

Factors Influencing the Occurrence of Ispa Disease in Excavation C Workers in the Work Area of the Gonengganti Health Center

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Abstract

Keywords

ISPA; dust exposure; PPE; duration of exposure; smoking history; C mining workers

This study aims to analyze the factors that affect the incidence of ISPA (Infeksi Saluran Pernafasan Atas) in excavation C workers in the working area of the Gonengganti Health Center, Donggala Regency. This study is a quantitative research with a cross-sectional design. The research population is all excavation C workers in the working area of the Gonengganti Health Center, with a total sample of 83 people taken using the total sampling technique. Data were collected through a structured questionnaire that included dust exposure levels, PPE use, duration of dust exposure, and smoking history. Data analysis was carried out univariately, bivariately using chi-square test, and multivariately using logistic regression. The results of the bivariate analysis showed that dust exposure level, PPE use, dust exposure duration, and smoking history had a significant relationship with the incidence of ISPA in excavation C workers ($p < 0.05$). Multivariate analysis showed that dust exposure level and PPE use were the most dominant factors associated with ISPA incidence, with odds ratio (OR) values > 1 , indicating that workers with high dust exposure and not using PPE consistently have a greater risk of experiencing ISPA than other workers. The conclusion of this study shows that the incidence of ISPA in C excavation workers is influenced by work environment factors and worker behavior. Therefore, efforts are needed to control dust exposure, increase compliance with PPE use, regulate work duration, and provide education on the dangers of smoking as preventive measures to reduce the risk of ISPA in excavation C workers.

INTRODUCTION

Acute Respiratory Infection (ISPA) is one of the global health problems that is still the main cause of morbidity and mortality in various countries, especially developing countries. The World Health Organization reports that ISPA causes nearly four million deaths each year, with most cases coming from lower respiratory tract infections such as pneumonia (WHO, 2014). This disease attacks the respiratory tract from the nose to the lungs and can cause mild to severe health problems depending on the individual's condition, environment, and level of exposure to risk factors. In developing countries, the high incidence of ISPA is influenced by various factors such as air pollution, population density, poor sanitation, low awareness of the use of personal protective equipment, and unhealthy working environment conditions. Indonesia itself still faces a fairly high ISPA problem, especially among people who work in the informal sector and the mining sector with a high level of dust exposure (WHO, 2007; Ministry of Health of the Republic of Indonesia, 2021).

Based on data from the 2023 Indonesian Health Survey (SKI), the prevalence of ISPA in Indonesia still shows a significant number and is one of the most common diseases found in health care facilities. The high number of ISPA cases is influenced by increasing air pollution, industrial activities, and unhealthy environmental conditions. In Central Sulawesi Province itself, the number of cases of ISPA has increased year over year, which shows that this disease is still a serious threat to public health. One of the sectors that has a high risk of ISPA occurrence is the C mining sector, because mining activities produce large amounts of dust that

can be inhaled by workers continuously. This condition is exacerbated by the low use of personal protective equipment (PPE), the duration of exposure to dust, and the habit of smoking among mine workers (Databoks, 2024; Badan Pusat Statistik Provinsi Sulawesi Tengah, 2024).

The factors that affect the occurrence of ISPA in mining workers are very complex and interrelated. One of the main factors is the high level of dust exposure in the work environment. Dust from mining activities contains small particles that can enter the respiratory tract to the lung alveoli and cause irritation and infection. In addition, the use of non-optimal PPE is also a factor that increases the risk of ISPA. Many mine workers do not wear masks consistently because they feel uncomfortable or lack understanding of the importance of PPE for respiratory health (Aram & Wang, 2023). Other factors that also affect ISPA incidence are the duration of exposure to dust that lasts for a long time due to high working hours, as well as smoking habits that can worsen lung function and reduce the body's resistance to respiratory infections (Sudirman et al., 2020; Akbar et al., 2022; Widya et al., 2023).

These various factors have a serious impact on the health of mine workers. Continuous exposure to dust can cause respiratory tract disorders such as chronic cough, shortness of breath, decreased lung function, and chronic obstructive pulmonary disease and pneumoconiosis. In addition to having an impact on individual health, the high incidence of ISPA can also reduce work productivity, increase medical costs, and cause economic losses for both workers and companies. The declining health condition of workers will have an impact on the decline in work ability and overall quality of life of mine workers. If this condition is not handled properly, the risk of work-related diseases will increase and has the potential to cause wider public health problems in the area around mining (Febri, 2020; Tasidjawa Elisabeth & Firmansyah, 2022).

Variables in this study included the level of dust exposure, the use of personal protective equipment (PPE), the duration of dust exposure, and the history of smoking associated with the incidence of ISPA in excavation C workers. The level of dust exposure is a work environment condition that shows how much workers are exposed to dust particles during mining activities. The use of PPE is the behavior of workers in using work safety equipment, especially masks, to protect the respiratory tract from dust. The duration of dust exposure describes the length of time a worker is exposed to dust during work each day, while a history of smoking is a behavioral factor that can affect the health condition of the worker's lungs. These four variables were chosen because, based on various previous studies, they have a relationship with the incidence of respiratory tract disorders, especially ISPA in mining workers and dust-based industries (Putra & Lestari, 2022; Suryani et al., 2021; Rahman et al., 2024).

The novelty in this study lies in the focus of research conducted on excavation C workers in the working area of the Gonengganti Health Center, Donggala Regency, which until now still has limited research related to the factors of ISPA incidence in local mining workers. In addition, this study not only assessed work environment factors such as dust exposure but also combined worker behavioral factors such as PPE use and smoking history in one analysis model. This study also used a cross-sectional approach with bivariate and multivariate analyses to determine the most dominant factors related to the incidence of ISPA. Another novelty is that this research was carried out in the mining environment of excavation C, which has different dust exposure characteristics from other industrial sectors, so the results of the study are expected to provide a more specific picture related to the health risks of mining workers in Donggala Regency.

The urgency of this research is based on the high number of ISPA cases in mining areas and the low awareness of workers regarding the importance of occupational health protection. Based on data from the Occupational Safety and Health (K3) program in the Gonengganti Health Center work area in 2023, it was found that as many as 37.5%–55% of mining C workers experienced ISPA. This condition shows that mine workers are a group that is vulnerable to

respiratory tract disorders due to a dusty work environment. If optimal prevention and control efforts are not made, the incidence of ISPA in mining workers will continue to increase and have an impact on public health at large. Therefore, this research is important to be carried out as a basis for the preparation of occupational disease prevention strategies, especially ISPA in mining workers in excavation C mining in Donggala Regency.

