

The Causes Analysis of Pulmonary Function Disorders at Semen X Company

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The Causes Analysis of Pulmonary Function Disorders at *Semen X Company*

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Abstract. The cement industry sector was the largest manufacturing industry which was important for sustainable development and it was very risky for workers to be exposed to dust in various processes including production. Continuous exposure to dust can cause pulmonary function disorders. This study aimed to analyze the relationship between dust exposure, age, length of work, working period, use of PPE (masks), smoking habits and pulmonary function disorders in labor. This research used an observational method with a cross sectional approach. The research sample was a total population of 38 male workers. Data collection was carried out by interviewing respondents and measuring the level of inhaled dust with a personal dust sampler and checking the lung capacity with a spirometer. Data analysis was performed bivariate with the chi-square test. The results showed that there was no relationship between inhaled dust levels as a result of work activities ($p = 0.205$), there was no relationship between age ($p = 1,000$), there was no relationship between length of work ($p = 0.450$), there was no relationship between work years ($p = 1,000$), there was a relationship between the use of PPE (mask) ($p = 0.006$), there was no relationship between smoking habits ($p = 0.613$) with pulmonary function disorders.

Keyword. Dust levels, pulmonary dysfunction, cement

INTRODUCTION

The industrial sector which is growing rapidly changes the pattern of disease in society, including for workers. Many workers spend their time every day at work and have the risk of health problems and occupational diseases that come from work exposures and activities (Sunaryo, 2020). Occupational diseases are diseases caused by the influence of activities in the work environment caused by physical, biological, psychosocial and biological risk factors (Salawati, 2015). Respiratory disease caused by work activities is a global disease that is a health problem that contributes to as much as 30% of occupational diseases. In addition, 10-20% of the causes of death are caused by respiratory problems (Gizaw et al., 2016). According to (Habybabad et al., 2018) when carrying out work activities, workers are vulnerable to being exposed to hazards or risks. One of the hazards or risks that can affect the health of workers is dust. When dust enters the human body through the respiratory tract it will cause harmful effects, especially it can cause health problems (Oktaviani & Prasasti, 2015). Dust is a small solid particle which has a diameter of about 1 to 100 μm suspended in the air resulting from drilling, sifting, crushing, grinding and blasting activities (WHO, 2014). There are various types of dust, namely cotton dust, asbestos, wood, cement, coal and others. Dust has the property of being able to settle because it is influenced by the force of gravity, forming lumps because the surface is always wet due to being coated with water and is able to catch the opposite particles (Tureková et al., 2019). Long-term dust exposure causes respiratory health problems (Fallahian, 2015). According to (WHO, 2017) the number three cause of death related to work is respiratory disease, which is 21%. The health risks caused by inhaled dust particles are influenced by the time

of exposure and the biological response caused by the dust particles (Yang et al., 2020). The cement industry sector is the largest manufacturing industry required for sustainable development. In addition, the cement industry sector also causes environmental pollution at all stages of the process including production. The environmental pollution generated from the cement industry sector is air pollution in the form of gases, noise, vibrations and dust. The cement industry is related to dust exposure which contributes to silicosis, bronchitis, and pulmonary function disorders (Sana et al., 2013). Lung function disorders are occupational respiratory disorders that often occur in workers exposed to dust in the industrial sector including the cement industry (Zelege et al., 2010). In addition to disturbances in the respiratory system, dust pollution can cause cardiovascular disorders (Manisalidis et al., 2020). This study aims to analyse the relationship between dust exposure, age, length of work, length of service, use of PPE (masks), smoking habits and pulmonary function disorders in labor.

METHOD

The research design used was cross sectional, measuring exposure to cement dust, age, length of work, working period, use of PPE, smoking habits and associated pulmonary function disorders. Where these variables are examined at the same time to determine the relationship between these variables. The sample of this study was 38 male workers. Data collection in this study was carried out by interviewing about age, length of work, working period, use of PPE, smoking habits and data on workers' lung function measured using a spirometer. Measurement of the inhaled dust level using a personal dust sampler. Then the data from observations, measurements and research interviews were analysed bivariate with statistical tests using the chi-square test at the 95% confidence level, so that the relationship between the research variables was known. The test was carried out at the level of significance ($\alpha = 0.005$), if $p \leq 0.005$, the test results were significant. This research was conducted in accordance with the Helsinki declaration guidelines and approved by the *Poltekkes* of the Ministry of Health in Pontianak. The research design was explained to the workers who participated in the research. Written consent was obtained from all workers who participated in the study.

