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Personal Protective Equipment Compliance In Preventing Hearing Loss In Agro-Industrial Area

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Abstract

Background: In Indonesia the impact of noise that causes hearing loss is still high compared to other countries in Southeast Asia. Noise can cause hearing loss in workers if the scale of the noise is high and occurs continuously. It can also trigger a decline in health that will have an impact on the performance of workers. Objective: to Analysis of PPE Compliance in Preventing Hearing Loss in Agro-Industrial Area. Methods: The research in this study used the literature review method. This search strategy uses several databases such as Pubmed, ResearchGate, and Google Scholar. This search use keywords PPE, Hearing Loss, and Agro-industrial. Results: Increasing noise intensity, duration of work, and duration of exposure can cause hearing loss because the inner hair cells and supporting cells are damaged. The longer the working period, the greater the noise exposure it will receive. The use of PPE can effectively prevent noise-induced hearing loss. Conclusion: Workers exposed to noise are highly susceptible to hearing loss. It depends on the intensity of the noise, the duration of exposure, the sensitivity of the individual or the worker itself and the frequency of the noise. Noise can be prevented, one of which is by using personal protective equipment when working. In this case, nurses can educate related to the use of PPE to prevent hearing loss.

Keywords: personal protective equipment, hearing loss, and agro-industrial

Introduction

Noise is one of the causes of physical conditions that pose a hearing hazard. Noise is all sounds or sounds whose presence is undesirable originating from production process tools and/or work equipment with a certain threshold value so that it can cause hearing loss. Noise can cause different responses from one individual to another. This is important to know when setting a standard because setting a standard or NAB at a certain level will not guarantee that all workers exposed to that level (8 hours/day or 40 hours/week) will be protected from health problems.[1]

Hearing loss is a condition where hearing is impaired due to exposure to noise in the workplace over a long and continuous period of time. Hearing loss has long been known as an occupational disease.[2] The most severe impact of a noisy work environment is permanent deafness known as noise-induced hearing loss. Hearing loss due to exposure to noise in the workplace is a major health problem. A common cause of hearing loss is exposure to noise in the workplace and this is the main problem of occupational diseases after presbyacusis in Asian regions such as Thailand, Myanmar, Vietnam, China, and so on. Occupational hearing loss causes 16% of cases of hearing paralysis in adults.[3]

There are around 360 million people who have hearing loss. Hearing Loss in the UK in 2013 stated that around 18 thousand people experienced hearing loss caused by conditions in the workplace. Not only on an international scale but also on a national scale there is a high level of hearing loss. Hearing Loss and Deafness in 2014 stated that in Indonesia the impact of noise causing hearing loss is still high, namely around 36 million or 16.8% when compared with countries in Southeast Asia. Exposure to noise does not occur in a relatively short time but over a long period of months to years and exposure to noise that exceeds the threshold is also one of the factors causing hearing loss.[4]

Personal Protective Equipment (PPE) is equipment that supports safety and workers in environments where there is a potential danger to the health and safety of workers. PPE used to protect workers from noise generally protects the hearing organs by reducing the intensity/strength of sound (Decibels - dB). Personal protective equipment to protect against noise exposure such as earplugs and earmuffs. Apart from the protection used for the ears, workers must also use other protection such as gloves

and so on. Effective steps to prevent accidents and protect workers from the impact of noise in the work area include repairing hardware or machines used during the production process and using personal protective equipment (PPE). The results of this scientific work aim to analyze the impact of noise on worker compliance in using personal protective equipment in agronursing areas. So by knowing the impact of noise, it will be easier to take steps or take preventive measures which can ultimately reduce the percentage of hearing loss experienced by workers.[5]