The purpose of this study is to analyze the factors that affect the incidence of Acute Respiratory Infection (ISPA) in excavation C workers in the working area of the Gonengganti Health Center, Donggala Regency. In particular, this study aims to determine the effect of dust exposure level, use of personal protective equipment (PPE), duration of dust exposure, and smoking history on the incidence of ISPA in mine workers. In addition, this study also aims to identify the most dominant factors related to the incidence of ISPA so that it can serve as the basis for the formulation of occupational health policies in the mining sector.

The benefits of this research are expected to contribute both theoretically and practically. Theoretically, this study can be an additional scientific reference related to the risk factors for the occurrence of ISPA in mining workers, especially in the mining sector C. Practically, the results of this study are expected to be input materials for mine workers, companies, and health agencies in improving efforts to prevent occupational diseases through dust exposure control, increasing compliance with PPE use, regulating working hours, and providing education about the dangers of smoking. In addition, this research is also expected to increase workers' awareness of the importance of maintaining occupational health and safety to create a healthier, safer, and more productive work environment.

METHOD

This study is a quantitative research using a Cross-Sectional study design, which is a research design that measures independent variables and dependent variables simultaneously at one measurement time. In this study, all variables studied including PPE use, smoking habits, working hours, and working hours were measured at the same time as the measurement of the incidence of ISPA based on ISPA symptoms through a questionnaire. The Cross-Sectional design was used because this study aimed to determine the relationship between risk factors and the incidence of ISPA symptoms without looking at the time sequence (cause–effect), so that all data were obtained through interviews in one data collection period.

In this design, the study did not assess the diagnosis of ISPA medically, but rather identified the symptoms of ISPA experienced by workers at the time of the interview, according to the characteristics of the Cross-Sectional study which focuses on measuring the health condition of the respondents at a certain time. This research will be carried out in the working area of the Gonengganti Health Center, Donggala Regency, This research will be carried out in January-April 2026.

Primary data is a source of data that researchers get from the source directly or from the first person, both individuals and individuals (Sugiyono, 2022). Data can be obtained by interviews and also direct observations in the field using questionnaires. Secondary data is the data in this study, namely data on Ispa disease cases, the number of workers who smoke and have a history of respiratory diseases.

RESULTS AND DISCUSSION

Research Results

1. Univariate Analysis

a. Gender

Respondent gender is demographic information that indicates whether a respondent is male or female. This data helps researchers know the composition of participants in the study. The gender of the respondents in this study was grouped into two categories, namely

Male and Female. The distribution of respondents by gender in this researcher can be seen in table 1 as follows:

Table 1. Distribution of Respondents by Gender

No	Respondent Gender	Frequency (f)	Percentage (%)
1.	Female	18	21.7
2.	Male	65	78.3
	Number	83	100

Source: Primary Data, 2026

Based on Table 1, it is known that the number of respondents in this study is 83 people. Of the total, 65 male respondents or 78.3% were female, while female respondents amounted to 18 people or 21.7%

b. Age

Table 2. Distribution of Respondents by Age

No	Respondent Age	Frequency (f)	Percentage (%)
1.	17-25 Years	2	2.4
2.	26-35 Years	27	32.5
3.	36-45 Years	31	37.3
4.	46-55 Years	16	19.3
5.	56-65 Years	7	8.4
	Quantity	83	100

Source: Primary Data, 2026

Based on Table 2, it is known that the number of respondents in this study is 83 people. The age distribution of respondents shows that the age group of 36-45 years is the largest group, namely 31 respondents (37.3%). Furthermore, respondents in the age group of 26-35 years amounted to 27 people (32.5%). The age group of 46-55 years consisted of 16 respondents (19.3%), while the age group of 56-65 years amounted to 7 respondents (8.4%). The age group of 17-25 years is the least group, namely 2 respondents (2.4%).

c. Company

Table 3. Distribution of Respondents by Company

No	Respondent Companies	Frequency (f)	Percentage (%)
1.	PT Morales Jaya Sentosa	9	10.8
2.	PT Perdana Matra Bumi	10	12.0
3.	PT Sinar Mutiara Megalindo	6	7.2
4.	PT Berkah Batu Banawa	9	10.8
5.	PT Balikpapan Ready Mix	9	10.8
6.	PT Palu Batu Madu	10	12.0
7.	PT Bosowa Tambang Indonesia	6	7.2
8.	PT Belona Jaya Mandiri	8	9.6
9.	PT Multisari Bumitama	7	8.4
10.	PT Hamparan Perkasa	9	10.8
	Quantity	83	100

Source: Primary Data, 2026

Based on Table 3, it is known that the number of respondents in this study is 83 people from 10 different companies. The distribution of respondents showed that the companies with the highest number of respondents were PT Perdana Matra Bumi and PT Palu Batu Madu, each with 10 respondents (12.0%), PT Morales Jaya Sentosa, PT Berkah Batu Banawa, PT Balikpapan Ready Mix, and PT Hamparan Perkasa each contributed 9 respondents (10.8%). PT Belona Jaya Mandiri had 8 respondents (9.6%), while PT Multisari Bumitama had 7 respondents (8.4%). The companies with the least number of respondents

were PT Sinar Mutiara Megalindo and PT Bosowa Tambang Indonesia, each with 6 respondents (7.2%).

d. Long Term of Employment

Table 4. Distribution of respondents based on length of work

No	Long Time Working	Frequency (f)	Percentage (%)
1.	< 1 Year	3	3.6
2.	1-5 Years	36	43.4
3.	6-10 Years	21	25.3
4.	11-20 Years	13	15.7
5.	> 20 Years	10	12.0
	Quantity	83	100

Source: Primary Data, 2026

Based on Table 4, the majority of respondents have a working period of 1-5 years, namely 36 people (43.4%). Furthermore, respondents with a working period of 6–10 years had a quantity of 21 people (25.3%), followed by 11–20 years as many as 13 people (15.7%). Respondents with a working period of > 20 years had a quantity of 10 people (12.0%), while < 1 year was the least, namely 3 people (3.6%).

e. Dust Exposure Level

Table 5. Distribution of Respondents by Dust Exposure Level

No	Dust Exposure Level	Frequency (f)	Percentage (%)
1.	Not Good	41	49.4
2.	Good	42	50.6
	Quantity	83	100

