

The relationship between noise pollution and blood pressure: A study on field workers at unit plan chemical industry company

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Abstract

Workers chemical companies employed at these facilities are exposed to inherent occupational health hazards, including occupational noise. Noise was considered disruptive because its presence was unwanted. The production process was one of the main sources of noise pollution that could disrupt health. Noise exceeding the Threshold Limit Value would cause abnormal blood pressure, as occupational noise was a risk factor for hypertension. This study aimed to identify the relationship between noise pollution and blood pressure. This research was an observational study with a cross-sectional approach. The research sample was obtained using proportional random sampling technique, comprising 95 samples from a population of 128. Of the 95 participants (median age <40 years; 87.4%), 20% (19/95) had abnormal blood pressure, used PPE (60%) and 32.6% (31/64) were exposed to high noise. The results of this study revealed a significant relationship with abnormal blood pressure experienced by Unit Plan field workers ($p=0.019$). Based on the research, it was found that high noise intensity coupled with not using PPE could increase the risk of abnormal blood pressure in workers.

Keywords: Occupational Noise; Workers Chemical Companies; Blood Pressure; Field workers

1. Introduction

The company essentially has complex issues. One common problem found in some industrial areas is noise pollution. Noise originates from unwanted sounds from activities or operations within a certain period of time that can trigger health problems in humans and environmental discomfort [1]. Therefore, with the presence of noise pollution in the work environment, it will result in human disturbances and disrupt environmental comfort, which in turn affects the decline in worker productivity and gives rise to other negative impacts that are detrimental to both the workers and the company.

The health effects caused by noise exceeding the threshold values (NAB) according to WHO 2011 include the emergence of hearing impairment, communication disorders, sleep disturbances, decreased employee performance, cognitive disorders in children, and cardiovascular diseases [2]. Noise pollution remains a significant environmental health issue, defined as unpleasant sounds. Research indicates that prolonged exposure to noise is associated with hearing impairment, which can trigger cardiovascular diseases such as heart conditions and high blood pressure [3].

Blood pressure-related diseases are poised to become a major crisis in global public health. Nearly 1 billion people worldwide suffer from high blood pressure. The World Health Organization predicts that by 2025, there will be an additional 1.5 billion cases of hypertension, affecting one in three individuals globally. This alarming trend suggests that approximately 10.44 million people die each year from hypertension and its complications [4]. In addition to the conventional risk factors for hypertension, current epidemiological evidence indicates that environmental factors, such as noise, contribute to an increased risk of high blood pressure.

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People encounter various sources of noise regularly in both work and home environments. While individuals may become accustomed to noise up to a certain threshold, continual exposure can disrupt the autonomic nervous system and endocrine system, induce oxidative stress, and disturb circadian rhythms, ultimately contributing to high blood pressure. Based on the background outlined above, the aim of this study was to identify the relationship between noise pollution and the blood pressure of field workers.

2. Material and methods

A cross-sectional design was used in this study. Data were collected using occupational physical examination and sound level meter. Sampling was conducted using the proportional random sampling method, resulting in 95 respondents meeting the following inclusion criteria in this study: willingness to participate as research respondents, participation in periodic occupational health examinations in 2022, working in field areas (SA Plan, Pa Plan, and Puri WWT) and exposed to noise. Exclusion criteria: Workers unwilling to participate as research respondents, workers who are currently ill, workers not working in SA Plan, PA Plan, and Puri WWT areas. The collected data will be analyzed statistical testing analysis using Chi-Square correlation, and conclusion will be drawn based on the analysis.

3. Results and discussion

A total of 95 workers were included according to the inclusion and exclusion criteria and were divided into 2 groups that developed abnormal blood pressure (n=19) and normal blood pressure (n=76). Among the workers who developed high blood pressure or abnormal blood pressure, a greater proportional of workers unit plan were exposed to combine noise pollution >85 dB (35,5%) and use PPE 12,3%). Based on the collected and analyzed articles, the findings are presented as follows:

