JURNAL PENDIDIKAN INDONESIA
p-ISSN : 2745-7141 e-ISSN : 2746-1920
Jurnal Pendidikan Indonesia
Vol. 6 No. 12 December 2025

The Relationship of Earphone Use to the Occurrence of Noise-Related Hearing Loss in Students of the Faculty of Medicine, Universitas Prima Class of 2022

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Keywords:
Earphones; hearing loss; student; noise; audiometry.

ABSTRACT

The widespread use of earphones among college students, especially with high volume and long duration, increases the risk of noise-induced hearing loss (NIHL). Global data show that adolescents and young adults are a vulnerable group, but there are still limited studies examining the relationship between earphone use patterns and audiometry results in medical students in Indonesia. This study aims to analyze the relationship between the use of earphones and noise-induced hearing loss in students of the Faculty of Medicine, Universitas Prima Indonesia. Using observational analytical approaches and cross-sectional designs, data were collected through questionnaires and audiometric examinations on 20 respondents. The results showed that there was a significant relationship between the duration of earphone use and hearing loss ($p = 0.010$), while the frequency of earphone use did not show a significant relationship ($p = 0.543$). These results provide important evidence regarding the impact of earphone use on students' hearing health. This research is expected to be the basis for educational institutions to develop educational programs regarding the safe use of earphones to prevent hearing loss.

INTRODUCTION

The use of earphones today has become an indispensable part of daily life, especially among college students. Earphones are used to listen to music, watch videos, and attend online meetings. Although they offer comfort and mobility, excessive use of earphones, especially at high volumes, can increase the risk of noise-induced hearing loss (NIHL) (Hendradewi et al., 2023; Timms et al., 2022). Data from the World Health Organization (WHO) shows that more than 1.1 billion adolescents and young adults in the world are at risk of hearing loss due to the habit of listening to loud sounds through personal audio devices, including earphones (Haile et al., 2021). This phenomenon requires special attention because it can have an impact on long-term quality of life and productivity (Le Prell, 2019). Long-term productivity refers to a person's ability to function effectively in various aspects of life, including academic, professional, and social (Khamidullaevich et al., 2024; McFarland, 2022; Meng et al., 2022).

Hearing loss due to the habit of listening to loud sounds through earphones can reduce this productivity in several ways (Natarajan et al., 2023). First, hearing loss can hinder communication, making it difficult for a person to understand conversations or instructions, which impacts the quality of work and learning. Second, decreased listening ability can interfere with concentration, as individuals have to focus more on hearing sounds clearly, thus reducing efficiency in completing tasks. In addition, hearing loss can affect the quality of social

life, causing isolation or difficulty interacting with others. This can lead to stress, mental fatigue, and decreased mental health, all of which reduce a person's ability to work or study optimally. Therefore, hearing loss can have a direct impact on a person's quality of life, reducing their productivity in the long run (Haile et al., 2021).

College students are a group that is prone to hearing loss due to the use of earphones. A study in Indonesia reported that the prevalence of hearing loss in earphone users reached 21.3%, with most cases found in the age group of 18-25 years c. The main contributing factor is the use of earphones at high volumes for a long time. This habit is often triggered by the need to isolate oneself from environmental noise, especially on campus or in public places. However, the lack of awareness of the long-term risks of this habit makes this problem continue to increase (Pohan et al., 2023).

However, this habit is often carried out without regard to safe time and volume restrictions. College students who spend long hours with earphones, whether in a study room, library, or even while traveling, are at risk of hearing loss. Plus, some streaming apps or platforms offer very high sound quality, which can tempt their users to increase the volume without realizing it (Hendradewi et al., 2023).

Therefore, while the use of earphones is common in students' academic lives, it is important to raise awareness of the long-term impact it can have on their hearing health. Education on the safe use of earphones, such as recommended volume rules and reasonable duration of use, is indispensable to prevent future hearing loss (Negara et al., 2022)

Physiologically, noise-induced hearing loss occurs due to exposure to loud noises that damage hair cells in the cochlea, an important structure in the inner ear (Nyarubeli et al., 2019; Seikel et al., 2023). This damage is cumulative and often goes unnoticed until the hearing loss becomes permanent (Angelita et al., 2024; Timms et al., 2022). Using earphones at volumes greater than 85 decibels for more than eight hours per day has been shown to significantly increase the risk of hearing loss (El-Mawgoud, 2020). Therefore, understanding the pattern of earphone use in college students is essential to prevent more serious health impacts in the future (Angelita et al., 2024).

