

## Conference Paper

# Analysis of Risk Factors that are Related to Lung Respiratory Symptoms

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**Abstract**

Lung respiratory symptoms are a collection of symptoms impairment in the functions of pulmonary due to accumulation high concentration of dust particle. The impact of lung respiratory symptoms is pneumoconiosis disease. 30%-50% of all occupational diseases are because of pneumoconiosis and 40,000 new cases of pneumoconiosis are caused by workplace dust exposure. The aim of the research is to analysis the risk factors related to lung respiratory symptoms in workers in PT. X West Java. The research used a cross-sectional study which was conducted in PT X with 65 respondents selected by proportional random sampling. Data was collected by interview, observation and measuring. The instrument was used in this research is a questionnaire American Thoracic Societ (ATS) standard consisting of 36 respiratory symptoms lung, low volume sampler, thermohigrometer, scale and microtois equipment. There were 55.4% respondents have respiratory symptoms lungs. The statistical results showed significant correlation of respiratory symptoms lungs with levels of dust total ( $p = 0.0001$ ,  $PR=2,813$ ), temperature ( $p=0,007$ ,  $PR=0,491$ ), humidity ( $p=0.0001$ ,  $PR=7,925$ ), and age ( $p=0,049$ ,  $PR=0,615$ ), while the daily of exposure ( $p=0,498$ ,  $PR=1,853$ ), smoking habit ( $0.038$ ,  $PR=1.944$ ), nutritional status ( $p=0,418$ ,  $PR=1,211$ ) and disease history ( $p=0,247$ ,  $PR=1,879$ ) were not associated with respiratory symptoms lung on workers PT. X West Java. The Respiratory symptoms lung was a symptom that the cause of the environment and the capacity of the worker

**Keywords:** respiratory symptoms lung, dust total levels, temperature, humidity, smoking habit

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## 1. Introduction

The process of industrial development in Indonesia uses a variety of modern technologies in accordance with national economic development. However, the negative impacts are inevitable, one of which is air pollution from processing industrial products (Budiono, 2003). A work environment which is full of dust, steam, gas and others can influence work productivity and reduces the quality of work, and the other adverse to

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the health effect of the labor (Suma'mur, 2014). The impact of the air pollution on the workplace to the human health revealed that respiratory diseases. According to WHO in 2007, 30% to 50% of all occupational diseases are silicosis and other pneumoconiosis diseases. In addition, the ILO (International Labor Organization) estimates that around 40,000 new cases of pneumoconiosis that caused by dust exposure in the workplace (WHO, 2007). Pneumoconiosis is the accumulation of environment factor such a dust, humidity, temperature, and any other medical conditions in a person such a age, gender, the length of exposure, and the history of diseases (Suma'mur, 2014). Based on the survey results of non-communicable diseases, five provincial hospitals in West Java, Central Java, East Java, Lampung and South Sumatra in 2004, showed COPD (chronic obstructive pulmonary disease) was a first ranked occupational illness in Indonesian, with morbidity rate 35%, followed bronchial asthma (33%), lung cancer (30%) and others (2%) (Mirza, 2017; Oemiati, 2013).

Respiratory Symptoms Lung is a symptom such as nasal congestion, coughing, rhinitis and asthma that experienced by industrial workers (Sholikhah A M & Sudarmaji, 2015). Based on Liaw research (2014), there was significantly a high prevalence of complaints of cough, morning cough with sputum and other symptoms were caused by exposure to chemical dust and workers' allergic with p value (0.001) (Liaw, Hashim, & Lye, 2014). Anindya research showed (2014) there was a significant relationship between total dust levels with respiratory complaints such as coughing and nasal congestion with p value (0.004) <0.05 (Mar'atus, Sholikhah, & Sudarmaji, 2015). In addition, based on the results of a cohort study conducted by Gransio from 2008/2009 - 2012/2013, it was found that the characteristics of respondents' age, length of working, smoking habits, and nutrition can affect lung disease with a p value (0.001) <0.05 (Granslo et al., 2017).

The dust particles with 5-10 microns of dusts will enter the upper airway, 3-5 microns into the middle airway, 1-3 microns can reach the vessels in the alveoli and 0.1 to 0.5 dust will float above the alveoli (Indonesian Ministry of Health, 2014). Dust can causes non-specific defense mechanism reactions in the form of coughing, sneezing, mucociliary transport disorders and phagocytosis by macrophages. Smooth muscle around the airway can be aroused, causing constriction. This situation is usually when the dust concentration exceeds the threshold value. The mucociliary system is also disrupted and causes increased mucus production accompanied by imperfect mechanisms that will occur airway resistance in the form of obstruction of the respiratory tract. This situation which in general can be said to have decreased lung vital capacity (GOLD, 2017). This study aims is to analysis the risk factors that related to respiratory symptoms lung on workers, such total dust levels, temperature, humidity, age, length of work,

smoking habits, nutrition status, and a history of previous illnesses of workers in PT. X West Java.