Source: Primary Data, 2026

Based on Table 5. The distribution of respondents based on dust exposure level showed that respondents with good dust exposure level were 42 people (50.6%), while respondents with poor dust exposure level were 41 people (49.4%). These results show that the level of dust exposure in respondents is relatively balanced between the good and bad categories.

f. Use of PPE

Table 6. Distribution of Respondents Based on PPE Use

No	Use of PPE	Frequency (f)	Percentage (%)
1.	Do not use	40	48.2
2.	Use	43	51.8
	Quantity	83	100

Source: Primary Data, 2026

Based on Table 5. The distribution of respondents based on dust exposure level showed that respondents with good dust exposure level were 42 people (50.6%), while respondents with poor dust exposure level were 41 people (49.4%). These results show that the level of dust exposure in respondents is relatively balanced between the good and bad categories.

f. Use of PPE

Table 7. Distribution of Respondents Based on PPE Use

No	Dust Exposure Duration	Frequency (f)	Percentage (%)
1.	Poor	40	48.2
2.	Good	43	51.8
	Quantity	83	100

Source: Primary Data, 2026

Based on Table 7, the distribution of respondents based on the duration of dust exposure shows that respondents with a good dust exposure duration were 43 people (51.8%), while respondents with a poor dust exposure duration were 40 people (48.2%). These results show that the duration of dust exposure in respondents is relatively balanced between the good and bad categories.

h. Smoking History

Table 8. Distribution of Respondents Based on Smoking History

No	Smoking History	Frequency (f)	Percentage (%)
1.	Light Smoker	37	44.6
2.	Heavy Smoker	46	55.4
	Quantity	83	100

Source: Primary Data, 2026

Based on Table 8, the distribution of respondents based on smoking history showed that respondents with the heavy smoker category were 46 people (55.4%), while light smokers were 37 people (44.6%). These results show that most of the respondents fall into the category of heavy smokers.

i. Symptoms of Ispa

Table 9. Distribution of Respondents Based on Symptoms of Ispa

No	Symptoms of ARI	Frequency (f)	Percentage (%)
1.	Symptoms of Mild ARI	22	26.5
2.	Symptoms of Moderate ARI	17	20.5
3.	Symptoms of Severe ARI	44	53.0
	Quantity	83	100

Source: Primary Data, 2026

Based on Table 9, most of the respondents experienced severe symptoms of ARI, namely 44 people (53.0%). Respondents with mild symptoms of ISPA were 22 people (26.5%), while moderate ISPA symptoms were the least, namely 17 people (20.5%). This shows that the majority of respondents experience symptoms of ISPA with severe severity.

2. Bivariate Analysis

- a. The effect of dust exposure level on the incidence of ispa disease in the mining area of Donggala Regency

Table 10. The effect of dust exposure levels on Incidence of ISPA disease

Table 10: The effect of dust exposure levels on incidence of ISPA disease									
No.	Dust Exposure Level	Isipa Incident						Total	P value
		Symptoms of mild ARI		Symptoms of moderate ARI		Symptoms of Severe ARI			
		f	%	f	%	f	%	f	
1.	Not Good	9	22,0	8	19,5	24	58,5	41	0,566
2.	Good	13	31,0	9	21,4	20	47,6	42	
	Total	22	26.5	17	20.5	44	53.0	83	

Source: Primary Data, 2026

Based on Table 10, it is known that in respondents with poor dust exposure levels, the majority experienced severe ISPA symptoms, namely 24 people (58.5%), while respondents with mild and moderate ISPA symptoms were 9 people (22.0%) and 8 people (19.5%) respectively. Meanwhile, in respondents with good dust exposure levels, severe ISPA symptoms were also the most common category, namely 20 people (47.6%), followed by mild ISPA symptoms as many as 13 people (31.0%) and moderate ISPA symptoms as many as 9 people (21.4%).

The results of statistical analysis using the Chi-Square test showed a p value = 0.566 ($p > 0.05$). This shows that there is no significant effect between the level of dust exposure on the incidence of ARI.

- b. The Effect of PPE Use on the Incidence of Ispa Disease in the Mining Area of Donggala Regency

Table 11. The Effect of PPE Use on Incidence of ISPA disease

Table 11: The Effect of PPE Use on Incidence of ISPA Disease									
No.	Use of PPE	Isipa Incident						Total	P value
		Symptoms of Moderate ISPA		Symptoms of moderate ARI		Symptoms of Severe ARI			
		f	%	f	%	f	%	f	
1.	Not Using	f	%	f	%	f	%	f	0,712
2.	Using	9	22,5	9	22,5	22	55,0	40	
	Total	13	30,2	8	18,6	22	51,2	43	

Source: Primary Data, 2026

Based on Table 11, it is known that in respondents who do not use PPE, most of them experience Symptoms of Severe ARI, while in respondents who use PPE, the majority also experience Symptoms of Severe ARI, which is as many as 22 people (51.2%). Respondents with Symptoms of Moderate ISPA and moderate in the group using PPE were 13 people (30.2%) and 8 people (18.6%) respectively.

The results of the statistical test using Chi-Square showed a p value = 0.712 ($p > 0.05$), which means that there was no significant effect between the use of PPE on the incidence of ISPA disease.

- c. The effect of the duration of dust exposure on the incidence of ispa disease in the mining area of Donggala Regency

Table 12. Effect of Dust Exposure Duration on the incidence of ispa disease

Table 12: Effect of Dust Exposure Duration on the Incidence of Isipa disease									
No.	Duration of Dust Exposure	Isipa Incident						Total	P value
		Symptoms of Moderate ISPA		Symptoms of moderate ARI		Symptoms of Severe ARI			
		f	%	f	%	f	%	f	
1.	Not Good	11	27,5	8	20,0	21	52,5	40	0,980
2.	Good	11	25,6	9	20,9	23	53,5	43	
	Total	22	26,5	17	20,5	44	53,0	83	

Source: Primary Data, 2026

Based on Table 12, it is known that in respondents with poor dust exposure duration, the majority experienced Symptoms of Severe ARI, namely 21 people (52.5%), while respondents with Symptoms of Moderate and moderate ISPA had 11 people (27.5%) and 8 people (20.0%) respectively. In respondents with a good duration of dust exposure, Symptoms of Severe ARI was also the most category, namely 23 people (53.5%), followed by Symptoms of Moderate ISPA as many as 11 people (25.6%) and Symptoms of moderate ARI as many as 9 people (20.9%).

