
UNIVERSITI PUTRA MALAYSIA

# *OCULAR SYMPTOMS AND TEAR FILM BREAK UP TIME (BUT) AMONG SECONDARY SCHOOL STUDENTS IN SABAH, MALAYSIA: ASSOCIATIONS WITH SCHOOL INDOOR AIR*

**ANIS ZAHIRA BINTI ZAINUDIN**

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BY

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## ABSTRACT

**OCULAR SYMPTOMS AND TEAR FILM BREAK UP TIME (BUT) AMONG SECONDARY SCHOOL STUDENTS IN SABAH, MALAYSIA: ASSOCIATIONS WITH SCHOOL INDOOR AIR**

**ANIS ZAHIRA BINTI ZAINUDIN**

**INTRODUCTION:** The school that have poor indoor air quality can causes the children to experience headache and irritation of the eye, nose, and skin. **OBJECTIVE:** This study aim to investigate the air quality parameter ($PM_{10}$, $PM_{2.5}$, VOC, humidity, temperature, formaldehyde and $CO_2$) in indoor air from school environment with the break up time of the school children. **METHOD:** A set of ISAAC questionnaire was distributed to the Form 2 students, BUT measured by SIBUT and NIBUT and assessment of indoor air parameter was conducted using multirae (formaldehyde), dust trak ($PM_{10}$ & $PM_{2.5}$) and velocicalc (temperature, humidity, VOC & $CO_2$). **RESULTS:** $CO_2$ (p=0.047) and temperature (p=0.034) have correlation with eye swelling. Temperature (p=0.013) and humidity (p=0.012) have correlation with NIBUT of the left eye while temperature (p=0.002), humidity (p=0.004) and VOC (p=0.041) have correlation with NIBUT of the right eye. Regression analysis was conducted and the result showed that father' smoking was the risk factor for eye irritation of respondent (OR=2.309, p=0.022). Respondent who were smoker (OR=1.602, p=0.045), humidity (OR=0.619, p=0.010) and $CO_2$ (OR=0.030, p=0.029) contributed to NIBUT of the left eye. Respondent smoking (OR=1.855, p=0.013) and humidity (OR=0.476, p =0.014) were risk factor for NIBUT of the right eye. **CONCLUSION:** $CO_2$ and temperature level in classroom contributed to eye swelling. Temperature and humidity were significantly correlated with NIBUT of the left eye while temperature, humidity and VOC reduced the tear film break up time for NIBUT of the right eye. Smoking was the risk factor for the tear film break up time as well as the eyes symptoms reported by the respondent. The risk factor for NIBUT of the left eye were respondent's smoking, humidity and $CO_2$ factors. Respondent smoking and humidity were risk factor for NIBUT of the right eye.



**Keywords: Tear film break up time, Ocular symptoms, Self-reported break up time and Non-invasive break up time**

## ABSTRAK

## SIMPTOM OCULAR DAN MASA PECAH FILEM (BUT) DENGAN PELAJAR SEKOLAH-SEKOLAH DI SABAH, MALAYSIA: HUBUNGANNYA DENGAN KUALITI UDARA SEKOLAH

**ANIS ZAHIRA BINTI ZAINUDIN**

**PENGENALAN:** Sekolah yang mempunyai kualiti udara dalaman yang teruk boleh menyebabkan kanak-kanak mengalami sakit kepala dan kerengsaan mata, hidung dan kulit. **OBJEKTIF:** Kajian ini bertujuan untuk mengkaji parameter kualiti udara ($PM_{10}$, $PM_{2.5}$, VOC, kelembapan, suhu, formaldehyde dan $CO_2$) di udara dalaman dari persekitaran sekolah dengan masa istirahat kanak-kanak sekolah. **KAEDAH:** Satu set soal selidik ISAAC telah diedarkan kepada pelajar tingkatan 2, BUT akan diukur menggunakan kaedah SIBUT dan NIBUT dan penilaian parameter udara dalaman dijalankan menggunakan multirae (formaldehyde), dust trak ($PM_{10}$ & $PM_{2.5}$) dan velocicalc (suhu, kelembapan , VOC & $CO_2$). **KEPUTUSAN:** $CO_2$ ($p = 0.047$) dan suhu ($p = 0.034$) mempunyai korelasi dengan bengkak mata. Suhu ($p = 0.013$) dan kelembapan ($p = 0.012$) mempunyai korelasi dengan mata kiri (NIBUT) manakala suhu ($p = 0.002$), kelembapan ($p = 0.004$) dan VOC ($p = 0.041$) mempunyai korelasi dengan mata kanan (NIBUT). Analisis regresi dijalankan dan hasilnya menunjukkan bahawa bapa yang merokok adalah faktor risiko yang menyebabkan kerengsaan mata responden (OR = 2.309, $p = 0.022$). Responden yang perokok (OR = 1.602, $p = 0.045$), kelembapan (OR = 0.619, $p = 0.010$) dan $CO_2$ (OR = 0.030, $p = 0.029$) menyumbang kepada mata kiri (NIBUT). Responden yang perokok (OR = 1.855, $p = 0.013$) dan kelembapan (OR = 0.476, $p = 0.014$) adalah faktor risiko untuk mata kanan NIBUT. **KESIMPULAN:** $CO_2$ dan paras suhu di dalam bilik darjah menyumbang kepada pembengkakan mata. Suhu dan kelembapan berkorelasi dengan mata kiri (NIBUT) sementara suhu, kelembapan dan VOC mengurangkan masa pecah filem untuk mata kanan (NIBUT). Merokok adalah faktor risiko untuk masa pecah filem dan juga gejala mata yang dilaporkan oleh responden. Faktor risiko mata kiri (NIBUT) adalah respondent yang merokok, kelembapan dan $CO_2$. Respondent yang merokok dan kelembapan adalah faktor risiko bagi mata kanan (NIBUT).



**Kata kunci: Masa pecah filem, Simptom ocular, Masa pelepasan diri dilaporkan dan Waktu pemecahan bukan invasif**

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## LIST OF ABBREVIATIONS

| | |
|---|---|
| WHO | World Health Organization |
| USEPA | United States Environmental Protection Agency |
| ICOP | Industry Code of Practice |
| IAQ | Indoor Air Quality |
| BUT | Break Up Time |
| SBUT | Self-reported Break up Time |
| NIBUT | Non-invasive Break up Time |
| $PM_{10}$ | Particulate matter 10 |
| $PM_{2.5}$ | Particulate matter 2.5 |
| VOC | Volatile Organic Compound |
| $CO_2$ | Carbon Dioxide |
| SCHOOL 1 | MRSM |
| SCHOOL 2 | SMK Bandaraya |
| SCHOOL 3 | SMK Sanzac |
| SCHOOL 4 | SMKA Tun Ahmad Shah |
| SCHOOL 5 | SMK Likas |
| SCHOOL 6 | SMK Inanam |
| TEMP | Temperature |
| HUMID | Humidity |
| FORMAL | Formaldehyde |

# CHAPTER 1

# INTRODUCTION

## 1.1 Research Background

The children in Malaysia start school at the age of 4 or 5 to study in kindergarten, then continue to primary school, secondary school and higher education institution. They spend most of their time in indoor environment compared to outdoor environment. The U.S. Environmental Protection Agency (EPA) studies of human exposure to air pollutants indicate that indoor levels of pollutants may be two to five times and occasionally more than 100 times higher than outdoor levels. These levels of indoor air pollutants are of particular concern because most people spend about 90 percent of their time indoors (USEPA, 2018).

The children have the tendency to expose to higher amounts of air pollution ($PM_{10}$, VOC, $NO_2$, $SO_2$, formaldehyde and $CO_2$) in school due to furnishings, cleaning activities, ventilation systems, building materials, motor vehicle exhaust from the nearby traffic, road dust and human indoor activities. The school that have poor indoor air quality can affect children, teacher and staff at school. The children can get headache, fatigue, sneezing and irritation of the eye, nose, throat and skin.

Poor IAQ including inadequate ventilation, contaminated air and extreme temperature are factors that if not adequately addressed, may contribute to absenteeism and reduced students' performance (Choo et al., 2015). Tear film break up time can measured in two ways namely by self-reported break up time (SBUT) and noninvasive break up time (NIBUT).

## 1.2 Problem Statement

Children breathe more air, eat more food and drink more liquid in proportion to their body weight than adults (USEPA, 2017). More than 1 in 4 deaths of children under 5 years of age are attributable to unhealthy environments. A polluted environment is a deadly one particularly for young children. Their developing organs and immune systems, and smaller bodies and airways, make them especially vulnerable to polluted air and water (WHO, 2018).

According to Adenike (2006), eye diseases are common amongst school children. Health education will go a long way in the prevention of ocular diseases amongst school children. Eye examination for all new intakes into both public and private primary and secondary schools is advocated. This will allow for early detection and prompt treatment of eye diseases in the young, which will go a long way in reducing ocular morbidity and unnecessary blindness. A survey conducted in July 2015 polled 1,000 eye care providers (ECPs) and 1,200 dry eye symptomatic adults.

## 1.2 Study Justification

It is important to determine status of ocular health among secondary school student because the student spend most of their time in classroom or indoor environment in school during study time compared to outdoor. There are many indoor air pollutant ($PM_{10}$, $PM_{2.5}$, temperature, humidity, VOC, $CO_2$ and formaldehyde) in classroom that can gave health effect to the student. Poor indoor air quality can causes the student experienced symptoms like eye irritation and eye swelling. Then, it also to determine the status of indoor air pollutant in classroom whether it is in acceptable range or not according to Industry Code of Practice (Indoor Air Quality),DOSH. The data can be used to come out with related suggestions for secondary school student in Kota Kinabalu, Sabah. It will also provide

preliminary and exploratory finding for further study related to ocular symptoms and tear film break up time among secondary school students.

## 1.4 Objective

### 1.4.1 General Objective

To study the relationship between air quality parameter ($PM_{10}$, $PM_{2.5}$, VOC, humidity, temperature, formaldehyde and $CO_2$) in indoor air from school environment with the break up time of the school children

### 1.4.2 Specific Objective

1. To measure and compare indoor air parameter such as $PM_{10}$, $PM_{2.5}$, VOC, humidity, temperature, $CO_2$ and formaldehyde between 6 different schools.

2. To determine the prevalence and compare the ocular symptoms and tear film break up time among school children in Kota kinabalu, Sabah.

3. To determine the relationship between air quality parameter ($PM_{10}$, $PM_{2.5}$, VOC, humidity, temperature, formaldehyde and $CO_2$) of the school indoor environment with ocular symptoms and tear film break up time (BUT) among school children.

4. To determine predictors influencing reported ocular symptoms and tear film break up time (BUT) among the school children in Kota Kinabalu, Sabah

## 1.5 Hypothesis

1. There are significant difference between indoor air parameter such as $PM_{10}$, $PM_{2.5}$, VOC, humidity, temperature, $CO_2$ and formaldehyde between 6 different schools.

2. There are significant difference between prevalence of ocular symptoms and tear film break up time BUT among school children in Kota kinabalu, Sabah.

3. There are significant relationship between indoor air parameter ($PM_{10}$, $PM_{2.5}$, VOC, humidity, temperature, formaldehyde and $CO_2$) of the school indoor environment with ocular symptoms and tear film break up time (BUT) among school children.

4. There is a probability of a predictors is associated reported ocular symptoms and tear film break up time (BUT) among the school children in Kota Kinabalu, Sabah

## 1.6 Conceptual Framework

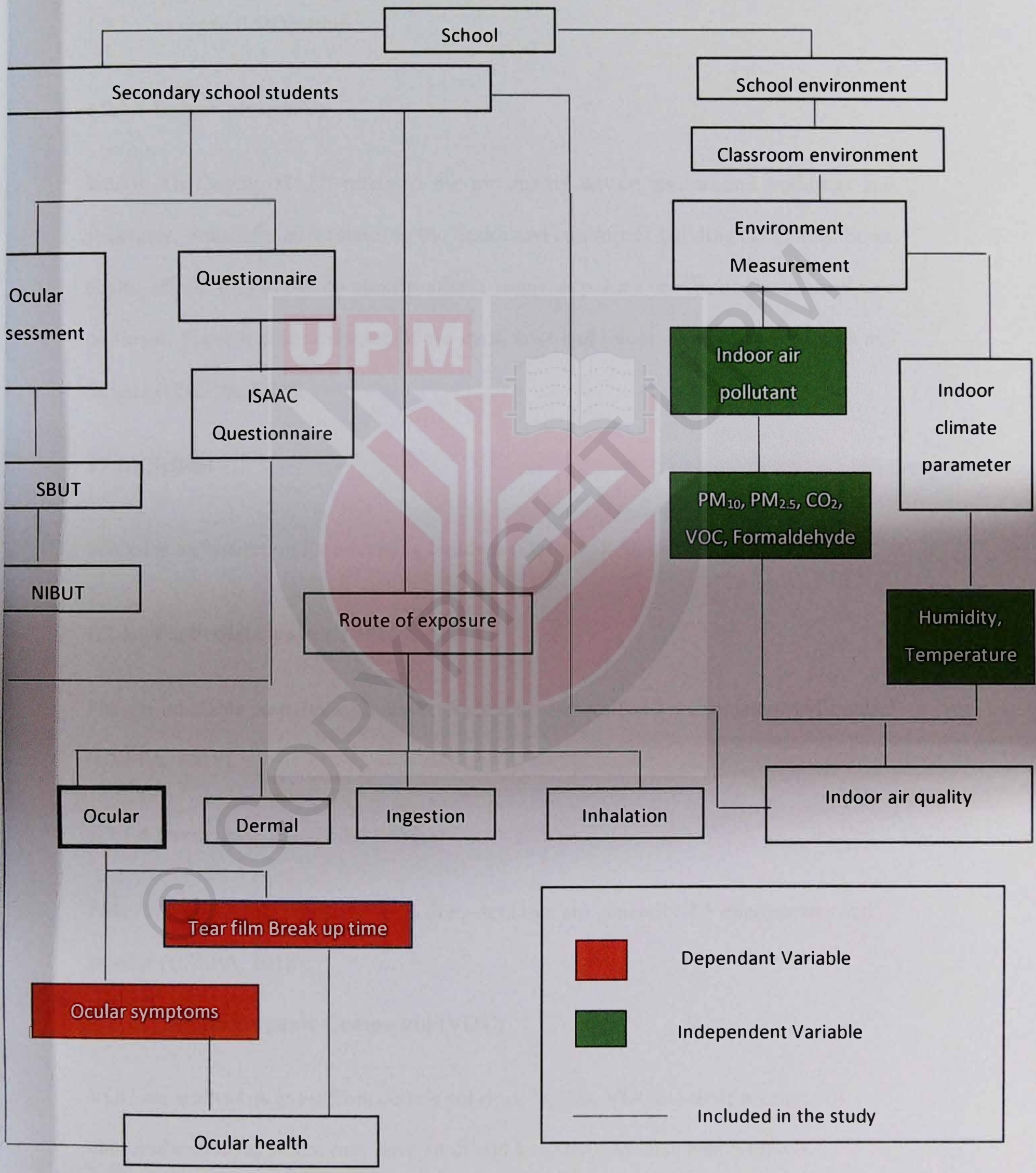



**Figure 1.6: Conceptual Framework of This Study**

## 1.7 Definition of Terms

### 1.7.1 Conceptual Definition

#### 1.7.1.1 Indoor air quality

Indoor Air Quality (IAQ) refers to the air quality within and around buildings and structures, especially as it relates to the health and comfort of building occupants. Some health effects may show up shortly after a single exposure or repeated exposures to a pollutant. These include irritation of the eyes, nose and throat, headaches, dizziness and fatigue (USEPA, 2018).

#### 17.1.2 School

School is an institution for educating children (Oxford Dictionaries, 2019)

#### 1.7.1.3 Particulate matter 10 ($PM_{10}$)

$PM_{10}$ is inhalable particles with diameters that are generally 10 micrometers and smaller (USEPA, 2018).

#### 1.7.1.4 Particulate matter 2.5 ($PM_{2.5}$)

$PM_{2.5}$ is fine inhalable particles with diameters that are generally 2.5 micrometers and smaller (USEPA, 2018).

#### 1.7.1.5 Volatile Organic Compound (VOC)

VOC are emitted as gases from certain solids or liquids. VOCs include a variety of chemicals, some of which may have short and long-term adverse health effects. Concentrations of many VOCs are consistently higher indoors (up to ten times higher) than outdoors (USEPA, 2017).

#### 1.7.1.6 Humidity

The ratio of the partial pressure (or density) of the water vapor in the air to the saturation pressure (or density) of water vapor at the same temperature and the same total pressure (ASHRAE, 2004).

#### 1.7.1.7 Temperature

The temperature of the air surrounding the occupant (ASHRAE, 2004).

#### 1.7.1.8 Formaldehyde

Formaldehyde is a colorless, flammable gas at room temperature and has a strong odor. Exposure to formaldehyde may cause adverse health effects (USEPA, 2018).

#### 1.7.1.9 Carbon Dioxide

Carbon dioxide ($CO_2$) is a colorless, odorless, non-flammable gas that naturally occurs in the atmosphere. $CO_2$ is produced by body metabolism and is a normal component of exhaled breath (USDA, 2019).

#### 1.7.1.10 Eye irritation

Eye irritation is a general term used to describe sensations that bother the eyes like dryness, itchiness, burning and grittiness (American Academy of Ophthalmology, 2019)

#### 1.7.1.11 Eye swelling

Swelling around the eye is inflammation that can affect the eyelids and tissues around the eye (American Academy of Ophthalmology, 2019).

#### 1.7.1.12 Tear film break up time

Tear breakup time (TBUT) is a clinical test used to assess for evaporative dry eye disease (Eye Rounds.org, 2016)

#### 1.7.1.13 Predictor

A person or thing that predicts that something will happen in the future or will be a consequence of something (Oxford Dictionaries, 2019).

#### 1.7.1.14 Route of exposure

Route of exposure is a substance comes into contact with an organism, such as through air or food (Business Dictionary, 2019).

#### 1.7.1.15 Ocular

Ocular were connected with the eyes or vision (Oxford Dictionaries, 2019)

### 1.7.2 Operational Definition

#### 1.7.2.1 Indoor air quality

The instrument use for assessment of indoor air quality Dust Trak to measure $PM_{10}$ and $PM_{2.5}$, Multirae to measure formaldehyde and Velocicalc used to measure $CO_2$, Temperature, Humidity and VOC level in school indoor environment.

#### 1.7.2.2 School

School consist of Secondary school student which was 14 years old students.

### 1.7.2.3 Particulate matter 10 ($PM_{10}$)

$PM_{10}$ level in Classroom can be measured by using Aerosol monitor TSI 8534 Dust Trak DRX.

### 1.7.2.4 Particulate matter 2.5 ($PM_{2.5}$)

$PM_{2.5}$ level in Classroom can be measured by using Aerosol monitor TSI 8534 Dust Trak DRX.

### 1.7.2.5 Volatile Organic Compound (VOC)

Level of Volatile Organic Compound in Classroom can be measured by using Air Velocity Meter/TSI 9565-P.

### 1.7.2.6 Humidity

Humidity level in Classroom can be measured by using Air Velocity Meter/TSI 9565-P.

### 1.7.2.7 Temperature

Level of temperature in Classroom can be measured by using Air Velocity Meter/TSI 9565-P.

### 1.7.2.8 Formaldehyde

Formaldehyde can measured in Classroom by using MultiRAE Lite Model PGM-6208

### 1.7.2.9 Carbon Dioxide

Level of Carbon dioxide in Classroom can measured by using Air Velocity Meter/TSI 9565-P.

#### 1.7.1.10 Eye irritation

Eye irritation is one of the ocular symptoms. Self-reported eye irritation among the secondary school student can get from the Questionnaire.

#### 1.7.1.11 Eye swelling

Eye swelling is one of the ocular symptoms. Self-reported eye swelling among the secondary school student can get from the Questionnaire.

#### 1.7.2.12 Tear film break up time

Tear film break up time are measured by two method which are SBUT and NIBUT.

#### 1.7.1.13 Predictor

Predictor is defined into Personal Characteristic and Indoor air Pollutant. Personal characteristic consist of gender, race, participant smoking, father smoking, mother smoking, family smoking, smoking at home, wear glasses, wear contact lenses, use eye cosmetics, use eye medication and usage of computer/television and handphone. Humidity, temperature, carbon dioxide, formaldehyde, $PM_{10}$, $PM_{2.5}$ and volatile organic compound are indoor air pollutant.

#### 1.7.1.14 Route of exposure

Route of exposure of indoor air pollutant from air in classroom to secondary student was through ocular.

