MJE : Muhammadiyah Jurnal of Epidemiologi
Website : https.//jurnal.umj.ac.id/index.php/MJE
Vol. 5 No. 1 Mei 2025 Hal. 1 – 14

The Impact of Environmental Noise on Hearing Health

[1)]Rizki Hashym, [2)]Triana Srisantyorini, [3)]Irna Hasanah
Public Health Study Program, Faculty of Public Health, University of Muhammadiyah Jakarta
Building A, Jl. K.H. Ahmad Dahlan, Ciputat, South Tangerang, 15419, Indonesia
Email : rizkihashym@gmail.com[1], triana.srisantyorini@umj.ac.id[2,], irnahasanah@staff.umj.ac.id[3]

ABSTRACT

The sound produced by a vibrating sound source is an undesirable sound and can disrupt human comfort and health. Noise, defined as undesired sound that can disturb or negatively affect health, poses a serious occupational hazard. Long-term exposure to high noise levels at work is frequently linked to auditory impairments like noise-induced hearing loss (NIHL). This problem has been made worse worldwide by the continuous industrialization processes and a lack of public awareness about the harmful effects of noise. An estimated one-third of people worldwide are thought to be impacted by noise-related disruptions. Knowing the prevalence of NIHL is crucial because it is one of the main preventable causes of disability. One of the main risks to employees' auditory health in industrial settings is noise exposure. The purpose of this review of the literature is to compile the results of numerous investigations into the effects of occupational noise on hearing health, established exposure thresholds, and practical preventative strategies. According to the review, extended exposure to noise levels higher than 85 dB(A) can cause tinnitus, fatigue, elevated stress levels, and permanent hearing loss. Therefore, to lessen the negative effects of noise exposure, it is imperative to implement hearing protection equipment and efficient workplace noise management techniques. Based on 15 literature reviews, it was determined that workplace noise has an impact on hearing health for a number of reasons: excessive noise levels can harm hearing, employees' ignorance of noise hazards raises the risk of hearing disorders, management can lessen adverse effects, and the use of hearing protection equipment is frequently disregarded even though it is essential.
Keyword*: Occupational Noise, Hearing Loss, Tinnitus, Occupational Health*

INTRODUCTION

The sound produced by vibrating sound sources is unwanted and can interfere with human comfort and health (Fithri & Qisty Annisa, 2015) and has been identified as a major hazard to workers' hearing health, especially in the industrial manufacturing sector (Héroux et al., 2015). According to the World Health Organization (WHO) and the National Institute for Occupational Safety and Health (NIOSH), the safe noise exposure for 8 hours per day is 85 dB(A). Exceeding this limit can lead to sound-induced hearing loss (NIHL) (Occupational Safety and Health Administration (OSHA), 1970). During the development of society, exposure to excessive noise has a negative impact on hearing. Staying away from noisy environments is a limited noise-induced hearing loss treatment suggestion (Ding et al., 2019). Occupational sensorineural deafness is a noise-induced disease (NIHL).

It occurs due to high noise exposure in the workplace and prolonged exposure, leading to damage of inner ear hair cells. This study investigated the risk factors associated with noise-induced hearing loss (NIHL) in factory employees. Hazards that can arise from the interaction of man, machine and work environment in the industrial production process can be found. Noise is one of the most frequent hazards faced by workers who work in equipment with high noise intensity. Noise is a condition that interferes with hearing due to unpleasant sounds and noises produced by production equipment and processes. Noise can harm hearing, mainly through damage to hair cells in the cochlea leading to noise-induced hearing loss (NIHL). To help prevent permanent hearing damage, NIOSH also suggests lower noise exposure limits and more appropriate decibel exchange rates (W. Murphy & Franks, 2002).

METHODS

This research uses the literature review method, in which researchers conduct a series of studies involving various kinds of information derived from journal articles taken from Google Scholar with the aim of finding various theories and ideas which can then be formulated in accordance with the research objectives. This research has received approval from the Research Ethics Committee of Muhammadiyah University Jakarta, with approval letter number 10.054.C/KEPK-FKMUMJ/V/2025. The following is a list of literature that has been reviewed by researchers and summarized, which is listed in **Table 1** below.

