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Epidemiology and Public Health Sciences
Public Health and Clinical Medicine
Umeå University

CHRONIC RESPIRATORY FUNCTION AND SYMPTOMS AMONG WORKERS IN RUBBER INDUSTRY AT HO CHI MINH CITY

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- My supervisor, Anders Emmelin at Department of Epidemiology and Public Health
- Epidemiology and Public Health Sciences Public Health and Clinical Medicine, Umeå International School in Public Health
- Department of Public Health in Medical School in Ho Chi Minh City.
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>FEV</td>
<td>Forced Expiratory Volume</td>
</tr>
<tr>
<td>FVC</td>
<td>Forced Vital Capacity</td>
</tr>
<tr>
<td>VC</td>
<td>Vital Capacity</td>
</tr>
<tr>
<td>%VC</td>
<td>% of Vital Capacity</td>
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<tr>
<td>M-H</td>
<td>Mantel Haenszel</td>
</tr>
<tr>
<td>CI</td>
<td>Confidence Interval</td>
</tr>
<tr>
<td>COPD</td>
<td>Chronic Obstructive Pulmonary Disease</td>
</tr>
<tr>
<td>COLD</td>
<td>Chronic Obstructive Lung Disease</td>
</tr>
<tr>
<td>MMEF</td>
<td>Maximum Mid-Expiratory Flow</td>
</tr>
<tr>
<td>AM</td>
<td>Attometer</td>
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<tr>
<td>SMR</td>
<td>Standardized Mortality Ratio</td>
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GLOSSARY

FEV1: This is the amount of air that you can forcibly blow out in one second, measured in liters. Along with FVC it is considered one of the primary indicators of lung function.

FVC: This is the total amount of air that can forcibly be blown out after full inspiration, measured in liters.

Tiffeneau = FEV1/FVC ratio, this is the ratio of FEV1 to FVC. In healthy adults this should be approximately 75–80%.

%VC % of vital capacity
M-H Mantel Haenszel
CI Confident interval
COPD Chronic obstructive pulmonary disease
COLD Chronic obstructive lung disease

MMEF: The MMEF (maximum midexpiratory flow) is the average expiratory flow over the middle half of the FVC. It should be taken from the blow with the largest sum of FEV1 and FVC (procedures, ref. 2). This index is very highly correlated with MEF50%FVC, so that one index offers no advantage over the other.

AM Definition of attometer (am): 1 am = 1 x 10^{-18} m (a billionth of a billionth of a meter).
INTRODUCTION

In the decade of 1920s -1930s, reports from British said that there was a higher rate of deaths and occupational health problems for workers working at the rubber industry than for a population. Many researches on relationship between impacts of hazards from the working environment of the industry and issues of occupational health such as cancers, respiratory and dermatitis diseases, muscle-skeleton disorders, etc have been conducted over the world especially in developed countries like the United State, England, etc \(^{(1)(2)}\).

In Vietnam, around 10-11% of labor force has been working in industrial zone. Ho Chi Minh City, the biggest economy center, is of the most importance industrial area in Vietnam. With over 7 millions of people living and working, Ho Chi Minh City has 217 State establishments, 717 foreign-invested establishments and 36,943 small/medium enterprises (SMEs) with ~ 168,000, 345,000, and 577,000 workers, respectively \(^{(3)}\). The city has contributed up to 43% of GDP of Vietnam each year.

The rubber industry has been one of the most important industries in Ho Chi Minh City, contributing into growing its economy. Despite benefits from the fast economy development in general and rubber industry in particular, Ho Chi Minh City has faced numerous environmental problems, which directly affect the corresponding workers and people in living in the neighborhoods. Many of workers at the industry expose hazards from working environments such as dusts with Kaolin, talc, and gases with Toluene, \(\text{SO}_2\) as well as noise, high temperature, low ventilation. Nowadays, Vietnam has had 25 occupational diseases compensated by the Government, especially silicosis and chronic respiratory diseases have accounted for the highest rate and rubber industry has participated part of the rate. The number of potential occupational diseases is believed much higher but there has not been any thorough study on this issue in Ho Chi Minh City. So, a research on “chronic respiratory function and symptoms among workers in rubber industry at Ho Chi Minh City,” is necessary for diagnosing early chronic respiratory such as silicosis and chronic bronchitis of workers in rubber industry, helping occupational health managers monitor and take care health for the workers well.
Outcomes of the proposed study would also help managers of rubber industry having policies or laws to protect labors from occupational diseases particularly respiratory diseases. I think many things remain to be done in the field of occupational safety and health, especially when the economy is growing faster due to the integration into WTO of Vietnam in general and Ho Chi Minh City in particular.
II. BACKGROUND

1/ Researches on rubber industry in foreign countries:

Many researches on the rubber industry related to health problems especially respiratory
diseases have been conducted by over the world particularly in developed countries such as the
United State, British, Europe, etc.

Zuskin and coworkers, 1996 found the same results in all rubber workers compared to
controls\(^{(4,5)}\). There was a significant change to symptom rates in exposure to inhalable dusts
between study populations and the workers examined the occupational respiratory health from
researchers. Besides, researches on chronic respiratory symptoms from developed countries in the
past showed that the curing workers had a higher prevalence of chronic bronchitis than the
controls. Workers working in curing places with greater than 10 years of the exposure to fume,
25% of them met the criteria for the epidemiologic diagnosis of chronic obstructive lung disease
(COLD); more than three times that of the control group. Researchers from Croatia also said that
the respiratory function in rubber-processing workers reduced. The prevalence of acute and
chronic respiratory symptoms and diseases as well as lung function changes were studied in 409
rubber male workers and 172 no exposed control male workers. A significantly higher prevalence
of all chronic respiratory symptoms except asthma was found in rubber workers in a comparison
to the controls. Smokers had a significantly higher prevalence of most of the chronic respiratory
symptoms than nonsmokers. Rubber workers exposed for more than 10 years had also a
significantly higher prevalence of chronic respiratory symptoms than those with shorter exposure.
A large number of rubber workers showed a decrease in lung functions tests less than 70% of the
predicted normal values. The results suggest that rubber workers were exposed to numerous
noxious agents which may lead to the acute and/or chronic impairment of lung function.

For workers working in the curing, there was the growth of respiratory morbidity related
to both a high level and length of exposure to fume\(^{(6)}\).

