

NOISE INTENSITY AND RAISING AWARENESS OF THE NURSING TEAM AT THE MATERIALS AND STERILIZATION CENTER

Intensidade de ruídos e conscientização da equipe de enfermagem no Centro de Materiais e Esterilização

Intensidad de ruido y conciencia del personal de enfermería del Centro de Materiales y Esterilización

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ABSTRACT: Objective: To identify the sound intensity, through decibels (dB), in the Materials and Sterilization Center (MSC) and to guide employees on the importance of ear protectors as personal protective equipment (PPE). **Method:** This is a descriptive and case report study. Sound Meter application was used to measure noise intensity in the MSC. Research was carried out in a large hospital in São Paulo City, for one week, in 2018. **Results:** The most intense noises were measured in the purge (93.0 dB), in the preparation area (92.3 dB), in sterilization areas at low temperature (91.6 dB), and steam sterilization (87.9 dB) different from the perception of collaborators. The team's awareness was based on the exposure of the measured results and discussion about the importance of PPE. **Conclusion:** There were more intense noises in the work areas with a higher number of machinery, and there was a divergence between the intensity of noise measured and that perceived by the professional. Reflective educational measures are needed to raise awareness about the importance of adhering to PPE.

Keywords: Environmental hazards. Personal protective equipment. Hearing loss, noise induced. Perioperative nursing.

RESUMO: Objetivo: Identificar a intensidade sonora, por meio de decibéis (dB), no Centro de Material e Esterilização (CME) e orientar os colaboradores quanto à importância dos protetores auriculares como equipamento de proteção individual (EPI). **Método:** Trata-se de um estudo descritivo, do tipo relato de experiência. Utilizou-se o aplicativo Sound Meter para medir a intensidade de ruído no CME. A pesquisa foi realizada em hospital de grande porte de São Paulo, no período de uma semana, em 2018. **Resultados:** Os ruídos mais intensos foram mensurados no expurgo (93,0 dB), na área de preparo (92,3 dB), nas áreas de esterilização a baixa temperatura (91,6 dB) e a vapor (87,9 dB), diferentemente da percepção dos colaboradores. A conscientização da equipe deu-se por exposição dos resultados mensurados e discussão sobre importância do EPI. **Conclusão:** Verificaram-se ruídos mais intensos nas áreas de trabalho com maior número de maquinários, e houve divergência entre a intensidade do ruído mensurado e o percebido pelo profissional. Medidas educativas reflexivas são necessárias para a conscientização sobre a importância e adesão ao uso do EPI.

Palavras-chave: Riscos ambientais. Equipamento de proteção individual. Perda auditiva provocada por ruído. Enfermagem perioperatória.

RESUMEN: Objetivo: Identificar la intensidad sonora, mediante decibels (dB), en el Centro de Material y Esterilización (CME) y orientar a los empleados sobre la importancia de los protectores auditivos como equipo de protección personal (EPP). **Método:** Se trata de un estudio descriptivo, del tipo informe de caso, La aplicación Sound Meter fue utilizada para medir la intensidad del ruido en el CME. La investigación se llevó a cabo en un gran hospital de São Paulo, durante una semana, en 2018. **Resultados:** Los ruidos más fuertes se midieron en la purga (93,0 dB), en el área de preparación (92,3 dB), en las áreas de esterilización a baja temperatura (91,6 dB) y vapor (87,9 dB), diferente a la percepción de los empleados. El equipo tomó conciencia al exponer los resultados medidos y discutir la importancia del EPI. **Conclusión:** Hubo ruido más intenso en las áreas de trabajo con mayor número de máquinas y hubo divergencia entre la intensidad del ruido medido y el percibido por el profesional. Las medidas educativas reflexivas son necesarias para sensibilizar sobre la importancia y adherencia al uso del EPI.

Palabras clave: Riesgos ambientales. Equipo de protección personal. Pérdida auditiva provocada por ruido. Enfermería perioperatoria.

