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The Effect of the Use of Respirators for Decreasing the Subjective Symptoms Disorders in the Center Nerve System in Digital Printing Printing Workers in Medan City

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Abstract:
Workers who are exposed to evaporated organic compound from printing in the long term will have the risk for subjective symptom of central nervous system disorder in which it is the main entrance to the body through inhalation process. Workers in the production unit will have the most dominant risk for it. The objective of the research was to analyze the influence of using respirator on subjective symptom of central nervous system disorder in worker who work at digital printing industry. The research used one group pretest-posttest design. The samples were workers, taken by using purposive sampling technique. Bivariate analysis used paired t-test at the significance level of 95% (a=0.05). The result of the research showed that p-value = 0.0001 (p<0.05) which indicated that there was significant difference in the scores of Q16 questionnaires between pre and post intervention. The result of Q16 questionnaire in Swedish version showed that 20 respondents (100%) had difficulty breathing and 20 respondents (100%) had headache at least once a week. In the post-intervention with using respirators in one month, there was no complaint anymore. Respirator is equipped with organic vapor cartridge which is able to absorb gas from contaminated air before it enters the workers' respiratory system. Using respirator as a personal protective device influences the decrease in subjective symptom of central nervous system disorder in printing workers. Using filter, cartridge, or tube in respirator should be done accurately otherwise it will cause danger for the workers.
Keywords:
health risk; printing; organic solvent

I. Introduction

Othman, et.al (2017) found that there are hazardous chemicals in printing raw materials, mainly derived from the categories of pigments, solvents and additives. The solvent was identified as the substance with the highest percentage containing hazardous chemicals found in printing inks, followed by additives and pigments. The results showed that production workers in the digital printing production process were very vulnerable to danger.

Another chemical that is no less dangerous to a solvent is toluene. Generally about 75% of these substances are widely used during the production process in printing. Generally the toluene enters the body of the worker through the process of breathing (ATSDR, 2017). Health problems often experienced by workers due to exposure to toluene in the form of dizziness, vertigo, eye irritation, skin irritation, respiratory problems, liver, kidney and Central Nervous System (Agency for Toxic Substance and Disease Registry, 2017).

Rusdi's research (2012) on paint manufacturing workers at PT. X, found that neurotoxic symptoms and some behavioral changes occurred in low-level xylene exposure. The most common acute symptoms found in printing workers are dizziness, drowsiness, eye irritation, mild

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dizziness, and rhinitis, shortness of breathing, coughing, chest tightness, nausea /vomiting, exacerbation of asthma, allergic skin reactions, and vision problems. The prevalence of symptoms is consistently higher among workers in the printing process compared to other workers (Decharat, 2014).

Agbenorku, et al. (2012) found that the three most common illnesses in printing industry workers in Ghana were allergic dermatitis (58.5%), asthma (13.0%) and hypertension 13%. While Amin (2016) found that the most common diseases found in printing industry workers in Dakha City were gastritis (21.73%), various types of skin diseases (15.65%), high blood pressure (16.52%), irritation eye (32.80%), cough (30.40%), joint pain (28%), muscle weakness (18.80%), etc. In addition, workers also suffer various injuries due to lack of proper safety training and protective clothing. Workers do not understand the proper medical facilities. Workers have been suffering from the above disease for years without realizing that the disease is an effect of their work.

II. Research Method

2.1 Central Nervous System

The nervous system is a group of nerve cells, or neurons. These cells are cells with a long branching process (nerve fibers) that can transmit nerve impulses (Cambridge Communication Limited, 1998). The nervous system consists of the brain, spinal cord and peripheral nerves. The brain is divided into three major parts, namely the cerebrum, brain stem and cerebellum. These parts have the responsibility to regulate and coordinate the activities of the body's cells through electronic impulses. The journey of these impulses takes place through nerve fibers and fibers directly and continuously. Changes in electrical potential produce a response that will transmit signals (Batticaca, 2008).

