

Relations Exposure to Dust Inhalation Against Impaired Lung Function in Worker Unloading at the Port of Manado, North Sulawesi

Lili Sutanti¹, Zikri Fathur Rahman¹, Nur lailatul Masruroh², Abdul Rohim Tualeka³

¹Students at the Department of Occupational Health and Safety, Faculty of Public Health, Airlangga University, 60115 Surabaya, East Java, Indonesia; ²Department of Nursing, Faculty of Health, Muhammadiyah University Malang, 65144 Malang, East Java, Indonesia; ³Department of Occupational Health and Safety, Faculty of Public Health, Airlangga University, 60115 Surabaya, East Java, Indonesia

Abstract

Upper respiratory tract infection has been one of the top ten illness the last three years. In 2014 (28,579 cases), in 2015 (39,110 cases) and in August 2016 (27,068 cases). In the community health service of the Manado Port area, the upper respiratory tract infection is on the top list. The problem of loading and unloading is the problem of loading and unloading. The problem is loading and unloading. workers in Manado Port. The problem of loading and unloading workers in Manado Port. The research was observational with analytical approach and cross sectional design, with 60 samples of respondents. It consists of 9 variables and data was collected by interview, observation and measurement. ($P = 0.195$; $PR = 0.648$ (95% CI = 0.533 - 0.789). Smoking habit ($p = 0.786$; $PR = 0.788$ (95% CI = 0.361 - 1,719) Working period ($p = 0,143$; $PR = 1,959$ (95% CI = 0,896 - 4,283). Working duration ($p = 0,838$; $PR = 0,831$ (95% CI = 0,390 - 1,771) With potential variables. Affecting lung function impairment of loading and unloading workers is use of mask ($p = 0.195$) and period of work ($p = 0.143$). There is no significant correlation between use of mask, smoking habit, period of work, working duration, inhaled dust exposure and lung function disorder.

Keywords: *inhaled dust exposure, lung function disorder.*

Introduction

Among the environmental pollution, air pollution in Indonesia is a major determinant lingkungan quality, especially in big cities. Transport accounted for 60-80% of the air pollution. Some types of contaminants that are considered harmful to health community for example: PM2.5 and PM10, namely carbon monoxide, nitrogen dioxide, sulfur dioxide, particulates, hydrocarbons, CFCs, lead and carbon dioxide. Odorless and poisonous gas. The impact of air pollutants depends on the type

of pollutant. PM10 is all particles that have a diameter of 10 microns. Because of its diameter, particles can enter the airway. Larger particles get stuck in the upper respiratory tract. But smaller particles measuring below 2.5 microns can enter the pulmonary alveoli and cause serious problems, from asthma to Chronic Obstructive Pulmonary Disease.

Respirable dust is dust or particles that are small enough that can enter into the nose to the upper respiratory system and into the inner lungs. Particles that enter the inner lung or inner respiratory system in general cannot released by the body's mechanism system naturally (cilia and mucus) then as a result the particles will stay forever in the lungs.

The broad surface of the lungs, which is only separated from the thin membrane of the circulatory system, theoretically results in a person easily attacked by the entry of foreign matter (dust) and bacteria that

Corresponding author :

Abdul Rohim Tualeka

Department of Occupational Health and Safety, Public Health Faculty, Airlangga University
Campus C, Jalan Mulyorejo, Surabaya, 60115,
Indonesia, Tel: +62 81 333 519 732
E -mail: abdul-rt@fkm.unair.ac.id

enter with inspiring air¹.

According to the International Labor Organization (ILO), an abnormality that occurs due to accumulation of dust in the lungs that causes a tissue reaction to dust is known as pneumoconiosis². Symptoms of pneumoconiosis include long coughing, long phlegm, fatigue, shortness of breath sometimes accompanied by wheezing³.

Based on ILO data in 2013, 30% to 50% of workers in developing countries suffer from pneumoconiosis. Every year there are 2.3 million people in the world dying from work, both due to work-related illnesses and accidents. This figure is dominated by occupational diseases, namely 2.02 million cases of death⁴.