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INTRODUCTION

Noise can cause a dull effect on hearing, interfere with people's personal and professional life, change their sensory perception, besides causing stress and irritability.¹

Noise is one of the most stressful factors in the workplace and can cause tinnitus and hearing loss. Tinnitus is characterized by an auditory sensation with no external stimulus, which appears in the form of whistles, beeps, hisses, among others. This sensation can be constant or intermittent, unilateral, or bilateral. Such injury can be classified by its duration; it can be chronic if it lasts for days; or acute, if the duration is short and lasts for a few seconds.²

Hearing loss is present in more than 360 million people worldwide. The most affected are older people, which can be due to the aging process itself or associated with other factors, whether genetic or environmental. A study carried out in Vila Velha City, Espírito Santo State, evaluated the epidemiological profile of 487 older and 303 young people, and found that, in both groups, speech disorders and tinnitus were some of the biggest complaints. Among participants, most presented damage due to exposure to noise, whose main symptom is tinnitus, present in more than 90% of cases.³

Noise-induced hearing loss (NIHL) is a damage caused by long-term exposure to noise and is defined as sensorineural hearing loss, usually bilateral, irreversible, and progressive with the time of exposure to noise.⁴

Among agents that damage hearing, noise is considered one of the aggressors that most contributes to the high rate of hearing impairment, causing sensorineural hearing loss.

The regulatory standard NR-15 establishes the limits of exposure to continuous noise, levels of 85 decibels (dB) as the maximum allowable daily exposure of eight hours, and 87 dB for six hours. The higher the dB index, the shorter the maximum exposure time.⁵

NR-15 establishes that not only exposure to extremely high thresholds and for a long period cause damage, but it portrays that ephemeral and exorbitant exposure can cause hearing damage, whether reversible or irreversible, given the trauma that leads to ear damage. In addition to the exposures, abrupt changes in acoustic levels can also cause damage. NIHL can be developed because of constant exposure to noise.⁵

Exposure time is directly proportional to injury. Thus, it is of utmost importance that the workplace has a favorable environment for employees to have adequate acoustic rest.⁴

NR-32 establishes basic guidelines for measures to protect the safety and health of health workers. Among these, there are essential supply of personal protective equipment (PPE) by the company, and its mandatory use by employees. Such equipment provides employees with greater security at the Materials and Sterilization Center (MSC), and the lack of its use exposes employees to occupational hazards, whether biological, ergonomic, or physical.⁶

The MSC is a unit with a high turnover of low, medium, and high complexity materials, and contains a variety of equipment. Such equipment must attend all stages of the process, especially automatic washers, compressed air jets, saturated steam autoclaves, and sterilization by hydrogen peroxide plasma, which, in turn, dissipate loud noises in the unit.

The unit shown in the study is one of the largest and most modern sterilization centers in Latin America, with numerous activities and very well divided. Employees working in this type of unit require constant training and responsibility in their actions. The MSC must provide materials for all units in the hospital; whether they are sterile or disinfected, both methods must be performed in an appropriate manner, always valuing quality for clients, that is, patients.

The occupational risk in this sector is quite significant, given the exposure to body fluids, present in materials in the process of arriving at the unit; sharps, erroneously left with other materials; in addition to the risks caused by the work environment itself.

Due to the work profile, the MSC is a critical area and predisposes employees to greater occupational risks. It is the institution's responsibility to provide continuing education and raising awareness of professionals about the risks to which they are exposed, besides adequate means of work. It is up to employees to engage to ensure work routines, as well as individual and collective protection carried out in an appropriate manner.⁷

Among the PPE used in the MSC, the present study highlights the use of hearing protection in environments in which noise pollution is high, above 85 dB, as established by NR-15. This level of sound pressure, associated with longer exposure times and frequency, can cause irreversible and more extensive damage.^{1,8}

In this context, allowing the sharing of measured noise levels with employees can help in understanding the importance of using PPE as a protective measure against hearing damage.

