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Presenteeism and health factors associated with occupational noise: association study in a company of the extraction industry

Presenteísmo e fatores de saúde associados ao ruído ocupacional: estudo de associação em uma empresa do ramo de extrativismo mineral

Presentismo y factores de salud asociados con el ruido ocupacional: Estudio de la asociación en una empresa de la industria de extracción

Renata da Silva Cardoso Rocha Tavares[*]
Jorge Muniz Junior[*]
Luiz Felipe Silva[*]

Resumo

O ruído ocupacional representa um risco à saúde dos trabalhadores, como perda auditiva e zumbido, ainda muito predominante em diversos ambientes e processos. O presenteísmo é definido como um fenômeno em que o trabalhador se encontra fisicamente no trabalho, mas por diversos fatores tem sua concentração e dedicação prejudicadas na realização da atividade. Este estudo tem como objetivo identificar que fatores estão associados, incluindo aqueles relacionados à exposição ao ruído, à ocorrência de presenteísmo. O estudo se caracteriza como exploratório, com abordagem quantitativa. No delineamento foi realizado um estudo de caso em uma empresa localizada no Vale do Paraíba, com uma amostra de 23 trabalhadores da indústria da mineração. Os dados foram obtidos por meio da aplicação do protocolo *Work Limitations Questionnaire* de presenteísmo e de questionário de dados sociodemográficos. A análise de associação dos desfechos foi realizada por meio de regressão logística múltipla. Foi possível verificar

* Universidade Estadual Paulista – São Paulo, SP; Brazil.

Authors' contributions:
RSCRT - researcher of the article, in which she participated in the construction of the theoretical background and field research, as well as in writing.
JMJ - advisor, participated in all stages of the research, mainly in writing and theoretical foundation.
LFS - co-supervisor, having effective participation in statistical methods and calculations, as well as, in the review of the final writing.

Correspondence e-mail: Renata da Silva Cardoso Rocha Tavares - renata_cardoso20@hotmail.com
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que, a demanda física foi a que teve maior escore, bem como o fator zumbido pode ser considerado como variável que influencia o presenteísmo.

Palavras chave: Presenteísmo; Ruído Ocupacional; Eficiência Organizacional; Saúde do Trabalhador.

Abstract

Occupational noise represents a risk to workers' health, such as hearing loss and tinnitus, still very prevalent in various environments and processes. Presenteeism is defined as a phenomenon in which the worker is physically at work, but due to various factors, his concentration and dedication are impaired in performing the activity. This study aims to identify which factors are associated, including those related to noise exposure, to the occurrence of presenteeism. The study is characterized as exploratory, with quantitative approach. In the design a case study was carried out in a company located in the Vale do Paraíba, with a sample of 23 workers from the mining industry. Data were obtained by applying the *Work Limitations Questionnaire* presenteeism protocol and the sociodemographic data questionnaire. The outcome association analysis was performed by multiple logistic regression. It was possible to verify that the physical demand was the one with the highest score, and the tinnitus factor can be considered as a variable that influences the presenteeism.

Keywords: Presenteeism; Noise, Occupational; Efficiency, Organizational; Occupational Health.

Resumen

El ruido laboral representa un riesgo para la salud de los trabajadores, como la pérdida de audición y el tinnitus, que sigue siendo muy frecuente en diversos entornos y procesos. El presentismo se define como un fenómeno en el que el trabajador está físicamente en el trabajo, pero debido a varios factores, su concentración y dedicación se ven perjudicados para realizar la actividad. Este estudio tiene como objetivo identificar qué factores están asociados, incluidos los relacionados con la exposición al ruido, a la ocurrencia de presentismo. El estudio se caracteriza por ser exploratorio, con enfoque cuantitativo. En el diseño se realizó un estudio de caso en una empresa ubicada en Vale de Paraíba, con una muestra de 23 trabajadores de la industria minera. Los datos se obtuvieron aplicando el protocolo de presentismo WLQ y el cuestionario de datos sociodemográficos. El análisis de asociación de resultados se realizó mediante regresión logística múltiple. Fue posible verificar que la demanda física fue la que obtuvo la puntuación más alta, y el factor tinnitus puede considerarse como una variable que influye en el presentismo.