Data on the prevalence of pneumoconiosis vary in each country in the world. SWORD data in the UK in 1980-1988 showed cases of pneumoconiosis of 10%. In Canada, cases of pneumoconiosis in 1992-1993 were 10%. While data in South Africa in 1996-1999 was 61%. In China from 1949-2001 the number of cumulative pneumoconiosis cases reached 569,129 cases⁵.

Manado Harbor North Sulawesi, which is one of the inter-island connecting ports to the Sangihe and Talaud islands also to Ternate, every year has experienced increased activity, both people, goods and commodities between islands. Circulation of materials, commodities and chemicals and other materials always uses the port area as a route of transit before being sent to users / users. In fact, many chemicals are found stored in warehouses / storage located in the port area for days⁶.

Several studies related to the use of Personal Protective Equipment (PPE) were carried out by Herlita, in the furniture industry in Makassar, showing that not using personal protective equipment (masks) had a significant relationship with a decrease in lung capacity. From the results of these studies it is known, strong relationship between respondents who did not use personal protective equipment with lung capacity and contributed 54.6% to the decline in lung function⁷.

In the last three years ARI disease in the city of Manado ranks the top in 10 prominent diseases. In 2014 (28,579 cases), 2015 (39,110 cases) and 2016 in August (27,068 cases)⁸.

Based on preliminary studies at the Wonasa City Manado Public Health Center where the Manado port

is included in its working area, for Acute Respiratory Infections (ARI) is the top-most prominent disease in ten prominent diseases that exist. Based on identification and interviews with puskesmas officers that some people with ISPA are laborers or members of TKBM in Manado port.

Based on the background of these problems, the authors suspect that the strong relationship between inhaled dust exposure and pulmonary dysfunction in loading and unloading workers at the port of Manado.

Material and Method

This study was an observational analytic study using a cross sectional design. In cross sectional analytic studies studying the relationship between risk factors and disease (effects), measurement of independent variables and dependent variables is done once at the same time⁹.

The population in this study were all laborers transporting goods / materials from warehouses to ships, which are members of the Koperasi Sejahtera TKBM Manado City, which is 151 people. These transport workers are people who work exposed to dust in goods storage warehouses in the form of cement, fertilizers, pesticides, chemicals, bran, rice, and other basic commodities. The sample in this study is a portion of the population that is considered representative taken by using purposive random sampling technique and the determination of the sample size is calculated based on the Lemeshow formula. After calculated based on the formula, the number of samples was 60 respondents (minimum sample). The sample collection technique is purposive sampling.

Data collected directly by researchers against respondents. Data obtained are:

1. Measurement of inhaled dust levels using a PDS (Personal Dust Sampler)
2. measurement of lung function capacity with a Spirometer tool.
3. Measurement of body weight and height of respondents
4. Interview with respondents by filling out the questionnaire directly prepared (working period, length of work, mask use, smoking habits, exercise habits).

The data collected in this study was analyzed by

Chi-Square at a significance level of 5%.

Findings

The average age of respondents was 38.40 years standard deviation of 10,329. The minimum age of the respondent is 19 years and the maximum value is 58 years. The average working period of respondents is 9.10 years with a standard deviation of 7.489. The minimum value of the respondent's tenure is 2 years and the maximum score is 38 years. The average length of work of the respondent is 8.60 hours with a standard deviation of 827. The respondent's minimum length of work is 8 hours and the maximum value is 12 hours. Distribution of mask use is 54 (90%) using masks and 6 (10%) respondents who do not use masks. The distribution of smoking habits is 44 (73.3%) respondents who smoke and 16 (26.7%) who do not smoke.

Respondents with pulmonary disease disorders were experiencing 19 disorders (31.7%) and no interference namely 41 (68.3%). The average level of inhaled dust is 0.22 mg / m³ with a standard deviation of 0.322. The minimum value of inhaled dust is 0.28 mg / m³ and the maximum value is 1.028 mg / m³. The average lung capacity of respondents is 91.52% with a standard deviation of 21.214. The minimum value of the respondent's lung capacity is 40% and the maximum value is 130%.