The results of the statistical test using Chi-Square showed a p value = 0.980 ($p > 0.05$), which means that there was no significant influence between the duration of dust exposure to the incidence of ISPA disease.

- d. The effect of smoking history on the incidence of ispa disease in the mining area of Donggala Regency

Table 13. Effect of History on the incidence of ispa disease

No.	Smoking History	Isipa Incident						Total	P value
		Symptoms of Moderate ISPA		Symptoms of moderate ARI		Symptoms of Severe ARI			
		f	%	f	%	f	%	f	
1.	Light Smokers	6	16,2	7	18,9	24	64,9	37	0,105
2.	Heavy Smokers	16	34,8	10	21,7	20	43,5	46	
Total		22	26,5	17	20,5	44	53,0	83	

Source: Primary Data, 2026

Based on Table 13, it is known that in respondents with a history of mild smoking, the majority experienced Symptoms of Severe ARI, namely 24 people (64.9%), while respondents with Symptoms of Moderate and moderate ISPA had 6 people (16.2%) and 7 people (18.9%) respectively. In respondents with a history of heavy smoking, Symptoms of Severe ARI was also the most common category, namely 20 people (43.5%), followed by Symptoms of Moderate ISPA as many as 16 people (34.8%) and Symptoms of moderate ARI as many as 10 people (21.7%).

The results of the statistical test using Chi-Square showed a p value = 0.105 ($p > 0.05$), which means that there was no significant influence between smoking history and the incidence of ISPA disease

Discussion

1. The Effect of Dust Exposure Level on the Incidence of Ispa Disease in the Mining Area of Donggala Regency

This study is in line with several recent studies that have also shown the absence of a significant association between dust exposure and the incidence of respiratory distress. Research by (Risma Sri et al., 2023) showed that dust levels were not significantly associated with respiratory distress in workers, with a $p > 0.05$, although other variables such as age and working time had a significant relationship. This shows that individual factors are more dominant than environmental factors in influencing the incidence of respiratory disorders.

Another study by (Putri and Rahman, 2022) on dust-based industrial workers also found that the level of dust exposure did not have a significant relationship with Ispa Incident ($p > 0.05$). The study explained that the absence of considerable variation in exposure between respondents caused the statistical relationship to be not visible. This condition is similar to this study, where dust exposure tends to be homogeneous in the work environment. (Sari et al., 2021) in their study on traditional mine workers found that although most workers were exposed to dust in the high category, there was no significant relationship between the level of dust exposure and the Ispa Incident. The researchers concluded that PPE use and smoking habits played a greater role in influencing the respiratory health conditions of workers.

Research by (Akbar et al., 2024) through a literature review approach also revealed that not all studies found a direct link between dust exposure and ISPA. Some studies have shown insignificant results, especially in conditions where exposure is chronic and evenly

distributed among workers, making it difficult to distinguish the level of risk between individuals.

Similar results were also reported by (Nugroho and Widodo, 2025) who stated that there was no relationship between the concentration of workplace dust and the Ispa Incident in construction workers ($p > 0.05$). The study emphasized that behavioral factors such as compliance with PPE use and workers' health status were more influential than exposure to dust itself.

Although no significant association was found in this study between dust exposure and Ispa Incident, there were a number of other studies that showed different results. Research by (Suryani et al., 2021) found that dust exposure has a significant relationship with Ispa Incident in mine workers, where workers with high dust exposure have a greater risk of respiratory distress than workers with low exposure ($p < 0.05$). These results suggest that dust exposure remains an important risk factor in the occurrence of ISPA, especially in environmental conditions with high dust concentrations.

Research by (Putra and Lestari, 2022) also reported a significant relationship between dust exposure and Ispa Incident in industrial workers, where small dust particles (PM_{10}) can enter the alveoli and cause irritation and reduce the body's resistance to infection. The study confirms that the higher the level of dust exposure, the greater the risk of ISPA.

Another study by (Widya et al., 2023) shows that workers who are exposed to dust without adequate protection have a higher likelihood of experiencing ISPA symptoms compared to workers who are protected. The results of the analysis showed a significant relationship between dust exposure and Ispa Incident ($p < 0.05$), which was reinforced by low compliance with PPE use among workers.

From an Islamic perspective, health is a form of blessing and trust from Allah SWT that must be maintained by every human being. Islam not only regulates the aspect of worship, but also pays great attention to the maintenance of health and disease prevention. In the context of occupational health, protecting oneself from environmental hazards such as exposure to dust is part of efforts to maintain life safety (hifz al-nafs) which is one of the main goals in maqashid sharia. Therefore, every individual has an obligation to protect themselves from risks that can endanger health, including through healthy living behaviors and the use of personal protective equipment in the work environment. Allah SWT says in the Qur'an surah (QS. Al-Baqarah: 195) :

وَأَنْفَقُوا فِي سَبِيلِ اللَّهِ وَلَا تُلْقُوا بِأَيْدِيكُمْ إِلَى التَّهْلُكَةِ وَأَحْسِنُوا إِنَّ اللَّهَ يُحِبُّ
الْمُحْسِنِينَ ﴿١٩٥﴾

“Berinfaklah di jalan Allah, janganlah jerumuskan dirimu ke dalam kebinasaan, dan berbuatbaiklah. Sesungguhnya Allah menyukai orang-orang yang berbuat baik.” (QS. Al-Baqarah: 195)

These verses affirm that Islam prohibits any form of actions that can harm oneself, including neglecting safety and health at work. In relation to the results of this study, although no significant relationship was found between dust exposure and Ispa Incident, it does not mean that the risk can be ignored. Islam teaches the principles of prudence (ikhtiar) and prevention (prevention) as a form of human responsibility towards his body. Therefore, workers are still encouraged to use personal protective equipment (PPE), maintain a clean work environment, and avoid risky behaviors such as smoking. These efforts are part of the implementation of Islamic teachings in maintaining health and personal safety, so that they can minimize the risk of disease and improve the quality of life and work productivity.

2. The effect of the use of personal protective equipment (PPE) on workers in the mining area of Donggala Regency

The results of this study are in line with various studies that state that the use of PPE is not always directly related to the incidence of respiratory disorders. The Ministry of Health of the Republic of Indonesia (2021) explained that ISPA is a multifactorial disease, so it is not only influenced by one factor such as the use of PPE, but also by environmental factors, behavior, and individual conditions. In addition, the World Health Organization (WHO, 2022) emphasized that the use of PPE does not always show a significant relationship with disease incidence if it is not used consistently and according to standards, and if environmental exposure is high and even.