E. Meijer, MD and his colleagues’ research\(^{(7)}\) indicated that the reported chronic
respiratory symptoms could not be attributed to the exposure to dust and fumes alone. Lung
function changes and respiratory symptoms investigated in a cross-sectional study in rubber
workers exposed to dust and fumes, it showed that a small loss in pulmonary functions in all rubber workers. There was the decrease in lung functions in workers working over 10-year-exposure to an average of 2.0 mg/m³ inhalable dust and FEV1/FVC ratio as well as the MMEF decreased a mean annual decline of 0.08% and 10 ml/s respectively. A recent cross-sectional and follow-up study was conducted by Zuskin and co-workers in 1996 (8) showed that there were the prevalence of respiratory symptoms and the lower ventilation capacity in workers exposure to respiratory dust fraction ranging from 1.0–12.4 mg/m³ higher than that of controls. Sparks and co-workers found no evidence of a relationship between exposure to respiratory particulates (range 0.04–0.70 mg/m³) and the lung function in the processing and milling areas in three tire-manufacturing facilities, suggesting the presence of a no-adverse-effect level. Another study of the rubber industry showed that all rubber workers exposing the respiratory dust at a mean level of 2.0 mg/m³ had the relatively small effect on their lung. Both smoking cigarettes and exposing cumulative dusts had negatively associated with the FEV1/FVC ratio and all flow-volume parameters (9).

Besides, a study from Iran (10) indicated that pulmonary function tests (PFTs) measured just before and after the work shift for workers exposing talc was associated with both acute and chronic respiratory disorders and induces bronchitis and interstitial lung diseases. However, study results of chronic changes in the pulmonary function in workers exposure to talc have yielded conflicting results; their findings indicated that there existed a general tendency for some parameters of pulmonary function to become smaller as estimated cumulative exposure (years exposed) increases. Researches on chronic diseases in the rubber industry including analysis of disability retirements, based on questionnaire and health testing surveys, showed excesses of chronic respiratory diseases. There was evidence of an interaction in relation with work and smoking habit with decreasing lung function. Cigarette smoking contributed into the usual effect but there not was an evidence to explain the difference between the curing and control groups. So, workers in curing places had the greater prevalence of the respiratory morbidity and reduced lung function for the exposure to fumes. Workers on the manual automobile tire presses are a labor population at the highest risk of growing lung diseases. No evidence of chest x-ray abnormalities was recorded (11).

According to Straughan JK, Sorahan T from Birmingham, UK, the research on mortality and cancer incidence survey of recent entrants (1982-91) to the United Kingdom rubber industry
(12) aimed to monitor the occurrence of stomach and lung cancers in a newly defined cohort of United Kingdom workers working in rubber industry and to report findings for other cancers in an early period of follow up. A prospective cohort of 9031 male and female workers from 42 United Kingdom rubber factories had been enumerated. The results should be treated with caution as they relate to an early period of follow up. Nevertheless, they hold out the prospect that the increased SMRs for stomach and lung cancers reported for historical cohorts of United Kingdom rubber workers may not be apparent in more recent cohorts.

Reports from the USA (13) recognized a negative association between ventilation functions and the exposure to hazards in curing workplaces with a geometric mean concentration of 0.56 mg/m$^3$ respiratory dust. They concluded that workers worked in the curing department with a loss of 12 ml per year of FEV$_1$ and of FVC. Pack-years of smoking and work-time in curing showed a small but a statistically significant decline of the FEV$_1$/FVC ratio. A recently reported study conducted by Zuskin and coworkers, 1996 (14) said that the mean annual decrease in lung function in all rubber workers with work-time over a 6-year period was slightly larger for smokers (FEF50:100 ml/s) than for nonsmokers (FEF25:83 ml/s). Although exposure levels differ substantially in these surveys, their results suggested no reduced lung function in curing areas at respiratory dust levels below 0.24 mg/m$^3$ (AM) and no reduced the lung function at respiratory dust levels below 0.7 mg/m$^3$ (AM) in weighing, milling and other processing areas. Screening for occupational health hazards in the rubber industry in the curing department of Weeks JL, Peters JM, Monson RR, a multi-phasic health testing was provided to 744 rubber workers at a tire manufacturing plant. Sixty-two white males from this population had worked longest in the curing areas. These relationships between hazards and outcomes were stronger with an increased duration of employment in the curing sites. This study further demonstrated the potential for using multi-phasic health testing combined with measurements of hazards in workplace for identifying occupational health hazards.

Almost studies from developed countries showed that the exposure to hazards from rubber industry causes health problems related chronic respiratory diseases, lung cancer and other cancers such as stomach, leukemia, etc. However, a limitation of using benzene in rubber industry decreases mortality of benzene-related cancers (14).
2/ Researches from Vietnam:

According to the data from Vietnam’s the health management system (15), the rubber industry is ranked the fourth in five levels of heavy and dangerous industries in Vietnam. Its working environment has high levels of dusts and gases as well as a very high temperature usually over the Vietnamese standard from 2°C to 5°C. Diseases related to the upper respiratory such as sore-throat and rhinitis accounted for 24 - 26%, eye-relation diseases accounted for 30 - 34%, skin-relation diseases accounted for 8 - 10%, etc. Besides, the activities of occupational health care of the rubber industry in particular and other industries in general in Vietnam have inefficiently worked especially in private companies, the activities have not almost established. In the early 2000, in Ho Chi Minh City, there were some workers working in private companies of the rubber industry died of the exposure to much more dusts with SiO₂ and asbestos. Nowadays, Vietnam has not had many researches on health problems like respiratory diseases, cancers in the rubber industry despite in fact that its production technology has been still backward and health problems of workers are increasingly growing.

A research on “chronic respiratory function and symptoms among workers in rubber industry at Ho Chi Minh City” is necessary for diagnosing early the chronic respiratory such as silicosis and chronic bronchitis of workers in the rubber industry, helping occupational health managers monitor and take care of health for the workers more and more.
III- METHOD:

Research question: What is the prevalence of chronic respiratory symptoms and the respiratory function of workers in the rubber industry at Ho Chi Minh City’s a state company.

Research objectives: To assess the relation between lung function and hazards and to estimate the prevalence of chronic respiratory symptoms and the respiratory function of workers in rubber industry at Ho Chi Minh City’s a state company.