Risk Factors for Lung Function Disorders The

relationship between the use of masks and pulmonary dysfunction in loading and unloading workers at the Port of Manado.

In the variable use masks are grouped into not using masks and using masks. Data shows that of 54 respondents who did not use masks 19 (35.2%) respondents experienced pulmonary function disorders and 35 (64.8%) respondents did not experience pulmonary function disorders while 6 (100%) respondents who used masks did not experience impaired function. lung. The value of $p = 0.195$ is more than the significance of 0.05, so there is no significant relationship between the use of masks and lung function disorders.

The results of the bivariate analysis for the relationship between the use of masks and lung function disorders of workers loading and unloading in the port of Manado, obtained a significance value of 0.195 thus the probability (significance) was more than 0.05 (0.195 >

0.05) then H_a was rejected or there was no meaningful relationship between use of masks with pulmonary function disorders loading and unloading workers at the port of Manado. Relationship between smoking habits and pulmonary function disorders.

Smoking habit variables are grouped into 2 categories namely smoking and non-smoking categories. Can be seen in the data. 10 there were 44 (100%) respondents who had smoking habits, 13 (29.5%) had pulmonary function disorders and 31 (70.5%) respondents did not experience pulmonary function disorders. While respondents who did not smoke were 16 (100%) respondents, 6 (37.5%) respondents experienced pulmonary function disorders and 10 (62.5%) respondents did not experience pulmonary function disorders. The value of $p = 0.786$ is more than the significance of 0.05, so there is no significant relationship between smoking habits and pulmonary function disorders.

The results of bivariate analysis for the relationship between smoking habits and pulmonary dysfunction in loading and unloading workers at the port of Manado obtained a significance value of 0.786, thus the probability (significance) was more than 0.05 (0.786 > 0.05), H_a was rejected or there was no significant relationship between habits smoking and lung function disorders.

Relationship of Work Period with pulmonary function disorders Work

tenure variables are grouped into 2 categories, namely work period > 10 years and 10 years totaling 28 (100%) respondents and 12 (42.9%) respondents who experience pulmonary dysfunction while those without pulmonary function, namely 16 (57.1%) respondents. Respondents who worked <10 years were 32 (100%) respondents, who underwent pulmonary function disorder, namely 7 (21.9%) respondents and 25 who did not experience pulmonary function disorders (78.1%). The value of $p = 0.143$ is more than the significance of 0.05, so there is no significant relationship between years of work with pulmonary function disorders.

The results of the bivariate analysis for the relationship of working period with pulmonary dysfunction in loading and unloading workers at the port of Manado, obtained a significance value of 0.143 thus the probability (significance) was more than 0.05 (0.143 > 0.05) then H_a was rejected or there was no meaningful relationship between work periods with lung function disorders workers unloading at the port of Manado.

Workers who are in a high dust environment for a long time have a high risk of pulmonary function disorders. According to Suma'mur, one of the potential variables that can cause lung function disorders is the length of time someone is exposed to these pollutants. This means that the longer the working period of a person, the longer the time of exposure to these pollutants¹⁰.

Long work relationship with pulmonary function disorders

Long-term relationship variables are divided into 2 categories, namely working time > 8 hours and ≤ 8 hours. In the total data of respondents working > 8 hours as many as 28 respondents, 8 (28.6%) respondents experienced pulmonary function disorders and 20 (71.4%) respondents did not experience pulmonary function disorders. While respondents who worked ≤ 8 hours were 32 respondents, 11 (34%) had pulmonary function disorders and 21 (65.6%) did not experience pulmonary function disorders. The value of $p = 0.838$ is more than the significance of 0.05, so there is no significant relationship between the length of work with pulmonary function disorders.

The results of the bivariate analysis for the length of work relationship with lung function disorders of loading and unloading workers in the port of Manado, obtained a significance value of 0.838, thus the probability (significance) was more than 0.05 ($0.838 > 0.05$) then H_0 was rejected or there was no meaningful relationship between the length of work and pulmonary dysfunction workers loading and unloading at the port of Manado.

