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Respiratory and skin effects of exposure to wood dust from the rubber tree *Hevea brasiliensis*

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ABSTRACT

Objectives: Potential health effects related to wood dust from the rubber tree, which produces natural rubber latex, have not been previously investigated. The main aim of this study was to investigate the relations of rubber tree dust exposure to respiratory and skin symptoms, asthma and lung function.

Methods: A cross-sectional study was conducted among 103 workers (response rate 89%) in a rubber tree furniture factory and 76 office workers (73%) in four factories in Thailand. All participants answered a questionnaire and performed spirometry. Inhalable dust levels were measured in different work areas.

Results: Factory workers showed increased risk of wheezing, nasal symptoms and asthma compared to office workers. There was a dose-dependent increase in wheeze and skin symptoms in relation to dust level. Significantly increased risks of nasal symptoms (adj OR 3.67, 95% CI 1.45 to 9.28) and asthma (8.41, 1.06 to 66.60) were detected in the low exposure category. Workers exposed to ethyl cyanoacrylate glue had significantly increased risk of cough, breathlessness and nasal symptoms. There was dose-dependent reduction in spirometric lung function with wood dust level.

Conclusions: This study provides new evidence that workers exposed to wood dust from the rubber tree experience increased risk of nasal symptoms, wheeze, asthma and skin symptoms and have reduced spirometric lung function. Exposure to cyanoacrylate is related to significantly increased respiratory symptoms. Results suggest that the furniture industry using rubber tree wood should implement appropriate exposure control measures to reduce wood dust exposure and cyanoacrylate glue exposure to protect their employees.

Exposure to wood dust is quite a common experience among working age populations, for example in the European Union 2% of the employed population is occupationally exposed to wood dust.¹ This corresponds to 3.6 million workers. The occupational groups most commonly exposed are construction carpenters and workers in the furniture industry. In the wood furniture industry, the processes of sawing, drilling and sanding release wood dust particles into the air. In addition, the wood furniture industry uses chemicals including thinners, lacquers, glues and wood preservatives. Thus, wood furniture workers are exposed to potentially sensitising and irritant substances.

Case reports, case series and registry-based studies have reported occupational asthma, rhinitis and dermatitis in workers exposed to different types of wood dust.^{2–6} Studies from different industries have linked wood dust exposure to

respiratory and/or skin symptoms and reduced lung function,^{7–13} although not all studies have found significant effects related to wood dust exposure.^{14–15} These health effects are suggested to depend on the species of wood used, with pine, oak, beech and red cedar having been commonly linked to non-malignant effects. The factory studied here manufactured furniture from the rubber tree *Hevea brasiliensis*, which produces natural rubber latex. A PubMed database search did not identify any previous study investigating potential health effects from exposure to wood dust from the rubber tree. Natural rubber latex is a well-known cause of hypersensitivity diseases in health care personnel.¹⁶ The white/yellow latex is found in the latex vessels in the bark of the rubber tree.

The objective of this study was to investigate the relations between exposure to wood dust from the rubber tree and chemicals used in the wood furniture industry, and respiratory and skin symptoms, asthma and lung function. The manufacturing processes of the wood furniture factory are shown in fig 1.

METHODS

Study design

A cross-sectional study was carried out among employees in a wood furniture factory as well as office workers in three other factories in Thailand from September 2006 to January 2007. The participants answered an interviewer-administered questionnaire and performed spirometry. The study was approved by the ethics committee of the Faculty of Public Health, Mahidol University, Thailand.

Study population

Overall, 103 of 116 workers in a wood furniture factory (response rate 89%) participated in the study. These included 90 production line workers, four quality control staff, six maintenance staff and three warehouse workers. The control population consisted of 76 office workers (response rate 73%) from four factories and included 18 from the wood furniture factory, 24 from a milk powder factory, 18 from a microfibre factory and 16 from a tile factory. Office workers were managers, other administrative staff, chauffeurs and security staff at factory gates.