Even though PPE does not eliminate risks, it effectively reduces them. One way of spreading the institution' and its collaborators' responsibility is by exposing the problem, developing critical-reflective thinking with those involved.⁹

During the experience of the first author as a resident nurse, employees were seen not to believe in the possibility of hearing damage or loss due to continuous exposure to noise from equipment in the areas that make up the MSC.

One of the problems in this context is not the product availability, since it is a low-cost material, but the support, which is offered without an analysis of the context of the work environment and a due clarification regarding resource use by employees.⁸

OBJECTIVE

To identify sound intensity, in dB, in the areas that make up the MSC and make employees aware of the importance of using hearing protectors.

METHOD

This is a descriptive-exploratory and field study, carried out at the MSC of a large, philanthropic hospital, located in São Paulo City. It was built based on theoretical grounds,¹⁰ norms, resolutions, and monitoring of the work process in the sector.

In this MSC, inaugurated in August 2016, equipment with high production capacity and low operating cost was purchased, with the objective of improving logistics in relation to the supply of materials, as well as the work structure, focusing on health, and the safety of patients and employees.¹¹

This unit's employees maintain a work schedule of 6x1, with 6 or 8-hour shifts, which can be extended depending on the sector's demand and the absence of other employees.

The division of labor is carried out on weekly scales, thinking about their physical and mental health, because these activities are classified as light, moderate, and heavy scales, thus avoiding an exhaustive work sequence for employees.

Given the concern for collaborators' health, an initial discussion with nurses and nursing technicians of the unit was held about the perception of noise in their daily activity scales and the auditory discomfort as damaging to work, in addition to the probable reasons for not using ear protectors, since, despite being made available in the unit, there is no adherence by employees. This was the problem that triggered interest to develop this study.

In the residency period in which the author worked at the MSC, the fact that employees did not use ear protectors, even though PPE was available, called attention; after all, the noise in the unit was quite uncomfortable most of the time. For better understanding the issue, conversations were held with employees individually so as not to influence opinions. In a standardized way, employees were asked about the reason for not using PPE and what they thought could be done to improve adherence. Most of the feedback regarding non-use of PPE was that employees had already become accustomed to the unit's noises; some said that they already felt their hearing was altered, so they did not give much importance to protection. On the other hand, others said that they did not believe that their exposure to the unit could cause any damage, or even hearing loss.

As for measures that would help improving adherence, most said that raising awareness of all employees on the subject is important, because most of them were not sure about the risk to which they were exposed. Another measure would be changing the ear protector model, as some found the one available in the unit to be uncomfortable and ineffective, preferring those of personal use, like headphones. Some employees believed headphones to be more effective because they drown out the sound better, besides being more comfortable.

Among the possibilities of the sector, the collection of data on dB was planned to obtain reliable measurements, so that it made employees aware of the work environment, providing the dimension of noise intensity to which they were exposed in most of their days, drawing a parallel with the damage shown in the literature on such exposure.

For the noise index, dB was collected using the Sound Meter application, available for Android and IOS, capable of evaluating the dB index within a given environment. Purge, preparation, autoclave sterilization, low temperature sterilization, and storage/distribution areas were measured.

Noise was collected at different times, from 7 a.m. to 7 p.m., which corresponds to the morning and afternoon work shifts, seeking each shift's highest peak noise.

Noise measurement locations were near washing machines in the purge, in instruments preparation areas, places close to the autoclave, areas of low temperature sterilization (hydrogen peroxide plasma), and in the distribution of materials to arsenals.

The locations selected for measurement were those mentioned by employees as having the most annoying noise. The value was measured for one minute per area, with or without the presence of a collaborator on the site, and the highest value reported by the application was used for comparison with the other areas. Measurement was performed and recorded in a specific spreadsheet for one week, in December 2018. The values provided by the Brazilian Ministry of Health were used as a basis for comparison.^{4,5}

The collected data were inserted in an Excel spreadsheet for later comparison with the maximum allowed noise exposure data, according to the Ministry of Health,^{4,5} considered the tolerable daily limit of 85 dB. A descriptive analysis of these data was carried out.