Palabras clave: Presentismo; Ruido en el Ambiente de Trabajo; Eficiencia Organizacional; Salud Laboral.

Introduction

Brazilian Ministry of Health (MS) considers Occupational Health as study of the relationship between work and the health / disease process[1]. Thus, the vision from the worker's health perspective covers the prevention of occupational or work-related accidents and illnesses, as well as health promotion. Aspects related to workers' health and safety, whether on production or on legal requirements, have been the subject of discussion and included in management strategies.

A work environment in which the worker is exposed daily, during an eight-hour day, to a noise intensity greater than 85 dB (A), without protection, is considered an environment at risk to health, that is, an unhealthy environment . It is understood that workers are exposed to the same physical risks as 20 years ago due to the intensification of work and the precariousness of the environment as a result of the development of new technologies and drastic changes in the organization of work[2].

Exposure to noise in work environments and processes has been investigated by several authors, comprising various health problems arising from or associated with it, such as discomfort[3]; hearing loss, the most classic; accidents at work; loss of work performance, reduced concentration[3].

In addition, excessive exposure to noise can cause stress, gastrointestinal, cardiac, psychologi-

cal, hearing, psychological problems, among others. Effects resulting from exposure to noise, such as ischemic heart disease, have been described as being associated with the production of discomfort and, mainly, with hearing loss[4]. Research has shown an association between noise exposure and the occurrence of absenteeism. However, studies on the phenomenon of presenteeism associated with noise have not been observed.

Presenteeism is defined as wasted time because of a diminished capacity during work. Authors refer to the term as being present at work but limited in some aspects in the development of work due to some health problem[5–8]. Presenteeism is a growing organizational problem and the importance of conducting new research on its impact on companies is emphasized, since only 14% of companies in the USA are studying and dealing with presenteeism[9], and in Brazil there is still lack of estimation of this data.

Research has shown the financial impact of presenteeism and its long-term impact on workers' health, and, consequently, on the sustainability of the productivity and economy of organizations[10,11].

It is understood that presenteeism is a complex phenomenon and, not just an alternative to the absence of disease, and that it should be studied with more detail[12]. Given this perspective, we sought to investigate whether exposure to noise is a factor that influences presenteeism.

Thus, this research seeks to explore this gap, seeking to show how certain factors related to health interfere in the loss of productivity and the negative impact of exposure to occupational noise.

The aim of this study was to investigate the association between auditory factors due to exposure to self-reported occupational noise and the occurrence of presenteeism, in a company in the field of mineral extraction.

Methods

The present study is characterized as exploratory, with a quantitative approach. In the design, the case study strategy was used.

The company is a small company in the field of mineral extraction (quarry), located in Paraíba's Valley, with a total of 25 workers. With a population of 25 employees, the sample consisted of 23 subjects (one subject chose not to participate and another was a driver and was not in the company during the procedure), all male.

The research project was submitted to the Research Ethics Committee through Brazil Platform, at an ordinary meeting held on 11/28/2016, being approved under nº 123854/2016. In order to carry out the research, the precepts of Resolution 196/96 of the National Health Council were respected, in which the participation of the subjects occurred by signing the Free and Informed Consent Term prepared for specific purposes of this research, guaranteeing the participants anonymity, as well how to minimize any kind of damage and embarrassment to individuals.

On the day of the presentation of the project in loco, the Researcher's Presentation Letter was delivered and the Institutional Free and Informed Consent Form were presented. Afterwards, scheduling for field research in companies was carried out. Every worker who came to participate in the research signed the Informed Consent Form for Participation.

Instruments

Sociodemographic and general health questionnaire

This questionnaire, with objective answers, is divided into four parts, related to sociodemographic data, health data, perceptions about noise, hearing and health in the last 12 months.

Work Limitations Questionnaire Protocol (WLQ)

It is a questionnaire developed by Tufts Medical Center, which maintains copyright. Thus, to use it, authorization was requested to use it in the research. The WLQ is a protocol with the author Lerner[13] and was translated and culturally adapted and validated for Brazilian culture by Soárez et al.[14].

