UNIVERSITI PUTRA MALAYSIA

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BY

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Abstract

Prevalence on respiratory symptoms among Latex Glove Workers at Senawang, Negeri Sembilan using Lung Function Test.

Khairul Anuar Bin Ahmad Erawan

Background: Latex glove process are one of the sources of organic dust in the working environment. Without any protection, the latex glove workers were exposed to them on their routine work. However, less study has been conducted to determine the level of dust exposure to the latex glove workers. Therefore, the **objective** of this study is to determine the prevalence of respiratory symptoms among latex glove workers using lung function test. **Methods:** This was a cross-sectional study that conducted at latex glove manufacturing industry at Senawang, Negeri Sembilan. The respondents were taken by using stratified random sampling. The workers (n=90) were interviewed using adopted questionnaire and examined lung function by using an electronic spirometer while the dust (PM2.5) was measured by using DustTrak DRX Aerosol Monitor 8534. **Results:** Majority of the workers were Indian (61.1%), Malay (24.4%), Chinese (3.3%) and Others (11.1%). For the educational level, Secondary educational level is the highest (56.7%), followed by Primary educational level (24.4%), Diploma/Degree (10.0%) and None (8.9%). The highest salary level was RM 1000-1900 (65.6%), followed by RM 2000 – 2900 (32.2%), and RM 2900 – 3900 (2.2%). The status level for the workers are Single (38.9%), Married (58.9%), and Divorced (2.2%). Descriptive analysis was used for the distribution of lung function abnormalities; Stripping station (46.7%), Quality Control (20%), and Technical and Maintenance (5.5%). While distribution of respiratory symptoms; Stripping station (Coughing – 43.3%, Phlegm – 37.7%, Wheezing – 32.2%, Shortness of breath – 32.3%), Quality Control (Coughing – 18.8%, Phlegm – 17.7%, Wheezing – 16.6%, Shortness of breath – 12.2%), and Technical and Maintenance (Coughing – 5.5%, Phlegm – 6.7%, Wheezing – 6.7%, Shortness of breath – 4.4%). Workers with high exposure to dust was majorly from stripping station (0.437 mg/m3). A Pearson Correlation test was used to determine relationship between exposure to dust and lung function abnormalities, for FEV1 ($r=0.074$, $p=0.490$), FVC ($r=0.454$, $p=0.454$), FEV1/FVC ($r=0.226$, $p=0.038$). There is significant relationship between exposure to dust and respiratory symptoms that analysed by using Chi square test, frequent coughing ($x^2=1.796$, $p=0.001$), coughing in the morning ($x^2=2.872$, $p=0.001$), phlegm in the morning ($x^2=3.451$, $p=0.032$) and both cough and phlegm ($x^2=4.476$, $p=0.021$). One-way Anova was used to determine the difference of lung function between work station are statistically differences was FEV1/FVC ($F=0.923$, $p=0.016$), FEV1 ($F=0.333$, $p=0.718$) and FVC ($F=0.245$, $p=0.783$). While difference between exposure to dust and different groups of workstations was statistically significant at Stripping station ($F=0.767$, $p=0.035$). **Conclusion:** Majority of the workers in stripping has abnormalities in lung function status, respiratory symptoms and exposed to high exposure of dust compare to the other station. Workers also had a significant relationship between exposure to dust and respiratory symptoms. Thus, several

preventions can be take such as improvement of ventilation system to a better system such as sucking fumes as it is an effective solution to reduce particulate emissions in the workplace. Besides, the management should give a proper and suitable mask to the workers such as N95 that provides 95 percent filtration efficiency of particles of the dust.

Keywords: Spirometer, Lung Function, Pulmonary Function Test, Latex Glove Manufacturing, Respiratory Disease

Abstrak

Kelaziman Simptom-Simptom Respiratori Di Antara Pekerja Sarung Tangan Lateks Di Senawang, Negeri Sembilan Menggunakan Ujian Fungsi Paru-Paru

Khairul Anuar Bin Ahmad Erawan

Latar belakang: Proses sarung tangan lateks adalah salah satu sumber debu organik dalam persekitaran kerja. Tanpa sebarang perlindungan, pekerja sarung tangan lateks terdedah kepada habuk dalam kerja rutin mereka. Walau bagaimanapun, sedikit kajian yang telah dijalankan untuk menentukan tahap pendedahan habuk kepada pekerja sarung tangan lateks. Oleh itu, **Objektif** kajian ini adalah untuk menentukan kelaziman simptom pernafasan di kalangan pekerja sarung tangan getah menggunakan ujian fungsi paru-paru. **Kaedah**: Kajian rentas keratan telah dijalankan di industri pembuatan sarung tangan getah di Senawang, Negeri Sembilan. Para pekerja (n = 90) telah ditemuramah menggunakan soal selidik dan menguji fungsi paru-paru menggunakan spirometer elektronik. **Keputusan**: Majoriti pekerja adalah India (61.1%), Melayu (24.4%), Cina (3.3%) dan Lain-lain (11.1%). Bagi peringkat pendidikan, tahap pendidikan menengah adalah yang tertinggi (56.7%), diikuti oleh peringkat pendidikan rendah (24.4%), diploma / ijazah (10.0%) dan tiada pendidikan (8.9%). Tahap gaji tertinggi adalah RM 1000- 1900 (65.6%), diikuti oleh RM 2000 - 2900 (32.2%), dan RM 2900 - 3900 (2.2%). Tahap status pekerja adalah bujang (38.9%), berkahwin (58.9%), dan bercerai (2.2%). Analisis deskriptif digunakan untuk mengagihkan keabnormalan fungsi paru-paru; Stesen pelucutan (46.7%), Kawalan Kualiti (20%), dan Teknikal dan Penyelenggaraan (5.5%). Sementara bagi pengedaran simptom pernafasan; Stesen pelucutan (Batuk - 43.3%, Berkahak - 37.7%, Dada Berbunyi - 32.2%, Sesak Nafas - 32.3%), Kawalan Kualiti (Batuk - 18.8%, Berkahak - 17.7%, Dada Berbunyi – 16.6%, Sesak Nafas – 12.2%), dan Teknikal dan Penyelenggaraan (Batuk - 5.5%, Berkahak - 6.7%, Dada berbunyi - 6.7%, Sesak nafas - 4.4%). Pekerja yang mempunyai pendedahan yang tinggi terhadap habuk adalah sebahagian besar dari stesen pelucutan (0.437 mg/m^3). Ujian korelasi Pearson digunakan untuk menentukan hubungan antara pendedahan kepada kelainan debu dan fungsi paru-paru, untuk FEV1 ($r = 0.074$, $p = 0.490$), FVC ($r = 0.454$, $p = 0.454$), FEV1 / FVC ($r = 0.226$, $p = 0.038$). Terdapat hubungan yang ketara antara pendedahan kepada habuk dan gejala pernafasan yang dianalisis menggunakan ujian Chi square, batuk yang kerap ($x^2 = 1.796$, $p = 0.001$), batuk pada waktu pagi ($x^2 = 2.872$, $p = 0.001$) $x^2 = 3.451$, $p = 0.032$) dan kedua-dua batuk dan kahak ($x^2 = 4.476$, $p = 0.021$). Satu arah Anova digunakan untuk menentukan perbezaan fungsi paru-paru antara stesen kerja dengan perbezaan statistik adalah FEV1 / FVC ($F = 0.923$, $p = 0.016$), FEV1 ($F = 0.333$, $p = 0.718$) dan FVC ($F = 0.245$, $p = 0.783$). Walaupun perbezaan antara pendedahan kepada habuk dan kumpulan kerja yang berlainan secara statistik adalah signifikan di stesen Stripping ($F = 0.767$, $p = 0.035$). **Kesimpulan**: Majoriti pekerja dalam stesen pelucutan mempunyai keabnormalan dalam status fungsi paru-paru, gejala pernafasan dan terdedah kepada pendedahan yang tinggi dari habuk berbanding stesen lain. Pekerja juga mempunyai hubungan yang ketara antara pendedahan kepada

debu dan gejala pernafasan. Oleh itu, beberapa pencegahan boleh diambil seperti peningkatan sistem pengudaraan ke sistem yang lebih baik seperti ventilasis habuk kerana ia merupakan penyelesaian yang berkesan untuk mengurangkan pelepasan zarahan di tempat kerja.

Kata kunci: Spirometer, Fungsi Paru, Ujian Fungsi Pulmonari, Pembuatan Sarung Tangan Latex, Penyakit Pernafasan

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List of Abbreviations

%	Percentage
FEV	Forced Expiratory Volume
FVC	Forced Vital Capacity
SPSS	Statistical Package for Social Sciences
MPOB	Malaysian Palm Oil Board
MPOC	Malaysian Palm Oil Council
COPD	Chronic Obstructive Pulmonary Disorder
OSHA	Occupational Safety and Health Act

Chapter 1

INTRODUCTION

1.1 Background

Latex is a natural product from the rubber tree. Rubber seed was introduced in Malaysia by British colonist named H.N. Ridley in 1877 via Brazil, Kew Gardens at London and Sri Lanka. For many years tin and rubber were Malaysia's primary exports.

Nowadays, in 2016 total world production of rubber had been increasing to 26.9 million tonnes, growing at an annual average rate of 2.2% from 23.7 million tonnes in 2010 and Malaysia becomes the world's fifth largest producer of natural rubber (NR) after Thailand, Indonesia, Vietnam and China according to Malaysian Rubber Export Production Malaysia (MREPC, 2017). Based on Ministry of International Trade and Industry (MITI, 2016), there were several products that based on latex rubber such as tires, safety or special function gloves and dry rubber products such as belting, hoses, pipes, and tubing and rubber profiles. Generally, production of latex gloves was divided into several stages or sections.

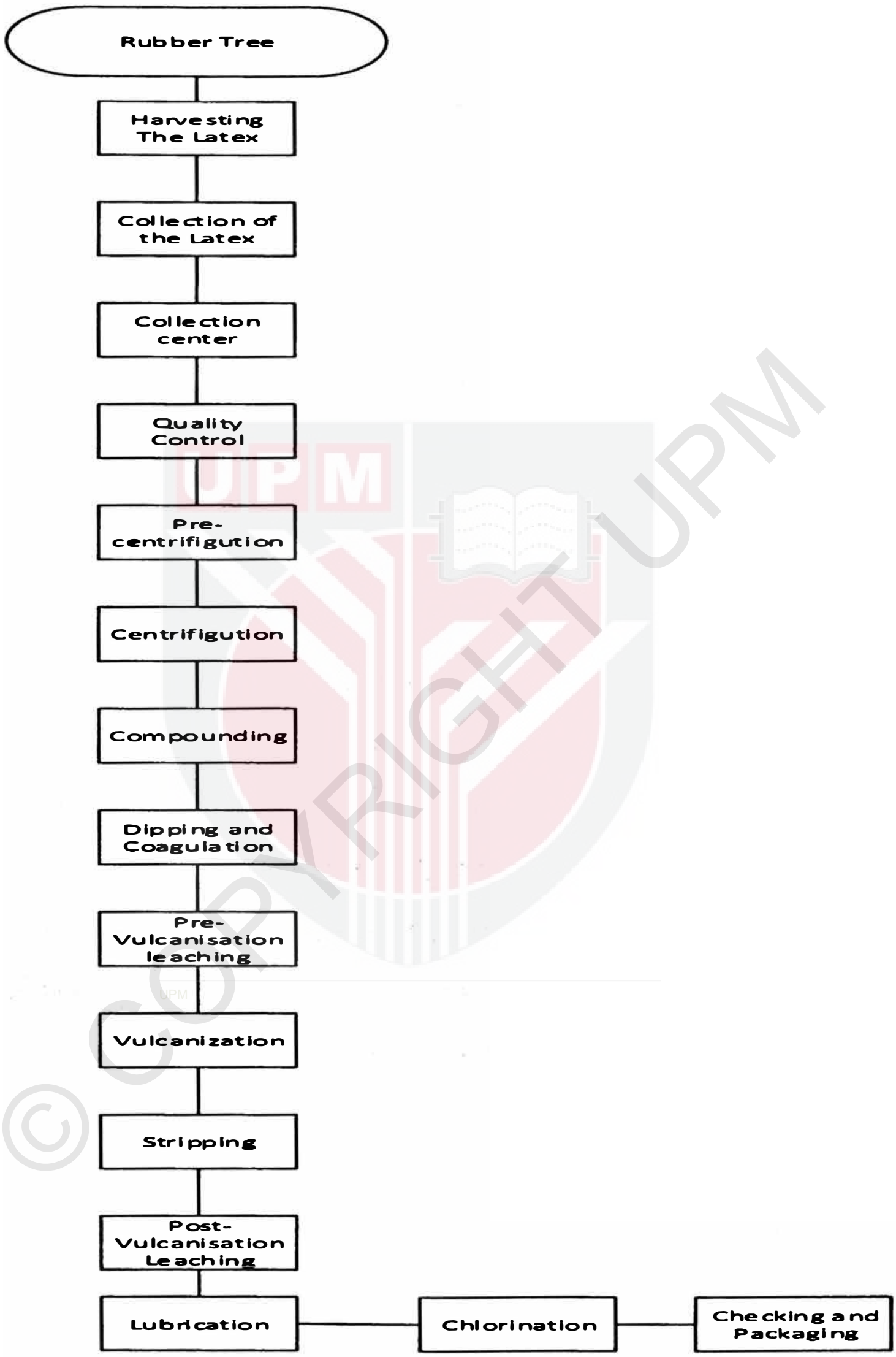


Figure 1.1: Latex Glove processing (Source: MREPC, 2017)

Similar to other industries, latex gloves workers were subjected to the occupational hazard. Among the hazard in the latex gloves were physical, chemical, biological, psychosocial and ergonomic. The workers of manufacturing industry were exposed to a lot of harmful factors in their work environment, such as dust, and fumes from rubber-making and vulcanization processes and potential carcinogenic exposures including N-nitrosamines, polycyclic aromatic hydrocarbons, solvents, and phthalates reported by Kogevinas and Garcia-closas (2014). However, in this study, chemical hazards in the latex manufacturing which was cornstarch dust that scattered all around the working area will be assessed. Exposure to dust was known to produce a variety of clinical responses, including asthma, chronic bronchitis, chronic airways obstructive disease (COPD), allergic alveolitis, and organic dust toxic syndrome (ODTS) stated by Viegas et al (2013).