Table 1. List of Literature Used in Research

No	Researcher Name	Title	Publication and Year	Conclusion
1	Héroux, Marie EveBabisch, WoalfgangBelojevic, Goran Brink, Mark Janssen, Sabine Lercher, Peter Paviotti, Marco Pershagen, Göran Waye, Kerstin Persson Preis, Anna Stansfeld, Stephen van den Berg, Martin Verbeek, Jos	WHO environmental noise guidelines for the European Region	Euronoise 2015	Based on this research, the "Guidelines for Environmental Noise for the European Region", published by the WHO in 2015, emphasizes the negative impact of environmental noise on human health, including sleep disturbance, stress, and heart disease. To safeguard public health, the guidelines limit noise exposure from various sources, such as industry and transportation. WHO suggests noise reduction through good spatial planning, use of quieter technology, and sustainable transportation laws.
2	Occupational Safety Health Administration (OSHA)	Temporary Worker Initiative	Occupational Safety and Health Administration (OSHA), 2013	Based on this research, through various programs, improve occupational safety and health. The regulations created and updated by the agency are intended to protect workers from hazards and improve enforcement against safety violations. In

No	Researcher Name	Title	Publication and Year	Conclusion
				addition, OSHA works closely with industries to come up with best safety practices. .
3	Murphy, William Franks, John	NIOSH Criteria for a Recommended Standard: Occupational Noise Exposure, Revised Criteria 1998	Journal of The Acoustical Society of America - J ACOUST SOC AMER	Based on this research, the NIOSH guidelines for noise exposure in the workplace are presented in the journal "NIOSH Criteria for a Recommended Standard: Occupational Noise Exposure, Revised Criteria 1998". NIOSH emphasizes in this revision that excessive noise exposure can cause permanent hearing loss and other health problems. Key recommendations include setting the highest noise exposure limit at 85 decibels (dBA) for an average eight-hour workday, as well as the importance of reducing noise sources.
4	Murphy, William J. Franks, John R. Krieg, Edward F.	Hearing protector attenuation: Models of attenuation distributions	The Journal of the Acoustical Society of America 2002	Based on this research in light of the changes that occurred in the standard using subject adjustment protocols, which reduced tester and manufacturer control over hearing protector use, this paper

No	Researcher Name	Title	Publication and Year	Conclusion
				proposes a new method for modeling sound reduction by hearing protectors. To overcome the problem of non-normal distribution of REAT data and to be more accurate in modeling data variation, a bimodal model is suggested. Standard-setting organizations, such as ANSI and ISO, are expected to produce objective and accurate standards by using empirical quantiles without certain distribution assumptions and specifying protection performance.based on distribution cumulative or bimodal model.
5	Báez R, Mirtha Villalba A, Cesar Mongelós M, Rosalilna Medina R, Blás Mayeregger, Ilda	Noise induced hearing loss in in their work workers exposed environment	Anales de la Facultad de Ciencias Médicas (Asunción) 2018	Based on this study, noise-induced sensorioneural hypoacusia in this study reached 45%, higher than previous literature, especially in men over 50 years old exposed to noise above 80 dB. There was a correlation between length of employment and hearing loss. This study

No	Researcher Name	Title	Publication and Year	Conclusion
				suggests that noise level limits in the workplace should be updated and audiometric examinations should be conducted regularly. This study suggests that to protect workers' health, hearing preservation programs are necessary. No information on conflict of interest or funding was mentioned.
6	Adhi, Alya Yasmin Martono, Wahyu Budi Fuad, Wijayanti	Analisis Faktor Risiko Noise Induced Hearing Loss (Nihl) Akibat Kerja Pada Pekerja Pabrik Pt Kayu Perkasa Raya	Jurnal Ilmu Kedokteran dan Kesehatan 2023	Based on this research, the study shows that there is no significant relationship between age, length of service, and hobbies or activities that cause sound-induced hearing loss (NIHL) in employees of PT Kayu Perkasa Raya. The company should provide ear protection devices and penalize those who do not. In addition, workers are advised to reduce their distracting hobbies or activities. For further research, samples should be collected with the same data pattern and additional risk factors analyzed, such as noise intensity, duration of exposure, use of ear protective