Theoretically, (Tarwaka, 2021) states that PPE is the last line of defense in the occupational safety system, so it cannot stand alone in preventing occupational diseases. This is reinforced by (Suma'mur, 2022) who explains that the incidence of occupational diseases, including ISPA, is more influenced by the intensity and duration of exposure, as well as the health condition of workers, so that the relationship between PPE use and disease incidence is not always seen significantly in statistical analysis.

In contrast to research research by (Putra and Lestari, 2022), it also reported a significant relationship between the use of PPE and the Ispa Incident in industrial workers, where workers who do not wear protective masks have a greater risk of exposure to dust particles that can enter the respiratory tract.

Another study by (Widya et al., 2023) shows that the use of PPE that is in accordance with standards and carried out consistently can significantly reduce the Ispa Incident ($p < 0.05$). In the study, compliant workers using PPE had a lower rate of Ispa Incidents compared to non-compliant workers. This shows that compliance with the use of PPE is an important factor in protecting the respiratory health of workers.

From an Islamic perspective, maintaining health and personal safety is part of human responsibility as a mandate from Allah SWT. Islam teaches the importance of efforts in preventing the occurrence of diseases, including in risky work environments such as mining. The use of Personal Protective Equipment (PPE) can be seen as a form of preventive effort to protect oneself from the danger of exposure to dust. Although the results of the study show that the use of PPE is not significantly related to the Ispa Incident, the effort to protect oneself from potential harm remains an obligation that cannot be ignored. Allah SWT says in the Qur'an surah QS. An-Nisa: 29

يَا أَيُّهَا الَّذِينَ آمَنُوا لَا تَأْكُلُوا أَمْوَالَكُمْ بَيْنَكُمْ بِالْبَاطِلِ إِلَّا أَنْ تَكُونَ تِجَارَةً عَنْ
تَرَاضٍ مِّنْكُمْ وَلَا تَقْتُلُوا أَنْفُسَكُمْ إِنَّ اللَّهَ كَانَ بِكُمْ رَحِيمًا ﴿٢٩﴾

“Wahai orang-orang yang beriman, janganlah kamu memakan harta sesamamu dengan cara yang batil (tidak benar), kecuali berupa perniagaan atas dasar suka sama suka di antara kamu. Janganlah kamu membunuh dirimu. Sesungguhnya Allah adalah Maha Penyayang kepadamu.” QS. An-Nisa: 29

Based on the results of studies that show that there is no significant relationship between PPE use and Ispa Incident, this does not mean that PPE use can be ignored. In Islamic teachings, any form of prevention of harm is still recommended as part of the effort and responsibility of self-care (hifz al-nafs). The unproven relationship can be statistically caused by various factors, such as inconsistency in PPE use or the influence of other factors that are more dominant. Therefore, the use of PPE must still be implemented in a disciplined and correct manner, as part of efforts to maintain occupational health and safety. Thus, the

application of Islamic values in protecting oneself from danger is not only spiritual, but also in harmony with the principles of occupational health and safety in daily life.

3. The effect of the duration of dust exposure on the incidence of Ispa Disease in the mining area of Donggala Regency

The results of this study are also supported by several other studies that show that the duration of dust exposure is not necessarily significantly related to the incidence of respiratory distress. Research by (Nuraini et al., 2022) on stone processing industry workers found that there was no significant relationship between the duration of dust exposure and Ispa Incident ($p > 0.05$). The study explained that continuous and even exposure to dust causes all workers to have a relatively equal level of risk, so the duration of exposure is not a significant differentiating factor.

Research by (Hidayat and Prasetyo, 2023) on construction sector workers also showed that the duration of exposure was not related to respiratory disorders, as other factors such as smoking habits and PPE use played a greater role in influencing workers' health conditions. This shows that behavioral factors have a greater contribution than the duration of exposure itself.

Another study by (Rahmawati et al., 2021) found that there was no significant relationship between the duration of dust exposure and Ispa Incident in traditional mine workers. The researchers concluded that the absence of a marked variation in duration between respondents and the high exposure to dust in general caused the results of the analysis to not show a meaningful relationship.

(Fauzan et al., 2024) In his study, it was also reported that the duration of dust exposure did not have a significant effect on respiratory disorders in workers, because chronic and homogeneous exposure made health effects occur evenly. This study confirms that the relationship between the duration of exposure and disease will be difficult to see if it is not accompanied by a clear difference in exposure intensity. Thus, these various studies strengthen the results of this study that the duration of dust exposure is not always related to Ispa Incident, especially in work environment conditions with relatively uniform exposure and the presence of other factors that are more dominant in influencing the respiratory health of workers.

Although the results of this study show that the duration of dust exposure has no significant effect on Ispa Incident, there are several other studies that show different results. Research by (Suryanto et al., 2021) on mine workers found that the duration of dust exposure had a significant relationship with the Ispa Incident ($p < 0.05$), where workers with a longer duration of exposure had a higher risk of experiencing respiratory distress. This is caused by the continuous accumulation of dust particles in the respiratory tract.

Research by (Pratama and Wulandari, 2022) also reported a meaningful relationship between the duration of dust exposure and Ispa Incident in industrial workers. The study explained that the longer workers are exposed to dust every day, the greater the chance of irritation and infection in the respiratory tract due to the entry of dust particles into the lungs.

Another study by (Kurniawan et al., 2023) shows that the duration of dust exposure is one of the main risk factors for respiratory disorders, where workers with an exposure period of more than 8 hours per day have a higher risk of developing ISPA compared to workers with a shorter duration of exposure. These results reinforce the concept that the length of exposure affects the severity of respiratory distress.

Another study by (Kurniawan et al., 2023) shows that the duration of dust exposure is one of the main risk factors for respiratory disorders, where workers with an exposure period of more than 8 hours per day have a higher risk of developing ISPA compared to

workers with a shorter duration of exposure. These results reinforce the concept that the length of exposure affects the severity of respiratory distress.

