct use of earplugs and muffs.

10 d) Sex

The factor that symbolizes the worker´s Sex has presented a significant value (-0,102), with a negative sign and contributed predominantly by the direct effect (-0,094) and the remainder coming from the indirect reaction through subconstruct Risk Index (-0,008). Its negative sign indicates that hearing loss tends to be lower in females and higher in the male sex, a fact which goes against table 7 (PPE use by sex).

Regarding the sex distribution in the study sample, the vast majority of workers were male, a common factor in the industrial sector, and that may contribute to explain the results. I am giving a strong tendency for a higher incidence of hearing loss among females, when compared to the same sample of males.

11 e) Age

The Age factor presents the highest of values (0,321), originated mostly by the direct effect (0,258) by the reaction of subconstructs Safety Culture, Risk Index, and Perception of Effects. It is of positive module, means that the higher the age of the employee, the greater is his degree of hearing loss. In this subconstruct study, the SPSS software used for the multiple linear regression automatically excluded the subconstruct Safety Culture, which seemed initially to collaborate indirectly to the composition of the factor.

12 f) Risk Index

The Risk Index also contributes to the study of the components associated with occupational hearing loss, presenting a significant factor (0,136), with the direct and indirect effects (influenced by factors Age and Sex) having same values: 0,063. This parameter is related to the sound pressure level at work (dB), with the noise exposure time (years). The higher this indicator, the greater the average hearing loss of the worker.

13 g) Risk Perception h) Perception of Effects

Regarding the Perception of Effects factor, there is a significant level (0,128) of participation, with a serious part being of direct effect (0,092) and the remainder (0,036) coming from the indirect interaction with the Age

factor. As a positive number, it indicates that the higher the degree of perception of negative health effects for occupational noise, the higher is the degree of hearing attenuation.

14 i) Chemicals Ototoxic Drugs

The impact study of Chemicals Ototoxic Drugs factor provides one of the lowest factors (0,014) of this model. Derived exclusively from indirect effects, it operates through the variables Age and Risk Index. As a positive value, it symbolizes the larger presence of these agents that are proven harmful to human hearing, the higher the occurrence of hearing loss of employees.

15 j) Use of PPE

Finally, the impact study of the Use of PPE provides a discrete factor (-0,018) in this model. Coming exclusively from indirect effects, it operates through the variables Perception of Effects and Safety Culture. Negative value symbolizes the higher use of hearing protection devices -provided by the company to workers, the lower will be the occurrence of hearing loss in employees.

V.

16 Conclusions

Multivariate analysis was adequate and essential in the study of risk factors associated with occupational noise-induced hearing loss in the industry. There is a need for research on risk perception and mitigation strategies in the context of noise-induced hearing loss. Such is found tied to the increased probability of occurrence associated with the risk factors identified in the study. The development of risk management strategies to reduce NIHL requires both knowledge of the physical environment, and the social, psychological and economic processes that can affect

The Risk Perception presents only one discrete factor (-0,030) of indirect effect arising from variables Age and Gender. As a negative number, it indicates the serious sensitivity of the employee against the risk of hearing loss, the lower will be the harm to the employee´s auditory system. The results collaborate to the trend that, the higher the perceived risk is (specifically through dimensions: Identification of risk sources, Knowledge about the noise, Perception of the efficiency of PPE and Means of protection), the smaller will be the chances of damaging the employee´s hearing.

people's responses to environmental conditions of danger.

Noise-induced hearing loss (NIHL) is a cumulative, insidious disease that grows over the years of exposure to noise associated with the workplacecausing damage to organ of Corti, usually bilateral, with progressive and irreversible loss and symptoms such as hearing loss, tinnitus, ear fullness, ear pain, dizziness, transient changes in blood pressure, stress, vision and mood disturbances, directly related to the exposure time, with sound pressure levels (SPL) and individual susceptibility.

NIHL is caused by any exposure to a daily average of 85dB, for several years. Noise is responsible for about 20% of global hearing loss, including being the second leading cause of the occupational disease that affects more American workers.

In an attempt to investigate the variables that impact on noise induced hearing loss, an analysis was developed taking into account the independent variable hearing loss, related to the variables dependent on metrics: Perceived Effects, Age, Risk Index, Culture of Safety and Sex.