Measurement methods

Dust measurements

Personal sampling of inhalable dust (particles $\leq 10 \mu\text{m}$ in diameter) was conducted in 12 factory and two office workers using the US National

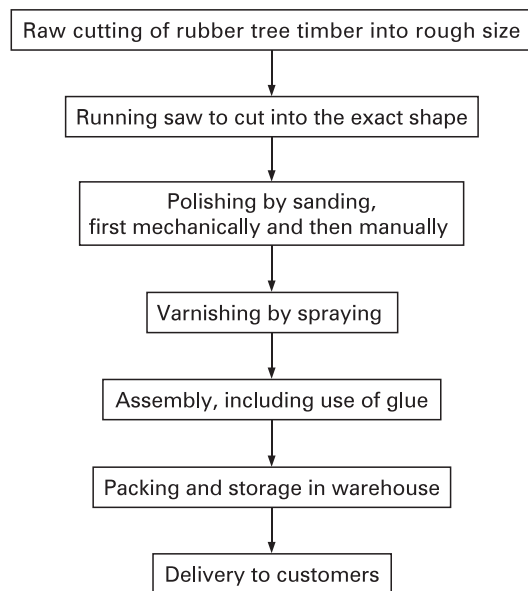


Figure 1 Wood furniture production processes.

Institute of Occupational Safety and Health (NIOSH) method 0600.¹⁷ Measurements were performed on two workers from each factory area, including the raw cutting, running saw, sanding, varnishing, assembly and packing areas, so altogether 14 measurements were performed, and the average concentration of inhalable dust for each area was calculated. SKC Personal Air Sampling Pumps universal model (SKC, Eighty Four, Philadelphia, USA) with glass microfibre filter paper (GF/A 37 mm diameter) were used. Personal pumps were calibrated before sampling. The personal pumps were fixed at the level of the collarbone close to the breathing zone and measurements were carried out during work but not during break times. The duration of sampling was 5–6 h. The concentration of inhalable dust was calculated with the formula:

$$C = \frac{(W_2 - W_1) - (B_2 - B_1)}{V} \times 10^3$$

where C is concentration of inhalable dust (mg/m³), W₁ is weight of the filter before sampling (mg), W₂ is weight of the sample-containing filter after sampling (mg), B₁ is weight of the blank filter before sampling (mg), B₂ is weight of the blank filter after sampling (mg), and V is total volume derived from the average sampling flow rate (2.0 l/min) and the duration of sampling.

Questionnaire

A questionnaire on respiratory health, occupational exposures and lifestyle factors was modified from the Finnish Environment and Asthma Study.^{18–23} It included five sections covering: (1) personal characteristics, (2) health information, including respiratory symptoms and diseases, (3) smoking and exposure to second-hand smoke (SHS) at home and at work, (4) job history and specific occupational exposures, and (5) exposures in the home environment. The questionnaire was translated into Thai and then back-translated into English to ensure the validity of translation.

Lung function

All participants performed spirometry according to the guidelines of the American Thoracic Society²⁴ using a Minato Autospiro PAL spirometer (Minato Medical Sciences, Osaka, Japan). The best forced expiratory volume in 1 s (FEV₁) and forced vital capacity (FVC) out of a minimum of three acceptable forced expirations were used as outcomes. FEV₁ and FVC as percentage (%) of predicted were calculated using predicted values from a healthy Thai population.²⁵

Outcome assessment

The outcomes of interest included the occurrence of respiratory and skin symptoms in the past 12 months and asthma currently and ever. These were defined according to table 1, based on questionnaire answers.

Lung function outcomes included FEV₁, FVC, FEV₁ % predicted and FVC % predicted based on the best values of FEV₁ and FVC in spirometry.