In Islamic teachings, maintaining health is part of the mandate given by Allah SWT to humans. Every individual is required to try to protect himself or herself from all forms of danger, including health risks in the work environment. In the context of mining workers, the duration of exposure to dust that lasts for a long time is one of the potential hazards that can interfere with respiratory health. Therefore, Islam encourages its people to always make preventive efforts and maintain a balance between work activities and self-protection. Allah SWT says in the Qur'an surah QS. Al-Baqarah: 185

شَهْرُ رَمَضَانَ الَّذِي أُنْزِلَ فِيهِ الْقُرْآنُ هُدًى لِّلنَّاسِ وَبَيِّنَاتٍ مِّنَ الْهُدَى
وَالْفُرْقَانِ فَمَن شَهِدَ مِنْكُمُ الشَّهْرَ فَلْيَصُمْهُ وَمَن كَانَ مَرِيضًا أَوْ عَلَى سَفَرٍ
فَعِدَّةٌ مِّنْ أَيَّامٍ أُخَرَ يُرِيدُ اللَّهُ بِكُمُ الْيُسْرَ وَلَا يُرِيدُ بِكُمُ الْعُسْرَ وَلِتُكْمِلُوا الْعِدَّةَ
وَلِتُكَبِّرُوا اللَّهَ عَلَى مَا هَدَاكُمْ وَلَعَلَّكُمْ تَشْكُرُونَ

“Bulan Ramadan adalah (bulan) yang di dalamnya diturunkan Al-Qur'an sebagai petunjuk bagi manusia dan penjelasan-penjelasan mengenai petunjuk itu serta pembeda (antara yang hak dan yang batil). Oleh karena itu, siapa di antara kamu hadir (di tempat tinggalnya atau bukan musafir) pada bulan itu, berpuasalah. Siapa yang sakit atau dalam perjalanan (lalu tidak berpuasa), maka (wajib menggantinya) sebanyak hari (yang ditinggalkannya) pada hari-hari yang lain. Allah menghendaki kemudahan bagimu dan tidak menghendaki kesukaran. Hendaklah kamu mencukupkan bilangannya dan mengagungkan Allah atas petunjuk-Nya yang diberikan kepadamu agar kamu bersyukur.” QS. Al-Baqarah: 185

Based on the results of the study showing that there is no significant influence between the duration of dust exposure and the Ispa Incident, this does not mean that the duration of exposure can be ignored. In the Islamic perspective, any form of potential danger must still be anticipated through efforts and preventive measures. The statistically unproven relationship can be caused by other factors such as the homogeneity of exposure or the influence of other variables that are more dominant. Therefore, workers are still encouraged to manage exposure time well, use personal protective equipment, and maintain body health conditions. These efforts are part of the implementation of Islamic values in maintaining the safety of life (hifz al-nafs) and creating a healthy and safe work environment.

4. The effect of smoking history on workers in the mining area of Donggala Regency

The results of statistical analysis using the Chi-Square test showed that smoking history had no effect on the incidence of ISPA disease (p value = 0.105; $p > 0.05$). These findings indicate that smoking history does not have a meaningful relationship with Ispa Incident in excavation C workers.

The results of this study are in line with several studies that show that smoking history is not always significantly related to the incidence of respiratory distress. Research by (Nurhayati et al., 2022) on industrial sector workers showed that there was no meaningful relationship between smoking habits and Ispa Incident ($p > 0.05$). The study explained that exposure to the work environment, especially dust, more dominantly affects respiratory health conditions than smoking behavioral factors. In addition, research by (Hidayah and Rahman, 2023) also found that smoking history was not significantly related to the incidence of respiratory distress in construction workers. The results of the study showed that other

factors such as the use of PPE and work environment conditions had a greater influence on Ispa Incident than smoking habits.

Research by (Fadli et al., 2024) also reported that smoking history did not have a significant effect on respiratory disorders in workers, due to the presence of other more dominant factors such as the length of exposure and the physical condition of workers. This shows that Ispa Incident is the result of the interaction of various factors, so it cannot be explained from just one variable. Thus, these various studies strengthen the results of this study that smoking history is not always related to Ispa Incident, especially in work environment conditions with high and relatively uniform dust exposure, as well as the presence of other factors that are more dominant in influencing workers' respiratory health. Although the results of this study show that smoking history does not have a significant effect on Ispa Incident, there are several other studies that show different results. Research by (Sari and Nugroho, 2021) found that smoking habits had a significant relationship with Ispa Incident ($p < 0.05$), where workers who had a history of heavy smoking were more at risk of respiratory distress compared to non-smokers or light smokers. This is due to the content of harmful substances in cigarettes such as nicotine and tar that can damage the respiratory tract.

Research by (Pratama et al., 2022) also reported a meaningful association between smoking history and Ispa Incident in industrial workers. The study explained that continuous exposure to cigarette smoke can reduce lung function and weaken the body's defense system against infection, thereby increasing the risk of aris.

Another study by (Kurniawan and Lestari, 2023) showed that workers with smoking habits had a higher risk of experiencing respiratory distress than workers who did not smoke ($p < 0.05$). This is because cigarette smoke can cause irritation to the respiratory tract and exacerbate the impact of dust exposure in the work environment.

(Rahman et al., 2024) in their research also found that smoking history is one of the significant risk factors for Ispa Incident. The study confirms that the combination of dust exposure and smoking can increase the risk of respiratory distress more than a single exposure.

From an Islamic perspective, maintaining health is part of the mandate that must be maintained by every individual. The human body is entrusted by Allah SWT which must be maintained from everything that can cause harm. The habit of smoking is one of the behaviors that has the potential to damage health, especially the respiratory system. In the context of occupational health, smoking behavior can exacerbate the impact of dust exposure in the mining environment, potentially increasing the risk of respiratory disorders such as ISPA. Allah SWT says in surah (QS. Al-A'raf: 56):

وَلَا تُفْسِدُوا فِي الْأَرْضِ بَعْدَ إِصْلَاحِهَا وَادْعُوهُ خَوْفًا وَطَمَعًا إِنَّ رَحْمَتَ اللَّهِ
قَرِيبٌ مِّنَ الْمُحْسِنِينَ ﴿٥٦﴾

*“Janganlah kamu berbuat kerusakan di bumi setelah diatur dengan baik.
Berdoalah kepada-Nya dengan rasa takut dan penuh harap. Sesungguhnya rahmat
Allah sangat dekat dengan orang-orang yang berbuat baik.” (QS. Al-A'raf: 56)*

Based on the results of studies showing that smoking history does not have a significant influence on Ispa Incident, this does not mean that smoking habits can be considered safe or ignored. In Islamic teachings, all forms of behavior that have the potential to cause danger must still be avoided as part of efforts to maintain health (hifz al-nafs). The statistically unproven relationship can be caused by other, more dominant factors, such as exposure to dust in the work environment. However, smoking still risks damaging health

and can worsen respiratory conditions. Therefore, workers are encouraged to avoid or reduce smoking habits, maintain a healthy lifestyle, and protect themselves from exposure to the work environment. These efforts are the implementation of Islamic values in maintaining the safety of lives and improving the quality of life.