### 1.7.1.15 Ocular

The ocular health can be assess through ocular assessment which consist of SBUT and NIBUT.

# CHAPTER 2

# LITERATURE REVIEW

## 2.1 Indoor air quality

Indoor air quality describes how inside air can affect a person's health, comfort, and ability to work. It can include but not limited to temperature, humidity, mould, bacteria, poor ventilation, or exposure to other chemicals (DOSH, 2019). Indoor Air Quality (IAQ) refers to the air quality within and around buildings and structures, especially as it relates to the health and comfort of building occupants. Understanding and controlling common pollutants indoors can help reduce your risk of indoor health concerns. Health effects from indoor air pollutants may be experienced soon after exposure or, possibly, years later (USEPA, 2018).

Indoor air pollution refers to toxic contaminants that we encounter in our daily lives in our homes, schools and workplaces. According to the California Air Resources Board (ARB), part of the California Environmental Protection Agency, many pollutants build up rapidly indoors, resulting in higher levels than usually found outside, especially in newer homes where tighter construction prevents particles from escaping the home. These pollutants can cause a variety of health problems and can even be fatal at high levels (Healthfully, 2019). IAQ should be defined in relation to its impact on human health, comfort, productivity and learning (Fanger, 2005).

## 2.2 Indoor air pollutant

According to the World Health Report 2002 indoor air pollution is responsible for 2.7% of the global burden of disease. The mission of WHO's Programme on Indoor Air Pollution is the reduction of diseases associated with indoor air pollution, with a particular focus on high-mortality developing countries. Indoor Pollutants include Asbestos, Biological Pollutants, Carbon Monoxide (CO), Formaldehyde/Pressed Wood Products, Lead (Pb), Nitrogen Dioxide ($NO_2$), Pesticides, Radon (Rn), Indoor Particulate Matter, Secondhand Smoke/ Environmental Tobacco Smoke, Stoves, Heaters, Fireplaces and Chimneys and Volatile Organic Compounds (USEPA, 2017).

Indoor air pollution can pose a serious health threat. EPA studies indicate that the levels of many air pollutants may be two to five times higher in indoor air than outdoors. In some cases, indoor air pollutants may even be 100 times higher than outdoors. High levels of indoor pollutants are of particular concern because people may spend as much as 90% of their time indoors. Possible indoor contaminants include Asbestos, Biologic agents, Building materials, radon, tobacco smoke, and wood stoves, gas range, or other heating devices (ATSDR, 2015). Inadequate ventilation can increase indoor pollutant levels by not bringing in enough outdoor air to dilute emissions from indoor sources and by not carrying indoor air pollutants out of the area. High temperature and humidity levels can also increase concentrations of some pollutants (USEPA, 2018).

According to Norback (2017), the study found an association between indoor formaldehyde and ocular symptoms, throat symptoms and tiredness. Indoor levels of xylene, formaldehyde, $NO_2$ and $CO_2$ in schools in Malaysia can be risk factors for ocular, throat symptoms and tiredness among the students

## 2.3 Health effects related to indoor air pollutant

The effects of children's exposure on high concentration of airborne pollutants at schools often associated with increased rate of absenteeism, low productivities and learning performances, and development of respiratory problems. Studies have found out that indoor air quality affects human especially children and the elderly more compared to ambient atmospheric air. Failure to identify and establish indoor air pollution status can increase the chance of long-term and short-term health problems for these young students and staff, reduction in productivity of teachers; and degrade the youngsters learning environment and comfort. Infants and young children have a higher resting metabolic rate and rate of oxygen consumption per unit body weight than adults because they have a larger surface area per unit body weight and because they are growing rapidly. Therefore, their exposure to any air pollutant may be greater (Marzuki, 2010). The indoor environment can influence the eyes by different physiological mechanisms including reduced stability of the lacrimal tear film causing symptoms of eye dryness sometime called " dry eye syndrome"(Wolkoff,2010; Wolkoff et al., 2012).

## 2.4 Ocular symptoms

Thirty-five percent of the occupants of the buildings were dissatisfied with the indoor air quality. Twenty nine percent of the office building occupants reported ocular discomfort (Backman, 1999). Indoor levels of xylene, formaldehyde, $NO_2$ and $CO_2$ in schools in Malaysia can be risk factors for ocular, throat symptoms and tiredness among the students. , indoor environmental conditions involving low humidity, excessive use of video display units (VDU), and high levels of $CO_2$ can be equally threatening to ocular surface health (Monica, 2014). The most common work related symptoms were irritated,

stuffy, or runny nose (20%), itching, burning, or irritation of the eyes (17%), and fatigue (16%). The complaints and work related symptoms associated with indoor air problems were common in office workers (K, Reijula et al, 2004).

## 2.5 Tear film break up time

A higher frequency of EDED findings with TFBUT <10 seconds. The decline in these values correlate with increase in pollutant levels in the metropolitan area compared with the rural area (Monica, 2014). A TBUT of less than 10 seconds is usually reported to be abnormal (Mohammed, 2016). 11.9% was reported weekly ocular symptoms, 18.8% rhinitis, 15.6% throat and 11.1% dermal symptoms, 20.6% headache and 22.1% tiredness (Dan, 2016).

# CHAPTER 3

# METHODOLOGY

## 3.1 Study Design

This was a prevalence study with Cross sectional study design. This study was aimed at assessing indoor air quality in terms of levels of particulate matter ($PM_{10}$ & $PM_{2.5}$), $CO_2$, VOC, Formaldehyde, temperature and humidity and its implications for student health, in terms of ocular symptoms and tear film break up time.

The design of cross sectional studies was selected based on limited time factors and the objectives of the study themselves to look at the symptoms that could be associated with the indoor air parameters in 6 different schools over short periods of time.

## 3.2 Study Location

This was a prevalence study with a cross-sectional study design. For study location, Kota Kinabalu, Sabah were selected by purposive sampling. Kota Kinabalu, Sabah were selected as these schools have many attending students and urban area. Kota Kinabalu, Sabah were selected and six secondary schools in Kota Kinabalu, Sabah were selected by random sampling from that district. Then, from each school, 4 class were selected by random sampling. From each selected class, 20 students were selected by random sampling from the list name of student and 20 students of Form 2 from each class were selected by purposive sampling. This will give a total of 480 students from 6 secondary schools in Kota Kinabalu, Sabah.

## 3.3 Sampling Method

### 3.3.1 Sampling Strategy

#### 3.3.1.1 School

6 secondary school in Kota Kinabalu, Sabah were selected in this study by purposive sampling which consist of school 1, school 2, school 3, school 4, school 5 and school 6.

#### 3.3.1.2 Respondents/ Students

In this study, from each selected class, 20 students were selected by random sampling from the list name of student and 20 students of Form 2 from each class were selected by purposive sampling.

### 3.3.2 Study Population

The study population consists of secondary school students from 6 secondary school in Kota Kinabalu, Sabah. Form 2 students which was 14 years old students were selected as these students was non-examination class (school principal restricted condition) and these children were old enough to fill up the questionnaire with some guidance from the researchers.

### 3.3.3 Sampling Frame

The sampling frame were from the random sampling of 4 classes of Form 2 students in the secondary school. From each selected class, 20 students were selected by random sampling from the name list of students from each secondary school.

### 3.3.4 Sampling Unit

Sample unit in this study consists of a secondary school student who was 14 years old exposed to indoor air pollutant ($PM_{10}$, $PM_{2.5}$, $CO_2$, VOC & Formaldehyde) and indoor climate parameter (Temperature & Humidity) in class during normal lectures in secondary school around Kota Kinabalu, Sabah. Secondary student who are studying in School around Kota Kinabalu, Sabah. The inclusive and exclusive criteria are listed as below:

**Inclusion Criteria:**

i.Consent

Written consent of all selected Year 2 (From 2) (non-examination class) students have to be obtained from their parents or guardians in order to participate in the study. All the procedures involved will be clearly explained to the respondents.

ii.Age

School children age 14 years (Form 2) will be involved in this study. Since these are non-examination class and they are old enough to fill out questionnaires

iii.Duration

Only school children who are in the same school previously in Year 1 (Form 2) will be involved in this study, to indicate that they have been exposed to the same environment for a year.

**Exclusion Criteria:**

i.Nationality

Subjects are Malaysian citizen will be included in the study.

### 3.3.5 Sample Size Calculation

$$N = \frac{Z^2_{1-\alpha/2}\,[\,P\,(1-P)\,]}{d^2}$$

Where,

P = estimated proportion

d = desired precision

n = (1.96)2 × (0.174) (0.897) / (0.05)2

= 240 + 20% of 239 = 288

According to (Dan, et al. 2017), the prevalence of eye symptoms is 17.4 %. Thus, the calculated sample size was 240 respondents. 20% from the total sample size which was roughly 48 was added to reduce the likelihood of refusals. Therefore, the final sample size for this study was 288 respondents.

## 3.4 Variables

Table 3.4.1: List of independent and dependent variables according to objectives

| Objective | Independent variable | Dependent variable |
|---|---|---|
| 1 | Indoor air parameter ($PM_{10}$, $PM_{2.5}$, VOC, humidity, temperature, $CO_2$ and formaldehyde) | Schools |
| 2 | Prevalence | ocular symptoms<br>tear film break up time (BUT) |
| 3 | Air quality parameter ($PM_{10}$, $PM_{2.5}$, VOC, humidity, temperature, formaldehyde and $CO_2$) | ocular symptoms<br>tear film break up time (BUT) |
| 4 | Predictors | reported ocular symptoms<br>tear film break up time (BUT) |

## 3.5 Study Instrumentation

### 3.5.1 Questionnaire

The questionnaire is a modified validated questionnaire translated into Malay language to document information on the demographic data, medical history, information on cigarette smoking, physical activities and lifestyle, psychological well-being and symptoms experienced by the respondents in relation to health effects caused by the indoor air pollutant. Questionnaires were given directly to students. Students completed the questionnaire with the assistance of enumerators/researchers. Questionnaires were collected again after all information was completed. If the students could not answer, the question, parents were called to get further information.

### 3.5.2 Indoor Air assessment using instrument

Indoor climate parameters and selected chemical pollutants were measured including room temperature, relative air humidity, carbon dioxide concentration, volatile organic compounds (VOC), formaldehyde, Particulate matter ($PM_{10}$ & $PM_{2.5}$). Aerosol monitor TSI 8534 Dust Trak DRX were used to measure the level of $PM_{10}$ and $PM_{2.5}$ in indoor school environment, MultiRAE Lite Model PGM-6208 was used to measure the level of formaldehyde and temperature, relative humidity, $CO_2$ and VOC concentrations were measured over 45 minute during normal lectures using Air Velocity Meter/TSI 9565-P.

Aerosol monitor TSI 8534 Dust Trak DRX were used to measure the level of $PM_{10}$ and $PM_{2.5}$ in indoor school environment. This is a multi-channel, data-logging, laser photometer for real-time aerosol readings and aerosol concentration range 0.001 to 150 mg/m3. Portable design allows to measure dust, fumes, mists and smoke and is suitable for engineering control evaluations. This tool can simultaneously measure both mass and size fraction, multi-channel, battery-operated, data-logging, light-scattering laser photometer that gives real-time aerosol mass readings.

MultiRAE Lite Model PGM-6208 was chemical detector which consist of six gas sensors and the conveniences of wireless portability, this multi-gas monitor was versatile and customizable while delivering real-time access to instrument reading and alarm status from any location. This tool consist of sensor, battery, and wireless option as specified, protective rubber boot, filter installed, data logging, travel charger/PC communications adapter, PC communications cable, AC adapter, Calibration adapter, Alkaline battery adapter, Hex tool, Quick start guide, CD with documentation, ProRAE Studio II instrument configuration and data management software, Calibration and test certificate,

Warranty/registration card, Built-in pump, Belt clip installed, 3 spare external filters and PID sensor cap removal.

Temperature, relative humidity, $CO_2$ and VOC concentrations were measured over 45 minute during normal lectures using Air Velocity Meter/TSI 9565-P. This tool were portable, handheld VelociCalc Multi-Function Ventilation Meter 9565-P features a menu-driven user interface for easy operation in your local language. On-screen prompts and step-by-step instructions guide the user through instrument setup, operation, and field calibration.

### 3.5.3 Ocular Assessment

Tear film break up time were measured by Non-invasive break up time (NIBUT) and Self-reported break up time (SIBUT). The Non-invasive break up time (NIBUT) and Self-reported break up time (SIBUT) technique were conducted by the researcher and the researcher was trained by Research Assistance of researcher supervisor

Non-invasive Break up time using Keeler Tearscope-plus

Tear film stability (eye irritation) were also investigated directly, using a small eye microscope (Keeler Tearscope Plus. Keeler UK). The Tearscope investigation is performed 1-2 minutes after the BUT investigation. Tearscope-plus allow you to view the tear film, non-invasively and to make assessments which help in the fitting of contact lenses and the treatment of dry eye. The cold light of the Tearscope-plus provides a white background against which the tear film can be observed and a range of grids, filters and rings specifically developed by Dr.Jean-Pierre Guillon for the Tearscope-plus can be used to enhance assessments. Tearscope-plus can be used in 3 different ways, mounted on a slit lamp, hand held with a slit lamp or hand held with its own detachable magnifier. The component of Tearscope-plus are include protective cover, diffused light, timer screen, Lap time/reset button, Start/Stop button, HI/LO Intensity switch and Standby (on/off) switch.

Setting up your Tearscope-plus by upon receipt, inspect the tearscope-plus for signs of transport damage for Power supply unit pins and enclosure, Power supply unit electrical connection to the instrument and Tearscope-plus enclosure. Before connecting the Tearscope-plus to your electrical power supply, check that the voltage rating of the instrument power supply unit is compatible with your local supply voltage. To using the Tearscope-plus, connect the instrument power supply unit to a suitably rated power outlet socket.

Instrument controls consist of several component which were Lap Time button to show an intermediate event time on the timer display, reset button to reset the timer display, start button to start the timer counting, stop button to stop the timer counting, HI Lamp to select High intensity light, LO Lamp to select low intensity light, On switch to switch the light on and make the timer function available and standby for ready to use.

Removable grids, rings and filter inserts were available with Tearscope-plus. The fine grid, rings and blue filter were placed into the tubular diffuser of the Tearscope-plus. The narrow side is inserted first. Please ensure the grids cover the tubular area. The coarse grid, yellow and blue filters are used with the magnifier. The coarse grid has been designed to maximise grid visibility at low magnification. It allows the practitioner to see irregularities of the cornea and detect poor

tear films without the slit lamp. The fine grid designed for use with the slit lamp magnification. It allows the practitioner to see irregularities of the cornea and detect poor tear films. Start by adjusting the Tearscope-plus and slit lamp so that the grid patterns are in focus, then move the Tearscope-plus and slit lamp away from the eye so that the tear film is in focus. Rings acts as an internally illuminated Placido disc providing full coverage. The keratoscope type rings are projected onto the cornea for observation of corneal distortion. It can be used with the magnifier or slit lamp. The Tearscope-plus can be used to observe the pre-ocular fluorescein stained tear film, its spreading and break up. The blue filter insert was placed inside the illuminating light and the yellow filter was placed inside the magnifier.

Procedure to use the Tearscope were firstly, hold the Tearscope-plus in front of the student. Next, switch on and hold Tearscope-plus close to the student eye with the timer side towards the observer. Then, the observer will see the alignment view (Coarse Grid and fine grid) in the Tearscope-plus, the observer can press the start button to start the timer counting and detect the student tear film break up time. After the tear film break up time of student have been detected, the observer can press the button stop to stop the timer counting and record the result. Press the reset button to reset the timer display for next assessment.

Self-reported Break up time

Tear film stability were estimated by a standardized method, measuring the time the student could keep the eyes open without pain, when watching a fixed point on the wall. This method was been used previously (Gunilla, 2000) and has a good agreement with the fluorescence method for detection of tear film break up time (BUT).

Procedure on Self-reported Break up time was the student will sit on the chair facing the walls that contain X mark. Distance of student with the X mark in the wall between 1.5 to 2 meter. Students were asked to see the X mark on the wall and the observer will measuring the time the student could keep the eyes open without pain when watching X mark on the wall using stop watch. Then, when the student have blink their eye, the observer was click the stop button of the stop watch to record the time.

### 3.6 Data Collection and Data Measurement

Measurement and data collection in this study uses several instruments such as Dust Trak, Air Velocity, Multirae, Tearscope and questionnaires from The International Study of Asthma and Allergies in Childhood. All of these instruments are used to derive data directly from the selected survey location and it is the primary data. This measurement data is an important data in the study so the equipment handling is in accordance with standard operating procedures.

Before the sampling, the questionnaire was distributed to the respondent to get the information about the demographic data. The collection of socio demographic data is using a 7-part questionnaire, Part A: Background Information, Part B: Asthma and Allergies, Part C: Health and allergies experienced now, Part D: Allergic problems among other family members, Part E: childhood, Part F: Current situation of home environment and Part G: Current symptoms. Apart from using the questionnaire, the survey also used Dust Trak to measure $PM_{10}$ and $PM_{2.5}$ and Multirae levels to measure the levels of formaldehyde. Water is used to measure temperature, humidity, $CO_2$ and VOC levels in the class.

Data was collected during January until February 2019 in school around Kota Kinabalu, Sabah. The set of questionnaire adapted from ISAAC Questionnaire was distributed to the student to identify their socio-demographic background, smoking status and ocular symptoms. The respondent were given the questionnaire to answer at their school during assessment. After the student have been finished completed the questionnaire the student was proceed with Ocular Assessment. Ocular assessment consist of two test which were SBUT and NIBUT.

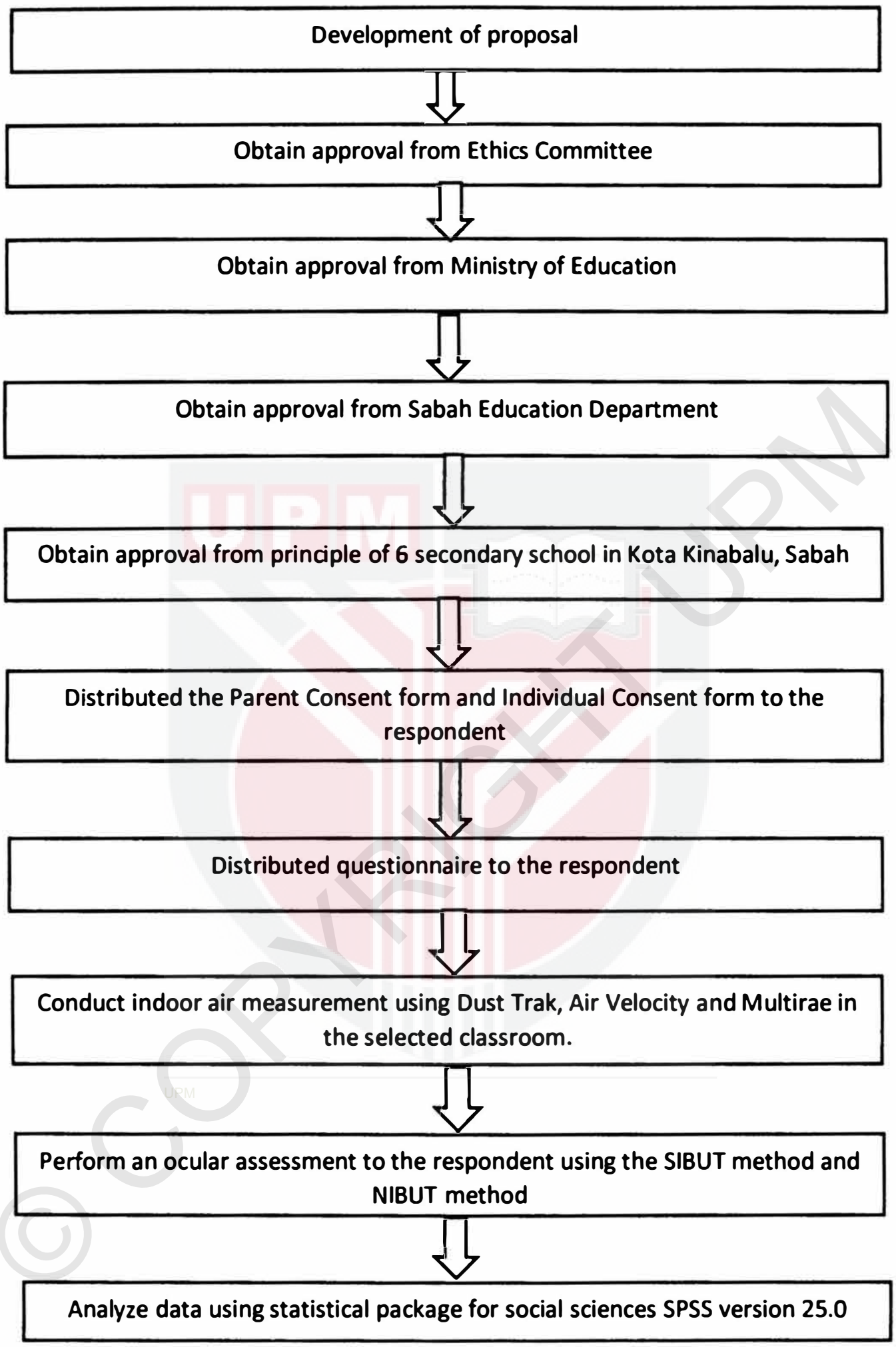



**Figure 3.5 : Data Collection Process**

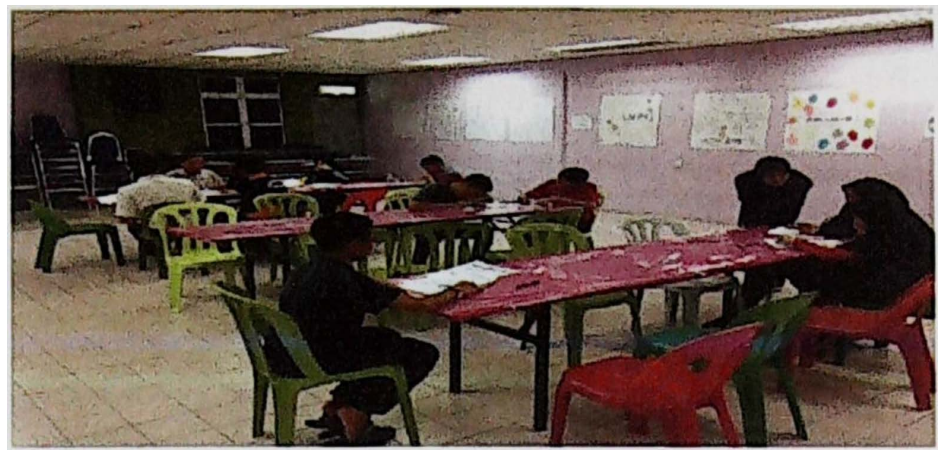


Figure 3.6 : Data Collection in School 1

Figure 3.7 : Data Collection in School 2

Figure 3.8 : Data collection in school 3

**Figure 3.9 : Data collection in school 4**

**Figure 3.10 : Data collection in school 5**

**Figure 3.11 : Data collection in school 6**

### 3.7 Data Analysis

The data obtained from this study were analyzed using the statistical package for social sciences (SPSS), the statistical software analysis version 25, Strata Software and Microsoft Excel. The analysis will be conducted in the univariate, bivariate and multivariate level.