Exposure assessment

Occupational exposures in the wood furniture industry were the exposures of interest. First, exposure was assessed based on whether the subject was a factory worker (coded 1) or office worker (coded 0). Second, the factory workers were categorised according to the level of exposure to inhalable dust based on the results of personal sampling measurements (table 2) and knowledge of exposures in different work areas, with the high exposure group including those working in the raw cutting, running saw and varnishing areas (42 subjects) and the low exposure group including those working in sanding, assembly, warehousing and maintenance (61 subjects). Office workers formed the unexposed reference category. Third, exposure was assessed based on any exposure to chemicals contained in thinners, lacquers, glues or cutting oils (56 subjects). These chemicals included ethyl cyanoacrylate, acetone, toluene, isopropyl alcohol, 1-methoxy-2-propanol acetate, naphthenic petroleum distillate and chlorinated paraffin. The office and unexposed factory workers formed the reference category. Finally, we compared those who reported exposure to glue that contained ethyl cyanoacrylate (n = 19, 10.6%) to those who did not report any exposure to the glue. The glue was used in the assembly and in the packing areas. Those working with the glue used it daily for several short periods.

Data analysis

Odds ratios (ORs) and 95% confidence intervals (95% CIs) were calculated to quantify the relation between the exposure and the symptoms/conditions of interest. All analyses were

Table 1 Conditions and symptoms

Symptoms/conditions	Definition
Cough	Recurrent or prolonged cough
Phlegm production	Recurrent or prolonged phlegm production
Wheezing	Wheezing or whistling of the chest
Breathlessness	Chest tightness or difficulty breathing
Nasal symptoms	Dryness, itching or smarting of nose, stuffy nose, runny nose, or repeated sneezing
Eye symptoms	Dryness of eyes, itchy eyes, irritation or smarting of eyes, watering of eyes, or redness of eyes
Skin symptoms	Dryness or flaking of skin, itchy skin, irritation, smarting or redness of skin, sore or tender skin, or urticaria
Current asthma	Asthma diagnosed by a physician in the past 12 months
Asthma ever	Asthma diagnosed by a physician ever during lifetime

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Table 2 Concentrations of inhalable dust in the rubber wood furniture factory

Factory area	Inhalable dust (mg/m ³)
Office	0.023
Raw cutting	1.34
Running saw	2.27
Sanding	0.38
Varnishing	2.93
Assembly	0.52
Packing	0.75

performed using SPSS statistical program v 14. A model was fitted for each symptom and asthma separately. Separate sets of models were formed for the four types of exposure variables (factory vs office worker, level of exposure to inhalable dust, exposure to any chemicals, exposure to glue). Multivariate logistic regression models adjusted for sex, age (≤ 30 years, 31–40 years, ≥ 41 years), educational level (primary/high school, vocational school/college, bachelor/higher university degree) and smoking status (current, ex, never) as potential confounders.

Multiple linear regression models were used to analyse the effects of exposures on lung function. A separate model was fitted for each outcome. Separate sets of models were formed for the four types of exposure variables. Lung function models adjusted for sex, age, height, education and smoking status, except that FEV₁ % predicted and FVC % predicted were already controlled for sex, age and height in the prediction equations.

RESULTS

Characteristics and symptoms of the study population

The study population included 99 men and 80 women aged 18–60 years. The characteristics of the factory and office workers are shown in the online appendix. Table 3 gives the occurrence of respiratory and skin symptoms and asthma among factory and office workers. Factory workers experienced more nasal symptoms, skin symptoms and asthma (both current and ever) compared to office workers.

Dust levels

Table 2 presents levels of inhalable dust in different areas of the wood furniture factory. The highest concentrations of 1.34–2.93 mg/m³ were detected in the raw cutting, running saw and varnishing areas. Smaller concentrations of 0.38–0.75 mg/m³ were measured in the other factory areas. The lowest concentration was measured in the office (0.023 mg/m³), as expected.