Research method:

Study design: A cross sectional study

Study subject: workers are working at Ho Chi Minh City’s a state company in rubber industry. CASUMINA Company is an only one of the industry in Ho Chi Minh city.

Characteristics of Caosu-mina Company and its workers: CASUMINA Company – HOC MON RUBBER INDUSTRY Company is placed in 4 area, Tân Thới Hiệp ward, 12 district, Ho Chi Minh City.

<table>
<thead>
<tr>
<th>Number</th>
<th>Workplaces</th>
<th>Kinds of production</th>
<th>Hazards at workplaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Processing (Mixing and producing crude production)</td>
<td>Producing the crude production</td>
<td>Dust, micro-climate</td>
</tr>
<tr>
<td>2</td>
<td>Inner-tube (Producing and curing inner-tube)</td>
<td>Producing inner-tube of bicycle and motorcycle</td>
<td>Dust, gases, micro-climate</td>
</tr>
<tr>
<td>3</td>
<td>Tire (Producing and curing tire)</td>
<td>Producing tires of bicycle and motorcycle</td>
<td>Micro-climate</td>
</tr>
<tr>
<td>4</td>
<td>Pressure, Boiler, Checking productions</td>
<td>All productions</td>
<td>Micro-climate</td>
</tr>
</tbody>
</table>

There are 623 workers working at HocMon rubber industry called Caosumina Company. In that 578 subjects accounting for 92.78% are permanent working; number of workers who work as seasonal workers account for 7.22%. Almost of them live in 12 District and Hocmon District.

Ethical issue of occupational health: Caosumina-company is one of three great factories in the south of Vietnam and only one in Ho Chi Minh City. According to Labor Law of Vietnam, a large company like caosumina with over 300 workers must annually be measured the working environment and conducted to examine health for workers. The company has freedom right to
choose institutes and hospitals with good conditions of professional in order to implement the activities. Agreed by Caosu-mina Company, Center of Tropical Environment in Ho Chi Minh City carried out measuring working environment for the company in June 12th 2007, as well as measuring respiratory function for workers in July from 14th 2007 to July 27th 2007. Questionnaire self reported for workers were given in that time.

Sample size:
With $\alpha = 5\% \rightarrow Z_{1-\alpha/2} = 1.96$
Because there has not been researches on the chronic respiratory health in the rubber industry in Vietnam, we choose the the highest proportion of $p$
$p = 50\%$ and $d = 0.05$ .
According to simple size formulation
$$n = Z^2 \left( 1-\frac{1}{2} \right) P (1-P) /d^2 = 3.84 \times 0.5 \times 0.5 / (0.05)^2$$
$$\Rightarrow \quad n = 384$$

o Choosing a total of workers working in the company.

Variables: (definitions from appendix)
When workers expose hazards like dust and gases for a long time or a high level, they are easy to have chronic respiratory symptoms being first thing in the morning or at any time during the day or night for as much as three months each year, decreasing their lung functions including $FVE1$ with amount of air that you can forcibly blow out in one second and $FVC$ with the total amount of air that can forcibly be blown out after full inspiration.

Dependent variables:
- Respiratory function: $%VC$, $FEV1$
- Chronic cough symptom
- Chronic phlegm symptom
- Chronic wheezing symptom

Independent variables: workers expose dusts or gas emitted by producing process and measuring dust and gases at work-place level, all individuals will have the same exposure.

Other variables
- Work time: the years of job
• Smoking: yes or no; the number of cigarettes, the number of months or years for smoking cigarettes.

• Age, sex, workplace, education, marriage status, etc

**Data collection:**

<table>
<thead>
<tr>
<th>Index</th>
<th>Instruments</th>
<th>Analysis</th>
<th>Implements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dust</td>
<td>F &amp; J ECONOAIR – Emergency Sampling system (F &amp; J SPECIALTY PRODUCTS INC - USA)</td>
<td>Scaling dust by Sartorius scale with $1 \times 10^{-5}$ gr-sensitivity (Germany)</td>
<td>Respiratory particles: dust and gas samples are taken the same level of the nose of workers</td>
</tr>
<tr>
<td>Gases</td>
<td>F &amp; J ECONOAIR – Emergency Sampling system (F &amp; J SPECIALTY PRODUCTS INC - USA)</td>
<td>Methods of absorbing and color-limetry by HACH DR 2010 – USA</td>
<td>Duts and gases: taking 30 minutes for each dust or gas sample</td>
</tr>
<tr>
<td>Respiratory function</td>
<td>SCHILLER instrument called as Spirovit SP-1. Error below 10%</td>
<td>Measured in free days of work in Caosumina Company</td>
<td>Workers are rested 10 minutes before measuring, Measuring for 3 times with choosing the highest value.</td>
</tr>
<tr>
<td>Personal information</td>
<td>Questionnaire with 41 closed questions</td>
<td>Collecting data for many times to get the sufficient information</td>
<td>Self– reported</td>
</tr>
</tbody>
</table>

Measuring the working environment and lung function is conducted by The Center of Tropical Environment in Ho Chi Minh City.

- Measuring respiratory function of workers: with SCHILLER instrument called as Spirovit SP-1. Error below 10%; carried out by physicians from Center of Tropical Environment in Ho Chi Minh City.
- Workers will be measured their functions in free days of their work in Caosumina Rubber Industry Company.
- They are rested 10 minutes before measuring.
- Workers clean their noses and mouths before measuring. They will wear comfortably their clothes and positions while they are measured their lung functions. Workers act by introducing from physicians including their positions, taking instruments, acting forcefully inhaling and exhaling. Measuring respiratory function is implemented for 3 days.
times, each time is 10-15 breathing times and then choosing the time with the highest value.

<table>
<thead>
<tr>
<th>Index</th>
<th>%VC (FVC)</th>
<th>FEV1%</th>
<th>Tiffeneau = FEV1/FVC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&gt; 80%</td>
<td>&gt; 70%</td>
<td>&gt; 70%</td>
</tr>
<tr>
<td>Restrictive</td>
<td>&lt; 80%</td>
<td>-</td>
<td>&gt; 70%</td>
</tr>
<tr>
<td>Obstructive</td>
<td>-</td>
<td>&lt; 70%</td>
<td>&lt; 70%</td>
</tr>
<tr>
<td>Obstructive and restrictive</td>
<td>&lt; 80%</td>
<td>&lt; 70%</td>
<td>&lt; 70%</td>
</tr>
</tbody>
</table>

**Data analysis:** Using Epidata and stata 9.0

**Step 1: description**
- Proportions (%) of variables such as: age, sex, education, workplace, work time, smoking habit, etc.
- Estimating prevalence rates of chronic respiratory symptoms and respiratory function.

