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## THE RELATIONSHIP OF NOISE INTENSITY WITH HEARING IMPAIRMENT IN WELDING WORKSHOP WORKERS IN BUKITTINGGI CITY

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### ABSTRACT

*Hearing loss due to noise exposure is a common problem among industrial workers globally, especially in developing countries like Indonesia. The maximum safe threshold established for human exposure is 80-84 dB. This study aims to determine the relationship between noise intensity and hearing loss. This research uses a quantitative and analytical approach with a cross-sectional research design. The study population consisted of 90 people, and data analysis required the use of the chi-square statistical test. The sampling technique used was total sampling. The research was conducted at a welding workshop in Bukittinggi City which was carried out from June to July. The findings showed that of the 90 respondents, 52 people (57.8%) experienced hearing loss. After analyzing the results, it was a relationship that was found between years of work and hearing loss ( $p$ -value = 0.061). In conclusion, this study found a relationship between the duration of occupational work and hearing loss. It is recommended that welding workshop workers in Bukittinggi prioritize their health to prevent health problems, especially hearing problems.*

**Keywords:** Noise, Working Period, Personal Protective Equipment (PPE)

### INTRODUCTION

Occupational Safety and Health (K3) are all conditions and factors that can have an impact on occupational safety and health for workers and other people in the workplace. Apart from that, Occupational Safety and Health (K3) is a form of effort to create a workplace that is safe, healthy, free from environmental pollution, so that it can be protected and free from work accidents, which ultimately increases work efficiency and productivity (Patrisia, 2018).

Occupational Safety and Health not only causes casualties but material losses for workers and employers, but can disrupt the

production process as a whole, damaging the environment which ultimately has an impact on the wider community (ILO, 2018).

Hearing loss is a partial or complete inability to hear sounds in one or both ears. Hearing loss can be classified into three, namely conductive deafness, sensory deafness, and mixed deafness. Noise-induced hearing loss (NIHL) is a type of sensorineural hearing loss caused by long-term exposure to loud sounds, usually due to noise from the work environment (WHO, 2020).

Occupational Safety and Health, hereinafter abbreviated to K3, are all activities

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to guarantee and protect the safety and health of workers through efforts to prevent work accidents and work-related diseases. Occupational Safety and Health also means the condition of being safe or safe from suffering, damage or loss in the workplace. (Permenaker, 2016).

Hearing loss or what is also called deafness is a hearing disorder where a person cannot hear sounds partially or completely in one or both ears. The standard applied by WHO is that a person cannot hear more than 85 decibels (dB) (Kemenkes RI, 2019).

The welding workshop is a workplace that has the potential to cause hearing problems. This hearing loss is caused by the high intensity of interference when workers cut iron while working. If the worker is exposed to an intensity that exceeds the NAB (>85dB) it will cause hearing loss (Akbar, Sugiarto and Yenni, 2020).

Hearing loss is commonly associated with aging, noise exposure, head trauma, and ototoxicity of medications. However, there is increasing evidence linking hearing loss to exposure to chemicals in the work environment. Workers in printing plants have a high risk of hearing loss in their work, this is due to the presence of the substance Toluene which has neurotoxic effects resulting from hearing loss or even deafness (Ridwan and Lestari, 2022).

Hearing loss due to noise is often found in industrial workers throughout the world, especially in developing countries like Indonesia. The maximum safe threshold limit for human noise is 80 dB. Persistent high intensity noise will take a long time to cause changes in metabolism and blood vessels. The result is the tearing of hair cells in the organ of Corti and damage to the degenerative cells, which then leads to total damage to the organ and permanent hearing loss. The impact of noise on hearing can be in the form of acoustic trauma, changes in the hearing threshold due

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to continuous noise. temporary, and changes in hearing threshold result in persistent noise becoming permanent. Noise-induced hearing loss occurs in the form of sensory deafness which is usually bilateral. Keywords: Noise, Organ of Corti, Permanent, Senso-Neural Deafness (Lintong, 2013).

Based on research conducted by Akbar, et al. there is a relationship between noise and hearing loss in welding workshop workers in Suka Karya Village. This is because respondents work very close to noise sources and last for 8 hours. Noise from these sources cannot be avoided by respondents, because of their activities and presence while working (Akbar, et all 2020).

