NOISE EFFECTS ON HOSPITAL LAUNDRY WORKERS' HEARING

Efeitos do ruído na audição de trabalhadores de lavanderia hospitalar

Francisca Pinheiro Fontoura[1], Cláudia Giglio de Oliveira Gonçalves[2], Adriana Bender Moreira de Lacerda[3], Herton Coifman[4]

ABSTRACT

Purpose: to carry out a characterize the hearing profile of workers from a hospital laundry. **Method:** crosscut study, with 95 workers, males and females, age averaging 38.23, held at the laundry of a public hospital located in the city of Curitiba, Parana State/Brazil. Documental laundry analysis was carried out (Medical Control and Occupational Health Program and Environmental Risk Prevention Program), noise measurement, anamnesis-applied hearing evaluation, tonal threshold audiometry, acoustic immittance, and transient otoacoustic emission testing. Audiograms were analyzed through clinical and occupational criteria (Labor Ministry/ Regulatory Norm 7). **Results:** noise levels found were 77.0 to 99.0 dB(A), 37.89% audiograms were altered, among them, 18.94% suggesting noise-induced hearing loss, mainly among the clothes folders. The test of otoacoustic emissions showed no transient responses in 13 subjects with no emissions in some ears. **Conclusion:** the laundry is a hazardous place for hearing loss, thus preventive measures, such as Hearing Conservation Programs must be adopted.

KEYWORDS: Noise Effects; Occupational Health; Hearing; Occupational Exposure

INTRODUCTION

Among all agents that may result in occupational hazard, noise certainly appears as the most frequent one, exposing a larger number of individuals.[1] It is known that workers exposed to high levels of noise, above the tolerance threshold, complain about hearing loss and tinnitus, besides headache, physiological changes in heart rate, blood pressure, sleep disorders, several digestive, vestibular, neurological and behavioral disorders such as irritability, tiredness, decreased productivity, noise intolerance, anguish, anxiety, depression, stress, among others[2,3].

In relation to the necessary time exposition for triggering noise-induced hearing loss, the highest number of impairing rates occurs between five and seven years, decreasing loss progression rate until fifteen years when it tends to stabilize as long as exposition conditions and absence of other causative factors are kept[2,4,5].

Noise-induced hearing loss characterized by irreversible cochlear damage, in configuration of high-frequency features one of the most serious, prevalent problems for workers' health. Studies have evidenced that there has not been a reduction in work-related deafness[6].

Occupational noise is also present in hospitals, mainly in hospital laundries where continuous exposition to high levels of sound pressure may bring about permanent changes in workers' hearing

(1) Nurse; Expert in Occupational Nursing and residence in Collective Health; Master's Degree in Communication Disorders from Universidade Tuiuti do Paraná, Curitiba, Paraná State, Brazil.

(2) Speech Therapist; Professor of Communication Disorders in Master's and Doctorate Programs at Universidade Tuiuti do Parana, Curitiba, Paraná State, Brazil; PhD in Collective Health from UNICAMP, São Paulo State, Brazil.

(3) Speech Therapist; Professor of Communication Disorders in Master's and Doctorate Programs at Universidade Tuiuti do Paraná, Curitiba, Paraná State, Brazil; PhD in Audiology from University of Montreal-CA.

(4) Doctor; Associate Professor at Universidade Federal do Paraná, Brazil; PhD in Otorhinolaryngology from Universidade de São Paulo, São Paulo State, Brazil.

Conflict of interest: non-existent

threshold. In a research study held in São Paulo Hospital laundry, noise levels found in several sectors of the laundry were between 70 and 101 dB(A), and workers did not actually wear any earpiece, being daily exposed to high levels of sound pressure[7].

