UNIVERSITI PUTRA MALAYSIA

EXPOSURE TO TRAFFIC AIR POLLUTANTS (BENZENE, TOLUENE, XYLENE AND PMI0) AND RESPIRATORY HEALTH IMPLICATIONS AMONG THE TRAFFIC POLICEMEN IN KLANG VALLEY

WAN AZNANI BINTI WAN MANSOR

lp
FPSK4 2017 43

ACKNOWLEDGEMENTS

I am grateful to many people who have helped me and contributed directly or indirectly in various ways in order to do and finish this Final Year Project.

First and foremost, thank you very much to my supervisor, Associate Prof. Dr. Juliana Jalaludin for giving up her time, endless guidance and encouragement. Her constructive criticism and comments based on this study has been very useful in the preparation and also in the writing of the Final Year Project paper.

I would also like to thank the Management of Police Headquarter in Bukit Aman for the permission given to do my project at eight Traffic Departments in Klang Valley. Sincere heartfelt appreciations to all staffs and officers who have contributed in making this study accomplished. Special thanks to the respondents for giving me fullest cooperation throughout the study period.

I would like to express my sincere thanks to all my lecturers and staffs at the Environmental and Occupational Health Unit, and colleagues, whom I cannot mention one by one here. I wish you the best in life and I apologize for every mistake I made during our short time together in UPM.

For my parents, I wish good health for both of you and thank you for being understanding and supportive during my hard days. Thank you again.

© COPYRIGHT UPM

ABSTRACT

EXPOSURE TO TRAFFIC AIR POLLUTANTS (BENZENE, TOLUENE, XYLENE, & PM10) AND RESPIRATORY HEALTH IMPLICATIONS AMONG TRAFFIC POLICEMEN IN KLANG VALLEY

WAN AZNANI BINTI WAN MANSOR

Introduction: Traffic policemen working nature caused them to be exposed to traffic pollutants continuously. This study aimed to identify the exposure level of traffic air pollutants (Benzene, Toluene, Xylene and PM_{10}) among traffic policemen and the risks to their respiratory health. **Methodology:** A cross-sectional comparative study was conducted among 42 traffic policemen and 42 police officers from Traffic Police Stations in Klang Valley as exposed and comparative group respectively. A purposive sampling method was used to select the respondents based on the inclusion criteria. The questionnaire used was adapted from the American Thoracic Society for Adult Respiratory Health Disease (ATS-DLD) to collect information on socio-demographic and respiratory symptoms. Spirometer (Chestgraph Hi-105) was used to perform lung function test. Personal Air Sampling Pump (Gilian GilAir-3) was used to measure personal exposure level to PM_{10}. Ppbrae 3000 was used to measure the concentration of Benzene, Toluene and Xylene. Whereas DustTrak DRX Aerosol Particulate Monitors was used to measure the concentration of PM_{10} in the indoor and outdoor ambient air. **Result:** The mean exposure level of PM_{10} among the traffic policemen was 150.14 ± 130.66 mg/m^3 compared to only 84.14 ± 94.11 mg/m^3 among the comparative group. There was no significant different in FVC (litre) with t= -0.622, p= 0.535, FEV_1 (litre) with t= -0.283, p= 0.778, FVC% predicted with t= -1.457, p= 0.149 and FEV_1% predicted with t= -0.028, p=0.325 between the exposed and comparative group. However, there was a significant difference in FEV_1/FVC% predicted with t= -2.990, $p<0.05$ between the exposed to comparative group. **Discussion:** Findings revealed that there was a significant difference in FEV_1/FVC% predicted between the two study groups and the lung function abnormalities were higher in the exposed group compared to the comparative group with a significant difference in FVC% predicted. The respiratory symptoms were significantly higher in the exposed group compared to the comparative group for chronic cough (OR=3.86, 95% CI = 1.44-10.34), wheezing (OR=4.08 95% CI= 1.50-11.10) and breathlessness (OR=3.48 95% CI =1.10-11.01). **Conclusion:** This study found that the traffic policemen that exposed to traffic air pollutants may have higher risk of having lung function reduction and increase the prevalence of respiratory symptoms.

ABSTRAK

PENDEDAHAN KEPADA UDARA PENCEMAR TRAFIK (BENZENA, TOLUENA, XILENA, & PM_{10}) DAN IMPLIKASI KEPADA KESIHATAN PERNAFASAN DALAM KALANGAN POLIS TRAFIK DI LEMBAH KLANG

WAN AZNANI BINTI WAN MANSOR

Pengenalan: Anggota polis trafik terdedah kepada pencemaran trafik secara berterusan disebabkan tuntutan pekerjaan. Kajian ini bertujuan untuk mengenal pasti tahap pendedahan pencemar udara trafik (Benzena, Toluena, Xilena dan PM_{10}) di kalangan anggota polis trafik dan risiko kepada kesihatan pernafasan mereka. **Metodologi:** Satu kajian perbandingan keratan rentas telah dijalankan di kalangan 42 anggota polis trafik sebagai kumpulan pendedahan dan 42 anggota polis sebagai kumpulan perbandingan dari Stesen Polis Trafik di Lembah Klang. Kaedah persampelan bertujuan telah digunakan untuk memilih responden berdasarkan kriteria inklusif. Soal selidik yang digunakan diadaptasi daripada American Thoracic Society for Adult Disease Health Respiratory (ATS-DLD) untuk mengumpul maklumat sosio-demografi dan simptom-simptom pernafasan. Spirometer (Chestgraph Hi-105) telah digunakan untuk menjalankan ujian fungsi paru-paru. Pam Udara Persampelan Peribadi (Gilian GilAir-3) digunakan untuk mengukur tahap pendedahan individu kepada PM_{10}. Ppbrae 3000 telah digunakan untuk mengukur kepekatan Benzena, Toluena dan Xilena manakala DustTrak DRX Aerosol Monitor Particulate digunakan untuk mengukur kepekatan PM_{10} di udara. **Keputusan:** Min paras pendedahan PM_{10} di kalangan anggota polis trafik adalah 150.14 ± 130.66 mg/m^3 berbanding hanya 84.14 ± 94.11 mg/m^3 di kalangan kumpulan perbandingan. Tiada perbezaan yang signifikan dalam FVC (liter) dengan nilai t = -0.622, p = 0.535, FEV_1 (liter) dengan nilai t = -0.283, p = 0.778, FVC% jangkaan dengan nilai t = -1.457, p = 0.149 dan FEV_1% jangkaan dengan t = -0.028, p = 0.325 di antara kumpulan yang terdedah dan perbandingan. Walau bagaimanapun, terdapat perbezaan yang signifikan dalam FEV_1/FVC% jangkaan dengan nilai t = -2.990, p <0.05. **Perbincangan:** Keputusan menunjukkan bahawa terdapat perbezaan yang signifikan dalam FEV_1/FVC% jangkaan antara kedua-dua kumpulan kajian dan keabnormalan fungsi paru-paru adalah lebih tinggi dalam kumpulan terdedah berbanding dengan kumpulan perbandingan dengan perbezaan yang signifikan dalam FVC% jangkaan. Simptom pernafasan adalah lebih tinggi secara singnikan dalam kumpulan terdedah berbanding kumpulan perbandingan bagi batuk kronik (OR=3.86, 95% CI = 1.44-10.34), nafas berdehit (OR=4.08 95% CI= 1.50-11.10) dan kesukaran bernafas (OR=3.48 95% ,CI =1. **Kesimpulan:** Kajian ini mendapati bahawa anggota polis trafik yang terdedah kepada pencemaran udara trafik (Benzena, Toluena, Xilena dan PM_{10}) mungkin mempunyai risiko lebih tinggi untuk mendapat penurunan fungsi paru-paru dan peningkatan prevalens symptom respiratori.

TABLE OF CONTENTS

© COPYRIGHT UPM

© COPYRIGHT UPM

© COPYRIGHT UPM

LIST OF TABLES

© COPYRIGHT UPM

© COPYRIGHT UPM

LIST OF FIGURES

© COPYRIGHT UPM

LIST OF APPENDIXES

© COPYRIGHT UPM

ABBREVIATIONS

<	Less Than
>	More Than
ATS	American Thoracic Society
COPD	Chronic Obstructive Pulmonary Disease
USEPA	United State Environment Protection Agency
FVC	Forced Vital Capacity
FEV1	Forced Exploratory Volume In 1 Second
NAAQS	National Ambient Air Quality Standard
SPSS	Statistical Package For Social Sciences
PM10	Particulate Matter With Diameter Less Than 10 Micron
BTX	Benzene, Toluene And Xylene
WHO	World Health Organization
ppm	parts per million
mg/m3	milligram per meter cubic
PEL	Permissible Exposure Limit
STEL	Short Term Exposure Limit
OSHA	Occupational Safety and Health Act

© COPYRIGHT UPM

CHAPTER 1

INTRODUCTION

1.0 Introduction

Air pollution is one of the environmental problems faced by many countries around the world especially in urban areas. Rapid development and increased in total number of the population continue to contribute to the increasing number of vehicles in cities in Malaysia which became the main sources of air pollution (Afroz et al, 2003). Based on the Malaysian Ministry of Transport data, motor vehicles are one of the major factors that contribute to the formation of air pollutants (Brauer et al, 2002; Azid et al, 2015). The Department of Statistics (2014) stated that the pollutants emitted into the atmosphere from the motor vehicles increased by 14.3% in 2014 as compared to 2010.

© COPYRIGHT UPM

The exhaust products that contain in the vehicle emission consist of (1) Hydrocarbons (unburned), (2) Carbon Monoxide, (3) Oxides of Nitrogen (NO_x), (4) Lead oxides, (5) Particulate Matters e.g. Lead, Carbon, alkaline earth compounds, Iron Oxide, tar, oil and mist, (6) Traces of Aldehydes, Esters, Ethers, Sulphur Dioxide, Peroxides, Benzene (C_6H_6), 1,3-butadiene, Poly Aromatic Hydrocarbons (PAH), metal dust, asbestos fibre, Dioxin, Furon, Ammonia, organic acids , Chlorofluorocarbons (CFCs) etc. In a study in New Delhi, India, these exhaust emissions were identified as the major sources which constituting about 60% of the total emission. Another 20% come from crankcase emission and 20% came from evaporative emission. This pollution did not only affects health, but also caused tremendous economic loss in India (Bhandarkar, 2013).

In the other hand, Malaysia has been introduced to unleaded petrol since 1990s as it is capable of saving fuel consumption and suitable to be used by various types of vehicles. A significant reduction of atmospheric lead content in Europe has been observed after the unleaded petrol has become mandatory (WHO, 1999). A study in Thailand revealed that unleaded gasoline uses monoaromatic compounds to increase the octane number such as Benzene, Toluene and Xylene (BTX) (Rungratanaubon and Panich, 2007).

BTX can also be found in coal tar, crude petroleum and a wide range of petroleum products. BTX is released into the environment via emissions from motor vehicles and aircraft exhaust, losses during petrol marketing, spills and cigarette smoke (Leusch and Bartkow, 2010). In Malaysia, the concentration of Benzene in

© COPYRIGHT UPM

gasoline is between the ranges of 3-7% by volume, whereas USA, China, Australia and a few of the European countries has reduced the volume to less than 2% (Bahadar et al, 2014).

Apart from BTX, airborne particulate matter (PM_{10}) is one of the traffic pollutants that are associated with mortality and other chronic effects. Exposure to low concentrations of PM_{10} for a long period can lead to an increased rate of bronchitis, reduced lung function (WHO, 2000) and will also affect the lungs and heart (USEPA, 2017).

In 2009, the air pollution in Klang Valley was related to the increased rate of respiratory diseases which are identified as one of the 10 principal causes of death in Malaysia (Ling et al, 2012). Increasing number of evidence suggests that air pollution contributes to the large global burden of respiratory and allergic diseases including asthma, COPD, pneumonia and possibly tuberculosis (Laumbach et al, 2013). The nature of work of traffic policemen causes them to be exposed to pollutants continuously. A local study in Selangor found that the traffic policemen exposed to PM_{10} are at risk of respiratory diseases with an increase in the reported respiratory symptoms and reduction in lung function (Muhammad[2] et al, 2014).

© COPYRIGHT UPM

1.2 Problem Statement

According to the Department of Statistics, the total population of Malaysia was estimated to be at 31.7 million in 2016. The environmental air pollution in Malaysia is mainly caused by the rapid development and industrial activities carried out in a highly populated and urbanized areas such as Klang Valley, Selangor. Transportation is the major contributor to air pollution in Malaysia (Ngalai et al, 2004).

High number of population causes the increasing number of vehicles in the country. Total vehicle registered with the Road Transport Department (JPJ) until the end of 2015 is approximately 26.3 million. Klang Valley is one of the most urbanized and highly populated areas in Malaysia with largest traffic volume. A previous study in Thailand proved that the prevalence of respiratory symptoms among the police who works in urban areas was slightly higher than those who work in rural areas (Karita et al, 2001) due to the traffic density.

BTX is a group of monoaromatic hydrocarbons emitted from vehicles as traffic pollutants. According to Lieberman & Blecher P.C, BTX is found in petroleum derivatives and can cause ill if exposed. Since Malaysia introduced the use of unleaded petrol, higher amount of BTX is released into the air. Therefore, the concentration of BTX was greater in urban areas compared to rural because of the heavy traffic volume (Al Madhoun et al, N.D) which enter the lung airways through

UNIVERSITI PUTRA MALAYSIA

inhalation (Turki, 2010). BTX is also known as Volatile Organic Compounds (VOC) and it can evaporate immediately into the air as soon as it is released. It can cause considerable risks to human health as it plays a vital role in tropospheric chemistry (Khoder, 2007).

The adverse health effects of BTX can be classified into acute and chronic. According to USEPA (1979), short-term exposure to BTX can cause eye, nose and throat irritation, headache, nausea/vomiting, dizziness, affect immune in infants or children and worsening of asthma symptoms whereas long-term exposure can increase the risk of cancer, liver, kidney and central nervous system damage (Turki, 2010). Several studies also showed that the inhalation of BTX can increase the risk of myeloid leukaemia, cause central nervous system disorders and give effects on blood, liver and kidneys (Hinwood et al, 2003).

Benzene which is a carcinogenic can be found in all cities and urban areas as it is mainly released from petrol-fuelled car exhausts (Skov et al, 2001). According to Mukherjee (2016), among BTX, exposure to Benzene was the highest (104.6 ± 99.0 $\mu g\ m^{-3}$) among traffic police personnel. The major health effect of benzene is known to be leukaemia. However, a few previous studies showed that workers who are exposed to BTX experienced decreases in lung function. A study carried out in Kolkata City, India showed that exposure to BTX causing a significant reduction of forced expiratory volume in one second (FEV_1) and forced vital capacity (FVC) of fuel fillers (Mukherjee et al, 2015). Another study in Jeddah, Makah suggested that

exposure to petrol fumes, diesel exhaust and VOCs among petrol pump workers causing a significant pulmonary impairment (Basahi et al, 2015).

Besides petrol pump workers, traffic policemen may also have the risk of occupational exposure to Benzene. A biological monitoring conducted in North India concluded that the traffic policemen are facing a serious health hazard through occupational exposure to benzene (Verma et al, 2003). Another study carried out in Pondicherry, India found that the exposure to vehicular pollution for several hours in a day for many years, causing a restriction to the lung expansion, obstruction and narrowing the lung airways of traffic police personnel compared to the general police personnel (Pal et al, 2010). According to Solanki et al (2015), the pulmonary function impairments are caused by the pollutants emitted from the vehicle exhausts and traffic policemen should be provided with PPE or preventive measures.

Another type of traffic air pollutants that its association with respiratory health had been observed as positive by many epidemiological studies is airborne particulate matter (Brunekreef and Holgate, 2002; Pope and Dockery, 2006). A review of air pollution in Malaysia has found that the concentration of the total suspended particulate matter in a few regions in Klang Valley often exceeded the Recommended Malaysian Air Quality Guidelines (Afroz et al, 2003).

The exposure to urban air pollution has been associated with several health effects such ascardiovascular diseases, lung cancer, respiratory and allergic diseases.

A study in Italy found a higher percentage of allergic subjects in the group of workers exposed to outdoor pollutants than in the controls (Vimercati et al, 2015). Another study of respiratory health effects when exposed to airborne particulate matter in Netherlands found that changes in the particle number concentration were associated with evidence of acute airway inflammation and impaired lung function (Strak, 2011).

© COPYRIGHT UPM

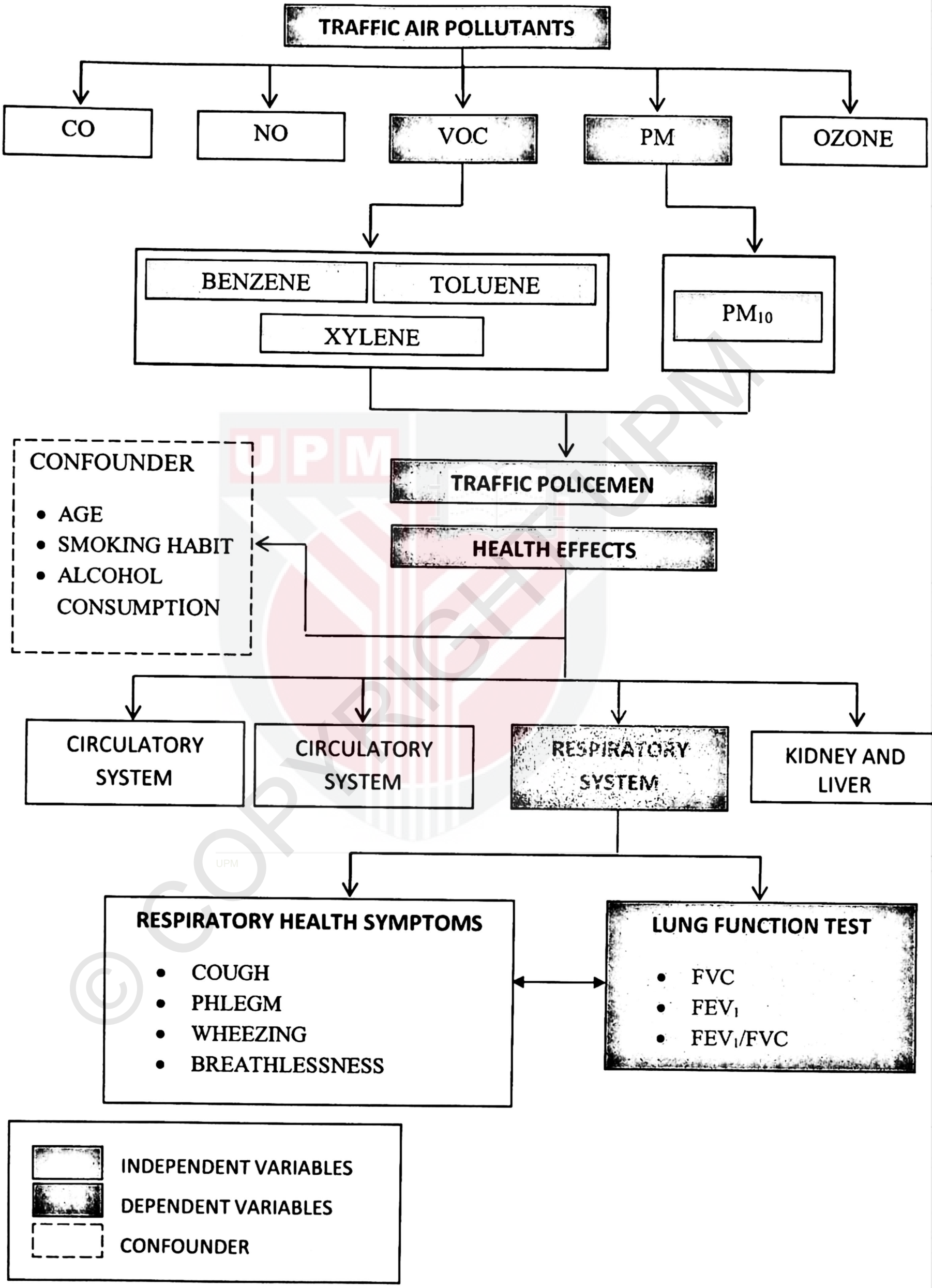

Figure 1.1 Conceptual Frameworks

© COPYRIGHT UPM

1.3 Study Justification

This study is proposed to determine the association between exposure to traffic air pollutants (Benzene, Toluene, Xylene and PM_{10}) and respiratory health implications among traffic policemen in Klang Valley, Selangor. The need to carry out this study is influenced by several reasons: Traffic policemen are chosen as the target population because they are exposed to the traffic air pollutants that can cause various health effects almost daily and urbanized area such as Klang Valley has recorded a higher number of pollutants emitted into the surrounding areas contributing to air quality problem.

Klang Valley is one of the densely populated areas in Malaysia. It is a mainstream economic region with extensive physical development of the infrastructure, industrialization and urbanization (Dept. of Statistics, 2011). One of the reasons that Klang Valley is recorded as a highly polluted area is due to its meteorological factors. The concentration of PM_{10} in Klang Valley is influenced by the ambient temperature, wind speed (Azmi et al, 2010) andis possibly caused by the hot weather (Rahman et al, 2015).

A high number of registered vehicles in the Klang Valley were recorded and it is still increasing. According to the Malaysia's Ministry of Finance, the number of cars in Klang Valley is expected to reach 7 million by the year of 2020, unless people prefer to use public transport (Borneo Post, 2011). The high number of vehicles will increase the level of pollutants emitted from the vehicles exhaust to the surrounding.

1000715789

BTX in the traffic surrounding are produced mainly by the evaporative and exhaust emission of vehicles (Bhandarkar, 2013). The use of unleaded petrol increased the concentration of BTX emitted into the environment, thus increasing the risk of exposure to these pollutants. Many epidemiological studies have also demonstrated that the increase in levels of ambient air particulate matter pollution is associated with increased in mortality and, respiratory and cardiovascular morbidity (Hime et al, 2015). Therefore, this study is important in order to access the exposure level of traffic pollutants among the traffic policemen and their health effects.

There are limited studies in Malaysia that are focusing on exposure to traffic air pollutants and it health effects of respiratory system among traffic policemen. Many studies are concerning more towards air pollution during the haze (Ngalai, 2014). Traffic policeman is one of the occupational groups with a high risk of exposure but was not provided with any appropriate personal protective equipment (PPE) while on duty. Through this study, the exposure level determined can be used to suggest the preventive measures and controls that can be taken to reduce the risks among traffic policemen as it is their nature of work to be exposed to outdoor air pollutants emitted by vehicles.

© COPYRIGHT UPM

1.3 Study Objectives

1.3.1 General Objective

To determine the exposure level of traffic air pollutants and respiratory health implications among traffic policemen in Klang Valley, Selangor.

1.3.2 Specific Objectives

1. To determine the demographic and occupational exposure to traffic air pollutants among the respondents.
2. To compare the personal exposure level of PM_{10} among traffic policemen and the comparative group.
3. To assess the exposure to the traffic air pollutants (Benzene, Toluene, Xylene and PM_{10}) among traffic policemen and the comparative group.
4. To compare the respiratory symptoms (Cough, Phlegm, Wheezing and Breathlessness) among traffic policemen and the comparative group.
5. To compare the lung functions (FVC, FEV_1, FVC% predicted and FEV_1% predicted) among traffic policemen and the comparative group.
6. To determine the relationship between the personal exposure to PM_{10} and respiratory symptoms (Cough, Phlegm, Wheezing and Breathlessness) among traffic policemen and the comparative group.
7. To determine the relationship between the personal exposure level to PM_{10} and lung functions among traffic policemen and the comparative group.
8. To determine the relationship between the years of employment and lung functions among traffic policemen.

© COPYRIGHT UPM

1.5 Study Hypothesis

1. The personal exposure level of PM_{10} among traffic policemen is significantly higher than the comparative group.
2. The exposure to the traffic air pollutants (Benzene, Toluene, Xylene and PM_{10}) among the traffic policemen is significantly higher than the comparative group.
3. The respiratory symptoms (Cough, Phlegm, Wheezing and Breathlessness) among the traffic policemen are significantly higher than the comparative group.
4. Lung functions (FVC, FEV_1, FVC% predicted and FEV_1% predicted) among the traffic policemen are significantly lower the comparative group.
5. There is a significant relationship between the personal exposure to PM_{10} and respiratory symptoms (Cough, Phlegm, Wheezing and Breathlessness) among traffic policemen and the comparative group.
6. There is a significant relationship between the personal exposure to PM_{10} and lung functions among traffic policemen and the comparative group.
7. There is a significant relationship between the years of employment and lung functions among traffic policemen.

© COPYRIGHT UPM

1.6 Research Question

1. Is the personal exposure level of PM_{10} among traffic policemen significantly higher than the comparative group?
2. Is the exposure to the traffic air pollutants (Benzene, Toluene, Xylene and PM_{10}) among the traffic policemen significantly higher than the comparative group?
3. Are the respiratory symptoms (Cough, Phlegm, Wheezing and Breathlessness) among the traffic policemen are significantly higher than the comparative group?
4. Are the lung functions (FVC, FEV_1, FVC% predicted and FEV_1% predicted) among the traffic policemen significantly lower the comparative group?
5. Is there a significant relationship between the personal exposure to PM_{10} and respiratory symptoms (Cough, Phlegm, Wheezing and Breathlessness) among traffic policemen and the comparative group?
6. Is there a significant relationship between the personal exposure to PM_{10} and lung functions among traffic policemen and the comparative group?
7. Is there a significant relationship between the years of employment and lung functions among traffic policemen?

© COPYRIGHT UPM

1.7 Definition of Variables

1.7.1 Conceptual definition

1. **Age**

   Age of respondent from the day of birth until the day of interview obtained from the study questionnaire (ATS, 1991)

2. **Traffic air pollutants**

a) Benzene

Benzene is a colourless liquid with a sweet odour that evaporates into the air very quickly and dissolves slightly in water. Benzene in outdoor air comes from tobacco smoke, automobile service stations, exhaust from motor vehicles, and industrial emissions. The vapours or gases in the products such as glues, paints, furniture wax, and detergents, can also be a source of exposure of Benzene. Breathing very high levels of Benzene can result in death, while high levels can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness (ASTDR, 2007).

b) Toluene

Toluene is a clear, colourless liquid with a distinctive smell and is a good solvent. Toluene is used in paints, paint thinners, fingernail polish, lacquers, rubber and in some printing and leather tanning processes. It is also added to the gasoline along with Benzene and Xylene to improve octane ratings.