Previous studies have examined various aspects of earphone use and their relationship to hearing loss. For example, research by Kurnia Angelita et al. (2024) found that the length of exposure and the volume level of headphones or earphones increase the risk of hearing loss in college students. However, the study found no significant difference in use based on the frequency of exposure in a week. On the other hand, research by Salsabilah (2022) showed that the frequency of earphone use did not have a significant relationship with tinnitus symptoms, but the volume of the earphones had a closer correlation. In addition, research by Dalimunthe & Anwar (2023) found a significant relationship between the duration of earphones and hearing loss, where a duration of 1-3 hours per day contributes to hearing loss. Similar findings were reported by Joshua Velaro & Zahara (2021) which showed that the duration of earphone use of 1-2 hours per day was the most common pattern in medical students.

The title of this study was taken because of the importance of understanding the relationship between the use of earphones and the occurrence of hearing loss due to noise in students. Students, as an active and dynamic young generation, need to be educated about the impact of improper use of earphones. This research also aims to make a scientific contribution in increasing public awareness and helping to develop effective preventive strategies. Thus, the

results of this study can be the basis for designing relevant health interventions. This research is also relevant considering the lack of specific local data on the relationship between earphone use and hearing loss in students in Indonesia. By examining this phenomenon, research can fill in the knowledge gap and provide a clearer picture of the prevalence and associated risk factors. In addition, this research is expected to encourage educational institutions to take proactive steps in protecting students' hearing health through education programs and policies for the use of healthier audio devices.

The formulation of the problem in this study includes two main questions: first, how is the relationship between earphone use and noise-induced hearing loss in college students, and second, the extent to which earphone use contributes to the risk of hearing loss. The general purpose of this study is to determine the relationship between the use of earphones and the occurrence of noise-induced hearing loss in college students, with the specific aim of analyzing the relationship between the duration of earphone use and hearing loss, as well as to determine the extent to which earphone use contributes to the risk of hearing loss. The benefits of this research are divided into theoretical and practical benefits. Theoretically, this study is expected to enrich scientific literature on the relationship between earphone use and hearing loss, especially in college students. Practically, this study provides deeper insight into the risk factors for hearing loss caused by the habit of using earphones, as well as providing useful information for educational institutions to understand the impact of earphone use on students' hearing health. The results of this research can also be used as a reference for Prima University to increase attention to hearing health problems among students and become the basis for educational programs on the importance of maintaining hearing health in the campus environment. On the other hand, this study is expected to increase public awareness, especially among students, about the negative impact of excessive use of earphones on hearing health.

RESEARCH METHOD

This research is observational analytics research with a cross-sectional approach. The location of this research is located at Universitas Prima Indonesia. This research was carried out from October 2025 to November 2025. The population in this study was students of the Medical Study Program of Universitas Prima Indonesia Class of 2022. This research was carried out using purposive sampling techniques to select students who have taken part in the progress test that meets the inclusion and exclusion criteria.

The data of the respondents of this study must meet the following inclusions and exclusions.

1. Inclusion criteria
   a. Students who are willing to fill out the questionnaire.
   b. Students who are willing to take an audiometric examination.
   c. Students of the Faculty of Medicine Program Semester 5.
   d. Students who use earphones for more than 30 minutes.
2. Exclusion criteria
   a. Students who are not willing to fill out the questionnaire
   b. Students who are not willing to do an audiometric examination.
   c. Students are not in the Medical Study Program Semester 5.

d. Students who do not use *earphones*.
e. Students who do not have DM disorders, hypertension, ear infections and ear tumors.

Slovin Formula for Samples

$$n = \frac{N}{1 + N(e)^2}$$

Information:

n = estimated sample size
N = estimated population size
e = *margin of error* (0,01)

$$\boldsymbol{n = \frac{N}{1 + N\,(0,1)^2}}$$

$$\boldsymbol{n = \frac{37}{1 + 37\,(0,01)}}$$

$$\boldsymbol{n = \frac{37}{1,37}}$$

$$\boldsymbol{n = 27,007}$$

Based on calculations, the number of samples used in this study was 27 respondents.

The primary data sources were the results of audiometric examinations on students using earphones and the results of questionnaires. The primary data that will be used in this study is data obtained from respondents, namely students of the Faculty of Medicine, Universitas Prima Indonesia Class of 2022.