Table 3 Occurrence of respiratory and skin symptoms and asthma in the study population

Symptoms/ conditions	Office workers (n = 76), No (%)	Factory workers (n = 103), No (%)	Total (n = 179), No (%)
Prolonged cough	13 (17.1)	18 (17.5)	31 (17.3)
Phlegm production	24 (31.6)	28 (27.2)	52 (29.1)
Wheezing	9 (11.8)	16 (15.5)	25 (14.0)
Breathlessness	12 (15.8)	19 (18.4)	31 (17.3)
Nasal symptoms	21 (27.6)	37 (35.9)	58 (32.4)
Eye symptoms	23 (30.3)	22 (21.4)	45 (25.1)
Skin symptoms	23 (30.3)	41 (39.8)	64 (35.8)
Asthma ever	3 (3.9)	7 (6.8)	10 (5.6)
Current asthma	0 (0)	4 (3.9)	4 (2.2)

Exposure to wood dust and symptoms and asthma

Table 4 shows the adjusted ORs of respiratory and skin symptoms and ever asthma in relation to rubber tree dust exposure. Factory workers experienced increased risk of wheezing (OR 2.66, 95% CI 0.82 to 8.66), nasal symptoms (2.84, 1.17 to 6.88) and asthma (6.10, 0.69 to 53.69) compared to office workers. There seemed to be a dose-dependent increase in the risk of wheezing (OR 2.51 and 2.97 in the low and high exposure levels, respectively) and skin symptoms (OR 1.70 and 2.44 in the low and high exposure levels, respectively) with increasing dust level, although these did not reach statistical significance. Statistically significantly increased risks of nasal symptoms (3.67, 1.45 to 9.28) and asthma (8.41, 1.06 to 66.60) were detected in the low exposure category. There were no subjects with asthma in the high dust exposure category.

Exposure to chemicals and symptoms and asthma

Table 4 also presents the adjusted ORs related to any exposure to chemicals and exposure to the glue containing ethyl cyanoacrylate. Workers with exposure to chemicals experienced significantly increased risk of cough (3.70, 1.44 to 9.55) and skin symptoms (2.53, 1.24 to 5.17). The risks of wheezing and breathlessness were also increased. Workers exposed to the glue had significantly increased risk of cough (3.57, 1.24 to 10.30), breathlessness (5.16, 1.86 to 14.35) and nasal symptoms (2.94, 1.17 to 7.41), and also increased risk of wheezing (2.83, 0.92 to 8.69).

Exposure to wood dust and chemicals and lung function

Factory workers had lower spirometric lung function compared to office workers (table 5). There seemed to be a dose-dependent reduction in spirometric lung function according to the level of inhalable dust. Those exposed to any chemicals had lower lung function levels compared to unexposed workers. Exposure to the glue was especially related to reduced FEV₁ % predicted. However, although these patterns were consistent, none of the effects on lung function reached statistical significance.

DISCUSSION

In this study of wood furniture factory workers exposed to dust from the rubber tree *H brasiliensis*, the milky fluid of which is used to produce natural rubber latex,²⁶ factory workers experienced increased risk of wheezing, nasal symptoms and asthma compared to office workers. There seemed to be a dose-dependent increase in the risk of wheezing and skin symptoms in relation to increasing dust level. Significantly increased risks of nasal symptoms and asthma were detected in the low dust group but not in the high dust group, which may reflect the smaller number of subjects in the high exposure group or could be explained by sensitisation already occurring at low exposure levels.²⁷ Consistent with the findings on symptoms and asthma, factory workers had lower lung function and there was a dose-dependent reduction in lung function with increasing dust level. However, the lung function effects were rather small and did not reach statistical significance.