The human nervous system has a complex structure with a variety of different and mutually influencing functions. If there is a disruption in one nerve function, physiologically it will affect other bodily functions. The central nervous system consists of the brain and spinal cord. Based on the function of the CNS is divided into three major parts, namely: the upper brain (cerebral cortex), lower brain (basal ganglia, thalamus, hypothalamus, brain stem, medulla oblongata, cerebellum) and spinal cord (Tarwoto, 2013).

2.2 Hazardous Chemicals Generated in the Printing Industry

One of the printing inks that are widely used in printing industries to print banners, banners, billboards, neonbox, stickers or other outdoor material is solvent ink. This type of ink has the best resistance because the print is more durable and resistant to water and UV rays, therefore it is widely used for outdoor printing. Solvent is a chemical that is useful for dissolving or diluting other chemicals. Commonly used solvents include trichlorethylene, perchlorethylene, methyl ethyl ketone, 1, 1, 1-trichlorethhane, n-hexane, toluene, xylene, and solvent mixtures such as mineral spirits and stoddart solvent. This solvent is very dangerous for health. The chemicals contained in solvent inks can be evaporated and absorbed into the worker's body through inhalation, ingestion and direct contact through the skin (Xiao and Levin, 2000).

The entire printing process, which includes input materials in terms of raw materials, energy, and water consumption, as well as the production of semi-finished products, contributes to the creation of waste. Each printing technique presents dispersed and permanent environmental pollutants with certain waste flow characteristics. Classification of pollutants produced in the printing industry is done through solid objects (broken plates, waste film and

paper developed, empty containers and cans), liquids (waste paints, cleaning solutions, film forming chemicals, acids, alkalis, and metals such as silver, iron, copper, and chromium) and waste gas (Volatile Organic Compounds / VOCs) (volatile organic compounds) emitted mainly using cleaning agents, inks, alcohols and other solutions to reduce printing plates, nitrogen dioxide, ammonia, carbon monoxide, carbon dioxide, non-methane hydrocarbons, etc.(Prica, et.al, 2016).

2.3 Respirator masks

Respirator masks are personal protective equipment specifically designed to protect users from inhalation of substances that can harm health. Respirator masks can help protect the wearer such as dust, smoke, vapors, harmful gases and other harmful particles found in the work environment and may enter the body through inhalation. This mask is commonly used by industrial, military, automotive or general public workers who understand the dangers of unsterile air in the surrounding environment. In general there are 2 types of safety masks, namely masks that can only be used once and masks that can be used repeatedly because they are equipped with cartridges that can be filled when carbon is used up (Occupational Safety and Health Administration [OSHA], 2002).

A respirator is a device used to reduce workers' exposure to respiratory hazards, such as smoke, fog, gas, steam or dangerous dust, because they are considered to provide effective and relatively inexpensive protection while preferred techniques, such as total cover, cannot be applied or are considered expensive (Howie, 2005; Cal/ OSHA, 2005). Respirators are also used to protect workers from oxygen-deprived atmospheres. An oxygen-deficient atmosphere is defined as having an oxygen content of less than 19.5 percent (Cal/ OSHA, 2005).

A respirator mask can be a tight-fitting mask that covers half the face, covers the mouth and nose or can also be a full face covering that covers the face from the hairline to the bottom of the chin. In addition to tigh-fitting, there are also loose-fitting masks in the form of hoods or helmets that cover the head completely (OSHA, 2002).

The main limitation of respiratory protective equipment is that anticipated protection will only be achieved if the equipment is worn properly. In addition, the performance of respiratory protection equipment in the workplace is generally far worse than recommended by the manufacturer's standards or literature. Respiratory protection equipment should be used only as a component of the overall prevention and control program. Hazards in the air must be controlled by replacing hazardous substances with safer substances, total covers, etc., not with respiratory protective equipment. In any situation, a "hierarchy of control" for personal prevention, control and protection must be applied (Howie, 2005).