In another study held in the contaminated area of a hospital laundry in Rio de Janeiro/Rio de Janeiro State, Brazil, noise levels did not exceed 76 dB(A), however, such levels may bring about health damages to workers who perform their job in the laundry quarters, although it is not enough to provoke hearing loss[8]. In a laundry at Hospital Universitário de Niteroi/ Rio de Janeiro State, Brazil (a teaching hospital), it was evidenced that workers' exposition to sound pressure levels is above the tolerance threshold, as noise level in the laundry ranged between 84 and 91 dB(A). Audiograms (44.0%) suggesting NIHL were found, being workers' average exposition time to high levels of pressure sound 4.5 to 5 years[9]. Study carried out at a laundry in the town of Salto de Pirapora/São Paulo State, Brazil, for the development of a Hearing Conservation Program, identified noise level in this laundry ranging from 57 to 94 dB(A), according to the sector[10]. The author found that 13.0% of the workers showed audiogram suggesting NIHL[10]. Similarly, research held at the Clinicas Hospital of Medical School from Universidade Federal de Goiás, the mapping of hospital noise evidenced averaged 75 dB(A) in all hospital settings, and in the laundry, the noise level found was 91dB (A) in the morning period and 90dB(A) in the evening period. The authors verified that 31.4% of the workers presented characteristic audiometries for NIHL[11].

In the aforementioned studies, Transient-Evoked Otoacustic EmissionsTest (TrOAEs) was not performed. However, in the present study, besides the audiometries carried out in the laundry workers in order to identify noise-induced hearing loss, the otoacoustic emissions test was held as it can identify cochlear changes even before they are detected by audiograms, thus contributing to the early diagnosis in occupational health[12].

Therefore, this study aimed to characterize the hearing profile of hospital laundry workers.

METHOD

This research study was approved by the Research Ethics Board (REB) of the institution under registration number 2208.102/2010-05. Laundry workers were invited to participate in the research and informed about its objective. All subjects who participated in the study signed the Free Informed Consent Form.

It is a crosscut study developed at the laundry of a large Public Federal Hospital located in Curitiba/ Parana State, Brazil, from May to December/2010, having hospital laundry workers as the research subjects. A total of 95 noise-exposed workers, participated in the study (57.89 % females and 42.11% males), age ranging 20 to 59 years (averaging 38.23 years, standard deviation of 9.26 years).

Inclusion criteria were to be a laundry worker and to accept the invitation to participate in the research. Among the laundry workers, there are three different kinds of employment relationship: (1) workers hired by the hospital, (2) workers hired by outsourced company under the Consolidation of Labor Laws, and (3) formally-hired civil servants.

In the first step of the research, a documental analisys from the Medical Control and Occupational Health Program and the Environmental Risk Prevention Program was carried out, proposed by the regulations of Health and Safety at Work (Regulation n.7 and n.9 by the Labor Ministry), of the three companies running the laundry, looking out for environmental hearing risks present in the laundry as well as the body of clinical and complimentary exams specific for each team of workers in this service.

In the second step, noise measurement was held by a qualified professional using a calibrated Minipa sound level meter, MSL 1350 model, operating in the compensation "A", *Slow* response circuit. The sound level meter was positioned at the laundry workers' ear from about half a meter distance. Each measurement consisted of 12 sound pressure level samples carried out every 120 seconds for twenty-two minutes. In each situation, minimum, maximum values and the equivalent level, which corresponds to the average integrated sound level during certain timespan, were recorded[13].

In the third step, a questionnaire was applied in order to identify and characterize the laundry workers' profile[14]. The instrument made use of closed questions, including personal data as well as workers' clinical and occupational background.

In the fourth step, hospital laundry workers' hearing profile was surveyed by means of tonal threshold audiometry and acoustic immitance testing. Ninety-five (95) workers, who participated in the study, underwent audiological testing at a Teaching Clinic in Curitiba. Rest period from occupational noise was 14 working hours, that is, the audiological testing was held before the working hours in the hospital laundry objectifying to exclude any temporary hearing loss. The inspection of the outer acoustic meatus was performed before audiological testing. Threshold tonal audiometry was held in frequencies between 250 and 8,000 Hz

by airway, and by bone conduction in frequencies between 500 and 4,000 Hz (when necessary), in a sound proof testing-booth, with properly calibrated Madsen Itera II audiometer and TDH 39 earphones, meeting INMETRO (National Institute of Metrology, Standardization and Industrial Quality) measurement regulations.

