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Analysis of Risk Factors of Exposure of Cement Dust to Pulmonary Disorders of Workers in Cement X Factories

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ABSTRACT
Background: Basically, there are various kinds of hazards in the workplace that can threaten the health of workers and people around the company. Working environments that are often filled with dust, steam, gas and so on can disrupt productivity and harm health. This is what often causes respiratory disorders or can interfere with lung vital capacity values.
Method: This study uses cross sectional study design. The analysis used in this study is a chi square test.
Results: The majority of cement factory workers in the production section I are ≥ 40 years of age (94.1%), abnormal nutritional status (66.7%), have no history of lung disease (68.6%), smoking workers (58.8%), have a physical habit (66.7%) have a work life ≥ 5 years (92.2%), exposure to dust < 3 mg/m3 (80.4%). There is a relationship between smoking habits, exercise habits and working time with the lung functioning capacity of cement factory workers X. There is no relationship between age, nutritional status, history of lung disease, in cement plant workers company X 2019.
Conclusion: Exposure to cement dust can potentially cause changes in lung function. This is more risky than other risk factors because cement can reach directly into the respiratory tract and trigger a response in the body.

Keywords:*Risk Factors; Exposure of Cement Dust; Pulmonary Disorder*

Introduction

Growth of development such as industry, transportation, etc. in addition to having a positive impact but on the other hand will have a negative impact, one of which is air pollution and noise occurring both indoors (indoor) and outdoors (outdoor) that can endanger human health and the occurrence of disease transmission. It is estimated that air pollution and noise from industrial activities and motor vehicles will double in 2000 from 1990 and 10 times (Depkes, 2020). Exposure to dust in the workplace can lead to various occupational lung diseases leading to pulmonary dysfunction and impairment, although the incidence appears to be smaller compared to the major diseases that cause other disabilities, there is evidence that the disease affects quite a large number of people, especially in industrialized countries(Zulfachmi, 2001).

Under certain conditions, dust is a hazard that can lead to reduced working comfort, visual impairment, pulmonary dysfunction that starts from small respiratory disease can even cause general poisoning. Respiratory diseases are widely found and are closely related to the length of exposure to certain dust because the respiratory tract is basically one of the most suscecompanyible to exposure by inhalable substances present in the environment (Bekti, 2012). Basically, there are a variety of hazards in the workplace that can threaten the health of workers and people who are around the company environment. Working environments that are often filled with dust, steam, gas and so on can disrucompany productivity and harm health. This is what often causes respiratory disorders or can interfere with lung vital capacity values. This negative impact arises from the interaction between industrial emissions or pollutants with the environment, i.e. air, water and soil, in addition to the direct physical effects of such industries (such as noise, vibration and smoke fog), then human individuals exploit the natural resources of both air, waters and soils, so that indirectly humans also consume the air emissions from these industries(Miftahur, 2012).

According to data from the World Health Organization in 2007, between 30% and 50% of all occupational diseases are silicosis and other pneumoconiosis diseases. In addition, the ILO (International Labour Organization) detects that around 40,000 new cases of pneumoconiosis caused by exposure to workplace dust occur around the world every year. Most work-related lung diseases have serious consequences. More than 3%

of deaths from chronic lung disease in New York are job-related (WHO, 2007). In addition, cases of pneumoconiosis are ranked first in Occupational Diseases (OD) in Japan and China(ILO, 2005).

A study conducted by Edy Sucicompanyo (2007) on the lung function capacity of lime burning workers in Karangdawa Village district of Tegal showed that 46.3% of workers experienced a reduction in lung function. While Yulaekah (2007) who conducted a study on workers in the limestone industry in Mrisi village of Grobogan district showed that more than 50% of workers suffered from pulmonary dysfunction with the category of mild, moderate and severe obstruction. Utomo (2009) conducted a study of the pulmonary capacity measurement of 283 employees in a limestone mine worker at Dharmakradenan district of Banyumas, known 24.0% normal lung capacity, 28.6% restriction, 16.2% obstruction and 31.1% combination of restriction and obstruction. And it is known that there has been an increase in the prevalence of reduced capacity of pulmonary workers in limestone mines from 24.0% in 1997 to 75% in 2004. The results also show that factors associated with reduced lung capacity are body time index, dust levels, smoking habits, and mask usage habits.

Rachmawati (2013) conducted an analysis of the impact of air emissions in calcium processing centers against disrucompanyion of lung function of workers and the community in the village of Karas district of Rembang, the results of the research showed that the air quality in the processing of calcium in Karas village based on PP No. 41 of 1999 is above the quality standards for CO and dust gas parameters, while for NO2 and SO2 gases are still indicated below the quality criteria.

Method

Research methods

The type of research used in this study is quantitative using analytical observational methods. This study uses cross sectional study design because in this study independent and dependent variables are observed in the same time (period).