Tabel 1. Code of Respirator

Code of Respirator	Explanation
(F)	Masks that cover the entire face (with the appropriate cartridge and filter)
AG	Acid Gas Respirator
AM	Ammonia / Methylamine Respirator
FORM	Formaldehyde Respirator
HF	Hydrogen Fluoride Respirator
Hg	Mercury Vapor Respirator
MG	Multi-gas / Vapor Respirator
N100	N100 Particulate Respirator

Code of Respirator	Explanation
N95	N95 Particulate Respirator
OV	Organic Vapor Respirator
OZ	Ozone Respirator
P100	P100 Particulate Respirator
P95	P95 Particulate Respirator
R95	R95 Particulate Respirator
SA	Supplied Air Respirator
SA(F)	Air respirators are provided with full face covers, helmets, loose hoods or covers, or half covers with proper eye protection

Source: Dawson Compliance (2015)

2.4 Swedish Version Q16 Questionnaire

This questionnaire was developed to monitor the effects on the central nervous system among workers exposed to organic solvents, and has also been successfully used to screen workers who are exposed to other neurotoxic agents. This questionnaire contains 16 short questions with yes or no as alternative responses to symptoms that are generally explained by workers exposed to organic solvents. Questionnaire Q16 cannot be used for screening patients with chronic toxic encephalopathy in groups without continuing exposure to organic solvents. It is recommended that people with more than six symptoms or answer yes in Q16 should be referred for further medical and psychiatric examination (Lunberg, et.al, 1997).

Ihrig, et.al (2001) modified Q16 to 18 questions, which became known as the German Q18 questionnaire. In Q18 there are 13 questions that are the same as Q16. Based on the results of Ihrig's (2001) study, it was concluded that the German Q18 questionnaire was a questionnaire used as a sensitive and reliable screening tool for complaints caused by exposure to organic solvents, but was not reliable enough for individual diagnoses (Ihrig, et.al. 2001).

The Swedish version of Q16 Questionnaire has 16 questions with yes and no answer choices, including: do you often experience abnormally tired; have you ever experienced a palpitating heart even when you were not forcing yourself; do you often feel tingling or painful numbness in some parts of your body; do you often feel annoyed / emotional for no reason; do you often feel depressed for no reason; do you have problems with concentration; do you often forget what just happened; do you often sweat for no apparent reason; do you feel difficulty when pressing buttons or putting on buttons; do you often find it difficult to understand the contents of newspapers and books; did your relatives ever tell you that you have a short / forgetful memory; Have you ever felt a feeling of tightness in the chest; do you often have to make notes about what you must remember; do you often have to go back and check the things you have done such as turning off the stove, locking the door, do you experience headaches at least once a week and whether your sexuality desires are less than normal. Based on research by Lunberg, et.al (1997), it was found that people with six or more symptoms were suspected of having central nervous system disorders and had to be referred for further medical and psychiatric examinations (Lunberg, et.al, 1997).

III. Research Method

In this study, the research method used was a quasi-experimental with One Group Pretest-Postest Design. In this study the results of the treatment can be known to be more accurate, because it can compare with the conditions before being given treatment (Sugiyono,

2014).

The One Group Pretest-Posttest Design research paradigm is described as follows:

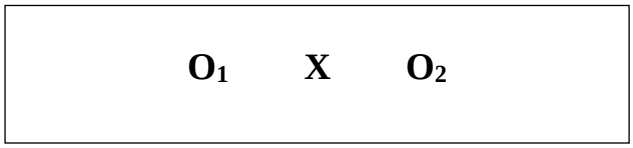

***Figure 1.** One group pretest-posttest design*

Where:
O_1 : Initial measurement of subjective symptoms of CNS disorders before being treated
O_2 : Final measurement of subjective symptoms of CNS disorders after treatment
X : Provision of treatment using respirator masks

The study was conducted in several printing in the city of Medan. The reasons for the researchers choosing the location as a place of research are:
1. Orders for printing banners in printing very much because many small businesses that make banners and the like to the printing press.
2. Printing starts operating from 08.00 - 23.00 WIB which is divided into two shifts.