## 2. Methods

### 2.1. Study design

The design of this research used analytical survey with cross sectional study (Sastroasmoro, 2014).

### 2.2. Samples

The populations of this study were a worker in PT X with a total 181 employees. The samples was calculated using provisions of Slovin formula as much as 65 participants that selected by proportional random sampling.

### 2.3. Instrument

The instrument was used in this research is a questionnaire and non questionanaire. The questionnaire used American Thoracic Societ (ATS) standard consisting of 36 respiratory symptoms lung questions containing subjective complaints of workers when working such as coughing, time of coughing, wheezing of breath, and chest pain, length of work, smoking habit, history of disease. While the non-questionnaire used low volume sampler, scales and microtois, and thermohygrometer.

### 2.4. Data collection procedures

Data was collected by interview, observation and measuring of total dust levels, temperatures, humidity, and nutrition status.

### 2.5. Statistical analysis

All data were analysis using the person Chi-square test to know the relationship categorical characteristic variables between the exposed and the non-exposed groups. The risks of having different respiratory symptoms lung among workers were measured as relative risks (RR) with 95% confidence intervals ( $p \leq 0.05$ ).

### 3. Result

This research was conducted on workers in PT. X West Java by 65 participants. The result of data analysis shows that from 65 participants, 55 % participants has symptoms respiratory such cough with sputum, wheezing, shortness of breath, and chest pain. The risk characteristic respondent to symptoms respiratory, 39% was aged <40 years old, most worker (97%) have a length of work more than 5 years, and 57% participants with smoking habit in the last 18 years ago. Based on nutrition status, 29% of respondent had malnutrition and 4,6% had a history of respiratory-related illnesses. Other general characteristic's and possible environmental which have risks to respiratory symptoms were, 31% of the participants was working at the environment with total dust levels in areas more than  $3,00 \mu/m^3$ , 88% working at the temperature  $28,6^{\circ}C - 31^{\circ}C$  and humidity 73%-75% (Table 1).

TABLE 1: Distribution of characteristics and environmental risk factors with the respiratory symptoms

Variable	Frequency	Percentage (%)
Respiratory Symptoms Lung		
Have a symptoms	36	55.4
No-symptoms	29	44.6
Age years		
Risk (>35 years old)	25	38.5
No Risk (<35 years old)	40	61.5
Length of work		
Long (> 5 years)	2	3.1
New (< 5 years)	63	96.9
Smoking habit		
Light smoker (1-200 cigarettes)	28	43.1
Moderate smokers (201-600 cigarettes)	37	56.9
Heavy smoker (> 600 cigarettes)	0	0
Nutrition status		
Malnutrition/Obesities	19	29.2
Normal	46	70.8
History of disease		
Yes	3	4.6
No	62	95.4
Total dust level		
High ( $\geq 3,00 \mu/m^3$ )	20	30.8
Low ( $< 3,00 \mu/m^3$ )	45	69.2
Temperature		
Not Normal ( $< 24^{\circ}C - > 26^{\circ}C$ )	57	87.7
Normal ( $24^{\circ}C - 26^{\circ}C$ )	8	12.3
Humidity		
Not Normal (< 65 dan > 95%)	53	81.5
Normal (65 - 95%)	12	18.5

\* n = 65

TABLE 2: Distribution of Type of Health Complaint

Health Complian	Frequency	Percentage (%)
Coughing		43.1%,
Coughing with sputum		24.6%
Wheezing of breath		13.8%
Shortness of breath		35.5%
Chest pain		29.2%

Table 2 shows nearly half of participants have respiratory lung symptoms, average participants complained 1-4 complaints of respiratory symptoms lung. Based on the bivariate analysis statistical test with person chi square between the risk factor and respiratory symptoms showed that lung show that age was significantly correlated with the respiratory symptoms lung score (PR=0.615) whereas the younger worker tend to have higher health complaint compare to the oldest. The Smoking habit (PR=1.944), total dust level (PR=2.813), temperature (PR=0.491), and humidity (PR=7.925) also showed a statistically significant correlation with the respiratory symptom lung with score p value ( $\leq 0.05$ ).