RESULT AND DISCUSSION

The Semen X company is engaged in the cement industry. The types of activities carried out are receiving, holding, as well as the process of packing or packing cement powder into bags to be distributed to the distributor. It was founded in 2017 and started to carry out production activities in 2018. Its type and production capacity of is divided into 2 products, namely cement in bags and bulk cement. The number of workers is 38 men, with the age range 20-40 years. The normal working hour schedule starts from 8 am- 4 pm, working time is 8 hours / day and 40 hours / week.

TABLE 1. The Variable Frequency Distribution for workers of Semen X Company in Mempawah, 2020

Variable	Category	N	(%)
Dust inhaled	>1,0 mg/m ³	10	26,3
	≤ 1,0 mg/m ³	28	73,7
Age	20-40 years	33	86,8
	> 40 years	5	13,2
Length of Working	> 8 hour/day	22	57,9
	≤ 8 hour/day	16	42,1
Working Period	2-3 years	35	92,1
	≤1 year	3	7,9
Use of PPE	Do not use PPE	14	36,8
	Use PPE	24	63,2
Smoking Habit	Smoking	32	84,2
	Do not smoking	6	15,8
Pulmonary Function Disorders	Distraction	9	23,7
	Normal	29	76,3

Source : Primary Data, 2020

Table 1 shows that inhaled dust levels > 1.0 mg / m³ were experienced by 26.3% of workers. Workers aged > 40 years are (13.2%). Length of working hours, 57.9% is > 8 hours / day. Most of the workers (92.1%) have worked 2-3 years. 36.8% of workers do not use PPE. Workers who have a smoking habit are 84.2%. Workers who experience lung function disorders are 23.7%.

TABLE 2. The Analysis of Inhaled Dust Levels (Respirable) with Pulmonary Function Disorders in Workers at *Semen X* Company in Mempawah, 2020

No	Dust Inhaled	Pulmonary Function Disorders				Total		p value ^a	OR
		Distraction		Normal		N	%		
		n	%	n	%				
1	>1,0 mg/m ³	4	40,0	6	60,0	10	26,3	0,205*	3,067
2	≤ 1,0 mg/m ³	5	17,9	23	82,1	28	73,7		
Total		9	23,7	29	76,3	38	100		

Source : Primary Data, 2020

^a Chi Square, α = 0.005; *Significance p ≤ 0.005

Based on the results of statistical tests between the variable levels of inhaled dust and pulmonary function disorders, obtained p value = 0.205, it can be concluded that there is no significant relationship between inhaled dust levels and pulmonary function disorders among workers. However, workers with inhaled dust levels > 1.0 mg / m³ has a tendency to have a greater risk of experiencing lung function disorders 3.067 times greater than workers with dust levels < 1.0 mg / m³. The level of inhaled dust is one of the causes of pulmonary dysfunction, as cement dust is inhaled and enters through the nose, throat and enters the lungs. Dust build-up in the lungs can occur when dust is inhaled with a size of 1-3 μ (respirable dust). If the respiratory dust accumulates in the lungs that exceeds the threshold value, it can cause pneumoconiosis (Nafisa et al., 2016). In order to minimize lung dysfunction due to inhaled cement dust, workers must undergo periodic medical examinations and regular work rotation changes (Shanshal & Al-Qazaz, 2020).