Location and Time of Research

The research will be carried out in companies that are at risk of dust exposure due to the work process, and will be conducted as soon as authorization is obtained.

Population

The population in this study was the whole of the workers who worked in Company X, in two different parts, namely workers in the high-risk part of exposure to dust as a result of the work process and employees in the non-risky part of dust exposure as a comparison.

Sample

Sampling is done by simple random sampling, where all populations that come and meet the selection criteria are included in a randomly taken study (Notoatmodjo, 2010), with the following inclusion criteria: 1) Willingness to follow the study with the signing of informed consent prepared by the researcher; 2) When performing the lung function examination, the worker concerned is not performing his job and has rested previously; 3) Do not have a history of work that is expected to cause respiratory disease, such as: scavenging, mining, management of asbestos, or dust, gas, and other steam environments; 4) Before work has suffered from chronic lung disease.

Data Collection

Data collection and instruments used:

1. Interviews with the quotioner to identify the characteristics of sports habits, smoking, mask use, employee age, working time, gender.
2. Spirometry to measure pulmonary functional disorders
3. High Volume Air Sample for measurement of dust levels
4. Thermometer for measuring the temperature of the working environment
5. Higrometer for the measuring of the humidity of the work environment
6. Flow rate meter for measures of the flow rate of air.
7. Weight count for weight measurements and meter for height measures

Analysis

The analysis used in this study is a chi square test.

Results

Table 1. Frequency distribution of age of X cement factory workers in 2019

Age	Frequency	Percentage (%)
< 40	3	5,9
>40	48	94,1
Total	51	100,0

Source: Primary Data 2018

According to table 1, there are more company X cement factory workers aged >40 years (94.1%) compared to employees aged <40 years (5.9%).

Table 2.Distribution of frequency status Nutrition of cement factory workers Company X

Nutritional status (BMI)	Frequency	Percentage (%)
Normal	17	33,3
Not Normal	34	66,7
Total	51	100,0

Source: Primary Data 2018

According to table 2 it is possible to identify Semen company X workers who have abnormal nutritional status as much as (66.7%) and that number is greater than workers whose status is normal (33.3%).

Table 3. Frequency distribution of lung disease history cement factory companyX

A history of lung disease	Frequency	Percentage (%)
No	35	68,6
Yes	16	31,4
Total	51	100,0

Source: Primary Data, 2019

Based on table 3, it can be seen that the majority of employees of the production department of company X have no history of lung disease.

Table 4. Distribution of Frequency of Smoking Habits of Workers of the Production Department of company X in 2019

Smoking habits	Frequency	Percentage (%)
Not a smoker.	21	41,2
Smokers	30	58,8
Total	51	100,0

Source: Primary Data, 2019

Seeing from table 4, 58.8% of the employees of the production department of company X are known to be smokers. This number is greater than the number of non-smokers, which is 41.2%.

Table 5. Distribution of Frequency of Sports Habits of Workers of the Production Department of compatny X in 2019

Exercise habits	Frequency	Percentage (%)
Always	34	66,7
Never	17	33,3
Total	51	100,0

Source: Primary Data, 2019

From table 5 we can see that the majority of cement workers have had the awareness to get used to doing the sports seen from the results showing that 66.7% of workers are used to the sports ranging from jogging, badminton and table tennis, where the factory also provides the facilities of the sports field.

Table 6. Distribution Frequency of working time of cement factory workers in 2019

Working hours	Frequency	Percentage (%)
<5 yrs	4	7,8
> 5 yrs	47	92,2
Total	51	100,0

Source: Primary Data, 2019

Based on table 6, it can be seen that employees of the production department of company X who have a working time <5 years are only 7.8%. This is due to the rare recruitment of new worker.

Table 7. Dust exposure of company X cement factory workers in 2019

Dust display (mg/m3)	**Frequency**	**Percentage (%)**
<3	41	80,4
>3	10	19,6
Total	51	100,0

Source: Primary Data, 2019

Based on table 7, it can be found that employees of the production department of company X who received exposure <3 mg/m3 (80.4%) greater than those who received dust exposure ≥3 mg /m3 (19.6%).

Table 8. Frequency distribution of pulmonary working capacity of company X cement factory workers in 2019

Dust display (mg/m3)	**Frequency**	**Percentage (%)**
Normal	25	49,0
Tidak normal	26	51,0
Total	51	100,0

Source: Primary Data, 2019

According to table 8, the number of cement factory workers with abnormal pulmonary capacity (51%) is higher than that of those with normal lung capacity (49%).