#### 3.7.1 Univariate level analysis

The data obtained are analyzed and descriptive type analysis will be used at this level. This is because the mean (mean), frequency (mode), median and standard deviation will describe the respondent background of the study.

#### 3.7.2 Bivariate level analysis

For this stage, the analysis used to examine the relevance and the differences between the variables. There are several statistical tests that have been used in this analysis including spearman rho correlation test. The spearman correlation test used to determine the relationship between two variables to measuring how close the association between the variables.

#### 3.7.3 Multivariate level analysis

In multivariate ranking analysis, multiple regression tests are used to identify the major factors affecting ocular symptoms and tear film break up time among secondary school students in Kota Kinabalu, Sabah.

**Table 3.6.1 : List of Statistical Analysis**

| Objective | Statistical Analysis |
|---|---|
| To measure and compare indoor air parameter such as $PM_{10}$, $PM_{2.5}$, VOC, humidity, temperature, $CO_2$ and formaldehyde between 6 different schools | Kruskall Wallis |
| To determine the prevalence and compare the ocular symptoms and tear film break up time (BUT) among school children in Kota kinabalu, Sabah | Descriptive analysis |
| To determine the relationship between air quality parameter ($PM_{10}$, $PM_{2.5}$, VOC, humidity, temperature, formaldehyde and $CO_2$) of the school indoor environment and dust with ocular symptoms and tear film break up time (BUT) among school children | Spearman Correlation |
| To determine the risk factors that influence reported ocular symptoms and tear film break up time (BUT) among the school children in Kota Kinabalu | Multiple linear regression |

### 3.8 Data quality control

Quality control needs to be done to minimize weaknesses in a material or instrument. Errors and bias of the study can be avoided if quality control is performed. If quality control is not done, then the results may be affected by this factor.

Dust Trak has been calibrated before it is used to measure the level of particulate matter ($PM_{10}$ & $PM_{2.5}$) in the class and all instructions and ways of use are in accordance with the manuals prepared.

Air Velocity has been calibrated before it is used to measure temperature, humidity, VOC and $CO_2$ levels in the class and all instructions and ways of use are in accordance with the manuals prepared.

Multirae also has been calibrated before it is used to measure the levels of formaldehyde in the class and all instructions and how to use are according to the manuals already provided.

### 3.9 Ethical Consideration

This study had been approved from the University Ethics Committee for Researches Involving Human Subject of Universiti Putra Malaysia (JKEUPM-2017-208). Written inform consent was requested from the respondents who were selected to participate in this study before the data was collected.

# CHAPTER 4

# RESULTS

## 4.1 Descriptive data on Socio-Demographic Background

### 4.1.1 Socio-Demographic Background between 6 school in Kota Kinabalu, Sabah

Referring Table 1, majority of respondent was female student from School 4. Majority of student's race among 6 school in Kota Kinabalu Sabah were Bajau. The majority of father education level was secondary school.

Most of the respondent's father was the fulltime worker. University level was the highest mother education level for School 1 and School 4 and the highest mother education for School 2, School 3, School 5 and School 6 were secondary school level. Mother working status for School 1, School 3 and School 4 was fulltime workers while School 2, School 5 and School 6 was not working. Majority of household income were less than RM 1500.

Table 1: Socio-Demographic Background between 6 school in Kota Kinabalu, Sabah (N=343)

| | School | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| **Gender** | | | | | | |
| Male | 13(33.3) | 14(24.1) | 19(43.2) | 27(35.5) | 42(73.7) | 25(36.2) |
| Female | 26(66.7) | 44(75.9) | 25(56.8) | 49(64.5) | 15(26.3) | 44(63.8) |
| **Race** | | | | | | |
| Kadazan-dusun | 13(33.3) | 13(22.4) | 3(6.8) | 7(9.2) | 3(5.3) | 12(17.4) |
| Bajau | 5(12.8) | 26(44.8) | 19(43.2) | 21(27.6) | 23(40.4) | 28(40.6) |
| Murut | 4(10.3) | 2(3.4) | 1(2.3) | 0(0.0) | 0(0.0) | 0(0.0) |
| Malay | 4(10.3) | 1(1.7) | 3(6.8) | 27(35.5) | 5(8.8) | 3(4.3) |
| Others | 13(33.3) | 16(27.6) | 18(40.9) | 21(27.6) | 26(45.6) | 26(37.7) |
| **Birthday month** | | | | | | |
| January | 3(7.7) | 8(13.8) | 6(13.6) | 9(11.8) | 7(12.3) | 7(10.1) |
| February | 2(5.1) | 5(8.6) | 4(9.1) | 7(9.2) | 1(1.8) | 5(7.2) |
| March | 9(23.1) | 6(10.3) | 5(11.4) | 6(7.9) | 3(5.3) | 4(5.8) |
| April | 8(20.5) | 4(6.9) | 4(9.1) | 8(10.5) | 5(8.8) | 4(5.8) |
| May | 4(10.3) | 4(6.9) | 3(6.8) | 7(9.2) | 2(3.5) | 7(10.1) |
| June | 1(2.6) | 3(5.2) | 1(2.3) | 7(9.2) | 8(14.0) | 6(8.7) |
| July | 4(10.3) | 1(1.7) | 4(9.1) | 4(5.3) | 4(7.0) | 5(7.2) |
| August | 1(2.6) | 1(1.7) | 6(13.6) | 3(3.9) | 7(12.3) | 10(14.5) |
| September | 1(2.6) | 4(6.9) | 3(6.8) | 8(10.5) | 2(3.5) | 5(7.2) |
| October | 3(7.7) | 2(3.4) | 1(2.3) | 7(9.2) | 2(3.5) | 3(4.3) |
| November | 2(5.1) | 6(10.3) | 4(9.1) | 3(3.9) | 3(5.3) | 6(8.7) |
| Disember | 1(2.6) | 5(8.6) | 3(6.8) | 7(9.2) | 6(10.5) | 7(10.1) |
| **Father education** | | | | | | |
| No formal school | 0(0.0) | 3(5.2) | 2(4.5) | 1(1.3) | 5(8.8) | 2(2.9) |
| Primary school | 1(2.6) | 7(12.1) | 7(15.9) | 2(2.6) | 4(7.0) | 7(10.1) |
| Secondary school | 21(53.8) | 38(65.5) | 30(68.2) | 17(22.4) | 39(68.4) | 46(66.7) |
| Certificate/ A level/ Diploma | 11(28.2) | 4(6.9) | 1(2.3) | 20(26.3) | 2(3.5) | 9(13.0) |
| University | 6(15.4) | 3(5.2) | 3(6.8) | 36(47.4) | 6(10.5) | 5(7.2) |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Father working status** | | | | | | |
| Not working | 5(12.8) | 6(10.3) | 10(22.7) | 5(6.6) | 8(14.0) | 6(8.7) |
| Part-time | 7(17.9) | 19(32.8) | 5(11.4) | 9(11.8) | 14(24.6) | 14(20.3) |
| Full-time | 27(69.2) | 28(48.3) | 28(63.6) | 62(81.6) | 33(57.9) | 49(71.0) |
| **Mother education** | | | | | | |
| No formal school | 1(2.6) | 5(8.6) | 1(2.3) | 1(1.3) | 8(14.0) | 3(4.3) |
| Primary school | 3(7.7) | 7(12.1) | 8(18.2) | 1(1.3) | 7(12.3) | 8(11.6) |
| Secondary school | 11(28.2) | 37(63.8) | 28(63.3) | 24(31.6) | 32(56.1) | 44(63.8) |
| Certificate/ A level/ Diploma | 10(25.6) | 3(5.2) | 3(6.8) | 20(26.3) | 5(8.8) | 7(10.1) |
| University | 14(35.9) | 4(6.9) | 3(6.8) | 30(39.5) | 3(5.3) | 7(10.1) |
| **Mother working status** | | | | | | |
| Not working | 13(33.3) | 41(70.7) | 20(45.5) | 19(25.0) | 31(54.4) | 40(58.0) |
| Part-time | 4(10.3) | 2(3.4) | 2(4.5) | 2(2.6) | 7(12.3) | 7(10.1) |
| Full-time | 22(56.4) | 13(22.4) | 21(47.7) | 55(72.4) | 16(28.1) | 22(31.9) |
| **Household income** | | | | | | |
| Less than RM 1500 | 11(28.2) | 37(63.8) | 22(50.0) | 5(6.6) | 25(43.9) | 38(55.1) |
| RM 1500 – RM 3000 | 8(20.5) | 14(24.1) | 10(22.7) | 9(11.8) | 17(29.8) | 18(26.1) |
| More than RM 3000 | 20(51.3) | 4(6.9) | 10(22.7) | 62(81.6) | 6(10.5) | 13(18.8) |

4.2 Descriptive data on health status of respondent and family member

4.2.1 Prevalence of respondent's self-reported allergy

Referring Table 2, School 5 was the highest student who have a cat allergy. Student from school 3 and School 4 have allergy to dog. The majority of student who have allergy to mold and pollen came from School 5 while School 6 was the highest respondent who have food allergy.

4.2.2 Family health condition

Referring to Table 3, the highest father asthma was from the father of School 5 student. School 6 have the highest mother asthma and sibling asthma compared to other school. School 4 was the majority of family member who experienced of nose allergy for father, mother and siblings. father of School 2 students and father of School 6 student had experienced eczema. The highest of mother of respondent had experienced the eczema came from School 3, School 4 and School 6. The highest of sbilings who had eczema allergy were from School 4.

Table 2: Prevalence of respondent's self-reported allergy (N=343)

| | School | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Cat allergy | 3(7.7) | 2(3.4) | 4(9.1) | 5(6.6) | 8(14.0) | 5(7.2) |
| Dog allergy | 0(0.0) | 0(0.0) | 2(4.5) | 2(2.6) | 0(0.0) | 0(0.0) |
| Mold allergy | 1(2.6) | 2(3.4) | 4(9.1) | 2(2.6) | 8(14.0) | 6(8.7) |
| Pollen allergy | 2(5.1) | 3(5.2) | 1(2.3) | 1(1.3) | 5(8.8) | 2(2.9) |
| Food allergy | 6(15.4) | 11(19.0) | 9(20.5) | 8(10.5) | 9(15.8) | 13(18.8) |

Table 3: Prevalence of family health condition (N=343)

| | School | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| **Asthma** | | | | | | |
| Father | 3(7.7) | 2(3.4) | 1(2.3) | 2(2.6) | 4(7.0) | 2(2.9) |
| Mother | 2(5.1) | 5(8.6) | 4(9.1) | 3(3.9) | 5(8.8) | 10(14.5) |
| Siblings | 7(17.9) | 8(13.8) | 9(20.5) | 13(17.1) | 9(15.8) | 21(30.4) |
| **Nose allergy** | | | | | | |
| Father | 2(5.1) | 4(6.9) | 5(11.4) | 9(11.8) | 4(7.0) | 5(7.2) |
| Mother | 2(5.1) | 4(6.9) | 4(9.1) | 7(9.2) | 4(7.0) | 3(4.3) |
| Siblings | 6(15.4) | 10(17.2) | 6(13.6) | 14(18.4) | 6(10.5) | 9(13.0) |
| **Eczema** | | | | | | |
| Father | 1(2.6) | 4(6.9) | 0(0.0) | 1(1.3) | 0(0.0) | 4(5.8) |
| Mother | 3(7.7) | 3(5.2) | 4(9.1) | 4(5.3) | 3(5.3) | 4(5.8) |
| Siblings | 3(7.7) | 6(10.3) | 8(18.2) | 9(11.8) | 5(8.8) | 4(5.8) |

4.2.3 Prevalence of smoking status of respondent and family member

Referring to Table 4, the highest respondent smoking was from school 5, highest father smoking was from school 6, mother smoking status was higher from school 3 and school 5 was higher of smoking status among members.

Table 4: Prevalence of smoking status of respondent and family member (N=343)

| | School | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Respondent smoking | 0(0.0) | 4(6.9) | 5(11.4) | 0(0.0) | 14(24.6) | 4(5.8) |
| Father smoking | 15(38.5) | 33(56.9) | 26(59.1) | 29(38.2) | 33(57.9) | 40(58.0) |
| Mother smoking | 0(0.0) | 0(0.0) | 4(9.1) | 1(1.3) | 2(3.5) | 2(2.9) |
| Family smoking | 13(33.3) | 20(34.5) | 20(45.5) | 23(30.3) | 33(57.9) | 29(42.0) |

4.2.4 Frequency of smoking at home

Referring to Table 5, the frequency of smoking at home for sometime was higher at school 6, the highest frequency of smoking at home for always (1-4 times/week) was from school 2 while frequency of smoking at home for everyday was highest for school 6.

Table 5: Frequency of smoking at home (N=343)

| | School | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Smoking at home | | | | | | |
| Never | 20(51.3) | 27(46.6) | 17(38.6) | 51(67.1) | 20(35.1) | 28(40.6) |
| Sometime (1-3 times in a month) | 7(17.9) | 10(17.2) | 4(9.1) | 10(13.2) | 9(15.8) | 11(15.9) |
| Always (1-4 times/week) | 2(5.1) | 7(12.1) | 3(6.8) | 5(6.6) | 5(8.8) | 2(2.9) |
| Everyday | 10(25.6) | 14(24.1) | 19(43.2) | 10(13.2) | 22(38.6) | 28(40.6) |

4.3 Prevalence of respondent's personal characteristic

Referring to Table 6, majority of respondent were wearing glasses came from School 1. Majority of student who wearing contact lenses came from school 5, most of student who use eye cosmetics was student from school 6 and majority of student who use eye medication came from school 3 and school 5. The highest respondent who spent in front of computer/ television/ handphone came from school 4 which more than 3 hours/day.

Table 6: Prevalence of respondent's personal characteristic (N=343)

| | School | | | | | |
|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** |
| **Wear Glasses** | 11(28.2) | 5(8.6) | 8(18.2) | 21(27.6) | 9(15.8) | 6(8.7) |
| **Wear Contact lenses** | 1(2.6) | 1(1.7) | 1(2.3) | 0(0.0) | 2(3.5) | 2(2.9) |
| **Use Eye cosmetics** | 6(15.4) | 10(17.2) | 4(9.1) | 2(2.6) | 8(14.0) | 11(15.9) |
| **Use Eye medication** | 2(5.1) | 3(5.2) | 5(11.4) | 4(5.3) | 5(8.8) | 3(4.3) |
| **computer/ television/ handphone usage** | | | | | | |
| 1-2 hours/day | 12(30.8) | 19(32.8) | 12(27.3) | 9(11.8) | 13(22.8) | 17(24.6) |
| 2-3 hours/day | 7(17.9) | 18(31.0) | 11(25.0) | 20(26.3) | 21(36.8) | 21(30.4) |
| More than 3 hours/day | 14(35.9) | 17(29.3) | 20(45.5) | 36(47.4) | 22(38.6) | 26(37.7) |

4.4 Indoor air pollutant level in 6 school in Kota Kinabalu, Sabah

**(a) Humidity level in 6 school in Kota Kinabalu, Sabah.**

Based on Table 7, Kruskall Wallis tests were conducted to test the first hypothesis to compare humidity levels between 6 different schools. From this test, it show that there is significant differences between humidity levels between 6 different schools with p-value were 0.006

**(b) $CO_2$ level in 6 school in Kota Kinabalu, Sabah.**

Based on Table 7, Kruskall Wallis tests were conducted to test the first hypothesis to compare $CO_2$ levels between 6 different schools. From this test, it show that there is no significant differences between $CO_2$ levels between 6 different schools with p-value were 0.132

**(c) VOC level in 6 school in Kota Kinabalu, Sabah.**

Based on, Table 7, Kruskall Wallis tests were conducted to test the first hypothesis to compare VOC levels between 6 different schools. From this test, it show that there is significant differences between VOC levels between 6 different schools with p-value were 0.001

**(d) $PM_{2.5}$ level in 6 school in Kota Kinabalu, Sabah.**

According to Table 7, Kruskall Wallis tests were conducted to test the first hypothesis to compare $PM_{2.5}$ levels between 6 different schools. From this test, it show that there is no significant differences between $PM_{2.5}$ levels between 6 different schools with p-value were 0.706

**(e) Temperature level in 6 school in Kota Kinabalu, Sabah**

According to Table 7, Kruskall Wallis tests were conducted to test the first hypothesis to compare temperature levels between 6 different schools. From this test, it show that there is significant differences between temperature levels between 6 different schools with p-value were 0.011

**(f) Formaldehyde level in 6 school in Kota Kinabalu, Sabah.**

Based on Table 7, Kruskall Wallis tests were conducted to test the first hypothesis to compared formaldehyde levels between 6 different schools. From this test, it show that there is significant differences between formaldehyde levels between 6 different schools with p-value were 0.019.

**(g) $PM_{10}$ level in 6 school in Kota Kinabalu, Sabah.**

According to Table 7, Kruskall Wallis tests were conducted to test the first hypothesis to compare $PM_{10}$ levels between 6 different schools. From this test, it show that there is no significant differences between $PM_{10}$ levels between 6 different schools with p-value were 0.252.