**Step 2: Analysis**
- Calculating OR, P-value, CI 95% of the association between exposures and outcomes.

**Step 3: Controlling recall bias, missed classification of outcomes and exposures**
- Controlling confounding factors (age, sex) or interactions (smoking, work-time) by classifying age, sex, etc or multi-variables analysis.

- **Controlling recall bias:** workers questionnaire self-reported and asked again when workers were measured their lung functions.
- **Controlling missed classification of outcomes and exposures:** based on records from the company.

Age, sex, work-time, workplace, smoking

Exposure to dust, gases

Symptoms, FEV, VC%
**Time plan:**

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</thead>
<tbody>
<tr>
<td>Preparing specific proposal</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Data collection</td>
<td></td>
<td></td>
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<tr>
<td>Data analysis</td>
<td></td>
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<tr>
<td>Writing thesis</td>
<td></td>
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<tr>
<td>Defending thesis</td>
<td></td>
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</tbody>
</table>
IV. RESULT

I/ Characteristics of study population:

Table 1: Characteristics of age and work-time

<table>
<thead>
<tr>
<th>Characters</th>
<th>Subjects</th>
<th>Mean</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>578</td>
<td>35.78</td>
<td>8.47</td>
<td>19</td>
<td>60</td>
</tr>
<tr>
<td>Work-time</td>
<td>578</td>
<td>11.91</td>
<td>7.5</td>
<td>1</td>
<td>35</td>
</tr>
</tbody>
</table>

The mean age and work-time of workers is 36 years-old and 12 years respectively.

There are 623 workers working at Caosumina Company. In that 578 subjects participate in the research, accounting for 92.78%; number of workers who work as seasonal workers account for 7.22%, not participating in the study.

An age average of 578 subjects is 36 years-old, from 19 to 60 years old. There are 176 female workers and 402 male workers accounting for 30.4% and 69.6% respectively. This shows that a number of male workers is more 3 times than that of female workers. In reality, the job characteristics of the rubber industry with its dangerous hazards such as free-silicon dust, gases, high temperature, etc at curing and processing workplaces is suitable for male workers.
Figure 1: Work-time of workers working at CASUMINA Company

The proportion of workers with work-time from 5-10 years is the highest

A work-time average of all workers is 12 years, from 1 to 35 years. Besides, there are 82.53% of workers with getting married, 2.25% window and divorced status and 15.22% single status.
Table 2: Other characteristics

<table>
<thead>
<tr>
<th>Variables</th>
<th>Men (%)</th>
<th>Women (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Workplace</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Processing</td>
<td>32 (5.5%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Curing</td>
<td>92 (15.9%)</td>
<td>1 (0.17%)</td>
</tr>
<tr>
<td>Inner-tube</td>
<td>92 (15.9%)</td>
<td>53 (9.12%)</td>
</tr>
<tr>
<td>Other</td>
<td>186 (32.17)</td>
<td>122 (21.11%)</td>
</tr>
<tr>
<td><strong>Age group</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 - 30</td>
<td>137 (23.7%)</td>
<td>38 (6.6%)</td>
</tr>
<tr>
<td>31 - 40</td>
<td>176 (30.4%)</td>
<td>63 (10.9%)</td>
</tr>
<tr>
<td>41-50</td>
<td>71 (12.3%)</td>
<td>62 (10.7%)</td>
</tr>
<tr>
<td>51-60</td>
<td>18 (3.1%)</td>
<td>13 (2.2%)</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Illiteracy</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Primary school</td>
<td>290 (50.17%)</td>
<td>144 (24.9%)</td>
</tr>
<tr>
<td>High school</td>
<td>83 (14.36%)</td>
<td>25 (4.3%)</td>
</tr>
<tr>
<td>Undergraduate and postgraduate</td>
<td>29 (5%)</td>
<td>7 (1.2%)</td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>335 (58%)</td>
<td>142 (24.57%)</td>
</tr>
<tr>
<td>Divorced/widow</td>
<td>3 (0.52%)</td>
<td>10 (1.73%)</td>
</tr>
<tr>
<td>Married</td>
<td>64 (11.07%)</td>
<td>24 (4.15%)</td>
</tr>
<tr>
<td><strong>Smoking</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-smoking</td>
<td>116 (20.07%)</td>
<td>175 (30.27%)</td>
</tr>
<tr>
<td>Ex-smoking</td>
<td>35 (6%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Smoking</td>
<td>251 (43.4%)</td>
<td>1 (0.17%)</td>
</tr>
</tbody>
</table>

Workers working in the company are divided into 4 specific areas such as the processing workplace with SiO₂, the curing site with high temperature as well as SO₂ gas, the sticking place with CₓHᵧ, the producing inner-tube products with talc as well as noise and other workplaces without hazards. In which 578 subjects participating in the research, there is 5.54% equal to 32 workers in the processing site, 16.26% equal to 94 workers in the curing and the sticking sites, 24.91% equal to 144 workers in the site of producing inner-tube products and 53.29% equal to 308 workers in other sites without exposing hazards.
In addition, 75.09% of workers have completed the primary and secondary, 18.6% of high school and only 6.23% of subjects with the undergraduate degree including the college and university. Therefore rates of workers in Hocmon Company with getting married status and the low education account for quite high rates.

For the smoking habit, there are 50% of male workers with smoking or ex-smoking. In 50% of nonsmoking, there are 20% of male workers and 30% of all female workers. The average of packs that workers have smoked is 701.07-packs-year and the maximum number of packs went up 1679 -packets per year. If workers have worked at workplaces with the exposure to both dust as well as gases hazards and smoking together, they would have a high risk of chronic respiratory diseases especially occupation-related chronic bronchitis.