© COPYRIGHT UPM

Individuals are exposed to Toluene by breathing air from a contaminated workplace or automobile exhaust (ATSDR, 2015)

c) Xylene

Xylene is a colourless, flammable liquid with a sweet odour that exist in three forms which are meta-xylene, ortho-xylene, and para-xylene. Xylene occur naturally in petroleum and coal tar. It is also used as a solvent in the printing, rubber and leather industries. It is found in small amounts in fuel and gasoline. Xylene exists in a various consumer product including gasoline, paint varnish, shellac, rust preventatives and cigarette smoke. It is absorbed through the respiratory tract and skin (ATSDR, 2007).

d) PM_{10}

PM_{10} are inhalable particles that has less than or equal to 10 micrometres of aerodynamics size in diameter. These particles come in many sizes and shapes and can be made up of hundreds of different chemicals. PM_{10} are emitted directly from construction sites, unpaved roads, fields, smokestacks or fires. Most of the particles form in atmosphere is as a result of complex reactions of chemicals such as sulphur dioxide and nitrogen oxides, which are emitted from power plants, industries and automobiles. It poses greatest problems because it can get deep into the lungs and some may even get into the bloodstream and cause serious health effect (USEPA, 2016).

3. Respiratory Health Symptoms

a) Cough

Experience cough for at least four days in a week for at least three consecutive months in one year (ATS, 1991).

b) Phlegm

Experience phlegm that cough up from the chest for at least four days in a week for at least three consecutive months in one year (ATS, 1991).

c) Wheezing

Experience wheezing or whistling sound in breathing related with breathlessness on most days or nights (ATS, 1991).

d) Breathlessness

Experience breathes discomfort that consists of qualitatively distinct sensations that vary in intensity (ATS, 1991).

4. Forced Vital Capacity (FVC)

Maximum volume of air exhaled with maximum forced effort from a maximum inspiration, i.e. vital capacity performed with a maximum forced expiratory effort, expressed in litres at body temperature and ambient pressure saturated with water vapour (ATS, 2005).

© COPYRIGHT UPM

5. **Forced Expiratory Volume in one second (FEV_1)**

   Maximum volume of air exhaled in the first second of a forced expiration from a position of full inspiration, expressed in litre (ATS, 2005).

6. **Forced Expiratory Ratio (FEV_1/FVC)**

   Forced expiratory volume in one second is express as the ratio on forced vital capacity (ATS, 1995).

© COPYRIGHT UPM

1.7.2 Operational definition

1. **Age**

   Age of respondent determined from the study questionnaire based on the American Thoracic Society (ATS, 1991)

2. **Traffic air pollutants**

a) Benzene

Concentration of Benzene in ambient and indoor air measured using a direct reading device (RAE Systems PpbRAE 3000 Monitor) in ppm level. The ppbRAE uses a 3rd gen photoionization detector (FID) and built-in correction factors for more than 200 compounds including Benzene (RAE Systems Inc, 2015).

b) Toluene

Concentration of Toluene in ambient and indoor air measured using a direct reading device (RAE Systems PpbRAE 3000 Monitor) in ppm level. The ppbRAE uses a 3rd gen photoionization detector (FID) and built-in correction factors for more than 200 compounds including Toluene (RAE Systems Inc, 2015).

© COPYRIGHT UPM

c) Xylene

Concentration of Xylene in ambient and indoor air measured using a direct reading device (RAE Systems PpbRAE 3000 Monitor) in ppm level. The ppbRAE uses a 3rd gen photoionization detector (FID) and built-in correction factors for more than 200 compounds including Xylene (RAE Systems Inc, 2015).

d) PM_{10}

Airborne particulates with aerodynamic diameter of 10 micrometres or less collected by using Personal Air Sampling Pump (Gilian GilAir-3) and are expressed in mg/m3. The concentration of PM_{10} in ambient and indoor air measured using a direct reading device (TSI Dusttrak DRX Aerosol Monitor 8533) in mg/m3 level. The Dusttrak uses light-scattering laser photometers that give real-time aerosol mass readings (TSI Inc, 2017)

3. Respiratory Health Symptoms

a) Cough

Symptoms of cough are identified through the study questionnaire based on the American Thoracic Society (ATS, 1991).

© COPYRIGHT UPM

b) Phlegm

Symptoms of phlegm are identified through the study questionnaire based on the ATS (1991).

c) Wheezing

Symptoms of wheezing are identified through the study questionnaire based on the ATS (1991).

d) Breathlessness

Symptoms of breathlessness are identified through the study questionnaire based on the ATS (1991).

4. Forced Vital Capacity (FVC)

The measurement of the volume of air exhaled maximally and forcefully by using a spirometer (Chestgraph HI-105) expressed in litres.

5. Forced Expiratory Volume in one second (FEV_1)

The measurement of the volume of air exhaled maximally in 1 second by using a spirometer (Chestgraph HI-105) expressed in litres.

© COPYRIGHT UPM

6. FVC% predicted

The calculation to determine the normal variable value of FVC among the respondent based on study done in a normal population group.

Formula: FVC% predicted = [FVC measured / FVC predicted] x 100.

7. FEV_1% predicted

The calculation to determine the normal variable value of FEV_1 among the respondent based on study done in normal population group.

Formula: FEV_1 predicted = [FEV_1measured / FEV_1 predicted] x 10.

© COPYRIGHT UPM

CHAPTER 2

LITERATURE REVIEW

2.1 Air Pollution

Urbanization and rapid development contribute to the problem of overpopulation Klang Valley. In 2013, Klang Valley has already populated by 7.2 million of people which is more than one over five of Malaysia's current population (The Star News, 2013). Few studies of air quality conducted in Klang Valley showed two distinct daily peaks which is one in the morning and another one in evening. The morning peak was mainly caused by the emissions of traffic pollutants by vehicles and the late evening peak was contributed by the meteorological conditions such as atmospheric stability and the speed of the wind (Afroz et al, 2003). Total suspended particulate matter has been identified as the main pollutants during haze and its concentration at a few areas in Klang Valley often exceeded the Recommended Malaysian Air Quality Guidelines (Afroz et al, 2003).

Land transportation, industrial emissions and open burning sources are the main sources of pollutants emitted into the air. However, air pollution is mostly contributed by land transportation (Afroz et al, 2003). The statistics from Road Transport Department (JPJ) showed an increasing number of vehicles in Malaysia from 2010 until 2015. Within six years, a total increase of 30.28 per cent was recorded. A study concerning air pollution and health impacts in Malaysia found that with the absent of haze, the vehicle emissions accounted for more than 70 per cent of the total emission in urban areas (Afroz et al, 2003).

2.2 Exposure to Traffic Air Pollutants

Traffic Air Pollutants is classified as anthropogenic as it is emitted from vehicles exhaust. Five major types of traffic pollutants are Carbon Monoxide (CO), Oxides of Nitrogen (NO_x), Volatile Organic Compounds (VOCs), Particulate Matter (PM) and Ozone (O_3) (Kebin et al, 2009).

Various types of vehicles such as cars, buses, trucks and others contributed to air pollution in urban area. Vehicular emissions of pollutants are divided into three which is the crankcase emission, evaporative emission and exhaust emission. (Bhandarkar, 2013). In 2014, the main source of emission of pollutants in Malaysia was from the motor vehicles which reach 2,092 thousand tonnes (Dept. of Statistics, 2015).

Table 2.1 Sources of emissions of air pollutants in Malaysia

Sources of Emission ('000 tonnes)	Year	
	2010	2014
Industrial	113.9	101.9
Motor Vehicles	1,829.7	2,092.0
Power Plant	619.2	742.9

Source: Malaysia Department of Statistics (2015)

The Occupational Safety and Health Administration (OSHA, 2004) has set 1 ppm (3.19 mg/m^3) and 200 ppm (753.6 mg/m^3) as workplace Time-Weighted Average (TWA) regulation limits for a normal 8-hours work day or 40-hours work week for Benzene and Toluene respectively whereas Xylene is 100 ppm (434 mg/m^3).

Table 2.2 Regulatory values set by OSHA

Pollutants	Duration	Values	
		ppm	mg/m^3
Benzene	8-h work day / 40-h work week	1	3.19
Toluene	8-h work day / 40-h work week	200	753.6
Xylene	8-h work day / 40-h work week	100	434

(Source: Han and Naeher, 2006)

USEPA has not proposed any standards for BTEX but has set the standards for $PM_{2.5}$ and PM_{10} to 65 $\mu g/m^3$ and 150 $\mu g/m^3$ for 24-hours duration and 15 $\mu g/m^3$ and 50 $\mu g/m^3$ for annual duration respectively.

Table 2.3 1997 USEPA NAAQS Standards

Pollutants	**Time duration**	**Values ($\mu g/m^3$)**
$PM_{2.5}$	24-h	65
	Annual	15
PM_{10}	24-h	150
	Annual	50

(Source: Han and Naeher, 2006)

2.3 Traffic Air Pollutants and Health Effects

Traffic policeman is one of the occupational groups that are exposed directly to the various traffic air pollutants as they are working outdoors. A study carried out in Beirut, Lebanon found that the exposure to BTEX was higher among traffic policemen compared to policemen who worked in the office (Borgie et al, 2014). In Milan, Italy the personal exposure among traffic police officers towards Benzene was also consistently higher than those who did office work and the exposure was not related to environmental concentrations. The study concluded that the excess risk of exposure by traffic policemen compared to general urban population cannot be excluded because exposure levels measured were considerably higher than ambient levels (Cattaneo et al, 2010).

© COPYRIGHT UPM

A number of studies also have proved the association between the particle pollution exposure and various health effects such as premature death in people with heart or lung disease, nonfatal heart attacks, irregular heartbeat, aggravated asthma, decreased lung function and increased in respiratory symptoms such as irritation of the airways, coughing or difficulty in breathing (USEPA, 2016). A study in Baltimore, Maryland suggested that exposure to particulate matter can influenced the lung development and also give impact on lung function in both children and adults, and in individual with and without existing lung diseases (Paulin and Hansel, 2016).

People who are living or working near the roadways will happened to experience an increase in cardiovascular and respiratory diseases due inhalation of pollution from vehicle emissions (Chen et al, 2015). A previous study carried out in Bogota, Colombia showed that the exposure to particles less than 10 micrometres in diameter (PM_{10}) had increased the risk of developing respiratory symptoms and signs among traffic policemen (Esteves-Garcia et al, 2013). Another study in Patiala, India recorded a significant decline in FVC and FEV_1 of non-smoking traffic policemen when compared to controls. This study also proved that the traffic policemen with more than 8 years of exposure to air pollution had lower values of FVC and FEV_1 compared to those who exposed less than 8 years (Gupta et al, 2011).

© COPYRIGHT UPM

CHAPTER 3

METHODOLOGY

3.1 Study Design

The study design for this research is a comparative cross-sectional study. The exposure level of traffic air pollutants (Benzene, Toluene, Xylene and PM_{10}) and lung function among traffic policemen is compared to police officers in the Traffic Department in Klang Valley areas.

3.2 Study Location

The study is conducted in selected areas in Klang Valley, Selangor (Kuala Lumpur, Sepang, Subang Jaya, Petaling Jaya, Kajang, Klang Utara, Klang Selatan and Ampang).

© COPYRIGHT UPM

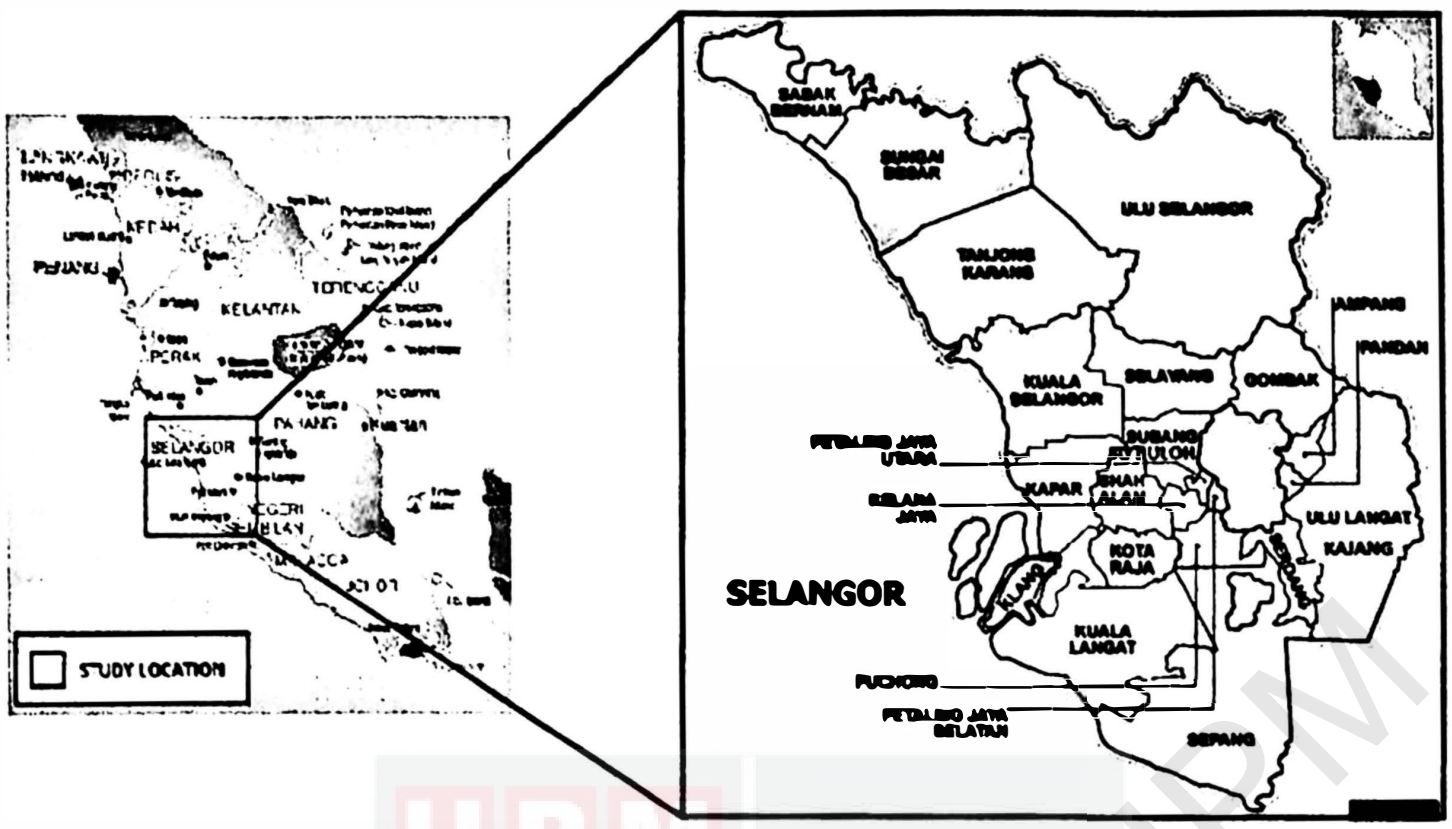

Figure 3.1 The area of study location

3.3 Sampling

3.3.1 Study Population

The study population in this study was divided into two groups:

a) Exposed group

Traffic policemen involved in controlling the traffic as a main duty.

b) Comparative group

Police officers work in the Department of Traffic.

3.3.2 Study Sample

The study sample of this research is traffic policemen who are exposed directly to ambient traffic air pollutants while on their duty on the roads and highways in the Klang Valley and police officers work in the Department of Traffic as comparative group.

© COPYRIGHT UPM

3.3.3 Sampling Frame

List of all traffic policemen and police officers in the Traffic Department according to their job duty and work area was obtained from the Traffic Branch of Headquarters in Klang Valley where they are working on.

3.3.4 Sampling Unit

Selected traffic policemen as exposed group that perform job duty of controlling the traffic and selected police officers as the comparative group that are working indoor and both groups should meet the inclusion criteria.

3.3.5 Sampling Method

Purposive sampling technique was used to select the subjects. Subjects are selected based on the inclusion criteria listed below:

UPM

<u>Exposed Group</u>

1. Malay male
2. Aged between 20 and 50 years old
3. Involve in controlling the traffic flow (outdoor)
4. No chronic respiratory diseases (Asthma, COPD, Pulmonary hypertension, etc.)
5. Did not undergo x-ray in the last 6 months

© COPYRIGHT UPM

Comparative Group

1. Malay male
2. Aged between 20 and 50 years old
3. Involve in administrative work only (indoor)
4. No chronic respiratory diseases (Asthma, COPD, Pulmonary hypertension, etc.)
5. Did not undergo x-ray in the last 6 months

Only respondents who fulfilled the inclusion criteria above were selected for personal exposure monitoring to traffic air pollutants (Benzene, Toluene, Xylene, $PM_{2.5}$, PM_{10}) measured in this study and to undergo lung function test that determine the lung function abnormality based on FVC and FEV_1 variables.

© COPYRIGHT UPM

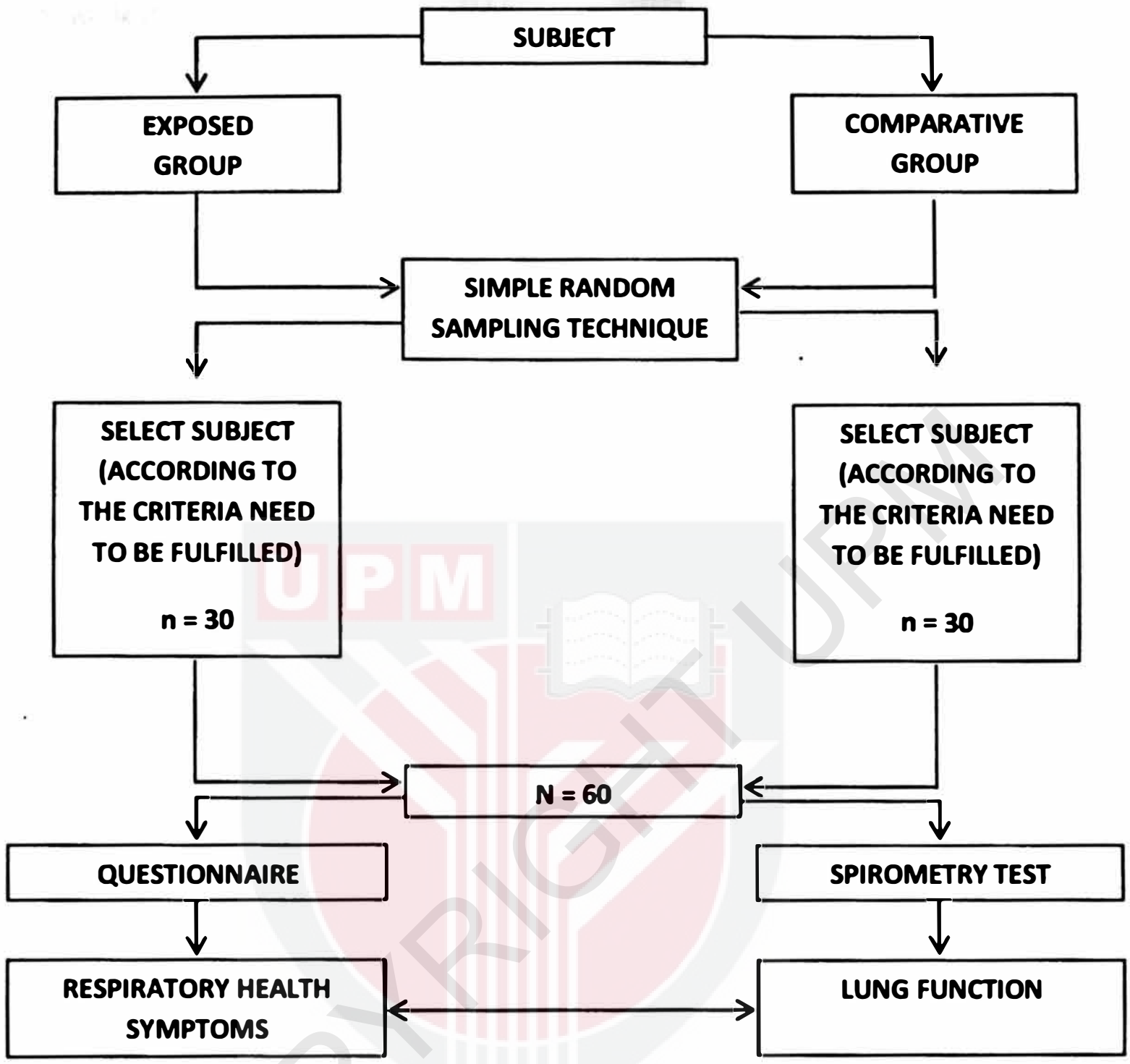

Figure 3.2 Research Flow

© COPYRIGHT UPM

3.3.6 Sample Size

Sample size calculation for this study is based on the formula by Lemeshow et al (1990).

The formula used is as follows:

1. $$\sigma = \frac{[\sigma_1{}^2 + \sigma_2{}^2]^{1/2}}{2}$$

Where,

σ = Standard deviation

σ_1 = Standard deviation of FEV1 (litre) among the exposed group (Esteves-Garcia et al, 2013)

σ_2 = Standard deviation of FEV1 (litre) among the comparative group (Esteves-Garcia et al, 2013)

Therefore,

$$\sigma = \frac{[0.7^2 + 0.7^2]^{1/2}}{2}$$

$$\sigma = 0.49$$

© COPYRIGHT UPM

2. $$N = \frac{2\sigma^2[Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}]^2}{(\mu_1 - \mu_2)^2}$$

Where,

N = Sample size

σ = Standard deviation

$Z_{1-\frac{\alpha}{2}}$ = 1.96 (Naing, 2003)

$Z_{1-\beta}$ = 0.842 (Naing, 2003)

μ_1 = Mean of FEV1 (litre) among the exposed group (Esteves-Garcia et al, 2013)

μ_2 = Mean of FEV1 (litre) among the comparative group (Esteves-Garcia et al, 2013)

Therefore,

$$N = \frac{2(0.49)^2[1.96 + 0.842]^2}{(4.8 - 3.6)^2}$$

$N = 41.89$

N = 42 respondents for each group

© COPYRIGHT UPM

3.4 Instruments

3.4.1 Questionnaire

The questionnaire used in this study is adapted and developed from the American Thoracic Society (1978) previous studies (Angelini et al, 2011; Aryasiri et al, 2010 & Manuela et al, 2012). The questionnaire consists of demographic information, occupational information and residential information, outdoor & indoor residential surroundings, environmental tobacco smoke (ETS), hobbies / activities, eating habits, allergies, medical / health status, self-perceived symptoms and history of respiratory health. The questionnaire consists of 93 questions in Malay and English.

3.4.2 Personal Air Sampling Pump

The instrument that was used to measure and determine the personal exposure to airborne particulate matter (PM_{10}) in ambient air while traffic policemen are working is the Personal Air Sampling Pump – Aircheck 52 from SKC Inc. This air pump has a flow rate range from 1 to 3 L/min and can be run up to 12 hours. It also provides a constant flow within ± 5% for accurate reading of air volumes (SKC Ins., 2016). During sampling, it sucks the air from the work environment through a filter holder that contains a filter paper.

The method used to measure PM_{10} personal exposure level is based on the NIOSH Manual of Analytical Methods (NMAM), Fourth Edition (Method 0600). The air sampling instruments included:

i. Personal air sampling pump with a flow rate of 1.7 L/min ± 5% for nylon cyclone, 2.2 L/min ± 5% for HD cyclone, or 2.5 L/min ± 5% for the Al cyclone, with flexible connecting tubing.

ii. Polyvinyl chloride (PVC) filter or equivalent hydrophobic membrane filters with 5.0 μm pore size supported by a cassette filter holder.

iii. Aluminium cyclone.

iv. Analytical balance with sensitivity of 0.001 mg.

v. Weights (NIST Class S-1.1, or ASTM Class 1).

vi. Static neutralizer.

vii. Forceps (preferably nylon).

viii. Environmental chamber or room for balance.

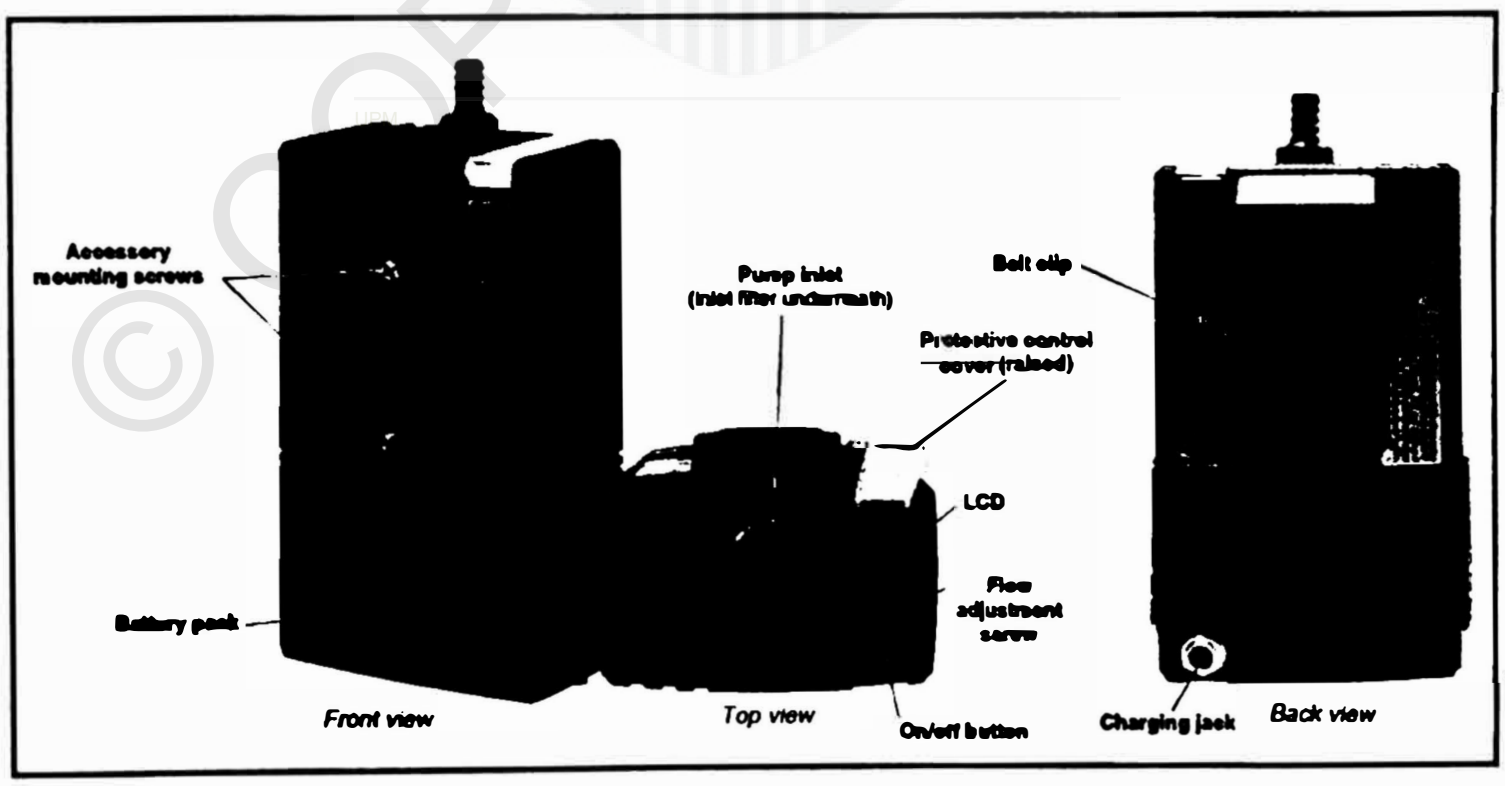

Figure 3.3 SKC Aircheck-52 Personal Air Sampling Pump

3.4.3 PpbRAE 3000

The ppbRAE 3000 was used to measure the ambient levels of Benzene, Toluene and Xylene. It has the Photoionization Detector's (PID) with an extended range of 1 ppb to 10,000 ppm. This device was zero-calibrated before each measurement was taken using zeroing tube.