Acoustic Imittance Testing was held to identify possible middle-ear changes using OTOFLEX 100, verifying the Tympanometric curve and Acoustic Reflexes. Audiograms were classified under Regulation N.7 (Labor Ministry) as suggestive for NIHL, non-suggestive for NIHL and inside acceptable thresholds. They were also analyzed by the kind of hearing loss, according to the recommendations of the Federal Council of Speech Therapy[15].

Transient Otoacoustic Emissions Test (TrOAES) was performed in order to verify cochlear impairment. A MADSEN CAPELLA (GN Otometrics) analyzer was used, coupled with a computer, NOAH software platform. In order to analyzeTrOAES, the reproduction of the cochlear response of 50% (minimum) was considered, and signal/noise of at least 6dB SPL in three consecutive frequency bands, according to recommendations in the equipment manual[16]. As for stimulus, nonlinear broadband ticks were used, 80dB SPL intensity. Workers presenting any inflammatory process or outer/middle ear impairment verified in the acoustic immittance testing and clinical exam, were excluded. Cases presenting earwax, even partial earwax were also excluded, taking up a sample of 47 assessed workers.

For data analysis, statistical procedures were carried out by means of the Chi-square test, variables as follows: working área, age and service time length with audiometric results. Adopted significance level was 5%. Prevalence Ratio between TrOAES and audiometric results was held in order to analyze cochlear impairment.

RESULTS

a) Results for documental analysis of the Environmental Risk Prevention Program and the Medical Control and Occupational Health Program:

By analyzing the Environmental Risk Prevention Program and the Medical Control and Occupational Health Program, it was observed that they were organized only by the outsourced firms and the Specialized Service in Safety Engineering and Occupational Medicine, responsible for the workers hired by the hospital. In the document of the Environmental Risk Prevention Program, elaborated and organized by the Specialized Service in Safety Engineering, there are references to noise rates only in the clean laundry area, more specifically, in the work stations: “table for sorting out clean clothes and clothes folding” with noise levels of 86.1dB (A) in both stations. In the Medical Control and Occupational Health Program, there is reference for occupational noise risk only in the clean laundry area. In relation to the recommended complementary exams, audiometry is among them for every semester. As for the workers from the outsourced company, the Environmental Risk Prevention Program and the Medical Control and Occupational Health Program are hired and held by a specialized company on Safety Engineering and Occupational Medicine. Audiometric exams are held at a specialized clinic, not related to the company. However, many workers have their exams overdue. Environmental risk assessment and noise measurement were carried out in the clean and dirty laundry areas. In the Environmental Risk Prevention Program of the outsourced company, occupational risks have been rated and noise is among them. In the reference of the measurement of sound pressure levels, it was observed in the clothes spin area, 78.3 dB(A), in the clean clothes sort-out area, clothes dryers and clothes folding, 71.1 dB(A), in the washing machines area (dirty area), 75,0 dB(A). In relation to the Medical Control and Occupational Health Program, in the document of the outsourced company, it was mentioned occupational noise risk and recommended yearly audiometric exam to all employees.

b) Results for the measurement of laundry noise levels:

In Figure 1, results for the measurement of laundry noise by area and service are shown.

In the measurement for laundry noise levels, it was evidenced that the studied population is exposed to noise levels between 77.0 and 99.0 dB(A).

Dirty Area		Clean Area		Clothing	
Working station	**Leq dB(A)**	**Working station**	**Leq dB(A)**	**Working station**	**Leq dB(A)**
Sorting out of dirty clothes	89.8	Spin drying	99.0	Folding area	84.0
Weighing of dirty clothes	89.8	clean clothes sort-out	85.0	Storage	84.0
Dirty clothes washing	89.8	Clothes drying	85.0	Compressed folding	77.0

Figure 1 – Laundry noise levels per area and service

c) Laundry workers' profile:

The studied population entailed 95 workers: 57.89% females and 42.11% males. Prevailed age group in the studied population ranged from 40 to 49 years old which featured 38.95% of the population. As for the work time length in the laundry, 71.58% featured 1 to 10 years. Regarding the working hours, 80.0% of the laundry workers are 12 hours on duty and 36 hours off duty. In relation to the use of earpiece, it was pointed out that 74.74% of workers do not wear earpiece, and 60.0% reported they had not been informed about the use of such equipment. As for the professional background on noise exposure, 48.42% (46) of the workers had already been exposed to occupational noise, being hospital laundries the main line of business, with 26.32% of the reports.

