Eduvest – Journal of Universal Studies
Volume 6 Number 2, February, 2026
p- ISSN 2775-3735- e-ISSN 2775-3727

The Relationship Between Knowledge Level of Noise Exposure and the Pattern of Personal Listening Devices (PLDS) Usage

Layla Rahma Fauzia, Asti Kristianti*, Sandi Lesmana Limanjaya Liem, Yanti Nurrokhmawati
Universitas Jenderal Achmad Yani, Indonesia
Email: laylarahmaf@gmail.com, asti1703@gmail.com*

ABSTRACT

This study examines the relationship between the level of knowledge about noise exposure and PLDs usage patterns among 2024 Cohort Medical Students, Faculty of Medicine, by describing PLD usage patterns based on user characteristics and type, duration of exposure, and volume of use. The study employs a descriptive analysis with a cross-sectional approach involving 154 students. This study uses the chi-square test, strengthened by the Spearman correlation test. The results showed that most students using PLDs were women (72.1%) and aged ≥18 years (94.2%). Knowledge levels were mostly categorized as good (86.4%). PLD usage patterns by type were predominantly in-ear (69.5%), with duration of exposure ≤60 minutes (58.4%) and volume ≤60% (81.8%). A significant relationship existed between knowledge level about noise exposure and PLD usage patterns [based on type ($p = 0.006$), duration of exposure ($p = 0.001$), and volume ($p = 0.000$)], with an odds ratio indicating that good knowledge was 214.5 times more likely to be associated with good usage patterns (OR > 1). The research analysis confirmed a relationship between knowledge level about noise exposure and PLD usage patterns.

KEYWORDS *Hearing loss, noise exposure, PLDs*

This work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International

INTRODUCTION

Hearing loss is a condition of impaired sound transmission from the outer ear to the brain. Hearing loss can occur due to exposure to noise, drug intoxication, and radiation (Anastasiadou & Al Khalili, 2023). Hearing loss is usually unnoticed in the first place. Noise-Induced Hearing Loss (NIHL) is a disorder caused by prolonged exposure to loud noise (Elmazoska et al., 2024; Bashiruddin & Alviandi, 2023). Risk factors that can aggravate the condition of NIHL include individual awareness, age, duration of exposure, and decibel intensity of use (Putri, 2023). Hearing intensity reaching more than 85 decibels (dB) for a maximum duration of 8 hours can lead to permanent hearing loss (Quiñonez Hurtado et al., 2025). High decibel intensity can disrupt the auditory system to the non-auditory system, such as depression, anxiety, psychological stress, and balance disorders (Zachreini, 2018; Kim et al., 2021; Syafila et al., 2023).

Noise exposure can be obtained from work noise and recreational noise. Recreational noise can be obtained in recreational venues such as bars, festival events, movie theaters, various music industry venues, and the use of Personal Listening Devices (PLDs). Repeated and intense exposure to noise can cause permanent damage to the structure of the ear, especially the cochlear hair cells that function in the transmission of sound to the brain, a condition referred to as Permanent Threshold Shift (PTS) (Dudarewicz et al., 2023; Ryan et al., 2016; Reichmuth et al., 2019). The World Health Organization (WHO) estimates that by 2050 at least 2.5 billion humans will have hearing loss and 700 million of them will need treatment. WHO

data shows that 430 million people or 5% of the global population need hearing loss (World Health Organization, 2025).

The Ministry of Health (Kemenkes) states that hearing sounds with a volume intensity of 60% or higher for more than 60 minutes for a day can be at risk of causing hearing loss (P2PTM Kemenkes RI, 2024). Most NIHLs can be prevented by increasing knowledge and implementing measures to detect what triggers hearing loss (Natarajan et al., 2023). The Coronavirus disease 2019 (Covid-19) pandemic that occurred several years ago caused many people to be active online and stay at home for a long time. Online activities can increase the use of earphones as one of the PLDs for communication during the pandemic (Wagatsuma et al., 2022).

The use of PLDs is referred to as a tool to help listen to sounds from electronic devices. Commonly used electronic devices are mobile phones, tablets, and others (World Health Organization, 2019). The use of PLDs that are often connected to electronic devices are headsets, circum-aural headphones, supra-aural headphones, earbuds, and canal phones, among others (Elmazoska et al., 2024; Zachreini, 2018; Kim et al., 2021). Over-ear and on-ear PLDs are relatively safer than in-ear PLDs (Breinbauer et al., 2012). Earbuds as a type of in-ear PLDs can produce an output level 5–6 dB higher than headphones that are types of on-ear PLDs (Darsana & Wiranadha, 2022). More With the development of technology, many PLDs are easy to carry and already have a longer battery life than previous generations, thus increasing the use of PLDs in society (Lee & Jeong, 2021).