Table 3: Characteristics of workers’ respiratory functions

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Obs</th>
<th>Mean</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEV</td>
<td>578</td>
<td>2810.62</td>
<td>659.93</td>
<td>1249.5</td>
<td>4876.4</td>
</tr>
<tr>
<td>VC</td>
<td>578</td>
<td>3220.8</td>
<td>645</td>
<td>1666</td>
<td>5079.6</td>
</tr>
<tr>
<td>% VC</td>
<td>578</td>
<td>90.67</td>
<td>5.03</td>
<td>74</td>
<td>102</td>
</tr>
</tbody>
</table>

The averages of FEV, VC and %VC are 2810.6 (from 1250 to 4876), 3220 (from 1666 to 5080), as well as 86.77% (from 74% to 102%) respectively. Almost workers with the abnormal lung function have smoked and exposed to hazards such as dust and gases.

II/ Prevalence of chronic respiratory symptoms of workers exposing dust and/or gases:

1/ Dust and gases:

Table 4: The results of dust and gases in the working environment

<table>
<thead>
<tr>
<th>Workplace</th>
<th>Measurements</th>
<th>Standard unit</th>
<th>Results of measurement</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processing</td>
<td>Respiratory dust</td>
<td>20</td>
<td>0.71 – 0.74</td>
<td>Below the national standard</td>
</tr>
<tr>
<td></td>
<td>(mg/m3)</td>
<td>50% SiO₂</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inner-tube production</td>
<td>Respiratory dust</td>
<td>20</td>
<td>0.65 – 1.73</td>
<td>Below the national standard</td>
</tr>
<tr>
<td></td>
<td>(mg/m3)</td>
<td>50% SiO₂</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Curing</td>
<td>SO₂ (mg/m³)</td>
<td>10</td>
<td>0.69 – 0.9</td>
<td>Below the national standard</td>
</tr>
<tr>
<td>Sticking</td>
<td>CxHy (mg/m³)</td>
<td>300</td>
<td>8.2</td>
<td>Below the national standard</td>
</tr>
</tbody>
</table>
In this company, the dust and gases involve the exposure to aerosols from dusty production functions and from curing fumes. Minerals are the most common materials used in the powder form in the compounding and mixing areas.

The level of SO₂ at curing places of the company is below the Vietnamese standard. However, workers expose SO₂ with a low level for a length of time, high temperature, low ventilation, SiO₂ together they have a quite high risk of chronic respiratory diseases.

Like SO₂, CxHy in the site of sticking valves is lower than Vietnamese standard (16)(17), however, the longer exposure to the gas happens, the higher risk of chronic respiratory symptoms appears, affecting their health and productivity.

Table 5: proportions of the exposure status, chronic respiratory symptoms and lung functions

<table>
<thead>
<tr>
<th>Variables</th>
<th>Men (%)</th>
<th>Women (%)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dust - gases</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exposure</td>
<td>190 (32.87%)</td>
<td>35 (6.05%)</td>
<td></td>
</tr>
<tr>
<td>Non-exposure</td>
<td>212 (36.68%)</td>
<td>141 (24.39%)</td>
<td></td>
</tr>
<tr>
<td>Chronic respiratory symptoms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cough</td>
<td>158 (27.33%)</td>
<td>22 (3.8%)</td>
<td></td>
</tr>
<tr>
<td>Phlegm</td>
<td>154 (26.64%)</td>
<td>16 (2.77%)</td>
<td></td>
</tr>
<tr>
<td>Wheezing</td>
<td>33 (5.7%)</td>
<td>3 (0.52%)</td>
<td></td>
</tr>
<tr>
<td>Lung functions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FEV1</td>
<td>13(2.2%)</td>
<td>1(0.17%)</td>
<td>&lt; 70%</td>
</tr>
<tr>
<td>FVC</td>
<td>3(0.51%)</td>
<td>2(0.34%)</td>
<td>&lt; 80%</td>
</tr>
</tbody>
</table>

According to the exposure status of workers to hazards, a data shows that they are 61.07% of them without exposing hazards, 38.92% of them with exposing gases and dusts. A rate of workers who expose hazards is higher than that of who do not expose hazards. The rate of female workers exposing hazards is lower 3 times than that of without exposing hazards, but the rates of male workers in exposing and non-exposing are equal to.

Results of chronic respiratory symptoms such as cough, phlegm and wheezing collected by self-reported questionnaires say that there is 31.14% equal to 180 workers with a chronic cough symptom, 29.41% equal to 170 workers with a chronic phlegm symptom, and 6.23% equal to 36 workers with a chronic wheezing symptom.
The lung function result of 578 participants indicates that 18 cases had disordered states, accounting for 3.11% including 72.3% of obstructed syndrome, 22.2% of restricted syndrome and 5.5% of combined syndrome.

**Table 6: The relationship between exposure to dust, gases, smoking and appearing chronic respiratory symptoms**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Exposure to dusts and gases</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chronic respiratory symptoms</strong></td>
<td><strong>P value</strong></td>
<td><strong>OR – 95% CI</strong></td>
</tr>
<tr>
<td>Cough</td>
<td>&lt; 0.0001</td>
<td>24.16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14.68-40</td>
</tr>
<tr>
<td>Phlegm</td>
<td>&lt; 0.0001</td>
<td>15.09</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9.45-24</td>
</tr>
<tr>
<td>Wheezing</td>
<td>&lt; 0.0001</td>
<td>11.12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.17-37.09</td>
</tr>
<tr>
<td><strong>Lung functions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>%VC</td>
<td>&lt; 0.0001</td>
<td>20.39</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.68 – 154.8</td>
</tr>
</tbody>
</table>

Respiratory symptoms are statistically significant relation to exposing dust and gases

A risk of appearing the chronic cough is 84.4% in the exposure group and 18.34% in non-exposure group. Odds ratio is 24.16 with 95% CI (14.68 - 40). In addition, a risk of appearing the chronic phlegm is 80.59% in the exposure group and 21.57% in non-exposure group. Odds ratio is 15.1 with 95% CI (9.45 – 24.31). Like the chronic cough and phlegm, the risk of appearing the chronic wheezing is 86.11% in the exposure group and 35.79% in non-exposure group. Odds ratio is 11.12 with 95% CI (4.18 – 37.09). These show workers working at the company have a high risk of appearing chronic respiratory symptoms such as cough, phlegm as well as wheezing, particularly in groups exposing to hazards.

A risk of reducing %VC <80% is 5.78% in the exposure group and 0.28% in the non-exposure group. Odds ratio is 20.39 with 95% CI (2.68 – 154.8). So, there is a relation between exposure to hazards and decreasing lung functions (Tiffeneau <70% or %VC <80%) of workers working in Caosumina Company.
Table 7: The confounder and interaction of relationship between exposure to dust, gases and appearing chronic respiratory symptoms adjusted by sex, smoking, age, workplace and worktime.