The occupational lung disease was most likely due to deposition of dust in lungs and influenced by sort of dust specifically corn starch in the latex glove production, the period of exposure, the concentration and size of airborne dust in the breathing zone that had been and various studies had shown that occupational exposures to vapours, gases, dust, and fumes or their composite measure negatively affect FEV1 and the FEV1/FVC ratio, indicating obstruction of predominantly the large airways stated by Jong de et al (2014). The lung with its extensive surface area, high blood flow and the thin alveolar epithelium is an important site of contact with the substance that had been exposed from the environment.

Pulmonary function testing was a valuable tool for evaluating the respiratory system, representing an important adjunct to the patient history, various lung imaging studies, and invasive testing such as bronchoscopy and open-lung biopsy as stated by Gildea et al. (2013). However, there are limited specific studies that had been conducted on the hazard of dust among the workers in latex glove manufacturing. Hence this study was carried out to measure the status of individual lung function among workers in latex gloves manufacturing according to their work unit. The results from this study will serve as a reference to help the employer to identify any lack along the process in order to improve the working environment in latex manufacturing. This is important to serve a better and safe working environment for workers health and productivity.

1.2 Problem Statement

Exposure to dust was known to cause an increased morbidity and mortality among exposed population all over the world as stated by Zilaout H. et al (2016) and Zamora-Rodriguez M. G. et al (2016). Thus, occupational exposure to the dust was detrimental to the workers. It was important to take account of since exposure to the dust can decline respiratory symptoms. According to report that have been stated out by Social Security Organization (SOCSO) in 2015, number of cases that have been reported involving disease of respiratory symptoms are 263 cases in male and 80 cases in female. While World Health Organization (WHO, 2014) also stated that there is no global database on dust exposure, but there are probably hundreds of millions of people worldwide exposed to hazardous dusts in the course of their work.

Overall, latex gloves manufacturing in this factory can be simplified into several stages which were rinsing, brushing, dripping, leaching, beading, powder/slurry tank and stripping process. However, most exposures to dust were mainly from the stripping process. This was supported by Sanguanchaiyakrit, Povey, & De Vocht, (2014) that indicated that workers are routinely exposed to measurable levels of latex aero-allergens in especially the stripping, tumbling, and packing departments, which may give rise to an increased incidence of allergic symptoms and occupational asthma. Evidence reported that the worker's complaints on respiratory problems such as asthma, cough with sputum, dry cough, breathlessness and wheezing.

The issues of respiratory problems in industrial workers were overwhelming. This can be seen by Soongkhang I. and Laohasiriwong W. (2015), a study in a wood furniture manufacturing factory, Northeast of Thailand, stated that 30% of wood furniture manufacturing factory workers had respiratory symptoms with related to both personal preventive behaviours and their working environments. Also, the study showed a strong association between substances inhaled in a factory environment (dust) and frequency of respiratory symptoms.

1.3 Study Justification

It was stated under Section 15, Occupational Safety and Health Act 1994 as duties of employers to take care the safety, health and welfare of the workers as far as practicable. Besides, in Malaysia, there were fewer studies conducted on occupational

exposures and deterioration of lung function and respiratory symptoms among latex gloves workers. Thus, this study was important as a baseline data for the assessment of lung function among the workers in latex gloves manufacturing besides being a benchmark to the management whether the control measure was adequate.

Even though, the manufacturing industry have been established since 1980 and has been operated more than 30 years, there were no any lung function test have been done to the workers. As according Rubber Journal Asia (RJA, 2017), Malaysia led the global production of rubber glove which was 63% total production in the worlds, it must be a high priority to make sure all the hazards such as exposure to the dust was taken care of. Furthermore, Negeri Sembilan also has the highest number of gloves factory which is seven factory compare to the other state (MREPC, 2017).

1.4 Conceptual Framework

This study was to determine the prevalence of respiratory symptoms and lung function among workers in latex glove manufacturing factory (Figure 1.2).

Generally, the hazard can be defined as anything that had potential to cause adverse effect or harm to the people, environment and things. In occupational fields, there were five types of hazard that can be exposed to the workers which were physical, chemical, biological, ergonomic and psychosocial. However, these hazards were exposed to the workers depending on their condition of workplace or work unit. It not necessary that all types of hazard can be in a place at one time.

Each type of hazard had their own consequences to the human. For the latex glove workers, the main hazard exposure was chemical and there was a lot of research that had been done about it. Unfortunately, the workers also had a potential to be exposed to physical hazards such as dust in their work environment. Effect of dust can be categorised into two consequences which were cardiopulmonary and respiratory health effects.

In this study, respiratory health effects were focused on. To measure the effects, lung function test was required and abnormality in the lung function was measured by using spirometer. The respiratory symptoms were measured by questionnaire and their relationship with some factors was measured.

As stated by World Health Organization (WHO, 1999), workers that exposed to the high level of dust in their work unit or workplace will tend to get respiratory symptoms which can lead to occupationally lung diseases such as bronchitis, asthma and Chronic Obstructive Pulmonary Disorder (COPD).

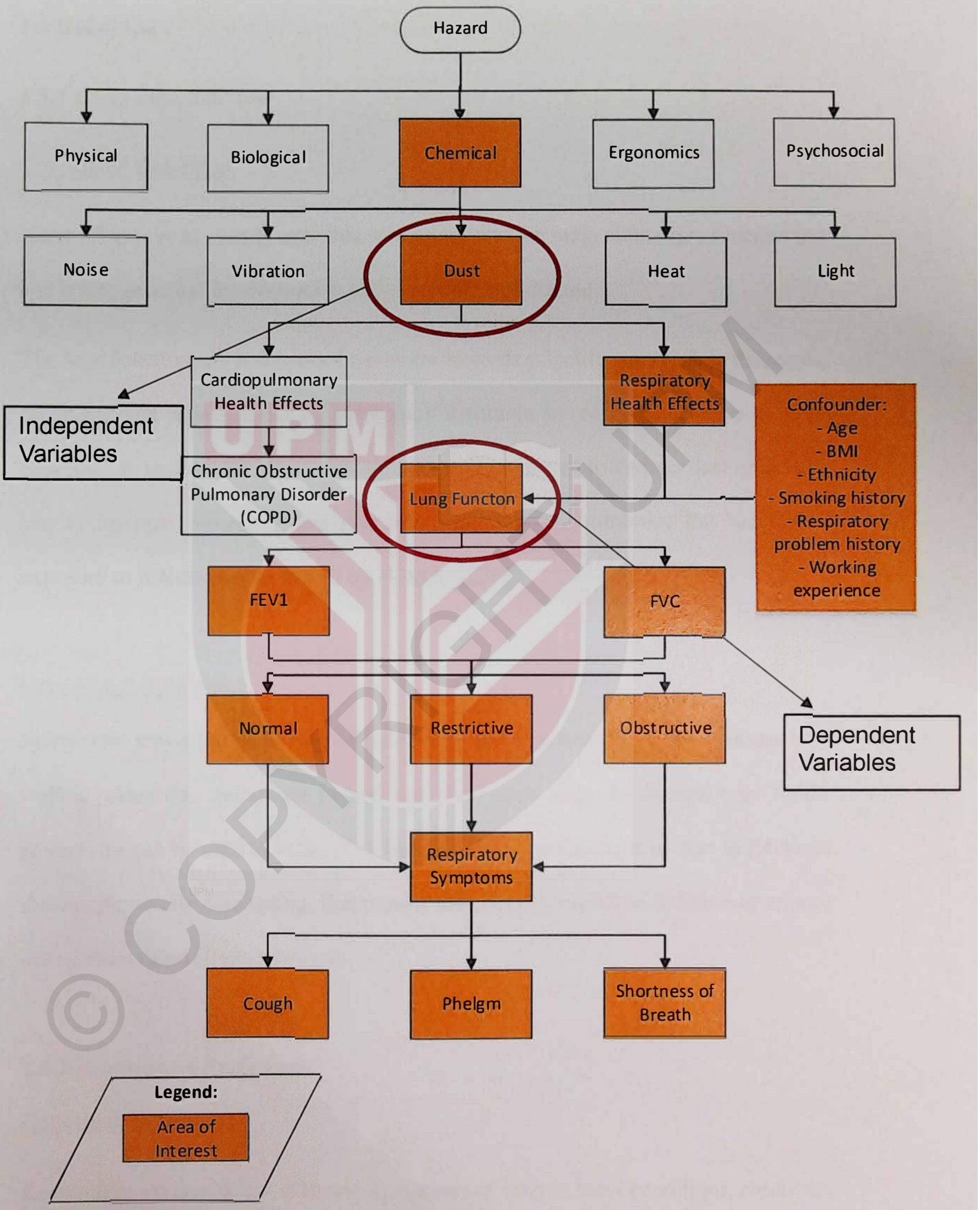


Figure 1.2: Conceptual Framework of the variable related to the study.

1.5 Definition

1.5.1 Lung Function Test

Conceptual Definition

Garcio-Rio F. et al. (2013) state that spirometry was the main pulmonary function test and it was essential for evaluation and monitoring of disease.

The lung function test had opened a new era towards scientific approach in diagnosis, prognosis and management of pulmonary disorders by early recognition of their alteration in industry workers who are constantly exposed to various dust pollutants and to institute protective and preventive measures to minimize the hazards of exposure to polluted environment by Vyas S. (2012).

Operational definition

Spirometry was a common type of pulmonary function test (PFT) that measure how well a person can move air in and out from their lung. In occupational fields, spirometry can be used to establish a baseline before assigning a worker to job tasks that are physically demanding, that require the use of a respirator, or that may expose the workers to respiratory hazards.

1.5.2 Respiratory Symptoms

Conceptual Definition

Respiratory symptoms are common symptoms of lung or heart conditions, emotions, or injury. Respiratory symptoms may accompany other symptoms affecting the respiratory system including: absence of breathing (apnea), cough that gets more severe over time, difficulty breathing, loose, wet cough that produce thick white or

yellow phlegm, rapid breathing (tachypnea), shortness of breath and wheezing (whistling sound made with breathing).

Breathing problems may occur in conditions affecting the lungs alone or may be seen in association with more generalized conditions, such as dehydration or infections. (Local Health, 2013)

Lungs can also produce non-respiratory symptoms such as par neoplastic symptoms of lung malignancy. (Singh. S., 2016)

Operational Definition

There are several ways to assess respiratory symptoms. In this study, respiratory symptoms are assessed by questionnaire. In the questionnaire it was included the early symptoms regarding respiratory health effects such as coughing, phlegm, wheezing and shortness of breath.

1.5.3 Anthropometry

Conceptual Definition

Anthropometry was the science that defines physical measures of a person's size, form, and functional capacities. As it was applied to occupational injury prevention, anthropometric measurements are used to study the interaction of workers with tasks, tools, machines, vehicles, and personal protective equipment, especially to determine the degree of protection against dangerous exposures, whether chronic or acute. (Centers for Disease Control and Prevention, 2012)

Operational Definition

The measurement of human body based on the parameters needed in the centimetre (cm). The anthropometry component is to collect high quality body measurement data using standardized examination procedures and calibrated equipment. Accurate data are fundamental to the evaluation of anthropometric trends over time.

1.6 Research Objectives

1.6.1 General Objective

To determine the prevalence of respiratory symptoms and lung function among latex gloves workers using lung function test.

1.6.2 Research Question

I. Is there any association between lung function abnormalities, respiratory symptoms and exposure to dust according to the work station?

II. What is the level of distribution of exposure to dust according to the work station?

III. Is there any association between occupational exposure to dust and lung function?

IV. Is there any association between occupational exposure to dust and respiratory symptoms?

V. Is there any differences of lung function and exposure to dust between work stations?

1.6.3 Specific Objectives

I. To determine the socio-demographic of respondents among latex gloves workers.

II. To determine the relationship of lung function abnormalities, respiratory symptoms and exposure to dust among latex glove workers according to the work station.

III. To determine the distribution of exposure to dust among latex glove workers according to the work station.

IV. To determine the relationship between occupational exposure to dust and lung function among latex gloves workers.

V. To determine the relationship between occupational exposure to dust and respiratory symptoms among latex gloves workers.