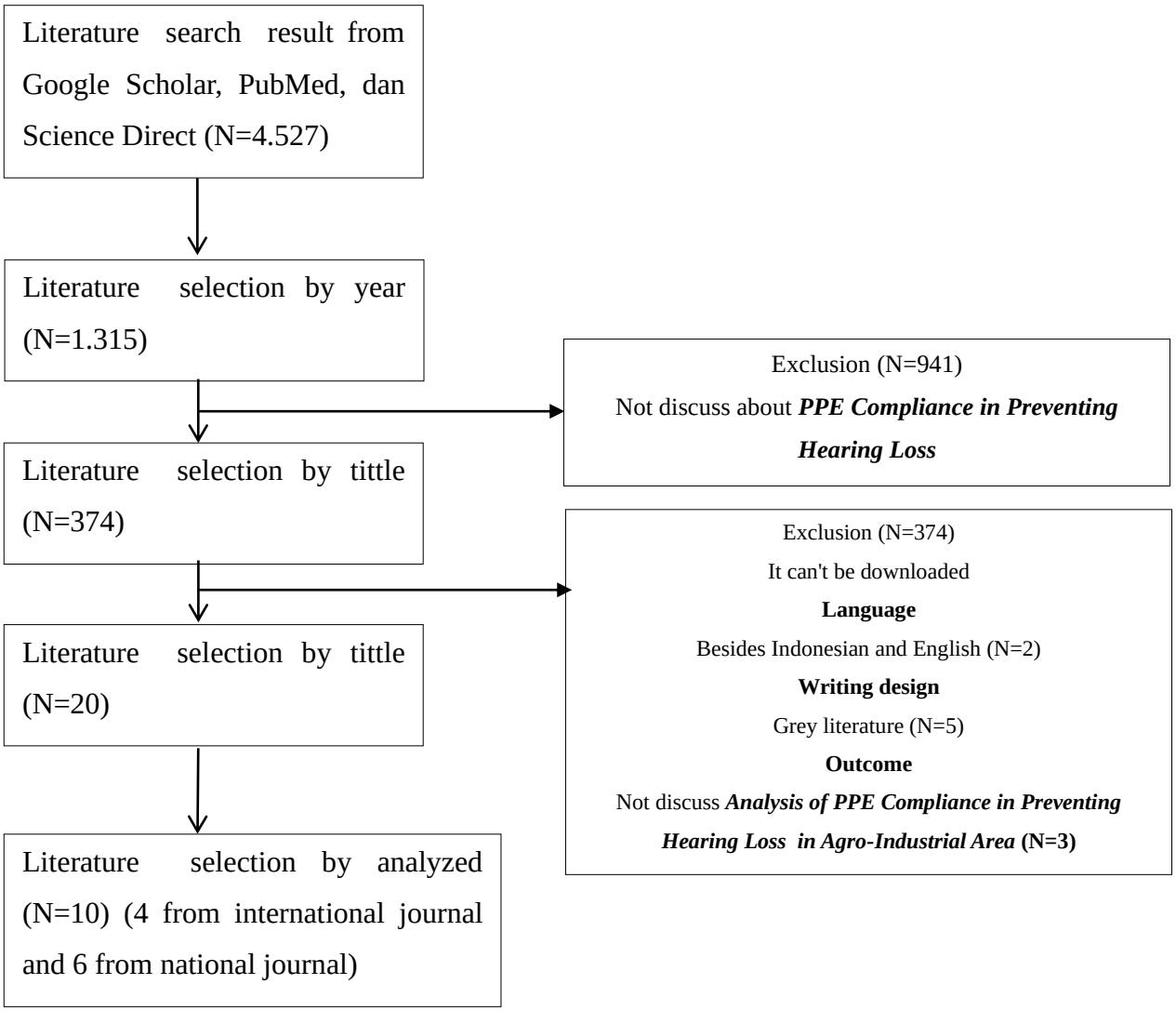
Method

The literature search process in this literature review used 3 databases: Google Scholar, PubMed, and ScienceDirect, with a range of publication years between 2020-2024. The Keyword generation as a tool to identify research using the Boolean Operator technique. The search was conducted using several keywords in English and Indonesian. The literature search process used the Indonesian language with the keywords "Intensitas Kebisingan" and "Kejadian Gangguan Pendengaran" and "Pemakaian APT" while in the English literature search, the keywords were "Noise Intensity" or "Incidence of Hearing Loss" or "use of ear protection device".

The article search process begins with the identification of keywords that have been determined. At the identification stage, 4,527 articles were obtained that match the keywords. The next stage is to select article titles and years of publication that match the research criteria. At the screening stage, 1,315 articles were obtained that fit the research criteria. After that, the articles were filtered according to the inclusion and exclusion criteria of the study. The inclusion criteria used in this study are research published in the last 5 years (2020-2024); research using Indonesian and/or English; full-text research, and research is not the result of a study (literature review, systematic review). Exclusion criteria in this study include: not an observational study and the study did not discuss the effectiveness of e-health on improving patient health services. There were 374 articles that met the inclusion and exclusion criteria. The next step is to filter articles based on abstracts to focus articles according to the research criteria. At this stage, 20 articles were found that met the research criteria.

