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Research Article

The Relationship between Work Duration and the Use of Personal Protective Equipment with Lung Capacity Disorders

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Abstract: One of the health problems caused by the work environment is the disruption of the lung function of workers and the community in the vicinity of industrial areas. This study aims to analyze the relationship between the length of work and the use of personal protective equipment (PPE) and lung capacity disorders at PT. Semen Tonasa Lapuko Packing Plant Unit. The populations in this study were all employees working at PT. Semen Tonasa Lapuko Packing Plant Unit is 36 people. The sample is a portion of the employees at PT. Semen Tonasa Lapuko Packing Plant Unit is 33 people, taken by simple random sampling. Data were analyzed using chi square test, phi coefficient and fisher exact test. The results showed that there was a relationship between work duration and use of PPE with impaired lung capacity.
Keywords: Personal Protective Equipment and Long Time of Work.

INTRODUCTION

The cement industry is now one of the sectors that plays a role in the economic development of a country. The positive impact of this industrial activity is contributing to the opening of employment, economic growth, investment growth, and increasing foreign exchange. While the negative impact is causing air pollution inside and outside the work environment that can cause health problems. The cement industry contributes to an increase in gas and particulate matter measuring 2.5 microns (Jayadipraja *et al.*, 2016).

Every workplace has a variety of potentials that are dangerous and can interfere with the health of the workforce or can cause occupational diseases, dust is a particle which is one of the chemical factors that exist in the workplace (Meita, 2012).

According to data reported by the International Labor Organization (ILO) about 30% to 50% of factory workers in industrialized countries are affected by respiratory diseases (pneumoconiosis, silicosis, etc.) due to dust exposure in the workplace. The results of research The Surveillance of Work Related and Occupational Respiratory Disease (SWORD) conducted in the UK found 3300 new cases of work-related lung disease. And one worker dies every 10 seconds due to work accidents and 130 workers experience work-related illness. Causes due to work-related deaths by 34% are cancer, 25% accidents, 21% respiratory diseases, 15% cardiovascular disease, and 5% are caused by other factors, most lung diseases due to work can be diagnosed based on history of disease, examination physical, chest X-ray, pulmonary physiology tests using spirometry, and laboratory tests (Ministry of Health, 2017).

The vital capacity of the lung reflects changes in the maximum lung volume which is useful for ensuring a description of the capacity of lung function. Pulmonary vascular capacity is an important measurement to determine pulmonary restrictive abnormalities as indicated by a decrease in lung function (Aryuni, 2014). The subject is first required to do maximum inspiration, then perform maximum expiration. The normal value of the vital lung capacity is 4800 ml (Aryuni, 2014).

The results of the examination of vital lung capacity will decrease in lung disease, heart disease that causes pulmonary congestion and respiratory muscle weakness. Meanwhile, the results of the measurement of vital lung capacity can be influenced by age, sex, health conditions, history of illness and occupation, smoking and exercise habits, and nutritional status (Aulia and Basuki, 2017).

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PT. Semen Tonasa The Lapuko Packing Plant Unit was established in 2012 and was inaugurated in 2013, in Lapuko Village, Moramo District, Konawe Selatan Regency. The land area is 2 ha with a production capacity of 300 thousand tons of cement per year, and the number of workers is 36 people. PT. Semen Tonasa has a positive and negative impact on work, society and the environment. The negative impact of this activity is due to exposure to substances that occur in the cement packing process. One of the negative impacts of cement packaging activities is the decline in environmental quality marked by air pollution.

Research related to dust exposure in the workforce at the cement mill section at PT Semen Bosowa Maros concluded that there was a relationship with the use of masks (p = 0,000) to the lung capacity events (Aryuni, 2014). The same research conducted at the Manado port of North Sulawesi showed that lung function impairment in loading and unloading workers at the Manado port concluded that there was a relationship with the use of masks for lung function disorders (p = 0.195) (Ombuh *et al.*, 2017). Then research conducted on the factors that affect lung function in stone-breaking workers said that there was a relationship between working time ≥ 8 hours by 75.4%, smoking behavior by 80.3% and the use of protective equipment by 72.1% (Dwiputra, 2018). While the results of research on the determinants of factors affecting lung capacity in ceramic craftsmen show that nutritional status is only an average of 24.4% and the frequency of wearing masks is an average of 4.75 times a week (Noviantio *et al.*, 2014). Based on the description above, researchers are interested in conducting research on the Relationship between Work Duration and Use of Personal Protective Equipment (Masks) with Lung Capacity Disorders in Labor at PT. Semen Tonasa Lapuko Packing Plant Unit Lapuko Village, Konawe Selatan Regency.