3.4.4 Dusttrak DRX Aerosol Monitor 8534

The DustTrak DRX was used to measure the ambient level of PM_{10}. It can simultaneously measure both mass and size fraction of the measured particles. It uses light-scattering laser photometers that give real-time aerosol mass readings. This device was zero-calibrated before each measurement was taken using particle zero filter.

Figure 3.4 PpbRAE 300

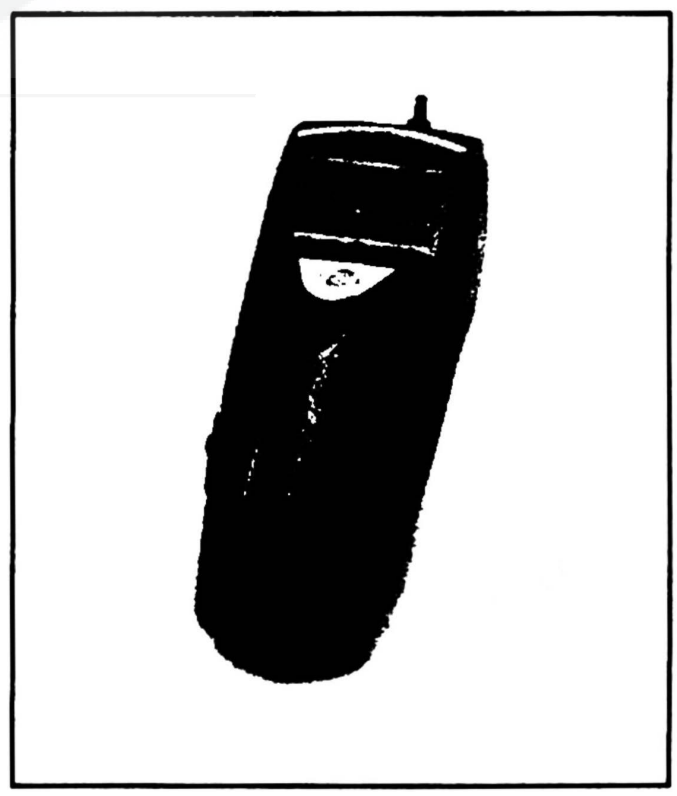

Figure 3.5 DustTrak DRX

© COPYRIGHT UPM

3.4.5 Spirometer

A Chestgraph HI-105 Spirometer was used during the lung function test to measure the maximum air capacity of the lung and the maximum volume of air breathed out in one second. Lung function test was carried out to determine the lung function abnormalities through different breathing measurements which are the FVC, FEV_1 (CLA, 2015) and FEV_1/FVC. This device was calibrated before the test is run. The method used to run the test will be based on the ATS Standardization of Spirometry, 2005. Additional accessories needed are as follows:

i. Nose clip (plastic or metal)

ii. Non-reusable mouth piece (plastic)

iii. Flow sensor head

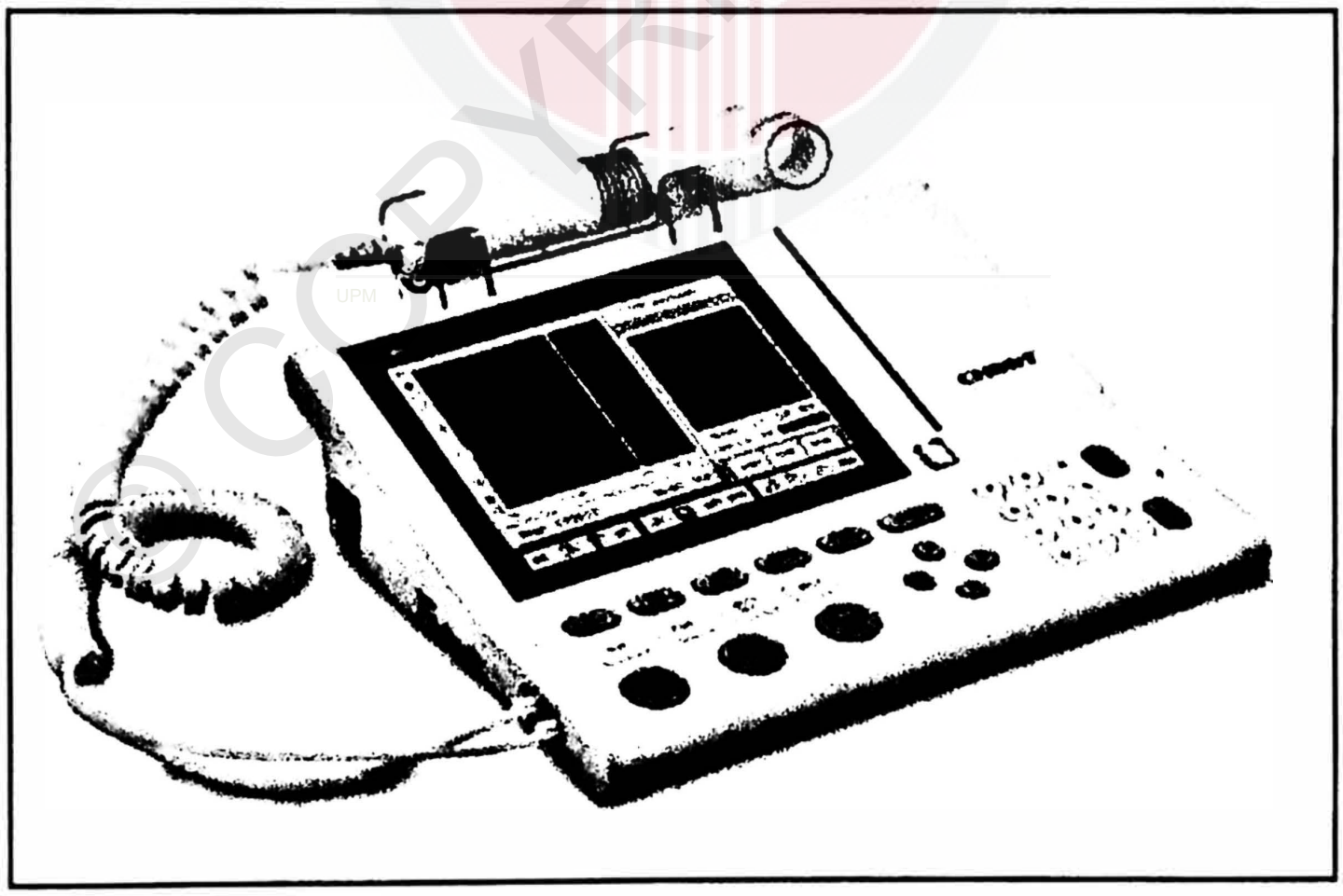

Figure 3.6 Chestgraph HI-108 Spirometer

3.4.5 TANITA Digital Scale

A TANITA Digital Scale was used to measure the weight of the respondents in kg.

3.4.6 Body Meter SECA 208

Body Meter SECA 208 was used to measure the height of the respondents in centimetres.

3.5 Quality Control

A few steps that will be taken to ensure the quality of the result are as follows:

i. A pilot study will be conducted on at least 10% of the sample size to determine the quality and reliability of the questionnaire.

ii. Each personal air sampling pump will be pre and post-calibrated using the Gilian Gilibrator-2 (20 cc/min to 6 L/min) before the measurement is taken.

iii. The spirometer will be calibrated using a calibration syringe (3L/1L) before carrying out the lung function test.

© COPYRIGHT UPM

3.6 Data Collection Techniques

3.6.1 Questionnaire

Self-administered questionnaire was distributed to the respondents. Respondents are required to answer all of the questions under the supervision and guidance from the researcher. The questionnaires were collected by researcher upon finish answering.

3.6.2 Personal Air Sampling

The cassettes used as the sample media were washed and rinsed separately with Nitric Acid (10%) and soaked for 24 hours. The cassettes and its filter papers were placed in the oven for 2 hours at 40℃. The filter papers were desiccated for another 2 hours. After that, the filter papers were weighted and its initial weight, W_1 (mg) recorded. Each of the filter papers was handled using a forceps to avoid contamination. The filter paper was then inserted into the cassette with a supporting pad. The cassettes were sealed by using shrink tape to avoid leakage. Each opening of the cassette was capped by a red and blue plug respectively. The air sampling pump was pre-calibrated to 1.7 L/min. The calibration process includes the calibration jar, cyclone, tygon tube and a calibrator (Gilian Gilibrator-2).

The purpose of the sampling was explained verbally to the selected traffic policemen. The total time of sampling was calculated using the following formula:

$VS = fc \times t$

Where,

VS = Volume

fc = Flow rate (L/min)

t = Time (min) / Total time of sampling

The final weight of the filter paper was also recorded. The air sampling pump was post-calibrated to identify the flow rate after sampling. The concentration and exposure of the pollutants will be analysed using gravimetric method and calculated using the following formula:

$$C = \frac{[(W_2 - W_1) - (B_2 - B_2)]}{VS} \times 10^3$$

Where,

C = Concentration (mg/m^3)

W_1 = Initial weight (mg)

W_2 = Final weight (mg)

B_1 = Initial blank (mg)

B_2 = Final blank (mg)

Meanwhile, the average exposure of the respondents (for 8 hours) was calculated using the formula below:

$$TWA = \frac{(W_1)(t_1) + (W_2)(t_2) + \ldots\ldots + (W_n)(t_n)}{t_1 + t_2 + \ldots\ldots + t_n}$$

© COPYRIGHT UPM

Where,

TWA = Time-weighted average

W_1 = The concentration measured during time interval t_1

n = The total number of intervals measured

3.6.3 Ambient Air Sampling

The ppbRAE 3000 was zero calibrated using the zeroing tube before the measurement of ambient concentration for Benzene, Toluene and Xylene were taken. The measurement took place for 15 minutes in the morning and another 15 minutes in the afternoon.

The DustTrak DRX was also zero calibrated using the particle zero filter before the measurement of ambient concentration of PM_{10} was taken. The measurement took place for 15 minutes in the morning and another 15 minutes in the afternoon and both measurements were compared to Standard Exposure Limit (STEL) by OSHA.

The two devices will be placed near to the roadside at 1.5 metre high and on the table in the office to ensure the exposure measured is at the breathing zone of the respondents.

© COPYRIGHT UPM

3.6.4 Lung Function Assessment

The spirometer was calibrated using the calibration syringe before the test is run. Before the respondents perform the test, their height and weight ~~were~~will be measured and recorded. The respondents' age, height and weight ~~was~~are needed during the test to indicate the normal value of FVC and FEV_1. The procedure of the test was explained and demonstrated to each respondent. The mouthpiece used is non-reusable. The respondents followed the correct techniques while performing the test. Three measurements were taken from each respondent and the best result was recorded and printed. This test was conducted under the supervision of a trained doctor.

3.7 Data Analysis

The data was analysed by using the 'Statistical Package for the Social Sciences Version 23.0' (SSPS 23.0). The variables in this study were analysed using descriptive and bivariate analysis only.

3.7.1 Descriptive Analysis

Descriptive analysis was done to obtain the mean of age, educational level, duration of exposure and smoking habit of the respondents.

3.7.2 Bivariate Analysis

Independent T-test was used to compare the personal exposure level to traffic air pollutants (Benzene, Toluene, Xylene, and PM_{10}) among traffic policemen and the comparative group. For non-parametric, Mann-Whitney U test had been used.

One-way Analysis of Variance (Anova) was used to compare the prevalence of respiratory symptoms (Cough, Phlegm, Wheezing and Breathlessness) among the traffic policemen and the comparative group.

Chi-square Test was carried out to compare lung function (FVC, FEV_1, FVC% predicted and FEV_1% predicted) among traffic policemen and the comparative group.

Pearson Correlation test was carried out to determine the relationship between personal exposure level to traffic air pollutants (Benzene, Toluene, Xylene and PM_{10}) and lung function; and the duration of exposure at work and lung function among traffic policemen. For non-parametric, Spearman Correlation had been carried out.

© COPYRIGHT UPM

3.8 Study Ethics

This study followed procedures before the research conduct as follows:

i. Ethical approval

The researcher had officially applied for the ethical approval from the Ethics Committee of Universiti Putra Malaysia.

ii. Permission letter

The researcher had officially applied for the permission from the Chief Traffic Inspector from Royal Malaysia Police of Bukit Aman to perform the study at several Police Stations in Klang Valley.

iii. Respondent's information sheet and consent form

The respondents that agree to participate in this research were required to fill up the respondent's information sheet and to sign the consent form.

iv. Respondents' confidentiality

All information collected from the respondents is confidential and was used for the purpose of this study only.

© COPYRIGHT UPM

CHAPTER 4

STUDY RESULT

4.1 Study Sample

The objective of this study is to assess the exposure level of PM_{10} and lung function of the traffic policemen in Klang Valley. Respondents participated in this study involved two groups which was the traffic policemen whose job was to control the traffic flow and police officer who doing administrative work from the Department of Traffic. The total respondents involved in this study were 42 for each group respectively. All of the preparation and data collection has been carried out from December 2016 until April 2017.

© COPYRIGHT UPM

4.2 Socio-demographic Characteristics

4.2.1 Age of the Respondents

The mean age of the respondents in exposed group was 35.31 years old with standard deviation of 9.84 and the mean age of the respondents in comparative group was 38.60 years old with standard deviation of 10.67. The youngest respondent was at age of 22 and the oldest was 58 years old. Statistical analysis results in Table 4.1 showed that there was no significant difference on the respondent's age between the two study groups.

Table 4.1 Age of the respondents

Variables	Exposed Group n = 42		Comparative Group n = 42		t	value
	Mean	Standard Deviation	Mean	Standard Deviation		
Age (Years) N = 84	35.31	9.84	38.60	10.67	-1.466	0.147

© COPYRIGHT UPM

4.2.2 Height and Weight of the Respondents

The mean height of the respondents in exposed group was 1.70 m with standard deviation of 0.05 and the mean weight was 75.14 kg with standard deviation of 11.62. Whereas, the mean height of the respondents in comparative group was 1.71 m with standard deviation of 0.06 and the mean weight was 79.63 kg with standard deviation of 14.95. Statistical analysis results in Table 4.2 showed that there was no significant difference of height and weight between the two study groups.

The body mass index was categorized into four, which is underweight (<18.5), normal (18.5 – 24.9), overweight (25 – 29.9) and obese (>30). Figure 4.1 summarized the distribution of BMI status in the two study groups. In exposed group, 4 respondents (9.5%) were in normal range, 36 respondents (85.7%) were overweight and 2 respondents (4.8%) were obese. Whereas, in comparative group, 5 respondents (11.9%) were in normal range, 34 respondents (81.0%) were overweight and 3 respondents (7.1%) were obese. The mean BMI of the respondents in exposed group was 27.60 with standard deviation of 1.60 and the mean BMI of the respondents in comparative group was 27.37 with standard deviation of 1.93.Statistical analysis results in Table 4.2 showed that there was no significant difference of height and weight between the two study groups.

© COPYRIGHT UPM

Table 4.2 Height and weight of the respondents

Variables	Exposed Group n = 42		Comparative Group n = 42		t	value
	Mean	Standard Deviation	Mean	Standard Deviation		
Height (m)	1.70	0.05	1.71	0.06	-0.870	0.387
Weight (kg)	75.14	11.62	79.63	14.95	-1.536	0.128
Body Mass Index	27.60	1.59	27.37	1.93	0.597	0.552

N = 84

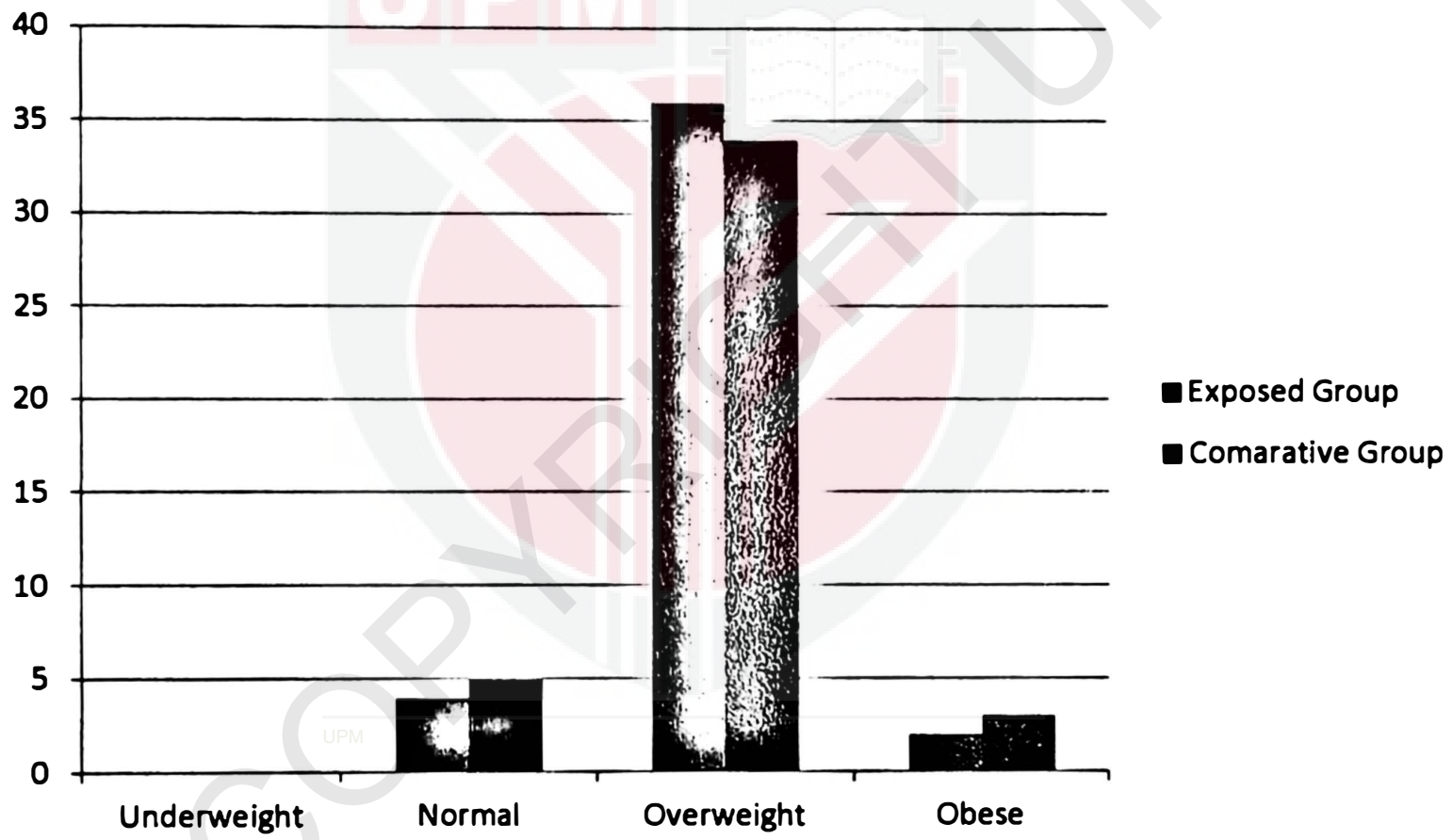

Figure 4.1 Distribution of the Body Mass Index (BMI) status of the respondents

© COPYRIGHT UPM

4.2.4 Educational Level of the Respondents

Educational level among the respondents was categorized into three which is SPM/STPM, Diploma and Bachelor's Degree. In exposed group, 37 respondents (88.1%) studied until SPM/STPM level and 5 respondents (11.9%) had Diploma. Whereas, in comparative group, 34 respondents (81.0%) studied until SPM/STPM level, 5 respondents (11.9%) had Diploma and 3 respondents (7.1%) had Bachelor's Degree. Statistical analysis results in Table 4.3 showed that there was no significant difference of educational level between the two study groups.

Table 4.3 Educational level of the respondents

Variables	Study Group Frequency (%) Exposed Group n = 42	Comparative Group n = 42	*p* value	
Educational Level				
SPM/STPM	37 (88.1)	34 (81.0)	3.127	0.209
Diploma	5 (19.9)	5 (11.9)		
Bachelor's Degree		3 (7.1)		
N = 84				

© COPYRIGHT UPM

4.2.5 Smoking Status of the Respondents

In exposed group, 25 respondents (59.5%) were smoker, 8 respondents (19.0%) had stopped smoking and 9 respondents (21.4%) had never smoked. Whereas, in comparative group, 23 respondents (54.8%) were smoker, 3 respondents (7.1%) had stopped smoking and 16 respondents (38.1%) had never smoked. Statistical analysis results in Table 4.4 showed that there was no significant difference of smoking status between the two study groups.

Table 4.4 Smoking status of the respondents

Variables	Study Group Frequency (%)		x^2	*p* value
	Exposed Group n = 42	Comparative Group n = 42		
Smoking Status				
Yes	25 (59.5)	23 (54.8)	4.316	0.116
Had stopped	8 (19.0)	3 (7.1)		
Never	9 (21.4)	16 (38.1)		

N = 84

© COPYRIGHT UPM

4.3 Occupational Background

4.3.2 Years of Employment of the Respondents

The mean of years of employment of the respondents in exposed group was 7.41 years with standard deviation of 5.11 and the mean of years of employment of the respondents in comparative group was 5.29 years with standard deviation of 4.47.The minimum year of employment was1 year and the maximum year of employment was 23 years. Statistical analysis results in Table 4.5 showed that there was a significant difference in years of employment between the two study groups with $p<0.05$.

Table 4.5 Years of employment of the respondents

Variables	Exposed Group n = 42		Comparative Group n = 42		t	*p* value
	Mean	Standard Deviation	Mean	Standard Deviation		
Years of Employment (Year)	7.41	5.11	5.29	4.47	2.022	0.046*

N = 84

4.3.2 Working Duration of the Respondents

The mean of working duration per day of the respondents in exposed group was 7.99 hours with standard deviation of 0.039 and the mean of working duration per day of the respondents in comparative group was 8.00 hours with standard deviation of 0.034. The minimum working hours recorded was 7.90 hours whereas the maximum working hours was 8.07 hours. Statistical analysis results in Table 4.6 showed that there was no significant difference of working duration between the two study groups.

Table 4.6 Working duration of the respondents

Variables	Exposed Group n = 42		Comparative Group n = 42		t	*p* value
	Mean	Standard Deviation	Mean	Standard Deviation		
Working Duration (Hour)	7.99	0.039	8.00	0.034	-1.618	0.110

N = 84

© COPYRIGHT UPM

4.4 Comparison of Personal Exposure Level to PM_{10} among the Respondents

Table 4.8 showed that the mean of concentration for both exposed and comparative group were 0.0015 ± 0.0013 mg/m^3 and 0.0008 ± 0.0009 mg/m^3 respectively. Statistical analysis results in Table 4.7 showed that there was a significant difference of concentration between the two study groups with $p < 0.05$.

Table 4.7 Comparison of personal exposure level to PM_{10} among the Respondents

Variables	Exposed Group n = 42		Comparative Group n = 42		T	*p* value
	Mean	Standard Deviation	Mean	Standard Deviation		
Concentrations (mg/m^3)	150.14	130.66	84.14	94.11	2.656	0.009*
N = 84						

*Significant at $p<0.05$

© COPYRIGHT UPM

4.5 Comparison of Exposure to the Ambient and Indoor Concentration of Air Pollutants (Benzene, Toluene, Xylene and PM_{10}) of the Respondents.

The median of ambient concentration in the morning of Benzene, Toluene, Xylene and PM_{10} among the exposed group were 0.1375 ppm, 0.0900 ppm, 0.0400 ppm and 0.8250 mg/m^3 respectively. The median of ambient concentration in the afternoon of Benzene, Toluene, Xylene and PM_{10} among the exposed group were 0.2970 ppm, 2.2780 ppm, 0.4100 ppm, 0.4100 ppm and 0.1120 mg/m3 in the afternoon respectively. Statistical analysis results in Table 4.8 showed that there was a significant difference of Xylene and PM_{10} ambient concentration between morning and afternoon among the exposed group with $p<0.05$.

Whereas, the median of indoor concentration in the morning of Benzene, Toluene, Xylene and PM_{10} among the comparative group were 0.1106 ppm, 0 ppm, 0 ppm and 0.8250 mg/m^3 respectively. The median of indoor concentration in the afternoon of Benzene and PM_{10} among the comparative group were 0.1175 ppm and 0.0930 mg/m^3 in the afternoon respectively while the median of indoor concentration of Toluene and Xylene remained to be 0 ppm. Statistical analysis results in Table 4.9 showed that there was a significant difference of PM_{10} indoor concentration between morning and afternoon among the comparative group with $p<0.05$.

© COPYRIGHT UPM

Table 4.8 Comparison of Exposure to the Ambient Concentration of Traffic Air Pollutants (Benzene, Toluene, Xylene and PM_{10}) among the Exposed Group.

Variables	Morning n = 8		Afternoon n = 8		z	*p* value
	Median	IQR	Median	IQR		
Benzene (ppm)	0.1375	0.2060	0.2970	0.2900	-1.157	0.247
Toluene (ppm)	0.0900	0.0930	2.2780	2.2840	-1.350	0.177
Xylene (ppm)	0.0400	0.0481	0.4100	0.4687	-1.695	0.090*
PM_{10} (mg/m^3)	82.50	43.58	11.20	3.85	-3.155	0.002*

N = 18

*Significant at $p<0.05$

Table 4.9 Comparison of Exposure to the Indoor Concentration of Air Pollutants (Benzene, Toluene, Xylene and PM_{10}) among the Comparative Group.