VI. To determine the differences of lung function and exposure to dust between work station.

1.7 Hypothesis

I. There is significant relationship between lung function abnormalities and work station.

II. There is significant relationship between respiratory symptoms and work station.

III. There is significant relationship between exposures to dust and work station.

IV. There are significant differences between exposures to dust according to the work station.

V. There is significant relationship between occupational exposure to dust and lung function.

VI. There is significant relationship between occupational exposure to dust at work and respiratory symptoms.

VII. There are significant differences between lung function and exposure to dust between work stations.

Chapter 2

LITERATURE REVIEW

2.1 Gloves Industry

Malaysia was currently the world's fifth largest producer of natural rubber after Thailand, Indonesia, Vietnam, China and India. Within a decade after it was introduced, agriculturalists in remote parts of Southeast Asia started to plant rubber trees in their cultivated plots. The first rubber tree that had been planted in Malaysia was planted in 1877 near the Kuala Kangsar District Office. Because of Malaysia ideal climate, soil for rubber and plenty of land, the production had been increased dramatically after the 1890s when there was a huge surge in demand for rubber. Figure 2.1 shows overall process of latex glove starts from the acid tank until the stripping station. This process will produce the high quality of gloves. The workers can be exposed to the dust at stripping and quality control station as it involves corn starch to be mixed with the gloves. The workers at stripping station need to pull of the latex gloves from artificial arm and it will cause the corn starch dust exposure that were added from previous process to enable easy donning and pull of process of the latex glove. While the quality control station, need to make sure all the latex glove produced were in best condition without any broken pieces by blew it to check any ripped part or hole at the latex glove. This process was important as to make sure that the quality of the product was at the best condition before get to the user.

2.2 Rubber

There were various types of rubber in the industries, however, they all fall into two broad types which were natural rubber (latex—grown from plants) and synthetic rubber (made artificially in a chemical plant or laboratory). Although natural rubber and synthetic rubbers were similar in some ways, they're made by entirely different processes and chemically quite different.

Natural rubber was made from a runny, milky white liquid called latex that oozes from the rubber tree *Hevea Brasiliense* when you cut into them. It was a polymer of isoprene with the chemical formula (C5H8). Besides, the things that make rubber can be pulled apart and untangled easily because it was made of many thousands of basic C5H8 units. These properties make natural rubber become elastic stated by US Department of Agriculture/Agricultural Research Service (USDA/ARS).

Synthetic rubbers were made in chemical plants using petrochemicals as their starting point. One of the first is neoprene (the brand name for polychloroprene), made by reacting together acetylene and hydrochloric acid. Emulsion styrene-butadiene rubber (E-SBR), another synthetic rubber, was widely used for making vehicle tires.

2.3 Latex

A latex was a mixture of organic compounds produced by some plants in special cells called caticifers as stated by Stanley (2014). The composition of latex differs from plant to plant. Most natural rubber comes from a single species of tree,

Hevea brasiliensis. Though native to South America, H. brasiliensis was planted in large plantations in Southeast Asia, including Malaysia.

When a rubber tree tapped by removing the thin barks, it will produce latex that grooves down the cut in the tree and flow into the collection cups. Rubber estate workers (also known as tappers) then proceed to collect the latex from the collection cups by pouring the contents of the collection cups into a larger container before replacing the collection cup into its original position. After natural latex was processed, it becomes a rubber with excellent mechanical properties. This rubber had excellent tensile, elongation, tear resistance and resilience. Furthermore, it also had good abrasion resistance and excellent low-temperature flexibility.

2.4 Latex gloves process

The process to produce gloves involves a lot of process (Figure 2.1) that can result in exposure to varieties of hazard.

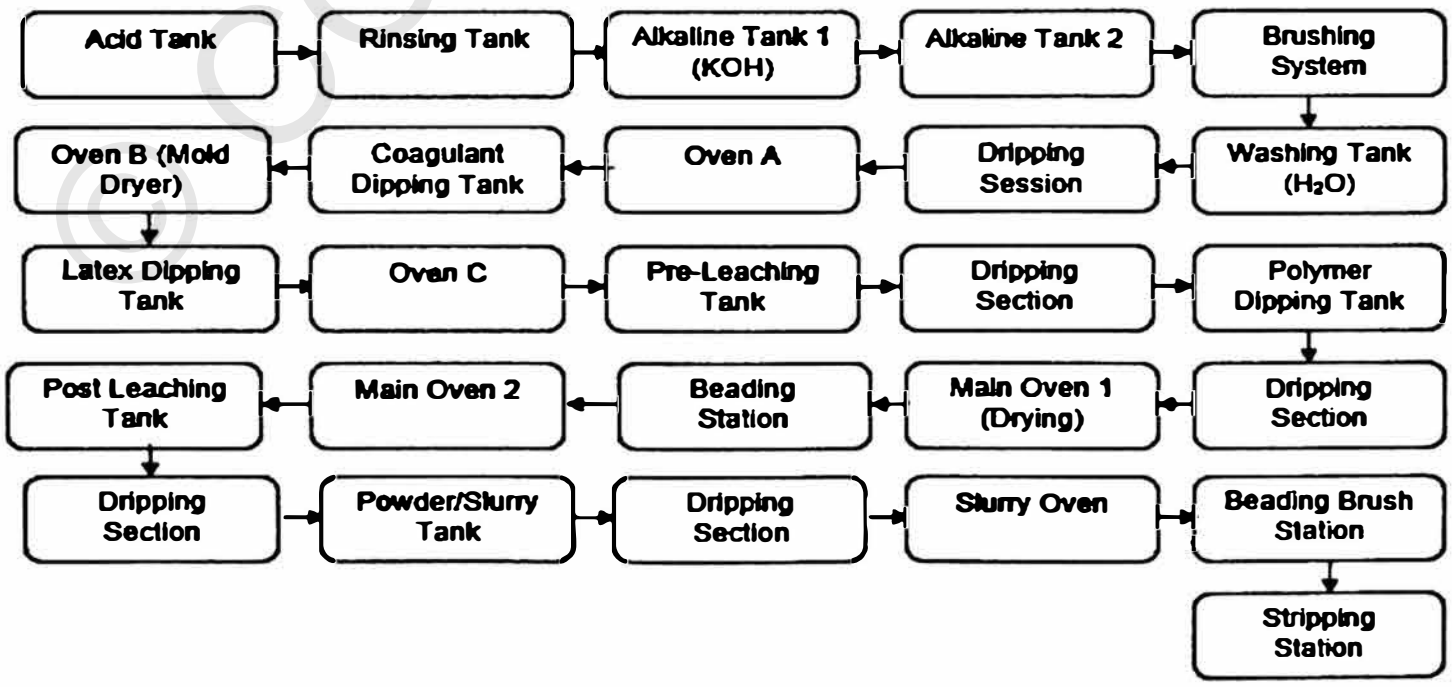


Figure 2.1: Latex Gloves process

The manufacturing process of latex glove was started with sanitize the artificial arm at acid and alkaline tanks. Then, the artificial arms were cleanse at the brushing, dripping and dry at the oven station. The process continues at the dipping station to dip the artificial arm into the latex and dry at the oven station. The beading station has the mixture of polymer and corn starch to made the latex gloves easy to be pulled of at the stripping station. Lastly, the latex gloves will undergo quality check to avoid any ripped gloves passed through to the consumer.

2.5 Occupational Hazard

As stated by Occupational Health Centre (OHC), all industries were exposed to one or more types of occupational hazards every day. There were five types of occupational hazards such as physical, biological, chemical, ergonomics and psychosocial.

Physical hazards were the most common type of workplace hazards. Examples of physical hazards include slips, trips, falls, and exposure to loud noises, working from heights, vibrations, and dust from unguarded machinery. Chemical hazards were present anytime workers were exposed chemical substances. Examples include cleaning solutions and solvents, vapours and fumes, carbon monoxide and any other gases.

Biological hazards occur due to working with people, animals or infectious plant material. Examples include blood or other bodily fluids, animal care, insect bites, bacteria or viruses.

Ergonomic hazards place certain strains on a worker's body. Ergonomic hazards occur as a result of physical factors that can harm the musculoskeletal system. This type of hazard was not easily identified, examples of this hazard were poor lighting, repetitive motion, awkward movements, and poor posture.

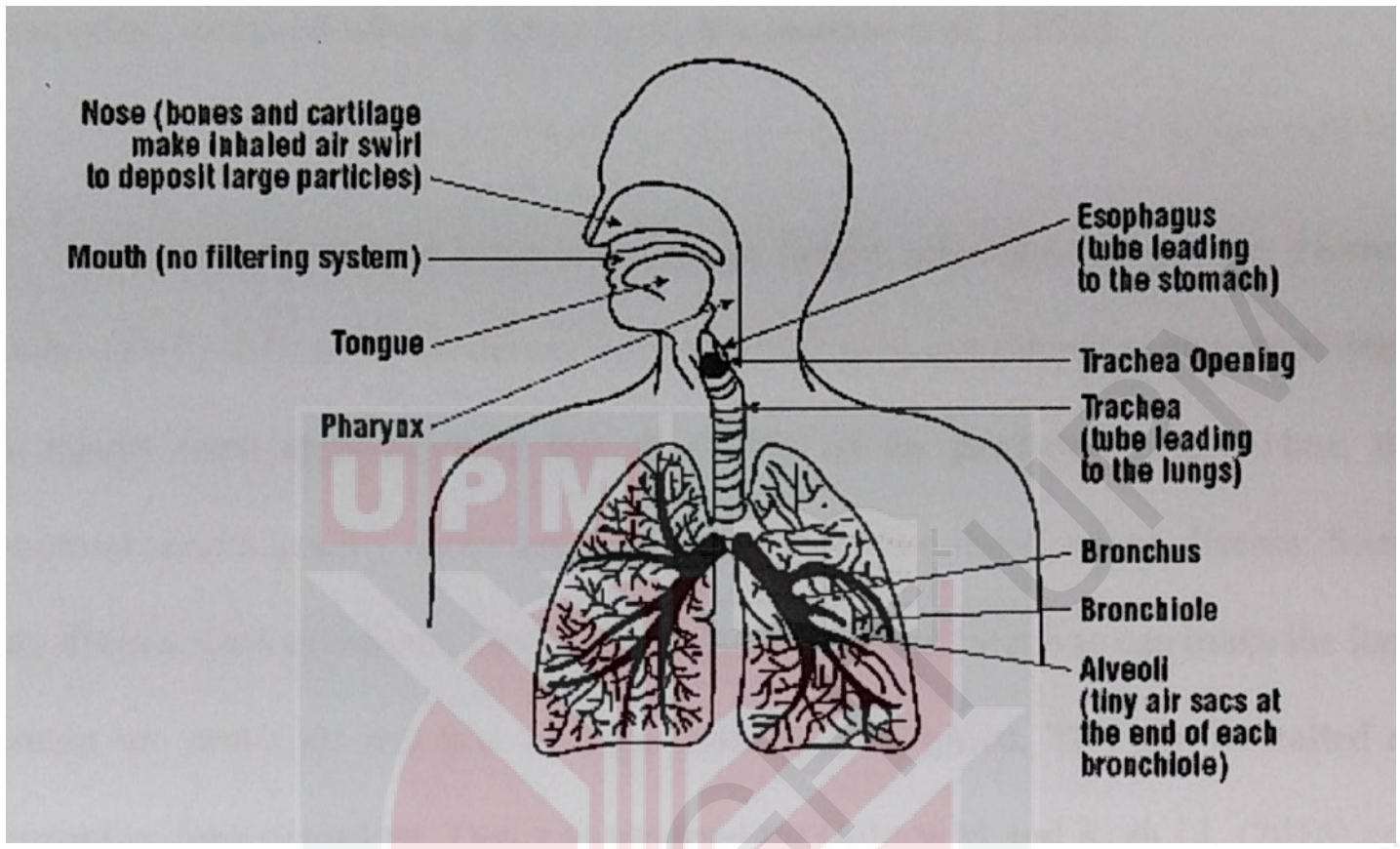
Psychosocial hazards include but weren't limited to stress, violence, and other workplace stressors. Work was generally beneficial to mental health and personal well-being because it provides people with structure and purpose and a sense of identity. It also provides opportunities for people to develop and use their skills, to form social relationships, and to increase their feelings of self-worth in the workplace.

2.6 Occupational Exposure to Dust

There were quite a number of studies done regarding occupational exposure to dust in the whole world. Occupational exposure to dust was among the main causes of pulmonary disease like asthma and bronchitis and Chronic Obstructive Pulmonary Disease (COPD) as reported by Arif AA (2017). A study by Beckett WS (2000) suggests that one of the potential risk factors for pulmonary disease were exposure to respirable dust particles in the work environment and hence the workers may develop various respiratory disorders as the result of long-term exposure to respirable mineral and organic dust in an occupational environment.

Due to various construction activities, the dust that was floating in their vicinity enter into their respiratory pathway through nose and mouth leading to chronic respiratory disease and cause the reduction in ventilator capacities. Several previous

studies done by Arif AA et al. (2017), Zilaout H et al. (2016), Hagstad S et al. (2015), and Rodriguez-Zamora MG (2016) had shown increased respiratory symptoms among workers of different categories.



As being documented in other studies, the respiratory health effects in workers exposed to a variety of dust in small and large-scale industries, which generates dust during their production process was significant.