<table>
<thead>
<tr>
<th>Variables</th>
<th>P-value of homogenity test</th>
<th>OR_{crude}</th>
<th>OR_{M-H}</th>
<th>(OR_{M-H} - OR_{crude}) / OR_{M-H}</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cough</td>
<td>&gt; 0.05</td>
<td>24.16</td>
<td>20.94</td>
<td>15.4%</td>
<td>Confounder</td>
</tr>
<tr>
<td>Phlegm</td>
<td>&gt; 0.05</td>
<td>15.09</td>
<td>12.87</td>
<td>17.3%</td>
<td>Confounder</td>
</tr>
<tr>
<td>Wheezing</td>
<td>&gt; 0.05</td>
<td>11.12</td>
<td>9.27</td>
<td>19.9%</td>
<td>Confounder</td>
</tr>
<tr>
<td>Smoking</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cough</td>
<td>&gt; 0.05</td>
<td>24.16</td>
<td>21.33</td>
<td>13.3%</td>
<td>Confounder</td>
</tr>
<tr>
<td>Phlegm</td>
<td>&gt; 0.05</td>
<td>15.09</td>
<td>13.02</td>
<td>15.9%</td>
<td>Confounder</td>
</tr>
<tr>
<td>Wheezing</td>
<td>&gt; 0.05</td>
<td>11.12</td>
<td>8.7</td>
<td>27.8%</td>
<td>Confounder</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cough</td>
<td>&gt; 0.05</td>
<td>24.16</td>
<td>22.95</td>
<td>5.3%</td>
<td>Non-confounder</td>
</tr>
<tr>
<td>Phlegm</td>
<td>&gt; 0.05</td>
<td>15.09</td>
<td>15.07</td>
<td>0.13%</td>
<td>Non-confounder</td>
</tr>
<tr>
<td>Wheezing</td>
<td>&gt; 0.05</td>
<td>11.12</td>
<td>12.36</td>
<td>10%</td>
<td>Confounder</td>
</tr>
<tr>
<td>Workplace</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cough</td>
<td>0.0091</td>
<td>24.16</td>
<td>25.71</td>
<td>Interaction</td>
<td></td>
</tr>
<tr>
<td>Phlegm</td>
<td>&gt; 0.05</td>
<td>15.09</td>
<td>13.57</td>
<td>11.2%</td>
<td>Confounder</td>
</tr>
<tr>
<td>Wheezing</td>
<td>&gt; 0.05</td>
<td>11.12</td>
<td>15.95</td>
<td>30.3%</td>
<td>Confounder</td>
</tr>
<tr>
<td>Worktime</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cough</td>
<td>0.0114</td>
<td>24.16</td>
<td>24.22</td>
<td>Interaction</td>
<td></td>
</tr>
<tr>
<td>Phlegm</td>
<td>0.045</td>
<td>15.09</td>
<td>16.48</td>
<td>Interaction</td>
<td></td>
</tr>
<tr>
<td>Wheezing</td>
<td>&gt; 0.05</td>
<td>11.12</td>
<td>10.96</td>
<td>1.5%</td>
<td>Non-confounder</td>
</tr>
</tbody>
</table>

Smoking, workplace and work-time interact with exposure to dust, gases causing respiratory symptoms growing increasingly.
Table 8: Correlation coefficient and linear regression between VEMS, VC and Tiffeneau and work-time

<table>
<thead>
<tr>
<th>Criteria</th>
<th>R correlation coefficient</th>
<th>Linear regression</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEV1</td>
<td>-0.645</td>
<td>y = 3486 – 56.75x</td>
</tr>
<tr>
<td>FVC</td>
<td>-0.56</td>
<td>y = 3792 – 48x</td>
</tr>
<tr>
<td>Tiffeneau = FEV1/FVC</td>
<td>-0.67</td>
<td>y = 92.59 – 0.49x</td>
</tr>
</tbody>
</table>

Light strong-negative correlation coefficient between respiratory function and work-time of exposure to dust and SO₂

Table 9: Logistic regression between respiratory symptoms, % VC, Tiffeneau and variables of exposure, age, sex, work-time, workplace, smoking, height.

<table>
<thead>
<tr>
<th>Variables</th>
<th>OR adjusted</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cough</td>
<td>4.04</td>
<td>2.93 – 5.57</td>
</tr>
<tr>
<td>Phlegm</td>
<td>2.42</td>
<td>1.81 – 3.25</td>
</tr>
<tr>
<td>Wheezing</td>
<td>1.94</td>
<td>1.19 – 3.15</td>
</tr>
<tr>
<td>% VC</td>
<td>4.83</td>
<td>0.77 – 30.07</td>
</tr>
<tr>
<td>Tiffeneau = FEV1/FVC</td>
<td>2.01</td>
<td>0.91 – 4.47</td>
</tr>
</tbody>
</table>

After adjusted confounding factors by the logistic regression between respiratory symptoms, % VC, Tiffeneau and variables of exposure, the results reveal that appearing chronic respiratory symptoms such as cough, phlegm, wheezing as well as decreasing VC, Tiffeneau index are quite high comparing the exposure group with the non-exposure group. However, there are statistically significant differences between the exposure and outcome including chronic respiratory symptoms for 95% CI not including 1; but the differences did not appear for %VC and Tiffeneau because of 95% CI including 1.
V. DISCUSSION:

The rubber industry in general, Caosumina company in particular, because of its heavy and
dangerous work characteristics, laborers are almost male with the average of 36-year olds. The
exposure to particles from Kaolin dust, talc dust, and the gases including CxHy, SO₂ emitted
from producing products causes a high risk of the chronic respiratory health for the workers.

In addition, the gas related to sulfur like SO₂ without color and with hard smell, easy to
dissolve in water, emitted from vulcanizing rubber, stimulates mucous membranes of the
respiratory system. The coal containing 1-5% of sulfur is used like materials in the rubber
industry. According to some researchers, SO₂ absorbs by skin and mucous membranes; and Theo
Henderson Haggard said that with over 50mg/m³ level, SO₂ could stimulate respiratory
membranes. With the level of 8-13mg/m³, SO₂ is detected by smelling, however, if workers
expose the low level of SO₂ for a long-time they are easy to affect chronic respiratory diseases
such as nose-throat infections, chronic bronchitis. Appearing both SO₂ gas and dust as well as
high temperature at curing workplaces causes decreasing the respiratory function increasingly¹⁸.