The occurrence of NIHL from the use of PLDs can develop slowly and reach serious problems if you do not have good knowledge (Alenzi et al., 2024; Mahmudi et al., 2021). Knowledge is an important factor for a person to behave. A high level of knowledge and insight reflects that a person has a high level of education. The level of knowledge is an important aspect in health problems, one of which is the level of knowledge about noise (Mahmudi et al., 2021). According to the WHO, the definition of noise is unwanted or annoying noise. Hearing loss caused by exposure to sound is called sound-induced. Sound-induced can be either music or noise (World Health Organization, 2019).

Knowledge of noise from the use of PLDs is important to know. The maximum sound level produced by PLDs can reach 110-120 dB. The number of PLDs users, especially adolescents who behave unsafely in using PLDs, is estimated to be more than 10% permanent hearing loss. Good knowledge of the safe behavior of using PLDs will reduce and prevent permanent hearing loss (Muyassaroh et al., 2015).

Research in the Al Jouf Region, Saudi Arabia in 2024 found that as many as 46.1% of respondents did not know about knowledge about NIHL. The research data found that as many as 28.1% of respondents needed further education about NIHL and as many as 24% of respondents showed a knowledge gap regarding sound intensity and its impact on hearing health (Alenzi et al., 2024).

Research in Semarang in 2015 found that there was a relationship between knowledge and the behavior of PLDs users in high school students/equivalent. The results of the study were obtained that the average knowledge score was 8.17 ± 1.96 out of a total score of 12 which means that 68.1% of students knew about the use of PLDs and 31.9% did not know about PLDs and all the effects they caused. It was found that 48.7% of respondents still consider NIHL to

be temporary and can return to normal even though NIHL is actually a permanent hearing loss (Muyassaroh et al., 2015).

Research on hearing characteristics conducted on high school students using PLDs in Denpasar in 2022 found that the majority of students using PLDs were women with a percentage of 60.4%. The study found that 35.4% of students with mild hearing loss in the right ear and 22.9% in the left ear. The research data showed that the results of students with moderate hearing loss were 2.1% in the right ear. This can be due to a lack of knowledge about safe behaviors in using PLDs (Darsana & Wiranadha, 2022).

A study in Cimahi City in 2018 regarding the description of auditory and non-auditory disorders in students using PLDs found results that as many as 9.5% complained of tinnitus or ringing, 14.7% complained of anxiety, 14.7% complained of insomnia or difficulty sleeping, 12.9% had difficulty concentrating, 4.3% complained of palpitations, and 12.9% complained of nausea/headache. Prevention of NIHL is a way to maintain hearing health. One of the prevention that can be done is an ear health campaign which is useful to reduce the risk of hearing loss due to PLDs (Kristianti, 2018).

The occurrence of NIHL can continue to increase over time. Efforts to increase knowledge about noise awareness can be done through counseling, socialization, and campaigns. One of the efforts that can be made in the student environment is to conduct public lectures or seminars. The researcher is interested in conducting research on the level of student knowledge about noise exposure to the pattern of use of PLDs at the Faculty of Medicine, Jenderal Achmad Yani University (FK UNJANI) because there has been no similar research before. FK UNJANI students Class of 2024 are first-year students who have not received Ear, Nose, Throat – Head and Neck Surgery (ENT-Head and Neck Surgery) material on hearing health.

Unwise use of PLDs risks causing hearing loss, especially due to exposure to high-volume sound over a long period of time. Until now, there has not been much quantitative data that evaluates students' behavior towards the use of PLDs. This study was conducted using a standardized questionnaire adapted from previous research by Muyassaroh, et al. (2015) and a validity and reliability test was conducted on 30 respondents to measure knowledge and patterns of use of PLDs.

This research is also relevant to the use of PLDs which is a lifestyle among students. FK UNJANI students Class of 2024 experienced online learning due to the Covid-19 pandemic which occurred for three years so that the use of PLDs can become a daily habit. Based on the above background, the researcher is interested in researching the relationship between the level of knowledge about noise exposure and the pattern of use of PLDs in FK UNJANI Students Class of 2024, by describing aspects of the pattern of use of PLDs based on characteristics and types, duration of exposure to use, and volume of use of PLDs.

This study aims to examine the characteristics of students of the FK UNJANI Class of 2024 who use PLDs based on gender, level of knowledge about noise exposure, and patterns of use of PLDs which include type, duration of exposure, and volume of use. In addition, this study also aims to determine the relationship between the level of knowledge about noise exposure and the pattern of use of PLDs in these students. The results of the research are expected to make an academic contribution to the development of medical science, especially in the field of otology and community ENT-Head and Neck Surgery, as well as provide

practical benefits for students in improving the understanding and behavior of using PLDs that are safer for the use of PLDs.