From the 20 selected articles, another screening was carried out based on language, research design, research results, and several other predetermined criteria,

until finally 10 articles were found that fit the research criteria and could be processed at the analysis stage.



Results

Results should be clear and concise. The results should summarize (scientific) findings rather than providing data in great detail. Please highlight differences between your results or findings and the previous publications by other researchers. Tables or figures are put in Results no more than six.

Tabel 1. Literature Review

No.	Author & Jurnal Identify	Journal Title	Objective	Population and Sample	Methods	Summary of Result
A1	Author: Mauril Yunita Putri , Ragil Ismi Hartanti , Ana Islamiyah Syamila Jurnal Identify: Human Care Journal Vol. 9 No. 1 (2024)	Effects of Noise Intensity on Hearing Loss in Rice Milling Workers.[6]	Analyzing the effect of noise intensity on hearing loss in rice mill workers	The research population was 35 respondents with a sample of 32 respondents. The sampling technique uses simple random sampling. Then the variables in this research include the independent variable and the dependent variable.	This research uses quantitative research with observational analytical methods using a cross-sectional approach. The research data source uses primary data originating from respondent interviews, workplace observations, noise measurements, and hearing loss examinations.	In the article, the results show that the age variable has a significant effect on hearing loss in workers. Workers aged >40 years will experience substantial hearing loss, making them more susceptible to hearing loss due to noise. Working period also has a significant effect on hearing loss in workers. The noise intensity variable obtained a significance value, so it means that it has a significant impact on hearing loss in workers.
A2	Author: Susan Fitriana Pakpahan , Rufina Kanasia Situmorang, Saftrina Ramadhani Jurnal Identify: JINTAN: Jurnal Ilmu Keperawatan Vol. 3 No. 1 (2023)	Risk Factor Analysis of Hearing Loss Due to Noise in Palm Oil Mill Employees at Pt Aice Sumatera Industri Sei Mangke, Simalungun, North Sumatra.[7]	Knowing the risk factors for hearing loss due to noise in palm oil mill employees	This research was conducted with a population of all palm oil factory employees in the processing section at PT Aice Sumatra Industry, a total of 32 people in the division, 3 sorting people, 4 loading ramp people, 3 press people, 3 sterilizer people, 4 clarifying people, 3 tippler people, 3 maintenance people, 3 kernel people, 3 boiler people, and 3 engine room people. The	This research uses an analytical study method with a cross sectional approach because it examines the independent variable and the dependent variable at one time. The independent variables measured were noise intensity, exposure time, work period, Ear Protective Equipment (APT). Meanwhile, the dependent variable is employee hearing loss. Research data uses questionnaires and observation sheets filled in by	The results showed that 22 people who were exposed to noise intensity > 85 dB experienced hearing loss, 2 people had severe hearing loss, 10 people had moderate hearing loss, while there was no mild hearing loss. 30 respondents who were exposed to noise intensity ≤ 85 dB, 1 person experienced hearing loss, none had severe hearing loss, 5 people had moderate hearing loss, while 4 people had mild hearing loss. It is also known that of the 32 respondents who had worked ≥ 5 years, 24 people had hearing loss, 4 people had severe hearing loss, 23 people had moderate hearing loss, while 1 person had mild

				sampling technique for this research is total population.	employees.	hearing loss. 30 respondents who had worked < 5 years, 4 people had hearing loss, none had severe hearing loss, 1 person had moderate hearing loss, while 3 people had mild hearing loss. And of the 32 respondents who were exposed to noise for ≥ 8 hours, 2 respondents experienced severe hearing loss, 22 people experienced moderate hearing loss, and none experienced mild hearing loss.
A3	Author: Donny Haryxon Tobing,Sri Marhaeni, Hidayatul Fitria, Muhammad Ilham Arfi & Yuharika Pratiwi Jurnal Identify: Collaborative Medical Journal (CMJ) Vol. 4 No. 2 (2021)	The Relationship of Noise Intensity with Sensorineural Type Hearing Loss in Workers at the Palm Oil Mill (Pks) Pt. X Rokan Hulu in 2020.[8]	To determine the relationship between noise intensity and sensorineural type hearing loss in workers at the PT palm oil mill (PKS). X	The sampling technique was carried out by total sampling with a sample size of 135 respondents. This is a sampling technique where the number of samples is the same as the population	The research design uses an analytical observational study with a cross sectional approach. This research was conducted at PKS PT. X Rokan Hulu. Data that can be tested statistically using the chi-square test.	It was found that there was a relationship between noise intensity and sensorineural type hearing loss in workers at PKS PT. X 2020. From this research it is known: 1. Description of the noise intensity experienced by workers at PKS PT. X means having a more significant percentage of workers in environments with risky noise intensity compared to workers in non-risk environments. 2. Description of sensorineural type hearing loss in workers at PKS PT. X means that a more significant percentage of workers experience sensorineural type hearing loss than workers who do not experience sensorineural type hearing loss.
A4	Author: Nur Khotimah Jamil, Sudarman, Anggi	The Effect of Weaving Machine Noise Exposure on	The research in this journal aims to determine the effect of	The population in this study was 100 people, and the sample used in	This research is a quantitative study using Cross Sectional design. The sampling	Respondents who experienced noise exposure with a duration of 8 hours / day were 22 people.