2.7 Lung Function Test

In occupational respiratory disease, spirometry was one of the most important diagnostic tools and measurement of dynamic lung functions was more important than of static lung volumes. A study by Garcio-Rio F. et al. (2013) states that spirometry was the main pulmonary function test and it was essential for evaluation and monitoring of any respirable disease. Besides, the competency on handling spirometry also was needed for detecting problems and prevent any human error during the reading was taken.

It was also used for screening workers with exposure to agents associated with pulmonary disease. Benefits of using lung function test were that it provides a clearer understanding of pulmonary function in subjects of different races, age, sex, occupation, and profession as stated by T. Mariammal et al. (2012).

Normal values were based on your age, height, ethnicity, and gender. Normal results usually defined by the percentage. A value can be considered as abnormal when the results were approximately less than 80% of the predicted value. Thus, the abnormal results usually mean that the person may have chest or lung disease. Some lung disease such as asthma, chronic bronchitis, and even infection can make the lung contain too much air and take a longer time to be emptied. This can be called as obstructive lung disorders. This was reported by Gold WM and Koth LL (2016) and Scanlon PD (2016).

2.7.1 Forced Vital Capacity (FVC) and Forced Expiratory Volume (FEV)

FVC and FEV were the primary variables in spirometry. The FVC represents the maximum volume of air exhaled in a maximal forced expiratory maneuver, initiated after a maximal inspiratory maneuver, that be expressed in liters. While the FEV corresponds to the maximum volume of air exhaled in the first second of the FVC maneuver, also expressed in liters (García-Río et al., 2013).

2.8 Normal Spirometry

A normal Flow-Volume loop begins on the X-axis (Volume axis): at the start of the test both flow and volume were equal to zero. After the starting point, the curve rapidly mounts to a peak: Peak (Expiratory) Flow. After the PEF the curve descends (the flow decreases) as more air was expired. A normal, non-pathological F/V loop will descend in a straight or a convex line from top (PEF) to bottom (FVC).

The forced inspiration that follows the forced expiration had roughly the same morphology, but the PIF (Peak Inspiratory Flow) is not as distinct as PEF.

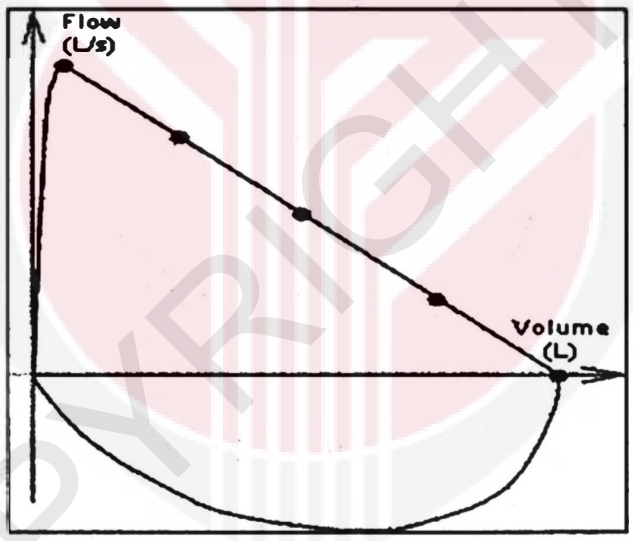


Figure 2.2: Normal spirometry results

2.9 Obstructive Lung Disease

Obstructive lung disease was shortness of breath due to difficulty in exhaling all the air from the lung. This can happen because of damage to the lungs or airways narrowing inside the lung, thus exhaled air comes out more slowly than normal. After the full exhalation, an abnormally high amount of air may still stay in the lungs.

The most common cause of obstructive lung disease was chronic obstructive pulmonary disease (COPD), which includes emphysema and chronic bronchitis, asthma, bronchiectasis and cystic fibrosis.

Obstructive lung disease makes it harder to breathe especially during heavy work activities. As the rate of breathing increase, there was less time to breathe all the air out before the next inhalation. (Mason, 2010)

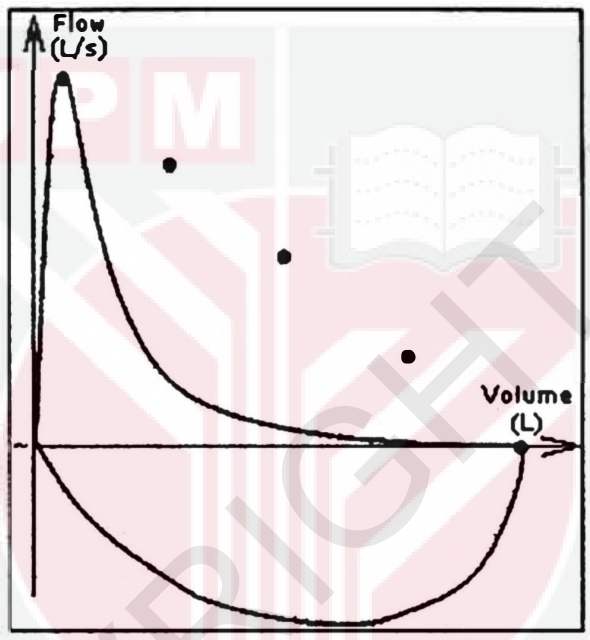


Figure 2.3: Obstructive lung disease results

2.10 Restrictive Lung Disease

Restrictive lung disease was a condition when patients cannot fully fill their lungs with air. The lungs become restricted from expanding. This happens because of condition that causing stiffness in the lungs. But, some other factors such as stiffness of the chest wall, weak muscles, or damaged nerves may also cause lung restriction.

Some conditions that cause restrictive lung disease were interstitial lung diseases, such as idiopathic pulmonary fibrosis, sarcoidosis which was an autoimmune

disease, obesity, Scoliosis and neuromuscular diseases, such as muscular dystrophy or amyotrophic lateral sclerosis (ALS). (Mason, 2010).

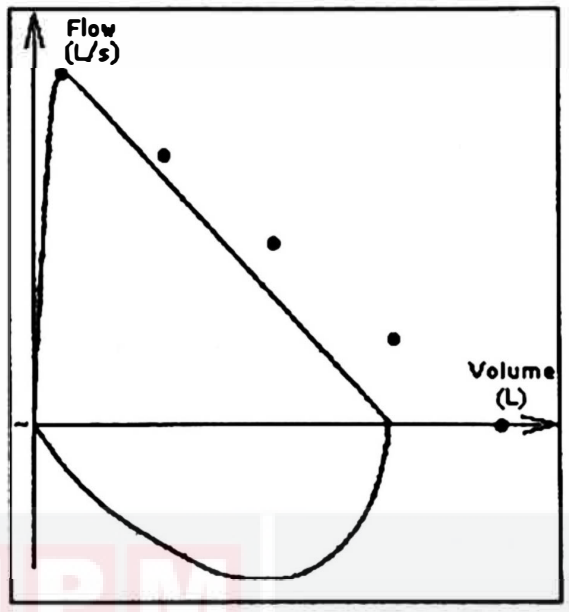


Figure 2.4: Restrictive lung disease results

2.11 Respiratory Symptoms

Singh S. (2016) had reported that the main symptoms of respiratory disorder were breathlessness, chest pain, wheeze, coughing and production of sputum. Lungs also can produce non-respiratory symptoms such as par neoplastic symptoms of lung malignancy.

In another study by Mijakoski et al. (2011), found a higher prevalence of nasal symptoms in bakers than in office workers with a significant difference in a runny nose, as well as higher prevalence of respiratory symptoms with a significant difference for a cough and phlegm. There was a significant association between these symptoms and duration of workplace exposure in bakers. Also, a study by Kayhan et al. (2013) found that respiratory irritants represent a major cause of occupational obstructive airways disease related to irritative agents causing occupational asthma.

Furthermore, Rovira E. at al (2014) found that there were differences in respiratory health effects between studies that may be related to qualitative and quantitative differences in exposure characteristics of places of studies.

Exposure to a particulate material can affect human heart and lungs, especially the fine particles which contained microscopic solids or liquid droplets that were so small that they can get deep into the lungs and cause serious health problems (EPA, 2002). EPA was concerned about particles that were 10 micrometres in diameter or smaller (PM10) because those were the particles that can pass through the human throat and nose. Once it passes through, these particles can affect the heart and lungs and can cause serious health effects.

2.12 Occupational respiratory disease

Airways disease can be either caused or exacerbated by occupational exposure. However, early recognition of work-related disease was crucial to achieving a successful outcome for the patient. Toxic exposure to workplace respiratory irritants can also result in airways disease reported by Szram J (2012). Furthermore, asthma was the most common airways disease. Toxic airways damage and obliterate bronchitis can occur following irritant exposures. COPD had also been associated with the occupation of a person.

Respiratory diseases were common entities in occupational industries because the lungs were the route of entry for noxious particles and gases. These agents can be

inhaled in the form of fibres or dust. Work-related or occupational asthma was defined by Kayhan et al. (2013) as a chronic inflammatory disorder of the airways with recurrent episodes of respiratory symptoms such as coughing, wheezing, chest tightness, dyspnea, shortness of breath at rest and reversible airflow limitation caused by a particular occupational environment.

Chapter 3

METHODOLOGY

3.1 Study Design

This was a cross-sectional study which designed to determine the prevalence of respiratory symptoms and lung function among workers in latex glove manufacturing using the lung function test.

3.2 Study Location

This study was conducted in latex gloves factory at Senawang, Negeri Sembilan which have been permitted by the major director of the factory.

3.3 Study population

The study population were the workers in latex glove factory in Senawang, Negeri Sembilan, specifically at stripping, quality control and technical and maintenance station.

3.4 Sampling

3.4.1 Study framework

The study framework was obtained from a list of all the workers in specific work unit that exposed to the dust in the latex gloves factory. The name list was obtained from the management office of the factory.

3.4.2 Sampling unit

The sampling unit met the inclusion criteria which were; male, aged between 19 to 69 years old and work at stripping, quality control, and technical and maintenance station.

3.4.3 Sampling method

The sampling method used was stratified random sampling where the respondents will be selected based on the inclusion criteria's. The respondents were chosen from production department specifically at stripping and quality control station that has exposed to the dust.

3.4.4 Sample size

By using the formula from Kirkwood (2009):

$$n = P (1 - P) / e^2$$

n = required sample size

P = expected prevalence

e = margin of error at 5%

Based on the formula, the numbers of respondents required by this study were:

$$n = 0.7 (1 - 0.7) / 0.52$$

$$n = 0.7 (0.3) / 0.025$$

$$n = 84$$

Hence, the sample size that will be used in this study was 84. After rounding up (5%) and hence to add 5 more to the sample size, the total sample size was 89. The respondent was chosen according to inclusion and exclusion criteria.

3.4.5 Exclusion criteria

The exclusion criteria were female workers and workers that have undergone surgery over the abdomen area for past 3 months. Workers that have any smoking history, asthma (inhaler user), any respiratory tract infection in the last three weeks, had a heart attack in last three months, any heart disease and female workers

3.5 Study instrumentation and data collection

3.5.1 Questionnaires

The questionnaires that used for the respiratory symptoms was adopted from the European Community Respiratory Health Survey II (EC-RHS II, 2014) and previous study by Putri Anis, (2014). Emphasis was laid on inquiry regarding an occurrence of chest tightness, chest compression, wheezing, cough and phlegm appearing in them and the frequency of occurrence, the day of occurrence, duration and relationship work was recorded. The questionnaires were translated into Malay version, consists of five sections that covers socio-demographic background, work information, health information, health information, lifestyle information, and respiratory problem.

3.5.2 Anthropometry

Age, body weight, and height were recorded in the questionnaires. While the body weight was recorded by standard weighing machine without shoes.

3.5.3 Spirometer

Figure 3.1: Chestgraph H1 – 101 Spirometer

Chestgraph H1 – 101 Spirometer will be used to measure the lung function status of the latex gloves workers. The procedures were as follows:

a) Procedure

After taking a detailed history and anthropometric data, the workers were informed about the whole manoeuver. The procedure was adopted from American Thoracic Society (ATS, 2017). The workers were encouraged to practice this maneuver before performing the pulmonary function test. The test performed with the subject in standing position without using a nose clip. The test was repeated three times after adequate rest and results obtained in the spirometer. The measured parameters were:

i) Forced vital capacity (FVC),

The FVC refer to the maximum volume of air exhaled with maximally forced effort from a maximum expiration, expressed in liters at body temperature and ambient pressure saturated with water vapour (ATS, 2005).

ii) Forced expiratory volume in one second (FEV_1),

The FEV_1 was the maximum volume of air exhaled in the first second of a forced expiration from the position of full inspiration, expressed in liters of body temperature and ambient pressure saturated with water vapour (ATS, 2005).

iii) Forced expiratory ratio (FEV_1/FVC %)

FEV_1/FVC measured how much air a person can exhale during a forced breath. The amount of air exhaled may be measured during the first (FEV_1), second (FEV_2), and/or third seconds (FEV_3) of the forced breath.

The measured results were printed out on a chart called as a spirogram. As for calculation, the FEV1/FVC ratio was calculated. In this study, evaluation of lung function test will be performed by comparing the obtained value with the normal value which was a standard value.

The evaluation of lung function (normal or abnormal) that have been done based on American Thoracic Society (1991) classification as shown in Table 1.