This questionnaire, with objective questions, was developed to increase the depth and breadth of information about disability and lost productivity at work. It is an instrument containing 25 items grouped into four work limitation domains: (1) time management (5 items), (2) physical demand (6 items), (3) mental-interpersonal demand (9 items) and (4) production demand (5 items). Thus, having the multidimensional character of the functions developed at work.

Procedures for data collection

The application of the Questionnaire and Protocol in the company was carried out in the last week of March 2019.

The questionnaires were applied to company employees personally, in an average time of 9 to 10 minutes with each participant. The method used for the application was of accessibility and not intentional, that is, the subjects who passing through the leisure area were approached. It should be noted that every employee approached had clarification regarding the research objective and signed the Informed Consent Form for Participation.

Data analysis

The association between the dependent variable ("presenteeism") and the explanatory variables was investigated by means of unconditional multiple logistic regression, to allow the control of confounding variables. The dependent variable ("presenteeism") represents the probability of characterizing the phenomenon or the probability log. Thus, the log of odds for the dependent variable was obtained using the logistic regression model.

The "β" coefficients estimated for the independent variables express the rate of change of a function of the dependent variable per unit of change in the independent variable. Each estimated coefficient provides an estimate of the probabilities of adjustment for all other variables in the model and, thus, the Prevalence Chance Ratio (CPR) of presenteeism was calculated.

The explanatory (independent) variables used to build the model were: sociodemographic (age, sex, education, marital status); professional characteristics (position, work sector, working time (in months), presence of noise at work, perception of noise as interference at work); health and lifestyle issues (classification of own health in general, quality of life and sleep, alcohol consumption, smoking, high blood pressure, diabetes, stress, anxiety, depression, asthma, heart problems, tinnitus report, complaint of difficulty hearing, allergy, back pain, headache.

The variables that had more than two answer options were categorized during the insertion of the variables in the Epi-Info software.

The univariate analyzes were conducted to build a multiple model, with the entry into the modeling process having $p \leq 0.20$ based on the likelihood ratio test. The stepwise forward methodology was used to define the most appropriate model, in which variables were included in decreasing order of significance, and non-significant variables that could interfere in the model adjustment were excluded, analyzing the variations of the values of the odds ratio (OR), confidence interval (95% CI) and the significance levels of the models. The significant variables in the final model were also verified by the previous test, allowing the variables to remain with *p* less than or equal to 0.05[15].

The calculations were made through multivariate analysis using unconditional logistic regression, according to the diagram shown in Figure 1.

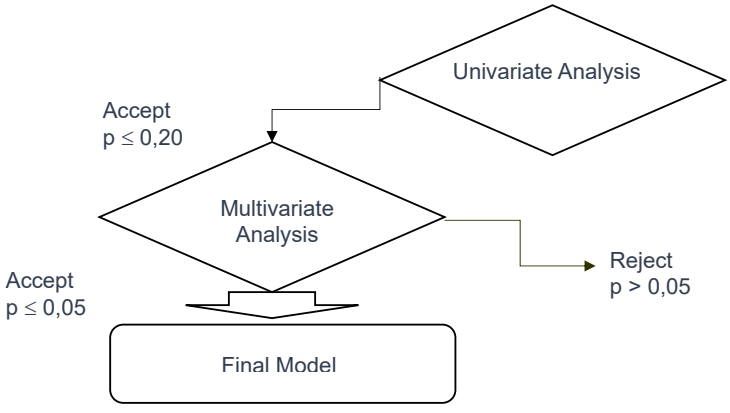

Figure 1. Flowchart of statistical analysis of the findings

In order to carry out an analysis of the sample data for an appropriate understanding of the studied population, the Chi-square test (analysis of differences between categorical variables) was applied. The variables used were categorized according to what is presented in Chart 1.

In the procedure of building the most adjusted model, the dependent variable presenteeism (present or absent) was categorized in two ways, according to the score of presenteeism WLQ by the median and the third quartile of the distribution of values.