TABLE 3. The Analysis of Age and Pulmonary function disorders in the Workers of the *Semen X* Company in Mempawah, 2020

No	Age	Pulmonary Function Disorders				Total		p value ^a	OR
		Distraction		Normal		N	%		
		n	%	n	%				
1	>40 years	1	20	4	80	5	13,2	1,000*	0,781
2	20-30 years	8	24,4	25	75,8	33	86,8		
Total		9	23,7	29	76,3	38	100,0		

Source : Primary Data, 2020

^a Chi Square, α = 0.005; *Significance p ≤ 0.005

Based on the results of statistical tests between the variable age and lung function disorders, the results obtained p value = 1.000, it can be concluded that there is no significant relationship between age and lung function disorders. This is in line with research (Qian et al., 2016) that There is no relationship between age and pulmonary function disorders in workers, because age is not a crucial factor that can cause pulmonary function disorders in workers, but age can also be a risk factor for decreased lung function leading to pulmonary function disorders in workers (Meo et al., 2013). Disorders of the lung function of workers are influenced by age factors because the older a person is, the more susceptible to health risks (Hasan & Maranatha, 2019). The age factor is a factor that can also affect the condition of a person's lungs. The older a person is, the performance and function of body organs decreases which causes changes in bone tissue, muscles, nervous system and organs including the lungs, causing a decrease in the immune system and susceptibility to disease (Pinugroho & Kusumawati, 2017). Decreased lung function which can then cause lung function disorders caused by damage to the elastic tissue of the lung due to age (Kumari Prasad et al., 2019).

TABLE 4. The Analysis of Worker's Working Length with Pulmonary Function Disorders at *Semen X* Company in Mempawah, 2020

No	Working Length/Day	Pulmonary Function Disorders				Total		p value ^a	OR
		Distraction		Normal		N	%		
		n	%	n	%				
1	> 8 hours/day	4	18,2	18	81,8	22	57,9	0,450*	0,489
2	≤ 8 hours/day	5	31,3	11	68,8	16	42,1		
Total		9	23,7	29	76,3	38	100,0		

Source : Primary Data, 2020

^a Chi Square, $\alpha = 0.005$; *Significance $p \leq 0.005$

Based on the results of statistical tests between the variable length of work and pulmonary function disorders, the results obtained p value = 0,45 it can be concluded that there is no significant relationship between length of work and lung function disorders. This is in accordance with the results of the study (Irfayanti et al., 2012) that there is no significant relationship between length of work and pulmonary function disorders in workers, because the length of work does not guarantee that exposure to inhaled dust which causes lung function disorders is also getting bigger because the number of exposures for each person is different.

TABLE 5. The Analysis of Working Period with Pulmonary Function Disorders at *Semen X* Company in Mempawah, 2020

No	Working Period	Pulmonary Function Disorders				total		p value ^a	OR
		Distraction		Normal		N	%		
		n	%	n	%				
1	2-3 years	9	25,7	26	74,3	35	92,1	1,000*	0
2	≤1 year	0	0	3	100	3	7,9		
Total		9	23,7	29	76,3	38	100,0		

Source : Primary Data, 2020

^a Chi Square, $\alpha = 0.005$; *Significance $p \leq 0.005$

The working period is related to the length of time the worker starts doing work activities at the place which is calculated in the annual period (Irfayanti et al., 2018). Based on the results of statistical tests using the chi-square test at the 95% confidence level, the results obtained p value = 1,000 which can be concluded that there is no significant relationship between tenure and lung function. This case in line with the previous research (Yuvaraj et al., 2016) that tenure or working period is not related to pulmonary function disorders in workers. This is because all respondents have a working period of < 10 years as shown in table 1. Occupational diseases such as pulmonary function disorders appear with an average working period of > 10 years. Based on research in China, a group of workers who have a service period of > 10 years experience lung function disorders with a p-value < 0.05 (Bian et al., 2015). The working period is related to a decrease in lung function capacity because the longer the working period of a worker who works in a place that is at risk of being exposed to dust will have an impact on health problems, especially related to respiratory disorders (Thomas et al., 2018).