Minimum sample sizes taken in this study according to Dahlan (2013) are:

$$n = \left\{\left[\frac{(Z\alpha + Z\beta)S}{x1\text{-}x2}\right]\right\}^2$$

Where:
Zα = 5% confidence level (1.96)
Zβ = type II error, where β value is 20% (0.842)
S = Standard deviation combined from previous studies = 2,347
X1 - X2 = Minimum difference in mean that is considered meaningful

The value of the standard deviation combined with previous research was obtained from the research of Yudhani (2017). Based on the calculation results obtained S = 2,347. So, the calculation of the sample size in this study as follows:

$$n = \left\{\left[\frac{(Z\alpha + Z\beta)S}{x1\text{-}x2}\right]\right\}^2$$

$$n = \left\{\frac{(1{,}96 + 0{,}842\ )2{,}347}{2}\right\}^2$$

$$n = \{3{,}289\}^2$$

$$n = 10{,}82$$

Based on the above calculation, the sample size in this study were 11 people, but to anticipate the loss of sample such as the sample experiencing illness or resigning, the sample in this study was selected as many as 20 people. Operational definitions in this study can be seen in the following table:

Tabel 2. Variables, Operational Definitions, Measuring Instruments, Measurement Results and Measurement Scales

Variables	Operational Definitions	Measuring Instruments	Measurement Results	Measurement Scales
Independent Variable				
Respirator mask	Safety equipment specifically designed to protect the wearer from inhaling anything that can endanger health such as steam and other hazardous chemicals that may be found in the work environment sourced from printing inks and solvents in the printing industry	Observation sheet	Yes No	Nominal
Dependent Variable				
Subjective symptoms of CNS disorders	Symptoms that occur due to exposure to hazardous chemicals contained in printing inks and solvents in the printing industry.	The Swedish Q16 Questionnaire that has 16 questions.	Score: No = 0 Yes = 1 Minimum Score is 0 and Maximum Score is 16 with cutoff point score is 6	Interval

The measurement of the dependent variable is based on the respondents' subjective complaints. Conducted with interviews using the Swedish Q16 Questionnaire as a tool introduced by Lunberg, et.al (1997). The questionnaire contained 16 short questions with yes or no answers to symptoms that are usually explained by workers exposed to solvents. If the respondent answers there will be no value of zero and if yes is worth one. The maximum score on this variable is 16 and the minimum score is 0 (zero). Positive respondent experienced subjective symptoms of CNS disorders if they answered "yes" by 6 or more questions (score ≥ 6).

Understanding of the questions on the Q16 questionnaire was investigated by doctors, psychologists and workers. Reliability was studied by validity retesting procedures and was evaluated by Lunberg, et.al (1997). Questionnaire Q16 has been widely used in previous studies, so that in this study the Q16 questionnaire was not tested again. The analysis plan used in this study includes:

Univariate Analysis

This analysis aims to look at the frequency distribution in categorical data such as respondents who experience subjective symptoms of CNS disorders and the absence of ventilation in the workspace. While numerical data such as age, years of service, subjective symptoms score of CNS disorders and duration of work will be seen the mean, standard deviation, 95% CI For Mean and minimum and maximum values

Bivariate Analysis

Bivariate analysis is performed to determine whether there is a relationship between two independent variables with the dependent variable. Paired T-Test was used to determine differences in subjective symptoms of CNS disorders in respondents before and after the intervention, because the data in this study were normally distributed.