Table 7: Indoor air pollutant level in 6 school in Kota Kinabalu, Sabah (N=29)

| Variable | Median (IQR) | z statistic | p value |
|---|---|---|---|
| **Temperature (°C)** | | | |
| School 1 | 26.300 ± 2.2 | 14.949 | 0.011* |
| School 2 | 26.300 ± 0.9 | 14.949 | 0.011* |
| School 3 | 25.100 ± 0.0 | 14.949 | 0.011* |
| School 4 | 25.400 ± 3.4 | 14.949 | 0.011* |
| School 5 | 30.300 ± 0.0 | 14.949 | 0.011* |
| School 6 | 31.950 ± 1.0 | 14.949 | 0.011* |
| **Humidity (%)** | | | |
| School 1 | 76.200 ± 4.3 | 16.374 | 0.006* |
| School 2 | 63.800 ± 6.3 | 16.374 | 0.006* |
| School 3 | 67.400 ± 6.9 | 16.374 | 0.006* |
| School 4 | 68.200 ± 3.0 | 16.374 | 0.006* |
| School 5 | 65.500 ± 3.4 | 16.374 | 0.006* |
| School 6 | 59.800 ± 7.8 | 16.374 | 0.006* |
| **$PM_{10}$ (ug/m3)** | | | |
| School 1 | 0.024 ± 0.010 | 6.603 | 0.252 |
| School 2 | 0.040 ± 0.018 | 6.603 | 0.252 |
| School 3 | 0.025 ± 0.000 | 6.603 | 0.252 |
| School 4 | 0.026 ± 0.018 | 6.603 | 0.252 |
| School 5 | 0.028 ± 0.000 | 6.603 | 0.252 |
| School 6 | 0.028 ± 0.009 | 6.603 | 0.252 |
| **$PM_{2.5}$ (ug/$m^3$)** | | | |
| School 1 | 0.021 ± 0.008 | 2.959 | 0.706 |
| School 2 | 0.027 ± 0.014 | 2.959 | 0.706 |
| School 3 | 0.019 ± 0.006 | 2.959 | 0.706 |
| School 4 | 0.019 ± 0.012 | 2.959 | 0.706 |
| School 5 | 0.024 ± 0.01 | 2.959 | 0.706 |
| School 6 | 0.022 ± 0.012 | 2.959 | 0.706 |

| | | | |
|---|---|---|---|
| **$CO_2$ (ppm)** | | | |
| School 1 | 566.000 ± 203.5 | 8.483 | 0.132 |
| School 2 | 464.000 ± 92.0 | 8.483 | 0.132 |
| School 3 | 409.000 ± 8.0 | 8.483 | 0.132 |
| School 4 | 416.000 ± 50.5 | 8.483 | 0.132 |
| School 5 | 501.000 ± 119.0 | 8.483 | 0.132 |
| School 6 | 442.000 ± 106.0 | 8.483 | 0.132 |
| **VOC (ppm)** | | | |
| School 1 | 0.560 ± 0.16 | 19.971 | 0.001* |
| School 2 | 0.450 ± 0.11 | 19.971 | 0.001* |
| School 3 | 0.480 ± 0.10 | 19.971 | 0.001* |
| School 4 | 0.560 ± 0.16 | 19.971 | 0.001* |
| School 5 | 0.690 ± 3.21 | 19.971 | 0.001* |
| School 6 | 7.520 ± 5.53 | 19.971 | 0.001* |
| **Formaldehyde (ppm)** | | | |
| School 1 | 0.023 ± 0.029 | 13.485 | 0.019* |
| School 2 | 0.003 ± 0.019 | 13.485 | 0.019* |
| School 3 | 0.007 ± 0.000 | 13.485 | 0.019* |
| School 4 | 0.000 ± 0.004 | 13.485 | 0.019* |
| School 5 | 0.002 ± 0.000 | 13.485 | 0.019* |
| School 6 | 0.023 ± 0.028 | 13.485 | 0.019* |

*p-value significant at 0.05 level

## 4.5 Prevalence of respondent's Ocular Symptoms

Referring to Table 8, majority of the respondent was never experienced eye irritation and the highest frequency of respondent who experienced eye irritation was 34.1% for sometimes (1-3 times in a month). Majority of the respondent was never experienced eye swelling and the highest frequency of respondent who experienced eye swelling was 17.9% for sometimes (1-3 times in a month).

Table 8: Prevalence of respondent's Ocular Symptoms (N=343)

| | School | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| **Eye irritation** | | | | | | |
| Never | 69.2% | 74.1% | 54.5% | 65.8% | 64.9% | 59.4% |
| 1-3 times in a month | 20.5% | 15.5% | 34.1% | 21.1% | 17.5% | 26.1% |
| 1-4 times/week | 7.7% | 5.2% | 11.4% | 9.2% | 15.8% | 10.1% |
| Every day | 2.6% | 5.2% | 0.0% | 3.9% | 1.8% | 4.3% |
| **Eye Swelling** | | | | | | |
| Never | 79.5% | 81.0% | 84.1% | 88.2% | 80.7% | 85.5% |
| 1-3 times in a month | 17.9% | 15.5% | 15.9% | 9.2% | 3.5% | 11.6% |
| 1-4 times/week | 2.6% | 1.7% | 0.0% | 1.3% | 14.0% | 2.9% |
| Every day | 0.0 | 1.7% | 0.0% | 1.3% | 1.8% | 0.0% |

## 4.6 Prevalence of Tear film break up time among school children in Kota Kinabalu, Sabah

Referring to Table 9, the highest student who experienced dry eye for left eye came from school 5 while the highest student who have normal left eye came from school 1. Majority of student who experienced dry eye for right eye was school 5 while majority of student who have normal eye for right eye was school 1. Most of respondent who have normal both eye for SIBUT came from school 4 and the highest respondent who have dry eye for SIBUT was student from school 5.

Table 9: Prevalence of BUT among school children (N=343)

| | School | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| **Left eye (NIBUT)** | | | | | | |
| Normal | 79.5% | 10.3% | 13.6% | 17.1% | 10.5% | 17.4% |
| Marginal | 17.9% | 63.8% | 38.6% | 40.8% | 3.5% | 24.6% |
| Dry eye | 2.6% | 25.9% | 47.7% | 42.1% | 86.0% | 58.0% |
| **Right eye (NIBUT)** | | | | | | |
| Normal | 76.9% | 12.1% | 13.6% | 13.2% | 10.5% | 11.6% |
| Marginal | 20.5% | 53.4% | 43.2% | 36.8% | 5.3% | 29.0% |
| Dry eye | 2.6% | 34.5% | 43.2% | 50.0% | 84.2% | 59.4% |
| **SIBUT** | | | | | | |
| Normal | 82.1% | 58.6% | 68.2% | 67.1% | 49.1% | 56.5% |
| Marginal | 15.4% | 27.6% | 15.9% | 23.7% | 35.1% | 33.3% |
| Dry eye | 2.6% | 13.8% | 15.9% | 9.2% | 15.8% | 10.1% |

4.7 Spearman correlation test to see the relationship between indoor air pollutant levels with the prevalence of ocular symptoms

Based on the Table 10, to test the third hypothesis, the spearman correlation test was conducted to see the relationship between $PM_{10}$, $PM_{2.5}$, $CO_2$, VOC, formaldehyde, temperature and humidity levels with eye irritation, eye swelling, NIBUT of the eye left, NIBUT of the eye right and SIBUT. There is no significant difference between $PM_{10}$, $PM_{2.5}$, $CO_2$, VOC, formaldehyde, temperature and humidity with eye irritation.

There is significant difference between $CO_2$ and temperature with eye swelling. To assess the direction of linear relationship between $CO_2$ and temperature with eye swelling, a bivariate Spearman Correlation (r ) were calculated. The bivariate correlation between $CO_2$ and eye swelling

was positive and fair, (r = 0.372, p = 0.047). The bivariate correlation between temperature and eye swelling was positive and fair, (r = 0.394, p =0.034).

There is significant difference between temperature and humidity with NIBUT left eye. To assess the direction of linear relationship between temperature and humidity with NIBUT left eye, a bivariate Spearman Correlation (r ) were calculated. The bivariate correlation between temperature and NIBUT left eye was positive and fair, (r = 0.457, p = 0.013). The bivariate correlation between humidity and NIBUT left eye was positive and fair, (r = 0.458, p = 0.012).

There is significant difference between temperature, humidity and VOC with NIBUT right eye. To assess the direction of linear relationship between temperature, humidity and VOC with NIBUT right eye, a bivariate Spearman Correlation (r ) were calculated. The bivariate correlation between temperature and NIBUT right eye was positive and good, (r = 0.550, p =0.002). The bivariate correlation between humidity and NIBUT right eye was positive and good, (r = 0.517, p =0.004). The bivariate correlation between VOC and NIBUT right eye was positive and fair, (r = 0.382, p = 0.041).

Table 10: Correlation between ocular symptoms and BUT with indoor air pollutant (N=343)

| | Eye irritation | | Eye Swelling | | NIBUT | | NIBUT | | SIBUT | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Left eye | | Right eye | | | |
| | r | p | R | p | r | p | r | p | r | p |
| $PM_{10}$ | -0.006 | 0.977 | -0.018 | 0.928 | -0.007 | 0.971 | 0.304 | 0.109 | 0.090 | 0.641 |
| $PM_{2.5}$ | 0.015 | 0.940 | 0.121 | 0.533 | -0.028 | 0.887 | 0.228 | 0.234 | 0.100 | 0.607 |
| Temp | -0.026 | 0.895 | 0.394 | 0.034* | 0.457 | 0.013* | 0.550 | 0.002* | -0.011 | 0.956 |
| Humid | -0.114 | 0.556 | 0.139 | 0.472 | 0.458 | 0.012* | 0.517 | 0.004* | -0.060 | 0.757 |
| $CO_2$ | -0.323 | 0.088 | 0.372 | 0.047* | 0.222 | 0.248 | 0.235 | 0.221 | 0.225 | 0.241 |
| VOC | 0.025 | 0.896 | -0.139 | 0.471 | 0.198 | 0.303 | 0.382 | 0.041* | 0.195 | 0.310 |
| Formal | -0.185 | 0.367 | -0.070 | 0.734 | 0.291 | 0.126 | 0.298 | 0.117 | 0.263 | 0.169 |

*p-value significant at 0.05 level

4.8 Multilevel Logistic regression tests between personal risk factor with ocular symptoms

Referring to Table 11, the results of the multilevel logistic regression test conducted showed that respondent who have smoker father was contribute to eye irritation. Respondent who have smoker father have odd ratio of 2 times the risk of experience eye irritation compared to other student who their father was not smoking (95% CI = 1.127 and 4.729, p = 0.022).

Table 11: Personal risk factors that influence reported eye irritation among the school student in Kota Kinabalu, Sabah (N=343)

| Personal risk factor | Eye Irritation | | | |
|---|---|---|---|---|
| | Odd Ratio | (95% CI) | | p* |
| | | Lower | Upper | |
| Gender | 0.634 | 0.322 | 1.237 | 0.180 |
| Race | 0.929 | 0.754 | 1.145 | 0.493 |
| Participant smoking | 0.602 | 0.157 | 2.306 | 0.460 |
| Father smoking | 2.309 | 1.127 | 4.729 | 0.022* |
| Mother smoking | 2.010 | 0.000 | 0.000 | 0.977 |
| Family smoking | 1.034 | 0.518 | 2.066 | 0.923 |
| Smoking at home | 1.104 | 0.857 | 1.422 | 0.444 |
| Wear glasses | 1.130 | 0.751 | 1.698 | 0.556 |
| Wear contact lenses | 3.930 | 0.000 | 0.000 | 0.986 |
| Use eye cosmetics | 1.589 | 0.638 | 3.952 | 0.319 |
| Use eye medication | 1.525 | 0.469 | 4.958 | 0.482 |
| Usage of computer/ television/ handphone | 1.260 | 0.876 | 1.811 | 0.211 |

* p-value significant at 0.05 level

Referring to Table 12, the results of the multilevel logistic regression test conducted showed that there was no personal risk factor which influenced the eye swelling among the secondary school children in Kota Kinabalu, Sabah.

Table 12: Personal risk factors that influence reported eye swelling among the school student in Kota Kinabalu, Sabah (N=343)

| Personal risk factor | Eye Swelling | | | |
|---|---|---|---|---|
| | Odd Ratio | (95%CI) | | P* |
| | | Lower | Upper | |
| Gender | 0.525 | 0.166 | 1.652 | 0.271 |
| Race | 0.946 | 0.679 | 1.317 | 0.744 |
| Participant smoking | 3.199 | 0.853 | 12.000 | 0.085 |
| Father smoking | 1.359 | 0.452 | 4.090 | 0.584 |
| Family smoking | 0.780 | 0.250 | 2.431 | 0.669 |
| Smoking at home | 1.305 | 0.874 | 1.947 | 0.913 |
| Wear glasses | 0.993 | 0.396 | 2.484 | 0.988 |
| Wear contact lenses | 4.672 | 0.413 | 52.801 | 0.213 |
| Use eye cosmetics | 0.393 | 0.046 | 3.342 | 0.393 |
| Use eye medication | 0.791 | 0.598 | 1.859 | 0.831 |
| Usage of computer/ television/ handphone | 1.054 | 0.092 | 6.774 | 0.853 |

* p-value significant at 0.05 level

4.9 Multilevel Logistic regression tests between personal risk factor with tear film break up time.

Referring to Table 13, the results of the multilevel logistic regression test conducted showed that respondents have tear film break up time for left eye (NIBUT) was smoker. Respondents who was smoking have odd ratio of 1 times the risk of tear film break up time for left eye (NIBUT) compared to respondents who was not smoking (95% CI = -3.166 and 0.037, p = 0.045).

Table 13: Personal risk factors that influence NIBUT left eye among the school student in Kota Kinabalu, Sabah (N=343)

| Personal risk factors | Left eye (NIBUT) | | | |
|---|---|---|---|---|
| | Odd Ratio | 95%CI | | p* |
| | | Lower | Upper | |
| Gender | 0.085 | -0.778 | 0.948 | 0.847 |
| Race | 0.005 | -0.115 | 0.126 | 0.927 |
| Participant smoking | 1.602 | -3.166 | 0.037 | 0.045* |
| Father smoking | 0.391 | -0.421 | 1.204 | 0.345 |
| Mother smoking | -0.455 | -2.971 | 2.060 | 0.723 |
| Family smoking | -0.070 | -0.899 | 0.759 | 0.868 |
| Wear glasses | 0.189 | -0.421 | 0.801 | 0.543 |
| Wear contact lenses | 0.749 | -2.066 | 3.565 | 0.602 |
| Use eye cosmetics | 0.708 | -0.530 | 1.946 | 0.262 |
| Use eye medication | -0.027 | -1.644 | 1.588 | 0.973 |
| Frequency of smoking | 0.110 | -0.205 | 0.427 | 0.493 |
| Usage of computer/television/ hand phone | -0.049 | -0.465 | 0.367 | 0.816 |

* p-value significant at 0.05 level

Referring to Table 14, the results of the multilevel logistic regression test conducted showed that respondents have tear film break up time for right eye (NIBUT) was smoker. Respondents who was smoking have odd ratio of 1 times the risk of tear film break up time for right eye (NIBUT) compared to respondents who was not smoking.

Table 14: Personal risk factors that influence NIBUT of the right eye among the school student in Kota Kinabalu, Sabah (N=343)

| | Right eye (NIBUT) | | | |
|---|---|---|---|---|
| | Odd Ratio | 95% CI | | p* |
| | | Lower | Upper | |
| Gender | -0.026 | -0.830 | 0.777 | 0.949 |
| Race | -0.017 | -0.130 | 0.094 | 0.757 |
| Participant smoking | 1.855 | -3.312, | -0.399 | 0.013* |
| Father smoking | 0.498 | -0.259, | 1.255 | 0.197 |
| Mother smoking | -0.646 | -2.991 | 1.697 | 0.589 |
| Family smoking | -0.217 | -0.990 | 0.555 | 0.582 |
| Wear glasses | 0.174 | -0.397 | 0.747 | 0.549 |
| Wear contact lenses | -0.091 | -2.725 | 2.543 | 0.946 |
| Use eye cosmetics | 0.289 | -0.868, | 1.447 | 0.624 |
| Use eye medication | -0.605 | -2.107 | 0.897 | 0.430 |
| Frequency of smoking | 0.226 | -0.067 | 0.521 | 0.131 |
| Usage of computer/television/ hand phone | 0.005 | -0.381 | 0.393 | 0.976 |

* p-value significant at 0.05 level

Referring to Table 15, the results of the multilevel logistic regression test conducted showed that there was no personal risk factor which influenced SIBUT among the secondary school children in Kota Kinabalu, Sabah.

Table 15 : Personal risk factors that influence SIBUT among the school student in Kota Kinabalu, Sabah (N=343)

| | SIBUT | | | |
|---|---|---|---|---|
| | Odd Ratio | 95% CI | | p* |
| | | Lower | Upper | |
| Gender | 7.485 | -21.381 | 36.353 | 0.611 |
| Race | -1.104 | -5.278 | 3.069 | 0.604 |
| Participant smoking | -1.500 | -53.985 | 50.983 | 0.955 |
| Father smoking | 17.206 | -10.288 | 44.701 | 0.220 |
| Mother smoking | -16.239 | -101.478 | 68.998 | 0.709 |
| Family smoking | -14.175 | -42.130 | 13.778 | 0.320 |
| Wear glasses | 12.284 | -8.462 | 33.032 | 0.246 |
| Wear contact lenses | 0.617 | -95.396 | 96.630 | 0.990 |
| Use eye cosmetics | -13.218 | -55.224 | 28.788 | 0.537 |
| Use eye medication | -11.323 | -66.213 | 43. 566 | 0.686 |
| Frequency of smoking | 9.900 | -0.657 | 20.458 | 0.066 |
| Usage of computer/television/ hand phone | -9.977 | -24.010 | 4.055 | 0.163 |

* p-value significant at 0.05 level

4.10 Multiple linear regression test between indoor air pollutant with ocular symptoms

Referring to Table 16, multiple linear regression tests have been performed to identify factors that contribute to the reduction of eye irritation value by controlling pollutant factors. The results showed that 20.6% of the expected eye irritation value was influenced by the combination of pollutant temperature, humidity, $PM_{10}$, $PM_{2.5}$, $CO_2$, VOC and Formaldehyde. However, there are no significant relationships between pollutant factor with expected eye irritation value.

Table 16: Indoor air pollutant that influence reported eye irritation among the school student in Kota Kinabalu, Sabah (N=343)

| Pollutant | Eye irritation | | | | |
|---|---|---|---|---|---|
| | Adjusted b | 95% CI | | t | p* |
| | | Lower | Upper | | |
| Temp | -0.049 | -0.237 | 0.140 | -0.547 | 0.592 |
| Humid | -0.025 | -0.127 | 0.077 | -0.519 | 0.611 |
| $PM_{10}$ | -46.985 | -210.336, | 116.367 | -0.610 | 0.551 |
| $PM_{2.5}$ | 66.374 | -158.012, | 290.760 | 0.627 | 0.539 |
| $CO_2$ | -0.002 | -0.008, | 0.00 | -0.852 | 0.407 |
| VOC | 0.081 | -0.137, | 0.299 | 0.791 | 0.441 |
| Formal | -4.932 | -32.820, | 22.955 | -0.375 | 0.713 |

*Significant $p < 0.05$
Method : Enter
$R^2 = 0.206$
Adjusted $R^2 = -0.192$

Referring to Table 17, multiple linear regression tests have been performed to identify factors that contribute to the reduction of eye swelling value by controlling pollutant factors. The results showed that 39.6% of the expected eye swelling value was influenced by the combination of pollutant temperature, humidity, PM10, PM2.5, CO2, VOC and Formaldehyde. However, there are no significant relationships between pollutant factors with expected eye swelling value.

Table 17: Indoor air pollutant that influence reported eye swelling among the school student in Kota Kinabalu, Sabah (N=343)

| Pollutant | Eye swelling | | | | |
|---|---|---|---|---|---|
| | Adjusted b | 95% CI | | t | p* |
| | | Lower | Upper | | |
| Temp | -0.089 | -0.229 | 0.051 | -1.350 | 0.196 |
| Humid | -0.022 | -0.098 | 0.053 | -0.622 | 0.543 |
| $PM_{10}$ | -90.020 | -211.022 | 30.981 | -1.577 | 0.134 |
| $PM_{2.5}$ | 129.151 | -37.061 | 295.363 | 1.647 | 0.119 |
| $CO_2$ | -0.003 | -0.007 | 0.002 | -1.233 | 0.235 |
| VOC | 0.033 | -0.128 | 0.195 | 0.439 | 0.666 |
| Formal | 2.352 | -18.305 | 23.009 | 0.241 | 0.812 |

*Significant $p < 0.05$
Method: Enter
$R^2 = 0.396$
Adjusted $R^2 = 0.094$

4.11 Multiple linear regression tests between indoor air pollutant with tear film break up time

Referring to Table 18, multiple linear regression tests have been performed to identify factors that contribute to the reduction of BUT for left eye (NIBUT) value by controlling pollutant factors. The results showed that 61.3% of the expected BUT for left eye (NIBUT) value was influenced by the combination of pollutant temperature, humidity, $PM_{10}$, $PM_{2.5}$, $CO_2$, VOC and Formaldehyde. However, only humidity and $CO_2$ factors have significant relationships with BUT for left eye (NIBUT) expected among students. Humidity and $CO_2$ factors are the biggest contributors affecting BUT for left eye (NIBUT) expected (Table 18).