Variables	Morning n = 8		Afternoon n = 8		z	*p* value
	Median	IQR	Median	IQR		
Benzene (ppm)	0.1106	0.1683	0.1175	0.4286	-0.789	0.430
Toluene (ppm)	0	3.6325	0	0.7485	-0.276	0.783
Xylene (ppm)	0	3.9607	0	2.2363	-0.128	0.898
PM_{10} (mg/m^3)	21.00	18.45	9.30	12.27	-2.521	0.012*

N = 18

*Significant at $p<0.05$

© COPYRIGHT UPM

4.5.1 Comparison of Ambient Concentration of Traffic Air Pollutants (Benzene, Toluene, Xylene and PM_{10}) Concentration among the Exposed Group

Figure 4.2, 4.3. 4.4 and 4.5 shows the ambient level of Benzene, Toluene, Xylene and PM_{10} among the exposed group respectively. Highest level of Benzene was recorded in Klang Utara (in the morning: 1.831 ppm; in the afternoon; 2.209 ppm) and highest level of Toluene and PM_{10} was recorded in Petaling Jaya which are (in the morning: 0.102 ppm; in the afternoon: 2.403 ppm) and (in the morning: 0.128 mg/m^3; in the afternoon: 0.194 ppm). Whereas the highest level of Xylene was recorded in Klang Utara (in the morning: 0.208 ppm) and Shah Alam (in the afternoon: 0.484 ppm).

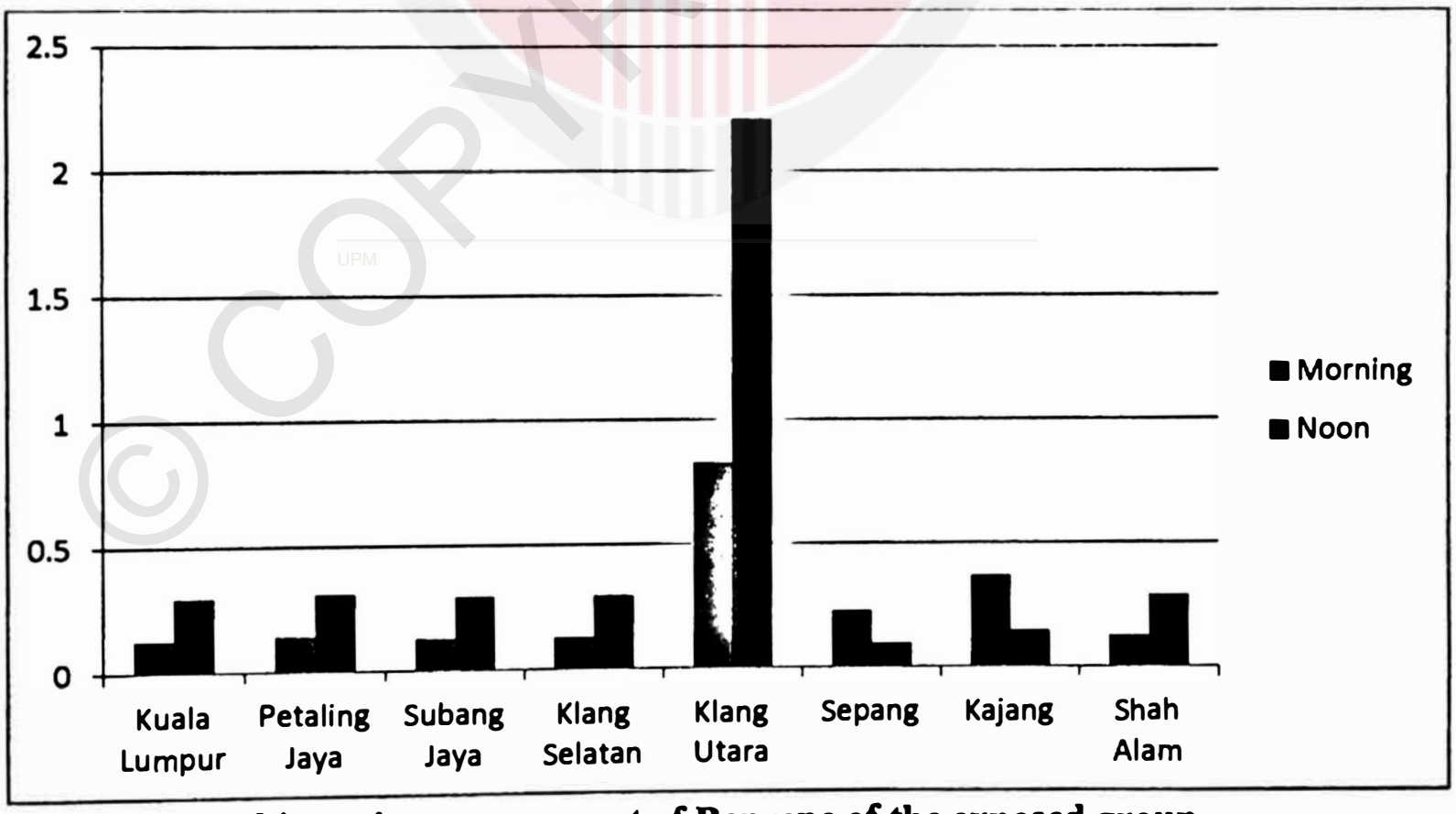

Figure 4.2 Ambient air measurement of Benzene of the exposed group

© COPYRIGHT UPM

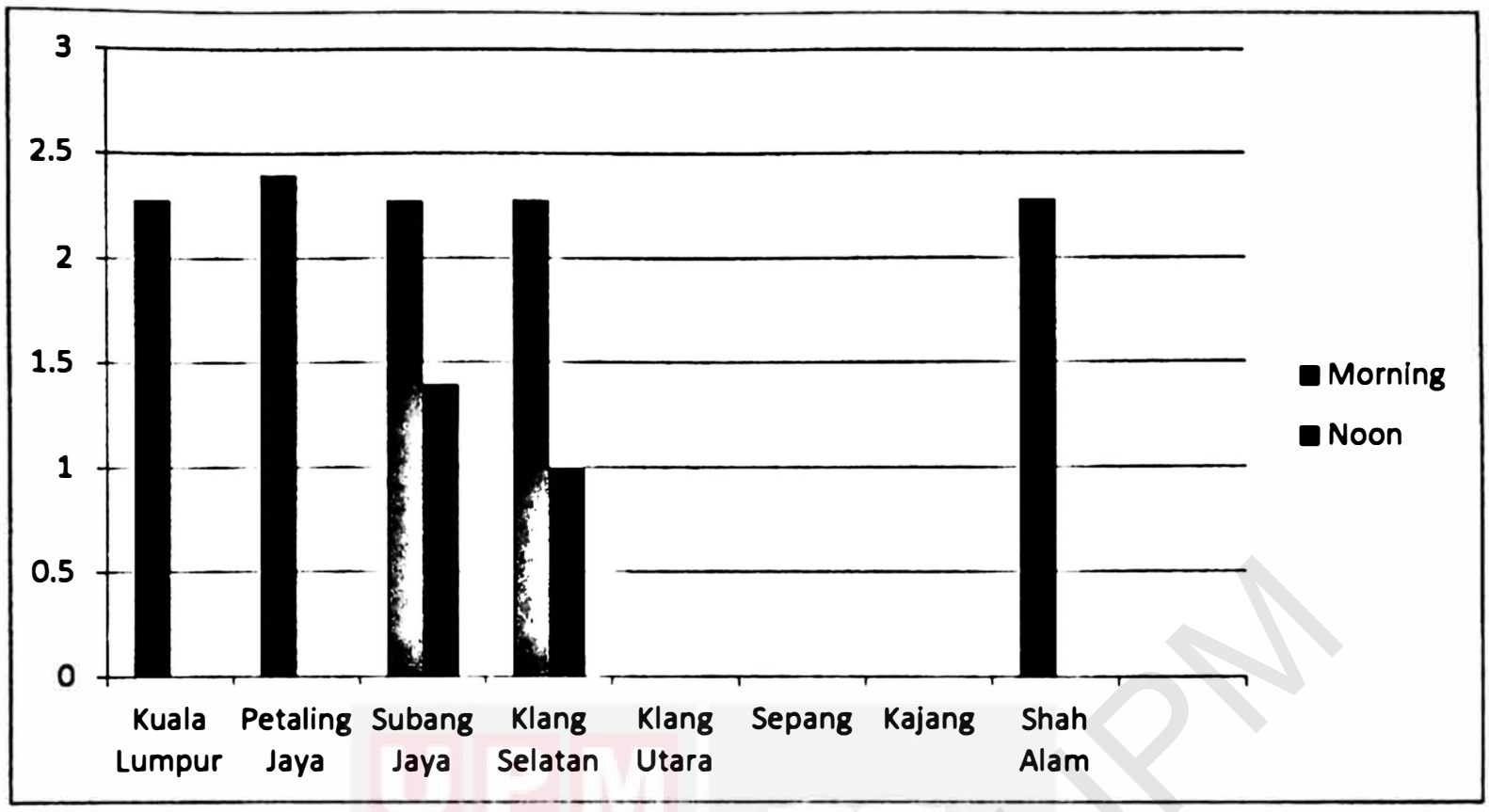

Figure 4.3 Ambient air measurement of Toluene among the exposed group

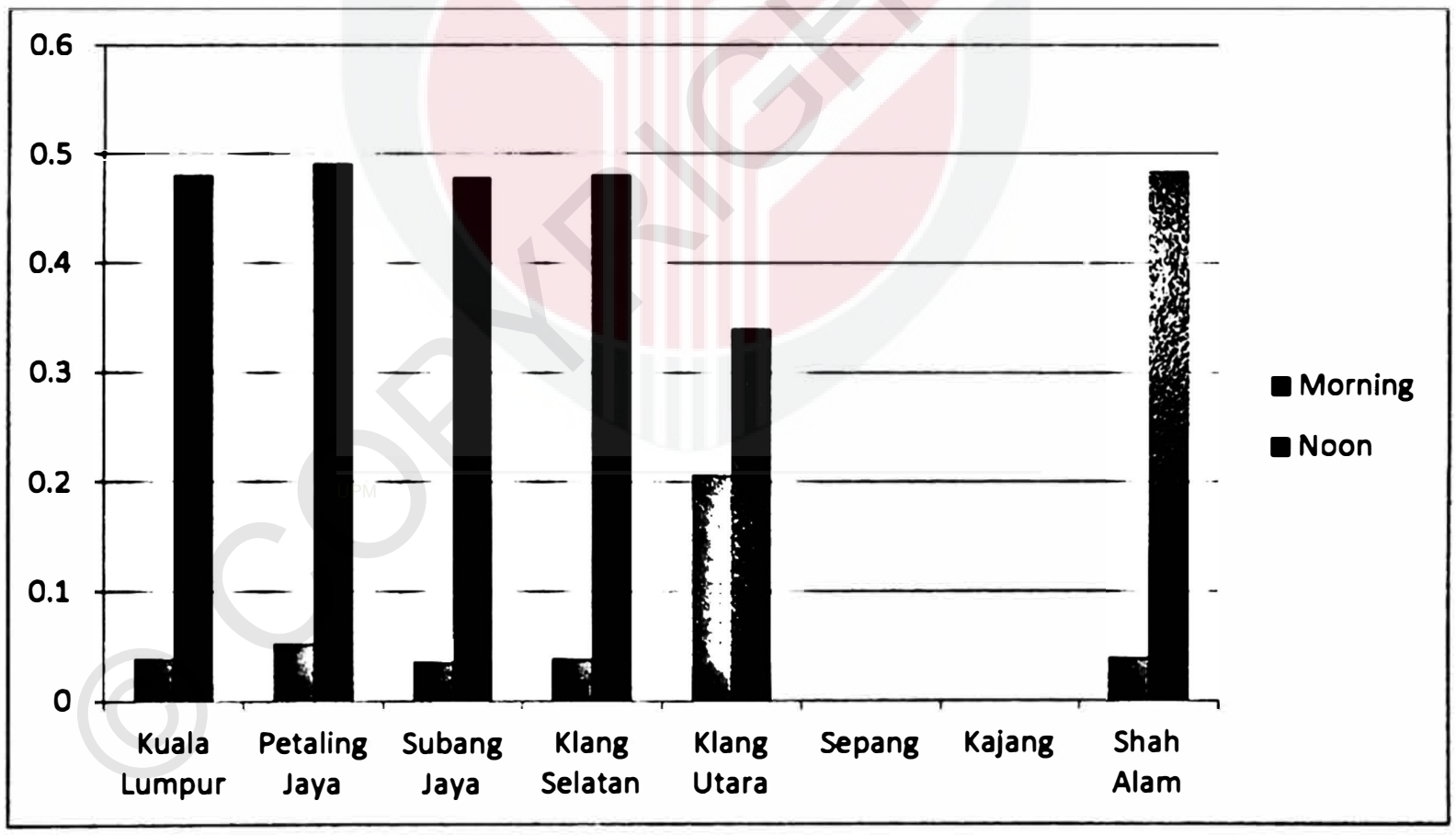

Figure 4.4 Ambient air measurement of Xylene among the exposed group

© COPYRIGHT UPM

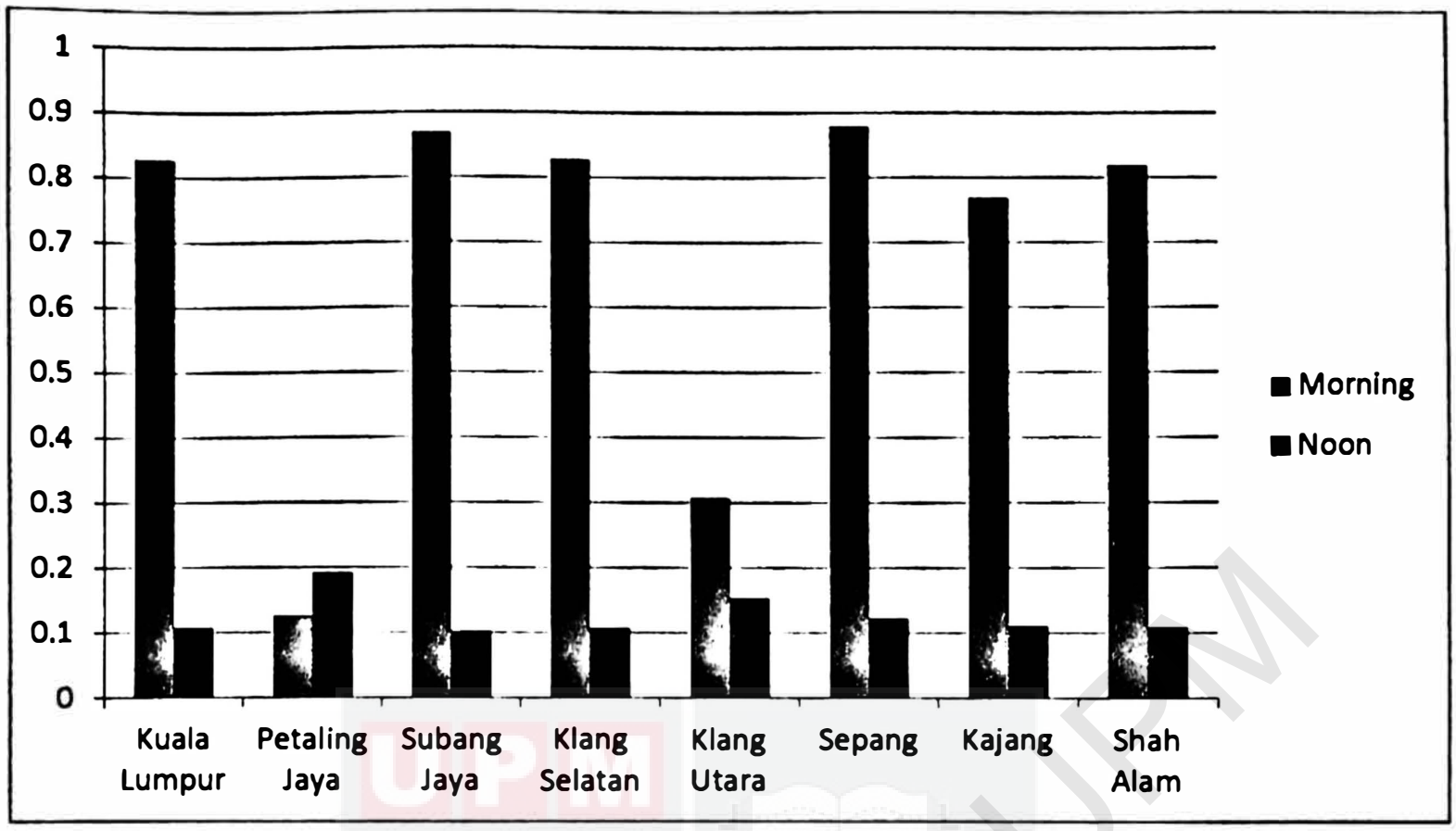

Figure 4.5 Ambient measurement of PM_{10} among the exposed group

© COPYRIGHT UPM

4.5.2 Comparison of Indoor Concentration of Air Pollutants (Benzene, Toluene, Xylene and PM_{10}) among the Comparative Group

Figure 4.6, 4.7. 4.8 and 4.9 shows the ambient level of Benzene, Toluene, Xylene and PM_{10} among the comparative group respectively. Highest level of Benzene was recorded in Subang Jaya (in the morning: 22.4 ppm) and Klang Utara (in the afternoon: 19 ppm) and highest level of Toluene was recorded in Subang Jaya (at afternoon: 51.2 ppm and 1.398 ppm respectively). Whereas, the highest level of Xylene and PM_{10} were recorded in Subang Jaya (in the morning: 5.595 ppm; at afternoon: 3.076 ppm and in the morning: 0.316 mg/m^3; at afternoon: 0.277 mg/m^3 respectively).

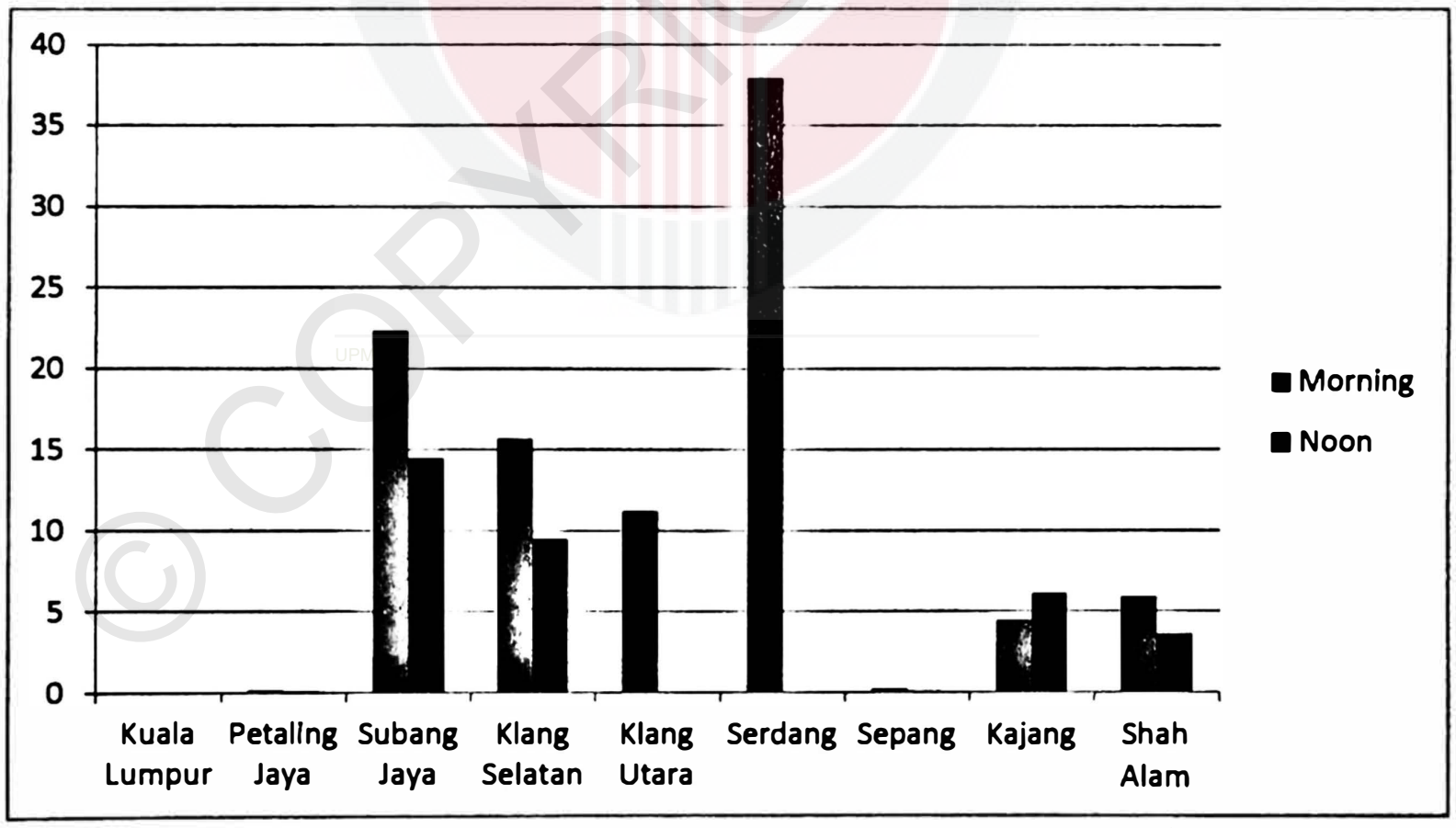

Figure 4.6 Indoor air measurement of Benzene among the comparative group

© COPYRIGHT UPM

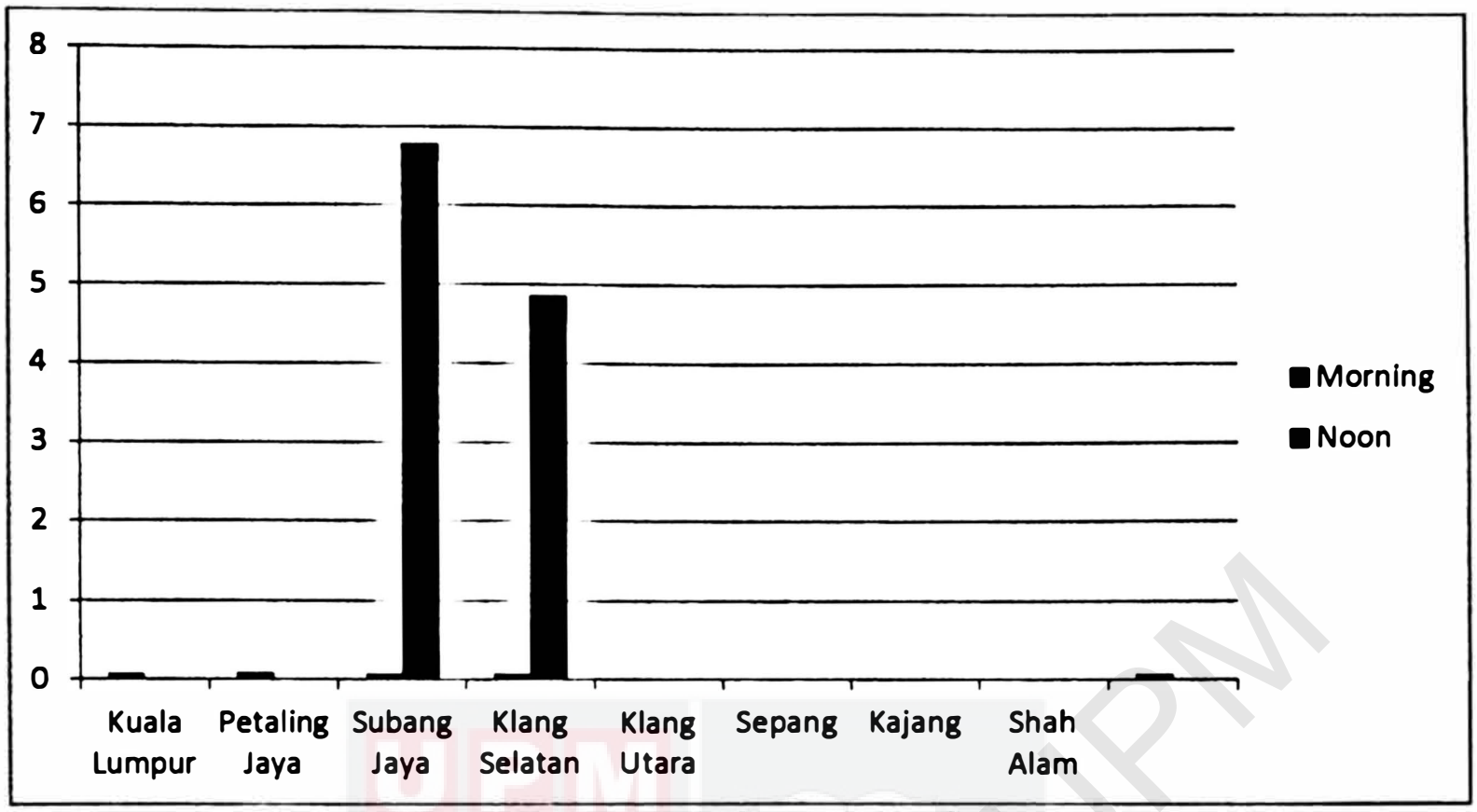

Figure 4.7 Ambient measurement of Toluene among the comparative group (Source: Floor Coverings, Newly Painted Wall Paint and Environmental Tobacco Smoke)