Table 1. Variable Operational Definition

Variable	Definition	Measuring Instruments	Measurement Results	Scale
Frequency of *Earphone Use*	The number of days in a week a person uses *earphones* to listen to sound or music.	Questionnaire	1.1-2 Days 2.3-4 Days 3.5-6 Days	Nominal
Duration of Use of Earphones	The length of time (hours or minutes) of earphone use in a single session or per day.	Questionnaire	1.< 1 Hour 2.1-3 Hours 3.> 1 Hour	Nominal
Hearing Loss	Hearing loss refers to a condition characterized by a decrease in the ability to hear, which can result in difficulty in carrying out daily activities, especially in understanding conversations.	Audiometers	≤ 25 dB :No hearing loss > 25 dB: hearing loss	Nominal

Source: Research Primary Data (2025)

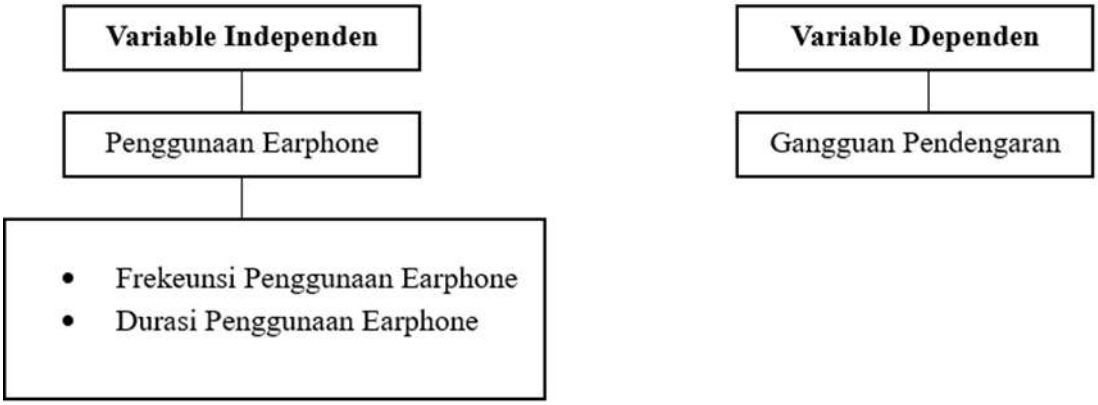

Figure 1. Concept Framework Table
Source: Researcher (2025)

The data analysis in this study included univariate and bivariate analyses. Univariate analysis was carried out to provide an overview of the frequency distribution and percentage for each independent variable (Use of Earphone) and the dependent variable (Hearing Loss) based on the distribution table. Bivariate analysis was conducted to test hypotheses regarding the relationship between the independent variable (Use of Earphone) and the dependent variable (Hearing Loss). Based on the results of the normality test, if the data were normally distributed, the Chi-Square test was used. If the data were not normally distributed, the non-parametric Fisher's Exact test was applied. The decision criteria for hypothesis testing were as follows: the null hypothesis (Ho) was rejected if the p-value was less than $\alpha = 0.05$, while the alternative hypothesis (Ha) was accepted if the p-value was greater than or equal to $\alpha = 0.05$.

RESULTS AND DISCUSSION

Univariate Results

Distribution of Respondents Based on Frequency of Earphone Use

Distribution overview based on the frequency of earphone use in students of the medical study program of Universitas Prima Indonesia Class of 2022. The results of the questionnaire for the respondents are found in table 2 as follows:

Table 2. Distribution of Respondents Based on Frequency of Earphone Use

Respondent Characteristics	Frequency (n)	Percentage (%)
Frequency of Earphone Use		
1-2 Days	13	65
3-4 Days	3	15
5-6 Days	4	20
Total	20	100

Source: Research Primary Data (2025)

Based on Table 2, it can be seen that from the 20 respondents, the distribution of respondents based on the frequency of earphone use was obtained, namely 1-2 days for 13

(65%) respondents, then 5-6 days for 4 (20%) respondents, and 3-4 days for 3 (15%) respondents.

Distribution of Respondents Based on Duration of Use of Earphones

Distribution overview based on the duration of earphone use in students of the medical study program of Universitas Prima Indonesia Class of 2022. The results of the questionnaire for the respondents are found in table 3 as follows:

Table 3. Distribution of Respondents Based on Duration of Earphone Use

Respondent Characteristics	Frequency (n)	Percentage (%)
Duration of Use of Earphones		
< 1 Hour	11	55
1-3 Hours	7	35
> 3 Hours	2	10
Total	20	100

Source: Research Primary Data (2025)

Based on Table 3, from 20 respondents, the distribution of respondents based on the duration of use of earphones was < 1 hour for 11 (55%) respondents, then 1-3 hours for 7 (35%) respondents, and >3 hours for 2 (10%) respondents.