METHOD

This research was an analytical descriptive study with a cross-sectional design conducted on students of the FK UNJANI Class of 2024. This design was chosen to determine the relationship between the level of knowledge about noise exposure and the pattern of PLD use at one point in time. All respondents who met the inclusion criteria were included as research subjects.

The population in this study consisted of all active students of FK UNJANI Class of 2024, with a total of 249 people. The sampling technique used non-probability sampling with a consecutive sampling method, so that all students who met the inclusion criteria and were willing to become respondents were included until the required sample size was reached. Based on calculations using the Slovin formula with an error rate of 5%, a minimum sample size of 154 respondents was obtained.

Data collection was carried out using standardized questionnaires adapted from previous research. The questionnaire included respondent characteristics, level of knowledge about noise exposure, and patterns of PLD use, including type, duration of exposure, and volume of use. The questionnaire was distributed online through Google Forms after the respondents had given informed consent. The data obtained in the form of scores were then converted into percentages to determine the category of knowledge level.

Data analysis was carried out in stages through univariate and bivariate analyses. Univariate analysis was used to describe the frequency and percentage distribution of each research variable, while bivariate analysis was used to test the relationship between knowledge level and PLD usage patterns using chi-square tests and reinforced by Spearman correlation tests. All data analysis was carried out using the SPSS program with a confidence level of 95% and a significance value of $p < 0.05$.

RESULT AND DISCUSSION

1. Overview of Knowledge Level of Noise Exposure

The variable level of knowledge of noise exposure shows the quality of knowledge of FK UNJANI Students Class of 2024 about noise exposure. This variable was measured using a questionnaire consisting of nine questions with the results of the recapitulation of respondents' answers as shown in Table 1.

Table 1. Distribution of knowledge-level answers about noise exposure

No.	Knowledge Level Statement on Noise Exposure	Alternative Answers	Total (n=154)	Percentage (%)
1	Do you know what Personal Listening Devices (PLDs) are?	Yes	136	88,3
		No	18	11,7
2	Did you know that the use of PLDs can affect hearing?	Yes	149	96,8
		No	5	3,2
3	Can PLDs cause problems in the outer or middle ear?	Yes	134	87,0
		No	20	13,0
4		Auditory hearing loss	83	53,9

	What type of hearing loss do you know of as a result of the use of PLDs?	Auditory and non-auditory hearing loss	44	28,6
		Don't know	27	17,5
5	Do you think that hearing loss due to noise from PLDs can recover as before?	Yes	85	55,2
		No	69	44,8
6	Can hearing loss due to noise PLDs be prevented?	Yes	152	98,7
		No	2	1,3
7	Is tinnitus (ringing in the ears) an early sign of noise exposure from PLDs?	Yes	141	91,6
		No	13	8,4
8	Which do you think are the early symptoms of hearing loss?	Increase the volume of electronic devices used	75	48,7
		Often repeating the word "what?" when asked a question by someone	62	40,3
		Often muttering or speaking incoherently	2	1,3
		Don't know	15	9,7
9	What type of PLDs do you think is the safest to use?	*Over-ear/on-ear*	122	79,2
		In-ear	32	20,8

Table 1 shows the distribution of answers regarding the level of knowledge about noise exposure in FK UNJANI Students Class of 2024. The majority of respondents stated that they were aware of PLDs, knew the impact of PLDs on hearing, knew that PLDs could cause problems in the outer or middle ear. The majority of respondents have a good level of knowledge according to the research of Muyassaroh, et al. (2015) where 95.8% of respondents know that PLDs can affect hearing.

Based on their knowledge of the types of hearing loss due to the use of PLDs, most respondents know that PLDs can cause auditory hearing loss alone. As explained in the study of Kristianti and Nurrokhmawati (2020), PLDs not only cause auditory disturbances but also non-auditory disturbances (Kristianti & Nurrokhmawati, 2020). This suggests that although awareness of the dangers exists, knowledge about the types of hearing loss due to the use of PLDs still needs to be improved.

Most respondents replied that NIHL can recover as it was, but in fact NIHL is a form of permanent hearing loss (Kristianti & Nurrokhmawati, 2020). This difference indicates a misconception about the prognosis of noise-induced hearing loss. Knowledge about the prevention of hearing loss due to noise PLDs was obtained, the majority answered that hearing loss due to noise can be prevented. The results of the research of Bako and Gomos (2024) found that noise exposure is an etiology of preventable hearing loss (Bako & Gomos, 2024). The majority of respondents also answered that tinnitus is an early sign of hearing loss due to noise exposure from the use of PLDs. The findings of the study of Kristianti (2018) also obtained similar results, where there were 9.5% of respondents who complained of tinnitus due to the use of PLDs (Kristianti, 2018).