A hypersensitivity reaction could underlie these symptoms. As the investigations were carried out at the workplace, we were not able to investigate IgE antibodies, so our discussion on potential mechanisms remains speculative. Some case reports of occupational asthma and/or rhinitis have measured IgE to specific species of wood, suggesting a type I hypersensitivity reaction,^{3,6} while type IV hypersensitivity has been suggested to play a role in occupational dermatitis.⁵ The mechanism

Table 4 Adjusted odds ratio of respiratory and skin symptoms and asthma in relation to being a factory worker, by dust exposure level, exposure to any chemicals and exposure to glue containing ethyl cyanoacrylate

Symptoms/diseases	Factory workers* (n = 103), OR‡ (95% CI)	Low dust level* (n = 61), OR‡ (95% CI)	High dust level* (n = 42), OR‡ (95% CI)	Any chemical exposure† (n = 56), OR‡ (95% CI)	Exposure to glue† (n = 19), OR‡ (95% CI)
Cough	1.67 (0.59 to 4.70)	2.14 (0.72 to 6.29)	0.99 (0.27 to 3.73)	3.70 (1.44 to 9.55)	3.57 (1.24 to 10.30)
Phlegm	0.92 (0.40 to 2.12)	0.87 (0.36 to 2.15)	1.00 (0.36 to 2.81)	0.74 (0.33 to 1.63)	0.67 (0.23 to 1.94)
Wheeze	2.66 (0.82 to 8.66)	2.51 (0.72 to 8.76)	2.97 (0.75 to 11.80)	2.66 (0.99 to 7.19)	2.83 (0.92 to 8.69)
Breathlessness	1.71 (0.61 to 4.84)	1.97 (0.67 to 5.79)	1.28 (0.36 to 4.64)	2.20 (0.90 to 5.34)	5.16 (1.86 to 14.35)
Nasal	2.84 (1.17 to 6.88)	3.67 (1.45 to 9.28)	1.65 (0.56 to 4.89)	1.64 (0.78 to 3.43)	2.94 (1.17 to 7.41)
Eye	1.14 (0.47 to 2.74)	1.08 (0.42 to 2.79)	1.25 (0.42 to 3.67)	1.49 (0.66 to 3.37)	0.86 (0.29 to 2.59)
Skin	1.96 (0.88 to 4.35)	1.70 (0.72 to 4.04)	2.44 (0.95 to 6.30)	2.53 (1.24 to 5.17)	0.91 (0.36 to 2.29)
Asthma ever	6.10 (0.69 to 53.69)	8.41 (1.06 to 66.60)	–	0.56 (0.09 to 2.90)	1.68 (0.27 to 10.42)

*Office workers formed the unexposed reference category (OR = 1); †office workers and unexposed factory workers formed the reference category (OR = 1); ‡adjusted for sex, age, education and smoking.

underlying red cedar asthma seems to be based on immunological reactions other than type I hypersensitivity.²⁸ Gripenbäck *et al*²⁹ investigated bronchoalveolar lavage in 11 healthy volunteers before and after 1 h exposure to pinewood dust. Exposure led to recruitment of eosinophils, T lymphocytes and mast cells into bronchoalveolar lavage, all of which are inflammatory cells typical for asthmatic airways inflammation. The rubber wood timber used in this furniture factory was not contaminated by natural rubber when inspected by eye, but contamination by small amounts of latex cannot be excluded. Czuppon and co-workers³⁰ showed that the purified allergen from raw latex, which is a 58 kDa protein, can induce allergic reactions in the nanogram exposure range. Furthermore, irritant mechanisms can also play a role for at least some of the detected effects.³¹

In Thailand where our study was conducted, no standard exposure limit has been set for wood dust exposure. The US NIOSH has established a recommended exposure limit for wood dust from all woods (except western red cedar) of 1 mg/m³ as the time-weighted average for a 10 h workday and 40 h work week.³² The concentrations of wood dust in our high exposure areas exceeded this limit as well as the recently proposed occupational exposure limit for the EU of 1–1.5 mg/m³ for inhalable wood dust,³³ but the concentrations in our low exposure areas were below them.