Table 1 shows the main findings regarding symptoms, hearing and non-hearing- related complaints, possibly due to noise exposition reported by the studied subjects.

Table 1 – Distribution of symptoms and complaints possibly related to noise exposition, reported by laundry workers (N=95)

Workers' symptoms and complaints	Absolute frequency	Relative Frequency
Tinnitus	28	29.47
Dizziness	22	23.16
Otalgia	12	12.63
Tiredness	74	77.89
Stress	57	60.00
Irritability	48	50.52
Headache	43	45.26
Depression	41	43.16
Concentration Disorder	24	25.26
Stomachache	18	18.95
Balance Disorder	11	11.58
No complaints	9	9,47

Obs.: Some workers reported more than one complaint.

It was observed that tinnitus was reported in 29.47% of the cases. As for non-hearing complaints, 77.89% of the workers reported tiredness followed by stress (60%).

d) Results for the audiological testing:

In the distribution of the audiometric results, 37.89% (36) of the workers presented hearing loss in at least one of their ears. Table 2 shows laundry workers' audiometric results, by ears, analyzed according to the kind of hearing loss, following the Federal Council of Speech Therapy recommendations[15].

Normal hearing thresholds were found in 70.52% of the right ears and 65.26% of the left ears. In the analysis of the kinds of hearing loss, neurosensory hearing loss prevailed.

In the analysis of the relationship between audiometric result (impaired or normal) - considering the worse ear – and age group, findings are displayed in Table 3.

Table 2 – Laundry workers' hearing profile (N=95)

Audiometric Result	Right ear		Left ear	
	Absolute frequency	Relative frequency	Absolute frequency	Relative frequency
Neurosensory hearing Loss	25	26.31	31	32.63
Conducive hearing loss	2	2.10	1	1.05
Mixed hearing loss	1	1.05	1	1.05
Normal hearing thresholds	67	70.52	62	65.26
Total	95	100.00	95	100.00

Table 3 – Correlation between audiometric result and age (N=95)

Age	Altered	Normal	*P*
20 to 29 years	4	16	
30 to 39 years	10	18	0,0300*
40 to 49 years	16	21	
Over 49 years	6	4	
Total	46	59	

StatisticalTest: Chi – Square. Adopted Significance Level of 5%.

By means of the Chi-Square Test, at a significance rate of 0.05, it was verified that the older, the higher ratio of hearing-impaired individuals.

In relation to work time length, it was verified that 71.58% of the workers featured until 10 years of work at a hospital laundry. However, it was not observed the correlation to audiometric results (impaired or normal) (p= 0.8420).

Rated according to Regulation n. 7, 65.26% of the workers (considering the worse ear) had audiograms within acceptable thresholds; 18.94% (18) featured audiometric exam suggesting NIHL, and 18.94% (18) featured hearing loss, but audiograms reported hearing loss unrelated to noise exposition.

Table 4 shows the subjects whose audiometric exams suggested NIHL (according to Regulation n. 7) distributed by gender and job position.

From the total of audiometric exams reporting NIHL (18 cases), most of them were males (11 cases) and in the clean laundry area. Among the work stations, subjects working with the clothes folders reported the most cases of impairment suggesting NIHL. No correlation was found between work area and NIHL (to the significance level of 0.05 p= 0.7582).