The question about the initial symptoms of hearing loss was the most answered answer was to increase the volume of electronic devices used. In a study conducted by Muyassaroh, et al. (2015), the results were obtained as much as 43.8% to increase the volume of electronic devices (Muyassaroh et al., 2015). Most of the respondents knew that the type of PLDs that was the safest to use, namely the over-ear/on-ear type.

This is also in line with the research of Muyassaroh, et al. (2015) which obtained results as many as 51.3% of respondents considered the over-ear/on-ear type to be safer to use. A similar thing was also found in the study of Breinbauer, et al. (2012) who explained that at the same volume level, the type of over-ear/on-ear PLDs is said to be effective in preventing the occurrence of NIHL (Breinbauer et al., 2012). In the study of Alenzi, et al. (2024) it was explained that the use of in-ear can increase the risk of hearing damage, especially if used for a long period of time (Alenzi et al., 2024).

Based on the results of the study, most of the FK UNJANI students Class of 2024 show a good level of awareness and knowledge about the dangers of excessive use of PLDs and the importance of prevention to avoid hearing loss. Nevertheless, there is still a need for further education on the types and prognosis of noise-induced hearing loss PLDs. The recapitulation of the answers that have been analyzed for each question will be measured by analyzing the percentage of knowledge level about noise exposure as presented in Table 2.

Table 2. Percentage distribution of knowledge levels about noise exposure

Level of Knowledge about Noise Exposure	Quantity (n)	Percentage (%)
Good (≥60%)	133	86,4
Bad (<60%)	21	13,6
Quantity	154	100,0

The recapitulation of the level of knowledge about noise exposure in all respondents was categorized as good (≥60%) with a score of ≥8 and poor (<60%) with a score of <8 out of a total score of 0-12 (Arikunto, 2010). The results of the analysis showed that most students had a good level of knowledge about noise exposure. This explains that the majority of research subjects have an adequate understanding of the risks, impacts, and prevention related to noise exposure to the use of PLDs.

Students who are categorized have a poor level of knowledge of around 13.6%. The percentage obtained is still quite high and requires additional attention and educational interventions to increase awareness and understanding of noise exposure to the use of PLDs. The findings of this study indicate that the information received and students' understanding of hearing health and the dangers of noise exposure resulted in a sample population with good awareness and knowledge. As explained in the research of Muyassaroh, et al. (2015) which obtained the results that 68.1% of respondents had a good level of knowledge.21

2. Overview of PLDs Use Patterns

The variables of the pattern of using PLDs in FK UNJANI Students Class of 2024 were measured using a questionnaire consisting of five questions with the results of the recapitulation of respondents' answers as shown in Table 3.

Table 3. Distribution of PLDs usage pattern answers

No.	Statement of Conduct	Alternative Answers	Total (n=154)	Percentage (%)
1	How long do you use PLDs in a day?	≤60 minutes	90	58,4
		>60 minutes	64	41,6
2	What types of PLDs do you use the most?	Over-ear/on-ear	47	30,5
		In-ear	107	69,5

3	What are you doing to reduce the risk of noise hearing loss from the use of PLDs?	Volume PLDs ≤60%	126	81,8
		Volume PLDs >60%	28	18,2
4	What do you do if you have hearing loss while using PLDs?	Check with a doctor	123	79,9
		Increase the volume of PLDs to keep hearing	16	10,4
		Not checking	15	9,7
5	If there is a disturbance in the ear due to PLDs, what will you do?	Stick to using PLDs	22	14,3
		Not using PLDs	132	85,7

Table 3 shows the results of the analysis of the pattern of use of PLDs in 154 respondents. Most respondents used PLDs ≤60 minutes per day. Based on research conducted by Muyassaroh, et al. (2015), the results of the majority of respondents using PLDs ≤60 minutes per day were obtained (Muyassaroh et al., 2015). The research of Kristianti and Nurrokhmawati (2020) and the research of Alenzi, et al. (2024) also found similar things (Alenzi et al., 2024; Kristianti & Nurrokhmawati, 2020). The duration of exposure to the use of PLDs >60 minutes has the potential to increase the risk of hearing loss (P2PTM Kemenkes RI, 2024).