Some wood furniture workers were exposed to chemicals, mainly irritants in thinners and lacquers, but assembly workers and some packing workers also had exposure to glue containing ethyl cyanoacrylate. Those with any exposure to chemicals experienced significantly increased risk of cough and skin symptoms, and also had increased risks of wheezing and breathlessness. The smaller group exposed to the glue experienced significantly increased risk of cough, breathlessness and nasal symptoms, and also had increased risk of wheezing, but

no increase in skin symptoms. The wheezing and breathlessness symptoms from the glue exposure could be related to a hypersensitivity reaction, as cyanoacrylates are potential sensitizers,³⁴ while upper respiratory symptoms from the glue could be due to irritant mechanisms described in exposure studies in mice³⁵ and among workers in an adhesive production facility.³⁶

Validity of methods

The response rate was good among both wood furniture workers (89%) and office workers (73%) indicating that selection bias is not likely to explain the results.

The outcomes of the study included subjective symptoms, reported doctor-diagnosed asthma and objective lung function measurements, and these gave consistent results, suggesting that reporting bias is not likely to be a major problem in this study. However, our risk estimates may underestimate the true effects, as symptomatic workers seemed to leave the job more frequently.

Exposure assessment was based both on job tasks and on measurements of inhalable dust in different work areas. We also used information on exposures gathered by the first author during a worksite visit. The dust measurements allowed us to roughly categorise the workers into low and high dust exposure categories. Thus we believe that our assessment reflects current exposure well, but not necessarily previous exposures. It is possible that symptomatic workers had been relocated into less exposed tasks or had left the workforce, which might be another possible explanation for our finding of significantly increased risks of nasal symptoms and asthma in the low dust exposure group but not in the high exposure group. For example, there were no subjects with asthma in the high dust group. Although the symptom patterns were somewhat different when looking at the effects of different types of exposures, it is not possible to

Table 5 Adjusted effect on lung function of being a factory worker, by level of dust exposure, and in relation to exposure to any chemicals and exposure to glue containing ethyl cyanoacrylate

Lung function parameter	Factory workers* (n = 103), β coefficient (95% CI)	Low dust level* (n = 61), β coefficient (95% CI)	High dust level* (n = 42), β coefficient (95% CI)	Any chemical exposure† (n = 56), β coefficient (95% CI)	Exposure to glue † (n = 19), β coefficient (95% CI)
FEV ₁ ‡ (l)	−0.03 (−0.16 to 0.09)	−0.01 (−0.15 to 0.12)	−0.06 (−0.21 to 0.09)	−0.04 (−0.16 to 0.07)	−0.14 (−0.30 to 0.006)
FVC‡ (l)	−0.04 (−0.18 to 0.09)	−0.01 (−0.16 to 0.14)	−0.10 (−0.27 to 0.07)	−0.03 (−0.16 to 0.10)	−0.10 (−0.27 to 0.06)
FEV ₁ % predicted§	−0.92 (−5.19 to 3.35)	−0.33 (−4.99 to 4.33)	−1.85 (−7.02 to 3.32)	−1.75 (−5.72 to 2.21)	−4.23 (−9.41 to 0.94)
FVC % predicted§	−1.55 (−5.43 to 2.32)	−0.36 (−4.57 to 3.84)	−3.44 (−8.11 to 1.23)	−1.57 (−5.17 to 2.03)	−1.34 (−6.08 to 3.39)

The predicted values controlled for age and height and were calculated separately for men and women.

*Office workers formed the unexposed reference category; †office workers and unexposed factory workers formed the reference category; ‡effect estimate adjusted for sex, age, height, education and smoking; §effect estimate adjusted for education and smoking.

FEV₁, forced expiratory volume in 1 s; FVC, forced vital capacity.

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Main messages

- This study provides new evidence that wood furniture workers exposed to dust from the rubber tree *Hevea brasiliensis* experience increased risk of nasal symptoms, wheeze and asthma, skin symptoms and reduced spirometric lung function.
- Exposure to cyanoacrylate glue used in furniture assembly is related to cough, breathlessness and nasal symptoms.
- Exposure to chemicals in the wood furniture industry is related to skin symptoms.

