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Effect of N95 Masks on Furniture-cutting Workers with Respiratory Symptoms

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Abstract

In a preliminary survey of furniture workers in 2017, 8 out of 15 workers reported that the wood-cutting process always led to tightness in their chest and made them cough. This is because the wood-cutting process produces dust and the workers do not use any personal protective equipment such as mask at work. Therefore, the aim of this study was to find the effect of wearing masks on the respiratory symptoms of woodcutters in Sentra Mebel Kemirahan, Malang. The researchers distributed N95 masks to all the workers. The research used a pre-experimental with one group pre- and post-test design. The study included a total of 21 people, selected through purposive sampling. Data were analysed using the Wilcoxon test. The result of pre–post-tests in every variable were: (i) *P*-value 0.000 for chest tightness; (ii) *P*-value 0.001 for cough; (iii) *P*-value 0.000 for chest pain, which is $P \leq 0.005$, meaning significant. Therefore, we conclude that there was a difference between before and after using N95 mask against the respiratory symptoms in the wood-cutting workers in Sentra Mebel Kemirahan Malang.

Keywords: subjective respiratory symptom, chest tightness, cough, chest pain, N95 mask

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1. Introduction

The wood processing industry in Indonesia is growing quite rapidly. The Malang Industry and Trade Office recorded in 2016 that there were 16 Large Industries also Small and Medium Enterprises working in the registered wood processing and furniture industry, one of which is the Sentra Mebel Kemirahan Malang.

Basically, the manufacture of wooden furniture goes through 5 main processes, namely sawing wood, preparing raw materials, preparing components, assembling and forming processes, and the final process. This process has the potential to produce hazards for workers and the work environment, including from wood dust. Wood dust

can be generated from mechanical processes such as refining, cutting, and processing organic materials such as wood [1].

Preliminary research is carried out by researchers to find out which process causes subjective complaints in the form of shortness of breath and coughing. 15 workers of processing wood into furniture Sentra Mebel Kemirahan Malang, 8 people (53.3%) said that the process of chopping wood often caused subjective complaints of shortness of breath and coughing, 4 people (26.6%) said the process colouring and finishing, and the remaining 3 people (20%) said the sanding process. Observations during the preliminary survey also indicated that workers processing wood into furniture mostly did not use nose protectors or masks while working.

The lungs and the respiratory tract are the organs most exposed to occupational exposure to hazardous substances [2]. As many as 25% of respondents' complaints of informal sector furniture workers in Tasikmalaya are shortness of breath [3]. Subjective complaints that arise on Coal Yard work area workers at PT. Indonesia Power, Suralaya, because they do not use PPE, one of them is shortness of breath [4]. There are several factors related to the lung capacity of workers in the Antang Makasar furniture industrial area. One of them is the length of time working for workers who are exposed to wood dust. The longer the working hours of a furniture worker, the more workers are exposed to wood dust [5].

According to Law No. 1 year 1970 workers / laborers / other people who enter the workplace are required to wear PPE according to the potential dangers and risks. The reality on the ground is not the same as the government's recommendation contained in this law. Whereas wood dust itself is dangerous if it contaminates wood processing workers into furniture. According to the study, 10 out of 18 workers who showed symptoms of clinical abnormalities due to exposure to dust were workers who were not used to wearing Personal Protective Equipment (PPE) in the form of masks. There is also a relationship between the use of PPE masks and the vital capacity of the lungs of furniture workers at UD Putra Kusuma Jati [6].

Based on the description above, the researcher wants to examine the effect of giving masks on respiratory problems in furniture workers in the cutting section at Sentra Mebel Kemirahan Malang.

Respiratory disorders are very diverse and can manifest in various other respiratory diseases. For example, several occupational diseases of the respiratory tract that can be caused by dust, especially wood dust, are upper airway irritation and sinonasal cancer. Some examples of respiratory problems are shortness of breath, coughing, chest pain, etc.[2].

Shortness of breath is caused by the flow of air in the airways narrowing. Narrowing can occur because the airways are tightened, oedema or because secretions block the flow of air. Shortness of breath can be determined by counting the breaths in one minute. In general, normal adults breathe around 12-17 times per minute (Mutaqqin, 2008: 40). If the respiratory rate is> 24x per minute, it is called tachypnoea or breathing quickly and does not experience changes in breathing depth (Lyrawati, 2012: 24). If there is a complaint of shortness of breath, the body will immediately make efforts to increase the frequency of breath.