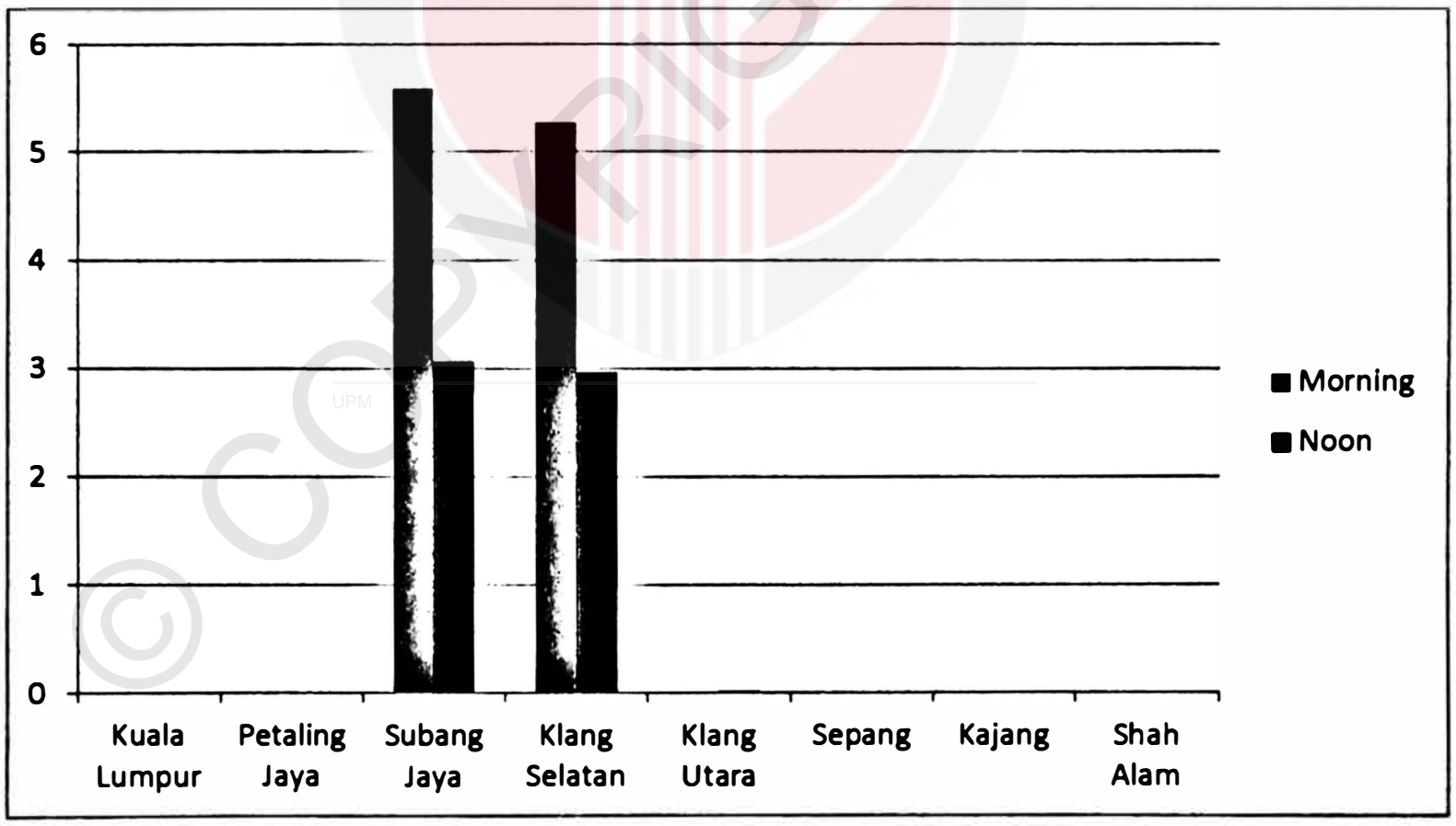

Figure 4.8 Ambient measurement of Xylene among the comparative group

© COPYRIGHT UPM

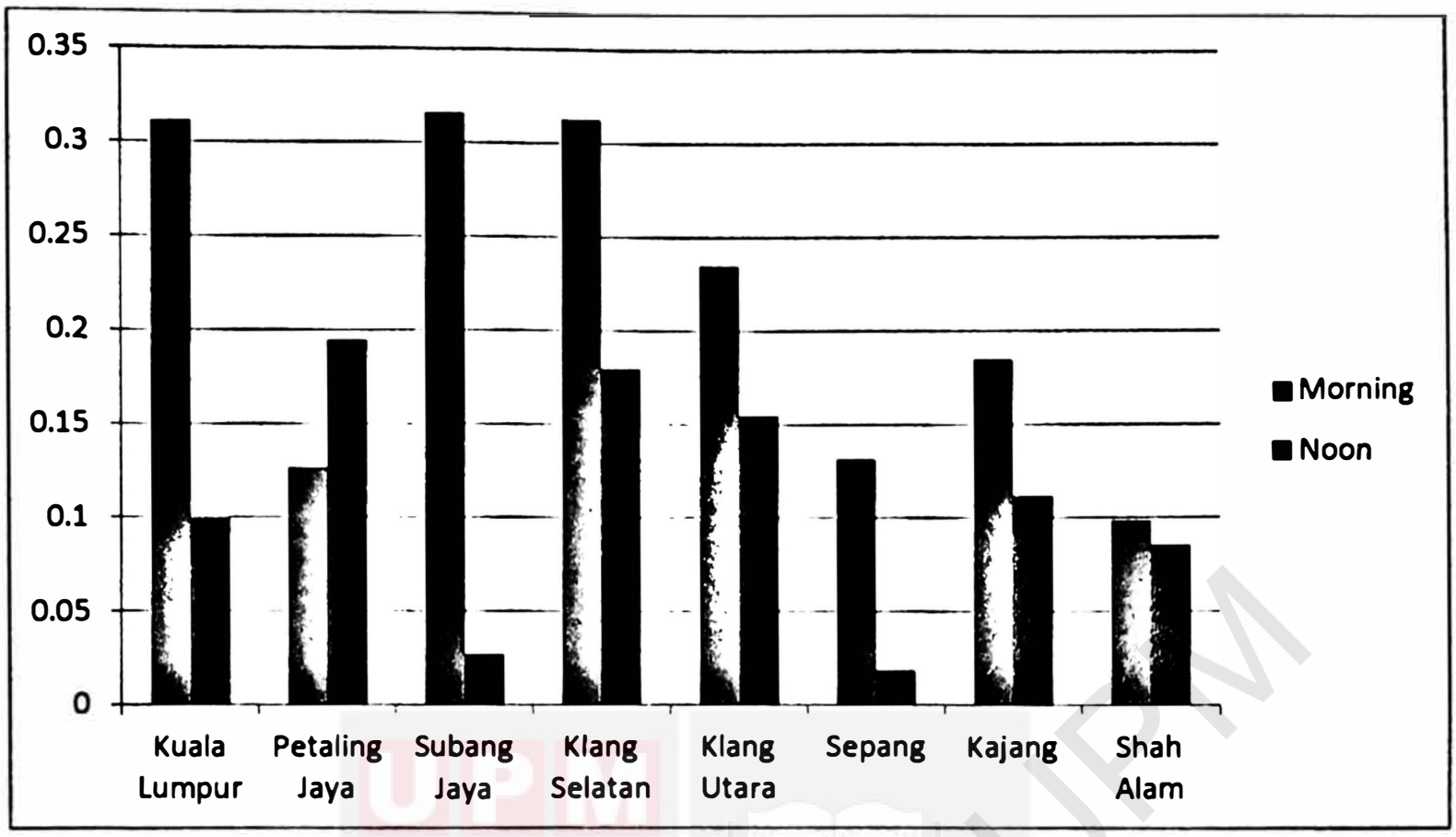

Figure 4.9 Ambient measurement of PM_{10} among the comparative group

© COPYRIGHT UPM

4.6 Comparison of respiratory symptoms among the respondents

Higher number of respondents in exposed group experienced the symptoms compared to the comparative group with significant difference in cough (x^2=7.269; p=0.007), wheezing (x^2=7.714; p=0.005) and breathlessness (x^2=4.525; p=0.033). Based on the statistical analysis result in Table 4.10, there was a significant relationship in cough (OR: 3.52; 95% CI: 1.38-8.95), wheezing (OR: 3.86; 95% CI:1.45-10.29) and breathlessness (OR: 3.32; 95% CI:1.06-10.37) between the two study groups.

Table 4.10 Comparison of lung function abnormalities among the respondents

Variables	Status	Study Group Frequency (%)		x^2	*p* value	OR (95% CI)
		Exposed Group n = 42	Comparative Group n = 42			
Cough	**Yes**	32 (76)	20 (67)	7.269	0.007*	3.52
	No	10 (24)	22 (33)			(1.38-8.95)
Phlegm	**Yes**	18 (54)	13 (42)	1.278	0.258	1.67
	No	24 (46)	29 (58)			(0.68-4.10)
Wheezing	**Yes**	20 (54)	8 (25)	7.714	0.005*	3.86
	No	22 (46)	34 (75)			(1.45-10.29)
Breathlessness	**Yes**	13 (8)	29 (17)	4.525	0.033*	3.32
	No	29 (92)	13 (83)			(1.06-10.37)

4.7 Parameters, Status and Abnormalities of Lung Function among the Respondents

4.7.1 Comparison of Lung Function Level among the Respondents

The mean of FVC (litre) was (3.03 ± 0.37 $\mu g/m^3$) and the mean of FEV_1 (litre) was (2.77 ± 0.32 $\mu g/m^3$) among the exposed group. Whereas, the mean of FVC (litre) was (3.10 ± 0.59 $\mu g/m^3$) and the mean of FEV_1 (litre) was (2.80 ± 0.53 $\mu g/m^3$) among the comparative group. Statistical analysis results in Table 4.11 showed that there was a significant difference in FEV_1/FVC% predicted between the two study groups with $p<0.05$.

Table 4.11 Comparison of lung function level among the respondents

Variables	Exposed Group n = 42		Comparative Group n = 42		t	*p* value
	Mean	Standard Deviation	Mean	Standard Deviation		
FVC (Litre)	3.03	0.37	3.10	0.59	-0.622	0.535
FEV1 (Litre)	2.77	0.32	2.80	0.53	-0.283	0.778
FVC% Predicted	81.33	10.28	84.76	11.23	-1.457	0.149
FEV1% Predicted	86.75	9.38	86.82	11.67	-0.028	0.325
FEV1/FVC% Predicted	103.35	4.22	106.72	5.95	-2.990	0.004*

N = 84
*Significant at $p<0.05$

© COPYRIGHT UPM

4.7.2 Comparison of Lung Function Abnormalities among the Respondents

The lung function abnormalities was categorized based on the American Thoracic Society; normal (≥80), mild (70-79), moderate (60-69) and severe (<60). Statistical analysis results in Table 4.12 showed that there was no significant difference in lung function parameters between the two study groups.

Table 4.12 Comparison of lung function abnormalities among the respondents

Variables	Status	Study Group Frequency (%)		x^2	*p* value
		Exposed Group n = 42	Comparative Group n = 42		
FVC% Predicted	Normal	17 (40.5)	27 (64.3)	5.833	0.120
	Mild	21 (50)	10 (23.8)		
	Moderate	3 (7.1)	5 (11.9)		
	Severe	1 (2.4)	-		
FEV1% Predicted	Normal	27 (64.3)	33 (78.6)	3.267	0.195
	Mild	14 (33.3)	7 (16.7)		
	Moderate	1 (2.4)	2 (4.8)		
	Severe	-	-		
FEV_1/FVC Predicted	Normal	42 (100.0)	42 (100.0)	-	-
	Mild	-	-		
	Moderate	-	-		
	Severe	-	-		

N = 84

© COPYRIGHT UPM

4.7.3 Comparison of Lung Function Status among the Respondents

Based on the American Thoracic Society (ATS),the normal value for FVC% predicted and FEV_1% predicted were ≥ 80% whilst FEV_1/FVC% predicted was >70%. Table 4.6 showed that 25 (59.4%) abnormal status for FVC% predicted and 15 (35.7%) abnormal status for FEV1 among exposed group while in comparative group, 14 (33.3%) abnormal status for FVC% predicted and 9 (21.4%) abnormal status for FEV_1% predicted were recorded. Statistical analysis results in Table 4.13 showed that there was a significant difference in FVC% predicted between the two study groups with $p<0.05$.

Table 4.13 Comparison of lung function status among the respondents

Variables	Status	Study Group Frequency (%) Exposed Group n = 42	Comparative Group n = 42		*p* value
FVC% predicted	**Abnormal**	25 (59.4)	14 (33.3)	5.791	0.016*
	Normal	17 (40.5)	28 (66.7)		
FEV_1% predicted	**Abnormal**	15 (35.7)	9 (21.4)	2.100	0.147
	Normal	27 (64.3)	33 (78.6)		
FEV_1/FVC% predicted	**Abnormal**				
	Normal	42 (100.0)	42 (100.0)		

N = 84

*Significant at $p<0.05$

© COPYRIGHT UPM

4.8 Association between Lung Function Status and the Factors Influencing Lung Function

Table 4.14 showed that there were no significant association between the FVC% predicted and years of employment (OR: 1.98; 95% CI: 0.39-2.49); and the PM_{10} personal exposure concentration (OR: 0.98; 95% CI: 0.39-2.49).

Table 4.15 showed that there was a significant association between FVC% predicted and Toluene ambient concentration (OR: 2.71: 95% CI: 1.05-6.96) and no significant association between FVC% predicted and Benzene ambient concentration (OR: 0.39; 95% CI: 0.15-1.03); Xylene ambient concentration (OR: 0.46; 95% CI: 0.14-1.45) and; PM_{10} ambient concentration (OR: 0.51; 95% CI: 0.21-1.25) in the morning.

Table 4.16 shows that there were no significant association between FVC% predicted between Benzene ambient concentration (OR: 0.54; 95% CI: 0.22-1.34); Toluene ambient concentration (OR: 1.46; 95% CI: 0.60-3.39); Xylene ambient concentration (OR: 0.46; 95% CI: 0.14-1.45) and; PM_{10} ambient concentration (OR: 0.57; 95% CI: 0.24-1.34) in the afternoon.

Table 4.17 shows that there were no significant association between FEV_1% predicted and years of employment (OR: 0.67; 95% CI: 0.23-1.94) and; PM_{10} personal exposure concentration (OR: 1.52; 95% CI: 0.56-4.12).

© COPYRIGHT UPM

Table 4.18 shows that there was a significant association between FEV_1% predicted and Toluene ambient concentration (OR: 3.00; 95% CI: 1.11-8.08) and no significant association between FEV_1% predicted and Benzene ambient concentration (OR: 0.26; 95% CI: 0.08-0.86); Xylene ambient concentration (OR: 0.30; 95% CI: 0.06-1.43) and PM_{10} ambient concentration (OR: 1.50; 95% CI: 0.58-3.90) in the morning.

Table 4.19 shows that there were no significant association between FVC% predicted between Benzene ambient concentration (OR: 0.18; 95% CI: 0.04-0.85); Toluene ambient concentration (OR: 2.25; 95% CI: 0.86-5.91); Xylene ambient concentration (OR: 1.15; 95% CI: 0.44-3.01) and; PM_{10} ambient concentration (OR: 0.53; 95% CI: 0.20-1.38) in the afternoon.

© COPYRIGHT UPM

Table 4.14 Association between factors (personal exposure and years of employment) influencing FVC% predicted and FVC% predicted among respondents

Variables	Category	FVC% Predicted				O.R. (95% CI)
		Exposed Group n = 42		Comparative Group n = 42		
		Abnormal n = 25	Normal n = 17	Abnormal n = 14	Normal n = 28	
PM_{10} Personal Exposure Concentration (mg/m3)	High	8 (47)	5 (29)	4 (29)	9 (32)	0.98 (0.39-2.49)
	Low	17 (53)	12 (71)	10 (71)	18 (64)	
Years of Employment	>10	5 (20)	6 (35)	7 (50)	8 (29)	1.98 (0.39-2.49)
	<10	20 (80)	11 (65)	7 (50)	20 (71)	

N = 84

© COPYRIGHT UPM

Table 4.15 Association between factors (ambient concentration in the morning) influencing FVC% predicted and FVC% predicted among respondents

Variables	Category	FVC% Predicted				O.R. (95% CI)
		Exposed Group n = 42		Comparative Group n = 42		
		Abnormal n = 25	Normal n = 17	Abnormal n = 14	Normal n = 28	
Benzene Ambient Concentration (ppm)	High	7 (28)	5 (29)	4 (29)	14 (50)	0.54 (0.22-1.34)
	Low	18 (72)	12 (71)	10 (71)	14 (50)	
Toluene Ambient Concentration (ppm)	High	17 (68)	10 (59)	0 (0)	0 (0)	2.71 (1.05-6.96)
	Low	8 (32)	7 (41)	14 (100)	28 (100)	
Xylene Ambient Concentration (ppm)	High	2 (8)	3 (18)	3 (21)	8 (29)	0.46 (0.14-1.45)
	Low	23 (92)	14 (82)	11 (79)	20 (71)	
PM_{10} Ambient Concentration (mg/m^3)	High	13 (52)	9 (53)	4 (29)	17 (61)	0.57 (0.24-1.34)
	Low	12 (48)	8 (47)	10 (71)	11 (39)	

N = 84

© COPYRIGHT UPM

Table 4.16 Association between factors (ambient concentration in the afternoon) Influencing FVC% predicted and FVC% predicted among respondents

Variables	Category	FVC% Predicted				O.R. (95% CI)
		Exposed Group n = 42		Comparative Group n = 42		
		Abnormal n = 25	Normal n = 17	Abnormal n = 14	Normal n = 28	
Benzene Ambient Concentration (ppm)	High	4 (16)	4 (24)	3 (21)	11 (65)	0.44 (0.16-1.22)
	Low	21 (84)	13 (76)	11 (79)	17 (35)	
Toluene Ambient Concentration (ppm)	High	17 (68)	10 (59)	2 (14)	8 (29)	1.43 (0.60-3.39)
	Low	8 (32)	7 (41)	12 (86)	20 (71)	
Xylene Ambient Concentration (ppm)	High	13 (52)	10 (59)	2 (14)	8 (29)	0.94 (0.39-2.26)
	Low	12 (48)	7 (41)	12 (86)	20 (71)	
PM_{10} Ambient Concentration (mg/m^3)	High	15 (60)	10 (59)	4 (29)	12 (43)	0.99 (0.42-2.34)
	Low	10 (40)	7 (41)	10 (71)	16 (57)	

N = 84

© COPYRIGHT UPM

Table 4.17 Association between factors (personal exposure and years of employment) influencing FEV_1% predicted and FEV_1% predicted among respondents

Variables	Category	FEV_1% Predicted				O.R. (95% CI)
		Exposed Group n = 42		Comparative Group n = 42		
		Abnormal n =15	Normal n = 27	Abnormal n = 9	Normal n = 33	
PM_{10} Personal Concentration (mg/m3)	High	4 (27)	9 (33)	2 (22)	11 (33)	0.67
	Low	11 (73)	18 (67)	7 (78)	22 (69)	(0.23-1.94)
Years of Employment	<10	11 (73)	20 (74)	4 (44)	23 (70)	1.52
	>10	4 (27)	7 (26)	5 (56)	10 (30)	(0.56-4.12)

N = 84

© COPYRIGHT UPM

Table 4.18 Association between factors (ambient concentration in the morning) influencing FEV_1% predicted FEV_1% predicted among respondents

Variables	Category	FEV_1% Predicted				O.R. (95% CI)
		Exposed Group n = 42		Comparative Group n = 42		
		Abnormal n = 15	Normal n = 27	Abnormal n = 9	Normal n = 33	
Benzene Ambient Concentration (ppm)	High	2 (13)	10 (37)	2 (22)	16 (48)	0.26 (0.08-0.86)
	Low	13 (87)	17 (63)	7 (78)	17 (52)	
Toluene Ambient Concentration (ppm)	High	3 (20)	15 (56)	0 (0)	0 (0)	3.00 (1.11-8.08)
	Low	12 (80)	12 (44)	9 (100)	33 (100)	
Xylene Ambient Concentration (ppm)	High	0 (0)	5 (19)	2 (22)	9 (27)	0.30 (0.06-1.43)
	Low	15 (100)	22 (81)	7 (78)	24 (73)	
PM_{10} Ambient Concentration (mg/m^3)	High	4 (27)	11 (41)	3 (33)	18 (55)	1.50 (0.58-3.90)
	Low	11 (73)	16 (59)	6 (67)	15 (45)	

N = 84

© COPYRIGHT UPM

Table 4.19 Association between factors (ambient concentration in the afternoon) influencing FEV_1% predicted and FEV_1% predicted among respondents

Variables	Category	FEV_1% Predicted				O.R. (95% CI)
		Exposed Group n = 42		Comparative Group n = 42		
		Abnormal n = 15	Normal n = 27	Abnormal n = 9	Normal n = 33	
Benzene Ambient Concentration (ppm)	High	0 (0)	8 (30)	7 (78)	12 (36)	0.18 (0.04-0.85)
	Low	15 (100)	19 (70)	2 (22)	21 (54)	
Toluene Ambient Concentration (ppm)	High	3 (20)	15 (56)	2 (22)	8 (24)	2.25 (0.86-5.91)
	Low	12 (80)	12 (44)	7 (78)	25 (76)	
Xylene Ambient Concentration (ppm)	High	8 (53)	15 (56)	2 (22)	8 (24)	1.15 (0.44-3.01)
	Low	7 (47)	12 (44)	7 (78)	25 (76)	
PM_{10} Ambient Concentration (mg/m^3)	High	7 (47)	18 (67)	2 (22)	14 (42)	0.53 (0.20-1.39
	Low	8 (53)	9 (33)	7 (78)	19 (58)	

N = 84

© COPYRIGHT UPM

4.9 Relationship between the Exposure to PM_{10} Concentration and Respiratory Symptoms among the Respondents.

The respiratory symptoms include in this study were cough, phlegm, wheezing and breathlessness. Statistical analysis results in Table 4.14 showed that there was a significant difference in cough, wheezing and breathlessness between the two study groups with $p<0.05$.

The Odd Ratio (OR) results showed a significant association between cough (OR: 3.521; 95% CI: 1.38-8.95), wheezing (OR: 3.864, 95% CI: 1.45—10.29) and breathlessness (OR: 3.317, 95% CI: 1.06-10.37) among the exposed and comparative group. No significant association between phlegm (OR: 1.673, 95% CI: 0.68-4.10) among the exposed and comparative group.

The result of logistic regression showed a significant association between cough (OR: 3.863, 95% CI: 1.443-10.337), wheezing (OR: 4.083, 91% CI: 1.501-11.102) and breathlessness (OR: 3.481, 95% CI: 1.101-11.008) after adjusted for age and smoking.

© COPYRIGHT UPM

Table 4.20 Association between the exposure to PM_{10} concentration and respiratory symptoms among the respondents

Variables	Exposure to PM_{10} concentration							
	Exposed Group n = 42		Comparative Group n = 42			value	O.R. (95% CI)	*O.R.
	High n = 13	Low n = 29	High n = 12	Low n = 30				
Cough								
Yes	22 (76)	10 (77)	8 (67)	12 (40)	7.269	0.007	3.52	3.86
No	7 (24)	3 (23)	4 (33)	18 (60)			(1.38-8.95)	(1.44-10.34)
Phlegm								
Yes	7 (54)	11 (38)	5 (42)	8 (27)	1.278	0.258	1.67	
No	6 (46)	18 (62)	7 (58)	22 (73)			(0.68-4.10)	
	7 (54)	13 (45)	3 (25)	5 (17)	7.714	0.005	3.86	4.08
	6 (46)	16 (55)	9 (75)	25 (83)			(1.45-10.29)	(1.50-11.10)
	1 (8)	12 (41)	2 (17)	27 (90)	4.525	0.033	3.32	3.48
	12 (92)	17 (59)	10 (83)	30 (100)			(1.06-10.37	(1.10-11.01

*Adjusted for age and smoking

© COPYRIGHT UPM

4.10 Relationship between Personal Exposure Level to PM_{10} and Lung Function Parameters among the Respondents

Spearman's Rho and Pearson Correlation Test were used to determine the relationship between personal exposure level to PM_{10} and lung function parameters (FVC% predicted, FEV_1% predicted and FEV_1/FVC% predicted) among the exposed and comparative group. Statistical analysis results in Table 4.21 showed that there was no significant relationship between PM_{10} exposure concentration and lung function parameters for the two study groups.

Table 4.21 Correlation between personal exposure level to PM_{10} and lung function parameters among the respondents

Variables	Concentrations (mg/m^3)			
	Exposed Group n = 42		Comparative Group n = 42	
	r value	*p* value	*r* value	*p* value
FVC% Predicted	-0.188	0.232	0.153	0.334
FEV_1% Predicted	-0.173	0.272	0.125	0.431
FEV_1/FVC Predicted	0.106	0.503	-0.165	0.295

N = 84

© COPYRIGHT UPM

4.11 Relationship between Years of Employment and Respiratory Symptoms among the Respondents

The prevalence of respiratory symptoms was compared between the exposed and comparative group. The Odd Ratio (OR) results in Table 4.22 showed no significant association for years of employment with cough (OR: 2.05; 95% CI: 0.79-5.28), phlegm (OR: 1.48; 95% CI: 0.55-3.96), wheezing (OR: 1.54; 95% CI: 0.56-4.27) and breathlessness (OR: 0.87; 95% CI: 0.29-2.64).

Table 4.22 Association between the years of employment and respiratory symptoms among the exposed group

Variables	Years of Employment						
	Exposed Group n = 42		Comparative group n = 42			*p* value	OR (95% CI)
	>10 n=11	<10 n=31	>10 n=15	<10 n=27			
Cough							
Yes	7 (64)	25 (81)	6 (40)	14 (52)	1.295	0.255	2.05 (0.79-5.28)
No	4 (36)	6 (19)	9 (60)	13 (48)			
Phlegm	4 (36)	14 (45)	4 (27)	9 (30)	0.257	0.612	1.48 (0.55-3.96)
Yes	7 (64)	17 (55)	11 (73)	18 (70)			
No							
Wheezing	2 (22)	6 (19)	3 (20)	5 (19)	0.007	0.932	1.54 (0.56-4.27)
Yes	9 (78)	25 (81)	12 (80)	22 (81)			
No							
Breathlessness	0 (0)	5 (16)	2 (13)	3 (11)	2.014	0.156	0.87 (0.29-2.64)
Yes	11 (100)	26 (84)	13 (87)	24 (89)			
No							

N = 84

© COPYRIGHT UPM

4.10 Correlation between Years of Employment and Lung Function Parameters among the Respondents

Spearman's Rho and Pearson Correlation Test were used to determine the relationship between the years of employment and lung function parameters (FVC, FEV1, FVC% predicted, FEV1% predicted and FEV1/FVC% predicted) among the exposed and comparative groups. Statistical analysis results in Table 4.23 showed that there was a significant relationship between years of employment and FVC% predicted; years of employment andFEV1% predicted and years of employment and FEV1/FVC% predicted among all respondents with $p<0.05$.