METHODOLOGY

This type of research is a cross sectional study. The population in this study were 36 respondents at PT Semen Tonasa Lapuko Packing Plant Unit in Southeast Sulawesi. The sample in this study were 33 respondents taken using simple random sampling. Data were analyzed using fisher exact test, chi square test and phi coefficient. Measurement of lung capacity using spirometry while work time and use of PPE is done by interview using a questionnaire.

RESULTS

The Relationship Work Duration with Lung Capacity Disorders

Table 1. Analysis of Relationship Duration Work with Lung Capacity Disorders at PT Semen Tonasa Unit of Lapuko Southeast Sulawesi Packing Plant

Work Duration	Lung Capacity Disorders				Total		*P*
	Abnormal		Normal				
	n	%	n	%	n	%	
Risky	3	60%	2	40%	5	100%	0,328
No Risk	9	32%	19	68%	28	100%	
Total	12	36%	21	64%	33	100%	

Table 1 shows that out of 5 respondents who worked for more than 5 years (at risk) there were 3 respondents (60%) who had impaired lung capacity (abnormal) and 2 respondents (40%) had no impaired lung capacity (normal). While of the 31 respondents who had worked <5 years (no risk) there were 9 respondents (32%) who experienced impaired lung capacity (abnormal) and 19 respondents (68%) who did not experience impaired lung capacity (normal).

Statistical test results using the fisher's exact test showed a value of P = 0.328> 0.05, which means there is no relationship between the length of work and lung capacity disorders in workers at the PT Semen Tonasa Unit of the Lapuko Southeast Sulawesi Packing Plant. Because there is no relationship between long periods of work with impaired lung capacity, it is not followed by a close relationship test.

Relationship of Personal Protective Equipment (PPE) Use with Lung Capacity Disorders

Table 2. Analysis of the relationship between PPE use and lung capacity disorders in PT Semen Tonasa Lapuko Southeast Sulawesi Packing Plant Unit

Use of PPE	Lung Capacity Disorders				Total		X^2 Calculate	*Phi* (Φ)
	Abnormal		Normal					
	n	%	n	%	n	%		
Risky	10	77%	3	23%	13	100%	15,249	0,680
No Risk	2	10%	18	90%	20	100%		
Total	12	36%	21	64%	33	100%		

Table 2 shows that of the 14 respondents with PPE use (at risk) there were 11 respondents (79%) who experienced impaired lung capacity (abnormal) and 3 respondents (21%) did not experience impaired lung capacity (normal). While of the 22 respondents who used PPE (no risk) there were 2 respondents (36%) who experienced impaired lung capacity (abnormal) and 20 respondents (91%) who did not experience lung capacity (normal).

Statistical test results using Chi Square analysis at $\alpha = 5\%$ and df = 1, obtained X^2 count> X^2 table (15,249 <3,841), meaning that there is no relationship between the use of PPE with impaired lung capacity in workers at PT Semen Tonasa Unit Packing Plant Lapuko Southeast Sulawesi. The results of the relationship closeness test showed a Phi coefficient (Φ) of 0.680, this shows the strength of the relationship between PPE usage and lung capacity disorders in workers at PT Semen Tonasa Unit of the Lapuko Southeast Sulawesi Packing Plant in the category of strong relationships.

DISCUSSION

The results showed that of 5 respondents who worked for more than 5 years (at risk) there were 3 respondents (60%) who experienced impaired lung capacity (abnormal). This illustrates that the length of work can be one of the risk factors for decreased lung function capacity. This is due to the accumulative pollutants that enter the body during work. As a result, the longer a person is exposed to pollutants caused by the work environment the more risk that the person experiences health problems.

The work period will have a positive influence on the workforce with the length of time a person has worked, so he will be more experienced in doing his work, on the contrary will have a negative influence if the longer a person works will lead to boredom. The longer working hours of workers who work in dusty environments have a negative impact on their health, especially the health of the respiratory tract (Hutama, 2013).

The results showed that of 5 respondents who worked> 5 years (at risk), there were also 2 respondents (40%) who did not experience impaired lung capacity (normal). This is due to other factors including the habits of respondents not smoking, good nutritional status to the habits of respondents at work always using masks or other personal protective equipment (PPE). Although using PPE, it cannot completely protect the body from dust exposure but can reduce the severity of lung function disorders that may occur. This is in line with the theory put forward by (Anugrah, 2013) which states that the use of respiratory protective equipment or personal protective equipment can reduce dust particles in the air that can enter the lungs so as to reduce disruption of lung capacity.

