

## OCCUPATIONAL DISEASES

**Drita YZEIRI- HAVZIU\***, Senem IBRAHIMI, Arlinda HAXHIU-ZAJMI, Arijeta SHABANI, Dorentina BEXHETI, Edita ALILI-IDRIZI, Merita DAUTI, Nexhibe NUHII, Gjylai ALIJA, Lulzime BALLAZHI, Sihana AHEMTI-LIKA, Melisa HAVZIU IDRIZI

*Department of Pharmacy, Faculty of Medical Sciences, University of Tetova*  
*\*Corresponding author e-mail: drita.havziu@unite.edu.mk*

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### Abstract

Occupational diseases continue to be one of the major health problems of the able-bodied population worldwide. The reasons for this are numerous, but the main one is of course the nature of these diseases which by definition are chronic, progressive and degenerative, and the period of latency in which the disease does not have to manifest clinically can last for decades. The factors that can contribute to the development of an occupational disease, ie disease, are numerous and range from chemical, physical and biological to psychosocial risks, so there is a need to find new ways to control long-known risks, to observations of the most common workplace pathologies in the last twenty years, such as recurrent traumatic illnesses, immunodeficiency transmitted as a result of biological injuries and violence, and psychological trauma in the workplace. The aim of this paper is to evaluate the effect of noise as a function of its levels and the duration of workplace exposure on workers' health. This study was conducted with 10 workers from the metal factory "Zhelezara", Skopj which have been exposed to the noise the longest period. According to the results of the research, it can be noted that workers working in a noisy environment experience certain side effects from the noise, although they use different protective equipment for the entire duration of the working time. New knowledge in occupational health and safety practice is needed to respond to new challenges in this field.

*Keywords:* occupational diseases, occurrence, risk, factors.

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### 1. Introduction

Occupational diseases are caused by exposure to harmful chemical, biological agents and physical hazards in the workplace. Although they appear to occur less frequently than other major disabling diseases, there is evidence that they affect significant numbers of people, especially in rapidly industrializing countries. In many cases, occupational diseases are severe and disabling for patients. However, two factors make them easily preventable: first, the causative agents of these diseases can be identified, measured and controlled; second, populations at risk are usually easily accessible and can be regularly monitored and treated. Furthermore, the initial changes are often reversible if treated promptly (Lorente-Pedreille, 2020) Early detection of occupational diseases is of primary importance. Every year, a significant number of people die or become disabled due to easily preventable and legally preventable occupational accidents and diseases. As a basic requirement for the recognition of an occupational disease is the definition of the occupational exposure (exposure). In practical conditions, it may happen that the concentration/level of an occupational hazard at the workplace in an individual measurement is significantly higher than the legally determined Maximum Allowable Concentration (MAC), but if the worker does not spend 8 hours a day or other protective measures are taken that reduce individual exposure (eg wearing personal protective equipment such as respirators for chemical hazards or antiphons for protection against noise), which minimizes the occupational risk and there is no basis for the occurrence

of an occupational disease (Concha, et al 2004). Conversely, the concentration/level of an occupational hazard may be lower than the legally established maximum residue values (MRL), but if the worker spends more than 8 hours a day at that workplace or performs very heavy physical work, which increases the number of respirations and greater concentrations/values of occupational harm than the MAC enter the body. In this way, an increased occupational risk for the occurrence of an occupational disease is created. Hence, it follows that the assessment of individual exposure as a product of time and level of exposure is an essential tool for determining the degree of occupational risk for each worker separately (Chirico et al, 2019). The beginning of the third millennium has witnessed the emergence of various challenges, including work-related musculoskeletal disorders, psychosocial issues and work-related mental health disorders (EU-OSHA, 2009). There are several definitions of the term "occupational disease". According to the 2002 Protocol to the Convention on Safety and Health at Work of the World Health Organization, 1981, the term "occupational disease" includes any disease that is acquired as a result of exposure to risk factors arising from work activity (International Labour Organization, 2002)