In order to predict any changes in the dependent variables -due to changes in the independent variable. The statistical analysis was applied to identify the latent dimensions of significant effect on the variable in the analysis of known risk factors, such as: Risk Behavior, Culture Security, Education, Sex, Age, Risk Index, Risk Perception, Perceived Effects, Chemical Substances, Ototoxic Drugs and Use of PPE.

To test these associations were used Pearson correlation coefficient and multiple linear regression on the subconstructs identified. Through path analysis, was performed a factor analysis of direct and indirect factors related to NIHL effects.

In this context, the present study examined the possible approaches that relate to understanding the exposure to noise risk in the workplace.

The study enabled us to verify that Hearing Conservation Programs (PCA), and other campaigns, to be developed by companies, particularly in the industrial field, are based on modifiable factors identified. Thus, promoting actions that encourage the expansion of perception of the effects of hearing loss induced by occupational noise, will contribute to the prevention of the risk to workers' health.

The path analysis showed how the exceptional impact variable on hearing loss, both direct and indirect effects aspect, the Age variable -demonstrating the effect of natural hearing loss related to agingpresbycusis. At the other extreme, the dependent minor indirect effect were variable Chemicals Ototoxic drugs.

According to the results obtained in the present study, the individual perception of the risk of job exposure to noise is an important issue with regard to safe behavior, in particular, to avoid the involvement of occupational hearing loss by noise in the industry. Workers seem to avoid exposure to noise based on their perceptions of the risk. Unfortunately, it appears that they are bad appraisers this risk.

Finally, other investigations may complement the study performed here. As this research was limited to the study of continuous or intermittent noise found in industrial environments surveyed, further research can evaluate the work environment whose employees are subject to impact noise. [1]