Table 4.23 Correlation between the years of employment and lung function Parameters among the exposed group

Variables	Years of Employment			
	Exposed Group n = 42		Comparative Group N = 84	
	r value	*p* value	*r* value	*p* value
FVC% Predicted	-0.093	0.556	-0.269	0.085
FEV1% Predicted	0.223	0.799	-0.200	0.204
FEV1/FVC Predicted	0.223	0.156	0.262	0.094

N = 84
*Significant at $p<0.05$

Chapter 5

Discussion, Conclusion and Recommendations

5.1 Discussion

5.1.1 Respondents Background

Upon granted the approval by the Ethics Committee of Universiti Putra Malaysia, the samples on traffic air pollutants (Benzene, Toluene, Xylene and PM_{10}) and assessment on the prevalence of respiratory symptoms were collected from December 2016 until April 2017.A total of 84 respondents participated in this study and the respondents were divided into two study groups which were exposed and comparative group. The exposed group consisted of 42 traffic policemen whose duty was to control traffic and were exposed to traffic air pollution. Whereas, the comparative group was 42 police officers that were not exposed to traffic air pollution while working. Total number of working hours of the respondents was in the range of 7 to 8 hours per day.

The respondents were selected according to the inclusion and exclusion criteria. Inclusion criteria for the selection of this study were male gender, Malay

ethnicity, aged between 20 to 50, non-smoker, involve in traffic control for exposed group and involved in administration work for comparative group. However, due to the limited number of non-smoker respondents, light category smoker were also included. Exclusion criteria used to exclude respondents from the study was the health status of chronic respiratory disease such as asthma, COPD or lung cancer developed before they started working as traffic policemen or police officers.

All of the information of the respondents was gathered using a set of questionnaire adapted from previous studies and the American Thoracic Society (ATS). The information gathered includes socio-demographic data, occupational information, smoking status, respiratory health status and respiratory symptoms experienced by the respondents.

5.1.2 Comparison of socio-demographic characteristics and occupational background of the respondents

Age, gender, race, height and weight were important factors that can influence the lung function parameters among the subjects (Sheldon, 2011). Older aged individuals might experience other occupational exposure in early life that develops symptoms later compared to younger aged individuals. Whereas, individuals with obesity were prone to have reduction in lung function even in the absence of specific respiratory disease, and may also increase the effects of existing airway disease (Salome et al, 2010).This study was restricted to only male individuals of Malay ethnicity, thus controlling the gender and race as confounding factors.

The mean age of the respondents in exposed group was 35.31± 9.84 years old and the mean age of the respondents in comparative group was 38.60 ± 10.67 years old. The youngest respondent was at age of 22 and the oldest was 58 years old. Based on the results, there was no significant different in age among the exposed and comparative group.

The mean height of the respondents in exposed group was 1.70 ± 0.05 m and the mean weight was 75.14 ± 11.62 kg. Whereas, the mean height of the respondents in comparative group was 1.71 ± 0.06 m and the mean weight was 79.63 ± 14.95 kg. The mean BMI of the respondents in exposed group was 27.60 ± 1.60 and the mean BMI of the respondents in comparative group was 27.37 ± 1.93. Based on the results, there was no significant different in height, weight and BMI among the exposed and comparative group.

In exposed group, 25 respondents (59.5%) were smoker, 8 respondents (19.0%) had stopped smoking and 9 respondents (21.4%) had never smoked. Whereas, in comparative group, 23 respondents (54.8%) were smoker, 3 respondents (7.1%) had stopped smoking and 16 respondents (38.1%) had never smoked. Based on the results, there was no significant different in smoking status among the exposed and comparative group.

The mean of years of employment of the respondents in exposed group was 7.41 ± 5.11 years and the mean of years of employment of the respondents in comparative group was 5.29 ± 4.47 years. Based on the results, there was no

significant different in the years of employment among the exposed and comparative group.

The mean of working duration per day of the respondents in exposed group was 7.99 ± 0.039 hours and the mean of working duration per day of the respondents in comparative group was 8.00 ± 0.034 years. Based on the results, there was no significant different in the working duration among the exposed and comparative group.

5.1.3 Comparison of Exposure to PM_{10} Concentration Level among the Respondents

Statistical result in Table 4.8 showed that the mean of PM_{10} concentration among the traffic policemen (0.0015 ± 0.0013 mg/m^3) were higher than the comparative group (0.0008 ± 0.0009 mg/m^3). Statistical analysis showed that there was a significant difference (t=2.656; p=0.009) in concentration levels between the study two groups. The PM_{10} concentration levels ranged from 0.022 – 5.169 mg/m3 and 0.002 – 3.821 mg/m3 among traffic policemen and comparative group respectively. However, the PM_{10} concentration level was compared with OSHA 8 hour Time-weighted Average (TWA) and the mean value recorded for both groups did not exceed the Permissible Exposure Limit (PEL), which were 0.1 mg/m^3.

The mean value of PM_{10} concentration recorded among the traffic policemen was lower than then mean value of (0.213 ± 72.92 mg/m3) recorded in a study done by Ngalai et al (2004) among traffic policemen in Kuala Lumpur and (0.208 ± 49.02

mg/m3) recorded in the study done by Muhammad[2] et al (2014) among traffic policemen in Petaling Jaya. Nevertheless, previous studies showed the same trend as in this study result in which the mean value of PM_{10} concentration was higher among the exposed group compared to the comparative group.

5.1.2 Ambient and Indoor Level of Benzene, Toluene, Xylene and PM_{10}

The ambient and indoor level of Benzene, Toluene, Xylene and PM_{10} was measured in eight districts in Klang Valley which are Kuala Lumpur, Petaling Jaya, SubangJaya, Klang Utara, Sepang, Kajang and Shah Alam. The measurement was taken in the morning and afternoon to compare the concentration of Benzene, Toluene, Xylene and PM_{10} during the morning peak hours and afternoon peak hours. For exposed group, the point of measurement was at the location of the traffic control and for comparative group, the point of measurement was in the office where the respondents were working.

The median of ambient concentration in the morning of Benzene, Toluene, Xylene and PM_{10} among the exposed group were 0.1375 ppm, 0.0900 ppm, 0.0400 ppm and 0.8250 mg/m^3 respectively. The median of ambient concentration in the afternoon of Benzene, Toluene, Xylene and PM_{10} among the exposed group were 0.2970 ppm, 2.2780 ppm, 0.4100 ppm and 0.1120 mg/m^3 in the afternoon respectively. The ambient concentration of Benzene, Toluene, and Xylene were higher in the afternoon while the concentration of PM_{10} was higher in the morning. Based on the result, there was a significant difference of Xylene and PM_{10} ambient concentration between morning and afternoon among the exposed group.

Whereas, the median of indoor concentration in the morning of Benzene, Toluene, Xylene and PM_{10} among the comparative group were 0.1106 ppm, 0 ppm, 0 ppm and 0.2100 mg/m^3 respectively. The median of indoor concentration in the afternoon of Benzene and PM_{10} among the comparative group were 0.1683 ppm and 0.1145 mg/m^3 in the afternoon respectively. While the median of indoor concentration of Toluene and Xylene remained to be 0 ppm. The same trend as in exposed group was observed in comparative group, in which the ambient concentration of Benzene was higher in the afternoon and the ambient concentration of PM_{10} was higher in the morning. Based on the result, there was a significant difference of PM_{10} indoor concentration between morning and afternoon among the comparative group.

Generally, the median concentration level of Benzene, Toluene and Xylene among the two study group do not exceeded the short term exposure limit (STEL) by OSHA which was 1 ppm, 10 ppm and 100 ppm respectively both in the morning and at noon. However, continuous exposure to low level of BTX can cause chronic respiratory health effects to the traffic policemen (World Health Organization, 2000). As for PM10, no STEL value was available in existing standards but to compare with Malaysian Ambient Air Quality Standard, the concentration must be below 0.15 mg/m^3 (150 $\mu g/m^3$) for 24 hours duration.

5.1.4 Comparison of Respiratory Symptoms among the Respondents

The respiratory symptoms that had been included in the questionnaire were cough, phlegm, wheezing and breathlessness. Higher number of respondents in

exposed group experienced the symptoms compared to the comparative group with significant difference in cough (x^2=7.269; p=0.007), wheezing (x^2=7.714; p=0.005) and breathlessness (x^2=4.525; p=0.033) and the result showed that there was a significant association in cough (OR=3.520; 95% CI=1.38-8.95), wheezing (OR=3.864; 95% CI=1.45-10.29) and breathlessness (OR=3.317; 95% CI=1.06-10.37) between the two study groups.

Based on previous study, there was a significant relationship in cough (OR: 4.235; 95% CI: 1.41-12.71) among the traffic policemen exposed to PM_{10} in Kuala Lumpur (Ngalai et al, 2003). Similar study by Muhammad[1] et al (2012) also showed that that there was higher prevalence of respiratory symptoms among the traffic policemen in Kuala Lumpur. Another study in Selangor showed significant relationship in cough (OR: 4.37; 95% CI: 1.78-10.71) and wheezing (OR: 2.81; 95% CI: 1.08-7.32) among the lorry drivers exposed to PM_{10} (Tan et al, 2006)

5.1.5 Comparison of Prevalence of Lung Function among the Respondents

The lung function of the respondents was evaluated by three parameters which were Forced Vital per cent (FVC%) predicted, Forced Expiratory Volume in 1 second per cent (FEV_1%) predicted and Forced Vital Capacity over Forced Expiratory Volume in 1 second per cent (FEV_1/FVC%) predicted.

All respondents had performed the lung function test with standardized steps based on ATS (2005) and the value for FVC% predicted, FEV_1% predicted and

FEV_1/FVC% predicted had been calculated using the prediction equation formula for Malaysian population. The statistical analysis result showed that there was a significant difference in FEV_1/FVC% predicted between the two study groups.

The mean value of FVC and FEV_1 among the traffic policemen was 3.03 ± 0.366 and 2.77 ± 0.322 whereas the mean value of FVC and FEV_1 among the comparative group was 3.10 ± 0.590 and 2.80 ± 0.532 respectively. The statistical analysis result in Table 4.9 showed that there was no significant difference in FVC ($t=-0.622$; $p>0.005$) and FEV1 ($t=-0.283$; $p>0.05$) between the two study groups. The FVC% predicted ($t=-1.457$; $p>0.05$) and FEV_1% predicted ($t=-0.028$; $p>0.05$) also showed no significant difference between the two study groups.

The lung function abnormalities of the two study groups were compared based on the Degree of Severity for FVC% predicted, FEV_1% predicted and FEV_1/FVC% predicted by ATS. The results summarized that higher frequency of traffic policemen were experiencing the lung function reduction compared to the comparative group.

Study by Muhammad[2] et al (2014) among traffic policemen exposed to PM_{10} in Selangor found that there was a significant difference in FVC (litre) with $z= -5.218$, $p<0.05$, FEV_1 (litre) with $z = -4.987$, $p<0.05$, FVC% predicted with $z = -3.716$, $p <0.05$ and FEV_1% predicted with $z = -2.953$, $p<0.05$ compared to comparative group. Another study by Raina et al (2014) in India also concluded that the traffic policemen exposed to air pollution had lower lung function compared to healthy person and those posted at rural areas. A global review of studies on traffic

police by Patil et al (2013) stated that majority of studies have reported a decrease in the lung function with significant reduction in the FVC, FEV1 and increase in respiratory morbidity compared to control subjects.

5.1.6 Correlation between Exposure Level of and Lung Function Parameters among the Respondents

The results from the Spearman Rho's correlation test showed that there was no significant association between the exposure level of and the lung function parameters (FVC% predicted, FEV_1% predicted and FEV_1/FVC predicted) among the traffic policemen and the comparative group when the analysis was performed separately.

The effect of air pollutants on health vary depending on several factors which includes the level of exposure, susceptibility and the subjects' characteristic such as age, gender, underlying disease, smoking, physiological and social status, genetic and nutritional deficiencies (WHO, 2000). Although there was no significant association, the r value in of FVC (-0.188) and FEV_1 (-0.173) was negative indicating that the lung function decreased as the exposure level of increased among the traffic policemen. The result obtained might be caused by the small number of subjects participated in the study.

5.1.7 Correlation between Years of Employment and Lung Function Parameters

The results from the Spearman Rho's correlation test showed that there were no significant association between the years of employment and the lung function parameters (FVC% predicted, FEV_1% predicted and FEV_1/FVC% predicted) among the traffic policemen and the comparative group when the analysis was performed separately.

Although there was no significant association, the r value of FVC (-0.093) was negative and is indicating that the lung function decreased as the years of employment increased among the traffic policemen. The result obtained might be caused by the small number of subjects participated in the study.

5.2 Conclusion

This study found that the personal exposure to PM_{10} concentration among the traffic policemen was higher compared to police officers. In addition, the ambient air concentrations of Benzene, Toluene, Xylene and PM_{10} among the traffic policemen were also higher compared to the indoor air concentrations among the police officers. The results also indicate that the number of traffic policemen with lung function abnormality and respiratory symptoms were higher than the police officers. Therefore, the traffic policemen were at higher risk of getting lung function reduction compared to the comparative group.

© COPYRIGHT UPM

5.3 Recommendations

As we know, the job nature of traffic policemen is spending their working time outdoors, standing or riding a motorcycle while carrying out their duties. The primary duties of traffic policemen are on the roads where the busy traffics emitted particulate matter and toxic gases directly to their breathing zones. To minimize the exposure, the researcher recommends following action to be taken.

5.3.1 Administrative Control

Based on the job nature of the traffic policemen, the most practicable action is focusing on the administrative control. The management head of each Traffic Department need to identify and categorize the point duty areas into different zones based on the level of pollution such as below and above permissible exposure limit (Benzene=1 ppm; Toluene=10 ppm, Xylene=100 ppm and PM_{10}=100 µg/m3 for 8 hours exposure). The management should create a job rotation by reducing the working hours to half if the areas are in highly polluted zones (above permissible limit). This method would be able to reduce the exposure duration of the traffic policemen.

The management head of the department are also responsible to monitor the personal exposure concentration to air pollutants inhaled by each traffic policemen and the dose received individually will be compared with the permissible exposure limit in existing standards. The management need to ensure the level of exposure do not exceed the standards. A periodic health check-up for all traffic policemen must

be done to check the level of respiratory health such as the lung function test for at least once in six months for continuous monitoring.

5.3.2 Future Studies

Due to the time limitation and lack of instruments, the researcher did not measure the personal exposure of Benzene, Toluene and Xylene (BTX). Future studies should measure the personal exposure of BTX in order to see the association between the BTX concentration and respiratory health. Future studies should also increase the number of subjects participated in the study to obtain a clear result of correlation. Beside lung function parameters, future researchers should take sputum, urine sample and biomarker of exposure for an accurate data and results.

© COPYRIGHT UPM

REFERENCES

Afroz, R., Hassan, M. N., & Ibrahim, N. A. (2003). Review of air pollution and health impacts in Malaysia. *Environmental Research*, 92(2): 71-77.

Al Madhoun, A. W., Ramli, N. A., &Yahaya, A. S., (2012). Monitoring the Total Volatile Organic Compounds (TVOCs) and Benzene Emitted at Different Locations in Malaysia. *Journal of Engineering Science,* 8: 59--67.

American Thoracic Society (1978). Lung Function Testing: Selection of Reference Values and Interpretive Strategies. *American Review of Respiratory Disease*, 85: 762-768.

American Thoracic Society (1995). Standardization of Spirometry: 1994 update. *Am. J. Respir. Crit. Care Med.*, 152: 1107-1136.

American Thoracic Society (2005). Standardization of Spirometry. *European Respiratory Journal*, 26(2): 319-338.

Angelini, S., Kumar, R., Bermejo, J. L., Maffei, F., Barbieri, A., Graziosi, F., Carbonea, F.,
Fortia, &Hrelia, P. (2011). Exposure to low environmental levels of benzene: evaluation of micronucleus frequencies and S-phenylmercapturic acid excretion in relation to polymorphisms in genes encoding metabolic enzymes. *Mutation Research/GeneticToxicology and Environmental Mutagenesis*, 719(1): 7-13.

Arayasiri, M., Mahidol, C., Navasumrit, P., Autrup, H., &Ruchirawat, M. (2010). Biomonitoring of benzene and 1, 3-butadiene exposure and early biological effects in traffic policemen. *Science of the Total Environment*, 408(20): 4855-4862.

Agency for Toxic Subtances and Disease Registry (ATSDR) (2015). Toxicological Profile for Benzene (Update). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Agency for Toxic Subtances and Disease Registry (ATSDR) (2007). Toxicological Profile for Xylene (Update). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Agency for Toxic Subtances and Disease Registry (ATSDR) (2015). Toxicological Profile for Toluene. Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

American Thoracic Society (ATS) (2005). Standardization of Spirometry 2005 update. *American Journal of Respiratory and Critical Care Medicine,* 26: 319-338.

American Thoracic Society (ATS) (1991). Lung Function Testing: Selection of Reference Values and Interpretive Strategies. American Review of Respiratory Disease, 144:1202-1218.

Azid, A., Juahira, H., Torimana, M. E., Enduta, A., Kamarudin, M. K. A., Rahman, A. M. N., Hasnama, C. C. N., Mohd, S. A. S. & Yunus, K. (2015). Source Apportionment of Air Pollution: A Case Study In Malaysia. *Jurnal Teknologi.* 72(1): 83-88.

Azmi, S. Z., Latif, M. T., Ismail, A. S., Juneng, L., &Jemain, A. A. (2010). Trend and status of air quality at three different monitoring stations in the Klang Valley, Malaysia. *Air Quality, Atmosphere & Health*, 3(1): 53-64.

Bahadar, H., Mostafalou, S., &Abdollahi, M. (2014). Current understandings and perspectives on non-cancer health effects of benzene: A global concern. *Toxicology and Applied Pharmacology*, 276(2): 83-94.

Baracelli, A. A., Zhen, Y., Zhang, X., Chang, D., Liu, L., Wolr, R. K., Zhang, Z., McCracken, P. J., Diaz, A., Bertazzi, A. P., Schwartz, J., Wang, S., Kang, C. M., Koutrakis, P., &Hou, L., (2014). Air pollution exposure and lung function in highly exposed subjects in Beijing, China: a repeated-measure study. Particle and Fibre Toxicology. 11(51): 1-10.

Basahi, J. M., Ismail, I. M., Hussain, H. K., El Behaedi, E. H., Balkhyour, M. A., Hassan, I. A., (2015). Air Pollution Assessment in Fuel Stations and its Impact on Workers' Health: a Case Study from Jeddah, KSA. *Advances in Environmental Biology,* 9(23): 326-331.

Bhandarkar, S., (2013). Vehicular Pollution, Their Effect on Human Heatlh and Mitigation Measures. *Vehicle Engineering (VE)*, 1(2): 33-40.

Borgie, M., Garat, A., Cazier, F., Delbende, A., Allorge, D., Ledoux, F., Courcot, D., Shirali, P., & Dagher, Z., (2014). Traffic-related air pollution. A pilot exposure assessment in Beirut, Lebanon. Chemosphere, 96: 122-128.

Brauer, M., Hoek, G., Vliet, P. V., Meliefste, K., Fischer, H. F., Wijga, A., Koopman, L. P., Neijens, H. J., Gerritsen, J., Kerkhof, M., Heinrich, J., Bellander, T. & Brunekreef, B. (2002). Air Pollution from Traffic and the Development of Respiratory Infections and Asthmatic and Allergic Symptoms in Children. *Am J Respir Crit Care Med*, 166: 1092-1098.

Brunekreef, B., & Holgate, S., (2002). Air pollution and health. The Lancet, 360(9341): 1233-1242.

Cattaneo, A., Taronna, M., Consonni, D., Angius, S., Costamagna, P., &Cavallo, M. D., (2010). Personal Exposure of Traffic Police Officers to Particulate Matter, Carbon Monoxide, and Benzene in the City of Milan, Italy. Journal of Occupational and Environmental Hygiene, 7(6): 342-351.

Chen, W., Hong, J., & Xu, C., (2015). Pollutants generated by cement production in China, their impacts, and the potential for environmental improvement. Journal of Cleaner Production, 103: 61-69.

Cortez-Lugo, M., Ramirez-Aguilar, M., Sansores-Martinez. R., Perez-Padilla, R., Ramirez-Venegas, A., & Barraza-Villareal, A., (2015). Effect of Personal Exposure to PM2.5 on Respiratory Health in a Mexican Panel of Patients with COPD. Int. J. Environ. Res. Public Health. 12(9): 10635-10647.

Esteves-Garcia, J. A., Rojas-Roa, N. Y., & Rodriguez-Pulido, A. I., (2013). Occupational exposure to air pollutants: particulate matter and respiratory symptoms affecting traffic-police in Bogota. Journal of Public Health, 15(^): 889-902.

Gehring, U., Gruzieva, O., Agius, M. R., Beelen, R., Custovic, A., Cyrys, J., Eeftens, M., Flexeder, C., Feurtes, E., Heinrich, J., Hoffnam, B., de Jongste, C. J., Kerkhof, M., Klumper, C., Korek, Michal, Molter, A., Schultx, S. E., Simpson, A., Sugiri, D., Svartengren, M., Berg, A., Wijga, H. A., Pershagen, G., Brunekreef, B., (2013). Air Pollution Exposure and Lung Function in Children: The ESCAPE Project. Environmental Health Perspectives, 121(11-12): 1357-1364.

Gupta, S., Mittal. S., Kumar, A., & Singh, D. K., (2011). Respiratory effects of air pollutants among nonsmoking traffic policemen of Patiala, India. Lung India, 28(4): 253-257.

Hinwood, L. A., Clemencia Rodriguez, C., Runnion, T., Farrar, D., Murray, F., Horton, A., Glass, D., Sheppeard, V., Edwards, W. J., Denison, L., Whitworth, T., &Eiseri, C., Bulsara, M., Gillett, W. R., Powell, J., Lawson, S., Weeks, I., Galbally, I., (2007). Risk factors for increased BTEX exposure in four Australian cities. *Chemosphere*, 66: 533–541.

Karita, K., Yano, E., Jinsart, W., Boudoung, D., & Tamura, k., (2001). Respiratory symptoms and pulmonary function among traffic police in Bangkok, Thailand. Arch Environ Health. 56(5): 467-70.

Laumbach, R. J. & Kipenn, H. M. (2013). Respiratory Health Effects of Air Pollution: Update on Biomass Smoke and Traffic Pollution. *J Allergy Clin Immunol,* 129(1): 3-13.

Lemeshow, S., Hosmer, D.. W, Klar, J. & Lwanga, S., K. (1990). Adequacy of Sample size in health sciences. *World Health Organization*, 1-4.

Ling, O. H. L., Ahmad, S., Aiyub, K., Jani, M. Y., & Hwa, T. K., (2012). Urban Air Environmental Health Indicators for Kuala Lumpur City. *SainsMalaysiana,* 41(2): 179–191.

Manuela, C., Francesco, T., Tiziana, C., Assunta, C., Lara, S., Nadia, N., Giorgia, A., Barbara, S., Maria, F., Carlotta, C., Valeria, D.G., Pia, S.M., Gianfranco, T., & Angela, S. (2012). Environmental and biological monitoring of benzene in traffic policemen, police drivers and rural outdoor male workers. *Journal of Environmental Monitoring*, 14(6): 1542-1550.

Muhammad[1], A. S., Jalaludin, J. & Yusof, N. A. M., (2012). Exposure to PM2.5 and respiratory health among traffic policemen in Kuala Lumpur. *Journal of Occupational Safety and Health,* 9(3): 55.64.

Muhammad[2], N. S., Jalaludin, J. & Sundrasegaran, S. (2014). Exposure to respirable dust (PM_{10}) and respiratory health among traffic policemen in Selangor. *Advances in Environmental Biology*, 8 (15): 199-206.

Mukherjee, K. A., Chattopadhay, P. B., Roy, K. S., Das, S., Mazumdar, D., Roy, M., Chakrabotry, R., & Yadav, A., (2016). Work-exposure to PM_{10} and aromatic volatile organic compounds, excretion of urinary biomarkers and effect on the pulmonary function and heme-metabolism: A study of petrol pump workers and traffic police personnel in Kolkata City, India. *Journal of Environmental Science and Health*, 51(2): 135-149.

Naing, N., N. (2003). Determination of Sample Size. *Malays J Med Sci.* 10(2): 84-86.

Pal, P., Robert, A. J., Dutta, T. K., Pal, G. K., (2010). Pulmonary function test in traffic police personnel in Pondicherry. *Indian Journal of Physiology and Pharmacology*. 54(4): 329-336.

Paulin, L., & Hansel, N., (2016). Particulate air pollution and impaired lung function. *F1000Research,* 5: 1-9.

Pope, A. C., & Dockery, W. D., (2006). Health Effects of Fine Particulate Air Pollution: Lines that Connect. *Journal of the Air & Waste Management Association,* 56(6): 709-742.

Powell, J., Lawson, S., Weeks, I., &Galbally, I., (2007). Risk factors for increased BTEX exposure in four Australian cities. *Chemosphere,* 66: 533–541.

Rahman, A. S. R., Ismail, S. S. N., Ramli. Ramli, F. M., Latif, T. M., Abidin, Z. E., &Praveena, S. M., (2015). The Assessment of Ambient Air Pollution Trend in Klang Valley, Malaysia. *World Environment 2015*, 5(1): 1-11.

Shakya, K. M., Rupakheti, M., Aryal, K., &Perltier, R., (2016). Respiratory Effects of High Levels of Particulate Exposure in a Cohort of Traffic Police in Kathmandu, Nepal. *Journal of Occupational & Environmental Medicine.* 58(6): 218-225

Skov, H., Hansen, B. A., Lorenzen. G., Andersen, H. V., Lotstrom, P., &Christensne, S. C., (2001). Benzene exposure and the effect of traffic pollution in Copenhagen, Denmark. *Atmospheric Environment,* 35(14): 2463-2471.

Solanki, B. R., Bhise, R. A., &Dangi, M. B., (2015). A study on spirometry in petrol pump workers of Ahmedabad, India. *Lung India,* 32(4): 347-352.

Strak, M., Stennhof, M., Godri, J. M., Gosens, I., Mudway, S. A., Cassee, R. F., Lebret, E., Brunekreef, B., Kelly, J. F., Harrison, M. R., Hoek, G., & Janssen, A. H. N., (2011). Variation in characteristics of ambient particulate matter at eight locations in the Netherlands – The RAPTES project. *Atmospheric Environment.* 45(26): 4442-4453.

US Environmental Protection Agency (USEPA) (2006). Air quality criteria for ozone and related photochemical oxidants (2006 final). Washington, DC: US EPA; 2006. Publication no. EPA/600/R-05/004aF-cF.

Verma, Y., Kumar, A., & Rana, S. S. V., (2003). Biological Monitoring of Exposure to Benzene in Traffic Policemen of North India. Industrial Health, 41(3): 260-264.