Table 1: Evaluation of lung function

Obstructive Disease	FEV1%
Normal	≥80
Mild	70 – 79
Severe	60 – 69
Very severe	< 60
Restrictive Disease	**FVC%**
Normal	≥80
Mild	70 – 79
Severe	60 – 69
Very severe	< 60

Source: American Thoracic Society (1991)

3.5.4 Dust Measurement

Figure 3.2: DustTrak Aerosol Monitor 8534

For dust measurement, a direct reading instrument by using DustTrak DRX Aerosol Monitor 8534 was used. It uses a sheath air system that isolates the aerosols in the optics clean for improved reliability and low maintenance. It was suitable for clean office settings as well as harsh industrial workplace, construction and

environmental sites, and other outdoor application (Sources TSI, 2018). This instrument measures aerosol contaminants such as dust, smoke, fumes and mists corresponding to PM1, PM2.5, respirable or PM10 size fraction with a concentration range from 0.001 to 150 mg/m3. The dust level PM2.5 was measured according to each workstation which were stripping, quality control and technical and maintenance station. The instrument was placed near the breathing zone of the workers. The sampling interval was set as 30 minutes over 4 times slots for 8 hours and taken from Industry Code of Practice (ICOP) on Indoor Air Quality (IAQ) from Department of Occupational Safety and Health (DOSH). The results were recorded and analyzed later.

3.6 Data Analysis

All statistical analysis was performed by SPSS version 22. Descriptive data were expressed as frequency and percentage. The descriptive test used to calculate mean, median, mode and standard deviation. Besides, Kolmogorov Smirnov test and Skewness will be used to determine the normality of the data. Descriptive analysis, Pearson correlation, Spearman's Rho and Chi Square will be used for association in parametric and non-parametric data respectively. ANOVA was used to compare the difference between more than two variables and a p-value of <0.05 as the significant level will be used.

Table 2: Data analysis

Objectives	Tests
To determine the socio-demography of respondents	Descriptive analysis
To determine the distribution of lung function abnormalities, respiratory symptoms and exposure to dust according to work station.	Descriptive analysis
To determine the relationship between occupational exposures to dust and lung function.	Parametric Pearson correlation Non-parametric Spearman's Rho
To determine the relationship between occupational exposures to dust and respiratory symptoms.	Chi Square
To determine the differences of lung function and exposures to dust between work station.	One way ANOVA

3.7 Quality Control

Quality control was important for every measurement, especially when using an instrument. These were to ensure the results of the data that obtain throughout the study can be avoided with biases and error. In this study, the quality controls were the questionnaire, spirometer, and anthropometric measurement. Before the study was conducted, a pre-test study was carried out for the questionnaire to determine the level of understanding of respondents to the questionnaires. Also, the spirometer was calibrated before use and check for any malfunction.

3.7.1 Questionnaire

An adopted questionnaire will be used to know the information background, general health status as well as the prevalence of respiratory symptoms among the respondents. The form used in Bahasa Malaysia so that the respondents can easily to understand the question given. The questionnaire had undergone constructive testing and reliability testing.

For the constructive test, a pre-test was conducted. The function of this test was to know either the subjects understand the questions in the questionnaire or not. Next, the questionnaire will be reviewed and edit if there were criticism from the respondents. As for the next day, the same questionnaire was given back to them to ensure the answer was the same.

3.7.2 Anthropometric measurement

The anthropometric measurements were taken using electronic weight scale and height tape that have been calibrated by the manufacturer. For each respondent, the measurements were taken three times in order to determine the average.

3.7.3 Spirometer

The manoeuvres for this test were used based on US Occupational Safety & Health Administration (OSHA). Apart from that, the spirometer was checked for calibration and accuracy. Based on Miller et al (2005), the attention to equipment quality control and calibration was an important part of good laboratory practice. At a minimum, the requirements were as follows: 1) a log of calibration results was maintained; 2) the documentation of repairs or other alterations which return the equipment to acceptable operation; 3) the dates of computer software and hardware updates or changes; and 4) if equipment was changed or relocated (e.g. industrial surveys), calibration checks and quality-control procedures must be repeated before further testing begins.

3.7.4 Dust Measurement

The DustTrak used was calibrated before started using PQ200 Ambient Fine Particle Sampler. Besides, several measurements were taken for the average. Several studies by Kim et al. (2004), David L. et al. (2002), Moosmueller H. (2001), Lee S. C. (2001) and Chung A. C. (2001) stated that DustTrak was suitable to be used to measure the outdoor or indoor particulate matter and respirable dust (PM2.5).

Chapter 4

RESULTS

4.1 Respondents Background

Table 4.1 shows some characteristics of the subjects in this study. It shows the socio-demographics of the respondents in the working environment of latex gloves workers. These workers were compromised to work in such situation may be due to poor socioeconomic status and low educational level.

Table 4.1 Socio-demographic on the subject

Variables	Frequency (f)	Percent (%)	Mean	SD
Race			2.59	0.982
Malay	22	24.4		
Chinese	3	3.3		
Indian	55	61.1		
Others	10	11.1		
Educational level			2.68	0.776
None	8	8.9		
Primary/UPSR	22	24.4		
Secondary/PMR/SPM/STPM	51	56.7		
Diploma/Degree Holder	9	10.0		

Salary			1.37	0.529
RM 1000 – 1900	59	65.6		
RM 2000 – 2900	29	32.2		
RM 2900 – 3900	2	2.2		
Status			1.63	0.529
Single	35	38.9		
Married	53	58.9		
Divorced	2	2.2		
Total	**90**	**100.0**		

4.2 The distribution of lung function abnormalities according to work station

Among the various section of the factory, workers in stripping have the highest number of workers with restrictive patterns of lung function, whereas quality control and technical and maintenance had the least as shown in Figure 4.1.

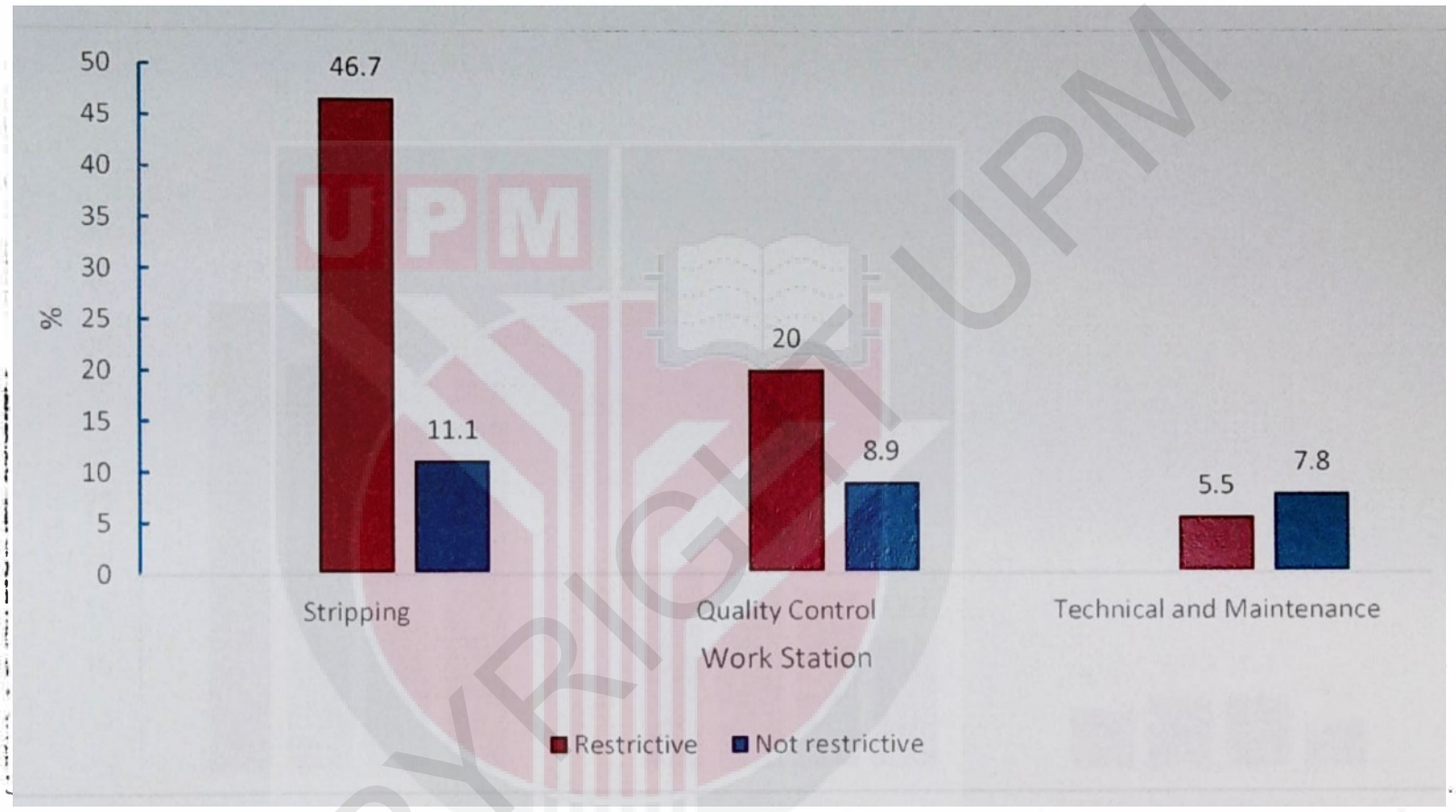


Figure 4.1 Distribution of lung function abnormalities according to work station

4.3 The distribution of respiratory symptoms according to work station

The distribution of workers with respiratory symptoms was as shown in Figure 4.2. Coughing was present highest in Stripping workstation compared to QC and Technical and Maintenance section. These results were same for phlegm, wheezing, and shortness of breath.

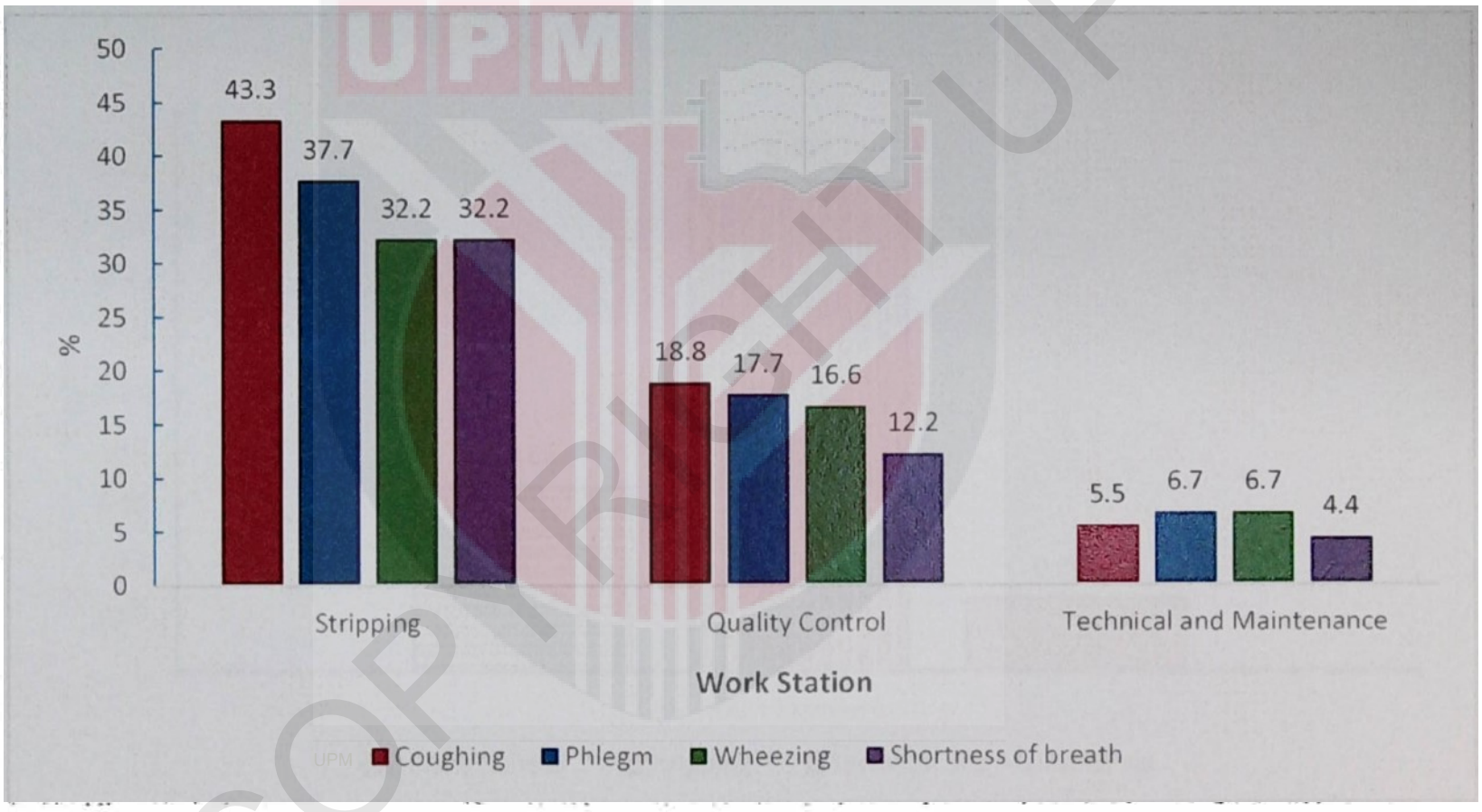


Figure 4.2 Distribution of respiratory symptoms according to work station

4.4 The distribution of exposure to dust according to work station

In Figure 4.3, it shows the distribution of workers with high exposure to dust. The dust that have been measured was PM2.5 for 8 hours. From the results, it can be concluded that workers in stripping section was exposed to the highest concentration of dust. Second to stripping section is quality control section that task was to perform finalise checked for the gloves and followed by technical and maintenance section.