The otoacoustic emissions test was performed in 47 workers (the ones with restrictions to perform the test were excluded), and among them, some workers had audiograms within acceptable thresholds (32) while others had audiograms reporting neurosensory hearing loss (15) (Table 5)

Table 4 - Distribution of workers with audiometric exams reporting NIHL, by gender and position (N=18)

Position	Males		Females		Total
	Absolute frequency	Relative frequency	Absolute frequency	Relative frequency	
Clean área					
Folder	-	-	7	7,36	7
Distributor	2	2,11	-	-	2
Spin dryer	2	2,11	-	-	2
Sort-out	1	1,05	-	-	1
Total	5	5,27	7	7,36	12
Dirty area					
Washer	3	3,15	-	-	3
Sort-out	2	2,11	-	-	2
Collector	1	1,05	-	-	1
Total	6	6,31	-	-	6

Table 5 – Result for Transient Otoacoustic Emissions according to the audiogram, from each ear, among laundry workers (N=47)

Audiometric Result	Absent TrOAES	Present TrOAES	Total
Right Ear			
Altered	9	2	11
Normal	3	33	36
Sub-total	12	35	47
Left Ear			
Altered	10	5	15
Normal	3	29	32
Sub-Total	13	34	47

Regarding the transient otoacoustic emissions test, separated ears, was found that 11 right ears presented altered audiograms, and among those, 9 (81.81%) had absence of responses (absent-TrOAES) while the 36 right ears with audiograms within acceptable standards had 3 (8.33%) presenting absent TrOAES. Regarding the left ear, 15 audiograms were found altered, and 10 (66.66%) of them had absent TrOAES, while among 32 audiograms within acceptable standards, 3 (9.37%) had absent TrOAES.

By calculating the Prevalence Ratio among these data, it was verified that for the right ear, workers presenting altered audiograms had 9.8 times more absent TrOAES than those with audiograms within acceptable standards (PR=9.8; C.I. 3.2 – 29.9; 95%). As for the left ear, workers with altered audiograms had 7.1 times more absent TrOAES than those with audiograms within acceptable standards (PR= 7.1; C.I. 2.3 – 22.1; 95%).

DISCUSSION

Documental analysis revealed that Environmental Risk Prevention Programs and Medical Control and Occupational Health Programs in the laundry were organized in two of the three companies (in the outsourced one and in the company responsible for workers hired by the hospital). However, legislation rules that companies are obliged to elaborate and implement those programs, disregarding the number of employees or hazard degree of their activities[17,18]. Even with the implementation of Environmental Risk Prevention Programs, in both companies, it was not verified references on implementation of collective noise control policies, and as for the implementation of individual protection policies, they only recommend the use of earpiece, without recommending other ways such as administrative policies in order to decrease, for example, the noise

exposure time. Other studies evidenced the same situation in companies of different lines of business, that is, the absence of recommending collective measures for occupational noise control[6,19].

Although there are no references of organized preventive measures in the documents of the companies running the laundry, noise exposure risk was verified in the working stations. The average levels found (Figure 1) are above 80 dB(A) and, according to Regulation 15, preventive measures and hearing monitoring must be performed. It is worth mentioning that this legislation is based on 8 daily working hours, and laundry working hours take up 12 hours, aggravating the situation of noise exposure. Similar results were found in other studies in the hospital laundry, evidencing a environmental hostility to hearing[7,9,20].

As NIHL risk is due to noise levels, daily exposure and accumulated long-term exposure, working time length of the laundry employees was verified but no correlation was observed between that and audiometric results (p= 0.8420). However, it is worth stressing that their professional background evidences that 48.42% of these workers had already been exposed to occupational noise, most of them in other hospital laundries.

Even taking NIHL risk, it was evidenced that 74.74% of the workers did not wear earpieces, increasing their chances for noise-induced hearing impairment[21,22]. When workers are exposed to noise above 85 dB(A), it is known that they may develop hearing loss, and the use of earpiece is an important preventive measure[23,24].

Regarding symptoms and complaints reported by the workers (Table 1), which can be consequential to occupational noise exposure, it was verified tiredness, stress, irritability, headache, depression, concentration difficulties, stomachache, among others. Noise exposures may bring about serious functional disorders to the organism. There are literature reports on the relation between high sound pressure levels to other symptoms unrelated to hearing, such as stress, psychological and sleep disorders, memory loss, digestive and circulatory disorders and psychological effects such as irritability, nervousness, tension, among others[3,25,26]. Tinnitus was reported by 29.47%. Literature mentions that it is a common symptom for those who work in noisy settings such as laundries[23,27].