Distribution of Respondents by Hearing Loss

Distribution overview based on hearing loss in students of the medical study program of Universitas Prima Indonesia Class of 2022. The results of the questionnaire for the respondents are found in table 4 as follows:

Table 4. Distribution of Respondents by Hearing Loss

Respondent Characteristics	Frequency (n)	Percentage (%)
Hearing Loss		
$\leq 25\ dB$	11	55
$> 25\ dB$	9	45
Total	20	100

Source: Research Primary Data (2025)

Based on Table 4, from 20 respondents, the distribution of respondents based on the duration of use of earphones was the most, namely 11 $\leq 25\ dB$ (55%) respondents while 9 $> 25\ dB$ (45%) respondents.

Bivariate Results

The Relationship between Frequency of Earphone Use and Hearing Loss

Based on research conducted on students of the medical study program at Universitas Prima Indonesia Class of 2022, the results of data analysis of the relationship between the frequency of earphone use and hearing loss can be seen in the following table 5:

Table 5. The Relationship Between Frequency of Earphone Use and Hearing Loss

Frequency of Earphone Use	Hearing Loss		Total	P value
	$\leq 25\ dB$	$> 25\ dB$		

	n (%)	n (%)		
1-2 Days	6 (30)	7 (35)	13 (65)	0.543
3-4 Days	2 (10)	1 (5)	3 (15)	
5-6 Days	3 (15)	1 (5)	4 (20)	
Total	11 (55)	9 (45)	20 (100)	

Source: Research Primary Data (2025)

Based on Table 5, it can be seen that out of 20 respondents, it was found that they had hearing loss with the $> 25\ dB$ highest frequency of earphone use for 1-2 days as many as 7 (35%) respondents, 3-4 days as many as 1 (5%) respondents, and 5-6 days as many as 1 (5%) respondents. Meanwhile, those who do not experience $\leq 25\ dB$ hearing loss have the most frequency of earphone uses for 1-2 days as many as 6 (30%) respondents, 5-6 days as many as 3 (15%) respondents, and 3-4 days as many as 2 (10%) respondents.

Based on the non-parametric Fisher Exact Test statistical test carried out which obtained a value of P = 0.543 (P > 0.05), this means that it can be concluded that there is no significant meaningful relationship between the frequency of earphone use and hearing loss in students of the medical study program of Universitas Prima Indonesia Class of 2022.

The Relationship between Duration of Earphone Use and Hearing Loss

Based on research conducted on students of the medical study program at Universitas Prima Indonesia Class of 2022, the results of the analysis of data on the relationship between the duration of earphone use and hearing loss can be seen in the following table 6:

Table 6. The Relationship Between Duration of Earphone Use and Hearing Loss

Duration of Use of Earphones	**Hearing Loss**			
	$\leq 25\ dB$	$> 25\ dB$	**Total**	**P value**
	n (%)	n (%)		
< 1 Hour	3 (15)	8 (40)	11 (55)	0.010
1-3 Hours	7 (35)	0 (0)	7 (35)	
> 3 Hours	1 (5)	1 (5)	2 (10)	
Total	11 (55)	9 (45)	20 (100)	

Source: Research Primary Data (2025)

Based on Table 6, it can be seen that out of 20 respondents, it was found that those who experienced hearing loss with $> 25\ dB$ the most duration of earphone use < 1 hour as many as 8 (40%) respondents, > 3 hours as many as 1 (5%) respondents, and 1-3 hours as many as 0 (0%) respondents. Meanwhile, those who do not experience $\leq 25\ dB$ hearing loss have the most duration of earphone use of 1-3 hours as many as 7 (35%) respondents, < 1 hour as many as 3 (15%) respondents, and > 3 hours as many as 1 (5%) respondents.

Based on the non-parametric Fisher Exact Test statistical test carried out which obtained a value of P = 0.010 (P < 0.05), this means that it can be concluded that there is a significant relationship between the duration of earphone use and hearing loss in students of the medical study program of Universitas Prima Indonesia Class of 2022.

Based on Table 5, it can be seen that out of 20 respondents, it was found that they experienced hearing loss by $> 25\ dB$ having the most frequency of earphone use for 1-2 days

as many as 7 (35%) respondents, in the non-parametric Fisher Exact Test statistical test conducted which obtained a value of P = 0.543 (P > 0.05), which means that it can be concluded that there is no significant relationship between the frequency of earphone use and hearing loss in college students medical study program of Universitas Prima Indonesia Class of 2022.