Vimercati, L., Gatti, F. M., Baldasarre, A., Nettis, E., Favia, N., Palma, M., Martina, L. M. G., Leo, D. E., &Musti, M., (2015). Occupational Exposure to Urban Air Pollution and Allergic Diseases. *International Journal of Environment Respriratory Public Health.* 12(10): 12977-12987.

World Health Organization (WHO, 2000). Air Quality Guidelines for Europe. 2nd Edition. WHO Regional Office for Europe, Copenhagen, Denmark.

© COPYRIGHT UPM

APPENDIX I

© COPYRIGHT UPM

ETHICS COMMITTEE FOR RESEARCH INVOLVING HUMAN SUBJECTS (JKEUPM)
UNIVERSITI PUTRA MALAYSIA

Research title	:	**Exposure To Traffic Air Pollutant (Benzene, Toluene, Ethylbenzene, Xylene, $PM_{2.5}$, PM_{10}) And Respiratory Health Implication Among Traffic Policeman In Klang Valley Selangor**
Study Site	:	**Klang Valley Selangor**
JKEUPM Ref No.	:	**FPSK(EXP16-OSH)U036**
Researcher	:	**Wan Aznani Binti Wan Mansor**
Supervisor	:	**Assoc Prof. Dr. Juliana Binti Jalaludin**

ents received and reviewed with reference to the above study:

Ethics Application Form, Version 1 dated 21/10/2016
Respondent Information Sheet & Consent (English) Version 2 dated 22/12/2016
Respondent Information Sheet & Consent (Malay) Version 1 dated 22/12/2016
Proposal (English), Version 1 dated 21/10/2016
Questionnaire (English), Version 1 dated 21/10/2016
6. Questionnaire (Malay), Version 1 dated 21/10/2016
7. Curriculum Vitae of:
   a. Assoc Prof. Dr.Juliana Jalaludin

The University Research Ethics Committee, Universiti Putra Malaysia (JKEUPM) operates in accordance to the ICH-GCP Guidelines.

Decision by JKEUPM:

[X] Approved

[x] **Permission MUST BE OBTAINED from the respective hospitals/ institutions before conducting the research**

[ ] Disapproved

Please note that the approval is valid until 22 December 2017

Researchers should comply with the following:

I. Complete a Study Final Report upon study completion (Form D).

II. Ethical approval is required in the case of amendments/ changes to the study documents/ study sites/ study team.

© COPYRIGHT UPM

APPENDIX II

© COPYRIGHT UPM

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

FORM B1: RESPONDENT'S INFORMATION SHEET AND CONSENT

Please read the following information carefully and do not hesitate to discuss any questions you may have with the researcher.

1. STUDY TITLE:

Exposure to traffic air pollutants (Benzene, Toluene, Ethylbenzene, Xylene, $PM_{2.5}$, PM_{10}) and respiratory health implication among traffic policemen in Klang Valley, Selangor

2. INTRODUCTION:

You are being invited to take part in this research experiment and your participation must be voluntary. However, before you make any decision to participate as a respondent, it is important that you fully understand what the research is about and what you will be asked to do.

This study is carried out to determine the association between the exposure to traffic air pollutants (Benzene, Toluene, Ethylbenzene, Xylene, $PM_{2.5}$, PM_{10}) emitted by vehicles exhaust and respiratory health implication among traffic policemen in Klang Valley, Selangor. Traffic policemen is one of the occupational groups with high risk of exposure to pollutants emitted from vehicle exhaust because they are directly involved in controlling the flow of traffic. Traffic pollutants involved in this study as parameters are Benzene, Toluene, Ethylbenzene, Xylene, $PM_{2.5}$, and PM_{10} Traffic policemen exposed to these pollutants by inhalation. Respiratory system is one of the target organ and long-term exposure will potentially effects the function of the lungs. The urbanization and rapid development in Klang Valley increase the number of vehicles entering the region every day which become the main factor that affecting the air quality. Therefore, this study is conducted to measure the amount of traffic air pollutants inhaled and to test the lung function abnormalities among the traffic policemen.

3. WHAT WILL YOU HAVE TO DO?

You are required to read and understand each page of this respondent's information sheet and consent form. If you agree to participate in this research, please fill up the respondent's information sheet and put your signature at each page of this form. You have to return back this form to the researcher after you have finish filling up the information needed.

One of the methods used in this research is a study questionnaire. You are required to read and understand all of the questions in the questionnaire before answering. After you finish answer all of the questions, please return back the questionnaire to the researcher.

*Please initial here if you have read and understood the contents of this page*_____

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

FORM B1: RESPONDENT'S INFORMATION SHEET AND CONSENT

Please read the following information carefully and do not hesitate to discuss any questions you may have with the researcher.

1. STUDY TITLE:

Exposure to traffic air pollutants (Benzene, Toluene, Ethylbenzene, Xylene, $PM_{2.5}$, PM_{10}) and respiratory health implication among traffic policemen in Klang Valley, Selangor

2. INTRODUCTION:

You are being invited to take part in this research experiment and your participation must be voluntary. However, before you make any decision to participate as a respondent, it is important that you fully understand what the research is about and what you will be asked to do.

This study is carried out to determine the association between the exposure to traffic air pollutants (Benzene, Toluene, Ethylbenzene, Xylene, $PM_{2.5}$, PM_{10}) emitted by vehicles exhaust and respiratory health implication among traffic policemen in Klang Valley, Selangor. Traffic policemen is one of the occupational groups with high risk of exposure to pollutants emitted from vehicle exhaust because they are directly involved in controlling the flow of traffic. Traffic pollutants involved in this study as parameters are Benzene, Toluene, Ethylbenzene, Xylene, $PM_{2.5}$, and PM_{10} Traffic policemen exposed to these pollutants by inhalation. Respiratory system is one of the target organ and long-term exposure will potentially effects the function of the lungs. The urbanization and rapid development in Klang Valley increase the number of vehicles entering the region every day which become the main factor that affecting the air quality. Therefore, this study is conducted to measure the amount of traffic air pollutants inhaled and to test the lung function abnormalities among the traffic policemen.

3. WHAT WILL YOU HAVE TO DO?

You are required to read and understand each page of this respondent's information sheet and consent form. If you agree to participate in this research, please fill up the respondent's information sheet and put your signature at each page of this form. You have to return back this form to the researcher after you have finish filling up the information needed.

One of the methods used in this research is a study questionnaire. You are required to read and understand all of the questions in the questionnaire before answering. After you finish answer all of the questions, please return back the questionnaire to the researcher.

*Please initial here if you have read and understood the contents of this page*_____

Second method that will be used is to measure the exposure level of the respondents to the traffic air pollutants using Personal Exposure Air Monitoring. During the monitoring, a personal air monitoring pump will be attached to you for 4 hours while working.

In addition, you are also required to perform Lung Function Test to determine the capacity and capability of your lungs whether they can function normally or not.

4. WHO SHOULD NOT PARTICIPATE IN THE STUDY?

This research did not involved female respondents and other races in addition to the Malay. In addition, the interested respondents' age must not less than 20 years old or more than 50 years old, do not undergo x-ray for the last 6 months and do not diagnosed with chronic diseases related to respiratory such as Asthma, COPD, Pulmonary hypertension, etc.

Whereas, respondents that will be included in this research must be complied with the following inclusion criterias:

Exposed Group

- Malay male
- Aged between 20 and 50 years old
- Involve in controlling the traffic flow (outdoor)
- No chronic respiratory diseases (Asthma, COPD, Pulmonary hypertension, etc.)
- Do not undergo x-ray in the last 6 months

Comparative Group

- Malay male
- Aged between 20 and 50 years old
- Involve in administrative work only (indoor)
- No chronic respiratory diseases (Asthma, COPD, Pulmonary hypertension, etc.)
- Do not undergo x-ray in the last 6 months

5. WHAT WILL BE THE BENEFITS OF THE STUDY:

(a) TO YOU AS THE SUBJECT?

Through this research, the respondents will get benefits mainly information on their health as follows:

- The respiratory health symptoms
- The early sign of COPD and Asthma through Lung Function Test
- The level of personal exposure to trafic pollutants

(b) TO THE INVESTIGATOR?

The reseacher will be able to determine the exposure level of traffic pollutants among the traffic policemen in Klang Valley. The data obtained will be used as reference in making any guidelines in the field of environmental and occupational health for police traffic. It is also to help the country to reduce the number of cases of respiratory diseases related to traffic pollutants. In addition to that, the result of this study also can help to make a benchmark for the susceptible groups such as children, pregnant woman and elderly.

*Please initial here if you have read and understood the contents of this page*_____

6. WHAT ARE THE POSSIBLE RISKS?

There is no possible risks to the respondents as this research is only involving a questionnaire and invasive method that is lung function test.

7. WILL THE INFORMATION THAT YOU PROVIDE AND YOUR IDENTITY REMAIN CONFIDENTIAL?

All of the information obtained from the respondents will be completely confidential and be used for the purpose of the study only. The detail of the respondents will not be included in any publication in future.

8. WHO SHOULD YOU CONTACT IF YOU HAVE ADDITIONAL QUESTIONS DURING THE COURSE OF THE RESEARCH?

PROFFESOR MADYA DR JULIANA JALALUDIN
Supervisor
Department of Environmental and Occupational Health
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia (UPM)
Pejabat: 03-8947 2397
Fax: 03-8974 2935
Email: juliana@upm.edu.my

WAN AZNANI BINTI WAN MANSOR
Researcher
Department of Environmental and Occupational Health
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia (UPM)
Tel: 011-3732 8450
Email: aznani.mansor@gmail.com

© COPYRIGHT UPM

Please initial here if you have read and understood the contents of this page_____

9. CONSENT

I ..... Identity Card No. .....
address.....
.....hereby voluntarily agree to take part in the research stated above *(clinical /drug trial/video recording/ focus group/interview-based/ questionnaire-based).

I have been informed about the nature of the research in terms of methodology, possible adverse effects and complications (as written in the Respondent's Information Sheet). I understand that I have the right to withdraw from this research at any time without giving any reason whatsoever. I also understand that this study is confidential and all information provided with regard to my identity will remain private and confidential.

I* wish / do not wish to know the results related to my participation in the research

I agree/do not agree that the images/photos/video recordings/voice recordings related to me be used in any form of publication or presentation (if applicable)

*delete where necessary

Signature .....
(Respondent)

Date :.....

Signature .....
(Witness)

Name :.....

I/C No. :.....

I confirm that I have explained to the respondent the nature and purpose of the above-mentioned research.

Date :.....

Signature .....
(Researcher)

© COPYRIGHT UPM

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

BORANG B1: PENERANGAN DAN PERSETUJUAN RESPONDEN

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

1.TAJUK KAJIAN

Pendedahan kepada pencemaran trafik udara (Benzene, toluena, Etilbenzena, Xylene, PM2.5, PM10) dan implikasi kesihatan pernafasan di kalangan anggota polis trafik di Lembah Klang, Selangor

2. PENGENALAN

Anda dijemput untuk mengambil bahagian dalam penyelidikan ini dan penyertaan anda adalah sukarela. Walau bagaimanapun, sebelum anda membuat sebarang keputusan untuk mengambil bahagian sebagai responden, adalah penting bagi anda untuk memahami sepenuhnya mengenai penyelidikan ini dan apa yang anda perlu lakukan.

Kajian ini dijalankan untuk menentukan hubungan antara pendedahan kepada pencemaran trafik udara (Benzene, toluena, Etilbenzena, Xylene, $PM_{2.5}$, PM_{10}) yang dilepaskan oleh ekzos kenderaan dan implikasi kesihatan pernafasan di kalangan anggota polis trafik di Lembah Klang, Selangor. Polis trafik adalah salah satu daripada kumpulan pekerjaan yang berisiko tinggi terdedah kepada pencemaran udara yang dilepaskan daripada ekzos kenderaan kerana mereka terlibat secara langsung dalam mengawal aliran trafik. Bahan pencemar trafik yang terlibat sebagai parameter dalam kajian ini adalah Benzene, Toluena, Etilbenzena, Xylene, $PM_{2.5}$, dan PM_{10}. Polis trafik terdedah kepada pencemaran ini melalui pernafasan. Sistem pernafasan adalah salah satu organ sasaran dan pendedahan jangka panjang berpotensi untuk memberi kesan kepada fungsi paru-paru. Pembandaran dan pembangunan yang pesat di Lembah Klang meningkatkan bilangan kenderaan yang memasuki kawasan itu setiap hari dan menjadi faktor utama yang menjejaskan kualiti udara. Oleh itu, kajian ini dijalankan untuk mengukur jumlah bahan pencemar udara trafik yang memasuki ruang pemafasan dan untuk menguji fungsi paru-paru di kalangan anggota polis trafik.

3. APAKAH YANG PERLU ANDA LAKUKAN?

Anda dikehendaki membaca dan memahami setiap halaman borang penerangan dan persetujuan responden ini. Jika anda bersetuju untuk mengambil bahagian dalam kajian ini, sila isi borang persetujuan responden dan tandatangan di setiap halaman borang ini. Anda perlu mengembalikan borang ini kepada penyelidik selepas anda selesai mengisi maklumat yang diperlukan.

Salah satu kaedah yang digunakan dalam kajian ini adalah kajian soal selidik. Anda dikehendaki membaca dan memahami semua soalan-soalan di dalam borang soal selidik sebelum menjawab. Selepas anda selesai menjawab semua soalan, sila kembalikan borang soal selidik kepada penyelidik.

Kaedah yang kedua adalah mengukur tahap pendedahan kepada pencemaran udara trafik melalui Pemantauan Udara Pendedahan Peribadi responden. Dalam pemantauan yang dijalankan, anda perlu memakai pam pensampelan udara peribadi semasa bekerja selama 4 jam.

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

Selain daripada itu, anda juga akan melakukan Ujian Fungsi Paru-paru untuk mengetahui kebolehan dan keupayaan paru-paru anda sama ada ianya berfungsi secara normal atau tidak normal.

4. SIAPA YANG TIDAK BOLEH MENYERTAI KAJIAN INI?

Kajian ini tidak melibatkan responden wanita dan kaum-kaum lain selain Melayu. Di samping itu, umur responden mesti tidak kurang daripada 20 tahun atau lebih daripada 50 tahun, tidak menjalani x-ray sepanjang tempoh masa 6 bulan yang lepas dan tidak menghidapi penyakit kronik yang berkaitan dengan pernafasan seperti Asma, Bronkitis, COPD , Pneumonia, dan lain-lain.

Manakala responden yang akan terlibat dalam penyelidikan ini mesti mematuhi kriteria yang berikut:

<u>Kumpulan terdedah</u>

- Lelaki Melayu
- Berumur antara 20 dan 50 tahun
- Terlibat dalam mengawal aliran trafik
- Tiada penyakit kronik yang berkaitan dengan pernafasan (Asma, COPD, Hypertensi pulmonal, dan lain-lain)
- Tidak menjalani x-ray dalam masa 6 bulan yang lepas

<u>Kumpulan perbandingan</u>

- Lelaki Melayu
- Berumur antara 20 dan 50 tahun
- Terlibat dengan kerja-kerja pejabat sahaja
- Tiada penyakit kronik yang berkaitan dengan pernafasan (Asma, COPD, Hypertensi pulmonal, Pneumonia, dan lain-lain)
- Tidak menjalani x-ray dalam masa 6 bulan yang lepas

5. APAKAH FAEDAH MENYERTAI KAJIAN INI?

a) KEPADA ANDA SEBAGAI PESERTA?

Melalui kajian ini, responden akan mendapat faedah terutamanya maklumat mengenai kesihatan mereka. Antaranya:

- Simptom-simptom kesihatan respiratori
- Tanda awal COPD dan asma melalui Ujian Fungsi Paru-paru
- Tahap pendedahan peribadi kepada bahan pencemar trafik

b) KEPADA PENYELIDIK?

Penyelidik akan dapat menentukan tahap pendedahan pencemaran trafik di kalangan anggota polis trafik di Lembah Klang. Data yang diperolehi akan digunakan sebagai rujukan dalam membuat apa-apa garis panduan dalam bidang kesihatan persekitaran dan pekerjaan bagi polis trafik. Ia juga adalah untuk membantu negara ini untuk mengurangkan bilangan kes penyakit respiratori yang berkait dengan bahan pencemar trafik. Di samping itu, hasil kajian ini juga boleh membantu untuk membuat penanda aras untuk kumpulan terdedah seperti kanak-kanak, wanita hamil dan warga tua.

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

6. ADAKAH IA BERISIKO?

Tiada risiko kepada responden kerana penyelidikan ini hanya melibatkan soal selidik dan kaedah tidak invasif iaitu ujian fungsi paru-paru.

7. ADAKAH MAKLUMAT DAN IDENTITI SAYA KEKAL RAHSIA?

Semua maklumat yang diperolehi daripada responden adalah sulit dan digunakan untuk tujuan kajian sahaja. Segala maklumat responden tidak akan dimasukkan ke dalam mana-mana penerbitan pada masa depan.

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

PROFFESOR MADYA DR JULIANA JALALUDIN
Penyelia
Jabatan Kesihatan Persekitaran dan Pekerjaan
Fakulti Perubatan
Universiti Putra Malaysia (UPM)
Pejabat: 03-8947 2397
Fax: 03-8974 2935
Email: juliana@upm.edu.my

WAN AZNANI BINTI WAN MANSOR
Penyelidik
Jabatan Kesihatan Persekitaran dan Pekerjaan
Fakulti Perubatan
Universiti Putra Malaysia (UPM)
Tel: 011-3732 8450
Email: aznani.mansor@gmail.com

© COPYRIGHT UPM

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. I/C :.....

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

Tarikh :.....

Tandatangan .....
(Penyelidik)

© COPYRIGHT UPM

APPENDIX III

© COPYRIGHT UPM

Kategori Responden: *Respondent Category:*

☐ Point duty/mengawal laluan trafik
Point duty/traffic control duty

☐ Staf/anggota trafik bahagian pentadbiran
Staff/police traffic in administration department

Tarikh kajian:_____
Date of research:

ID Responden:_____
Respondent's ID:

UNIVERSITI PUTRA MALAYSIA

JABATAN KESIHATAN PERSEKITARAN & PEKERJAAN
FAKULTI PERUBATAN & SAINS KESIHATAN
UNIVERSITI PUTRA MALAYSIA

PENDEDAHAN KEPADA BAHAN PENCEMAR TRAFIK UDARA (BENZENE, TOLUENA, ETILBENZENA, XYLENE, PM2.5, PM10) DAN IMPLIKASI KESIHATAN PERNAFASAN DI KALANGAN ANGGOTA POLIS TRAFIK DI LEMBAH KLANG, SELANGOR

EXPOSURE TO TRAFFIC AIR POLLUTANTS (BENZENE, TOLUENE, ETHYLBENZENE, XYLENE, PM2 5, PM10) AND RESPIRATORY HEALTH IMPLICATION AMONG TRAFFIC POLICEMEN IN KLANG VALLEY, SELANGOR

Borang soal selidik ini terdiri daripada beberapa bahagian. Sila jawab semua soalan. Segala maklumat yang diperoleh melalui borang soal selidik ini akan di gunakan untuk **TUJUAN KAJIAN SAHAJA** serta **SULIT** dan **TIDAK AKAN DIDEDAHKAN** kepada mana-mana pihak ketiga. Kejujuran serta kerjasama Tuan adalah amat diperlukan untuk melengkapkan borang soal selidik ini.

*This questionnaire booklet consists of several sections Please answer them thoroughly Every single information given through this questionnaire will be used for the **RESEARCH PURPOSES ONLY** and **CONFIDENTIAL** and **NOT TO BE EXPOSED** to any third party Your honesty and commitment are essential to complete this questionnaire*

BAHAGIAN I: MAKLUMAT DEMOGRAFIK
PART I: DEMOGRAPHIC INFORMATION

1) Tarikh Lahir: *Date of Birth:* ☐☐☐☐☐☐

2) Berat: *Weight:* ☐☐☐ kg

3) Tinggi: *Height:* ☐☐☐ m

4) Agama: *Religion:*

- ☐ Islam/*Islam*
- ☐ Budha/*Buddhist*
- ☐ Hindu/*Hindu*
- ☐ Christian/*Christian*
- ☐ Lain-lain/*Others.* _____ (Sila nyatakan / *Please specify*)

5) Status: *Status.*

- ☐ Bujang/*Single*
- ☐ Berkahwin/*Married*
- ☐ Duda/*Widower*

6) Tahap Pendidikan: *Educational level:*

- ☐ SPM/*SPM*
- ☐ Diploma/*Diploma*
- ☐ Ijazah/*Degree*
- ☐ Sarjana/*Master*
- ☐ Doktor Falsafah/*PhD*
- ☐ Lain-lain/*Others:* _____ (Sila nyatakan / *Please specify*)

7) Pendapatan bulanan (RM) / *Monthly Income (RM)* :_____

©COPYRIGHT UPM

BAHAGIAN II: MAKLUMAT PEKERJAAN
PART II: OCCUPATIONAL INFORMATION

8) Tahun mula bekerja:
Year of employment:

9) Jenis kenderaan yang digunakan untuk ke tempat kerja
Types of transport used to go to work

- ☐ Motorsikal / *Motorcycle*
- ☐ Kereta / *Motorcar*
- ☐ Pengangkutan awam (LRT, Bas, Teksi & lain-lain) / *Public transports (LRT, Bus, Taxi & etc)*
- ☐ Kenderaan berat (van, lori, & lain-lain) / *Heavy duty car (van, lorry, & etc)*

10) Jenis bahan api yang digunakan untuk kenderaan anda
Types of fuels using for your vehicle

- ☐ Petrol / *Petrol*
- ☐ Diesel / Diesel
- ☐ Bateri, Hibrid / *Battery, Hybrid*
- ☐ Lain-lain. Sila nyatakan:_____ / *Others Please specify*

11) Purata masa yang diambil untuk tiba di tempat kerja
The average time taken to arrive at work

- ☐ kurang daripada 30 minit / *less than 30 minutes*
- ☐ 30 minit -1 jam / *30 minutes-1 hour*
- ☐ lebih daripada 1 jam / *more than 1 hour*

Soalan-soalan 12 hingga 14 hanya perlu dijawab oleh responden polis trafik lelaki yang terlibat dalam tugas mengawal laluan trafik sahaja.
Questions 12 to 14 required to be answered by traffic policemen involved in traffic control duty only.

12) Kekerapan mengawal laluan trafik:
Frequency in traffic control duty:

Sehari / *Perday*: [ ] kali / *times*

Seminggu / *Per week*: [ ] kali / *times*

13) Kawasan yang terlibat dalam tugas mengawal laluan trafik:
Covered areas in traffic control duty:

i. iv.
ii. v.
iii. vi.

14) Tempoh masa yang terlibat dalam tugas mengawal laluan trafik:
Duration taken to control the traffic flows:

i) Dari / *from*: ☐ am/pm sehingga / *to*: ☐ am/pm

ii) Dari / *from*: ☐ am/pm sehingga / *to*: ☐ am/pm

15) Adakah anda diberikan sebarang alat pelindung diri untuk pekerjaan sekarang?
Have you been provided the personal protective equipment for current occupation?

- ☐ Ya / *Yes*
- ☐ Tidak / *No*

© COPYRIGHT UPM

16)	Jika Ya, sila nyatakan jenis alat pelindung diri tersebut *If Yes, Pease specify that type of personal protective equipment* _____		
17)	Adakah anda memakai alat pelindung diri tersebut? *Do you apply the given personal protective equipment?*	☐	Ya / *Yes* Tidak / *No*
18)	*Pekerjaan sambilan sekarang (jika ada)* *Current part-time job (if any)*	☐	Ya / *Yes* Tidak / *No*
	Jika Ya, Sila nyatakan / *If Yes, Please specify:*		
19)	Jenis pekerjaan: *Type of occupation:* _____	20)	Jumlah tahun bekerja: *Employment duration* _____ tahun / *year*
21)	Adakah anda diberikan sebarang alat pelindung diri untuk pekerjaan tersebut? *Have you been provided the personal protective equipment for that occupation?*	☐	Ya / *Yes* Tidak / *No*
22)	Pekerjaan terdahulu (jika ada) *Past employment*	☐	Bekerja/ *Employed* Tidak bekerja/ *Unemployed*
	Jika Ya, Sila nyatakan / *If Yes, Please specify:*		
23)	Jenis pekerjaan: *Type of occupation* _____	24)	Jumlah tahun bekerja: *Employment duration* _____ tahun / *year*
25)	Adakah anda diberikan sebarang alat pelindung diri untuk pekerjaan tersebut? *Have you been provided the personal protective equipment for that occupation?*	☐	Ya / *Yes* Tidak / *No*

BAHAGIAN III: MAKLUMAT KEDIAMAN
PART III: RESIDENTIAL INFORMATION

26)	Dimanakah anda tinggal sekarang? *Where is your current residence?*	_____ daerah (*district*) / negeri (*state*)
27)	Berapa lamakah anda telah menetap disini? *How long have you been lived here?*	Hari (*day*)/ bulan (*month*)/ tahun (*year*)
28)	Berapakah anggaran jarak tempat tinggal anda dari tempat kerja? *What is the estimated distance from your residence to your workplace?*	_____kilometer/ *kilometer*
29)	Apakah bahan yang telah digunakan semasa pembinaan rumah kediaman anda sekarang? *What materials were used in the construction of your current residence?*	☐ Batu-bata, konkrit / *bricks, concrete* ☐ Papan / *wood* ☐ Lain-lain / *Others*. Sila nyatakan *Please Specify*:
30)	Adakah terdapat sebarang renovasi rumah kediaman anda sekarang bagi tempoh dua belas (12) bulan yang lepas? *Is there any renovation of your current residence for past of twelve (12) months penod?*	☐ Ya / *Yes* ☐ Tidak / *No*

31) Adakah anda melakukan sebarang aktiviti mengecat di rumah kediaman anda sekarang dalam tempoh dua belas (12) bulan yang lepas?
Have you done any painting activities in your current residence for past of twelve (12) months period?

☐ Ya / *Yes*
☐ Tidak / *No*

32) Adakah tempat tinggal anda berdekatan laluan jalan raya yang sibuk?
Do you live nearest to the busy road?

☐ Ya / *Yes*
☐ Tidak / *No*

33) Jika Ya, berapakah anggaran jarak rumah anda dari laluan jalan raya yang sibuk tersebut?
If Yes, what is the estimated distance from your residence to the busy road?

☐ < 100 meter *(< 100 meter)*
☐ 100-500 meter *(100-500 meter)*
☐ >500-1000 meter *(>501-1000 meter)*
☐ >1000 meter *(>1000 meter)*

34) Adakah tempat tinggal anda berdekatan dengan stesen minyak?
Do you live nearest to the petrol pump station?