RESULTS

In discussions with employees in the sector, the areas of autoclave sterilization, low temperature sterilization, purge, preparation of instruments, and distribution were

mentioned as those perceived with intense noise. Of these, the first three are work areas considered to be as heavy scales for noise intensity.

A total of 10 daily samples were collected, five in each shift, one for each daily scale. Despite scales division, some areas do not have structural division between one another, so noises end up merging in the sector, which made it difficult to accurately measure dB by scale.

With the application, reaching a dB value was possible, but measuring to how much this number falls with the use of ear protectors was not possible. The measured values are shown in Table 1.

The average of values with higher decibels in the morning corresponds to the preparation area (92.3 dB), followed by low temperature sterilization (91.6 dB), and autoclave (87.9 dB). In the morning, there is a greater number of surgical box screening to meet the daily demand and the beginning of sterilization processes.

In the afternoon, the areas with the highest average dB corresponded to the purge (93.0 dB), the preparation area (91.5 dB), and low temperature sterilization (91.0 dB). In the afternoon, there is a greater movement to finish surgical procedures and receive consigned materials, and the number of materials in the process of cleaning in the purge is high.

The perception of noise by employees differs in the classification of greater noise. When the autoclave sterilization

Table 1. Noise measurements in decibels (dB) by area and period of work at the Materials and Sterilization Center.

Scale	12/12/2018	12/13/2018	12/14/2018	12/15/2018	12/17/2018	12/19/2018	12/26/2018	Average
	Shift - Morning							
	dB	dB	dB	dB	dB	dB	dB	
Preparation	90.9*	91.5*	93.2*	95.6*	98.6*	90.3*	86.6*	92.3*
Autoclave	84.7	94.3*	83.9	89.6*	88.5*	85.8*	88.9*	87.9*
Low temperature	95.0*	86.8*	96.3*	94.8*	92.9*	85.2*	90.3*	91.6*
Distribution	83.8	83.9	84.9	82.3	82.3	82.2	80.0	82.7
Purge	93.7*	90.1*	84.6	85.0	85.7*	87.7*	83.9	87.2*
	Shift - Afternoon							
	dB	dB	dB	dB	dB	dB	dB	
	dB	dB	dB	dB	dB	dB	dB	
Preparation	100.2*	92.1*	95.8*	85.0	89.3*	92.4*	85.9*	91.5*
Autoclave	90.0*	94.0*	93.2*	89.2*	87.9*	85.7*	88.3*	89.7*
Low temperature	96.8*	89.7*	89.3*	95.4*	90.3*	88.3*	87.6*	91.0*
Distribution	85.2*	85.0	83.6	85.8	85.5*	86.0*	84.3	85.0
Purge	95.2*	92.6*	98.1*	90.9*	92.3*	90.7*	91.6*	93.0*

*Values above the Brazilian Ministry of Health recommendations.

area mentioned by employees as the one with the highest noise perceptions, this area is below the highest levels measured in the preparation, purge, and low temperature sterilization areas when dB level is measured.

With the measured values, the awareness of the nursing team took place with an expository presentation of the measured values and employees' initial perception, demonstrating that the noise may not have been perceived by them. Emphasis was placed on the importance of using ear protectors as an essential PPE to protect hearing health. After showing the values, the group had time to discuss the use of PPE. Later, raising awareness was observed as not yet being effective for most employees to use ear protectors. This fact encourages the authors to create new action measures to improve the group's adherence.

DISCUSSION

The data in this study demonstrate high levels of noise to which employees are exposed in the MSC, when compared to the reference level of the Brazilian Ministry of Health, which shows that employees exposed to noise above 85 dB for certain periods can suffer hearing damage.^{4,5} The areas with the highest dB intensity correspond to those perceived by employees as having the highest intensity (autoclave sterilization, low temperature sterilization, and purge), but they differ in the classification of the highest noise level.