Table 18: Indoor air pollutant that influence NIBUT left eye among the school student in Kota Kinabalu, Sabah (N=343)

| Pollutant | Left eye (NIBUT) | | | | |
|---|---|---|---|---|---|
| | Adjusted b | 95% CI | | t | p* |
| | | Lower | Upper | | |
| Temp | 0.515 | -0.319 | 1.349 | 1.310 | 0.209 |
| Humid | -0.619 | -1.070 | -0.168 | -2.909 | 0.010* |
| $PM_{10}$ | -590.744 | 1312.726 | 131.238 | -1.735 | 0.102 |
| $PM_{2.5}$ | 794.836 | -196.908 | 1786.580 | 1.699 | 0.109 |
| $CO_2$ | 0.030 | 0.004 | 0.057 | 2.403 | 0.029* |
| VOC | -0.679 | 1.642 | 0.284 | -1.495 | 0.154 |
| Formal | -11.406 | -134.662 | 111.849 | -0.196 | 0.847 |

*Significant $p < 0.05$
Method : Enter
$R^2 = 0.613$
Adjusted $R^2 = 0.420$

Multiple linear regression tests have been performed to identify factors that contribute to the reduction of BUT for right eye (NIBUT) value by controlling pollutant factors. The results showed that 63.6% of the expected BUT for right eye (NIBUT) value was influenced by the combination of pollutant temperature, humidity, $PM_{10}$, $PM_{2.5}$, $CO_2$, VOC and Formaldehyde. However, only humidity factors have significant relationships with BUT for right eye (NIBUT) expected among students. Humidity factors are the biggest contributors affecting BUT for right eye (NIBUT) expected (Table 19).

Table 19 : Indoor air pollutant that influence NIBUT right eye among the school student in Kota Kinabalu, Sabah (N=343)

| Pollutant | Right eye (NIBUT) | | | | |
|---|---|---|---|---|---|
| | Adjusted b | (95% CI) | | t | p* |
| | | Lower | Upper | | |
| Temp | 0.641 | -0.037 | 1.319 | 2.005 | 0.062 |
| Humid | -0.476 | -0.843 | -0.109 | -2.750 | 0.014* |
| $PM_{10}$ | -241.730 | -828.940 | 345.480 | -0.873 | 0.396 |
| $PM_{2.5}$ | 356.063 | -450.552 | 1162.678 | 0.936 | 0.363 |
| $CO_2$ | 0.014 | -0.007 | 0.036 | 1.399 | 0.181 |
| VOC | -0.759 | -1.543 | 0.024 | -2.055 | 0.057 |
| Formal | -2.605 | -102.853 | 97.642 | -0.055 | 0.957 |

*Significant $p < 0.05$
Method : Enter
$R^2$=0.636
Adjusted $R^2$ =0.454

Referring to Table 20, multiple linear regression tests have been performed to identify factors that contribute to the reduction of BUT for SIBUT value by controlling pollutant factors. The results showed that 39.9% of the expected BUT for SIBUT value was influenced by the combination of pollutant temperature, humidity, $PM_{10}$, $PM_{2.5}$, $CO_2$, VOC and Formaldehyde. However, there are no significant relationships between pollutant factor with expected BUT for SIBUT value.

Table 20 : Indoor air pollutant that influence SIBUT among the school student in Kota Kinabalu, Sabah (N=343)

| Pollutant | SIBUT | | | | |
|---|---|---|---|---|---|
| | Adjusted b | 95% CI | | t | p* |
| | | Lower | Upper | | |
| Temp | -5.847 | -18.336 | 6.642 | -0.992 | 0.336 |
| Humid | -2.593 | -9.352 | 4.165 | -0.813 | 0.428 |
| $PM_{10}$ | -2207.456 | -13023.605 | 8608.693 | -0.433 | 0.671 |
| $PM_{2.5}$ | 3361.089 | -11496.410 | 18218.588 | 0.480 | 0.638 |
| $CO_2$ | 0.310 | -0.087 | 0.708 | 1.656 | 0.117 |
| VOC | 11.586 | -2.841 | 26.014 | 1.702 | 0.108 |
| Formal | -577.489 | -2424.004 | 1269.027 | -1.158 | 0.264 |

*Significant $p < 0.05$
Method : Enter
$R^2 = 0.399$
Adjusted $R^2 = 0.099$

# CHAPTER 5

# DISCUSSION

## 5.1 Socio-Demographic background

### 5.1.1 Socio-Demographic Background between 6 school in Kota Kinabalu, Sabah

From this study, most of the respondent gender were female which was14 years old. A total of the respondents were Bajau. Sabah is not only famous for its beautiful and breath-taking fauna and flora, it is also known for its multiethnicity which has more than 40 different ethnic groups including the sub-ethnic groups. The second largest ethnic group in Sabah is the Bajau (Halina, 2008).

The education level of the parent of respondent were secondary school for father education and 51.3% for mother education. Based on study conducted by Emily (2015), adult who have completed a certain level of school typically grade five are classified as " literate " because they can read and write and those who have not as "illiterate". Most of the father of respondent was the full-time worker while most of the mother respondent was housewife or not working. Majority of household income of this study was less than RM 1500.

## 5.2 Descriptive data on health status

### 5.2.1 Prevalence of smoking status of respondent and family member

24.6% of respondent from school 5 was smoker, highest father smoking (58.0%) was from school 6, mother smoking status (9.1%) was higher from school 3 and school 5 was higher of smoking status among family members (57.9%). Franck (1986) reported a significant correlation between eye irritation and reduced TBUT in non- industrial buildings with indoor climate problems and noted that the TBUT values of smokers were lower than those of non-smokers. The presence of smoke in the environment causes conjunctival reactions in many people and the

mechanical effects of suspended particles on the ocular surface may cause eye irritation (Ahmet, 2003)

Smoking is a significant risk factor in the development of dry eyes and ocular surface disorder characterised by squamous metaplasia and loss of goblet cells. Furthermore, the severity of dry eyes has positive correlation with amount of smoking. The effects of children's exposure on high concentration of airborne pollutants at schools often associated with increased rate of absenteeism, low productivities and learning performances, and development of respiratory problem. According to Solberg (1998), Cigarette smoking is highly irritating to the conjunctival mucosa, also affecting the eyes of nonsmokers by passive exposure (secondhand smoking).

## 5.3 Indoor air pollutant level in 6 school in Kota Kinabalu, Sabah

### Humidity level in 6 school in Kota Kinabalu, Sabah.

Humidity level in school 1 was exceeded the acceptable limit range set by the Industry code of practice on indoor air quality by DOSH for humidity level which was 40-70%. The factors that have higher humidity because the schools do not have a mechanical ventilation system or an air conditioning unit in the classrooms. All classrooms in school in Kota Kinabalu, Sabah use electric fans in the ceiling and contain glass window at both side in classroom that were kept open during lectures and there is natural ventilation flow in the classroom.

According to Maryam, Higher humidity tends to enhance particle growth via the transformation of finer particles to coarser size fractions and boost the amplification of microbiological contaminants. In contrast, recent evidence revealed that temperature has an inverse relationship with PM in which high temperature in indoor environment will force the air out of the building hence diluting the indoor concentrations. Relative humidity refer to the amount of water vapour in the air (ICOP, 2003). Maintaining the relative humidity level is minimizes the growth of molds and other biological contaminant. The stations that were exceeding the relative humidity levels were because of their natural ventilation system. The fresh air enters through the windows without filter thus introduces the water vapour from ambient air into the indoor air inside

the childcare institutions. High humidity is associated with fatigue and stuffiness of the occupants (Schwartz, J.2004).

**VOC level in 6 school in Kota Kinabalu, Sabah.**

VOC level for school 6 has exceeded the acceptable limit range set by the Industry code of practice on indoor air quality by DOSH for VOC which was 3 ppm. This factors are because there are source of VOC because in classroom have wall that was paint. According to Qie, Volatile Organic Compounds (VOCs) VOCs are chemical contaminants that are emitted by several indoor sources like paints, aerosol sprays, cleansers, air fresheners, sealants, adhesives, partition boards and office equipment. Many sources have reported that VOCs can easily enter the air and cause various SBS, which include headache, shortness of breath, nausea, dry and watery eyes, flu-like symptoms and others. During the field measurement, the readings of the electronic sensor showed no sign of this indoor gas within the refectory. The main reason for this was that this location was unlike office spaces where large numbers of equipment are available. The only possible sources of VOCs were the detergents used for floor and table cleaning, which were only carried out after operating hours and no measurement was held. Moreover, this area has been in use since the past decades and there was no recent renovation or repainting of the interior walls. Sources of VOC in school include paints, paint strippers, building materials, furnishings, correction fluids, permanent markers, glues and adhesives (USEPA, 2017).

**Temperature level in 6 school in Kota Kinabalu, Sabah.**

Temperature level in school 1, school 2, school 5 and school 6 has exceeded the acceptable limit range set by the Industry code of practice on indoor air quality by DOSH for temperature which was 23-26 (°C). According to Hazrin, The finding revealed that most of the temperatures in the school either during occupied and non-occupied exceeded ICOP 2010 acceptable limit. This is expected because during the sampling days were done during dry season/southwest monsoon whereby Pahang experienced fewer total amount of rainfall and less frequency of wet days during the southwest monsoon compared to northeast monsoon. However, control measurement should

be implemented to ensure the temperature of the classroom is within the acceptable limit. With the normal situation where pupils sitting close to each other, high temperature might cause discomfort and fatigue to them.

As recommended by the guidelines, the acceptable range for temperature is between 23-26℃ while RH is between 40-70%. Surprisingly, none of these measured parameters was within the acceptable range. Perhaps this is likely due to the climate of this country. As a country located near the equator, Malaysia experiences hot and humid climate throughout the year. Instead of causing health problems directly, these unfavourable conditions are more related in causing discomfort, inconvenience, and distraction of children which possibly have an adverse effect on learning performance. However, its effects may vary among individuals depending on their clothing, activity level, age, and physiological factors (Maryam, 2018). Higher temperature during weekdays can be linked to the occupancy at the classroom during the period, which will increase the heat released from their activity (Valavanidis et al., 2008).

Previous studies indicate that decreasing the air temperature from 23-24°C to 21°C may improve the perceived IAQ by a factor of two. Decreased humidity has also a beneficial effect on perceived IAQ down to 20% rh. Below that, dry air may have negative effects on the eye blinking rate and on productivity. By decreasing the temperature (and humidity), we may furthermore improve perceived IAQ by a factor of two to a level 400 times better than the reference. We do not need such a dramatic improvement of the IAQ. Less is required and there may therefore even be room for simultaneous energy savings by reduced ventilation. Poor IAQ including inadequate ventilation, contaminated air and extreme temperature are factors that if not adequately addressed, may contribute to absenteeism and reduced students' performance (Choo et al., 2015).

## 5.4 Prevalence of respondent's Ocular Symptoms

The highest frequency of respondent who experienced eye irritation was 34.1% for 1-3 times in a month, 15.8% of respondent was experienced eye irritation 1-4 times/week and 5.2% of respondent from school 2 was experienced eye irritation everyday. The highest frequency of respondent who experienced eye swelling was 17.9% for sometimes (1-3 times in a month), 14.0% of respondent experienced 1-4 times/week for eye Swelling while 1.8% of respondent was experienced eye swelling everyday. According to Dan (2017), a total of 368 students (58%) participated and 17.4% reported weekly eye symptoms the last 3 months. There was one question on eye symptoms the last 3 months, with four alternatives (never, sometimes, weekly or daily symptoms) used in the previous school environment studies. Totally 11.9% reported weekly ocular symptoms, 18.8% rhinitis, 15.6% throat and 11.1% dermal symptoms, 20.6% headache and 22.1% tiredness (Dan, 2016).

Based on Jamaliah (2002) study, dry eye was considered present if at least one symptom was experienced often or always, within the past 3 months.The distribution of symptoms in the population showed 204 men (0.8%) who experienced dryness constantly, 924 (3.6%) often, 4716 (18.5%) sometimes and 19 597 (77.0%), never. For symptoms of irritation, 126 men (0.5%) reported experiencing irritation constantly, 1050 (4.1%) often, 10 622 (41.8%) sometimes and 13 644 (53.6%) never. Considering both symptoms together, the proportion of the population experiencing at least 1 symptom sometimes or more frequently was 49.2%, whereas 21.8% of men reported both symptoms at least sometimes.

There were 6.8% of men who reported experiencing at least 1 symptom constantly or often and 2.2% who reported experiencing both dryness and irritation either constantly or often (Debra, 2009). The prevalence of weekly eye symptoms was 15.8% for eye irritation and 14.0% of respondent experienced eye swelling for 1-4 times/week which was higher than prevalence of weekly eye symptoms in study in Johor Bahru, Malaysia by 11.6% of student in johor bahru experienced weekly eye symptoms (Dan et al.,2016).

## 5.5 Prevalence of Tear film break up time among school children

Measurement of BUT have been used in experimental and epidemiological studies on ocular effects of indoor exposures (Norback and Wieslander, 2002). The highest student who experienced dry eye for left eye (86.0%) came from school 5, 84.2% of student who experienced dry eye for right eye was school 5 and highest respondent who have dry eye for SIBUT (15.8%) was student from school 5. Student who experienced dry eye have the value of tear film break up time (NIBUT or SIBUT) which was less than 10 seconds. A higher frequency of EDED findings with TFBUT <10 seconds were reported among the individuals living within the metropolitan area. The decline in these values correlate with increase in pollutant levels in the metropolitan area compared with the rural area (Monica, 2014).

A TBUT of less than 10 seconds is usually reported to be abnormal. The TBUT also varies depending on race. For example, Hong Kong Chinese had a reported TBUT of 7.8 seconds, Singaporean Chinese had a reported TBUT of 6.5 seconds, a Scotland population had a reported TBUT of around 15 seconds and Malaysians had a reported TBUT of 5 to 7 seconds (Mohammed, 2016).

The highest student who have normal left eye (79.5%) came from school 1, while majority of student who have normal eye for right eye (76.9%) was school 1. Most of repondent who have normal both eye for SIBUT came from school 4 which was 67.1%. One study found that, the Non-invasive tear break up time (NITBUT) is greater in children in comparison to adults (Jones and Nischal, 2018). To our knowledge, this prospective study is the first to evaluate NITBUT in normal children. The results demonstrate that NITBUT is greater in children in comparison to adults. These normative data are a useful benchmark for further research into tear film instability in children (Jones, 2013). The mean NIBUT for left eye was 6.6 s while mean NIBUT for right eye was 6.3 s for this study. According to Norhani (2002), The mean NIBUT of the sample was 15.8 +/- 9.4 (SD) seconds. The median was 14.6 seconds with range of 4.2 seconds to 48.6 seconds. The majority (73 per cent) of subjects had NIBUT values between six and 20 seconds. There was no significant difference in NIBUT values between males and females but there was a decrease of NIBUT with age.

## 5.6 Correlation between ocular symptoms with indoor air pollutant

There is significant difference between $CO_2$ and temperature with eye swelling. The study found an association between indoor formaldehyde and ocular symptoms, throat symptoms and tiredness. Indoor levels of xylene, formaldehyde, $NO_2$ and $CO_2$ in schools in Malaysia can be risk factors for ocular, throat symptoms and tiredness among the students (Norback et al, 2017).

There is significant difference between temperature and humidity with eye left (NIBUT). On the other hand, indoor environmental conditions involving low humidity, excessive use of video display units (VDU), and high levels of $CO_2$ can be equally threatening to ocular surface health. Case-control studies confirm the cause-effect relationship between the indoor or outdoor environmental conditions and the irritant symptoms in exposed individuals (Monica, 2014). There is significant difference between temperature, humidity and VOC with eye right (NIBUT). Among outdoor environmental parameter, climate variable including temperature, atmospheric precipitation, humidity and UV radiation and air pollutant including particulate matter (PM), $CO_2$, $NO_2$, $O_3$ and $SO_2$ were correlated with ocular and systemic disease (Monica, 2014).

There is significant difference between $NO_2$ with SIBUT. According to Norback (2017), found associations between indoor $NO_2$ level and eye symptoms, throat symptoms and tiredness. Studies have found out that indoor air quality affects human especially children and the elderly more compared to ambient atmospheric air. Failure to identify and establish indoor air pollution status can increase the chance of long-term and short-term health problems for these young students and staff, reduction in productivity of teachers; and degrade the youngsters learning environment and comfort. Infants and young children have a higher resting metabolic rate and rate of oxygen consumption per unit body weight than adults because they have a larger surface area per unit body weight and because they are growing rapidly. Therefore, their exposure to any air pollutant may be greater (Marzuki, 2010). Studies indicate that RH about 40% is better for the eyes and upper airways than levels below 30%. The optimal RH may differ for the eyes and the airways regarding desiccation of the mucous membranes (Wolkoff, 2007).

### 5.7 Association between personal risk factor with ocular symptom

The results of the logistic regression test conducted showed that respondents with eye irritation had a relationship with the father who smoked. Respondents who are exposed to smoking dad have odd ratio of 2 times the risk of experiencing eye irritation symptoms compared to respondents who are not exposed to smoking dad. Multiregression analysis showed that the most important determinants of dry eye were CCR and number of cigarettes/day (Amany, 2012). According to Women and Smoking: A Report of the Surgeon General, several studies reported that girls and boys are equally susceptible to the effects of parental smoking and to parental attitudes toward smoking.

The results of the logistic regression test conducted showed that respondents have tear film break up time for left eye (NIBUT) was smoker. Respondents who was smoking have odd ratio of 1 times the risk of tear film break up time for left eye (NIBUT) compared to respondents who was not smoking. The results of the logistic regression test conducted showed that respondents have tear film break up time for right eye (NIBUT) was smoker. Respondents who was smoking have odd ratio of 1 times the risk of tear film break up time for right eye (NIBUT) compared to respondents who was not smoking. Multivariate logistic regression analysis showed that female gender (adjusted odds ratio [OR] = 2.1, 95% CI = 1.7–2.6), older age (>56 years; OR = 1.5, 95% CI = 1.0–2.1), current smoking (OR = 1.4, 95% CI = 1.1–1.8) and history of diabetes mellitus (OR = 1.5, 95% CI = 1.2–2.0) were significantly associated with DES (Abdulaziz, 2017).

# CHAPTER 6

# CONCLUSION

In this study, $CO_2$ and temperature level in classroom contributed to eye swelling. Temperature and environmental humidity were significantly correlated with NIBUT of the left eye while temperature, humidity and VOC reduced the tear film break up time for NIBUT of the right eye. Smoking was the risk factor for the tear film break up time as well as the eyes symptoms reported by the respondent. The risk factor of NIBUT for left eye were respondent who were smoker, environmental humidity and $CO_2$. Respondent smoking and environmental humidity were risk factor for NIBUT of the right eye.

**Acknowledgement**

The authors would like to thank all the student in the school in Kota Kinabalu, Sabah who volunteered to participate in this study and their cooperation given throughout the data collection process. The authors would also like to thank the teachers and staffs of school in the Kota Kinabalu, Sabah for their assistance in the collection of data.

**Limitation**

Limitation in this study were lack of literature review, recall bias on questionnaires and the period time to conduct this study is too short due to the time constraints.

**Recommendation**

More research should be conducted related to this topic: ocular symptom and tear film break up time.