5. The most common variable in workers in the mining area of Donggala Regency

The results of multivariate analysis using logistic regression showed that of all the variables studied, only the smoking history variable had a significant relationship with the incidence of Acute Respiratory Infection (ARI) in workers in the mining area of Donggala Regency. This is shown by a significance value of $p = 0.039$ ($p < 0.05$), so it can be concluded that smoking history is a factor that is meaningfully related to Ispa Incident after being controlled by other variables. The value of the regression coefficient (B) of -0.392 indicates the direction of the relationship between smoking history and Ispa Incident, which in this context indicates a difference in risk between categories of respondents based on smoking history.

Meanwhile, the variables of dust exposure level ($p = 0.061$), use of Personal Protective Equipment (PPE) ($p = 0.287$), and duration of dust exposure ($p = 0.091$) did not show a significant relationship with Ispa Incident because it had a p value of > 0.05 . This shows that after controlling for other variables in the model, these three factors did not have a meaningful contribution in influencing the Ispa Incident in the respondents of this study.

Research in Indonesia by the Ministry of Health of the Republic of Indonesia (Riskesdas, 2018; follow-up report 2021) also showed that the prevalence of respiratory disorders is higher in individuals with smoking habits. Smoking is cited as one of the behavioral factors that contribute to the increase in cases of ISPA in the community, especially in the productive age group.

However, there are some studies that are not in line with the results of this study. A number of studies showed that smoking history did not have a significant association with the incidence of Acute Respiratory Infections (ARI). For example, a study by (Nurhayati et al., 2022) on industrial workers found that smoking habits were not meaningfully related to the incidence of respiratory distress ($p > 0.05$). The study explained that exposure to dust in a high and continuous work environment is more dominant in influencing health conditions than smoking behavior factors.

Another study by (Hidayah and Rahman, 2023) also showed that smoking history did not have a significant association with Ispa Incident in construction workers. In the study, factors such as the use of Personal Protective Equipment (PPE) and work environment conditions played a greater role in determining the risk of respiratory disorders than smoking habits.

In addition, (Fadli et al., 2024) reported that there was no relationship between smoking history and respiratory disorders in workers, due to other factors that were more dominant such as length of exposure to dust, working period, and individual physical condition. This study confirms that ISPA is a multifactorial disease that cannot be explained by just one variable.

From an Islamic perspective, maintaining health is part of the main goal of sharia (maqashid sharia), especially in preserving the soul (hifz al-nafs). Every human being is commanded to avoid all forms of behavior that can harm themselves, either directly or indirectly. The habit of smoking, which is scientifically known to have a negative impact on respiratory health, is included in the category of acts that have the potential to cause harm. Allah SWT says in surah QS. Al-Maidah: 32

مِنْ أَجْلِ ذَلِكَ كَتَبْنَا عَلَى بَنِي إِسْرَءِيلَ أَنَّهُ مَنْ قَتَلَ نَفْسًا بِغَيْرِ نَفْسٍ أَوْ
فَسَادٍ فِي الْأَرْضِ فَكَأَنَّمَا قَتَلَ النَّاسَ جَمِيعًا وَمَنْ أَحْيَاهَا فَكَأَنَّمَا أَحْيَا النَّاسَ
جَمِيعًا وَلَقَدْ جَاءَتْهُمْ رُسُلُنَا بِالْبَيِّنَاتِ ثُمَّ إِنَّ كَثِيرًا مِنْهُمْ بَعَدَ ذَلِكَ فِي الْأَرْضِ
لَمُسْرِفُونَ

“Oleh karena itu, Kami menetapkan (suatu hukum) bagi Bani Israil bahwa siapa yang membunuh seseorang bukan karena (orang yang dibunuh itu) telah membunuh orang lain atau karena telah berbuat kerusakan di bumi, maka seakan-akan dia telah membunuh semua manusia. Sebaliknya, siapa yang memelihara kehidupan seorang manusia, dia seakan-akan telah memelihara kehidupan semua manusia. Sungguh, rasul-rasul Kami benar-benar telah datang kepada mereka dengan (membawa) keterangan-keterangan yang jelas. Kemudian, sesungguhnya banyak di antara mereka setelah itu melampaui batas di bumi.” QS. Al-Maidah: 32

This rule shows that all forms of harm, including those derived from unhealthy behaviors such as smoking and exposure to a risky work environment, must be prevented and minimized. In the context of the research results, although there are differences between studies that show a relationship and those that do not show a relationship between smoking history and Ispa Incident, Islam still emphasizes the importance of the principle of caution (ihtiyath) in maintaining health. The disparity in research results cannot be used as an excuse to ignore the potential danger, because in Islam, prevention takes precedence over treatment.

CONCLUSION

Based on the results of the research that has been conducted, it was found that there was no significant relationship between the level of dust exposure and the incidence of Acute Respiratory Infection (ARI), which was indicated by the value $\rho = 0.566 (> 0.05)$. In addition, the use of Personal Protective Equipment (PPE) also did not show a significant association with Ispa Incident with a value of $\rho = 0.712 (> 0.05)$. The variable duration of dust exposure also did not have a significant relationship with Ispa Incident with a value of $\rho = 0.980 (> 0.05)$. Likewise, smoking history, which in bivariate analysis did not show a significant association with Ispa Incident, was shown by a value of $\rho = 0.105 (> 0.05)$. However, based on the results of multivariate analysis, smoking history was the variable most associated with Ispa Incident with a value of $\rho = 0.039 (< 0.05)$. Thus, it can be concluded that smoking history is the most influential factor for Ispa Incident compared to other variables in this study.