No	Researcher Name	Title	Publication and Year	Conclusion
				equipment, and smoking history.
7	Satya Wibawa, Fatah Alfarisi, Ringgo	Pengaruh Bising Mesin Giling Terhadap Fungsi Pendengaran Pada Pekerja Di Ptpn 7 Pewa Natar, Lampung Selatan	Jurnal Ilmu Kedokteran dan Kesehatan 2014	Based on this study at PTPN 7 Pewa Natar, South Lampung, there were 77 employees involved in the study which aimed to evaluate the impact of milling machine noise on hearing function. Results showed that 58 employees experienced low noise (< 82 dB) and 19 experienced high noise (> 82 dB). Only 1 worker (5.3%) was normal in the high noise group, while 34 workers (58.6%) were normal in the low noise group.low noise group. 54 employees were exposed to more than 7.5 hours during exposure, with 17 employees (31.5%) experiencing normal work. The intensity and duration of noise exposure had a significant relationship with hearing function, as shown by statistical tests.
8	Hidayat, Sahvira Aswin, BudiSyukri, Muhammad	Analisis Upaya Pengendalian Bahaya	JUMANTIK (Jurnal Ilmiah Penelitian	Based on the research, the journal's conclusion emphasizes how

No	Researcher Name	Title	Publication and Year	Conclusion
		Kebisingan Kerja dengan Pendekatan Hirarki Pengendalian di Area Produksi Basah PT. Hok Tong Jambi Tahun 2023	Kesehatan)	important it is to use a hierarchical control approach to reduce noise hazards in the wet production area of PT Hok Tong Jambi. These efforts include reducing noise sources, using hearing protective equipment, and raising employee awareness about noise hazards
9	Fithri, Prima Qisty Annisa, Indah	Analisis Intensitas Kebisingan Lingkungan Kerja pada Area Utilities Unit PLTD dan Boiler di PT. Pertamina RU II Dumai	Jurnal Sains, Teknologi dan Industri	Based on the research, the noise level in the PLTD unit area on the 1st floor is 108.62 dBA, while the 2nd floor is 106.99 dBA. The noise level in high-pressure machines such as compressors, turbines, and pumps, as well as the lack of noise cancellation, causes the highest noise level on the 1st floor of the PLTD, which has a negative impact on health and safetyc
10	Ella Anastasya Sinambela Rahayu Mardikaningsih	Efek Tingkat Kebisingan Pada Masalah Pendengaran Pada Pekerja	PADURAKSA: Jurnal Teknik Sipil Universitas Warmadewa 2022	Based on the research in the workplace, most of the respondents had hearing loss and were exposed to high noise. There is a relationship between noise intensity and hearing loss, according to statistical test results. Researchers advise businesses to start a Hearing Conservation Program

No	Researcher Name	Title	Publication and Year	Conclusion
				(HCP) to prevent hearing damage, ensure the use of ear protection equipment according to procedures, and conduct regular check-ups. Further research is recommended to study additional factors such as the quality of ear protection.
11	Anino, J. O. Afullo, A. Otieno, F.	Occupational noise-induced hearing loss among workers at Jomo Kenyatta international airport, Nairobi	East African Medical Journal 2010	Based on this study, occupational noise caused 15.3% of Jomo Kenyatta International Airport employees to experience hearing loss. Those most at risk were males and the elderly. Impairment was most common at frequencies of 3, 4 and 6 kHz. The longer one works in a noisy area, the more likely the problem is to occur. To prevent workers from losinghearing, regular hearing checks and prevention programs are recommended.
12	Choi, Yoon Hyeong Kim, Kyoo Sang	Noise-induced hearing loss in Korean workers: Co-exposure to organic solvents and heavy metals in nationwide industries	PLoS ONE 2014	Studies show that industrial workers in Korea who are exposed to occupational noise, organic solvents, and heavy metals are more susceptible to noise-induced hearing loss (NIHL). Compared