Occupational factors can have both positive and negative effects on the worker's health, largely depending on the nature of a certain factor and the degree of exposure to it. Occupational factors are classified as (1) chemical, (2) physical, (3) biological, and (4) ergonomic and psychosocial. In addition to the individual classes of factors, they can occur in combination, that is, the development of the occupational disease can be influenced simultaneously by several factors. The professional environment as a physical factor is often characterized by noise, ie, any unwanted sound or combination of sounds. When characterizing the effect of noise on the body, the following physical parameters are used: (1) intensity, (2) frequency spectrum, (3) duration of exposure (Stikova et al 2015) According to weather characteristics, noise can be considered constant if its level does not change by more than 5 dB during the day; sounds which under the same conditions change by a greater value are described as "fluctuating" (Lorente-Pedreille, 2020). Among the fluctuating sounds, it is possible to distinguish those "time-related", sounds that change continuously and "intermittent" sounds whose levels drop sharply to the background value; there are also "pulsating" sounds that contain one or more beeps, each less than 1 second in length. Broadband noise covers a frequency range with a continuous spectrum, while tonal noise is characterized by audible discrete tones. The response of the organism to noise with different physical characteristics shows some peculiarities. Thus, noise whose energy is concentrated mainly in the high frequency range causes a much more negative effect on the body than low frequency noise. Tone noise produces an even less favorable effect than wide-band noise. Noise that periodically drops in volume level throughout the workday produces less effect than continuous noise at the same level. In order to assess the health effect of fluctuating noise as a function of its levels and duration of exposure, the International Organization for Standardization (ISO) recommends using a mathematical method for calculating the equivalent noise level. The calculation of the equivalent noise level is widely used in many countries, although the average parameter (q) differs from country to country. This situation complicates the comparison of assessments of the health effects of noise undertaken in different countries. In recent years, it has been suggested that efforts should be made to estimate the noise energy dose to which the worker is exposed, (International Organization for Standardization, 1975). The company Brüel & Kjær (Denmark) already produces two types of portable dosimeters for personnel, types 4424 (q = 3 dB) and 4425 (q = 5 dB) (Alexeyev et al 2017).

Occupational noise causes various effects on the body: it has negative non-specific effects on the functioning of the nervous and cardiovascular system, the gastrointestinal tract and other organs. The majority of countries have accepted the reduction of the ability to hear, especially

the temporary reduction of the hearing threshold, as a criterion for assessing the effect of occupational noise on the health of workers.

Hearing function in industrial settings can be tested in one of the following ways:

1. One-time examination of patients subjected to prolonged exposure to industrial noise using tone threshold audiometry;
2. One-time examination of patients subjected to a certain type of noise;
3. Long-term observation (several years) of changes in hearing function of workers who showed progressive hearing loss.

The main characteristics of occupational hypoacusis are the initial loss of hearing function in the region of 4000-8000 Hz with further spread to medium and low frequencies. In addition to tone threshold audiometry at frequencies of 125-8000 Hz, the assessment of hearing function is performed using vocal audiometry and whisper perception tests (International Organization for Standardization, 1978).

Occupational hearing disorders are divided into the following categories. In category I hearing loss, disorders characteristic of cochlear neuritis are present in the area of the basal margin of the cochlea where the perception of high-frequency sounds is observed. In category II, the mediobasal part of the cochlea is affected, resulting in a failure to receive sounds in the vocal zone. In category III, the entire middle and apical level of the cochlea are affected and patients begin to complain of subjective tinnitus and the inability to perceive noise, even loud speech (Kolomijchenko, et al 2015).

Waitzman and Smith have published coefficients calculated by multivariate regressions for two age groups for workers in construction, manufacturing/mining and other subsectors. Construction workers experienced between 2 and >3.5 times greater risk than workers in 'other industries'. The pattern of their hearing loss at normal speech frequencies significantly impaired their ability to communicate. In addition to the specific effect of the hearing organ, noise has a non-specific effect on a number of systems and organs. It is worth mentioning that, according to several studies, the specific effect of noise on the hearing organ becomes noticeable much later than the non-specific effect on other organs, especially on the nervous system. This can quickly lead to the development of neurasthenic and asthenic syndromes, autonomic dysfunction and neurocirculatory disorders associated with hypertension, hypotension and cardiac symptoms (Dini, et al. 2019) The aim of this paper is to evaluate the effect of noise as a function of its levels and the duration of workplace exposure on workers' health.