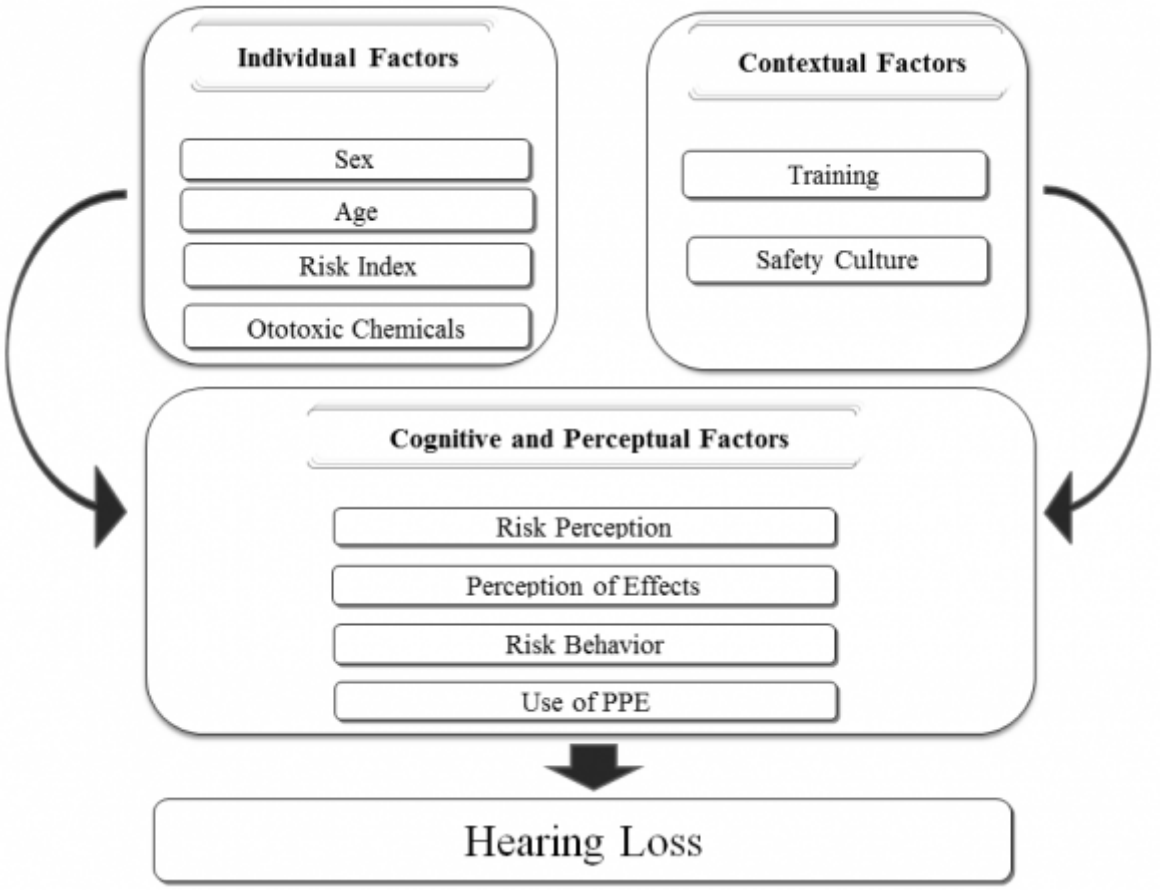

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Figure 1: Figure 1 :

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Correlations

Subconstructs		Sex	Age	Risk Index	Ototoxic Chemicals	Training	Safety Culture	Risk Perception	Perception of Effects	Risk Behavior	Use of PPE	Hearing Loss
Sex	Pearson Correlation	1	-,062	-,142*	,011	,032	,010	-,213**	-,082	-,028	,093	-,126*
	Sig. (2-tailed)		,314	,021	,865	,602	,872	,000	,183	,648	,145	,041
	N	264	264	264	264	264	264	264	264	264	248	264
Age	Pearson Correlation	-,062	1	,428**	,142*	-,012	,251**	-,203**	,165**	-,034	-,116	,330**
	Sig. (2-tailed)	,314		,000	,021	,841	,000	,001	,007	,587	,067	,000
	N	264	264	264	264	264	264	264	264	264	248	264
Risk Index	Pearson Correlation	-,142*	,428**	1	,263**	,108	0,0248	0,0521	0,072	-,071	,018	,195**
	Sig. (2-tailed)	,021	3,4E-13		,000	,080	,688	,399	,245	,251	,775	,001
	N	264	264	264	264	264	264	264	264	264	248	264
Ototoxic Chemicals	Pearson Correlation	,011	,142*	,263**	1	,099	,054	-,069	,014	,007	,040	,068
	Sig. (2-tailed)	,865	,021	,000		,110	,383	,265	,816	,904	,533	,268
	N	264	264	264	264	264	264	264	264	264	248	264
Training	Pearson Correlation	,032	-,012	,108	,099	1	,058	,164**	-,102	-,153*	-,004	-,010
	Sig. (2-tailed)	,602	,841	,080	,110		,344	,007	,098	,013	,956	,877
	N	264	264	264	264	264	264	264	264	264	248	264
Safety Culture	Pearson Correlation	,010	,251**	,025	,054	,058	1	-,091	-,103	,047	-,136*	,154*
	Sig. (2-tailed)	,872	,000	,688	,383	,344		,141	,096	,445	,033	,012
	N	264	264	264	264	264	264	264	264	264	248	264
Risk Perception	Pearson Correlation	-,213**	-,203**	,052	-,069	,164**	-,091	1	-,092	-,129*	,200**	,026
	Sig. (2-tailed)	,000	,001	,399	,265	,007	,141		,134	,036	,002	,669
	N	264	264	264	264	264	264	264	264	264	248	264
Perception of Effects	Pearson Correlation	-,082	,165**	,072	,014	-,102	-,103	-,092	1	,185**	-,125*	,136*
	Sig. (2-tailed)	,183	,007	,245	,816	,098	,096	,134		,003	,050	,027
	N	264	264	264	264	264	264	264	264	264	248	264
Risk Behavior	Pearson Correlation	-,028	-,034	-,071	,007	-,153*	,047	-,129*	,185**	1	-,158*	,015
	Sig. (2-tailed)	,648	,587	,251	,904	,013	,445	,036	,003		,013	,814
	N	264	264	264	264	264	264	264	264	264	248	264
Use of PPE	Pearson Correlation	,093	-,116	,018	,040	-,004	-,136*	,200**	-,125*	-,158*	1	-,049
	Sig. (2-tailed)	,145	,067	,775	,533	,956	,033	,002	,050	,013		,438
	N	248	248	248	248	248	248	248	248	248	248	248
Hearing Loss	Pearson Correlation	-,126*	,330**	,195**	,068	-,010	,154*	,026	,136*	,015	-,049	1
	Sig. (2-tailed)	,041	,000	,001	,268	,877	,012	,669	,027	,814	,438	
	N	264	264	264	264	264	264	264	264	264	248	264