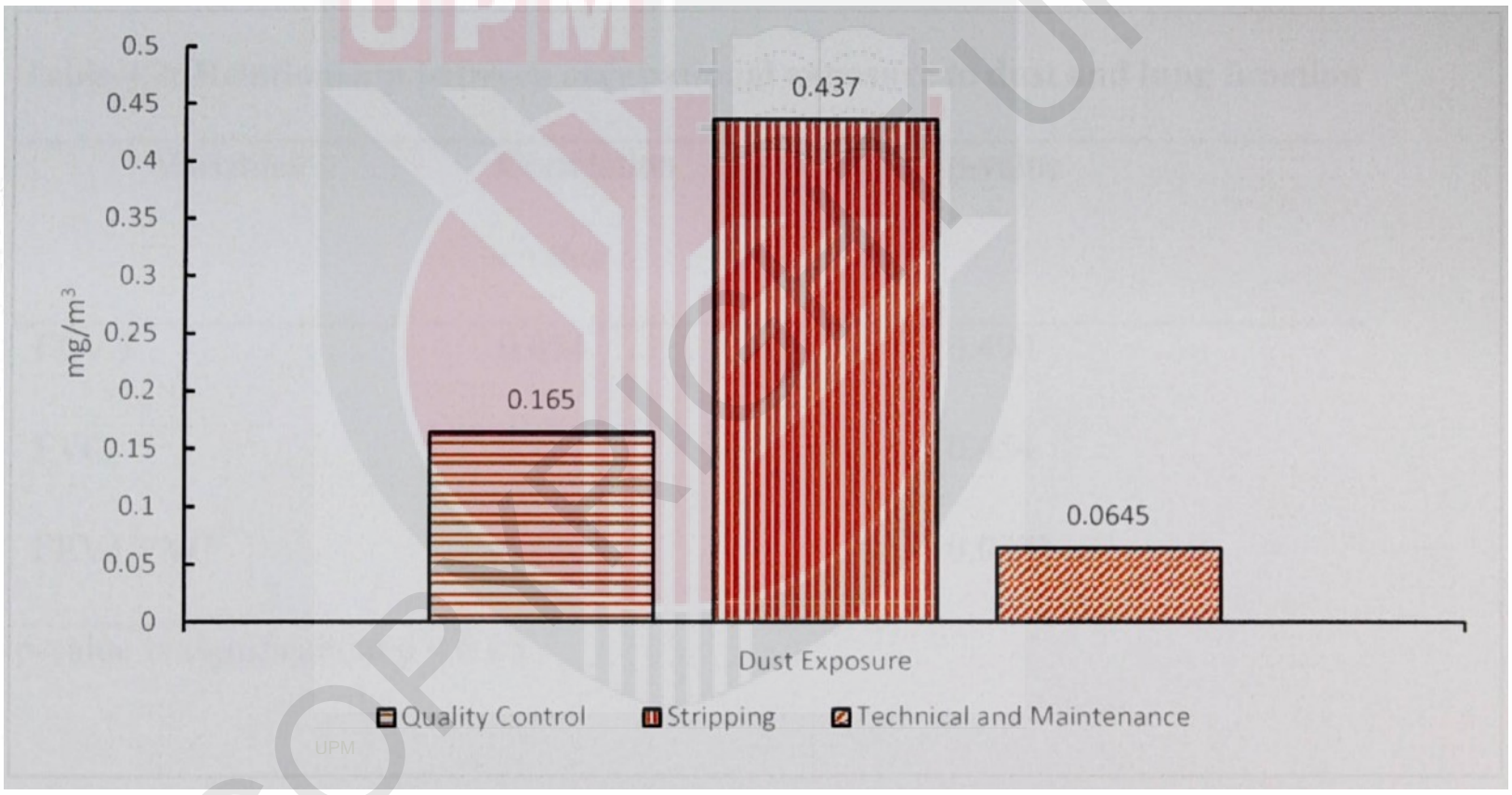


Figure 4.3 Distribution of high exposure to dust according to work station

4.5 Occupational exposures to dust and lung function among latex gloves workers

In Table 4.2, it shows the relationship between occupational exposure to dust and lung function. There is no significant between exposure to dust and measured FEV1 as well as exposure to dust and measured FVC. However, the association between exposure to dust and ratio FEV1/FVC variables were found statistically significant.

Table 4.2: Relationship between occupational exposure to dust and lung function

Variables	Correlation *r* value	p-value
FEV 1	0.074	0.490
FVC	0.454	0.454
FEV1/FVC	0.226*	0.038*

p-value is significant at $p < 0.05$

4.6 Occupational exposures to dust and respiratory symptoms

Table 4.3 shows the relationship between occupational exposures to dust and respiratory symptoms which suggest that there is a significant relationship detected (p-value < 0.05) in frequent coughing, coughing in the morning, phlegm in the morning as well as cough and phlegm. However, there was no significant relationship between other symptoms such as wheezing and shortness of breath.

Table 4.3: Relationship between occupational exposure to dust and respiratory symptoms

Variables	Dust Exposure			x^2	p-value
	Low	Middle	High		
COUGHING					
Yes	5(41.7%)	16(61.5%)	30(57.7%)	1.373	0.503
No	7(58.3%)	10(38.5%)	22(42.3%)		
Frequent					
Yes	5(41.7%)	14(53.8%)	6(11.5%)	16.796	0.000*
No	7(58.3%)	12(46.2%)	46(88.5%)		
In the morning					
Yes	10(83.3%)	16(61.5%)	11(21.2%)	21.872	0.000*
No	2(16.7%)	10(38.5%)	41(78.8%)		
All the days					
Yes	0(0.0%)	4(15.4%)	5(9.6%)	2.179	0.336
No	12(100%)	22(84.6%)	47(90.4%)		
3 month continuously					
Yes	0(0.0%)	2(7.7%)	16(30.8%)	9.231	0.412
No	12(100%)	24(92.3%)	36(69.2%)		
PHLEGM					
Yes	6(50.0%)	15(57.7%)	33(63.5%)	0.817	0.665
No	6(100%)	11(42.3%)	19(36.5%)		

Frequent					
Yes	0(0.0%)	2(7.7%)	2(3.8%)	1.248	0.536
No	12(100%)	24(92.3%)	50(96.2%)		
In the morning					
Yes	0(0.0%)	12(46.2%)	8(15.4)	13.451	0.001*
No	12(100%)	14(53.8%)	44(84.6%)		
All the days					
Yes	0(0.0%)	3(11.5%)	1(1.9%)	4.471	0.110
No	12(100%)	23(88.5%)	51(98.1%)		
3 month continuously					
Yes	0(0.0%)	2(7.7%)	3(5.8%)	0.937	0.626
No	12(100%)	24(92.3%)	49(94.2%)		
COUGH AND PHLEGM					
Yes	6(50.0%)	12(46.2%)	6(11.5%)	14.476	0.001*
No	6(50.0%)	14(53.8%)	46(88.5%)		
WHEEZING					
Yes	4(33.3%)	13(50.0%)	29(55.8%)	1.982	0.371
No	8(66.7%)	13(50.0%)	23(44.2%)		
SHORTNESS OF BREATH					
Yes	4(33.3%)	11(42.3%)	23(44.2%)	0.475	0.789
No	8(66.7%)	15(57.7%)	29(55.8%)		

p-value is significant at $p < 0.05$

4.7 Differences of lung function and exposures to dust between work stations

The results as shown in Table 4.4, it shows that there is a statistical difference in the mean of ratio FEV1/FVC between the different workstation (F = 0.923, p-value = 0.016). Furthermore, there are no significant differences between other groups of the workstation (p-value > 0.05).

Table 4.4 Comparison of lung function between work stations

Variables		Mean	SD	F (df)	p-value
FEV1	Quality Control	2.572	0.659	0.333 (2,87)	0.718
	Stripping	2.638	0.696		
	Technical and Maintenance	2.742	0.784		
FVC	Quality Control	3.007	0.794	0.245 (2,87)	0.783
	Stripping	3.061	0.762		
	Technical and Maintenance	3.227	0.822		
FEV1/FVC	QualityControl	0.868	0.124	0.923 (2,87)	0.016*
	Stripping	0.865	0.095		
	Technical and Maintenance	0.853	0.107		

p-value is significant at p < 0.05

By referring to Table 4.5, the difference between exposure to dust and different groups of workstations is statistically significant (F = 0.767, p-value = 0.035). After further analysis by post hoc test, it is found that there is statistically significant different mean of dust exposure between the workstations of stripping. There is no significant difference in between other groups of the workstation in their mean of dust exposure (p-value > 0.05).

Table 4.5 Comparison of exposure to dust between work stations

Variables		Mean	SD	F (df)	p-value
Dust Exposure	Quality Control	0.873	0.326		
	Stripping	0.731	0.194	0.767 (2,87)	0.035*
	Technical and Maintenance	0.918	0.289		

p-value is significant at p < 0.05

Chapter 5

DISCUSSION

5.1 Respondent background

In this study, there were 90 males worker at the latex glove involved. The highest respondent was Indian ethnicity, followed by Malay, Chinese and others. Most of the respondents have the secondary educational level with 51 workers while only 9 of them were diploma or degree holder. According to Steven W. (2015), educational level was related to health because it has a lot of benefits that may lead to improved health by a higher income, increase resources and knowledge to adopt healthier behaviour and the resources to live in healthier neighbourhoods and also decrease the level of unemployment.

Besides, the information about salary and marital status also recorded as socio-economic factors. Salary level was considered as factors that influence attitudes among the workers as explained by Dole and Schroeder (2001). While according to James W. et al. (2012) stated that marital status and living arrangements have been shown to have a significant effect on a person's health and mortality.

5.2 The distribution of lung function abnormalities according to work station

The respiratory symptoms and abnormal pulmonary function tests were used to identify the respiratory disorders among the workers. According to Das PKL, Jha N (2009) and American Thoracic Society (2017), the abnormal lung function test was observed mainly on restrictive changes and it can be detected when FEV1/FVC was higher than 0.7. While the respiratory symptoms can be noticed by the trend of coughing, wheezing, phlegm and shortness of breath. The workstations that involved were the Stripping station, Quality Control and Technical and Maintenance. These stations were the main stations that the workers particularly exposed to the dust that has been produced during the manufacturing process.

Based on Figure 4.1, the highest distribution of lung function abnormalities and respiratory symptoms were from Stripping station followed by Quality Control and the lowest was Technical and Maintenance. These results due to the different process in each station.

The workers in stripping station were responsible in remove the glove from the artificial hand that has been mix with corn starch as a lubricant, to enable easy donning of the glove by tumbling the gloves in a slurry of starch and biocide (Pro2 Solutions, 2007). Thus, as the workers removed the glove, the highest volume of dust was exposed to them. Besides, the number of glove production also play a role, as the highest number of glove need to be produced in a month can result in more dust exposed to the workers.

As stated by Michael B. Brown (2012), corn starch is a nutrient, thus it can cause allergic reactions involving the upper airways that lead to lung function abnormalities and respiratory problems.

A worker with an obstructive pattern of impairment occurs as a result of damage to the small airways or bronchioles, resulting in a decreased ability to exhale air. While workers with a restrictive pattern of impairment describe a condition in which there is a reduction in the volume of air that can be taken in and then pushed out of the lungs. It is possible for both patterns of impairment to occur at the same time. These are explained in an article by Subbarao P., Mandhane P.J., and Sears M.R. (2009).

5.3 The distribution of respiratory symptoms according to work station

From the study, it can be noticed a trend of respiratory symptoms such as coughing, wheezing, phlegm and shortness of breath. As overall, the majority of the workers in stripping station and quality control were having coughing. This might be due to the nature of the work which they were exposed directly to the dust while the workers in technical and maintenance section do not expose directly to the source of hazard which is cornstarch dust due to better ventilation in the room. This is harmonized to a study by Mohammadien, Hussein, & El-Sokkary (2013), showed that respiratory complaints in the study group are high.

Besides, another studied by (Tomazic et al., 1994) stated that cornstarch is an example of organic dust that contains nutrient, which bacteria can grow. This bacteria can cause the pathogenic reaction including not only fever, but also coughs, aches, nausea, shortness of breath, and acute airflow obstruction when inhaled.

World Health Organization (WHO) had reported that exposures to heavy concentrations of organic dusts that contaminated by microorganism can lead to serious respiratory and systemic illness, such as *organic dust toxic syndrome* (ODTS).

5.4 The distribution of dust according to work station

In this study, it is found that the workers at stripping station were exposed to high concentration dust compare to quality control and technical and maintenance station. The main cause of this result was the cornstarch from the slurry tank that been added as a lubricant before the stripping station. Besides, the stripping station workers need to follow the rate production of gloves by that day, as the highest the rate of production, the highest exposure of dust to the workers.