Especially, exposing the high level of SO₂ for a long time is easy to make the state of lung
sclerosis as well as emphysema for workers. In the rubber industry, particularly at curing sites,
workers expose SO₂, high temperatures, low ventilations and SiO₂ together so they would have a
high risk of chronic respiratory diseases. According to Folke Peterson Professor, from Sweden
University, his research in 1990 showed that if the temperature at working environments
increases 1°C comparing with a standard, its dangerousness will go up about 10%. Besides, some
studies revealed that digestion diseases are 15% and 7.5%, skin diseases are 6.3% and 1.6%,
cardiocvascular diseases are 1% and 0.6%, nerve disorder syndromes are 17% and 5.6%
comparing cases exposing high temperature with controls. In addition, a low ventilation makes
dangerous gases diffuse slowly easy to absorb into the body¹⁹. Researches of Ledar, Gramble
and Fine, Peter revealed that free-silicon and talc dusts used in rubber industry and gases like SO₂
are hazards causing occupational diseases including silicosis, chronic bronchitis and chronic
respiratory symptoms.
In caosumina company, results of the working environment including dusts, gases show that respiratory dusts and gases have been in processing, producing inner-tire and curing places despite below the Vietnamese standards. These make workers feel uncomfortable and tired of their job, causing a quite high risk of pneumoconiosis and other lung diseases for workers. Besides, seldom using personal protective equipment devices and smoking cigarettes create a higher risk of appearing chronic respiratory symptoms and decreasing respiratory functions as well as infecting easily germs.

In reality, chronic respiratory symptoms such as cough, phlegm and wheezing collected by self-reported questionnaires are quite high rates including 31.14% equal to 180 workers with chronic cough symptom, 29.41% equal to 170 workers with chronic phlegm, and 6.23% equal to 36 workers with wheezing symptoms.

After classified by sex, age, smoking, workplace and work-time, in the relationship between dependent variables and independent variables; for the cough symptom, because model of homogeneity test has p-value <0.05 similar to difference of OR between classifications, work-time and workplace are interaction factors with exposure while sex, age, smoking habit are confounding factors. For wheezing symptom, because model of homogeneity test has p-value >0.05 and OR among classifications is different and their difference between OR crude and OR M-H is over 10%, sex, age, smoking, workplace and work-time are confounding factors in relation between exposure and outcome. However, for the phlegm symptom, variables such as smoking habit, workplace and work-time are interaction factors with exposure while sex is a confounder factor in relationship between the exposure and outcome. Therefore, the more smoking and working time workers do the higher risk of appearing chronic respiratory and decreasing lung functions they have.

The cross sectional study has exposure and outcome factors presenting together at the same time, so it is difficult to identify the time progress between the exposure to hazards and the outcome of happening chronic respiratory symptoms. However, a retrospective document of workers is based on the company’s records including from beginning to current jobs of workers. This helps determine an exposure history of workers. Besides, measuring hazards of working
environments and collecting an occupation-related data of workers are to the information source to identify the point of time exposure to dust and/or gases. In addition, self-reported questionnaires of workers could limit bias of observation. However, a recall bias could present because of the chronic respiratory symptoms appearing in the past. To restrict the bias, we design a simple and closed questionnaire self reported suitable for almost workers and ask them again when they are routine examined their occupational health. We are convinced that a misclassification of workers is rare because workers seldom changed departments during their job history.

In Vietnam, until now, there has not been few studies related to effects on the chronic respiratory health of workers working in the rubber industry. However, a research on exposure to SO2 of workers at small and middle enterprises carried out in Hà Thái district, Hà nội (20) indicated that OR (from a relation between dusts and chronic respiratory symptoms) is 2.92 and 95% CI (1.13 – 7.57); OR (from the relation between gases and chronic respiratory symptoms) is 3.72 ; 95% CI (1.4 – 9.8). In addition, there was an interaction between the exposure and smoking habit. Although chronic respiratory symptoms are the subjective feeling of workers, they quietly affect workers’ health, comfortableness, productivity, life activities, etc. They are early signs to diagnose occupational respiratory diseases of workers working in rubber industry in particular and workers working in industries in general.

Like appearing chronic respiratory symptoms, decreasing lung functions of workers is considering. According to the study, the scatter result between the work-time and VC of workers show that there is a quite-strongly negative correlation between two variables with a correlation efficient equal – 0.56 and the regression leaner is (VC) = 3792 – 48(work-time). A definite value of correlation efficient is – 0.56 and R square is 31%, as work-time explaining 31% of changing VC. Similarly, the scatter result between work-time and FEV of workers say that there is a quite-strongly negative correlation between two variables with a correlation efficient equal – 0.645 and the regression leaner is (FEV) = 3486 – 56.75(work-time). A definite value of a correlation efficient is – 0.645 and R square is 41.6%, as work-time explaining 41.6% of changing FEV. Like VC, FEV, the scatter result between work-time and Tiffeneau of workers reveal that there is a quite-strongly negative correlation between two variables with a correlation efficient equal – 0.67 and the regression leaner is (Tiffeneau) = 92.59 – 0.49(work-time) and R square is 48.81,
as work-time explaining 48.81% of changing Tiffeneau. These results indicate that workers working for a long-time have a risk decreasing increasingly lung functions. Regression liners $y_{(FEV)} = 3486 – 56.75x$ and $y_{(VC)} = 3792 – 48x$ can help supervising the status of lung functions for workers in caosumina company especially laborers with a length of work-time, exposing hazards, as well as smoking so that health supervisors can identify early occupational respiratory diseases such as silicosis and chronic bronchitis.

Adjusted by multiple regression, results indicate that the risk of happening chronic respiratory symptoms such as cough, phlegm, wheezing as well as decreasing VC, Tiffeneau index is quite high comparing the exposure group with the non-exposure group. However, there are statistically significant differences between the exposure and outcome including chronic respiratory symptoms for 95% CI not including 1; but the differences did not appear for %VC and Tiffeneau because of 95% CI including 1.