## **2. Materials and methods**

To achieve the objectives of the study, a transversal (cross-sectional) descriptive type study was chosen to assess the impact of the noisy work environment on workers' health. This study was conducted with 10 workers from the metal factory "Zhelezara", Skopje, in the period 03.04 - 06.04.2022, the average age of the respondents is 58 years, all respondents are male, the average value of the work experience of the respondents is 22 ,8 years, of which the shortest work experience is 14 years, and the longest work experience of a particular respondent is 34 years and 2 months. For this purpose, a survey questionnaire (Appendix 1) was used as a research tool, with a total of 5 open-ended questions.

## **3. Statistical data processing**

The results were processed and presented in tabular and graphic form using Microsoft Office Excel

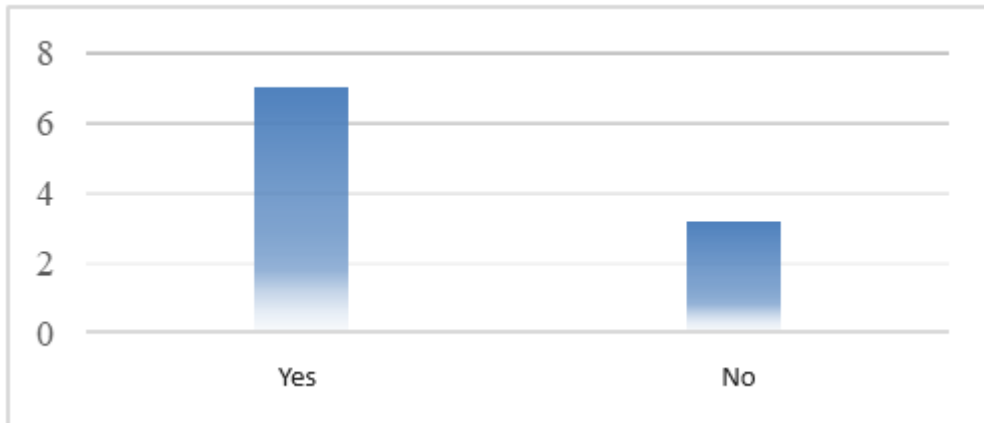
#### 4. Results and discussion

Regarding this question, all 10 respondents answered that they are exposed to noise during the working day. Regarding the sources from which the noise originates, according to the respondents, they are the following:

Furnaces for melting metals;

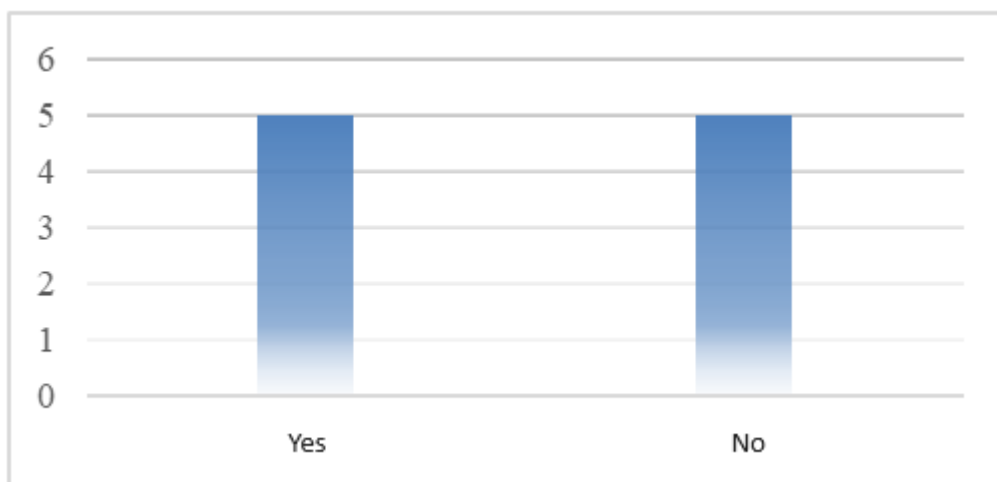
- Machines for extracting metal products;
- Noise from cooling/heating motors;
- Noise from heated, raw material.

The workers were exposed to the noise for a period of 8-10 hours a day, depending on the production process, and the following results were obtained, which are presented in "Graph, 1,2,3,4 and 5".