Coughing is an explosive expiration to remove secretions and foreign bodies from the tracheobronchial tract (Isselbacher et al, 2012). Coughing is the most common cardio-respiratory symptom. The cough reflex removes foreign bodies and microorganisms and helps remove the accumulated mucus. Finally, the body will respond to coughing to remove the foreign object (dust).

In the respiratory tract, the incoming dust will settle and cause mucosal oedema of the respiratory wall. This causes narrowing of the airways. The response to airway narrowing can range from shortness of breath and to chest pain, especially on inspiration. Chest pain does not directly indicate a specific disease, but can be an indicator if the respiratory tract is damaged [7].

The N95 respirator mask is a respiratory protection device designed to tightly cover the user's face, especially the nose and mouth, and is very efficient at filtering out particles in the air including microorganisms. It was also stated that NIOSH and OSHA recommended that the N95 mask be able to protect workers well against even very dusty conditions [8].

2. Method

The research design used was pre-experimental research, with a one group pre- and post-test research design, and used a cross sectional approach. This study aims to determine whether there is an effect of giving masks (independent variable) on respiratory problems (dependent variable) of woodcutter workers at Sentra Mebel Kemirahan Malang. The sampling technique used in this study was purposive sampling. The samples used were woodcutter workers at Sentra Mebel Kemirahan Malang who met the following inclusion criteria: 1) Wood cutting workers, 2) Following the research process from pre-test, intervention to post-test, 3) When cutting wood, the frequency of breath more than normal (12-17x per minute), 4) Not wearing a mask when cutting wood, 5) Willing to be involved in research. Meanwhile, the exclusion criteria are: 1) Workers who

have chronic obstructive pulmonary disease (COPD), 2) Workers who have a history of chest trauma, 3) Workers who have a history of treatment for heart and kidney diseases and are taking medications for respiratory problems,

The instruments in this study were: 1) a stopwatch used to measure the number of breaths in 1 minute, 2) an observation sheet containing a cough scale of 1-5. Scale 1 which means workers do not experience coughing while working, scale 2 cough workers 1-2x, scale 3 cough workers 3-5x, scale 4 cough workers> 5x, 3) Virtual Analog Scale (VAS) questionnaire in the form of lines with numbers 0- 10, where each number is the same distance, namely 1 cm. Workers are asked to mark the level of chest pain on the number line to describe the feeling of chest pain experienced at work, 4) N95 masks. The statistical test used was the Wilcoxon test, with ordinal data. This test is conducted to determine whether or not there is a difference between the pre-test and post-test.

3. Results

Based on the research that has been done, the largest distribution of respondents' age is between the ages of 45 - 54 years, which is 12 people (57.1%). Followed by respondents aged 55 - 64 years as many as 7 people (33.4%), and as many as 2 people (9.5%) were respondents aged less than 45 years.

3.1. Result of breath frequency statistical test

Based on the measurement of the frequency of breath of respondents at Sentra Mebel Kemirahan Malang, before and after using the N95 mask are:

TABLE 1: Statistical test results of breath frequency before and after using the N95 mask.

Variable	*N*	Mean	SD	P-value
Pre-test	21	2.43	0.507	0.000
Post-test	21	1.57	0.507	

Source: Author's own work.

The results of the Pre Test and Post Test of the respondent's breathing frequency before and after using the N95 mask, obtained that the P Value is 0.000 ($P \leq 0.005$, which means significant).

3.2. Cough statistical test results

Based on the measurement of cough intensity on respondents at Sentra Mebel Kemirahan Malang, before and after using the N95 mask are:

Table 2: Cough statistical test results before and after using the N95 mask.

Variable	*N*	Mean	SD	P-value
Pre-test	21	1.86	0.910	0.001
Post-test	21	1.24	0.539	

Source: Author's own work.

The results of the Pre Test and Post Test of the cough intensity of the respondents before and after using the N95 mask, obtained that the P value is 0.001 ($P \leq 0.005$, which means significant).

3.3. Chest pain statistical test results

Based on the measurement of chest pain using the Visual Analog Scale (VAS) for respondents at Sentra Mebel Kemirahan Malang, before and after using the N95 mask are:

Table 3: Statistical test results for chest pain before and after using the N95 mask.

Variable	*N*	Mean	SD	P-value
Pre-test	21	2.69	1,239	0,000
Post-test	21	0.81	0.782	

Source: Author's own work.

The results of the Pre Test and Post Test for chest pain using the Visual Analog Scale (VAS) on respondents before and after using the N95 mask, obtained that the P Value is 0.000 ($P \leq 0.005$, which means significant).