In Law Number 23 of 1992 concerning Health, the sixth part of "Occupational Health" article 23 is: 1) Occupational Health is implemented to realize optimal work productivity; 2) Occupational Health includes occupational health services, prevention of work-related diseases, and occupational health; 3) Every workplace is obliged to organize occupational health; 4) Provisions regarding occupational health as intended in Paragraph (2) and Paragraph (3) are regulated in Government Regulations (Kementrian and Umum, 2014).

According to WHO data year in 2018, around 466 million or 6.1% of the world's population experienced hearing loss, consisting of 432 million or 93% of adults. And it is estimated that 1/3 of the population aged over 65 years experience hearing loss that occurs naturally (ILO, 2018) .

Based on Riskesdas 2019, Indonesian data shows that the prevalence of deafness is quite high, namely 4.6 %, namely ear disease 18.5%, hearing loss 16.8%, severe deafness 0.4%. The population reaches 2.6% of all regions in Indonesia. The high rate of hearing loss threatens the occurrence of moderate, severe to very severe deafness. Deafness is sensorineural, ranging from mild to very

severe (Riskesdas, 2018).

Based on Province, prevalence disturbance hearing in the Sumatra West on year 2019 as big as (2.5%) with prevalence disorder hearing from average national (2.6%) on program prevention and countermeasures disturbance hearing and deafness. There are five hearing loss diseases that may be preventable including chronic suppurative otitis media (OMSK), congenital deafness, obstruction cerumen, noise-induced hearing loss (GPAB), and deafness person old age (presbycusis) (Central Statistics Agency, 2019).

Previously, noise level measurement of welding workshop was done by measuring Sound Level Meter. Data was analyzed using Statistical Product and Service Solution Program (SPSS) and using Fisher's Exact test. The results showed that workers with noise exposure > 90 dB were 27 workers with a percentage (90%) experiencing hearing loss and 3 workers with a percentage (10%) not experiencing hearing loss. The results of the analysis obtained by Fisher's Exact showed that there was a significant relationship between the effect of noise on hearing function ( $p = 0.002$ ). Noise at high intensity and exposed to a long period of time in people can cause hearing and non-hearing function disorders (Koagouw, Supit and Rumampuk, 2013).

Based on the results of an initial survey conducted by researchers on 10 workshop workers welding, there are 6 welding workshops whose workers have hearing problems. At the welding workshop located on Jl. Sukarno Hatta Number 59 There was 1 worker who had moderate hearing loss with noise measurement results of 85.04 dB. In the welding workshop at Jl. Skip it namely the brother workshop, there was 1 worker who had moderate hearing loss with a noise measurement result of 85.26 dB. In the welding workshop in Garegeh, namely

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engineering workshop 99, there was 1 worker who had moderate hearing loss with a noise measurement result of 85.25 dB. In the Medan Engineering welding workshop there were 2 workers who experienced severe hearing loss with noise measurement results of 86.4 dB. And at the Berkah welding workshop there were 2 workers who experienced severe hearing loss with a noise measurement of 85.76 dB. Measurements were carried out using a tuning fork and also the working environment conditions had quite high noise intensity. These types of noise include continuous noise or fixed noise.

Working for 9-10 hours also affects workers' hearing because they are exposed to noise for more than 8 hours. This is made worse by not using personal protective equipment (PPE), especially ear protectors, when working. And long previous work experience is one of the factors causing hearing loss in workers (Iqbal and Nisha R, 2022).

Based on the description above, researchers are interested in conducting research with the title *The Relationship between Noise Intensity and Hearing Loss in Welding Workshop Workers in Bukittinggi City in 2023*.

## RESEARCH METHODS

Hearing loss is a term for any condition or disease that results in a disruption in the hearing process. This condition can be caused by many things, from long-term exposure to loud noises to disorders of the auditory nervous system.

Length of service is the length of time between doing an activity. Length of service is the length of time an employee works on the job currently being carried out. The length of a work period can create a business experience, where experience can influence a person's observation in behaving.

Personal protective equipment is equipment used to protect oneself against the dangers of work accidents.