**Graph 1.** Answers to the question Does the noise prevent you from having a normal conversation with your colleagues when speaking at a normal intensity?

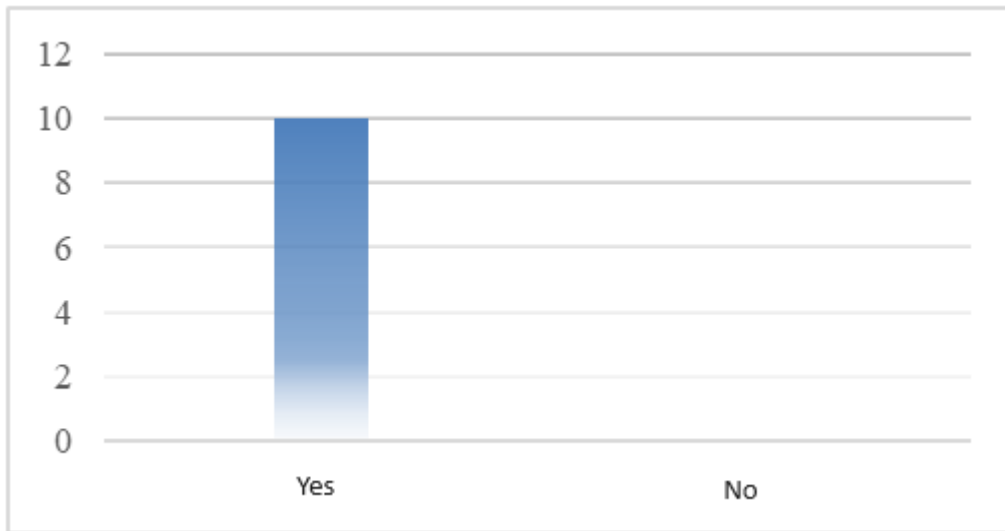
According to the data shown in Graph 1, it can be concluded that the majority of respondents (7 respondents out of a total of 10 or 70% of the total number of respondents) answered that they have a problem when conducting a conversation with colleagues and other associates at a normal level of speech intensity, while only 3 respondents out of a total of 10 (30% of the respondents) answered that they had no such problem.



**Graph 2.** Answers to question Are you usually exposed to noise outside the workplace (engines, tools, machines, loud music)?

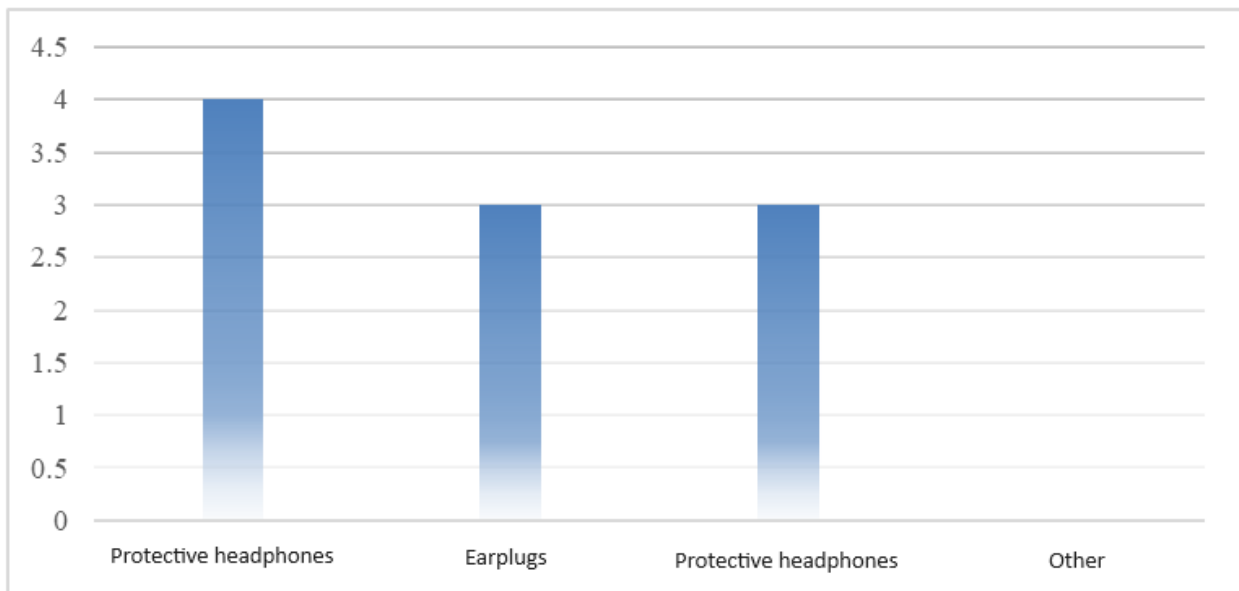
From Graph 2, it can be seen that half of the respondents, 50% or 5 out of 10 respondents, stated that they are exposed to noise outside the workplace, while the same number of