4. Discussion

4.1. General description

It is known that the age distribution of workers between 45 - 54 years is 12 people (57.1%), 7 people aged 55 - 64 years (33.4%), and 2 people <45 years old (9.5%). The increasing age of a person will affect the tissues in the body, including the function of the decreased elasticity of the lungs. In line with the relationship between age and lung function disorders in furniture workers in Sragen. A total of 28 workers aged over 40

years, 21 of them (75%) had abnormal lung function [9]. People aged 30-40 years will experience a decrease in lung capacity on average. This is caused by a decrease in the body's biological abilities due to aging cells with age.

4.2. Respondent subjective respiratory symptom

4.2.1. Chest tightness

From the pre-test results, it was found that 12 respondents had a breath frequency of 18-23x per minute and 9 people with a breath rate> 23x per minute. The results showed that the breath frequency of workers who did not use PPE masks while working chopping wood was quite high, with an average of 22.5 times per minute, with normal adult breathing frequencies around 12-17 times per minute (Mutaqqin, 2008: 40). Like research vital capacity of the lungs of furniture workers at UD Putra Kusuma Jati 10 out of 18 workers show symptoms of clinical abnormalities, in the form of increased breathing effort due to exposure to dust, are workers who are not used to wearing Personal Protective Equipment (PPE) in the form of masks [6]. Research on Jati Berkah furniture workers in Jambi City shows that 61.5% of workers who do not use PPE experience respiratory problems, while 80% of workers who use PPE do not experience respiratory problems [10]. This also results in an increase in the frequency of breath of a person who inhales the dust continuously

4.2.2. Cough

Coughing is a reflex response from the body when there is irritation in the airways. Dust that enters the respiratory tract will cause a cough reflex. The results of the cough intensity pre-test showed that 9 people did not cough and 12 coughed while cutting wood. With details of 7 people coughing between 1-2 times, 4 people coughing between 3-5 times, and 1 person coughing more than 5 times. This is the same as the complaints of shortness of breath felt by 25% of informal sector furniture workers in Tasikmalaya [3] especially those who don't use PPE. That there is a relationship between the habit of wearing masks and the incidence of cough experienced by furniture workers in Pasuruan. 34% of workers who rarely wear masks during work experience severe coughs by 7% and moderate coughs by 27% [11].

4.2.3. Chest pain

Most of them feel difficulty when doing deep inspiration and feel uncomfortable sensations in the chest while working. The average pre-test results conducted by researchers showed a value of 2.71 cm or can be categorized as a scale of 2 (2-4 cm), with details:

Table 4: Distribution of VAS points of respondents before being given an N95 mask.

No. of respondents	VAS point (cm)
1	4
2	3
3	3
4	4
5	1
6	1.5
7	2
8	4
9	2
10	4
11	2
12	3
13	2
14	5
15	1.5
16	1
17	1
18	4
19	4
20	3
21	1.5
	$\sum$ = 2.71

The pre-test results were obtained after the respondents worked for 30 minutes in the cutting section. Because according to most respondents, the feeling of discomfort in the chest and the process of breathing occurs about 30-45 minutes after cutting wood. For example, Jati Berkah furniture workers in Jambi City, 61.5% of workers who do not use PPE experience respiratory problems, including working in the wood cutting division [10].

4.3. After given the N95 mask

4.3.1. Chest tightness

With the provision of N95 masks to respondents, the average respiratory frequency of respondents from 22.5 times per minute decreased to 18.95 times per minute. This is supported by a statement stating that the feeling of tightness, which in this case is due to an increase in the frequency of breath experienced by the respondent, can be prevented by avoiding the irritant (wood dust). And one way to avoid this is to wear an N95 mask. N95 mask which can filter 95% dust which is 0.1-0.3 micron in size [11].

Ichsani's research (2015) illustrates that if there are no split stone processing workers, the value of Forced Vital Capacity (FVC) is abnormal. Meanwhile 45.5% of workers who do not wear masks while working have an abnormal FVC. This happens because the dust that workers continue to inhale affects their airways.

4.3.2. Cough

Giving N95 masks to respondents caused a change in the cough scale. The cough scale used by researchers was the cough scale as follows: 1) Scale 1: no cough, 2) Scale 2: slight cough (1-2 times), 3) Scale 3: moderate cough (3-5 times), 4) Scale 4: severe cough (> 5 times).

There was a change from scale 2 (1.85) to scale 1 (1.23), with details:

In a similar study, the use of masks can reduce pharyngitis symptoms in mining workers exposed to sulphur gas in Ijen Crater Banyuwangi. 23% of respondents (5 people) got a score of 1 with a severity of 4% -6%, while 77% of respondents (17 people) got a score of 2 with a severity of 10% -12%. The significance test carried out by the study was 0.00 ($p < 0.05$), so it means that by using a mask, there is a decrease in pharyngitis symptoms in workers exposed to sulphur gas in Ijen Crater Banyuwangi [13].

