

Respiratory Tract Problems among Wood Furniture Manufacturing Factory Workers in the Northeast of Thailand

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ABSTRACT

Background

Wood furniture manufacturing factory workers are at high risk of exposure to wood dust in wood working processes. Wood dust exposure could cause respiratory symptoms, such as reduce lung function, chronic bronchitis, and asthma. The Northeast region of Thailand has many wood furniture manufacturing factories. However, limited studies were carried out to explore the effect of wood dust exposure on workers.

Objective

This study aimed to assess the respiratory symptoms and determine factors associated with these symptoms among wood furniture manufacturing factory workers.

Method

This cross-sectional analytical research used a multistage random sampling to select 511 workers from three provinces in the Northeast of Thailand. The data was collected using a structured questionnaire interview. The content validity of questionnaire was tested by 3 experts and had a Cronbach's alpha coefficient of 0.82. Data were analyzed using descriptive statistics and multiple logistic regressions.

Result

The result indicated that 29.94% of these workers had respiratory symptoms, including coughing(18.79%), nasal secretion (15.66%), and stuffy nose (15.07%). Factors that were significantly associated with respiratory symptoms (p -value<0.05) were (a) not always wearing mask (adjusted OR=2.26;95% CI=1.37-3.72), (b) low to medium level of knowledge on dust prevention (adjusted OR=1.83;95% CI=1.23-2.73) and (c) contacted softwood dust (adjusted OR=1.97;95% CI= 1.06-3.64).

Conclusion

About 30% of wood furniture manufacturing factory workers had respiratory symptoms with related to both personal preventive behaviors and their working environments. Therefore, the raising awareness for using personal protective equipment during work will help them to prevent from various respiratory track problems.

KEY WORDS

Northeast of Thailand, respirable dust, respiratory symptoms, wood dust, wood furniture manufacturing.

INTRODUCTION

Respiratory system is the first tract that was harmed by toxic dust.¹ Prolong occupational exposure to the toxic dust could irritate the respiratory system, damage the lung tissues, create fibrotic tissues and impair lung function (Occupational respiratory diseases) such as asthma, asbestosis, silicosis etc.²⁻⁵ In Thailand, occupational respiratory diseases have been increasing each year.⁶ Wood processing from furniture factory caused wood dust and other health hazards including chemicals, bacteria and mold. The dust are divided into 2 groups according to their size, the first is called "Total dust" which particle are larger than 10 micron (PM₁₀), mainly are soft dust that could enter the upper respiratory tract and excreted by coughing or sneezing,⁷ another type is "Respirable dust" that has particle smaller than 10 micron (PM_{<10}), mainly from hardwood which could enter the lower respiratory tract to alveoli, the disposition of these particles is limited and tends to accumulate in the lung tissues that leads to chronic bronchitis and impairs lung function.^{8,9} Scientific evidences suggested that abnormalities of respiratory system were directly correlated with the type of wood, concentration of wood dust, duration of dust exposure, types of chemical, individual sensitivity, use of personal protective equipments and air ventilation system.¹⁰ Lack of knowledge and incorrect attitude on preventive measures of wood manufacture workers also associated with abnormality of respiratory symptoms such as wood dust allergy which was the leading cause of asthma related to their works.¹¹ The study of these issues in Thailand were limited, this study therefore aimed to assess the respiratory symptoms and determine factors associated with these symptoms of wood furniture manufacturing factory workers which will be schemed for the policy proposed to reduce health risk of workers and improve the working environment for better health of the workers.

METHODS

Recruitment of Subjects: This cross sectional analytical study was conducted among wood furniture manufacturing factory workers in the Northeast of Thailand. The required sample size was estimated using a formula for multiple logistic regressions to identify relationships between multiple independent variables and a dichotomous dependent variable.¹² Multistage random sampling was utilized to select 511 workers from three provinces (Nong Khai, Nakhon Ratchasima, Loei) (fig. 1).

The inclusion criteria for participants were that they were 18-59 years old, working in wood furniture manufacturing factory for > 6 months, could verbally communicated with the researchers, not pregnant, not being prohibited to use spirometer. Data were collected between November 20, 2012 to February 20, 2013.

