

**THE EFFECT OF AGE, YEARS OF SERVICE, AND THE
APPLICATION OF HEARING PROTECTION DEVICES ON THE
HEARING THINGS OF WORKERS IN NOISY WORK
ENVIRONMENT
(Case Study In The Engine Room Of Tanker Ship PT. Tanto Intim Line
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ABSTRACT

The noise intensity in the tanker engine room which is the source of noise reaches more than 115 dB, where the noise there has exceeded the threshold and is at great risk of causing health problems such as a decrease in the hearing threshold of workers inside because the machines must remain on for 24 hours. The purpose of this study was to analyze the effect of age, years of service, and use of hearing protection devices on the hearing threshold of ship workers in the engine room environment of the tanker PT. Tanto Intimate Line. This study uses analytic observational research by conducting a cross-sectional approach to find the relationship between descriptive variables with observational methods and qualitative data types. The results showed that the noise intensity in the ship's engine room was 115.3-118 dB(A), 60% of workers who used ear protection according to SOPs, 63.3% of workers aged 40 years, 70% of workers with 15 years of service, the normal hearing threshold of workers is 66.7% of workers, and age, years of service, and the use of hearing protection device affect the hearing threshold of workers. Suggestions for the company are providing training or socialization for workers, as well as seeking ear protection facilities that are comfortable to wear, as well as conducting supervision. Suggestions for other researchers are to investigate further the comfort or condition of hearing protection devices and examine the length of noise exposure experienced by workers.

Keywords: noise intensity, age, hearing protection device, hearing threshold

BACKGROUND

According to the Regulation of the Ministry of Manpower of the Republic of Indonesia No. 5 of 2018 concerning Health and Occupational Safety in the Work Environment, *noise* is every unwanted sound that comes from production equipment and/or working tools which, at a certain level, could cause hearing loss. In 2015, WHO (World Health Organization) stated that 466 million adults and children experienced hearing loss because of several factors, including excessive noise exposure in the workplace or

neighborhood. Unfortunately, there is still no extensive data on work accidents or illnesses caused by noise in the workplace in Indonesia.

Hearing loss is the most common impact experienced by humans exposed to noise. Frequently, people affected by noise are unaware of its effects because it does not occur immediately. Generally, the impact happens when humans are getting old. However, many people experience the effect directly in some cases. As one gets older, humans experience a decrease in the function of the organ system, one of which is hearing. A research by Rahmawati about *Faktor-Faktor yang Berhubungan dengan Gangguan Pendengaran pada Pekerja di Departemen Metal Forming dan Heat Treatment PT. Dirgantara Indonesia (PERSERO) Tahun 2015* (Factors Associated with Hearing Loss in Workers in the Metal Forming and Heat Treatment Department of PT. Dirgantara Indonesia (PERSERO) in 2015) uncovered that the elderly encounter hearing loss more than the younger ones (Rahmawati, 2015).

Other than the age factor, the duration of exposure and working period significantly affect human health. In the journal *Hubungan Usia Dan Masa Kerja Dengan Nilai Ambang Dengar Pekerja Yang Terpapar Bising Di PT. X Sidoarjo* (The Correlation between Age and Work Period with Hearing Threshold Value of Workers Exposed to Noise at PT. X Sidoarjo) explains the possibility of workers experiencing hearing loss with a working period of >5 years with noise exposure >85 dB(A) is 1%. The risk of hearing loss could be prevented by using HPD (Hearing Protection Device) according to workers' needs and following the SOP, such as earplugs and earmuffs. Using HPD is one way of controlling noise to reduce the risk of the decreased hearing threshold of workers.

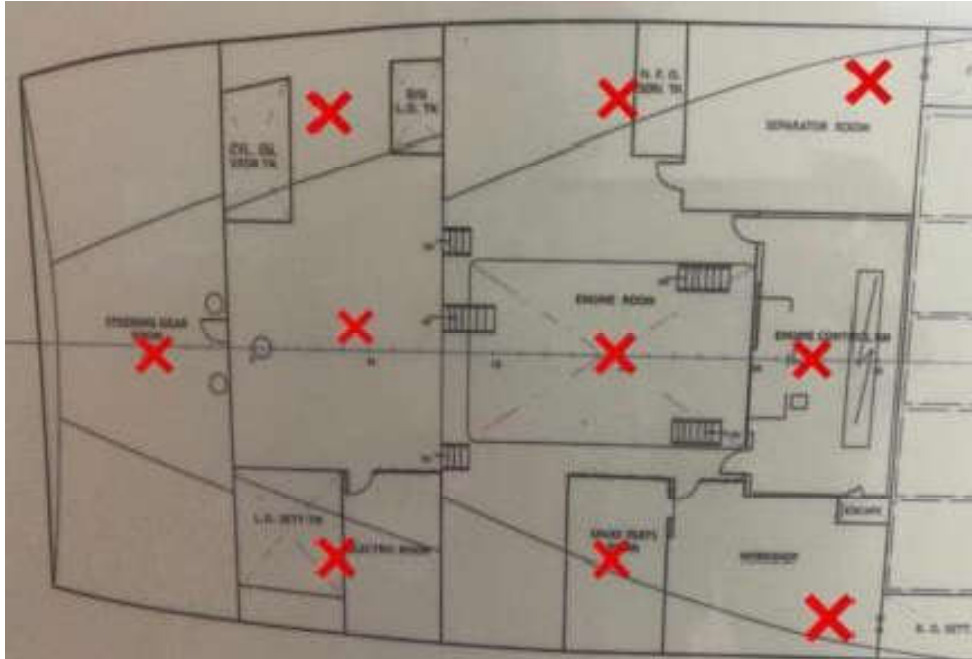
According to researchers' observation, PT. Tanto Intim Line tanker sails for a year. It means the engine must remain running for 24 hours. The machines will produce a noise source while running. At the same time, some workers stay in the engine room, which makes them exposed to noise during working hours or approximately 8 hours. Noise in the engine room of PT. Tanto Intim Line tanker ship reaches more than 115 dB(A). According to the Regulation of the Ministry of Manpower of the Republic of Indonesia No. 5 of 2018, the noise has exceeded the threshold and is at significant risk of causing health issues (Menteri Tenaga Kerja dan Transmigrasi, 2010).