TABLE 6. The Analysis of PPE (mask) used with Pulmonary Function Disorders at *Semen X* in Mempawah, 2020

No	The Use of PPE	Pulmonary Function Disorders				Total		p value ^a	OR
		Distraction		Normal		N	%		
		n	%	n	%				
1	Do not use	7	50	7	50	14	36,8	0,006*	11
2	Use	2	8,4	22	91,6	24	63,2		
Total		9	23,7	29	76,3	38	100,0		

Source : Primary Data, 2020

^a Chi Square, $\alpha = 0.005$; *Significance $p \leq 0.005$

Based on the results of statistical tests using the chi-square test at a 95% confidence level, the results obtained p value = 0.006 which can be concluded that there is a significant relationship between the use of PPE (masks) and lung function disorders. The workers who do not use PPE has a tendency to have a risk of experiencing lung function disorders is greater than 11 times greater than workers who use PPE. Personal protective equipment is needed to minimize exposure or hazards that result in injury or health problems in the workplace that cannot be controlled administratively or technically, PPE serves to protect the respiratory tract from exposure to steam, gas or dust in the workplace, using PPE can affect the occurrence of malfunctioning lungs in workers, so that dust exposure needs to be minimized by using PPE (Muhith, 2018). Based on the results of observations and interviews conducted by

researchers, 36.8% of workers did not use PPE because the PPE used did not make it comfortable when used so that it prevented workers from doing work. PPE is equipment used to protect the body from exposure to hazards in the workplace. Disciplined use of PPE when carrying out work activities can protect certain body parts from exposure to hazards. One of the PPE that functions to protect the respiratory tract from the risks of dust exposure is a mask, a mask has a role as a deterrent to dust exposure. The masks used must also be appropriate and meet standards to prevent dust of any size from entering the worker's body (Fatimah et al., 2018). The use of masks can prevent and reduce the entry of dust, although they do not protect completely, but can minimize the risk of pulmonary function disorders.

TABLE 7. The Analysis of Smoking Habit with Pulmonary Function Disorders at Semen X Company in Mempawah, 2020

No	Smoking Habit	Pulmonary Function Disorders				Total		p value ^a	OR
		Distraction		Normal		N	%		
		n	%	n	%				
1	Smoking	7	21,9	25	78,1	32	84,2	0,613*	0,560
2	Do not Smoking	2	33,3	4	66,7	6	15,8		
Total		9	23,7	29	76,3	38	100,0		

Source : Primary Data, 2020

^a Chi Square, $\alpha = 0.005$; *Significance $p \leq 0.005$

Based on the results of statistical tests using the chi-square test at the 95% confidence level, the results obtained p value = 0.613 which can be concluded that there is no significant relationship between smoking habits and lung function disorders. This is in line with research (Kumari Prasad et al., 2019) there is no significant relationship between smoking habits and pulmonary function disorders, this is due to several factors, namely the length of smoking, the number of cigarettes smoked per day and others. Analysis of the relationship between variables obtained OR = 0.560, which means that workers who have a smoking habit experience a tendency of pulmonary function disorders 0.560 times greater than workers who do not smoke. Cigarette smoke is a mixture consisting of complex chemicals. Given the chemical complexity contained in cigarettes, cigarette smoke has many effects on human health and contributes to adverse health problems such as chronic bronchitis and other respiratory symptoms (Ghanem & Hage, 2018). Smoking can cause death and health problems, including being a risk factor for lung function disorders, causing respiratory disease and cardiovascular disease (Tantisuwat & Thaveeratitham, 2014). A person who has a smoking habit can accumulate sediment in the lungs, causing narrowing of the air in and out passages (Balkhyour et al., 2019).

CONCLUSION

There is a relationship between the use of PPE (masks) and lung function disorders in cement company workers with p value = 0.006; OR = 11. From the results of the bivariate analysis it is also known that there is no relationship between inhaled dust levels (p value = 0.0205; OR = 3,067), length of work (p value = 0.450; OR = 0.489), age (p value = 1,000; OR = 0.781), smoking habits (p value = 0.613; OR = 0.560), and working period (p value = 1,000) with pulmonary function disorders in cement company workers. Based on the research results, Semen X company should be able to monitor dust levels by checking the dust levels in the area of the production unit regularly, increasing the personal awareness of workers in using PPE through organizing socialization activities with the help of related third parties regarding the importance of using PPE, conducting health checks regularly routine as an effort to prevent disruption of work functions among workers who work in the production section and improve administrative control by providing PPE in the form of masks and gloves that meet standards, conducting regular supervision to increase workers' compliance in using PPE, regulating working hours, cleaning ventilation and dust collectors when workers do work and enforcing regulations regarding occupational safety and health in the company as an effort to prevent occupational accidents and occupational diseases.

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