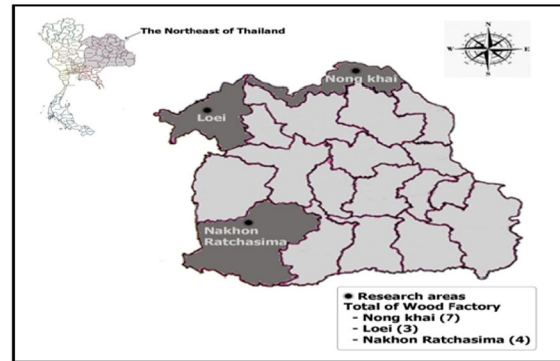


Figure 1. Map of the 3 provinces studied in the Northeast of Thailand.

Research Instruments: The study used a structured questionnaires consisted of 5 parts including (a) individual characteristics and socioeconomics (b) knowledge on wood dust prevention (c) attitude wood dust prevention (d) preventive behaviors during working and (e) the questions related to respiratory symptoms that were adapted from "The society of thoracic diseases of America and Department of Health in Thailand" questionnaire that was modified from the standard version of the American thoracic society division of lung disease questionnaire (ATS-DLD 1978) which considered to be highly reliable,¹³ and have been documented for the field test and widely used in many survey research.¹⁴ Three experts inspected and commented on the draft questionnaire, then revisions were made to improve its validity. This tool was also pre-tested among 30 workers in wood furniture manufacturing factories in Khon Kaen province. Reliability was assessed using Cronbach's alpha, yielding a score of 0.82, which was judged acceptable.

Data Analysis: After data collection, the data were validated, coded and analyzed using the statistical application package STATA version 12. Descriptive statistics were used to examine the characteristics of workers and the prevalence of respiratory symptoms. Associations between independent variables and respiratory symptoms were analyzed using multiple logistic regression analysis to determine the adjusted odds ratio with a 95% confidence interval.

Research Ethics: This study was approved by the ethical committees of research in human, Khon Kaen University (reference no. HE 552153). The research objectives and the right of participants were clearly explained to subjects and the consent form was signed before collecting the data.

RESULTS

Individual characteristics and wood dust exposure history of the study sample:

About half of study subjects were male (50.50%) with an average aged of 37.73±9.79 years old, most of them finished primary education (63.99%). Almost all had never worked

in factory involved with dust (96.08%). However 29.75% were current smokers. Half of study subjects worked in an operation division (dust involved), 40.31% has been working in the wood factory for more than 5 years. The average working hour was 8.00±0.66 a day, 5.78±1.18 days a week. Approximately 73.58% self-reported of exposed with hardwood dust, see (Table 1).

Table 1. Characteristics of Subjects. (n=511)

Characteristics	Number	%
Gender: Male	258	50.50
Age (years)		
< 20	24	4.70
20-30	109	21.33
31-40	148	28.96
41-50	188	36.79
51-59	42	8.22
Mean S.D. = 37.73 9.79 yrs, Median (min, max) = 39 (18, 59) yrs		
Education: Finished primary education	327	63.99
Smoking		
Never	323	63.21
Ever, but current have stopped	36	7.05
Current smokers	152	29.75
Worked in factory involved with dust:	491	96.08
Never		
Duration of experience in working in the wood factory (years)		
Mean S.D. = 37.73 9.79 yrs, Median (min, max) = 39 (18, 59) yrs		
Average working hour per day		
Mean S.D. = 8.00 ± 0.66 hrs, Median (min, max) = 8 (3, 12) hrs		
Average working day per week		
Mean S.D.= 5.78± 1.18 day, Median (min, max) = 6 (1, 7) day		
Wood dust exposure		
Exposed with soft wood dust	436	85.32
Exposed with solid wood dust	376	73.58

Majority of the workers had high level of knowledge related wood dust prevention (52.84 %) which the average scores of 7.49±1.41 (total scores =10), 54.99% had good level of attitude on wood dust prevention with the average scores of 39.67 ±5.78 (total score =50), and 54.01% had middle level of wood dust preventive behaviors with the average scores of 25.36 ± 6.27 (total score = 40) (fig. 2).