This research is a descriptive analytical study with a cross sectional study design to determine the factors that cause hearing loss in welding workshop workers in Bukittinggi City in 2023. In this study data collection was carried out simultaneously. Learn this will be implemented in June 2023 in the workshop Las City Bukittinggi. Population is regional generalization which consists of

object/subject which own quantity and characteristics certain determined by researchers to be studied and then withdrawn the conclusion

The population in this study is all workers in workshop welding City Bukittinggi, that is as many as 90 workers.

## RESULTS AND DISCUSSION

### 1. Univariate Analysis

**Table 1. Frequency Distribution of Noise Intensity with Hearing Loss in Welding Workers**

Variable	Frequency (f)	Percent (%)
<b>Hearing Disorders</b>		
Disturbed	52	57.8
Not bothered	38	42.2
<b>Years of service</b>		
More than 5 years	86	95.6
Not quite 5 years	4	4.4
<b>Noise</b>		
≥ 85 NAV	52	57.8
<85 NAB	38	42.2
<b>Working hours</b>		
More than 8 hours	88	97.8
Not quite 8 hours	2	2.2
<b>Use of PPE</b>		
There is no point	53	58.9
Use	37	41.1
<b>Total</b>	<b>90</b>	<b>100</b>

#### a. Hearing disorders

Based on the results of univariate analysis The frequency distribution obtained for Hearing Loss was 52 respondents (57.8%) and 38 respondents (42.2%) did not experience hearing loss.

Hearing impaired who experienced more noise. Of the 85 NAB there were 52 respondents (57.8%) and those who did not experience more noise as many as 85 NAB there were 38 respondents (42.2%).

#### b. Years of service

Work Period: There were 86 respondents (95.6%) who had worked more than 5 years and 4 respondents (4.4%) who had worked less than 5 years.

#### c. Noise

Based on the results of univariate analysis in table 5.2, it was found that the frequency distribution of hearing loss was that workers who experienced noise of more than



85 NAB were 52 respondents (57.8%) and those who did not experience noise of more than 85 NAB were 38 respondents (42.2%).

**d. Working hours**

The working hours of workers who experienced working hours of more than 8 hours were 88 respondents (97.8%) and those who experienced working hours of less than 8 hours were 2 respondents (2.2%).

**e. Use of PPE**

Personal protective equipment (PPE) is equipment that must be used when working according to work hazards and risks to maintain safety. The use of PPE means that 53 respondents (58.9%) of workers use PPE, and 37 respondents use PPE (41.1%).

**a. The Relationship between Noise and Hearing Loss**

Based on the results of the analysis in table 6, it is known that of the 64 respondents who experienced more noise, namely 85 NAB, there were 41 workers (64.1%) while of the 26 workers who did not experience noise more than 85 NAB, there were 11 workers (42.3%). The results of the chi square statistical test were obtained (p value) of 0.097 ( $\geq 0.05$ ), so it can be concluded that there is no relationship between noise and hearing loss.

This research is in line with research conducted (Permaningtyas, 2019 ) entitled hearing loss due to noise during working hours with hearing loss with  $p = 0.000$ . Workers who have worked > 5 years are 0.557 times more likely to suffer from hearing loss than those who have work experience < 5 years.

**2. Bivariate Analysis**

**Table 2. Relationship Between Noise Intensity and Hearing Loss in Welding Workshop Workers**

Independent Variable	Hearing disorders				Total	p-value	OR (95% CI)
	Disturbed		Not bothered				
	N	%	N	%			
<b>Noise</b>							
≥ 85 NAB	41	64.1	23	35.9	64	100	0.097
<84 NAV	11	42.3	15	57.7	26	100	
<b>Years of service</b>							
≥ 5 years	52	60.5	34	39.5	86	100	0.029
≤ 5 years	0	0	4	100	4	100	
<b>Working hours</b>							
≥ 8 hours	51	58.0	37	42.0	88	100	1,000
≤ 8 hours	1	50.0	38	50.0	2	100	
<b>Use of PPE</b>							
There is no point	34	64.2	19	35.8	53	100	0.212
Use	18	48.6	19	51.4	37	100	
<b>Total</b>	<b>52</b>	<b>57.8</b>	<b>38</b>	<b>42.2</b>	<b>90</b>	<b>100</b>	

According to the researchers' assumptions, the research results show that the risk of hearing complaints is high, this is

because the respondents are located too close to the noise source and the service time is too long. So, exposure to noise is high and they



don't follow the SOP set by the company. And many workers experience hearing loss due to frequent exposure to high levels of noise caused by machines and work equipment. Based on observations, workers who are exposed to quite a lot of noise come from several machines such as drying machines, plate vutter machines, mobile crusher machines and extruder machines.