## References


Adenike, A., Tunji, S, O., Ajaiyeoba, A, I & Michaeline, A, I. (2006). Prevalence and Causes of Eye Diseases amongst Students in South-Western Nigeria. Annals of African medicine 5(4). January 2006

Ahmet, S., Muharrem, B., Ilyas, O., Huseyin, V., Adil, K & Mustafa, G. (2003). The effects of chronic smoking on the ocular surface and tear characteristics: a clinical, histological and biochemical study. Acta Ophthalmologica Scandinavica 2003 : 81: 583–587

Ansi/Ashrae Standard 55-2004. (2004). Thermal environmental conditions for human occupancy

Backman, H., & Haghighat, F. (1999). Indoor air quality and ocular discomfort. Journal of the American Optometric Association 70(5):309-31

Chua, P, C., Juliana, J., Titi, R, H & Nor, M, A. (2015). Preschools' indoor air quality and respiratory health symptoms among preschoolers in Selangor. International Conference on Environmental Forensics 2015 (iENFORCE2015). Procedia Environmental Sciences 30 ( 2015 ) 303 – 308

Norbäck, D., Jamal, H., Markowicz, P & Gui, H, C. (2016). Endotoxin, ergosterol, muramic acid and fungal DNA in dust from schools in Johor Bahru, Malaysia — Associations with rhinitis and sick building syndrome (SBS) in junior high school students. Science of the Total Environment. Volumes 545–546, 1 March 2016, Pages 95-103

Debra, A, S., Reza, D & Julie, E, B. (2009). Prevalence of Dry Eye Disease Among US Men. Estimates From the Physicians' Health Studies. Archives of ophthalmology. 2009;127(6):763-768

Franck, C. (1986): Eye symptoms and signs in buildings with indoor climate problems ('office eye syndrome'). Acta Ophthalmologica Scandinavica (Acta Ophthalmol Scand) 64: 306–311

Gunilla, W., Torsten, L., Dan, N & Per, V. (2000). Changes in the ocular and nasal signs and symptoms of aircrews in relation to the ban on smoking on intercontinental flights. Scandinavian Journal of Work, Environment & Health 2000;26(6):5 14-522

Halina, S, Mohd, Y., & Saidatul, N & Saidatul, M. (2016). Duang: the semiotic interpretation and perception of the bajau-sama community in sabah. Jurnal Komunikasi, Malaysian Journal of Communication Vol 24: 63-71

Hazrin, A, H., Maryam, Z., Hizrri, A., Norhidayah, A., Samsuddin, N & Mohd Shukri, M, A. (2017). Occupancy implications on indoor air quality (iaq) in selected primary school classrooms around kuantan, pahang. malaysian journal of Public Health Medicine 2017, Special Volume (1): 95-105

Jia, Y, Z., Yuan, C, L., Chia, J, Hsieh., Chun, C, T & Lih, M, Y. (2018). Association between Dry Eye Disease, Air Pollution and Weather Changes in Taiwan. International Journal of Environmental Research and Public health. 2018 Oct; 15(10): 2269

Jones, S, M & Nischal, K, K. (2013). The non-invasive tear film break-up time in normal children. British Journal of Ophthalmology. 2013 Sep;97(9):1129-33. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/23821656

Reijula, K & Digert, C, S. (2004).Assessment of indoor air problems at work with a questionnaire. Occupational Environmental Medicine 2004; 61:33-38. Volume 61. Issue 1

Monica, A., Priscila, Novaes., Monica, d, A, M., Peter, S, R & Eduardo, M, Rocha. (2014). Is dry eye an environmental disease. Abo-arquivos brasileiros de oftalmologia vol.77 no.3 São Paulo May/June 2014. Retrieved from http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0004-27492014000300193

Mohammed, A., Mohd, Z, C, A., & Noor, E, B. (2016). Comparison of Dry Eye Parameters between Diabetics and Non-Diabetics in District of Kuantan, Pahang. Malaysian Journal of Medical Sciences 23(3):72-77. Retrieved from https://www.researchgate.net/publication/303124699_Comparison_of_Dry_Eye_Parameters_between_Diabetics_and_Non-Diabetics_in_District_of_Kuantan_Pahang

Marzuki, I., Nur, Z., Ahmad, M, A & Mohd, S. (2010). Indoor Air Quality in Selected Samples of Primary Schools in Kuala Terengganu, Malaysia. EnvironmentAsia 3(Special issue):103-108 · January 2010. Retrieved from https://www.researchgate.net/publication/234102912_Indoor_Air_Quality_in_Selected_Samples_of_Primary_Schools_in_Kuala_Terengganu_Malaysia

Maryam, Z., Hazrin, A, H., Hizmi, A., Norhidayah, A., Samsuddin, N & Mohd Shukri, M, A. (2018). Association of particulate matter (pm) with respiratory symptoms among children in selected primary schools in pahang. Journal CleanWAS 2 (1) (2018) 11-15

Norbäck, D., Hashim, J, H., Hashim, Z., Sooria, V., Ismail, S, A & Wieslander, G. (2017). Ocular symptoms and tear film break up time (BUT) among junior high school students in Penang, Malaysia – Associations with fungal DNA in school dust. International Journal of Hygiene and Environmental Health 220 (2017) 697-703

Norback, D & Wieslander, G. (2002). Biomarkers and chemosensory irritations. International Archives of Occupational and Environmental Health. June 2002, Volume 75, Issues 5, pp 298-304

Norback, D., Jamal, H, H., Zailina, H & Faridah, A. (2017). Volatile organic compounds (VOC), formaldehyde and nitrogen dioxide ($NO_2$) in schools in Johor Bahru, Malaysia : Associations with rhinitis, ocular, throat and dermal symptoms, headache and fatigue. Science of the Total Environment 592 (2017) 153-160

Norback, D., Jamal, H, H., Cai, G, H., Zailina, H., Faridah, A., Bloom, E., & Larsson, L . (2016). Rhinitis, Ocular, Throat and Dermal Symptoms, Headache and Tiredness among students in schools from Johor Bahru, Malaysia : Associations with Fungal DNA and Mycotoxins in Classroom Dust. Retrieved from https://doi.org/10.1371/journal.pone.0147996

Jamaliah, R & Fathilah, J. (2002). Prevalence of Dry Eye in University Malaya Medical Centre. Medicine Journal Malaysia Volume 57 No 4 December 2002

Solberg, Y., Rosner, M & Belkin, M. (1998). The association between cigarette smoking and ocular diseases. Survey of Ophthalmology. 1998 May-Jun; 42(6):535-47

Schwartz, J. (2004). Air pollution and children's health. Pediatrics. 2004 Apr; 113(4 Suppl):1037-43

United States Environmental Protection Agency. (2018). Why Indoor Air Quality is Important to Schools. Retrieved from https://www.epa.gov/iaq-schools/why-indoor-air-quality-important-schools

United States Environmental Protection Agency. (2018). Particulate Matter (PM) Pollution. Retrieved from https://www.epa.gov/pm-pollution/particulate-matter-pm-basics

United States Environmental Protection Agency. (2018). Volatile Organic Compounds' Impact on Indoor Air Quality. Retrieved from https://www.epa.gov/indoor-air-quality-iaq/volatile-organic-compounds-impact-indoor-air-quality

United States Environmental Protection Agency. (2018). Facts about formaldehyde. Retrieved from https://www.epa.gov/formaldehyde/facts-about-formaldehyde

United States Department of Agriculture. (2019). Health Hazard Information Sheets (HHIS). Retrieved from https://www.fsis.usda.gov/wps/portal/informational/aboutfsis/audience-employees/employee-safety/environmental-safety-health

Wolkoff, P & Kjaergaard, S, K. (2007). The dichotomy of relative humidity on indoor air quality. Environmental International 2007 Aug ;33(6):850-7

# APPENDIX

# Appendix I

# (Approval letter from Ministry of Education)

KEMENTERIAN PENDIDIKAN MALAYSIA
BAHAGIAN PERANCANGAN DAN PENYELIDIKAN DASAR PENDIDIKAN
ARAS 1-4, BLOK E8
KOMPLEKS KERAJAAN PARCEL E
PUSAT PENTADBIRAN KERAJAAN PERSEKUTUAN
62604 PUTRAJAYA

TEL : 0388846591
FAKS : 0388846579

**Ruj. Kami :** KPM.600-3/2/3-eras(2483)
**Tarikh :** 29 November 2018

**ANIS ZAHIRA BINTI ZAINUDIN**
**NO. KP : 950611105004**

LOT 1817 LORONG 1 KAMPUNG LABOHAN DAGANG
42700 BANTING, SELANGOR DARUL EHSAN 42700 BANTING
SELANGOR

Tuan,

**KELULUSAN UNTUK MENJALANKAN KAJIAN DI SEKOLAH, INSTITUT PENDIDIKAN GURU, JABATAN PENDIDIKAN NEGERI DAN BAHAGIAN DI BAWAH KEMENTERIAN PENDIDIKAN MALAYSIA**

Perkara di atas adalah dirujuk.

2. Sukacita dimaklumkan bahawa permohonan tuan untuk menjalankan kajian seperti di bawah telah diluluskan.

**" OCULAR SYMPTOMS AND TEAR FILM BREAK UP TIME (BUT) AMONG SECONDARY SCHOOL STUDENTS IN SABAH, MALAYSIA : ASSOCIATIONS WITH SCHOOL INDOOR AIR AND DUST "**

3. Kelulusan adalah berdasarkan kepada kertas cadangan penyelidikan dan instrumen kajian yang dikemukakan oleh tuan kepada bahagian ini. Walau bagaimanapun kelulusan ini bergantung kepada kebenaran Jabatan Pendidikan Negeri dan Pengetua / Guru Besar yang berkenaan.

4. Surat kelulusan ini sah digunakan bermula dari **10 Januari 2019** hingga **13 Februari 2019** .

5. Tuan dikehendaki menyerahkan senaskhah laporan akhir kajian dalam bentuk *hardcopy* bersama salinan *softcopy* berformat pdf dalam CD kepada Bahagian ini.Tuan juga diingatkan supaya mendapat kebenaran terlebih dahulu daripada Bahagian ini sekiranya sebahagian atau sepenuhnya dapatan kajian tersebut hendak diterbitkan di mana-mana forum, seminar atau diumumkan kepada media massa.

Sekian untuk makluman dan tindakan tuan selanjutnya. Terima kasih.

**"BERKHIDMAT UNTUK NEGARA"**

Saya yang menjalankan amanah,

Ketua Sektor
Sektor Penyelidikan dan Penilaian
b.p. Pengarah
Bahagian Perancangan dan Penyelidikan Dasar Pendidikan
Kementerian Pendidikan Malaysia

salinan kepada:-

JABATAN PENDIDIKAN SABAH

# Appendix II
# (Approval letter from Sabah education department)

# Appendix III
# (Approval letter from Ethic Committee)

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

| | | |
|---|---|---|
| **Research title** | : | **Ocular Symptoms and Tear Film Break Up Time (But) Among Secondary School Students in Sabah, Malaysia: Associations With School Indoor Air and Dust** |
| **Study Site** | : | **Sabah** |
| **JKEUPM Ref No.** | : | **JKEUPM-2018-396** |
| **Researcher** | : | **Anis Zahira binti Zainudin** |
| **Supervisor** | : | **Prof. Dr. Zailina binti Hashim** |

Documents received and reviewed with reference to the above study:

1. Ethics Application Form, Version 1 dated 29/10/2018
2. Respondent Information Sheet & Guardian's/ Parent's Consent (Malay), Version 2 dated 26/12/2018
3. Respondent Information Sheet & Consent (Malay), Version 2 dated 26/12/2018
4. Proposal (English), Version 2 dated 26 /12/2018
5. Questionnaires/ Interviews (Malay), Version 1 dated 29/10/2018
6. Curriculum Vitae of:
    a. Prof. Dr. Zailina binti Hashim
    b. Assoc Prof. Dr. Shamsul Bahari bin Shamsuddin

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 7 JANUARY 2020**

# Appendix IV
# (Parent Consent Form)

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

## BORANG 2.5: PENERANGAN DAN PERSETUJUAN IBUBAPA/PENJAGA

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

### L.TAJUK KAJIAN

Kualiti udara serta kesan alahan dan asma dalam kalangan pelajar sekolah di Malaysia.

### !. PENGENALAN

Penyelidikan ini akan dijalankan untuk mengkaji hubungan di antara pendedahan terhadap pencemaran udara dengan asma, alahan dan simptom-simptom pemafasan dikalangan kanak-kanak sekolah menengah.

### ). APAKAH YANG PERLU ANDA LAKUKAN?

Penyertaan dalam kajian ini adalah secara sukarela dan tidak akan ada sebarang pembayaran likenakan. Persetujuan dari ibu bapa atau penjaga diperlukan bagi setiap peserta sebelum menyertai ajian ini. Semua peserta akan menerima satu cenderamata sebagai tanda penghargaan menyertai sesi penyelidikan ini. Tiada pampasan tambahan akan diberikan.

Peserta yang memenuhi kriteria inklusi akan menjalani beberapa prosedur penyelidikan termasuk:

1. Isikan soal selidik yang dibantu oleh penyelidik.
2. Ujian penilaian nitrogen oksida dalam hembusan nafas (FeNO), pelajar akan diminta untuk menarik nafas sedalam-dalam dan menghembus nafas dengan aliran berterusan ke dalam alat penganalisa. Pelajar akan mengulangi proses ini selama tiga kali untuk mendapatkan hasil purata. Prosedur ini hanya mengambil masa 5 minit.
3. Ujian untuk mengukur kadar masa bagi selaput mata untuk pulih, satu alat khas akan didekatkan kepada mata dan pelajar akan diminta untuk melihat ke dalam alat tersebut. Penilaian akan dibuat oleh penyelidik. Prosedur ini tidak menyakitkan dan hanya mengambil masa dalam 5 minit.
4. Ujian fungsi paru-paru, pelajar akan bernafas melalui mulut yang dipasang pada alat rakaman (spirometer). Pelajar akan melakukan ujian selama 3 kali untuk hasil purata.
5. Ujian alahan (hama rumah, debunga yang berkaitan, kucing dan lipas) hanya akan dilakukan pada kulit tangan peserta. Jumlah kecil alergen (hama rumah, debunga yang berkaitan, kucing, dan lipas) dalam bentuk cecair akan dimasukkan ke dalam lapisan atas kulit dengan membuat tusukan kecil. Pelajar akan dipantau dengan teliti untuk melihat bagaimana reaksi kulit terhadap alergen selama 20 minit. Prosedur ini akan dijalankan oleh pegawai perubatan yang pengalaman.

## 4. SIAPA YANG TIDAK BOLEH MENYERTAI KAJIAN INI?

Subjek yang mempunyai fizikal yang normal dan sihat boleh menyertai kajian ini secara sukarela selepas mendapat keizinan daripada ibu/bapa atau penjaga. Subjek mestilah pelajar Tingkatan 2 yang telah bersekolah di sekolah yang sama sejak Tingkatan 1. Selain itu, individu yang mempunyai penyakit kronik seperti penyakit jantung, hipertensi dan kelainan dada fizikal kongenital tidak akan dimasukkan dalam kajian ini.

## 5. APAKAH FAEDAH MENYERTAI KAJIAN INI?

### a) KEPADA ANAK/JAGAAN SAYA SEBAGAI PESERTA?

Hasil kajian yang bakal diperolehi daripada ujian kesihatan percuma yang akan dijalankan boleh membantu pelajar dan ibu bapa untuk mengetahui status keadaan kesihatan pelajar tanpa sebarang kos. Pihak pengurusan sekolah juga akan mendapat manfaat maklumat kadar pencemaran udara di sekolah dan tahap kesihatan pelajar tanpa perlu mengeluarkan sebarang kos. Di samping itu, kami berharap hasil kami akan menambah pengetahuan mengenai hubungkait persekitaran sekolah terhadap alergi dan asma.

### b) KEPADA PENYELIDIK?

Hasil dari kajian ini akan memberikan maklumat penting dalam usaha untuk membina pangkalan data komprehensif untuk memantau kualiti udara dalaman di kalangan kanak-kanak. Selain itu,melalui kajian ini juga akan memberikan pemahaman yang lebih baik dan keupayaan yang lebih baik untuk mengenal pasti pencemar toksik semasa dan mengesyorkan strategi yang berkesan untuk mengurangkan pencemaran udara dalaman.

## 6. ADAKAH IA BERISIKO?

Peserta tidak akan mengalami apa-apa risiko dalam menghadiri set soal selidik yang hanya memerlukan anda menyatakan butiran peribadi, sejarah perubatan, pendedahan kepada alergen dan gejala yang berpengalaman berkaitan dengan pencemaran udara dalaman.

Begitu juga dengan ujian kadar nitrogen oksida dalam hembusan nafas (FeNO), ujian fungsi paru-paru dan ujian kadar masa bagi selaput mata untuk pulih, tidak ada sebarang risiko yang akan berlaku sepanjang prosedur-prosedur ini dijalankan. Semua prosedur yang bakal dijalankan adalah seragam dan selamat.

Prosedur ini akan dilakukan oleh ahli perubatan dan teknologi yang telah terlatih dan mempunyai pengalaman yang mencukupi dalam prosedur. Pegawai perubatan akan berada di tempat proses mengaruhkan kahak setiap masa semasa prosedur dijalankan.

Manakala untuk prosedur ujian alahan, terdapat risiko anafilaksi (reaksi di dalam salur darah) yang sangat rendah. Prosedur ini akan dijalankan oleh pegawai perubatan yang terlatih dan sebagai langkah keselamatan ubat alahan akan disediakan jika berlaku anafilaksi. Disamping itu pemantauan akan dibuat terhadap semua peserta untuk tempoh 40 minit selepas prosedur dijalankan.

Secara keseluruhannya, pihak penyelidik akan menggunakan pegawai perubatan dan ahli teknologi perubatan yang terlatih dan berpengalaman untuk menjalankan semua prosedur klinikal terhadap peserta. Pihak penyelidik juga akan menyediakan ambulance sebagai langkah berjaga-jaga jika berlaku sebarang risiko yang tidak diingini.

Pihak penyelidik juga akan menyediakan Insuran Liabiliti Awam untuk setiap peserta jika berlaku sebarang kecelakaan sepanjang tempoh prosedur klinikal ini dijalankan. Sebarang tuntutan boleh dibuat berdasarkan terma dan syarat yang telah ditetapkan oleh pihak pembekan Insuran Liabiliti Awam tersebut.

Diakhir proses penyelidikan, semua peserta akan diberi cenderamata sebagai tanda penghargaan daripada pihak penyelidik di atas kesudian menjadi peserta secara sukarela.

**7. ADAKAH MAKLUMAT DAN IDENTITI ANAK/JAGAAN SAYA KEKAL RAHSIA?**

Semua maklumat peserta adalah rahsia. Hanya penyelidik yang terlibat dalam kajian ini dan mereka yang bertanggungjawab untuk penyelidikan akan mempunyai akses kepada maklumat yang anda berikan. Keputusan umumnya akan diterbitkan sebagai ringkasan perbincangan, bukan transkrip / balasan individu. Bahan penerbitan tidak akan dikenal pasti nama atau dengan apa cara lain yang mana peserta dapat dikenal pasti oleh pembaca laporan tersebut.

**8. SIAPA YANG SAYA PERLU HUBUNGI SEKIRANYA SAYA MEMPUNYAI SOALAN TAMBAHAN SEPANJANG PENYELIDIKAN INI?**

Jika anda mempunyai pertanyaan, sila hubungi:

| No | Nama | Alamat | No Tel.Bimbit/ No Tel. Pejabat | E-mail |
|---|---|---|---|---|
| 1 | Prof. Dr. Zailina Hashim | Jabatan Kesihatan Persekitaran & Pekerjaan Faculti Perubatan & Sains Kesihatan, UPM Serdang | 017- 6361367/ 03-947240 | zailina@upm.edu.my |
| 2 | Nur Haslyna binti Mohd Hamizul | Jabatan Kesihatan Persekitaran & Pekerjaan Faculti Perubatan & Sains Kesihatan, UPM Serdang | 018-2182320 | nurhaslynamh@gmail.com |
| 3 | Nur Shahira binti Mohamad Fadzil | Jabatan Kesihatan Persekitaran & Pekerjaan Fakulti Perubatan & Sains Kesihatan, UPM Serdang | 011-40685226 | nurshahirafadzil@gmail.com |
| 4 | Siti Raihan binti Mohd Fuad | Jabatan Kesihatan Persekitaran & Pekerjaan Fakulti Perubatan & Sains Kesihatan, UPM Serdang | 017-7527076 | sitiraihanmohdfuad@gmail.com |
| 5 | Anis Zahira binti Zainudin | Jabatan Kesihatan Persekitaran & Pekerjaan Fakulti Perubatan & Sains Kesihatan, UPM Serdang | 013-2803841 | anisiera95@gmail.com |

*Nota: Borang penerangan dan persetujuan ibu bapa ini adalah gabungan daripada empat (4) kajian pelajar.*

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

**9. PERSETUJUAN**

Saya..... No Kad Pengenalan. .....
beralamat.....
.....dengan ini secara sukarela bersetuju membenarkan *anak / jagaan saya ..... menyertai **penyelidikan tersebut di atas *(ujian klinikal/temubual soal selidik).**

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

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

**I setuju/tidak bersetuju untuk imej/gambar berkaitan dengan anak/ jagaan saya digunakan dalam apa jua bentuk penerbitan atau pembentangan. (sekiranya berkaitan).**

*potong yang tidak berkenaan

Tandatangan ..... Tandatangan .....
(*Ibubapa/ Penjaga*) (*Saksi*)

Tarikh :..... Nama :.....

No. K/P: .....