respondents indicated the opposite, that they are not exposed to additional noise , except at work.



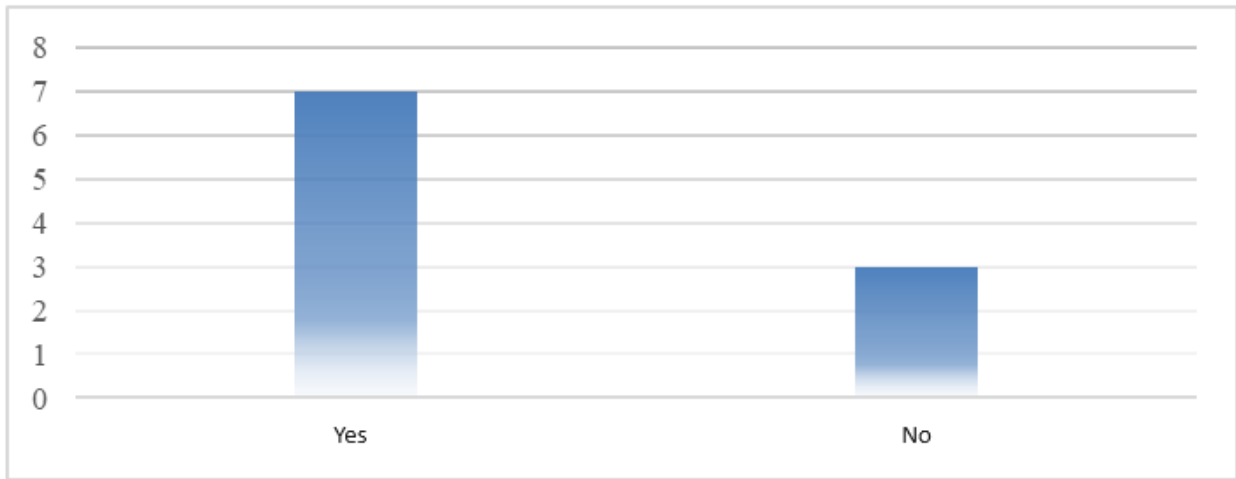
**Graph 3.** Results of question: Do you use noise protection in the workplace and if so, what kind of protection?

Regarding the obtained results shown in Graph 3, all respondents answered that they wear adequate protection against noise at the workplace.