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 2:

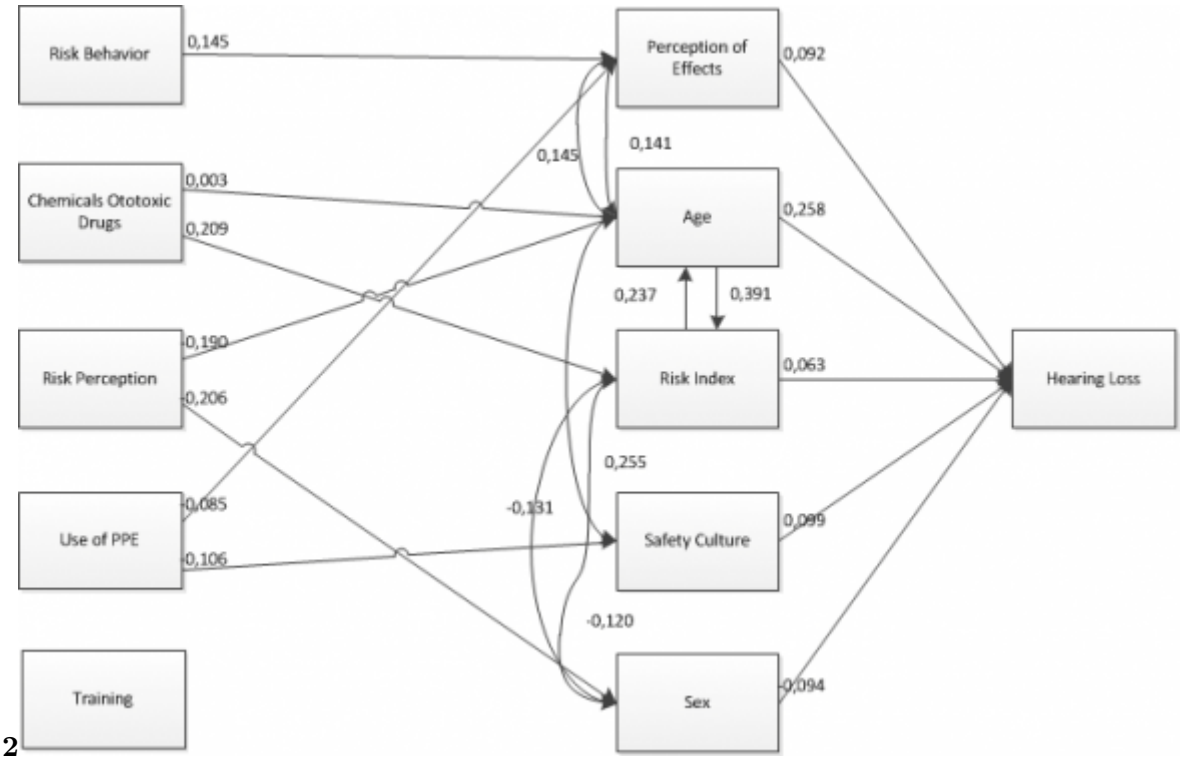

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Figure 3: Figure 2 :

1

Figure 4: Table 1 :

Table2: Sample distribution between factories

Factory	Total number of workers	Number of workers in the sample (N)	Number of workers in the sample (%)	Age (years) Average	Standard Deviation	Period of s
A	689	152	22%	36,2	10,1	15,7
B	516	63	12%	42,9	9,2	3,3
C	153	20	13%	48,2	11,1	8,2
D	225	43	19%	42,6	8,9	7,9
Total	1583	278	18%	39,6	9,2	11,1

Figure 5:

4

Variable	Indirect Effect	Direct Effect	Total Effect
Risk Behavior	0,013	-	0,013
Safety Culture	-	0,099	0,099
Training	-	-	-
Sex	-0,008	-0,094	-0,102
Age	0,063	0.258	0,321
Risk Index	0,061	0,063	0,124
Risk Perception	-0,030	-	-0,030
Perception of Effects	0,036	0,092	0,128
Hearing Loss	-	-	-
Chemicals Ototoxic Drugs	0,014	-	0,014
Use of PPE	-0,018	-	-0,018

Figure 6: Table 4 :

[Javzmaa] , Jamsranjav Javzmaa .