IV. Discussion

Based on the characteristics of respondents obtained data that the average age of workers is 29.40 years with the youngest age of 20 years and the oldest 45 years. Based on the work period, it is obtained data that the average worker has worked for 3.6 years with a minimum service period of 1 year and a maximum of 11 years. Based on the length of work per day, the average worker in a day works for 9, 10 hours with a minimum of 8 hours and a maximum of 12 hours. Respondent characteristics in the form of employee data distribution based on age, years of service and length of work per day are presented in table 4 below:

Table 3. Data Distribution of Workers by Age, Working Period and Length of Work per Day

Characteristic n=20	Mean ± SD	95% CI	Min-Max
Age	29,40 ± 7,983	25,66-33,14	20-45
Work	3,60 ± 2,3688	2,365-4,835	1-11
Work time in a day	9,10 ± 1,294	8,49-9,71	8-12

Distribution of room ventilation data. Based on the results of monitoring during the study it was found that the six printing production rooms where respondents worked had inadequate ventilation. The production room has a vent with a size of approximately 40 x 40 cm, and is rarely opened, but there is also a printing company that has a fan as much as one production room.

Symptoms of subjective CNS disorders. Based on the results of the Swedish version of the Q16 questionnaire obtained data that before the intervention was carried out it was known as many as 20 people (100%) workers had experienced tightness in the chest and experienced headaches at least once a week, but after intervening the use of respirators in workers for 4 weeks when work was obtained the result was that no more workers complained of tightness in the chest and headaches. The most common CNS symptoms were complained by workers who often felt painful tingling or numbness in various parts of the body and had problems concentrating as many as 12 people (60%) after the intervention was carried out symptoms had problems with concentration reduced to 3 people (15 %) and symptoms have problems with concentration reduced to 11 people (55%). The next biggest complaint is often forgetting what has just happened. Before the intervention the results were as many as 10 people (50%) workers who experienced the complaint and after the intervention was implemented decreased to 8 people (40%). Distribution of the complete results of each Swedish Question Q16 questionnaire answered by the respondent can be seen in the following table:

Table 4. Distribution of Questioner Result Q16 Version Swedia Before and After Using Intervention

Question	Before Intervention		After Intervention	
	Yes	No	Yes	No
	n (%)	n (%)	n (%)	n (%)
Do you often experience fatigue abnormally	7 (35)	13 (65)	4 (20)	16 (80)
Have you ever experienced a palpitating heart even when you were not forcing yourself?	5 (25)	15 (15)	4 (20)	16 (80)
Do you often feel tingling or painful numbness in some parts of your body?	12 (60)	8 (40)	3 (15)	17 (85)
Do you often feel upset / emotion without a certain reason?	1 (5)	19 (95)	0 (00)	20 (100)
Do you often feel depressed for no reason?	1 (5)	19 (95)	1 (5)	19 (95)
Do you have problems with concentration?	12 (60)	8 (40)	11 (55)	9 (45)
Do you often forget the events that just happened?	10 (50)	10 (50)	8 (40)	12 (60)
Do you often sweat for no apparent reason?	3 (15)	17 (85)	3 (15)	17 (85)
Do you feel difficulty when pressing buttons or putting on buttons?	0 (00)	20 (100)	0 (00)	20 (100)
Do often find it difficult to understand the contents of newspapers and books?	6 (30)	14 (70)	5 (25)	15 (75)
Have your relatives ever told you that you have a short / forgetful memory?	9 (45)	14 (55)	8 (40)	12 (60)
Have you ever felt a feeling of tightness in the chest?	20 (100)	0 (00)	0 (00)	20 (100)
Do you often have to make notes about what you have to remember?	2 (10)	18 (90)	2 (10)	18 (90)
Do you often have to go back and check things you have done such as turning off the stove, locking the door, etc?	8 (40)	12 (60)	6 (30)	14 (70)
Do you experience headaches at least once a week?	20 (100)	0 (00)	0 (00)	20 (100)
Are your sexuality desires less than usual?	0 (00)	20 (100)	0 (00)	20 (100)

Symptoms of CNS system disorders occur in respondents if the respondent answers "yes" as many as 6 questions or more on the Swedish Version Q16 questionnaire. Based on the results of the study respondents who indicated experiencing symptoms of CNS system disorders (Q16 score ≥ 6) before the intervention of the use of respirators were 11 people (55%) and after the intervention was implemented decreased to 1 person (5%). Data Distribution of Workers Who Have CNS Disorders Based on Questionnaire Q16 With a Score ≥ 6 Before and After Intervention can be seen in the following table 6:

Table 5. Data Distribution of Workers Who Have CNS Disorders Based on Questionnaire Q16 before and After Intervention

Symptoms of CNS Disorders (Score Q16 ≥ 6)	Before Intervention		After Intervention	
	N	%	n	%
YES	11	55	1	5
NO	9	45	19	95
TOTAL	20	100	20	100

From the results of the study obtained the average score of the Swedish version of the Q16 questionnaire answered by respondents before the intervention was 5.80, after the intervention using respirator, the mean score decreased to 2.75. Before the intervention obtained complaints or a minimum score of 3 and a maximum of 9, but after the intervention was applied the minimum score decreased to 0 and the maximum score decreased to 6. Based on the results of the analysis with the Paired T-Test, a significance figure of 0.0001 was obtained. In relation to the value of ϱ <0.05, it can be concluded that there are significant differences in the Q16 questionnaire scores before and after the intervention. After using respirator for 1 month of work, there was a decrease in the Q16 questionnaire score on the respondents. The results of the analysis of the differences in the Q16 questionnaire scores to respondents can be seen in the following table 7.

Table 6. Results of Analysis of Paired T-Test Tests on Q16 Questionnaire Scores before and After Intervention

Questionnaire Score Q16	Mean ± SD	95% CI	Min-Max	ϱ
Score Before Intervention	5,80 ± 1,508	5,09-6,51	3-9	0,0001
Score After Intervention	2,75 ± 1,650	1,98-3,52	0-6	
Δ gain score pre and post	3.05 ± 1,234	2.47-3.63	2-7	

In this study, before the intervention was conducted, respondents were found with a questionnaire score Q16 ≥ 6, as many as 11 people (55%), this indicates that the respondent was indicated to experience symptoms of CNS system disorders. The mean score indicates a score of 5.80 with a minimum score of 3 and a maximum of 9. The Hassan, et.al (2013) study also showed that the results of the neuropsychological symptom score (Q22) revealed that 63.04% of solvents exposed to paint factory workers had neuropsychological symptoms, compared with only about 2.1% in the control group and the difference was statistically significant. Regarding the relationship between the type of work performed and the results of the neuropsychological symptom score (Q22) there is an increased risk for neuropsychological symptoms in the production group rather than the packing group and for the duration of work the risk is increased in workers with a duration of more than 15 years.

Work-related exposure to organic solvents generally occurs through inhalation. Organic solvents absorbed in the human body can affect tissues, such as the brain and nerve tissue, because they have lipophilic character. Long-term exposure to low-dose organic solvents can cause cognitive decline such as impaired concentration and memory disorders; affective disorders including anxiety, fatigue and depression; and movement disorders. This is called a symptom of chronic toxic encephalopathy (Seo & Kim, 2018). This is in accordance with the results of the study, before the use of respirator intervention found as many as 7 people (35%) of respondents who were experiencing fatigue abnormally and there were also found respondents as many as 1 person (5%) often felt depressed for no reason.

Most groups of organic carbon compounds are solvent substances that are widely used in general printing. This compound is easily liquid at a temperature of 0-250o and volatile, causing air pollution. The nervous system is the most common target organ of the effects of this compound. Damage to the nervous system is the effect of exposure to these compounds (Silaban, 2017). Some aromatic hydrocarbon solvents that are very dangerous to the CNS include benzene, toluene (methylbenzene) and xylene (xylol and diamethylbenzene) (Williams & Burson, 1985).

An acute effect due to exposure of aromatic hydrocarbon compounds such as benzene, toluene and xylene to health in general is the occurrence of CNS disorders. The symptoms of CNS disorders include: nausea, vomiting, dizziness and headaches. Exposure to high concentrations can cause symptoms such as disorders of blood pressure, weakness, headaches, tremors, vertigo, vomiting, lack of fluids (dehydration), sudden dizziness (Smith, 2010), dizziness can develop into unconsciousness, seizures, and death . Eye, nose and throat irritation can also occur (Dick, 2006). Chronic effects due to exposure to benzene, toluene, and xylene can result in damage to organ systems including: the nervous system, respiratory system, reproductive and endocrine systems, and can damage the organs of the kidneys, liver and skin (Smith, 2010; Indrawan & Oginawati, 2014).