**Saya mengesahkan bahawa saya telah menerangkan kepada ibubapa/penjaga responden mengenai sifat dan tujuan penyelidikan tersebut di atas.**

Tarikh ..... Tandatangan .....
(*Penyelidik*)

**MAKLUMAT TAMBAHAN**

Berikut adalah maklumat tambahan mengenai prosedur-prosedur terlibat. Peserta akan menjalani penilaian klinikal yang mudah pada nitrogen oksida (NO) dalam hembusan nafas (FeNO) dengan menggunakan alat penganalisa seperti dicadangkan American Thoracic Society (ATS). Peserta akan diminta untuk menarik nafas sedalam-dalam dan menghembus nafas dengan aliran berterusan ke dalam corong mulut khas alat penganalisa. Peserta perlu mengulangi proses ini selama tiga kali untuk mendapatkan hasil purata. Prosedur ini hanya mengambil masa 5 minit.

Ujian Spirometry (ujian fungsi paru-paru) dilakukan selepas seperti yang dicadangkan oleh American Thoracic Society, 1987. Spirometer telah dikalibrasi terlebih dahulu dengan menyuntikkan 3 liter udara ke dalam spirometer menggunakan jarum 3L. Untuk ujian, pelajar akan bernafas melalui mulut yang dipasang pada alat rakaman (spirometer). Untuk mendapatkan hasil yang terbaik, semua responden melakukan ujian selama 3 kali. Maklumat yang dikumpul oleh spirometer dicetak pada carta yang disebut spirogram.

Peserta akan menjalani satu ujian klinikal yang mudah dan selamat menggunakan alatan khas, Tearscope Plus untuk mengukur kadar masa bagi selaput mata untuk pulih (Tear Film Break Up Time). Peserta akan diberi penerangan dan alatan khas ini akan didekatkan kepada mata dan peserta akan diminta untuk melihat kedalam alat tersebut. Penilaian akan dibuat oleh penyelidik. Prosedur ini tidak menyakitkan dan hanya mengambil masa dalam 5 minit.

Penilaian klinikal ujian alergi hanya akan dilakukan pada kulit peserta. Jumlah kecil alergen (hama rumah, debunga yang berkaitan, kucing dan lipas ) dalam bentuk cecair akan dimasukkan ke dalam lapisan atas kulit dengan membuat tusukan kecil. Peserta akan dipantau dengan teliti untuk melihat bagaimana reaksi kulit terhadap alergen. Selepas 20 minit, diameter wheal akan diukur. Prosedur ini akan dijalankan oleh pegawai perubatan yang pengalaman.

Selain langkah keselamatan yang dijelaskan seperti di atas, pihak penyelidik akan menyediakan pegawai perubatan, penolong pegawai perubatan/ jururawat yang terlatih dan bertauliah untuk membantu dan memantau semua prosedur klinikal yang dinyatakan di atas. Pihak penyelidik juga akan menyediakan insuran liabiliti untuk setiap peserta jika berlaku sebarang perkara yang tidak diingini. Sebagai langkah keselamatan yang terakahir, sebuah ambulance akan ditempatkan di lokasi persempalan setiap masa.

# Appendix V
# (Respondent Consent Form)

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

## BORANG 2.4: PENERANGAN DAN PERSETUJUAN RESPONDEN

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

### 1.TAJUK KAJIAN

Kualiti udara serta kesan alahan dan asma dalam kalangan pelajar sekolah di Malaysia.

### 2. PENGENALAN

Penyelidikan ini akan dijalankan untuk mengkaji hubungan di antara pendedahan terhadap pencemaran udara dengan asma, alahan dan simptom-simptom pernafasan dikalangan kanak-kanak sekolah menengah.

### 3. APAKAH YANG PERLU ANDA LAKUKAN?

Penyertaan dalam kajian ini adalah secara sukarela dan tidak akan ada sebarang pembayaran dikenakan. Persetujuan dari ibu bapa atau penjaga diperlukan bagi setiap peserta sebelum menyertai kajian ini. Semua peserta akan menerima satu cenderamata sebagai tanda penghargaan menyertai sesi penyelidikan ini. Tiada pampasan tambahan akan diberikan.

Peserta yang memenuhi kriteria inklusi akan menjalani beberapa prosedur penyelidikan termasuk:

1. Isikan soal selidik yang dibantu oleh penyelidik.
2. Ujian penilaian nitrogen oksida dalam hembusan nafas (FeNO), pelajar akan diminta untuk menarik nafas sedalam-dalam dan menghembus nafas dengan aliran berterusan ke dalam alat penganalisa. Pelajar akan mengulangi proses ini selama tiga kali untuk mendapatkan hasil purata. Prosedur ini hanya mengambil masa 5 minit.
3. Ujian untuk mengukur kadar masa bagi selaput mata untuk pulih, satu alat khas akan didekatkan kepada mata dan pelajar akan diminta untuk melihat ke dalam alat tersebut. Penilaian akan dibuat oleh penyelidik. Prosedur ini tidak menyakitkan dan hanya mengambil masa dalam 5 minit.
4. Ujian fungsi paru-paru, pelajar akan bernafas melalui mulut yang dipasang pada alat rakaman (spirometer). Pelajar akan melakukan ujian selama 3 kali untuk hasil purata.
5. Ujian alahan (hama rumah, debunga yang berkaitan, kucing dan lipas) hanya akan dilakukan pada kulit tangan peserta. Jumlah kecil alergen (hama rumah, debunga yang berkaitan, kucing, dan lipas) dalam bentuk cecair akan dimasukkan ke dalam lapisan atas kulit dengan membuat tusukan kecil. Pelajar akan dipantau dengan teliti untuk melihat bagaimana reaksi kulit terhadap alergen selama 20 minit. Prosedur ini akan dijalankan oleh pegawai perubatan yang pengalaman.

## 4. SIAPA YANG TIDAK BOLEH MENYERTAI KAJIAN INI?

Subjek yang mempunyai fizikal yang normal dan sihat boleh menyertai kajian ini secara sukarela selepas mendapat keizinan daripada ibu/bapa atau penjaga. Subjek mestilah pelajar Tingkatan 2 yang telah bersekolah di sekolah yang sama sejak Tingkatan 1. Selain itu, individu yang mempunyai penyakit kronik seperti penyakit jantung, hipertensi dan kelainan dada fizikal kongenital tidak akan dimasukkan dalam kajian ini.

## 5. APAKAH FAEDAH MENYERTAI KAJIAN INI?

### a) KEPADA ANDA SEBAGAI PESERTA?

Hasil kajian yang bakal diperolehi daripada ujian kesihatan percuma yang akan dijalankan boleh membantu pelajar dan ibu bapa untuk mengetahui status keadaan kesihatan pelajar tanpa sebarang kos. Pihak pengurusan sekolah juga akan mendapat manfaat maklumat kadar pencemaran udara di sekolah dan tahap kesihatan pelajar tanpa perlu mengeluarkan sebarang kos. Di samping itu, kami berharap hasil kami akan menambah pengetahuan mengenai hubungkait persekitaran sekolah terhadap alergi dan asma.

### b) KEPADA PENYELIDIK?

Hasil dari kajian ini akan memberikan maklumat penting dalam usaha untuk membina pangkalan data komprehensif untuk memantau kualiti udara dalaman di kalangan kanak-kanak. Selain itu,melalui kajian ini juga akan memberikan pemahaman yang lebih baik dan keupayaan yang lebih baik untuk mengenal pasti pencemar toksik semasa dan mengesyorkan strategi yang berkesan untuk mengurangkan ncemaran udara dalaman.

## . ADAKAH IA BERISIKO?

Peserta tidak akan mengalami apa-apa risiko dalam menghadiri set soal selidik yang hanya memerlukan anda menyatakan butiran peribadi, sejarah perubatan, pendedahan kepada alergen dan gejala yang berpengalaman berkaitan dengan pencemaran udara dalaman.

Begitu juga dengan ujian kadar nitrogen oksida dalam hembusan nafas (FeNO), ujian fungsi paru-paru dan ujian kadar masa bagi selaput mata untuk pulih, tidak ada sebarang risiko yang akan berlaku sepanjang prosedur-prosedur ini dijalankan. Semua prosedur yang bakal dijalankan adalah seragam dan selamat.

Prosedur ini akan dilakukan oleh ahli perubatan dan teknologi yang telah terlatih dan mempunyai pengalaman yang mencukupi dalam prosedur. Pegawai perubatan akan berada di tempat proses mengaruhkan kahak setiap masa semasa prosedur dijalankan.

Manakala untuk prosedur ujian alahan, terdapat risiko anafilaksi (reaksi di dalam salur darah) yang sangat rendah. Prosedur ini akan dijalankan oleh pegawai perubatan yang terlatih dan sebagai langkah keselamatan ubat alahan akan disediakan jika berlaku anafilaksi. Disamping itu pemantauan akan dibuat terhadap semua peserta untuk tempoh 40 minit selepas prosedur dijalankan.

Secara keseluruhannya, pihak penyelidik akan menggunakan pegawai perubatan dan ahli teknologi perubatan yang terlatih dan berpengalaman untuk menjalankan semua prosedur klinikal terhadap peserta. Pihak penyelidik juga akan menyediakan ambulance sebagai langkah berjaga-jaga jika berlaku sebarang risiko yang tidak diingini.

Pihak penyelidik juga akan menyediakan Insuran Liabiliti Awam untuk setiap peserta jika berlaku sebarang kecelakaan sepanjang tempoh prosedur klinikal ini dijalankan. Sebarang tuntutan boleh dibuat

berdasarkan terma dan syarat yang telah ditetapkan oleh pihak pembekan Insuran Liabiliti Awam tersebut.

Diakhir proses penyelidikan, semua peserta akan diberi cenderamata sebagai tanda penghargaan daripada pihak penyelidik di atas kesudian menjadi peserta secara sukarela.

## 7. ADAKAH MAKLUMAT DAN IDENTITI SAYA KEKAL RAHSIA?

Semua maklumat peserta adalah rahsia. Hanya penyelidik yang terlibat dalam kajian ini dan mereka yang bertanggungjawab untuk penyelidikan akan mempunyai akses kepada maklumat yang anda berikan. Keputusan umumnya akan diterbitkan sebagai ringkasan perbincangan, bukan transkrip / balasan individu. Bahan penerbitan tidak akan dikenal pasti nama atau dengan apa cara lain yang mana peserta dapat dikenal pasti oleh pembaca laporan tersebut.

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

Jika anda mempunyai pertanyaan, sila hubungi:

| No | Nama | Alamat | No Tel.Bimbit/ No Tel. Pejabat | E-mail |
|---|---|---|---|---|
| 1 | Prof. Dr. Zailina Hashim | Jabatan Kesihatan Persekitaran & Pekerjaan Faculti Perubatan & Sains Kesihatan, UPM Serdang | 017- 6361367/ 03-947240 | zailina@upm.edu.my |
| 2 | Nur Haslyna binti Mohd Hamizul | Jabatan Kesihatan Persekitaran & Pekerjaan Faculti Perubatan & Sains Kesihatan, UPM Serdang | 018-2182320 | nurhaslynamh@gmail.com |
| 3 | Nur Shahira binti Mohamad Fadzil | Jabatan Kesihatan Persekitaran & Pekerjaan Fakulti Perubatan & Sains Kesihatan, UPM Serdang | 011-40685226 | nurshahirafadzil@gmail.com |
| 4 | Siti Raihan binti Mohd Fuad | Jabatan Kesihatan Persekitaran & Pekerjaan Fakulti Perubatan & Sains Kesihatan, UPM Serdang | 017-7527076 | sitiraihanmohdfuad@gmail.com |
| 5 | Anis Zahira binti Zainudin | Jabatan Kesihatan Persekitaran & Pekerjaan Fakulti Perubatan & Sains Kesihatan, UPM Serdang | 013-2803841 | anisiera95@gmail.com |

*Nota: Borang penerangan dan persetujuan ibu bapa ini adalah gabungan daripada empat (4) kajian pelajar.*

*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 *(ujian klinikal//temubual soal selidik).

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

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

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

*potong yang tidak berkenaan

Tandatangan .....
(*Responden*)

Tarikh :.....

Tandatangan .....
(*Saksi*)

Nama :.....

No. K/P: .....

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

Tarikh .....

Tandatangan .....
(*Penyelidik*)

**MAKLUMAT TAMBAHAN**

Berikut adalah maklumat tambahan mengenai prosedur-prosedur terlibat. Peserta akan menjalani penilaian klinikal yang mudah pada nitrogen oksida (NO) dalam hembusan nafas (FeNO) dengan menggunakan alat penganalisa seperti dicadangkan American Thoracic Society (ATS). Peserta akan diminta untuk menarik nafas sedalam-dalam dan menghembus nafas dengan aliran berterusan ke dalam corong mulut khas alat penganalisa. Peserta perlu mengulangi proses ini selama tiga kali untuk mendapatkan hasil purata. Prosedur ini hanya mengambil masa 5 minit.

Ujian Spirometry (ujian fungsi paru-paru) dilakukan selepas seperti yang dicadangkan oleh American Thoracic Society, 1987. Spirometer telah dikalibrasi terlebih dahulu dengan menyuntikkan 3 liter udara ke dalam spirometer menggunakan jarum 3L. Untuk ujian, pelajar akan bernafas melalui mulut yang dipasang pada alat rakaman (spirometer). Untuk mendapatkan hasil yang terbaik, semua responden melakukan ujian selama 3 kali. Maklumat yang dikumpul oleh spirometer dicetak pada carta yang disebut spirogram.

Peserta akan menjalani satu ujian klinikal yang mudah dan selamat menggunakan alatan khas, Tearscope Plus untuk mengukur kadar masa bagi selaput mata untuk pulih (Tear Film Break Up Time). Peserta akan diberi penerangan dan alatan khas ini akan didekatkan kepada mata dan peserta akan diminta untuk melihat kedalam alat tersebut. Penilaian akan dibuat oleh penyelidik. Prosedur ini tidak menyakitkan dan hanya mengambil masa dalam 5 minit.

Penilaian klinikal ujian alergi hanya akan dilakukan pada kulit peserta. Jumlah kecil alergen (hama rumah, debunga yang berkaitan, kucing dan lipas ) dalam bentuk cecair akan dimasukkan ke dalam lapisan atas kulit dengan membuat tusukan kecil. Peserta akan dipantau dengan teliti untuk melihat bagaimana reaksi kulit terhadap alergen. Selepas 20 minit, diameter wheal akan diukur. Prosedur ini akan dijalankan oleh pegawai perubatan yang pengalaman.

Selain langkah keselamatan yang dijelaskan seperti di atas, pihak penyelidik akan menyediakan pegawai perubatan, penolong pegawai perubatan/ jururawat yang terlatih dan bertauliah untuk membantu dan memantau semua prosedur klinikal yang dinyatakan di atas. Pihak penyelidik juga akan menyediakan insuran liabiliti untuk setiap peserta jika berlaku sebarang perkara yang tidak diingini. Sebagai langkah keselamatan yang terakahir, sebuah ambulance akan ditempatkan di lokasi persempalan setiap masa.

# Appendix VI
# (Questionnaire)

FAKULTI PERUBATAN DAN SAINS KESIHATAN
FACULTY OF MEDICINE AND HEALTH SCIENCES
UNIVERSITI PUTRA MALAYSIA, 43400 UPM SERDANG, SELANGOR, MALAYSIA

| | |
|---|---|
| NO | |
| NAME | |
| CLASS | |

# BORANG SOAL SELIDIK KAJIAN

## TAJUK: FAKTOR KUALITI UDARA SERTA KESAN ALAHAN DAN ASMA DI KALANGAN PELAJAR SEKOLAH DI MALAYSIA

**ADALAH DIMAKLUMKAN BAHAWA ANDA TELAH TERPILIH UNTUK MENYERTAI KAJIAN INI**
**SILA JAWAB SEMUA SOALAN DENGAN TEPAT DAN LENGKAP**

***TERIMA KASIH DI ATAS KERJASAMA ANDA***

### MAKLUMAT KEPADA PESERTA KAJIAN

**Pengenalan**

Penyelidikan ini akan dijalankan untuk mengkaji hubungan di antara pendedahan terhadap pencemaran udara dengan asma, alahan dan simptom-simptom pernafasan dikalangan kanak-kanak sekolah menengah. Persekitaran sekolah adalah persekitaran yang penting untuk kanak-kanak, dan terdapat keperluan untuk mengetahui bagaimana persekitaran tersebut dapat memberi kesan kesihatan terhadap kanak-kanak sekolah di Malaysia. Dengan mengaplikasikan kombinasi soal selidik yang telah dipiawaikan, penyiasatan kesihatan, dan pengukuran persekitaran udara dalaman di bilik darjah, pengetahuan baru mengenai hubungan di antara persekitaran sekolah dengan simptom-simptom asma, alahan dan simptom-simptom yang lain dapat diperolehi.

**Hak Responden**

Penyertaan dalam kajian ini adalah secara sukarela dan tidak akan ada sebarang pembayaran dikenakan. Persetujuan dari ibu bapa atau penjaga amatlah diperlukan bagi setiap peserta sebelum menyertai kajian ini. Peserta bebas untuk tidak mengambil bahagian, untuk menamatkan penyertaan pada bila-bila masa atas sebarang sebab atau enggan menjawab sebarang pertanyaan tanpa penalti atau kehilangan cenderamata.

Semua peserta akan menerima satu cenderamata sebagai tanda penghargaan menyertai sesi penyelidikan ini. Tiada pampasan tambahan akan diberikan.

**Maklumat Rahsia**

Semua jawapan peserta adalah rahsia. Hanya penyelidik yang terlibat dalam kajian ini dan mereka yang bertanggungjawab untuk penyelidikan akan mempunyai akses kepada maklumat yang anda berikan. Keputusan umumnya akan diterbitkan sebagai ringkasan perbincangan.

Jika terdapat sebarang kemusykilan atau soalan mengenai kajian atau soal selidik ini, sila bertanya kepada para penyelidik yang mengendalikan kajian ini di sekolah anda.
Sekian, terima kasih.