No	Researcher Name	Title	Publication and Year	Conclusion
				with workers exposed only to noise, workers exposed to heavy metals and organic solvents have a 1.64 times higher risk. Frequencies of 2, 3, and 4 kHz had the strongest impact.
13	Buqammaz, Mariam Gasana, Janvier Alahmad, Barrak Shebl, Mohammed Albloushi, Dalia	Occupational noise-induced hearing loss among migrant workers in Kuwait	International Journal of Environmental Research and Public Health	Berdaskan penelitian Kehilangan pendengaran dapat mengurangi beban sosial dan kesehatan individu dan populasi secara signifikan. Penelitian ini dilakukan dengan persetujuan Dewan Etik Kementerian Kesehatan Kuwait dan sesuai dengan pedoman Deklarasi Helsinki, dan tidak menerima dana eksternal. Karena data yang digunakan adalah data sekunder yang tidak diidentifikasi, persetujuan pasien freed
14	Ding, Tonghui Yan, Aihui Liu, Ke	What is noise-induced hearing loss?	British Journal of Hospital Medicine 2019	Based on research during the development of society, exposure to excessive noise harms hearing. To treat limited noise-induced hearing loss, people are advised to avoid extremely noisy environments.

No	Researcher Name	Title	Publication and Year	Conclusion
				Regeneration of stem cells and hair cells shows potential for healing. It is difficult to predict a person's susceptibility to hearing loss because genetic research is still very new.
15	Ranga, Rupender K. Yadav, S. P.S. Yadav, Ankush Yadav, Neha Ranga, Saroj Bala	Prevalence of occupational noise induced hearing loss in industrial workers	Indian Journal of Otology 2014	According to Rupender's research, 51% of industrial employees exposed to noise experience hearing loss. The habit of listening to loud music was the main risk factor, while age, tenure and smoking had no significant correlation. This study emphasizes the importance of education on the effects of noise and the use of ear protection devices to prevent hearing damage for industrial workers.

RESULTS

High-intensity unwanted sounds emanating from machinery, vehicles, heavy equipment, and industrial equipment are known as workplace noise (W. Murphy & Franks, 2002). Industries such as construction and heavy manufacturing typically generate high levels of noise. Unwanted sounds that disturb or endanger health are known as noise. Some Recent research has found that noise not only affects hearing (auditory), but can also cause non-auditory disturbances, such as emotional stress, changes in blood flow, fatigue, and annoyance (Satya Wibawa & Alfarisi, 2014). the need for increased workplace noise level limits and periodic audiometric examinations.

This study shows that to protect workers' health, hearing preservation programs are necessary. No information on conflicts of interest or funding mentioned (Báez R et al., 2018). According to time, the noise threshold value (NAB) applied by the Minister of Environment in 1996 is 1 to 8 hours per day for noise intensity between 85 dB and 94 dB; in minutes, it is 0.94 to 30 minutes per day for noise intensity between 97 dB and 112 dB; and in seconds, it is 0.11 to 28.12 seconds per day for noise intensity between 115 dB and 139 dB. However, between 60 and 70 dB for offices, industrial areas, stations, markets, and other public facilities (Satya Wibawa & Alfarisi, 2014).

DISCUSSION

Hearing loss, tinnitus (ringing in the ears), emotional stress, impaired concentration, and increased risk of heart disease such as high blood pressure can arise as a result of prolonged noise exposure (Héroux et al., 2015), (Occupational Safety and Health Administration (OSHA), 1970). Noise-Induced Hearing Loss (NIHL) usually develops gradually and often cannot be identified at first (W. Murphy & Franks, 2002). Noise-induced damage to hearing health can lead to a decline in hearing function, especially in people exposed to continuous high noise. The journal discusses the attenuation distribution model of hearing protectors, which can help us understand how effective they are in reducing the risk of noise-induced hearing damage (W. J. Murphy et al., 2002)

During the development of society, exposure to excessive noise has a negative impact on hearing. Staying away from noisy environments is a limited noise-induced hearing loss treatment suggestion