Chart 1. Demonstration of categorization of variables

Variables	Categorization
Marital status	Married/ stable relationship
	Single/ separated/ widowed
Education level	Complete High School
	Complete Higher School
General health/ Quality of life/ Sleep	Very bad/ bad/ regular
	Good/ very good/ excellent
Drinking alcohol	No/ rarely
	Two or more times a week
Tinnitus/ allergy/ back pain/ headache/ noise	Never/ sometimes
	Frequent/ very frequent
Work sector	Administrative
	Production

Source: Author's own production

Results

Sociodemographic and Health Data in general

Table 1 shows the profile of the sample of workers in the study, through which it appears that most of them are married, with incomplete elementary education, who work in the production part. Regarding the health and quality of life aspects, it was found that most of them consider having good health (87%), good quality of life (91%), good sleep quality (73%) and not be an alcohol consumer (82%).

Regarding the findings of chronic diseases (Table 2), it was observed that the most reported was arterial hypertension.

Table 1. Distribution of sociodemographic data of the 23 workers in a mining industry (2017)

Variables		N (%)
Marital Status	Single	3 (13.0)
	Married	18 (78.3)
	Separated	1 (4.3)
	Widowed	1 (4.3)
Education level	Incomplete Elementary School	18 (78.3)
	Complete Elementary School	2 (8.7)
	Complete High School	2 (8.7)
	Complete Higher School	1 (4.3)
Function/ Sector	Production	20 (87.0)
	Driver	2 (8.7)
	Administrative	1 (4.3)
General Health	Regular	3 (13.0)
	Good	17 (74.0)
	Excellent	3 (13.0)
Quality of life	Very bad	1 (4.3)
	Regular	7 (30.4)
	Good	14 (60.9)
	Excellent	1 (4.3)
Sleep	Very bad	1 (4.3)
	Bad	1 (4.3)
	Regular	4 (17.4)
	Good	15 (65.2)
	Very good	2 (8.7)
Alcohol consumption	Never	15 (65.2)
	Rarely	4 (17.4)
	Two or more times a week	4 (17.4)

Legend: N = number of subjects

Table 2. Distribution of self-reported chronic diseases among 23 workers in a mining industry (2017)

Variables	N (%)
Arterial Hypertension	5 (21.7)
Diabetes	1 (4.3)
Stress	1 (4.3)
Anxiety	0 (0.0)
Depression	0 (0.0)
Heart disease	0 (0.0)
Asthma	1 (4.3)

Legend: N = number of subjects

Hearing and health data for the past 12 months

Table 3 presents the findings on hearing and other risk factors and their occurrence in the last 12 months.

Regarding tinnitus, it is highlighted that 39% of the sample reported having tinnitus. Taking into account that the presence of tinnitus is related to hearing problems and / or metabolic disorders, it is an extremely important finding.

From the data obtained related to hearing, it can be seen that the complaint of the presence of tinnitus is greater than that related to any change in hearing (26%).

The finding related to allergy (13%) was lower than expected due to the characteristics of the work environment.

Table 3. Distribution of explanatory variables. corresponding to the last 12 months, reported by 23 workers in a mining industry (2017)

Variables		N (%)
Allergy	Never	18 (78.3)
	Sometimes	2 (8.7)
	Frequent	2 (8.7)
	Very frequent	1 (4.3)
Back pain	Never	11 (47.8)
	Sometimes	10 (43.5)
	Frequent	1 (4.3)
	Very frequent	1 (4.3)
Headache	Never	10 (43.5)
	Sometimes	10 (43.5)
	Frequent	3 (13.0)
Exposure to occupational noise	Never	0 (0.0)
	Sometimes	0 (0.0)
	Frequent	4 (17.4)
	Very frequent	19 (82.6)
Noise interference in the work	Never	13 (56.5)
	Sometimes	9 (39.1)
	Frequent	1 (4.3)
	Very frequent	0 (0.0)
Presence of tinnitus	Yes	9 (39.1)
Hearing	Bad or regular	6 (26.1)
	Good	17 (73.9)

Legend: N = number of subjects

WLQ findings

Regarding the Time Management factor, in the five issues related to time management, no significant value was attributed to this item. The score for this demand 0.65, on the protocol scale, showing minimal or no interference in productivity in this regard.

The Physical Demand factor, which contains six questions about it, was the demand that presented a Scale Score of 29.64, that is, the highest score of all four demands that make up the WLQ protocol.