4.3.3. Chest pain

The test results after being given an N95 mask were that the average value of chest pain felt by respondents changed. The scale of discomfort the researchers used were: 1) Scale 1) (0-2 cm): no sensation, 2) Scale 2 (2-4 cm): uncomfortable, 3) Scale 3 (4-6 cm): unpleasant, 4) Scale 4 (6-8 cm): very unpleasant, 5) Scale 5 (8-10 cm): unbearable sensation.

The change in value after giving the N95 mask is at 0.8 cm (scale 1) with details:

Table 5: Distribution of cough severity scale of research respondents.

No. of respondents	Pre-test (Scale)	Post-test (Scale)
1	3	2
2	2	1
3	2	1
4	3	2
5	1	1
6	1	1
7	1	1
8	3	1
9	1	1
10	3	2
11	1	1
12	2	1
13	2	1
14	4	3
15	1	1
16	1	1
17	1	1
18	2	1
19	2	1
20	2	1
21	1	1

This means that the value of the respondent's chest pain decreased by 1.91 cm, from the previous 2.71 cm (scale 2). Similar to research in Beijing, which shows that the number of health workers who are already wearing N95 masks continuously was found to be less (7.2%) symptoms of Clinical Respiratory Illness (CRI) arise than the number of workers who do not use N95 masks continuously (17%) [14].

4.4. Analysis of the effect of giving N95 masks on subjective complaints of respiratory symptom

Personal protective equipment (PPE) is a device that has the ability to protect a person in work which functions to isolate workers from hazards in the workplace. Protection of workers through technical efforts to secure work premises, equipment and environment needs attention. In fact, the use of personal protective equipment for masks also has an impact on the lung capacity of rice mill workers in Sidrap Regency, with p = 0.038 for the use of PPE [15]. This is the same as the relationship between length of work and use PPE with the vital lung capacity (VC) of gold miners in the mining area of the

Table 6: Distribution of VAS points of respondents after being given an N95 mask.

No. of respondents	VAS point (cm)
1	2
2	1
3	1
4	2
5	0
6	0.5
7	1
8	1
9	0
10	1
11	0
12	0.5
13	0.5
14	1
15	0
16	0
17	0
18	2.5
19	2
20	0.8
21	0
	$\sum$ = 0.8

Tatelu. The relationship between the use of PPE and the value of Vital Lung Capacity (VC) of workers shows that there is a relationship (p value = 0.021 <0.05) [16]. The habit of using a mask will reduce exposure to dust in the lungs, and the tool functions as a filter for respiratory air, so that lung disorders can be inhibited.

The choice of the N95 mask compared to other masks is because the N95 mask itself has become a recommendation for personal protective equipment from NIOSH and OSHA [8]. Like a study comparing the effectiveness of surgical masks, ordinary cloth masks and N95 masks in warding off dust measuring 1.6 microns. The result is the N95 mask can ward off 89.6% [17]. The effectiveness of the N95 mask causes the cough intensity scale on the post-test to drop.

Chest pain also does not directly indicate a disease in the body, but can be an indicator if there are problems in the respiratory tract. In the respiratory tract, the incoming dust can settle around the respiratory walls. This can lead to narrowing of the airways, where the response of the narrowing of the airways is one of them is pain in the chest when breathing [7]. By using the N95 mask in the right way, it can block

the dust that will be inhaled by the workers' noses. By dissipating dust, the factors that cause deposits on the respiratory wall can be avoided. So that the airway of the workers does not narrow due to sediment and workers will no longer feel chest pain due to the dust in the inhaled air.

5. Conclusion

Based on the results of the research and data analysis on the test results of measuring respiratory frequency, cough intensity, and chest pain using the Visual Analog Scale (VAS) method before and after being given the N95 mask, it can be concluded that there is an effect of using N95 masks on respiratory symptom of furniture workers cutting section at Sentra Mebel Kemirahan Malang. Workers are expected to wear personal protective equipment (PPE) masks while working, so that complaints of respiratory problems can be reduced and do not endanger health in the long term. It is hoped that this research can become a reference for conducting further research with the addition of variables and several other factors, such as the time period and the amount of dust that furniture workers may inhale and the variable working period. In addition, variables and instruments can also be developed, such as using Spirometry, Dust Sampler Meter.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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