(Ding et al., 2019) WHO (2018) and NIOSH (1998) state that safe noise exposure should not exceed 85 dB(A) for 8 hours per day. Every 3 dB(A) increase above this limit reduces the safe exposure time by 50%. The effects of noise on workers are divided into two categories: Auditorial Effects consist of Noise Induced Hearing Loss (NIHL), which usually occurs in work environments with high noise levels. Non-auditory effects can include issues such as communication breakdown, restlessness, discomfort, sleep disturbance, increased blood pressure and more, with noise levels between 115 dB and 139 dB. The permissible noise threshold value is 55 dB in open green areas, hospitals, residential areas, schools, and places of worship. The permissible noise threshold value is 60 to 70 dB in offices, industrial areas, stations, markets and other public facilities (Satya Wibawa & Alfarisi, 2014)

Measures to reduce noise include the use of ear protection devices such as earplugs or earmuffs, maintenance of machinery to reduce sound, design of plant layouts that minimize direct exposure, and informing employees about noise hazards. Occupational Safety and Health Administration (OSHA) (Héroux et al., 2015). The strategy to prevent sound-induced hearing loss (NIHL) is to implement hearing protection in the workplace and provide employees with training in the use of personal protective equipment such as earmuffs and earplugs. To identify risk areas and ensure that noise does not exceed safe limits, measure and monitor noise levels.should be carried out on a regular basis. To reduce noise at the source, quieter devices and silencers are used in the redesign of the work environment. It is vital to these efforts to inform employees and raise their awareness of the dangers of noise. One can discover hearing loss early by conducting regular health checks. Regulations that set noise exposure limits and mandatory use of protective equipment ensure a safe and hearing-healthy work environment support this strategy (Báez R et al., 2018).

CONCLUSIONS AND SUGGESTIONS

According to the literature, noise in the workplace increases the risk of hearing loss for employees. Therefore, in order to protect workers' health, occupational safety regulations, the use of protective equipment, and noise management approaches should be implemented. the need for increased workplace noise level limits and periodic audiometric examinations. This study shows that in order to protect the health of workers,

hearing preservation programs are needed. No information about conflicts of interest or funding was mentioned. To safeguard employee health, regular audiometric examinations and updates to noise level limits are necessary. Workplace hearing protection programs should include education and awareness-raising of noise hazards. It is hoped that these measures will reduce the risk of hearing loss and create a healthier and safer workplace for all employees.

REFERENCES

Báez R, M., Villalba A, C., Mongelós M, R., Medina R, B., & Mayeregger, I. (2018). Noise induced hearing loss in workers exposed in their work environment. Anales de La Facultad de Ciencias Médicas (Asunción), 51(1), 47–56. https://doi.org/10.18004/anales/2018.051(01)47-056

Ding, T., Yan, A., & Liu, K. (2019). What is noise-induced hearing loss? British Journal of Hospital Medicine, 80(9), 525–529. https://doi.org/10.12968/hmed.2019.80.9.525

Fithri, P., & Qisty Annisa, I. (2015). Analisis Intensitas Kebisingan Lingkungan Kerja pada Area Utilities Unit PLTD dan Boiler di PT.Pertamina RU II Dumai. Jurnal Sains, Teknologi Dan Industri, 12(2), 278–285.

Héroux, M. E., Babisch, W., Belojevic, G., Brink, M., Janssen, S., Lercher, P., Paviotti, M., Pershagen, G., Waye, K. P., Preis, A., Stansfeld, S., van den Berg, M., & Verbeek, J. (2015). WHO environmental noise guidelines for the European Region. Euronoise 2015, 2589–2593.

Murphy, W., & Franks, J. (2002). NIOSH Criteria for a Recommended Standard: Occupational Noise Exposure, Revised Criteria 1998. Journal of The Acoustical Society of America - J ACOUST SOC AMER, 111, 2397.

Murphy, W. J., Franks, J. R., & Krieg, E. F. (2002). Hearing protector attenuation: Models of attenuation distributions. The Journal of the Acoustical Society of America, 111(5), 2109–2116. https://doi.org/10.1121/1.1461835

Occupational Safety and Health Administration (OSHA). (1970). Temporary Worker Initiative. 9, 1–5.

Satya Wibawa, F., & Alfarisi, R. (2014). Pengaruh Bising Mesin Giling Terhadap Fungsi Pendengaran Pada Pekerja Di Ptpn 7 Pewa Natar, Lampung Selatan. Jurnal Ilmu Kedokteran Dan Kesehatan , 1(No 3), 1–10.