Through the results of the preliminary survey, it was also found that workers in the engine room of PT. Tanto Intim Line tanker still underestimates the noise problem. For example, when the laborers worked close to noise sources, about six workers did not wear HPD utterly. Some wore it inappropriately for about an hour even though an equipped HPD was available in the tanker. When the preliminary survey was conducted, PT. Tanto Intim Line has facilitated and implemented other noise controls such as adding silencers, maintaining and repairing machines that become the source of noise, applying work shifts, and providing HPD for workers exposed to noise. The objective of this study is to analyze the impact of age, years of service, and HPD on the hearing threshold of workers in the engine room of PT. Tanto Intimate Line tanker.

RESEARCH METHODS

This research uses analytic observational methods with a *cross-sectional* approach. The sampling technique used in this study is *simple random sampling* with a total sample of 30 workers and a sample population of 32 workers. The data collection is done by observation and interviews. The highlighted variables are the hearing threshold, age, years of service,

the use of HPD on workers, and noise intensity. In analyzing the data, the researchers use *Exact Fisher Test*.



RESULTS

1. Overview of Workforce Locations

Figure 1. Overview of Workforce Locations

Noise measurements carried out in the engine room showed a noise intensity of 115.3 dB(A) -118 dB(A), which means that the noise intensity has exceeded the Recommended Exposure Limits (REL). Workers without ear protection equipment can only be exposed to the noise for 0.94 minutes. If workers who do not use HPD are exposed to noise for more than 0.94 minutes, the risk of workers experiencing a reduced hearing threshold increases (Kemenaker, 2018)

2. The Characteristics of Workers toward Hearing Threshold

a. The Effect of Age on Hearing Threshold

Table 1 The Effect of Age On Hearing Threshold

Age	Hearing Threshold				Amount		p	α
	Normal		Abnormal		N	%		
	N	%	N	%				

≤ 40 Years Old	18	94.7	1	5.3	19	100		
> 40 Years Old	2	18.2	9	81.8	11	100	0.000	0.05
Total	20	66.7	10	33.3	30	100		

From the report of the table above, it can be concluded that the abnormal hearing threshold is mostly experienced by workers aged > 40 years with the percentage 81.8% or nine workers. According to the statistical test, the value of $p < \alpha$. It means that age affects the workers' hearing threshold.

b. The Effect of Years of Service on Hearing Threshold

Table 2 The Effect of Years of Service On Hearing Threshold

Years of Service	Hearing Threshold				Amount		p	α
	Normal		Abnormal		N	%		
	N	%	N	%				
≤ 15 Years	20	95.2	1	4.8	21	100		
> 15 Years	0	0.0	9	100	9	100	0.000	0.05
Total	20	66.7	10	33.3	30	100		

Table 2 illustrates that 9 out of 10 workers experienced a decrease in hearing threshold after the statistical test. Only one or 4.8% of workers had an abnormal hearing threshold. According to the statistical test, it was found that the value of $p < \alpha$. It means that the period of service influences the hearing threshold of workers.

3. The Effect of HPD on Hearing Threshold

Table 3 The Effect of HPD on Hearing Threshold

HPD	Hearing Threshold				Amount		p	α
	Normal		Tidak Normal		N	%		
	N	%	N	%				
Using	15	83.3	3	16.7	18	100		
Using without following the SOP/Not using at all	5	41.7	7	58.3	12	100	0.045	0.05
Total	20	66.7	10	33.3	30	100		

The table above illustrates that 58.3% of seven workers who wore HPD without following the SOP or did not wear HPD utterly experienced a decreased hearing threshold. Furthermore, as many as 16.7% or three workers who wore HPD also experienced decreased hearing thresholds. Based on the statistical test, the value of $p < \alpha$ is obtained, which means that the year of service affects the hearing threshold of workers.