The type of respirator used in this study is respirator with air purifiers. This respirator is able to prevent the entry of organic solvents into the worker's body by capturing contaminants in the air when passing through the filter element so that air entering the respiratory tract of workers is expected to be cleaner. The mask is equipped with an organic vapor cartridge type. The use of respirators is adjusted based on the type of danger being faced. The selection of filters, cartridges or tubes in the respirator must be done properly, if not suitable can cause fatality for workers. Cartridges generally use sorbents to filter out gas / vapor molecules in the air. The workings of the cartridge are binding gas or steam that passes through the sorbent on its surface, both physically or chemically (absorbed) so that the inhaled air becomes cleaner (NIOSH, 2012).

The use of respirators is applied to printing workers for 4 weeks. During the use of a respirator, workers often feel uncomfortable using it, because vision and mobility become limited. In addition, the face around the respirator often sweats. However, based on the research it was found that there was a decrease in subjective symptoms of CNS disorders in workers. Before the intervention was carried out all workers had experienced tightness in the chest and headaches at least once a week. After 4 weeks of intervention, the feeling of tightness in the chest and headaches in respondents no longer found. The most common CNS symptoms were complained by workers who often felt painful tingling or numbness in various parts of the body and had problems concentrating as many as 12 people (60%) after the intervention was carried out symptoms had problems with concentration reduced to 3 people (15 %) and symptoms have problems with concentration reduced to 11 people (55%).

Based on the Q16 questionnaire score, it was found that respondents who indicated experiencing symptoms of CNS system disturbance (Q16 score $\geq$ 6) before the intervention using respirators were 11 people (55%) and after the intervention was implemented it decreased to 1 person (5%). The mean score answered by respondents was 5.80 with a standard deviation of 1.508. A minimum score of 3 and a maximum score of 9. After the intervention of the use of respirator obtained the average score decreased to 2.75 with a standard deviation of 1.650. A minimum score of 0 and a maximum of 6. From the results of the analysis test using the Paired T-Test, a significance number of 0.0001 was obtained, which means that it could be concluded that there were significant differences in the Q16 questionnaire scores before and after the

intervention.

Organic vapor respirators are very effective for workers in printing, because these respirators are designed with sorbent elements (tubes or cartridges) that absorb steam or gas from contaminated air before the hazardous substances enter the worker's breathing zone (NIOSH, 2012). The gas / vapor is absorbed by the sorbent and stored, the sorbent's ability to absorb depends on the type and surface area. Generally the sorbent's surface area is around 1500 m2 / gram. Gas / vapor that passes through the sorbent will be bound to the surface of the sorbent both physically and chemically which is commonly called absorption. Absorption is the ability of sorbents to bind to molecules of gas / steam either chemically or physically. Usually the physical attachment of the sorbent is weak and can come back. Chemical bonds are usually stronger than physical bonds, for steam / gas usually used activated carbon that has been treated or added with special chemicals so that it is selective for binding certain gases or vapors. Chemical bonds are usually not reversible as are physical bonds. The cartridge and canister have a high absorption ability at the beginning of use and will decrease until the end of the life span (saturation period). The duration of saturation depends greatly on the concentration of vapor or gas in the air and the treatment of the respirator. The canister or cartridge must be replaced before it is saturated, there is no provision set by OSHA for how long the cartridge or canister can be used, but OSHA provides instructions when to replace (HSP, 2011).

V. Conclusion

The most common complaint felt by workers is tightness in the chest that is as many as 20 people and headaches at least once a week as many as 20 people after the intervention using respirator for 1 month of work no more workers who experience the disorder. The use of respirators as personal protective equipment has an effect on decreasing the subjective symptoms of CNS disorders in printing workers

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