Based on the type of PLDs that are often used by respondents, the majority of respondents choose in-ear type PLDs. This shows similar results to the research of Muyassaroh, et al., where most of the respondents are also users of in-ear PLDs (Muyassaroh et al., 2015). Similar research results were also found in the research of Darsana and Wiranadha (2022) and the research of Alenzi, et al. (2024) (Darsana & Wiranadha, 2022; Alenzi et al., 2024). Users of in-ear PLDs are more at risk of causing NIHL. Most respondents showed awareness of the volume of use of PLDs (Breinbauer et al., 2012).

The results of the study also found that the majority of respondents regulated the volume of PLDs ≤60%. In the study of Alenzi, et al. (2024) a similar finding was also obtained, where as many as 74.4% of respondents listened to PLDs with low to moderate volume or a volume range of ≤66.6% (Alenzi et al., 2024). Sound volume of more than 60% for more than 60 minutes for one day in the long term can cause NIHL (P2PTM Kemenkes RI, 2024).

The level of awareness of respondents if they experience hearing loss when using PLDs varies, but the majority of respondents stated that they will check with a doctor if they have hearing loss. These results were also obtained from the research of Muyassaroh, et al. which stated that as many as 91.2% of respondents would check with a doctor (Muyassaroh et al., 2015). The majority of respondents also showed the behavior of not using PLDs in the event of hearing loss, as well as the research of Alenzi, et al. (2024) which obtained results as many as 80.8% of respondents would do the same (Alenzi et al., 2024).

The level of awareness and preventive behavior on the variables of PLDs usage patterns showed good results, namely regulating the duration of exposure, the volume of use of PLDs, and choosing to see a doctor if hearing loss occurs. Further attention is that the dominance of the use of in-ear type PLDs with a volume of >60% can result in NIHL (P2PTM Kemenkes RI, 2024). The recapitulation of the pattern of use of PLDs in all respondents was categorized as good (≥60%) with a score of ≥6 and poor (<60%) with a score of <6 out of a total score of 0-10 (Arikunto, 2010).

Table 4. Percentage distribution of PLDs usage patterns

Patterns of Use of PLDs	Quantity (n)	Percentage (%)
Good (≥60%)	140	90,9
Bad (<60%)	14	9,1
Quantity	154	100,0

The recapitulation of the pattern of use of PLDs in all respondents was categorized as good (≥60%) with a score of ≥6 and poor (<60%) with a score of <6 out of a total score of 0-10.25 The results of the analysis showed that the majority of respondents behaved well, but there were still respondents who behaved poorly in the use of PLDs. The percentage of good patterns of PLDs use dominated, so it can indicate that most students have managed the duration of exposure and volume of PLDs well. Similar findings were also obtained in the study of Muyassaroh, et al. (2015) that around 53.5% of respondents behaved well in the use of PLDs (Muyassaroh et al., 2015). The percentage of poor PLDs use patterns tended to indicate risky behaviors, such as listening to PLDs >60 minutes at a volume of >60% and ignoring signs of noisy hearing loss due to PLDs.

3. The Relationship of Knowledge Level of Noise Exposure with the Pattern of Use of PLDs

The analysis used to calculate the relationship between the level of knowledge about noise exposure and the behavioral patterns of using PLDs was using Chi-square test analysis. The analysis will be strengthened by the Spearman correlation test. The results of the recapitulation of the Chi-square test are presented in Table 5 with a confidence level of 95% and a degree of significance of p <0.05.

Table 5. Chi-square test results relationship of knowledge level of noise exposure with types of PLDs

Types of PLDs	Knowledge Level				Total		*p-value*	OR
	Good		Poor					
	n	%	n	%	n	%		
Over-ear/on-ear	46	97,9	1	2,1	47	100,0	0,006	0,095
In-ear	87	81,3	20	18,7	107	100,0		

*Chi-square test; p-value <0.05 (significant relationship)

Based on Table 5, it can be seen that of the 47 respondents who use the types of over-ear/on-ear and in-ear PLDs, the majority have a good level of knowledge. The data obtained shows that despite having good knowledge about noise exposure, most still choose the type of device that has a higher risk of NIHL as in the research of Muyassaroh, et al. (2015) which also found that there are still many respondents who still use in-ear type PLDs.21

From the odds ratio, it can be concluded that the respondents of over-ear/on-ear users have an odds of experiencing poor knowledge which is around 0.095 times compared to in-ear users. The interpretation is that the respondents of in-ear users tend to have good knowledge. The results of this study show that good knowledge does not effectively motivate respondents to switch to using over-ear/on-ear type PLDs. In general, over-ear/on-ear type PLDs produce

lower sound intensity than in-ear types. Types of over-ear/on-ear PLDs are said to be effective in preventing the occurrence of NIHL (Breinbauer et al., 2012; Darsana & Wiranadha, 2022).