[Oyunbileg et al.] , Shagdarsuren Oyunbileg , Oyuntogos , Lkhaasuren; .

[Collee et al.] , A; De Collee , F Boodt , E Degrave .

[Lusk] , Sally L Lusk .

[Cordeiro et al.] , Ricardo ; Cordeiro , Lima-Filho , Euclydes C .

[Medeiros et al.] , Márcia Medeiros , Pinheiro , De .

[Mehrdad et al.] , Ramin Mehrdad , Mohammadi , Saber; .

[Alvarenga et al.] , Kátia Alvarenga , José De Freitas; Bastos , Roberto Magalhães .

[Botelho and Tomaz; Frota] , Carla Botelho , Silvana ; Tomaz; Frota .

[Goncalves et al.] , Cláudia Goncalves , Giglio De , Oliveira .

[Marques and Mendes] , Jair Marques , Mendes .

[Attarchi et al.] , Mir Attarchi , Saeed; , Mohammad Mazhari , Mahdi , Amir Mehrparvar , Houshang .

[Ayçiçek et al.] , Abdullah ; Ayçiçek , F Dereköy , Sefa .

[Figueiredo and Lacerda] , Gisele ; Figueiredo , Adriana ; Lacerda .

[Chagas et al.] , Patrícia Da Silva Chagas , Thiago Carlos; Diniz , Hernandes .

[Guida and Lorena] , Heraldo Guida , Lorena .

[Bg] , Im Hj; Jang Tw; Kim Bg .

[Brunskill] , Emma Brunskill .

[Finucane] , Mariel Finucane .

[Flaxman] , Seth Flaxman .

[Mascarenhas] , Maya Mascarenhas .

[Mathers] , Colin D Mathers .

[Oliveira et al.] , Cristiane Oliveira , Costa Da , Cunha .

[Bramatti et al.] , Luciana ; Bramatti , Betina Kunz , Thomas .

[Guedes and Pinto] , Dartagnan Guedes , Pinto .

[Bonet et al.] , Mariano ; Bonet , Cañizares , Mayilée; .

[Hair and Jr] , J F Hair , Jr .

[Revista Brasileira de Otorrinolaringologia ()] , *Revista Brasileira de Otorrinolaringologia* 2009. 75 (1) p. .

[Pró-Fono R. Atual. Cient ()] , *Pró-Fono R. Atual. Cient* 2009. 21 (1) p. .

[Neves et al. ()] 'A protecao auditiva utilizada pelos militares do Exercito brasileiro: há efetividade'. Eduardo Neves , Borba; , Marcia Soalheiro . *Ciência e Saúde Coletiva* 2010. 74 (5) p. 889.

[Massarolo et al. ()] 'Achados audiológicos e queixas relacionadas à audição dos motoristas de ônibus urbano'. Massarolo , Jeane ; Neto , Jair Marques , Mendes . *Rev. Soc. Bras. Fonoaudiol* 2010. 15 (2) p. .

[Caldana et al. ()] *Alterações auditivas em trabalhadores de indústrias madeireiras do interior de Rondônia. Rev. bras. Saúde ocup*, Magali Caldana , Mariza De Lourdes; Feniman , Tatiane Ribeiro; Jorge , Martins; . 2009. São Paulo. 34 p. .

[Sumberzul et al. ()] 'Analysis of Incidence Rates of Occupational Diseases in Mongolia'. Nyamjav; Sumberzul , Wang , Jung-Der . *International Journal of Occupational and Environmental Health* 1986-2006. 2014. 17 (1) .

[Arakawa et al. ()] 'Análise de diferentes estudos epidemiológicos em audiologia realizados no'. A M Arakawa , M L Caldana , Sales-Peres , É I Shc; Sitta . *Brasil. Rev. CEFAC* 2010.