Respiratory symptoms of workers in wood furniture factory:

29.94% of wooden furniture factory workers ever had at least one respiratory problem. Respiratory symptoms were coughing (18.79%), followed by having sputum, stuffy nose, breathless, and wheezing (15.66%, 15.07%, 7.83% and 5.09%, respectively) as shown in fig. 3.

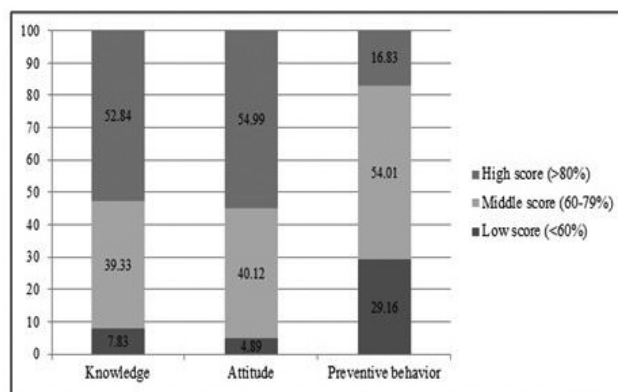


Figure 2. Knowledge, attitude, and dust preventive behavior of workers in wooden furniture factory.

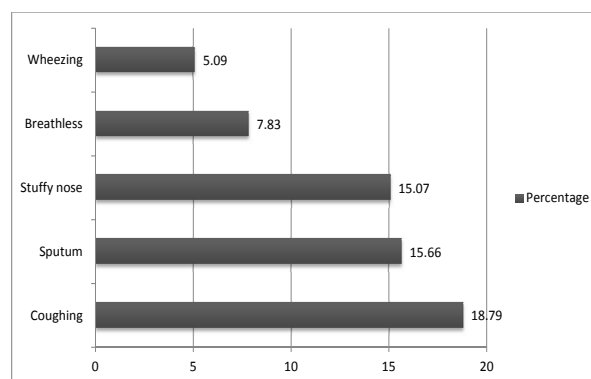


Figure 3. Prevalence with respiratory symptoms of workers in wooden furniture factory .

Table 2. The relationship between factors Associated with respiratory symptoms of workers in wood furniture factory (Binary correlation) (n=511)

Factors	N	Respiratory symptoms (%)	OR	95% CI	p-value
Wearing mask while working					
Always	427	27.40	1	1	0.005
Not always	84	42.86	1.98	1.22 to 3.21	
Softwood exposure					
No contact	75	20.00	1	1	0.044
Contact	436	31.65	1.85	1.02 to 3.38	
Smoking					
No	468	28.42	1	1	
Yes	43	46.51	2.19	1.16 to 4.12	0.015
Air vacuum in factory					
Continuously	415	27.47	1	1	
Not continuously	96	40.63	1.80	1.13 to 2.86	0.012
Knowledge on dust prevention					
High level	241	24.07	1	1	0.006
Low to medium level	270	35.19	1.71	1.16 to 2.52	

Factors associated with respiratory symptoms of workers in wooden furniture factory:

Bivariate analysis was showed that some factors were statistically significant associated with respiratory symptoms. Factors with p-value ≤ 0.25 in the bivariate analysis including were selected as variables for the multivariate modeling process, and the results are given in Table 2.

Multivariate analysis using multiple logistic regression analysis indicated Factors that were significantly associated with respiratory symptoms (p-value <0.05) were 1) not wearing mask (adjusted OR=2.26; 95% CI = 1.37 to 3.72; p-value = 0.001) 2) lower level of knowledge on dust prevention (adjusted OR=1.83; 95% CI = 1.23 to 2.73; p-value = 0.003), and 3) contacted softwood dust (adjusted OR=1.97; 95% CI = 1.06 to 3.64; p-value = 0.030) (Table 3).