DISCUSSION

The Effect of Age on Hearing Threshold

This research indicates that workers aged > 40 years experienced the most hearing loss. After applying *the Fisher test* on the correlation of age and hearing threshold, the value of p is 0.000 or $p \leq \alpha$. It means that age affects the workers' hearing threshold in the

tanker's engine room. This result follows the research conducted by Putri and Martiana, which revealed that age is a vital factor in decreasing hearing function. However, it is possible that workers aged < 40 years may experience hearing loss due to prolonged exposure to noise with great intensity(Putri & Martiana, 2017).

Human aging causes changes in physiological conditions, one of which is the alteration in hearing. The gradual decline in hearing function due to the aging process is known as *presbycusis*. The cause of presbycusis is unknown until today, but it is generally known that the cause is multifactorial. Presumably, the onset of presbycusis is related to genetic factors, diet, metabolism, atherosclerosis, diabetes mellitus, infection, noise, lifestyle, and drugs(Sugiyono & Caesaria, 2015). Human aging could lead to pathological changes in their organs and hearing system. Humans over the age of 40 will experience a significant decrease in hearing function. Thus, age is one factor that influences hearing loss, and humans are also vulnerable to experiencing it(Rizqi & Widowanto, 2015).

The Effect of Years of Service on Hearing Threshold

This study found that most workers with more than 15 years of service experience have hearing loss. After the *Fisher test* was carried out on the effect of the working period on the hearing threshold, it was found that the value of p was 0.000 or $p \leq \alpha$. It means that there was an impact on the working period with the hearing threshold of workers in the tanker's engine room. The result of this research is in line with the study of Syah and Keman(Syah & Keman, 2017). which found that workers with a working period of 10-15 years are at high risk of experiencing hearing loss. The impact of the working period on the reduction of hearing threshold is related to the noise exposure to workers while working in a place that produces noise that exceeds the threshold. The longer workers are exposed to noise, the greater the risk of decreased hearing function. More damage is found as the noise intensity and the duration of exposure increase, such as loss of stereocilia or tiny hairs that convert the vibrations caused by sound into voltage and are sent via nerves to the brain(Setyawan FEB, 2021).

Hearing loss due to continuous noise exposure or *intermittent* increases most rapidly in the first 10-15 years of exposure. Hearing loss due to noise exposure could cause acoustic trauma. Acoustic trauma is divided into two types: Noise-Induced Temporary Threshold Shift (NITTS) or a loss of hearing sensitivity. However, this hearing sensitivity could be regained if workers are given sufficient break time. Noise-Induced Temporary Threshold Shift (NITTS) occurs when workers do not use HPD and experience noise exposure for the first 16 to 48 hours(Ding, et al, 2019). At the noise of > 85 dB(A), a rest period of 3-7 days is required. If the rest time is insufficient and workers are exposed to noise for a more extended period, the deafness will get worse every day. Moreover, it will result in permanent deafness. The other acoustic trauma is Noise Induced Permanent Threshold Shift (NIPTS) or a loss of hearing sensitivity that cannot be regained. It is caused by acoustic trauma that persists for years without a continuous recovery. Noise exposure that lasts for the first 10 to 15 years results in Noise-Induced Permanent Threshold Shift (NIPTS)(Eryani, et al, 2017).

The Effect of HPD on Hearing Threshold

This research reveals that workers who experience decreased hearing threshold use HPD without following the SOP, such as using HPD only on one ear or not using it utterly. The results of interviews with workers indicate that workers do not use HPD while

working because they feel uncomfortable using it. In addition, HPD is considered could interrupt communication between workers so that they choose not to use it or use the device only in one ear. Another reason is that they think the room is not noisy because they are used to being exposed to the noise without using HPD. It is possible because noise exposure could cause an adaptive reaction of the immune and inflammatory reaction created by the cochlea that occurs within 1-2 days. The peak is in 3-7 days; then, it will disappear slowly (Setyawan, 2021).

According to the Regulation of the Ministry of Manpower and Transmigration No. PER.08/MEN/VII/2010, Hearing Protection Device (HPD) is a protective tool that safeguards hearing devices against noise or pressure. Earplugs could reduce the received noise intensity by 15-30 dB, while earmuffs could reduce 30-40 dB noise intensity. Hence, hearing protection equipment plays a significant role in preventing hearing loss and reducing the risk of NIHL (Menteri Tenaga Kerja dan Transmigrasi, 2018).

Providing counseling, motivation, and education to all workers, especially those exposed to high noise, to raise awareness about the importance of preventing noise-induced hearing loss is an obligation for the company with the help of other workers. The education on the use of HPD for all workers could be in the form of seminars or special training held by the company or related institutions (Rizqi, et al, 2017).

CONCLUSION AND RECOMMENDATION

According to statistical tests conducted in this research, age, years of service, and use of Hearing Protection Devices (HPD) affect the workers' hearing threshold in the engine room of PT. Tanto Intimate Line's tanker. It is recommended that the company conduct training or socialization to workers regarding noise and its effects, strive for comfortable ear protection facilities (HPD), and carry out other supervision for the use of HPD.

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