Table 9. Cross tabulation of age and lung function capacity of company X cement workers in 2019

Age	Lung function capacity					
	Normal		Not Normal		Normal	
	F	%	F	%	F	%
<40	1	33,3	2	66,7	3	100,0
>40	24	50,0	24	50,0	48	100,0
Total	25	49,0	26	51,0	51	100,0

Source: Primary Data 2019

Based on table 9, it can be found that workers of the production department with conditions of abnormal pulmonary vital capacity were found at age <40 years of age by 66.7%

compared to age >40 years is of 50,0% The test results of the chi square at obtained a significant p value of 0,575, then the processed conclusion there is no relationship between age and lung capacity of employees of the cement factory X Company.

Table 10. Cross tabulation between nutritional status and pulmonary functional capacity of companyX cement workers in 2019

Nutritional Status	Lung function capacity					
	Normal		Not normal		Normal	
	F	%	F	%	F	%
Normal	9	52,9	8	47,1	17	100,0
Not normal	16	47,1	18	52,9	34	100,0
Total	25	49,0	26	51,0	51	100,0

Source: Primary Data, 2019

From table 10 it can be found that workers of the production department with conditions of abnormal pulmonary vital capacity were more often found in workers whose condition of illness was unnormal i.e. of 52.9% compared to employees whose status of illessness was normal year is of 47.1%. The results of the chi square test have been obtained p Value of a significant value of 0.692, so the result was no relationship between nutritional status and pulmonar functional capacity in cement workers company. X.

Table 11. Cross tabulation between history of lung disease and lung functioning capacity in cement factory workers X company in 2018

A history of lung disease	Lung function capacity					
	Normal		Not normal		Normal	
	F	%	F	%	F	%
No	18	51,4	17	48,6	35	100,0
Yes	7	43,8	9	56,3	16	100,0
Total	25	49,0	26	51,0	51	100,0

Source: Primary Data 2018

Based on table 11, it is known that workers of the production department with conditions of abnormal pulmonary vital capacity were more likely to be found in those with a history of lung disease, which is 56.3% compared to those with no history of pneumonia, that is 48,6.

Table 12. Cross tabulation between smoking habits and pulmonary functioning capacity of cement factory workers in X company in 2019

Smoking habits	Lung function capacity					
	Normal	Not normal	Normal			
	F	%	F	%	F	%
Not smoker	14	66,7	7	33,3	21	100,0
Smoker	11	36,7	19	63,3	30	100,0
Total	25	49,0	26	51,0	51	100,0

Source: Primary Data 2018

From table 12 it can be seen that workers of the production department with conditions of abnormal pulmonary vital capacity more often found in smokers is 63.3 % compared to non-smokers 33.3 % chisquare test has obtained a significant value p value of 0,035, then the result has a connection between smoking habits and lung function capsulitis and will make it worse and worse with the presence of exposure of cement dust in cement factory workers company X.

Table 13. Cross tabulation between sports habits and pulmonary dysfunction in cement factory workers of X company in 2019

Exercise habits	Lung function capacity					
	Normal		Not normal		Normal	
	F	%	F	%	F	%
Exercise	20	58,8	14	41,2	21	100,0
Not Exercise	5	29,4	12	70,6	30	100,0
Total	25	49,0	26	51,0	51	100,0

Source: Primary Data, 2019

The results of the chisquare test resulted in a significant p value of 0.048, and the result was that there was a relationship between sports habits and pulmonary function. This reduced

the time-consuming workload, so that the majority of workers did not exercise regularly. Otherwise, the working hours with the shif method made no time in the exercise habits. The majority who can do the exercise are those who have positions in a factory unit with a workload that does not take too much time.

Table 14. Cross tabulation of working hours and working capacity in cement factory workers of X company in 2019

Smoking habits	Lung function capacity					
	Normal		Not normal		Normal	
	F	%	F	%	F	%
<5 yrs	5	3,0	6	12,0	10	100,0
>5 yrs	20	50,3	20	44,8	41	100,0
Total	25	49,0	26	51,0	51	100,0

Source: Primary Data 2018

Based on the above tabulation can be known abnormal lung function capacity more found in workers whose working time is <5 years 3.0% compared to workers who have a long working time >5 years 44,8% results of the chisquare test obtained a significant result is 0.052 then can obtain results there is a relationship between long work with lung function.

Table 15. Cross tabulation between exposure to dust and pulmonary capsulity in cement factory workers of X company in 2019

Dust exposure (mg/m3)	Lung function capacity					
	Normal		Not normal		Normal	
	F	%	F	%	F	%
<3	20	44,9	23	56,1	41	100,0
>3	5	68,1	3	30,0	10	100,0
Total	25	49,0	26	51,0	51	100,0

Source: Primary Data, 2019

Based on the above cross tabulation it can be known that workers at the cement factory company x many were found in workers who were exposed to direct dust i.e. in the workers of the product part and packing who got dust exposure directly of 56,1% and who were not exposed dust directly of 30,1% and the results of the square test obtained p value of significant value of 0,145 then there is a relationship between dust exposition and pulmonary work capacity of the ciment factory workers company x in 2019 and the most exposed are the production part and on the packing part.