Furthermore, it may be due to nature of working processes which are dusty with high humidity/temperature. It implies that humidity/temperature may condense dust and increase the exposure in the workplaces. This is supported by Moghaddasi, Mirmohammadi, Ahmad, Etemadi Nejad, & Yazdani, (2014).

Besides, the workplace also can be one of the factors because stripping station was a closed space with low ventilation while the workers in the quality control station have a good local exhaust ventilation and technical and maintenance station was an open space. A study by Ye, Gao, Zhang, & Yu, (2017) stated that ventilation was the primary solution to reduce the concentration of undesirable contaminants. Even though air pollution can't be reduced by ventilation alone, but it can reduce the pollutants to the recommended or regulated levels given by indoor air quality guidelines or by national standards. This was supported by Guillam et al., (2017) that maintaining a positive pressure gradient between the sorting room and the outside may be a collective prevention measure.

However, the exposure of the dust does not limit the permissible exposure limit (PEL) as listed in Schedule 1, Occupational Safety and Health (Use and Standards of Exposure of Chemicals Hazardous to Health) Regulation 2000* which was 4 mg/m^3 for grain dust.

5.5 Occupational exposure to dust and lung function among latex glove workers

In this study, there is no significant between exposures to dust and measured FEV1 as well as exposure to dust and measured FVC. However, the association between exposure to dust and ratio FEV1/FVC variables were found statistically significant. FEV1/FVC is the fraction of air exhaled in the first second relative to the total volume exhaled. If the value is below 0.7, it indicates an obstructive disease while above 0.7 indicates a restrictive disease. A study by Coplu et al (2005) suggest that

exposure to dust was associated with both respiratory symptoms and lung function status.

5.6 Occupational exposure to dust and respiratory symptoms among latex glove workers

This study shows that there is a significant association between occupational exposure to dust and coughing in the morning and wheezing. This was supported by Pramchoo, Geater, Jamulitrat, Geater, & Tangtrakulwanich, (2015) that stated a decrease in lung function or an increased in prevalence of respiratory symptoms such as a cough, dyspnea, wheeze and sneeze was associated with long-term occupational exposure to air pollutants, including wood smoke, and other dust.

Singh, (2016) has stated that respiratory disorder is breathlessness, chest pain, wheeze and cough, which may be productive of sputum. Coughing is one of the natural response that acts to force dirt and dust out of the airways and lung. The lungs work against the debris and use mucus in an attempt to remove the dust and dirt particles out. It will increase the pressure in the throat and lung and release explosive air that causes the cough sound. While wheezing is a type of whistling sound that caused by the build-up of fluid and debris in the lungs. It was caused by the constricted air passages insides the lungs making it more difficult to breathe.

5.7 Differences of lung function and exposure to dust between work stations

The mean in ratio FEV1/FVC and between the different workstations was significantly different in stripping and quality control probably due to high exposure compared to technical and maintenance stations. This is similar to study by Sanguanchaiyakrit, Povey, & De Vocht, (2014) that labelled "high exposure group" which includes glove stripping, inspection, powdered glove packaging, and curing. In addition, the stripping area was located near the main oven and industrial fans, which may have increased the dispersion of airborne dust.

5.8 Conclusion

In general, the conclusion can be summarized as follows:

1. Lung function test was conducted and the results were recorded in order to achieve the first objective. It was collected from respondents which do not have any smoking history, asthma (inhaler user), any respiratory tract infection in the last three weeks, had a heart attack in last three months, any heart disease and female workers. Since the majority of the workers has abnormalities in lung function status, thus, a further proper screening program was needed.

2. The high respiratory problem was reported among the latex glove workers in this study.

3. Stripping station has the highest exposure to dust compared to quality control and technical and maintenance station but it still under the PEL under USECHH Regulation 2000* which was 4 mg/m^3.

4. The exposure to dust was identified as a health hazard among the workers. Thus, a further study was required to identify the factors that determine the consistent present of occupational hazard related to respiratory symptoms.

5. The workers have a significant association with respiratory symptoms such as a cough in the morning and wheezing due to exposure to dust.

To conclude, latex glove workers were mainly exposed to chemical hazards which is organic dust produced along the process. Therefore, recognition of the hazards associated with occupational lung disease and prevention of exposure must be a high priority.

5.9 Limitation

1. Limited access and time to the workstation for the measurement that caused restriction in proper time measurement for the dust exposure. Besides, the measurement need to be taken for a longer time to consider the rate of gloves production in the factory.

2. Language barrier for spirometry assessment. A better understanding about the steps for spirometry measurement was required to make sure the results were reliable.

3. Lack of previous study as references in the research area to get a better understanding about the effect of corn starch dust exposure to the workers.

5.10 Recommendations

1. As for the socio-demographic data, a large number of samples from each latex glove factory in Malaysia should be considered for the study to get the better results of the data that can be used to represent the worker's populations of latex glove factory.

2. From the results obtained, it shows that the workers need to obtain a proper screening program and periodic lung function test as stated by Dehghan F. et al (2009).

3. The management can consider the hierarchy of control in order to ensure the safety of the workers that start with:

   a. Substitution - The management can ask the researchers team to find out the high quality of cornstarch powder that have the function as the old one.

   b. Engineering control - The ventilation in the factory can be improved to a better system such a sucking fumes as it is an effective solution to reduce particulate emissions in the workplace. This was supported by Farshid G. S. et al (2015) that stated this method that conducted along with health and environmental standards not only can solve the pollution problems but also will reduce expense and dust recycling.

   c. Administrative control - Then, the management can make a shift rotation schedule for the workers to reduce the time of dust exposure to the workers

   d. Personal Protective Equipment (PPE) - A suggestion to the management to give a proper and suitable mask to the workers such as N95 that provides 95 percent filtration efficiency of particles as it is stated under OSH Act 1994 Section 15 (General Duties of Employer)

to provide a safe working environment for the workers to do their job and USECHH Regulation 2000*, Regulation 16 that stated the use of approved personal protective equipment.

4. Clinical tests conducted by a medical specialist such as registered Occupational Health Doctor (OHD) as stated in USECHH Regulation 2000*, Regulation 2 are recommended for assessing lung function and respiratory problems more specifically among the workers.

5. Also, a long-term follow-up studies with larger samples and an accurate test should be conducted to confirm the findings in this present study.

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Appendix 1

JAWATANKUASA ETIKA UNIVERSITI UNTUK PENYELIDIKAN MELIBATKAN MANUSIA (JKEUPM)
UNIVERSITI PUTRA MALAYSIA, 43400 UPM SERDANG,
SELANGOR, MALAYSIA

BORANG 2.4: PENERANGAN DAN PERSETUJUAN RESPONDEN

Sila baca maklumat berikut dengan teliti. Sekiranya anda mempunyai sebarang pertanyaan, sila kemukakan kepada penyelidik.

1.TAJUK KAJIAN

Satu kajian terhadap kelaziman simptom-simptom respiratori di antara pekerja sarung tangan lateks di Senawang, Negeri Sembilan menggunakan ujian fungsi paru-paru

2. PENGENALAN

Kami ingin menjemput anda untuk terlibat dalam satu uji kaji berkenaan penilaian ujian paru-paru di kalangan pekerjaan yang terdedah kepada habuk. Sebelum anda mengambil keputusan yang terlibat, adalah amat penting bagi anda untuk memahami tujuan uji kaji ini dijalankan dan apa yang dirangkumi dalam ujian ini. Pekerja di bahagian pembuatan akan terdedah kepada pelbagai faktor bahaya dari persekitaran seperti habuk dan asap daripada proses pemvulkanan dan pembuatan getah selain terdedah kepada bahan karsinogenik seperti N-nitrosamines, pelarut dan pthalates (Kogevinas. M. and Garcia-closas M., 2014). Selain itu, terdedah kepada habuk akan menyebabkan pelbagai respon klinikal seperti asthma, kronik bronchitis, penyakit saluran pernafasan yang kronik dan alergik (Viegas S. et al, 2013). Kajian ini akan menumpukan untuk mendapat tahu sama ada terdedah kepada habuk akan menyebabkan pekerja mengalami simptom-simptom seperti di atas. Sila ambil masa yang secukupnya untuk membaca maklumat berikut dan berbincang dengan yang lain jika perlu. Sila hubungi kami sekiranya terdapat sebarang maklumat yang tidak jelas atau untuk mendapatkan maklumat lanjut.

3. APAKAH YANG PERLU ANDA LAKUKAN?

Jika anda bersetuju untuk terlibat dalam kajian ini, kami akan meminta anda untuk menyiapkan borang kaji selidik yang disertakan bersama helaian ini. Borang kaji selidik ini perlu diisi dengan maklumat seperti maklumat diri, maklumat pekerjaan, maklumat kesihatan, maklumat gaya hidup dan masalah gejala respiratori. Sekiranya anda mengambil keputusan untuk turut serta dalam kajian ini, responden yang mempunyai gejala respiratori seperti asthma, bronkitis dan berdeham adalah tidak digalakkan untuk turut serta dalam kajian ini. Sekiranya anda terpilih, anda akan diberikan satu set borang kaji selidik sebelum anda mengikuti ujian fungsi paru-paru. Berat dan tinggi anda akan diambil sebelum anda mengikuti ujian paru-paru tersebut. Seterusnya kami akan menerangkan langkah-langkah yang perlu diikuti sebelum, semasa dan selepas ujian fungsi paru-paru untuk menghasilkan keputusan yang sah. Pekerja yang mempunyai masalah kesihatan seperti demam teruk, batuk yang kuat, sakit jantung atau pernah terlibat dengan apa-apa pembedahan yang melibatkan paru-paru atau mana-mana bahagian abdomen tidak akan dibenarkan untuk mengambil ujian ini untuk mengelakkan kesan sampingan selepas mengikuti ujian fungsi paru-paru tersebut.

4. SIAPA YANG TIDAK BOLEH MENYERTAI KAJIAN INI?

Responden tidak dipilih berdasarkan kriteria berikut:

i. Perempuan
ii. Mempunyai sejarah masalah kesihatan seperti asma, bronkitis dan berdeham.
iii. Mempunyai apa-apa masalah berkaitan jantung yang memerlukan pengambilan ubat-ubatan.
iv. Mempunyai serangan jantung dalam tempoh tiga bulan yang lepas.

5. APAKAH FAEDAH MENYERTAI KAJIAN INI?

a) KEPADA ANDA SEBAGAI PESERTA?

Tiada sebarang faedah individu jika anda mengikuti kajian ini.

b) KEPADA PENYELIDIK?

Walaubagaimanapun, dengan penyertaan anda dalam uji kaji ini, anda dapat membantu kami untuk lebih memahami dalam menentukan kelaziman simptom-simptom respiratori di antara pekerja yang terdedah kepada habuk di industri pembuatan lateks.

6. ADAKAH IA BERISIKO?

Sekiranya anda bersetuju untuk turut serta dalam kajian ini, responden yang mempunyai sejarah masalah kesihatan seperti asma, bronkitis, berdeham, masalah kesihatan berkaitan jantung yang memerlukan pengambilan ubat-ubatan dan pernah mempunyai serangan jantug dalam tempoh tiga bulan lepas adalah tidak digalakkan untuk menyertai uji kaji ini. Anda mungkin akan mengalami kesan sampingan dan ketidakselesaan selepas mengikuti ujian fungsi paru-paru. Hal in kerana, ujian fungsi paru-paru memerlukan anda untuk menghembus nafas dengan sehabis daya selama enam saat sebanyak tiga kali untuk mendapatkan keputusan yang sah. Kami dari pasukan penyelidik akan mengajar anda cara untuk mengikuti ujian fungsi paru-paru dengan selamat dan betul.

7. ADAKAH MAKLUMAT DAN IDENTITI SAYA KEKAL RAHSIA?

Ya, segala maklumat dan identiti responden akan dirahsiakan dan tidak akan disebarkan melalui apa-apa cara sekalipun dan hanya digunakan untuk tujuan kajian sahaja.

8. SIAPA YANG SAYA PERLU HUBUNGI SEKIRANYA SAYA MEMPUNYAI SOALAN TAMBAHAN SEMASA MENGIKUTI PENYELIDIKAN INI?

Sekiranya anda mempunyai apa-apa soalan tambahan atau masalah yang berkaitan semasa mengikuti penyelidikan ini, anda boleh hubungi:

Khairul Anuar Bin Ahmad Erawan

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Sila tandatangan di sini sekiranya anda telah membaca dan memahami kandungan halaman ini _____

9. PERSETUJUAN

Saya..... No Kad Pengenalan. .....
beralamat.....
.....dengan ini bersetuju untuk mengambil bahagian secara sukarela dalam penyelidikan yang tersebut di atas *(kajian klinikal/percubaan ubat-ubatan/rakaman video/kumpulan sasaran/temuduga/ soal selidik).

Saya telah diberi penjelasan secara menyeluruh mengenai penyelidikan ini dari segi metodologi, risiko dan komplikasi (seperti tertulis pada Helaian Penerangan Responden). Saya memahami bahawa saya berhak menarik diri dari penyelidikan ini pada bila-bila masa tanpa memberi sebarang alasan.Saya juga memahami bahawa sebarang maklumat yang berkaitan identiti saya akan dirahsiakan.

Saya* berminat / tidak berminat untuk mengetahui keputusan kajian yang melibatkan saya.