	Resina Putri. Jurnal Identify: Medical Journal of Nusantara (MJN) Vol. 2 No. 3 (2023)	the Risk of Hearing Imparement in Employees of Pt. Kecubung Mojogedang.[9]	exposure duration to weaving machine noise on the risk of hearing impairment in employees at PT Kecubung Mojogedang.	this study was 40 people.	technique is total sampling. The data collected will be analyzed univariately and bivariately, the data analysis technique in this study uses the contingency coefficient test.	And those who experienced noise exposure with a duration of <8 hours / day were 18 people. There is an effect of weaving machine noise exposure on hearing impairment in employees of PT Kecubung Mojogedang, according to the results of the Coefficient Contingency test obtained a value of 0.367 with a significance (p) of 0.013.
A5	Author: Nabilla Damar, Sukma Andjani, Dian Mediana Jurnal Identify: Jurnal Biomedika dan Kesehatan Vol. 4 No. 2 Juni 2021.	The relationship of noise exposure with hypertension in employees of cable industry plants.[10]	The purpose of the study in the journal was to determine a relationship between noise exposure and hypertension	The population in this research journal is all workers who work in the production unit at the PT X cable factory who are exposed to noise at work and meet the criteria and the number of samples used is 78.	In this study the authors used an observational analytic method with a cross sectional approach. The sample was selected by probability sampling method, namely stratified random sampling, the data obtained were analyzed with univariate and bivariate using Chi-square and Kolmogorov-Smirnov tests with a significance level of <0.05.	It was found that the results of blood pressure measurements showed prehypertension, normal stage hypertension, and stage 2 hypertension. From this description it can be concluded that there is a relationship between noise intensity and age with hypertension, but there is no relationship between noise type, length of service and cigarette consumption with hypertension.
a A6	Author: Aung K. Zaw, Aung M. Myat, Mya Thandar, Ye M. Htun, Than H. Aung, Kyaw M. Tun, Zaw M. Han Jurnal Identify: Safety and	Assessment of Noise Exposure and Hearing Loss Among Workers in Textile Mill (Thamine), Myanmar: A Cross-Sectional Study.[11]	The main objective of this article is to assess the noise exposure level and associated factors of hearing loss among textile workers in Yangon	The population in this study consisted of textile mill workers in the Yangon Region, Myanmar. The total number of workers involved in the study was 226 individuals who were	The research method used in the article is a cross-sectional study conducted at a textile mill (Thamine) in the Yangon Region, Myanmar, from April to December 2018. A total of 226 workers from 3 weaving sections	The study found that 66.4% of the workers were exposed to noise levels equal to or greater than 85 dB(A), and the prevalence of hearing loss among the workers was 25.7%. Factors positively associated with hearing loss included age 35 years or older, below high school education, hearing difficulty,