### **b. Relationship between Working Period and Hearing Loss**

Of the 86 respondents who had more than 5 years of working experience, 52 respondents (60.5%) experienced hearing loss, while 4 respondents (100%) had less than 5 years of working experience. The results of the chi square statistical test were obtained (p-value) of 0.061 ( $\leq 0.05$ ), so it can be concluded that there is a relationship between work experience and hearing loss.

This study is also in line with research conducted which shows that there is a relationship between hearing loss and length of service in workers who have worked >5 years. From the results of the analysis, it was obtained that p value = 0.022, OR of 3.656, which means that workers who have worked > 5 years are more easily exposed to noise than workers < 5 years

A long period of work will shape the performance of an employee to be more effective, because he can control various obstacles based on the experience he has gained

The most severe impact of a noisy work environment is permanent deafness known as Noise Induced Hearing Loss (NIHL). In addition to its impact on hearing (auditory), noise also has non-auditory effects such as disruption in daily activities, loss of clarity in speech (speech disorders), concentration problems, sleep disorders that can increase stress caused by hearing disorders (Halim, 2023).

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### **c. The Relationship between Working Hours and Hearing Loss**

Of the 88 respondents whose working hours were more than 8 hours, 51 respondents (58.0%) experienced hearing loss, while of the 2 respondents whose working hours were less than 8 hours, there was 1 respondent (100%). The results of the chi square statistical test were obtained (p-value) of 1.000 ( $\geq 0.05$ ), so it can be concluded that there is no relationship between working hours and hearing loss.

This research is in line with research by Apin, et al. 2021 which states that the results of the t test/partial test for the working hours variable with a calculated t result of 0.734 with a significant probability level ( $0.000 < 0.05$ ) in this study showed that the results of  $H_0$  were rejected and  $H_a$  was accepted. , meaning that there is a partial influence of Working Hours on Employee Performance at PT. Sumatra Global Group. Furthermore, the results of research using the Correlation Coefficient Test (R) obtained a value of 0.568 in the positive direction.

Noise is a sound or noise that is not desired because it is disturbing or occurs outside the will of the person concerned. The recommended noise threshold is 85 dB for 8 hours of work time. Humans need lighting to recognize objects that affect vision: eyes, nerves, and the visual nerve center in the brain. If the noise is above the lighting threshold (300 Lux) it can cause health problems or potential work hazards (Syahrizal, Junaidi and Nasrullah, 2022).

Hearing loss is one of the health disorders at risk. A person who suffers from hearing loss is not only seen from several things such as difficulty speaking, but can also be seen from the physiological condition of the worker himself (Puspita et al., 2023).

### **d. Relationship between PPE Use and Hearing Loss**

Of the 53 respondents who did not use PPE, 34 respondents (64.52%) while of the 37 respondents who did, 18 respondents (48.6%). The results of the chi square statistical test were obtained (p value) of 0.212 ( $\geq 0.05$ ), so it can be concluded that there is no relationship between the use of PPE and hearing loss.

As people get older, they will experience pathological changes in their hearing organs. Elderly people over 40 years old will experience a significant decrease in hearing, making them more susceptible to hearing loss due to noise. The tympanic membrane shows thinning and stiffness. Meanwhile, the auditory muscles experience artistic joints.

To overcome these hazards, an approach is carried out using the Job Safety Analysis (JSA) method to identify, analyze, and design risk control in the welding process in the workshop area of the external transportation garage. JSA (Job Safety Analysis) is a method used as a consideration in identifying hazards in the work environment and determining its control is considered appropriate in an effort to control the occurrence of work accidents (Salsabillah, 2024)

Hearing loss can be caused by several factors, including age, noise intensity, work period, length of exposure, and use of PPE (Panggeleng, Ananda and Maharja, 2022)

## CONCLUSION

The conclusion of the research results shows that there is a relationship between work period and hearing loss and it is suggested to welding workshop workers in Bukittinggi City to prioritize health and avoid things that can cause health problems, especially in the hearing area. by always using personal protective equipment, to health checks at health services if there are signs of decreased hearing intensity of workers.

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