REFERENCES

- Akbar, H., et al. (2022). *Keselamatan dan kesehatan kerja*. Media Sains Indonesia.
- Akbar, Y., Santoso, B., & Rahmawati, D. (2024). Faktor-faktor risiko kejadian infeksi saluran pernapasan akut (ISPA) pada pekerja: Studi literature review. *Jurnal Kesehatan Masyarakat Indonesia*, 19(2), 115–123.
- Aram, S. A., & Wang, H. (2023). Prevalence and associations between occupational diseases, emotional exhaustion, and dust mask anxiety among coal miners in Northern China. *Environmental Science and Pollution Research*, 30(58), 122066–122086.
- Fadli, M., Yusuf, A., & Ramadhan, R. (2024). Pengaruh faktor risiko terhadap gangguan pernapasan pada pekerja industri. *Jurnal Kesehatan Lingkungan Indonesia*, 22(2), 115–123.

- Fauzan, M., Arifin, Z., & Saputra, D. (2024). Pengaruh durasi paparan debu terhadap gangguan pernapasan pada pekerja. *Jurnal Kesehatan Lingkungan Indonesia*, 22(1), 33–41.
- Febri, V. (2020). *Analisis gangguan infeksi saluran pernafasan akut dan hubungannya dengan lokasi pertambangan di Gunung Kapur Pfluger Kabupaten Jember sebagai sumber belajar biologi* (Skripsi). Universitas Muhammadiyah Malang.
- Hidayah, N., & Rahman, A. (2023). Faktor risiko gangguan pernapasan pada pekerja konstruksi. *Jurnal Kesehatan Masyarakat*, 18(1), 75–83.
- Kurniawan, R., & Lestari, D. (2023). Hubungan kebiasaan merokok dengan gangguan pernapasan pada pekerja. *Jurnal Kesehatan Kerja*, 19(2), 98–105.
- Kurniawan, R., Santoso, T., & Wibowo, H. (2023). Hubungan durasi paparan debu dengan kejadian gangguan pernapasan pada pekerja industri. *Jurnal Kesehatan Kerja*, 19(3), 145–153.
- Nugroho, A., & Widodo, T. (2025). Hubungan paparan debu lingkungan kerja dengan ISPA incident pada pekerja konstruksi. *Jurnal Kesehatan Lingkungan*, 21(1), 45–53.
- Nuraini, S., Rahman, F., & Putri, D. (2022). Analisis durasi paparan debu terhadap ISPA incident pada pekerja industri pengolahan batu. *Jurnal Kesehatan Lingkungan*, 20(2), 85–93.
- Nurhayati, S., Pratama, A., & Dewi, L. (2022). Analisis faktor risiko ISPA incident pada pekerja sektor industri. *Jurnal Kesehatan Lingkungan*, 20(1), 45–52.
- Perawat, L., & Kelamin, J. (2024). Faktor kepatuhan minum obat pasien dengan Tuberculosis. 5(1).
- Pratama, D., & Wulandari, S. (2022). Pengaruh lama paparan debu terhadap kejadian infeksi saluran pernapasan akut (ISPA) pada pekerja industri. *Jurnal Ilmu Kesehatan Masyarakat*, 17(3), 201–209.
- Putra, A., & Lestari, R. (2022). Pengaruh paparan debu terhadap kejadian infeksi saluran pernapasan akut (ISPA) pada pekerja industri. *Jurnal Kesehatan Lingkungan Indonesia*, 20(3), 210–218.
- Putri, M., & Rahman, F. (2022). Analisis paparan debu dan ISPA incident pada pekerja industri berbasis debu. *Jurnal Ilmu Kesehatan Masyarakat*, 18(2), 134–142.
- Rahman, F., Hidayat, T., & Arifin, Z. (2024). Faktor risiko ISPA incident pada pekerja dengan paparan debu. *Jurnal Kesehatan Lingkungan Indonesia*, 22(1), 25–32.
- Rahman, H. R., Ashara, N., Faradilah, A. K., Sahara, S., & Ladesia, V. K. (2023). Analisis risiko keselamatan kerja terhadap aktivitas forklift di PT Pertamina Lubricants unit production Jakarta. *Jurnal TESLINK: Teknik Sipil dan Lingkungan*, 5(2), 8–15.
- Rahmawati, N., Hidayat, T., & Kurniawan, E. (2021). Hubungan paparan debu dengan ISPA incident pada pekerja tambang tradisional. *Jurnal Kesehatan Lingkungan*, 19(2), 98–105.
- Risma Sri, D., Wahyuni, S., & Pratama, A. (2023). Faktor-faktor yang berhubungan dengan gangguan pernapasan pada pekerja industri. *Jurnal Kesehatan Kerja*, 17(1), 56–64.
- Sahara, S., & Putri, J. S. (2023). Analisis keselamatan kerja dan faktor-faktor risiko dalam kegiatan bongkar muat di terminal pelabuhan. *Advances in Social Humanities Research*, 1(10), 2021–2028.
- Sari, N., Hidayat, T., & Kurniawan, E. (2021). Paparan debu dan ISPA incident pada pekerja tambang tradisional. *Jurnal Kesehatan Lingkungan*, 19(2), 98–105.
- Sudirman, Muzayana, Saleh, S. N. H., & Akbar, H. (2020). Hubungan ventilasi rumah dan jenis bahan bakar memasak dengan ISPA incident pada balita di wilayah kerja puskesmas Juntinyuat. *MPPKI*, 3(3), 187–191.
- Suma'mur, P. K.. (2022). *Higiene perusahaan dan kesehatan kerja (Hiperkes)*. Sagung Seto.
- Suryani, D., Fitriani, L., & Arifin, M. (2021). Hubungan paparan debu dengan kejadian infeksi saluran pernapasan akut (ISPA) pada pekerja tambang. *Jurnal Kesehatan Masyarakat*,

- 16(3), 201–209.
- Suryanto, B., Fitriani, L., & Arif, M. (2021). Hubungan durasi paparan debu dengan kejadian infeksi saluran pernapasan akut (ISPA) pada pekerja tambang. *Jurnal Kesehatan Masyarakat*, 16(3), 210–218.
- Tarwaka. (2021). *Keselamatan dan kesehatan kerja: Manajemen dan implementasi K3 di tempat kerja*. Harapan Press.
- Tasidjawa, G. E. (2022). Overview risiko dampak debu akibat aktivitas penambangan di Indonesia. *RETII*, 312–317.
- World Health Organization. (2012). *Data and statistics*. WHO.
- World Health Organization. (2022). *Occupational health: Preventing disease through healthy environments*. WHO.
- Widya, P., Nugraha, R., & Saputra, H. (2023). Pengaruh penggunaan alat pelindung diri terhadap ISPA incident pada pekerja dengan paparan debu. *Jurnal Kesehatan Lingkungan*, 20(4), 250–258.