In relation to audiometric findings (Table 2), 37.89% of the laundry workers evidenced neurosensory hearing loss. As for the laundry workers' age (Table 3) and their hearing profile, most workers were over 30 years old; there was prevalence of the age group between 40 and 49 years old (38.95%), featuring a not young group and close to age groups when natural hearing wear starts. There was a correlation between the audiometric result and age as cases of hearing impairment increase, the older age groups are (p<0.03). Among workers presenting neurosensory hearing loss, 18.0% had audiogram suggesting NIHL. Among workers evidencing NIHL, most of them work in the clothes folding station (7.36%) (Table 4). It is pointed out that noise level reported in that work station is not above the tolerance threshold of 84 dB(A). Formerly, however, some female workers performed tasks in other laundry stations where reported noise levels were above 85 dB(A), such as the clothes washing area (89.9 dB(A)) and the spin-drying area (99 dB(A)).

Not wearing earpiece is worrying data when the results of the audiological assessment of laundry workers are observed because workers get unprotected. Audiological results match results found in the literature[28,29].

In a study held with 34 workers from a teaching hospital laundry in the city of Niteroi, Rio de Janeiro State/Brazil, it was found an alarming proportion of cases suggesting NIHL, about 44.0%[9], being superior to findings in the current study. A study with 100 laundry workers from the city of Salto de Pirapora/Brazil, exposed to harmful noise levels, 13.0% of hearing impairment suggesting NIHL[10] was found, a lower proportion than in the current study. And, in another study carried out in the laundry of the Clinicas Hospital from the medical school of Universidade Federal de Goias (UFG) with 86 workers exposed to high noise levels, 31.4% of the audiograms were altered[11], without identifying the cases suggesting NIHL among them. In the present study, 37.89% of altered audiograms were found, superior to the UFG study. These findings suggest that laundry workers may develop neurosensory hearing loss, possibly related to the exposure of high sound pressure levels. This evidences an alarming proportion as occupational hearing loss can be prevented. Thus, it is fundamental to carry out not only audiometric exams for hearing monitoring, but also the implementation of a Hearing Conservation Program for laundry workers. Results from the transient otoacoustic emissions testing (TrOAES) evidenced cochlear impairment in workers with altered audiogram, suggesting that the reason for the hearing disorders found are noise-related as NIHL is characterized by cochlear damage (Table 5). These findings match literature data where TrOAES can verify the impairment degree of the outer hair cells in noise-exposed individuals even if Threshold Tonal Audiometry has not yet detected evident disorders[30]. Results from the analyzed scientific publications suggest that the use of OAE

in occupational health has been valuable instrument to investigation and early diagnosis of NIHL[31,32].

CONCLUSION

Prolonged environmental noise exposure above safe levels along with recklessness in the use of earpiece, was enough to cause hearing damage suggesting NIHL in 18.94% of the laundry workers. Besides, complaints unrelated to hearing, which may be related to exposure to high sound pressure levels, were reported. It is deemed necessary that this laundry urgently plans strategies to minimize noise levels as workers are exposed to it for 12 hours on a daily basis.

In such a context, it is recommended to invest in Hearing Conservation Programs aiming noise-emission control at source, and intervention in the evolution of noise-induced hearing losses objectifying the preservation of hearing health and decrease of related symptoms. It is also necessary to carry out ongoing educational actions in order to increase awareness as well as guide managers and laundry workers towards hearing health care.

RESUMO

Objetivo: caracterizar o perfil auditivo de trabalhadores de uma lavanderia hospitalar. **Método:** estudo transversal, realizado numa lavanderia de um hospital público em Curitiba-PR, com 95 trabalhadores de ambos os sexos, média de idade de 38,23. Realizou-se análise dos documentos do Programa de Controle Médico e Saúde Ocupacional e do Programa de Prevenção de Riscos Ambientais da lavanderia, mensuração do ruído, avaliação auditiva com aplicação de anamnese, audiometria tonal limiar, imitância acústica e teste de emissões otoacústicas evocadas por estímulo transiente. Analisou-se os audiogramas por critérios clínico e ocupacionais (Norma Regulamentadora 7). **Resultados:** os níveis de ruído encontrados foram de 77,0 a 99,0 dB(A), houve 37,89% audiogramas alterados, destes 18,94% com características sugestivas de Perda Auditiva Induzida por Ruído, principalmente entre os dobradores de roupas. O teste de Emissões Otoacústicas Evocadas por Estímulo Transiente demonstrou ausência de respostas em 13 sujeitos com ausência de emissões em alguma das orelhas. **Conclusão:** a lavanderia é um local de risco para a perda auditiva. Desse modo, medidas preventivas, por meio de Programas de Preservação Auditiva, devem ser adotadas.