Such perception divergence may be related to the adaptation of employees to their work area, but it raises the question of employees maybe failing to wear ear protectors because they believe that the area in which they work has less noise intensity and, therefore, would not cause damage to their health. In fact, it is an area of greater intensity and can cause hearing damage according to the prolonged exposure time. A study showed that 25% of workers are exposed to noise-induced hearing loss.¹²

Regarding noise average, the only area with values according to the recommendation is the storage/distribution of materials, and this is due to the characteristic of the place in which storage of sterile material is carried out, without machinery, with reduced personnel flow. This is also the area perceived by employees as having the lowest noise intensity.

A similar study obtained strong and disturbing noises as results, evidenced in 97 and 96% of state and municipal

hospitals, respectively; noises came from machines and equipment. The areas of greatest intensity have a finding like those from the present study, which are preparation of instruments and sterilization at low temperature.¹¹ Other studies have obtained a similar perception about the presence of noise in areas in which autoclaves are concentrated and in instruments preparation.^{13,14}

A study compared several damages to which MSC workers are exposed, and identified noise as one of the most prevalent, ranking third or present in 82.2% among all damage. In this study, employees reported using PPE, but after obtaining data, hearing protection was not mentioned among the most prevalent protective equipment used by employees.¹⁵

The lack of adherence to the use of hearing protection by employees and their perception of little importance in relation to the use of PPE are observed in the behavior of several employees working at the MSC.

In relation to poor PPE adherence and hearing damage, employees mentioned that the use of hearing protection causes some discomfort, drowns out verbal requests or bells, interfering with the sector's dynamics.¹³ Therefore, even though PPE minimizes the damage caused by noise, such equipment is little used by health professionals and requires different actions to raise awareness about its importance.

NIHL appears as the second most recurrent condition of the hearing system and is often perfectly feasible for prevention. The progression of damage stagnates when people are removed from the noise source.

A study, whose prevalence of NIHL in the participants was 30%, suggests that this pathology is more prevalent in people with advanced age and finds the prevalence before the longer time of exposure to noise.¹⁶

The way in which workers perceive reality is often inadequate from the point of view of occupational safety. Thus, actions related to perception and risk propensity must be promoted so that employees are aware of health preservation as a priority.¹⁷

Each human being has a different sensitivity to noise, and having a dimension of the damage caused is only possible with consultation with a specialized professional, with proper anamnesis, inspection of the external auditory canal, audiometric examination, immittance test, which analyzes the functional integrity of the eardrum, and noise stimulus test, which checks for the presence of cochlear damage.¹

In a study carried out in São Paulo City, the effectiveness of noise attenuation was measured with the use of foam plug ear protectors, similar to what was found at the MSC headquarters of present research. The study was applied to 18 participants of both sexes, and the efficiency of the ear protector was measured with a noise dosimeter that contained two microphones, both strategically positioned in the same positions. With a microphone located in the external auditory canal, in the plug foam, and another near the shoulder, the authors simulated a normal work situation. Although the study reports differences among participants, which is also caused by the anatomical characteristics of each one, there was noise attenuation in all situations with the use of PPE. In all samples, the values of the microphone installed in the ear were lower when compared to those of the shoulder, thus showing the effectiveness and importance of wearing ear protectors, especially in situations in which the environment presents noise above the level recommended by the Brazilian Ministry of Health.¹⁸

Educational actions are effective when they encourage the reflection of workers, promote their autonomy, and encourage the adoption of protective measures for them and for others.¹⁷

Among research limitations, not being able to measure how much ear protectors decrease the chances of developing damage without the proper devices is one of them. However, what became clear was the extent to which employees are subject to affecting their physical and mental health if exposed to their work environment with no protection.

CONCLUSION

More intense noise was measured in work areas with a greater number of machinery, and there was a difference between the intensity of the measured noise and that perceived by the professionals. In the morning, the low temperature preparation and sterilization areas had the highest noise levels, with averages of 92.3 and 91.6 dB, respectively. In the afternoon, the purge and preparation areas had the highest noise levels, 93.0 and 91.5 dB, respectively.

Mere guidance on the importance of using PPE is not enough for conscious adherence. Therefore, other strategies, such as educational campaigns on hearing health, are required to raise awareness of MSC workers.

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