In the two knowledge groups, both dominated the use of in-ear PLDs. These results indicate that factors beyond the level of knowledge, i.e. flexibility, are more influential in determining the type of PLDs used. Data analysis (p = 0.006) also showed that although there is a statistically significant relationship.

The test results between the level of knowledge about noise exposure and the duration of exposure to the use of PLDs are presented in Table 6 and it was found that there was a statistically significant relationship. A significant association showed that a good level of knowledge was positively correlated with a safer pattern of using PLDs (p = 0.001), i.e. limiting the use of PLDs to a duration of ≤60 minutes.

Table 6. Chi-square test results relationship of knowledge level of noise exposure with duration of exposure to PLDs

Duration of Exposure of PLDs	Knowledge Level				Total		*p-value*	OR
	Good		Bad					
	n	%	n	%	n	%		
≤60 minutes	85	94,4	5	5,6	90	100,0		
>60 minutes	48	75,0	16	25,0	64	100,0	0,001	0,176

*Chi-square test; p-value <0.05 (significant relationship)

Of the total 90 repsondens who used PLDs with an exposure duration of ≤60 minutes, most of the knowledge levels were good. These results show that good knowledge is effective in encouraging respondents' awareness to limit the duration of exposure to the use of PLDs. From the two categories of length of exposure to PLDs, it can be concluded that a good level of knowledge about noise exposure significantly makes the respondents aware to limit the duration of use of PLDs to a safe limit, which is ≤60 minutes as well as the results of Muyassaroh's research, et al. (2015) which showed that the majority of well-informed respondents were PLDs users with an exposure period of ≤60 minutes.21 From the odds ratio, it can be concluded that respondents with a duration of exposure to PLDs of ≤60 minutes had a 0.176 times chance of being ill-informed compared to respondents with an exposure period of >60 minutes. In other words, respondents who were exposed to PLDs for ≤60 minutes tended to have better knowledge.

In Table 7, there is a statistically significant relationship between the level of knowledge about noise exposure and the volume of use of PLDs (p = 0.000). This relationship shows that good knowledge has a positive influence on the volume of safe use of PLDs, which is ≤60%.

Table 7. Chi-square test results relationship of knowledge level of noise exposure to the volume of use of PLDs

Volume of PLDs Use	Knowledge Level				Total		*p-value*	OR
	Good		Bad					
	n	%	n	%	n	%		
≤60%	121	96,0	5	4,0	126	100,0		
>60%	12	42,9	16	57,1	28	100,0	0,000	0,031

*Chi-square test; p-value <0.05 (significant relationship)

The majority of respondents use PLDs with a volume of ≤60% and have a good level of knowledge as obtained in the study of Alenzi et al. (2024). The results of this study explain that good knowledge is effective in encouraging respondents to use the safe use of PLDs which is a factor in the risk prevention of NIHL. The ratio odds obtained in this analysis showed that respondents with a usage volume of ≤60% had a 0.031 times chance of being knowledgeable. It can be concluded that respondents with a usage volume of ≤60% tend to have a good level of knowledge.

Based on Table 8, it was found that there was a statistically significant relationship between the level of knowledge about noise exposure and the overall pattern of use of PLDs (p = 0.000). This relationship suggests that good knowledge is positively correlated with safe behaviors in the use of PLDs.

Table 8. Chi-square test results relationship between knowledge level of noise exposure and pattern of use of PLDs

Patterns of Use of PLDs	Knowledge Level				Total		*p-value*	OR
	Good		Bad					
	n	%	n	%	n	%		
Good	132	94,3	8	5,7	140	100,0		
Bad	1	7,2	13	92,9	14	100,0	0,000	214,500

*Chi-square test; p-value <0.05 (significant relationship)

Of the 140 respondents who had a good pattern of using PLDs, most had a good level of knowledge. The results explain that good knowledge of noise exposure is effective in forming safe behavioral habits in the use of PLDs. Good knowledge is one of the factors for creating good behavior, for example in implementing the prevention of hearing loss due to noise exposure (Mahmudi et al., 2021; Kristianti, 2018). The odds ratio value of this test result is 214.5 (OR >1) which indicates a positive relationship. Well-informed respondents were 214.5 times more likely to have a good pattern of using PLDs.

The results from Table 8 show that the level of knowledge is a factor that affects the pattern of use of PLDs, as in the study of Mahmudi, et al. (2021) that the breadth of knowledge can be determined from the level of education, a person with a low level of education tends to find it difficult to receive new information, one of which is about noise exposure (Mahmudi et al., 2021). This analysis concludes that educational interventions to improve knowledge are very important and effective in improve the pattern of use of PLDs of respondents in daily life.