[Hilhorst ()] 'Appraisal of Risk Perception in Occupational Health and Safety Research in Developing Countries'. Thea J Hilhorst . *International Journalof Occupational and Environmental Health* 2014. 2 (4) .

[Nascimento ()] 'Associação da Perda Auditiva Induzida pelo Ruído com o Tempo Acumulado de Trabalho entre Motoristas e Cobradores'. Lilian C R Nascimento . *Cad. Saúde Públ* 1994. 10 (2) p. .

[Coleman ()] 'Breaking News: Restaurants Serve Up an Extra Helping of Hearing Loss'. Matthew Coleman . *The Hearing Journal* 2012. 65 (10) p. 38.

[Kenar and Sargân ()] 'Can Rh antigens be a risk factor in noise-induced hearing loss?'. Fethullah Kenar , Ramazan Sargân . *EurArchOtorhinolaryngol* 2009. 266 p. .

[Mohammadi ()] 'Cigarette smoking and occupational noise-induced hearing loss'. Saber Mohammadi . *European Journal of Public Health* 2009. 20 (4) p. .

[Hong and Ronis ()] 'Comparison of the Original and Revised Structures of the Health Promotion Model in Predicting Construction Workers' Use of Hearing Protection'. Oisaeng Hong , David L Ronis . *Research in Nursing & Health* 2006. 29 p. .

[Mutlu et al. ()] 'Determination of noise induced hearing loss in mining: an application of hierarchical log linear modelling'. Atakan; Mutlu , Mustafa Onder , Seyhan Onder . *Environmental Monitoring and Assessment* 2012. 184 p. .

[Prince ()] 'Distribution of risk factors for hearing loss: Implications for evaluating risk of occupational noise-induced hearing loss'. Mary M Prince . *Journal of the Acoustical Society of America* 2002. 112 (2) .

[Garofani et al. ()] 'Efeitos auditivos em operadores de empilhadeira'. Vanessa Garofani , Adriana ; Gregorczyk; Lacerda , Jair Marques , Mendes; , Leila Ribeiro . *Rev. Soc. Bras. Fonoaudiol* 2010. 15 (4) p. .

[Lacerda et al. ()] 'Efeitos ototóxicos da exposição ao monóxido de carbono: uma revisão'. Adriana ; Lacerda , Tony ; Leroux , Thais Morata . *Pró-Fono R. Atual. Cient* 2005. 17 (3) .

[Gonçalves et al.] *Estudo comparativo de exames audiométricos de metalúrgicos expostos a ruído e ruído associado a produtos químicos*, André Gonçalves , Martins; , Anna Paulla Maia Paz , Lopes .

[Stevens (2013)] 'Global and regional hearing impairment prevalence: an analysis of 42 studies in 29 countries'. Gretchen Stevens . *EuropeanJournalofPublic Health* Feb 2013.

[Pender ()] *Health Promotion in Nursing Practice*, N J Pender . 1982. Norwalk, CT: Appleton-Crofts.

[Fernández et al. ()] 'Health-risk Perception in the Inner City Community of Centro Habana'. Niurys Fernández , Pedro ; Mas , Robert B Tate , Annalee Yassi . *Cuba. International Journal of Occupational and Environmental Health* 2014. 6. (Issue 1)

[Dube et al. ()] *Hearing impairment among workers exposed to excessive levels of noise in ginning industries. Noise and Health*, Kamalesh Dube , Ingale , Sopan Lalit; Ingale . 2011.

[Koskinen and Toppila ()] *Hearing loss among classical-orchestra musicians. Noise and Health*, Heli Koskinen , Esko Toppila . 13.50. 2011. p. 45.

[Engdahl B et al. ()] 'Hearing status among Norwegian train drivers and train conductors'. Johnsen Engdahl B , Ts , Lie A , Skogstad M , Tambs K . *Occup. Med* 2013.

[Almeida and De ()] 'História natural da perda auditiva ocupacional provocada por ruído'. S I C Almeida , De . *Rev. Assoc. Med. Bras* 2000.

[Pouryaghoub ()] 'Interaction of smoking and occupational noise exposure on hearing loss: a cross-sectional study'. Gholamreza Pouryaghoub . *BMC Public Health* 2007. p. 137.