With regard to Mental and Interpersonal Demand, in the nine questions related to mental and interpersonal demand, no significant value was attributed to this item. The Scale Score was 6.40, showing minimal interference in productivity in this regard.

In the five issues related to Production Demand, there was no significant value attributed to this item. The Scale Score for this demand was 5.43, indicating minimal or no interference in productivity in this regard.

According to the WLQ calculation protocol, a score above 5 points to an estimated 4.9% decrease in productivity. Taking into account the finding of Total Score equal to 2.29, it can be stated that in the sample studied, the loss of productivity due to presenteeism is negligible or non-existent.

Relationship between sociodemographic factors, WLQ score and noise

When analyzing the possible relationships between the Presenteeism Total Score and the variables, through univariate analysis, and using the Median and the likelihood test (Likelihood Ratio), the WLQ Score was related to the quality of sleep of workers, alcohol consumer and tinnitus. When using the Third Quartile, there was a relationship between the Presenteeism Total Score and the quality of life and, again, with the alcohol consumption (Table 4).

However, as the score of presenteeism by physical demand was the most relevant, it became a continuous variable, and thus, related it to other variables, dichotomizing them (0 or 1), that is, in bad or good. The same was done with the other de-

Table 4. Univariate analysis showing the significant variables for the occurrence of presenteeism (Total WLQ Score) by Median and Third Quartile among 23 workers in the mining industry, 2017

Variables	Median		Third quartile	
	OR	*p	OR	*p
Sleep quality	5.62	0.11		
Alcohol consumption	0.19	0.16	2.12	0.07
Tinnitus	3.12	0.20		
Quality of life			0.21	0.15

*p – Significant values (p≤0,20)
Legend: N = number of subjects; OR= odds ratio; p= likelihood test

mands, and only the Mental-Interpersonal demand showed such a relationship as well.

Thus, there was an association of WLQ physical demand with sleep, employees with arterial hypertension and tinnitus by the likelihood test (Likelihood Ratio) (Table 5). Thus, it is understood that, for example, those who declared sleep as bad have 7.14 times the chance of presenteeism due to physical demand, compared to those who declared having good sleep.

Regarding the WLQ Score of Mental-Interpersonal Demand, using the same analysis presented in the previous demand, but using the Third Quartile, there was an association with the variable age, working time and presence of tinnitus (Table 5).

There was no possibility to elaborate a significant multiple model.

Table 5. Univariate analysis showing the significant variables for the occurrence of presenteeism (Total WLQ Score), interpersonal physical and mental demands, by the Median and the Third Quartile, respectively, among 23 workers in the mining industry, 2017

Características	Physical demand - Median		Mental-Interpersonal demand - Third Quartile	
	OR	*p	OR	*p
Sleep quality	7.14	0.10		
Arterial hypertension	4.99	0.14		
Tinnitus	6.30	0.04	3.12	0.20
Age			4.66	0.09
Working time			3.60	0.14

*p – Significant values (p≤0,20)
Legend: N = number of subjects; OR= odds ratio; p= likelihood test

Discussion

In the mineral extraction company, as the main sources of noise involved in the drilling, blasting, removal, crushing and shipping process[16] and there are damages such as the degradation of nature; noise and vibrations; vehicle traffic; dust and gases; contamination of water; rejected and sterile[17], so do a search to verify the impact of noise and its consequences on health in the face of the study.

Among the sociodemographic findings, it could be observed that the socioeconomic aspect directly influences a subject's life perspective, that is, how he assesses aspects of quality of life and working conditions. Regarding the term Quality of life, it is understood that it is the result of the subject's perception of well-being, or that it encompasses subjectivity[18].

In the light of the findings on health-related findings in general, some aspects related to qualitative analysis and others observed at the time of the field research were:

- According to the workers' own reports, they live in rural areas; many live in the same community, including being part of the same religious group;
- The low number of employees who frequently consume alcohol is also due to the fact that many employees are evangelicals, in which, according

to the doctrine of this religion, alcohol consumption is not allowed;
- The low level of school education and also the socioeconomic aspects reflected in the difficulty for employees to recognize terms such as anxiety, depression, stress and in the analysis on quality of life and health.