Consistent educational efforts are very important in overcoming the prevalence of increased NIHL as described in the research of Alenzi, et al. (2024).19 To prove the significance value of Chi-square analysis, a test was carried out using the Spearman test on the total score data of each knowledge level variable (0-12) and the pattern of use of PLDs (0-10) with the results listed in Table 9.

Table 9. Spearman test results relationship of knowledge level about noise exposure to PLDs usage patterns

Variabel	n	Correlation Coefficient / ρ (rho)	*p-value*	Interpretasi
Knowledge Score – Behavior Score	154	0,434	<0.001	Moderate, significant correlation

Based on Table 9, a positive value was obtained that shows a unidirectional relationship and can be interpreted that the higher the level of knowledge of the respondents about noise exposure, the better the pattern of using PLDs. The ρ value of 0.434 is in the category as a medium correlation, which is between 0.26 – 0.50. The results of the Spearman test (p = <0.001; ρ = 0.434) statistically proved that the level of knowledge had a significant positive relationship with the pattern of use of PLDs with a moderate correlation rate.

Similar findings were also found in the research of Muyassaroh, et al. (2015) with the results of the study there was a significant relationship between knowledge scores and behavioral scores. The research of Mahmudi, et al. (2021) also explains that a person with a good level of knowledge can be a factor in the creation of good behaviors.20 The analysis supports the hypothesis that the knowledge possessed by respondents plays a role in shaping the behavior of using PLDs.

This research has the potential for bias. The cross-sectional design of the study on the cause-and-effect relationship between the level of knowledge about noise exposure and the pattern of use of PLDs cannot be directly ascertained. Data was obtained through questionnaires that depend on the respondents' honesty and ability to remember, thus allowing recall bias to occur. External factors such as experience with PLDs, sources of information obtained regarding noise exposure, and individual motivation are not strictly controlled, which may affect the final results of the research obtained.

CONCLUSION

The study among FK UNJANI Class of 2024 students revealed that most PLD users were women, knowledge levels about noise exposure were predominantly good, and usage patterns favored in-ear devices with exposure durations ≤60 minutes and volumes ≤60%. A significant relationship existed between knowledge level and PLD usage patterns across type, duration, and volume. For future research, longitudinal studies could track changes in usage behaviors over time and assess the impact of targeted educational interventions on reducing noise-induced hearing risk.

REFERENCES

Alenzi, M. M. G., Alenzi, O. M. F., Alenzi, F. M. G., Aldaham, A. S. D., Alkhaldi, M. H. E., Alruwaili, A. M. G., et al. (2024). Awareness about the noise-induced hearing loss (NIHL) and its relation to headphones use at Al Jouf Region, Northern Saudi Arabia. *Asian Journal of Medicine and Health*, *22*(6), 46–58.

Anastasiadou, S., & Al Khalili, Y. (2023). Hearing loss. In *NCBI Bookshelf*. StatPearls.

Arikunto, S. (2010). Memilih pendekatan. In *Prosedur penelitian suatu pendekatan praktek* (15th ed., pp. 384–393). Rineka Cipta.

Bako, B. B., & Gomos, P. O. (2024). Social effects of hearing loss on patients in Jos, North Central Nigeria. *International Journal of Otorhinolaryngology and Head and Neck Surgery*, *13*(05), 403–417.

Bashiruddin, J., & Alviandi, W. (2023). Gangguan pendengaran akibat bising (Noise induced hearing loss). In E. A. Soepardi, N. Iskandar, J. Bashiruddin, & R. D. Restuti (Eds.), *Buku ajar ilmu kesehatan telinga, hidung, tenggorok, kepala, dan leher* (7th ed., pp. 42–45). Universitas Indonesia Publishing.

Breinbauer, H. A., Anabalõn, J. L., Gutierrez, D., Cárcamo, R., Olivares, C., & Caro, J. (2012). Output capabilities of personal music players and assessment of preferred listening levels of test subjects: Outlining recommendations for preventing music-induced hearing loss. *Laryngoscope*, *122*(11), 2549–2556.

Darsana, P. C. L., & Wiranadha, I. M. (2022). Karakteristik pendengaran pada pelajar pengguna peranti dengar di Denpasar, Bali, Indonesia. *Intisari Sains Medis*, *13*(1), 332–335.

Dudarewicz, A., Pawlaczyk-Łuszczyńska, M., Zaborowski, K., Pontoppidan, N. H., Wolniakowska, A., Bramsløw, L., et al. (2023). The adaption of noise-induced temporary hearing threshold shift predictive models for modelling the public health policy. *International Journal of Occupational Medicine and Environmental Health*, *36*(1), 125–138.