DESCRITORES: Efeitos do Ruído; Saúde do Trabalhador; Audição; Exposição Ocupacional

REFERENCES

1. Ogido R, Costa EA, Machado HC. Prevalência de sintomas auditivos e vestibulares em trabalhadores expostos a ruído ocupacional. Rev. Saúde Pública. 2009;43(2):377-80.

2. Zamberlan NE. Ruído em unidade de cuidado intermediário neonatal de um hospital universitário de Ribeirão Preto-SP. Ciênc Cuid. Saúde. 2008;7(4):431-8.

3. Azevedo AN, Bernardo LD, Shing SCAC, Santos JN. Perfil auditivo de trabalhadores de um entreposto de carnes. Rev. CEFAC. 2010;12(2):223-34.

4. Lopes AC, Santos CC, Alvarenga KF, Feniman MR, Caldana ML, Oliveira NA et al . Alterações auditivas em trabalhadores de indústrias madeireiras do interior de Rondônia. Rev. bras. Saúde ocup. 2009;34(119):88-92.

5. Dias A, Cordeiro R. Interação entre grau de perda auditiva e o incomodo com zumbidos em trabalhadores com história de exposição ao ruído. Rev Bras Otorrinolaringol. 2008;74(6):876-83.

6. Lopes ACL, Otubo KA, Basso TC, Marinelli EJI, Lauris JRP. Perda Auditiva Ocupacional: Audiometria Tonal X Audiometria de Altas Frequencias. Arq. Int. Otorrinolaringol. 2009;13(3):293-9.

7. Silva MC, Orlandi CG, Mi Chang E, Siviero J, Pinto MM, Armellini PFS et al. Níveis de ruído na lavanderia de um hospital público. Rev. CEFAC. 2011;13(3):472-8.

8. Arsego J, Poletto A R, Medeiros E, Contijo LM. Riscos ocupacionais na área contaminada de uma lavanderia hospitalar. Anais do 28º Encontro Nacional de Engenharia de Produção; 2008 Out 13-6; Rio de Janeiro, Brasil. Rio de Janeiro; 2008.