[Daniel et al. ()] 'Interação entre grau de perda auditiva e o incômodo com zumbidos em trabalhadores com história de exposição ao ruído'. E Daniel , Hearing Noise , ; Loss , Ricardo ; Cordeiro , Adriano Dias . *A Review. Journal of School Health* 2007. 2008. 74 (6) p. 16. (Rev. Bras. Otorrinolaringol.)

[Anderson et al. ()] *Multivariate Data Analysis*, R E; Anderson , R L Tatham , W C Black . 1995. Englewood Cliffs: Prentice Hall. (with readings. 4 ed)

[Karimi et al. ()] *Noise induced hearing loss risk assessment in truck drivers. Noise and Health*, Ali ; Karimi , Kazerooni , Farshid; Nasiri , Mohammad Saleh; Oliaei . 2010. p. 49.

[Govaerts et al. ()] 'Occupational exposure to noise and the prevalence of hearing loss in a Belgian military population: A cross-sectional study'. B Govaerts , C Legrand , P V Veken . *Noise Health* 2011. 13 p. .

[Penney and Earl ()] 'Occupational noise and effects on blood pressure: exploring the relationship of hypertension and noise exposure in workers'. P Penney , C E Earl . *AAOHN J* 2004. 52 (11) p. .

[Arezes ()] *Percepção do risco de exposição ocupacional ao ruído*, P M Arezes . 2002. Tese submetida à Escola de Engenharia da Universidade do Minho para obtenção do grau de Doutor em Engenharia de Produção. Minho

[Goncalves et al. ()] 'Percepção e o impacto da música na audição de integrantes de banda militar'. Cláudia Goncalves , Giglio De , Oliveira , Al . *Rev. Soc. Bras. Fonoaudiol* 2009. 14 (4) p. .

[Kinoshita and Koodi ()] 'Perfil audiológico em policiais militares do Estado de São Paulo'. Sérgio Kinoshita , Koodi . *Arquivos Int. Otorrinolaringol* 2010. 14 (4) .

[Teles and De Mesquita ()] 'Perfil audiométrico de trabalhadores do distrito industrial de Maracanaú -CE'. Renata Teles , De Mesquita . *Rev. soc. bras. fonoaudiol* 2007. 12 (3) p. .

[References Références Referencias] *References Références Referencias*,

[Attiaa et al. ()] 'Relative risk of elevated hearing threshold compared to ISO1999 normative populations for Royal Australian Air Force male personnel'. John ; Attiaa , May ; Boggess , Maya Guest . *Hearing Research* 2012. 285 (2) p. .

[Menin and Gai (2014)] 'Relação da perda auditiva induzida por ruído e o uso de tabaco em trabalhadores de uma indústria alimentícia'. Eliziane Menin , Gai . *Rev. CEFAC* Paulo Mar./Apr. 2014. 16 (2) .

[Guedes et al. (2005)] 'Reprodutibilidade e validade do Questionário Internacional de Atividade Física em adolescentes'. Joana Guedes , Elisabete , Cynthia Pinto; Lopes , Correa . *RevBrasMed Esporte* Mar/Abr, 2005. 11 (2) .

[Mota and Miranda] *Ruído e idade: análise da influência na audição em indivíduos com*, Pedro Henrique De Mota , Miranda . p. .

[Sena et al. (2013)] 'Saúde auditiva e qualidade de vida em trabalhadores expostos a agrotóxicos'. Tereza Raquel Ribeiro De; Sena , Marlizete Vargas , Maldonado . *Ciência Saúde Coletiva* June 2013. 18 (6) . (Rio de)

[Kwon ()] 'The association between impaired fasting glucose and noise-induced hearing loss'. Y J Kwon . *J. Occup. Health* 2011. 53 (4) p. .

[Parker et al. ()] 'The Norwegian Labour Inspectorate's Registry for Work-Related Diseases: Data from'. David ; Parker , Yogindra Samant , Axel ; Wannag , Ebba Wergeland . *International Journal of Occupational and Environmental Health* 2006. 2014. 14. (Issue 4)

[Brady ()] *Training to promote worker's use of hearing protection: The influence of work climate factors on training effectiveness*, J Brady . 1999. Michigan State University (PhD Thesis)