Elmazoska, I., Mäki-Torkko, E., Granberg, S., & Widéa, S. (2024). Associations between recreational noise exposure and hearing function in adolescents and young adults: A systematic review. *Journal of Speech, Language, and Hearing Research*, *67*(2), 688–710.

Kim, G., Shin, J., Song, C., & Han, W. (2021). Analysis of the actual one-month usage of portable listening devices in college students. *International Journal of Environmental Research and Public Health*, *18*(16), Article 8436.

Kristianti, A. (2018). Gambaran gangguan auditorik dan non auditorik pada pelajar pengguna PLDs SMKN 1 Cimahi (Auditoric and non auditoric disorders in student users PLDs of SMKN 1 Cimahi). *Midwife's: Jurnal Ilmiah Kebidanan*, *2*(1), 15–22.

Kristianti, A., & Nurrokhmawati, Y. (2020). Gambaran pola penggunaan personal listening devices (PLDs) dan hasil audiogram pelajar SMPN 3 Cimahi (Description of personalized listening devices (PLDs) patterns and results of SMPN 3 Cimahi students' audiogram). *Midwife's: Jurnal Ilmiah Kebidanan*, *3*(2), 103–112.

Lee, H. J., & Jeong, I. S. (2021). Personal listening device use habits, listening belief, and perceived change in hearing among adolescents. *Asian Nursing Research*, *15*(2), 113–120.

Mahmudi, Sari, D., & Joegijantoro, R. (2021). Faktor-faktor yang mempengaruhi perilaku pekerja terhadap pencegahan gangguan pendengaran akibat bising. *Jurnal Ilmu Kesehatan Masyarakat Husada*, *10*(2), 109–114.

Muyassaroh, Dimas, & Citra. (2015). Hubungan pengetahuan dengan perilaku pelajar pengguna personal listening devices (PLDs). *Medical Hospital*, *3*(1), 15–19.

Natarajan, N., Batts, S., & Stankovic, K. M. (2023). Noise-induced hearing loss. *Journal of Clinical Medicine*, *12*(6), Article 2347.

P2PTM Kemenkes RI. (2024). *Aman menggunakan earbuds: Lindungi pendengaranmu dengan rumus 60:60 dan kenali peran penting koklea*. https://p2ptm.kemkes.go.id/informasi-p2ptm/aman-menggunakan-earbuds-lindungi-pendengaranmu-dengan-rumus-6060-dan-kenali-peran-penting-koklea

Putri, B. I. (2023). Pencegahan gangguan pendengaran akibat bising pada anak dan remaja. *GALENICAL: Jurnal Kedokteran dan Kesehatan Mahasiswa Malikussaleh*, *2*(4), 103–111.

Quiñonez Hurtado, V. A., Medrano Aulestia, J. V., & Núñez Solano, S. J. (2025). Hearing impairment due to occupational noise exposure in workers in a plastics industry, 2024. *Lex Localis: Journal of Local Self-Government*, *23*.

Reichmuth, C., Sills, J. M., Mulsow, J., & Ghoul, A. (2019). Long-term evidence of noise-induced permanent threshold shift in a harbor seal (*Phoca vitulina*). *Journal of the Acoustical Society of America*, *146*(4), 2552–2561.

Ryan, A. F., Kujawa, S. G., Hammill, T., Le Prell, C., & Kil, J. (2016). Temporary and permanent noise-induced threshold shifts: A review of basic and clinical observations. *Otology & Neurotology*, *37*(8), 271–275.

Syafila, A. A., Rohimah Putri, A., Rani, D., Putri, S., Amin, M. I., Altika, N., et al. (2023). Literature review: Faktor risiko paparan kebisingan terhadap gangguan kesehatan tenaga kerja. *Madani: Jurnal Ilmiah Multidisiplin*, *1*(6), 676–686.

Wagatsuma, Y., Daimaru, K., Deng, S., & Chen, J. Y. (2022). Hearing loss and the COVID-19 pandemic. *BMC Research Notes*, *15*(1), Article 349.

World Health Organization. (2019). *Safe listening devices and systems: A WHO-ITU standard*. https://www.who.int/publications/i/item/9789241515276

World Health Organization. (2025). *Deafness and hearing loss*. https://www.who.int/news-room/fact-sheets/detail/deafness-and-hearing-loss

Zachreini, I. (2018). Dampak gangguan psikologis penggunaan personal listening devices (PLDs) pada siswa SMA di Kota Lhokseumawe. *AVERROUS: Jurnal Kedokteran dan Kesehatan Malikussaleh*, *2*(1), 29–34.