☐ Ya / *Yes*
☐ Tidak / *No*

35) Jika Ya, berapakah anggaran jarak rumah anda dari stesen minyak tersebut?
If Yes, what is the estimated distance from your residence to the petrol pump station?

☐ < 500 meter *(< 500 meter)*
☐ 500-1 km *(500-1 km)*
☐ >1-1.5 km *(>1-1.5 km)*
☐ >1.5-5 km *(>1.5-5 km)*
☐ >5 km *(>5 km)*

36) Adakah tempat tinggal anda berdekatan dengan kilang pembuatan bahan petrokimia/bahan kimia?
Do you live nearest to the petrochemical plant / chemical manufacturing?

☐ Ya / *Yes*
☐ Tidak / *No*

37) Jika Ya, berapakah anggaran jarak rumah anda dari kilang pembuatan bahan petrokimia/bahan kimia tersebut?
If Yes, what is the estimated distance from your residence to the petrochemical plant / chemical manufacturing?

☐ < 500 meter *(< 500 meter)*
☐ 500-1 km *(500-1 km)*
☐ >1-1.5 km *(>1-1.5 km)*
☐ >1.5-5 km *(>1.5-5 km)*
☐ >5 km *(>5 km)*

© COPYRIGHT UPM

38) Adakah tempat tinggal anda berdekatan stesen janakuasa?
Do you live nearest to the power station??

☐ Ya / *Yes*

☐ Tidak / *No*

39) Jika Ya, berapakah anggaran jarak rumah anda dari stesen janakuasa tersebut?
If Yes, what is the estimated distance from your residence to the power station?

☐ < 500 meter *(< 500 meter)*

☐ 500- 1 km *(500-1 km)*

☐ >1- 1. 5km *(>1-1.5 km)*

☐ >1. 5- 5km *(>1.5-5 km)*

☐ >5 km *(>5 km)*

BAHAGIAN IV: PERSEKITARAN DI LUAR & DALAM RUMAH
PART IV: OUTDOOR & INDOOR RESIDENTIAL SURROUNDINGS

40) Bagaimanakah kawasan persekitaran rumah anda?
How is your house surroundings?

☐ Kurang berhabuk / *Less dusty*

☐ Sederhana berhabuk / *Fairly dusty*

☐ Sangat berhabuk /*Heavy dusty*

41) Adakah anda mempunyai tempat letak kereta (garaj) berhampiran rumah anda?
Do you have a parking lot (garage) nearest to your residence?

☐ Ya / *Yes*

☐ Tidak / *No*

42) Jika Ya, berapakah anggaran jarak tempat letak kereta dengan rumah anda?
If yes, what is an estimated distance from the garage to your residence?

☐ <100 meter *(<100 meter)*

☐ 100- 500 meter *(100-500 meter)*

☐ >500- 1000 meter *(> 500-1000 meter)*

☐ >1000 meter *(>1000 meter)*

43) Apakah jenis bahan api yang anda gunakan untuk memasak?
What the type of fuel do you used for cooking?

☐ Elektrik / *Electric*

☐ Minyak tanah / *Kerosine*

☐ Arang / *Coal*

☐ Gas memasak / *Cooking gas*

☐ Kayu api / *Fire woods*

44) Kekerapan memasak dalam sehari:
The frequency of cooking in a day:

☐ kali / *times*

45) Kuantiti bahan api yang digunakan untuk memasak dalam sebulan:
The quantity of fuel used for cooking in a month:

☐ Kg / *kg*

© COPYRIGHT UPM

46)	Adakah anda membuka tingkap, kipas atau sistem pengudaraan yang lain semasa memasak? *Do you open windows, fans or other ventilation system during cooking?*	☐ Ya / *Yes* ☐ Tidak / *No*
47)	Adakah anda menggunakan sebarang jenis racun penghalau serangga di dalam rumah anda? *Do you use any type of poison repellent insecticide in your house*	☐ Ya / *Yes* ☐ Tidak / *No*
48)	Jika Ya, apakah jenis racun penghalau serangga yang anda sering gunakan? *If yes, what type of poison repellent insecticide you often used?*	☐ Semburan aerosol / *aerosol* ☐ Elektrik / *Electric* ☐ Lingkaran / *coil*
49)	Kuantiti jenis racun penghalau serangga yang digunakan dalam sebulan: *The quantity of poison repellent insecticide used in a month:*	☐ Botol / kotak/ lingkaran *bottle / box / coil*
50)	Adakah anda menggunakan sebarang jenis pewangi di dalam rumah anda? *Do you use any the air freshener inside your house?*	☐ Ya / *Yes* ☐ Tidak / *No*
51)	Jika Ya, apakah jenis pewangi yang sering digunakan di dalam rumah anda? *If Yes, what type of the air freshener frequently used inside your house?*	☐ Semburan aerosol / *aerosol* ☐ Jenis cecair / *Liquid form* ☐ Jenis pepejal / *Solid form*
52)	Kuantiti jenis pewangi yang sering digunakan di dalam rumah anda dalam sebulan: *The quantity of the air freshener frequently used in your home in a month:*	☐ Botol (*bottle*) / Kotak *(Box)* ☐ Liter per botol *(Liter per bottle)* / Bilangan per kotak *(No per box)*
53)	Adakah anda menggunakan sebarang jenis pewangi di dalam kereta anda? *Do you use any of the air freshener inside your car?*	☐ Ya / *Yes* ☐ Tidak / *No*
54)	Jika Ya, apakah jenis pewangi yang sering digunakan di dalam kereta anda? *If Yes, what type of the air freshener frequently used inside your car?*	☐ Semburan aerosol / *aerosol* ☐ Jenis cecair / *Liquid form* ☐ Jenis pepejal / *Solid form*
55)	Kuantiti jenis pewangi yang sering digunakan di dalam kereta anda dalam sebulan: *The quantity of the air freshener frequently used inside your car in a month:*	☐ Botol (*bottle*) / Kotak *(Box)* ☐ Liter per botol (*Liter per* bottle) Bil per kotak (No per box)

© COPYRIGHT UPM

BAHAGIAN V : PENDEDAHAN TERHADAP ASAP ROKOK
PART V : ENVIRONMENTAL TOBACCO SMOKE (ETS)

56) Adakah terdapat ahli keluarga anda yang tinggal bersama anda yang merokok?
Are there family members who live with you are smoking?
☐ Ya / *Yes*
☐ Tidak / *No*

57) Jika Ya, berapakah bilangan ahli keluarga anda yang tinggal bersama anda yang merokok?
If yes, how many of your family members who live with you are smoking?
[ ]

58) Bilakah ahli keluarga anda tersebut mula merokok?
When he/she is starting to smoking?
[ ] Umur/*age*

Berapakah jumlah batang rokok yang dihisap dalam sehari bagi kesemua ahli keluarga yang merokok?
How many cigarettes consumed a day for all smoking family members?
[ ] Batang/*cigarettes*

Adakah anda terdedah kepada asap rokok dalam tempoh 24 jam sebelumnya?
Have you exposed to the cigarette smoke for past 24 hours?
☐ Ya / *Yes*
☐ Tidak / *No*

Adakah anda sering terdedah kepada asap rokok di tempat kerja?
Are you often exposed to the cigarette smoke in the workplace?
☐ Ya / *Yes*
☐ Tidak / *No*

☐ Sudah Berhenti / *Had stopped*
☐ Tidak pernah / *Never*

Jika Ya, sila jawab soalan 63, 64 & 65 *If Yes, please answer questions 63, 64 & 65*	Jika **Sudah Berhenti**, sila jawab soalan 63, 66, & 67 *If Had stopped, please answer questions 63, 66 & 67*

63) Jika Ya, apakah jenis rokok yang anda hisap?
If Yes, what types of cigarettes do you smoked?

☐ Tembakau / *Tobacco*
☐ Shisha / *shisha*
☐ Rokok elektronik / *E-cigarettes*
☐ Cerut / *cigars*
☐ Vape / *vape*

64) Jika Ya, bilakah anda mula merokok?
If Yes, when did you start smoking?
[ ] Umur/*age*

65) Berapakah bilangan rokok yang dihisap dalam sehari?
How many cigarettes consumed a day?
[ ] Batang/*cigarettes*

66) Sejak bila anda mula dan behenti merokok?
Since when you start and stop smoking? Mula/*Start*:_____Umur/*age* Berhenti/*Stop*:_____Umur/*age*

Sebelum ini, berapakah bilangan rokok yang dihisap dalam sehari?
Before this, how many cigarettes consumed a day

Batang/*cigarettes*

Berapa kerapkah anda menggunakan bahan-bahan berikut untuk sebarang aktiviti atau hobi yang anda lakukan?
How often do you consume these following materials for any activities or hobbies?

Aktiviti/ hobi *Activities/hobbies*	Namakan jenis bahan yang digunakan *Please name the type of material used*	Kekerapan *Frequency*			
		Tidak pernah *Never*	Per bulan *Per month*	Per minggu *Per week*	Per hari *Per day*
Penggunaan racun serangga untuk aktiviti berkebun *The usage of the pesticides for gardening activities*	Jenis racun serangga yang digunakan: *Types of the pesticides used:* _____				
Penggunaan gam pelekat untuk sebarang aktiviti atau hobi yang berkaitan *The usage of the adhesives/glues for any related activities or hobbies*	Jenis gam pelekat yang digunakan: *Types of the adhesives/glues used.* _____				
Penggunaan cat untuk sebarang aktiviti atau hobi yang berkaitan *The usage of the paint solvents for any related activities or hobbies*	Jenis cat yang digunakan: *Types of the paint solvents used:* _____				
Penggunaan bahan-bahan pencuci untuk sebarang aktiviti yang berkaitan *The usage of the cleaning solvents for any related activities*	Jenis bahan-bahan pencuci yang digunakan: *Types of the cleaning solvents used:* _____				

69) Kekerapan anda mengisi minyak di stesen minyak?
How often do you refuel at the petrol stations?

Sehari / *Per day*	☐	kali / *times*	☐	liter / *liter*
Seminggu / *Per week*	☐	kali / *times*	☐	liter / *liter*
Sebulan / *Per month*	☐	kali / *times*	☐	liter / *liter*

70) Adakah anda sering melakukan pembakaran terbuka di kawasan rumah anda seperti membakar daun-daun kering?
Do you frequently do open burning nearest to your residence such as burning the dry leaves?

☐ Ya / *Yes*

☐ Tidak / *No*

© COPYRIGHT UPM

71) Berapakah kekerapan anda melakukan pembakaran terbuka?
How frequent you do open burning?

- ☐ Sehari sekali / *once a day*
- ☐ Seminggu sekali / *once a week*
- ☐ Lebih seminggu sekali / *more than once per week*
- ☐ Sebulan sekali / *once a month*
- ☐ Lain-lain, sila nyatakan: / *Others, please specify:*

72) Berapakah kekerapan anda membersihkan rumah anda?
How often do you clean your home?

- ☐ Sehari sekali / *once a day*
- ☐ Seminggu sekali / *once a week*
- ☐ Lebih seminggu sekali / *more than once per week*
- ☐ Sebulan sekali / *once a month*
- ☐ Lain-lain, sila nyatakan: / *Others, please specify:*

73) Adakah anda kerap menggunakan sebarang ubat gegat di dalam tandas atau almari pakaian di rumah anda ?
Do you regularly use any of mothballs in the toilet or wardrobe in your house?

- ☐ Ya / *Yes*
- ☐ Tidak / *No*

BAHAGIAN VII: TABIAT PEMAKANAN
PART VII: EATING HABIT

74) Adakah anda mengambil minuman beralkohol?
Do you consume the alcohol beverages?

☐ Ya / *Yes* ☐ Sudah Berhenti / *Stopped* ☐ Tidak pernah / *Never*

Jika Ya, sila jawab soalan 75 & 76
If Yes, please answer questions 75 & 76

75) Jika Ya, sudah berapa lamakah anda mengambil minuman beralkohol?
If Yes, when do you start consume the alcohol beverages?

Umur/*age*

76) Berapa kalikah anda mengambil minuman beralkohol?
How many times do you consume the alcohol beverages?

Sebulan / *Per month*: ☐ kali/*times*

Jika Sudah Berhenti, sila jawab soalan 77 & 78
If Had stopped, please answer questions 77 & 7

77) Sejak bila anda mula dan behenti minum?
Since when you start and stop consume the alcohol beverages?

Mula/*Start*:_____Umur/*age*

Berhenti/*Stop*:_____Umur/*age*

78) Sebelum ini, berapa kalikah anda mengambil minuman beralkohol?
Before this, how many times do you consume the alcohol beverages?

Sebulan / *Per month*: ☐ kali/*times*

79) Berapa kerapkah anda mengambil makanan/minuman seperti berikut:
How often do you consume these food/drinks as follow:

Makanan/minuman Food/drinks	Tidak pernah *Never*	Per bulan *Per month*	Per minggu *Per week*	Perhari *Per day*
Makanan diproses/bertin (sardine, tuna) *Processed/Canned food (sardine, tuna)*				
Makanan bergoreng (ayam goreng) *Fried food (fried chicken)*				
Makanan yang dibakar (satay, ayam bakar, daging salai) *Grilled food (satay, chicken roasted, smoked meats)*				
Makanan segera (Burger, kentang goreng) *Fast food (Burger, French fries)*				
Minuman berkarbonat (Coca-cola) *Bicarbonate dnnks (Coke)*				
Minuman berjus (jus oren, limau) *Juice drinks (orange juice, lime juice)*				

80) Adakah anda mengambil sebarang jenis suplemen seperti vitamin C, B, herba dan lain-lain?
Do you consume any supplement such as vitamin C, B, herbs or etc?

☐ Ya / *Yes* ☐ Tidak / *No*

81) Jika Ya, sila nyatakan jenis suplemen tersebut.
If Yes, please specify the types of supplement consumed.

_____

BAHAGIAN VIII: ALAHAN
PART VIII:ALLERGIES

82) Adakah anda alah kepada sebarang makanan seperti makanan laut, kekacang atau lain-lain?
Are you allergic to any food, such as seafood, nuts or other?
☐ Ya / *Yes* ☐ Tidak / *No*

83) Adakah anda alah terhadap haiwan peliharaan seperti kucing dan lain-lain?
Are you allergic to pets such as cats and etc?
☐ Ya / *Yes* ☐ Tidak / *No*

84) Adakah kediaman anda sekarang mempunyai karpet?
Does your current house have a carpet?
☐ Ya / *Yes* ☐ Tidak / *No*

85) Adakah anda sering tidur/baring di karpet tersebut?
Do you often sleep / lie down on the carpet?
☐ Ya / *Yes* ☐ Tidak / *No*

© COPYRIGHT UPM

86) Berapa kerapkah anda membersihkan karpet tersebut
How often do you clean that carpet?

- ☐ Sehari sekali / *once a day*
- ☐ Seminggu sekali / *once a week*
- ☐ Lebih seminggu sekali / *more than once per week*
- ☐ Sebulan sekali / *once a month*
- ☐ Lain-lain, sila nyatakan: / *Others, please specify:*

_____

BAHAGIAN VIII: STATUS PERUBATAN/KESIHATAN
PART VIII: MEDICAL/HEALTH STATUS

87) Adakah anda atau keluarga anda pernah didiagnosis/disahkan mempunyai penyakit-penyakit seperti berikut: (*Do you or your family members have been diagnosed had any these following conditions.*)

☐ Anda / You ☐ Keluarga anda / Your family members

Penyakit berkaitan darah (***Blood related diseases***)

☐ Anemia
(darah rendah, kekurangan bilangan jenis sel darah merah, atau kekurangan zat besi)
Anemia (low blood, low red cell count, or low iron)

☐ Leukopenia
[kekurangan bilangan jenis sel darah putih iaitu jenis sel darah yang membantu dalam proses imuniti (perlindungan) terhadap jangkitan]
Leukeponia (low white cell count that helps in the process of immunity (protection) against infection)

☐ Thrombocytopenia
[kekurangan bilangan sel darah yang dikenali sebagai platelet untuk proses pembekuan darah]
Thrombocytopenia (low platelet count known as platelets for blood clotting process)

☐ Pancytopenia
(kekurangan tiga jenis sel darah iaitu sel darah merah, sel darah putih dan sel darah platelet)
Pancytopenia (low three types of blood cells, namely red cell, white cell & platelets count)

☐ Hemofilia (proses pembekuan darah yang perlahan)
Hemophilia (slow blood clotting process)

☐ Leukemia (bilangan jenis sel darah putih yang tidak normal yang tinggi)
Leukemia (high numbers of abnormal white blood cells)

Penyakit berkaitan hati (***Liver related disease***)

☐ Hepatitis B
[keradangan hati disebabkan oleh jangkitan oleh virus hepatitis B (HBV)]
Hepatitis B [inflammation of the liver caused by infection by the hepatitis B virus (HBV)]

☐ Hepatitis C
[keradangan hati disebabkan oleh jangkitan oleh virus hepatitis C (HCV)]
Hepatitis C [

Penyakit hati berlemak
(Penyakit hati disebabkan pemendapan lemak yang berlebihan di dalam hati kebiasaannya akibat kegemukan)
☐ *Non-alcoholic fatty liver disease (NAFLD) [Liver disease caused by deposition of excessive fat in the liver normally caused by obesity]*

☐ Penyakit hati alkoholik
(Kerosakan hati akibat pengambilan alkohol yang berlebihan)
Alcoholic hepatitis (Liver damage due to overconsumption of alcohol)

☐ Kerosakan hati akibat ubat
Drug-induced hepatitis

©COPYRIGHT UPM

Penyakit / kanser yang lain
Other diseases/cancers

- ☐ Penyakit buah pinggang
  Renal disease
- ☐ Asma
  Asthma
- ☐ Pneumonia (Radang paru-paru)
  Pneumonia (Lung inflammation)
- ☐ Bronkitis kronik (keradangan pada tiub bronkial)
  Chronic Bronchitis (Inflammation of the bronchial tubes)
- ☐ Barah paru-paru
  Lung Cancer
- ☐ Tibi
  Tibi
- ☐ Penyakit/kanser lain yang tidak dinyatakan
  Other diseases/cancers as not mentioned above

  Sila nyatakan:
  Please specify: _____
- ☐ Tiada
  None

88) Jika anda menghidapi sebarang penyakit seperti diatas, sila nyatakan:
If yes to any of the above, please specify:

Tarikh mula penyakit disahkan: ☐
Date of first disease diagnosed:

Tarikh mula menerima rawatan: ☐
Date of first treatment received:

89) Sila nyatakan ubat-ubatan yang anda telah ambil dalam tempoh 30 hari yang lalu (jika ada).
Please list the medications that you have taken in the past 30 days (if any).

i)
ii)
iii)
iv)
v)
vi)

90) Adakah anda pernah mendapat rawatan x-ray/kemoterapi/radioterapi dalam tempoh enam (6) bulan yang lepas?
Do you have received any x-ray/chemotherapy/radiotherapy treatment for the past six (6) months?

☐ Ya / *Yes* ☐ Tidak / *No*

91) Adakah anda pernah menjalani pembedahan?
Have you ever had surgery?

☐ Ya / *Yes* ☐ Tidak / *No*

© COPYRIGHT UPM

PART IX: GEJALA SIMPTOM YANG DIALAMI
PART IX: SELF-PERCEIVED SYMPTOMS

Sila tanda (/) jika Ya
Please tick (/) if Yes

92) Adakah anda kerap menghidapi gejala simptom berikut dalam tempoh **tiga (3) bulan** lalu?
Have you had the following symptoms in the last three (3) months frequently?

- ☐ Pening
  Dizziness
- ☐ Rasa sangat lemah dan letih sepanjang masa
  Feel very weak and tired all the time
- ☐ Sukar untuk menghentikan luka pendarahan
  Difficult to stop bleeding in wounds
- ☐ Pendarahan gusi atau di dalam mulut
  Bleeding from the gums or inside the mouth
- ☐ Sering atau mudah mengalami bengkak
  Frequent or easy bruising
- ☐ Terdapat ketulan / kalenjar/lebam yang membesar pada bahagian badan / leher / ketiak / pangkal paha dan lain-lain
  There are lumps / gland / bumps that grow on the body / neck / armpit / groin etc.
- ☐ Kadar jantung cepat ketika melakukan aktiviti normal/tidak berat
  Rapid heart rate with normal/non-heavy activities
- ☐ Nafas pendek ketika melakukan aktiviti normal/tidak berat
  Shortness of breath during exercise
- ☐ Nafas pendek semasa melakukan senaman
  Shortness of breath during exercise
- ☐ Penurunan berat badan tanpa sebab
  Weight loss for no reason
- ☐ Jangkitan kerap dan berulang-ulang
  Frequent and repeated infections
- ☐ Sering deman / berpeluh pada waktu malam
  Fever / night sweats
- ☐ Sakit tulang / sendi
  Pain in bones/joints
- ☐ Kulit gatal
  Bone pain (ribs/back)
- ☐ Kulit sering bertukar menjadi pucat
  Skin often turned pale
- ☐ Mengalami penglihatan yang kabur atau berganda
  Experience blurring of vision or double vision

© COPYRIGHT UPM

PART XI: SEJARAH KESIHATAN RESPIRATORI
PART XI: HISTORY OF RESPIRATORY HEALTH

Sila tanda (/) jika Ya
Please tick (/) if Yes

93) Adakah anda kerap menghidapi masalah kesihatan berikut di bahagian dada dalam tempoh **tiga (3) bulan** yang lalu?
Do you often suffer from following health problems in the chest in the last three (3) months?

a) Batuk / *Cough*

☐ Adakah anda sering mengalami batuk?
Do you often have a cough?

Jika Ya, sila jawab soalan berikut
If Yes, please answer the following questions

Adakah anda mengalami batuk ketika:
Do you had a cough during:

☐ Demam / *fever*
☐ Bekerja / *working*
☐ sejuk / waktu pagi / selepas bangun dari tidur / *cold / in the morning / at all on getting up*
☐ Seharian / *all the day*

☐ Adakah anda batuk berkahak selama tiga (3) bulan berturut-turut atau lebih sepanjang tahun?
Do you have a cough for three (3) consecutive months or more during the year?

☐ Adakah anda mengikuti rawatan untuk penyakit ini?
Do you follow the treatment for this disease?

Berapa tahun telah anda mengalami batuk tersebut? Sila nyatakan.
For how many years have you had this cough? Please specify

_____ tahun / *year(s)*

b) Batuk berkahak / *Phlegm*

☐ Adakah anda sering mengalami batuk berkahak
Do you often expenence phlegm?

Jika Ya, sila jawab soalan berikut
If Yes, please answer the following questions

Adakah anda mengalami batuk berkahak ketika:
Do you had a phlegm during:

☐ Demam / *fever*
☐ Bekerja / *working*
☐ sejuk / waktu pagi / selepas bangun dari tidur / *cold / in the morning / at all on getting up*
☐ Seharian / *all the day*

☐ Adakah anda batuk berkahak selama tiga (3) bulan berturut-turut atau lebih sepanjang tahun?
Do you have phlegm for three (3) consecutive months or more during the year?

☐ Adakah anda mengikuti rawatan untuk penyakit ini?
Do you follow the treatment for this disease?

☐ Berapa tahun telah anda mengalami batuk berkahak tersebut? Sila nyatakan.
For how many years have you had this phlegm? Please specify.

tahun / *year(s)*

c) Nafas berbunyi / *Wheezing*

☐ Adakah anda pernah mengalami bunyi nafas yang berdehit?
Have you ever felt a wheezing?

Jika Ya, sila jawab soalan berikut
If Yes, please answer the following questions

© COPYRIGHT UPM

Adakah anda mengalami bunyi nafas berdehit ketika:
Do you had a wheezing during:
Demam / *fever*
Bekerja / *working*
sejuk / waktu pagi / selepas bangun dari tidur / *cold / in the morning / at all on getting up*
Seharian / *all the day*

☐ Adakah anda mengalami nafas berdehit selama tiga (3) bulan berturut-turut atau lebih sepanjang tahun?
Do you have a wheezing for three (3) consecutive months or more during the year?

☐ Adakah anda pernah mengalami nafas berbunyi yang menyebabkan anda sukar bernafas?
Have you ever experienced a wheezing which caused to shortness of breath?
Jika Ya, ketika usia berapa anda mengalami serangan tersebut? Sila nyatakan
If Yes, what age you are experiencing these attack(s)? Please specify
_____ tahun / *year*

☐ Adakah anda mengikuti rawatan untuk penyakit ini?
Do you follow the treatment for this disease?

☐ Adakah anda memerlukan sebarang ubatan untuk penyakit tersebut
Have you ever required medicine or treatment for the (se) attack(s)?

d) Sesak Dada / *Breathlessness*

Adakah anda sering mengalami sesak nafas atau sakit dada apabila batuk?
Do you often expenence shortness of breath h or chest pain when coughing?
Jika Ya, sila jawab soalan berikut
If Yes, please answer the following questions
Adakah anda mengalami sesak nafas ketika:
Do you had a shortness of breath during
Demam / *fever*
Bekerja / *working*
sejuk / waktu pagi / selepas bangun dari tidur / *cold / in the morning / at all on getting up*
Seharian / *all the day*

☐ Adakah anda mengalami sesak nafas apabila berjalan dengan cepat atau mendaki bukit?
Are you troubled by shortness of breath when hurrying on the level and walking up a slight hill?
Jika Ya, sila jawab soalan berikut
If Yes, please answer the following questions

☐ Adakah anda berjalan perlahan berbanding dengan mereka yang sama umur dengan anda disebabkan anda mudah mengalami sesak nafas?
Do you have walk slower than people of your age level because of breathlessness?

☐ Adakah anda pernah sesak nafas ketika berjalan?
Do you have ever to stop for breath when walking at your own pace on the level?

☐ Adakah anda pernah sesak nafas selepas berjalan 100 kaki (atau selepas beberapa minit)?
Do you have ever to stop for breath after walking about 100 yards (or after few minutes) on the level?

☐ Adakah anda tercunggap-cunggap ketika keluar dari rumah atau sesak nafas ketika memakai atau menanggalkan baju?
Are you too breathless to leave the house or breathless on dressing or undressing?

☐ Adakah anda mengalami sesak dada selama tiga (3) bulan berturut-berturut atau lebih sepanjang tahun?
Do you had shortness of breath for three (3)consecutive months or more dunng the year

☐ Adakah anda mendapat rawatan doktor untuk masalah ini?
Did you seek medical treatment for this problem?

☐ Adakah anda telah menjalani ujian x-ray kerana masalah sesak nafas?
Have you been tested x-ray because of the shortness of breath?

Terima Kasih

Thank You