Table 3. The relationship between associated factors with respiratory symptoms of workers in wood furniture factory (Multivariate analysis) (n=511)

Factors	N	Respiratory symptoms (%)	Unadjusted		Adjusted*	
			OR	95% CI	OR	95% CI
Wearing mask while working						
Always	427	27.40	1		1	
Not always	84	42.86	1.98	1.22 to 3.21	2.26	1.37 to 3.72
Softwood exposure						
Not contact	75	20.00	1	1	1	
Contact	436	31.65	1.85	1.02 to 3.38	1.97	1.06 to 3.64
Knowledge on dust prevention						
High level	241	24.07	1		1	
Low to medium level	270	35.19	1.71	1.16 to 2.52	1.83	1.23 to 2.73
*Adjusted OR when control of sex, age, duration of exposure and smoking variables						

DISCUSSION

The results indicated that the majority of workers in wood furniture factory were in an operational division, has been working in the present factory for more than 5 years, working for 6 days a week (84.15%) with 8 average working hours a day. These findings were concordant with the study of Anamai Thetkathuek and Tanongsak Yingratanasuk that reported 92.30% of wooden furniture factory in Eastern part of Thailand with the average working hours of 8 hours a day and the Study of Kathawut Deepreecha reported 96.60% of the workers working more than 6 hours a day.^{15,16} This may be explained by the fact that every organization has to follow the Labour Protection Act B.E. 2541 Chapter 2, Section 23 concerning the normal working hour, for not more than 8 hours a day.¹⁷ The prevalence of respiratory

symptoms among workers in wood furniture factory was 29.94%, the highest reported respiratory symptom was coughing (18.79%), followed by having sputum and sneezing (15.66% and 15.07% respectively). The scientific evidence indicated that when dust enter the respiratory tract, it could irritate the mucous membrane which lead to acute respiratory symptoms such as nose-itching, throat irritation, coughing, sneezing, sputum,¹⁸ stuffy/running nose.¹⁹ The study indicated that majority of the workers in wood furniture factory had high level of knowledge and attitude of dust prevention, whereas the overall dust preventive behaviors was at middle level. Individual dust preventive behaviors involved equipment's such as mask which might not available or the workers might not like wearing it especially among those who do not aware of its benefits. This was confirmed by the multivariate analysis results indicated the relationships between not wearing mask while working, low level of knowledge about dust and dust protection, and soft dust exposure with respiratory systems. Factors significantly associated with respiratory symptoms of workers in wood furniture factory were not wearing mask while working (p-value=0.001), low level of knowledge about dust and dust protection (p-value=0.003), and soft dust exposure (p-value=0.030). The woods mostly used in the wood furniture factory were softwood. The study indicated that 85.32% of workers exposed to softwood dust which its particle was larger than 10 micron, therefore when it entered the upper respiratory tract,²⁰ it could cause the respiratory symptoms such as coughing, sputum, sneezing, breathless, shortness of breath. The recommendations to preventing and solving respiratory tract problems among wood furniture manufacturing factory workers should concentrated on reducing dust concentration in the working environment and reduced individual workers exposure to dust. Therefore appropriate preventive measures should be: 1) dust reduction by improving air ventilation in the factory, adequately install and operate dust collectors, cleaning the workplaces and annually air quality monitoring 2) Improve preventive behaviors of the workers by strictly wearing mask when on duty, regularly cleaning their bodies, stop smoking, annual physical checkup and establish responsible body to look after the whole system.

CONCLUSION

The results of this study showed that wood dust induced respiratory symptoms in 30% of the workers in wood furniture factory. The significant factors associated with respiratory symptoms of workers were not wearing mask while working, low level of knowledge about dust and dust protection, and soft dust exposure. So that, the raising awareness for using personal protective equipment during work will help them to prevent from respiratory track problems. Furthermore, the periodic health examination of the workers and improve the working environment with assured quality will reduce the burdens. In addition, it

would be better to conduct future studies which focus on pulmonary function of workers in wood furniture factory and factors associated with decrease the pulmonary function.

Limitation

One important limitation of this study is that it relies on a cross sectional design that does not permit causal inferences from the observed relationships. The findings should therefore be seen as provisional ones that provide a starting point for further research, including cohort studies that are better able to identify causal factors that are

associated with respiratory symptoms of wood furniture manufacturing factory workers.

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