9. Braz LA. Avaliação da prevalência de PAINPSE em lavanderia de um hospital Universitário e a sua

relação com os efeitos psicofisiológicos. 2006. [Monografia]: Niterói (RJ), Universidade Federal Fluminense; 2006.
10. Melaré FA. Alterações auditivas ocupacionais em uma lavanderia: uma proposta de ação. Saúde Rev. 2005;7(15):21-6.
11. Curado JAF, Rabelo WCSV, Alves W, Perini RF, Siqueira PH. A incidência de PAIR na lavanderia de um Hospital Universitário. Arq. Int. Otorrinolaringol. 2001;5(2):113-6
12. Coelho MSB, Ferraz JRS, Almeida EOC, Filho NA. As emissões otoacústicas no diagnóstico diferencial das perdas auditivas induzidas por ruído. Rev. CEFAC. 2010;12(6):1050-8.
13. Fundacentro. NHO/01. Avaliação da exposição ocupacional ao ruído. São Paulo: 2001.
14. Ibañez RN, Schneider LO, Seligman J. Anamnese dos trabalhadores expostos ao ruído. In: Nudelman AA, Costa EA, Seligman J, Ibañez RN. Pair: perda auditiva Induzida pelo Ruído. 2 edição. Rio de Janeiro: Revinter, 2001. p. 45-50.
15. Fonoaudiologia. Conselhos Federal e Regional de Fonoaudiologia. Audiometria tonal, logoaudiometria e medidas de imitância acústica: Orientações dos Conselhos de Fonoaudiologia para o laudo audiológico 2009. Disponível em:< http://www.fonoaudiologia.org.br/publicacoes/eplaudoaudio.pdf>. Acesso em 2.10.11.
16. Gorga MP, Neely ST, Dorn PA. Distortion product otoacoustic emission test performance for a priori criteria and for multifrequency audiometric standards. Ear Hear. 1999;20(4):345-62.
17. _____. Lei n.° 6514, de 22 de dezembro de 1977. NR 9. p. 95. 61. ed. São Paulo. Atlas, 2007.
18. _____. Lei n.° 6514, de 22 de dezembro de 1977. NR-7. Item 7.1. 1. ed. São Paulo. Atlas, 2007.
19. Miranda CR, Dias CR. PPRA/PCMSO: auditoria, inspeção do trabalho e controle social. Cadernos de Saúde Pública. 2004;20(1):224-32.
20. Mafra SCT, Silva VE, Carlos CALV. Envelhecimento funcional precoce dos trabalhadores de uma lavanderia sob o enfoque dos riscos físicos e ergonômicos. Rev. INGEPRO. 2011;3(8):21-31.
21. Santoni CB, Fiorini AC. Músicos de pop – rock: avaliação da satisfação com protetores auditivos. Braz J Otorhinolaringol. 2010;76(4):454-61.
22. Gonçalves CGO, Lacerda ABM, Zocoli AMF, Oliva FC, Almeida SB, Iantas MR. Percepção e o impacto da música na audição de integrantes da banda militar. Rev da Soc Bras de Fonoaudiologl. 2009;14(3):515-20.
23. Lopes AC, Nelli MP, Lauris JRP, Amorim RB, Mello ADP. Condições de saúde auditiva no trabalho: investigação dos efeitos auditivos em trabalhadores expostos ao ruído ocupacional. Arq. Int. Otorrinolaringol. 2009;13(1):49-54.
24. _____. Lei n.° 6514, de 22 de dezembro de 1977. NR-6. Item 6.6. 1. ed. São Paulo. Atlas, 2007.
25. Souza MN, Fiorini AC, Guzman MB. Incômodo causado pelo ruído a uma população de bombeiros. Rev da Soc Bras de Fonoaudiologl. 2009;14(3):508-14.
26. Macedo ISC, Mateus DC, Costa EMGC, Asprino ACL, Lourenço EA. Avaliação do ruído em Unidades de Terapia Intensiva. Braz J Otorhinolaryngol. 2009;75(6):844-6.
27. Steinmetz LG, Zeigelboim BS, Lacerda AB, Morata TC, Marques JM. Características do zumbido em trabalhadores expostos a ruído. Rev Bras Otorrinolaringol. 2009;75(1):7-14.
28. Boger ME, Branco AB, Ottonni AC. A influência do espectro de ruído na prevalência de Perda Auditiva Induzida por Ruído em trabalhadores. Braz J Otorhinolaryngol. 2009;75(3):328-34.
29. Monteiro VM, Samelli AG. Estudo da audição de ritmistas de uma escola de samba de São Paulo. Rev da Soc Bras de Fonoaudiologl. 2010;15(1):14-8.
30. Amorim RB, Lopes AC, Santos KTP, Melo ADP, Lauris JRP. Alterações Auditivas da Exposição Ocupacional em Músicos. Arq. Int. Otorrinolaringol. 2008;12(3): 377-83.
31. Guida HL, Morini RG, Cardoso ACV. Avaliação Audiológica e de Emissões Otoacústicas em Indivíduos Expostos a Ruído e Praguicidas. Arq. Int. Otorrinolaringol. 2009;13(3):264-9.
32. Vasconcelos RM, Serra LSM, Aragão VMF. Emissões otoacústicas evocadas transientes e por produto de distorção em escolares. Rev Bras Otorrinolaringol. 2008;74(4):503-7.

Received on: June 11, 2012
Accepted on: February 07, 2013

Mailing address:
Francisca Pinheiro Fontoura
Rua Antônio Bartapeli, 115
Curitiba – PR
E-mail: franfon@ufpr.br