In the survey, the findings from the univariate analysis pointed out variables such as tinnitus and sleep, and issues related to physical demand. However, in this scenario of exposure of workers there are found aspects as hearing loss; respiratory diseases; contact dermatoses; repetitive strain injury and work-related musculoskeletal disorder[19].

The finding related to allergy was a fact that does not match the work environment, due to the high exposure of workers to dust, both from sand and from crushers and explosions.

With regard to the percentage obtained related to the complaint of back pain, there appears to be a certain contradiction, given the physical effort that work activity requires of them.

In this study, exposure to noise, as a factor that interferes with productivity, was not significant, in contrast to what was revealed in a survey of restaurant workers in the state of Rio de Janeiro, in which it stands out as the second nuisance in the environmental aspect (51.2% of reports). Such data do not corroborate, starting from the fact that the studied company allows greater exposure to noise to its workers than that of restaurants[20].

It should be noted the disagreement between the percentages found in the recognition of the high frequency of exposure to occupational noise in relation to its interference in the performance of work activity.

The finding related to the presence of tinnitus is consistent with the findings of a study conducted with 284 workers in general in the city of Bauru, which found 48% of complaints about tinnitus[21] and, with another study that found a prevalence of 28.2%[22]. With regard to the findings of complaints of hearing impairment due to exposure to occupational noise, the result obtained was lower than that found in another study, in which, with a sample of 175 workers in the city of Campinas, a prevalence of 74% was obtained[23].

With regard to the report of allergy, this finding is not in line with scientific findings[24] that highlight the relationship between working in quarries and the occurrence of respiratory allergies.

The estimated productivity impact of health-related work limitations based on the WLQ index score was insignificant. It is speculated that this finding is related to the peculiarity of the sample, in relation to the lifestyle habits characteristic of rural housing, consequently with low values of prevalence of chronic disease.

The fact that the highest score of presenteeism was that of physical demand, it is understood that it is the one that most influences the loss of productivity of the analyzed sample.

However, although at the moment there was little interference, the demands for presenteeism have a certain impact, and that in the long run, this can be cumulative and eventually become absenteeism[25].

The protocol used for the research allowed making the desired analysis, but, since the focus of the study tends to compare the loss of productivity with those who have health problems, perhaps for this reason, a low score was found.

It is understood as a limitation of the research the sample size and the fact that no data on noise dosimetry, PPRA and PCA, were added.

It is clear that this work is exploratory, and because it addresses several broad themes, it is understood that this is a limitation in the deepening of each topic and a deeper analysis.

Certain factors perceived in the field may have interfered with the result obtained, such as organizational culture and the difficulty in unveiling the perception of mental health in a population made up of workers, whose education level is lower than high school. It was noted during the research a certain distrust and insecurity of workers when answering the questionnaire, and that according to their reports, the company had never participated in any scientific research until then. Even though it was explained about all the reliability criteria, it is recognized that this may have interfered with the findings and be considered as one of the limitations of the research.

It is noteworthy that, data of presenteeism are scarce in the business environment and, consequently, strategies are minimal aiming at the reduction of presenteeism. The focus of corporate health programs is still predominant in reducing absenteeism. Thus, the absence of the vision of managing health as an active asset is perceived, being reduced merely to the administration of expenses and profits.

Thus, studies that seek to investigate the impact of productivity related to noise indices by sector, sleep and even health promotion projects will add, synergistically, towards the improvement of an effective management in worker health in the production and long-term strategic management in corporate health, or the sustainability of human capital. The importance of companies starting to publicize successful actions and projects is also emphasized.

This study is expected to encourage discussion in the field of occupational health and also of presenteeism and absenteeism in the organizational sphere associated with the impact of exposure to noise and other health risk factors, as well as to encourage researchers to discuss topics of this nature so that it is possible to promote improvements in this field and expand the knowledge of this area.

Conclusion

The study revealed, through univariate analysis, that the presence of tinnitus is a variable associated with presenteeism.

It was found that the highest score of presenteeism was related to physical demand, being consistent with the company's operating segment

The extent of this impact includes, in a predictable and non-measurable way, hearing loss, hypertension, tension index, stress, anxiety and well-being, according to the evidence presented and discussed regarding the extra-auditory and auditory outcomes resulting from exposure occupational noise.

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