	Health at Work 11 (2020)		Region, Myanmar.	randomly selected from 3 weaving sections in the textile mill. The sampling method used was a multistage sampling technique. Firstly, the 3 noisiest weaving sections (water jet loom, towel loom, and bed sheet loom) were selected using purposive sampling.	were selected for face-to-face interviews using a structured questionnaire. The assessment of noise exposure level and hearing loss was done using a digital sound level meter and pure-tone audiometer, respectively. Logistic regression analysis was performed to assess the associated factors of hearing loss.	tinnitus, hypertension, and more than 9 years of service duration in the textile mill. After adjusting for confounding factors, age 35 years or older and tinnitus remained significantly associated with hearing loss. The study suggests the importance of occupational hazard education, enforcement of safety regulations, regular audiometry tests, and implementation of hearing conservation programs in workplaces where noise exposure reaches or exceeds 85 dB(A) for 8 hours.
A7	Author: Xingsong Wang, Oluseyi Adewale Orelaja, Dauda Sh. Ibrahim, Stephen Mbam Ogbonna Jurnal Identify: Scientific African 8 (2020)	Evaluation of noise risk level and its consequences on technical operators of tobacco processing equipment in a cigarette producing company in Nigeria.[12]	To evaluate the noise risk level and its consequences on technical operators of tobacco processing equipment in a cigarette producing company in Nigeria.	Population: Technical operators of tobacco processing equipment in a cigarette producing company in Nigeria. Sample: The study included 90 technical operators from each of the three departments (PMD, SMD, and UD) in three cigarette-producing companies located in different geopolitical areas of Nigeria	The study utilized industrial noise measurement using a Sound Level Meter to measure the noise level emitted by the machinery. Questionnaires were administered to evaluate the psychological and physiological impact of noise on the technical operators. The methods of noise control were also explored to address the identified noise risks.	The study found that the noise levels in the tobacco processing companies exceeded 85 dB, indicating that operators were exposed to high-intensity noise for 12-hour shifts, posing health hazards. The effects of noise on workers included physiological deterioration such as hearing impairment, while machines experienced excessive vibration and wear. The analysis revealed that the use of personal protective equipment (PPE) was the most common noise control method, but engineering controls were deemed more reliable for long-term solutions.
A8	Author : etcharat Kerdonfag, Winai Wadwongtham, Surasak Taneepanich	Hearing threshold levels among steel industry workers in Samut Prakan,	The studies aimed to identify the prevalence of hearing loss; factors contributing	The study population consisted of 93 male steel industry workers in high noise	The study utilized a cross-sectional design to investigate hearing threshold levels among steel industry	The discussed studies focused on occupational noise-induced hearing loss (NIHL) among steel industry workers in Thailand. The studies

	skul Jurnal Identify : Risk Management and Healthcare Policy 2019:12 57–66	Thailand.[13]	to NIHL such as age, exposure time, and noise levels, and the importance of regular assessment of hearing levels.	zones in two factories.	workers.	highlighted the high prevalence of hearing loss, especially at high frequencies, among workers exposed to high noise levels for long hours. It emphasized the importance of regular assessment of hearing levels, effective hearing conservation programs, and the use of hearing protection devices to prevent NIHL.
A9	Author : Rizky Andrian Sutrisno, Siswi Jayanti, dan Bina Kurniawan Jurnal Identify : Jurnal Kesehatan Masyarakat Vol.9 No. 1 (2021)	Faktor-Faktor yang Berhubungan Dengan Kepatuhan Penggunaan Alat Pelindung Diri Pada Pekerja Pabrik Tahu X Semarang.[14]	The objective of this study was to examine the factors related to compliance with the use of personal protective equipment (PPE) among workers at Tofu Factory X in Semarang.	The population of the study consisted of all workers at Tofu Factory X in Semarang, totaling 35 individuals.	The study utilized an observational analytic approach with a cross-sectional design to analyze the correlation between various factors and compliance with personal protective equipment (PPE) usage among workers at Tofu Factory X in Semarang.	. The findings revealed that knowledge and attitude of the workers were associated with compliance, while factors such as age, supervision, coworkers, comfort, and availability of PPE showed no correlation with compliance. Recommendations included promoting safety awareness through the installation of safety signs and posters in easily accessible areas within the factory, as well as encouraging coworkers to remind each other to use PPE.
A10	Author : Wei Gong, Liangliang Zhao, Ling Li, Thais C. Morata, Wei Qiu, Huiling Amy Feng, and Baoli Zhu Jurnal Identify : International Journal of Environmental Research and Public Health (2021)	Evaluating the Effectiveness of Earplugs in Preventing Noise-Induced Hearing Loss in an Auto Parts Factory in China.[15]	The objective of the study was to evaluate the effectiveness of hearing protection programs, specifically earplugs, in preventing noise-induced hearing loss among workers in industrial settings, with a focus on auto parts	The study population consisted of 385 noise-exposed workers from an auto parts factory in China, as well as 1268 non-noise-exposed employees from the health department. The sample included individuals who met specific eligibility	Participants provided their consent to participate in the study; historical noise exposure information was obtained through a questionnaire and company data	The collection of studies evaluated the effectiveness of hearing protection programs, specifically earplugs, in preventing noise-induced hearing loss among workers in industrial settings. Findings emphasized the importance of proper training, fit testing, and individualized approaches to hearing protection to mitigate the risk of high-frequency hearing loss. Factors such as age, gender, and cumulative noise exposure were

	factories.	criteria, such as a minimum of one year of employment for noise-exposed workers	identified as influencing hearing outcomes, highlighting the need for tailored interventions to protect workers' hearing health.