Policy implications

- The results suggest that wood furniture factories using rubber tree wood should implement appropriate exposure control measures to reduce wood dust exposure as well as exposure to glue to protect their employees.
- Clinicians should be aware of the link between rubber tree exposure and respiratory and skin conditions.

clearly disentangle the effects of wood dust exposure and chemical exposures sharply because these exposures overlapped to a certain extent.

We collected extensive data on potential confounders in our questionnaire, including personal characteristics (sex, age), genetic background (parental atopy or asthma), socio-economic status (education), lifestyle habits (smoking), and other risk factors at work (secondhand tobacco smoke exposure and stress at work). All of these factors were considered as potential confounders, and adjustment was made for factors that proved to be important in the multivariate regression models to exclude confounding as a potential explanation for the findings.

Synthesis with previous findings

The health effects that have been related to wood dust exposure in different industries employing wood mill workers, carpenters, joiners and furniture workers, are probably dependent on the species of wood, with non-malignant respiratory and skin effects commonly reported in relation to pine, oak, beech and red cedar.^{4 5 7-9 11-13 37} The furniture factory in our study used rubber wood, the health effects of which have not been previously studied according to a PubMed database search. This species is interesting as it produces natural rubber latex, a well-known potential sensitiser in health care workers.¹⁶ The rubber tree is widely used for making wooden furniture, both because of its properties (http://en.wikipedia.org/wiki/Para_rubber_tree) and because it is considered ecologically friendly, as it makes use of trees cut down at the end of their latex-producing cycle. We found an increased risk of mainly hypersensitivity-type respiratory symptoms (wheezing and nasal symptoms), asthma and skin symptoms, as well as reduced lung function in relation to rubber wood dust exposure.

We also found an increased risk of cough, breathlessness, nasal symptoms and wheezing in workers exposed to a glue containing cyanoacrylate. Some case reports and case series have previously linked exposure to cyanoacrylates to occupational asthma in different industries.^{34 38} Upper airway irritation has

been reported in adhesive facility workers exposed to cyanoacrylates.³⁶

CONCLUSIONS

This study provides new evidence that wood furniture workers exposed to dust from the rubber tree *H brasiliensis* experience an increased risk of nasal symptoms, wheeze and asthma, skin symptoms and reduced spirometric lung function. Exposure to cyanoacrylate glue used in furniture assembly is related to cough, breathlessness and nasal symptoms, while exposure to chemicals in general in this industry is also related to skin symptoms. The results suggest that furniture factories using rubber tree wood should implement appropriate exposure control measures to reduce wood dust exposure as well as exposure to glue to protect their employees. Clinicians should be aware of the link between rubber tree exposure and respiratory and skin conditions.

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Competing interests: None.

Ethics approval: The study was approved by the ethics committee of the Faculty of Public Health, Mahidol University, Thailand.

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Appendix 1. Characteristics of the study population (can be published as on-line supplement)

	Office workers N = 76		Factory workers N = 103		Total N = 179	
	n	%	n	%	n	%
Sex						
Male	35	46.1	64	62.1	99	55.3
Female	41	53.9	39	37.9	80	44.7
Age						
≤ 30 years	24	31.6	34	33.0	58	32.4
31 – 40 years	26	34.2	38	36.9	64	35.8
≥ 41 years	26	34.2	31	30.1	57	31.8
Education						
Primary or high school	29	38.1	90	87.4	119	66.5
Vocational training or College	17	22.4	8	7.7	25	14.0
Bachelor or higher university degree	30	39.5	5	4.9	35	19.5
Smoking status*						
Never	55	75.4	69	67.0	127	70.9
Past	5	6.8	11	10.7	16	8.9
Current	3	17.8	23	22.3	36	20.1

* Information on smoking status was missing for 3 subjects