I setuju/tidak bersetuju untuk imei/gambar/rakaman video/ rakaman suara digunakan dalam apa jua bentuk penerbitan atau pembentangan. (sekiranya berkaitan).

*potong yang tidak berkenaan

Tandatangan .....
(*Responden*)

Tarikh :.....

Tandatangan .....
(*Saksi*)

Nama :.....

No. K/P: .....

Saya mengesahkan bahawa saya telah menerangkan kepada responden ini sifat dan tujuan penyelidikan yang tersebut di atas.

Tarikh .....

Tandatangan .....
(*Penyelidik*)

Appendix 2

PROJEK PENYELIDIKAN TAHUN AKHIR
B.S. KESIHATAN PERSEKITARAN DAN PEKERJAAN
FAKULTI PERUBATAN DAN SAINS KESIHATAN
UNIVERSITI PUTRA MALAYSIA
SERDANG, SELANGOR

"BORANG SOAL SELIDIK BAGI KAJIAN KELAZIMAN SIMPTOMS RESPIRATORI DAN KESANNYA TERHADAP PEKERJA DI KILANG SARUNG TANGAN"

ARAHAN SOALAN:

1. Borang soal selidik ini mengandungi lima (5) bahagian iaitu:

   BAHAGIAN A: MAKLUMAT DIRI
   BAHAGIAN B: MAKLUMAT PEKERJAAN
   BAHAGIAN C: MAKLUMAT KESIHATAN
   BAHAGIAN D: MAKLUMAT GAYA HIDUP
   BAHAGIAN E: MAKLUMAT SIMPTOM RESPIRATORI

2. Anda diminta untuk menjawab semua soalan yang ada di dalam buku ini.

3. Untuk menjawab, sila tandakan jawapan di bahagian jawapan yang telah disediakan.

4. Borang soal selidik hendaklah dikembalikan kepada pengkaji setelah selesai menjawab semua soalan.

5. Semua maklumat yang diperoleh di dalam kajian ini adalah rahsia dan hanya digunakan untuk tujuan pembelajaran semata-mata.

Sekian, terima kasih.

BAHAGIAN A: MAKLUMAT DIRI

1.1	Bangsa	: 1. ☐ Melayu	2. ☐ Cina
		3. ☐ India	4. ☐ Lain-lain
1.2	Warganegara	: 1. ☐ Warganegara	
		2. ☐ Bukan Warganegara	
1.3	Status	: 1. ☐ Bujang	2. ☐ Berkahwin
		3. ☐ Bercerai	
1.4	Pendidikan	: 1. ☐ Tidak Bersekolah	
		2. ☐ Rendah/Upsr.	
		3. ☐ Menengah/Pmr/Spm/Stpm	
		4. ☐ Sijil/Diploma/Ijazah	

BAHAGIAN B: MAKLUMAT PEKERJAAN

2.1 Pernahkah Anda Bekerja Di Tempat Lain Sebelum Ini?

1. ☐ YA 2. ☐ TIDAK

Jika Ya, Nyatakan Jenis Pekerjaan Dan Tempoh Bekerja:

Jenis Pekerjaan	Tempoh Bekerja (Jumlah Tahun)	Tahun Mula Bekerja (Contoh: 2015)

2.2 Apakah Jawatan Anda Sekarang?

_____

2.3 Di Bahagian Mana Anda Bekerja Sekarang?

_____

2.4 Berapa lamakah anda telah bekerja sebagai (pekerjaan di atas)?

_____ tahun

2.5 Berapa lamakah anda bekerja di kilang sawit ini?

_____ tahun

2.6 Shift kerja?

1. ☐ Normal
2. ☐ Shift

2.7 Berapa hari anda bekerja dalam seminggu?

____ hari

2.8 Adakah anda bekerja lebih masa (OT)?

1. ☐ Ya 2. ☐ Tidak

2.9 Jika Ya, secara purata, berapa kerap anda bekerja lebih masa?

1. ☐ Tiada 2. ☐ 1-3 kali sebulan
3. ☐ 3-5 kali sebulan 4. ☐ Lebih dari 5 kali sebulan

2.10 Berapa jamkah anda bekerja dalam sehari?

____ jam

2.11 Adakah anda menggunakan sebarang Peralatan Perlindungan Diri (PPE)?

1. ☐ Ya 2. ☐ Tidak

2.12 Tandakan jenis PPE yang digunakan:

1. ☐ Kasut Keselamatan
2. ☐ Topi Keselamatan
3. ☐ Cermin mata keselamatan
4. ☐ Sarung tangan
5. ☐ Pakaian perlindungan diri
6. ☐ Respirator
7. ☐ Lebih dari 1 PPE
8. Lain-lain:_____

2.13 Berapa lamakah anda menggunakan PPE dalam sehari?

___ jam

2.14 Adakah latihan penggunaan PPE diberikan?

1. ☐ Ya 2. ☐ Tidak

2.15 Adakah anda terdedah kepada sebarang hazad seperti di bawah:

1. ☐ Bahan Kimia
2. ☐ Panas melampau
3. ☐ Habuk
4. ☐ Bunyi bising
5. ☐ Binatang berbisa
6. ☐ Lebih dari 1 hazad
7. Lain-lain: _____

2.16 Bilangan pekerja yang menjalankan skop kerja yang sama:

____ orang

2.17 Adakah anda membuat kerja sambilan?

1. ☐ Ya 2. ☐ Tidak

Jika Ya, isikan maklumat berkaitan kerja sambilan di bawah.

Jenis Pekerjaan	Jam bekerja sehari	Kekerapan bekerja dalam seminggu (hari)

2.18 Adakah latihan mengelakkan masalah otot rangka semasa bekerja diberikan?

1. ☐ Ya 2. ☐ Tidak

BAHAGIAN C: MAKLUMAT KESIHATAN

3.1 Adakah anda mengalami sebarang simptom-simptom seperti di bawah? Tandakan

Simptom	1. Ya	2. Tidak
3.1.1 Keletihan		
3.1.2 Pening Kepala		
3.1.3 Pedih Mata		
3.1.4 Sesak Nafas		
3.1.5 Berdebar-debar		
3.1.6 Ruam		
3.1.7 Loya		
3.1.8 Muntah		
3.1.9 Kekejangan Otot		
3.1.10 Strok		
3.1.11 Pitam		
3.1.12 Berdengung		
3.1.13 Sakit Telinga		
3.1.14 Kehilangan Pendengaran Sementara		
3.1.15 Batuk		
3.1.16 Berpeluh		

3.2 Adakah anda menghidapi penyakit berikut dan telah disahkan oleh doktor?

Penyakit (a)	1. Ya (b)	2. Tidak (c)	Adakah anda pernah mengambil sebarang ubat-ubatan untuk penyakit tersebut?	
			1. Ya (d)	2. Tidak (e)
3.2.1 Darah Tinggi				
3.2.2 Kencing Manis				
3.2.3 Asma/Lelah				
3.2.4 Jantung				
3.2.5 Schizopernia (mental)				
3.2.6 Insomnia				
3.2.7 Rheumatic Arthritis (Sakit Sendi)				

3.3 Adakah anda mengalami sebarang kecederaan di mana-mana bahagian anggota badan berikut?

0. ☐ Tiada Kecederaan
1. ☐ Kepala
2. ☐ Bahu
3. ☐ Tangan
4. ☐ Tulang Belakang
5. ☐ Pinggul
6. ☐ Peha
7. ☐ Lutut
8. ☐ Kaki
9. ☐ Lebih dari 1 bahagian

3.4 **Adakah anda menjalani aktiviti-aktiviti berikut:**

0. ☐ Tidak berkaitan
1. ☐ Pembedahan telinga
2. ☐ Terdedah bunyi bising
3. ☐ Ketenteraan
4. ☐ Senjata api
5. ☐ Lain-lain: _____
6. ☐ Lebih dari satu aktiviti

3.5 **Adakah anda mengambil sebarang ubat-ubatan selain dari yang dinyatakan dalam soalan 3.2?**

1. ☐ Ya 2. ☐ Tidak

Jika Ya, nyatakan jenis ubat: _____

3.6 **Adakah anda menghidap sebarang penyakit selain dari yang dinyatakan dalam soalan 3.2?**

1. ☐ Ya 2. ☐ Tidak

Jika Ya, nyatakan jenis ubat: _____

3.7 **Adakah penyakit yang dinyatakan di soalan 3.6 (jika ada), menganggu pekerjaan dan menyakitkan otot rangka semasa bekerja?**

1. ☐ Ya 2. ☐ Tidak

BAHAGIAN D: MAKLUMAT GAYA HIDUP (LIFESTYLE)

4.1 Adakah anda mengambil sebarang jenis dadah?

1. ☐ Ya 2. ☐ Tidak

4.2 Adakah anda merokok?

1. ☐ Ya 2. ☐ Tidak

4.3 Adakah anda nelakukan sebarang aktiviti fizikal?

1. ☐ Ya 2. ☐ Tidak

4.4 Adakah anda mengalami kesukaran untuk tidur?

1. ☐ Ya 2. ☐ Tidak

4.5 Adakah anda mengalami gangguan ketika tidur?

1. ☐ Ya 2. ☐ Tidak

4.6 Adakah anda mengambil minuman beralkohol?

1. ☐ Ya 2. ☐ Tidak

4.7 Dalam masa terluang, adakah anda melakukan sebarang aktiviti tersebut?

1. ☐ Berburu
2. ☐ Berkebun
3. ☐ Memasak
4. ☐ Kerja-kerja rumah
5. ☐ Memancing
6. ☐ Olahraga

BAHAGIAN E: MASALAH GEJALA RESPIRATORI

BATUK

5.1 Adakah anda selalu mengalami batuk? (Batuk yang dibuat untuk mengeluarkan kahak tidak dikira)

Ya ☐ Tidak ☐

5.2 Adakah anda batuk sekerap 4 hingga 6 kali sehari, atau lebih dari 4 hari seminggu?

Ya ☐ Tidak ☐

5.3 Adakah anda batuk ketika bangun tidur atau pada pagi hari?

Ya ☐ Tidak ☐

5.4 Selalukah anda batuk sepanjang hari atau pada malam hari

Ya ☐ Tidak ☐

Jika Ya pada mana-mana soalan di atas (5.1-5.4), Sila jawab soalan 5.5 dan 5.6

Jika Tidak pada semua soalan di atas, Sila terus ke soalan 5.7.

5.5 Adakah anda biasanya batuk sedemikian (soalan 3, 4, 5 atau 6) untuk selama 3 bulan berturut-turut sepanjang tahun?

Ya ☐ Tidak ☐

KAHAK (PHELGM)

5.6 Adakah anda selalu berkahak? (termasuk kahak yang ditelan)

Ya ☐ Tidak ☐

5.7 Adakah anda berkahak sekerap 2 kali sehari, 4 hari atau lebih dalam seminggu?

Ya ☐ Tidak ☐

5.8 Adakah anda berkahak ketika bangun tidur atau pada pagi-pagi hari?

Ya ☐ Tidak ☐

5.9 Selalukah anda berkahak sepanjang hari atau pada malam hari?

Ya ☐ Tidak ☐

Jika Ya pada mana-mana soalan di atas (5.6 – 5.9), Sila jawab soalan 5.10

Jika Tidak pada semua soalan di atas, Sila terus ke soalan 5.13.

5.10 **Adakah anda berkahak sedemikian (soalan 6, 7, 8 atau 9) untuk selama 3 bulan berturut-turut sepanjang tahun?**

Ya ☐ **Tidak** ☐

BATUK SERTA BERKAHAK

5.11 **Pernahkah anda mengalami peningkatan batuk-batuk serta berkahak yang berpanjangan lebih dari 3 minggu seriap tahun? (Jika Ya, sila jawab soalan 14)**

Ya ☐ **Tidak** ☐

DADA BERBUNYI (WHEEZING)

5.12 **Adakah anda terasa dada anda berbunyi seperti wisel:**

i. **Apabila anda mengalami selsema** **Ya** ☐ **Tidak** ☐

ii. **kadang-kala di samping selsema** **Ya** ☐ **Tidak** ☐

iii. **hampir setiap hari (siang atau malam)** **Ya** ☐ **Tidak** ☐

SUKAR BERNAFAS (BREATHLESSNESS)

5.13 **Adakah anda mengalami kesukaran bernafas apabila berjalan dengan pantas atau semasa mendaki?**

Ya ☐ **Tidak** ☐

(Jika jawab Ya pada soalan 5.13, sila jawab soalan 5.14 – 5.17. Jika jawab Tidak pada soalan 5.13, sila ke bahagian H)

5.14 **Adakah anda berjalan dengan perlahan kerana sukar bernafas?**

Ya ☐ **Tidak** ☐

5.15 **Adakah anda perlu berhenti seketika untuk bernafas semasa berjalan?**

Ya ☐ **Tidak** ☐

5.16 **Adakah anda perlu berhenti untuk bernafas setelah berjalan sejauh 30 meter (atau selepas beberapa minit)?**

Ya ☐ **Tidak** ☐

5.17 **Adakah anda terasa sukar bernafas semasa meninggalkan rumh atau semasa memakai atau membuka pakaian?**

Ya ☐ **Tidak** ☐

Terima kasih atas kerjasama anda dalam menyiapkan kajian ini.

Appendix 3