Table 1 Description of the study population

No.	Exposure	Blood Pressure		p-value	C
		Normal	Abnormal		
1.	Age				
	<40 years	68 (81.9%)	15 (18.1%)	0.250	0.126
	≥40 years	8 (66.7%)	4 (33.3%)		
2.	Noise Pollution				
	<85 dB	56 (87.5%)	8 (12.5%)	0.019	0.260
	≥85 Db	20 (64.5%)	11 (35.5%)		
3.	Using PPE				
	Yes	50 (87.7%)	7 (12.3%)	0.041	0.230
	No	26 (68.4%)	12 (31.6%)		

Based on the data above, The majority of employees in the field unit of the Chemical Industry Company are below 40 years of age. This is because the Chemical Industry Company in East Java is a relatively new company, having been established around 10 years ago, and its workforce is still primarily composed of young people. Additionally, the company specifically focuses on hiring Plan workers, who are considered to have a strong physique and good health, which leads to high performance and productivity. The majority of workers under 40 years of age had normal blood pressure, with 68 individuals (66.45%), while 15 individuals (18.1%) had abnormal blood pressure. In contrast, among workers aged 40 and above, 8 individuals (66.7%) had normal blood pressure, and 4 individuals (33.3%) had abnormal blood pressure. Based on the statistical test results, the p-value was found to be 0.485 or (p>0.05), indicating that there was no significant relationship between the age of field workers in the Plan unit of the Chemical Industry Company in East Java and their blood pressure. The search results do not provide information on the relationship between the age of field workers in the Plan unit of the Chemical Industry Company in East Java and their blood pressure. However, the results do indicate that occupational noise exposure is associated with an increased risk of elevated arterial blood

pressure. Additionally, the age of field workers is mentioned in relation to their job experience and safety experience in the mining industry, but no significant correlation was found between age and blood pressure.

This research is supported by the opinion that high blood pressure is not uncommon among individuals over the age of 40, but it can also affect young adults. The majority of prehypertension cases occur in the age range of 25-45 years, with only about 20% of cases occurring in individuals under 20 years or over 50 years. This is attributed to the lack of focus on health during the productive years, which includes unhealthy lifestyle and dietary habits. [5]

Presently, among 20 workers exposed to noise above NAB (≥ 85 dB), 64.5% had normal blood pressure and 35.5% had abnormal blood pressure. The chi-square analysis yielded a p-value of 0.008 or ($p < 0.05$), indicating a significant correlation between noise exposure and blood pressure in the field workers in the Plant unit of the Chemical industry Company. Presently, the findings from the research conducted by Lendo et al. (6) on 60 workers in the furniture industry in Touliang village Oki show a significant correlation between noise intensity and blood pressure among workers, with a p-value of 0.000. Rahmawati and Hariyono's study [7] also supports these findings, confirming that the prevalence ratio of 16,667 indicates that the risk of stage 1 and 2 hypertension among workers exposed to noise above NAB (hazardous) is 16,667 times higher compared to those exposed to noise below NAB. These findings suggest that occupational noise exposure may be a significant risk factor for elevated blood pressure and other cardiovascular health issues. Its supported by the discovery of a case of occupational disease caused by noise hazard that indicated as the cause of the high blood pressure of one of the workers that made a fatality case.

The use of APT or ear protection devices is a common practice among field workers in the Chemical Industry Company in East Java. These devices, which include earmuffs, earplugs, and others, are used when workers are in noisy workplaces. According to the analysis in Table 1, the majority of field workers in the Plan unit of the Chemical Industry Company have used APT (60%). Based on the statistical test, the p-value was found to be 0.041 or ($p < 0.05$), indicating that there is a significant relationship between the use of APT (ear protection devices) and blood pressure among field workers in the Plan unit of the Chemical Industry Company. Research by Sari et al. [8] which found a p-value of 0.017, indicating a significant correlation between the use of ear protection devices and blood pressure.

4. Conclusion

Based on this study, demonstrated a harmful association of occupational noise exposure with hypertension. Occupational exposure to noise levels of ≥ 85 dBA was associated with high blood pressure (abnormal) in young adults. This is supported by the use of ear protection devices, which have a significant correlation with abnormal blood pressure in the field unit of the Chemical Company's Plant. Future studies with prospective designs and clinical trials are needed to confirm the results of the current study and to develop effective strategies for preventing and managing occupational noise-induced hypertension.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare no conflict of interest regarding the publication of this article.

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