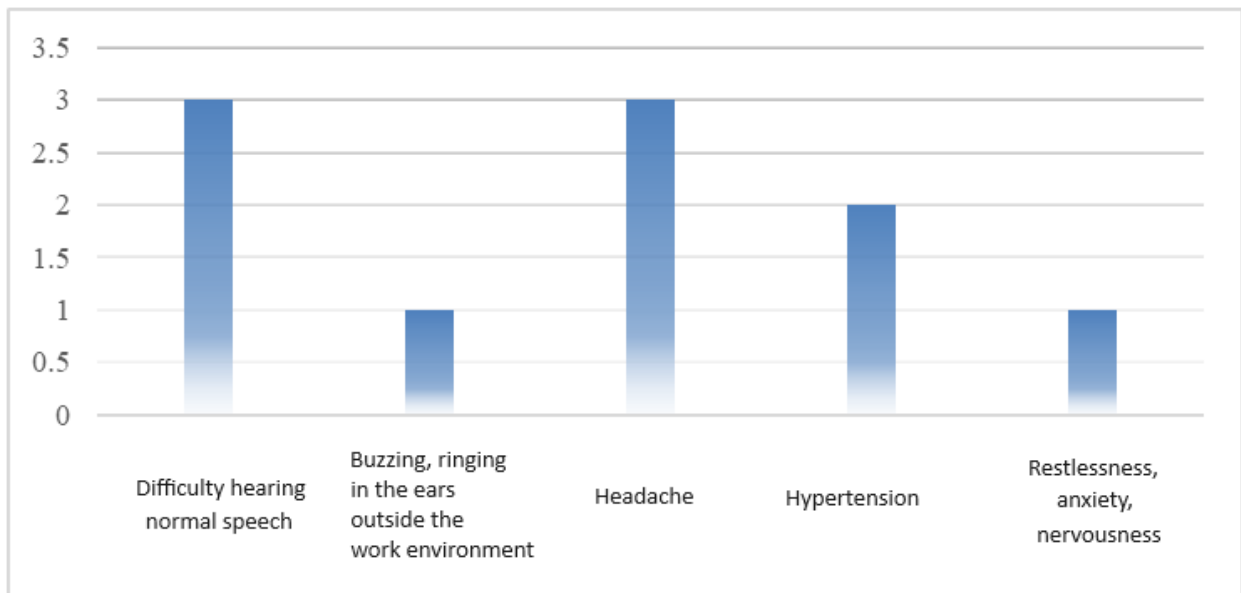
**Graph 4.** Results of the sub-question about the type of protection they wear

According to the displayed results, from Graph 4 it can be seen that the largest number of respondents, 4 respondents out of a total of 10 (or 40%), wear protective headphones during the working day, 3 out of a total of 10 respondents or 30%, wear earplugs, and the same number of respondents, 3 out of a total of 10 or 30%, wear a combination of protective headphones and earplugs.



**Graph 5.** Results of question: Have you noticed any health symptoms due to the noise at work?

From Graph 5, it is clearly seen that the largest number of respondents (7 out of 10, or 70%) stated that they have noticed some health symptoms that are related to noise at the workplace. However, there are respondents who have not noticed such effects so far, and only 3 respondents out of a total of 10, or only 30% of respondents.



**Graph 6.** The results of a questionnaire about the symptoms experienced by workers working in a noisy environment.

According to the results shown in Graph 6, it can be noted that the largest number of respondents, 3 respondents out of a total of 10 or 30% of the respondents experience difficulties in listening to normal speech and headache. Two of the respondents, or 20%, stated that they had acquired hypertension during their working life, while one respondent stated that they felt buzzing, ringing in the ears even after the end of the working day, and one respondent stated that they felt restlessness, anxiety and nervousness and after the end of the working day, precisely because of the noise. According to the results of the research, it can be noted that workers working in a noisy environment experience certain side effects from the noise, although they use different protective equipment for the entire duration of the working time. However, as shown in the results, the working time is not short, sometimes up to 10 hours depending on the production process, and hence the exposure to noise over time is high.

Although noise in such industrial facilities is almost unavoidable, it originates from various sources, as mentioned – furnaces for melting metals which emit a loud, explosive sound during manipulation, engines of various machines, the machines themselves, the movement of molten metals and so on. The period of work experience, which is not small, despite the use of protective equipment to protect against noise, contributes to the development of certain symptoms of diseases in which noise has a direct impact, such as reduced hearing threshold, headaches, hypertension, ringing in the ears and after finishing working hours and even nervousness and anxiety in one of the respondents, which corresponds with the results of Dini, G., et al 2019 who confirmed that the specific effect of noise on the hearing organ becomes noticeable much later than the non-specific effect on other organs, especially on the nervous system. This can quickly lead to the development of neurasthenic and asthenic syndromes, autonomic dysfunction and neurocirculatory disorders associated with hypertension, hypotension and cardiac symptoms (Dini, et al 2019).

## 5. Conclusion

- It can be noted that workers working in a noisy environment experience certain side effects from the noise, although they use different protective equipment for the entire duration of the working time.
- Prevention of occupational accidents and diseases is certainly cheaper than compensation.
- It is extremely important to have good workplace health and safety measures in place to eliminate risks before an accident and illness occur, as well as social security services that compensate the loss of income and/or increased costs to the employee or family after the occurrence of occupational accidents and illnesses.

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