While from 31 respondents who have worked <5 years (not at risk) there are 9 respondents (32%) who have impaired lung capacity (abnormal). These results illustrate that impaired lung capacity experienced by workers is not caused due to the duration of work but there are other factors such as smoking, not using personal protective equipment (PPE), so that the nutritional status of workers can also affect the occurrence of lung function disorders of this respondent. This can also be seen from the results of the analysis using the fisher's exact test, the value of P = 0.328> 0.05, which means there is no relationship between the length of work and lung capacity disorders in workers at PT Semen Tonasa Unit of the Lapuko Southeast Sulawesi Packing Plant.

This research is in line with research conducted on Furniture Industry Workers in CV. Sinar Mandiri Kota Bitung, which states that there is no relationship between length of work and impaired lung capacity (Kumendong *et al.,* 2012). While research conducted on workers in rice mills in Dumoga Timur District, Bolaang Mongondow Regency shows a different thing, namely there is a relationship between the length of work and the lung capacity of workers. (Lumantow *et al.,* 2017). The results of this study are also not in line with research conducted on sorting staff who have lung problems in the tea factory of PT. Candi Loka Jamus Ngawi which states that workers with a work period of> 5 years are more at risk of experiencing lung function disorders than workers who work <5 years (Imania *et al.*, 2015).

Personal protective equipment (PPE) is a means of personal protection from various potential hazards or illnesses caused by work at work, but PPE is not absolutely able to protect the body from various potential dangers but the use of a good PPE can minimize the severity if things occur undesirable (Fahmi, 2012).

The results of this study indicate that of the 14 respondents using PPE (at risk) there were 11 respondents (79%) who experienced impaired lung capacity (abnormal). This illustrates that the behavior of the use of PPE (masks) of respondents who are still less than the maximum can increase the risk of lung function disorders coupled with other factors such as smoking habits while working and contributing to the occurrence of lung function disorders in these respondents. The behavior of workers in using PPE masks can prevent dust particles from entering the body directly, thereby affecting lung function disorders. The use of PPE is very important in preventing occupational diseases or work-related accidents (Rorimpandey, 2014).

Based on research from 14 respondents with the use of PPE (at risk), there were also 3 respondents (21%) who did not experience impaired lung capacity (normal). This is due to other factors including the respondent working in the administration section so that they are not directly exposed to dust particles. Another factor is regular exercise habits and good respondent's nutritional status. In addition to the availability of a vacuum cleaner in the room where the respondent. With the existence of a vacuum cleaner can reduce dust particles that enter the workspace (Miftakhurizka, 2014).

While of the 22 respondents who used PPE (no risk) there were 2 respondents (36%) who experienced impaired lung capacity (abnormal). This is because, although respondents use PPE (masks) often are not used properly so that dust particles can easily enter the body. This if further explored is caused by the type of masks used by respondents which are sometimes inappropriate, then often the respondents also use masks that have been damaged or dirty. In addition to the above factors, factors from the company also participate in the behavior of using PPE less than the maximum, such as the absence of strict regulations or actions from the company towards workers who do not use PPE (masks), the company also seems to pay less attention to health and safety aspects employment (K3) employees. Workers who adhere to the use of masks will minimize the amount of exposure to particles that can be inhaled (Fathurrahman and Jayanti, 2014).

Statistical test results using Chi Square analysis at $\alpha = 5\%$ and df = 1, obtained X^2 count> X^2 table (15,249 <3,841), meaning that there is no relationship between the use of PPE with impaired lung capacity in workers at PT Semen Tonasa Unit Packing Plant Lapuko, Southeast Sulawesi. The results of the relationship closeness test showed a Phi coefficient (Φ) of 0.680, this shows the strength of the relationship between PPE usage and lung capacity disorders in workers at PT Semen Tonasa Unit of the Lapuko Southeast Sulawesi Packing Plant in the category of strong relationships.

This study is in line with research conducted on road sweepers in protocols 3, 4 and 6 of Semarang City which states that there is a relationship between PPE use and lung function disorders (Wulandari *et al.*, 2017). This research is also in line with research conducted on press-packing process workers in the battered shelter business of Tanjung Mulia Lihir District, Medan, which states that there is a relationship between the use of PPE (masks) and impaired lung vital functions (Sihombing, 2014). Unlike the case with research conducted on workers in the textile industry production department CV Bagabs Makassar, which shows that there is no relationship between the use of PPE with lung function disorders (Umakaapa *et al.*, 2013). In addition, research conducted on employees at PT. Madubaru, Bantul Regency, also showed that there was no relationship between the use of PPE and impaired lung capacity (Saputra and Hariyono, 2016).

CONCLUSION

There is no relationship between the length of work and impaired lung capacity in workers at PT Semen Tonasa Lapuko Packing Plant Unit in Southeast Sulawesi. There is a relationship between PPE use and impaired lung capacity in workers at PT Semen Tonasa Lapuko Packing Plant Unit in Southeast Sulawesi.

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