Discussion

Workers' hearing can be impaired due to high noise. Noise exposure can have an impact on outer hair cells causing degeneration to increase according to the intensity and duration of exposure. The higher the intensity and duration of noise exposure, causing the inner hair cells and supporting cells to be damaged which causes sensorineural hearing loss. Based on research by Tobing et al. (2021) noise intensity affects the hearing loss of workers.[8] Noise intensity >85 dB in the range of 8 to 10 hours of work every day is not in accordance with the Regulation of the Minister of Health of the Republic of Indonesia Number 56 of 2016 concerning the Implementation of Occupational Disease Services which stipulates 8 hours of work per day at 85 dBA.[16] In a study from Jamil et al. (2023) workers exposed to noise exposure for 8 hours per day were more than workers exposed to noise exposure <8 hours.[9] This is in line with Putri's research (2024), where some workers were exposed to noise >8 hours with noise intensity >85 dB.[6] The noise intensity factor is also reinforced by research from Wang (2020) which proves that workers who work with exposure for 12 hours have a high risk of experiencing noise-related disorders. Workers are exposed to 118.02 dB of noise, which exceeds the normal standard of noise acceptable to the ear.[12]

Based on Putri's research (2024), exposure duration does not have a significant effect on hearing loss. This is because workers are not exposed to noise in areas with high noise intensity for a long time, and symptoms appear when workers of vulnerable age are exposed to noise. Workers over the age of 40 will experience a significant decrease in hearing so that hearing loss is easy to occur due to the decreased function of the hearing organ.[6] While in the research of Jamil et al. (2023) showed a relationship between exposure duration and hearing loss. The higher noise duration will be followed by the risk of hearing loss.[9] This is in line with the research of Zaw et al. (2020), who said that a long duration of exposure to noise in the work environment can cause progressive and irreversible hearing damage to both ears.[11]

The working period also has an influence on the hearing loss of workers. In workers with a working period above 10 years with high noise intensity, it causes damage to the hearing organ. So that the longer the working period of workers, the greater the noise exposure received by workers. Based on research by Zaw et al. (2020) workers who have more than 9 years of service in textile factories have a significant relationship with hearing loss. This suggests that the tenure factor can be an important risk factor in the development of hearing loss in textile workers.[11] This is in line with the research of Fitriana Pakpahan et al. (2023) who said hearing loss can be influenced by tenure.[7]

Health history is one of the factors where workers can experience noise-related disorders. Based on research from Damar (2021), the results show that workers who have hypertension are at risk of suffering from noise-related disorders. Noise is considered a non-specific biological stressor. Stress caused by high noise levels increases the release of adrenaline, constricts peripheral blood vessels, and eventually causes hypertension.[10]

Workers' knowledge of compliance with the use of PPE has an impact on noise disturbance. Based on research from Sutrisno (2021) workers who have good knowledge are more compliant in using PPE than workers who have less knowledge.[14] The research is also in accordance with Soekidjo's theory where the theory says knowledge is an essential dominant to shape a person's actions. Behavior based on knowledge will continue to be carried out rather than behavior that is not based on knowledge.

Based on research from Gong (2021), it is proven that older workers have a higher risk of experiencing noise-related disorders than younger workers. Older workers have a body condition that is not as good as younger workers, thus increasing the risk of being affected by noise disturbance.[15] Kerdonfag's (2019) research corroborates Gong's (2021) research where 23 - 40 years old have a small risk of experiencing noise disturbance than workers aged 40 - 59 years.[13] However, research from Sutrisno (2021) says age is not associated with the risk of noise-induced annoyance. Age is not related to hearing loss but rather to PPE compliance, where young workers have a higher risk of hearing loss when not using PPE than older workers who use PPE.[14]

Conclusion

Noise can cause hearing loss in workers. Noise-induced hearing loss depends on noise intensity, duration of noise exposure, working period, worker's medical history, worker's knowledge about PPE compliance, and working age. Noise can be prevented by using personal protective equipment (PPE) during work such as earplugs. It also takes the role of nurses to educate workers to always comply with health protocols while working and the importance of using personal protective equipment in the form of earplugs.

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Conflict of Interest

None.

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