TABLE 3: Bivariate correlation of characteristics and environmental risk factors with the respiratory symptoms

Variables	Prevalence Ratio	p Value
Age	0.615	0.049
Length of work	1.853	0.498
Smoking habit	1.944	0.038
Nutrition status	1.211	0.418
History of disease	1.879	0.247
Total dust level	2.813	0.0001
Temperature	0.491	0.007
Humidity	7,925	0,0001

#### 4. Discussion

The results of the study identified age and smoking habit as variable that influence the respiratory symptoms lung of the participants. Those who are younger age have higher score to complained health symptoms. Age is closely related to the length of working, smoking habit, and workplace. This finding is in line whit the study conducted by Brandsma (2017) that age related to Chronic Obstructive Pulmonary Disease (COPD). Another assumption is that the younger worker was exposed to environmental pollution, therefore they more risk than the older one (Jing-shiang & Chang-Chuan, 2002). The

aged 40 years, the quality of the lungs can deteriorate rapidly (Salawati, 2016). Respiratory symptoms lung is a collection of symptoms of decreased lung function caused by the accumulation of dust particles with high concentrations (Mirza, 2017).

The smoking habit of the participant mostly have long theorem as long as 18 years with cigarettes spent 11cigarettes/day. Smoking will stimulates mucus secretion while nicotine will paralyze cilia, so that inhibited the function of airway cleansing. The accumulation of mucus secretions that cause coughing, the amount of sputum and shortness of breath (Gold. D & Wypij. X W, 2005).

This study also identified a significant relationship between total dust level in work-place, temperature, and humidity score with respiratory symptoms lung. The participants who work in areas with total dust levels do not meet to the time weighed average (TWA) have high risk to the respiratory symptoms lung. Dust is a particle of solid objects floating in the air. Air entering breathing contains particles in the form of dust, and some of the dust will be retained in the lungs, and inhaled too much dust can cause pneumoconiosis. This is because lung tissue is a medium in the body that has the ability to capture and absorb air pollution (Moeljosoedarmo, 2008). The study conducted by Maratus (2015), revealed that, measured dust can be used to assess the negative impact on the welding worker lung function (Mar'atus et al., 2015). Dust entering the airways causes non-specific defense mechanism reactions in the form of coughing, sneezing, mucocillary transport disorders and phagocytosis by macrophages. Smooth muscle around the airway can be stimulated, causing constriction. This situation usually occurs when the dust level exceeds the threshold value (Yunus F., 2007). Prolonged contact with the environment containing dust particles will produce severe stress on the respiratory tract organs so that it will cause impaired respiratory function. Generally the symptoms of pneumoconiosis only occur after exposure to work dust after working for at least 5 years. The severity of symptoms that arise depends on the intensity and duration of exposure (Harrianto R, 2009).

Based on the temperature and humidity measurements, 4 points in the PT X area did not meet to the TWA, which temperatures around 28.6°C - 31°C. Temperature and humidity are one of the factors that influence of weather in the workplace (Suma'mur, 2014). High temperatures will accelerate with the levels of pollutants in the air. The higher air temperature, the particles will become drier and cause the particles more reactive and can last longer in the air. High temperatures can cause dehydration up to heat stroke. While low temperatures can interfere with comfort at work, low temperatures can cause health problems to hypothermia (Jing, 2012; Sookchaiya, T., Monyakul, & Thepa, 2010). Humidity is the concentration of water vapor in the air. Humidity is also

the degree of wetness of air expressed as relative percentages/relative to saturation point (Suma'mur, 2014). Humidity is influenced by temperature, air velocity and heat radiation from the air and will certainly affect the state of the body where humans when receiving or releasing heat from the body. The most higher the water vapors in the air, the higher the humidity value too. High humidity values make pollutants more easily react with water so that the density of pollutants will increase. High humidity is an ideal condition for mold and other microorganisms to breed, while the humidity is too low can affect the occurrence of various disorders such as mucous membrane irritation, dry eyes and sinus (Andrzej M. Marciniak, 2014).

## 5. Conclusion

The Respiratory symptoms lung was a symptom that the cause of the environment and the capacity of the worker. The study identifies that age, smoking habit; total dust level, temperature and humidity were relationship with the respiratory symptoms lung. This study finding suggest the necessity of controlling vehicle and minimizing the exposure effect by safe action such as using personal protective equipment and engineering control of environment.

## Authorship Statement

All persons who meet authorship criteria are listed as authors and all authors certify that they have participated sufficiently in the work to take public responsibility for the content, including participation in the concept, design, analysis, writing, or revision of the manuscript. Furthermore, each authors certifies that this material or similar material has not been and will not be submitted to or published in any other publication.

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