This study is in line with research (Kurnia Angelita et al., 2024), which obtained a significance value of 0.059 (p>0.05) which means that there is no difference in the use of earphone and headphone hearing devices based on exposure in a week. Exposure factors for use in a week, both respondents who use earphones for 1-2 days, 3-4 days, or 5-6 days a week.(Kurnia Angelita et al., n.d., 2024)

In the study conducted by (Salsabilah, 2022), it was found that the average respondent had the frequency of earphone use ≥4 days a week (28.2%), the respondents who experienced the most tinnitus were in the category of degree 1 (80.9%) according to the results of the THI questionnaire, in this study a p-value of 0.620 was obtained, which means that p>0.05 there is no relationship between the frequency of earphone use and the symptoms of tinnitus. In this study, the relationship between earphone volume is more closely related than the duration of use, frequency of use, and length of earphone use to tinnitus.(Salsabilah, 2022)

Hearing threshold changes due to noise exposure depend on the frequency of sound, intensity, and length of exposure. Noise with an intensity of ≥85 dB can result in damage to the auditory receptors of the inner ear. Increasing the intensity and duration of exposure will result in more damage such as loss of stereocilia. The area that was first affected was the basal area. The loss of stereocilia will result in hair cells dying and being replaced by scarring. The higher the intensity of the exposure to sound, the inner hair cells and supporting cells are also damaged. (Erlanda Putra Negara et al., 2022)

Based on Table 6, it can be seen that out of 20 respondents, it was found that $8 > 25\ dB$ (40%) respondents experienced hearing loss with the most duration of earphone use < 1 hour, in the non-parametric Fisher Exact Test statistical test carried out which obtained a value of P = 0.010 (P < 0.05), this means that it can be concluded that there is a significant relationship between the duration of earphone use and hearing loss in students of the study program medicine of Universitas Prima Indonesia Class of 2022.

This study is in line with research conducted by (Dalimunthe & Anwar, 2023) Based on the Chi-square test, the relationship between the duration of earphone use and hearing loss has a significant relationship p-value 0.001 (p-Value <0.05) obtained regarding the relationship between the duration of earphone use and hearing loss, usually found in respondents with a duration of 1-3 hours with a percentage of 14.29% (8 people).(Dalimunthe & Anwar, 2023)

In a study (Joshua Velaro & Zahara, 2021), about the correlation between the use of earphones and the incidence of tinnitus symptoms at the Faculty of Medicine, University of Sumatra Utaa at Adam Malik Hospital, it was found that the most earphone use in 1-2 hours per day was found by 55 (37.2%) people. These results show that the duration of earphone use at the Faculty of Medicine, University of North Sumatra is better, this can be due to the level of knowledge about the dangers of using earphones, concerns about the dangers of using earphones on ear health, the understanding that noise-induced hearing loss is permanent, and the level of exposure to information about ear health in medical students.(Joshua Velaro & Zahara, 2021)

The threshold for the noise intensity that can be received by the ear is less than 85 dB. Exposure to 110 dB intensity sounds for 1-4 hours per day can cause damage to hair cells, cell buffers, blood vessels, and afferent nerves in the ear. Volume of 80-90% is at risk of causing hearing loss if used for more than 1 hour per day. The use of headphones or ear earphones with a volume of 40-50% is still considered safe if used for no more than 4 hours per day.16Based on this standard, this study calculated and analyzed the use of headphones or earphones with a risk volume of ≥60% based on weekly and daily frequency. The value considered safe according to this standard is ≤7 hours per week with a volume of ≥60% and ≤28 hours per week for a volume level of <60% (Catalina et al., 2025).

The difference in results obtained in each study can vary due to multifactorial, such as differences in the number of respondents, differences in the criteria determined, and differences in the examination methods used, but it is still necessary to pay attention to the limits of duration, intensity, and frequency of earphone use in accordance with the provisions.

CONCLUSION

Based on the results of a study involving 20 students of the Faculty of Medicine, Universitas Prima Indonesia Class of 2022, it was concluded that students who experienced hearing loss with >25 dB had the most frequency of earphone use of 1-2 days and the most duration of use <1 hour. No significant association was found between the frequency of earphone use and hearing loss ($p = 0.543$), but there was a significant relationship between the duration of earphone use and hearing loss ($p = 0.010$). The suggestions given include making students wiser in using earphones, by limiting the maximum duration of use to 60 minutes per session and keeping the volume below 60% of the maximum limit. Educational institutions are expected to organize hearing health education programs and provide access to regular audiometric examinations. Further research is recommended to use larger samples and additional variables for more in-depth analysis. The public, especially students, need to be more aware of the importance of maintaining hearing health by following the principle of the "80-60 rule".

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