**Ketua Penyelidik**
Prof. Dr. Zailina Hashim
Jabatan Kesihatan Persekitaran & Pekerjaan, Fakulti Perubatan & Sains Kesihatan, UPM
+6017-6361367/03-947240

**BAHAGIAN A : MAKLUMAT LATAR BELAKANG**

Arahan: Sila isi maklumat dan tandakan (✓) untuk setiap jawapan yang berkenaan.

| | |
|---|---|
| | **MAKLUMAT LATAR BELAKANG RESPONDEN** |
| 1 | **Nama Penuh:** |
| 2 | **Jantina:**<br>☐ Lelaki ☐ Perempuan |
| 3 | **Bangsa:**<br>☐ Kadazan-Dusun ☐ Bajau ☐ Murut ☐ Lain-lain, nyatakan: _____ |
| 4 | **Tarikh Lahir:** |
| 5 | **Alamat Rumah:**<br>_____<br>_____<br>_____ |
| 6 | **No. Telefon:**<br>Diri Sendiri _____ Ibu/Bapa _____ |
| 7 | **Nama Sekolah:**<br>_____<br>Nama Kelas: _____ |
| | **MAKLUMAT LATAR BELAKANG IBUBAPA/PENJAGA** |
| 8 | **Tahap pendidikan tertinggi bapa/penjaga anda:**<br>☐ Tiada pendidikan formal ☐ Sijil/A Level/Diploma<br>☐ Sekolah Rendah ☐ Universiti (Sarjana Muda/Master/PhD)<br>☐ Sekolah Menengah |
| 9 | **Status pekerjaan bapa/penjaga anda sekarang:**<br>☐ Tidak bekerja ☐ Bekerja separuh masa ☐ Bekerja sepenuh masa<br>**Jika bekerja, sila nyatakan maklumat dibawah:**<br>a) Nama pekerjaan: _____<br>b) Tempat kerja: _____ |
| 10 | **Pendapatan semasa bapa/penjaga anda dalam sebulan: RM** _____ |
| 11 | **Tahap pendidikan tertinggi ibu anda:**<br>☐ Tiada pendidikan formal ☐ Sijil/A Level/Diploma<br>☐ Sekolah Rendah ☐ Universiti (Sarjana Muda/Master/PhD)<br>☐ Sekolah Menengah |

| | | |
|---|---|---|
| 12 | Status pekerjaan ibu/penjaga anda sekarang:<br><br>☐ Tidak bekerja ☐ Bekerja separuh masa ☐ Bekerja sepenuh masa<br>Jika bekerja, sila nyatakan maklumat dibawah:<br>a) Nama pekerjaan: _____<br>b) Tempat kerja: _____ | |
| 13 | Pendapatan isirumah anda dalam sebulan (jumlah pendapatan ibu dan bapa sebulan):_____ | |

**BAHAGIAN B : ASMA DAN ALAHAN (ALERGI)**

| Dada Berbunyi & Bersiul<br>Arahan: Sila tanda (✓) untuk setiap jawapan | | Ya | Tidak |
|---|---|---|---|
| 14 | Pernahkah anda mengalami dada berbunyi dan bersiul dalam tempoh tahun 2018?<br><br>Jika "TIDAK", teruskan ke SOALAN 18, jika "YA" jawab soalan di bawah (SOALAN 15-17): | | |
| 15 | Pernahkah anda mengalami sesak nafas apabila dada anda berbunyi? | | |
| 16 | Pernahkah anda mengalami dada berbunyi tanpa menghidap selsema? | | |
| 17 | Pernahkah anda mengalami kesempitan dada apabila anda bangun dari tidur pada tahun 2018? | | |

| Kesukaran bernafas<br>Arahan: Sila tanda (✓) untuk setiap jawapan | | Ya | Tidak |
|---|---|---|---|
| 18 | Pernahkah anda mengalami sesak nafas di siang hari ketika anda berehat pada bila-bila masa pada tahun 2018? | | |
| 19 | Pernahkah anda mengalami sesak nafas setelah anda melakukan aktiviti lasak pada bila-bila masa pada tahun 2018? | | |
| 20 | Pernahkah anda terjaga dari tidur akibat sesak nafas tahun 2018? | | |

| Dada Berbunyi & Bersiul<br>Arahan: Sila isi maklumat dan tandakan (✓) untuk setiap jawapan yang berkenaan. | | Ya | Tidak |
|---|---|---|---|
| 21 | Pernahkah anda menghidapi asma?<br><br>Jika "Tidak", teruskan ke SOALAN 28, jika "Ya" jawab soalan di bawah (22-27): | | |
| 22 | Jika YA, adakah penyakit asma itu telah didiagnosis oleh doktor? | | |
| 23 | Jika YA, berapakah umur anda apabila anda didiagnosis oleh doktor? | _____tahun | |
| 24 | Jika YA, berapakah umur anda pada kali pertama anda diserang asma? | _____tahun | |

| | | | |
|---|---|---|---|
| 25 | **Jika YA, pada umur berapakah anda diserang asma yang terkini?** | _____tahun | |
| 26 | **Pernahkah anda mengalami serangan asma pada tahun 2018?** | | |
| 27 | **Adakah anda kini mengambil ubatan asma? (semburan, ubat pil, serbuk sedutan)**<br>**Jika YA, sila nyatakan nama ubat :** _____ | | |

| **Alahan (Alergi) Hidung**<br>Arahan: Sila tanda (✓) untuk setiap jawapan yang berkenaan. | | Ya | Tidak |
|---|---|---|---|
| 28 | **Pernahkah anda mengalami masalah bersin, hidung berair atau hidung tersumbat dalam keadaan anda tidak selsema pada tahun 2018?**<br><br>**Jika "Tidak", teruskan ke SOALAN 30, jika "Ya" jawab soalan di bawah (29):** | | |
| 29 | **Jika YA, adakah masalah ini berlaku disertai dengan mata berair atau gatal?** | | |

| **Ekzema atau Alahan (Alergi) Kulit**<br>Arahan: Sila tanda (✓) untuk setiap jawapan yang berkenaan. | | Ya | Tidak |
|---|---|---|---|
| 30 | **Pernahkah anda mengalami ruam-ruam gatal yang wujud dan sembuh dalam tempoh masa sekurang-kurangnya 6 bulan mulai Jun 2018 – Januari 2019?**<br><br>**Jika "Tidak", teruskan ke SOALAN 33, jika "Ya" jawab soalan di bawah (31-32):** | | |
| 31 | **Jika YA, pernahkah anda mengalami ruam gatal ini sepanjang tahun 2018?** | | |
| 32 | **Jika YA, pernahkah ruam gatal ini berlaku pada bila-bila masa di kawasan seperti di lipatan siku, lipatan lutut, di buku lali, di bawah punggung atau di sekitar leher, telinga dan mata?** | | |

## BAHAGIAN C : KESIHATAN DAN ALAHAN (ALERGI) YANG DIALAMI SEKARANG

| Arahan: Sila isi maklumat dan tandakan (✓) untuk setiap jawapan yang berkenaan. | | | | |
|---|---|---|---|---|
| 33 | **Berapa kalikah anda mengalami jangkitan saluran pernafasan dalam tempoh 3 bulan yang lepas mulai September – Disember 2018?** | | _____kali | |
| 34 | **Pernahkah anda menghidapi penyakit yang memerlukan anda berjumpa dengan doktor pada tahun 2018?**<br><br>**Jika YA, apakah penyakit tersebut? Sila nyatakan:**<br>_____ | **Ya, lebih dari sekali** | **Ya, sekali** | **Tidak pernah** |
| 35 | **Pernahkah anda mengambil antibiotik (contoh penicillin) untuk masalah jangkitan saluran pernafasan pada tahun 2018?** | **Ya, lebih dari sekali** | **Ya, sekali** | **Tidak pernah** |
| 36 | **Adakah anda seorang perokok?** | | **Ya** | **Tidak** |

| | | | | |
|---|---|---|---|---|
| | | | | |
| Arahan: Sila isi maklumat dan tandakan (✓) untuk setiap jawapan yang berkenaan. | | Ya | Tidak pasti | Tidak |
| 37 | Adakah anda hipersensitif/alahan terhadap **kucing**? | | | |
| 38 | Adakah anda hipersensitif/alahan terhadap **anjing**? | | | |
| 39 | Adakah anda hipersensitif/alahan terhadap **barangan berkulat**? | | | |
| 40 | Adakah anda hipersensitif/alahan terhadap **debunga**? | | | |
| 41 | Adakah anda hipersensitif/alahan terhadap **makanan**?<br><br>Jika **YA**, sila nyatakan jenis makanan tersebut:<br>_____ | | | |

**BAHAGIAN D : MASALAH ALAHAN (ALERGI) DI KALANGAN AHLI KELUARGA LAIN**

| Arahan: Sila isi maklumat dan tandakan (✓) untuk setiap jawapan yang berkenaan. | | |
|---|---|---|
| 42 | Bilangan adik beradik yang lebih tua daripada anda | _____ orang |
| 43 | Bilangan adik beradik yang lebih tua yang menetap di rumah bersama anda sekarang | _____ orang |
| 44 | Bilangan adik beradik yang lebih muda daripada anda | _____ orang |
| 45 | Bilangan adik beradik yang lebih muda yang menetap di rumah bersama anda sekarang | _____ orang |
| 46 | Adakah di antara ahli keluarga anda yang mengalami masalah alahan?<br>**Tandakan ( √ )**pada ruangan yang berkenaan, sama ada mereka pernah atau tidak mengalami masalah alahan. | |

| Alahan | Bapa | | Ibu | | Adik beradik | |
|---|---|---|---|---|---|---|
| | Ya | Tidak | Ya | Tidak | Ya | Tidak |
| Asma | | | | | | |
| Simptom alahan hidung | | | | | | |
| Ekzema | | | | | | |

**BAHAGIAN E : ZAMAN KANAK-KANAK**

| Arahan: Sila isi maklumat dan tandakan (✓) untuk setiap jawapan yang berkenaan. | |
|---|---|
| 47 | Adakah anda disusui ibu semasa zaman kanak-kanak?<br><br>☐ Ya ☐ Tidak ☐ Tidak Pasti<br><br>Jika **YA**, sehingga anda berusia_____bulan |

**48** Adakah ahli keluarga anda yang merokok sejak anda dilahirkan sehingga anda berusia satu tahun?

**Tandakan (√) pada ruangan yang berkenaan, sama ada mereka pernah atau tidak merokok ketika itu.**

| Keluarga | Ya | Tidak |
|---|---|---|
| Ayah merokok | | |
| Emak merokok | | |
| Ahli keluarga lain merokok | | |

**49** Pernahkah anda ditempatkan di rumah asuhan kanak-kanak?

☐ Tidak pernah ☐ Ya, 1-3 tahun

☐ Ya, kurang dari 1 tahun ☐ Ya, lebih dari 3 tahun

Jika **YA**, pada umur berapakah anda mula ditempatkan di rumah asuhan tersebut?

☐ Kurang dari 1 tahun ☐ 1-2 tahun ☐ Lebih dari 2 tahun

## BAHAGIAN F : KEADAAN SEMASA PERSEKITARAN RUMAH

Arahan: Sila isi maklumat dan tandakan (✓) untuk setiap jawapan yang berkenaan.

**50** Apakah jenis bangunan kediaman anda sekarang?

☐ Rumah Teres/ Berkembar

☐ Rumah Sebuah

☐ Rumah Bertingkat (Apartment/Flat/Condo)

☐ Lain-Lain, sila nyatakan: _____

**51** Adakah anda tinggal di kediaman yang sama sejak lahir?

☐ Ya ☐ Tidak

Jika **TIDAK**, pada tahun berapakah anda berpindah ke kediaman sekarang?

_____(tahun)

**52** Pada tahun berapakah (anggaran) kediaman anda sekarang dibina?

_____(tahun)

**53** Berapa meter persegikah keluasan kediaman anda sekarang?

_____($m^2$)

**54** Bahan apakah yang digunakan untuk membina bangunan kediaman anda sekarang? (Tandakan satu atau lebih jawapan yang sesuai).

☐ Bata ☐ Konkrit/Simen

☐ Kayu ☐ Bahan lain,sila nyatakan: _____

**55** Adakah bahagian dalaman rumah anda yang telah dicat pada tahun 2018?

☐ Ya ☐ Tidak

Jika **YA**, bilakah ia dicat? _____(bulan)_____(tahun)

| | |
|---|---|
| 56 | **Adakah lantai di dalam rumah anda telah ditukar pada tahun 2018?**<br><br>☐ Ya ☐ Tidak |
| 57 | **Adakah terdapat haiwan peliharaan di kediaman anda ?**<br><br>☐ Ya ☐ Tidak<br>**Jika YA, sila nyatakan jenis haiwan peliharaan anda:** _____ |
| 58 | **Adakah anda/ahli keluarga merokok di dalam kediaman anda sekarang?**<br><br>☐ Tidak Pernah ☐ Ya, Selalu (1-4 kali/minggu)<br><br>☐ Ya, Kadang-kala (1-3kali/bulan) ☐ Ya, Setiap hari |
| 59 | **Pernahkah terdapat masalah kelembapan atau kerosakan air berlaku di kediaman anda dalam tempoh 5 tahun yang lepas mulai 2014-2018?**<br><br>☐ Ya ☐ Tidak<br>**Jika YA, sila nyatakan sebab masalah kelembapan atau kerosakan air.**<br><br>☐ Kebocoran paip ☐ Masalah struktur binaan ☐ Bencana alam |
| 60 | **Pernahkah salah satu daripada perkara di bawah berlaku di kediaman anda pada tahun 2018?** |

| Perkara | Ya | Tidak |
|---|---|---|
| Kebocoran air atau kerosakan air pada dinding, lantai atau siling dalam rumah | | |
| Buih atau warna kekuningan pada lantai plastik atau kehitaman pada lantai parket | | |
| Kulat yang tumbuh pada dinding, lantai atau siling rumah | | |
| Bau kulat dalam satu atau dua bilik | | |
| Bau lain yang terdapat di rumah, sila nyatakan: _____ | | |

## BAHAGIAN G : SIMPTOM SEMASA

Arahan: Sila tanda (✓) untuk setiap jawapan yang berkenaan.

61 Adakah anda mengalami simptom-simptom berikut dalam tempoh <u>tiga (3) bulan</u> yang lepas **mulai Oktober –Disember 2018?**

| | Simptom | Ya, setiap hari | Ya, selalu (1-4 kali/minggu) | Ya, Selalu (1-3 kali/bulan) | Tidak Pernah |
|---|---|---|---|---|---|
| A | Ruam pada tangan atau lengan | | | | |
| B | Ruam pada muka atau leher | | | | |
| C | Kemerahan kulit, Jika YA, dimana? Sila nyatakan:_____ | | | | |
| D | Gatal pada muka atau leher | | | | |
| E | Gatal pada tangan atau lengan | | | | |
| F | Iritasi mata (kemerahan, kering, gatal) | | | | |
| G | Kelopak mata bengkak | | | | |
| H | Pening kepala | | | | |
| I | Rasa loya/mual | | | | |
| J | Hidung berair/hidung berhingus | | | | |
| K | Hidung tersumbat | | | | |
| L | Tekak kering | | | | |
| M | Terasa akan menghidapi selsema | | | | |
| N | Sakit tekak | | | | |
| O | Batuk yang beriritasi | | | | |
| P | Susah bernafas | | | | |
| Q | Berasa letih dan tidak bermaya | | | | |

Arahan: Sila isi maklumat dan tandakan (✓) untuk setiap jawapan yang berkenaan.

62 Adakah simptom-simptom di atas (Soalan 61) terdapat peningkatan?

Apabila anda **berada di sekolah**

- ☐ Ya
- ☐ Tidak
- ☐ Tidak Pasti

Jika **YA**, simptom yang mana satu? (tuliskan huruf bagi simptom berkenaan, Sila rujuk **SOALAN 61:**

_____

Apabila anda **berada di rumah**

- ☐ Ya
- ☐ Tidak
- ☐ Tidak Pasti

Jika **YA**, simptom yang mana satu? (tuliskan huruf bagi simptom berkenaan, Sila rujuk **SOALAN 61:**

_____

# Appendix VII

# (Clinical assessment form)

| NO. | |
|---|---|

# BORANG UJIAN KESIHATAN

**TAJUK: FAKTOR KUALITI UDARA SERTA KESAN ALAHAN DAN ASMA DI KALANGAN PELAJAR SEKOLAH DI MALAYSIA**

**ADALAH DIMAKLUMKAN BAHAWA ANDA TELAH TERPILIH UNTUK MENYERTAI KAJIAN INI.**

***TERIMA KASIH DI ATAS KERJASAMA ANDA***

| **STESEN 1 : LATAR BELAKANG** | |
|---|---|
| 1 | Jantina: ☐ Lelaki ☐ Perempuan |
| 2 | Bangsa: ☐ Melayu ☐ Cina ☐ India ☐ Lain-lain, Nyatakan: _____ |
| 3 | Alamat Rumah: _____ _____ |
| 4 | Sekolah: _____ |
| 5 | Kelas: _____ |
| 6 | Tinggi: _____ cm Berat: _____ kg |

| [redacted] NITROGEN OKSIDA DALAM HEMBUSAN NAFAS | |
|---|---|
| 7 | Do you have any allergies?<br>☐ Yes ☐ No<br>If **YES**, please state your allergy: _____ |
| 8 | Do you have any respiratory infections / common cold/ influenza the past week?<br>☐ Yes ☐ Yes, BUT no Fever ☐ Yes, WITH fever |
| 9 | Does FENO Test be conducted?<br>☐ Refused / without consent<br>☐ Consented, done<br>☐ Consented, excluded. If excluded, state reason: _____ |
| 10 | FENO Value: _____ ppb |

## STESEN 3 : UJIAN MENGUKUR KADAR MASA BAGI SELAPUT MATA UNTUK PULIH (BUT)

11

| | Eyes Condition | Yes | No |
|---|---|---|---|
| a | Do you wear glasses? | | |
| b | Do you use contact lenses? | | |
| c | Do you use eye cosmetics? | | |
| d | Do you have any eye medication for eye disease? | | |

12 How many hours do you spend with computers / television / cellphone (on average)?

☐ Less than 1 Hour/ day ☐ 2 – 3 Hours / day

☐ 1 -2 Hour / day ☐ More than 3 Hours / day

13 Does Tear Film Break Up Time (But) be conducted?

☐ Refused / without consent
☐ Consented, done
☐ Consented, excluded. If excluded, state reason: _____

14

| Tearscope | Test 1 | Test 2 | Test 3 | Mean reading for all tests |
|---|---|---|---|---|
| Left NIBUT (seconds) | | | | |
| Right NIBUT (seconds) | | | | |
| Self-reported BUT (seconds) | | | | |

## STESEN 4 : UJIAN FUNGSI PARU-PARU

15 Do you have any respiratory problem?

☐ Yes ☐ No

If YES, please state your respiratory problem: _____

16 Does Lung Function Test be conducted?

☐ Refused / without consent
☐ Consented, done
☐ Consented, excluded. If excluded, state reason: _____

17

Measured FVC : _____

Measured $FEV_1$ : _____

Measured $FEV_1$ / FVC% : _____

## STESEN 5 : UJIAN ALAHAN

**18** Do you have asthma medication (asthma medicine)?

☐ Yes ☐ No

If **YES**, please state name of medication: _____

**19** Do you have allergy medication (allergy medicine)?

☐ Yes ☐ No

If **YES**, please state name of medication: _____

**20** Does this Allergy Test be conducted?

☐ Refused / without consent

☐ Consented, done

☐ Consented, excluded. If excluded, state reason: _____

**21**

| No | Allergens | Reading 1 (mm) | | Reading 2 (mm) | Mean Area | Positive if diameter >3 mm | |
|---|---|---|---|---|---|---|---|
| | Derp1 | | * | | | Positive | |
| | Derf | | * | | | Positive | |
| | Cladosporium | | * | | | Positive | |
| | Alternaria | | * | | | Positive | |
| | Cat | | * | | | Positive | |
| | Positive Control | | * | | | Positive | |
| | Negative Control | | * | | | Positive | |

Conducted by: _____



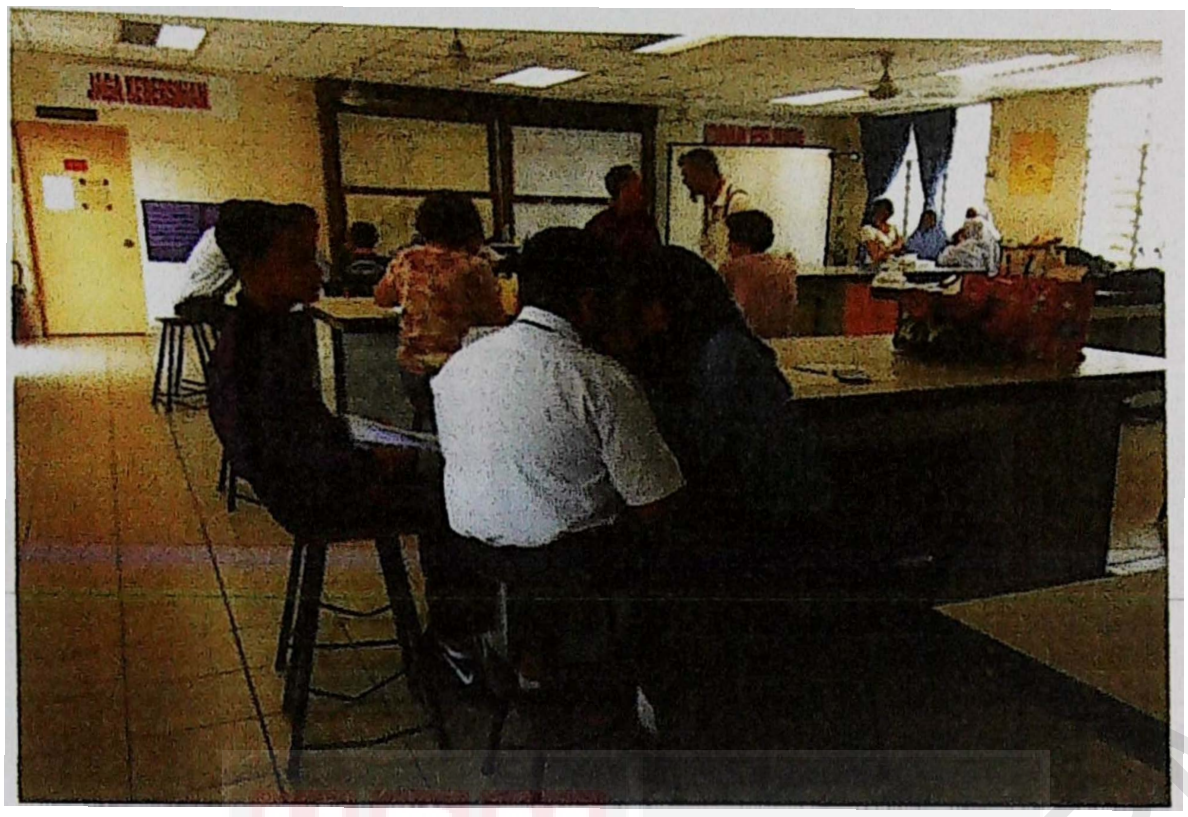
**TERIMA KASIH DI ATAS KERJASAMA ANDA!!**

# Appendix VIII
# (Instrument Calibration Certificate)

# Appendix IX
# (Photograph of Research Study)

**Data collection in school 1**

**Data collection in school 2**



**Data collection in school 3**

**Data collection in school 4**

Data collection in school 5

Data collection in school 6