Discussion

This study showed that the relationship between age and lung function capacity did not affect the reduction in lung function. According to the research by Arrsayidi in the title factor related to the vital capacity of the lungs in workers in the library industry that stated that there is no relationship between age and pulmonary life capacity (p = 0,948) Physiologically with the increase of age then the ability of the organs of the body will undergo a natural decrease not except disruption of lung function in this case lung capacity. Conditions like this are dusty environments and other factors such as smoking habits, lack of access to masks as well as undisciplined use, long exposure and a history of respiratory-related diseases(Aji, 2012).

Age factors influence pulmonary impairment of other tissues in the body. According to Nugraheni (2004), age tends to affect the body's resistance to disease. As a person ages, his body's endurance decreases, so ageing is a process of gradually losing the ability of the tissue to repair itself, or to replace and maintain the structure of its normal function.Further, the relationship between nutritional status and pulmonary functional capacity suggests that nutritional capacity does not have much influence on lung functional capability.

Basically the problem of deficiency and overnutrition in adulthood (18 years and over) is an important problem because in addition to having a risk of certain diseases can also affect the productivity of work because health and workforce are very closely related to the level of nutrition of a person. According to a 2010 Prasetyo study in Factors Relating to Vital Capacity of Lungs in Workers of the Welding Workshop in Ciputat Banana, there is no relationship between nutritional status and lung vital capacity.

The results of the study revealed that there was no link between the history of lung disease and pulmonary capsulitis in cement factory workers of company X. In line with the Anugrah (2013) study in the title Factors Relating to the Vital Capacity of Lungs in White Stone Milling Workers Division of the Company. The research shows that there is no link between a history of lung disease and lung vital capacity.

In this study, the results were obtained that there was a link between smoking habits and pulmonary capsulitis. It suggests that smoking habits have a major influence on reduced lung function. Cigarette smoke can irritate the lungs and can enter the bloodstream, smoking can lower the capacity of lung failure. According to Princess's research, there is a link between smoking habits and lung vital capacity.

Then there's the relationship between sports habits and pulmonary capillaries in cement factory workers. X suggests that exercise is a good way to boost the vitality of lung function, exercise can stimulate deep breathing so that the lungs will expand, more oxygen will enter and will be circulated throughout the bloodstream. The results of this study are in line with a study from Khumaidah (2009) showing that there is a link between exercise habits and pulmonary dysfunction. This is inconsistent with the theory of pulmonary function and exercise have interrelated relationships, lung function disorders can affect the ability to exercise. On the contrary, regular physical exercise or exercise can improve lung function. A person who is active in exercise will have greater aerobic capacity and higher fitness as well as increased lung capacity (Adriska, Yunus & Setiawa, 1997).

From the results of this study, it can be seen that working time has a relationship with pulmonary activity. The longer a person works, the longer one is exposed to the work environment, and one of the potential variables that can cause lung dysfunction is the length of the person's exposure to the dust he receives, so the likelihood of lung disorder will also be greater. The results of this study are in line with a study by Putra (2014) entitled Factors Relating to the Vital Capacity of Lungs in Workers of the Welding Workshop in the Cirendeu Valley in 2014. The results show that there is a relationship between working time and the vital capacity of the lung workers of the welding workshop. Based on research carried out on finish mill workers and packer Tonasa 2&3 there are 6 people or about 30.0% workers who have pulmonary

dysfunction at a working time <5 years. This shows that workers with working time of less than 5 years also have a risk of being disturbed lung function due to having some other factors that can be found on the filling of the questionnaire, such as smoking and being exposed to dust more than 8 hours/day. The next variable indicates that there is a relationship between dust exposure and pulm function capacity of cement factory employeesX. The majority of respondents who get dust discharge above the NAB due to the large number of machines produced by more than normally, the large demand of custumer cement makes all the machines in the factory operate so that the many workers who accompany the company exhibit more dust than NAB has specified. The limestone and silica sand which are the raw materials of cement manufacture are included in the profilferative dust. This type of dust in the lungs will form scar tissue(fibrosis). This fibrosis will harden the alveoli tissue and disrupt lung function.

Conclusion

The majority of cement factory workers are ≥ 40 years of age, abnormal nutritional status, have no history of lung disease, workers, smokers, have exercise habits, have working time ≥ 5 years, dust exposure < 3 mg/m3. There is a relationship between smoking habit, exercise habit, and working time with pulmonary performance capacity in ciment factory employees X company. No relationship between age, nutrition status, lung disease history, in cement Factory workers X company in 2018.

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