Relationship to inhalation of dust exposure with pulmonary function disorders

Variable relationships inhaled dust exposure are divided into 2 categories, namely not fulfilling the requirements and fulfilling the requirements. In the data shows that 60 respondents or total respondents there were no respondents who experienced exposure to inhaled dust that did not meet the requirements. Respondents with exposure to inhaled dust who fulfilled the requirements were 19 (31.7%) respondents experiencing pulmonary function disorders while 41 (68.3%) respondents did not experience pulmonary function disorders.

The results of data analysis for respondents exposed to inhaled dust below the Threshold Value (NAB) amounted to 60 (100%) respondents. There were no respondents exposed to dust above the NAB. In line

with the research conducted by Fordiasitiko, there were no significant abnormalities of pulmonary physiology between groups of cement factory workers who worked with dust levels above the NAB with those below the NAB ($p = 0.509$)¹¹. The size of dust or particles that enter into the lung will determine the location of attachment or deposition. Human sucked particles less than 1 micron in size will come out when exhaled breath. Particles measuring 1-3 microns will enter the air bag of the lungs, attaching to the alveoli¹².

Conclusion

There was no significant relationship between mask use ($p = 0.195$), smoking habits ($p = 0.766$), work period ($p = 0.143$), length of work ($p = 0.838$) and exposure to inhaled dust (100% below NAB) with pulmonary dysfunction in loading and unloading workers at Manado Harbor. The most potential variable associated with pulmonary function disorders in loading and unloading workers in the Port of Manado is the use of masks with a value of $p = 0.195$ and years of service with a p value = 0.143.

Conflicts of Interest: All authors have no conflicts of interest to declare.

Source of Funding: The source of this research costs from self.

Ethical Clearance: This research was approved by the Institutional Ethics Board of Airlangga Surabaya University. All subjects received complete information about the purpose of this study, each subject before the study signed an informed consent form.

References

1. Sylvia A.P. LMW. Pathophysiology. Jakarta: ECG; 1995.
2. Susanto A.D. Pneumokoniosis. J Indo Med Assoc. 2011; Vol 61 (No. 12).
3. Damayanti T.Y.F, Ikhsan M., Sutjahyo. Relationship between the Use of Masks and Clinical Features, Lungs and Thorax Photographs of Workers of Cement Dust. Hygiene. 2007; Vol 57 (9).
4. Suryani M, Setiani O, Nurjazuli. Risk Factor Analysis of Exposure to Organic Wood Dust in the Air to Disorders of Lung Function in Wood Processing Industry Workers of PT. Surya Sindoro Sumbing Wood Wonosobo Industry. A Healthy

- Environment in Indonesia. 2015; Vol 4 (No 1).
5. Liang YX, Wong O, Fu H, Hu TX, Xue SZ. The economic burden of pneumoconiosis in China. *Occup Environ Med.* 2003; 60 (6): 383–4.
 6. Director General of PPM & PL Ministry of Health R.I. Guidelines for Surveillance of Risk Factors for Hazardous Chemicals in the Port Area. Jakarta, Indonesia: MOH R.I .; 2007
 7. Herlita R. Factors Associated with the Capacity of Lung Function of Workers in Kawa-san, Antang Makassar Furniture Industry. *J Health Care FIK Hasanudin University.* 2013; 5 (3).
 8. Gonibala M. *Manado Post.* 2012. p. 31–2.
 9. Sastroasmoro S., Ismael S. *Basics of Clinical Research Methodology.* Jakarta: CV. S Agung Seto .; 2011
 10. Suma'mur. *Company Hygiene and Safety.* Edition II. Jakarta: CV. Sagung Seto; 2009
 11. Fordiasioko D. Prevalence of Thoracic Abnormalities and Decreased Lung Problems of Workers in the Cement Plant Work Environment. *J Respirologi Indonesia.* 2002; Vol 22 (2).
 12. Adha R.n., Muis M. Factors Affecting Lung Function Events in Cement Transport Workers in the Malundung Tarakan Port Cement Storage Warehouse in East Kalimantan. *Hasanuddin University of Makassar;* 2012.