In rubber industry, workers expose hazards such as gases and respiratory dusts including free silicon and talc, so the risk of appearing chronic respiratory symptoms and decreasing lung functions is quite high. Although exposure to hazards is different from many factories or many countries, results of changes of chronic respiratory symptoms and reduces in lung functions are not different so much. This showed that the limitation of hazards from rubber industry is very necessary for protecting workers working in there in order to prevent the chronic respiratory health such as silicosis, chronic bronchitis and COPD.
VI. CONCLUSION

The rubber industry has developed and contributed into growing the economy not only for Vietnam but also for the world to meet demands of rubber products such as tires, inner tubes, etc. However, results of the working environment and effects on health of laborers at caosumina company show that although the levels of respiratory dust at the processing site and producing inner-tube have not been over the National standard, workers working for a long time are difficult to avoid affecting their health if health managers have not had an early good health strategy to protect them. In addition, chronic respiratory symptoms including cough, phlegm, wheezing, and reducing lung functions of workers have happened increasingly as well as have relations with a statistic significance to exposing hazards. The results are aimed at sounding alarm and helping health administrators consider more and more the health of workers in the rubber industry in Vietnam to detect early occupation-related respiratory problems, protecting health of workers as well as growing their productivity. Our research has only been conducted to determine on changing the working environment, appearing chronic respiratory symptoms, decreasing lung functions of workers at a state company of the rubber industry symbolized nation-wide state companies. We hope that there will have some detail studies carried out in Vietnam to assess occupation-related health respiratory problems at small and middle enterprises in future because they have been lack of health care activities for workers as well as the surveillance of working environments.
REFERENCES


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13. Special NIOHS hazard review. Rubber products manufacturing industry. DHHS (NIOSH) publication no. 93-106.


APPENDIX

Definitions of Exposures

- Non-exposure: workers working in environments without dusts or gas such as administrative work, checking products, product-export workplace
- Exposure: workers working in environments with dusts or gas emitted by producing process such as workplaces of rubber-refined, rubber vulcanized, tire and tube made.
- High exposure: workers exposing high levels of dusts or gas over standards

Definitions of Outcomes

*Chronic respiratory symptoms: According to standard MRC definitions*

- Chronic cough being cough first thing in the morning or at any time during the day or night for as much as three months each year.
- Chronic phlegm being the production of phlegm from the chest first thing in the morning or at any time during the day or night for as much as three months each year.
- Chronic wheezing symptom includes a musical or whistling sound and labored breathing, particularly when exhaling; sometimes accompanied by a feeling of tightening in the chest.

Definitions of Cigarette smoking

- A cigarette smoker was defined as one who reported current regular or occasional cigarette smoking.
- An ex-cigarette smoker as one who was a cigarette smoker.
- A never-cigarette smoker one who reported no regular or occasional cigarette smoking.
- A non-cigarette smoker was either an ex-cigarette or never-cigarette smoker.

Workplaces as groups with specific works

- Rubber processing
- Rubber curing
- Tire and inner-tube products
- Checking products, Exporting products, Boiler place, Pressure place
QUESTIONNAIRE

To get well study result aimed at giving good solutions to prevent pollution of working environment. You would answer trustily and please stick “X” in blank.

1/ Full Name:
Sex:   Male ☐ Female ☐

2/ your birthday:
Height:      Weight:

3/ Marriage status:
Single ☐ Married ☐ Widow ☐ Divorced ☐

4/ Education background:
Elementary ☐ Secondary school ☐ High school ☐
College ☐ Under graduated ☐ Post graduated ☐

5/ which workplace are you working for? What is your job?
........................................................................................................................................................................
........................................................................................................................................................................
........................................................................................................................................................................
How long have you worked for this workplace:
The year of starting:
The level of your skill:

6/ which workplace did you work in the factory:
How long did you work for this workplace?
The year of starting:
The level of your skill:

7/ how long have you worked in this factory?

8/ What was your job you did before coming to this factory?
........................................................................................................................................................................
........................................................................................................................................................................
........................................................................................................................................................................

How long (months or years):

9/ Do you smoke cigarettes?
Yes ☐ no ☐
If yes
How long have you smoked cigarette?
How many cigarettes do you smoke each day?
If no

31
10/ did you smoke cigarette?
Yes □  no □

How many cigarettes did you smoke each day?
How many years did you smoke?

11/ the reason made you stop smoking:

12/ Do you have coughed?
Yes □  No □

If yes
13/ what it happens?
Usually □  sometimes □  rarely □

14/ what time it happens?
Morning □  night □  at any times during a day □

15/ What time did it start?
Time:  ……………..months  ……………………..years

16/ how long is your cough lasting for a month?
Time:  ……………..months  ……………………..years

17/ how many months have you coughed for a year?

18/ did your cough continue or interrupt?
Continue □  interrupt □

19/ did you have phlegm?
Yes □  No □

20/ what is your phlegm color?
White □  Yellow □  Green □  with blood □

21/ what it happens?
Usually □  sometimes □  rarely □

22/ what time it happens?
Morning □  night □  at any times during a day □

23/ What time did it start?
Time:  ……………..months  ……………………..years

24/ how long is your phlegm lasting for a month?
Time:  ……………..months  ……………………..years

25/ how many months have you phlegmed for a year?

26/ did your phlegm continue or interrupt?
Continue □  interrupt □
27/ Do you usually have coughed and phlegm together?
Yes □ No □

28/ If yes
How about it happens?
Usually □ sometimes □ rarely □

29/ How long have you had cough and phlegm?
…………months ………………………..years

30/ Which time did your status of cough and phlegm start?
…………months ………………………..years

31/ How long did they take………months ………………………..years
continue □ interrupt □

32/ Have you ever had status of leaking liquid from your noses?
Yes □ No □

33/ what is your liquid color?
White □ Yellow □ Green □ with blood □

34/ what it happens?
Usually □ sometimes □ rarely □

35/ what time it happens?
Morning □ night □ at any times during a day □

36/ What time did it start?
Time: ………………..months ………………………..years

37/ how long is your leaking lasting for a month?
Time: ………………..months ………………………..years

38/ how many months have you leaked for a year?

39/ did your leaking continue or interrupt?
Continue □ interrupt □

40/ Have you ever had breathing?
Yes □ No □

41/ When has it happened?
Morning □
Night □
At any time during a day □
All day □
All night □

Thanks so much your helps answering study questionnaires.